

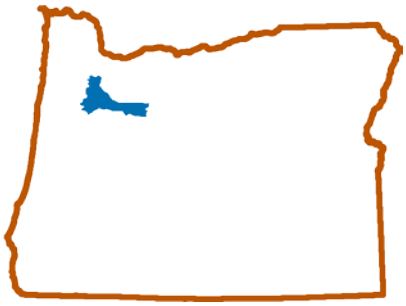




Marion County

MULTI-JURISDICTIONAL ALL- HAZARDS MITIGATION PLAN VOLUME I: BASIC PLAN

- Marion County
- City of Aumsville
- City of Aurora
- City of Detroit
- City of Gervais
- City of Hubbard
- City of Idanha
- City of Jefferson
- City of Keizer
- Keizer Fire District



- City of Mill City
- City of Mt Angel
- Mt Angel Fire District
- City of Scotts Mills
- City of Stayton
- City of Sublimity
- City of Turner
- City of Woodburn/ Woodburn Fire District

FEMA

Effective Month X, 2022 through Month X, 2027

The 2023 Marion County Multi-Jurisdictional All-Hazards Mitigation Plan (HMP) is a living document that will be reviewed and updated periodically to address the requirements contained in 44 CFR 201. It will be integrated with existing plans, policies, and programs. The Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved mitigation plan to receive federal funds for hazard mitigation grants. This plan meets those requirements as evidenced by FEMA approval which is effective per the cover date range of this plan.

Cover photos: (clockwise from top left): Marion County post-fire scene (2020); City of Detroit post-fire scene 10/20/2020; Tanker tipped on Hwy 22. Photos courtesy of Marion County.

Mission:
Create a more resilient Marion County by partnering with the whole community.

Comments, suggestions, corrections, and additions are encouraged to be submitted from all interested parties.

For further information and to provide comments, contact:

Marion County Emergency Management
5155 Silverton Road NE
Salem, OR 97305
Phone: 503-588-5108
Email: mcem@co.marion.or.us

Marion County
OREGON

Acknowledgements

The 2023 Marion County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP) update was conducted via a multi-jurisdictional partnership of Marion County and the Cities of Aumsville, Aurora, Detroit, Gates, Gervais, Hubbard, Idanha, Jefferson, Keizer, Mill City, Silverton, Stayton, Turner, and Woodburn, and the special districts of Keizer Fire District, Mt. Angel Fire District, and Woodburn Fire District.

2023 Marion County Hazard Mitigation Plan Steering Committee

Marion County
Adam Crateau, Alisa Zastoupil, Alyssa Schrems, Brandon Reich, Brian May, Brian Nicholas, Candace Jamison, Chris Eppley, Dain Thomas, Danielle Gonzalez, Dennis Mansfield, Cmdr. Eric Hlad, Kaylynn Gesner, Katrina Griffith, Kelly Weese, Jaden Emminger, Joaquin Ramos, Matt Knudsen, Sgt. Matt Wilkinson, Scott Wilson

City of Aumsville
Matt Etzel, Chief Richard Schmitz, Chief Damian Flowers

City of Aurora
Stuart Rodgers, Mark Gunter

City of Detroit
Mayor Jim Trett, Kelly Galbraith, Christine Pavoni

City of Gervais
Susie Marston, Chief Mark Chase

City of Hubbard
Melinda Olinger, Chief Dave Rash

City of Idanha
Rebecca Stormer, Robyn Johnson, Mayor Rob Weikum

City of Jefferson
Sarah Cook, Kyle Ward

City of Keizer
Matt Reyes

City of Mill City
Gary Olson, Mayor Tim Kirsch

City of Mt. Angel
Chief Mark Daniel

City of **Scotts Mills**
Robin Fournier, Mayor Paul Brakeman

City of Stayton
Alissa Angelo, Chief Dave Frisendahl

City of Turner
Scott McClure, Chief Don Taylor, Aaron Bales

City of Woodburn
Chief Marty Pilcher, Andy Shadrin

Woodburn Fire District
Chief Joe Budge

Keizer Fire District
Chief Jeff Cowan

Mt. Angel Fire District
Chief Jim Trierweiler

Interested Parties

Cherriots
Randy Navalinski

Consumer Power
Jeff Carlson, Kelley Bruneau, Billy Terry

Linn County
Alyssa Boles, Ric Lentz

METCOM 911
John Thompson, Mark Spross

City of Silverton
Chief Jim Anglemier

Aumsville Fire District
Chief Roy Hari, Captain Brad McKenzie

Aurora Fire District
Chief Joshua Williams, Mike Corless

Hubbard Fire District
Chief Joe Budge, Asst. Chief Michael Karhmann

Jefferson Fire District
Chief Levi Eckhardt

Marion County Fire District 1
Dep Fire Chief Ron Lee, Sam Phillips

Pacific Gas & Electric
John Plechinger

Salem Electric
JB Phillips, Britni Davidson-Cruikshank

Salem Health
Christina Bunnell, Nathan Streight

Salem-Keizer School District
Ryan Mikesh

Santiam Hospital
Adam Mauer

U.S. Forest Service
Shawn Rivera, Duane Bishop

Santiam Water Control District
Brett Stevenson

Agency Partners

Oregon Department of Geology and Mineral Industries (DOGAMI)
Matt C. Williams, Ian P. Madin

Federal Guidance and Review Team

Federal Emergency Management Agency Region X, Mitigation Division
Erin Cooper, Supervisory Community Planner

Oregon Department of Emergency Management (OEM)
Stephen Richardson, Joseph Murray, Jason Gately

Project Managers
Marion County
Kathleen Silva, County Emergency Manager

Mike Hintz, Emergency Preparedness Coordinator

Oregon Department of Land Conservation and Development
Katherine Daniel, Natural Hazard Planner Pamela Reber, Natural Hazard Planner Tricia Sears, Natural Hazard Planner Marian Lahav, Natural Hazards Mitigation Planning Program Coordinator

In 2019, the Department of Land Conservation and Development (DLCD) applied for and received a Pre-Disaster Mitigation grant. PDMC-PL-10-OR-2019-005 from FEMA through the Oregon Department of Emergency Management (OEM) to assist Marion County.

This page intentionally left blank.

The Marion County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP) is comprised of four (4) volumes. These volumes include:

- Volume 1: Basic Plan
- Volume 2: City Addenda
- Volume 3: Appendices
- Volume 4: DOGAMI

To assist the viewer of this plan, each volume as its own table of contents.

Table of Contents

1 Introduction 1-1
1.1 Background & Context 1-1
1.2 What is Hazard Mitigation? 1-1
1.3 Why Maintain a Mitigation Plan? 1-2
1.4 What Federal Requirements Does This Plan Address? 1-3
1.5 What is the Policy Framework for Natural Hazard Planning in Oregon? 1-3
1.6 How Was the Plan Developed and Updated 1-4
1.7 How is the Plan Organized 1-6
2 Risk Assessment 2-1
2.1 Risk Assessment Approach 2-2
2.2 Federal Disaster and Emergency Declarations 2-3
2.3 Risk Assessment Summary 2-4
2.4 Hazard Identification and Assessment 2-14
2.5 DOGAMI Multi-Hazard Risk Assessment 2-15
2.6 Hazard Characterization 2-18
2.6.1 Drought 2-18
2.6.2 Earthquake 2-23
2.6.3 Flood 2-25
2.6.4 Landslide 2-30
2.6.5 Volcano 2-32
2.6.6 Wildfire 2-34
2.6.7 Severe Weather/Storm 2-37
2.7 High Hazard Potential Dams 2-42
2.8 Community Vulnerability Identification and Assessment 2-45
2.8.1 Community Characteristics 2-46
2.9 Population 2-46
2.9.1 Population Vulnerabilities 2-46
2.10 Economy 2-47
2.10.1 Economic Vulnerabilities 2-47
2.11 Environment 2-47
2.11.1 Environment Vulnerabilities 2-47
2.12 Housing 2-48
2.12.1 Housing Vulnerabilities 2-48
2.13 Critical Facilities and Infrastructure 2-48

2.13.1 Critical Facilities and Infrastructure Vulnerabilities 2-49
2.14 Lifeline Sector Analysis 2-50
2.14.1 Energy 2-50
2.14.2 Communications 2-52
2.14.3 Transportation 2-55
2.14.4 Water 2-58
2.15 Hazard Policy Evaluation 2-59
2.16 City Specific Risk Assessment 2-65
2.17 Future/Complimentary Risk Assessment Information 2-65
2.17.1 Threat Hazard Identification Risk Assessment (THIRA) 2-65
2.17.2 Marion County Community Wildfire Protection Plan (CWPP) 2-74
2.17.3 North Santiam Drought Contingency Plan 2-75
3 Mitigation Strategy 3-1
3.1 Mitigation Plan Mission 3-1
3.2 Mitigation Plan Goals 3-1
3.3 Priority Mitigation Actions 3-3
3.4 Lifelines 3-4
3.5 Action Item Development Process 3-5
3.6 Priority Action Item Forms 3-6
3.7 Proposed Action Title 3-6
3.8 Alignment with Plan Goals 3-6
3.9 Alignment with Existing Plans and Policies 3-6
3.10 Rationale or Key Issue Addressed 3-6
3.11 Implementing through Existing Programs 3-6
3.12 Coordinating Organization 3-7
3.13 Internal and External Partners 3-7
3.14 Potential Funding Sources 3-7
3.15 Estimated Cost 3-7
3.16 Timeline 3-7
3.17 Status 3-7
4 Plan Implementation and Maintenance 4-1
4.1 Plan Adoption 4-1
4.2 Implementing the Plan 4-1
4.3 Convener 4-2
4.4 Hazard Mitigation Plan Steering Committee 4-2

4.5 Interested Parties 4-5
4.6 Programmatic Implementation 4-7
4.7 Plan Maintenance 4-8
4.8 Meetings 4-8
4.9 Funding Sources 4-9
4.10 Plan Integration Resources 4-10
4.11 Mitigation Ideas/Best Practices Resources 4-10
4.12 Project Prioritization Process 4-11
4.12.1 Step 1: Examine Funding Opportunities 4-12
4.12.2 Step 2: Complete Risk Assessment Evaluation 4-12
4.12.3 Step 3: HMP Steering Committee Recommendations 4-13
4.12.4 Step 4: Complete Quantitative and Qualitative Assessment and Economic Analysis . 4-13
4.13 Continued Public Involvement and Participation 4-14
4.14 Five-Year Review of Plan 4-15
5 Plan Adoption 5-17
5.1 Final FEMA Approval Letter 5-18
5.2 FEMA APA Letter 5-18
5.3 Resolution of Approval 5-18
5.4 FEMA Review Tool 5-18
6 References 6-1

1 Introduction

Section I: Introduction provides a general introduction to hazard mitigation planning in Marion County. In addition, it addresses the planning process requirements contained in 44 CFR 201.6(b) thereby meeting the planning process documentation requirement contained in 44 CFR 201.6(c)(1). The section concludes with a general description of how the plan is organized.

1.1 Background & Context

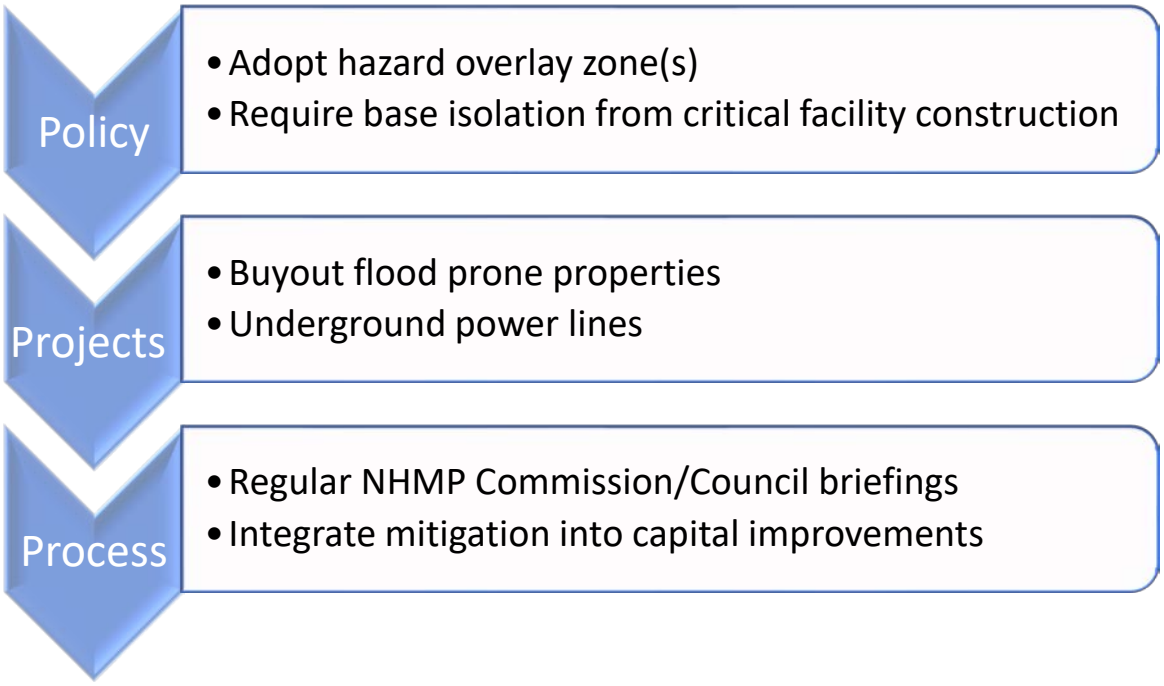
This Multi-Jurisdictional All Hazards Mitigation Plan (HMP) is a framework for mitigating and preparing for the effects of hazards on the people, property, economy, and environment of Marion County. This plan was developed by Marion County in partnership with the jurisdictions of Aumsville, Aurora, Detroit, Gervais, Idanha, Jefferson, Keizer, Keizer Fire District, Mill City, Mt. Angel Fire District, Scotts Mills, Stayton, Sublimity, Turner, Woodburn, and Woodburn Fire District, among many other special districts included within the Marion County limits.

Hazards are unpredictable and vary in impact. Multi-jurisdictional collaboration is critical to achieving meaningful risk reduction and contributes to community resilience overall.

1.2 What is Hazard Mitigation?

The Federal Emergency Management Agency (FEMA) defines mitigation as “the effort to reduce loss of life and property by lessening the impact of disasters . . . through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk.”

Hazards mitigation uses long and short-term strategies and actions to reduce the effects of hazards on the lives, property, and critical infrastructure and facilities in a community. This can be achieved through policies, such as adjustments to land use designation within floodplains; projects, such as seismic retrofits to critical facilities; and processes, such as regular reporting to the Board of County Commissioners and City Councils on mitigation activities (see Figure 1.1). It is the role of communities, private businesses and industries, nonprofits, school districts, and more to work with the local, state, and federal government to prepare their community for threats and hazards.



Source: Oregon Partnership for Disaster Resilience (revised by Marion County)

Hazard mitigation also incorporates a "Whole Community" approach to planning, in which all parts of the community are engaged and empowered in the development and implementation of an HMP. This positions the planning team to better understand and comprehensively approach the actual needs of a community. To work well, this approach requires a diverse array of community members at the table. Interested parties can include social and community service groups and institutions, faith-based groups, school districts, organization that work with those who have intellectual and physical disabilities, academia, professional associations, non-profit and private sectors, Tribal sovereign government representatives, among others.

1.3 Why Maintain a Mitigation Plan?

This hazard mitigation plan is designed to assist Marion County and the jurisdictions of Aumsville, Aurora, Detroit, Gervais, Idanha, Jefferson, Keizer, Keizer Fire District, Mill City, Mt. Angel Fire District, Scotts Mills, Stayton, Sublimity, Turner, Woodburn, and Woodburn Fire District in reducing the risk associated with hazards by providing information, resources, and strategies for mitigation. This plan will also assist other agencies, districts, and jurisdictions in coordinating risk reduction activities throughout Marion County. Although the plan includes information about man-made and technological hazards, many of the hazards identified are natural, recurring disasters.

The Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in Title 44 Code of Federal Regulations (CFR) Part 206 require that jurisdictions maintain an approved hazard mitigation plan (HMP) to receive federal Hazard Mitigation Assistance funding for mitigation projects. Marion County uses an "all-hazard" approach to hazard mitigation. Local and federal approval of this plan ensures that the county and participating

cities will remain eligible for pre- and post-disaster mitigation project grants available through FEMA.

This plan is non-regulatory; it is strategic and does not introduce new policy. However, this plan provides a framework for coordination and collaboration on mitigation action strategies and actions. It also meets federal requirements for qualifying for relevant FEMA assistance programs. This mitigation plan is developed and implemented in coordination with other county and city plans and programs, including the Marion County Comprehensive Plan, various Local Emergency Operations Plans (LEOP), and the State of Oregon Natural Hazards Mitigation Plan.

1.4 What Federal Requirements Does This Plan Address?

The Disaster Mitigation Act of 2000 is the latest federal legislation addressing mitigation planning. This legislation reinforces the importance of mitigation planning and emphasizes planning for hazards before they occur. Specifically, DMA2K established the Pre-Disaster Mitigation (PDM) grant program and introduced new requirements for the post-disaster Hazard Mitigation Grant Program (HMGP). These two grant programs and the Flood Mitigation Assistance grants are collectively referred to by FEMA as the Hazard Mitigation Assistance program.

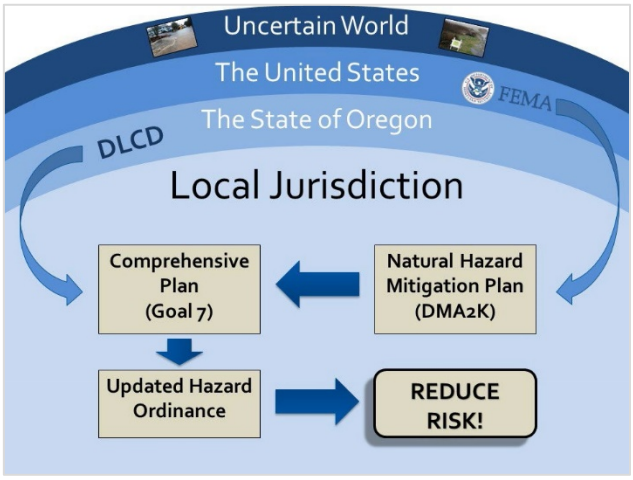
Section 322 of DMA2K addresses mitigation planning at the state and local levels. Chapter 44 Code of Federal Regulations (CFR), section 201.6 specifically requires that jurisdictions have an approved hazard mitigation plan in place to receive Hazard Mitigation Grant Program (HMGP) funds. Pursuant of Chapter 44 CFR, the Natural Hazard Mitigation Plan planning processes shall include opportunity for the public to comment on the plan during review, and the updated Natural Hazard Mitigation Plan shall include documentation of the public planning process used to develop the plan. The Natural Hazard Mitigation Plan update must also contain a risk assessment, mitigation strategy and a plan maintenance process that has been formally adopted by the governing body of the jurisdiction. Lastly, the Natural Hazard Mitigation Plan must be submitted to Oregon Department of Emergency Management (OEM) for initial plan review, and then federal approval (Department of Homeland Security, Federal Emergency Management Agency, 2023).

1.5 What is the Policy Framework for Natural Hazard Planning in Oregon?

Planning for hazards is an integral element of Oregon's statewide land use planning program. All Oregon cities and counties must have comprehensive plans and implementing ordinances that comply with the statewide planning goals. The challenge faced by state and local governments is to keep this network of local plans coordinated in response to the changing conditions and needs of Oregon communities. Oregon Statewide Planning Goal 7: Areas Subject to Natural Hazards requires that local governments "adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards" (State of Oregon, Department of Land Conservation and Development, N.d.) Goal 7, along with other land use planning goals, has helped to reduce losses from natural hazards.

Through risk identification and the recommendation of risk-reduction actions, this plan aligns with the goals of Marion County's Comprehensive Plan, and helps each jurisdiction meet the requirements of Oregon Statewide Planning Goal 7. The primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions. However, additional resources exist at the state and federal levels. Some of the key agencies in this area include Oregon Department of Emergency Management (OEM), Oregon Building Codes Division (BCD), Oregon Department of Forestry (ODF), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Department of Land Conservation and Development (DLCD).

Figure 1-1, Uncertain World of Hazard Mitigation



Source: Oregon Partnership for Disaster Resilience

1.6 How Was the Plan Developed and Updated

The 2023 Marion County Multi-Jurisdictional All-Hazards Mitigation Plan update is the result of multiple community and stakeholder engagement activities. To facilitate the HMP update, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) to research, facilitate and complete the plan update process. As part of that process, Marion County Emergency Management coordinated with multiple stakeholders and conducted an internal process using the methodology developed by University of Oregon during the 2016 HMP update described below:

- **Marion County HMP steering committee**. Marion County formally convened the HMP steering committee on eleven occasions to discuss and revise the plan. Steering committee members contributed data, maps, and reviewed and updated the community profile, risk assessment, action items, and implementation and maintenance plan.

- **Lifeline Sector Assessment**. The UO Community Service Center previously conducted assessments of four Marion County identified lifeline sectors – communication, energy, transportation, and water. The assessment included review of each sector's adaptive capacity and vulnerabilities, as well as critical dependencies and interdependencies. These sections were reviewed and updated as needed by DLCD and Marion County Emergency Management.
- **Threat Hazard Identification and Risk Assessment (THIRA)** process. In conjunction with the HMP update, Marion County initiated FEMA's a four-step common risk assessment process known as THIRA. The process engages individuals, businesses, faith-based organizations, nonprofit groups, schools and academia and all levels of government to better understand its risks and estimate capability requirements as they relate to the 32 core capabilities.
- **North Santiam Watershed Drought Contingency Plan** (DCP). Marion County participated in the Santiam Water Control District's Bureau of Reclamation funded. Drought Planning project. Findings and recommendations of the Drought Task Force are included by reference where appropriate in the HMP.
- **Marion County Community Wildfire Protection Plan (CWPP).** During the 2022 HMP update, Marion County Emergency Management, the Fire Defense Board, and the Oregon Department of Forestry initiated an update of the Marion County Community Wildfire Protection Plan. Developed to meet the requirements of the Healthy Forest Restoration Act, FEMA Disaster Mitigation Act of 2000, National Cohesive Wildland Fire Management Plan, 2010 Comprehensive Strategy, Senate Bill 360, Flame Act 2009, and the Oregon Statewide Land Use Planning Goal 4 and 7, findings and recommendations of the CWPP working group are included by reference where appropriate in the HMP.
- **Marion County Emergency Operations Plan (EOP).** During the 2016 HMP update, Marion County Emergency Management initiated an update of its Emergency Operations Plan. To ensure consistency across local hazard planning documents, the risk assessment information in the HMP is consistent with the EOP, THIRA and other emergency management assessment data and plans.
- **FEMA Middle-Willamette Risk Map Project.** FEMA Region X initiated the Discovery effort for the Middle Willamette Watershed in December 2015. Risk MAP Discovery is a process of data collection, hazard mapping, and cooperative information exchange with community stakeholders to understand a watershed area. FEMA Region X determined that a flood risk project is not appropriate at this time. If this need is identified in the future, FEMA Region X and Marion County Emergency Management will collaborate on project planning.

- **Hazardous Materials: Commodity Flow Study.** In February 2016 the Marion County Emergency Management Office commissioned a Hazardous Materials Commodity Flow Study (HMCFS), to be carried out by the Center for Public Service (CPS) research team at Portland State University. PSU completed the study in accordance with recommendations from the US Department of Transportation (USDOT). The HMCFS identifies the types and amounts of hazardous materials transported through Marion County and provides a methodological approach to understanding the unique hazards that may be present. The HMCFS findings provide the data necessary to estimate risks facing the County and provide grounding for emergency response and other emergency management related plans.

The Marion County Emergency Manager is responsible for implementing, maintaining, and conducting future updates of the plan. The public will have the opportunity to provide feedback about the plan in an ongoing fashion. The steering committee will meet on a semi-annual basis to discuss implementation of the plan, as well as updating the plan.

1.7 How is the Plan Organized

Each volume of the Plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing county and city residents, businesses, and the environment. Combined, the sections work in synergy to create a mitigation plan that furthers the community's mission to reduce or eliminate long-term risk to people, property, and the environment from hazards. This plan structure enables stakeholders to use the section(s) of interest to them.

Volume I: Basic Plan

Section 1: Introduction

The Introduction describes the purpose of mitigation planning, as well as the framework for developing the plan.

Section 2: Risk Assessment

The risk assessment provides the factual basis for the mitigation strategies contained in Section 3. The risk assessment includes a brief description of community sensitivities and vulnerabilities, and characteristics that may be impacted by all-hazards.

A hazard summary is provided for each of the hazards addressed in the HMP, which includes a hazard characteristic, history, probability assessment, and vulnerabilities. The following hazards are profiled in the risk assessment: Drought, Earthquake, Flood, Landslide, Volcano Eruption, Wildfire, Severe Weather.

Section 3: Mitigation Strategy

This section documents the plan's missions, goals, and actions. Actions address community vulnerabilities that are identified in the risk assessment.

Section 4: Implementation & Maintenance

This section provides information on the implementation and maintenance of the plan. It describes the process for prioritizing strategies and includes suggested tasks for semiannual maintenance and five-year plan update processes.

Section 5: Plan Adoption

This section describes the process taken to secure a FEMA approved plan.

Volume II: City/Special District Addendums

This section contains city addenda for the cities of Aumsville, Aurora, Detroit, Gervais, Idanha, Jefferson, Keizer, Keizer Fire District, Mill City, Mt. Angel Fire District, Scotts Mills, Stayton, Sublimity, Turner, Woodburn, and Woodburn Fire District. These addenda describe how each city's risk from hazards varies from that of the county and includes city-specific action items and plan implementation and maintenance strategies.

Volume III: Appendices

The resource appendices provide supplemental information to the Plan, as well as resources for users and interested parties.

Appendix A: Marion County Priority Actions

This appendix contains the detailed action items for each of the mitigation strategies identified in this Plan.

Appendix B: Community Profile

The community profile describes the county and participating cities from several perspectives to help define and understand the regions sensitivity and resilience to hazards. The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the region when the Plan was updated. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by hazard incidents, (e.g., special populations, economic factors, and historic and cultural resources).

Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs).

Appendix C: Planning and Public Process

This appendix includes documentation of all the countywide public processes utilized to develop the Plan. It includes an overview of the outreach strategy used, project timeline, and shares documentation of these efforts including Steering Committee meeting agendas and notes, as well documentation of the public outreach conducted.

Appendix D: Marion County Hazard Vulnerability Survey Report

This section presents the survey and its results conducted during the 2022 HMP update process.

Appendix E: Economic Analysis of Hazard Mitigation Projects

This appendix describes the Federal Emergency Management Agency's (FEMA)

requirements for benefit cost analysis in hazard mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities. The Oregon Partnership for Disaster Resilience developed this appendix, but this version has been updated by DLCD with new links at the end and reformatted. It has been reviewed and accepted by FEMA as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Appendix F: Grant Programs

This appendix lists state and federal resources and grant programs.

Appendix G: Hazard History

Past hazard events are listed, described, and documented in detail in this section.

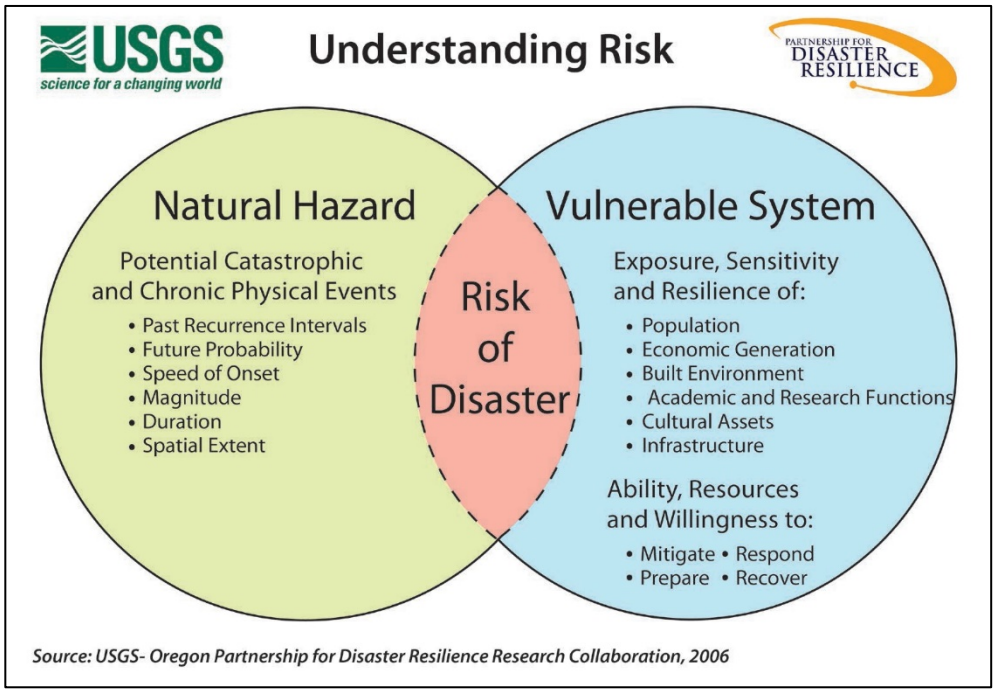
Volume IV: DOGAMI Report

2 Risk Assessment

This section of the HMP addresses 44 CFR 201.6(c)(2) - Risk Assessment. The Risk Assessment applies to Marion County, the cities of Aumsville, Aurora, Detroit, Gervais, Hubbard, Idanha, Jefferson, Keizer, Mill City, Mt. Angel, Scotts Mills, Stayton, Sublimity, Turner and Woodburn, and the special districts of Keizer Fire District, Mt. Angel Fire District, and Woodburn Fire District. City specific information is called out where relevant. In addition, this chapter can assist with addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

The information presented below, and community characteristics presented in the Community Profile are used to inform the risk reduction actions identified in Section 3 – Mitigation Strategy. The risk assessment process is graphically depicted in Figure 2-1 below. Ultimately, the goal of hazard mitigation is to reduce the area where hazards and vulnerable systems overlap.

Figure 2-1, Understanding Risk



2.1 Risk Assessment Approach

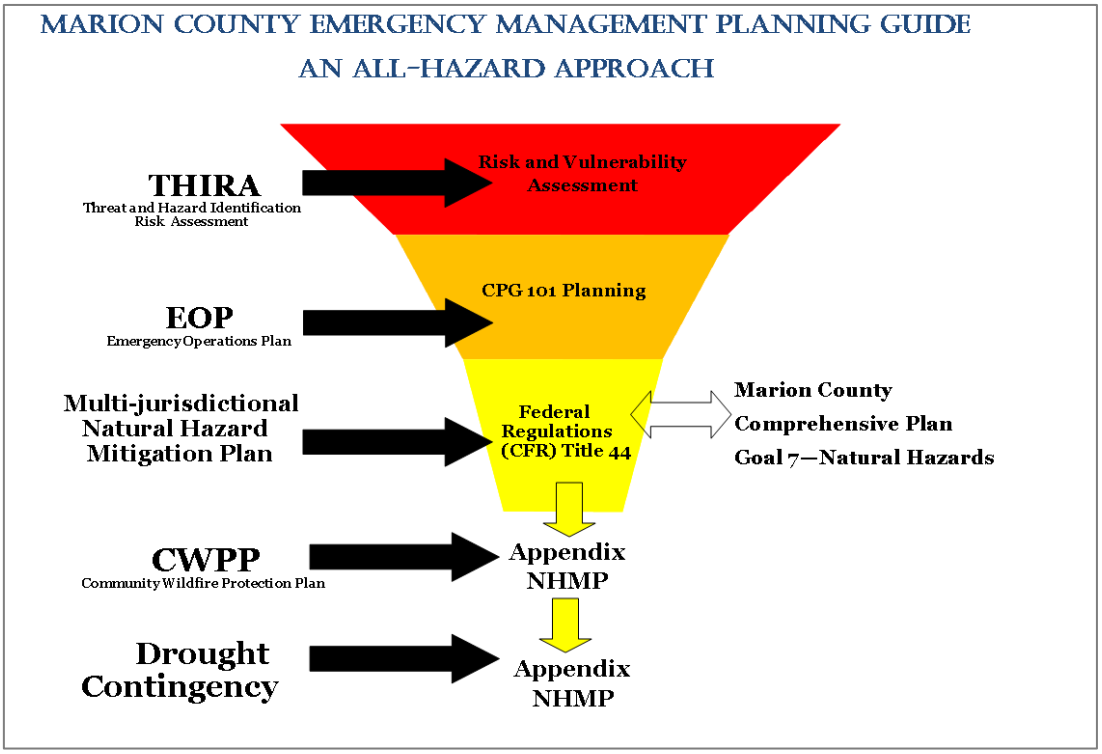
A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce loses from identified hazards." To complete the risk assessment, the HMP update team first updated the description, type, location, and extent of each hazard. Next, the team updated the vulnerability information based on each hazard's potential impact on the community. Next, the HMP update team held interviews with each community and special district stakeholder that participates in this plan, to acquire their information concerning their threats and hazards to their local communities.

For this HMP update, the risk assessment also focusses on four key lifeline sectors: transportation, water, communication, and energy. The lifeline sector risk assessment process included assessing each sector's existing infrastructure, determining potential impacts and sensitivity to specific hazards, and developing risk reduction recommendations for each sector.

Finally, the risk assessment integrates relevant information and data from the Marion County Comprehensive Risk Assessment and other multi-hazard specific assessment activities.

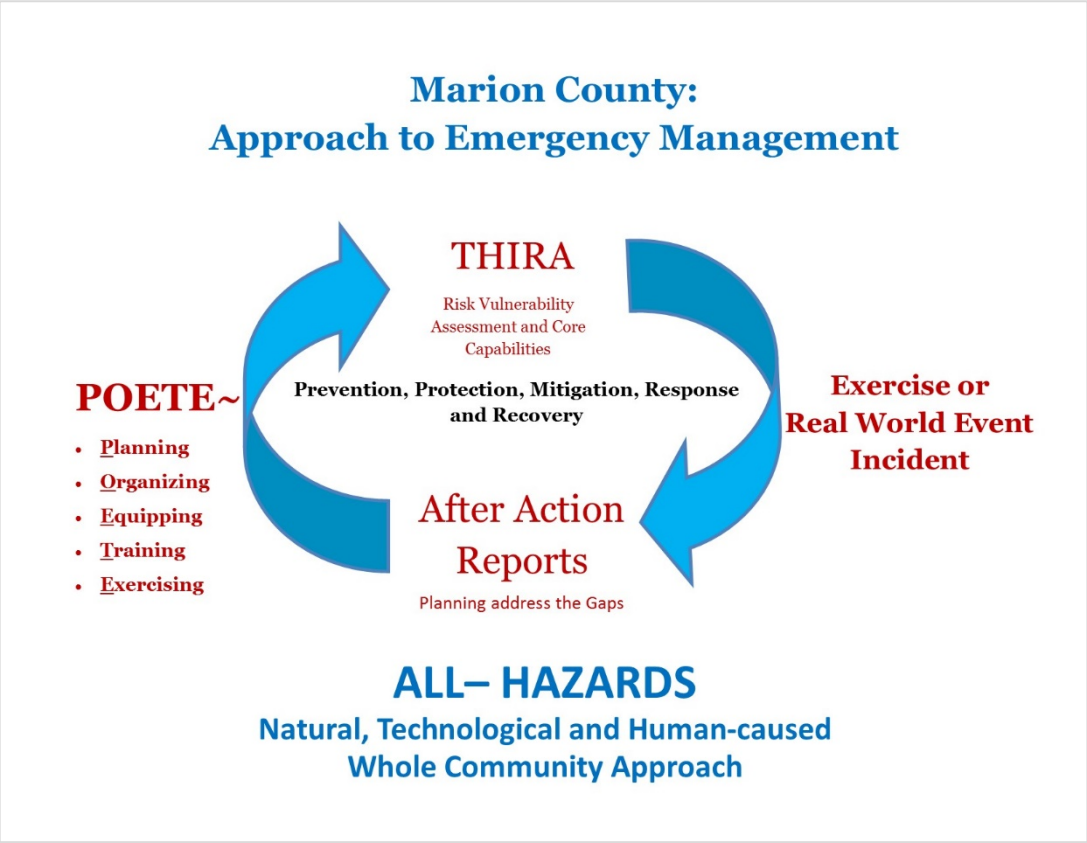
Marion County's approach to all-hazard risk assessment is presented in Figures 2-2 and 2-3 below.

Figure 2-2, Marion County Emergency Management Planning Guide



Source: Marion County Emergency Operations Plan, 2020-2025

Figure 2-3, Marion County Approach to Emergency Management



Source: Marion County Emergency Management

2.2 Federal Disaster and Emergency Declarations

Reviewing past events can provide a general sense of the hazards that have caused significant damage in the county. Where trends emerge, disaster declarations can help inform hazard mitigation project priorities.

President Dwight D. Eisenhower approved the first federal disaster declaration in May 1953 following a tornado in Georgia. Since then, federally declared disasters have been approved within every state because of natural hazard related events. As of May 2016, FEMA has approved a total of 30 major disaster declarations, two (2) emergency declarations, and 64 fire management assistance declarations in Oregon (Department of Homeland Security, Federal Emergency Management Agency, 2021). When governors ask for presidential declarations of major disaster or emergency, they stipulate which counties in their state they want included in the declaration. Table 2-1 summarizes the major disasters declared in Oregon that have included Marion County since 2009. The table shows that there have been eight (8) major disaster declarations for the county. All but two of these were related to severe wind or storm events in the county resulting primarily in flooding, landslides, and wind damage.

An Emergency Declaration is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and

funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring.

Table 2.1, FEMA Major Disaster (DR), Emergency (EM), and Fire Management Assistance (FMA) Declarations for Marion County from 2009-2022

Declaration Number	Declaration Date	Incident Period	Incident
DR-4599-OR	May 4, 2021	February 11-15, 2021	Winter Storm
DR-4562-OR	Sept. 15, 2020	Sept. 7-Nov. 3, 2020	Wildfire and Straight-line Winds
DR-4499-OR	March 28, 2020	January 20, 2020, and continuing	COVID-19
DR-4055-OR	March 2, 2021	January 17-21, 2012	Severe Winter Storm, Flooding, Landslides and Mudslides
DR-1824-OR	March 2, 2009	Dec. 13-26, 2008	Severe Winter Storm, Record and Near Record Snow

Source: FEMA Disaster Declarations for States and Counties

2.3 Risk Assessment Summary

Multi-jurisdictional Risk Assessment - §201.6(c) (2) (iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area. This section contains both a risk assessment prepared by Marion County staff for risks facing the county as well as a summary of the risk assessments for all the other jurisdictions participating in this multi-hazard Hazard Mitigation Plan update.

Marion County is vulnerable to a wide range of hazards that threaten its communities, businesses, and environment. To determine the hazards that pose the greatest threat, Marion County has prepared a Threat Hazard Identification and Risk Assessment. The County has utilized a method developed by BOLD Planning, Critical Priority Risk Index, to document and maintain the county's comprehensive risk assessment. The risk assessment is maintained as a formal annex to the Marion County Emergency Operation Plan.

Critical Priority Risk Index

The objective of any risk analysis is to minimize impact and maximize response efforts. In order to accomplish these all-relevant hazards, potential vulnerabilities and exposures for the region or jurisdiction should be assessed in a consistent way, with a clear numeric methodology. Based on this understanding of risk, communities can then develop a

strategy to identify and prioritize response, continuity, and mitigation actions.

Hazard Analysis Definitions

- **Hazard**
  - A potential source of injury, death, or damage
- **Vulnerability**
  - Susceptibility to injury, death, or damage
- **Exposure**
  - People and property within the area the potential hazard could affect.
- **Risk**
  - The likelihood of a hazard resulting in injury, death, or damage.
- **Mitigation**
  - A systematic reduction to the exposure and vulnerability to a potential hazard.

Based on the identification of potential hazards, a robust hazard profile includes data concerning previous occurrences, the probability of future occurrences and the threat to the County.

Hazards can be defined individually in each plan for specific considerations, or at the Master level where overall hazards and vulnerability do not vary greatly across the jurisdiction. Weather-related and large-scale infrastructure hazards such as drought, extreme temperatures, hail, windstorms, and utility failures can affect an entire region.

As such, these hazards are built out at the master level; however, some hazards such as dam and levee failure, flood and erosion or subsidence soils may have local variations and multiple profiles may be developed if the risk is not uniform across the jurisdiction or organization. For each identified hazard the following information should be provided in the description and impact statement sections:

- **Hazard Description**
  - A general discussion of the hazard and its outcome.
- **Hazard Location**
  - The geographic extent or location of the hazard in the County.
- **Prior Instances**
  - Information on historic incidents and their impact.
- **Associated Secondary Hazards**
  - Those hazards of a unique nature that stem from the original occurrence.
- **Probability of Future Occurrence**

- Frequency of past events used to gauge the likelihood of future occurrences.

CPRI Calculations

MCEM uses the Calculated Priority Risk Index (CPRI) methodology to prioritize each of the identified hazards across the County. CPRI rankings consider the following four elements of risk:

- Probability
- Magnitude / Severity
- Warning Time
- Duration

The following tables provide a summary for each of the risk elements, including a rationale behind each numerical ratio.

Table 2.2, CPRI Risk Elements, Probability

	Rating	Rating Criteria
Probability	4 – Highly Likely	▪ Event is probable within the calendar year. ▪ Event has up to 1 out of 1 chance of occurring this year. ▪ History of events is greater than 33% likely per year.
	3 – Likely	▪ Event is probable within the next 3 years. ▪ Event has up to 1 in 3 years chance of occurring. ▪ History of events is greater than 20% but less than or equal to 33% likely per year.
	2 – Intermittent	▪ Event is probable within the next 5 years. ▪ Event has up to 1 in 5 years chance of occurring. ▪ History of events is greater than 10% but less than or equal to 20% likely per year.
	1 – Unlikely	▪ Event is possible within the next 10 years. ▪ Event has up to 1 in 10 years chance of occurring. ▪ History of events is less than or equal to 10% likely per year.

Table 2.3, CPRI Risk Elements, Magnitude-Severity

	Rating	Rating Criteria
Magnitude / Severity	4 - Catastrophic	▪ Multiple fatalities. ▪ Complete shutdown of facilities for 30 or more days. ▪ More than 50% of property is severely damaged.
	3- Critical	▪ Injuries and/or fatalities result in permanent disability. ▪ Complete shutdown of critical facilities for at least two (2) weeks. ▪ 25-50% of property is severely damaged.
	2- Limited	▪ Injuries and/or illnesses do not result in permanent disability. ▪ Complete shutdown of critical facilities for more than one (1) week. ▪ 10-25% of property is severely damaged.
	1- Negligible	▪ Injuries and/or illnesses are treatable with first aid. ▪ Minor quality of life lost. ▪ Shutdown of critical facilities and services for 24 hours or less. ▪ Less than 10% or property is severely damaged.

Table 2.4, CPRI Risk Element-Warning Time

	Rating	Rating Criteria
Warning Time	4	Less than 6 hours
	3	6 to 12 hours
	2	12-24 hours
	1	24+ hours

Table 2.5, Risk Assessment Hazard Ranking Scoring Values

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

Source: Marion County Emergency Management; BOLD Planning

For emergency management planning purposes, the critical analysis that must be undertaken is an assessment of the consequences of each hazard, including potential area of impact, population exposed and impacted, duration of the hazard, and potential economic consequences. These rankings utilize the criteria laid out in the THIRA assessment to weight them proportionally using historic data as well as future projections based on economic, demographic, the critical infrastructure information. The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate – Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low – Low probability of occurrence or low threat to population; minor physical impacts. A summary of the risk assessment findings and rankings prepared by Marion County staff and DLCD project managers for risk facing the county is presented below.

Using the rankings described in the tables above, the following weighted formula was used to determine each hazard's CPRI.

(Probability x 0.45) + (Magnitude x 0.30) + (Warning time x 0.15) + (Duration x 0.10)

When discussing probability, it is important to note that while many events occur frequently, they often result in little quantifiable impact. For example, lighting strikes the earth on average of 2,000,000 timers per year; however, few of these strikes have adverse outcomes.

As such, when discussing the probability for each hazard, the discussion will be framed by the likelihood of that event have a measurable, large scale or detrimental impact. In addition, it is important to note that the occurrence of many, if not all, hazard event cannot be predicted with certainty. Simply because an event has occurred once prior, even if

devastating, does not significantly weight its likelihood of reoccurrence with any certainty.

The CPRI values should be general indicators of response action criticality in an EOP or COOP plan. The following table details planning significance in the CPRI ranges:

Table 2.6, CPRI Rang Values

CPRI Range Values		
Impact	**Low CPRI**	**High CPRI**
High	3.0	4.0
Moderate	2.0	2.9
Low	.10	1.9

The terms high, moderate, and low indicate the level of prioritization in response efforts for each hazard, and do not indicate the potential impact of a hazard occurring. Hazards rated with moderate or high significance should be more extensively discussed due to the availability of data and historic occurrences, while those with a lower significance more generally addressed due to lack of available data and historical occurrences.

Marion County is vulnerable to a wide range of hazards that threaten its communities, businesses, and environment. To determine the hazards that poses the greatest threat,

Marion County has prepared a Threat Hazard Identification and Risk Assessment. The major findings are summarized below. The assessments were developed from historical data of events that have occurred and specifically examined.

Table 2.7, Hazard and Vulnerability Assessment Summary for Marion County - Natural Hazards

Hazard Profile Summary for Marion County Using Bold Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Earthquake	4	4	4	4	4.0	**High**
Wildland Interface Fire	4	4	2.5	4	3.6	**High**
Drought	4	1	3	4	3.3	**High**
Flood	4	1.5	2.5	3.5	3.1	**High**
Dam or Levee Failure	2	3.5	4	4	3.0	**High**
Landslide	3	4	2.5	3	3.0	**High**
Extreme Weather - High Temperature	3	1	3	3.5	2.8	**Moderate**
Severe Weather/Storm	3	1	3	3	2.7	**Moderate**
Tornado	1.5	4	2.5	2.5	2.2	**Moderate**
Avalanche	2	4	1.5	1.5	2.1	**Moderate**
Volcanic Eruption	1.5	1	3	3	2.0	**Moderate**

Source: Marion County Emergency Management, BOLD Planning Hazard Analysis Conducted 10/14/2021

Figure 2-4, Hazard and Vulnerability Assessment Summary for Marion County - Other Hazards

Hazard Profile Summary for Marion County Using Bold Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Terrorism/Active Shooter/Workplace Violence	4	4	3.5	3.5	3.8	**High**
Hazardous Materials - Non-Transportation	4	4	3.5	3	3.8	**High**
Fire - Residential / Commercial (Arson)	4	4	3.5	3	3.8	**High**
Hazardous Materials Release - Transportation	4	4	3	3	3.6	**High**
Cyberterrorism	3	4	3.5	4	3.4	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	3	4	3.5	4	3.4	**High**
Unauthorized Entry	3	4	2.5	2.5	3.0	**High**
Public Health	3	1	3.5	4	3.0	**High**
Agricultural Terrorism	2	1	3.5	4	2.5	**Moderate**

Source: Marion County Emergency Management, BOLD Planning Hazard Analysis Conducted 10/14/21

The summary table for the entities who will hold plans as part of this multi-jurisdictional hazard mitigation plan is below. The table could be reorganized to see regional differences, but here it is alphabetical. Other interested parties completed Hazard Vulnerability Assessment exercises that are incorporated throughout the risk assessment and capability analysis rather than as the tables produced during the interviews. These organizations include Salem Health, Salem Water Control District, Consumer Power, and Santiam Electric.

Table 2.8, Summary of HVA Scores

Average of all scores in Marion County	Aumsville & Aumsville RFPD	Aurora & Aurora RFPD	Detroit	Gervais	Hubbard & Hubbard RFPD	Idanha	Jefferson	Keizer & Keizer FD	Mill City	Mt. Angel	Scotts Mills	Stayton	Sublimity	Turner RFPD	Woodburn	Average Risk Score
Natural Hazard																
Earthquake	2.8	3.5	3.7	3.6	4.0	3.6	3.6	3.3	2.8	3.6	4.0	3.6	3.3	3.4	4.0	3.5
Wildland Interface Fire	3.0	3.3	4.0	1.8	4.0	4.0	2.0	3.7	3.4	3.2	3.9	3.7	3.7	2.7	3.0	3.3
Severe Weather/Storm	3.6	2.9	2.9	2.4	3.6	3.4	2.0	2.4	3.3	3.4	3.9	2.6	4.0	3.2	3.3	3.1
Extreme Weather - High Temperature	2.4	2.4	2.1	2.3	3.4	2.8	2.0	2.4	3.0	3.0	2.4	3.1	2.6	2.6	2.7	2.6
Tornado	2.8	2.2	1.8	2.7	3.1	2.7	1.6	2.4	1.1	2.8	3.1	3.3	2.4	2.3	2.3	2.4
Drought	2.8	2.2	2.7	1.0	2.4	2.2	1.0	2.1	2.8	2.8	2.4	2.8	2.8	2.6	2.8	2.4
Flood (including dam failure)	2.1	2.2	2.0	2.4	2.4	2.1	2.4	2.4	2.0	2.1	2.7	2.4	1.0	2.7	2.8	2.2
Landslide	1.7	1.3	3.2	NA	2.2	3.2	1.0	2.1	2.4	1.3	3.6	2.0	1.0	2.1	1.7	2.1
Volcanic Eruption	1.7	2.0	2.1	2.4	1.9	1.9	1.5	2.1	1.8	2.4	2.2	2.2	1.6	1.5	1.7	2.0
Avalanche (new in 2021)	1.0	1.0	2.1	NA	1.0	2.3	1.0	1.0	1.5	1.0	1.3	NA	1.0	1.6	1.7	1.4
Other Hazards																
Hazardous Materials Release - Transportation	2.7	3.5	3.6	3.2	3.3	3.7	2.5	2.9	3.2	3.1	2.4	2.9	3.0	2.5	3.3	3.0
Public Health	1.0	2.1	3.6	3.3	4.0	3.0	2.5	3.3	2.8	3.2	3.0	3.0	2.7	3.0	2.8	2.9
Cyberterrorism	2.8	2.0	3.8	1.8	3.3	1.8	2.5	3.6	2.5	3.6	3.4	2.3	3.7	2.7	3.0	2.8
Terrorism, Active Shooter, Workplace Violence	3.1	3.1	2.4	3.1	2.5	1.8	3.1	2.7	3.1	3.1	2.4	2.5	3.1	3.0	3.0	2.8
Unauthorized Entry	2.5	2.5	2.5	2.5	3.1	2.5	2.4	3.1	2.4	3.6	2.8	2.625	2.5	2.7	2.4	2.7
Fire - Residential / Commercial (Arson)	2.4	2.5	2.5	2.5	2.7	2.5	2.5	2.9	2.5	3.4	2.8	3.0	2.7	2.6	2.4	2.7
Chemical, Biological, Radiological, Nuclear, Explosive	1.0	3.1	2.5	3.1	3.1	2.7	2.5	3.1	2.7	2.0	2.7	1.9	2.7	3.0	2.8	2.6
Hazardous Materials - Non-Transportation	1.0	2.9	2.0	2.0	2.8	2.0	2.4	3.2	2.5	3.6	1.0	3.0	2.6	2.5	3.6	2.4
Agricultural Terrorism	1.0	1.9	2.1	1.3	2.5	1.3	2.1	2.7	1.9	2.4	2.2	2.7	2.2	2.1	2.5	2.0

Source: Work Product of DLCD Project Team, August 2022

2.4 Hazard Identification and Assessment

The 2020 State of Oregon NHMP Region 3 Risk Assessment identifies potential hazards in Marion County. Table 2.9 compares the natural hazards listed in the Marion County Comprehensive Risk Assessment with those identified in the State of Oregon NHMP for the Mid/Southern Willamette Valley (Region 3). Table 2-5 identifies other hazards listed in the Marion County Threat and Hazard Identification Risk Assessment. These hazards are included for continuity with the EOP.

Table 2.9, Marion County Natural Hazard Identification

Marion County Natural Hazards	Oregon NHMP Region 3 – Mid & Southern Willamette Valley
Drought	Droughts
Earthquake	Earthquakes
Extreme Heat / High Temperature	Extreme Heat
Flood	Floods
Landslide	Landslides
Volcanic Eruption	Volcanoes
Wildland Interface Fire	Wildfires
Tornado	Windstorms
Severe Weather / Storm (Winter)	Winter Storms
Avalanche	NA

Source: State of Oregon NHMP, 2020; BOLD Risk Assessment Data 2021

Table 2-5, Marion County Non-Natural Hazards

Marion County Non-Natural Hazards	
Cyberterrorism	Hazardous Materials – Non-Transportation Release
Hazardous Materials-Transportation Release	Unauthorized Entry
Fire – Residential or Commercial	Public Health Emergency
Terrorism, Active Shooter, or Workplace Violence	Agricultural Terrorism
Chemical, Biological, Radiological, Nuclear, Explosive (CBRNE)	

Source: 1Marion County Emergency Operations Plan (2020-2025), BOLD Risk Assessment Data (2021)

2.5 DOGAMI Multi-Hazard Risk Assessment

The Department of Geology and Mineral Industries performed a risk assessment for the communities of Marion County, Oregon, with funding provided by the Federal Emergency Management Agency (FEMA). The report, which is attached as Volume 4 DOGAMI Report, describes the methods and results of natural hazard risk assessments performed in 2021 and 2022 by the Oregon Department of Geology and Mineral Industries (DOGAMI) within the study area shown below in Table 2.10. The purpose of this project is to provide communities within the study area a detailed risk assessment of the natural hazards that affect them to enable them to compare hazards and act to reduce their risk. The risk assessment contained in this project quantifies the impacts of natural hazards to these communities and enhances the decision-making process in planning for disaster.

The DOGAMI Analyst arrived at these findings and conclusions by completing three main tasks: compiling an asset database, identifying, and using best available hazard data, and performing natural hazard risk assessment.

In the first task, they created a comprehensive asset database for the entire study area by synthesizing assessor data, U.S. Census information, Hazus-MH general building stock information, and building footprint data. This work resulted in a single dataset of building points and their associated building characteristics. With these data they were able to represent accurate spatial location and vulnerability on a building-by-building basis.

The second task was to identify and use the most current and appropriate hazard datasets for the study area. Most of the hazard datasets used in this report were created by DOGAMI; some were produced using high-resolution lidar topographic data. While not all the data sources used in the report are countywide, each hazard dataset was the best available at the time of writing.

In the third task the DOGAMI Analyst, Matt Williams, performed risk assessments using Esri® ArcGIS Desktop® software. He took two risk assessment approaches: (1) estimated loss (in dollars) to buildings from flood (recurrence intervals) and earthquake scenarios using FEMA Hazus®-MH methodology, and (2) calculated number of buildings, their value, and associated populations exposed to earthquake, and flood scenarios, or susceptible to varying levels of hazard from landslides, channel migration, wildfire, and volcanic lahar.

The findings and conclusions of this report show the potential impacts of hazards in communities within Marion County.

- While earthquake damage will occur throughout the entire county, extensive damage and losses are more probable in the northeastern portion of the county and areas of high liquefaction prone soils. Hazus-MH earthquake simulations illustrate the potential reduction in earthquake damage through seismic retrofits.
- Some communities in the study area have moderate risk from flooding, and we quantify the number of elevated structures that are less vulnerable to flood hazard. The analysis shows that new landslide mapping based on improved methods and lidar information show some communities are at risk to landslide hazard.
- Exposure to channel migration hazard is high for areas and communities along the Pudding River and Santiam and North Santiam Rivers.
- The wildfire hazard data used in this study was created prior to the unprecedented 2020 Labor Day Wildfires, however the results corresponded to the actual impacts of the 2020 Labor Day Wildfires in the county.
- Lahar hazard is a potential risk and could have significant impact for areas and the communities along the North Santiam River. The study's findings indicate that most of the critical facilities in the study area are at high risk from an earthquake and channel migration. We found that the two biggest causes of population displacement are earthquake and landslide hazard.

Results were broken out for the following geographic areas:

Table 2.10, Geographic Study Areas

- Unincorporated Marion County (rural)
- City of Aurora
- City of Donald
- City of Gervais
- City of Idanha
- City of Keizer
- City of Mount Angel
- City of Salem
- City of Silverton
- City of Stayton
- City of Turner
- Community of Four Corners
- Community of Butteville
- Community of Labish Village
- Community of Mehama
- City of Aumsville
- City of Detroit*
- City of Gates*
- City of Hubbard
- City of Jefferson
- City of Mill City*
- City of St. Paul
- *City of Salem (West Salem)
- City of Scotts Mills
- City of Sublimity
- City of Woodburn
- Community of Hayesville
- Community of Brooks
- Community of Marion

*Portions of the cities of Detroit, Gates, and Mill City that were within Linn County are included in this report. The City of Salem that was within Polk County was examined individually and designated as City of Salem (West Salem).

Selected Study-Wide Results **Total Buildings: 170,562** **Total estimated building value: $62 billion**	
Mt. Angel Deterministic Magnitude 6.8 Earthquake Scenario **Red-tagged buildings: 7,479*** **Yellow-tagged buildings: 17,028**** **Loss estimate: $6.7 billion** *Landslide (High and Very High-Susceptibility)* **Number of buildings exposed: 7,470.** **Exposed building value: $2.7 billion** ***Wildfire (High and Moderate Risk):*** **Number of buildings exposed: 2,819 Exposed building value: $814 million**	***100-year Flood*** Number of buildings damaged: 2,552 Loss estimate: $126 million. ***Channel Migration Zone (30-year):*** Number of buildings exposed: 826 Exposed building value: $300 million. ***Lahar (1,000 to 15,000-year):*** Number of buildings exposed: 1,789 Exposed building value: $415 million.
Red-tagged buildings are considered uninhabitable due to complete damage.** * Yellow-tagged buildings are considered limited habitability due to extensive damage.**	

2.6 Hazard Characterization

The following subsections list each natural hazard by type. Information presented includes descriptions developed for the 2016 Marion County THIRA and EOP update processes. Location, extent, history, and probability information is summarized for each hazard.

For additional background on the hazards, vulnerabilities, and general risk assessment information for Willamette Valley hazards in Oregon, refer to the State of Oregon NHMP, Region 3: Mid-Southern Willamette Valley Oregon (2020). Since the 2016 Marion County NHMP, several hazard events have occurred in the county. For a full hazard history, please see Appendix G, Hazard History.

2.6.1 Drought

Table 2.11, Drought Summary

Hazard	**Drought**
Type	Climatic
Speed of onset	Slow
Location	Varies, County wide
Extent	Moderate to Severe*
Prior Occurrences	Three > 6-month duration since 1982
Probability	9%
***Defines as between -2 and -4 on the National Resource Conservation Service (NRCS) Surface Water Supply Index (SWSI)**	

Source: Oregon NHMP, NRCS; analysis by OPDR

Characteristics

A drought is a period of drier than normal conditions. Drought occurs in virtually every climatic zone, but its characteristics vary significantly from one region to another. Drought is a temporary condition; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. The extent of drought events depends upon the degree of moisture deficiency, and the duration and size of the affected area. Typically, droughts occur as regional events and often affect more than one city and county.

The Marion County Emergency Operations Plan (EOP) defines the following drought sub-types as follows:

Meteorological drought happens when abnormally dry weather patterns dominate an area. This can include above average air temperatures in addition to low precipitation.

Hydrological drought occurs when low water supply becomes evident, especially in streams, reservoirs, and groundwater levels, usually after many months of meteorological drought. Meteorological drought can begin and end rapidly, while hydrological drought takes much longer to develop and then recover.

Socioeconomic drought relates the supply and demand of various goods (e.g., agricultural commodities) and services (e.g., outdoor recreation) to drought. Sometimes "agricultural drought" is defined separately; however, for this DCP it is included under socioeconomic drought. Likewise, environmental concerns may also be included here.

Regulatory drought relates to water shortages to specific water users because of water laws and regulations prioritizing water usage to what are deemed higher priority uses. Higher priority uses often include in-stream uses (i.e., leaving the water in the stream) to maintain environmental conditions for sensitive aquatic life. When regulatory drought occurs, those with junior water rights typically lose the use of their water first, with senior rights holders the last to be affected.

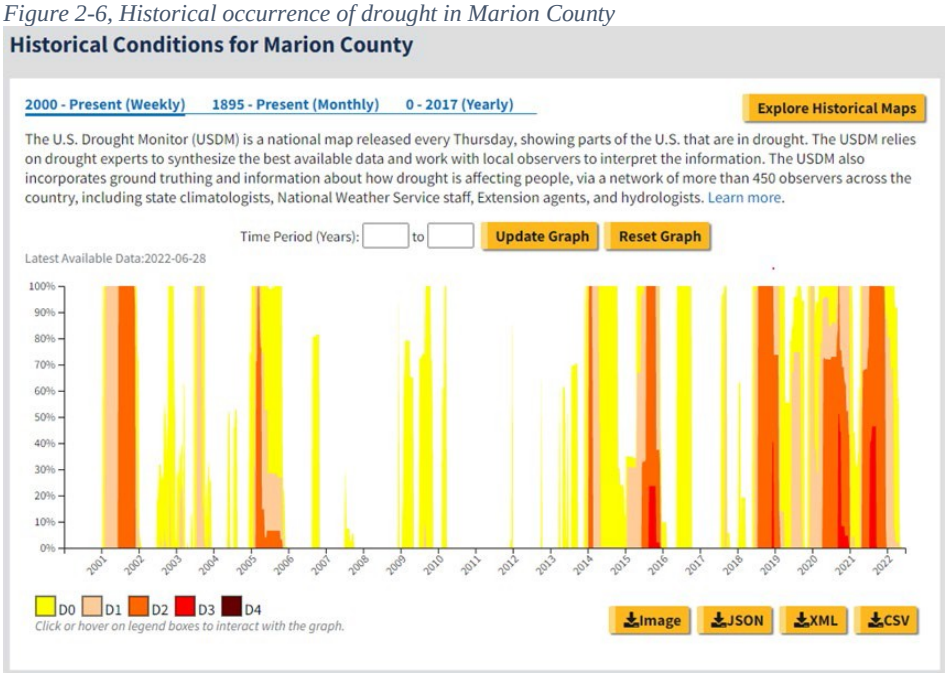
The Marion County EOP includes the following description of the drought hazard:

Drought can affect all segments of Marion County's population, particularly those employed in water-dependent activities (e.g., agriculture). Also, domestic water users may be subject to stringent conservation measures (e.g., rationing) and could be faced with significant increases in electricity rates. Water is not only a concern for drinking water, but irrigation, commercial (e.g., washing, canning), hydropower, fire suppression, habitat for fish and wildlife, recreation, and transportation. Therefore, a negative water flow could impact multiple productions. A deficiency of moisture has an adverse impact on people, animals, or vegetation over a sizeable area. The severity of a drought occurrence poses a risk for agricultural and timber losses, property damage, and disruption of water supplies and availability in urban and rural areas. In addition, water-borne transportation systems, such as the ferry in Buena Vista, could be impacted by periods of low water. Drought normally affects more people than other natural hazards, and its impact spreads over a larger geographical area. This makes it more difficult to assess impacts and to aid drought-stricken areas. In addition, drought has a direct impact on power for the Willamette Valley as there are two power sources Detroit Dam and Big Cliff that produce power.

Notably, the governor signed a drought declaration for Marion County covering the period from September 18 – December 31, 2015, (State of Oregon, Oregon Water Resources Department, N.d.).

Although the county saw Severe Drought conditions in 2018, 2020 and 2021 as measured by the US Drought Monitor, no other drought emergency declarations were made by the Oregon Governor. The figure below shows the increase in drought conditions in the recent past.

Figure 2-6, Historical occurrence of drought in Marion County



Source: Drought.Gov, consulted July 2022.

Location and Extent

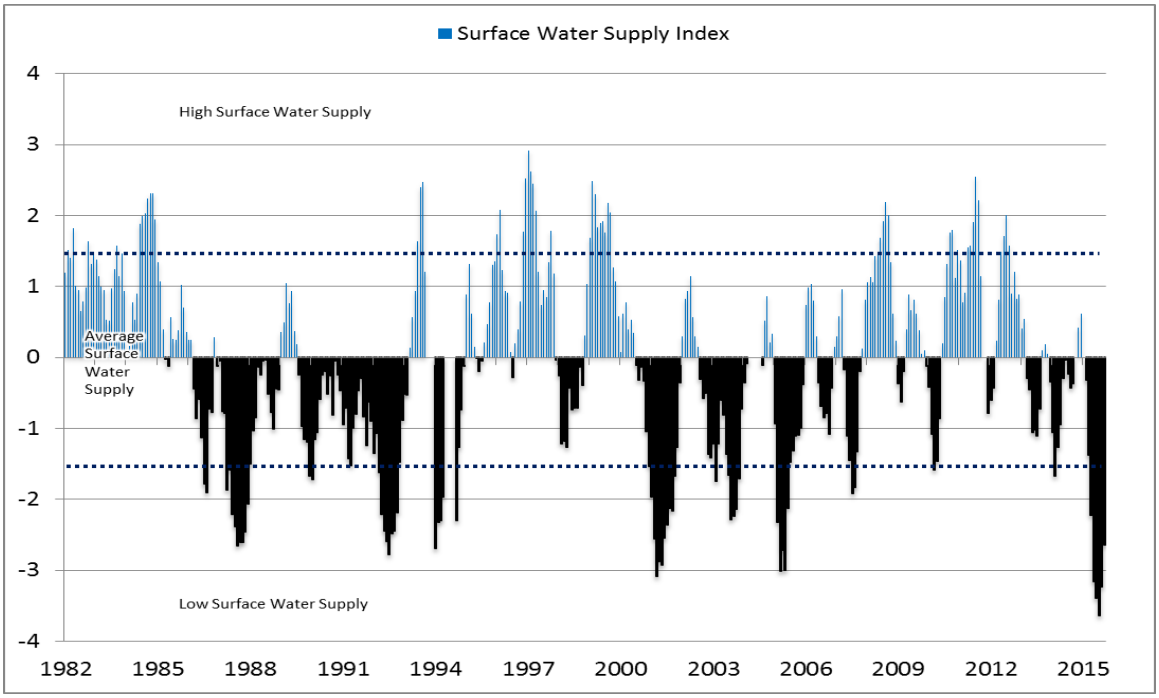
Droughts occur in every climate zone and can vary from region to region. Drought may occur throughout Marion County and may have profound effects on the economy, particularly the municipal water, agricultural, and recreation sectors. Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index that ranks severity. Most federal agencies use the Palmer Method which incorporates precipitation, runoff, evaporation, and soil moisture. However, the Palmer Method does not incorporate snowpack as a variable. Therefore, it is not believed to provide a very accurate indication of drought conditions in Oregon and the Pacific Northwest, although it can be very useful because of its a long-term historical record of wet and dry conditions.

With climate change, snow droughts—the type of drought in which snowpack is low, but precipitation is near normal—are expected to occur more often. The 2015 drought in Oregon was a "snow drought" and serves as a good example of what future climate projections indicate may become commonplace by mid-21st century. Going forward, drought indices that can account for a changing climate, such as the Standard Precipitation-Evapotranspiration Index (SPEI), may provide a more accurate estimate of future drought risks.

In the previous Marion County NHMP (2016) the Surface Water Supply Index (SWSI) from the Natural Resources Conservation Service was used as an index of current water conditions. The index utilizes parameters derived from snow, precipitation, reservoir, and stream flow data. The data is gathered each month from key stations in each basin. The lowest SWSI value, -4.2, indicates extreme drought conditions (Low Surface Water Supply ranges from -1.6 to -4.2). The highest SWSI value, +4.2, indicates extreme wet conditions (High Surface Water Supply ranges from +1.6 to +4.2). The mid-point is 0.0, which

indicates an average water supply (Average Water Supply ranges from +1.5 to -1.5). Figure 2-9 below shows the monthly history of SWSI values from February 1982 to October 2015 for the Willamette Basin which includes Marion County. Research shows that the periods of drought have fluctuated; recent drought periods occurred in 1987, 1992, 1994, 2001, 2003, 2005, and 2015.

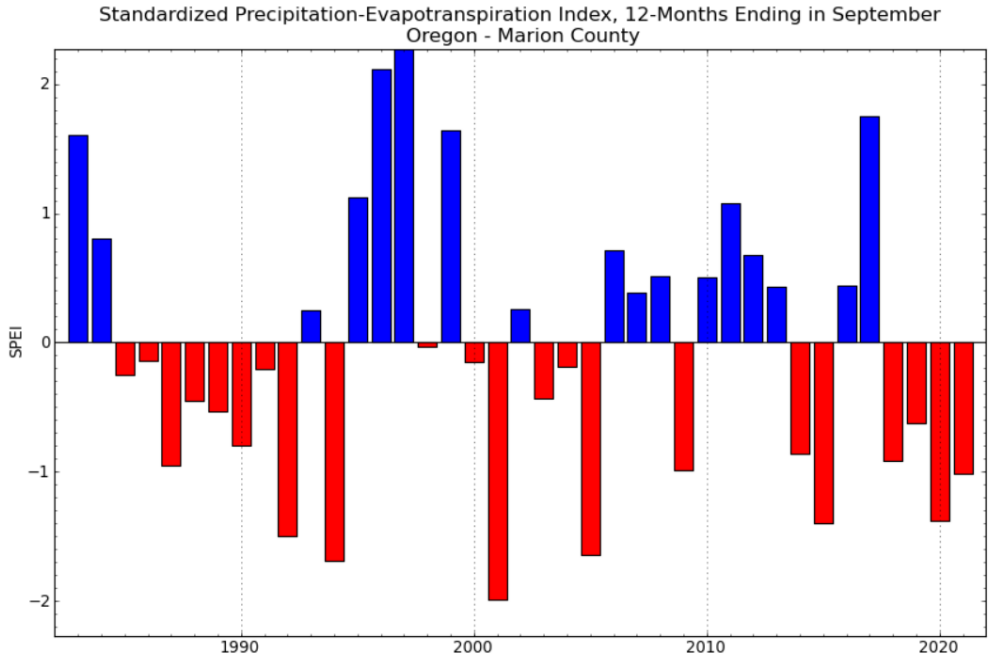
Figure 2-7, SWSI Values for the Willamette Basin (1982-2015)



Source: 2Department of Agriculture-Natural Resources Conservation Service, "Surface Water Supply Index, Willamette Basin" www.or.ncrs.usda.gov. Accessed February 2016

The 2020 Oregon NHMP uses the SPEI to estimate drought conditions and is presented below with the parameters set for 12-month time periods using the “water year” from October through September as the measure of water availability in Marion County. The time-period is set for 1982 through 2021 to mirror the data presented in the prior update.

Figure 2-8, SPEI for Marion County 1982-2021



Source: 3 West Wide Drought Tracker consulted August 2022

Additional information pertaining to the drought hazard in Marion County is available in the North Santiam Drought Contingency Plan, completed in April 2018. Additional information related to Marion County's Drought Contingency Planning efforts is discussed later in this section.

2.6.2 Earthquake

Table 2.12, Earthquake Summary Crustal

Hazard	Earthquake – Crustal
Type	Geologic
Location	Multiple active faults; Willamette Valley
Speed of Onset	Rapid
Extent	Very Strong to Severe Shaking, 500 years*
Prior Occurrence	One over Magnitude 5 last 100 years**
Probability	Approximately 1% annual
*** DOGAMI HazVu; ** PNSN- 1993 Scotts Mills just north of Marion County**	

Source: DOGAMI - Oregon HazVu; Oregon NHMP; Pacific Northwest Seismic Network

Table 2.13, Earthquake Summary Subduction

Hazard	Earthquake – Subduction
Type	Geologic
Location	Primarily west of Cascades; CA-BC
Speed of Onset	Rapid
Extent	Catastrophic
Prior Occurrence	One over Magnitude 9 last 500 years*
Probability	Magnitude 9+ is 7% - 12% over 50 years**
*** DOGAMI HazVu; ** Oregon Natural Hazard Mitigation Plan, analysis by Oregon Department of Geology and Mineral Industries (DOGAMI)**	

Source: DOGAMI, Oregon HazVu; Oregon NHMP; Pacific Northwest Seismic Network

Characteristics

The Pacific Northwest in general is susceptible to earthquakes from four sources: 1) the offshore Cascadia Subduction Zone; 2) deep intraplate events within the subducting Juan de Fuca Plate; 3) shallow crustal events within the North American Plate, and 4) earthquakes associated with volcanic activity. Marion County is primarily susceptible to crustal and subduction zone earthquakes.

According to the Oregon NHMP, the return period for the largest of the CSZ earthquakes (Magnitude 9.0+) is 530 years with the last CSZ event occurring 323 years ago in January of 1700. The probability of a 9.0+ CSZ event occurring in the next 50-years ranges from 7 - 12%. Notably, 10 - 20 “smaller” Magnitude 8.3 - 8.5 earthquakes occurred over the past 10,000 years that primarily affected the southern half of Oregon and northern California. The average return period for these events is roughly 240 years. The combined probability of any CSZ earthquake occurring in the next 50 years is 37 - 43%.

Location & Extent

The region has also been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered off the Oregon coast. There have been multiple moderate earthquakes in Marion County in the past 100 years. Earthquakes with magnitudes of 5.0 and 4.6 occurred in Salem in 1957 and 1963 respectively. Minor damage was reported following both events. The most significant event in the region occurred near Scotts Mills in March of 1993. This magnitude 5.7 event resulted in damage throughout Marion County. In Salem, the rotunda of the State Capitol cracked, and the

Golden Pioneer statue nearly rocked off its base. In Mount Angel, authorities closed the historic St. Mary Catholic Church for fear its 200-foot bell tower could collapse. Chunks of plaster fell from the walls at the Queen of Angels Monastery. Woodburn felt the strongest effects of the quake. Officials shut down four century-old brick and mortar buildings that began to crumble. At the Wal-Mart store, fumes overcame several employees when pesticides, paints and car batteries mixed.

Figure 2-11 shows a generalized geologic map of Marion County including active fault locations. The historic earthquake epicenters shown in the figure below are primarily small events below M 2.0. The larger events may have been slightly felt but little to no structural/property damage resulted. Thus, the risk of damaging seismic events in Marion County arises primarily from major earthquakes on the Cascadia Subduction Zone. Smaller, crustal earthquakes in or near Marion County could be locally damaging but would not be expected to produce widespread or major damage.

The Marion County Emergency Operations Plan (EOP) describes the Cascadia Subduction Zone threat as follows:

The 700-mile-long Cascadia Subduction Zone (CSZ) runs along Interstate 5 (I-5) and divides Marion County in half. When a 9.0 magnitude earthquake takes place and lasts 4 to 5 minutes in duration, the impact will be widespread. The shaking, liquefaction, lateral spreading, and co-seismic settlement will cause significant structural and non-structural damage to homes and businesses. Prospectively experts estimate 9,000 injuries and 400 fatalities along the I-5 corridor. Critical infrastructure systems will be disrupted, including the four major lifelines communications, energy, transportation, and water.

The utilities within the valley are estimated to be restored in six months to one year, water for drinking and or sewer will take one-month to one-year to be restored, transportation is estimated to have partial restoration of roads and bridges in six months to several years and communications is estimated to take two to three months to be restored. Secondary hazards will include but are not limited to spot fires and landslides. Population impacts are extensive as shelter services will be limited due to safety regulations of inhabited dwellings. Medically fragile patients will need to be evacuated in addition to commuters that will need reunification and may need life sustaining support. In addition, there will be major impacts on the economy and the way of life for months and even years following a catastrophic earthquake of this magnitude.

DOGAMI's Multi-hazard Risk Report for Marion County includes the following figure which shows anticipated shaking due to a magnitude 6.6 earthquake on the Mt. Angel fault or more information on the earthquake hazard in Marion County, refer to the following reports, incorporated herein by reference:

DOGAMI - IMS-24, - Geologic hazards, earthquake and landslide hazard maps, and future earthquake damage estimates for six counties in the Mid/Southern Willamette Valley including Yamhill, Marion, Polk, Benton, Linn, and Lane Counties, and the City of Albany, Oregon.

Interpretive Map Series: IMS-8 Relative earthquake hazard maps for selected urban areas in western Oregon: Canby-Barlow-Aurora, Lebanon, Silverton-Mount Angel, Stayton-Sublimity-Aumsville, Sweet Home, Woodburn-Hubbard.

Geologic Map Series: GMS-105 - Relative earthquake hazard maps of the Salem East and Salem West quadrangles, Marion and Polk Counties, Oregon by Yumei Wang and William J. Leonard, 1996, 10 p., 1:24,000. Interpretive Map Series: IMS-006 - Water-induced landslide hazards, western portion of the Salem Hills, Marion County, Oregon by Andrew F. Harvey and Gary L. Peterson, 1998, 13 p., 1:24,000.

Additional reports are available via DOGAMI's Publications Search website: https://www.oregongeology.org/pubs/index.htm

Oregon Seismic Safety Policy Advisory Commission Reports: Oregon Resilience Plan (2013). https://www.oregon.gov/oem/documents/oregon_resilience_plan_final.pdf

2.6.3 Flood

Table 2.14, Flood Summary

Hazard	Flood
Type	Climatic
Location	Mapped flood zones, flood plain
Speed of Onset	Slow to moderate
Extent	Moderate to severe
Prior Occurrence	Seventeen significant events since 1964
Probability	~18% overall; 1% annual within SFHA

Source: DOGAMI - Oregon HazVu; Oregon NHMP; FEMA NFIP; Oregon Risk Map

Characteristics

Flooding results when rain and snowmelt create water flow that exceeds the carrying capacity of rivers, streams, channels, ditches, and other watercourses. In Oregon, flooding is most common from October through April when storms from the Pacific Ocean bring intense rainfall. Most of Oregon's destructive natural disasters have been floods (Taylor, Hatton, & Taylor). The principal types of flooding that occur in Marion County include riverine floods, shallow area floods, and urban floods.

In Marion County there are numerous streams, creeks, and rivers that provide a water source for the community. If the water volume or flow rate exceeds the capacity of the channel, flooding is possible. Flooding occurs at various frequencies and heights along the various water channels located in the county and sister counties. Nearly every community in Marion County has been affected by flooding at some point.

Within the planning period for this update three incidents of flooding were reported through the NOAA Storm Event Database. These occurred in February 2017, April 2019, and December 2020. Details of these events can be found in Appendix G.

Location & Extent

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies often use historical records, such as streamflow gages, to determine the probability of occurrence for floods of different magnitudes. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year.

The magnitude of flood used as the standard for floodplain management in the United

States is a flood having a probability of occurrence of one percent in any given year. This flood is also known as the 100-year flood or base flood. The most readily available source of information regarding the 100-year flood is the system of Flood Insurance Rate Maps (FIRMs) prepared by FEMA. These maps are used to support the National Flood Insurance Program. The FIRMs show 100-year floodplain boundaries for identified flood hazards. These areas are also referred to as Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements. The DOGAMI Multi-hazard Risk Report for Marion County contains the following figure showing the SFHAs in Marion County following map updates in the City of Turner.

The Marion County EOP includes the following description of the flood hazard:

Some floodplain areas in Marion County are located amongst residential dwellings and have been mapped by FEMA. These floodplain areas are located throughout the Willamette River and Santiam River, as well as areas along smaller creeks. Other portions of Marion County, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage. Major river basins including the Willamette, Little Pudding and North Santiam drainages run through Marion County and the Mill Creek drainage running through Salem; all these drainages are subject to flooding. Ten dams also pose a significant hazard to Marion County; the Detroit reservoir is located 20 miles east of Salem. Excessive rain through the months of October to March there is potential for increased flooding, impacting communities in low lying areas or in areas adjacent to the flood plans. The flood waters can occupy major roadways and incapacitate bridges creating a transportation standstill minimizing the ability to rapidly respond.

Of special note, in January 2012, Marion County was 1 of 7 counties that sustained flood damage from heavy rain, wind, and ice. One hundred thirty homes and seven businesses were damaged in the City of Turner; 29 streets were closed in the City of Salem; the state motor pool lost 150 vehicles and thousands of gallons of fuel; Thomas Creek in the City of Scio overtopped, damaging several buildings (National Oceanic and Atmospheric Administration, N.d.). On December 18, 2015, in Turner, the Mill Creek almost flooded from a 7–8-year rain event. This was reported by a member of the NHMP steering committee.

National Flood Insurance Program (NFIP) Vulnerability

The Marion County Flood Insurance Rate Maps (FIRMs) for unincorporated Marion County and the cities of Turner and Salem became effective in October 2019. The City of Sublimity FIRM became effective in January 2003. The remaining cities have individual FIRMs current as of January 2000. Table 2.15 below shows that as of September 14, 2022, Marion County (including the incorporated cities) has 1,563 National Flood Insurance Program (NFIP) policies in force. Of those, 826 (53%) ensure structures constructed before development of the initial FIRM. FEMA has made 396 paid claims in the county totaling $5,878,435. Tables 2.16 show that the last Community Assistance Visit (CAV) for unincorporated Marion County occurred on July 28, 2021. Among the jurisdictions within the county the City of Keizer received the most recent CAV in the county on March 4, 2020. Unincorporated Marion County participates in the Community Rating System (CRS) as does the City of Salem. The county has a CRS rating of 6, 20% discount, 6 repetitive loss properties. The table below shows that the majority (just under 90%) of flood insurance policies are for residential structures, primarily single-family homes.

Table 2.15, Flood Insurance Participation

Community	Effective FIRM and FIS	Initial FIRM Date	Number Policies	Pre-FIRM Policies	Single Family	2-4 Family	Other Residential	Non-Residential	Minus Rated A Zone
MARION COUNTY									
MARION COUNTY*	10/18/2019	8/15/1979	235	124	207	1	4	23	7
AUMSVILLE, CITY OF	1/19/2000	3/1/1979	15	4	15	0	0	0	2
AURORA, CITY OF	1/19/2000	6/5/1997	2	1	2	0	0	0	0
DETROIT, CITY OF	1/19/2000	6/30/1976	1	0	1	0	0	0	0
GATES, CITY OF	1/19/2000	12/4/1979	2	1	2	0	0	0	0
GERVAIS, CITY OF	1/19/2000	6/30/1976	0	0	0	0	0	0	0
HUBBARD, CITY OF	1/19/2000	2/5/1986	0	0	0	0	0	0	0
JEFFERSON, CITY OF	1/19/2000	3/1/1979	10	4	10	0	0	0	0
MT. ANGEL, CITY OF	1/19/2000	1/19/2000	0	0	0	0	0	0	0
SALEM, CITY OF	10/18/2019	6/15/1979	723	464	440	86	54	143	32
SCOTTS MILLS, CITY OF	1/19/2000	3/1/1979	1	1	1	0	0	0	0
SILVERTON, CITY OF	1/19/2000	3/1/1979	71	30	43	5	21	2	20
ST. PAUL, CITY OF	1/19/2000	1/19/2000	0	0	0	0	0	0	0
STAYTON, CITY OF	1/19/2000	3/1/1979	17	8	15	0	0	2	0
SUBLIMITY, CITY OF	1/2/2003	1/19/2000	0	0	0	0	0	0	0
TURNER, CITY OF	10/18/2019	4/2/1979	143	34	133	7	0	3	0
WOODBURN, CITY OF	1/19/2000	3/1/1979	29	5	26	0	0	3	2
KEIZER, CITY OF	1/19/2000	8/15/1979	314	150	285	7	7	15	6
County Total:			**1,563**	**826**					

Source: FEMA CIS database consulted September 2022.

Table 2.16, Flood Insurance Detail

Community	Total Coverage	Total Premium	No. of Claims	No. of Pre-FIRM claims paid	Substantial Damage Claims	Paid Claims	Repetitive Loss Structures	CRS Class Rating	Last CAV Date	Last CAC Date
MARION COUNTY										
MARION COUNTY*	$64,663,800	$189,154	101	76	6	$ 1,218,648	20	6	07/28/2021	
AUMSVILLE, CITY OF	$3,851,600	$ 9,095	0	0	0	$ 0	0	na	09/24/1997	12/28/1990
AURORA, CITY OF	$633,000	$2,294	0	0	0	$ 0	0	na		12/02/1992
DETROIT, CITY OF	$70,000	$279	0	0	0	$ 0	0	na	01/01/1989	04/29/2021
GATES, CITY OF	$490,000	$838	0	0	0	$ 0	0	na		06/28/2021
GERVAIS, CITY OF	$0	$0	0	0	0	$ 0	0	na		03/14/1991
HUBBARD, CITY OF	$0	$0	0	0	0	$ 0	0	na	06/17/1991	
JEFFERSON, CITY OF	$2,936,400	$4,925	7	6	0	$ 43,990	0	na		
MT. ANGEL, CITY OF	$0	$0	4	3	0	$ 14,301	1	na		06/27/1991
SALEM, CITY OF	$ 199,098,100	$ 738,282	204	156	8	$ 3,472,820	27	4	3/22/2017	1/26/2022
SCOTTS MILLS, CITY OF	$144,100	$1,714	1	1	0	$ 11,254	0	na	03/31/1995	08/24/1992
SILVERTON, CITY OF	$ 18,262,300	$ 60,864	15	11	0	$ 70,080	0	na	03/31/1995	08/24/1992
ST. PAUL, CITY OF	$0	$0	0	0	0	$ 0	0	na		
STAYTON, CITY OF	$5,760,000	$10,086	1	0	0	$ 8,200	0	na	08/09/2006	08/24/1992
SUBLIMITY, CITY OF	$0	$0	0	0	0	$ 0	0	na		
TURNER, CITY OF	$ 41,345,600	$ 75,227	25	20	3	$ 595,584	3	na	02/06/2012	02/25/1993
WOODBURN, CITY OF	$ 7,667,900	$ 19,384	6	3	0	$ 14,781	0	na	06/24/2004	02/25/1993
KEIZER, CITY OF	$ 99,857,300	$ 198,812	32	20	1	$ 428,778	3	na	3/4/2020	6/27/1991
County Total:	**$444,780,100**	**$1,310,954**	**396**			**$5,878,436**	54			

Source: FEMA CIS database consulted September 2022.

2.6.4 Landslide

Table 2.17, Landslide Summary

Hazard	Landslide
Type	Climate / Geologic
Location	Steep slopes, weak geology (West Salem, East County
Speed of Onset	Slow too rapid
Extent	Minor to severe, but localized
Prior Occurrence	Landslides occur annually in Marion County
Probability	100% for minor events, 10%-20% for severe events.

Source: DOGAMI - Oregon HazVu; Oregon NHMP

Characteristics

A landslide is any detached mass of soil, rock, or debris that falls, slides, or flows down a slope or a stream channel. Landslides are classified according to the type and rate of movement and the type of materials that are transported. In a landslide, two forces are at work: 1) the driving forces that cause the material to move down slope, and 2) the friction forces and strength of materials that act to retard the movement and stabilize the slope. When the driving forces exceed the resisting forces, a landslide occurs.

Location & Extent

The severity or extent of landslides is typically a function of geology and the landslide triggering mechanism. Rainfall initiated landslides tend to be smaller, and earthquake induced landslides may be very large. Even small slides can cause property damage, result in injuries, or take lives.

The Marion County EOP includes the following description of the landslide hazard:

The landslide area within Marion County identified by the State Engineering Geologist is located on the west-facing slope of the Salem Hills and in the Cascades. The slides in this area have developed o n steep slopes of soils originating from the marine sedimentary bedrock units. Landslides also occur in the canyon of Abiqua Creek about five miles east of Silverton and along the slopes of the Little North Fork of the Santiam River. In these areas, the slides are developed in deeply weathered tuffs of the Mehama Volcanics. Landslides may also occur in the clay soils overlying the Columbia River Basalt in the Salem Hills area and in the Waldo Hills-Silverton Hills area, if slopes are artificially over steepened. Steep slopes associated with landslide activity areas are themselves a deterrent to high density development. The landslides or debris flows, (mudslides), may affect buildings, roads, and utilities. Landslides are one of the most widespread and damaging natural hazards in Oregon.

Of note in the 2016 Marion County Multi-Jurisdictional NHMP is North Fork Road which experiences regular (annual) landslides and closures.

More detailed landslide hazard assessment at specific locations requires a site-specific analysis of the slope, soil/rock, and groundwater characteristics at a specific site. Such assessments are often conducted prior to major development projects in areas with moderate to high landslide potential, to evaluate the specific hazard at the development site. Table 2-18 below shows Landslide Susceptibility and Exposure for the county and its incorporated jurisdictions. Notably, Scotts Mills and Idanha have significant percentages of landslide susceptible areas with very high exposure

Table 2.18, Landslide Susceptibility Exposure in Marion County by city

Jurisdiction	Area, ft^2	Low	Moderate	High	Very High
Marion County	33,185,295,063	42.4%	23.0%	28.8%	5.8%
Aumsville	30,637,393	93.0%	6.4%	0.6%	0.0%
Aurora	13,534,706	55.7%	35.7%	8.6%	0.0%
Detroit	26,659,361	45.5%	34.0%	20.6%	0.0%
Donald	7,787,724	99.2%	0.8%	0.0%	0.0%
Gates	7,683,876	50.2%	32.3%	17.5%	0.0%
Gervais	10,716,349	98.7%	1.3%	0.0%	0.0%
Hubbard	19,587,769	92.7%	5.4%	1.9%	0.0%
Idanha	23,496,523	29.9%	26.2%	21.0%	23.0%
Jefferson	22,291,901	90.4%	8.8%	0.8%	0.0%
Keizer	202,393,226	88.5%	9.8%	1.8%	0.0%
Mill City	23,105,987	74.5%	16.9%	8.6%	0.0%
Mt. Angel	29,486,393	89.0%	10.5%	0.5%	0.0%
Salem	1,368,874,853	69.3%	23.3%	3.5%	3.9%
Scotts Mills	10,197,012	29.6%	10.4%	3.3%	56.8%
Silverton	97,150,554	67.2%	25.7%	7.0%	0.0%
St. Paul	8,154,929	92.1%	7.1%	0.8%	0.0%
Stayton	81,891,198	84.6%	13.4%	2.0%	0.0%
Sublimity	25,724,506	93.3%	6.5%	0.1%	0.0%
Turner	40,337,405	63.7%	24.2%	7.2%	4.8%
Woodburn	148,853,259	92.0%	7.3%	0.7%	0.0%

Source: DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

or more information, refer to the following report and maps provided by DOGAMI:

- Introduction - SLIDO - Statewide Landslide Information Database for Oregon (SLIDO) - Oregon Department of Geology and Mineral Industries (oregongeology.org)
- Open File Report: O-16-02, Landslide Susceptibility Overview Map of Oregon
- Open-File Report: O-10-03, Digital geologic map of the southern Willamette Valley, Benton, Lane, Linn, Marion, and Polk Counties, Oregon

2.6.5 Volcano

Table 2.19, Volcano Summary

Hazard	Volcano
Type	Geologic
Location	Cascade Mountains
Speed of Onset	Slow too rapid
Extent	Moderate to severe
Prior Occurrence	One significant event 1980 (Mt. St. Helens)
Probability	<1% annual

Source: DOGAMI - Oregon HazVu; Oregon NHMP

Characteristics:

The Pacific Northwest lies within the "ring of fire," an area of very active volcanic activity surrounding the Pacific Basin. Volcanic eruptions occur regularly along the ring of fire, in part because of the movement of the Earth's tectonic plates. The Earth's outermost shell, the lithosphere, is broken into a series of slabs known as tectonic plates. These plates are rigid, but they float on a hotter, softer layer in the Earth's mantle. As the plates move about on the layer beneath them, they spread apart, collide, or slide past each other. Volcanoes occur most frequently at the boundaries of these plates and volcanic eruptions occur when molten material, or magma, rises to the surface.

The primary threat to lives and property from active volcanoes is from violent eruptions that unleash tremendous blast forces, generate mud and debris flows, or produce flying debris and ash clouds. The immediate danger area in a volcanic eruption generally lies within a 20-mile radius of the eruption location.

Location & Extent

Geologic hazard maps have been created for most of the volcanoes in the Cascade Range by the USGS Volcano Program at the Cascade Volcano Observatory in Vancouver, WA and are available at http://vulcan.wr.usgs.gov/Publications/hazards_reports.html.

Oregon is located on the Pacific Rim. Tectonic movement within the earth's crust can activate dormant volcanoes in or near Marion County resulting in eruptions, lahars and ash fallout. Volcanic activity is possible from anywhere along the Cascade Range. Direct impacts from lava are possible in the southeast corner of Marion County in the Cascade Range. Lahar flows are possible along most of Marion County's eastern border (see Figure 2-17) as shown emanating from Mount Jefferson, the closest potential source of volcanic activity. Of particular concern are communities and infrastructure throughout the Santiam Canyon has far west as Stayton. Ash fall is possible county wide with potential

impacts to municipal water and transportation systems as well as sensitive mechanical and electrical equipment.

The plate of the projected location of a lahar from Mount Jefferson into Marion County is included in the DOGAMI Multi-hazard Risk Assessment found in Volume 4.

The Marion County EOP includes the following description of the volcano hazard:

> *Several Oregon and Washington volcanos are located relatively near Marion County, including Mount St. Helens and Mt. Hood. In the past 200 years, seven of the Cascade volcanoes in the United States have erupted, including Mt. Baker, Glacier Peak, Mt. Rainier, Mount St. Helens, Mt. Hood, Mt. Shasta, and Mt. Lassen. Within Marion County, the impacts of volcanic events are likely to be only minor ash falls, lahars, and lava flow, with perhaps some impact on public water supplies, utilities and transportation including aviation. Impacts include temporary disruption of transportation, sewer disposal, and water treatment systems; highway and road closures; power outages; clogged filters and damage to mechanical equipment and vehicles; and eye irritation. Previous history of volcanic eruption includes the 1980 Mount St. Helens eruption; ash fall from which did not cause any major problems in Marion County. Eruptions in the Cascades have occurred at an average of 1-2 per century during the last 4,000 years and future eruptions are certain. Mount Jefferson poses the greatest threat of volcanic eruption to Marion County. Located on the eastern edge of the county, Mount Jefferson presents not only a threat of lahars and lava flows, but also a threat of ash fallout. The Cascade volcanic arc in central Oregon, from Mount Jefferson to Diamond Peak, is composed of hundreds of individual volcanoes that lie among the major volcanic centers of Mount Jefferson, Three Sisters, and Newberry Volcano. The area has witnessed numerous eruptions during the past 14,000 years.*

2.6.6 Wildfire

Table 2.20, Wildfire

Hazard	Wildfire
Type	Climatic, Human Caused
Speed of onset	Moderate to rapid
Location	County wide, Wildland Urban Interface
Extent	Minor to extreme
Prior Occurrences	74 fires from 2016 through 2021; 398,354 acres burned*
Probability	100% for minor events, 1% for extreme events
***Oregon Department of Forestry Data, consulted September 2022, ODF Fire | ODF Fire | ODF ArcGIS Hub**	

Source: DOGAMI - Oregon HazVu; Oregon NHMP

Marion County updated its Community Wildfire Protection Plan (CWPP) in 2017. The CWPP is incorporated into the NHMP by reference and will serve as the guiding document for wildfire mitigation activities in the county.

Characteristics

Wildfires occur in areas with large amounts of flammable vegetation that require a suppression response due to uncontrolled burning. Fire is an essential part of Oregon's ecosystem but can also pose a serious threat to life and property, particularly in the state's growing rural communities. Wildfire can be divided into three categories: interface, wildland, and firestorms. The increase in residential development in interface areas has resulted in greater wildfire risk. Fire has historically been a natural wildland element and can sweep through vegetation that may now be adjacent to a combustible home. New residents in remote locations are often surprised to learn that in moving away from built- up urban areas, they have also left behind readily available fire services providing structural protection.

The Marion County Community Wildfire Protection Plan wildfire risk assessment considers:

- **Risk:** the potential and frequency for wildfire ignitions (based on past occurrences).
- **Hazard:** the conditions that may contribute to wildfire (fuels, slope, aspect, elevation, and weather).
- **Values:** the people, property, natural resources, and other resources that could suffer losses in a wildfire event.
- **Protection Capability:** the ability to mitigate losses, prepares for the hazard, responds to, and suppresses wildland and structural fires.
- **Structural Vulnerability:** the elements that influence the level of exposure of the hazard to the structure (roof type and building materials, access to the structure, and whether or not there is defensible space or fuels reduction around the structure.)

Location & Extent

The Marion County EOP includes the following description of the wildfire hazard:

The forest lands in Marion County make up about 43 percent of the eastern part of the county and are significant to the economic, recreational and environment. The eastern region of the county is suited to forest use due to the large amount of precipitation, rugged terrain, remoteness from urban areas and large ownerships. The forest cover consists predominantly of the coniferous species of Douglas Fir, Western and Mountain Hemlock, Western Red Cedar, and True Firs. Deciduous species occur to a lesser extent at lower elevations and have only limited commercial value.

An area located east and south of the city of Silverton and commonly referred to as the Silverton Hills consists of a mixed pattern of farm and forest land uses. The topography of this area consists of relatively level ridge tops with intervening stream canyons. Marion County remains vulnerable to wildfire events and has identified 17 areas in the county as vulnerable wildland/urban interface communities.

Most of Marion County wildfires occur east of the Cascade Highway. Uncontrolled fires often occur in wild land areas; however, can also consume houses or agricultural resources. Wildfires have been a feature of the Oregon landscape, including Marion County, for thousands of years. Within Marion County especially vulnerable areas include Santiam Canyon area, Idanha, Detroit, Gates, Stayton, Silverton, Turner, and unincorporated areas to the south and east of Salem. It is estimated that 8- 10% (20-25,000 people) of the County's total population live in areas potentially subject to an interface with wildland fire. Losses from a fire could range as high as $10 to $15 million dollars. The impacts include loss of communications, utilized and compromises water quality and the transportation of goods and services to the affected communities. The fire season typically occurs between May and October. Most of the fires are caused by humans or lightning strikes.

Wildfire hazard areas are commonly identified in regions of the Wildland Urban Interface (WUI). The interface is the urban-rural fringe where homes and other structures are built into a densely forested or natural landscape. If left unchecked, it is likely that fires in these areas will threaten lives and property.

Communities at-Risk, for the purposes of this plan, are those areas within city or Rural Fire District boundaries of the fire department that provide fire protection services for the community. The Communities-at-Risk are surrounded by an additional area identified as the "Wildland Urban Interface" (WUI). The area where forest fuel can be modified to reduce fire behavior and spread so that wildland agencies can use the area to manage suppression fires more effectively from spreading to communities at risk and other important infrastructure.

Methods for identifying communities at risk require assessing residential density and location within a fire district. While several of Marion County's communities are listed as "unprotected," it is important to note that these communities are NOT without fire service. Several Rural Fire Protection Districts provide firefighting services throughout the unprotected areas of Marion County including:

- Breitenbush
- Detroit
- Drakes Crossing
- Elkhorn (Little North Fork, Santiam Canyon)
- Gates
- Idanha
- Jefferson
- Lyons
- Marion
- Mehama
- Salem (South and East)
- Scotts Mills
- Silverton
- Stayton
- Sublimity
- Turner

The Marion County CWPP update of 2017 discusses a high-level wildfire risk assessment called the West Wide Wildfire Risk Assessment (WWA). The Oregon Department of Forestry, on behalf of the Council of Western State Foresters and the Western Forestry Leadership Coalition, has conducted a wildfire risk assessment and report for the 17 western states and selected U.S. affiliated Pacific Islands. This assessment was funded by the U.S. Forest Service and is known as the West Wide Wildfire Risk Assessment, or WWRA. The WWRA is a multi-state assessment that provides multiple data sets that can be used to evaluate and weigh the relative risk of various factors that contribute to wildfire risk.

In 2021, the Oregon State Legislature passed Senate Bill (SB) 762 which required ODF to develop a new statewide wildfire risk map updating the current use of the 2018 Quantitative Wildfire Risk Assessment. The new Wildfire Risk Map was released on June 30, 2023, as part of the Oregon Explorer Natural Resources Digital Library, Home | oregonexplorer | Oregon State University.

Following concerns from the public concerning the data and the impacts that this data could have on insurance, ODF made the decision to remove the Oregon Wildfire Risk Map and reevaluate the data to ensure its accuracy and impact. ODF plans to release the new updated risk map sometime in 2023.

Marion County has chosen to not include data acquired from the Oregon Wildfire Risk Map while it was available and will reexamine the new data and determine is usefulness once released by ODF.

2.6.7 Severe Weather/Storm

Table 2.21, Severe Weather/Storm

Hazard	Severe Weather / Storm
Type	Climatic
Speed of onset	Slow to moderate
Location	Countywide
Extent	Minor to severe
Prior Occurrences	Minor events occur annually; 30 moderate to severe events over the past 130 years.
Probability	100% for minor events, 23% for moderate to severe events

Source: Oregon NHMP; Marion HMP Hazard History

Marion County is vulnerable to multiple forms of severe weather. The Marion County Comprehensive Risk Assessment ranks the following severe weather hazards: Tornado, Severe Weather/Storm, and Extreme Weather - High Temperature. The NOAA Storm Event Database is the source for the tables below containing records for events of many types of Severe Weather. The data are grouped showing events of Winter Storms, Winter Weather, Snowstorm, and Ice Storms in the first table. Presented separately are High Wind, Strong Wind, Funnel Cloud, and Tornado events. The final table contains reported events of Heat and Excessive Heat. The occurrences are listed in date/time order and the episodes are grouped together with banding. Note that the drought, wildfire, and flood hazards are covered under separate sections. These hazards can also be tied to severe weather events and the impact of a changing climate.

Table 2.22, Severe Weather/Storm

Zone	Begin Date	Event Type
CENTRAL WILLAMETTE VALLEY (ZONE)	1/7/2017	Winter Storm
NORTH OREGON CASCADES FOOTHILLS (ZONE)	1/7/2017	Winter Storm
CENTRAL WILLAMETTE VALLEY (ZONE)	1/10/2017	Heavy Snow
CENTRAL WILLAMETTE VALLEY (ZONE)	3/5/2017	Heavy Snow
NORTH OREGON CASCADES (ZONE)	3/5/2017	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	3/5/2017	Heavy Snow
NORTH OREGON CASCADES (ZONE)	12/19/2017	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	2/20/2018	Heavy Snow
NORTH OREGON CASCADES (ZONE)	2/25/2018	Heavy Snow
NORTH OREGON CASCADES (ZONE)	4/7/2018	Heavy Snow
NORTH OREGON CASCADES (ZONE)	12/11/2018	Winter Weather
NORTH OREGON CASCADES FOOTHILLS (ZONE)	2/8/2019	Heavy Snow
NORTH OREGON CASCADES (ZONE)	2/10/2019	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	2/10/2019	Heavy Snow
NORTH OREGON CASCADES (ZONE)	2/23/2019	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	2/23/2019	Heavy Snow
NORTH OREGON CASCADES (ZONE)	2/24/2019	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	2/24/2019	Heavy Snow
NORTH OREGON CASCADES (ZONE)	11/26/2019	Heavy Snow
NORTH OREGON CASCADES (ZONE)	1/10/2020	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	1/13/2020	Heavy Snow
NORTH OREGON CASCADES (ZONE)	3/30/2020	Heavy Snow
NORTH OREGON CASCADES (ZONE)	11/13/2020	Heavy Snow
NORTH OREGON CASCADES (ZONE)	11/13/2020	Heavy Snow
CENTRAL WILLAMETTE VALLEY (ZONE)	1/26/2021	Winter Weather
NORTH OREGON CASCADES (ZONE)	2/11/2021	Winter Storm
NORTH OREGON CASCADES FOOTHILLS (ZONE)	2/11/2021	Winter Storm
CENTRAL WILLAMETTE VALLEY (ZONE)	2/11/2021	Ice Storm*
NORTH OREGON CASCADES (ZONE)	2/25/2021	Winter Storm
NORTH OREGON CASCADES (ZONE)	12/11/2021	Heavy Snow
NORTH OREGON CASCADES (ZONE)	12/19/2021	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	12/19/2021	Heavy Snow
NORTH OREGON CASCADES (ZONE)	12/24/2021	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	12/24/2021	Heavy Snow
CENTRAL WILLAMETTE VALLEY (ZONE)	12/25/2021	Heavy Snow
NORTH OREGON CASCADES (ZONE)	1/2/2022	Heavy Snow
NORTH OREGON CASCADES FOOTHILLS (ZONE)	1/3/2022	Heavy Snow

Source: NOAA Storm Event Database, consulted September 2022, Storm Events Database - Search Page | National Centers for Environmental Information (noaa.gov)

* $10,000,000 was the value of damage reported for this February 2021 Ice Storm.

Table 2.23, High or Strong Wind, Thunderstorm Wind, Tornado, Hail and Funnel Cloud events in Marion Co. 2016-2021

Zone	Begin Location	Begin Date	Event Type	Magnitude (mpg or inches)	Tornado Strength	Deaths	Injuries	Property Damage
CENTRAL WILLAMETTE VALLEY		4/7/2017	High Wind	63		0	0	$5,000
MARION CO.	Aurora ARPT.	10/12/2017	Tornado		EF0	0	0	$40,000
NORTH OREGON CASCADES FOOTHILLS		3/8/2018	Strong Wind	35		0	0	$4,000
NORTH OREGON CASCADES FOOTHILLS		4/7/2018	High Wind	50		0	0	$3,000
CENTRAL WILLAMETTE VALLEY		4/7/2018	Strong Wind	39		0	0	$2,000
MARION CO.	JEFFERSON	10/29/2018	Tornado		EF0	0	0	$200
MARION CO.	ST PAUL	12/1/2018	Funnel Cloud			0	0	$0
CENTRAL WILLAMETTE VALLEY		12/18/2018	Strong Wind	39		0	0	$3,000
CENTRAL WILLAMETTE VALLEY		1/5/2019	Strong Wind	47		0	0	$100,000
NORTH OREGON CASCADES		9/7/2020	High Wind	57		0	0	$1,000,000,000
NORTH OREGON CASCADES FOOTHILLS		9/7/2020	High Wind	61		5	0	$2,000,000,000
MARION CO.	(SLE)MCNARY FLD	9/17/2020	Thunderstorm/Wind	45		0	0	$2,000
MARION CO.	ST PAUL	9/18/2020	Thunderstorm/Wind	45		0	0	$1,000
MARION CO.	SUBLIMITY	9/18/2020	Hail	0.75		0	0	$0
CENTRAL WILLAMETTE VALLEY		1/12/2021	Strong Wind	27		0	0	$5,000
CENTRAL WILLAMETTE VALLEY		5/22/2021	Strong Wind	47		0	0	$0
CENTRAL WILLAMETTE VALLEY		11/4/2021	Strong Wind	39		0	0	$1,000
CENTRAL WILLAMETTE VALLEY		12/11/2021	High Wind	53		0	0	$0

Source: NOAA Storm Event Database, consulted September 2022, Storm Events Database - Search Page | National Centers for Environmental Information (noaa.gov)

Table 2.24, Heat and Excessive Heat Events in Marion County 2016-2021.

Zone	Begin Date	Begin Time	Event Type	Deaths
NORTH OREGON CASCADES (ZONE)	5/22/2017	1200	Heat	0
CENTRAL WILLAMETTE VALLEY (ZONE)	8/1/2017	1200	Excessive Heat	0
CENTRAL WILLAMETTE VALLEY (ZONE)	7/18/2018	700	Heat	0
CENTRAL WILLAMETTE VALLEY (ZONE)	8/16/2020	700	Heat	0
CENTRAL WILLAMETTE VALLEY (ZONE)	8/17/2020	800	Heat	0
NORTH OREGON CASCADES FOOTHILLS (ZONE)	6/26/2021	1000	Excessive Heat	2
CENTRAL WILLAMETTE VALLEY (ZONE)	6/26/2021	1200	Excessive Heat	16
CENTRAL WILLAMETTE VALLEY (ZONE)	7/29/2021	1400	Heat	0
CENTRAL WILLAMETTE VALLEY (ZONE)	8/11/2021	1400	Excessive Heat	0
NORTH OREGON CASCADES (ZONE)	8/11/2021	1400	Excessive Heat	0
NORTH OREGON CASCADES FOOTHILLS (ZONE)	8/11/2021	1400	Excessive Heat	0

Source: NOAA Storm Event Database, consulted September 2022, Storm Events Database - Search Page | National Centers for Environmental Information (noaa.gov)

To maintain consistency with previous versions of this plan and to simplify the mitigation strategy, this section focuses on wind and winter storm events and the range of conditions common to each.

Characteristics

A windstorm is generally a short duration event involving straight-line winds and/or gusts in- excess of 50-mph. The most common type of wind events affecting Marion County are straight-line winds. These events originate as a downdraft of rain-cooled air which spreads out rapidly when they reach the ground. Straight- line winds can produce gusts of up to 100-mph.

Winter storms are generally characterized by a combination of heavy rains, snow, hail, or ice often accompanied by high winds. This section deals primarily with the snow and ice effects of winter storms. The winter storms that affect Marion County are typically large cyclonic low-pressure systems that move in from the Pacific Ocean and affect regions within Oregon or the entire Pacific Northwest. These storms are most common from October through March.

Location & Extent

In Marion County, the wind events occur county-wide, but are generally highest near the Willamette River. In the mountainous areas, the level of wind hazard is largely determined by topography and vegetation cover at the local level. Mountainous terrain slows down wind speed, particularly in valley areas. However, along ridge lines and other exposed areas, the wind speeds increase. Although windstorms can affect the entirety of the county, they are especially hazardous in developed areas where tree damage can impact transportation, housing, and electrical infrastructure. Snow and ice events can also occur county wide; however, impacts are most common at elevations above 300-feet.

The Marion County EOP includes the following description of the severe weather hazard:

Ice, hail, thunderstorms, and winter storms: An ice storm within the county can be devastating and is caused by freezing rain. Even a thin layer of ice on the ground, trees, cars, and other objects can impact transportation and utilities. As the Ice accumulates roads become slick making it dangerous to travel and trees become compromised impacting power poles and telephone lines. Significant ice accumulations are usually accumulations of one-quarter inch or greater. Hail is relative during thunderstorms producing winds of at least 58 mph (50 knots) and/or hail at least "1-inch" (quarter size) in diameter. Near severe or strong thunderstorms typically account for wind gusts of 40- 57 mph and/or for small hail less than 1-inch in diameter. Heavy snow and blizzards storms: A heavy snow event that produces or forecasted to produce heavy snow accumulations. A blizzard is a winter storm with sustained or frequent winds of 35 mph or higher with considerable falling and/or blowing snow that frequently reduces visibility to one-quarter mile or less. These conditions are expected to prevail for a minimum of 3 hours. Marion County has experienced several disruptive storms including heavy snowstorms and ice resulting in building and property damage, utility failures, and in some cases injury or death. The winter storms that affect

Marion County are typically large cyclonic low-pressure systems that move in from the Pacific Ocean and affect large areas of Oregon and/or the whole Pacific Northwest. These storms are most common from October through March.

Notably, on March 2, 2012, FEMA issued a disaster declaration for twelve Oregon counties, including Marion, to assist with recovery from "severe winter storm, flooding, landslides, and mudslides."

2.7 High Hazard Potential Dams

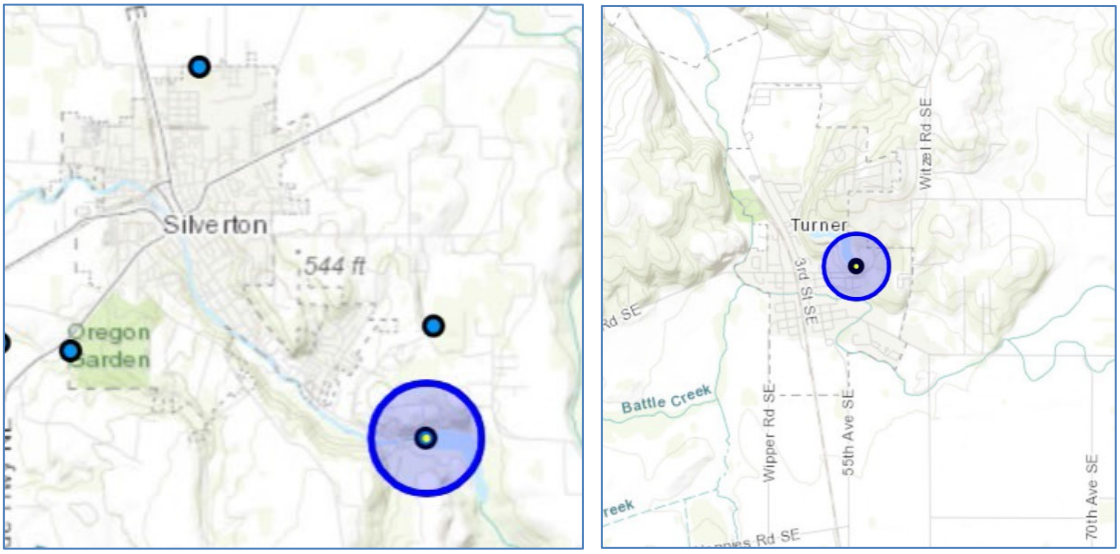
Dams that pose a high risk to life safety in the event of a failure event are called high-hazard potential dams (HHPDs). In June 2020, FEMA released new grant program guidance for Rehabilitation of High Hazard Potential Dams (Department of Homeland Security, Federal Emergency Management Agency, 2022) and new guidance for inclusion of HHPDs in Local Mitigation Planning Policy that becomes effective April 19, 2023. This information provides a basis for future planning updates (Department of Homeland Security, Federal Emeregncy Managemetn Agency, 2022).

According to the National Inventory of Dams, there are a total of 40 dams in Marion County (U.S. Army Corps of Engineers, 2020). The average age of these dams is 117 years. Marion County is also subject to risk from dams outside of the county, for example, Detroit Dam in Linn County which poses a daytime risk to 77,181 people. There are thirteen dams operated by the USACE on the Willamette River, nine of which are upstream of communities in the Willamette River floodplain subject to flood risk in Marion County.

See the list below for a summary of all the dams in Marion County. Three dams pose a high risk to life safety in the event of a dam failure event, these are called High-Hazard Potential Dams (HHPD). One of these is federally regulated and produces hydropower, Big Cliff Dam. Detroit dam is also a High-Hazard Potential Dam which divides Marion and Linn Counties.

Two HHPDs that are state regulated are Franzen Dam, located in Turner but owned by the City of Salem; and Silver Creek Dam owned by the City of Silverton.

Figure 2-9, Silver Creek Dam (left) and Franzen Dam (right)



Oregon Water Resources Department regulates dams in Oregon. All the dams that pose a significant or high hazard potential are regularly inspected. As part of the 2022 plan update, the OWRD State Engineer for Water Resources/ Dam Safety Program Manager confirmed that Marion County has no dams in poor or unsatisfactory condition.

Table 2.25, Dams in Marion County (NID)

Name	Hazard Classification	Owner	Purpose
Big Cliff Dam	High	USACE, Portland District	Hydro-electric
Silver Creek	High	City of Silverton	Water Supply
Franzen	High	City of Salem	Water Supply
Koinenia Lake	Significant	Cindy Jerger	Irrigation
Neil Creek Reservoir	Significant	Dean Yeager	Irrigation
Spring Lake Estates	Significant	Spring Lake Estates	Recreation

Name	Hazard Classification	Owner	Purpose
Barnes Bros. Reservoir	Significant	Eric and Pamela Barnes	Irrigation
Funrue	Significant	City of Aurora	Irrigation

Heater Dam	Significant	Jim Heater	Irrigation
Heater Dam #2	Significant	James M. Heater	Irrigation
Lorence Lake	Significant	Greg & Kara Pilcher	Other
Peterson, Floyd	Significant	Erik Rodgers	Recreation
Fredericks Pond	Significant	Maple Leaf Lake Homeowners Association	Irrigation
Pettit Reservoir	Significant	Dr. Virgil Pettit	Other
Berger Lake	Significant	Hidden Lakes Recreation Association	Irrigation
Waldo Lake	Significant	Krautmann Family Nursery, LLC	Irrigation
Willards Pool	Low	Terry Caster	Recreation
Duck Pond Dam	Low	Douglas Fries	Recreation
Woodburn Nursery	Low	Woodburn Nursery and Azaleas	Other
S-M-S #1	Low	Cody & Barbara Duerst	Recreation
Lakewood Estates	Low	Lakewood Homeowners, Inc.	No data entered
River Bend No. 2	Low	James L. Payne	Irrigation
Tribbett Reservoir	Low	Kelly Farms	Recreation
Spada Farms #2 (Ryan)	Low	A&R Spada Nursery and Farms	Irrigation
Baker West Nursery Dam	Low	Baker West, Inc.	Fish & wildlife
Fox Reservoir	Low	Tom Fox	Irrigation
Name	Hazard Classification	Owner	Purpose
Spada Nursery Runoff #2	Low	A&R Spada Nursery and Farms	Irrigation
Westbrook Dam	Low	Krautmann Family Nursery, LLC	Fish & wildlife

Mission Creek Dam and Reservoir Company	Low	Jerry Mullen	Irrigation
Case Creek Dam 1	Low	Douglas & Patricia Krahmer	Irrigation
O.E. Loe Dam 2 Porter Place	Low	Larie Loe	Irrigation
Spada Reservoir #1 (Champoeg)	Low	A&R Spada Nursery and Farms	Irrigation
Stadeli	Low	Brooke Craeger-Stadeli	Irrigation
Mallories Dairy Lagoon #2	Low	Mallories Dairy, Inc.	Irrigation
Mckay Acres Dam	Low	Mark McKay	Irrigation
4-B Farms	Low	Butsch Properties, LLC	No data entered
Kraemer Farms Dam	Low	Kraemer Farms, Inc.	Irrigation/ Fish & wildlife
Silver Falls Log Pond	Low	Gelco Investment, LLC	Irrigation
Mallories Lagoon #1	Low	Mallories Dairy, Inc.	Irrigation
City of Mt Angel Lagoon	Low	City of Mt Angel	No data entered

Source: USACE (2022). National Inventory of Dams. https://nid.usace.army.mil/#/

2.8 Community Vulnerability Identification and Assessment

Understanding community impacts and how they relate to its vulnerability and risk is one of the most essential components of the risk assessment. For the purposes of this HMP, the county and cities utilized BOLD Planning analysis exercises and results from interviews with staff from each plan holding jurisdiction or district to assess vulnerability. For an in-depth analysis of community characteristics in Marion County, please refer to the Community Profile in Volume III: **Appendix C**. The Marion County Risk Assessment Annex to the EOP, incorporated herein by reference, includes a risk impact assessment for each hazard.

2.8.1 Community Characteristics

Vulnerability assesses the extent to which people are susceptible to injury or other impacts resulting from a hazard as well as the exposure of the built environment or other community assets (social, environmental, economic, etc.) to hazards. The exposure of community assets to hazards is critical in the assessment of the degree of risk a community has to each hazard. Identifying the populations, facilities, and infrastructure at risk from various hazards can assist the county in prioritizing resources for mitigation and can assist in directing damage assessment efforts after a hazard event has occurred. The exposure of county and city assets to each hazard and potential implications are explained in each hazard section and within each Addendum in Volume II.

Vulnerability includes the percentage of population and property likely to be affected under an "average" occurrence of the hazard. Marion County and the DLCD natural hazards planners evaluated the best available vulnerability data to develop the vulnerability evaluation presented below.

2.9 Population

The socio-demographic qualities of the community population such as language, race and ethnicity, age, income, and educational attainment are significant factors that can influence the community's ability to cope, adapt to, and recover from natural disasters. A disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low-income persons. Population vulnerabilities can be reduced or eliminated with proper outreach and community mitigation planning.

2.9.1 Population Vulnerabilities

- Marion County is the fifth most populous county in Oregon. Between 2010 and 2020 Marion County's population increased by slightly less than 10 percent (U.S. Census Bureau, 2020).
- Between 2015-2021 the median age in Marion County was 36.6 years old, this is approximately 3 years younger than the state median of 39.3 years old at the same time-period (U.S. Census Bureau, 2022).
- As part of the 2021 Coordinated Population Forecast for Marion County, Portland State University, Population Research Center identified the following:
- When compared to the 2000 and 2010 decennial census the portion of the population in the younger age group (e.g., those under 18) is projected to decrease in 2030 and 2040.
- 24.3% of people in Marion County are under 18 years old.
- 10.4% of people under the age of 65 are living with a disability.
- 16.2% percent of the population is considered elderly (Over 65 years of age)

(Portland State University, Population Research Center, 2021).

2.10 Economy

Economic diversification, employment, and industry are measures of economic capacity. However, economic resilience to natural disasters is far more complex than merely restoring employment or income in the local community. Building a resilient economy requires an understanding of how the components of employment sectors, workforce, resources, and infrastructure are interconnected in the existing economic picture. The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families, and the community to absorb disaster impacts for a quick recovery.

2.10.1 Economic Vulnerabilities

- Marion County has the third most diverse county out of all the 36 counties evaluated (State of Oregon, Employment Department, 2022).
- Marion County is not listed as an economically distressed community (State of Oregon, Business Oregon, 2022).
- Unemployment remains about 2 percent higher in Marion County than the Oregon average unemployment rate (State of Oregon, Employment Department, 2022).
- The top five industry sectors in Marion County with the most employees, as of the 2020 U.S. Census: (U.S. Census Bureau, 2021)
    - Educational Services, Health Care, and Social Services (20.2%)
    - Retail Trade (11%)
    - Manufacturing (10.7%)
    - Professional, Scientific, Management, and Administrative (10.7%)
    - Public Administration (9.25)

2.11 Environment

The capacity of the natural environment is essential in sustaining all forms of life including human life, yet it often plays an underrepresented role in community resiliency to natural hazards. The natural environment includes land, air, water, and other natural resources that support and provide space to live, work, and recreate. Natural capital such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. When natural systems are impacted or depleted by human activities, those activities can adversely affect community resilience to natural hazard events.

2.11.1 Environment Vulnerabilities

- The western half of Marion County is in the Willamette Valley and is relatively flat. The eastern portion of Marion County has a mountainous topography and is bordered by the Cascade Mountain Range.
- The average elevation for Marion County is 154 feet and elevations range from 154 feet near the Willamette River in Salem to 2400 feet in the foothills of the Cascade

mountains.

- Most water resources originate in the eastern portion of Marion County.
- Marion County receives 40 inches of rain annually.
- There are several rivers in Marion County, including the Willamette River, North Santiam River, Pudding River, Little Pudding River, and Mill Creek.
- The largest reservoir in Marion County is Detroit Reservoir; Detroit Reservoir is located 50 miles east of Salem and covers roughly 5.5 square miles in area.

2.12 Housing

Housing type and age are important factors in hazard mitigation planning. Certain housing types tend to be less disaster resilient and warrant special attention. Mobile homes, for example, are generally more prone to wind and water damage than standard wood-frame construction. Homes built before 1993 may be more vulnerable to earthquakes because they were built prior to the incorporation of strict earthquake standards in Oregon's building codes. Structures built in Oregon after 1993 use earthquake resistant designs and construction techniques. Additionally, in the 1970s, the Federal Emergency Management Agency (FEMA) began assisting communities with floodplain mapping and communities passed floodplain ordinances to regulate floodplain development.

2.12.1 Housing Vulnerabilities

- 68 percent of housing units in Marion County were built prior to 1990; therefore, are not built to current earthquake standards.
- Slightly more than 60 percent of units are owner-occupied, and 39 percent are occupied by renters. In 2020, Marion County had 128,541 housing units. Of those, 4.6 percent of Marion County's housing units are vacant (U.S. Census Bureau, 2020).
- 8.3 percent of county residents live in mobile homes and less than one percent live in boats, RV, vans, or other forms of housing (U.S. Census Bureau, 2020).
- 44 percent of renter households in Marion County are rent burdened and spend 35 percent or more of their monthly income on housing (U.S. Census Bureau, 2020).
- For every affordable housing unit available in Marion County, there are 16 extremely low-income households (State of Oregon, Oregon Housing & Community Services, N.d.).

2.13 Critical Facilities and Infrastructure

Critical facilities (i.e., police, fire, and government facilities) and physical infrastructure are vital during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster. Following a disaster, communities may experience isolation from surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available

resources. For the purposes of this plan, critical facilities and infrastructure were evaluated through the lifeline sector analysis. The results of this analysis are below.

2.13.1 Critical Facilities and Infrastructure Vulnerabilities

- Communication
  - Many providers share infrastructure and/or collocate their infrastructure.
  - During a power outage, battery sustainability and generators would only provide limited power for two to three days.
  - The largest barriers to respond in a Cascadia event is staff ability to respond, access to facilities, time, funding, and political support.
  - After a Cascadia event, all providers anticipate a 75 to 100 percent shutdown.
- Energy
  - Generators are used as backups for critical infrastructure throughout the county, but they require access to various fuel types.
  - Oregon's fuel storage facilities are located in Portland and are susceptible to failure due to soil liquefaction. The storage capacity is six days.
  - The estimated level of electrical service interruption during a Cascadia event is approximately one to three months.
- Transportation
  - The most critical routes in Marion County include Interstate 5 and Highway 22.
  - Cherriots operates city and regional buses and Cherriots Lift for people with disabilities. Yearly, they provide about 4 million rides.
  - Following a Cascadia event transportation will be limited for 6-12 months.
  - Per day, Salem-Keizer Public Schools transport an estimated 22,000 students.
- Water
  - Infrastructure located near rivers could be impacted from floods, wildfires, or earthquake causing service disruption.
  - People living in incorporated areas of Marion County rely on septic tanks and wells.
  - Low water reserves and river flow pose a serious threat to Marion County's water supply.
  - Damage assessments and repair of impacted facilities cannot be conducted without road access.

2.14 Lifeline Sector Analysis

The lifeline sector analysis evaluates key resources and facilities within specific sectors through sector stakeholder feedback. Please see **Appendix D** for the full lifeline sector analysis.

2.14.1 Energy

The energy sector is critical to modern life. Electricity is vital for virtually all household, business, and emergency operations; liquid fuel is used for transportation, facility construction and repair, and backup power; natural gas is used for electricity generation, heating, cooking, powering vehicles, and other uses. The resilience, redundancy, and interdependencies of the energy sector will largely determine the timeline for emergency response and long-term community recovery. Diverse and redundant energy supply and distribution can significantly increase regional resilience.

Table 2.26, Energy Sector Summary

Critical Interdependencies: Systems of all types are dependent on other systems to function. To operate, the communication sector is particularly ***DEPENDENT ON:*** ➢ Transportation ➢ Communication Other critical lifeline sectors that ***DEPEND ON*** the communication sector to operate include: ➢ Public Safety ➢ Transportation ➢ Water ➢ Communication ➢ Economy	***Critical Vulnerabilities:*** Each sector is vulnerable to a variety of impacts. The energy sector is particularly vulnerable to the following: ➢ Consumption consists almost entirely of one of three forms: electricity, liquid fuels, or natural gas. ➢ Dependence on BPA for electric power; Marion County produces very little power locally. ➢ Lead time for ordering critical system components (e.g., transformers) ➢ Concentration of liquid fuel storage facilities in Portland; limited local fuel storage and supply. ➢ Lack of capability to pump fuel locally without power. Reliance on supply and distribution facilities located outside Marion County.
Major Findings: ➢ Generators are co-located by equipment and are used at critical infrastructure throughout the county; however, require various fuel types depending on the unit. ➢ Oregon's fuel storage facilities are in Portland and are susceptible to failure due to soil liquefaction. The storage capacity on a normal day is six days; therefore, it is anticipated that fuel will be an undersupplied commodity during a Cascadia event. It will take 3-6 weeks to reacquire fuel.	

- Energy is critically interdependent with the transportation, communication, and water sectors. For example, not having access to roads nor having the ability to communicate with responders leaves the energy sector extremely vulnerable. In addition, there is a need for energy in powering water treatment plants. These vulnerabilities are particularly heightened in areas where accesses via bridges or singular roads are susceptible to failure.
- The EPA regulates energy in terms of emissions limiting the capacity to produce additional energy resources.
- Damage assessments will be critical to capture the impacts to this lifeline. Downed trees, accumulating ice, and high winds can impact the resiliency of energy as a lifeline.
- The energy sector also prepares and mitigates against human-made disasters, such as cyberattacks.
- The energy sector grants people with uninterrupted services due to medical status during non-catastrophic events.
- An estimated 1-3 months of electrical service interruption during a Cascadia event.

2.14.2 Communications

The communication sector facilitates the rapid exchange of information across a broad range of systems and technologies. These include broadcast television and radio, telephone, cellular phone, cable, internet, two-way radio, and Ham (or amateur) radio.

Communication is an essential aspect of virtually all public and private sector activities. The ability to communicate is especially critical during an emergency. Notably, FEMA's Emergency Support Function #2 – Communications specifically supports the restoration of communications infrastructure. The scope of ESF #2 includes "restoration of public communications infrastructure" and assisting "State, tribal, and local governments with emergency communications and restoration of public safety communications systems and first responder networks" (Department of Homeland Security, Federal Emergency Management Agency, 2008).

The assessment focused on (1) the adaptive capacity of the communications sector, (2) hazard-specific vulnerabilities to communication infrastructure, and (3) mitigation opportunities that can support uninterrupted or rapid restoration of communication capability during or following emergency or disaster event.

Table 2.27, Communication Sector Summary

<table>
<tr>
<td>Critical Interdependencies:

Systems of all types are dependent on other systems to function. To operate, communication sector is particularly <u>DEPENDENT ON</u>:

➢ Electricity
➢ Energy (Fuel)
➢ Transportation

Other critical lifeline sectors that <u>DEPEND ON</u> the communication sector to operate include:

➢ Water (SCADA)
➢ Electricity
➢ Public Safety
➢ Transportation
➢ Economy</td>
<td>Critical Vulnerabilities:

Each sector is vulnerable to a variety of impacts. The communication sector is particularly vulnerable to the following:

➢ All systems rely on electricity for operation and maintain generators for backup power. Generators rely on fossil fuels to operate leading to questions about what systems and services would be prioritized for gasoline/diesel fuel use if there were a disruption to fuel supply. Also, some generates operate on propane or natural gas, neither of which are included in state or federal energy assurance plans.
➢ All systems rely on infrastructure (towers, antennae) spread across large areas, often in remote locations. Road access to repair equipment is a primary concern.
➢ 911 service and other emergency communication relies online-of-site microwave transmission. Even small changes in antennae alignment can disrupt transmission and require recalibration to re-establish connections between towers. Fiber infrastructure is vulnerable to earthquake damage, where lines are connected to bridge spans.</td>
</tr>
<tr>
<td colspan="2">Major Findings:

➢ Many providers share infrastructure and or have their infrastructure co- located.
➢ Stakeholders are well prepared to address winter storms and other disasters if there is access to their facilities. Transportation, water, and energy are equally dependent on communication infrastructure. In addition, trees, wind, and ice are hazards that can impact this lifeline.</td>
</tr>
</table>

- During a power outage, battery and generator backups provide limited power for a varying duration of time depending on the fuel source and capacity. Redundancy is a needed resource for critical infrastructure that requires access and the supply of multiple fuel types, primarily gasoline and diesel. Notably, propane is a fuel source for some generators; however, propane will not be provided through state resources. Some generates operate on propane or natural gas, neither of which are included in state or federal energy assurance plans.
- All providers anticipate a 75-100% shutdown after a Cascadia event. Due to the roads and bridges being impassable, network connections could be severed.
- Largest barriers to respond in a Cascadia event include staff ability to respond, access to facilities, shortage of supplies to repair infrastructure, time, funding, and political support.
- Stakeholders recognize that their staff and families need to be prepared. To address this need, they are supporting a proactive approach to disasters. In particular, the Communications sector is working to train employees to be prepared for disasters so they can address their own immediate needs before safely addressing the needs of the sector post-event.
- Some towers have fiber optic lines as a redundancy. However, these lines are vulnerable in a catastrophic earthquake, where lines are connected to bridge spans.
- Water infrastructure systems rely on communication for operations and maintenance through a “Supervisory Control and Data Acquisition” (SCADA) system. The system provides remote monitoring and control of the water system components. Radio system capability is needed for these systems to operate effectively. Much of this infrastructure is isolated. For example, Salem’s infrastructure is located on an island.
- Amateur Radio provides critical back up to public safety radio communications in a disaster but does not provide the necessary capacity to meet emergency management needs. Jurisdictions should consider investing in satellite voice and data capabilities.
- Local servers may be damages in an earthquake. Jurisdictions should consider "cloud based" data storage solutions to backup vital records.

2.14.3 Transportation

Transportation is critical lifeline infrastructure. The transportation network facilitates the movement of people, goods, resources, and commerce throughout Marion County and beyond. The transportation system consists of local, state, and federal road and highway networks; passenger and freight rail; passenger and freight air service; pipelines; transit; dedicated bicycle and pedestrian systems; and limited water-based modes. All lifeline sectors depend on the transportation system.

Access to means of transportation is fundamental to human existence. Transportation infrastructure facilitates everything from a local trip to the park, drugstore, or place of employment to international trade and commerce. Furthermore, the ability to move people, goods and services is vital before, during and after emergency events. It is no accident that FEMA's number one Emergency Support Function is transportation. ESF #1 covers the following:

- Aviation/airspace management and control
- Transportation safety
- Restoration/recovery of transportation infrastructure
- Movement restrictions
- Damage and impact assessment

The scope of ESF #1 includes supporting, ". . . prevention, preparedness, response, recovery and mitigation activities among transportation stakeholders and coordinating, the restoration of the transportation systems and infrastructure" (Department of Homeland Security, Federal Emergency Management Agency, N.d.).

Transportation lifeline sector participants identified several interconnected resources and elements of their operations. These include roads, bridges, buses, and physical buildings. While this assessment focusses on infrastructure, participants noted that transportation staff and professionals are a critical resource as well.

Table 2.28, Transportation Sector Summary

Critical Interdependencies:	***Critical Vulnerabilities:***
Systems of all types are dependent on other systems to function. To operate, the transportation sector is particularly ***DEPENDENT ON***: ➢ Energy and Fuel ➢ Communication ➢ Business and Industry ➢ Public Works Other critical lifeline sectors that ***DEPEND ON*** the transportation sector to operate include: ➢ Water ➢ Electricity ➢ Liquid Fuel ➢ Public Safety ➢ Public Works ➢ Economy	Each sector is vulnerable to a variety of impacts. The transportation sector is particularly vulnerable to the following: ➢ Federal, state, and local bridge infrastructure is particularly vulnerable to earthquake (especially ODOT facilities over the Willamette). ➢ System relies heavily on fossil fuels for construction, operation, and maintenance. ➢ Hwy 22 is the primary east-west connection; there are few redundant east-west routes. ➢ Significant backlog of deferred transportation maintenance projects.

Table 2.29, Sector Summary-Transportation, Major Findings

Major Findings:

- ODOT considers I-5 and Highway 22 to be critical routes. Other critical concerns include bridges, roads, communication, and energy including power and fuel.
- Much of the existing transportation infrastructure, including those of major roadways such as I-5, Highway 22, and Mission Road, are not seismically retrofitted and will likely experience structural failures during a Cascadia event.
- Following a Cascadia event, transportation will be limited for 6-12 months; aftershocks may extend that timeframe.
- Transportation is interdependent with communication, water, and energy systems and requires coordination and collaboration during the response and recovery process.
- Although winter storms continue to impact transportation systems, stakeholders respond to these events efficiently and continue to improve plans with every winter weather event. Downed trees, debris, and accumulated ice impact the response of this lifeline.

- Cherriots operates city and regional buses, dial-a-ride, Cherriots Lift for people with disabilities, and coordinates non-emergent medical transportation services. They provide about 4 million rides a year and are currently working to improve individual employee preparedness as well as existing emergency plans.
- Salem-Keizer Public Schools transports an estimated 22,000 students a day including about 2,000 medically fragile students. The top priority for this organization is student safety.
- The electricity grid in Oregon is not particularly dependent on the transportation sector to operate. However, the power generation and distribution network does rely on the transportation network for construction as well as ongoing maintenance and repairs.
- Conversely, all the liquid fuel in the state is transported by one of three primary transportation modes: truck, rail, and pipeline. Therefore, the distribution fuel in the state is completely dependent on the transportation sector.
- Like the electric grid, the communications sector is not particularly dependent on the transportation sector to operate. However, the power generation and distribution network does rely on the transportation network for construction as well as ongoing maintenance and repairs.
- Business and industry are very dependent on the transportation sector. From the movement of raw material, to getting employees to and from work, to getting finished products to market, virtually all business and industry activity in the region is facilitated by transportation.
- Public works is dependent on transportation in two primary ways. First, the transportation sector facilitates the movement of equipment, materials, and workers. Second, significant portions or components of public works' infrastructure are collocated within transportation rights of way.

2.14.4 Water

For the purposes of this assessment, the water sector includes information pertaining to drinking water, stormwater, and wastewater. Stakeholder participants included a range of local and regional infrastructure and service providers. The information provided in this summary is based on research of the county's water resources and infrastructure.

Ready access to virtually unlimited amounts of clean drinking water is often taken for granted, particularly here in the Pacific Northwest. Water is vital for basic daily living, for business and industry especially including agriculture, for fire protection and medical service provision, and for wastewater management. In addition, stormwater facilities provide critical protection from a variety of localized flood risks. FEMA Emergency Support Function #3 covers public works, including water, wastewater, and stormwater services. Ensuring that all water related public works infrastructure is operational is critical to the function of any community.

Table 2.30, Water Sector Summary

<table>
<tr>
<td>Critical Interdependencies:

Systems of all types are dependent on other systems to function. To operate, the water sector is particularly <u>DEPENDENT ON</u>:
➢ Electricity
➢ Communication
➢ Transportation
➢ Liquid Fuel

Other critical lifeline sectors that <u>DEPEND ON</u> the transportation sector to operate include:
➢ Fire and EMS
➢ Business Industry
➢ Electricity</td>
<td>Crucial Vulnerabilities:

Each sector has several vulnerabilities. The water sector is particularly vulnerable to the following:
➢ The water sector in Marion County consists of numerous local and regional systems.
➢ Several reservoirs, transmission lines and the Salem Treatment Facility are vulnerable to multiple hazards.
➢ Aquifer storage capacity not sufficient to meet need as a backup source.</td>
</tr>
<tr>
<td colspan="2">Major Findings:
➢ People living in unincorporated areas of Marion County rely on wells and septic tanks.
➢ Low water reserves and low river flow pose a serious threat to the water supply.</td>
</tr>
</table>

- Some infrastructure pertaining to water systems are old which increases the risk vulnerability to withstand a Cascadia event. Impacted infrastructure could have secondary impacts throughout the system.
- Water infrastructure facilities located near rivers could experience service disruptions and flooding during an event or incident. Power is vital to the water facilities continued operation.
- Generators are co-located at critical facilities and need to be maintained requiring various fuel types to support redundancy.
- Road access is vital to conduct damage assessments and to enable the repair impacted infrastructure.

2.15 Hazard Policy Evaluation

In 2016, the University of Oregon Community Service Center team reviewed the Marion County Comprehensive Plan to determine existing policies that shape the county's hazard mitigation activity and to better inform mitigation action items for the 2016 HMP. Table 2.34 details the findings on policies related to hazards. The comprehensive plan specifically addresses floods, landslides and wildfires, the sections of the plan that address these hazards could include additional information to better support hazard mitigation. To better align with Goal 7 of the comprehensive plan, the county should consider adding policies related to earthquakes, drought, windstorms, and winter storms to strengthen hazard mitigation efforts.

Table 2.31, Marion County Comprehensive Plan Policies Concerning Hazards

Hazard	Policy	Marion Comp Plan Section
Earthquake	None	NA
Flood	Permanent structures shall not be constructed in the floodway of the floodplain. Structures constructed in the floodplain fringe shall have their lowest floor elevation at least 2 feet above the 100-year flood level or 2 feet above natural grade where the base flood level has not been established.	Rural Development
Flood	Marion County should strengthen watershed management to reduce impact of flooding by pursuing a regional approach for developing mitigation solutions to flooding problems that overlap individual jurisdictions.	Rural Development
Flood	Marion County should encourage and support local communities in their efforts to protect their water supplies from flood water contamination and turbidity from watershed runoff.	Rural Development
Flood	Marion County should educate citizens about the flood hazard, risks involved, and mitigation measures available. The County shall ensure that information about the flood hazard in Marion County is readily available to the public.	Rural Development
Flood	Development in floodplains should be restricted to balanced cut and fill, within the parcel to be developed.	Urbanization

Hazard	Policy	Marion Comp Plan Section
Flood	Within stream or wetland buffers and areas within the 100-year FEMA floodplain natural vegetation should be retained.	Urbanization
Flood	The streams and watersheds of the County flow without regard to political boundaries, and their health depends on a consistent and coordinated approach throughout the County. City plans should protect streams, wetlands, riparian corridors, floodplains, and significant wildlife areas from the negative effects of development in accordance with state law.	Urbanization
Flood	Multiple use of lands such as those adjacent to reservoirs, land reclamation sites, power line rights-of-way, flood control areas, public transportation rights-of-way, under overpasses, etc., are encouraged as open space providing public health and safety standards are met.	Parks & Recreation
Landslide	Construction, involving the placement of structures on or in the land surface and other such disturbances or excavations of the land surface in active or inactive landslide areas (as identified in the Background and Inventory Report) shall require specific site study by a qualified engineering geologist prior to development.	Rural Development

Hazard	Policy	Marion Comp Plan Section
Wildfire	Strict criteria should be applied to ensure that any dwellings and accessory structures permitted on existing parcels will not interfere with accepted forest or farm management practices on adjacent lands, have adequate road access, fire protection and domestic water supply, and do not increase fire hazard.	Forest Land and Farm/Timber Lands
Wildfire	If special siting and fire hazard protection requirements are imposed dwellings may be appropriate on existing parcels with low cubic foot per acre per year productivity, on parcels with timber management limitations due to the proximity of dwellings and a highly parcellated ownership pattern, or on existing parcels of 160 acres or more created prior to January 1, 1994. Dwellings allowed under OAR 660-06-0027(1)(a), (e), and (f), as limited in the TC zone, are consistent with this policy.	Forest Land and Farm/Timber Lands
Wildfire	Non-forest and non-farm uses included in OAR 660-06-0025 and OAR 660-33-120 may be allowed when the activity meets criteria that ensure there will be no significant adverse impacts on farm or forest practices occurring on nearby lands or increase risks associated with fire.	Forest Land and Farm/Timber Lands

Hazard	Policy	Marion Comp Plan Section
Wildfire	Marion County shall require evidence that the level of fire protection provided by a fire district is adequate to service proposed land developments. If service is not adequate the development shall be denied or be conditioned so that necessary facilities are provided.	Rural Development
Wildfire	In those areas not served by a fire district, Marion County shall require evidence of fire protection by private means prior to approval of future rural subdivision, commercial or industrial development. Implementation of the fire protection program recorded in Chapter 3 of Fire Safety Consideration for Development in Forested Areas, 1978, shall be a requirement of use approval for residences located near timber land whether or not they are located in a fire district.	Rural Development
Multi-Hazard	Provide adequate review of development of permanent structures in the identified natural hazard or damage areas to minimize potential loss of life or property.	Urbanization

Hazard	Policy	Marion Comp Plan Section
Multi-Hazard	The County shall mitigate flood damage through planning and regulations by: A. Developing and maintaining links between land use, hazard mitigation and emergency operations planning throughout the County. B. Continuously seeking methods to improve management of the floodplain and landslide-prone areas of the unincorporated portion of the County. C. Considering the use of appropriate incentives, including taxes, to encourage mitigation measures by property owners.	Rural Development
Other Hazards	Encourage DEQ to expand their monitoring program and increase sample areas to determine locations approaching or exceeding drinking water standards. Impacts from domestic sewage outfalls should be assessed to identify any possible hazards.	Environment
Other Hazards	In areas experiencing proven water pollution from septic tanks or inadequate water supply, encourage the provision of alternative individual treatment system or water systems to overcome health hazards or to provide a greater margin of public safety in allowable developments.	Environment

Source: Marion County Comprehensive Plan

2.16 City Specific Risk Assessment

Multi-jurisdictional Risk Assessment - §201.6(c) (2) (iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area. Refer to Volume II for city and district specific risk assessments for each of the participating jurisdictions in the county.

2.17 Future/Complimentary Risk Assessment Information

Several key risk assessment tools are in development or were being updated and will be completed in conjunction with or following adoption of this HMP in 2022.

2.17.1 Threat Hazard Identification Risk Assessment (THIRA)

Threat and Hazard Identification and Risk Assessment (THIRA) is a FEMA developed method for assessing community capabilities across a range of hazards. According to the FEMA website:

The Threat and Hazard Identification and Risk Assessment (THIRA) is a 4-step common risk assessment process that helps the whole community—including individuals, businesses, faith-based organizations, nonprofit groups, schools and academia and all levels of government—understand its risks and estimate capability requirements. The THIRA process helps communities map their risks to the core capabilities, enabling them to determine whole-community informed:

- *Desired Outcomes*
- *Capability Targets*
- *Resources required to achieve their capability targets.*

The outputs of this process inform a variety of emergency management efforts, including emergency operations planning, mutual aid agreements, and hazard mitigation planning. Ultimately, the THIRA process helps communities answer the following questions:

- *What do we need to prepare for?*
- *What shareable resources are required in order to be prepared?*
- *What actions could be employed to avoid, divert, lessen, or eliminate a threat or hazard?* (Department of Homeland Security, Federal Emeregncy Managemetn Agency, 2021).

Marion County conducted is latest THIRA in 2016 and is planning for a new one during this plan 5-year cycle.

Critical Priority Risk Index

The objective of any risk analysis is to minimize impact and maximize response efforts. In order to accomplish these all-relevant hazards, potential vulnerabilities and exposures for the region or jurisdiction should be assessed in a consistent way, with a clear numeric methodology. Based on this understanding of risk, communities can then develop a strategy to identify and prioritize response, continuity, and mitigation actions.

Hazard Analysis Definitions

- **Hazard**
  - A potential source of injury, death, or damage
- **Vulnerability**
  - Susceptibility to injury, death, or damage
- **Exposure**
  - People and property within the area the potential hazard could affect.
- **Risk**
  - The likelihood of a hazard resulting in injury, death, or damage
- **Mitigation**
  - A systematic reduction to the exposure and vulnerability to a potential hazard.

Based on the identification of potential hazards, a robust hazard profile includes data concerning previous occurrences, the probability of future occurrences and the threat to the County.

Hazards can be defined individually in each plan for specific considerations, or at the Master level where overall hazards and vulnerability do not vary greatly across the jurisdiction. Weather-related and large-scale infrastructure hazards such as drought, extreme temperatures, hail, windstorms, and utility failures affect can affect an entire region.

As such, these hazards are built out at the Master level. However, some hazards such as dam and levee failure, flood and erosion or subsidence soils may have local variations and multiple profiles may be developed if the risk is not uniform across the jurisdiction or organization. For each identified hazard the following information should be provided in the description and impact statement sections:

- **Hazard Description**
  - A general discussion of the hazard and its outcome.
- **Hazard Location**
  - The geographic extent or location of the hazard in the County.
- **Prior Instances**
  - Information on historic incidents and their impact
- **Associated Secondary Hazards**
  - Those hazards of a unique nature that stem from the original occurrence.
- **Probability of Future Occurrence**
  - Frequency of past events used to gauge the likelihood of future occurrences.

CPRI Calculations

MCEM uses the Calculated Priority Risk Index (CPRI) methodology to prioritize each of the identified hazards across the County. CPRI rankings consider the following four elements of risk:

- Probability
- Magnitude / Severity
- Warning Time
- Duration

The following tables provide a summary for each of the risk elements, including a rationale behind each numerical ratio.

Table 2.32, CPRI Risk Elements, Probability

	Rating	Rating Criteria
Probability	4 – Highly Likely	▪ Event is probable within the calendar year. ▪ Event has up to 1 out of 1 chance of occurring this year. ▪ History of events is greater than 33% likely per year
	3 – Likely	▪ Event is probable within the next 3 years. ▪ Event has up to 1 in 3 years chance of occurring. ▪ History of events is greater than 20% but less than or equal to 33% likely per year
	2 – Intermittent	▪ Event is probable within the next 5 years. ▪ Event has up to 1 in 5 years chance of occurring. ▪ History of events is greater than 10% but less than or equal to 20% likely per year
	1 – Unlikely	▪ Event is possible within the next 10 years. ▪ Event has up to 1 in 10 years chance of occurring. ▪ History of events is less than or equal to 10% likely per year

Table 2.33, CPRI Risk Elements, Magnitude-Severity

	Rating	Rating Criteria
Magnitude / Severity	4 - Catastrophic	▪ Multiple fatalities ▪ Complete shutdown of facilities for 30 or more days ▪ More than 50% of property is severely damaged
	3- Critical	▪ Injuries and/or fatalities result in permanent disability. ▪ Complete shutdown of critical facilities for at least two (2) weeks ▪ 25-50% of property is severely damaged
	2- Limited	▪ Injuries and/or illnesses do not result in permanent disability. ▪ Complete shutdown of critical facilities for more than one (1) week ▪ 10-25% of property is severely damaged
	2- Negligible	▪ Injuries and/or illnesses are treatable with first aid. ▪ Minor quality of life lost. ▪ Shutdown of critical facilities and services for 24 hours or less ▪ Less than 10% or property is severely damaged

Table 2.34, CPRI Risk Element-Warning Time

	Rating	Rating Criteria
Warning Time	4	Less than 6 hours
	3	6 to 12 hours
	2	12-24 hours
	1	24+ hours

Using the rankings described in the tables above, the following weighted formula was used to determine each hazard's CPRI.

(Probability x 0.45) + (Magnitude x 0.30) + (Warning time x 0.15) + (Duration x 0.10)

When discussing probability, it is important to note that while many events occur frequently, they often result in little quantifiable impact. For example, lighting strikes the earth on average of 2,000,000 timers per year; however, few of these strikes have adverse outcomes.

As such, when discussing the probability for each hazard, the discussion will be framed by the likelihood of that event have a measurable, large scale or detrimental impact. In addition, it is important to note that the occurrence of many, if not all, hazard event cannot be predicted with certainty. Simply because an event has occurred once prior, even if devastating, does not significantly weight its likelihood of reoccurrence with any certainty.

The CPRI values should be general indicators of response action criticality in an EOP or COOP plan. The following table details planning significance in the CPRI ranges:

Table 2.35, CPRI Range Values

CPRI Range Values		
Impact	**Low CPRI**	**High CPRI**
High	3.0	4.0
Moderate	2.0	2.9
Low	.10	1.9

The terms high, moderate, and low indicate the level of prioritization in response efforts for each hazard, and do not indicate the potential impact of a hazard occurring. Hazards rated with moderate or high significance should be more extensively discussed due to the availability of data and historic occurrences, while those with a lower significance more generally addressed due to lack of available data and historical occurrences.

Marion County is vulnerable to a wide range of hazards that threaten its communities, businesses, and environment. To determine the hazards that poses the greatest threat,

Marion County has prepared a Threat Hazard Identification and Risk Assessment. The major findings are summarized below. The assessments were developed from historical data of events that have occurred and specifically examined.

Table 2.36, Marion County THIRA Capability, 2016

Core Capabilities	Severe Storms	Train Derailment	School/Work Violence	Power Outage	Average Scores*
Cybersecurity	-	-	-	5	5
Supply Chain Integrity and Security	-	5	-	5	5
Long-term Vulnerability Reduction	5	5	5	5	5
Planning	3	5	5	5	4.5
Public Information and Warning	3	5	5	5	4.5
Screening, Search, and Detection	5	5	3	5	4.5
Community Resilience	3	5	5	5	4.5
Fatality Management	5	5	5	3	4.5
Public Health, Healthcare, and Emergency Medical Services	3	-	5	5	4.33
Situational Assessment	3	-	5	5	4.33
Operational Coordination	5	1	5	5	4
Intelligence and Information Sharing	3	5	3	5	4

Core Capabilities	Severe Storms	Train Derailment	School/Work Violence	Power Outage	Average Scores*
Risk and Disaster Resilience Assessment	3	3	5	5	4
Threats and Hazards Identification	1	5	5	5	4
Infrastructure Systems	1	5	5	5	4
Mass Care Services	5	-	5	5	4
Housing	5	-	-	3	4
Operational Communications	5		3	3	3.66
Interdiction and Disruption	-	5	1	5	3.6
Risk Management for Protection Programs and Activities	-	3	3	5	3.6
Access Control and Identity Verification	1	5	3	5	3.5
Physical Protective Measures	1	5	3	5	3.5
Environmental Response / Health and Safety	3	1	5	5	3.5

Core Capabilities	Severe Storms	Train Derailment	School/Work Violence	Power Outage	Average Scores*
Forensics & Attribution	-	1	5	-	3
Critical Transportation	5	1	3	3	3
Logistics and Supply Chain Management	3	-	3	3	3
On-Scene Security, Protection, and Law Enforcement	3	3	1	5	3
Economic Recovery	1	5	-	3	3
Natural and Cultural Resources	3	-	3	3	3
Fire Management and Suppression	1	1	3	3	2
Mass Search and Rescue	3	-	1	1	1.66
Health and Social Services	-	-	-	-	No Data

Source: Marion County THIRA, 2016

*****Average calculated based on the number of capabilities assessed
Note: Capabilities scored based on; 1-High Capability, 3-Medium Capability, and 5 low capabilities.

For emergency management planning purposes, the critical analysis that must be undertaken is an assessment of the consequences of each hazard, including potential area of impact, population exposed and impacted, duration of the hazard, and potential economic consequences. These rankings utilize the criteria laid out in THIRA to weight those proportionally through historic data as well as future projections based on economic, demographic, the critical infrastructure information. Three levels of risk have been identified: High, Moderate and Low.

- **High**
  - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC, and shelters).
- **Moderate**
  - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.
- **Low**
  - Low probability of occurrence or low threat to population; minor physical impacts.

2.17.2 Marion County Community Wildfire Protection Plan (CWPP)

In June of 2017, Marion County issued a County Community Wildfire Protection Plan (CWPP) for review that was subsequently approved by the Marion County Board of Commissioners, the Marion County Emergency Manager, the Marion County Fire Defense Board Chief, and the Oregon Department of Forestry District Forester. Developed in coordination with the Oregon Department of Forestry, the Marion County CWPP is the result of a countywide effort initiated to reduce wildland fire risk to communities, citizens, and environmental resources in Marion County. The CWPP was developed in accordance with provisions of the Healthy Forest Restoration Act of 2003. In 2022, the CWPP is being updated and is provided data towards this plan.

The CWPP identifies the following wildfire mitigation related objectives:

- Provide oversight to all activities related to the CWPP.
- Ensure representation and coordination between the sub-committees.
- Develop and refine goals for fire protection in Marion County.
- Develop a long-term structure for sustaining efforts of the CWPP.
- Identify grant funding opportunities for possible wildfire mitigation projects.

Risk Assessment:

- Identify and update as needed Communities-at-Risk and the Wildland-Urban Interface.
- Develop and conduct a wildland fire risk assessment.
- Identify and prioritize hazardous fuels treatment projects.

Fuels Reduction:

- Identify strategies for coordinating fuels treatment projects at a landscape scale.
- Coordinate administration of fuels program so that it is equitable across fire districts.
- Provide low-income special need citizens with an opportunity to reduce their fuels and participate in local programs.
- Identify opportunities for marketing and utilization of smaller diameter wood products.

With respect to wildfire risk, the CWPP identifies specific Communities at Risk. In addition, the plan includes a set of maps and data that specifically identify the location, severity, extent, and probability of wildfire in Marion County. The final CWPP risk assessment is incorporated herein by reference as a specific wildfire supplement to the all-hazard risk assessment.

2.17.3 North Santiam Drought Contingency Plan

Marion County is a key partner in a multi-jurisdictional, multi-stakeholder process to develop a drought contingency plan for the North Santiam Watershed. The effort includes an overall assessment of drought risk, a process for ongoing monitoring of drought in the region, and a set of mitigation strategies and recommendations to ensure coordinated management of water resources. Identified vulnerabilities by sector or asset category include agriculture, municipal water supplies (i.e., drinking water), energy, forestry, environmental (e.g., endangered species), recreation, and socio-economic (i.e., commercial, industrial and community uses).

Various portions of the plan are in draft form. However, full integration of the Drought Contingency Plan with the HMP will need to take place during the post-adoption maintenance and implementation phase. Refer to Section 4 for more information.

3 Mitigation Strategy

This section outlines Marion County's strategy to reduce or avoid long-term vulnerabilities to the identified hazards. Specifically, this section presents a mission and specific goals and actions thereby addressing the mitigation strategy requirements contained in 44 CFS 201.6(c). The HMP steering committee reviewed and updated the mission, goals, and action item-related documents in this plan at the May 4, 2022, meeting of the 2022 plan update. Additional planning process documentation is in Appendix B.

3.1 Mitigation Plan Mission

The Plan mission states the purpose and defines the primary functions of Marion County's HMP. It is intended to be adaptable to any future changes made to the Plan and need not change unless the community's environment or priorities change.

The mission of the Marion County HMP is:

Create a more resilient Marion County by partnering with the whole community.

3.2 Mitigation Plan Goals

Mitigation plan goals are specific statements of direction that Marion County citizens and public/private partners can take to reduce the county's risk from hazards. These statements of direction link the broad mission statement and particular action items. The goals listed serve as checkpoints for agencies and organizations implementing mitigation action items.

Stakeholder participation was a key aspect in developing the Plan goals. Meetings with the project steering committee and lifeline sector stakeholders served as methods to obtain information and priorities for developing goals, reducing risk, and preventing loss from hazards in Marion County.

On July 5, 2022, the 2023 Marion County HMP Steering Committee reviewed the revised plan goals and compared them to the 2020 State Natural Hazard Mitigation Plan goals. They retained the goals as they were aligned with current Marion County conditions and the State Natural Hazard Mitigation Plan in 2016.

All Plan goals are listed below in no order or priority. Establishing community priorities within action items neither negates nor eliminates any goals, but instead, establishes which action items to consider for implementation first. Below is a list of the 2022 revised plan goals:

Goal 1: Awareness & Education

Increase awareness and education for all hazards, emergency notification methods, and resources for citizen, businesses, and government agencies.

Goal 2: Resilience

Increase the resilience of communities, by providing capacity to the private sector, rural/urban cities, and NGO's.

Goal 3: Risk Reduction

Minimize risks to life, public and private property, infrastructure, the environment, and the economy from hazards.

Goal 4: Funding and Implementation

Track and utilize potential funding sources to implement mitigation projects.

Goal 5: Partnerships and Coordination

Create, maintain, and enhance partnerships with stakeholders, adjacent jurisdictions, and public and private agencies' risk management activities.

Goal 6: Natural Resources Utilization

Use natural resources, watershed planning, and land use planning to reduce long-term costs and maximize effectiveness.

Goal 7: Plan Integration

Integrate hazard mitigation activities, where appropriate, with existing plans and policies.

Goal 8: Data Collection

Document county expenditures and benefits of hazard mitigation policy & projects.

Goal 9: Development Relocation

Direct development away from areas within mapped hazardous where risks to people, property, and infrastructure cannot be mitigated.

Goal 10: Hazard Loss Reduction

Collaborate with public, private, and non-profit sectors to create a county wide hazard loss reduction strategy.

Goal 11: Historic Preservation

Retrofit and restore historical and cultural resources susceptible to damage from a hazard event.

3.3 Priority Mitigation Actions

Action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. For a more strategic approach, Marion County is listing a set of high priority actions in an effort to focus attention on an achievable set of high leverage activities over the next five-years. This plan identifies priority actions based on an evaluation of high impact hazards, resource availability, and FEMA identified best practices.

Please refer to the individual city addenda and Appendix A-2 for city specific actions.

- ***Multi-Hazard # 1***: Develop a countywide evacuation plan through an approved FEMA grant.
- ***Wildfire # 1***: Update/revise 2017 Community Wildfire Protection Plan.
- ***Wildfire # 2***: Implement identified "Action/Tasks" within the 2022-2027 CWPP related to wildland fire reduction.
- ***Multi-Hazard # 2***: Develop an all-hazard recovery plan.
- ***Multi-Hazard # 3***: Begin preliminary process to examine the potential of adding an all- hazard siren warning system within the Santiam Canyon communities.
- ***Drought #1***: Participate in the Drought Contingency Plan update.
- ***Flood #1***: Identify flood prone areas and develop stormwater plans to target specific drainage areas to encourage community floodplain management. These actions support the county's FEMA CRS (Community Rating System) rating.
- ***Multi-Hazard # 4***: Provide and support all-hazard public outreach campaigns.
- ***Earthquake #1***: Promote Great Oregon Shakeout in October. Participate in activities for schools, business, and industry.

Special Note: "The Marion County Multi-Jurisdictional All-Hazard Mitigation Plan, is non-regulatory in nature, meaning that it does not set forth any new policy. This plan is designed to be an action plan and depends upon communities and partnerships to carry it forward."

3.4 Lifelines

In addition to the hazard specific priority actions listed above, the lifeline sector groups identified the following priorities. The priority actions are organized by lifeline sector.

Communications

- Joint Utility Liaison: Establish a position responsible for coordinating information sharing across sector service providers. NOTE: this position could also link to or coordinate activities in other critical infrastructure sectors.
- Communication: Examine the possibility of creating a special district to generate revenue for ongoing system maintenance and sustainability, equipment modernization and hazard mitigation activities.

Transportation

- Integrate Lifeline Corridor Inventories into Transportation System Plans: TSPs in Marion County does not currently include inventories of lifeline transportation corridors; however, we do have emergency routes that can assist county with a framework.
- Identify and Designate Priority Transportation Routes: Develop a "hub and spoke" approach to priority route planning focused on post-event resource collection and distribution.

Water

- Add Risk Assessment and Hazard Mitigation Information to Water Master Plans.
- Participate in the North Santiam Watershed Drought Contingency Plan update: Ensuring success of this ongoing effort related to water quantity is the top water sector priority.
- Continue to coordinate with utility providers in Marion County on their preparedness, mitigation, response, and recovery plans. Coordinate with utilities on Marion County's Critical Infrastructure Systems for prioritization during outages: Increase collaboration and common operating framework between energy utilities, emergency management, and end-users by sharing and aligning critical facilities lists.

3.5 Action Item Development Process

Development of action items was a multi-step, iterative process that involved brainstorming, discussion, review, and revisions. Action items can be developed through several sources. The figure below illustrates some of these sources.

Figure 3-1, Development of Action Items



Source: Oregon Partnership for Disaster Resilience, 2008

The Marion County steering committee, together with DLCD, developed the action items presented in this plan. The actions were developed based upon local vulnerability information gathered during the lifeline sector and steering committee meetings. The following action items are the result of stakeholder meetings, feedback from individual steering committee members, and an analysis of local plans and reports. During the update process, DLCD worked with the Marion County steering committee to identify which actions from the 2017 plan had been completed or not completed, and whether actions should continue to be listed in the plan. A table listing the 2017 plan's actions and their status are listed in Appendix A.

The action items in this plan address the following hazards found in Marion County: avalanche, drought, earthquake, extreme heat, flood, landslide, tornado, volcano, wildfire, severe weather, dam failure, and multi-hazard. In addition, the plan includes actions that address plan implementation. Each Marion County priority action item has a corresponding action item worksheet describing the activity, identifying the rationale for

the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item forms can assist the community in pre-packaging potential projects for grant funding. The worksheet components are described below. These action item forms are in Appendix A-1.

3.6 Priority Action Item Forms

Each priority action item has a corresponding action item form describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item forms can assist the community in pre-packaging potential projects for local elected official consideration, grant applications or other implementation opportunities. The components are described below.

3.7 Proposed Action Title

The action item describes the proposed action. It can be a simplified problem statement that identifies the hazard and specific risk reduction outcomes or protected assets, infrastructure, or communities.

3.8 Alignment with Plan Goals

The Plan goals addressed by each action item are identified as a means for monitoring and evaluating how well the mitigation plan is achieving its goals, following implementation.

3.9 Alignment with Existing Plans and Policies

Identify any existing community plans and policies where the action item can be incorporated. Incorporating the mitigation action into existing plans and policies, such as comprehensive plans, will increase the likelihood that it will be implemented. Implementation presents an opportunity for plan implementation as many of the recommendations contained in the Marion County HMP are consistent with the goals and objectives of the existing plans and policies. Where possible, Marion County and the participating cities will implement the recommendations and actions contained in the HMP through existing plans and policies.

3.10 Rationale or Key Issue Addressed

Action items should be fact-based and tied directly to issues or needs identified throughout the planning process. Action items can be developed at any time during the planning process and can come from several sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed action items is based on the information documented in Section II and the Hazard Annexes.

3.11 Implementing through Existing Programs

For each action item, the form is designed to solicit ideas for implementation, which serve as the starting point. The ideas for implementation offer a transition from theory to practice and serve as a starting point. This component of the action item is dynamic, this section should be used for ideas for implementation that include such things as: collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and updates to buildings and infrastructure. FEMA requires the

identification of existing programs and other authorities that might be used to implement these action items.

3.12 Coordinating Organization

The coordinating organization is the public agency with the regulatory responsibility to address natural hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation.

3.13 Internal and External Partners

The internal and external partner organizations listed in the action item forms are potential partners recommended but not necessarily contacted during the development of the Plan. The coordinating organization should contact the identified partner organizations. Internal partner organizations are departments within the jurisdictions that may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization. External partner organizations can assist the coordinating organization in implementing the action items in various functions and may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations.

3.14 Potential Funding Sources

When possible, identify potential funding sources for the action item. Example funding sources can include: the federal Building Resilient Communities and Infrastructure (BRIC) and Flood Mitigation Assistance (FMA) Grant Program; or local funding sources such as capital improvement or general funds. An action item may also have multiple funding sources. For additional information, see section 4 – Implementation and Maintenance.

3.15 Estimated Cost

Where possible, an estimate of the cost for implementing the action item is included. Making an entry is more important than having certainty of potential cost. If there is a number listed, it will provide key information for all partners to understand the scale of the project.

3.16 Timeline

During the 2022 update, an effort was made to add specific timelines using months and years to each action item. This is presented in a generic fashion in one box on the action item form in which action items are described as ongoing, short- (0-2 years), mid- (2-5 years), and long-term (5+ years) action items.

3.17 Status

As action items are implemented or new ones are created during the Plan maintenance process, it is important to indicate the status of the action item – whether it is new, ongoing, started, not started, discontinued, or complete. Documenting the status of the action will make reviewing and updating the mitigation Plan easier during the Plan's five-year update and can be used as a benchmark for progress.

4 Plan Implementation and Maintenance

The Implementation and Maintenance section details the formal process that will ensure that the Hazard Mitigation Plan (HMP) remains an active and relevant document. The implementation and maintenance process includes a schedule for monitoring and evaluating the plan semi-annually, as well as producing an updated plan every five years. Finally, this section describes how the county will integrate public participation throughout the maintenance and implementation process. Implementation begins with adoption of the plan.

4.1 Plan Adoption

The Marion County HMP was developed and will be implemented through a collaborative process. After the plan is locally reviewed and deemed complete, the Marion County Emergency Manager joins the DLCD Natural Hazard Planners in submitting it to the State Hazard Mitigation Officer (SHMO) at the Oregon Department of Emergency Management (OEM). OEM submits the plan to FEMA- Region X for review. This review addresses the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, Marion County will adopt the plan by resolution by the Marion County Board of Commissioners. Upon adoption, the County will gain eligibility for the Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds. The participating plan holders (cities and special districts) should convene local decision makers and adopt the Marion County Multi-Jurisdictional Hazard Mitigation Plan by resolution following adoption by the county, or concurrently.

4.2 Implementing the Plan

The success of the Marion County HMP depends on how well the outlined action items are implemented. To ensure that the activities identified are implemented, the following steps will be taken following adoption of the 2023 Marion County Multi-Jurisdictional Hazard Mitigation Plan by Marion County and each of the participating cities and special districts.

- The Hazard Mitigation Plan (HMP) Steering Committee will act as the countywide coordinating body convened annually to support action item implementation and plan maintenance.
- While the Marion County Emergency Manager is designated as the convener of the HMP, an HMP Committee representative will be determined for each of the participating cities. These representatives will act as local liaison and convener as needed.
- The HMP Steering Committee identifies mitigation planning activities, as well as specific mitigation actions which are then prioritized and evaluated.
- The plan is implemented through existing plans, programs, and policies.

4.3 Convener

The Marion County Emergency Director or his/her Designee will take responsibility for tracking and supporting plan implementation and will facilitate the Marion County Hazard Mitigation HMP Steering Committee. The Marion County Emergency Manager will share key information, grant opportunities, and FEMA requirements with members of the Hazard Mitigation Plan Committee, which may include time-sensitive requests for coordination on tasks such as updating the plan. Implementation and evaluation of the plan will be a shared responsibility among all the assigned Hazard Mitigation HMP Steering Committee members.

The Convener's responsibilities include:

- Convening the Hazard Mitigation Plan Committee annually each year in June and inviting key stakeholders.
- Organizing and notifying members of Hazard Mitigation Plan Committee meeting dates, times, locations, and agendas.
- Documenting the discussions and outcomes of committee meetings.
- Serving as a communication conduit between the Hazard Mitigation Plan Committee and the public/stakeholders.
- Identifying funding sources for natural hazard mitigation projects.
- Utilizing and communicating the findings of the Risk Assessment as a tool and factual basis for prioritizing risk reduction projects.

4.4 Hazard Mitigation Plan Steering Committee

The Marion County Convener will engage the Marion County Hazard Mitigation Plan (HMP) Steering Committee. The current process involves a single annual report out meeting in June. During this HMP update process, the Project Management team agreed on a biannual spring and fall meeting process. The Convener expressed enthusiasm for a more engaged plan maintenance process where the representatives are active participates in doing the work of the committee between biannual meetings.

The Mitigation Plan (HMP) Steering Committee is responsible for updating and implementing the HMP on behalf of their jurisdictions and in support of the collective countywide efforts.

HMP Steering Committee member responsibilities include:

- Attend future maintenance and plan update meetings (or designating a representative to serve in your place).
- Prioritize local projects and requesting funding support for hazard risk reduction projects.
- Evaluate and updating the HMP in accordance with the prescribed maintenance schedule.
- Develop and coordinate ad hoc and/or standing subcommittees as needed.
- Coordinate public involvement activities.

Table 4.1, Marion County HMP Steering Committee

Name	Position	Organization
Matthew Etzel	Assistant Public Works Director	City of Aumsville
Damian Flowers	Police Sergeant	City of Aumsville
Stuart Rodgers	City Recorder	City of Aurora
Mark Gunter	Public Works Supervisor	City of Aurora
Jim Trett	Mayor	City of Detroit
Kelly Galbraith	City Recorder	City of Detroit
Susie Marston	City Manager	City of Gervais
Mark Chase	Police Chief	City of Gervais
Melinda Olinger	Public Works Administrative Manager	City of Hubbard
Dave Rash	Police Chief	City of Hubbard
Rebecca Stormer	City Manager/Recorder	City of Idanha
Robyn Johnson	City Clerk	City of Idanha
Sarah Cook	City Manager/Recorder	City of Jefferson
Kyle Ward	Utility Foreman	City of Jefferson
Matt Reyes	Project Manager	City of Keizer
Tim Kirsch	Mayor	City of Mill City
Gary Olson	Volunteer	City of Mill City
Mark Daniel	Police Chief	City of Mt. Angel
Robin Fournier	Business Manager	City of Scott Mills

Name	Position	Organization
Dave Frisendahl	Police Chief	City of Stayton
Alissa Angelo	Interim City Manager	City of Stayton
Alan Frost	Public Works Director	City of Sublimity
Scott McClure	City Manager	City of Turner
Marty Pilcher	Police Chief	City of Woodburn
Kevin Hendricks	Fire Chief	Jefferson Fire District
Louis Gisler	Division Chief	Jefferson Fire District
Jeff Cowan	Fire Chief	Keizer RFPD
Joe Budge	Fire Chief	Woodburn Fire District
Kathleen Silva	Emergency Manager	Marion County
Mike Hintz	Emergency Preparedness Coordinator	Marion County
Danielle Gonzales	Management Analyst	Marion County Community Services
Alisa Zastoupil	Environmental Health Program Supervisor	Marion County Health & Human Services
Kaylynn Gesner	Public Health Educator	Marion County Health & Human Services

Name	Position	Organization
Joaquin Ramos	Diversity & Inclusion Strategist	Marion County Health & Human Services
Dain Thomas	GIS Analyst	Marion County Information Technology
Adam Crateau	GIS Analyst	Marion County Information Technology
Matt Knudsen	Environmental Services Supervisor	Marion County Public Works
Scott Wilson	Operations Division Manager	Marion County Public Works
Alyssa Schrems	Planning Division Associate Planner	Marion County Public Works
Eric Hlad	Division Commander	Marion County Sheriff's Office
Matt Wilkinson	Sergeant	Marion County Sheriff's Office
Jim Trierweiler	Chief	Mt. Angel Fire District

4.5 Interested Parties

To make the coordination and review of the Marion County HMP as broad and as useful as possible, the HMP Steering Committee will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items. Specific organizations have been identified as Interested Parties who will be included in the Marion County HMP Steering Committee meetings. See Table 4.2 Marion County HMP Interested Parties

Table 4.2, Interested Parties

Name	Position	Organization
Jeff Carlson	Safety, Compliance, Loss Control Specialist	Consumers Power
Ric Lentz	Emergency Manager	Linn County Sheriff's Office
Alyssa Boles	Planning Director	Linn County Planning & Bldg. Dept.
Mark Spross	Director	METCOM 911
John Plechinger	Emergency Manager	Pacific Gas and Electric
Randy Navalinski	Emergency Coordinator	Salem Area Mass Transit District (Cherriots)
JB Phillips	Engineering & Operations Manager	Salem Electric
Christina Bunnell	Emergency Preparedness Administrator	Salem Health
Nathan Streight	Emergency Preparedness Specialist	Salem Health
Ryan Mikesh	Emergency Management Coordinator	Salem-Keizer School District
Adam Maurer	Ambulance Director	Santiam Hospital
Brent Stevenson	District Manager	Santiam Water Control District
Shawn Rivera	District Ranger	U.S. Forest Service, Detroit RD
Duane Bishop	Deputy Forest Supervisor	U.S. Forest Service, Willamette NF

Name	Position	Organization
Ron Lee	Deputy Fire Chief	Marion County Fire District #1
Sam Phillips	Fire Management Analyst	Marion County Fire District #1
Ed Grambusch	Deputy Fire Chief	Silverton Fire District
Jim Anglemier	Police Chief	City of Silverton
Roy Hari	Fire Chief	Aumsville RFPD
Joshua Williams	Fire Chief	Aurora RFPD

4.6 Programmatic Implementation

The HMP includes a range of actions that, when implemented, reduce losses from hazard events throughout Marion County. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Marion County, and the participating cities, currently address statewide planning goals and legislative requirements through their comprehensive land use plans, capital improvement plans, mandated standards, and building codes. Marion County and cities participating in the HMP will work to incorporate the recommended mitigation action items from the HMP into existing programs and policies. In addition to specific actions related to plan integration, implementation of the Marion County HMP will be considered as part of the county budget and capital improvements planning cycles.

Marion County has significant internal capacity to implement this plan. The emergency management planning team is led by a member of the Marion County Board of Directors. This leadership structure adds significant political capacity and ensures that mitigation policies, planning and implementation needs are communicated directly to the county's elected officials. The emergency management staff team organizational structure consists of five full-time equivalent staff as follows:

- Board of Commissioners- Board Designee
- Emergency Management Director
- County Emergency Manager
- Emergency Preparedness Coordinator
- Emergency Management Program Coordinator II
- Emergency Management Program Coordinator I

In addition, Marion County Emergency Management utilizes federal AmeriCorps funded service volunteers to supplement internal capacity and achieve mitigation outcomes. The county maintains numerous federal, state, regional, and local partnerships as well.

Many of the recommendations contained in the HMP are consistent with the goals and objectives of Marion County and participating cities' plans and policies. Where possible, Marion County, and participating cities, should implement the recommended actions contained in the HMP through existing plans and policies.

Plans and policies already in existence often have support from residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.

Implementing the action items contained in the HMP through such plans and policies increases the likelihood of these actions being supported and implemented.

For examples of plans, programs, and policies that could be used to implement mitigation actions within the HMP, please refer to the Community Profile in Appendix B.

4.7 Plan Maintenance

Plan maintenance is one of the most critical components of the HMP. Proper maintenance of the plan ensures that it will maximize efforts of participating jurisdictions to reduce the risks posed by natural hazards. This section was developed by the Oregon Partnership for Disaster Resilience (OPDR) and retained in the 2022 plan update. It includes a process to ensure that regular review and updates of the Plan occur. The HMP Steering Committee, Marion County staff, and staff of participating local jurisdictions are responsible for implementing this process. These participating stakeholders and conveners are also responsible for maintaining and updating the Plan through a series of meetings outlined in the maintenance schedule below.

4.8 Meetings

The HMP Steering Committee will meet on a semiannual basis to complete the following tasks.

During the spring meeting, the HMP Steering Committee will:

- Document and update hazard history.
- Prioritize potential mitigation projects for the coming year.
- Review existing action items to determine appropriateness for local funding before the Marion County budget is approved in July.
- Review existing action items to determine appropriateness for any available state and federal funding opportunities.
- Discuss methods for continued public involvement and education, such as outreach and educational workshops before the summer months begin.

During the fall meeting, the HMP Steering Committee will:

- Review and update the risk assessment as needed.
- Review existing action items to determine continued appropriateness for local funding.
- Review existing action items to determine appropriateness for any available state and federal funding opportunities.
- Update County Administrator and Board on plan progress.
- Document successes and lessons learned during the year.

These meetings are an opportunity for the cities and special districts to report back to the county on progress that has been made towards their components of the HMP. The HMP Convener or HMP Steering Committee may revise the schedule as resources and events shift.

The Convener will be responsible for documenting the outcome of the semiannual meetings. The process the HMP Steering Committee will use to prioritize mitigation projects is detailed in the section below [this will be the next section of the plan, not included in this memo]. The plan's format allows the County and participating jurisdictions to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a HMP that remains current and relevant to the participating jurisdictions.

The Convener is also responsible for scheduling meetings with stakeholders from the lifeline sectors. The lifeline sector stakeholder meetings are not bound by the same scheduling cycle as the steering committee, but the Convener should aim to schedule periodic, consistent meetings.

4.9 Funding Sources

This comprehensive FEMA website provides a list of resources and information on key elements of the Building Resilient Infrastructure and Communities (BRIC) program. Resource List for the BRIC Grant Program | FEMA.gov

The Region 10 Wildfire Mitigation Funding Opportunity Guides provide state, tribes, and local officials with a wide range of application development resources for hazard mitigation grants. Mitigation Funding Opportunity Guides | FEMA.gov

This factsheet provides information on Planning related activities from The Hazard Mitigation Grant Program (HMGP) . State, Tribal, and/or local governments may use planning-related funding to reduce risk and include hazard mitigation with planning. Look at this guide for information on what types of mitigation activities may help you implement your projects.

Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program: The President signed the Water Infrastructure Improvements for the Nation Act or the "WIIN Act," on December 16, 2016, which adds a new grant program under FEMA's National Dam Safety Program (33 U.S.C. 467f). Section 5006 of the Act, Rehabilitation of High Hazard Potential Dams, provides technical, planning, design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. High Hazard

Potential is a classification standard for any dam whose failure or mis-operation will cause loss of human life and significant property destruction. Learn more at - https://www.fema.gov/emergency- managers/risk-management/dam-safety/grants

4.10 Plan Integration Resources

The **Region 10 Coffee Break Webinar on Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it on FEMA's YouTube page at The **Region 10 Coffee Break Webinar on Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it on FEMA's YouTube page at Integrating Natural Hazard Mitigation Plans into Local Planning - YouTube along with our other Mitigation Planning coffee break series webinars at Natural Hazards Mitigation Planning Coffee Break Series - YouTube

Plan Integration: Linking Local Planning Efforts (2015)- This step-by-step guide helps communities review local plans for possible integration and improve alignment efforts, including interagency coordination. Plan Integration: Linking Local Planning Efforts (2015)

The **Mitigation Planning and Community Rating System Bulletin** provides an overview of how to bring together planning efforts between the Community Rating System (CRS) and hazard mitigation plans. Mitigation Planning and the Community Rating System: Key Topics Bulletin (fema.gov)

4.11 Mitigation Ideas/Best Practices Resources

The **Region 10 Seismic Mitigation Showcase Guides** highlight mitigation successes in earthquake and tsunami mitigation by documenting specific locations and communities, the decision-making process, path to funding, and how partnerships were developed. Seismic Mitigation Showcase Guides | FEMA.gov

The **Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. You can find it in the FEMA Library at Mitigation Ideas (fema.gov)

The **Local Mitigation Planning Handbook** provides guidance to local governments on developing or updating hazard mitigation plans to meet and go above the requirements. You can find it in the FEMA Library at Local Mitigation Planning Handbook (fema.gov).

The FEMA Region 10 **Risk Mapping, Analysis, and Planning program (Risk MAP)** releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region.

Past newsletters can be viewed at Newsletter (starr-team.com) If you would like to receive future newsletters, email rxnewsletter@starr-team.com and ask to be included.

This Post Disaster Redevelopment Guide has guidance on how to integrate risk reduction strategies into existing local plans, policies, codes, and programs for community development or redevelopment patterns. Planning for Post-Disaster Redevelopment (fema.gov)

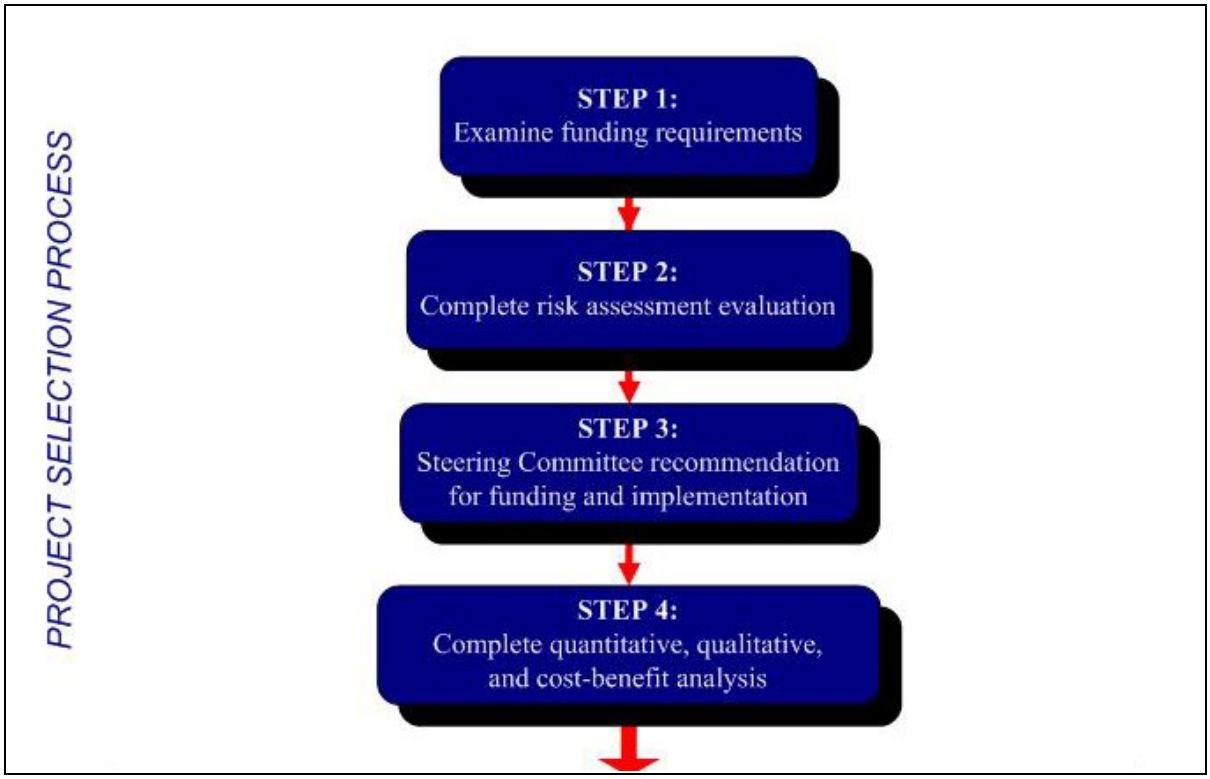
The mitigation strategy may include eligible projects to be funded through FEMA's hazard mitigation grant programs (Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program, and Flood Mitigation Assistance). Contact your State Hazard Mitigation Officer, Anna Feigum at: anna.f.feigum@oem.oregon.gov for more information.

4.12 Project Prioritization Process

Each of the participating jurisdictions has identified a list of mitigation actions that can be found in the addenda in Volume II. DOGAMI completed multi-hazard risk assessment reports both through FEMA's Risk MAP program and as a part of this 2022 update. The Oregon Climate Change Research Institute's Future Climate Projections for Marion County provides data on the impacts of climate change on future natural hazard severity. Furthermore, other local or regional hazard risk mitigation plans including the Community Wildfire Protection Plan, Drought Contingency Plan, and Commodity Flow Study. Future mitigation plan maintenance meetings will revisit the prioritization process based on new information and actions identified through these and other related planning studies or projects.

The Disaster Mitigation Act of 2000 requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore, the project prioritization process needs to be flexible. Committee members, local government staff, related planning documents and efforts, or risk assessments can each be used to identify projects. Figure 4-1 illustrates the project development and prioritization process.

Figure 4-1, Action Item and Project Review Process



Source: Oregon Partnership for Disaster Resilience.

4.12.1 Step 1: Examine Funding Opportunities

The first step in prioritizing the Plan's action items is to determine and identify potential grants and funding sources. Examples of mitigation funding sources include but are not limited to FEMA's Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance (FMA) program, Hazard Mitigation Grant Program (HMGP), National Fire Plan (NFP), Community Development Block Grants (CDBG), local general funds, and private foundations, among others. Please see Appendix F, Grant Programs, for a more comprehensive list of potential grant programs.

As grant programs open and close on differing schedules, the HMP Steering Committee will examine upcoming funding streams' requirements to determine which mitigation activities are eligible. The HMP Steering Committee may consult with the funding entity, Oregon Department of Emergency Management (OEM), or other appropriate state or regional organizations about eligibility requirements. Examination of funding sources and their requirements will take place during the HMP Steering Committee's semi-annual meetings.

4.12.2 Step 2: Complete Risk Assessment Evaluation

The second step in prioritizing the plan's action items is to examine which hazards the selected actions are associated with and where these hazards rank in terms of community risk. The HMP Steering Committee will determine whether the plan's risk assessment supports the implementation of eligible mitigation activities. This determination is based

on the location of the potential activities, proximity to known hazard areas, and whether community assets are at risk. The HMP Steering Committee will also consider whether the selected actions have any impact on mitigation of future hazard events and essentially, measure their overall strategic effectiveness.

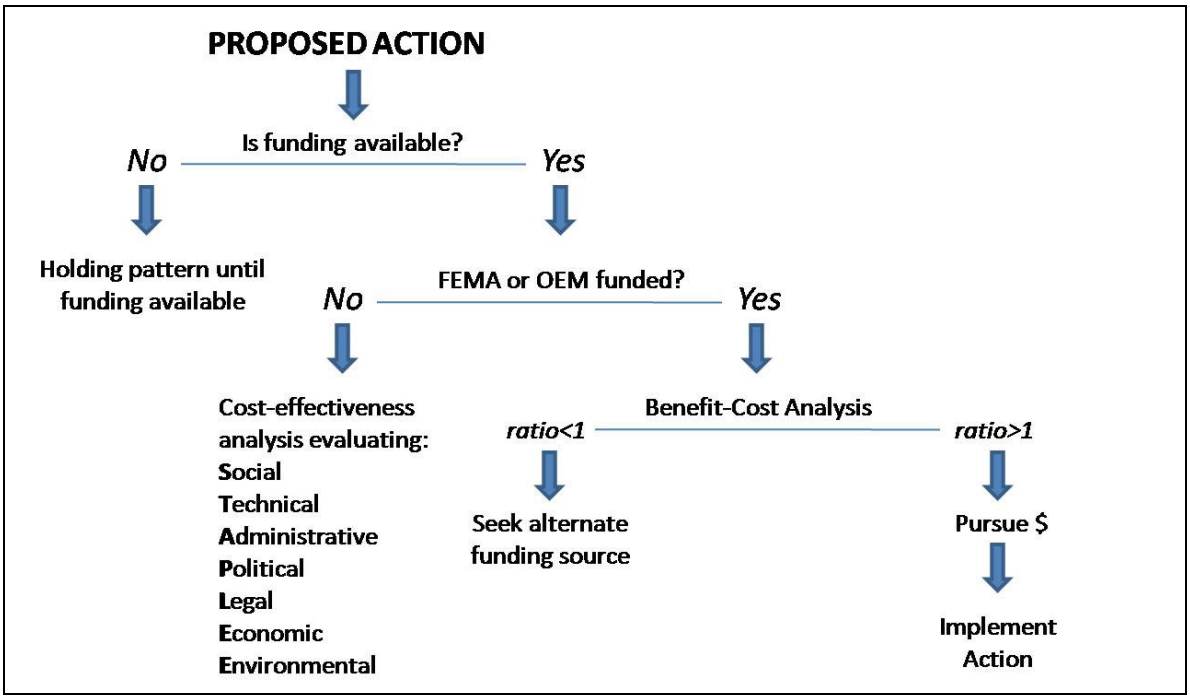
4.12.3 Step 3: HMP Steering Committee Recommendations

Depending on the results of the previous steps, the HMP Steering Committee will recommend which mitigation activities should be moved forward. If the HMP Steering Committee decides to move forward with an action item, the coordinating organization designated as the lead agency on the action item form is responsible for implementation and maintenance. The HMP Steering Committee will also convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process may afford greater coordination and less competition for limited funds.

4.12.4 Step 4: Complete Quantitative and Qualitative Assessment and Economic Analysis

The fourth step is to identify the costs and benefits associated with the selected hazard mitigation strategies, measures, or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity assists in determining whether a project is worth undertaking now to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating hazards provides decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 4-2 shows decision criteria for selecting the appropriate method of analysis.

Figure 4-2, Action Item and Project Review Process



Source: Oregon Partnership for Disaster Resilience.

If the activity requires federal funding for a structural project, the HMP Steering Committee uses a FEMA- approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit/cost ratio of greater than one to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment is completed to determine the project's cost effectiveness. The HMP Steering Committee will use a multivariable assessment technique called STAPLE/E to prioritize these actions. STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables helps define a project's qualitative cost effectiveness.

4.13 Continued Public Involvement and Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Marion County HMP. Although members of the HMP Steering Committee represent the public to some extent, the public also has the opportunity to provide consistent feedback about the plan.

To actively encourage public engagement, participation and feedback, Marion County has embarked on an ongoing education and outreach campaign in partnership with American Red Cross Northwest Oregon Chapter, U.S. Geological Survey (USGS), Everbridge, Marion County Citizens Corps Council (which is a consortium of volunteers from C.E.R.T., ARES (Amateur Radio Emergency Service), Fire Rehab, and Medical Reserve Corps (MRC)) and other local, state and federal partners. Emergency managers across Marion County leverage local outreach efforts to periodically focus attention on hazard mitigation and risk reduction opportunities.

In addition, the County and participating jurisdictions will continue to:

- Post links to the 2023 Marion County HMP on the County website and on its social media platforms.
- Place articles in the local online newspaper, the Statesman Journal, directing the public where to view the 2023 Marion County HMP and provide feedback.
- Use existing newsletters such as schools and utility bills to inform the public where to view and provide feedback.
- Present new and relevant information at community events such as the Marion County Fair, Oregon State Fair, Stayton Summer Fest, St. Paul Rodeo, and Oktoberfest.

Finally, Marion County will ensure continued public involvement by posting the Marion County HMP on the County's website (https://emergency-management-marioncounty.hub.arcgis.com/)

4.14 Five-Year Review of Plan

This plan is updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. The Marion County HMP shall be updated by [Month] [Day], 2027. The Marion County Emergency Manager is responsible for organizing the HMP Steering Committee to address plan update needs. The HMP Steering Committee is responsible for updating any deficiencies found in the plan and ultimately, for meeting the requirements of the Disaster Mitigation Act of 2000.

The following 'toolkit' may assist the Marion County Emergency Manager in determining which plan update activities are best discussed during regularly schedule plan maintenance meeting, and which activities may require additional meetings or subcommittees.

Table 4.3, Natural Hazards Mitigation Plan Update Toolkit

Question	Yes	No	Plan Update Action
Is the planning process description still relevant?			Modify this section to include a description of the plan update process. Document how the planning team reviewed and analyzed each section of the plan, and whether each section was revised as part of the update process. (This toolkit will help you do that).
Do you have a public involvement strategy for the plan update process?			Decide how the public will be involved in the plan update process. Allow the public an opportunity to comment on the plan process and prior to plan approval.
Have public involvement activities taken place since the plan was adopted?			Document activities in the "planning process" section of the plan update
Are there new hazards that should be addressed?			Add new hazards to the risk assessment section
Have there been hazard events in the community since the plan was adopted?			Document hazard history in the risk assessment section
Have new studies or previous events identified changes in any hazard's location or extent?			Document changes in location and extent in the risk assessment section
Has vulnerability to any hazard changed?			Document changes in vulnerability in the risk assessment section
Have development patterns changed? Is there more development in hazard prone areas?			Document changes in vulnerability in the risk assessment section
Do future annexations include hazard prone areas?			Document changes in vulnerability in the risk assessment section
Are there new high risk populations?			Document changes in vulnerability in the risk assessment section
Are there completed mitigation actions that have decreased overall vulnerability?			Document changes in vulnerability in the risk assessment section
Did the plan document and/or address National Flood Insurance Program repetitive flood loss properties?			Document any changes to flood loss property status
Did the plan identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?			1) Update existing data in risk assessment section, or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update
Did the plan identify data limitations?			If yes, the plan update must address them: either state how deficiencies were overcome or why they couldn't be addressed
Did the plan identify potential dollar losses for vulnerable structures?			1) Update existing data in risk assessment section, or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update
Are the plan goals still relevant?			Document any updates in the plan goal section
What is the status of each mitigation action?			Document whether each action is completed or pending. For those that remain pending explain why. For completed actions, provide a 'success' story.
Are there new actions that should be added?			Add new actions to the plan. Make sure that the mitigation plan includes actions that reduce the effects of hazards on both new and existing buildings.
Is there an action dealing with continued compliance with the National Flood Insurance Program?			If not, add this action to meet minimum NFIP planning requirements
Are changes to the action item prioritization, implementation, and/or administration processes needed?			Document these changes in the plan implementation and maintenance section
Do you need to make any changes to the plan maintenance schedule?			Document these changes in the plan implementation and maintenance section
Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?			If the community has not made progress on process of implementing mitigation into existing mechanisms, further refine the process and document in the plan.

Source: Oregon Partnership for Disaster Resilience

5 Plan Adoption

Federal Emergency Management Agency (FEMA) mitigation program is guided by agency guidance that interprets federal regulations and the legislation that creates and amends these regulations. There are specific steps that need to be taken to secure a FEMA- approved plan, and in Oregon, these include coordination with the Oregon Department of Emergency Management. Final Steps include:

- FEMA Review Tool
  - Plan writers complete a review tool used for plan review with the plan section and page numbers where the plan addresses the FEMA criteria.
- Plan Review
  - OEM reviews the full final plan draft with Review Tool as a guide to compliance with the Code Federal Regulations (CFRs) plan must meet.
  - OEM returns the plan for final edits that will support FEMA approval.
  - The Marion County Emergency Management completes the final edits and returns the revised final plan draft to OEM for submission to FEMA.
  - OEM sends the plan to FEMA which has a 45-day statutory review period.
  - FEMA reviews the plan for compliance with the CFRs and may return for edits and resubmission, or FEMA may issue a letter of preliminary approval called an APA letter.
- "APA"
  - FEMA issues letter stating that the plan is "Approvable Pending Adoption" or APA.
- Plan Adoption
  - All participating plan holders must pass a resolution adopting the final FEMA-approved plan.
  - Plan holders submit their signed resolutions as evidence of adoption to the HMP plan to OEM or the plan writer.
- Plan Approval
  - OEM submits all the signed resolutions to FEMA.
  - FEMA issues a final approval letter.

The remainder of this section includes the completed FEMA Review Tool, the FEMA APA letter, Resolutions of Approval from all plan holding cities and special districts and the final FEMA Approval Letter.

5.1 Final FEMA Approval Letter

To be added

5.2 FEMA APA Letter

To be added

5.3 Resolution of Approval

To be added

5.4 FEMA Review Tool

6 References

Department of Homeland Security, Federal Emeregncy Managemetn Agency. (2021, August 13). *National Risk and Capability Assessment*. Retrieved from FEMA.gov: https://www.fema.gov/emergency-managers/risk-management/risk-capability-assessment

Department of Homeland Security, Federal Emeregncy Managemetn Agency. (2022, November 4). *Hazard Mitigation Planning*. Retrieved from FEMA.Gov: https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning

Department of Homeland Security, Federal Emergency Management Agency. (2008). *Emergency Support Function #2 - Communications Annex*. Retrieved from FEMA.gov: https://www.fema.gov/pdf/emergency/nrf/nrf-esf-02.pdf.

Department of Homeland Security, Federal Emergency Management Agency. (2021, February 25). *Disaster Declarations for States and Counties*. Retrieved from FEMA.gov: https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Department of Homeland Security, Federal Emergency Management Agency. (2022, October 5). *Rehabilitation of High Hazard Potential Dams Grant Program Guidance & Resources*. Retrieved from FEMA.gov: https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams/resources

Department of Homeland Security, Federal Emergency Management Agency. (2023, January 11). *44 CFR 201.6(C) (2)(i) - Local Mitigaiton Plans, Subsection A.* Retrieved from Regulation and Guidance: https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning/regulations-guidance

Department of Homeland Security, Federal Emergency Management Agency. (N.d.). *Emergency Support Function #1 - Transportation*. Retrieved from Emergency Support Functions: https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response#esf

National Oceanic and Atmospheric Administration. (N.d.). *Storm Event Database*. Retrieved from NOAA.gov: https://www.ncdc.noaa.gov/stormevents/

Portland State University, Population Research Center. (2021). *Coordinated Population Forecast for Marion County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2021-2071*. Retrieved from https://pdxscholar.library.pdx.edu/opfp/60/

State of Oregon, Business Oregon. (2022). *Distressed Counties, 2022*. Retrieved from Distressed Areas in Oregon: https://www.oregon.gov/biz/reports/Pages/DistressedAreas.aspx

State of Oregon, Department of Land Conservation and Development. (N.d.). *Goal 7: Areas Subject to Natural Disasters and Hazards*. Retrieved from Oregon.gov: https://www.oregon.gov/lcd/OP/Pages/Goal-7.aspx

State of Oregon, Employment Department. (2022). *Mid-Valley Local Labor, Regional Herfindahl Index Scores*. Retrieved from State of Oregon Employment Department: https://www.qualityinfo.org/mid-valley

State of Oregon, Oregon Housing & Community Services. (N.d.). *Local Innovation and Task Force (LIFT) Housing Development*. Retrieved from Bond Financing & Loans: https://www.oregon.gov/ohcs/development/Pages/bond-financing-loans.aspx

State of Oregon, Oregon Water Resources Department. (N.d.). *Drought Declarations*. Retrieved from Oregon.gov: https://apps.wrd.state.or.us/apps/wr/wr_drought/declaration_status_report.aspx

Taylor, G., Hatton, R., & Taylor, G. H. (n.d.). The Oregon Weather Book: A State of Extremes. Oregon State University Press.

U.S. Army Corps of Engineers. (2020). *Dams of The Nation*. Retrieved from National Inventory of Dams: https://nid.usace.army.mil/#/

U.S. Census Bureau. (2020). *Housing*. Retrieved from Selected Housing Characteristics: 2020 American Community Survey 5-Year Estimates: https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047

U.S. Census Bureau. (2020). *Marion County, Oregon*. Retrieved from U.S. Census Bureau : https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047

U.S. Census Bureau. (2020). *Physical Housing Characteristics for Occupied Housing Units* . Retrieved from American Community Survey 5-Year Estimates: https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047

U.S. Census Bureau. (2021). *Selected Economic Characteristics*. Retrieved from American Community Survey: https://data.census.gov/table?q=Marion+County,+Oregon+Employment&tid=ACSDP1Y2021.DP03

U.S. Census Bureau. (2022, December 8). *American Community Survey 5-Year Data (2009-2021)*. Retrieved from U.S. Census Bureau: https://www.census.gov/data/developers/data-sets/acs-5year.html



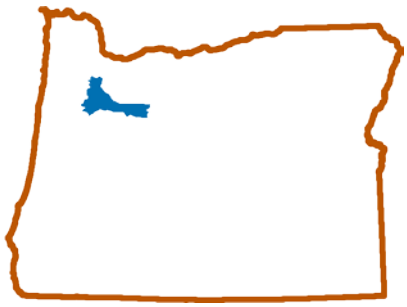




Marion County

MULTI-JURISDICTIONAL ALL- HAZARDS MITIGATION PLAN
VOLUME II: JURISDICTIONAL ADDENDA

- Marion County
- City of Aumsville
- City of Aurora
- City of Detroit
- City of Gervais
- City of Hubbard
- City of Idanha
- City of Jefferson
- City of Keizer
- Keizer Fire District



- City of Mill City
- City of Mt Angel
- Mt Angel Fire District
- City of Scotts Mills
- City of Stayton
- City of Sublimity
- City of Turner
- City of Woodburn/ Woodburn Fire District

FEMA

Effective Month X, 2022 through Month X, 2027

The 2023 Marion County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP)is a living document that will be reviewed and updated periodically to address the requirements contained in 44 CFR 201. It will be integrated with existing plans, policies, and programs. The Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved mitigation plan to receive federal funds for hazard mitigation grants. This plan meets those requirements as evidenced by FEMA approval which is effective per the cover date range of this plan.

Cover photos: (clockwise from top left): Marion County post-fire scene (2020); City of Detroit post-fire scene 10/20/2020; Tanker tipped on Hwy 22. Photos courtesy of Marion County.

Mission:
Create a more resilient Marion County by partnering with the whole community.

Comments, suggestions, corrections, and additions are encouraged to be submitted from all interested parties.

For further information and to provide comments, contact:

Marion County Emergency Management
5155 Silverton Road NE
Salem, OR 97305
Phone: 503-588-5108
Email: mcem@co.marion.or.us

Marion County
OREGON

Acknowledgements

The 2022 Marion County Hazard Mitigation Plan (HMP) update was conducted via a multi-jurisdictional partnership of Marion County and the Cities of Aumsville, Aurora, Detroit, Gates, Gervais, Hubbard, Idanha, Jefferson, Keizer, Mill City, Silverton, Stayton, Turner, and Woodburn, and the special districts of Keizer Fire District, Mt. Angel Fire District, and Woodburn Fire District.

2022 Marion County Hazard Mitigation Plan Steering Committee

Marion County
Adam Crateau, Alisa Zastoupil, Alyssa Schrems, Brandon Reich, Brian May, Brian Nicholas, Candace Jamison, Chris Eppley, Dain Thomas, Danielle Gonzalez, Dennis Mansfield, Eric Hlad, Kaylynn Gesner, Katrina Rothenberger, Kelly Weese, Jaden Emminger, Joaquin Ramos, Matt Knudsen, Matt Wilkinson, Scott Wilson

City of Aumsville
Matt Etzel, Richard Schmitz, Damian Flowers

City of Aurora
Stuart Rodgers, Mark Gunter

City of Detroit
Mayor Jim Trett, Kelly Galbraith, Christine Pavoni

City of Gervais
Susie Marston, Mark Chase

City of Hubbard
Melinda Olinger, Dave Rash

City of Idanha
Rebecca Stormer, Robyn Johnson, Mayor Rob Weikum

City of Jefferson
Sarah Cook, Kyle Ward

City of Keizer
Matt Reyes

City of Mill City
Gary Olson, Mayor Tim Kirsch

City of Mt. Angel
Mark Daniel

City of **Scotts Mills**
Robin Fournier, Mayor Paul Brakeman

City of Stayton
Alissa Angelo, Dave Frisendahl

City of Turner
Scott McClure, Don Taylor, Aaron Bales

City of Woodburn
Marty Pilcher, Andy Shadrin

Keizer Fire District
Jeff Cowan

Woodburn Fire District
Joe Budge

Mt. Angel Fire District
Jim Trierweiler

Interested Parties

Cherriots
Randy Navalinski

Linn County
Alyssa Boles, Ric Lentz

City of Silverton
Jim Anglemier

Aurora Fire District
Joshua Williams, Mike Corless

Jefferson Fire District
Levi Eckhardt

Pacific Gas & Electric
John Plechinger

Salem Health
Christina Bunnell, Nathan Streight

Santiam Hospital
Adam Mauer

Santiam Water Control District
Brett Stevenson

Consumer Power
Jeff Carlson, Kelley Bruneau, Billy Terry

METCOM 911
John Thompson, Mark Spross

Aumsville Fire District
Roy Hari, Brad McKenzie

Hubbard Fire District
Joe Budge, Michael Kahrmann

Marion County Fire District 1
Ron Lee, Sam Phillips

Salem Electric
JB Phillips, Britni Davidson-Cruikshank

Salem-Keizer School District
Ryan Mikesh

U.S. Forest Service
Shawn Rivera, Duane Bishop

Agency Partners

Oregon Department of Geology and Mineral Industries (DOGAMI)
Matt C. Williams, Ian P. Madin

Federal Guidance and Review Team

Federal Emergency Management Agency Region X, Mitigation Division
Edgar Gomez

Oregon Department of Emergency Management (OEM)
Stephen Richardson, Joseph Murray, Jason Gately

Project Managers

Marion County
Kathleen Silva, County Emergency Manager

Mike Hintz, Emergency Preparedness Coordinator

Oregon Department of Land Conservation and Development
Katherine Daniel, Natural Hazard Planner Pamela Reber, Natural Hazard Planner Tricia Sears, Natural Hazard Planner Marian Lahav, Natural Hazards Mitigation Planning Program Coordinator

In 2019, the Department of Land Conservation and Development (DLCD) applied for and received a Pre-Disaster Mitigation grant. PDMC-PL-10-OR-2019-005 from FEMA through the Oregon Department of Emergency Management (OEM) to assist Marion County.

This page intentionally left blank.

The Marion County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP) is comprised of four (4) volumes. These volumes include:

- Volume 1: Basic Plan
- Volume 2: City Addenda
- Volume 3: Appendices
- Volume 4: DOGAMI

To assist the viewer of this plan, each volume as its own table of contents.

Table of Contents

1 City of Aumsville Addendum 1-1
1.1 Purpose 1-1
1.2 Plan Process, Participants, and Adoption 1-1
1.3 Risk Assessment 1-2
1.4 Community Profile 1-2
1.4.1 Community Characteristics 1-3
1.5 Critical and Important Facilities 1-4
1.5.1 Transportation 1-4
1.5.2 Energy 1-4
1.5.3 Water/Wastewater 1-4
1.5.4 Communication 1-5
1.5.5 Emergency Services 1-5
1.5.6 Cultural/Historical Resources 1-6
1.5.7 Environment and Economy 1-6
1.5.8 Functional and Access Needs (Vulnerable Populations) 1-6
1.6 City of Aumsville Plans and Policies 1-7
1.7 Hazard Profile 1-8
1.8 Hazard Analysis 1-9
1.9 Hazard Characteristics 1-12
1.9.1 Avalanche 1-12
1.9.2 Drought 1-12
1.9.3 Earthquake 1-12
1.9.4 Extreme Heat 1-13
1.9.5 Flood 1-13
1.9.6 Landslide 1-14
1.9.7 Severe Weather 1-14
1.9.8 Tornado 1-14
1.9.9 Wildfire 1-14
1.9.10 Volcanic Eruption 1-14
1.9.11 Mitigation Strategy 1-15
1.9.12 Mitigation Success 1-15
1.9.13 Mitigation Actions 1-15
1.9.14 City of Aumsville Mitigation Table 1-15
2 City of Aurora Addendum 2-1

2.1 Purpose 2-1
2.2 Plan Process, Participation, and Adoption 2-1
2.3 Risk Assessment 2-2
2.4 Community Profile 2-2
2.4.1 Community Characteristics 2-2
2.4.2 Economy 2-3
2.5 Critical and Important Facilities 2-4
2.5.1 Transportation 2-4
2.5.2 Energy 2-4
2.5.3 Water / Wastewater 2-4
2.5.4 Communication 2-5
2.5.5 Emergency Services 2-6
2.5.6 Cultural / Historical Resources 2-6
2.6 Plans and Polices 2-8
2.7 Hazard Profile 2-9
2.8 Hazard Analysis 2-10
2.9 Hazard Characteristics 2-13
2.9.1 Avalanche 2-13
2.9.2 Drought 2-13
2.9.3 Earthquake 2-13
2.9.4 Extreme Heat 2-14
2.9.5 Flood 2-14
2.9.6 Landslide 2-17
2.9.7 Severe Weather 2-17
2.9.8 Tornado 2-17
2.9.9 Wildfire 2-18
2.9.10 Volcano 2-18
2.10 Mitigation Strategy 2-19
2.10.1 Ongoing Mitigation Actions 2-19
2.10.2 Mitigation Success 2-19
2.10.3 City of Aurora Mitigation Action Tables 2-19
3 City of Detroit Addendum 3-1
3.1 Purpose 3-1
3.2 Plan Process, Participation, and Adoption 3-1
3.3 Risk Assessment 3-2
3.4 Community Profile 3-2

3.4.1 Community Characteristics 3-2
3.5 Critical and Important Facilities 3-2
3.5.1 Transportation 3-2
3.5.2 Dams 3-3
3.5.3 Energy and Utilities 3-4
3.5.4 Water 3-4
3.5.5 Wastewater 3-5
3.5.6 Emergency Services 3-5
3.5.7 Environmental / Historical Preservation Sites 3-5
3.5.8 Communication / Information Technology 3-6
3.5.9 Agriculture and Food 3-6
3.5.10 Banking and Finance 3-7
3.5.11 Hazardous Materials 3-7
3.5.12 Government Facilities 3-7
3.5.13 Education 3-8
3.5.14 Healthcare and Public Health 3-8
3.5.15 Access and Functional Needs 3-9
3.6 Plans and Polies 3-9
3.7 Hazard Profile 3-10
3.8 Hazard Analysis 3-11
3.9 Hazard Characteristics 3-14
3.9.1 Avalanche 3-14
3.9.2 Drought 3-14
3.9.3 Earthquake 3-15
3.9.4 Extreme Heat 3-15
3.9.5 Flood 3-15
3.9.6 Landslides 3-15
3.9.7 Volcanic Eruption 3-16
3.9.8 Wildfire 3-16
3.9.9 Severe Weather / Storms 3-16
3.9.10 Tornado 3-17
3.10 Mitigation Strategy 3-17
3.10.1 Priority Actions 3-17
3.10.2 Action Item Status Report 3-17
3.10.3 Action Item Pool 3-17
3.10.4 City of Detroit Mitigation Action Tables 3-17

4 City of Gervais Addendum 4-1
4.1 Purpose 4-1
4.2 Plan Process, Participation, and Adoption 4-1
4.3 Risk Assessment 4-2
4.4 Community Profile 4-2
4.4.1 Community Characteristics 4-2
4.5 Critical and Important Facilities 4-3
4.5.1 Transportation 4-3
4.5.2 Energy 4-3
4.5.3 Water / Wastewater 4-4
4.5.4 Communications 4-4
4.5.5 Emergency Services 4-4
4.5.6 Cultural/Historical Resources 4-4
4.5.7 Events/ Festivals 4-4
4.5.8 Environmental and Economic 4-5
4.5.9 Functional and Access Needs (Vulnerable Populations) 4-5
4.6 Plans and Policies 4-6
4.7 Hazard Profile 4-7
4.8 Hazard Analysis 4-8
4.9 Hazard Characteristics 4-11
4.9.1 Avalanche 4-11
4.9.2 Drought 4-11
4.9.3 Earthquake 4-11
4.9.4 Extreme Heat 4-11
4.9.5 Flood 4-12
4.9.6 Landslide 4-12
4.9.7 Severe Weather 4-12
4.9.8 Tornado 4-12
4.9.9 Wildfire 4-12
4.9.10 Volcanic Eruption 4-12
4.10 Mitigation Strategy 4-13
4.10.1 City of Gervais Mitigation Tables 4-13
5 City of Hubbard Addendum 5-1
5.1 Purpose 5-1
5.2 Plan Process, Participation, and Adoption 5-1
5.3 Risk Assessment 5-2

5.4 Community Profile 5-2
5.4.1 Community Characteristics 5-2
5.4.2 Economy 5-2
5.4.3 Hubbard Rural Fire Protection District 5-3
5.5 Critical and Important Facilities 5-3
5.5.1 Transportation 5-3
5.5.2 Energy 5-4
5.5.3 Communications 5-4
5.5.4 Water/ Wastewater 5-4
5.5.5 Emergency Services 5-5
5.5.6 Cultural/Historical Resources 5-5
5.5.7 Events/ Festivals 5-5
5.5.8 Environmental/ Economic 5-5
5.5.9 Functional and Access Needs (Vulnerable Populations) 5-6
5.6 Plans and Policies 5-6
5.7 Hazard Profile 5-7
5.8 Hazard Analysis 5-8
5.9 Hazard Characteristics 5-11
5.9.1 Avalanche 5-11
5.9.2 Drought 5-11
5.9.3 Earthquake 5-11
5.9.4 Extreme Heat 5-11
5.9.5 Flood 5-12
5.9.6 Landslide 5-13
5.9.7 Severe Weather 5-13
5.9.8 Tornado 5-14
5.9.9 Wildfire 5-14
5.9.10 Volcano 5-14
5.10 Mitigation Strategy 5-15
5.10.1 Ongoing Mitigation Actions 5-15
5.10.2 Mitigation Success 5-15
5.10.3 City of Hubbard Mitigation Action Tables 5-15
6 City of Idanha Addendum 6-1
6.1 Purpose 6-1
6.2 Plan Process, Participation, and Adoption 6-1
6.3 Risk Assessment 6-2

6.4 Community Profile 6-2
6.4.1 Community Characteristics 6-2
6.4.2 Economy 6-3
6.5 Critical and Important Facilities 6-3
6.5.1 Communication/Information Technology 6-3
6.5.2 Water 6-3
6.5.3 Dams 6-4
6.5.4 Transportation Systems 6-4
6.5.5 Energy & Utilities 6-5
6.5.6 Agriculture and Food 6-5
6.5.7 Banking and finance 6-6
6.5.8 Hazardous Materials 6-6
6.5.9 Emergency Services 6-7
6.5.10 Government Facilities 6-7
6.5.11 Environmental/Historical Preservation Sites 6-7
6.5.12 Education 6-8
6.5.13 Healthcare & Public Health 6-8
6.5.14 Access and Functional Needs 6-8
6.6 Plans and Policies 6-9
6.7 Hazard Profile 6-10
6.8 Hazard Analysis 6-11
6.9 Hazard Characteristics 6-14
6.9.1 Avalanche 6-14
6.9.2 Drought 6-14
6.9.3 Earthquake 6-14
6.9.4 Extreme Heat 6-14
6.9.5 Flood 6-14
6.9.6 Landslide 6-14
6.9.7 Severe Weather 6-15
6.9.8 Tornado 6-15
6.9.9 Wildfire 6-15
6.9.10 Volcano 6-15
6.10 Mitigation Strategy 6-16
6.10.1 Mitigation Successes 6-16
6.10.2 Ongoing Mitigation Actions 6-16
6.10.3 City of Idanha Mitigation Action Tables 6-16

7 City of Jefferson Addendum 7-1
7.1 Purpose 7-1
7.2 Plan Process, Participation, and Adoption 7-1
7.3 Risk Assessment 7-2
7.4 Community Profile 7-2
7.4.1 Community Characteristics 7-2
7.5 Critical and Important Facilities 7-4
7.5.1 Transportation 7-4
7.5.2 Energy 7-4
7.5.3 Water/ Wastewater 7-4
7.5.4 Emergency Services 7-4
7.5.5 City Hall: 7-5
7.5.6 Schools 7-5
7.5.7 Communication 7-5
7.5.8 Cultural/Historical Resources 7-5
7.5.9 Functional and Access Needs (Vulnerable Populations) 7-5
7.5.10 Community Facilities 7-5
7.6 Plans and Policies 7-5
7.7 Hazard Profile 7-6
7.8 Hazard Analysis 7-7
7.9 Hazard Characteristics 7-10
7.9.1 Avalanche 7-10
7.9.2 Drought 7-10
7.9.3 Earthquake 7-10
7.9.4 Extreme Heat 7-11
7.9.5 Flood 7-11
7.9.6 Landslide 7-12
7.9.7 Severe Weather 7-13
7.9.8 Tornado 7-13
7.9.9 Wildfire 7-13
7.9.10 Volcano 7-13
7.10 Mitigation Strategy 7-14
7.10.1 City of Jefferson Mitigation Action Tables 7-14
8 City of Keizer Addendum 8-1
8.1 Purpose 8-1
8.2 Plan Process, Participation, and Adoption 8-1

8.3 Risk Assessment 8-2
8.4 Community Profile 8-2
8.4.1 Community Characteristics 8-2
8.5 Critical and Important Facilities 8-4
8.5.1 Transportation 8-4
8.5.2 Energy 8-5
8.5.3 Water 8-5
8.5.4 Communication 8-5
8.5.5 Emergency Services 8-6
8.5.6 Cultural / Historical Resources 8-6
8.5.7 Vulnerable Populations – Functional and Access Needs 8-6
8.6 Plans and Policies 8-7
8.7 Hazard Profile 8-8
8.8 Hazard Analysis 8-9
8.9 Hazard Characteristics 8-12
8.9.1 Avalanche 8-12
8.9.2 Drought 8-12
8.9.3 Earthquake 8-12
8.9.4 Extreme Heat 8-14
8.9.5 Flood 8-15
8.9.6 Landslide 8-18
8.9.7 Severe Weather 8-18
8.9.8 Tornado 8-20
8.9.9 Wildfire 8-20
8.9.10 Volcano 8-20
8.10 Mitigation Strategy 8-21
8.10.1 City of Keizer Mitigation Actions 8-21
8.10.2 Action Item Pool 8-21
9 Keizer Fire District Addendum 9-1
9.1 Purpose 9-1
9.2 Plan Process, Participation, and Adoption 9-1
9.3 Risk Assessment 9-2
9.4 District Profile 9-2
9.4.1 District Characteristics 9-2
9.5 Critical and Important Facilities 9-3
9.6 Plans and Policies 9-3

9.7 Hazard Profile 9-4
9.8 Hazard Analysis 9-5
9.9 Hazard Characteristics 9-9
9.9.1 Avalanche 9-9
9.9.2 Drought 9-9
9.9.3 Earthquake 9-9
9.9.4 Extreme Heat 9-11
9.9.5 Flood 9-12
9.9.6 Landslide 9-13
9.9.7 Severe Weather 9-14
9.9.8 Tornado 9-15
9.9.9 Wildfire 9-15
9.9.10 Volcano 9-15
9.10 Mitigation Strategy 9-16
9.10.1 Action Item Pool 9-16
10 City of Mill City 10-1
10.1 Purpose 10-1
10.2 Plan Process, Participation, and Adoption 10-1
10.3 Risk Assessment 10-2
10.4 Community Profile 10-2
10.4.1 Community Characteristics 10-2
10.5 Critical and Important Facilities/Infrastructure 10-3
10.5.1 Communication/Information Technology 10-3
10.5.2 Water 10-3
10.5.3 Wastewater 10-3
10.5.4 Dams 10-4
10.5.5 Transportation System 10-4
10.5.6 Energy and Utilities 10-6
10.5.7 Agriculture and Food 10-7
10.5.8 Banking and Finance 10-7
10.5.9 Hazardous Materials 10-8
10.5.10 Emergency Services 10-8
10.5.11 Government Facilities 10-8
10.5.12 Environmental / Historical Preservation Sites 10-9
10.5.13 Education 10-9
10.5.14 Healthcare and Public Health 10-10

10.5.15 Access and Functional Needs (Vulnerable Populations) 10-11
10.5.16 Plans and Policies 10-11
10.6 Hazard Analysis 10-13
10.7 Hazard Characteristics 10-16
10.7.1 Avalanche 10-16
10.7.2 Drought 10-16
10.7.3 Earthquake 10-16
10.7.4 Flood 10-16
10.7.5 Landslide 10-17
10.7.6 Volcano 10-17
10.7.7 Wildfire 10-17
10.7.8 Severe Weather 10-18
10.8 Mitigation Strategy 10-18
10.8.1 Priority Actions 10-18
11 City of Mt. Angel Addendum 11-1
11.1 Purpose 11-1
11.2 Plan Process, Participation, and Adoption 11-1
11.3 Risk Assessment 11-2
11.4 Community Profile 11-2
11.4.1 Community Characteristics 11-2
11.5 Critical and Important Facilities 11-3
11.5.1 Transportation 11-3
11.5.2 Energy 11-3
11.5.3 Communications 11-3
11.5.4 Water / Wastewater 11-3
11.5.5 Emergency Services 11-4
11.5.6 Cultural / Historical 11-4
11.5.7 Functional and Access Needs (Vulnerable Populations) 11-4
11.6 Plans and Policies 11-4
11.7 Hazard Analysis 11-6
11.8 Hazard Characteristics 11-9
11.8.1 Avalanche 11-9
11.8.2 Drought 11-9
11.8.3 Earthquake 11-9
11.8.4 Extreme Heat 11-9
11.8.5 Flood 11-9

11.8.6 Landslide 11-10
11.8.7 Severe Weather 11-10
11.8.8 Tornado 11-10
11.8.9 Wildfire 11-10
11.9 Mitigation Strategy 11-10
11.9.1 Mitigation Actions 11-10
12 Mt. Angel Fire District Addendum 12-1
12.1 Purpose 12-1
12.2 Plan Process, Participation, and Adoption 12-1
12.3 Risk Assessment 12-1
12.4 Community Profile 12-2
12.4.1 Community Characteristics 12-2
12.5 Critical and Important Facilities 12-2
12.5.1 Transportation 12-2
12.5.2 Energy 12-3
12.5.3 Emergency Services 12-3
12.5.4 Communications 12-3
12.5.5 Functional and Access Needs (Vulnerable Populations) 12-3
12.6 Plans and Policies 12-3
12.7 Hazard Profile 12-4
12.8 Hazard Analysis 12-5
12.9 Hazard Characteristics 12-8
12.9.1 Avalanche 12-8
12.9.2 Drought 12-8
12.9.3 Earthquake 12-8
12.9.4 Extreme Heat 12-8
12.9.5 Flood 12-8
12.9.6 Landslide 12-9
12.9.7 Severe Weather 12-9
12.9.8 Tornado 12-9
12.9.9 Wildfire 12-9
12.10 Mitigation Strategy 12-10
12.10.1 Mitigation Actions 12-10
13 City of Scotts Mills Addendum 13-1
13.1 Purpose 13-1
13.2 Plan Process, Participation, and Adoption 13-1

13.3 Risk Assessment 13-2
13.4 Community Profile 13-2
13.4.1 Community Characteristics 13-2
13.5 Critical and Important Facilities 13-2
13.5.1 Transportation 13-2
13.5.2 Energy 13-2
13.5.3 Water / Wastewater 13-3
13.5.4 Dams 13-3
13.5.5 Communication 13-3
13.5.6 Emergency Services 13-3
13.5.7 Cultural/Historical Resources 13-3
13.5.8 Functional and Access Needs (Vulnerable Populations) 13-4
13.6 Plans and Policies 13-4
13.7 Hazard Profile 13-5
13.8 Hazard Analysis 13-6
13.9 Hazard Characteristics 13-9
13.9.1 Avalanche 13-9
13.9.2 Drought 13-9
13.9.3 Earthquake 13-9
13.9.4 Extreme Heat 13-9
13.9.5 Flood 13-10
13.9.6 Landslide 13-10
13.9.7 Severe Weather 13-10
13.9.8 Tornado 13-10
13.9.9 Wildfire 13-10
13.9.10 Volcanic Eruption 13-11
13.10 Mitigation Strategy 13-11
13.10.1 Mitigation Actions 13-11
14 City of Stayton Addendum 14-1
14.1 Purpose 14-1
14.2 Plan Process, Participation, and Adoption 14-1
14.3 Risk Assessment 14-2
14.4 Community Profile 14-2
14.4.1 Community Characteristics 14-2
14.4.2 Economy 14-2
14.5 Critical and Important Facilities 14-4

14.5.1 Transportation 14-4
14.5.2 Energy 14-5
14.5.3 Water / Wastewater 14-6
14.5.4 Communications 14-6
14.5.5 Emergency Services 14-7
14.5.6 Cultural / Historical Resources 14-7
14.5.7 Functional and Access Needs (Vulnerable Populations) 14-8
14.6 Plans and Policies 14-9
14.7 Hazard Analysis 14-11
14.8 Hazard Characteristics 14-14
14.8.1 Avalanche 14-14
14.8.2 Drought 14-14
14.8.3 Earthquake 14-14
14.8.4 Extreme Weather - Heat 14-15
14.8.5 Flood (including dam failure) 14-16
14.8.6 Landslide 14-18
14.8.7 Severe Weather 14-18
14.8.8 Tornado 14-19
14.8.9 Wildfire 14-19
14.8.10 Volcano Eruption 14-20
14.9 Mitigation Strategy 14-20
14.9.1 Mitigation Actions 14-20
15 City of Sublimity Addendum 15-1
15.1 Purpose 15-1
15.2 Plan Process, Participation, and Adoption 15-1
15.3 Risk Assessment 15-2
15.4 Community Profile 15-2
15.4.1 Community Characteristics 15-2
15.5 Critical and Important Facilities 15-3
15.5.1 Transportation 15-3
15.5.2 Energy 15-4
15.5.3 Water / Wastewater 15-4
15.5.4 Emergency Services 15-4
15.5.5 Cultural / Historical Resources 15-5
15.5.6 Functional and Access Needs (Vulnerable Populations) 15-5
15.6 Plans and Policies 15-5

15.7 Hazard Profile 15-6
15.8 Hazard Analysis 15-7
15.9 Hazard Characteristics 15-10
15.9.1 Avalanche 15-10
15.9.2 Drought 15-10
15.9.3 Earthquake 15-10
15.9.4 Flood (Includes Dam Failure) 15-10
15.9.5 Landslide 15-11
15.9.6 Severe Weather 15-12
15.9.7 Tornado 15-12
15.9.8 Wildfire 15-12
15.9.9 Volcanic Eruption 15-12
15.10 Mitigation Strategy 15-13
15.10.1 Mitigation Actions 15-13
16 City of Turner Addendum 16-1
16.1 Purpose 16-1
16.2 Plan Process, Participation, and Adoption 16-1
16.3 Risk Assessment 16-2
16.4 Community Profile 16-3
16.4.1 Community Characteristics 16-3
16.4.2 Economy 16-3
16.4.3 Turner Fire District 16-4
16.5 Critical and Important Facilities 16-5
16.5.1 Transportation 16-6
16.5.2 Energy 16-6
16.5.3 Water / Wastewater 16-7
16.5.4 Communications 16-8
16.5.5 Emergency Services 16-8
16.5.6 Cultural / Historical Resources 16-8
16.5.7 Functional and Access Needs (Vulnerable Populations) 16-9
16.6 Plans and Policies 16-9
16.7 Hazard Profile 16-10
16.8 Hazard Analysis 16-11
16.9 Hazard Characteristics 16-14
16.9.1 Avalanche 16-14
16.9.2 Flood (Dam Failure) 16-14

16.9.3 Drought 16-15
16.9.4 Earthquake 16-15
16.9.5 Flood 16-16
16.9.6 Landslide 16-19
16.9.7 Severe Weather 16-19
16.9.8 Tornado 16-19
16.9.9 Wildfire 16-20
16.9.10 Volcanic Eruption 16-20
16.10 Mitigation Strategy 16-21
16.10.1 Mitigation Successes 16-21
16.10.2 Ongoing Actions 16-24
16.10.3 City of Turner Mitigation Action Table 16-24
17 City of Woodburn and Woodburn Rural Fire Protection District Addendum 17-1
17.1 Purpose 17-1
17.2 Plan Process, Participation, and Adoption 17-1
17.3 Risk Assessment 17-2
17.4 Community Profile 17-2
17.4.1 Community Characteristics 17-3
17.4.2 Economy 17-4
17.5 Critical and Important Facilities 17-5
17.5.1 Transportation 17-5
17.5.2 Energy 17-5
17.5.3 Water / Wastewater 17-6
17.5.4 Emergency Services 17-6
17.5.5 Cultural / Historical Resources 17-7
17.5.6 Functional and Access Needs (Vulnerable Populations) 17-7
17.6 Plans and Policies 17-8
17.7 City of Woodburn Hazard Profile 17-9
17.8 Hazard Analysis 17-11
17.9 Hazard Characteristics 17-14
17.9.1 Avalanche 17-14
17.9.2 Drought 17-14
17.9.3 Earthquake 17-14
17.9.4 Severe Weather – Heat 17-15
17.9.5 Flood (Includes Dam Failure) 17-16
17.9.6 Landslide 17-16

17.9.7 Severe Weather / Storm 17-16
17.9.8 Tornado 17-17
17.9.9 Volcanic Eruption 17-17
17.9.10 Wildfire 17-17
17.10 Mitigation Strategy 17-18
17.10.1 Mitigation Success 17-18
17.10.2 Ongoing Actions 17-19
17.10.3 City of Woodburn and Woodburn Fire District Mitigation Action Table 17-19
18 References 18-1

1 City of Aumsville Addendum

1.1 Purpose

This document serves as the City of Aumsville's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Aumsville to improve the resilience of the community. Mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful.

Information contained in Volume I (Basic Plan) and Volume III (Appendices) of the HMP provides additional information (hazard characteristics/events/extent, countywide mitigation actions, and community profile data) and forms the basis of this addendum.

1.2 Plan Process, Participants, and Adoption

In the summer of 2021 Marion County partnered with the Oregon Department of Land Conservation and Development and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Aumsville, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003). By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Aumsville will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program.

The Aumsville City Administrator is the designated local convener of this addendum. The convener delegates authority to staff for the lead in implementing, maintaining, and updating the addendum to the HMP in collaboration with Marion County Emergency Management.

The City of Aumsville will convene a Steering Committee drawing from the following departments to maintain and update the Aumsville addendum and action items:

- Convener, City Administrator
- Public Works Director
- Police representative
- Fire representative
- School District
- Marion County Emergency Management (as necessary)
- Marion County Public Works representative (as necessary)

For the 2022 HMP update, the City of Aumsville held the following meetings:

- On November 4th, 2021, staff from the City of Aumsville (Richard Schmitz, Police Chief, and Steve Oslie, Public Works Director) and the Aumsville Rural Fire Protection District (Brad McKenzie) met with DLCD and Marion County Emergency Management to conduct a Hazard Vulnerability Analysis to evaluate the hazards impacting the city. On November 8th, 2021, DLCD and Chief Schmitz had a follow-up discussion about mitigation actions for the city.
- On March 11, 2022, and March 30, 2022, staff from the City of Aumsville (Matthew Etzel, Assistant Public Works Director and Damian Flowers, Police Sergeant) reviewed and updated the Aumsville draft addendum with Pam Reber, DLCD Natural Hazard Planner.

1.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

1.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of the City of Aumsville, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city-specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

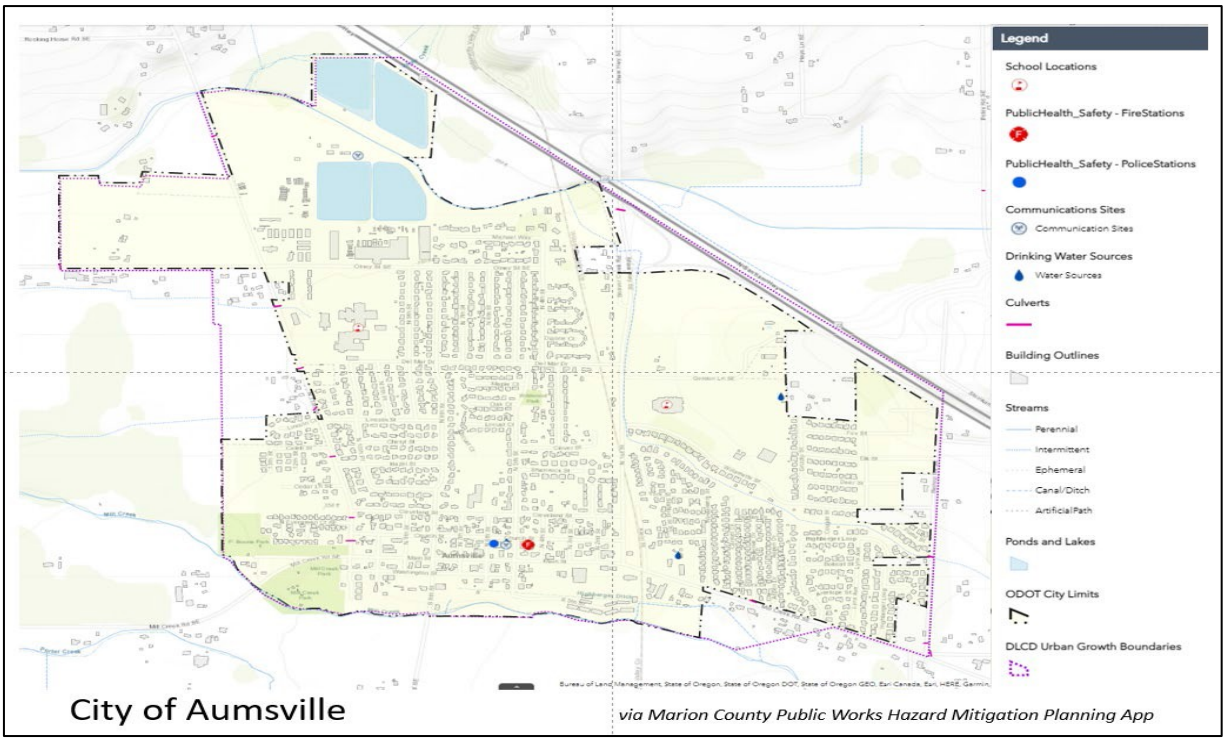
The City of Aumsville used multiple approaches to engage the public. The Marion County HMP flyer was distributed via the December 2021 issue of City of Aumsville newsletter. City staff is providing regular updates to City Council and plans to present the draft plan to the City Council during an open public council session. City of Aumsville staff attended Marion County HMP Steering Committee meetings and promoted the HMP survey and outreach efforts throughout the plan update.

1.4.1 Community Characteristics

The city of Aumsville is in Marion County, Oregon, southeast of Salem, just south of Hwy 22 at Exit 9. Aumsville is in Oregon's Willamette Valley, which experiences a moderate climate. In August, the average high temperature is 80 degrees, and the average low temperature is 52 degrees. Wintertime temperatures in January range from an average high of 47 degrees to an average low of 33 degrees. The average annual precipitation is 39.6 inches. Aumsville is bordered on the north by Beaver Creek and on the south by Mill Creek. Mill Creek has a small offshoot on the southeastern side of town called Highberger Ditch. Aumsville is almost completely flat.

The Population Research Center at Portland State University lists Aumsville's 2020 population at 4,376 which constitutes approximately 1.3% of the population of Marion County. This 2020 population represents a 36.3% increase (1,165 people) from 2010 (Portland State University, Population Research Center, 2021). Median household income in Aumsville 2015-2019 was $61,620. This is a 13.3% increase from the previous period (2010- 2014) (U.S. Census Bureau, 2022). For more economic demographic information, refer to Volume III, Appendix B: Community Profile.

Figure 1-1, City of Aumsville Map



Source: DLCD, Marion County.

1.5 Critical and Important Facilities

City of Aumsville's critical and important facilities include the following:

1.5.1 Transportation

- Highway OR-22 (North Santiam Highway)
- Shaw Hwy overpass on Hwy 22
- Aumsville Highway SE
- Mill Creek Bridge on W. Stayton Rd.
- Mill Creek Bridge on W end of Mill Creek Rd (this bridge hosts a fiber optic cable)
- Beaver Creek Bridge on Aumsville Hwy
- Note: City of Aumsville is not responsible for any of these highways or bridges – they are all managed by Marion County or ODOT

1.5.2 Energy

- Electricity Source: Pacific Power
  - All transmission lines, no substations
- Fuel Assets/Needs:
  - The city does not have a fuel station. City Hall does have back-up fuel: diesel generator for a well, City Hall/Police, and Fire District – diesel will last for 24 hours.
  - The Police Department buys fuel from retail fueling source. (Note that the local fuel station probably does not have a back-up power source to pump gas from underground tanks.)
  - Public Works back-up fuel: 500 gallons of diesel, up to 1000 gallons of gas above ground – there are electric pumps now, but fuel could be manually pump if necessary.
  - Wastewater Treatment Plant back-up fuel: diesel generator – diesel will last for 24 hours.
  - Boone Well site #1 back-up fuel: diesel generator – diesel will last for 24 hours.
- School District has propane and diesel back-up.

1.5.3 Water/Wastewater

- Drinking water sources:
  - Reservoir – 1 million gallons
  - Tower Well, located at 195 N. 5th St. (has back-up generator) – 100,000 gallons.
  - Boone Well #1, located at 1105 Main St. (has back-up generator)
  - Reservoir Well, located at 9313 Mill Creek Rd.

- Boone Well #2, located at 1105 Main St.
- Church Well, located at 675 Grizzly St.
- Two water filters that will filter 3,000 gallons per day (pumped from surface water sources).

- Wastewater treatment plant: City operates and is located at 955 Olney St
- Water treatment plant: City operates and is located at 9613 Mill Creek Rd
- Aumsville's five wells deposit water into a 1-million-gallon reservoir. Water is treated before it is stored in the reservoir. Chlorine and Potassium Permanganate is added in the treatment process and chlorine is added as needed in the reservoir. and then distributed out via a booster pump station to water customers.
- The 2015 Water Master Plan includes a section on water conservation, including a list of exiting or proposed water conservation programs. The Plan also provides a Water Curtailment Plan with accompanying curtailment actions.

1.5.4 Communication

- Emergency service communication tower is mounted on City Hall.
- Water Tower, 195 N. 5th St.: hosts 4 cellular providers.
- Wastewater Treatment Plant, 955 Olney St.: hosts one cell tower (owned by a cellular provider) with a diesel generator with back-up fuel for 24 hours.
- Telephone (ground line) switching station, 980 Main St.: has a diesel generator with back-up fuel for 24 hours.
- City-owned vehicle mounted radios provide the ability to interconnect Police and Fire
- Police and Fire can dispatch out of the Police Department and Fire stations.

1.5.5 Emergency Services

- Police:
  - Police Department, 597 Main St.
- Fire: Aumsville Rural Fire Protection District
  - 490 Church St.
  - Shaw Station, 5604 Shaw Highway SE
  - Provides coverage for city and county areas served by the district.
- Aumsville Public Works
- Emergency Operations Center is city or the fire department.
- Medical
  - Aumsville Medical Clinic, 205 Main St. (note this is just a doctor's office)

- Shelter:
    - Aumsville community center is a shelter and has a generator, working on MOUs with Willamette Baptist Church and schools.
    - MOUs with Willamette Baptist Church and Schools.

1.5.6 Cultural/Historical Resources

- Old City Hall is the Historic Museum, 599 Main St.
- Events that may have large crowds:
    - June: Emergency Preparedness fair/School Carnival
    - June – August, Mondays & Fridays: Kids summer parks program (run by the city)
    - August: Aumsville Corn Festival (10,000 – 12,000 attendance)
    - November: Saturday before Thanksgiving: Turkey Bingo (500-600 attendance)

1.5.7 Environment and Economy

- The largest employer is Blazer Industry that builds modular homes, etc.
- Agricultural lands surrounding community produces corn, mint, and hazelnuts and grass seed.
- Bedroom community to Salem.

1.5.8 Functional and Access Needs (Vulnerable Populations)

- Schools:
    - Aumsville Elementary School, 572 N. 11th St. (3 separate buildings)
    - Willamette Valley Baptist Church and School, 650 N. 1st St.
    - Kuntry Kids (Daycare), 200 Main St.
- Lower-income areas:
    - S 5th St next to Mill Creek
    - 11th St and Olney

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

1.6 City of Aumsville Plans and Policies

Table 1-1, City of Aumsville Plans and Policies

Document	Year
Aumsville Comprehensive Plan	2022
Development Ordinance Update	2021
Parks Master Plan	2017
Stormwater Master Plan	2000
Water System Master Plan	2015
Wastewater Master Plan & Facilities Plan	2022

Note: Year is year acknowledged or last revision. Source: Aumsville, 2022, Public Works website. https://www.aumsville.us/publicworks. 2022, PAPA Database https://www.oregon.gov/lcd/CPU/Pages/Adopted-Plan-Amendments.aspx.

1.7 Hazard Profile

Table 1-2, City of Aumsville Hazard Profile and Critical Facilities

Community Overview							
Community Name		Population		# Of Buildings		Critical Facilities[1]	Total Building Value ($)
Aumsville		4,215		1,459		5	509,635,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	6	0	76,000	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	36	0.9%	93	2	16,580,652	3.3%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	0	0.0%	0	0	0	0.0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0.0%	0	0	0	0.0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Aumsville Elementary School						
Aumsville Police Department						
Aumsville RFPD		X				
Aumsville Sewage Treatment Plant		X				
Willamette Valley Baptist School						

Source: DOGAMI (2022)

1.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a method developed by BOLD Planning. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the hazard vulnerability assessment findings and rankings is presented below.

Table 1-3, City of Aumsville Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary for the ***City of Aumsville including Aumsville FD*** using BOLD Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Severe Weather/Storm	4	3	3	4	3.6	**High**
Wildland Interface Fire	3	2	3	4	3.0	**High**
Drought	3	1	3	4	2.8	**Moderate**
Earthquake	2	4	3	4	2.8	**Moderate**
Tornado	2	4	3	4	2.8	**Moderate**
Extreme Heat	3	1	2	3	2.4	**Moderate**
Flood (incl. dam failure)	2	2	2	3	2.1	**Moderate**
Landslide	1	4	1	3	1.7	**Low**
Volcanic Eruption	1	2	2	3	1.7	**Low**
Avalanche	1	1	1	1	1.0	**Low**

Source: Marion County Emergency Management and City of Aumsville, 11/04/2021.

Table 1-4, City of Aumsville Hazard Vulnerability Assessment – Non-Natural Hazards

Hazard Profile Summary for the ***City of Aumsville including Aumsville FD*** using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Terrorism, Active Shooter, Workplace Violence	2	4	4	4	3.1	**High**
Cyberterrorism	2	4	3	4	2.8	**Moderate**
Hazardous Materials Release - Transportation	2	4	3	3	2.7	**Moderate**
Unauthorized Entry	2	4	2	4	2.5	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2	3	2.4	**Moderate**
Agricultural Terrorism	1	1	1	1	1.0	**Low**
Chemical, Biological, Radiological, Nuclear, Explosive	1	1	1	1	1.0	**Low**
Hazardous Materials - Non-Transportation	1	1	1	1	1.0	**Low**
Public Health	1	1	1	1	1.0	**Low**

Source: Marion County Emergency Management and City of Aumsville, 11/04/2021.

1.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Aumsville. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events.

The following section identifies vulnerabilities specific to the City of Aumsville, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

1.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Event – NA

Vulnerability – None

1.9.2 Drought

CPRI=2.8 Risk Level: Moderate

Events: In 2021, there was an event where a pump was lost during a period of extended heat; 14' of water was lost in the city's reservoir. This was the driver for securing additional storage and supply.

Vulnerability: The city is doing extensive resilience work on their water storage and the city coordinates messages on water conservation with the Aumsville RFPD and uses the utility bill and newsletter to educate the community. But an extreme drought could result in a water shortage. The city has 1 million gallons of storage. The city approved $3.5 million in funding for an additional 1 million gallons and 2 additional wells; the city holds unused water rights. The city had a well-siting study done that shows that city-owned sites could produce 400 gallons per minute (45% increase to water supply) water rights. The city had a well-siting study done that shows that city-owned sites could produce 400 gallons per minute (45% increase to water supply).

1.9.3 Earthquake

CPRI = 2.8, Risk Level: Moderate

Events: No damaging earthquake events occurred during the previous five years. On March 25, 1993, a Mw 5.7 earthquake occurred with an epicenter approximately 3 miles east of the City of Scotts Mills, Oregon. Many buildings were damaged from the event, including the capitol building in Salem. The many unreinforced buildings in the area were significantly damaged due to intense shaking. The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County.

Vulnerability: There is one locally active fault within the Aumsville city limits, one crossing over on the far northwest corner of the town. Other active faults also exist about six miles to the northwest and west. Vulnerable structures include the museum (unreinforced masonry) and the Aumsville Elementary School.

A 100,000-gallon elevated tank may need seismic retrofits. A new 1-million-gallon reservoir should be resilient; the current 1-million-gallon reservoir needs seismic upgrades which will be implemented after the new reservoir is constructed.

1.9.4 Extreme Heat

CPRI = 2.4, Risk Level: Moderate

Events: No conservation orders, annual water conservation advisories/education.

Vulnerability: City has started a vulnerable population list for response to an extreme heatwave (also power outages, wildfire smoke, etc.); Water supply was stressed in recent years, but new reservoir should address.

1.9.5 Flood

CPRI = 2.1, Risk Level: Moderate

Events: No major flood events 2017-2021.

Vulnerability: Certain residential areas; sewage lagoons; rural highway outlets to town.

Portions of Aumsville have areas of flood plains (special flood hazard areas). These include areas along Mill Creek and the High Berger Ditch, and Beaver Creek (see Figure 1-2). Furthermore, other portions of Aumsville, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage.

Figure 1-2, Aumsville Flood Hazard Map



Source: FEMA Map Service Center, 5/25/2022. https://msc.fema.gov/

Historically, Aumsville has experienced major floods in 1996, around 2000, and in 2011. Since then, no major floods have affected the population, but Aumsville continues to experience regular localized flooding during the wet season. In particular, the steering committee noted issues along Bishop Road, 1st Street, and in the Highberger Ditch area. The steering committee also noted that Porter Boone and Mill Creek Parks often flood during the winter. According to the steering committee, many of the flooding issues affecting Aumsville can be attributed to poor ditch maintenance.

1.9.6 Landslide

CPRI = 1.7, Risk Level: Low

Events: n/a

Vulnerability: Aumsville is very flat, there is no landslide risk.

1.9.7 Severe Weather

CPRI = 3.6, Risk Level: High

Events: Ice storm in 2021 resulted in 4 days without power and communication (cell, internet, regular phone).

Vulnerability: Significant wind events occur in Aumsville each year, sometimes interrupting services, downing trees, and causing power outages. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

1.9.8 Tornado

CPRI=2.8, Risk Level: Moderate

Events: Aumsville tornado December 14, 2010.

Vulnerability: In December 2010, a tornado touched down in Aumsville, causing around $1.2 million dollars in damage. Nichols Plumbing had their building destroyed, scattering plumbing parts across the street. Other building damage included a house, a metal building, and the roofs of several manufactured were damaged. Since this event, Aumsville has not experienced wind events that were quite as severe.

1.9.9 Wildfire

CPRI = 3.0, Risk Level: High

Events: n/a

Vulnerability: Aumsville is surrounded by agricultural lands which are highly managed and pose low risk for wildfire.

1.9.10 Volcanic Eruption

CPRI = 1.7, Risk Level: Low

Events: 1980 Mount St Helens eruption.

Vulnerability: The City would have several hours before ash from an eruption of Mt. Hood, or another volcano impacted the community; impacts could last more than a week.

1.9.11 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Aumsville Addendum update process, the Oregon Department of Land Conservation & Development and Aumsville city staff developed a list of priority actions. Actions that were thought to be relevant but not considered to be priorities were placed in the Action Item Pool for consideration at annual plan review meetings.

1.9.12 Mitigation Success

Aumsville is upgrading their water supply by putting the water rights they have, to work and building sufficient storage capacity to endure low production times, pump failures, and other risks. A 100,000-gallon elevated tank may need seismic retrofits. If these are too costly however, the tower will just be used as a communications tower. A new 1-million-gallon reservoir will be built to seismic standards; and the current 1-million-gallon reservoir needs seismic upgrades which will be implemented after the new reservoir is constructed. The city is also active in messaging to the community about water conservation and what is needed for a resilient water system.

1.9.13 Mitigation Actions

- Aumsville requires that new development puts new power lines underground. Undergrounding electric utilities is included in the city's development standards; it is a criterion for new construction. The city also encourages Pacific Power to underground lines as much as they are able.
- Include emergency preparedness resources in the city's monthly newsletter.
- Hold an annual preparedness fair.
- Participate in the Marion County's MORE Agreement.
- Develop stronger connections with the business community and encourage businesses to develop continuity of operations plans.
- Participate in Marion County Drought Contingency Plan update.

1.9.14 City of Aumsville Mitigation Table

The following pages include the City's Priority Action Items (Table 1.5) and Action Item Status Report (Table 1.6).

Table 1-5, City of Aumsville and Aumsville Fire District Mitigation Actions

City of Aumsville and Aumsville Fire District Priority Mitigation Actions 2022-2027							
#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-MH-01	Multi-Hazard	Develop a communications plan between the city, police, and fire. This will include purchasing more radios so all key personnel can be in contact during an emergency.	H	1-3 Years	$25-75k	Include Incident Command System (ICS) and National Incident Management System (NIMS) training in the communication plan development.	Not Started
2022-MH-02	Multi-Hazard	Update the City's Evacuation and Mass Care Plan. Important components include List of vulnerable populations, Fuel Management and access plan, Detailed Asset Inventory	H	1-3 Years	$25-75k	Revised City EOP action items, Continuation/edit of 2017 MH-02, Update City's Evacuation and Mass Care plan	New
2022-MH-03	Multi-Hazard	Develop a MOU with facilities that could function as emergency shelter during a hazard event.	H	1-3 Years	$5-10k	Brought over from 2017 plan, #MH-5	Not Started
2022-MH-04	Multi-Hazard	Identify and purchase materials the city needs to operate successfully in all emergency situations.	M	1-5 Years	$250k-$1.5 million	Generators at all locations. Church and Boone currently do not have generators, Include generators in all future well projects. Generator at new PW facility.	Started
2022-MH-05	Multi-Hazard	Develop MOU with local gas stations that give emergency services first access to stations stored fuel.	M	2-5 Years	Staff time	Tentative gas station agreements but they need backup generator. Brough over from 2017 plan #MH-1	Started
2022-MH-06	Multi-Hazard	Update the City's Comprehensive Plan to reflect Statewide Land use Goal 7 language surrounding natural hazards	M	2-5 Years	Staff time	Consider using the County's HMP hazard chapters to update the Goal 7 section with hazard characterization, events, special city vulnerabilities and recommendations for policies and strategies to protect the city from hazards. Was brought over from 2017 plan, #MH-06	Not Started
2022-EQ-01	Earthquake	Conduct a seismic analysis on the empty elevated water tank.	H	2-5 Years	$8-15k	Working with Engineer of Record to draft a report on the seismic analysis of the empty tank with Cell Phone antennas still on tower with no water.	Started

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-EQ-02	Earthquake	Complete seismic assessment on critical facilities (water tower assessment currently underway). Retrofit facilities based on recommendations of the assessment.	H	2-5 Years	$10k-$3.5 million	Seismic Analysis was done on elevated tank and showed 1.5+ Million in needed retrofits. Redoing analysis on tank empty now that City is constructing a new 1-million-gallon reservoir. Existing 1-million-gallon reservoir will need seismic upgrades once construction of new tank is complete.	Started
2022-EQ-03	Earthquake	Support school district's efforts to secure a bond for school seismic retrofitting.	H	2-5 Years	Staff time	Help advertise the need for retrofits in newsletter??	Not Started
2022-EQ-04	Earthquake	Consider requiring new city facilities to exceed the minimum structural requirements for seismic loading.	M	2-5 Years	TBD	Lead: City Council Partners: Marion Co. Building Inspection	Not Started
2022-EQ-05	Earthquake	Encourage residents to prepare and maintain 2-week survival kits.	M	0-18 months	TBD	Newsletter articles from Marion County Emergency Management and Police Chief.	Started
2022-EQ-06	Earthquake	Send employees to an ATC 20 training	M	0-18 months	TBD	Brought over 2017 HMP, EQ-08	Not Started
2022-FL-01	Flood	Remove culvert on Gordon Lane at 1st Street; replace with a bridge.	M	5-10 Years	$2 million	To prevent potential flooding in the Highberger Estates subdivision or 1st Street. To be implemented with development; the city will have an engineered set of drawings ($400k). Funding: city budget, developer	Started
2022-FL-02	Flood	Upsize culverts on Bishop Rd.	M	5-10 Years	$1 million	To prevent potential flooding to Highberger Estates and Bishop Road. To be implemented with development. Funding: city budget, developer	Not Started
2022-FL-03	Flood	Update the stormwater management plan	M	2-5 Years	$50-$60k	Continued 2017 P-3 Funding: FEMA	Started

Table 1-6, City of Aumsville Action Item Status Report

2017-2022 City of Aumsville & Aumsville Fire District Action Status Update					
#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-MH-01	Multi-Hazard	Develop MOU with the gas station that gives emergency services first access to station's stored fuel.	Tentative gas station agreement but they need backup power. 2022 MH-05	City Administration	Started
2017-MH-02	Multi-Hazard	Update the City's Emergency Operations Plan. Important components to include are: -A list of vulnerable populations -Fuel management and access plan -Detailed asset inventory	All sub items are complete. Follow up to confirm that the city is working towards its own EOP or if it is coordinating with the County's EOP. The city has emergency response plans for the water and wastewater systems. 2022 MH-02	Police Chief, Public Works, and City staff	Complete or revised
2017-MH-03	Multi-Hazard	Identify and purchase materials the city needs to operate successfully in an emergency.	2022 MH-04	City Administration	Started
2017-MH-04	Multi-Hazard	Develop a communications plan between the city, Police, and Fire. This will include purchasing more radios so all key personnel can be in contact during an emergency.	2022 MH-01	City Administration and Police Chief	Started
2017-MH-05	Multi-Hazard	Develop a memorandum of understanding with facilities that could function as emergency shelters during a hazard event.	2022 MH-03	City Administration	No Started
2017-MH-06	Multi-Hazard	Update the Aumsville Comprehensive Plan to reflect statewide land use Goal 7 language surrounding natural hazards.	2022 MH-06 Consider using the Marion Co HMP hazard chapters to update the Goal 7 section with: hazard characterization, events, specific city vulnerabilities, and recommendations for policies and strategies to protect the city from these hazards.	City Administration	Not started
2017-MH-07	Multi-Hazard	Include emergency preparedness resources in the city's monthly newsletter	Moved to ongoing mitigation actions.	City Executive Office	Started
2017-MH-08	Multi-Hazard	Hold an annual preparedness fair.	Moved to ongoing mitigation actions.	City Executive Office	Not Started
2017-MH-09	Multi-Hazard	Participate in the Marion County's MORE Agreement.	Moved to ongoing mitigation actions.	City Administration	No Started
2017-MH-10	Multi-Hazard	Develop stronger connections with the business community and encourage businesses to develop continuity of operations plans.	Moved to ongoing mitigation actions.	City Administration	Started

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-DR-01	Drought	Partner with Marion County to support local agencies' training on water conservation measures.		Public Works	Complete
2017-DR-02	Drought	Participate in Marion County Drought Contingency Plan.	Moved to Ongoing.	Public Works	Not Started
2017-P4/EQ-00	Earthquake	Assess the seismic vulnerability of the City's reservoir (as described in the 2015 Water Plan). Retrofit facility as funding becomes available.	The analysis showed the need for seismic upgrades to be greater than the cost than replacing the tank.	Public Works	Complete/ Revised 2022 EQ-02
2017-EQ-01	Earthquake	Complete seismic assessment on critical facilities (water tower assessment currently underway). Retrofit facilities based on recommendations of the assessment.	complete part 1; USE ongoing doing another analysis based on the tank being empty.	Public Works	Ongoing
2017-EQ-02	Earthquake	School seismic retrofitting action – need to talk to school district representative.	Discuss replacement of Aumsville Elementary School with the school district.	School District	School District action item
2017-EQ-03	Earthquake	Purchase a 4-wheel drive vehicle that could provide transportation if major access points to the city are not passable.	City to purchase two 4x4 vehicles; one has been received; the other is coming but delayed due to supply chain issue.	Public Works	Complete
2017-EQ-04	Earthquake	Consider requiring new city facilities to exceed the minimum structural requirements for seismic loading.		City Council	Not Started
2017-EQ-05	Earthquake	Install automatic shut-off valves in all city facilities that use natural gas.		Public Works	Complete
2017-EQ-06	Earthquake	Develop dam inundation maps.		FEMA	Discontinue
2017-EQ-07	Earthquake	Encourage residents to prepare and maintain 2-week survival kits.		City Executive Office	Not Started
2017-EQ-08	Earthquake	Send employees to Marion County's ATC 20 training.		City Executive Office	Not Started
2017-FL-1	Flood	Remove culvert on 1st and Gordon and replace with a bridge.	Design completed in 2022.	City Administration/ Public Works	Started/ 2022 FL-01
2017-FL-2	Flood	Upsize culverts on Bishop Rd.		City Administration/ Public Works	Not Started/ 2022 FL-02
2017-FL-03	Flood	Create an agreement for flood mitigation along Beaver Creek and Mill Creek/ Highberger Ditch	Discontinued except	City Administration	Discontinued

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-FL-03	Flood	Create an agreement for flood mitigation along Beaver Creek and Mill Creek/ Highberger Ditch (agreement would have to be regional). Aumsville could do the following: • Use city property as a water detention space. • Increase the detention capacity to accommodate effects of new development. Update the Stormwater Management Plan.	Discontinued except, 2022 FL-03 Update Stormwater Management Plan	City Administration	Discontinued
2017-SW-01	Severe Weather	Require new development to put power lines underground.	Included in the city's development standards, a criterion for new construction. See Ongoing Mitigation Action section.	City Administration	Complete
2017-SW-02	Severe Weather	Encourage Pacific Power to underground lines was they are able.	See Ongoing Mitigation Action section.	City Administration	Complete

Source: City of Aumsville, 3/30/2022

2 City of Aurora Addendum

2.1 Purpose

This document serves as the City of Aurora's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Aurora to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

2.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including the City of Aurora, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003). The City of Aurora joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on December 14, 2021.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Aurora will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program.

The City of Aurora Steering Committee is comprised of the following:

- Convener, City of Aurora City Recorder
- City of Aurora Administrative Assistant
- City of Aurora Wastewater Treatment Plant Operator
- City of Aurora Finance Officer
- Marion County Sheriff
- Fire Chief, Aurora Rural Fire Protection District
- North Marion School District – Public/Private Schools K-12
- Marion County Emergency Management Representative (as necessary)
- American Red Cross Representative
- CenturyTel Representative
- Willamette Broadband Representative
- Northwest Natural Gas Representative
- Portland General Electric Representative

On November 16, 2021, Stuart Rodgers (Aurora City Recorder), Mike Corless (Aurora Rural Fire Protection District Assistant Fire Chief), Josh Williams (Aurora RFPD District Chief), Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the City of Aurora that included a Hazard Vulnerability Assessment ranking. This addendum was updated on June 15, 2022, in a meeting with Stuart Rodgers, Mark Gunter (Public Works Director), and Pam Reber (DLCD). The City of Aurora staff holds regular meetings with Aurora RFPD and coordinates on all relevant issues to the City. The Aurora Preparedness Group is a nonprofit organization that is funded by the City where the City, Fire District, and School District coordinate regularly on mitigation action items. The City of Aurora publicly notified the local community about this plan update process by linking to the Marion County Emergency Management webpage.

2.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

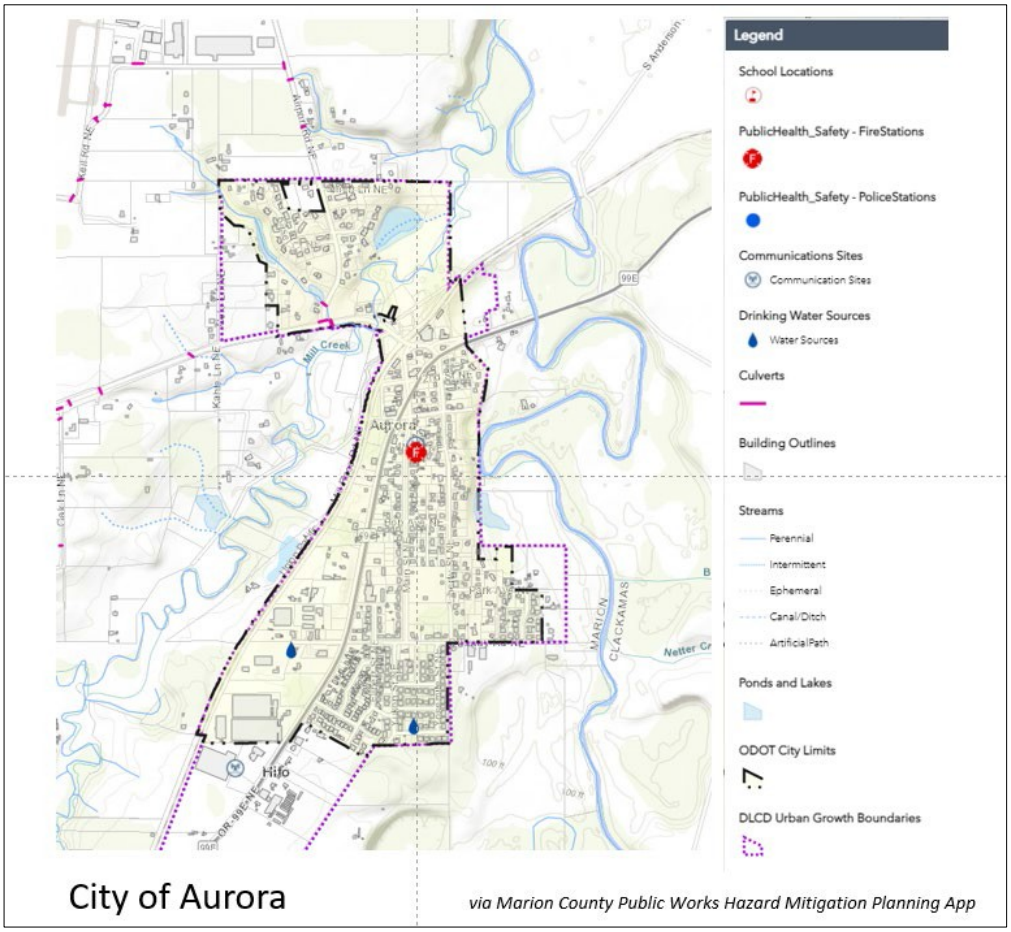
2.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of City of Aurora, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

2.4.1 Community Characteristics

The City of Aurora is in the Willamette Valley in Marion County, Oregon, approximately 23 miles south of the city of Portland. The Aurora experiences a moderate climate with an average high temperature of 82 degrees and low of 54 degrees in August, and an average high temperature of 47 and low of 35 in January. The city receives an average annual precipitation of 40.67 inches. Aurora is located on a gently sloping hill bordered by Mill Creek to the west and the Pudding River to the east. Surrounding the rural community is hilly farm and forest land. The Population Research Center at Portland State University lists Aurora's 2020 population at 1,023. This represents a 36% increase from 2000 (Portland State University, Population Research Center, 2021). For more demographic information, refer to Volume III, Appendix B – Community Profile.

Figure 2-1, City of Aurora Map



2.4.2 Economy

Historically, Aurora's economy focused on agriculture and manufacturing, which remain major employment sectors today. The city also has large heritage tourism component, which capitalizes on Aurora's history as a religious colony and large number of historic buildings dating to the 1850s. Aurora is also known as the "Antique Capital," and the city's downtown has several large antiques retailers which draw several visitors to the community. Median household income in Aurora during the period 2015-2019 was $87,632, an 11.6% increase from the previous 5-year period (U.S. Census Bureau, 2022). For more economic information, refer to Volume III, Appendix B – Community Profile.

2.5 Critical and Important Facilities

Aurora's critical and important facilities include the following:

2.5.1 Transportation

- Two bridges provide primary access to the city from I-5 and Hwy 99E:
  - Mill Creek Bridge (County-owned) – City sewer and water co-located.
  - Pudding River Bridge (ODOT-owned)
  - If either collapsed, transportation in and out of the city would require lengthy detours.
- Aurora State Airport, 22801 Airport Rd NE, Aurora
- School district: contracts out bus service to Canby (diesel)
- Canby CAT bus runs along Hwy 99E between Canby and Woodburn
- Note: Hwy 99E and Ehlen Rd are the only 2 entrances to town (if bridges are out, it would be difficult to get in and out).
- Note: Intersection of Ehlen Rd. and the railroad tracks is dangerous.
- Note: The wastewater treatment plant is across a bridge – in the event of a train derailment or bridge collapse, the wastewater treatment plant would not be accessible.

2.5.2 Energy

- PGE – electricity (all above ground lines)
- NW Natural – natural gas
- The city gets fuel from Shell Station in town.
- Fire gets fuel from various gas stations.
- City Hall (21420 Main St.) would likely shut down without power, even if the building did withstand seismic activity. City Hall does not currently have a backup generator.
- Fire Station (21390 Main St.) has a generator that would run the whole station. The generator runs on natural gas but could also run on propane. The fire station does not keep reserves of natural gas or propane.
- Public Works has backup power at the wastewater treatment plant.
- Wastewater treatment plant staff are in the process of purchasing a new generator for the facility, and currently have backup generators at both pump stations.

2.5.3 Water / Wastewater

- City water and wastewater
  - Water treatment plant (14682 Ottaway Rd.) – Includes filtration system and a reservoir that treats water drawn from 5 city wells. Water from the treatment plant is then pumped back to the residents.

- Three city wells have generators, 2 do not, and there is 1 traveling diesel generator.
- The wastewater treatment plant (21496 Mill Race Rd.) was completed in 2001 and serves a maximum capacity of 2,000 residents.
- City has 4 water wells, #1 Well has gone down and city is working on replacing it, cost approx. $1.4 million to replace (land purchase, construction); Storm water project also, 24-36 million for both, going after a bond Levey in 2022. The drinking water system needs to be replaced and the city will be coordinating with partners on this. Wells are used to fill storage tanks, which supplies the fire protection (hydrant system) in the city.

  Note: Sewer pump station is vulnerable to Mill Creek flooding events, and the wastewater treatment plant could be vulnerable as well.

  Note: The water tower in town does not have water, just communications.

- North Marion School District Water and Wastewater:
  - Two wells and a 355,000-gallon water tank with its own filtration system. This system is equipped with a propane back-up generator. Propane is stored in a 100-gallon above ground storage tank.
  - Sewer system, equipped with a propane back-up generator.

2.5.4 Communication

- City Communications:
  - The city has a server with a redundant backup system offsite.
  - Public Works has a cell phone and radio capabilities; radio training is planned internally.
  - Regional emergency communication improvements are underway.
- Water Tower (this is a communications tower; it does not hold water):
  - The Fire District has their communications located on the water tower. They also have a backup generator.
  - The Sheriff has communications equipment located on the water tower, but it is currently turned off.
  - Three cell phone companies – Verizon, Sprint, AT&T – use the water tower and they all have backup generators.
- North Marion School District:
  - The School District has a radio connection with the County and other emergency responders, along with emergency backup power.

2.5.5 Emergency Services

- Police:
  - Located at City Hall (21420 NE Main St., Aurora, OR) – the Marion County Sheriff provides police services.
- Fire: Aurora Rural Fire Protection District
  - Located at 21390 NE Main St., Aurora, OR
  - Aurora Fire Station seismic upgrades are complete.
- Medical (none in Aurora):
  - Woodburn and Canby have immediate care facilities (Providence in Canby – sometimes not staffed by doctors, Legacy in Woodburn).
  - Meridian Park Hospital in Tualatin
  - Willamette Falls Hospital in Oregon City
  - Silverton Hospital in Silverton
  - Providence Medical Center in Newberg
  - Salem General Hospital
  - Ambulances are out of Woodburn, secondary out of Canby, third out of Wilsonville or Tualatin.

2.5.6 Cultural / Historical Resources

- Historic district encompasses 150 acres of the city and includes buildings and historic sites, including:
  - Aurora Old Colony Historical Museum (15038 2nd St.)
  - George Steinbach Cabin & Ox Barn (15018 2nd St.)
  - Giesy-Kraus House (15028 2nd St NE) c. 1875
    - This house was moved from 3rd & Main Street.
  - Jacob Miller House Shed (15038 2nd St NE) c. 1890
  - Siebert House (15048 2nd St NE) c. 1890
  - Unnamed (15058 2nd St NE) c. 1872
    - This house was moved from 2nd & Main Street.
  - Jacob Miller House (21624 Liberty St. NE) c. 1890
  - Charles Snyder House (14996 3rd St NE) Built 1875-1880
  - Ernest Snyder House (21328 Hwy 99E NE) c. 1890
  - Emmanuel Keil House (14643 Ehlen Rd. NE) Built 1903-1905.
  - Frederick Keil House & Grounds (21883 Airport Rd NE)

- Joseph Miller House (21892 Airport Rd NE) c. 1890
- Southern Pacific RR Hop & Ziegler Warehouse (14971 1st St NE) c. 1885
- Unknown/ "California Storefront" (21781 Main St. NE) c. 1890
- Aurora State Bank (21690 Main St NE) c. 1905
- Wm. Keil & Co. General Merchandise Store (21581 Main St NE) c. 1871
    - The Octagon Building is in the rear yard of this property.
- Frederick Will House (21361 Main St NE) c. 1905
- Events that may have large crowds:
    - City Hall – court held here Wednesdays every other month starting in February (every even month). Monthly Tuesday meetings 1st-4th for public meetings (council, planning commission, parks).
    - American Legion Hall: church services on Sundays
    - Aurora Presbyterian Church & Christ Lutheran Church: services on Sundays
    - McLaren Auction House: some evening events
    - Aurora Historical Museum: Colony Hand Spinners Guild in March and Strawberry Social in June
    - Mothers' Day weekend: wine and chocolate walk.
    - August: Aurora Colony Days Festival – biggest event of the year with a couple thousand visitors.
    - Summer: Music in the Park on Wednesday nights
    - School District events

Functional and Access Needs (Vulnerable Populations)

- School's: (no school's within the city limits):
    - North Marion Primary School
    - North Marion Middle School
    - North Marion Intermediate School
    - North Marion High School
    - 2,000 students and 250 staff on the 55-acre North Marion School District property (20246 Grim Rd.)
- Areas proximate to but not served by City water and sewer service:
    - Deer Creek Trailer Park (outside of city limits; southwest of the airport) Note: Aurora is a retirement community, so there may be residents with special medical needs.

See hazard sections below and Section 2, Risk Assessment, for potential hazard vulnerabilities to these facilities.

2.6 Plans and Polices

Table 2-1, Plans and Policies, City of Aurora

Document Name	Year
Comprehensive Plan & Zoning Map	2019
Wastewater Facilities Planning Study	2017
Transportation System Plan	2009
Stormwater Master Plan	2021
Water System Master Plan	2009
Water Management and Conservation Plan	2009

2.7 Hazard Profile

Table 2-2, City of Aurora Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Aurora		985		560	2		258,763,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	2	0	7,000	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	32	3.3%	100	2	31,708,988	12%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	27	2.7%	15	0	5,511,000	2.1%
Channel Migration	Channel Migration Zone	0	0%	1	0	118,000	0.05%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
None Reported						

Source: DOGAMI (2022)

2.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 2-3, City of Aurora Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary for the ***City of Aurora*** using BOLD Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Earthquake	3.5	4	3	4	3.5	**High**
Wildland Interface Fire	3.5	4	3	2.5	3.3	**High**
Severe Weather/Storm	3.5	1	3	3	2.9	**Moderate**
Extreme Temperature	3	1	2	2.5	2.4	**Moderate**
Drought	2	1	3	4	2.2	**Moderate**
Tornado	2	4	2	1	2.2	**Moderate**
Flood	2.5	1	2	3	2.2	**Moderate**
Volcanic Eruption	2	1	2	3	2.0	**Moderate**
Landslide	1	1.5	1.5	2	1.3	**Low**
Avalanche	1	1	1	1	1.0	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and City of Aurora staff on 11/16/21

Table 2-4, Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the ***City of Aurora*** using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Hazardous Materials Release - Transportation	4	4	3	2	3.5	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	4	4	3.1	**High**
Terrorism, Active Shooter, Workplace Violence	2	4	4	4	3.1	**High**
Hazardous Materials – Non- Transportation	3	4	2.5	2	2.9	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2	4	2.5	**Moderate**
Unauthorized Entry	2	4	2	4	2.5	**Moderate**
Public Health	2	1	2	4	2.1	**Moderate**
Cyberterrorism	1	4	2	3	2.0	**Low**
Agricultural Terrorism	1	1	3	4	1.9	**Low**

Source: Marion County Emergency Management and City of Aurora staff on 11/16/21.

2.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to City of Aurora. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to City of Aurora, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

2.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: n/a

Vulnerability: n/a

2.9.2 Drought

CPRI = 2.2, Risk Level: Moderate

Events: According to the steering committee, Aurora has twice implemented their water curtailment ordinance, first in 2010 and then in 2014. Governor Kate Brown declared a drought emergency for all of Marion County in September 2015.

Vulnerability: The City's water supply comes primarily from subsurface sources, making vulnerability to drought moderate. Due to a cool, wet climate, past and present weather conditions have generally spared Marion County communities from the effects of drought.

Aurora has five wells that send water through a filtration system and into a reservoir, located on Ottaway Rd. Water from the reservoir is then pumped back to residential and commercial customers in Aurora.

2.9.3 Earthquake

CPRI = 3.5, Risk Level: High

Events: The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County. No damaging earthquake events occurred during the previous five years.

Vulnerability: The characteristics of both a crustal earthquake and a Cascadia Subduction Zone (CSZ) earthquake are similar to the county as a whole. This hazard was not rated as distinct CSZ and crustal events in the previous HMP. There are no locally active faults within the Aurora city limits. The nearest active fault runs northwest to southeast just outside of Canby, about five miles away from Aurora.

In 2017, the Aurora steering committee identified liquefaction as a primary concern related to the earthquake hazard. The committee indicated that many critical facilities and transportation routes might not withstand a high magnitude earthquake. In particular, the committee expressed concerns over City Hall, the two bridges in the north of town, and the North Marion High School. The committee identified mitigation efforts to address these vulnerabilities as "priority actions" in this plan.

2.9.4 Extreme Heat

CPRI = 2.4, Risk Level: Moderate

Events: Summer of 2021 had a set of heat waves in the Willamette Valley that affected Aurora in like kind to the rest of the valley.

Vulnerability: The Aurora RFPD hosted a cooling center in 2021. The city does not have the facilities to host a facility but coordinated to provide information about nearby alternatives.

2.9.5 Flood

CPRI = 2.2, Risk Level: Moderate

Events: Historically, Aurora experienced major floods in 1986, 1996, and in 2011 on the Pudding River. Since then, no major floods have affected the population, but Aurora continues to experience regular localized flooding during the wet season. According to the steering committee, properties along the Pudding River experience the most regular flooding. In these instances, structures are rarely affected. In the past, Mill Race Rd. (the gravel road leading to the Wastewater Treatment Plant) experienced flooding issues, but these issues have been resolved.

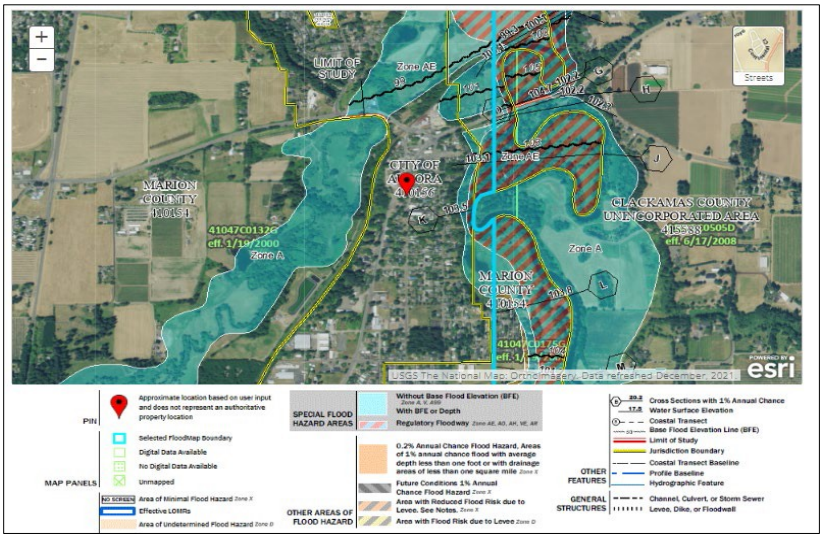
Vulnerability: Portions of Aurora have areas of floodplains (special flood hazard areas). These include areas along Mill Creek and the Pudding River (see Figure 2-3). According to the DOGAMI Risk Report for Marion County, portions of the communities of Aurora and Mehama are at risk to channel migration from the Pudding River.7

National Flood Insurance Program (NFIP)

The NFIP has two types of loss classifications, Repetitive Loss (RL) Property and Severe Repetitive Loss (SRL) Property. ***RL***, property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP. ***SRL,*** property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

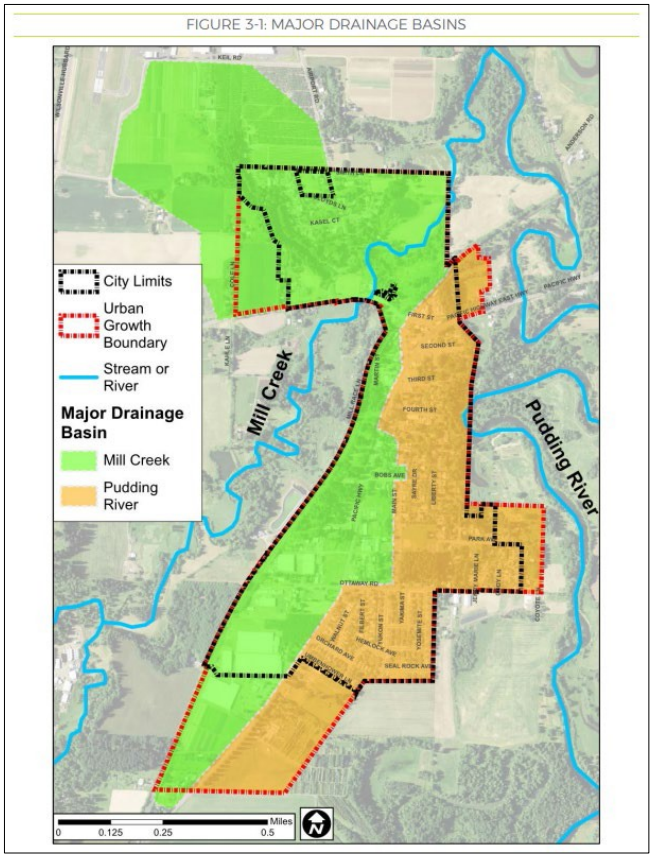
FEMA modernized the Aurora Flood Insurance Rate Maps (FIRMs) in January of 2000, and they became effective January 19, 2000. Aurora has not had any Community Assistance Visits (CAV) and is not a member of the Community Rating System (CRS). There have been no paid flood claims in Aurora.

Figure 2-2, Aurora Floodplain FIRM Map



Source: FEMA Map Service Center, https://msc.fema.gov/

Figure 2-3, Aurora Stormwater Basins



Source: Keller and Associates. (2021, June). City of Aurora Stormwater Master Plan.

Table 2-5, Aurora Stormwater Deficiencies

TABLE 6-1: SUMMARY OF EXISTING STORMWATER DEFICIENCIES

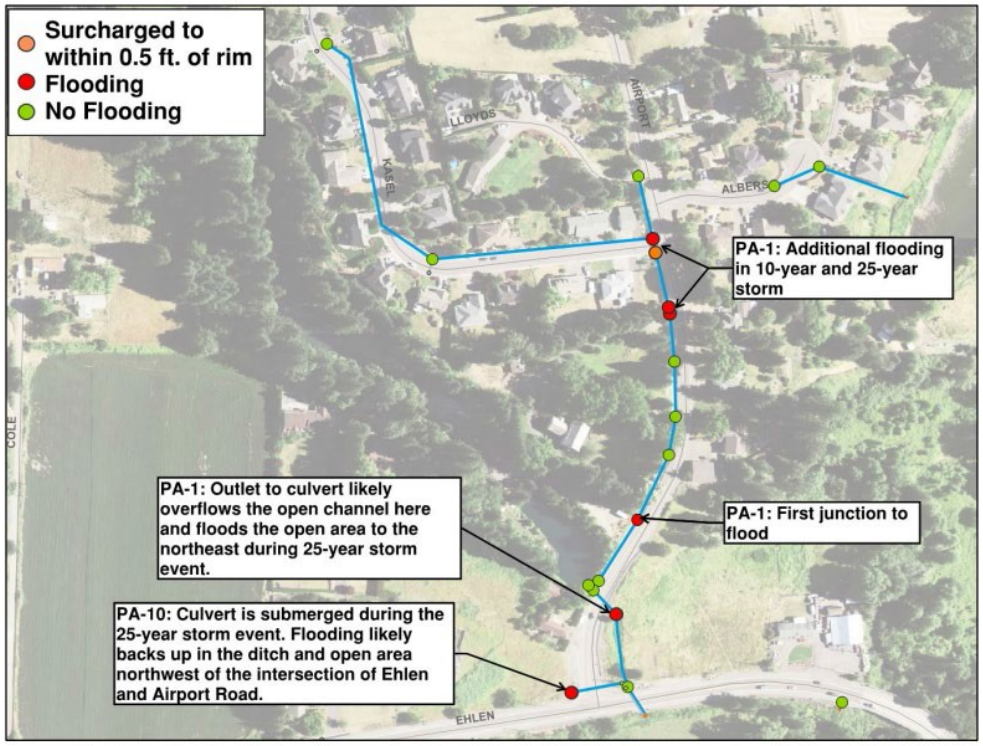
Problem Area ID	Location Description	First Storm Event with Surcharging[1]	First Storm Event with Flooding
PA-1	Airport Road Ditch	-	2-Year
PA-2	Main Street and 1st Street	-	10-Year
PA-3	2nd Street (Church Parking Lot)	10-Year	100-Year
PA-4	3rd Street and Main Street	-	2-Year
PA-5	Highway 99 North of 2nd Street	-	10-Year
PA-6	Main Street and Ottaway Road	-	2-Year
PA-7	Main Street North of Ottaway Road	2-Year	10-Year
PA-8	Cody Lane	-	2-Year
PA-9	Highway 99 and Ottaway Road	2-Year	10-Year
PA-10	Ehlen Road	-	25-Year
PA-11	Culvert under HWY 99 between Bobs and Ottaway	-	10-Year
PA-12	Liberty St.	-	25-Year
PA-13	Albers Way	25-Year	100-Year
PA-14	3rd Street Outfall	25-Year	100-Year
PA-15	Orchard Avenue	-	100-Year
PA-16	Kasel Court	-	100-Year

1) Junctions are considered surcharged when the HGL is within 0.5 feet of the rim elevation

Source: Keller and Associates. (2021, June). City of Aurora Stormwater Master Plan

Figure 2-4, Airport Road Stormwater Deficiencies

FIGURE 6-1: AIRPORT ROAD DEFICIENCIES



Source: Keller and Associates. (2021, June). City of Aurora Stormwater Master Plan.

2.9.6 Landslide

CPRI = 1.0, Risk Level: Low

Events: Volume I, Section 2, Risk Assessment, adequately describes the causes and characteristics of landslides, and appropriately identifies previous landslide occurrences within the region.
Vulnerability: Aurora has a relatively flat topography. Landslide risk in Aurora is low to moderate in most populated areas, but moderate to high in other areas, particularly along Mill Creek and the Pudding River.

2.9.7 Severe Weather

CPRI = 2.9, Risk Level: Moderate

Events: In 2021, Aurora experienced a significant ice storm event that impacted travel, downed power lines, debris from downed trees was extensive and part of the declared countywide disaster. Power was out for 8 days.

Significant wind events occur in Aurora each year, sometimes interrupting services, downing trees, and causing power outages. More recently, windstorms in April 2010, May 2014, and July 2015 toppled trees in the Aurora Municipal Park, with one tree causing damage to a nearby house.

Major winter storms can and have occurred in the Aurora area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. During a storm in April 2009, snow and ice caused City Hall to lose power for one day and debilitated the City's water tanks. During the winter of 2012-13, the steering committee reported that residents experienced power outages. These power outages also affected the pump stations used to transfer water to customers. The most recent winter storms (December 2016 – January 2017) included snow and ice and resulted in transportation and power interruptions combined with government office and school closures. A state of emergency was declared on January 11 and a Presidential Disaster was declared for the State of Oregon on January 25, 2017.

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

2.9.8 Tornado

CPRI = 2.2, Risk Level: Moderate

Events: Significant wind events occur in Aurora each year, sometimes interrupting services, downing trees, and causing power outages. Since 1957, five reported tornadoes have struck Marion County – one of which occurred near Aurora on August 26, 1984. The tornado destroyed a machine shop and scattered its pieces over a half-mile area.

Vulnerability: The risk of a severe wind event is interrupted services, downed trees, and power outages.

2.9.9 Wildfire

CPRI = 3.3, Risk Level: High

Events: No history of wildfire events in Aurora.

Vulnerability: In 2017, the Aurora Steering Committee determined that the city was fairly isolated from wildfire risk. However, the steering committee identified the hillside above the Pudding River at the end of 4th St. as a potential issue. The committee also determined that should a wildfire occur nearby, the city could be affected by smoke, impacting people with respiratory problems, the elderly, and children.

In 2020, Aurora was impacted by wildfire smoke in the manner that the rest of the valley experienced. The City coordinates with Aurora RFPD on all wildfire issues.

2.9.10 Volcano

CPRI = 2.0, Risk Level: Moderate

Events: When Mt. Saint Helens erupted in 1980, the city was impacted only by falling ash.

Vulnerability: Aurora is very unlikely to experience anything more than volcanic ash during a volcanic event.

2.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and City of Aurora Addendum update process, Oregon Department of Land Conservation & Development and City of Aurora developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring and summer of 2022.

2.10.1 Ongoing Mitigation Actions

- Mid-Valley Council of Governments ensures compliance with the National Flood Insurance Program for the City of Aurora through the enforcement of local floodplain ordinances.
- Create and publicize alternative transportation routes in the event of road closures.
- The City of Aurora publicizes/educates residents about signing up for the Aurora Alerts email system; this has now expanded to include text and social media.
- Coordinate with Marion County on trainings; send employees to the ATC 20 training.
- Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices through public education.
- Develop a multi-agency emergency response team for N. Marion County.
- Update the Water Conservation Plan
- Partner with Marion County to support agencies' determination of locations for additional aquifer studies that might lead to greater water supplies and help determine fundings sources for the studies.
- Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices through public education
- Coordinate with PGE about undergrounding power lines that run along Grim (serving the School District).
- Perform fuel reduction projects.

2.10.2 Mitigation Success

- The city has approved a bond and is rebuilding City Hall to seismic standards. It will fund a new city hall, library, and emergency facility with an estimated 25–50-person capacity.
- The City of Aurora completed a Stormwater Master Plan in 2021 that identifies priority projects for mitigation. See action item #s: 22-FL-01.
- The City of Aurora updated their code to require new developments to underground utilities.

2.10.3 City of Aurora Mitigation Action Tables

The following pages include the City's Priority Action Items (Table 2.6) and Action Item Status Report (Table 2.7)

Table 2-6, City of Aurora "Priority" Action Items

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-FL-01	Flood	Address stormwater problem areas #1 & #10 – Airport Ditch Road and Ehlen Road	H	1-3 Years	$250k	Problem Area (PA) #1: Outlet to culvert likely overflows the open channel here and floods the open area to the northeast during 25-year storm event. PA#2: Culvert is submerged during the 25- year storm event. Flooding likely backs up in the ditch and open area northwest of the intersection of Ehlen and Airport Road.	New
2022-MH-01	Multi-Hazard	Acquire emergency backup generators for all critical facilities (including City Hall and 2 wells).	H	2-5 Years	$100k each		Started
2022-MH-02	Multi-Hazard	Develop mutual aid agreements and partner with private sector and local jurisdictions.	M	2-5 Years	Staff time	Fuel	Revised
2022-MH-03	Multi-Hazard	Work with the Northwest Oregon Chapter of the Red Cross to identify potential shelters. Create MOUs and partner with Red Cross to address this capability.	L	2-5 Years	Volunteer time	Aurora Community Preparedness is the City's liaison with the Red Cross. The city endorses the efforts of Aurora Community Preparedness to raise disaster awareness.	Started

Source: Source: City of Aurora Addendum revision with staff and DLCD, June 15, 2022, and August 25, 2022

Table 2-7, City of Aurora Action Item Status Report

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-P-1	Multi-Hazard	Create and publicize alternative transportation routes in the event of road closures.		City Planner	On-going
2017-P-2	Earthquake	Seek funding to further assess the "probability of collapse" for North Marion High School.	This is our partner's mitigation action. NHSD could coordinate with MCEM.	N. Marion School District	Discontinue
2017-P-3	Earthquake	Work with the Salem Red Cross to identify potential shelters within the city. Create MOUs and partner with Red Cross to address this capability make it official.		City Administration	Not Started
2017-P-4	Windstorm	Identify backup power needs and acquire new backup generators (not propane) for the School District (which serves as the Emergency Shelter).	This is our partner's mitigation action. NHSD could coordinate with MCEM.	N. Marion School District	Discontinue
2017-PW-5	Windstorm	Acquire emergency backup generators for all critical facilities (including City Hall and 2 wells). Do not purchase generators fueled by propane.		City Administration	Started
2017-MH-2	Multi-Hazard	Publicize and sign-up residents for the reverse 911 system.	Not a city project; Larger project to aggregate 911		Discontinue
2017-MH-3	Multi-Hazard	Publicize/educate residents about signing up for the Aurora Alerts email system; expand to include text and social media.		City Administration	Moved to 2022 ongoing
2017-MH-4	Multi-Hazard	Expand the emergency communication system to include text and social media	This is our partner's mitigation action. NHSD could coordinate with MCEM.		Discontinue
2017-MH-5	Multi-Hazard	Build relationships with sister counties/jurisdictions/districts and create mutual aid agreements.	The City relies upon MCEM to coordinate this item.		Discontinue
2017-MH-6	Multi-Hazard	Partner with private sector and create mutual aid agreements.	The city partnered with local business during the 2021 Ice. storm		Discontinue
2017-MH-7	Multi-Hazard	Develop a multi-agency emergency response team for N. Marion County.	The City relies upon MCEM to coordinate this item.	City Administration	Moved to on-going
2017-DR-1	Drought	Update the Water Conservation Plan		Public Works	Moved to on-going

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-DR-2	Drought	Partner with Marion County to support agencies' determination of locations for additional aquifer studies that might lead to greater water supplies and help determine fundings sources for the studies.		City Council	on-going
2017-EQ-1	Earthquake	Send employees to the County's ATC 20 training.		Public Works	on-going
2017-EQ-2	Earthquake	Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices through public education.		City Administration	on-going
2017-EQ-3	Earthquake	Seek funding to further assess the 'probability of collapse' for Aurora City Hall.	The city has secured a bond and is rebuilding City Hall to seismic standards.	City Administration	Complete
2017-EQ-4	Earthquake	Continue to run earthquake drills		N. Marion School Dist.	On-going
2017-EQ-5	Earthquake	Encourage residents to prepare and maintain 2-week survival kits. Publicize through City newsletter, website, and the resilience and preparedness trainings the School District is creating.	City is creating and funding a nonprofit org to support community preparedness, . $2k/yr.	City Administration	Started
2017-FL-1`	Flood	Create a Stormwater Master Plan.	Completed plan in 2021	Public Works	Complete
2017-FL-2	Flood	Continue compliance with the National Flood Insurance Program through the enforcement of local floodplain ordinances.		Public Works	On-going
2017-FL-3	Flood	Identify strategies for mitigation and/or preventing flooding from impacting the city's wastewater lagoon system.	Completed Aurora Stormwater Master Plan in 2021.	Public Works	Complete
2017-FL-4	Flood	Work with property owners who regularly experience flooding along the Pudding River to mitigate their risks.	There are no properties that fit this description at this time.	Public Works	Discontinue
2017-SW-1	Severe Weather	Educate citizens about ways to weatherize their homes, as well as safe emergency heating equipment.	Aurora RFPD action item		Discontinue
2017-SW-2	Severe Weather	Support/encourage electrical utilities to use underground construction methods where possible to reduce power outages from windstorms.	Planning and building rules that require this.	Public Works	Ongoing
2017-SW-3	Severe Weather	Review code and revise to require new developments to underground utilities if requirement doesn't currently exist.	Mitigation success	City Administration	Complete
2017-SW-4	Severe Weather	Outreach to PGE about undergrounding power lines that run along Grim (serving the School District).		City Administration	Discontinue

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-WF-1	Wildfire	Outreach to residents on the hillside at the end of 4th Street adjacent to Pudding River about performing fuel reduction projects.		City Administration with Aurora Fire Dist.	On-going
2017-WF-2	Wildfire	Check with the fireworks storage facility at the end of Ottaway to make sure they have a safety plan.		City Administration with Aurora Fire Dist.	On-going

Source: City of Aurora Addendum revision with staff and DLCD, June 15, 2022

3 City of Detroit Addendum

3.1 Purpose

This document serves as Detroit ’s Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Detroit to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

3.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD), the Oregon Department Emergency Management (OEM) and Marion County cities, including the City of Detroit, to update the August 2017 Marion County Multi-Jurisdictional Hazard Mitigation Plan (Marion County HMP), an update which includes the City of Detroit to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County NHMP, locally adopting it, and having it approved by FEMA, the City of Detroit will gain eligibility for FEMA Hazard Mitigation Assistance funding that includes three programs: BRIC (Building Resilient Infrastructure and Communities), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and Flood Mitigation Assistance grant program funds. This project is funded through the Federal Emergency Management Agency’s (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Detroit joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on September 21, 2021. On October 18, 2021, City of Detroit Mayor, Jim Trett, City of Detroit City Recorder Kelly Galbraith, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the City of Detroit that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on March 31, 2022, to update this addendum.

City of Detroit staff attended HMP Steering Committee meetings on October 5, 2021, November 21, 2021, January 4, 2022, March 1, 2022, and May 4, 2022. The city staff promoted the HMP outreach efforts throughout the plan update by posting the initial flyer provided by DLCD to the city’s website throughout the update process.

3.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

3.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of Jurisdiction, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix C, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

3.4.1 Community Characteristics

The City of Detroit is located approximately 50 miles east of Salem, bordering the Detroit Reservoir. It is the third largest community in the North Santiam River Canyon with a population in 2020 of 203 people in 45 households (U.S. Census, 2020). With an elevation of 1630 feet, the climate of Detroit is moderate; the average monthly temperatures range from 51 – 79 degrees in July and August, and 31-42 degrees in December and January. Detroit receives approximately 68 inches of rain and 10 inches of snow each year. The city's topography is relatively flat but does possess sloped terrain adjacent to Detroit Reservoir. Outside of city limits, steep slopes surround the city on all sides.

Detroit benefits from its location along State Highway 22, a major east-to-west transportation route connecting Salem to Bend. It serves as a recreation hub with two marinas, restaurants, and lodging, for residents of the North Santiam Canyon and the traveling public along the State Highway 22 corridor. Historically, Detroit prospered from the development of the railroad and dam, which helped spur growth in manufacturing and logging. Today, the economy relies upon the recreational opportunities available through state/federal lands, and Detroit Lake.

3.5 Critical and Important Facilities

3.5.1 Transportation

Oregon State Highway 22 is the major transportation route for auto, public transit, and emergency vehicle access throughout the Santiam Canyon. State Highway 22 extends about 50 miles west, connecting Detroit to Salem and the remainder of the Willamette Valley. To the east, the highway connects to Idanha, and ends at the Santiam Pass interchange.

The Cherriots Canyon Connector is the only existing public transit service in the Santiam Canyon. This service runs four round trips on weekdays with buses running twice in the morning and twice in the afternoon. Detroit residents must drive to Gates to utilize these services, as the Canyon Connector does not reach Detroit or Idanha.

In case of a major State Highway 22 closure, Detroit residents will have to rely on alternate routes for supplies and to receive emergency medical services. The cities alternate routes are limited with NF-46, also known as Highway 46 Breitenbush Road and north of Detroit, French Creek Road. Depending on weather conditions, these roads may be unpassable. Alternatively, Life flight operates out of McNary Airport in Salem and can provide medivac if needed with a flight time of less than 10 minutes from Detroit.

Table 3-1, Bridges in the City of Detroit

Structure Name	Year Built	Structural Condition	Seismic Vulnerability
Tumble Creek; Bridge ID 07295	1949	Fair	Potentially vulnerable
Breitenbush River; Bridge ID 07017	1949	Fair	Potentially vulnerable

Source: 12021 Dashboards Interactive Bridge Report, Oregon Department of Transportation, consulted June 2022
Oregon Department of Transportation: Bridge Condition Report: Bridge: State of Oregon

Strengths:

- Proximity to ODOT facility may increase access to public works services.
- Docked boats along Detroit Lake can be utilized to transport residents to safety during concentrated hazard events (ex. hazardous materials, and wildfire).
- Fuels reduction measures have been taken along Weber Street to minimize risk to water system infrastructure.

Weaknesses:

- The loss of Breitenbush River bridge would isolate Detroit from the remainder of the Santiam Canyon and the Willamette Valley.
- Alternate routes are long, and most likely impassable in winter months.
- Hwy 22 closures could make travel outside of North Santiam Canyon extremely difficult.
- Public transportation options are limited and only reach to the City of Gates.
- The city's drain and culvert infrastructure is old and getting to the point where some won't flush a lot of water away anymore (street maintenance person keeps them in best shape and unclogs them when needed).

3.5.2 Dams

Two dams sit below Detroit, Detroit Dam and Big Cliff Dam. Previous steering committees have concluded that the likelihood of Dam Failure is Low. Current conditions still represent the previous decision. If Dam failure occurred in either dam, Detroit would most likely lose access to the western portion of Hwy 22.

3.5.3 Energy and Utilities

Detroit receives energy and utility services from Consumer Power Inc. There are no substations located in Detroit. One main power line runs along Hwy 22, connecting to Gates and Mill City.

Strengths:

- Gas stations with fuel storage exist within Detroit and possess both gasoline and diesel fuel.
- An electric car powering station and a Tesla electric car powering station exists within city limits; the capability to utilize this infrastructure is unknown.

Weaknesses:

- Gas stations possess below ground tanks which cannot be pumped without electricity.
- Gas stations do not currently possess backup diesel generators to pump fuel from storage tanks.
- No alternate sources of energy (wind, solar) exist to power basic services.
- Citizens rely on propane and there is limited access to propane during a disaster.

3.5.4 Water

The City of Detroit has two water sources which include Mackie Creek and the Breitenbush intake. Mackie Creek is Detroit's main water source in the winter months, located approximately 1/3 mile uphill from the water treatment plant. The Breitenbush intake, located approximately 1/3 mile up from Breitenbush Road, is utilized in the summer months.

Detroit's water treatment facility is located at the top of Gaymore, with a backup propane generator. The generator is accompanied by a 500-gallon propane storage tank and can power water facilities for approximately one week.

Detroit has two treated water storage tanks equaling 440,000 gallons (200,000 and 240,000). The city also has one un-treated water storage tank which holds 35,000 gallons. The water level in this tank is maintained from the Breitenbush intake and is gravity fed from the treatment plant.

Strengths:

- Two (2) water intake sources (Mackie & Breitenbush).
- One (1) backup propane generator on-site.
- Two (2) above-ground storage tanks located near water treatment facility. This is equivalent to 440,000 gallons or 3-4 days of water storage in summer months or 4-8 days in winter months.

Weaknesses:

- The current backup generator runs on propane.
- Water intake sources are susceptible to wildfire damage.
- The city is losing approximately 40% of water distributed through leaky pipes. Roughly 40% of the water travelling through the water pipes is lost due to deficient infrastructure.
- Water usage estimates are 60,000 gallons in the winter and 120,000 gallons in the summer.

3.5.5 Wastewater

Detroit does not have any municipal waste-water infrastructure. The city's residents and business owners rely on individual septic tanks. These septic tanks can be up to 60-years old and could be leaching hazardous material into the ground water/ Detroit Reservoir.

3.5.6 Emergency Services

Detroit receives emergency service support from Marion County Sheriff's Office and the Idanha- Detroit Rural Fire Protection District. Both are located at 160 Detroit Avenue, Detroit, OR.

Strengths:

- Detroit possesses emergency services for fire and law enforcement.
- An emergency propane generator with 70-gallons of storage exists inside City Hall; utilized by both fire and law enforcement.

Weaknesses:

- Fire and law enforcement rely on City Hall facilities to operate.
- Ambulance services must travel from the City of Lyons.
- First responders are very limited to basic life monitoring services.
- Currently, emergency services do not have trained HAM radio operators.

3.5.7 Environmental / Historical Preservation Sites

Detroit is surrounded by environmental preservation sites including federal land, state parks and designated wilderness areas. The housing stock in Detroit was built after the 1950s and does not contain any sites of historical significance. The city does possess the Detroit Ranger Station, Detroit State Park, and Detroit Lake, which help to bring in a high volume of recreational tourism in the summer months.

Strengths:

- Proximity to pristine state and federal land could attract residents or business.
- Some remnants remain of the old Detroit location (now at the bottom of Detroit Lake)

Weaknesses:

- Detroit lacks buildings with historical “timber”.

3.5.8 Communication / Information Technology

There is currently one communication provider in Detroit. Zipply Fiber, formerly Frontier, provides phone service, and broadband internet with limited fiber infrastructure adjacent to Hwy 22.

Strengths:

- Limited fiber internet infrastructure already presents along Hwy 22.
- Cellular Tower (AT&T/Verizon) east of Detroit, past the ranger station, with diesel generator backup.
- AT&T cellular tower at entrance of town.
- Public Works possesses low range walk-talkie access (>1/2) mile.

Weaknesses:

- Limited communication access including internet and phone.
- Currently no known HAM radio operators in the community.
- Main communication line runs down Hwy 22 and is susceptible to downed trees and wind.
- Phone lines are both buried and overhead, which could prove difficult for maintenance.

3.5.9 Agriculture and Food

Although Detroit is home to the Detroit Market and Mountain High Grocery the closest large- scale grocery is in Stayton approximately 37 miles east on State Highway 22. While other restaurants and lounges are located on Detroit’s Main Street, the loss of State Highway 22 as a transportation route would cause serious concern for residents and food accessibility. The city is surrounded by steep slopes that are state and federal land. There is no agricultural capability other than small-scale “urban” farms within city limits.

Strengths:

- Private sector entities possess limited (1-2 days) food supplies.

Weaknesses:

- No major, full-service grocery store inside of city limits.
- Surrounding land not suitable for agricultural purposes.

3.5.10 Banking and Finance

Detroit's nearest option for banking services is in Mill City. This one-story structure sits along Hwy 22 and could be utilized for emergency financial services during a hazard event. Detroit does not have any financial services within city-limits.

Strengths:

- Cash flow from nearby businesses could possibly be utilized.

Weaknesses:

- Lack of banking/financing institutions within city limits.
- Full "urban" financial services unavailable.

3.5.11 Hazardous Materials

The city resident's reliance on propane as a backup fuel source can be hazardous in certain conditions. These above ground propane tanks can be susceptible to leaking after an earthquake or to explosion during a wildfire.

The City of Detroit does not contain any large manufacturing firms that possess hazardous materials. By consulting the Department of Environmental Quality Environmental Cleanup Site Information (ECSI) database this plan has identified one brownfield, defined as a vacant or underused property where actual or perceived environmental contamination complicates its expansion or reuse. The former Detroit Elementary School heating oil tank brownfields currently require no further action. Remediation was completed in 2011.

Strengths:

- There are currently not enough known hazardous materials to cause major concern.
- Brownfield site could be utilized and attract private sector development.

Weaknesses:

- Propane tanks within city limits can be extremely hazardous.

3.5.12 Government Facilities

Detroit is in the process of constructing a new facility for City Hall located at 345 Santiam Avenue West. City Hall and the offices of the Fire Department were destroyed during the September 2020 wildfires. The facility will contain office space for all city services as well as the headquarters for the Detroit Fire District and space for Marion County Sheriff's Office staff. The city has a generator that assures continuance of city business, and provides power to the meeting hall (emergency center). This includes outlets for electric heaters and lights only.

- Detroit City Hall, 345 Santiam Avenue West
- Post Office, 170 Detroit Ave

Strengths:

- The new City Hall facility will have a kitchen, six (6) bathrooms, and one (1) emergency generator with two (2) 25-gallon propane storage tanks that work in unison.

Weaknesses:

- Propane fuel maybe limited and could only power City Hall for a couple of days.

3.5.13 Education

The City of Detroit is part of the Santiam Canyon School District. This district encompasses all cities in the Santiam Canyon including Mill City, Gates, and Idanha. All the district's school facilities are in Mill City.

Strengths:

- School facilities could be utilized to shelter a large amount of community residents including Access and Functional Needs populations.
- School facilities possess needed infrastructure for a shelter which includes restrooms, showers, and a kitchen.
- School buses could be utilized for transportation after an emergency or disaster.

Weaknesses:

- Detroit is over 20 miles from school services.
- There are no current agreements or Memoranda of Understanding (MOU's) between the City and School District to utilize facilities after an emergency or disaster.

3.5.14 Healthcare and Public Health

Detroit's nearest medical services are in Mill City which contains one clinic with limited services. The nearest hospital and full-service health clinic are located in Stayton, Oregon. Emergency Medical Services (EMS) are in the City of Lyons.

Strengths:

- A clinic with minor services is located within the north Santiam canyon.

Weaknesses:

- Closest health services are located over 20 miles.
- No facilities with major life-saving equipment are currently located within city limits.
- Emergency health supplies are limited to what exists within the community.

3.5.15 Access and Functional Needs

Detroit's vulnerable population consists of the elderly and those that may have mobility issues. About 7% of Detroit's population is 75 or older, and over 6.9% of full-time residents are living below the poverty line (U.S. Census, 2020). The city is quickly turning into a 2nd home community, increasing the actual population to 1000+ (210 full-time, 790+ part-time).

Strengths:

- Over 65% of full-time residents are over the age of 45, this older population can volunteer and promote social cohesion in the community.

Weaknesses:

- No medical services exist for the aging population.

3.6 Plans and Polies

Table 3-2, Plans and Policies of the City of Detroit

Document Name	Year
City of Detroit Charter	2012
Detroit, Oregon Community Wildfire Protection Plan	2017
Former Elementary Site Park Plan	2013
Wastewater Feasibility Study	2014
Comprehensive Plan	Adopted in 1979, most recent
Transportation System Plan	2009
North Santiam Watershed Drought Contingency Plan	2018
Mid-Willamette Valley Council of Governments Comprehensive Economic Development Strategy	2018

3.7 Hazard Profile

Table 3-3, City of Detroit hazard profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Detroit		205		315	1		69,925,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	0	0%	2	0	186,986	0.3%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	52	26%	78	0	18,032,000	26%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	120	59%	185	0	36,915,258	53%
Lahar	Medium Zone (1000 to 15000 – Year)	128	62%	198	0	47,132,000	67%
[1] Facilities with multiple buildings were consolidated into one building complex. [2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).							
Critical Facilities							
Critical Facilities by Community		Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
None Reported							

Source: DOGAMI (2022)

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

3.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 3-4, City of Detroit Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary for the ***City of Detroit*** using BOLD Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Wildland Interface Fire	4	4	4	4	4.0	**High**
Earthquake	4	4	3	4	3.7	**High**
Landslide	4	2.5	2.5	3	3.2	**High**
Severe Weather/Storm	4	1	2	3	2.9	**Moderate**
Drought	3	1	2.5	4	2.7	**Moderate**
Extreme Weather - High Temperature	3	1	1	3	2.1	**Moderate**
Avalanche*	2	2	2	3	2.1	**Moderate**
Volcanic Eruption	2	1	2	4	2.1	**Moderate**
Flood**	2	1	2	3	2.0	**Moderate**
Tornado***	1	4	1	4	1.8	**Low**

Source BOLD Planning Risk Assessment Method: Analysis by the City of Detroit representatives to the NHMP update on 10/18/2021.

Table 3-5, City of Detroit Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the ***City of Detroit*** using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Cyberterrorism	3.5	4	4	4	3.8	**High**
Hazardous Materials - Transportation	4	4	3	3	3.6	**High**
Public Health	4	4	3	3	3.6	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	2	4	2.5	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2	4	2.5	**Moderate**
Unauthorized Entry	2	4	2	4	2.5	**Moderate**
Terrorism/Active Shooter/Workplace Violence	2	4	2	3	2.4	**Moderate**
Agricultural Terrorism	2	1	2	4	2.1	**Moderate**
Hazardous Materials - Non-Transportation	1	4	2	3	2.0	**Low**

Source Hazard Profile Summary for the City of Detroit using BOLD Planning Analysis Scoring

3.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Detroit. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to the City of Detroit recent localized hazard events and impacts and illustrates the basis for the city's HVA scores.

3.9.1 Avalanche

CPRI = 2.1, Risk Level: Moderate

Events: None during the effective period of the prior plan.

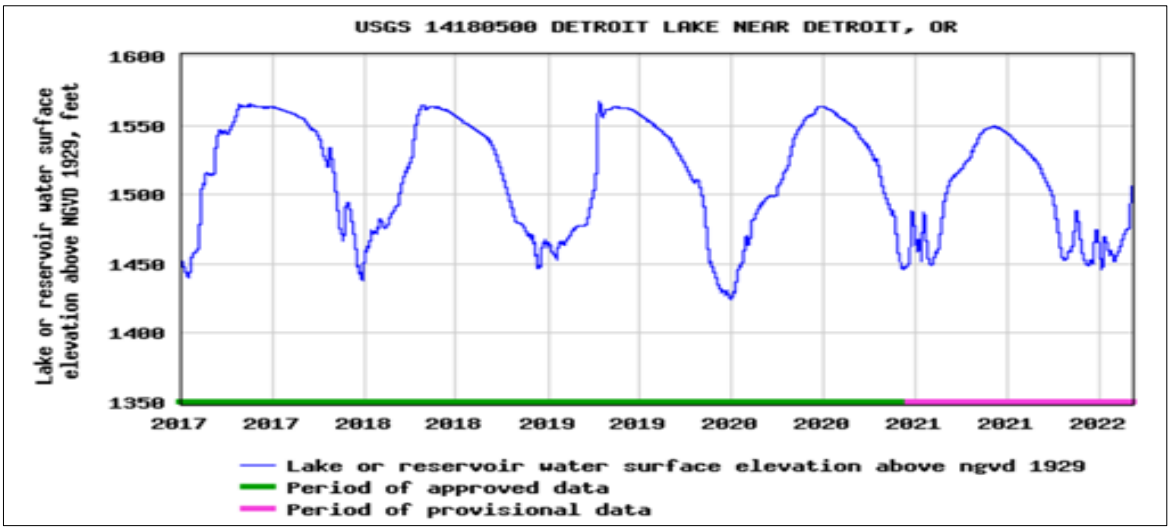
Vulnerability: None.

3.9.2 Drought

CPRI=2.7 Risk Level: Moderate

Events: During the effective period of the Marion County Multi-Jurisdictional NHMP, the City of Detroit did experience significant drought events during the effective period of the plan. However, the level of Detroit Lake dipped to its lowest level in the summer of 2020.

Figure 3-1, Detroit Lake levels 2016-2021



Source: *USGS Current Conditions for USGS 14180500 DETROIT LAKE NEAR DETROIT, OR*

3.9.3 Earthquake

CPRI = 3.7 Risk Level: High

Events: During the effective period of the prior NHMP a magnitude 2.8 earthquake occurred 6.8 miles (11 km) NNW of the City of Detroit on August 30, 2018, at a depth of 3.8 km. Detroit also experienced a crustal earthquake on August 19, 1961. A 4.5 magnitude earthquake struck 6 miles from Mill City, with shaking felt throughout the Santiam Canyon, up to Detroit.

Vulnerability: If another larger and more substantial earthquake occurs (Cascadia), Detroit could experience damage to buildings, utility (electric power, communication, water, wastewater, natural gas) and transportation systems (ex. bridges, and pipelines).

3.9.4 Extreme Heat

CPRI = 0, Risk Level: Low

Events:

Vulnerability: The Community Center will soon be operational as a cooling center.

3.9.5 Flood

CPRI = 2.0, Risk Level: Moderate

Events: Detroit experienced a major flooding event in 2006. Heavy rains and high winds caused damage in the Detroit, Idanha, and Breitenbush area.

Vulnerabilities: Impacts of flooding on the community included roofing damage, flooding of public facilities, sinkholes, erosion, and impacts to availability of drinking water. The water facility intake experienced clogging due to turbidity.

3.9.6 Landslides

CPRI = 3.2 Risk Level: High

Events: Historically, Detroit has not experienced major impacts from landslides within city limits. A rockslide blocked Hwy 22 during the effective period of the prior plan (2012-2017) that involved the Detroit Fire District to assist in removing debris. Areas in the east and northern portion of the city are susceptible because of steep mountains terrain. The western portion and reminder that border Detroit Lake are also at higher risk.

Vulnerability: Potential landslide-related impacts include infrastructure damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evaluation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Marion County; throughfares beyond city limits are susceptible to obstruction as well.

3.9.7 Volcanic Eruption

CPRI = 2.1, Risk Level: Moderate

Events: Detroit has not been impacted previously by volcanic activity; however, Mount Jefferson is located east of the city into the Cascade Mountains and could produce lahars or ash if an eruption occurs.

Vulnerability: The city sits in the Mount Jefferson Moderate Hazard Zone and could experience ash fall, debris avalanches, pyroclastic flows, lahars, and slow-moving lava flows. City residents should be evacuated before an eruption begins in case of impassible roads and dangerous conditions.

3.9.8 Wildfire

CPRI = 4.0 Risk Level: High

Events: September 2020 Beachie Creek and Lionshead fires.

Vulnerability: The economy of the city was devastated by the 2020 Labor Day fires. The fires have left many dead and dying trees that will not be removed and will continue to be a source of wildfire hazard.

Marion County updated the Community Wildfire Protection Plan (CWPP) in 2016 and the City of Detroit prepared its own Wildfire Protection Plan in 2017. These plans mapped wildland urban interface (WUI) areas and developed actions to mitigate wildfire risk. The city is a participant in the county CWPP both of which identify hazard mitigation action items intended to reduce risk from wildfire hazard.

3.9.9 Severe Weather / Storms

CPRI = 2.9, Risk Level: Moderate

Severe Weather/ Storms encompasses both windstorms and severe winter storms that may bring snow and ice.

Events: About once or twice per year the city will experience a windstorm event that can interrupt services, down trees, and cause power outages. Typically, windstorms occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

An ice storm occurred in February 2021 that resulted in downed trees and some damage to homes, as well as power outages. The water plant continued to operate well during the storm.

Vulnerability: Winter storms are among the more frequent natural hazard events in Detroit and usually cause transportation issues and communication failures from downed trees and icy/snow filled roads. The ability to respond to these hazards quickly and effectively determines the potential impacts these regular occurrences will have in the community.

3.9.10 Tornado

CPRI = 1.8, Risk Level: Low

Events: None during the effective period of the prior plan.

Vulnerability: The location of the city at the head of Detroit Lake may allow winds to develop over the lake.

3.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Jurisdiction Addendum update process, Oregon Department of Land Conservation & Development and Jurisdiction developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

Detroit developed a list of priority actions (Table 3.7), any actions that were not prioritized were placed in the Action Item Pool (Table 3.8) and will be considered during the semi-annual meetings.

3.10.1 Priority Actions

The city is listing a set of high priority actions to focus attention on an achievable set of high leverage activities over the next five years. The city's priority actions are listed below in the Priority Action Item table (Table 3.6)

3.10.2 Action Item Status Report

The city is carrying out several mitigation actions on an ongoing basis. These actions are identified in in the Action Item Status Report (Table 3.7)

3.10.3 Action Item Pool

This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

Many actions carry forward from prior versions of the Marion County NHMP and other local planning documents including the Community Wildfire Protection Plan, Drought Contingency Plan, and Mid-Willamette Economic Development study. They are grouped into Short Term and Long-Term action items.

3.10.4 City of Detroit Mitigation Action Tables

The following pages include the city's Priority Action Items (Table 3.6) and Action Item Status Report (Table 3.7).

Table 3-6, City of Detroit "Priority "Action Items

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-MH-01	Multi-Hazard	Update planning documents (comprehensive plan, development code) to reflect new hazard information.	High	1-3 years	Staff time	The city is in the process of updating the development code. The 2020 wildfires expedited the need to update the code. The Mid-Willamette Valley Council of Governments (MWCOG) is assisting to address how the city wants to redevelop. Updating the Comprehensive Plan is progressing more slowly because there is so much else to do in issuing building permits as recovery happens.	Progressing
2022-MH-02	Multi-Hazard	City staff should assess the amount of KWH needed to run city facilities. City staff should purchase propane storage accordingly to run their generator.	High	1-3 years	Cost is being born by Detroit Lake Foundation ; General Fund, MWVCOG grants/loan s	A new, larger facility is being built for the Detroit Lake Foundation and then the developers will gift it to the city. The assessment of the KWH needed to run city facilities is being done as part of this project.	Progressing
2022-MH-03	Multi-Hazard	Create a reservoir to allow the back flush water from the city's membrane system to infiltrate slowly;	High	Timeline will be established when funding source is identified	Funding source needs to be identified	The city water system utilizes a membrane to filter water. This membrane needs to be back flushed to maintain the viability of the membranes. The city is in the process of identifying suitable locations for the reservoir. A potential location may be in Spotted Owl habitat that could impede its development.	New

Table 3-7, City of Detroit Action Item Status Report

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-EQ-1	Earthquake	Promote Great Oregon Shakeout Awareness month in October. Participate in activities for schools, business, and industry. Participating with the Mid-Willamette Emergency Communications Collective on initiatives that are focused on household preparedness.		City of Detroit	On-going
2017-EQ-2	Earthquake	Collaborate with GROW EDC to develop relevant public-private partnerships with businesses that can contribute to response and recovery. (Multi-Hazard 4)	Remove, GROW EDC no long exits.	City of Detroit	Discontinue
2017-MH-1	Multi-Hazard	Develop an Energy Assurance Plan. The city has identified that the commercial "card lock" fuel station is the source of gasoline and there will be a propane tank located at the new Community Center that will be filled by company in the valley		City of Detroit	On-going
2017-MH-2	Multi-Hazard	Incentivize and assist local fueling stations to purchase diesel generators capable of pumping fuel from in-ground storage tanks.	Remove, this action no longer makes sense as only one fuel company remains after the fires	City of Detroit	Discontinue
2017-MH-3	Multi-Hazard	Assess the short and long term needs for sheltering access and functional needs populations for all hazards. This action will be completed when the Community Center is complete. It will serve as a shelter and will be ADA compliant. Cots and other materials will be added to support the use of the facility as a shelter.		City of Detroit	On-going
2017-MH-4	Multi-Hazard	Develop a MOU with community fuel stations to utilize fuel resources found in below-ground tanks after a hazard event.		City of Detroit	On-going
2017-MH-5	Multi-Hazzard	Join Marion County CERT Team	Marion County does not host CERT teams	City of Detroit	Discontinue
2017-MH-6	Multi-Hazard	Develop a community education program – such as an all-hazard community outreach forum for students and residents. *	Remove because the 2020 Wildfires saw the city doing emergency response on their own w/o any special training.	City of Detroit	Discontinue

*Identified in Marion County Community Wildfire Protection Plan (Action Plan & Priorities)
**Identified in North Santiam Watershed Drought Contingency Plan (Priority Drought Mitigation Actions)
***Identified in Mid-Willamette Valley Council of Governments Comprehensive Economic Development Study (Appendix C)

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-MH-7	Multi-Hazard	Expand auxiliary radio capabilities by developing a team of HAM Radio operators for EMS and interested public.		City of Detroit	On-going
2017-DR-1	Drought	Monitor economic impacts on recreation, tourism, and agriculture communities.	Long-term	City of Detroit	On-going
2017-DR-2	Drought	Collaborate with NSWC to complete WMCP's and improve community understanding of water usage and opportunities to increase efficiencies. **	Long-term	City of Detroit	On-going
2017-DR-3	Drought	Collaborate with Detroit Lake Recreation Area Business Association (DLRABA) to create a Detroit Lake Master Recreation Plan focused on economic drought resiliency. **	Long-term	City of Detroit	On-going
2017-DR-4	Drought	Collaborate with local Marina's and DLRABA to excavate marinas and allow for use at low water levels. **	Long-term	City of Detroit	On-going
2017-DR-5	Drought	Collaborate with Detroit Ranger Station to extend boat ramps that are usable year-round. **	Long-term	City of Detroit	On-going
2017-DR-6	Drought	Conduct leak detection surveys for the water system to increase efficiency and prevent further water loss. **	Long-term	City of Detroit	On-going
2017-MH-8	Multi-Hazard	Designate evacuation routes outside of Hwy 22 for EMS.	Long-term	City of Detroit	On-going
2017-MH-9	Multi-Hazard	Collaborate with Marion County to connect to a more resilient regional water/sewer system. ***	Long-term	City of Detroit	On-going
2017-MH-10	Multi-Hazard	Gather community support for the installation of resilient fiber communication infrastructure throughout the community. ***	Long-term	City of Detroit	On-going
2017-WF-1	Wildfire	Collaborate with Detroit Ranger District, ODF, and BLM to conduct fuel hazard reduction along the Wildland Urban interface and Hwy 22. *	Long-term	City of Detroit	On-going
2017-WF-2	Wildfire	Collaborate with ODF and Detroit RFD to develop strategic community fuel breaks. *	Long-term	City of Detroit	On-going
2017-WF-3	Wildfire	Collaborate with ODF and Idanha- Detroit RFD on the North Santiam River acres project to develop defensible space. *	Long-term	City of Detroit	On-going

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-LS-1	Landslide	Integrate new DOGAMI landslide hazard information into land use zoning/development codes.	Long-term	City of Detroit	On-going
2017-FL-1	Flood	Collaborate with Marion County to survey and assess current culvert infrastructure most susceptible to natural hazards	Long-term	City of Detroit	On-going

Source: City of Detroit, 2022

4 City of Gervais Addendum

4.1 Purpose

This document serves as the City of Gervais's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (MHMP, HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Gervais to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

4.2 Plan Process, Participation, and Adoption

For the 2022 Hazard Mitigation Plan update, Marion County partnered with the Oregon Department of Land Conservation and Development to secure FEMA grant funding to support the multi-jurisdictional plan update. This effort included the City of Gervais and created the city's first addendum to the Marion County Hazard Mitigation Plan, as a new plan holder jurisdiction.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Gervais will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre- Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Gervais joined the Marion County HMP update by executing an intergovernmental agreement with DLCD in December 2021. On January 10, 2022, City of Gervais Susie Marston (City Manager), Mark Chase, City Police Chief, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Pam Reber conducted a risk assessment meeting with the city that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on March 14, 2022, to update this addendum.

The City of Gervais City Manager attended HMP Steering Committee meetings on 1/4/22, 3/1/22, 5/4/22, and 6/7/22. Gervais staff promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the city's website and Facebook page in January 2022 to distribute the plan update public survey to interested parties in the Gervais service area.

4.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

4.4 Community Profile

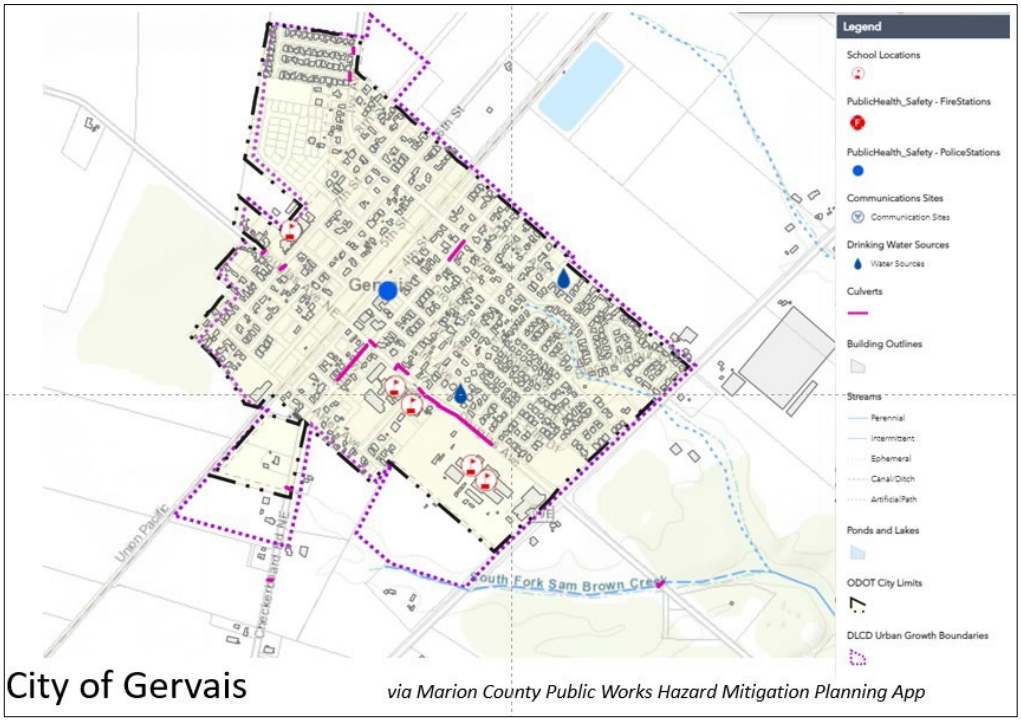
This section provides information on city specific assets and populations. For additional information on the characteristics of the City of Gervais, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city-specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

4.4.1 Community Characteristics

The City of Gervais is in Marion County, 2 miles south of the City of Woodburn and 16 miles north of the City of Salem along Highway 99E. Gervais is in the central Willamette Valley, primarily surrounded by agricultural land, with elevations from 175 to 185 feet above sea level. The terrain within the UGB is relatively impervious and level resulting in slow runoff and ponding during storm events. The city and surrounding agricultural lands drain into Sam Brown Creek and the northern tributary of the Pudding River. The Pudding River is a tributary to the Molalla River, which is a tributary to the Willamette River. These soils are characterized by a high-water table, moderate or slow permeability and low shear strength for building foundations (City of Gervais, 2019).

The Population Research Center at Portland State University lists the City of Gervais's 2020 population at 2,624. This represents a 26.3% increase from 2000. Prior to 1990, population change was minimal, affected primarily by factors outside the community. The largest increase in population took place between 1990 and 2000 due to the development of two residential subdivisions—Winfield Ranch and French Prairie Meadows. Another subdivision, developed in 2007, and localized infill development have led to further growth since 2000 (Portland State University, Population Research Center, 2021). Gervais is a bedroom community with most working residents commuting to Salem, Portland, or Woodburn. The city has experienced steady growth over the years as developable land in the Portland metropolitan area has become more limited. Median household income in Gervais during the period 2015-2019 was $74,191, a 31.4% increase from the previous 5-year period6. For more demographic and economic information, refer to Volume III, Appendix C – Community Profile.

Figure 4-1, City of Gervais Map



4.5 Critical and Important Facilities

City of Gervais's critical and important facilities include the following:

4.5.1 Transportation

Road	Owner	Notes
OR-99E	ODOT	East of city
I-5	ODOT	A half-mile west of city
Railroad	Union Pacific	Operated by Union Pacific and Amtrak

4.5.2 Energy

- PGE, NW Natural Gas provide services to City and its residents, No above or underground fuel tanks. City staff travels to Woodburn, Mt. Angel, and Salem to use local Pacific Pride cardlock facilities.
- City is in the process of acquiring a generator for City Hall through a grant funded project, estimated completion 2023.
- Fuel storage tanks: none known. Pacific Pride in Woodburn or Mt Angel.

4.5.3 Water / Wastewater

- Water treatment plant: Two city wells and two storage tanks, each with the capacity to hold 350,000 gallons. One storage tank built in 2014; the other original tank was built in the 1980s but refurbished in 2016.
    - Location of storage tanks: 115 E. Douglas Ave.
    - Location of wells: 115 Douglas Ave. and 35 Juniper St., both in Gervais.
- Wastewater treatment plant: City operates the plant; it is co-located with lagoons area north of city limits with two (2) lift stations in town.
    - Location of wastewater treatment plant: 13000 block of Portland Rd

4.5.4 Communications

- Police communication equipment is located on City Hall.
- Landline Phone Provider: Datavision
- Cable Provider: Wave Cable
- Cell Service: Verizon with a tower in the vicinity of 40 Alder Ave., Gervais, behind local elementary school.

4.5.5 Emergency Services

- Fire: Woodburn Fire District
- Police: Two locations: Operations at City Hall; Fleet at 115 E. Douglas
- Public Works: City of Gervais, 115 E. Douglas
- CERT: Yes
- Medical: No hospitals or clinics within city limits
- Emergency Operations Center: City Hall
- City Hall: Yes, built in 2012.
- Shelter: No established cooling or warming centers.

4.5.6 Cultural/Historical Resources

- Historic homes as listed in Comprehensive Plan.
- Sam Brown House 12878 Portland Rd NE., Gervais, OR 97026 is on register, but not within the city limits.

4.5.7 Events/ Festivals

- Basketball Tournament at Sacred Heart Catholic Church: July 2022; 200-500 people
- 4th of July Celebration: approximately 1,500 people
- Annually in August, first Tuesday. National Night Out https://natw.org/
- May 22, 2022, Circus at Elementary School 4,000 to 5,000 attendees anticipated.
    - 150 Douglas St. Gervais, Oregon 97026

4.5.8 Environmental and Economic

- Bauman Farms: outskirts of city limits
- Small businesses: Gervais Market, Dollar General, Gervais Bar, and Summit Tile Roofing Inc.
- American Bath—largest commercial property within city limits.
- Woodburn Area Chamber of Commerce
- Amazon Fulfilment Center: 4 million square feet facility being sited approx. 1 mile north of town in Woodburn behind WinCo.
- Sam Brown Creek, a tributary of the Pudding River, has its headwaters near Gervais and runs through the community.
- A city-owned poplar farm is natural infrastructure used to address the city's wastewater. By irrigating the poplar farm instead of discharging to the creek, nutrients and elevated temperatures do not pollute the creek.

4.5.9 Functional and Access Needs (Vulnerable Populations)

- School/Day Cares: daycare/pre-k, elementary, middle, and high school (Gervais School District), Sacred Heart Catholic School.
- Assisted-Senior Living/Medical-Hospitals Facilities/Medical Fragile
  - <10 residents at 837 Lantana Ln NE, Gervais, Oregon 97026
  - <10 residents at 830 Mesquite Ln NE, Gervais, Oregon 97026
- Non-English speaking
- People with low economic status
- County Senior Services
- Cherriots (Regional Transportation-Bus), https://www.cherriots.org/
- Seniors/Retired
- Sacred Heart Food Bank

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

4.6 Plans and Policies

Table 4-1, Plans and Policies of the City of Gervais

Document	Year
Gervais Comprehensive Plan	2015
Stormwater Master Plan	2019
Water System Master Plan	2019
Wastewater System Master Plan	2019
Economic Opportunities Analysis	2015
Housing Needs Analysis	2015

Source: City of Gervais, 2022. Public Works website.
http://www.gervaisoregon.org/public-works.html DLCD, 2022. PAPA Database
https://www.oregon.gov/lcd/CPU/Pages/Adopted-Plan-Amendments.aspx

4.7 Hazard Profile

Table 4-2, City of Gervais Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Gervais		2,620		719	3		247,297,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	397	15%	266	4	55,400,740	22%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0	0	0	0	0
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0	0	0	0	0
Lahar	Medium Zone (1000 to 15000 – Year)	0	0	0	0	0	0

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
None reported						

Source: DOGAMI (2022)

4.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a method developed by BOLD Planning7. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and.
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Medium, and Low

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the hazard vulnerability assessment findings and rankings is presented below.

Table 4-3, Hazard Profile Summary for the City of Gervais using BOLD Planning Analysis Scoring

Hazard Profile Summary for the ***City of Gervais*** using BOLD Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Earthquake	3	4	4	4	3.6	**High**
Tornado	1	4	4	4	2.7	**Moderate**
Flood (including dam failure)	2	3	2	4	2.4	**Moderate**
Severe Weather/Storm	2	1	3	4	2.4	**Moderate**
Volcanic Eruption	2	3	2	4	2.4	**Moderate**
Extreme Weather - High Temperature	2	1	3	3	2.3	**Moderate**
Wildland Interface Fire	1	3	2	3	1.8	Low
Drought	1	1	1	1	1.0	**Low**
Avalanche	0	0	0	0	0.0	Not rated
Landslide	0	0	0	0	0.0	Not rated

Source: Marion County Emergency Management and City of Gervais, 01/10/2022; revised 3/14/22.

Table 4-4, City of Detroit Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the ***City of Gervais*** using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Public Health	4	1	3	4	3.3	**High**
Hazardous Materials Release - Transportation	3	4	3	3	3.2	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	4	4	3.1	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Fire - Residential / Commercial (Arson)	2	4	2	4	2.5	**Moderate**
Unauthorized Entry	2	4	2	4	2.5	**Moderate**
Hazardous Materials - Non-Transportation	1	4	2	3	2.0	**Low**
Cyberterrorism	1	4	1	4	1.8	**Low**
Agricultural Terrorism	1	1	1	4	1.3	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by the City of Detroit representatives to the NHMP update on 10/18/2021

4.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Gervais. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events.

The following section identifies vulnerabilities specific to the City of Gervais, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

4.9.1 Avalanche

CPRI = 0.0, Risk Level: Low

Events: n/a

Vulnerability: None

4.9.2 Drought

CPRI = 1.0, Risk Level: Low

Events: n/a

Vulnerability: Water supply is in wells. No alternative water supplies, e.g., no reservoir. Two water storage tanks are each 350,000 gallons.

4.9.3 Earthquake

CPRI = 3.6, Risk Level: High

Events: No damaging earthquake events occurred during the previous five years. The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County.

Vulnerability: Downtown Gervais has an older stock of unreinforced masonry buildings. One water reservoir that was built in the 1980s but refurbished has a higher vulnerability. Water treatment facility was also built in the late 1980s and likely needs reinforcement to withstand an earthquake. The water distribution system would be susceptible to breakage in an earthquake event. Wastewater lagoons dikes and underground lift stations are susceptible to failure in a seismic event.

4.9.4 Extreme Heat

CPRI = 2.3, Risk Level: Moderate

Events: n/a

Vulnerability: No cooling center in the community.

4.9.5 Flood

CPRI = 2.4, Risk Level: Moderate

Events: n/a

Vulnerability: Less than probable, but possible. The Pudding River floods downstream from the city but has not impacted the city.

4.9.6 Landslide

CPRI = 0.0, Risk Level: Low

Events: n/a

Vulnerability: Gervais is very flat, there is no landslide risk.

4.9.7 Severe Weather

CPRI = 2.4, Risk Level: Moderate

Events: 2021 Ice Storm

Vulnerability: Extended power outage impacted communications, internet, which included the Emergency Operations Center. Destroyed poplar tree farm that serves wastewater plant, the city's only natural infrastructure facility that filters the city's wastewater. Debris from tree damage.

4.9.8 Tornado

CPRI = 2.7, Risk Level: Moderate

Events: n/a

Vulnerability: Scenario considered was Aumsville tornado December 14, 2010. Possible, would impact community for more than one week.

4.9.9 Wildfire

CPRI = 3.6, Risk Level: High

Events: n/a

Vulnerability: Gervais is surrounded by agricultural lands which are highly managed and pose low risk for wildfire.

4.9.10 Volcanic Eruption

CPRI = 2.4, Risk Level: Moderate

Events: 1980 Mount St Helens eruption.

Vulnerability: The City would have 6 to 12 hours before ash from an eruption of Mt. Hood, etc. impacted the community; impacts could last more than a week.

4.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Gervais Addendum update process, the Oregon Department of Land Conservation & Development and Gervais city staff developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

4.10.1 City of Gervais Mitigation Tables

The following pages include the city's initial list of Priority Action Items (Table 4.5).

Table 4-5, City of Gervais "Priority" Action Items

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-MH-1	Multi-Hazard	Install a backup generator for the Emergency Operations Center (EOC) at the Gervais City Hall.	H	1-3 years	$75k	The city was awarded a grant for a generator through Marion County Emergency Management and OEM. Construction is planned for Summer 2022.	New
2022-MH-2	Multi-Hazard	Partner with Woodburn Fire on the construction of a local fire house in Gervais.	H	1-3 years	$2.2 million	Fire District is currently looking for possible locations and plans to fund the structure with a renewal bond, grants, and loans. Land and some funding would be the city's role.	New
2022-MH-3	Multi-Hazard	Coordinate evacuation planning with Marion County Emergency Management and Woodburn.	H	1-3 years	Staff time	The city would like to coordinate on regional efforts to improve emergency response or planning.	New
2022-EQ-1	Earthquake	Consider seismic retrofits such as flexible pipe connectors for water treatment facilities.	M	5-10 years	TBD	In an earthquake event, it would be ideal to prevent water distribution lines from breaking. If flexible connectors are installed at key locations to be determined by a consultant, some sections of line could be more easily repaired, and water conserved.	New
2022-EQ-2	Earthquake	Consider seismic retrofits such as automatic shutoff valves for water treatment facilities.	M	5-10 years	TBD	In an earthquake event, it would be ideal to prevent loss of water supply or discharge of waste.	New

Source: City of Gervais, 03/14/2022.

5 City of Hubbard Addendum

5.1 Purpose

This document serves as the City of Hubbard's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Hubbard to improve the resilience of the community. Mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful.

Information contained in Volume I (Basic Plan) and Volume III (Appendices) of the HMP provides additional information (hazard characteristics/events/extent, countywide mitigation actions, and community profile data) and forms the basis of this addendum.

5.2 Plan Process, Participation, and Adoption

In the summer and fall of 2021 Marion County partnered with the Oregon Department of Land Conservation and Development and the Oregon Department of Emergency Management (OEM), and Marion County cities, including the City of Hubbard, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Hubbard will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre- Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Hubbard 2022 Hazard Mitigation Committee is comprised of the following:

- Convener, City of Hubbard Public Works Administrative Manager Melinda Olinger
- City of Hubbard Police Chief Dave Rash
- Hubbard Rural Fire Protection District Fire Chief Joe Budge
- Hubbard Rural Fire Protection District Assistant Fire Chief Michael Kahrmann

The City of Hubbard joined the Marion County HMP update by approving an intergovernmental agreement with DLCD in October 2021. On December 9, 2021, Representatives from the City of Hubbard (Melinda Olinger, Dave Rash, Hubbard RFPD (Joe Budge, Michael Kahrmann), Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the City of Hubbard that included a Hazard Vulnerability Assessment ranking. The Hazard Mitigation Committee coordinated internally on documents for the City of Hubbard. City staff met again with DLCD on May 12, 2022, to update this addendum. The city shared the addendum with City Council at their June 14th and July 12th meetings of 2022.

City of Hubbard staff attended the majority of Marion County HMP Steering Committee meetings and promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the City's website and Facebook page on January 18, 2022, to distribute the plan update public survey to interested parties in the City of Hubbard service area.

5.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

5.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of the City of Hubbard, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the City's specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

5.4.1 Community Characteristics

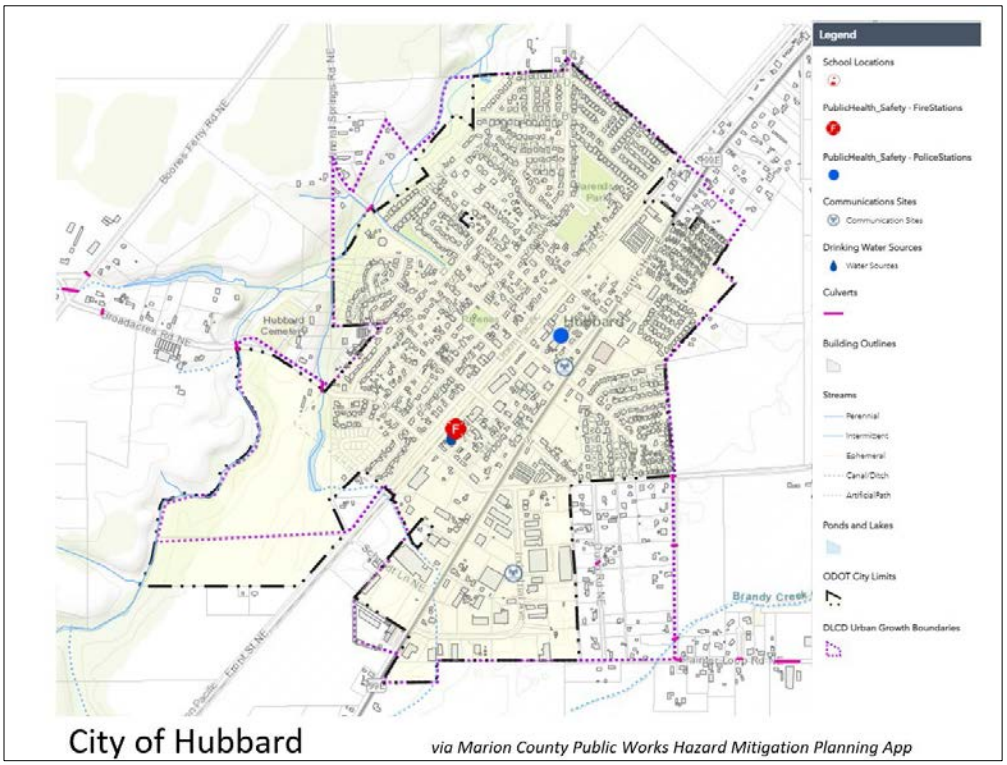
The City of Hubbard is in the Willamette Valley in Marion County, Oregon, approximately 30 miles south of the City of Portland. Hubbard experiences a moderate climate with an average high temperature of 82 degrees and low of 54 degrees in August, and an average high temperature of 47 and low of 35 in January. The city receives an average annual precipitation of 40.7 inches. The confluence of Mill Creek and Little Bear Creek is along the west side of Hubbard. Hubbard is located on a flat area, with farmland surrounding the city on all sides.

The Population Research Center at Portland State University lists Hubbard's 2020 population at 3,454. This represents a 36.9% increase from 2000 (Portland State University, Population Research Center, 2021). For more demographic information, refer to Volume III, Appendix C – Community Profile.

5.4.2 Economy

Historically, the City of Hubbard was an agricultural and light industrial community that is based upon the nursery, hops, hazelnut, and hemp industries. Today, Hubbard's economy is still largely based on its proximity Woodburn and to I-5. Median household income in Hubbard 2015-2019 was $59,803, a 14.1% increase from the previous 5-year period (Portland State University, Population Research Center, 2021) For more economic information, refer to Volume III, Appendix C – Community Profile.

Figure 5-1, City of Hubbard Map



5.4.3 Hubbard Rural Fire Protection District

The Hubbard Fire District serves the City of Hubbard and the surrounding areas, covering. square miles. The district is a combination district with 4 full-time employees and 33 volunteer members. Career members work 24 hour shifts with daily staffing supplemented by volunteer members. Close working relationships with neighboring fire districts have been established through both mutual and auto-aid emergency response agreements and intergovernmental contacts. The Hubbard Fire District provides all hazard response, including fire suppression, emergency medical services, motor vehicle accident response, hazmat mitigation, and public services. The district offers part time advanced life support and full-time basic life support. The district responded to a total of 800 incidents in 2020 (Hubbard Rural Fire Protection District, 2022).

5.5 Critical and Important Facilities

City of Hubbard's critical and important facilities include the following:

5.5.1 Transportation

- See designated truck route map.
- Broadacres, Boones Ferry Rd, Pacific Hwy 99E main road, Whiskey Hill Rd turns into J Street, D Street turns into Mineral Springs Rd
- The Union Pacific Railroad runs parallel to Pacific Highway 99E through Hubbard (between 2nd & 3rd Streets). The fire station, City Hall and our WTP, well #1 and one of our 1,000,000 gallon above-ground reservoirs are near the tracks and are vulnerable

to a train derailment incident. The fire station is our primary EOC, and City Hall is our secondary EOC.

- Hubbard is served by Canby Transit and Cherriots for public transit.
- First Student is the area's school bus company. No schools are within the city limits. Schools are located at 20246 Grim Rd., Aurora. First Student has a local parking area on "J" Street for school buses.
- Interstate-5 runs north-south to the west of the City of Hubbard.

5.5.2 Energy

- Natural gas pipeline runs along Hwy 99E.
- PGE provides electric service.
- City has backup generators at city hall, fire station, water plant, wastewater plant, and water tower locations.
- City has no fuel storage, but a fuel storage plan or facility is under development.
- Gas is available at cardlock and regular gas stations, but if the electricity goes out Tualatin is the closest supply. City has reached out to farmers to get needed fuel in the past.

5.5.3 Communications

- Dispatch service is provided by METCOM 911
- All Police, Public Works and Fire have radio access.
- All Police, Public Works and Fire have cell phones.
- Verizon and T-Mobile have equipment located on the water tower (3652 1st Street). Verizon has a backup generator on-site.
- T-Mobile (originally Sprint) has a telecommunications tower located at 2783 Industrial Avenue
- Police, Public Works, and Administration internet is provided by Datavision.
- Comcast, Datavision, Wave and Century Link all provide service throughout the city.
- The city server is backed up daily on an autotimer.

5.5.4 Water/ Wastewater

- City owned water system:
    - Water Treatment Plan, 3101 2nd Street
    - Well #1 3101 2nd Street
    - Well #2 2600 "D" Street
    - Well #3 3652 1st Street
    - Well #4 2858 "J" Street

- 1,000,000 gallon above-ground storage tank 3101 2nd Street
- 1,000,000 gallon above-ground storage tank 2858 "J" Street
- 50,000-gallon elevated water tower 3652 1st Street (elevated tank currently provides water pressure for the system.

- Hood view Estates has private well.
- 2674 Pacific Hwy 99E has a private well.
- The city's owned wastewater system.
  - Waste Water Treatment Plan and Public Works main office 3607 Sunset Drive.
  - Lift Station 3607 Sunset Drive
  - Lift Station 3rd and "J" Streets
- 3133 and 3113 Schmidt Lane have private septic systems.
- 2674 Pacific Hwy 99E has a private septic system.
- 2021 Winter Storm Fuel issue: Generators at water treatment plant were damaged by bad fuel during the event. The city is looking at funding to replace generator. Internet is needed but can be operated manually but much harder.

5.5.5 Emergency Services

- Fire protection by Hubbard Rural Fire Protection District (RFPD).
- Police protection by Hubbard Police Department.
- Emergency Operations Center
  - Primary: Hubbard RFPD
  - Secondary: City Hall 3720 2nd St., Hubbard, OR
- Medical: Closest services in Canby or Woodburn.
- No CERT Team currently
- Shelter/Mass Care: No agreements in place, just work with the County.

5.5.6 Cultural/Historical Resources

- n/a

5.5.7 Events/ Festivals

- Hop Festival – July, Hosted by Volunteer Committee, 1–2-day event, 4 to 5k attendees.

5.5.8 Environmental/ Economic

- Agriculture and Light Industrial / Commercial
- Hops, Hazelnuts, Nursery

5.5.9 Functional and Access Needs (Vulnerable Populations)

- Schools: No schools in Hubbard.
- Mobile Home Parks
- NE section of city is of a lower economic level than average.
- 33% of the City's population speaks Spanish; some residents may need materials in a disaster event translated into Spanish. City strives for bi-lingual flyers. Bi-lingual staff would be needed in an evacuation or other emergency event.
- No assisted living facilities in Hubbard.

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

5.6 Plans and Policies

Table 5-1, Plans and Policies of the City of Hubbard and Hubbard RFPD

Document Name	Year
Hubbard Emergency Operations Plan (currently being updated)	2022
Hubbard Comprehensive Plan	2013
Transportation System Plan	2012
Stormwater Master Plan	1996
Water Master Plan	2020
Wastewater Facilities Plan (currently being updated)	2022

Source: Source: City of Hubbard, 2022.

5.7 Hazard Profile

Table 5-2, City of Hubbard Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Hubbard		3,315		1,187	3		458,199,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	397	11%	466	3	125,813,507	28%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	6	0.2%	2	0	594,000	0.1%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0	0	0	0	0
Lahar	Medium Zone (1000 to 15000 – Year)	0	0	0	0	0	0

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
None Reported						

Source: DOGAMI (2022)

5.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a method developed by BOLD Planning[7]. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event.
2. Magnitude of event.
3. Expected warning time before event.
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 5-3, City of Hubbard Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary for the ***City of Hubbard*** using BOLD Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Earthquake	4	4	4	4	4.0	**High**
Wildland Interface Fire	4	4	4	4	4.0	**High**
Severe Weather/Storm	4	3.5	3	4	3.6	**High**
Extreme Weather - High Temperature	4	2	3	4	3.4	**High**
Tornado	2	4	4	4	3.1	**High**
Flood *	2	2	3	3	2.4	**Moderate**
Drought	2	1	3	4	2.4	**Moderate**
Landslide	2	2	2	4	2.2	**Moderate**
Volcanic Eruption	1	1	3	4	1.9	**Low**
Avalanche**	1	1	1	1	1.0	**Low**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management; City of Hubbard; Hubbard RFPD, 12/7/21 *Including Dam Failure, **New in 2021*

Table 5-4, City of Hubbard Hazard Vulnerability Assessment – Non-Natural Hazards

Hazard Profile Summary for the ***City of Hubbard*** using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	**0.45**	**0.15**	**0.3**	**0.1**		
Public Health	4	1	3	4	3.3	**High**
Hazardous Materials Release - Transportation	3	4	3	3	3.2	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	4	4	3.1	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Fire - Residential / Commercial (Arson)	2	4	2	4	2.5	**Moderate**
Unauthorized Entry	2	4	2	4	2.5	**Moderate**
Hazardous Materials - Non-Transportation	1	4	2	3	2.0	**Low**
Cyberterrorism	1	4	1	4	1.8	**Low**
Agricultural Terrorism	1	1	1	4	1.3	**Low**

Source: Hazard Profile Summary for the City of Hubbard using BOLD Planning Analysis Scoring

5.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Hubbard. Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to the City of Hubbard, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

5.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: n/a

Vulnerability: none

5.9.2 Drought

CPRI = 2.4, Risk Level: Moderate

Events: n/a

Vulnerability: An extended drought has the potential to limit the ability of the City's wells to keep up with demand, particularly during high water use periods.

5.9.3 Earthquake

CPRI = 4.0, Risk Level: High

Events: On March 25, 1993, a Mw 5.7 earthquake occurred with an epicenter approximately 3 miles east of the City of Scotts Mills, Oregon. Many buildings were damaged from the event, including the capitol building in Salem. The many unreinforced buildings in the area were significantly damaged due to intense shaking." (DOGAMI, 2022)

Vulnerability: There are several single-story unreinforced masonry buildings (URMs) in the community. City Hall, the alternate EOC, was built in 1800's and seismic improvements have been completed. Damage could also disrupt City services including water, sewer, transportation, and communications. Private services could also be disrupted including power, disposal, and the supply chain of critical resources.

The communities in the northeast part of the county (Gervais, Hubbard, Mt. Angel, Scotts Mills, Silverton, and Woodburn), close to the Mount Angel Fault all have higher levels of estimated losses compared the rest of the county. (DOGAMI, 2022)

5.9.4 Extreme Heat

CPRI = 3.4, Risk Level: High

Events: n/a

Vulnerability: No cooling center locally, so community members must travel outside the city for cooling center facilities. The city conducts spot checks on vulnerable persons.

5.9.5 Flood

CPRI = 2.4, Risk Level: Moderate

Events: No major flood events 2017-2021.

Vulnerability: Some areas in the western part of the city are vulnerable to flooding from Mill Creek. The City's lower wastewater treatment plant is in the floodplain. In addition, there are some areas throughout the city which experience localized flooding during high rain events.

Figure 5-2, Hubbard Flood Hazard Map 1

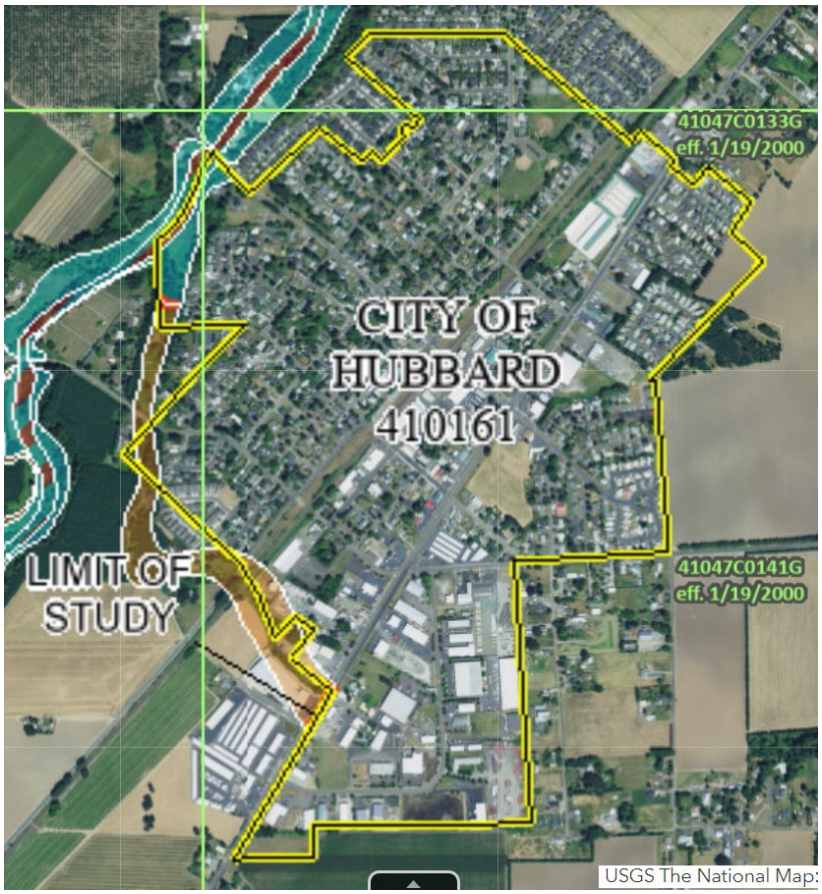
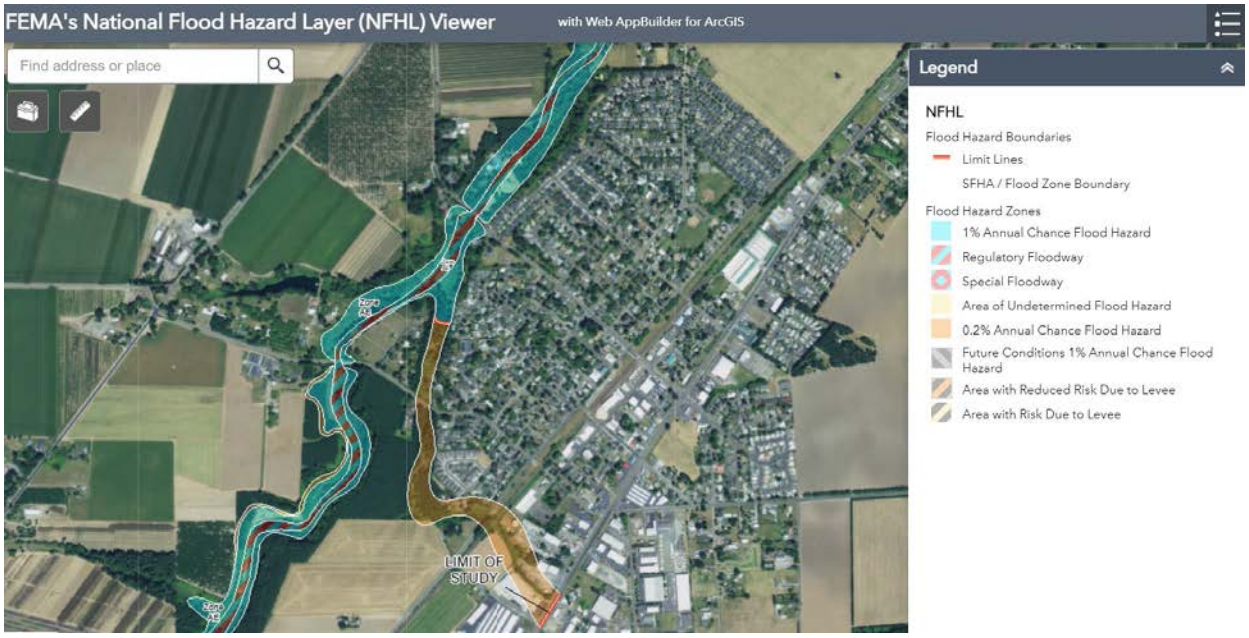


Figure 5-3, Hubbard Flood Hazard Map 2



5.9.6 Landslide

CPRI = 2.2, Risk Level: Moderate

Events: NA

Vulnerability: NA

5.9.7 Severe Weather

CPRI = 3.6, Risk Level: High

Events: 2021 Winter Storm; Periodic Extreme Heat

Vulnerability: Risk is primarily from downed trees blocking roads and impacting powerlines. The extended power outage experienced during the 2021 Winter Storm highlighted the challenges of keeping the City's emergency generators fueled and running 24/7 for extended periods of time. These generators provide power to both the water system, sewer system, and computer/SCADA systems. The city does not have local warming/cooling centers, so travel is required for our community to access these resources.

5.9.8 Tornado

CPRI = 3.1, Risk Level: High

Events: Aumsville tornado December 14, 2010.

Vulnerability: Homes and businesses are vulnerable to high wind forces created by a tornado. Structures and critical equipment can be damaged both by the tornado itself and falling trees, branches, and other debris.

5.9.9 Wildfire

CPRI = 4.0, Risk Level: High

Events: n/a

Vulnerability: The Mill Creek Wildland Area is a large track of dense trees and undergrowth that runs through the Hubbard Fire District. While this area is subdivided into many tax lots there are no distinguishable property lines or markings. It is just one large area. The fire danger is high from the unmanaged undergrowth, the damage and debris from the ice storm of 2020, and the lack of maintenance in the form of fuel reduction. A wildfire in this area would threaten all structures located on the perimeter of this area. Wildfire would burn through this area very quickly and the Hubbard Fire District would have a problem putting a stop to the fire based on the amount of fuel, limited access, and lack of defensible spaces or fire breaks.

A total of 179 structures, residential homes, and their outbuildings, are in direct danger in the event of a wildfire in the Mill Creek Area. Another 97 structures have been identified as secondary exposures. In addition to the property at risk are the lives of those occupants. A fast-moving wildfire, especially wind driven, would have the potential to put many lives and properties at risk as well. The impact on the citizens and communities of Hubbard would extremely great. This would impact those who live and work in the community as well as the local economics. A reduction of property value would cause budget shortfalls in property tax collections for the City of Hubbard and the Hubbard Fire District. Rebuilding from a catastrophic fire would take a minimum of several years.

5.9.10 Volcano

CPRI = 1.9, Risk Level: Low

Events: n/a

Vulnerability: The City is vulnerable to falling ash as it is corrosive and can get into critical equipment, potentially damaging or rendering equipment useless. In addition, falling ash can cause health issues.

5.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and the City of Hubbard Addendum update process, Oregon Department of Land Conservation & Development and the City of Hubbard developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

5.10.1 Ongoing Mitigation Actions

- City newsletter is issued six times per year, usually with a focus on emergency preparedness.
- Website is regularly updated with information on emergency preparedness.
- Backup generators are test-run on a weekly basis and re-fueled quarterly or as needed.
- Catch basins are cleared prior to rain events.
- Sand and sandbags are stocked and made available to our community on a self- serve basis for localized flooding.
- City staff are equipped with emergency go-packs.
- Service trucks fuel tanks are kept half full at a minimum.

5.10.2 Mitigation Success

The City of Hubbard actively educates the community on emergency preparedness via their website and City newsletter, and previously through emergency preparedness fairs.

Figure 5-4, Hubbard Emergency Planning



5.10.3 City of Hubbard Mitigation Action Tables

The following pages includes the city's initial Priority Action Items (Table 5-5).

Table 5-5, City of Hubbard "Priority" Actions

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-MH-1	Multi-Hazard	Fire Hall dormitory improvements.	High	1-3 years Short-term	$180k	Funding: ARPA	New
2022-MH-2	Multi-Hazard	Fuel storage plan development and implementation	High	Short-term	$20k+	Funding: $20k Public Works fund allocated.	New
2022-WF-1	Wildland Fire	Mill Creek Wildland Fuel Reduction Plan	High	Short-term	TBD	Funding: $20k Public Works fund allocated.	New
2022-MH-3	Multi-Hazard	Update the Hubbard Comprehensive plan to reflect the characteristics of high priority hazards and recommended policies and implementation actions that reflect new hazard information.	High	1-3 years	$40k	Funding: under development	New
2022-MH-4	Multi-Hazard	Replace Water Treatment Plant Generator	High	Short-term	$20k+	Will be incorporated into the pending Water System Improvements Project. Funding: ARPA, City funds	New
2022-MH-5	Multi-Hazard	Emergency Communications Upgrade	High	2-5 years	TBD	Partners: METCOM, Sheriff's Office, Public Works Director.	New
2022-MH-6	Multi-Hazard	Public Education	High	Ongoing	Staff Time		New
2022-MH-7	Multi-Hazard	Review Marion County's Mitigation Actions to determine potential partnership.	High	Ongoing	Staff Time	Mill Creek riparian zone	New
2022-MH-8	Multi-Hazard	Replacement of City Hall, Police, and Public Works for seismic, other resilience.	Medium	Long-term	TBD	Public Works and Police Dept. would be in City Hall, as well as EOC and outdoor assembly area.	New
2022-FL-1	Flood	Develop a stormwater master plan.	Medium	Long-term	$100k+	Outdated but lack funding. Need to address localized flooding issues.	New
2022-EQ-1	Earthquake	Evaluate critical facilities for seismic preparedness by identifying structural deficiencies and vulnerabilities to dependent systems (e.g., water, fuel, power).	Medium	Long-term	$100k+	Added based upon 2022 DOGAMI Risk Report recommendation.	New

Source: City of Hubbard, 5/12/22.

6 City of Idanha Addendum

6.1 Purpose

This document serves as the City of Idanha' s Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Idanha to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

6.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Idanha, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the Idanha will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre- Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Idanha joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on October 27, 2021. On October 28, 2021, Rebecca Stormer, City Manager/City Recorder, and Robyn Johnson, City Clerk, met with Marion County Emergency Manager Kathleen Silva, and DLCD Planner Tricia Sears to conduct a risk assessment meeting with the City of Idanha that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on March 31, 2022, to update this addendum.

Idanha staff have been unable to attend HMP Steering Committee meetings due to wildfire impacts to communication and transportation lifeline infrastructure during the Beachie Creek and Lionhead fires. However, Idanha staff have worked with City Council to promote the HMP survey and outreach efforts throughout the plan update to engage interested parties in the Idanha service area.

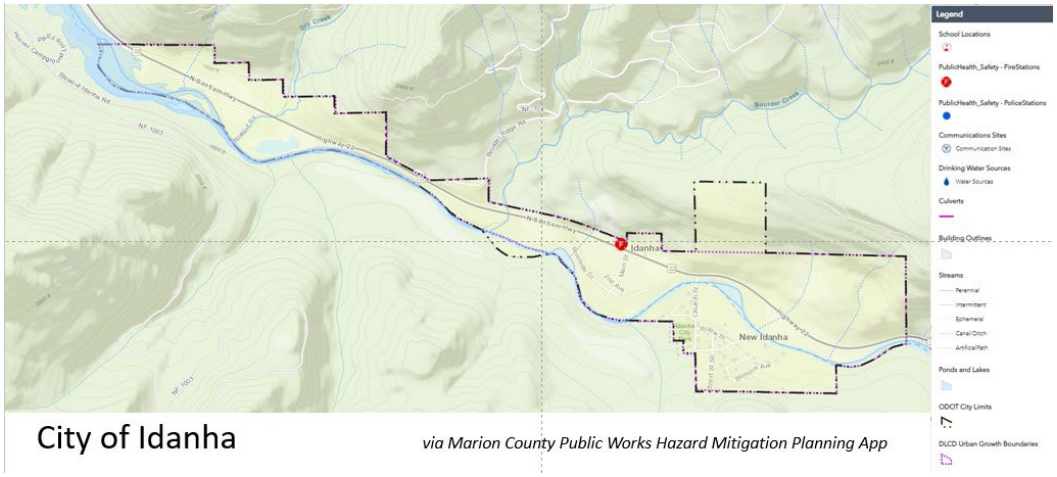
6.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

6.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of Idanha, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

Figure 6-1, City of Idanha Map



6.4.1 Community Characteristics

Idanha is located approximately 57 miles east of Salem, bordering the North Santiam River. It is the smallest community in the North Santiam River Canyon with a population of 148. Idanha' s urban growth boundary (UGB) spans two counties. In 2020, the Linn County UGB population was 58 people, while the Marion County UGB population was 90 people (Portland State University, Population Research Center, 2021). With an elevation of 1718 feet, the climate of Idanha is moderate; the average monthly temperatures range from 50 – 80 degrees in July and August, and 29-41 degrees in December and January. Idanha receives approximately 66 inches of rain and 35 inches of snow each year. The city's topography is relatively flat with steep slopes surrounding the area along Hwy 22.

6.4.2 Economy

Idanha benefits from its location along Hwy 22, a major east-to-west transportation route connecting Salem to Bend. Median household income in Idanha during the period 2015-2019 was $43,500, a 20.3% increase from the previous 5-year period (U.S. Census Bureau, 2022). But due to its small population size and lack of development, the city lacks many commercial amenities. The city has one retail storefront along Hwy 22, but most of the manufacturing and timber related employment has left the city. Historically, Idanha prospered from the development of the railroad and dam, which helped spur growth in manufacturing, logging, and fishing. Today, the economy relies upon the recreational opportunities available through state/federal lands, and the North Santiam River.

Unfortunately, these lands and the related opportunities were severely impacted by the wildfires of 2020. Prior to the wildfires, the PSU Population Research Center reported for the Linn County portion of the UGB that features 'New' Idanha, "the 5-year average annual housing unit growth rate is generally very low and is assumed to slightly increase to 0.13 percent during the first 10 years and then very slightly decline to almost zero thereafter. The occupancy rate is assumed to be steady at 76.9 percent throughout the 50-year horizon…There is no group quarters population in Idanha."

6.5 Critical and Important Facilities

Idanha' s critical and important facilities include the following:

6.5.1 Communication/Information Technology

There is currently one communication provider in Idanha. Frontier provides phone service, and various satellite businesses provide broadband speed internet.

Strengths:

- Most residents utilize scanners or citizen band (CB) radios.
- A phone substation is in nearby Detroit.

Weaknesses:

- Limited internet speeds and provider access.
- Poor phone services and reception.
- Main communication line runs down highway 22 and is susceptible to from trees and wind.

6.5.2 Water

The City of Idanha has two water sources from Chittum Creek, and Mud Puppy Creek fed by a natural spring named rainbow creek. This system currently utilizes a surface water intake to pull water from these sources. The city also contains dike and jetty infrastructure along the North Santiam River. However, the town is still vulnerable due to the geographic topography of the river.

6.5.3 Dams

Two dams sit below Idanha, *Detroit Dam* and *Big Cliff Dam.* Previous steering committees have concluded that the likelihood of Dam Failure is ***Low[5].*** Current conditions still represent the previous decision. If Dam failure occurred in either dam, Idanha would most likely lose access to the western portion of Hwy 22.

Strengths:

- (2) water intake sources (Chittum & Mud Puppy Creek)
- (1) backup diesel generator on-site, near water intake sources.

Weaknesses:

- Limited diesel fuel is available inside of city limits.
- Water intake sources are susceptible to wildfire damage.
- The city is losing large amounts of water distributed through leaky pipes.

6.5.4 Transportation Systems

Oregon Route 22 is the major transportation route for auto, public transit, and emergency vehicle access throughout the Santiam Canyon. Hwy 22 spans about 57 miles west, connecting Idanha to Salem and the remainder of the Willamette Valley. To the east, the highway connects Idanha to the Santiam Pass interchange.

The Cherriots Canyon Connector is the only existing public transit service in the entire Santiam Canyon. This route has three total round trips with buses running approximately every (5) hours. Idanha residents are forced to drive to Gates to utilize these services, as the canyon connector does not reach Detroit or Idanha.

In case of a major Oregon Route 22 closure, Idanha residents will have to rely on alternate routes to reach supplies or safety. The cities alternate routes are limited with NF-2231, NF-2233, and NF-2234. Depending on weather conditions, these roads may be unpassable.

The city is home to a bridge that crosses over the North Santiam River. Water lines that serve the population in “New Idanha” are co-located on this bridge. Bridge failure could disrupt water services for these residents.

Bridges

Structure Name	Year Built	Structural Condition
Church St. Bridge	n/a	Fair

Strengths:

- Proximity to ODOT facility may increase access to public works services.
- The Idanha-Detroit RFD location is in city limits and could be utilized in a hazard event.

- National Forest Roads exist outside of Idanha and could be utilized as emergency evacuation routes.

Weaknesses:

- Loss of Church St. Bridge would isolate a large percentage of Idanha residents.
- Loss of Church St. Bridge could disrupt drinking water services.
- Alternate routes are long, and most likely impassible in winter months.
- Hwy 22 closures could make travel outside of North Santiam Canyon extremely difficult.
- Public transportation options are limited and only reach to the city of Gates.
- The lack of a pedestrian sidewalk along Hwy 22 created safety hazards for pedestrians.

6.5.5 Energy & Utilities

Idanha receives energy and utility services from Consumer Power Inc. There are no substations located in Idanha. One main power line runs along Hwy 22, connecting to Detroit, Gates, and Mill City.

Strengths:

- Many residents have their own generators and are able to power basic home amenities during power outages.
- Most residents utilize firewood as a heating source, making them more resilient in case of a power outage.

Weaknesses:

- No fueling stations exist within city limits.
- Nearby gas stations in Detroit do not currently possess backup diesel generators to pump fuel from storage tanks.
- No alternate sources of energy (wind, solar) exist to power basic services.
- Downed power lines are a reoccurring issue around Hoover Campground (Santiam Park).
- Power lines are co-located on the bridge.
- Residents rely on wood burning stoves for heat.

6.5.6 Agriculture and Food

Although Idanha possesses the “Idanha County Store” the closest large-scale grocery exists down Hwy 22 in Stayton, Oregon. The loss of Hwy 22 as a transportation route would cause serious concern for residents and food accessibility. The city is surrounded by steep slopes that are state and federal land. There is no agricultural capability other than small-scale “urban” farms within city limits.

Strengths:

- Country stores within city limits provides limited amenities and food supplies.
- Many residents have food storage already in place because of the lack of availability.

Weaknesses:

- No major (full service) grocery store inside of city limits.
- Surrounding land not suitable for agricultural purposes.

6.5.7 Banking and finance

Idanha' s nearest option for banking services is in Mill City. This one-story structure sits along Hwy 22 and could be utilized for emergency financial services during a hazard event. Idanha does not have any financial services within city limits.

Strengths:

- Country stores within city limits provides limited amenities and food supplies.
- Many residents have food storage already in place because of the lack of availability.

Weaknesses:

- No major (full service) grocery store inside of city limits.
- Surrounding land not suitable for agricultural purposes.

6.5.8 Hazardous Materials

The city's history of manufacturing and logging activities have created concerns around hazardous materials found on abandoned lots. Although only one lot has been identified as a brownfield, many lots contain underground storage tanks that most likely need to be removed for any further development to occur. These tanks could be leeching hazardous materials previously used by local businesses.

Brownfields Location

DEQ ID	Facility Name	Location
2479	Green Veneer & Lumber Mill (assessment recommended)	886 Hwy 22

Strengths:

- There are currently not enough known hazardous materials to cause major concern.
- Brownfield sites could be utilized and attract privates sector development.

Weaknesses:

- Current brownfields may be susceptible to leaching of unknown materials.
- Many lots still contain underground storage tanks that are even more susceptible to leaching of hazardous materials.

6.5.9 Emergency Services

Idanha receives emergency service support from the Idanha-Detroit Rural Fire Protection District. Idanha-Detroit Rural Fire Protection District, 107 Hwy 22 NW

Strengths:

Idanha possesses emergency services provided by the Idanha-Detroit RFD within city ***limits.***

Weaknesses:

- Idanha lacks any police or medical services.
- Ambulance services must travel from Lyons.
- First responders are very limited to basic life monitoring services.
- Emergency services do not have trained HAM radio operators.

6.5.10 Government Facilities

Idanha City Hall contains the office space for all city services.

- Idanha City Hall, 111 Hwy 22
- Post Office, 103 Hwy 22

Strengths:

- The City Hall facility has bathrooms and could be utilized in an emergency event.

Weaknesses:

- City Hall is small with space already utilized by other services.
- The building lacks any backup generator to power the facility.

6.5.11 Environmental/Historical Preservation Sites

Idanha is surrounded by environmental preservation sites including federal land, state parks and designated wilderness areas. The city is also home to the beginning of the Oregon Pacific Railroad Linear Historic District. Designated in 1999 this 20-mile section of old railroad connects Idanha to the Cascade Range Summit.

Strengths:

- Proximity to pristine state and federal land could attract residents or business.
- Oregon Pacific Railroad Linear Historic District could be utilized to as an emergency trail system.

Weaknesses:

- Idanha lacks any buildings with character that exemplify the historical “timber” identity in the community.

6.5.12 Education

Idanha is part of the Santiam School District. This district encompasses all cities in the Santiam Canyon including Mill City, Gates, and Detroit. This district includes the Santiam Elementary School, and the Santiam Jr./Sr. High School.

- Santiam School District
  - Santiam Elementary School, 450 SW Evergreen St.
  - Santiam JR./SR. High School, 265 SW Evergreen St.

Strengths:

- School facilities could be utilized to shelter a large amount of community residents including functional needs populations.
- School facilities already possess needed infrastructure for a shelter which includes restrooms, showers, and a kitchen.
- School buses could be utilized for transportation after a hazard event.

Weaknesses:

- Idanha is over 25 miles from these school services.
- There are no current agreements or MOUs between the city and school district to utilize facilities after a hazard event.

6.5.13 Healthcare & Public Health

Idanha' s nearest medical services is in Mill City which possesses one clinic with limited services. The nearest hospital and full-service health clinic are located in Stayton, Oregon.

- Santiam Medical Clinic, 280 S 1st Ave.

Strengths:

- A clinic with minor services exists within the North Santiam Canyon

Weaknesses:

- The closest health services are located over 20 miles.
- No facilities with major life-saving equipment currently exist within city limits.
- Emergency health supplies are limited to what exists within the community.

6.5.14 Access and Functional Needs

Idanha' s vulnerable population consists of the elderly and those that are medically dependent and require life safety equipment. About 22% of Idanha' s population is characterized as being elderly, and one legally blind resident resides within city limits.

Strengths:

- Over 55% of residents are over the age of 45, this older populous can volunteer and promote social cohesion in the community.

Weaknesses:

- Full medical services do not exist nearby for an aging population.

6.6 Plans and Policies

Table 6-1, Plans and Policies of the City of Idanha

Document Name	Year
Idanha Comprehensive Plan	2007
Water Plant Emergency Operations Plan	1996
North Santiam Watershed Drought Contingency Plan	2013
Mid-Willamette Valley Council of Governments Comprehensive Economic Development Strategy	2020
Marion County Community Wildfire Protection Plan	2017

6.7 Hazard Profile

Table 6-2, City of Idanha Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Idanha		155		159	1		35,338,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	3	1.7%	2	0	23,000	0.1%
Earthquake	Mt. Angel Mw 6.8 Deterministic	0	0.1%	1	0	149,000	0.4%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	28	18%	39	0	9,935,000	28%
Channel Migration	Channel Migration Zone	23	15%	21	0	4,094,000	15%
Wildfire	High and Moderate Risk	79	51%	66	0	13,610,108	39%
Lahar	Medium Zone (1000 to 15000 – Year)	141	91%	127	0	27,525,000	78%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
None Reported						

Source: DOGAMI (2022)

6.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning6. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 6-3, City of Idanha Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Idanha** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Wildland Interface Fire	4	4	3	4	3.7	**High**
Earthquake	3	4	3	4	3.3	**High**
Severe Weather/Storm	3	1	2	3	2.4	**Moderate**
Landslide	3	1	2	3	2.4	**Moderate**
Extreme Weather - High Temperature	3	1	2	3	2.4	**Moderate**
Tornado	2	4	2	3	2.4	**Moderate**
Avalanche	2	2	2	3	2.1	**Moderate**
Drought	2	1	2	4	2.1	**Moderate**
Flood*	2	1	2	4	2.1	**Moderate**
Volcanic Eruption	1	1	1	1	1.0	**Low**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and City of Idanha, 10/28/21. *Includes Dam Failures*

Table 6-4, Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Idanha** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Hazardous Materials Release - Transportation	4	4	3	4	3.7	**High**
Other: Bridge capability over N. Santiam River	3	4	4	4	3.6	**High**
Public Health	4	1	2	4	3.0	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	1	4	4	4	2.7	**Moderate**
Fire - Residential / commercial (Arson)	2	4	2	4	2.5	**Moderate**
Unauthorized Entry	2	4	2	4	2.5	**Moderate**
Hazardous Materials - Non-Transportation	1	4	2	3	2.0	**Moderate**
Cyberterrorism	1	4	1	4	1.8	**Low**
Terrorism/Active Shooter/ Workplace Violence	1	4	1	4	1.8	**Low**
Agricultural Terrorism	1	1	1	4	1.3	**Low**

Source: Marion County Emergency Management and City of Idanha, 10/28/21.

6.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Idanha. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to Idanha, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

6.9.1 Avalanche

CPRI = 2.3, Risk Level: Moderate

Events: n/a

Vulnerability: none

6.9.2 Drought

CPRI = 2.2, Risk Level: Moderate

Events: 2021 was very dry, but no water use restrictions.

Vulnerability: Water supply from Rainbow Lake could be affected.

6.9.3 Earthquake

CPRI = 3.6, Risk Level: High

Events n/a

Vulnerability: Losing bridge and road system lifelines is primary concern.

6.9.4 Extreme Heat

CPRI = 2.8, Risk Level: Moderate

Events: 2021 was very hot (~105 degrees) for several weeks.

Vulnerability: Older community members are at risk; increased wildfire risk.

6.9.5 Flood

CPRI = 2.1, Risk Level: Moderate

Events: n/a; 1996 a portion of the road washed away.

Vulnerability: Losing bridge and road system lifelines is primary concern.

6.9.6 Landslide

CPRI = 3.2, Risk Level: High

Events: n/a

Vulnerability: Losing bridge and road system lifelines is primary concern.

6.9.7 Severe Weather

CPRI = 3.4, Risk Level: High

Events: Dec. 2021 Snow event— a lot of snow fast.

Vulnerability: n/a

6.9.8 Tornado

CPRI = 2.7, Risk Level: Moderate

Events: n/a

Vulnerability: none

6.9.9 Wildfire

CPRI = 4.0, Risk Level: High

Events: Sept. 8, 2020, wildfire

Vulnerability: Evacuation through wildfire conditions; risk of wildfire in the community; power outage; individual citizen preparedness. The communities of Detroit, Idanha, Gates, Mill and City have the highest percentage of exposure to high and moderate wildfire hazard within the study area.

6.9.10 Volcano

CPRI = 1.9, Risk Level: Low

Events: n/a

Vulnerability: Risk of ashfall and lahar flow. The communities most threatened from a volcanic eruption and lahar event are Gates, Detroit, Idanha, and Mill City.

6.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and the City of Idanha Addendum update process, Oregon Department of Land Conservation & Development and Idanha developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

6.10.1 Mitigation Successes

- The city has improved their water system resilience by installing a new plant and water lines.

6.10.2 Ongoing Mitigation Actions

- City sends out a CCR report annually that advises on steps to conserve water; City uses water bills to communicate.
- Promote Great Oregon Shakeout Awareness month in October. Participate in activities for schools, business, and industry.
- Conduct leak detection surveys for the water system to increase efficiency and prevent further water loss.

6.10.3 City of Idanha Mitigation Action Tables

The following pages include the city's Priority Action Items (Table 6.5), and Action Item Status Report (Table 6.6).

- Following the 2020 wildfires, the City of Idanha has limited capacity for the implementation of mitigation actions as they are focused on rebuilding and recovery. This list are the highest priority items that staff are aware of, some of which are outside of their authority, but critical to life in the Upper Santiam Canyon.

Table 6-5, City of Idanha 2022 Mitigation Action Table

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-MH-1	Multi-Hazard	Purchase a diesel generator for City Hall.	H	2-5 Years	$50-75k	City Hall is the Idanha EOC.	Started
2022-MH-2	Multi-Hazard	Retrofit or replace Church St. bridge to ensure its structural integrity in case of a hazard event	H	5-10 Years	$2-20 million	Bridge holds the new water lines and goes across the N. Santiam River.	New
2022-MH-3	Multi-Hazard	Collaborate with Marion County to develop a resilient regional sewer system.	H	2-10 Years	Staff time	No sewer service in Idanha in 2022. Funding: grants secured by Marion County/ N. Santiam Sewer Authority	Started/ Revised
2022-MH-4	Multi-Hazard	Coordinate with Marion County on evacuation planning and education.	H	0-18 Months	Staff time		New
2022-WF-1	Wildfire	Collaborate with Detroit Ranger District, ODF, and BLM to conduct fuel hazard reduction along the Wildland Urban interface and Hwy 22. *	M	1-5 Years	TBD	Firewise activities were underway prior to 2020 fires. These action items are not needed in 2022 due to the recent wildfires eliminating fuel.	Future Priority Action
2022-WF-2	Wildfire	Collaborate with ODF and Idanha-Detroit RFD to develop strategic community fuel breaks. *	M	1-5 Years	TBD	These action items are not needed in 2022 due to the recent wildfires eliminating fuel.	Future Priority Action

Source: City of Idanha, 3/31/

Table 6-6, City of Idanha, 2017 Action Items Status Report

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-P-1	Multi-Hazard	Update planning documents (comprehensive plan, development code) to reflect new hazard information.	Funding: general fund	City of Idanha	Not Started
2017-P-2	Multi-Hazard	City staff should assess the amount of KWH needed to run city facilities. City staff should purchase a diesel generator with additional storage accordingly.	Have a generator at the water plant; had two weeks of fuel during 2020 fires. Bought a pickup truck with a diesel pump in the back of it. No backup power for city hall. Funding: general fund, MWCOG grants/ loans	City of Idanha	Started
2017-MH-1	Multi-Hazard	Develop an Energy Assurance Plan.		City of Idanha	Discontinue
2017-MH-2	Multi-Hazard	Assess the short and long term needs for sheltering access and functional needs populations for all hazards.	Identify an assembly location in Idanha and secure a generator for this site.	City of Idanha	Not started
2017MH-3	Multi-Hazard	Establish a strategic plan to utilize community resident amenities. (Hill brothers) – Kubota Tractor, Skidder		City of Idanha	Discontinued
2017MH-4	Multi-Hazard	Establish an Idanha CERT team.		City of Idanha	Discontinued
2017-MH-5	Multi-Hazard	Develop a community education program, such as an all-hazard community outreach forum for students and residents. (From CWPP)	Support the Fire Dept in conducting community outreach on hazards.	City of Idanha	Started
2017-MH-6	Multi-Hazard	Expand auxiliary radio capabilities by developing a team of HAM Radio operators for EMS and interested public.	Improve emergency communications through the purchase of equipment and the development of plans (communication, evacuation, emergency, etc.) and trainings such as ICS/ NIMS.	City of Idanha	Not started
2017-DR-1	Drought	Monitor economic impacts of drought on recreation, tourism, and agriculture communities.	Detroit Lake is the primary source of tourism in the area.	City of Idanha	Discontinued

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-DR-2	Drought	Collaborate with NSWC to complete WMCP's and improve community understanding of water usage and opportunities to increase efficiencies. **	City sends out a CCR report annually that advises on steps to conserve water; City uses water bills to communicate.	City of Idanha	Ongoing
2017-DR-3	Drought	Conduct leak detection surveys for the water system to increase efficiency and prevent further water loss. **	City just ordered a leak tester.	City of Idanha	Ongoing
2017-DR-4	Drought	Develop water storage tanks to hold treated water for municipal use.	City has a holding tank and is gravity fed. System held up great during the fire.	City of Idanha	Complete
2017-MH-7	Multi-Hazard	Collaborate with local residents and NSWC to mitigate risks from the Idanha revetment/floodplain project.		City of Idanha	Discontinued
2017-MH-8	Multi-Hazard	Conduct a fatigue test on Church St. bridge to ensure its structural integrity in case of a hazard event	ODOT tests this bridge annually and it is city owned and a very old, important bridge.	City of Idanha	Ongoing
2017-MH-9	Multi-Hazard	Designate evacuation routes outside of Hwy 22 for EMS.	There is only one route out, east or west.	City of Idanha	Discontinued
2017-MH-10	Multi-Hazard	Collaborate with Marion County to connect to a more resilient regional water/sewer system.	There is only one route out, east or west.	City of Idanha	Discontinued
2017-MH-11	Multi-Hazard	Gather community support for the installation of resilient fiber communication infrastructure throughout the community. ***	Working with N. Santiam Sewer Authority to develop a sewer system for Idanha/Detroit/Gates/Mill City.	City of Idanha/ N. Santiam Sewer Authority	Started
			Starting in 2021, Idanha has good internet via underground cable.	City of Idanha	Complete
2017-EQ-1	Earthquake	Promote Great Oregon Shakeout Awareness month in October. Participate in activities for schools, business, and industry.			
2017-EQ-2	Earthquake	Collaborate with GROW EDC to develop relevant public-private partnerships with businesses that can contribute to response and recovery.			
2017-WF-1	Wildfire	Collaborate with USFS, BLM, and ODF to conduct fuel hazard reduction along the Wildland Urban Interface (WUI) and Hwy. 22	Firewise activities were underway prior to 2020 Wildfires; not needed now, as vegetation is just coming back.	City of Idanha	Continue
2017-WF-2	Wildfire	Collaborate with ODF and Idanha-Detroit Fire Dist., to develop strategic community fuel breaks. *		City of Idanha	Started

#	Hazard	Mitigation Action	Description	Coordinating Organization	Status
2017-LS-1	Landslide	Integrate new DOGAMI landslide hazard information into land use zoning/development codes.	There is a new DOGAMI study underway. No concern in city limits, just for lifelines.	City of Idanha	Not Started
2017-FL-1	Flood	Widen the North Santiam River and reassess the dike		City of Idanha	Discontinue

Source: City of Idanha, 3/31/22

* Identified in Marion County Community Wildfire Protection Plan (Action Plan & Priorities)

**Identified in North Santiam Watershed Drought Contingency Plan (Priority Drought Mitigation Actions)

***Identified in Mid-Willamette Valley Council of Governments Comprehensive Economic Development Study (Appendix C)

7 City of Jefferson Addendum

7.1 Purpose

This document serves as the City of Jefferson's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (MHMP, HMP). The purpose of this addendum is to guide the implementation of mitigation actions by The City of Jefferson to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor— one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

7.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including the City of Jefferson, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Jefferson will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) grant program funds.

This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Jefferson joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on September 24, 2021. On September 30, 2021, City of Jefferson's City Manager and Recorder, Sarah Cook, City of Jefferson's Utility Foreman, Kyle Ward, Marion County Emergency Manager Kathleen Silva, and DLCD Planner Tricia Sears conducted a risk assessment meeting with City of Jefferson staff that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on April 11, 2022, to develop this addendum.

City of Jefferson staff attended HMP Steering Committee meetings on September 7, 2021, October 5, 2021, and December 7, 2021. The city promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the city's Facebook page on January 20, 2022, to distribute the plan update public survey to interested parties in the City of Jefferson.

7.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

7.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of City of Jefferson, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

7.4.1 Community Characteristics

The City of Jefferson is a middle- to low-income community located in the Willamette Valley in Marion County, Oregon, commuting distance to Albany and Salem.

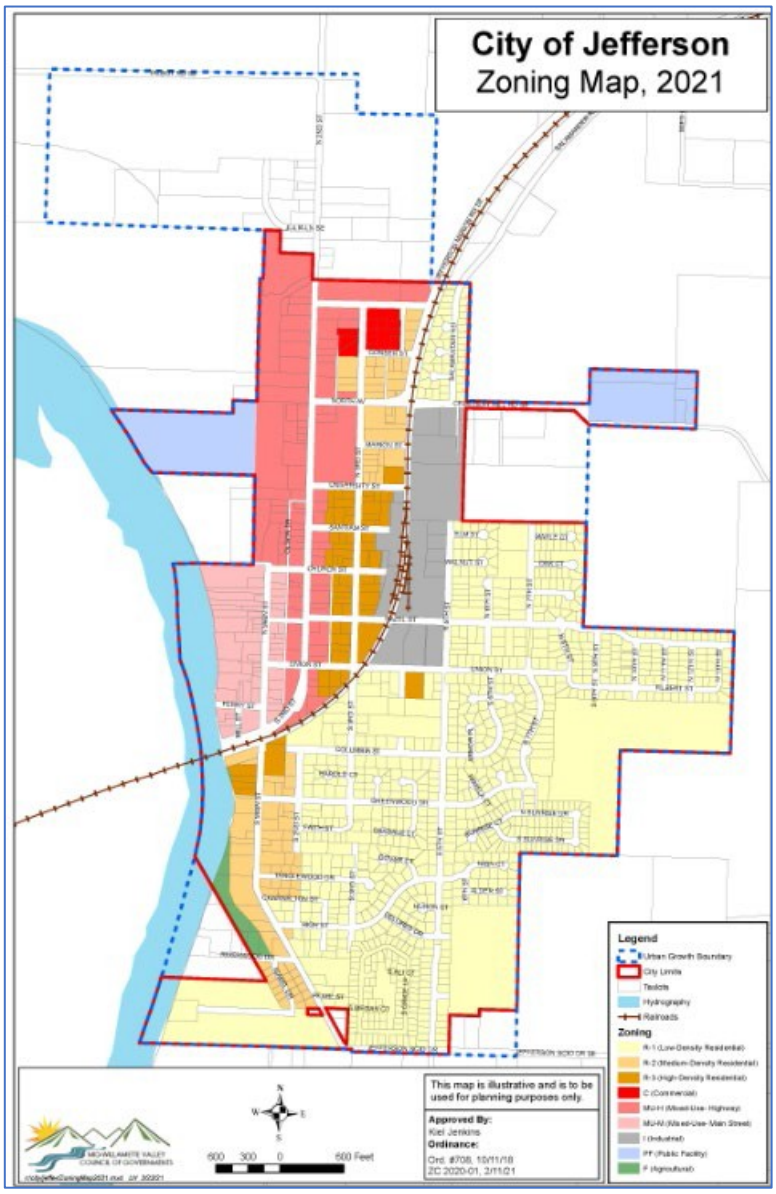
The largest employer in Jefferson is the school district. There is a significant Hispanic, non- English speaking population Jefferson, first known as Conser's Ferry, was informally established in 1851. It is situated on the north bank of the Santiam River, one mile below the junction of the north and south forks of the river, and nine miles above the confluence with the Willamette River.

When Jacob Conser moved to what is now Jefferson, the only road through the area was a wagon trail to Santiam City, a community that would later be washed away during the flood of 1861. Conser built his ferry over the Santiam in 1851. Later, he would build a sawmill, an education center, and a flour and grist mill all in Jefferson. Jacob Conser went on to become a state legislator and later, a noted Marion County Judge.

Jacob Conser built the Conser House in 1854 as his home and as a hotel. It was the first framed building in Jefferson. Many notables stayed there including General Phil Sheridan and Ben Holiday, a noted railroad builder. It later housed Jefferson City Hall as well as the Jefferson Public Library and today is listed on the national register of historic buildings.

The Jefferson municipal government was incorporated on October 20, 1870. As of the 2020 U.S. Census, there are 3,329 people residing in the city (Portland State University, Population Research Center, 2021).

Figure 7-1, City of Jefferson Zoning Map



7.5 Critical and Important Facilities

City of Jefferson's critical and important facilities include the following:

7.5.1 Transportation

Road	Owner	Notes
OR 164	ODOT	Enters city from the southwest and travels north along the western side of the city.
Railroad	Union Pacific	Operated by Union Pacific and Amtrak

Railroad: Rail split community in half. Rail incidents can block vehicle transportation within the city for hours. Should there be an emergency on the southeast side of town during a rail incident, citizens would rely on the City of Scio for response.

Bridge: Hwy Or 164 (Conser Bridge) on the south end of town. ODOT is due to begin upgrade or maintenance work on bridge in 2022. A trunk sewer line runs under the bridge; there may also be utilities of concern such as phone lines or fiber optic cable.

7.5.2 Energy

Electricity: Pacific Power

Gasoline and Diesel: The Town Pump is the local gas station. There is no town owned fuel storage. It is town policy to refuel vehicles if <3/4 full.

7.5.3 Water/ Wastewater

Water: A new water treatment plant has recently come online. The old plant is still operational and was constructed in 1988, Water is drawn from the South Santiam.

The city has a 1.75-million-gallon reservoir. Assuming winter consumption of 200k-300k gal/day, the supply would last 7 days. In the summer at 400k-600k gal/day the supply would last 3 days. All residents use city water although some properties use wells for irrigation.

The water treatment plan can treat 2 million gallons each day. The facility is equipped with a diesel-powered backup generator and is fueled on call by Carson Oil.

Wastewater: The new wastewater treatment plant was completed in 2010. The facility has a diesel generator that could run 24/7 for 6-7 days. The system is all gravity fed.

7.5.4 Emergency Services

Fire: Jefferson Fire District maintains two stations serving Jefferson and Millersburg. Police: Law Enforcement contract with Marion County.

Public Works: Three staff members operate and maintain the systems (700 N 2nd Street) EOC: No location has been identified within the City of Jefferson

7.5.5 City Hall:

This facility is equipped with a backup gasoline powered generator but is sufficient only to power half the building. The city uses internet-based phones. (150 N. 2nd)

7.5.6 Schools

The schools are in unincorporated Marion County. The Middle School is new, and the Elementary School was seismically retrofitted.

7.5.7 Communication

Cell service: AT&T and Verizon have cell towers on the hill where water reservoir site is located.

7.5.8 Cultural/Historical Resources

The city owns the historic Jacob Conser house located at 114 N Main Street (also listed as 128 N. 28th Street)

Events Festivals: The Mint festival ran in July on a Saturday. It is put on by volunteers as Jefferson was at one time the "mint capitol of the world". The National Night Out: 1st Tuesday in August is an event at City Hall and has expanded into the downtown.

7.5.9 Functional and Access Needs (Vulnerable Populations)

Jefferson has a significant non-English speaking population.

7.5.10 Community Facilities

Jefferson Community Center is a privately owned center. They coordinate some events; have a kitchen, restrooms, and a large multipurpose room.

An Elementary School that includes a gym is in Jefferson.

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

7.6 Plans and Policies

Table 7-1, Plans and Policies of the City of Jefferson

Document Name with Hyperlink if the document is available online	**Year**
Comprehensive Plan	Most recently amended 7/2022
Transportation System Plan	2022
Strategic Plan	2018, updated in 2021

7.7 Hazard Profile

Table 7.2, City of Jefferson hazard profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Jefferson		3,280		1,243	2		389,441,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	5	0.1%	2	0	8,000	0.0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	2	0.1%	12	0	3,211,000	0.8%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Channel Migration	Channel Migration Zone	62	1.9%	25	0	8,146,000	2.1%
Wildfire	High and Moderate Risk	15	0.5%	4	0	1,626,000	0.4%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Jefferson Elementary	0	0%	0	0	0	0%
Jefferson Fire Dist. Main Station	0	0%	0	0	0	0%

Source: DOGAMI (2022)

7.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and
4. Expected duration of event.

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).
Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.
Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below

Table 7-2, City of Jefferson Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Jefferson** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Earthquake	3	4	4	4	3.6	**High**
Flood*	2	1	3	4	2.4	**Moderate**
Extreme Weather - High Temperature	2	1	2	3	2.0	**Moderate**
Severe Weather/Storm	2	1	2	3	2.0	**Moderate**
Wildland Interface Fire	2	1	2	3	2.0	**Moderate**
Tornado**	1	3	2	1	1.6	**Low**
Volcanic Eruption	1	1	2	3	1.5	**Low**
Avalanche***	1	1	1	1	1.0	**Low**
Drought	1	1	1	1	1.0	**Low**
Landslide	1	1	1	1	1.0	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and City of Jefferson staff on September 30, 2021. *Including dam failures; **Split out of Severe Weather in 2021; ***New in 2021

Table 7-3, City of Jefferson Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Jefferson** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Chemical, Biological, Radiological, Nuclear, Explosive (CBRNE)	2	4	2	4	2.5	**Moderate**
Cyberterrorism	2	4	2	4	2.5	**Moderate**
Fire - Residential / commercial (Arson)	2	4	2	4	2.5	**Moderate**
Hazardous Materials Release - Transportation	2	4	2	4	2.5	**Moderate**
Public Health	3	1	2	4	2.5	**Moderate**
Hazardous Materials - Non-Transportation	2	4	2	3	2.4	**Moderate**
Unauthorized Entry	2	4	2	3	2.4	**Moderate**
Agricultural Terrorism	2	1	2	4	2.1	**Moderate**

Source: Marion County Emergency Management and City of Jefferson staff on September 30, 2021.

7.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Jefferson. Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to the City of Jefferson, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

7.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: None during the effective period of the prior plan.

Vulnerability: Low. The location of Jefferson does not include mountainous areas.

7.9.2 Drought

CPRI = 1.0, Risk Level: Low

Events: Due to a cool, wet climate, past and present weather conditions have generally spared Marion County communities from the effects of drought; however, Marion County was included in Presidential Drought Declarations in 1992 and 2015.

Vulnerability: Low. The city utilizes surface water from the North Santiam as it's drinking water source. The draught location is after the confluence with the S. Santiam and the city's water rights are old providing access to this source above younger water right holders. The city can draw around 2 million gallons from the river. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

7.9.3 Earthquake

CPRI = 3.6, Risk Level: High

Events: The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County. No damaging earthquake events have occurred during the five-year effective period of the prior plan update.

Vulnerability: Turner is about one mile from several active faults: a string of faults run to both the north and south of Turner.

Jefferson's probability for an earthquake event is "likely" and vulnerability to an earthquake event is "catastrophic". The assessment of risk did not differentiate between Cascadia Subduction Zone and crustal events as mitigation does not differ substantially.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure 7-2 shows that ground shaking in Jefferson for both crustal and subduction earthquakes are expected to be very strong, with some nearby areas experiencing severe shaking.

The Jefferson steering committee identified earthquake damage to homes and the historic bridge that is important to evacuation routes as primary concerns. Transportation isolation due to bridge failure could have a significant impact on the city. The City's priority actions reflect these concerns.

7.9.4 Extreme Heat

CPRI = 2.0, Risk Level: Moderate

Events: June 26-28, 2021, and August 11-12, 2021, saw temperatures over 100 degrees in Jefferson.

Vulnerability: The city identified and stood up cooling centers and made water available during that recent event.

7.9.5 Flood

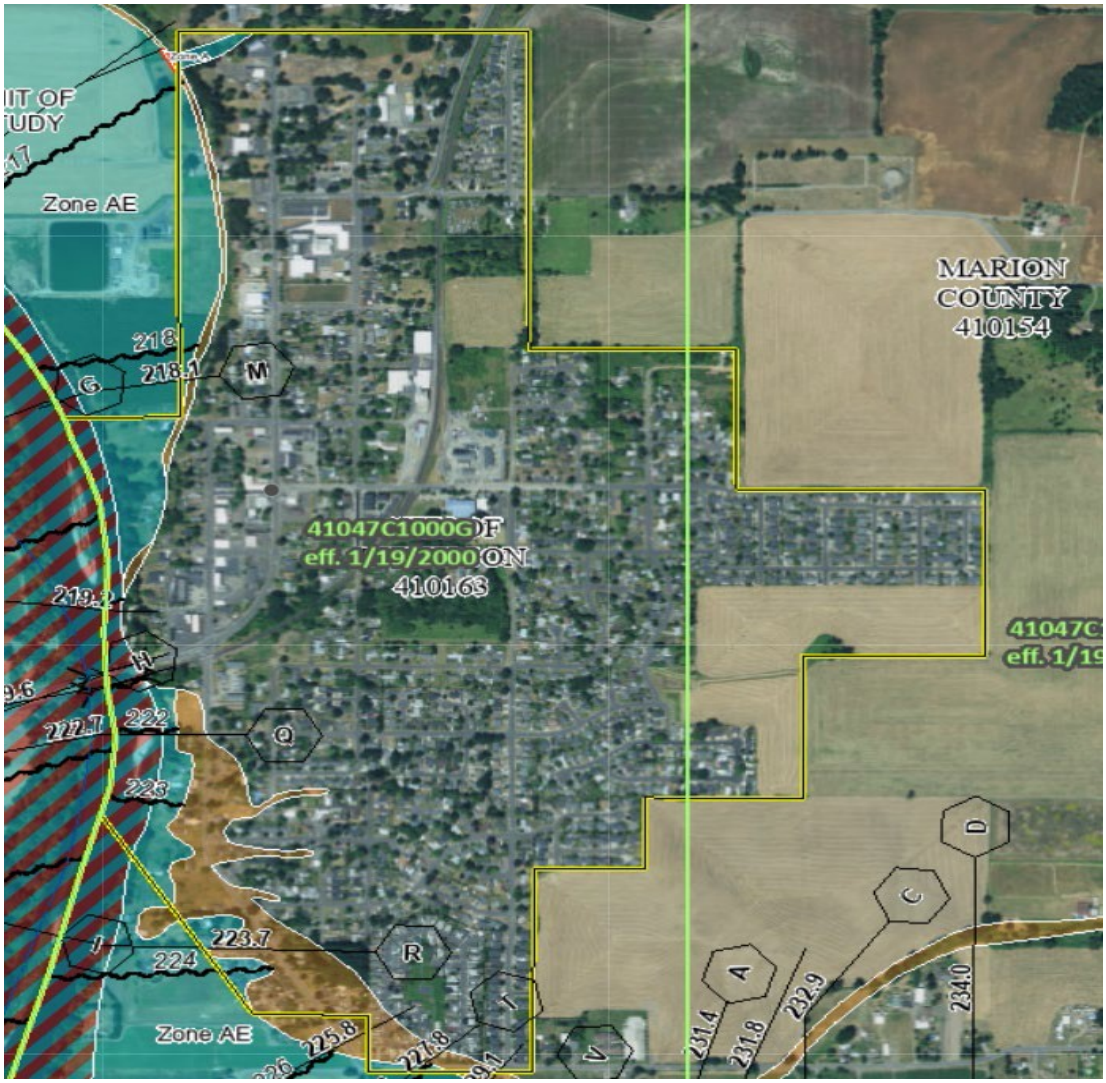
CPRI = 2.4, Risk Level: Moderate

Events: On December 20-21, 2020, a series of strong Pacific fronts moved across the region bringing high winds to the coast with heavy rain across much of the area. The gage on the Santiam River at Jefferson (JFFO3) crested at 15.3 feet. Flood stage is 15.0 feet. No damage was reported.

On April 8-9, 2019, a particularly strong atmospheric river took aim for the south Willamette Valley, sitting over areas south of Salem for two days, producing anywhere from 2.5 to 5 inches of rain over a 48-hour period. The Santiam River at Jefferson crested at 15.8 feet around 11 PM on April 8th, which is 0.8 foot above flood stage.

Vulnerability: High. The city ranked the magnitude of a flood event as "critical" with the duration lasting more than a week. The location of the city adjacent to the North Santiam poses flood risk as shown in the FEMA Special Flood Hazard Area map.

Figure 7-2, FEMA Special Flood Hazard Area map for Jefferson



7.9.6 Landslide

CPRI = 2.4, Risk Level: Moderate

Events: n/a

Vulnerability: Jefferson has a relatively flat topography, therefore the probability for landslide is unlikely and their vulnerability to landslides is limited.

7.9.7 Severe Weather

CPRI = 2.0, Risk Level: Moderate

Windstorm

Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Winter Storm (Snow/Ice)

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

Major winter storms can and have occurred in Jefferson, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. The most recent winter storms (December 2016 through January 2017 and February 2021) included snow and freezing rain and ice, transportation and power interruptions, loss of all internet service, loss of all cellular phone service and government office and school closures.

Vulnerability: Jefferson City representatives ranked the city's probability for Severe Weather as "possible" and vulnerability to windstorm as "critical".

7.9.8 Tornado

CPRI = 1.6, Risk Level: Low

Events: None during the effective period of the prior plan update.

Vulnerability: Risk of damage to buildings, power outages, and road closures.

7.9.9 Wildfire

CPRI = 2.0, Risk Level: Moderate

Events: Jefferson is surrounded on all sides by open farmland, forests, or waterways. Although Jefferson has some forested areas within the city limits the impact of the 2020 wildfires was predominantly smoke.

Vulnerability: The county updated the Community Wildfire Protection Plan (CWPP) in 2016 and portions of Jefferson are listed as having wildland urban interface (WUI). Areas of concern are north of the city. The community is aware of and concerned about creating and maintaining defensible space.

7.9.10 Volcano

CPRI = 1.5, Risk Level: Low

Events: n/a

Vulnerability: Ashfall only

7.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Jurisdiction Addendum update process, Oregon Department of Land Conservation & Development and Jurisdiction developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

7.10.1 City of Jefferson Mitigation Action Tables

The following pages includes the city's initial Priority Action Items (Table 7.4)

Table 7-4, City of Jefferson Priority Action Items

#	Hazard	Mitigation Action	Priority	Timeline	Cost	Description	Status
2022-MH-1	Multi-Hazard	Public education on preparations to be able to shelter in place.	H	1-3 Years	TBD	Because the city does not have control over repairs to the bridges that link the city with the outside, public information about how to be prepared for sheltering in place is an action the city can take to reduce risk to its citizens. Methods for doing this might include developing flyers to include in water bill, Facebook posts, and Nixle notification.	Not Started
2022-MH-2	Multi-Hazard	Public outreach to encourage sign up for Nixle notifications	H	1-3 Years	TBD	Nixle is an efficient way to communicate with the residents of the city. Citizens do have to opt in to the system and this effort would seek to increase the ability of the city to communicate with its citizens during an emergency.	Not Started
2022-MH-3	Multi-Hazard	Develop an agreement with the Elementary School District or Community Center (private) to allow the city to use the facilities for respite or shelter.	H	1-3 Years	TBD	The community center opened up to the public to provide respite from recent high heat events when asked by the city. The elementary school may also be a location for sheltering or respite. No formal agreement is in place currently and preparations or equipment needed to provide respite or shelter could be included in this agreement.	Not Started

Source: City of Jurisdiction HMP Steering Committee, April 11, 2022

8 City of Keizer Addendum

8.1 Purpose

This document serves as the City of Keizer's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (MHMP, HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Keizer to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor— one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

8.2 Plan Process, Participation, and Adoption

In 2021 and early 2022 Marion County partnered with the Oregon Department of Land Conservation and Development and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Keizer, to update their addendum to the Marion County HMP, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Keizer will regain eligibility for FEMA Hazard Mitigation, Pre- Disaster Mitigation, and Flood Mitigation Assistance grant program funds. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Keizer joined the Marion County HMP update by executing an intergovernmental agreement with DLCD in December 7, 2021. On September 27, 2021, City of Keizer Project Manager Matt Reyes, Marion County Emergency Preparedness Coordinator Mike Hintz, Marion County Emergency Manager Kathleen Silva and DLCD Planner Tricia Sears conducted a risk assessment meeting with the Jurisdiction that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on April 8, 2022, to update this addendum.

City of Keizer staff attended HMP Steering Committee meetings on August 3, 2021, September 7, 2021, and May 4, 2022, and promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the Keizer Fire District Facebook page to distribute the plan update public survey to interested parties in the Jurisdiction service area.

8.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards."[1] This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

8.4 Community Profile

This section provides information on city specific assets. For additional information on the characteristics of the City of Keizer, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

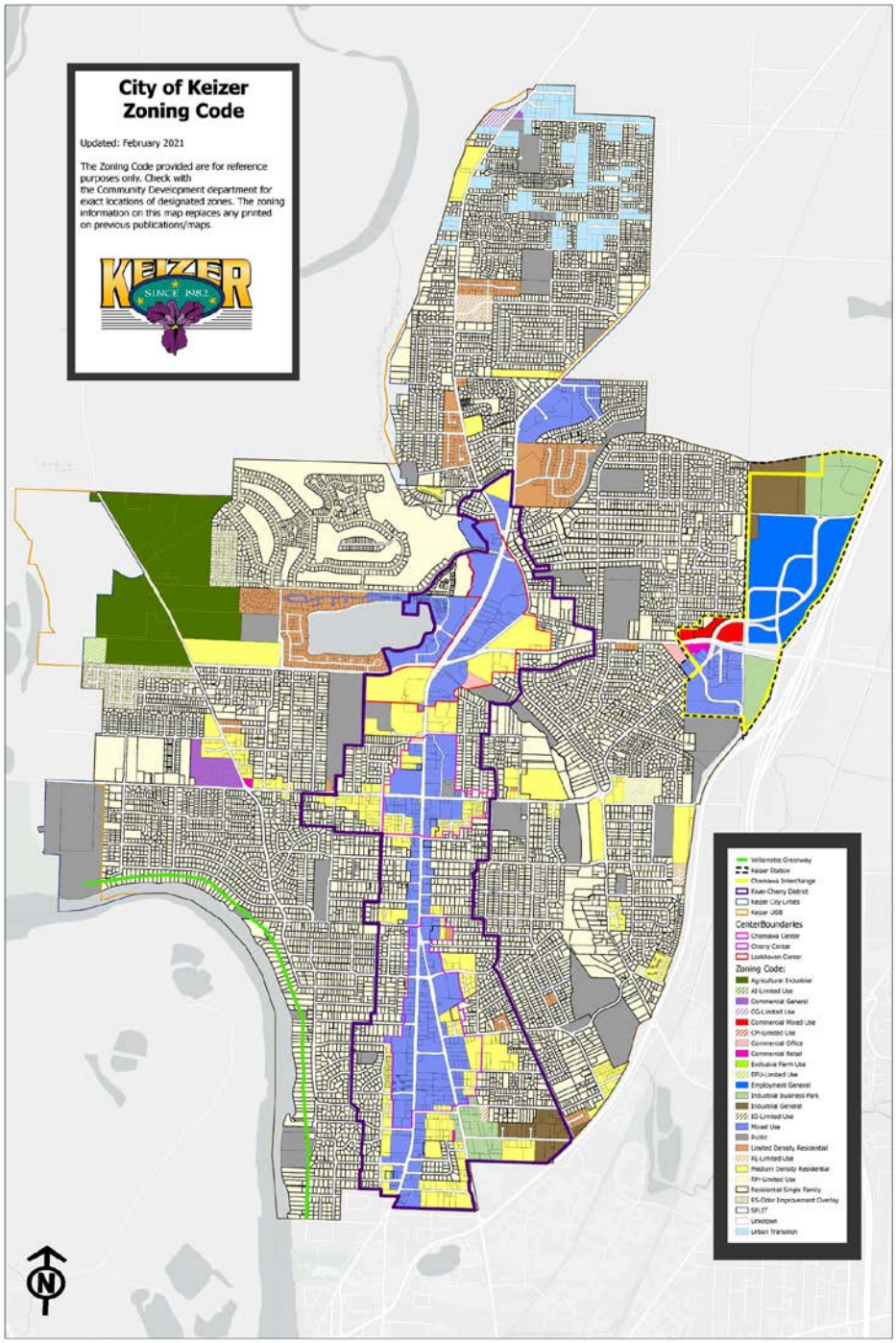
8.4.1 Community Characteristics

The City of Keizer is in Marion County, Oregon, immediately north of the City of Salem. The city is bordered to the west by the Willamette River and to the east by Highway 99 and Interstate 5. Keizer is in Oregon's Willamette Valley, which experiences a moderate climate. In August, the average high temperature is 82 degrees, and the average low temperature is 51 degrees. Wintertime temperatures in January range from an average high of 46 degrees to an average low of 33 degrees. The average annual precipitation is 39.9 inches. In addition to the Willamette River, other bodies of water that run through the city include Stats Lake, Claggett Creek, and Labish Ditch. Keizer is located on a relatively flat area, with a few steep slopes bordering the Willamette River.

The 2020 US Census lists Keizer's population at 39,376 people, a nearly 6.5% increase from the 2015 population of 36,985. For more demographic information, refer to Volume III, Appendix B, *Community Profile*

Historically, Keizer was an agricultural community, but in the 1960s and 70s, the city grew rapidly into a residential suburb of Salem along North River Road. Today, Keizer's primary employment sectors are service, retail, and public administration. The median household income in Keizer is $50, 897. For more economic information, Volume III, Appendix B, *Community Profile*

Figure 8-1, Zoning Map of the City of Keizer



Source: City of Keizer website,
https://www.keizer.org/media/Departments/Planning%20Department/Maps/Zoning%20map%20base%20-%20Feb%202021.pdf

8.5 Critical and Important Facilities

Critical and important facilities include:

8.5.1 Transportation

Facilities:

Bridges and Culverts:

Three bridges over Claggett Creek: Chemawa, Dearborn, and Alder. 2022 participants in the HVA assessment reported that in the past 10 years Dearborn and Chemawa bridges have been redone. If damaged, evacuation of the eastern half of the community would be disrupted.

Alder Bridge is one of only two access points to Claggett Creek Middle School and Weddle Elementary School.

Alder Bridge has water and communications.

Bridge over Labish Ditch at 35th (Owned by Marion County). If damaged, access to areas north of Keizer would be limited.

Keizer has two concrete box culverts located on River Rd. at Lockhaven Drive and at Wheatland Road. If they become non-functional, parts of town would be cut off.

Major roads: I-5, the Salem Parkway, River Rd., and Lockhaven Drive.

Keizer Transit Center: 5860 Keizer Station Blvd.

Flooding Concerns:

Since the 1996 100-year event flooding has been mitigated with the river wall tide flex value Willamette River USACE-Dam.

Stormwater Concerns:

The system is built well so that the city doesn't commonly have high water events. Rainfall of 1"/hour receded quickly in places such as the Winco parking lot at Lockhaven Dr. N and River Rd. N. Nonetheless mitigation of flooding through removal of sediment build up could be considered.

Multiple Hazard Concerns:

While not within Keizer, earthquake damage to Detroit, Parkersville, and Lookout Point Dams could have significant impacts in Keizer, such as widespread flooding or road blockage.

8.5.2 Energy

Electricity suppliers: Salem Electric and Portland General Electric.

Fuel storage capacity for diesel and unleaded to run generators at critical facilities is a concern for the city. Pump stations should be upgraded, and fuel station capacity increased to store diesel and unleaded to supply generators.

The Fire Station has diesel fuel supply for backup power for 3 days. Generators are in place at City Hall and the Police Department, and they have been used.

Bonneville Power Administration (BPA) – Chemawa Substation

Chemawa Station has a site fuel capacity issue and needs a generator (Tepper Lane NE)

8.5.3 Water

Drinking Water:

Drinking water exclusively from groundwater sources that come from the Troutdale Aquifer, pumped through 14 or 15 wells.

Three water storage facilities with a storage capacity of 2.75 million gallons. Note: Currently built to withstand earthquakes, however the water distribution system may not withstand a significant earthquake.

An emergency water agreement and curtailment plan with the City of Salem are in place. Note: Chemical spills could potentially contaminate drinking water.

Wastewater:

Willow Lake Wastewater Treatment Facility (5915 Windsor Island Rd. N) Note: The Willow Lake Wastewater Treatment Facility and main sewer lines are vulnerable to earthquakes and could potentially contaminate groundwater aquifers. The sewage system infrastructure was built in the 1960s and has not been updated. There is no. Keizer cut off due to concrete box culverts at River Road, Lock Haven, Manziella, Chemawa, Claggett Creek. Note: The Keizer Public Works building was built prior to earthquake standards.

8.5.4 Communication

Most towers are at one location, the Qwest hub in the downtown area: several cell phone towers. One tower located in Bear Park is leased out. PGE Keizer Station used for weather events. Fire upgrade 800 MHz fiber down to WVCC communications. Cell towers and internet- threshold reached. City Hall (the Civic Center) has a communication tower – includes a cell carrier and the police radio. This tower has a diesel-fueled generator.

Note: City of Salem is currently mapping communication system locations.

8.5.5 Emergency Services

Fire

Keizer Fire District, 661 Chemawa Rd. NE

Marion County Fire District 1, (300 Cordon Rd. NE) – serves the northern part of Keizer, starting at Centennial.

Police

Keizer Police Department, 930 Chemawa Rd NE co-located with Keizer Civic Center, City Hall, Human Resources, Community Center, and Public Works.

Medical

Legacy Keizer Health Center (5685 Inland Shores Way N).

8.5.6 Cultural / Historical Resources

Keizer Heritage Community Center houses the Chamber of Commerce, the library, and the Keizer Museum.

Note: older buildings may be vulnerable to earthquakes.

8.5.7 Vulnerable Populations – Functional and Access Needs

Assisted living facilities:

Brookdale River Road (592 Bever Drive NE)

Avamere Court at Keizer (5210 River Road N)

Avamere – memory care (Claggett Ct).

The Village at Keizer Ridge (1165 Mcgee Court NE)

Willamette Lutheran Retirement (7693 Wheatland Road N)

Sweet Bye N Bye Adult Foster Care Home (4072 Brooks Ave. NE)

Sherwood Park Nursing & Rehabilitation Center (4062 Arleta Ave. NE)

Bonaventure Senior Living Facility (1615 Brush College Rd. NW)

Schools:

Keizer has 10 public schools, for a complete list of schools, visit the following link:

https://salkeiz.k12.or.us/

Simonka Place (5119 River Rd. N) – women's shelter

Large Spanish speaking population – might be language barriers.

See hazard sections below and Section 2, Risk Assessment, for potential hazard vulnerabilities to these facilities.

8.6 Plans and Policies

Table 8-1, Plans and Policies of the City of Keizer

Document Name with Hyperlink if the document is available online	**Year**
Emergency Operations Plan	
Comprehensive Plan	1/19/1987, most recently updated 12/2021
Transportation System Plan	4/2009, revised 6/2014
Keizer Growth Transportation Impacts Study	10/2020
Salem-Keizer metropolitan area Regional Economic Opportunity Analysis 2012 to 2032	5/2011
Keizer Revitalization Plan	11/18/2019
Housing Needs Analysis	2019
Keizer Vision 2029	2009
Keizer Development Code	Most recently revised 11/17/2021
Stormwater Master Plan	
Public Works Strategic Plan	August 2006

8.7 Hazard Profile

Table 8-2, City of Keizer Hazard Profile

Community Overview				
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)
Keizer	38,585	16,380	15	5,592,798,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	704	1.8%	336	0	26,571,000	0.5%
Earthquake	Mt. Angel Mw 6.8 Deterministic	2,479	6.4%	3,994	5	722,048,109	13%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	142	0.4%	62	0	18,852,000	0.3%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	17	0.0%	6	0	2,190,893	0.0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Centennial School		X				
Claggett Creek Middle School						
Clear Lake Elementary						
Forest Ridge Elementary		X				
Gubser Elementary						
Keizer Elementary		X				
Keizer Fire District		X				
Keizer Police Department		X				
Kennedy Elementary School						
MCFD 1- Clearlake Station						
McNary High School						
Urgent Care inland Shores						
Weddle Elementary School						

Whitaker Middle School						

Source: Multi-hazard Risk Report, DOGAMI, Williams, 2022

8.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning.[2] This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event
2. Magnitude of event
3. Expected warning time before event.
4. Expected duration of event

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 8-3, City of Keizer Hazard Vulnerability Assessment - Natural Hazards

Hazard Profile Summary for the City of Keizer Using BOLD Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Wildland Interface Fire	4	4	3	4	3.7	**High**
Earthquake	3	4	3	4	3.3	**High**
Extreme Weather - High Temperature	3	1	2	3	2.4	**Moderate**
Flood (including dam failure)	3	1	2	3	2.4	**Moderate**
Severe Weather/Storm	3	1	2	3	2.4	**Moderate**
Tornado (split out of Severe Weather in 2021)	2	4	2	3	2.4	**Moderate**
Landslide	2	2	2	3	2.1	**Moderate**
Drought	2	1	2	4	2.1	**Moderate**
Volcanic Eruption	2	1	2	4	2.1	**Moderate**
Avalanche (new in 2021)	1	1	1	1	1.0	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by City of Keizer on September 27, 2021.
*Includes dam failures; **Split out of Severe Weather; ***New in 2021

Table 8-4, City of Keizer Hazard Vulnerability Assessment – Other HazardsHazard Profile Summary for the City of Keizer Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Cyberterrorism	3	4	4	4	3.6	**High**
Public Health	4	1	3	4	3.3	**High**
Hazardous Materials - Non-Transportation	3	4	3	3	3.2	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	4	4	3.1	**High**
Unauthorized Entry	2	4	4	4	3.1	**High**
Hazardous Materials Release - Transportation	2.5	4	3	3	2.9	**Moderate**
Fire - Residential / Commercial (Arson)	3	4	2	3	2.9	**Moderate**
Terrorism/Active Shooter/Workplace Violence	2	4	3	3	2.7	**Moderate**
Agricultural Terrorism	2	1	4	4	2.7	**Moderate**

Source: BOLD Planning Risk Assessment Method; Analysis by City of Keizer on September 27, 2021.

8.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Keizer. Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to the City of Keizer and illustrates the basis for the City of Keizer's HVA scores.

Recent localized natural hazard events are detailed below for the City of Keizer. Otherwise, previous occurrences are well-documented within the county's plan, and unless otherwise specified impacts described by the county would generally be the same for the City of Keizer as well.

8.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: None during the effective period of this plan.

Vulnerability: None. The City of Keizer is not subject to avalanche.

8.9.2 Drought

CPRI = 2.1, Risk Level: Moderate

Events: Marion County experienced D2 and D3 drought conditions during periods of 2018, 2019, 2020 and 2021.[3]

Vulnerability: Because the City of Keizer's water supply is primarily subsurface, the city's vulnerability is moderate. Due to a cool, wet climate, past and present weather conditions have generally spared Marion County communities from the effects of drought. Governor Kate Brown declared a drought emergency for all of Marion County in September 2015.

Keizer's primary water supply comes from the Troutdale Aquifer. Raw water is treated for consumption at the Willow Lake Water Treatment Facility. The City has three (3) storage reservoirs with storage capacity for 2.75 million gallons of treated water. In addition, Keizer maintains an emergency water agreement with the City of Salem.

Plan Integration: Keizer reviewed and updated Keizer's water management plan during the previous update period to include new information and revisit emergency water agreements with the City of Salem. Keizer adopted the revised agreements and ordinance language in 2016. The ordinance includes a water curtailment plan.

8.9.3 Earthquake

CPRI = 3.3, Risk Level: High

Events: Five earthquakes ranging between, 1.5 and 1.7 and one registering 3.0 occurred northwest of Keizer during the effective period of the prior plan (Figure 8-2)

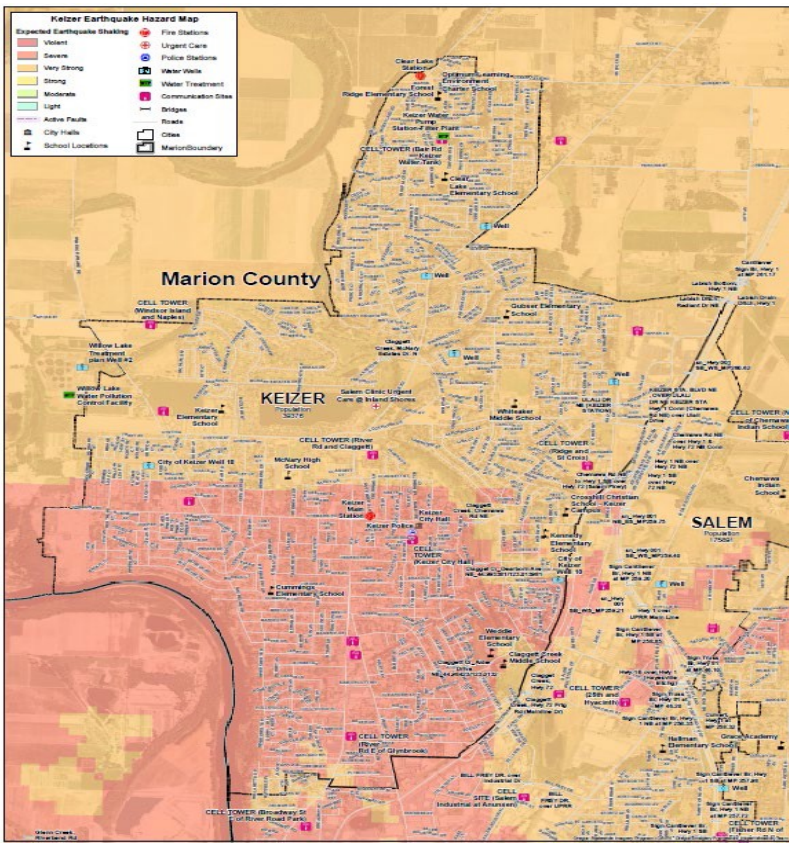
Vulnerability: There are no locally active faults within the Keizer City Limits. Active faults do exist within five miles to the west and south. The 1993 Scott Mills quake caused $28 million in damage to cities throughout Marion County. Generally, an event that affects the county is likely to affect Keizer as well. Previous occurrences are well-

documented within the county's plan, and the community impacts described by the county would generally be the same for Keizer as well.

The City of Keizer's probability for a Crustal Earthquake event is "possible" and that the city's vulnerability to a Crustal Earthquake event is "limited". The county steering committee determined that the probability for a CSZ Earthquake event is "highly likely" and that the vulnerability to a Cascadia Earthquake event is "catastrophic". This hazard was not rated as distinct CSZ and crustal events in the previous HMP.

In many major earthquakes, damage has primarily been caused by the behavior of the soil. Figure 8-3 shows that ground shaking in Keizer for both crustal and subduction earthquakes are expected to be very strong to severe.

Figure 8-2, Keizer Earthquake Hazard Map



Source: DOGAMI Multi-Hazard Risk Report, 2022

The representatives from Keizer and the Keizer Fire District identified vulnerabilities related to the earthquake hazard.

- The 2016 steering committee members suggested conducting analysis of the city's 16 wells and how they will be impacted by earthquake.
- Another concern identified is the potential impact to Claggett Creek from sanitary sewer infrastructure impacts. Broken wastewater infrastructure could result in contamination.

- The 2016 steering committee members and the 2022 city representatives also noted that if culverts on River Road collapsed, significant portions of the city could be cut off from vehicle access.

In 2022, the Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk report for critical facilities including public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices, and other law enforcement agency buildings. The DOGAMI analysis used a deterministic scenario method along with a User Defined Facility (UDF) database containing attributes for each building (such as building seismic codes) so that loss estimates could be calculated on a building-by-building basis. Within the City of Keizer, the following critical facilities are predicted at >50% probability to experience a moderate or complete damage in a Mw 6.8 earthquake:

- Centennial School
- Cummings Elementary School
- Keizer Elementary School
- Keizer Fire District
- Keizer Police Department

Keizer participates in the Great Oregon Shakeout each year and posts "Living on Shaky Ground" education documents at city hall. In addition, the City's Community Emergency Response Team is actively engaged in the promotion of earthquake safety and community outreach actions. The city eliminated two actions from the previous HMP related to earthquake preparation due to these ongoing efforts.

8.9.4 Extreme Heat

CPRI = 2.4, Risk Level: Moderate

Events:

8/9 through 8/12/2021 Excessive heat; Hot weather began to develop August 9, peaking August 11-12, but temperatures continued above normal into the weekend. Peak afternoon temperatures of 100 to 105 degrees drove people to seek relief in or near bodies of water. Heat caused slowdowns on public transportation systems and some businesses did close due to the heat. Cooling shelters were opened in several counties.

7/29/2021 Heat; on July 29th, the high temperature at the Salem Airport reached 99 degrees Fahrenheit. Temperatures in the area peaked in the mid and upper 90s.

6/26/2021 Excessive Heat; temperatures across the area warmed into the 100s to mid-110s over a three-day period. Record breaking temperatures up to 117 degrees were recorded in Salem, OR. A total of 18 heat related deaths were reported, including two middle aged men who drowned in the Willamette River on Saturday, June 26.

8/14 through 8/17/2020 Heat; high pressure over the region led to a stretch of hot days from August 14 through August 17. Hot temperatures resulted in many people

seeking locations to cool off in local rivers, which lead to two drownings as well as multiple people going to local hospitals for treatment of typical heat-related medical symptoms.

7/12 through7/18/2018 Heat; high pressure over the region led to a stretch of hot day July 12 through July 17th. Hot temperatures led people to cool off in local rivers. There were two drownings recorded on July 16 and July 18.

8/1/2017 Excessive Heat; the record-breaking heat led people to seek relief at local rivers. One child drowned (indirectly) while swimming in the Willamette River near the Wallace Marine Park.

Vulnerability: NA

8.9.5 Flood

CPRI = 2.4, Risk Level: Moderate

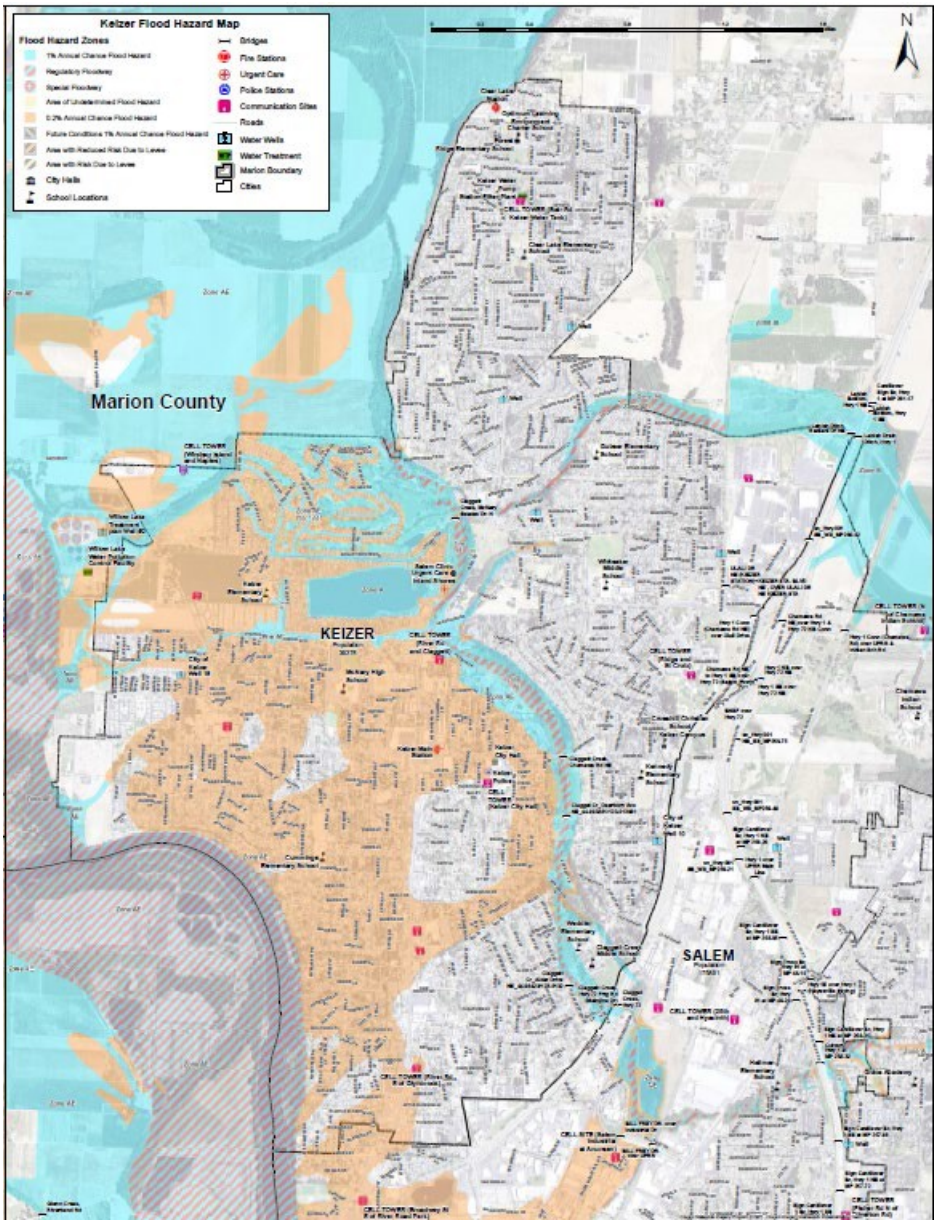
Events: NA

Vulnerability: The city's probability for riverine flood is likely and their vulnerability to flood is critical. Committee members noted that ongoing FEMA flood map updates may increase the base flood elevation by roughly three feet. This is primarily related to an existing earthen dike and flood wall constructed along the Willamette River after the 1996 flood event. If the flood elevation increases, the wall will no longer be certifiable. Any breaching of the dike or wall would result in the inundation of the western half of Keizer.

Some minor flooding does occur on Claggett Creek. However, the flooding is generally isolated. A related mitigation success is the ongoing retrofit and upgrade of Dearborn Bridge over Claggett Creek.

Portions of Keizer have areas of flood plains (special flood hazard areas). These include areas along Mary's River (see Figure 3). Furthermore, other portions of Keizer, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage.

Figure 8-3, City of Keizer Special Flood Hazard Area (FEMA flood map)



Source: DOGAMI Multi-Hazard Risk Report, 2022

National Flood Insurance Program (NFIP)

The NFIP has two types of loss classifications, Repetitive Loss (RL) Property and Severe Repetitive Loss (SRL) Property. ***RL***, property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP. ***SRL,*** property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with

cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

FEMA modernized the Keizer Flood Insurance Rate Maps (FIRMs) in January of 2000. The table below shows that as of June 2022, Keizer has 315 National Flood Insurance Program (NFIP) policies in force. Of those, 151 are for properties that were developed before the development of the initial FIRM. The last Community Assistance Visit (CAV) for Keizer was on March 4, 2020. Keizer is not a member of the Community Rating System (CRS). The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There have been 32 paid flood claims in Keizer totaling $428,779.

The Community Repetitive Loss record for Keizer identifies 2 Repetitive Loss Properties[4] and no Severe Repetitive Loss Properties[5]. Notably, following flooding in 1996/1997, Keizer successfully used FEMA HMGP funds to relocate several homes out of the floodplain.

Table 8-5, Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Polices by Building Type				Minus Rated Policies A Zone
					Single Family	2 to 4 Family	Other Residential	Non-residential	
Marion County			240	128	212	1	4	23	7
City of Keizer	1/19/2000	8/15/1979	316	151	287	7	7	15	6

Jurisdiction	Total Insurance in Force	Total Paid Losses	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Losses Paid	Repetitive Loss Buildings	Severe Repetitive Loss	CRS Rating	Last Community Assistance
Marion County	$66,156,800	101	76	6	$1,218,648	20		6	7/28/2021
City of Keize	$101,581,800	32	20	1	$428,779	2			3/4/2020

Source: Information compiled by Department of Land Conservation and Development, June 2022.

Please review the Risk Assessment (Volume 1, Section 2) for additional information on this hazard.

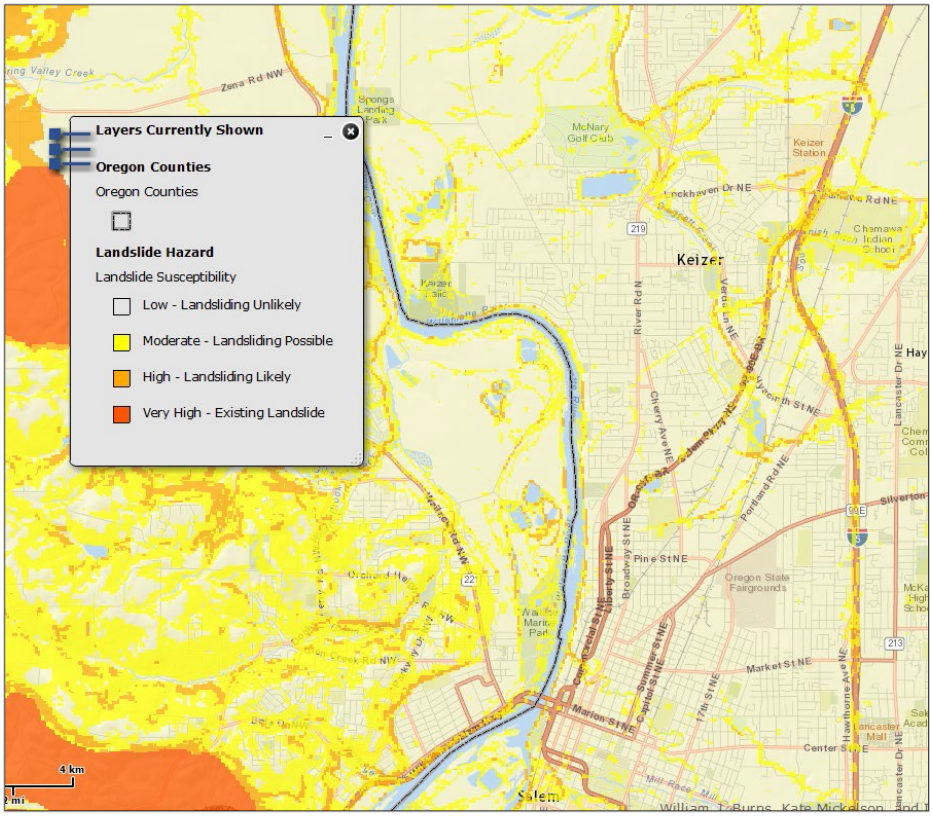
8.9.6 Landslide

CPRI = 2.1, Risk Level: Moderate

Events: None

Vulnerability: The City of Keizer has a relatively flat topography, however some areas of Keizer have hills, which could result in a landslide event. Figure 8-5, highlights the area of vulnerability.

Figure 8-4, Landslide Susceptibility Exposure



Source: Oregon HazVu: Statewide Geohazards Viewer (DOGAMI)

8.9.7 Severe Weather

CPRI = 2.4, Risk Level: Moderate

Windstorm

Events:

12/11/2021; High Wind; a strong Pacific front caused high winds along the coast and coast range, as well as strong winds through the Willamette Valley. Several reports of downed trees and branches as well as power outages for thousands of customers.

11/4/2021; Strong Wind; deep low-pressure system and associated front moved

ashore brought high wind to the coast and windy conditions to the Willamette Valley.

1/12/2021; Strong Wind; a series of slow-moving fronts brought periods of heavy rain along with strong winds.

1/5/2019; Strong Wind; the Salem Airport ASOS recorded wind gusts up to 54 mph.

12/8/2018; Strong Wind; a strong low-pressure system over the Gulf of Alaska brought a strong cold front through. This generated strong winds across northwest Oregon. Reports of trees downed near McMinnville and a section of fence 3 miles WNW of Salem blown over.

4/7/2017; High Wind, Salem Airport recorded wind gusts up to 60 mph. There were reports of downed trees and power outages around Salem and Keizer.

Vulnerability: Significant wind events occur in Keizer each year. Damaging wind events are only slightly less common; once or twice per year the city will experience a windstorm event that will interrupt services, experience downed trees, and cause power outages.

Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Winter Storm (Snow/ Ice)

Events:

12/25/2021; Heavy Snow showers increased the night of the 25th, continuing through the 26th, resulting in significant travel issues for the holiday weekend. Around 4 to 8 inches of snowfall were reported.

2/11 to 2/13/2021; Ice Storm, this was a crippling ice storm for the Salem metro area where generally amounts of 0.5 to 1.25 inches of ice were reported, and many were without power for days.

1/26/2021; Winter Weather, light snow fell during the day as a front moved through the area. General amounts were 1 to 2 inches with local snow amounts of 3 inches. The snow ended in the evening.

3/5 to 3/6/2017; Heavy Snow, reports of 3.5 to 4 inches near Dallas/Falls City and 6 inches in McMinnville.

1/10 to 1/11/2017; Heavy Snow, 1 to 2 inches reported in the Salem area.

1/7 to 1/8/2017; Winter Storm with 1-2 inches of snow/sleet and 0.25 inches of freezing rain.

Vulnerability: Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the city typically originate in the Gulf of Alaska or in the central

Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Keizer area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. The February 2021 ice storm was the most significant severe weather event in the recent past. The key impacts included widespread tree damage and power outages, and approximately 110,000 customers without power in Salem. Multiple road closures as well including Highway 99.

8.9.8 Tornado

CPRI = 2.4, Risk Level: Moderate

Events: None identified during the effective period of the prior plan.

Vulnerability: Not reported

8.9.9 Wildfire

CPRI = 3.7, Risk Level: High

Events: There were no wildfires within the City of Keizer during the effective period of the prior plan. The wildfires that occurred in the foothills of the Cascades during September 2020 did impact the city with smoke.

Vulnerability: Keizer is located on the far western side of Marion County, surrounded by open farmland, waterways, or urban development. There are no forests within the city limits, and the closest forested area is Keizer Rapids Park, located half a mile west of the city. Due to its location, Keizer faces minimal risk of experiencing wildfires. There is no history of wildfire events in Keizer.

The County updated the Community Wildfire Protection Plan in 2016 and Keizer is not listed as a "Community at Risk."

8.9.10 Volcano

CPRI = 2.1, Risk Level: Moderate

Events: No events in the City of Keizer during the effective period of the prior plan.

Vulnerability: Keizer is very unlikely to experience anything more than volcanic ash during a volcanic event. When Mt. Saint Helens erupted in 1980, the city was not impacted.

Please review the Risk Assessment (Volume I, Section 2) for additional information on these hazards.

8.10 Mitigation Strategy

The 2022 mitigation actions were categorized as Priority Actions or actions listed in the Action Item Pool.

8.10.1 City of Keizer Mitigation Actions

The city listed a set of high priority actions to focus attention on an achievable set of high leverage activities over the next five years. The City's priority actions are listed in Table on the following pages.

8.10.2 Action Item Pool

Table 8.6 on the following pages presents a pool of mitigation actions. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

During the 2022 Marion County and Keizer update process, the City of Keizer NHMP Steering Committee member, Matt Reyes, worked with the DLCD Natural Hazards Planner to discuss the city's Mitigation Strategy. Reyes also conveyed the updates provided to the County Emergency Services Coordinator in 2021.

These are included as the 2022 updates and changes in the City of Keizer Mitigation Strategy.

The proposed updates to the mitigation actions were then re-reviewed by the steering committee to finalize. Keizer reviewed a list of priority actions and other actions that were not prioritized. These mitigation actions may be considered during the annual plan maintenance meeting.

Table 8-6, City of Keizer Mitigation Action Items

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
Priority Actions							
2022-P-1	Earthquake	Work with Cities of Salem and Turner to perform seismic evaluation of wastewater transmission infrastructure and impact on drinking water supply.	H	1-2 Years	TBD	City of Keizer Public Works	Not Started
2022-P-2	Earthquake	Conduct seismic evaluation of Keizer's drinking water well field.	H	3-5 Years	TBD	City of Keizer Public Works	Not Started
2022-P-3	Earthquake	Conduct seismic evaluation of Chemawa, Dearborn, and Alder Street bridges over Claggett Creek	H	1-2 Years	TBD	City of Keizer Public Works	Not Started
2022-P-4	Earthquake	Assess the feasibility and cost to seismically retrofit Keizer's public works facilities (City shops).	H	5+ Years	TBD	City of Keizer Public Works	Not Started
Action Items							
2022-MH-1	Multi-Hazard	Create an emergency preparedness section on the City's website. Populate with resources and publicize.	M	12 months	Staff Time	City Administration	On-going
2022-MH-2	Multi-Hazard	Maintain a regular presence at outreach events, especially neighborhood association events, and provide the public with preparedness resources.	M	Annually	Staff Time	City Administration	On-going
2022-MH-3	Multi-Hazard	Make guest appearance on local radio shows to provide announcements and resources for preparedness.	M	Annually	Staff Time	City Administration	On-going
2022-MH-4	Multi-Hazard	Add hazard awareness material into existing environmental education currently done in schools.	M	1-3 Years	TBD	City Administration	On-going
2022-MH-5	Multi-Hazard	Join Marion County's Everbridge communication system.	M	1-2 Years	TBD	City Administration	On-going
2022-MH-6	Multi-Hazard	Encourage residents to participate in Everbridge.	M	Annually	Staff Time	City Administration	On-going

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-7	Multi-Hazard	Meet with the City of Salem to discuss the Willow Lake Wastewater Treatment Plant: *How it can be reinforced to minimize damage in a hazard event. *How hazardous materials can be secured or removed to prevent groundwater contamination	H	1-2 Years	TBD	City of Keizer Public Works	Not Started
2022-MH-8	Multi-Hazard	Further develop risk assessment maps to show areas at risk for all hazards.	M	1-2 Years	TBD	City Administration	Not Started
2022-MH-9	Multi-Hazard	Develop mutual aid agreements with surrounding counties.	M	1-2 Years	TBD	City Administration	Not Started
2022-MH-10	Multi-Hazard	Expand on the information gathered for the internal public works operational manual to create a full registry of populations that may need assistance in an emergency.	M	3-5 Years	TBD	City of Keizer Public Works	Not Started
2022-MH-11	Multi-Hazard	Update the Continuity of Operations Plan.	M	1-2 Years	TBD	City Administration	Not Started
2022-MH-12	Multi-Hazard	Participate in Marion County's post-disaster recovery planning efforts.	M	3-5 Years	TBD	City Administration	Not Started
2022-MH-13	Multi-Hazard	Continue development of CERT teams to ease the load on emergency services following a disaster.	M	1-5 Years	Staff Time	City Administration	Not Started
2022-MH-14	Multi-Hazard	Develop memoranda of understanding with appropriate facilities specifying that they will function as emergency shelters during disruptive events with support from the City.	M	1-2 Years	Staff Time	City Administration	Not Started
2022-MH-15	Multi-Hazard	Educate businesses and governmental organizations about the importance of developing continuity of operations plans.	M	Annually	Staff Time	Environmental Services	On-going
2022-MH-16	Multi-Hazard	Update the Keizer Comprehensive Plan to reflect statewide land use Goal 7 language surrounding natural hazards.	M	3-5 Years	TBD	Planning	Not Started

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-EQ-1	Earthquake	Participate in the Great Shakeout each year.	M	Annually	Staff Time	City Administration	On-going
2022-EQ-2	Earthquake	School seismic retrofitting action - need to talk to school district representative.	M	1-2 Years	TBD	City Administration	Not Started
2022-EQ-3	Earthquake	Send city employees to the County's ATC 20 training.	M	1-5 Years	TBD	City of Keizer Public Works	Not Started
2022-EQ-4	Earthquake	Perform a seismic analysis of box culverts in Keizer and repair or upgrade as resources become available.	M	3-5 Years	TBD	City Administration	Started
2022-EQ-5	Earthquake	Encourage residents to prepare and maintain 2-week survival kits.	L	Annually	Staff Time	City Administration	On-going
2022-FL-1	Flood	Continue compliance with the National Flood Insurance Program through the enforcement of local floodplain ordinances. Update enforcement based on changes to the NFIP (such as flood elevation level changes).	M	1-5 Years	TBD	Planning	On-going
2022-FL-2	Flood	Improve water quality and water flow through wetland vegetation restoration and stream cleanup, especially along Claggett Creek.	M	1-5 Years	TBD	Environmental	On-going
2022-FL-3	Flood	Educate residents and business owners near Labish and Claggett creeks about how to manage flood risks.	M	Annually	Staff Time	Environmental	On-going
2022-SW-1	Severe Weather	Educate the public about windstorm-resistant trees and landscaping practices and the role of proper tree pruning and care in preventing damage during windstorms.	M	Annually	Staff Time	Environmental	On-going
2022-SW-2	Severe Weather	Ensure that all critical facilities have backup power and/or emergency operations plans to deal with power outages.	M	1-5 Years	TBD	City Administration	On-going
2022-SW-3	Severe Weather	Record instances of infrastructure failure and notify PGE of infrastructure that regularly fails.	M	1-5 Years	TBD	City Administration	On-going

9 Keizer Fire District Addendum

9.1 Purpose

This document serves as the Keizer Fire District's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (MHMP, HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Keizer Fire District to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor— one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

9.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Keizer Fire District, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the Keizer Fire District will gain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The Keizer Fire District joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on October 1, 2021. On September 27, 2021, Keizer Fire District Fire Chief James Cowan, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the Keizer Fire District that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on April 11, 2022, to update this addendum.

Chief Cowan of the Keizer Fire District attended HMP Steering Committee meetings on August 3, 2021; October 5, 2021; November 21, 2021; December 7, 2021; March 1, 2022; and April 5, 2022. The district promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the Keizer Fire District Facebook page on November 2, 2021, to inform the public of the project and on January 25, 2022, to distribute the plan update public survey to interested parties in the Keizer Fire District service area.

9.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

9.4 District Profile

This section provides information on district specific assets and populations. For additional information on the characteristics of Keizer Fire District, in terms of geography, environment, population served, demographics, employment and economics, as well as housing and transportation for the city it serves see Volume III, Appendix C, Community Profile. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the district specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

9.4.1 District Characteristics

The Keizer Fire District serves the City of Keizer and some adjacent areas in Marion County, Oregon. Keizer Fire District is a full-service fire, rescue, and EMS agency with a force of 38 career employees, 20 volunteer firefighters, and 12 explorer scouts and 5 elected Board of Directors who serve the district's 39,315 citizens from one centrally located fire station. Keizer Fire District ran 5,235 emergency calls in 2020.

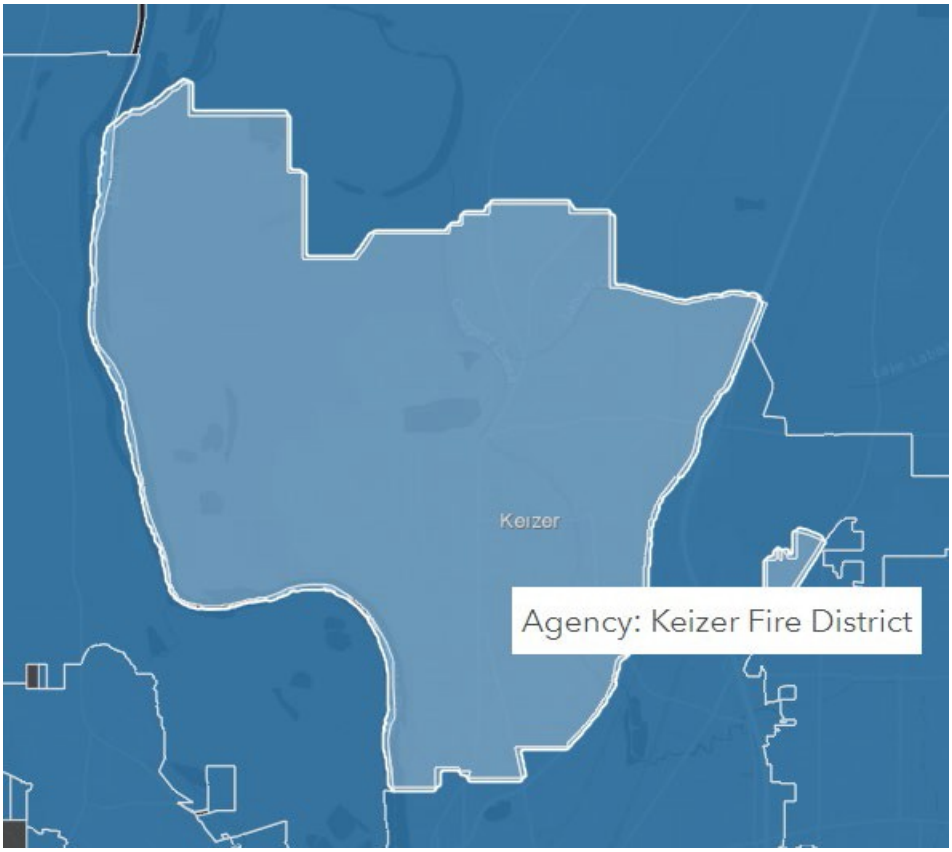
The Keizer Fire District is approximately 10 square miles with a population of just over 39,000. Fire, rescue, and emergency medical services are provided to a majority of the city from one fire station. Station 350 is Keizer Fire District's only station. The district is made up of various types of building occupancies, with the majority being residential. There are multiple levels of educational facilities within the district, as well as several retirement complexes.

In 1996, the original fire station was demolished so that a new fire station could be built in the same location. This new fire station will house eight pieces of fire or medical apparatus, offices, sleeping quarters, an exercise room, training rooms, two kitchens, and a multi- purpose room.

In January of 1950, the Fire District acquired a 1500-gallon tanker. Due to its size and the way it was designed, the Firefighters named it "Jumbo". This equipment was purchased through the School District and cost $400.00. In October of 1953, a third piece of equipment was added. This piece of apparatus had a high-pressure pump, and several compartments designed to carry salvage equipment, lights, a generator and air masks.

Radios were first added to the fleet in 1953. I t wasn't until 1979 that the first Rescue vehicle was purchased. This vehicle was the primary response vehicle for EMS calls.

Figure 9-1, Keizer Fire District Service Area



Source: Oregon State Fire Marshall Structural Fire District map
Structural Fire Districts | Structural Fire Districts | OSFM (arcgis.com)

9.5 Critical and Important Facilities

Keizer Fire District's critical and important facilities include its fire station and equipment. The district maintains four fire engines and a ladder truck as well as four ambulances and five other vehicles. The fire station was constructed in 1997. The district has diesel fuel supply for backup power for 3 days.

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

9.6 Plans and Policies

Table 9-1, Keizer Fire District Policies and Plans

Document Name with Hyperlink if the document is available online	**Year**
Standard of Cover	NA
Emergency Operations Plan	NA

9.7 Hazard Profile

The City of Keizer Hazard profile is used to represent the vulnerabilities of the Keizer Fire District.

Table 9-2, Keizer Fire District Hazard Profile

Community Overview					
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)	
Keizer	38,585	16,380	15	5,592,798,000	
Hazus-MH Analysis Summary					
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	704	1.8%	336	0	26,571,000	0.5%
Earthquake	Mt. Angel Mw 6.8 Deterministic	2,479	6.4%	3,994	5	722,048,109	13%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	142	0.4%	62	0	18,852,000	0.3%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	17	0.0%	6	0	2,190,893	0.0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities*						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Centennial School		X				
Claggett Creek Middle School						
Clear Lake Elementary						
Forest Ridge Elementary		X				
Gubser Elementary						
Keizer Elementary		X				
Keizer Fire District		X				
Keizer Police Department		X				
Kennedy Elementary School						

MCFD 1- Clearlake Station						
McNary High School						
Urgent Care inland Shores						
Weddle Elementary School						
Whitaker Middle School						

Source: Multi hazard Risk Report, DOGAMI, Williams, 2022.

* The Critical Facilities of the Keizer Fire District are included within the City of Keizer Critical Facilities list. The city's facilities are within the service district of the Keizer Fire District and therefore are of concern to the district as they provide services to children and people seeking health care.

9.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event,
2. Magnitude of event,
3. Expected warning time before event, and
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 9-3, Keizer Fire District Hazard and Vulnerability Assessment - Natural Hazards

Hazard Profile Summary for the Keizer Fire District Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Wildland Interface Fire	4	4	3	4	3.7	**High**
Earthquake	3	4	3	4	3.3	**High**
Extreme Weather - High Temperature	3	1	2	3	2.4	**Moderate**
Flood*	3	1	2	3	2.4	**Moderate**
Severe Weather/Storm	3	1	2	3	2.4	**Moderate**
Tornado**	2	4	2	3	2.4	**Moderate**
Landslide	2	2	2	3	2.1	**Moderate**
Drought	2	1	2	4	2.1	**Moderate**
Volcanic Eruption	2	1	2	4	2.1	**Moderate**
Avalanche ***	1	1	1	1	1.0	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by City of Keizer on September 27, 2021

*Including dam failures; **Split out of sever weather in 2021; ***New in 2021

Table 9-4, Keizer Fire District Hazard and Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the City of Idanha Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Cyberterrorism	3	4	4	4	3.6	**High**
Public Health	4	1	3	4	3.3	**High**
Hazardous Materials – Non-Transportation	3	4	3	3	3.2	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	4	4	3.1	**High**
Unauthorized Entry	2	4	4	4	3.1	**High**
Hazardous Materials Release - Transportation	2.5	4	3	3	2.9	**Moderate**
Fire - Residential / Commercial (Arson)	3	4	2	3	2.9	**Moderate**
Terrorism/Active Shooter/Workplace Violence	2	4	3	3	2.7	**Moderate**
Agricultural Terrorism	2	1	4	4	2.7	**Moderate**

Source: BOLD Planning Risk Assessment Method; Analysis by City of Keizer on September 27, 2021

9.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to Keizer Fire District. Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to Keizer Fire District, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

9.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: None during the effective period of this plan.

Vulnerability: None. Keizer Fire District is not subject to avalanche.

9.9.2 Drought

CPRI = 2.1, Risk Level: Moderate

Events: Marion County experienced D2 and D3 drought conditions during periods of 2018, 2019, 2020 and 2021 (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, N.d).

Vulnerability: Because the City of Keizer's water supply which serves the Keizer Fire District is primarily subsurface, the city's vulnerability is moderate. Due to a cool, wet climate, past and present weather conditions have generally spared Marion County communities from the effects of drought. Governor Kate Brown declared a drought emergency for all of Marion County in September 2015.

The City of Keizer's primary water supply comes from the Troutdale Aquifer. Raw water is treated for consumption at the Willow Lake Water Treatment Facility. The city has three (3) storage reservoirs with storage capacity for 2.75 million gallons of treated water. In addition, Keizer maintains an emergency water agreement with the City of Salem.

The City of Keizer reviewed and updated its water management plan during the previous update period to include new information and revisit emergency water agreements with the City of Salem. Keizer adopted the revised agreements and ordinance language in 2016. The ordinance includes a water curtailment plan.

9.9.3 Earthquake

CPRI = 3.3, Risk Level: High

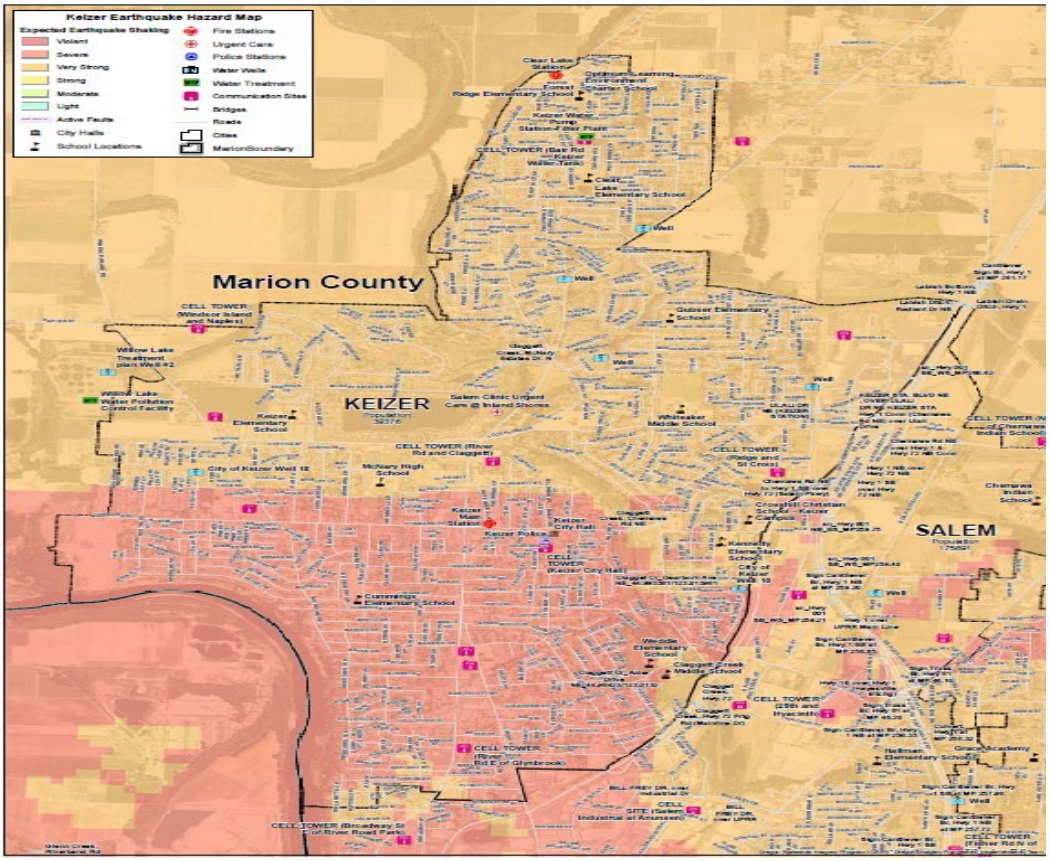
Events: Five earthquakes ranging between, 1.5 and 1.7 and one registering 3.0 occurred northwest of Keizer during the effective period of the prior plan.

Vulnerability: There are no locally active faults within the Keizer City Limits. Active faults do exist within five miles to the west and south. The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County. Generally, an event that affects the county is likely to affect Keizer as well. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Keizer as well.

The City of Keizer's probability for a Crustal Earthquake event is "possible" and that the city's vulnerability to a Crustal Earthquake event is "limited". The county steering committee determined that the probability for a CSZ Earthquake event is "highly likely" and that the vulnerability to a Cascadia Earthquake event is "catastrophic". This hazard was not rated as distinct CSZ and crustal events in the previous HMP.

In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure 9-2 shows that ground shaking in Keizer for both crustal and subduction earthquakes are expected to be very strong to severe.

Figure 9-2, Keizer Earthquake Hazard Map



Source: DOGAMI Multi-Hazard Risk Report, 2022

The representatives from Keizer and the Keizer Fire District identified vulnerabilities related to the earthquake hazard.

- The 2016 steering committee members suggested conducing analysis of the city's 16 wells and how they will be impacted by earthquake.
- Another concern identified is the potential impact to Claggett Creek from sanitary sewer infrastructure impacts. Broken wastewater infrastructure could result in contamination.
- The 2016 steering committee members and the 2022 city representatives also noted that if culverts on River Road collapsed, significant portions of the city could be cut off from vehicle access.

In 2022, the Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk report for critical facilities including public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices, and other law enforcement agency buildings. The DOGAMI analysis used a deterministic scenario method along with a User Defined Facility (UDF) database containing attributes for each building (such as building seismic codes) so that loss estimates could be calculated on a building-by-building basis. Within the City of Keizer, the following critical facilities are predicted at >50% probability to experience a moderate or complete damage in a Mw 6.8 earthquake:

- Centennial School
- Cummings Elementary School
- Keizer Elementary School
- Keizer Fire District
- Keizer Police Department

9.9.4 Extreme Heat

CPRI = 2.4, Risk Level: Moderate

Events:

8/9 through 8/12/2021; Excessive heat; Hot weather began to develop August 9, peaking August 11-12, but temperatures continued above normal into the weekend. Peak afternoon temperatures of 100 to 105 degrees drove people to seek relief in or near bodies of water. Cooling shelters were opened in several counties.

7/29/2021; Heat; on July 29th, the high temperature at the Salem Airport reached 99 degrees Fahrenheit. Temperatures in the area peaked in the mid and upper 90s.

6/26/2021; Excessive Heat; temperatures across the area warmed into the 100s to mid-110s over a three-day period. Record breaking temperatures up to 117 degrees were recorded in Salem, OR. A total of 18 heat related deaths were reported, including two middle aged men who drowned in the Willamette River on Saturday, June 26.

8/14 through 8/17/2020; Heat; high pressure over the region led to a stretch of hot days from August 14 through August 17. Hot temperatures resulted in many people seeking locations to cool off in local rivers, which lead to two drownings as well as multiple people going to local hospitals for treatment of typical heat-related medical symptoms.

7/12 through7/18/2018; Heat; high pressure over the region led to a stretch of hot day July 12 through July 17th. Hot temperatures led people to cool off in local rivers. There were two drownings recorded on July 16 and July 18.

8/1/2017; Excessive Heat; the record-breaking heat led people to seek relief at local rivers. One child drowned (indirect) while swimming in the Willamette River near the Wallace Marine Park.

Vulnerability: Vulnerability to Extreme Heat in the Keizer Fire District service area relates to the likely probability of an event occurring and possibility of the event lasting up to a week in the district.

9.9.5 Flood

CPRI = 2.4, Risk Level: Moderate

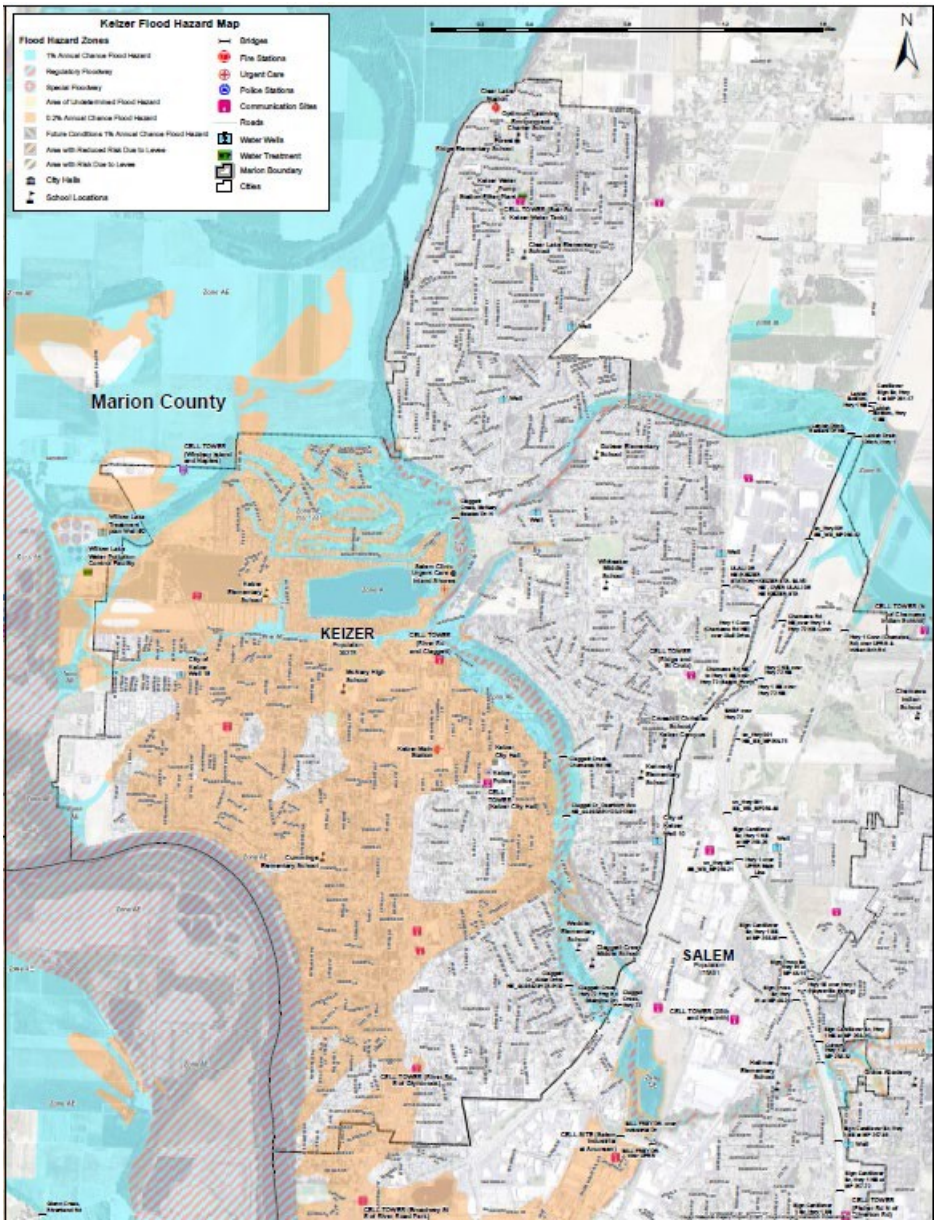
Events: None during the effective period of the previous plan (2017-2022)

Vulnerability: The probability for riverine flood in the Keizer Fire District service area is "likely" and the vulnerability to flood is "critical". Committee members noted that ongoing FEMA flood map updates may increase the base flood elevation by roughly three feet. This is primarily related to an existing earthen dike and flood wall constructed along the Willamette River after the 1996 flood event. If the flood elevation increases, the wall will no longer be certifiable. Any breaching of the dike or wall would result in the inundation of the western half of Keizer.

Some minor flooding does occur on Claggett Creek. However, the flooding is generally isolated. A related mitigation success is the ongoing retrofit and upgrade of Dearborn Bridge over Claggett Creek.

Portions of Keizer have areas of flood plains (special flood hazard areas). These include areas along the Mary's River (see Figure 9-3). Furthermore, other portions of Keizer, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage.

Figure 9-3, City of Keizer Special Flood Hazard Area (FEMA flood map)



Source: DOGAMI Multi-Hazard Risk Report, 2022

9.9.6 Landslide

CPRI = 2.1, Risk Level: Moderate

Events: None during the effective period of the prior plan.

Vulnerability: The Keizer Fire District service area has a relatively flat topography, therefore probability for landslide is unlikely and vulnerability to landslide is negligible.

9.9.7 Severe Weather

CPRI = 2.4, Risk Level: Moderate

Windstorm

Events:

12/11/2021; High Wind; a strong Pacific front caused high winds along the coast and coast range, as well as strong winds through the Willamette Valley. Several reports of downed trees and branches as well as power outages for thousands of customers.

11/4/2021; Strong Wind; deep low-pressure system and associated front moved ashore brought high wind to the coast and windy conditions to the Willamette Valley.

1/12/2021; Strong Wind; a series of slow-moving fronts brought periods of heavy rain along with strong winds.

1/5/2019; Strong Wind; the Salem Airport ASOS recorded wind gusts up to 54 mph.

12/8/2018; Strong Wind; a strong low-pressure system over the Gulf of Alaska brought a strong cold front through. This generated strong winds across northwest Oregon. Reports of trees downed near McMinnville and a section of fence 3 miles WNW of Salem blown over.

4/7/2017; High Wind, Salem Airport recorded wind gusts up to 60 mph. There were reports of downed trees and power outages around Salem and Keizer.

Vulnerability: Significant wind events occur in Keizer each year. Damaging wind events are only slightly less common; once or twice per year the city will experience a windstorm event that will interrupt services, experience downed trees, and cause power outages.

Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Winter Storm (Snow/ Ice)

Events:

12/25/2021; Heavy Snow; snow showers increased the night of the 25th, continuing through the 26th, resulting in significant travel issues for the holiday weekend. Around 4 to 8 inches of snowfall were reported.

2/11 to 2/13/2021; Ice Storm; this was a crippling ice storm for the Salem metro area where generally amounts of 0.5 to 1.25 inches of ice were reported, and many were without power for days.

1/26/2021; Winter Weather; light snow fell during the day as a front moved through the area. General amounts were 1 to 2 inches with local snow amounts of 3 inches. The snow ended in the evening.

3/5 to 3/6/2017; Heavy Snow, reports of 3.5 to 4 inches near Dallas/Falls City and 6 inches in McMinnville.

1/10 to 1/11/2017; Heavy Snow, 1 to 2 inches reported in the Salem area.

1/7 to 1/8/2017; Winter Storm with 1-2 inches of snow/sleet and 0.25 inches of freezing rain.

Vulnerability: Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms

affecting the city typically originates in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Keizer Fire District service area, and while they typically do not cause significant damage, they are frequent and have the potential to result in calls for assistance to the district. The February 2021 ice storm was the most significant severe weather event in the recent past. The key impacts included widespread tree damage and power outages, and approximately 110,000 customers without power in Salem. Multiple road closures as well including Highway 99.

9.9.8 Tornado

CPRI = 2.4, Risk Level: Moderate

Events: None identified during the effective period of the prior plan.

Vulnerability: Vulnerability to damage by a tornado in the Keizer Fire District are due to the limited warning time (less than 6 hours) and the potential for effects to last up to a week in duration.

9.9.9 Wildfire

CPRI = 3.7, Risk Level: High

Events: There were no wildfires within the City of Keizer during the effective period of the prior plan. The wildfires that occurred in the foothills of the Cascades during September 2020 did impact the city with smoke.

Vulnerability: Keizer is located on the far western side of Marion County, surrounded by open farmland, waterways, or urban development. There are no forests within the city limits, and the closest forested area is Keizer Rapids Park, located half a mile west of the city. Due to its location, Keizer faces minimal risk of experiencing wildfires. There is no history of wildfire events in Keizer.

The County updated the Community Wildfire Protection Plan in 2016 and Keizer is not listed as a "Community at Risk."

9.9.10 Volcano

CPRI = 2.1, Risk Level: Moderate

Events: No events in the ity of Keizer during the effective period of the prior plan.

Vulnerability: Keizer is very unlikely to experience anything more than volcanic ash during a volcanic event. When Mt. Saint Helens erupted in 1980, the city was not impacted.

Please review the Risk Assessment (Volume I, Section 2) for additional information on these hazards.

9.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Keizer Fire District Addendum update process, Oregon Department of Land Conservation & Development and Keizer Fire District developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the summer of 2022.

9.10.1 Action Item Pool

The following pages includes the Fire Districts initial Priority Action Items (Table 9.5).

Table 9-5, Keizer Fire District "Priority" Actions

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-1	Multi-Hazard	Work with Marion County Emergency Management Coordinator to develop an Emergency Management Advisory Committee that could focus on joining county and local resources under a common incident command management system. Participate with Marion County to educate emergency managers, emergency managers and citizens, and to coordinate among cities and districts to develop a unified incident command management system.	H	1-3 Years	Staff Time	Develop agreements to form a FEMA incident management system; utilize common terminology; encourage relevant staff to take NIMS 100-800 Incident Command System courses; conduct tabletop exercises to practice the principles taught in these courses. The objective of unified Incident Command Systems is to coordinate State, county and local resources working together sharing resources efficiently.	New
2022-MH-2	Multi-Hazard	Reinstate the CERTs; involve citizens in coordination and communication at a neighborhood level to support Keizer Fire District and City of Keizer efforts to respond to natural hazard events.	H	1-3 Years		Citizen Emergency Response Teams involve citizens in providing support to other residents including provision of basic first aid, direction to access or evacuation routes and supporting the ability of the district and the city to coordinate block by block in a neighborhood.	New

Source: Personal communication with Chief Cowan, Keizer Fire District, April 11, 2022

10 City of Mill City

10.1 Purpose

This document serves as the City of Mill City's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Mill City to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

10.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Military Department's Office of Emergency Management (OEM), and Marion County cities, including the City of Mill City, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Mill City will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Mill City joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on 10/12/2021, fully executed by DLCD on 10/19/2021. On 10/7/2021, Mill City Mayor, Tim Kirsch and Mill City volunteer, Gary Olson, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the Jurisdiction that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on 3/25/2022 to update this addendum.

Mill City staff attended HMP Steering Committee meetings on 8/3/21, 9/7/21, 10/5/21, 11/21/21, 1/4/22, 3/1/22, 5/4/22, and promoted the HMP survey and outreach efforts throughout the plan update, including promotion through the city's newsletter on February 1, 2022, and through public posting of the survey on the city's website and Facebook page to distribute the public survey to interested parties in the Jurisdiction service area.

10.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

10.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of Jurisdiction, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

10.4.1 Community Characteristics

Mill City is nestled along the North Santiam River. The northern third of Mill City and the Hwy 22 corridor are located north of the river in Marion County. The remainder of the city, including most of the residential areas, schools, fire station and city offices are located south of the Santiam River in Linn County. Mill City is the largest community in the North Santiam River Canyon with a population in 2020 of 1,971 (U.S. Census Bureau, 2022).

With an elevation of 827 feet, the climate of Mill City is moderate; the average monthly temperatures range from 51 – 79 degrees in July and August, and 33-45 degrees in December and January. Mill city receives approximately 60-70 inches of rain, and 6-12 inches of snow each year. The city's topography is relatively flat but does possess terrain attributed to the North Santiam River. Outside of city limits, steep slopes surround the city on the North and South sides.

Mill City benefits from its location along Oregon Hwy 22, a major east-to-west transportation route connecting Salem to Bend. The city serves as a local small business, education, and service center for residents of the North Santiam Canyon and the traveling public along the Hwy 22 corridor. The existing business types include hospitality, restaurants, professional, financial, real estate, service stations, repair/service shops, and personal service businesses; primarily serving the daily needs of residents. (Timber is the largest industry).

10.5 Critical and Important Facilities/Infrastructure

10.5.1 Communication/Information Technology

There are currently three communication providers in Mill City. WAVE provides broadband internet and phone services, Stayton Cooperative Telephone Company provides phone service, Stayton Cooperative Telephone Company provides phone service, and Frontier provides phone services and broadband internet with limited fiber infrastructure adjacent to Hwy 22.

Strengths

- Fiber internet infrastructure already present along Hwy 22.
- Ziply is currently installing fiber gig speed internet in Mill City (to be completed in 2022) and other communities throughout the Santiam Canyon.
- Cellular Tower (T-Mobile) near 155 NE Santiam Blvd.
- ATT cell tower on Potato Hill.

Weaknesses

- Phone/Fiber lines may cross over 1st Ave. bridge.
- Currently limited certified HAM radio operators.

10.5.2 Water

The City of Mill City has two municipal wells (Kingwood Wells 1 & 2) and a water pump station located at SE 4th and SE Kingwood Avenue. The two wells were drilled to a depth of 168 feet. Well 1 has the capacity to produce 800 gpm and Well 2 has the capacity to produce 450 gpm (City of Mill City, N.d.). Both wells are near each other, pulling water from depths of 45-158 feet deep from the same aquifer.

The city municipal water system currently depends on these wells to distribute water throughout the community. Unless other water facilities are created to pull water from the North Santiam, Mill City must preserve the well head protection area from any possible pollution attributed to encroaching development.

10.5.3 Wastewater

Mill City's has a municipal wastewater treatment facility and collection system. Individual homes are served by a STEP (Septic Tank Effluent Pumping) system. The building sewer from a home or business drains to an interceptor tank located on the property. Solids are collected in the interceptor tanks and the liquids are discharged into the city's sewer collection system. The liquid effluent flows to the City's wastewater treatment facility where it goes through a rock filtration system and is discharged into a large drain field. The City contracts with a private firm to pump out the interceptor tanks at each home or business. Residential interceptor tanks are pumped on a 7-10-year cycle, with tanks serving businesses or heavy water users pump on a more frequent basis.

10.5.4 Dams

Two dams sit above Mill City, Detroit Dam and Big Cliff Dam. Federal officials and Marion County's Emergency Managers have previously concluded that the likelihood of Dam Failure is Low**.** Current conditions still represent the previous decision. If dam failure occurred in either dams, Mill City would experience catastrophic impacts from a surge of water expelled from either Detroit or Big Cliff Lake.

Strengths:

- (2) Municipal wells (Kingwood 1 &2)
- (1) Backup diesel generator on-site
- (2) Above-ground water storage reservoirs at 155 NE Santiam Blvd (Marion County side of river) and SE 4th Avenue (Linn County side of river))
    - Equivalent to (1.5 million) gallons or 3-5 days of water storage
- Municipal wastewater treatment system
- (3) sewage pump stations

Weaknesses:

- No current storage supply of diesel fuel
- Main water lines cross highway & pedestrian bridge
- No backup generator at wastewater pump stations
- Main wastewater line crosses 1st Ave. bridge

10.5.5 Transportation System

Oregon Hwy 22 is the major transportation route for auto, public transit, and emergency vehicle access throughout the Santiam Canyon. Mill City is located along Hwy 22, 30 miles east of the Interstate-5, the City of Salem, and the remainder of the Willamette Valley. To the east, Hwy 22 connects to Gates, Detroit, Idanha, and ends at the Santiam Pass interchange with U.S. Route 20/Oregon Hwy 126, which continue east to the Central Oregon cities of Sisters, Redmond, and Bend.

The Cherriots Canyon Connector is the only existing public transit service serving communities in the North Santiam Canyon. The Canyon Connector route has three total round trips with buses running approximately every (5) hours.

In case of the closure of Oregon Hwy 22, Mill City residents will have to rely on alternate routes to reach supplies or safety in the Willamette Valley. Lyons-Mill City Drive runs from Mill City to Lyons, where it connects to OR 226 and Hwy 22.

Table 10-1, Bridges in Mill City

Structure Name	Construction	Location	Owner	Year Built	Structural Condition
Little North Fork Santiam River Bridge (Hwy 22)	Steel/Concrete	Mehama	ODOT	1952	Fair
North Santiam River Railroad (Pedestrian) Bridge	Steel/Concrete	Mill City	Mill City	1919	Good; 10,000 lb. capacity – Updated 2021/2022
Mill City Bridge 1st Ave. (over N. Santiam River)	Steel/Concrete	Mill City	Linn County	1960	Completely updated in 2020-2021; meets all new code requirements; previously sufficient rating of 32.1
Gates Bridge (Over N. Santiam River)	Unknown	Gates	Unknown	Unknown	Unknown
OR 226 Bridge (Over N. Santiam River)	Unknown	Lyons	Unknown	Unknown	Unknown

Source: City of Mill City, Oregon (2021)

***Note** -* There are three bridges across De Ford Creek and Rock Creek located in Linn County in or adjacent to Mill City on Lyons-Mill City Road across De Ford Creek, and Kingwood Avenue across both. Sufficiency ratings for all three are in 97, 96.9 and 68.8.

Strengths:

- The Pedestrian Bridge owned by Mill City and updated in 2021/2022 could be used by some light duty emergency vehicles weighing no more than 10,000 lb.
- First Avenue bridge has been completely updated in 2021/2022 which removed weight restrictions.
- Lyons/Mill City Drive serves as an additional evacuation route to Lyons (west).
- SE Kingwood Avenue serves as an additional evacuation route to Gates (east).
- Bridges over the N. Santiam River in Gates and Lyons provide an alternative route for Mill City traffic if problems occur on the 1st Avenue bridge in Mill City.

Weaknesses:

- 1st Ave Bridge has weight restrictions (owned by ODOT).
- Pedestrian Bridge s has just gone through extensive restoration and operates under more stringent weight restrictions (10,000 lbs).
- Hwy 22 closures could make travel outside of North Santiam Canyon extremely difficult.

10.5.6 Energy and Utilities

Mill City receives energy and utility services from Pacific Power and NW Natural Gas. The main power service line to Mill City comes from Lyons to Mill City, along Lyons-Mill City Drive. It was rebuilt in 2015-2016.

BPA transmission lines run south of Mill City from the Detroit Dam generating turbines, connecting to the Lyons power station.

Table 10-2, Fuel Storage Sites

Location	Owner	Fuel Type	Capacity (in gallons)
Mill City – Hwy 22	Mobile Gas Station,	Diesel / Gasoline (Below Ground)	17,000 of gas 3,000 of diesel
Mill City – Hwy 22	Union 76 Gas Station	Diesel / Gasoline (Below Ground)	40,000 of gas 7,500 of diesel
Lyons – Lumber Plant	Freres Lumber	Diesel (Above Ground)	10,000 of diesel
Mill City – Lumber Plant	Frank Lumber	Diesel (Above Ground)	2 x 20,000 tanks of diesel
Mill City – Lumber Plant	Frank Lumber	Gasoline (Above Ground)	20,000 of gas

Strengths:

- Gas stations with fuel storage exist within Mill City.
- Businesses including Freres Lumber and Frank Lumber Co. possess fuel storage.

Weaknesses:

- Gas stations possess below ground tanks which cannot be pumped without electricity.
- Gas stations do not currently possess backup diesel generators to pump fuel from storage tanks.
- No alternate sources of energy (wind, solar) exist to power basic services.

10.5.7 Agriculture and Food

Mill City has a small 10,000 sf grocery store, the Mill City Marketplace, convenience stores, Dollar General and three restaurants plus a coffee house to provide groceries and food services. The closest full-service grocery exists 17 miles west in Stayton. The closure of Hwy 22 as a transportation route would cause serious concern for residents and food accessibility.

Strengths:

- Private sector entities which possess limited (1-2 days) food supplies.
- Agricultural land availability near Mill City.

Weaknesses:

- No major (full service) grocery store inside of city limits.
- Surrounding agriculture is currently not used for food production.

10.5.8 Banking and Finance

A U.S Bank exists on the north side of the North Santiam River in Mill City. The bank is located along Hwy 22 and could be utilized for emergency financial services during a hazard event.

Strengths:

- Presence of a banking/financing institution within city limits.

Weaknesses:

- Full “urban” financial services unavailable.

10.5.9 Hazardous Materials

Mill City does not possess any large manufacturing firms that possess hazardous materials. The city has identified hazardous materials releases through the Oregon Department of Environmental Quality which may be susceptible to leaching including the Texaco gas station and Remine Mill site.

Strengths:

- There are currently not enough known hazardous materials to cause major concern.
- Brownfield sites could be utilized and attract privates sector development.

Weaknesses:

- Current brownfields may be susceptible to leaching of unknown materials.

10.5.10 Emergency Services

Mill City receives emergency services from Linn County Sheriff's Office and the Mill City Rural Fire Protection District.

- Fire: Mill City Volunteer Fire Dept: 400 SW 1st Ave. Mill City, OR 97360 – (503) 897-2309
- Police: Mill City Contracts with Linn Co. Sheriff, Albany OR – Non-Emergency ((800) 884-3911
- Public Works: 475 Kingwood Ave. Mill City, OR 97360 - (503) 930-8256 Supervisor
- CERT: N/A
- Medical: Santiam Medical Clinic, 280 1st Ave Mill City, OR 97360 - (503) 897-4100
- Emergency Operations Center: N/A

Strengths:

- Mill City possesses community specific emergency services for fire and law enforcement.
- The Mill City RFPD main fire station possesses a backup generator.

Weaknesses:

- Emergency services do not have trained HAM radio operators.
- Emergency services do not possess rescue rafts for North Santiam River access.

10.5.11 Government Facilities

Mill City's City Hall contains the office space for the administration, finance, permits, planning, public works, municipal court and also serves as the Mill City Sheriff substation.

- City Hall: 444 SW 1st Avenue, Mill City, Oregon 97360 (503) 897-2302.
- Mill City Post Office: 101 SE Kingwood Avenue.

Strengths:

- City Hall may be utilized as a shelter or emergency response center.

Weaknesses:

- City Hall does not possess a backup diesel generator to power facility in the event of a power outage.

10.5.12 Environmental / Historical Preservation Sites

Mill City is surrounded by environmental preservation sites including state parks and designated wilderness areas. 50% of the housing stock in Mill City was built before 1950. The Hinkle-Reid house located at 525 NE Alder St. was built in 1916. It is the only structure in Mill City listed on the National Register of Historic Places. There are four other structures listed on the City's local historic resource inventory, including a wrought iron Phoenix column railroad bridge on timber trusses that crosses the North Santiam River at 1st Avenue in Mill City. The railroad bridge was originally constructed in 1888, and then moved up to Mill City in 1919. The bridge remained in railroad use until 1967 and was refurbished for pedestrian use in the mid - 1990's. The City of Mill City has created a recreational trail on the abandoned railroad right of way through the City, with the refurbished railroad bridge as its focal point. In 2019, the community repainted and refurbish the bridge to celebrate its centennial.

Strengths:

- Proximity to pristine state and federal land could attract residents or business.
- Buildings of historical significance are located within city limits.
- History and "timber" character provided by Mill City pedestrian bridge.

Weaknesses:

- Mill City bridge needs funding for restoration.

10.5.13 Education

Mill City is home to the Santiam Canyon School District. This district encompasses four cities in the Santiam Canyon including Mill City, Gates, Detroit and Idanha. All of the district's schools, the Early Childhood Center, the Santiam Elementary School, and the Santiam Jr./Sr. High School, are located in Mill City.

- Santiam Canyon School District, #129J
    - Santiam Early Childhood Center, 319 SW 3rd Ave, Mill City OR 97360
    - Santiam Elementary School, 450 SW Evergreen St. Mill City, OR 97360 (503) 897-2368
    - Santiam Jr./Sr. High School, 300 SW Cedar St. Mill City, OR 97360 (503) 897- 2311

Santiam Canyon School District has made several large upgrades in the last few years to update facilities, expand programming and square footage, and improve safety measures. This work has largely been paid for by the passage of a community voted school bond and through competitive state grants.

Santiam Elementary School has a locked campus with single entry point security, where patrons must be buzzed into the locked doors to enter the school. This campus now has a service facility for food and a new parking lot that nearly tripled the parking and made for better pickup and drop-off traffic flow.

Santiam Junior/Senior High School has seen significant change in the past few years. It, too, is a locked campus with single entry point security. The old high school was demolished and replaced with three new school buildings, modernizing the educational space, improving the learning environment, and adding a significant amount of new space. Along with the new school, an additional auxiliary gymnasium was added, to complement the existing large main gymnasium. Additionally, the existing gymnasium and auditorium were seismically retrofitted, adding them to our list of buildings that meet current life safety standards. All district buildings now meet current seismic standards for life safety.

Strengths:

- School facilities could be utilized to shelter a large amount of community residents including functional needs populations. Currently have an MOU with American Red Cross and Linn County for sheltering.
- School facilities already possess needed infrastructure for a shelter which includes restrooms, showers, and a kitchen.
- School buses could be utilized for transportation after a hazard event.

Weaknesses:

- There are no current agreements or MOUs between the city and school district to utilize facilities after a hazard event.
- There is no backup generator to heat, cool or prepare and store food in case of a power outage.

10.5.14 Healthcare and Public Health

Santiam Memorial Hospital operates a satellite medical clinic in Mill City. The clinic provides outpatient services for residents. The Mill City Pharmacy enables residents to fill prescriptions and purchase in-home medical supplies. The Santiam Memorial Hospital in Stayton and its adjacent medical clinics provide outpatient, surgery center, birthing services, and in-patient medical care.

- Santiam Medical Clinic, 280 S. 1st Ave. Mill City, Oregon

Strengths:

- A clinic with out-patient services exists within the community.

Weaknesses:

- No facilities with major life-saving equipment currently exist within city limits.
- Emergency health supplies are limited to what exists within the community.

10.5.15 Access and Functional Needs (Vulnerable Populations)

Mill City's vulnerable population consists of the elderly and those that are medically dependent and require life safety equipment. In 2020, 15% of Mill City's residents were elderly, 65 years of age or older (U.S. Census Bureau, 2022).

Strengths:

- Nearly 41.5% of residents are over the age of 45 based on 2020 American Community Survey data, this older populous can volunteer and promote cohesion in the community (U.S. Census Bureau, 2022).

Weaknesses:

- There are no assisted living or full-service medical care facilities to serve the aging population.

10.5.16 Plans and Policies

Table 10-3, City of Mill City Plans and Policies

Document	Year
Mill City Comprehensive Plan update	2015
Water System Master Plan	2003
Parks Master Plan	2014
Buildable Lands Assessment Update	2012

Table 10-4, City of Mill City Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Mill City		1,915		1,269	3		293,237,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	5	0.3%	17	0	4,876,531	1.6%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	126	6.6%	78	0	19,040,000	6.4%
Channel Migration	Channel Migration Zone	196	10%	72	0	25,451,000	8.5%
Wildfire	High and Moderate Risk	260	14%	171	2	38,745,652	13%
Lahar	Medium Zone (1000 to 15000 – Year)	1,604	84%	1,069	3	245,855	82%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Mill City RFPD – Main Station					X	X
Santiam Elementary					X	X
Santiam JR SR High School						X

10.6 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning8. This assessment method ranks the following factors to determine risk from the range of natural hazards identified:

1. Probability (frequency) of event.
2. Magnitude of event.
3. Expected warning time before event.
4. Expected duration of event.

The table below shows the scoring values for each ranking category.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings for the City of Mill City is presented below.

Hazard Profile Summary **City of Mill City** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Wildland Interface Fire	3.5	3	3.5	3.5	3.4	**High**
Severe Weather/Storm	4	1.5	3	3.5	3.3	**High**
Extreme Weather - High Temperature	3.5	1	3	4	3.0	**High**
Drought	3	1	3	4	2.8	**Moderate**
Earthquake	2	4	3	4	2.8	**Moderate**
Landslide	2	4	2	3	2.4	**Moderate**
Flood*	1	2	3	3	2.0	**Moderate**
Volcanic Eruption	1	1	3	3	1.8	**Low**
Avalanche**	1	4	1	1	1.5	**Low**
Tornado***	1	1.5	1	1	1.1	**Low**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and the City of Mill City on March 25, 2022. *Including dam failures; **New in 2021; ***Split out from Severe Weather in 2021.*

Table 10-5, City of Mill City Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Mill City** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Hazardous Materials Release - Transportation	3	4	3	3.5	3.2	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Public Health	3	1	3	4	2.8	**Moderate**
Chemical, Biological, Radiological, Nuclear, Explosive	1	4	4	4	2.7	**Moderate**
Cyberterrorism	2	4	2	4	2.5	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2	4	2.5	**Moderate**
Hazardous Materials – Non-Transportation	2	4	2	4	2.5	**Moderate**
Unauthorized Entry	2	4	2	3	2.4	**Moderate**
Agricultural Terrorism	1	1	3	4	1.9	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and the City of Mill City on March 25, 2022.

10.7 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Mill City. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to Mill City, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

10.7.1 Avalanche

CPRI = 1.5, Risk Level: Low

Events: N/A

Vulnerability: None

10.7.2 Drought

CPRI = 2.8, Risk Level: Moderate

Events: Governor Kate Brown declared a drought emergency for all of Marion County in September 2015.

Vulnerability: Dryer conditions in the summer months have impacted the North Santiam Canyon as a whole, including the area around Mill City. During the 2015 drought, 2019 wildfires and 2020 extreme heat, many trees and vegetation died off which created increased risk of wildfire hazards.

10.7.3 Earthquake

CPRI = 2.8, Risk Level: Moderate

Events: Mill City experienced a crustal earthquake on August 19, 1961. A 4.5 magnitude earthquake struck 6 miles from Mill City, with shaking felt throughout the Santiam Canyon, up to Detroit.

Figure 10-1, Cascadia Earthquake Expected

Events: Mill City experienced a crustal earthquake on August 19, 1961. A 4.5 magnitude earthquake struck 6 miles from Mill City, with shaking felt throughout the Santiam Canyon, up to Detroit.

Vulnerability: If another larger and more substantial earthquake occurs (i.e., Cascadia), Mill City is expected to experience damage to buildings, utility (electric power, communications, water, wastewater, natural gas) and transportation systems (roads, bridges, pipelines),

10.7.4 Flood

CPRI = 2.0, Risk Level: Moderate

Events: None since 2017.

Historically, Mill City experienced minor flooding events in 1964 and 1996. This was due to a specific weather pattern named "pineapple express", which blows warm, moist air from the southwest into the Pacific Northwest.

Vulnerability: The City of Mill City is located approximately 10 miles downstream of the Big Cliff and Detroit dams. The U.S. Army Corps of Engineer regulates water levels behind the dams and manages discharges to prevent downstream flooding. Therefore, the N. Santiam River near Mill City rarely sees more than minor flooding.

The City's drinking water is pulled from an aquifer, and thus, high and dirty river levels do not impact those facilities.

10.7.5 Landslide

CPRI = 2.4, Risk Level: Moderate

Events: None since 2017.

Historically, Mill City has not experienced major impacts from landslides within city limits. Areas near Hwy 22 and the northern edge of the city are more susceptible to this hazard because of steep slopes. Debris flows can occur in the Snake/Deford creek channels, as they did in the 1964 flood event.

Vulnerability: Potential landslide-related impacts are adequately described within the county's plan, and include infrastructural damage, economic impacts due to isolation and/or arterial road closures, property damage, and obstruction to evacuation routes.

10.7.6 Volcano

Hazards from volcanic eruptions include both ash and lahar.

Events: None since 1980, which was the year of the Mount St Helens eruption.

Vulnerability: Mill City has not been impacted previously by volcanic activity, and the city would have 6 to 12 hours before ash from an eruption of Mt. Hood or Mount Jefferson impacted the community; impacts could last more than a week.

The city's risk of damage from a lahar following an eruption of Mt. Jefferson is substantial. Most of the 350,000 residents in the county are not exposed to the Lahar hazard, but the hazard poses significant concerns for those closer to Mount Jefferson and those within the distal riverine valley. The communities most threatened from a volcanic eruption and lahar event are Gates, Detroit, Idanha, and Mill City.

10.7.7 Wildfire

Events: September 2020, the Beachie Creek fire burned 193,565 acres of land in Linn, Marion and Clackamas counties including portions of the City of Mill City.

Vulnerability: During the wildfire, evacuation routes were restricted due to wildfire movement. Following the wildfire, the impact of smoke and poor air quality affected residents who remained in the area. Long term impacts to the local economy persist. Marion County updated the Community Wildfire Protection Plan (CWPP) in 2023, which mapped wild land urban interface areas and developed actions to mitigate wildfire risk. The city is a participant in the CWPP and has included hazard mitigation action items in this plan that are directly in line with the CWPP actions.

10.7.8 Severe Weather

Windstorm

Events: September 2020, strong easterly wind was one of the principal factors in the speed with which the wildfires spread across the foothills of the Cascades.

Vulnerability: About once or twice per year the city will experience a windstorm event that can interrupt services, down trees, and cause power outages. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Winter Storm (Snow/Ice)

Events: Not reported during assessment

Vulnerability: Ice storms can down power lines and can cause the city to lose power for 2-3 days. In 2014, a similar storm knocked down tree's and caused hazardous road conditions. These types of storms are more frequent and usually cause transportation issues and communication failures from phone lines downed by falling trees and icy/snow filled roads.

10.8 Mitigation Strategy

This section of the HMP addendum addresses 44 CFR 201.6(c)(3(iv), *Mitigation Strategy*. During the 2022 HMP update, the Mill City representative and DLCD Natural Hazards Planner,

Katherine Daniel evaluated the Action Items noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time. In 2016, Mill City developed a list of two priority actions (Table A-1 in the prior plan).

The first of these priority actions was completed. Review the Natural Resource Chapter of the Comprehensive plan document and modify policies to reflect new hazard information.

The second of the 2016 priority actions were retained and revised to develop a more comprehensive energy assurance plan. These include Multi-hazard Action Items #MH 3 and MH 8.

10.8.1 Priority Actions

Priority Actions for the 2022 Mill City HMP Addendum center around ensuring that power is available to run an emergency refuge or shelter, maintain city water and

wastewater service using generators and fuel stored locally to address the needs of citizens in the event of an Excessive Heat emergency, when there are pre-emptive power shut-offs due to high wildfire hazard and high wind events.

The table below (Table,10-6) lists all mitigation action items and identifies a whether the action is in-progress, Started, or not started.

Many actions are carried forward from prior versions of the Marion County HMP and other local planning documents including the Community Wildfire Protection Plan, Drought Contingency Plan, and Mid-Willamette Economic Development study. Notably, given the location of Mill City, collaboration with both Marion County and Linn County will be required during the implementation process.

Table 10-6, Mill City Mitigation Action Items

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-EQ-1	Earthquake	Promote Great Oregon Shakeout Awareness month in October. Participate in activities for schools, business, and industry. Participating with the Mid- Willamette Emergency Communications Collective on initiatives that are focused on household preparedness.	H	Annually	Staff Time	Mill City	In-progress
2022-EQ-2	Earthquake	Collaborate with GROW EDC to develop relevant public- private partnerships with businesses that can contribute to response and recovery. (Multi-Hazard 6-9)	M	1-3 Years	Staff Time	Mill City	In-progress
2022-MH-1	Multi-Hazard	Develop an Energy Assurance Plan. (Multi-Hazard 2-4)	L	1-3 Years	Staff Time	Mill City	In-progress
2022-MH-2	Multi-Hazard	Develop and better utilize early warning system with possibly using multiple siren towers and PA system.	M	1-3 Years	TBD	Mill City	New
2022-MH-3	Multi-Hazard	Evaluate the diesel generation power needed for critical city facilities. Acquire a mobile backup diesel generator, trailer, and necessary generator hookups, capable of powering city facilities and fueling stations for a minimum of 3 days.	M	1-3 Years	TBD	Mill City	In-progress
2022-MH-4	Multi-Hazard	Develop diesel storage near Kingwood Wells #1 & #2 to support the generator for a minimum of 3 days.	H	1-3 Years	TBD	Mill City	New
2022-MH-5	Multi-Hazard	Assess the short and long term needs for sheltering access and functional needs populations for all hazards.	M	1-3 Years	Staff Time	Mill City	New
2022-MH-6	Multi-Hazard	Obtain portable generator and necessary electrical hookup for School District to power gym's cooling/heating & cafeteria.	L	1-3 Years	TBD	Mill City	New
2022-MH-7	Multi-Hazard	Develop and MOU with Canyon Senior Center for cooling/heating station during and after hazard event.	L	1-3 Years	TBD	Mill City, Canyon Senior Center,	New

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-8	Multi-Hazard	Develop and MOU with Santiam Outreach Community Center (SOCC) for cooling and Heating during hazard events	L	1-3 Years	TBD	Mill City, Santiam Outreach Community Center	New
2022-MH-9	Multi-Hazard	Develop a MOU with the Santiam School District to utilize generator and facilities for refuge or sheltering of residents during a hazard event.	L	1-3 Years	TBD	Mill City	New
2022-MH-10	Multi-Hazard	Develop a MOU with First Student to utilize buses during/after hazard events	L	1-3 Years	TBD	Mill City	In-progress
2022-MH-11	Multi-Hazard	Establish a Mill City CERT team.	L	1-3 Years	Staff Time	Mill City	New
2022-MH-12	Multi-Hazard	Develop a community education program - such as an all-hazard community outreach forum for students and residents. *	L	1-3 Years	Staff Time	Mill City	Retained
2022-MH-13	Multi-Hazard	Expand auxiliary radio capabilities by developing a team of HAM Radio operators for EMS and interested public.	L	1-3 Years	Staff Time	Mill City	New
2022- MH-14	Multi-Hazard	Explore need for 'Opt-In' form on City website for those in need of help in evacuating, along with all needed equipment (walkers, wheelchairs, oxygen	L	1-3 Years	Staff Time	Mill City	New
2022-MH-15	Multi-Hazard	Explore & create MOU for early warning system for all citizens using School District parent/student notification program. Email, phone, text.	L	1-3 Years	Staff Time	Mill City	New
2022-MH-16	Multi-Hazard	Obtain portable electronic signs for evacuation routes. Create MOU with Chamber of Commerce to place evacuation routes on electronic reader board on Hwy 22 Same with Santiam School District for electronic reader board at City Hall.	L	1-3 Years	TBD	Mill City	New

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-DR-1	Drought	Monitor economic impacts on recreation, tourism, and agriculture communities.	M	1-5 Years	NA	Mill City	In-Progress
2022-FL-1	Flood	Create partnerships and strategic plans with NSWC to facilitate riparian habitat restoration projects in flooding or erosion prone areas (e.g., Areas subject to reoccurring flood events –Elizabeth, Cedar, Deford, and Snake Creeks.)	M	1-5 Years	Staff Time	Mill City / Marion County Environmental Services	In-Progress
2022-DR-2	Drought	Collaborate with NSWC to complete WMCP's and improve community understanding of water usage and opportunities to increase efficiencies.	M	1-5 Years	Staff Time	Mill City	In-Progress
2022-MH-17	Multi-Hazard	Repair retaining wall on North Santiam Riverbank and develop recreational access dock to leverage retaining wall repair costs.	M	1-5 Years	TBD	Mill City	In-Progress
2022-MH-18	Multi-Hazard	Designate evacuation routes outside of Hwy 22 for EMS. Add flood warning signs.	M	1-5 Years	TBD	Mill City	In-Progress; Flood signs installed
2022-MH-19	Multi-Hazard	Collaborate with Marion County to connect to a more resilient regional water/sewer system.	M	1-5 Years	TBD	Mill City	In-Progress
2022-MH-20	Multi-Hazard	Gather community support for the installation of resilient fiber communication infrastructure throughout the community.	M	1-5 Years	TBD	Mill City	In-Progress to be completed in 2022 Q1.
2022-WF-1	Wildfire	Collaborate with Detroit Ranger District, ODF, and BLM to conduct fuel hazard reduction along the Wildland Urban interface.	H	1-5 Years	TBD	Mill City	In-progress

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-WF-2	Wildfire	Collaborate with ODF and Mill City RFD to develop strategic community fuel breaks along Hwy 22, Sitcum road, and Bud Long.	H	1-5 Years	TBD	Mill City	In-progress
2022-LS-1	Landslide	Integrate new DOGAMI landslide hazard information into land use zoning/development codes.	L	1-5 Years	Staff Time	Mill City	In-Progress

Source: City of Mill City

11 City of Mt. Angel Addendum

11.1 Purpose

This document serves as the City of Mt. Angel's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Mt. Angel to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

11.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including the City of Mt. Angel, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Mt. Angel will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Mt. Angel joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on October 5, 2021. On October 13, 2021, City of Mt. Angel Chief of Police and Interim City Manager, Mark Daniel, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the City of Mt; Angel that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on July 7, 2022, to update this addendum.

The City of Mt. Angel staff attended HMP Steering Committee meetings on August 3, 2021, October 5, 2021, November 21, 2021, December 7, 2021, March 1, 2022, April 5, 2022, May 4, 2022, June 7, 2022, and July 5, 2022, and promoted the HMP survey and outreach efforts throughout the plan update. The city staff encouraged public input on the NHMP through presentations to the city council to inform the public about the NHMP update process in the City of Mt. Angel.

11.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

11.4 Community Profile

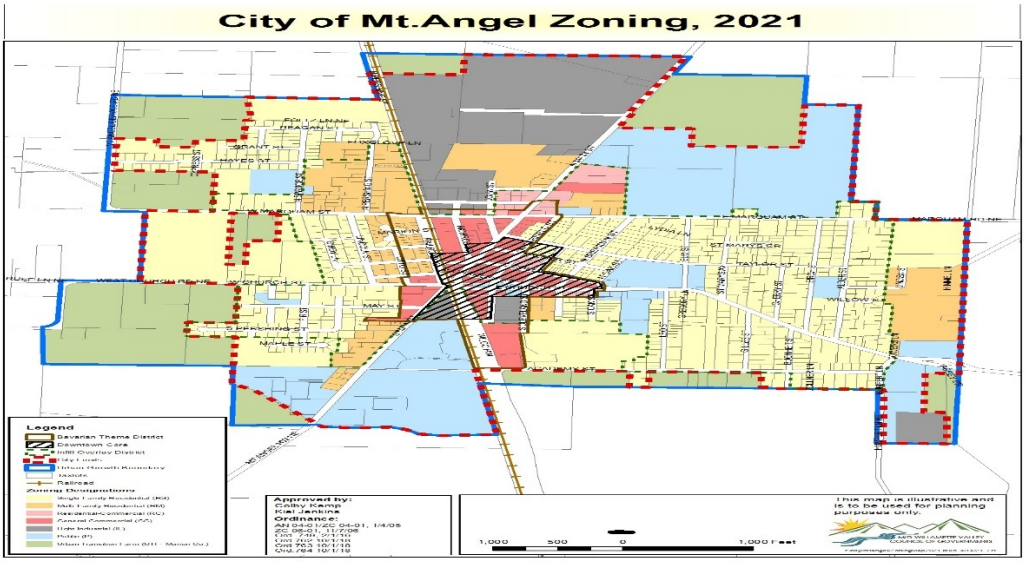
This section provides information on city specific assets and populations. For additional information on the characteristics of the City of Mt. Angel, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

11.4.1 Community Characteristics

Mt. Angel is a small community of about 3,392 people in 2020, approximately eighteen miles northeast of Salem. Indians had worshipped on the butte, called Tapalamaho, for generations, traveling from Klamath country to the southeast and from east of the Cascades. The first white settlers in the area included William and Jane (Graves) Glover, in 1847, and Benjamin and Rachel (Tompkins) Cleaver in 1850.

The considerable German influence in Mt. Angel is evident in its Bavarian-style storefronts and in its boast that it has the largest Glockenspiel in the United States. The town's four-day Oktoberfest, held every year since 1966, is the largest folk festival in the Northwest. Mt. Angel's economy is based on both agriculture and industry. Farmers grow berries, Christmas trees, seeds, and grain crops, and several businesses operate in the industrial zone next to the Southern Pacific line (Oregon Encyclopedia, 2022).

Figure 11-1, City of Mt. Angel



11.5 Critical and Important Facilities

Mt. Angel's critical and important facilities include the following:

11.5.1 Transportation

Road	Owner	Notes
OR-214	ODOT	Runs North South through the city
Mt. Angel Hwy NE	County	Enters city from the southwest
Railroad	Willamette Valley	The rails are located next to the Mt. Angel Fire District's main fire

11.5.2 Energy

- Electric service provided by Portland General Electric.
- Gasoline is available at Pacific Pride cardlock station and at 76 gas station.
- Generators: City Hall has a diesel-powered generator for emergency backup use.

11.5.3 Communications

Telephone communications consist of landlines, and cell service provided by Verizon, AT&T and T-Mobile. Internet service is provided by Direct Link.

11.5.4 Water / Wastewater

- **Drinking Water**: The city's drinking water source is groundwater from two active wells through the distribution system. The distribution system is comprised of over twenty miles of pipe, nearly 1,000 valves, as well as two reservoirs that total over 1.3 million gallons of storage capacity. The City does not treat its water and provides a required annual water quality report.
- **Wastewater**: The Wastewater Treatment Facility is located west of Mt. Angel Gervais Road west of the urban growth boundary. The facility is equipped with emergency power fueled by natural gas.
    - The treatment plant consists of a headworks, three facultative lagoons and a polishing wetland. Wastewater is conveyed to the Wastewater Treatment Facility through a gravity collections system comprised of nearly 13.3 miles of pipe, ranging from 6 inches up to 24 inches, as well as approximately 260 manholes.
    - Wastewater is stored in the lagoons during the summer months and is treated and discharged to the Pudding River during the winter months, starting in November based on a discharge permit from the Oregon Department of Environmental Quality. Daily flows into the facility average approximately .5 million gallons a day, total wastewater storage capacity is approximately 86 million gallons, and typical discharge rates being between 1.1 and 4.2 million gallons per day.

11.5.5 Emergency Services

- The Emergency Operations Center would be located in the library/community center as a primary location with the Fire Station providing a back-up location.
- Medical services are available from the Legacy Clinic.
- The city can provide emergency shelter, cooling & warming as appropriate in the library/community center.

11.5.6 Cultural / Historical

Mt. Angel attracts visitors to the historic buildings in town and to events and festivals including the 4th of July the Bach Festival at the Abby in the Spring, Octoberfest in October and in December a Hazelnut Festival is held annually.

11.5.7 Functional and Access Needs (Vulnerable Populations)

- Schools/Day Care: The city holds several day care facilities, an elementary, middle, and high school.
- Non-English speakers are among the residents of Mt. Angel some of whom are farm workers.
- Seniors and Retired people reside in Mt. Angel in the 3 facilities in the city.

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

11.6 Plans and Policies

Table 11-1, Plans and Policies of the City of Mt. Angel

Document Name with Hyperlink if the document is available online	**Year**
Emergency Operations Plan	2021
Comprehensive Plan	Acknowledged 1987; most recently amended 2013
Transportation System Plan	2003
Stormwater Master Plan	2011
Wastewater Facilities Plan	2014
Water System Master Plan & Water Management and Conservation Plan	2010
Parks Master Plan	2009, updated most recently 2011

Table 11-2, Mt. Angel Hazard Profile

Community Overview				
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)
Mt. Angel	3,520	1,219	7	539,815,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	613	17%	553	1	197,469,572	37%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	2	0	87,000	0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
John F Kennedy SR High School		X				
Mount Angel Fire Department						
Mount Angel Police Department *						
Mount Angel Public Works						
Mt Angel Middle School						
Silverton - Mt Angel Family Medicine						
St Mary's Public School						

*Source: (Williams & Madin, 2022); * The DOGAMI Risk Report for Mt. Angel may not have considered that this building was constructed in the early 1900's and there are cracks in the building. The back half of the building that held fire trucks was*

remodeled but no seismic upgrades were made to the structure. There are two large HVAC units on the roof. The source of this information is Chief Mark Daniel, Interim City Manager and Police Chief.

11.7 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning[4]. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event
2. Magnitude of event
3. Expected warning time before event
4. Expected duration of event

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 11-3, Mt. Angel Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Mt. Angel including Mt. Angel Fire District** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Earthquake	3	4	4	4	3.6	**High**
Severe Weather/Storm	4	2	3	4	3.4	**High**
Wildfire	3	3.5	3	4	3.2	**High**
Extreme Weather - High Temperature	3	2	3	4	3.0	**High**
Drought	3	1	3	4	2.8	**Moderate**
Tornado*	2	4	3	4	2.8	**Moderate**
Volcanic Eruption	2	1	3	4	2.4	**Moderate**
Flood**	2	1	2.5	3	2.1	**Moderate**
Landslide	1	1.5	1	3	1.3	**Low**
Avalanche***	1	1	1	1	1.0	**Low**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and Mt. Angel on October 13, 2021. *Split out of Severe Weather in 2021; **Includes dam failure; ***New in 2021.*

Table 11-4, Mt. Angel Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Mt. Angel including Mt. Angel Fire District** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Cyberterrorism	3	4	4	4	3.6	**High**
Hazardous Materials – Non-Transportation	3	4	4	4	3.6	**High**
Unauthorized Entry	3	4	4	4	3.6	**High**
Fire - Residential / Commercial (Arson)	4	4	2	4	3.4	**High**
Public Health	3	4	3	3	3.2	**High**
Hazardous Materials Release - Transportation	2	4	4	4	3.1	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Agricultural Terrorism	2	1	3	4	2.4	**Moderate**
Chemical, Biological, Radiological, Nuclear, Explosive	2	2	2	2	2.0	**Moderate**

Source: Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and Mt. Angel on October 13, 2021.

11.8 Hazard Characteristics

11.8.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: None during the past five years.

Vulnerability: Probability, Warning Time, Magnitude and Duration are anticipated to be low.

11.8.2 Drought

CPRI = 2.8, Risk Level: Moderate

Events: No specific drought related events over the past five years.

Vulnerability: Moderate. Although the duration of an event would exceed a week, the probability of an event is low due to the nature of the city's water source.

11.8.3 Earthquake

CPRI = 3.6, Risk Level: High

Events: A magnitude 4.0 earthquake occurred 5 km east of Scotts Mills on December 14, 2017. A magnitude 3.1 earthquake occurred 6 km SSE of Silverton on April 15, 2018. A 2.0 earthquake occurred 2 km ESE of Scotts Mills on July 26, 2018, and a magnitude 2.6 earthquake occurred 6 km ESE of Scotts Mills on April 1, 2020. Other smaller quakes occurred in the vicinity of Mt. Angel during the period since 2017.

The 1993 Scott Mills quake caused $28 million in damage to cities throughout Marion County.

Vulnerability: High. All four factors are ranked highly. The city's water system reservoirs and distribution system would be susceptible to breakage in an earthquake event.

11.8.4 Extreme Heat

CPRI = 3.0, Risk Level: High

Events: June 26-28, 2021, and August 11-12, 2021, saw temperatures over 116 degrees in Mt. Angel. 2021 event Temps over 116; many self-reliant minded folks, not as much use of the cooling in the library as might have.

Vulnerability: High. The city's residents were categorized by Chief Daniel as being self-reliant and not as many of them made use of the cooling center available in the library as might have done so.

11.8.5 Flood

CPRI = 2.1, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: Moderate.

11.8.6 Landslide

CPRI = 1.3, Risk Level: Low

Events: None during the past five years.

Vulnerability: Low due to the geographical location of the city away from steep slopes.

11.8.7 Severe Weather

CPRI = 3.4, Risk Level: High

Events: January 7-8, 2017, and February 11-13, 2021, were the dates of winter storms/ice storms that affected the northern Oregon Cascade foothills.

Vulnerability: High rankings of the factors of probability and duration. The city is vulnerable to the loss of power due to downed wires and to the loss of telephone communications and internet due to the loss of power. The city was without power for a week following the 2021 ice storm.

11.8.8 Tornado

CPRI = 2.8, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: Power and communications systems could be affected. Although the probability of an event is likely, the impact and warning time could be extreme.

11.8.9 Wildfire

CPRI = 3.2, Risk Level: High

Events: September 2020, the Beachie Creek fire burned 193,565 acres of land in Linn, Marion, and Clackamas counties. Although the Beachie Creek fire was within 7-10 miles of Mt. Angel, the city was not impacted by the fires directly. Wildfire smoke did affect the city's residents in 2020.

Vulnerability: High. High and moderately high rankings of all factors. The experience of the 2020 wildfires heightened awareness among residents of the limited warning time and the potential magnitude and length of the duration of an event.

11.9 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Jurisdiction Addendum update process, Oregon Department of Land Conservation & Development and Jurisdiction developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

11.9.1 Mitigation Actions

The table below (Table, 11.5) shows the City of Mt. Angel initial mitigation actions.

Table 11-5, City of Mt. Angel Mitigation Actions

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-1	Multi-Hazard	Obtain and install a generator to serve city hall.	H	1-3 Years	TBD	City of Mt. Angel	New
2022-EQ-1	Earthquake	Construct a new City Hall/Police facility	H	1-3 Years	TBD	City of Mt. Angel	New
2022-EQ-2	Earthquake	Evaluate and plan to improve aging water distribution system based on the Water System Master Plan & Water Management and Conservation Plan, 2010	H	3-5 Years	$10 million	City of Mt. Angel	New
2022-EQ-3	Earthquake	Evaluate and plan to improve aging wastewater collection and treatment facilities based on Wastewater Systems Facilities Plan, 2013.	H	3-5 Years	$7 million	City of Mt. Angel	New

Source: City of Mt. Angel HMP Steering Committee representative, July 2022.

12 Mt. Angel Fire District Addendum

12.1 Purpose

This document serves as the Mt. Angel Fire District's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Mt. Angel Fire District to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor— one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

12.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Mt. Angel Fire District, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the Mt. Angel Fire District will gain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The Mt. Angel Fire District joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on December 15, 2021. On January 13, 2022, Mt. Angel Fire District Jim Trierweiler, Fire Chief, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Katherine Daniel conducted a risk assessment meeting with the Mt. Angel Fire District that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on April 7, 2022, to update this addendum.

Mt. Angel Fire District staff was unable to attend regular HMP Steering Committee meetings due to scheduling conflict with standing fire district meetings. However, the Mt. Angel Fire District promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the district's Facebook page on April 8, 2022, and on the district's webpage prior to the May 4, 2022, public engagement focused Marion County HMP Steering Committee meeting.

12.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards."1 This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

12.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of Mt. Angel Fire District, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

12.4.1 Community Characteristics

The Mt. Angel Fire District is located in the heart of Marion County, Oregon, The Fire District is approximately 35 square miles with one fire station located in the City of Mt. Angel. The district is a force of approximately 36 volunteers, 5 part-time employees, and a Fire Chief.

The Mt. Angel Fire District, formerly known as "Mt. Angel Fire Department", was formed after the 23rd legislature incorporated Mt. Angel as a city in 1905 and Fred Schwab became the first Mayor. Mt. Angel had a fire department before the 1905 date (1890's) but 1905 was when the formal organization was put in place with a city government. Over the years the organization has changed many times, the Mt. Angel Rural Fire Protection District was formed in 1946 and contracted for fire protection from the City of Mt. Angel in 1947. In November of 2003, the decision was made to consolidate the City and Rural District into one.

12.5 Critical and Important Facilities

Mt. Angel Fire District's critical and important facilities include the following:

12.5.1 Transportation

Road	Owner	Notes
OR-214	ODOT	OR-214 runs approximately north-south through Mt. Angel from Silverton to the south and running north to connect to OR-99E
Railroad	Willamette Valley Railway	The rails are located next to the Mt. Angel Fire District's main fire station. The rail company occasionally parks rail cars full of compressed gas on the tracks. This has been a concern for Fire Chief.

12.5.2 Energy

- Portland General Electric provides electricity to the city and to the fire district.
- The Mt. Angel Fire District uses the local fueling stations and the commercial fuel provider Pacific Pride card lock fueling station to provide diesel fuel.
- During the last two winter storms that involved ice and snow, the fueling stations were impacted with the loss of power and the inability to pump the fuel.

12.5.3 Emergency Services

- Fire Station – The station is seismically retrofitted. It was built around 1994 with a metal roof, but the building is outfitted with a fire suppression sprinkler system. There are five double bays that hold 10 trucks, and there are four offices, a kitchen, and a general meeting room.

  The station might be considered for refuge or shelter, but it is not currently equipped for that use. The size of the station is a bit tight for a shelter, but the district is considering construction of a new storage structure that might be equipped as a shelter.

12.5.4 Communications

The district uses a Verizon hotspot that was set up during the 2021 ice storm which caused interruption of cell service due to power outage. The drawback to this communication method is that it serves only Verizon customers.

12.5.5 Functional and Access Needs (Vulnerable Populations)

Schools/Day Care: The district contains several day care facilities, an elementary, middle, and high school.

Non-English speakers are among the residents of Mt. Angel Fire District, some of whom are farm workers, Seniors and Retired people reside in Mt. Angel in the three facilities in the city. Vulnerability exists in housing where additional dwelling units are not constructed to building code. This can be a concern for migrant workers, low-income families, and people with compromised health (e.g., drug use).

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

12.6 Plans and Policies

The Mt. Angel Fire District is governed by a Board of Director. The district maintains a Strategic Plan, which, although it is not required, is an important method for the district to plan for future operations and resilience. It covers staffing, facilities, vehicles, and building maintenance considerations.

12.7 Hazard Profile

Table 12-1, Mt. Angel Critical Facilities

Community Overview				
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)
Mt. Angel	3,520	1,219	7	539,815,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	613	17%	553	1	197,469,572	37%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	2	0	87,000	0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
John F Kennedy SR High School		X				
Mount Angel Fire Department						
Mount Angel Police Department *						
Mount Angel Public Works						
Mt Angel Middle School						
Silverton - Mt Angel Family Medicine						
St Mary's Public School						

Source: Multihazard Risk Report for Marion County, DOGAMI, Williams, 2022.

12.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning3. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event
2. Magnitude of event
3. Expected warning time before event
4. Expected duration of event

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

A summary of the risk assessment findings and rankings is presented below.

Table 12-2, Mt. Angel Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Mt. Angel including Mt. Angel Fire District** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Earthquake	3	4	4	4	3.6	**High**
Severe Weather/Storm	4	2	3	4	3.4	**High**
Wildfire	3	3.5	3	4	3.2	**High**
Extreme Weather - High Temperature	3	2	3	4	3.0	**High**
Drought	3	1	3	4	2.8	**Moderate**
Tornado*	2	4	3	4	2.8	**Moderate**
Volcanic Eruption	2	1	3	4	2.4	**Moderate**
Flood**	2	1	2.5	3	2.1	**Moderate**
Landslide	1	1.5	1	3	1.3	**Low**
Avalanche***	1	1	1	1	1.0	**Low**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and Mt. Angel Fire District on April 17, 2022. *Split out of Severe Weather in 2021; **Includes dam failure; ***New in 2021.*

Table 12-3, Mt. Angel Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Mt. Angel including Mt. Angel Fire District** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Cyberterrorism	3	4	4	4	3.6	**High**
Hazardous Materials – Non-Transportation	3	4	4	4	3.6	**High**
Unauthorized Entry	3	4	4	4	3.6	**High**
Fire - Residential / Commercial (Arson)	4	4	2	4	3.4	**High**
Public Health	3	4	3	3	3.2	**High**
Hazardous Materials Release - Transportation	2	4	4	4	3.1	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Agricultural Terrorism	2	1	3	4	2.4	**Moderate**
Chemical, Biological, Radiological, Nuclear, Explosive	2	2	2	2	2.0	**Moderate**

Source: Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and Mt. Angel Fire District on April 17, 2022.

.

12.9 Hazard Characteristics

12.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: None during the past five years.

Vulnerability: Probability, Warning Time, Magnitude and Duration are anticipated to be low.

12.9.2 Drought

CPRI = 2.8, Risk Level: Moderate

Events: No specific drought related events over the past five years.

Vulnerability: Moderate. Although the duration of an event would exceed a week, the probability of an event is low due to the nature of the city's water source.

12.9.3 Earthquake

CPRI = 3.6, Risk Level: High

Events: A magnitude 4.0 earthquake occurred 5 km east of Scotts Mills on December 14, 2017. A magnitude 3.1 earthquake occurred 6 km SSE of Silverton on April 15, 2018. A 2.0 earthquake occurred 2 km ESE of Scotts Mills on July 26, 2018, and a magnitude 2.6 earthquake occurred 6 km ESE of Scotts Mills on April 1, 2020. Other smaller quakes occurred in the vicinity of Mt. Angel during the period since 2017.

The 1993 Scott Mills quake caused $28 million in damage to cities throughout Marion County.

Vulnerability: High. All four factors are ranked highly. The city's water system reservoirs and distribution system would be susceptible to breakage in an earthquake event.

12.9.4 Extreme Heat

CPRI = 3.0, Risk Level: High

Events: June 26-28, 2021, and August 11-12, 2021, saw temperatures over 116 degrees in Mt. Angel. 2021 event Temps over 116; many self-reliant minded folks, not as much use of the cooling in the library as might have.

Vulnerability: High. The city's residents were categorized by Chief Daniel as being self-reliant and not as many of them made use of the cooling center available in the library as might have done so.

12.9.5 Flood

CPRI = 2.1, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: Moderate.

12.9.6 Landslide

CPRI = 1.3, Risk Level: Low

Events: None during the past five years.

Vulnerability: Low due to the geographical location of the city away from steep slopes.

12.9.7 Severe Weather

CPRI = 3.4, Risk Level: High

Events: January 7-8, 2017, and February 11-13, 2021, were the dates of winter storms/ice storms that affected the northern Oregon Cascade foothills.

Vulnerability: High rankings of the factors of probability and duration. The city is vulnerable to the loss of power due to downed wires and to the loss of telephone communications and internet due to the loss of power. The city was without power for a week following the 2021 ice storm.

12.9.8 Tornado

CPRI = 2.8, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: Power and communications systems could be affected. Although the probability of an event is likely, the impact and warning time could be extreme.

12.9.9 Wildfire

CPRI = 3.2, Risk Level: High

Events: September 2020, the Beachie Creek fire burned 193,565 acres of land in Linn, Marion, and Clackamas counties. Although the Beachie Creek fire was within 7-10 miles of Mt. Angel, the city was not impacted by the fires directly. Wildfire smoke did affect the city's residents in 2020.

Vulnerability: High. High and moderately high rankings of all factors. The experience of the 2020 wildfires heightened awareness among residents of the limited warning time and the potential magnitude and length of the duration of an event.

12.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Mt. Angel Fire District Addendum update process, Oregon Department of Land Conservation & Development and Mt. Angel Fire District developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

12.10.1 Mitigation Actions

The table below (Table, 12.5) shows the City of Mt. Angel initial mitigation actions.

Table 12-4, Mt. Angel Fire District Priority Action Items

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-1	Multi-Hazard	Install a diesel generator on top of district fuel tank to power fire station and reservoir to fuel the apparatus.	H	1-3 Years	TBD	Mt. Angel Fire District	New
2022-MH-2	Multi-Hazard	Evaluate options for providing communication access to all citizens during power system outages.	H	1-3 Years	TBD	Mt. Angel Fire District	New
2022-WF-1	Wildfire	Install sprinkler system in Fire Station.	H	1-3 Years	TBD	Mt. Angel Fire District	New
2022-MH-3	Multi-Hazard	Consider the needs for shelter and refuge for natural hazard events and the equipment needed for those uses.	H	1-3 Years	TBD	Mt. Angel Fire District	New
2022-MH-4	Multi-Hazard	Purchase and install a reader board to provide timely information to the public.	H	1-3 Years	TBD	Mt. Angel Fire District	New

Source: Mt. Angel Fire District, April 7, 2022

13 City of Scotts Mills Addendum

13.1 Purpose

The purpose of the City of Scotts Mills Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP) is to guide the implementation of mitigation actions by the City of Scotts Mills to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

13.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including City of Scotts Mills, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Scotts Mills will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Scotts Mills joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on October 15, 2021. On January 6, 2022, City of Scotts Mills Clerk, Robin Fournier, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Katherine Daniel conducted a risk assessment meeting with the City of Scotts Mills that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on April 4, 2022, to update this addendum.

City of Scotts Mills staff attended HMP Steering Committee meetings on April 5, 2022, and May 4, 2022. The city promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the city's website and Facebook page to inform the public about the development of the Hazard Mitigation Plan update.

13.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

13.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of City of Scotts Mills, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix C, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

13.4.1 Community Characteristics

The City of Scotts Mills is located in the Willamette Valley in Marion County, Oregon, approximately 2 miles south of Marquam and Oregon Route 213, between Silverton and Molalla. The city takes its name from the sawmill and flour mill owned by Robert Hall Scott and Thomas Scott at this location, which became known as Scotts Mills in about 1866. The city has a total area of 0.36 square miles and is home to 399 people. Butte Creek flows just to the east of Scotts Mills as it makes its way north to join the Pudding River.

13.5 Critical and Important Facilities

City of Scotts Mills' critical and important facilities include the following:

13.5.1 Transportation

Road	Owner	Notes
OR-213E	ODOT	3.5 miles west of the city
Mt. Angel/Scotts Mills Rd.	Marion County	Runs east-west through the city
Crooked Finger Rd.	Marion County	Runs north-south on the eastern side of the city
3rd. Ave Bridge over Butte Creek at Mt. Angel Rd.	Marion County	Project started to replace the bridge with a tentative completion date in 2024.

13.5.2 Energy

Portland General Electric is the electricity provider to the city. A backup generator located at the city's water pumps and reservoir. Fuel is brought in by truck to the water system generator. Otherwise, the city residents must travel to get fuel from fuel locations in Silverton, as there are no fuel stations in the city. The city is interested in getting a backup generator for city hall (Mitigation action item).

13.5.3 Water / Wastewater

Water System: The city's water source is a well that supplies more water than the city uses. and the well is equipped with a backup generator. The water system also includes two reservoirs, the lower reservoir, and the upper reservoir. The upper reservoir is also equipped with a backup generator.

Wastewater: The city residents utilize on-site septic systems.

13.5.4 Dams

The cement and boulder dam located on Butte Creek at the Scotts Mills falls is decaying and slowly crumbling. Debris has fallen into the pool below and has become a hazard.

The Pudding River Watershed Council, with assistance from the Oregon Department of Fish and Wildlife, is proposing to demolish the dam to eliminate the safety hazard and to increase fish habitat and improve survival of threatened native salmon. Butte Creek is the native habitat for Endangered Species Act-listed Spring Chinook, and Winter Steelhead as well as Coho and Cutthroat Trout.

13.5.5 Communication

Zipply & Wave provide internet and phone services; and the city is served by all major cell service providers (AT &T, T-Mobile, Verizon), Satellite TV service.

Zipply has a substation located in Scotts Mills at 251 3rd St. near the location of the new bridge.

13.5.6 Emergency Services

Fire: Served by the Silverton Fire District which maintains a station in the city. Police: Served by the Marion County Sheriff's office

Public Works: The city does not have separate Public Works Department and city employees manage public infrastructure.

Medical: No facilities

Emergency Operations Center: City Hall serves as the EOC when needed. City Hall: Located at 265 4th Street.

The city does not have a community emergency response team or a shelter.

Emergency notification system is through the City Clerk and the multiple social media and website-based methods for notification employed by the city. The City of Scotts Mills is not taking up the Everbridge system.

13.5.7 Cultural/Historical Resources

The Historical Society is located at 210 Grandview and the historic Scott's house is located at 530 Crooked Finger Rd.

13.5.8 Functional and Access Needs (Vulnerable Populations)

- Schools/Day Cares: The city is located within the Silver Falls School District and contains the Scotts Mills Elementary School
- Non-English-speaking people comprise 5% of the population.
- A Food Bank located at 295 4th St.

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

13.6 Plans and Policies

Table 13-1, Plans and Policies of the City of Scotts Mills

Document Name with Hyperlink if the document is available online	**Year**
Comprehensive Plan	2013
Water Master Plan	2002

13.7 Hazard Profile

Table 13-2, City of Scotts Mills Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Scotts Mills		385		242	2		63,043,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	96	24.9%	118	0	16,983,461	26.9%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	234	61%	140	0	31,315,000	50%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	15	3.9%	7	0	1,280,323	2.0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
None Reported						

Source: Multi-hazard Risk Report, DOGAMI, Williams, 2022.

13.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning2. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event
2. Magnitude of event
3. Expected warning time before event
4. Expected duration of event

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 13-3, City of Scotts Mills Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Scotts Mills** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Earthquake	4	4	4	4	4.0	**High**
Wildfire	4	3.5	4	4	3.9	**High**
Severe Weather/Storm	4	3	4	4	3.9	**High**
Landslide	3	4	4	4	3.6	**High**
Tornado*	2	4	4	4	3.1	**High**
Flood**	3	2	2	4	2.7	**Moderate**
Extreme Weather-High Temperature	3	1	2	3	2.4	**Moderate**
Drought	2	1	3	4	2.4	**Moderate**
Volcanic Eruption	2	2	2	4	2.2	**Moderate**
Avalanche***	1	1	1	4	1.3	**Low**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and City of Scotts Mills on January 6, 2022. *Split out of Severe Weather 2021; **Includes dam failure; ***New to 2022)*

Table 13-4, Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Scotts Mills** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Cyberterrorism	3	4	3.5	4	3.4	**High**
Public Health	3	2	3	4	3.0	**High**
Fire - Residential / Commercial (Arson)	2	4	3	4	2.8	**Moderate**
Unauthorized Entry	2	4	3	4	2.8	**Moderate**
Chemical, Biological, Radiological, Nuclear, Explosive	1	4	4	4	2.7	**Moderate**
Hazardous Materials Release - Transportation	1	4	3	4	2.4	**Moderate**
Terrorism/Active Shooter/Workplace Violence	1	4	3	4	2.4	**Moderate**
Agricultural Terrorism	1	4	2.5	4	2.2	**Moderate**
Hazardous Materials – Non-Transportation	1	1	1	1	1.0	**Low**

Source: Marion County Emergency Management and City of Scotts Mills, January 6, 2022

13.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to City of Scotts Mills. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to City of Scotts Mills, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

13.9.1 Avalanche

CPRI = 1.3, Risk Level: Low

Events: None during the past five years.

Vulnerability: Probability, Warning Time, Magnitude and Duration are anticipated to be low.

13.9.2 Drought

CPRI = 2.4, Risk Level: Moderate

Events: No specific drought related events over the past five years.

Vulnerability: Low; water supply is in a very productive well and two reservoirs. Although the duration of an event would exceed a week, the probability of an event is low due to the nature of the city's water source.

13.9.3 Earthquake

CPRI = 4.0, Risk Level: High

Events: A magnitude 2.0 earthquake occurred 2 km ESE of Scotts Mills on July 26, 2018. The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County.

Vulnerability: High. All four factors are ranked highly. The city's water system reservoirs and distribution system would be susceptible to breakage in an earthquake event. The city's structures were generally constructed prior to building codes that address seismic resilience and the magnitude of the event could be catastrophic.

13.9.4 Extreme Heat

CPRI = 2.4, Risk Level: Moderate

Events: June 26-28, 2021, and August 11-12, 2021, saw temperatures of 100 degrees or more.

Vulnerability: Moderate; the city is equipping the City Hall to serve as a cooling center. The probability of an event is ranked as likely and the duration of an event is estimated to continue more than a day, but less than a week.

13.9.5 Flood

CPRI = 2.7, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: Moderate. The city has limited exposure to flooding based on the FEMA flood maps. Butte Creek floodway may impact several structures adjacent to the river.

13.9.6 Landslide

CPRI = 3.6 Risk Level: High

Events: None during the past five years.

Vulnerability: High. The southern portion of the city is built on a landslide deposit. Probability of occurrence is ranked as likely, and all other factors are ranked very high.

13.9.7 Severe Weather

CPRI = 3.9 Risk Level: High

Events: January 7-8, 2017 and February 11-13, 2021 were the dates of winter storms that affected the northern Oregon Cascade foothills.

Vulnerability: High rankings of all factors. The city is vulnerable to the loss of power due to downed wires and to the loss of telephone communications and internet due to the loss of power. The city is prepared to continue water service by equipping its water system with generators and fuel for them.

13.9.8 Tornado

CPRI = 3.1, Risk Level: High

Events: None in the past five years.

Vulnerability: Power and communications systems could be affected. Although the probability of an event is likely, the impact and warning time could be extreme.

13.9.9 Wildfire

CPRI = 3.9, Risk Level: High

Events: September 2020, the Beachie Creek fire burned 193,565 acres of land in Linn, Marion, and Clackamas counties. Although the Beachie Creek Wildfire was within miles of Scotts Mills, the city was not impacted by the fires directly. Wildfire smoke did affect the city's residents.

Vulnerability: High rankings of all factors. The city is vulnerable due to a need for vegetation management. Dead and diseased trees in public rights of way need to be addressed as well as proper vegetation management to maintain defensible space on private property. The experience of the 2020 Beachie Creek fire heightened awareness among residents of the limited warning time and the potential magnitude and length of the duration of an event.

13.9.10 Volcanic Eruption

CPRI = 2.2, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: The city, which is approximately 50 miles away from Mt. Hood, would have limited time before ash from an eruption would impact the community; the impacts could last more than one week.

13.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and City of Scotts Mills Addendum update process, Oregon Department of Land Conservation & Development and City of Scotts Mills developed a list of mitigation actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

13.10.1 Mitigation Actions

The table below (Table 13.5) shows the City of Scotts Mills mitigation actions.

Table 13-5, City of Scotts Mills Priority Mitigation Action Items

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-WF-1	Wildfire	Development code revisions to address the vegetation management of public and residential property.	H	1-3 Years	General funds and grants	City of Scotts Mills	New
2022-MH-1	Multi-Hazard	Replacement of 3rd Street bridge over Butte Creek.	H	Unknown	TBD	City of Scotts Mills	New
2022-MH-2	Multi-Hazard	Water system updates – Replace the lower reservoir and connect lower portion of town to the upper reservoir.	H	3-5 Years	$750,000	City of Scotts Mills	New
2022-MH-3	Multi-Hazard	Secure a generator for City Hall to allow it to be used as a place for respite from high temperatures or wildfire smoke.	H	1-3 Years	TBD	City of Scotts Mills	New

Source: City of Scotts Mills addendum update interview, April 4, 2022

14 City of Stayton Addendum

14.1 Purpose

This document serves as the City of Stayton's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Jurisdiction to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

14.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including the City of Stayton, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Stayton will retain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Stayton joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on February 2, 2022. On January 11, 2022, City of Stayton Police Chief Dave Frisendahl, and City Manager – Interim Alissa Angelo, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Katherine Daniel conducted a risk assessment meeting with the city that included a Hazard Vulnerability Assessment ranking. City staff met again with DLCD on April 8, 2022, to update this addendum.

City of Stayton staff attended HMP Steering Committee meetings on August 3, 2021, March 1, 2022, April 5, 2022, and May 4, 2022. The city's staff promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the city's website and Facebook and Next-Door pages beginning on February 15, 2022, to distribute the plan update public survey to interested parties in the City of Stayton.

14.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce loses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

14.4 Community Profile

This section provides information on city-specific assets. For additional information on the characteristics of the City of Stayton, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city-specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

14.4.1 Community Characteristics

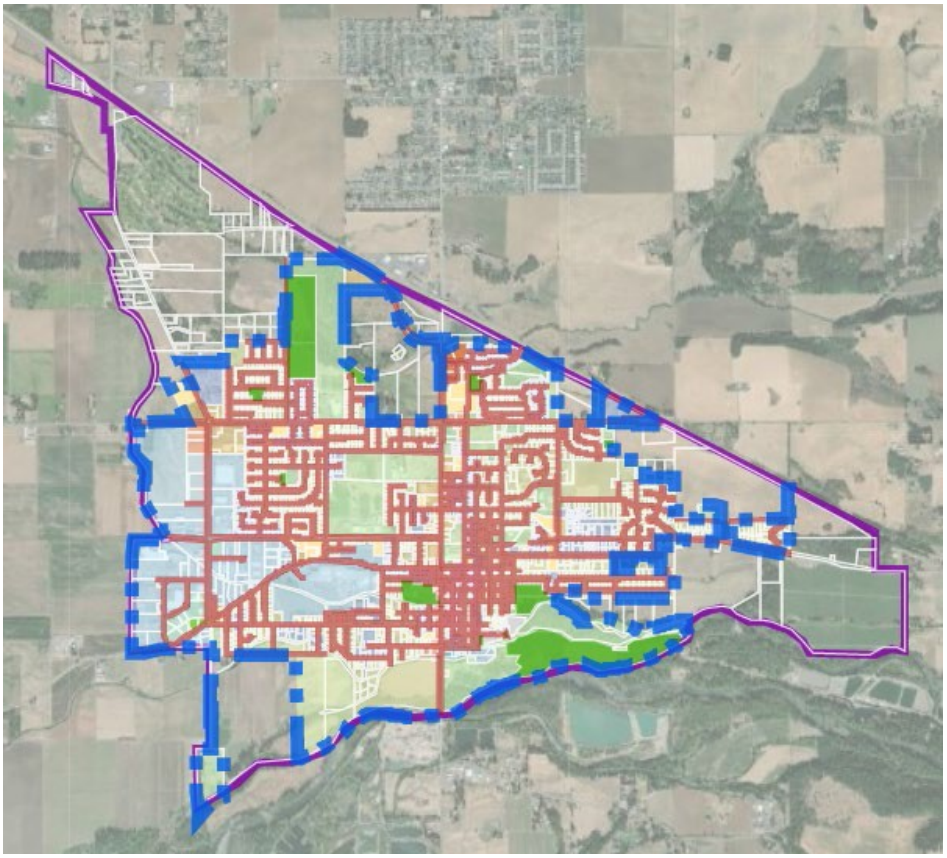
The City of Stayton is in Marion County, Oregon, at the confluence of the Santiam Canyon and Willamette Valley. Located roughly 15-miles east of Salem, the city is bordered to the north and east by Highway 22, the south and east by the Santiam River, and the west by agricultural lands. Stayton is in Oregon's Willamette Valley, which experiences a moderate climate. In August, the average high temperature is 82 degrees, and the average low temperature is 51 degrees. Wintertime temperatures in January range from an average high of 46 degrees to an average low of 33 degrees. The average annual precipitation is 39.9 inches. Stayton is relatively flat, except at the terminus of Santiam canyon in the northeast portion of the city.

The US Census lists Stayton's 2020 population at 8,244. This represents a 6.72% increase from 2015. For more demographic information, refer to Volume III, Appendix B, Community Profile

14.4.2 Economy

Stayton was founded as a mill city. Its location near a plentiful water source made it attractive for water-powered industry. Several mills, from timber to flour, operated in Stayton following its establishment. In the early part of the 20th century, Stayton transitioned to an emphasis on agricultural – the NORPAC Foods, Inc. processing plant is currently the city's largest employer. Today, Stayton benefits from a relatively diverse local economy. The average household income in Stayton is $41,432. For more economic information, refer to Volume III, Appendix B, Community Profile

Figure 14-1, City of Stayton Zoning Map



Source: City of Stayton, Oregon (staytonoregon.gov) Interactive Map on city website

14.5 Critical and Important Facilities

The City of Stayton's critical and important facilities include:

14.5.1 Transportation

Bridges

Table 14-1, Stayton Bridge Inventory

Stayton Bridge Inventory								
Water Body	Street	Owner	Inspection Date	Co-Located Utility				
				Sewer	Water	Electricity	Natural Gas	Telecomm
Salem Ditch	N. First Ave.	Stayton	8/10/2016	Yes	Yes	Yes	No	Yes
Salem Ditch	N. Second Ave.	Stayton	8/10/2016	No	No	No	No	No
Salem Ditch	N. Third Ave.	Stayton	8/10/2016	No	Yes	No	No	No
Salem Ditch	W. Washington St.	Stayton	8/10/2016	Yes	Yes	No	No	No
Stayton Ditch	N. Holly Ave.	Stayton	8/10/2016	No	Yes	No	No	No
Stayton Ditch	Jetters Way	Stayton	8/10/2016	Yes	Yes	No	No	No
Stayton Ditch	E. Water St.	Stayton	8/10/2016	No	No	No	No	No
Stayton Ditch	N. Fourth Ave.	Stayton	8/10/2016	No	No	No	No	No
Stayton Ditch	N First Ave	Marion	N/A	No	Yes	No	No	No
Salem Ditch	N Fourth Ave.	Stayton	N/A	No	No	No	No	No
Salem Ditch	N. Evergreen Ave.	Stayton	N/A	Yes	Yes	No	No	No
Salem Ditch	Wilco Rd.	Marion	N/A	Yes	Yes	No	No	No
Salem Ditch	UPRR	UPRR	N/A	No	No	No	No	No
Salem Ditch	Shaff Rd.	Marion	N/A	No	No	No	No	No
Mill Creek	Golf Club Rd.	Marion	N/A	No	No	No	No	No
Mill Creek	Cascade Highway	Marion	N/A	No	No	No	No	No

Source: City of Stayton

Note: Access to the water treatment plant requires crossing two bridges: 1 over the N Santiam R, 1 over the Stayton Canal. This could cause problems in the event of an earthquake that disables the bridges.

Note: Access to the wastewater treatment plant requires crossing two bridges: 1 bridge on Jetters Way and one bridge over Salem Ditch on Wilco Rd. This could cause problems in the event of an earthquake that disables the bridges.

Note: Pacific Power employees would have to cross three bridges to reach the Pacific Power plant.

Main Roads through Town:

- State Highway 22 (North Santiam Highway)
- Golf Club Rd/Wilco Rd.
- Stayton Rd./Washington Rd.
- 1st St/Cascade Hwy (leads to water treatment plant)
- Shaff Rd./Fern Ridge Rd.

Public Transit

- Cherriots Regional Transportation

14.5.2 Energy

Gasoline: Marc Nelson Oil Products (MNOP) local cardlock fueling center is the city's primary fuel source. It provides fuel when needed. The amount of diesel fuel needed during the 2020 wildfires increased to 8,000 gallons.

The county fuel assessment for 2022 reflects the Stayton Public Works Director's assessment of fuel needs for 190 gallons of unleaded fuel per week and 65 gallons of diesel fuel per week to run generators at the following locations for emergency service operation:

- Police
- Wastewater Treatment Plant
- Sanitary Sewer Collections
- Storm Sewer Collections
- Water Treatment Plant
- Water Collections

Police have a natural gas generator that won't run on any other fuel The Fire District has a generator.

Electricity: Pacific Power

Natural Gas: NW Natural

14.5.3 Water / Wastewater

Water:

Drinking Water – There is a current project underway to identify a backup water source.

- Source: N Santiam River via the Stayton Power canal.
- One shallow well – just supplemental
- There are a very small number of residents on wells.
- Water treatment plant from 1st Ave. utilizes slow sand filtration system.
- Water storage:
    - Pine St. = 1 million gallons
    - Regis St. = .5 million gallons
    - Old, decommissioned storage tank on Holly

Note: Stayton has access to Salem's system and can buy from Salem, if necessary, but there is no other water back-up source.

Note: There are pump stations throughout the city, the pump station lines would likely not survive an earthquake.

Wastewater:

- The wastewater treatment facility is located on Jetters Way which has a backup generator.
- Most of the sewer system is 50-year-old concrete pipe.
- Very, very few residents are on septic systems.
- NORPAC has its own wastewater treatment ponds on Jetter's Way.

14.5.4 Communications

Communication Towers:

- Regis St. Reservoir – Police, Sprint
- Pine St. Reservoir has cell antennas – Fire, T-Mobile
- High school athletic field cell tower – Verizon (with a generator)
- Cell tower south of Shaff and west of Wilco
- Backup tower on the Police Department

The city relies on cell phones to communicate.

Auxiliary radio access for Police (portable).

Landline – SCTC (Stayton Cooperative Telephone Company). Problems occur when Stayton Cooperative shuts down one portion of their service area; it typically impacts the city's system.

CERT has a radio system.

911 Communications, provided by METCOM, is old in the area. The city finds that they need the new county radio communication system to be implemented as soon as possible.

14.5.5 Emergency Services

Fire:

Stayton Rural Fire Protection District, 1988 W. Ida Street, Stayton, Oregon (503) 769-2601.

Police:

Police Department, 386 N. 3rd Ave. Stayton, Oregon (503) 769-3423.

Public Works:

City of Stayton, 311 N. 3rd Ave. Stayton, Oregon (503) 769-2919.

Municipal Services:

City Hall, 362 N. 3rd Ave. Stayton, Oregon (503) 769-3425.

Shelter: Community Center, 400 Virginia St. Stayton, Oregon (503) 769-2919.

Medical:

Santiam Memorial Hospital, 1401 N. 10th Ave. Stayton, Oregon (503) 769-2175.

14.5.6 Cultural / Historical Resources

Properties on the National Registry of Historic Places:

- Deitrich Building (3rd and Florence)
- Gehlens-Sims Building (2nd)
- The city has a preliminary listing of downtown buildings that would qualify for the national registry.

Properties:

- "The Brown House" Santiam Heritage Foundation (425 N. 1st Ave.)
- Library (515 N 1st Ave.)
- Community Center and City Swimming Pool (all next to library)

Events that may have large crowds:

- July: SummerFest and Car show– last Saturday of July, approx. 500 to 1,000 visitors
- July: 4th of July – 1,000-2,000 visitors
- July: Stampede – at Sublimity fair grounds (slight impact to traffic in town)
- September: Harvest Festival –at Sublimity fair grounds (slight impact to traffic in town)

14.5.7 Functional and Access Needs (Vulnerable Populations)

Schools – enrollment ~2,400:

Stayton High School (757 W. Locust St.)

Stayton Middle School (1021 Shaff Rd. SE)

Stayton Elementary School (875 N. 3rd Ave.)

Regis St. Mary's School (550 W. Regis St. and 1066 N. 6th Ave.)

Daycares/preschools:

Rise and Shine Day Care (2350 Martin Dr.)

Tree House Day Care (287 E Washington St.)

Tiny Hands Day Care (451 Hobson St.)

Highland Pre-school (1450 Fern Ridge Rd.) – First United Methodist Church

All Star Pre-school (975 Fern Ridge Rd.) – Foothills Church

Assisted living:

Brookdale Senior Living Solutions (2201 3rd Ave.)

Other Facilities:

Santiam Senior Center (41818 Kingston Jordan Rd.)

Apartment complexes for seniors:

Elder Manor (900 W Ida)

Stayton Manor (3rd and Washington)

Oak Apartment (10th and Santiam)

Additional Information:

Some Spanish-speaking residents, but most also speak English.

Stayton has a small Somali population, but most also speak English.

Low-income: 47% of Stayton's housing stock are rental properties.

Table 14-2, Government Subsidized Housing Developments from Stayton's Comprehensive Plan

Name	Location	# of Units	Type
Hollister Apartments	315 W Hollister St	20	family
Northridge Apartments	1633 N. 3rd Ave	24	family
Oak Park Village	1011-1087 N. 10th Ave	32	elderly
Stayton Elder Manor	660 N Ida St	32	elderly
Stayton Manor	820 N 3rd Ave	16	elderly
Westside Apartments	965 Gardner Ave	24	family
Wolf Ridge	1301-1371 E Santiam St	51	family

Source: Oregon Dept of Housing and Community Services

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

14.6 Plans and Policies

Table 14-3, Plans and Policies of the City of Stayton

Document Name	Year
City of Stayton Comprehensive Plan, Comp Plan Map	2021
Facilities Master Plan	2007
Local Wetland and Riparian Inventory	1999
Emergency Operations Plan	
Transportation System Plan – Vol 1, Vol 2	2004
Sublimity Interchange Area Management Plan	2006
Downtown Transportation and Revitalization Plan	2007, amended 2010
Park and Recreation Master Plan	2005
Water Master Plan	2006
Wastewater Master Plan	2006
Stormwater Master Plan	2009

Source: City of Stayton website, consulted June 2022 http://www.staytonoregon.gov/page/planning_master_plans.

Table 14-4, City of Stayton Hazard Profile and Critical Facilities

Community Overview				
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)
Stayton	7,880	3,043	12	1,546,547,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	1	0.0%	2	0	33,000	0.0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	62	0.8%	150	0	64,343,000	4.2%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	97	1.2%	32	0	13,290,000	0.9%
Channel Migration	Channel Migration Zone	866	11%	379	2	157,134,000	10%
Wildfire	High and Moderate Risk	50	0.6%	22	2	9,114,000	0.6%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Regis High School					X	
Santiam Memorial Hospital - Stayton						
St Mary's Catholic School						
Stayton Christian School						
Stayton City Shops						
Stayton Elementary School						
Stayton Emergency Services						
Stayton High School					X	
Stayton Middle School						
Stayton Police Department				X		
Stayton RFPD						
Stayton Water Treatment Plant				X		

14.7 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the HMP update team first updated the description, type, location and extent of each hazard. Next, the team updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event.
2. Magnitude of event.
3. Expected warning time before event.
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 14-5, City of Stayton Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Stayton** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Wildfire	4	4	3	4	3.7	**High**
Earthquake	3	4	4	4	3.6	**High**
Tornado*	3	4	3	4	3.3	**High**
Extreme Weather - High Temperature	3	1	4	4	3.1	**High**
Drought	3	1	3	4	2.8	**Moderate**
Severe Weather/Storm	3	2	2	3.5	2.6	**Moderate**
Flood**	3	1	2	3	2.4	**Moderate**
Volcanic Eruption	2	2	2	4	2.2	**Moderate**
Landslide	2	1	2	3	2.0	**Moderate**
Avalanche***	NA	NA	NA	NA	NA	**NA**

*Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and City of Stayton on April 8, 2022. *Split out of Severe Weather in 2021; ** Includes Dam failures; ***New in 2022*

Table 14-6, City of Stayton Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Stayton** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Fire - Residential / Commercial (Arson)	3	4	2	4	3.0	**High**
Hazardous Materials – Non-Transportation	3	4	2	4	3.0	**High**
Public Health Emergency (pandemic, water toxin)	4	1	2	4	3.0	**High**
Hazardous Materials Release - Transportation	3	4	2	3.5	2.9	**Moderate**
Agricultural Terrorism	2	1	4	4	2.7	**Moderate**
Unauthorized Entry	2.5	4	2	3	2.6	**Moderate**
Terrorism/Active Shooter/Workplace Violence	2	4	2	4	2.5	**Moderate**
Cyberterrorism	2	4	2	2	2.3	**Moderate**
Civil Disturbance	2	2	2	3.5	2.2	**Moderate**
Chemical, Biological, Radiological, Nuclear, Explosive	1	1	3	4	1.9	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and City of Stayton on April 8, 2022

14.8 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Stayton. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to the City of Stayton, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

14.8.1 Avalanche

Events: None

Vulnerability: Not ranked because there is no risk of this hazard in the City of Stayton.

14.8.2 Drought

CPRI = 2.8, Risk Level: Moderate

Events: Governor Kate Brown declared a drought emergency for all of Marion County in September 2015. Stayton was close to local drought conditions during that event.

Vulnerability: The probability of drought in Stayton is likely, the same as for the county. Stayton relies on surface water from the North Santiam River via the Stayton Power canal. Raw water is directed into the City's slow sand filtration system. Once treated, finished potable water is delivered to residential, commercial, and industrial customers through 44 miles of water distribution pipes. Stayton also maintains a shallow well for supplemental water supply. Finally, Stayton maintains an intertie with the City of Salem and can purchase water from Salem if needed. The city has a water curtailment plan that they never had to use.

14.8.3 Earthquake

CPRI = 3.6, Risk Level: High

Events: None in the past five years.

Vulnerability: Stayton's assessment of probability for a earthquake event without differentiating between a Crustal Earthquake event and a Cascadia Subduction Zone earthquake was "Likely" and their vulnerability to a Crustal Earthquake event was assessed as "Catastrophic".

An active earthquake fault located northwest of the city exists within five miles of the Stayton City Limit. Other active faults exist within ten miles to the west. The 1993 Scott Mills quake caused $28 million in damage to cities throughout Marion County.

The City of Stayton is working with Marion County to complete a seismic retrofit project on the North First Avenue (Stayton-Scio Road) bridge over the Santiam River. Stayton expects that this project will increase transportation redundancy, allowing travel north and south post-earthquake.

The Stayton steering committee identified earthquake damage to the downtown central business district as a primary concern. Most of the buildings are old and constructed of masonry. The City's police department is also at risk of collapsing during an earthquake. The City's priority actions reflect these concerns.

Additional local concerns include:

- Questions about the hospital's seismic condition. Historically, the city and hospital have had limited communication or coordination related the earthquake vulnerability.
- The police department is the highest priority critical facility for retrofit. Notably, it houses all the city's computers.
- Stayton Community Center is the primary EOC (400 Virginia); secondary location is at the old 911 dispatch center.
- Pacific Power building will probably be standing (Wilco Rd. south end, across from Circle K) – this is their back up center for what operates the whole northwest.

In 2007, the Department of Geology and Mineral Industries (DOGAMI) conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices, and other law enforcement agency buildings. Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within the City of Stayton, the following buildings received a "high" or "very high" probability of collapse:

- Stayton Elementary: high (> 10%)
- Stayton Middle School: very high (100%)
- Stayton High School: very high (100%)
- Stayton Police Department: very high (100%)
- Stayton Memorial Hospital: high (> 10%)
- Stayton Fire (west Ida): very high (100%)

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

14.8.4 Extreme Weather - Heat

CPRI = 3.1, Risk Level: High

Events: Several Extreme Heat events have occurred in Stayton and other areas of the Willamette Valley and Cascade foothills during the past five years.

8/9 thru 8/12/2021-Excessive heat; Hot weather began to develop August 9, peaking August 11-12, but temperatures continued above normal into the weekend. Peak afternoon temperatures of 100 to 105 degrees drove people to seek relief in or near bodies of water. Cooling shelters were opened in several counties.

6/26/2021-Excessive Heat; temperatures across the area warmed into the 100s to mid-110s over a three-day period. Record breaking temperatures up to 117 degrees were

recorded in Salem, OR. A total of 18 heat related deaths were reported, including two middle aged men who drowned in the Willamette River on Saturday, June 26.

8/1/2017-Excessive Heat; the record-breaking heat led people to seek relief at local rivers.

Vulnerability: The city's representatives ranked the magnitude of an Extreme Heat event as "Catastrophic" due to the limited use of air conditioning equipment by residents.

14.8.5 Flood (including dam failure)

CPRI = 2.4, Risk Level: Moderate

Events: None during the past five years.

Vulnerability: The city's probability for riverine flood is likely and their vulnerability to flood is limited. The city representatives for the City of Stayton are, however, concerned about the risks associated with dam failure.

Portions of Stayton have areas of flood plains (special flood hazard areas). These include areas along the Santiam River in the south and Mill Creek in the north. Overall, Stayton has relatively limited development in the mapped 100-year flood plain. However, the City's water and wastewater treatment plants are located adjacent to the Santiam River. Past flood events have threatened those critical facilities. The Santiam water treatment plant almost flooded during a 2006 flood event.

Stayton has two irrigation canals that go through town. Those canals have head gates that can be closed. However, those gates have been breached at least once during historical flood events (e.g., 1996). The city has successfully worked with the county to clear ditches along Shaff Road. This mitigation effort has reduced localized nuisance flooding through that corridor.

The Steering Committee specifically identified the following areas as subject to nuisance urban flooding:

- Silvan Springs subdivision has a small area of street that floods periodically, but the homes have not been impacted.
- Undersized storm pipes cause localized flooding issues throughout town.
    - Intersection of 6th and Pine is a prime example of this issue.

Figure 14-2, Special Flood Hazard Area

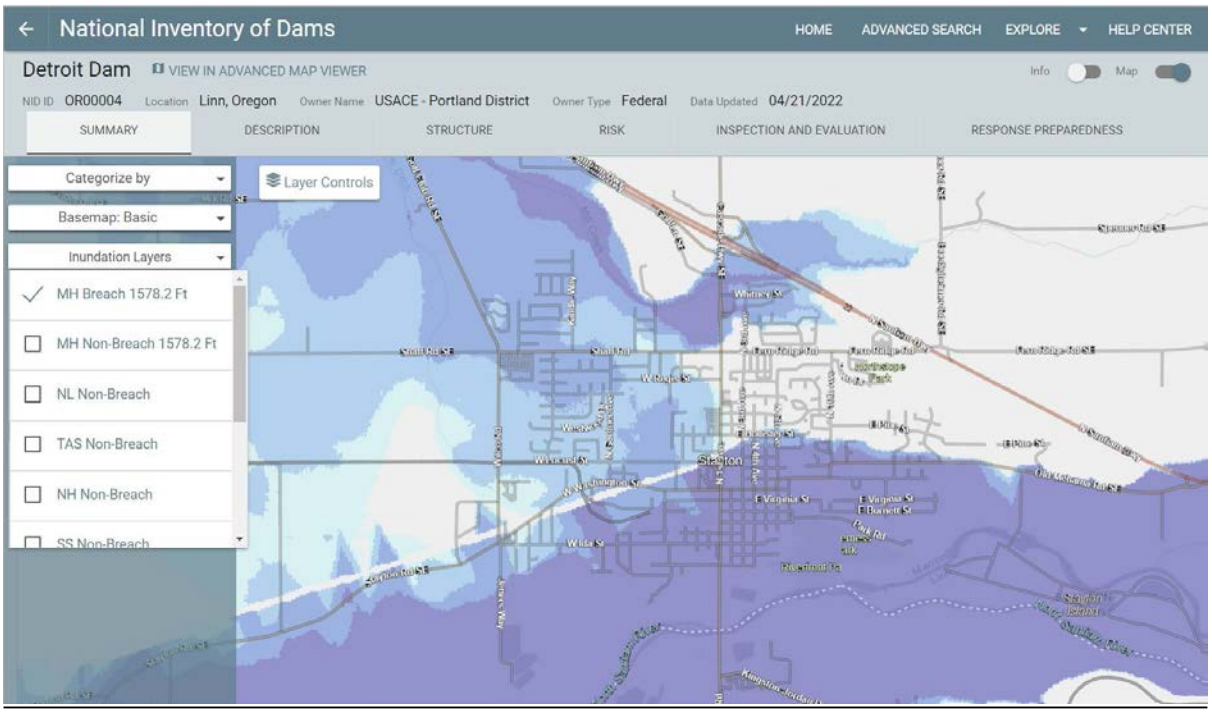


Source: [Oregon HazVu: Statewide Geohazards Viewer (DOGAMI)]

With respect to the risk of dam failure, the National Inventory of Dams is a resource that provides information on dams and inundation mapping for a range of scenarios. The image below (Figure 14-4) represents the inundation for a maximum height breach of the Detroit Dam, a sort of worst-case scenario. The city may consider the information contained in the NID for locating of new emergency response services.

The city has installed a siren on the water tower, however, whether the siren is functional is in question.

Figure 14-3, Inundation map from the National Inventory of Dams (Maximum Height Breach scenario for Detroit Dam)



Source: National Inventory of Dams, National Inventory of Dams (army.mil)

14.8.6 Landslide

CPRI = 2.0, Risk Level: Moderate

Events: None during the past five years.

Vulnerability: Stayton has a relatively flat topography, except for the area north of East Santiam Road at the terminus of Santiam Canyon. DOGAMI does not currently identify existing landslides on the statewide inventory in Stayton.

14.8.7 Severe Weather

CPRI = 2.6, Risk Level: Moderate

Events:

Windstorm: December 11, 2021, saw strong winds (gusts up to 60 mph) through the Willamette Valley. Several reports of downed trees and branches as well as power outages for thousands of customers.

Winter Storm: On January 7-8, 2017, a broad shortwave trough brought multiple rounds of precipitation, including a wintry mix of snow and ice for many locations across Northwest Oregon.

Ice Storm: February 11-15, 2021, Disaster Declared (DR-4599)

Vulnerability: The city's representatives assessed probability for severe weather events including windstorm and winter storms as highly likely and that their vulnerability to these Sever Weather events as "Limited" with durations of about a day. Once or twice per year

the city will experience a windstorm event that will interrupt services, experience downed trees, or cause power outages. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Major winter storms can and have occurred in the Stayton area. While these events do not typically cause significant damage, they are frequent and have the potential to impact economic activity. The most recent winter storms (December 2016 – January 2017) included snow and ice. Transportation and power interruptions combined with government office and school closures.

14.8.8 Tornado

CPRI = 3.3, Risk Level: High

Events: None in the past five years

Vulnerability: The city's representatives identified the probability of a tornado as "Likely" and the magnitude of the impact as "Catastrophic". With little warning and potential effects lasting more than a week, this hazard rated highly with the City of Stayton representatives.

14.8.9 Wildfire

CPRI = 3.7, Risk Level: High

Events: The City of Stayton experienced an influx of people who were forced to evacuate their homes due to the Beachie Creek fire in the Santiam Canyon during September 2020. This natural disaster was federally declared DR-4562 for Wildfire and Straight-line Winds and the Beachie Creek Fire was also declared a fire Management Assistance disaster FM- 5356-OR)

Vulnerability: Stayton has limited exposure to wildfire. Likely origination would be on agricultural lands outside the city limit or in wooded areas of Pioneer Park. Due to its location and limited fuels within the city, Stayton faces minimal risk of experiencing wildfires. There is no history of wildfire events in Stayton.

The County updated the Community Wildfire Protection Plan (CWPP) in 2016 and portions of Stayton are listed as having wildland urban interface (WUI) with areas of concern, see figure (14-5, City of Stayton-Wildfire Areas of Concern). depicts the areas near Stayton that the CWPP identifies as areas of concern. These areas were affected during the 2020 wildfires and should continue to be targeted for fire suppression activities.

14.8.10 Volcano Eruption

CPRI = 2.2, Risk Level: Moderate

Events: None in the past five years.

Vulnerability: The city's representatives determined that the city's probability for volcanic event is "Possible", and the magnitude of a volcanic event is "Limited", however the effects would last more than a week.

Stayton's location at the terminus of Santiam Canyon makes it susceptible to impacts from lahar flows originating at Mount Jefferson.

14.9 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and City of Stayton Addendum update process, Oregon Department of Land Conservation & Development and the City of Stayton representatives reviewed the list of priority and Action Item Pool actions. Relevant updates and new actions were developed to address the city's current priorities. These actions were reviewed internally by staff and by the city council during the plan development process.

14.9.1 Mitigation Actions

The table below (Table 14.7) shows the City of Stayton mitigation actions.

Table 14-7, City of Stayton Mitigation Actions (Note: The first 4 actions items are "Priority Actions")

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-FL-1	Flood	Upsize stormwater pipes at 6th and Pine, at the north end of Silvan Springs, and other streets with chronic localized flooding issues.	H	1-2 Years	Unknown	City of Stayton Public Works	Ongoing
2022-MH-1	Multi-Hazard	Assess the wastewater and water treatment plants' ability to function during different hazard scenarios and begin to mitigate issues. This could include assessing and gathering supplies that will allow the plants to operate under emergency conditions and upgrading the facilities, so they are more resilient.	H	1-2 Years	Unknown	City of Stayton Public Works	Ongoing
2022-EQ-1	Earthquake	Purchase two portable temporary bridges to facilitate redundant transportation access to the wastewater treatment plan (via Wilco Rd. and Jetters Way) and downtown (via N. First Ave.).	H	1-2 Years	TBD	City of Stayton Public Works	Ongoing
2022-EQ-2	Earthquake	Acquire portable water filtration system(s) to improve water redundancy. The city's sand bed filtration method is likely to be impaired after an earthquake.	H	1-2 Years	TBD	City of Stayton Public Works	Ongoing
2022-MH-2	Multi-Hazard	Work with the county to create memoranda of understanding with fuel stations that allows emergency responders first access to fuel. The county EM Coordinator has initiated a fuel inventory to address the need for fuel throughout the county under a power outage scenario.	H	1-2 Years	Staff Time	City of Stayton Public Works, and Police Department	Ongoing

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-3	Multi-Hazard	Work with fuel stations to understand their storage capacity and backup power capabilities. The city is working at the county's direction to provide an inventory of fuel resources in the county. The city can work with Pacific Pride to anticipate a need for access to fuel in an emergency.	H	1-2 Years	Staff Time	City of Stayton Public Works and Police Department	Ongoing
2022-MH-4	Multi-Hazard	Develop an agreement with the City's fuel distributor around providing fuel to backup generators during a disaster event.	H	1-2 Years	Staff Time	City of Stayton	Ongoing
2022-MH-5	Multi-Hazard	Implement 2006-2007 water, wastewater, and stormwater master plan facility improvement recommendations. Include hazard vulnerabilities and mitigation measures for reducing infrastructure vulnerability. Consider hazards in all future facilities master plan updates.	M	3-5 Years	TBD	City of Stayton Public Works	New
2022-MH-6	Multi-Hazard	Acquire multi-band radios for public works.	H	1-2 Years	TBD	City of Stayton Public Works	New
2022-MH-7	Multi-Hazard	Develop memoranda of understanding with a port- o-potty company to establish "relief stations" throughout town post-event.	H	1-2 Years	TBD	City of Stayton	New
2022-MH-8	Multi-Hazard	Update the City's Emergency Operations Plan. Invite more critical partners to participate in the plan update, including the hospital and private sector representatives. Update should cover: *Formalizing emergency shelter locations *What supplies to acquire for shelters *How to acquire supplies for shelters *Stronger relationship with the Red Cross - more official shelters and a Red Cross wagon	M	3-5 years	Staff Time	City of Stayton Police Department	New
2022-MH-9	Multi-Hazard	Update the City's Continuity of Operations Plan. Consider conducting the COOP update in parallel with the EOP update.	M	3-5 Years	Staff Time	City of Stayton Police Department	New

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-10	Multi-Hazard	Provide mitigation and preparedness information and resources to residents via schools, faith organizations, utility billings, and special events such as SummerFest. Use social media (Facebook , Next Door and digital newsletter) to provide this information. Educate businesses about the importance of continuity of operations plans to make them more resilient to hazards	L	Annually	Staff Time	City of Stayton Police Department	On-going
2022-MH-11	Multi-Hazard	Create a hazard resilience section on the City's website that provides mitigation and preparedness resources.	H	1-2 Years	Staff Time	City of Stayton	Completed, Ongoing updates
2022-MH-12	Multi-Hazard	Outreach to residents to increase participation in the Everbridge communication system.	H	Annually	Staff Time	City of Stayton Police Department	On-going
2022-MH-13	Multi-Hazard	Partner with Marion Co. to provide city staff with emergency management and response training City is anticipating opportunities from the county and will participate provided time and personnel are available.	M	Annually	Staff Time	City of Stayton Police Department	On-going
2022-MH-14	Multi-Hazard	Install automated shutoff valve to limit impact of spills on highway to surface water resource.	H	1-3 Years	TBD	City of Stayton Public Works	New
2022-MH-15	Multi-Hazard	Replace the aging generator at the Police Department.	H	1-3 Years	TBD	City of Stayton Police Department	New
2022-MH-16	Multi-Hazard	Obtain and install a generator at the radio tower to power radio communications that support police, fire, and ambulance services.	H	1-3 Years	TBD	City of Stayton	New
2022-MH-17	Multi-Hazard	Establish a city owned fuel storage facility.	M	2-5 Years	TBD	City of Stayton	New
2022-MH-18	Multi-Hazard	Improve the ability of the city to access grant funding and training by providing additional capacity such as assistance in grant application through state agencies.	M	2-5 Years	Staff Time	City of Stayton	New

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-DR-1	Drought	Participate in the Marion Co. Drought Contingency Plan. Provided this is still an ongoing effort, the city staff would participate to the best of their ability.	H	12 months	Staff Time	City of Stayton	Starting in 2023
2022-EQ-3	Earthquake	Host outreach events aimed at teaching residents how to turn off their gas and water valves.	M	Annually	Staff Time	Stayton Fire District	Ongoing
2022-EQ-4	Earthquake	Encourage residents to prepare and maintain two- week (at minimum) survival kits. Part of city's messaging; staff have done posts in September about preparedness	M	Annually	Staff Time	City of Stayton	Ongoing
2022-EQ-5	Earthquake	Determine whether the City's water tanks (Pine St. and Regis St. locations) are seismic resilience.	M	3-5 Years	TBD	City of Stayton Public Works	New
2022-FL-2	Flood	Work with Marion Co. public works to clear and maintain ditches on county roads.	M	Annually	Staff Time	City of Stayton Public Works	Ongoing
2022-FL-3	Flood	Create a memorandum of understanding with Knife River so they will supply sandbags during a flood.	M	1-2 Years	Staff Time	City of Stayton	Ongoing
2022-SW-1	Severe Weather	Meet with utility companies to build relationships. Outcome should be an understanding of where infrastructure is located, who to contact in an emergency, and strategies for doing more outreach to the community.	M	1-2 Years	Staff Time	City of Stayton Public Works and Police Department	Ongoing
2022-SW-2	Severe Weather	Work with Pacific Power to encourage them to upgrade old infrastructure.	M	1-2 Years	Staff Times	City of Stayton	Ongoing

15 City of Sublimity Addendum

15.1 Purpose

This document serves as the City of Sublimity's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by the City of Sublimity to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

15.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Sublimity, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the City of Sublimity will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly Pre-Disaster Mitigation, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Sublimity joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on 11-15-21. On November 8, 2021, City of Sublimity staff including, Alan Frost, Public Works Director, and Jason Devine, Senior Maintenance Operator, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the City of Sublimity that included a Hazard Vulnerability Assessment ranking. Director Frost and Mayor James Kingsbury met again with DLCD's Pam Reber on March 29, 2022, to update this addendum.

15.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

15.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of City of Sublimity, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

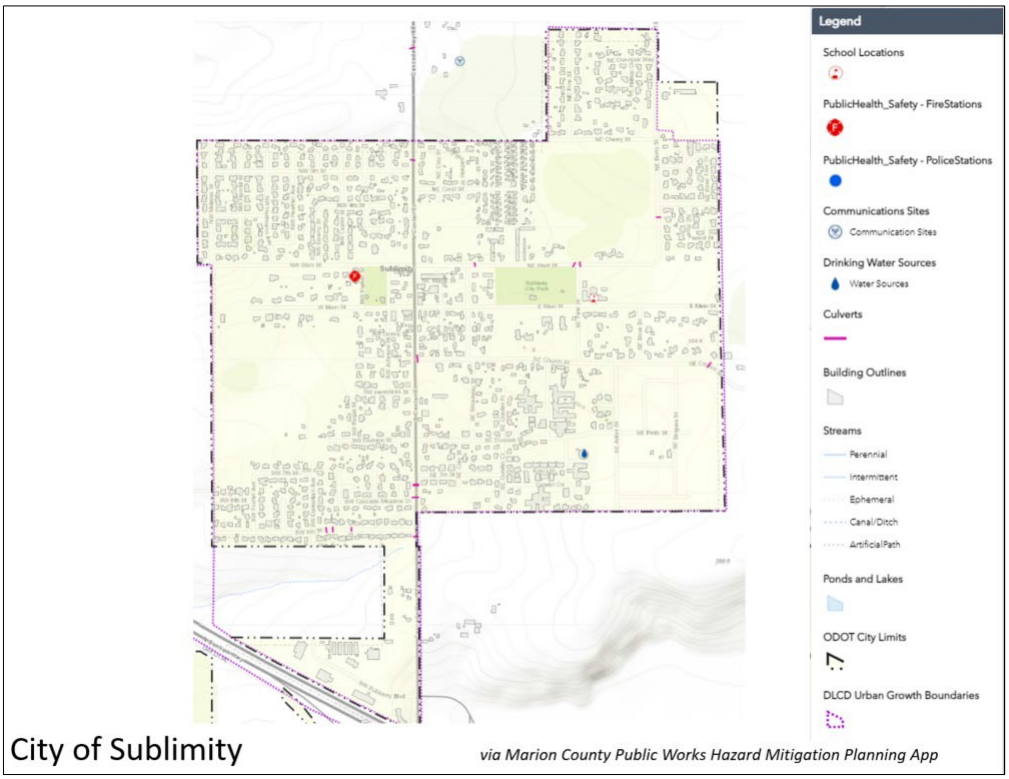
15.4.1 Community Characteristics

The City of Sublimity is a rural residential community about 15 miles east of Salem. It is situated on the western low foothills of the Oregon Cascades, on a plateau, amid gently rolling hills dropping down all around into grassy valleys. Sublimity is in Oregon's Willamette Valley, which experiences a moderate climate. The Santiam River flows nearby, through the neighboring community of Stayton, to the south.

The Population Research Center at Portland State University lists the City of Sublimity's 2020 population at 3,050. This represents a 60.9% increase from 2000 (Portland State University, Population Research Center, 2021). This small rural community was one of the earliest settlements in the Willamette Valley and had a population of 1,500 before the Civil War. A post office, school district, and a college were established in the 1850s.

Median household income in Sublimity during the period 2015-2019 was $73,997, a 27.7% increase from the previous 5-year period (U.S. Census Bureau, 2022). Significant representations of the community in terms of demographics include Marian Estates, a retirement village, and St. Boniface, a Catholic Church.

Figure 15-1, City of Sublimity Map



15.5 Critical and Important Facilities

City of Sublimity's critical and important facilities include:

15.5.1 Transportation

- Two overpasses serve the City of Sublimity; they connect to Hwy 22 and to the City of Stayton. These have bridge structures that would be at risk in a Cascadia earthquake event.
- Hwy 22 cut off Golf Club Road one connection Burn Ridge Boone Hammer East Southeast part of town if bridge culverts mill creek and golf club road North Beaver creek 1.5 mi out of town then Hwy 22 if bridge out mill creek has a culvert then there is high water norther and south would be impacted.
- Bridge underground water, fiber, gas. Some might be connected to the bridge at Mill Creek (N/S).
- No rail
- Cascade Highway 213 runs through Sublimity bypass the 1-5 corridor Marion Co maintains the Hwy 213.

15.5.2 Energy

- Pacific Power-West
- Consumer Power- Old Mehama Road substation East of Sublimity Fern Ridge feed for the water tank gravity fed 8388 Bodenheimer Rd
- Fuel- City gasoline and diesel locations.

15.5.3 Water / Wastewater

- 4 well sites
- 376 SE Church St no backup power or portable generator.
- 245 NW Johnson St no backup power portable generator
- 538 SE Oak Grove Ave Sublimity Water Master Plan 2021 will have backup power installed in approximately two years, if not sooner.x`
- 8388 Bodenheimer Rd Water Reservoir 500k gallon reservoir to be removed; 750k gallon reservoir to be installed.
- New well in next year at Public Works Facility 542 NE Berry St.
- Water testing, well house building, installing distribution line to get it to the system. 2021 ARPA funds.
- Lift stations: 693 NE Berry street & 100 SW sublimity Blvd.
- 1970's concrete and asbestos cement pipe infrastructure systems. Could isolate system but 700-800 residents in the 70's new sub-division could be impacted.
- Two (2) of the wells are originals.

15.5.4 Emergency Services

Fire:

Sublimity Rural Fire Protection District, 115 NW Parker St. Sublimity, Oregon (503) 769-3282.

Police:

Marion County Sheriff's Office, 100 High Street NE Salem, Oregon (503) 588-5094.

Public Works:

City of Sublimity Public Works, 542 N. Berry St. Sublimity, Oregon (503) 769-2860.

CERT: Not Reported

Medical: Not Reported

Emergency Operations Center: Not Reported

City Hall:

City of Sublimity, 245 NW Johnson St. Sublimity, Oregon (503) 769-5475.

Shelter: Not Reported

15.5.5 Cultural / Historical Resources

- St. Boniface Catholic Church, 375 SE Church St. Sublimity, Oregon (503) 769-5664.

15.5.6 Functional and Access Needs (Vulnerable Populations)

- Schools: Not Reported

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

15.6 Plans and Policies

Table 15-1, Plans and Policies of the City of Sublimity

Document Name	Year
Comprehensive Plan: Development Code Update	2020
Parks Analysis and Sublimity Parks Master Plan	2022
Transportation System Plan	2023
Sublimity Water Master Plan	2021
Sublimity Drinking Water Emergency Operations Plan	

15.7 Hazard Profile

Table 15-2, City of Sublimity Hazard Profile

Community Overview					
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)	
Sublimity	3,050	1,157	4	546,449,000	
Hazus-MH Analysis Summary					
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	6	0.2%	19	0	7,850,753	1.4%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	0	0.0%	0	0	0	0.0%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0.0%	0	0	0	0.0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Not Reported						

15.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning5. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event
2. Magnitude of event
3. Expected warning time before event
4. Expected duration of event

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 15-3, City of Sublimity Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Sublimity** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Severe Weather/Storm	4	4	4	4	4.0	**High**
Wildland Interface Fire	4	4	3	4	3.7	**High**
Earthquake	3	4	3	4	3.3	**High**
Drought	3	1	3	4	2.8	**Moderate**
Extreme Weather - High Temperature	3	2	2	3	2.6	**Moderate**
Tornado*	1	4	3	4	2.4	**Moderate**
Volcanic Eruption	1	1	2	4	1.6	**Low**
Avalanche**	1	1	1	1	1.0	**Low**
Flood	1	1	1	1	1.0	**Low**
Landslide	1	1	1	1	1.0	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and Sublimity on 11/8/21. *Split out from Severe Weather in 2022; **New in 2022; ***Including dam failures.

Table 15-4, City of Sublimity Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the **City of Sublimity** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Cyberterrorism	4	4	3	4	3.7	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	4	4	3.1	**High**
Hazardous Materials Release - Transportation	3	4	2.5	3	3.0	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	2.5	4	2.7	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2.5	4	2.7	**Moderate**
Public Health	3	1	2.5	4	2.7	**Moderate**
Hazardous Materials - Non-Transportation	2	4	2.5	3	2.6	**Moderate**
Unauthorized Entry	2	4	2.5	2.5	2.5	**Moderate**
Agricultural Terrorism	2	1	2.5	4	2.2	**Moderate**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management and Sublimity on 11/8/21.

15.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Sublimity. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to City of Sublimity, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

15.9.1 Avalanche

CPRI = 1.0, Risk Level: Low

Events: No events

Vulnerability: Not reported

15.9.2 Drought

CPRI = 2.8, Risk Level: Moderate

Events: Governor Kate Brown declared a drought emergency for all of Marion County in September 2015. Stayton was close to local drought conditions during that event.

Vulnerability: An extreme drought could result in a water shortage.

15.9.3 Earthquake

CPRI = 3.3, Risk Level: High

Events: None in the past five years.

Vulnerability: The City is updating their Transportation System Plan in part to identify other evacuation routes and evaluate the overpasses on Hwy 22 in case the overpasses fail.

15.9.4 Flood (Includes Dam Failure)

CPRI = 1.0, Risk Level: Low

Events: N/A

Vulnerability: Low flood risk within the city. Some risk near the southern city limits as seen in the FEMA flood map.

Figure 15-2, FEMA flood map for Sublimity



Source: FEMA Map Service Center,7/25/2022. https://msc.fema.gov/

15.9.5 Landslide

CPRI = 1.0, Risk Level: Low

Events: N/A

Vulnerability: Sublimity is very flat, there is no landslide risk.

15.9.6 Severe Weather

CPRI = 4.0, Risk Level: High

Events: Ice storm in 2021 resulted in 4 days without power and communication (cell, internet, regular phone).

Vulnerability: Significant wind events occur in Sublimity each year, sometimes interrupting services, downing trees, and causing power outages. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

15.9.7 Tornado

CPRI = 2.4, Risk Level: Moderate

Events: A tornado touched down in nearby Aumsville on December 14, 2010.

Vulnerability: In December 2010, a tornado touched down in Aumsville, causing around $1.2 million dollars in damage.

15.9.8 Wildfire

CPRI = 3.7, Risk Level: High

Events: None Reported

Vulnerability: Sublimity is surrounded by agricultural lands which are highly managed and pose low risk for wildfire.

15.9.9 Volcanic Eruption

CPRI = 1.6, Risk Level: Low

Events: 1980 Mount St Helens eruption.

Vulnerability: Impacts from ash from an eruption of Mt. Hood could impact the community.

15.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and the City of Sublimity Addendum update process, Oregon Department of Land Conservation & Development and the City of Sublimity developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

15.10.1 Mitigation Actions

The table below (Table 1-5) shows the City of Sublimity mitigation actions.

Table 15-5, Sublimity Priority Action Items

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-1	Multi-Hazard	Install a backup generator and fuel storage at Berry St Lift Station. Two sewer lift stations do not have on site backup power, they rely on portable generators. This poses the risk of an overflow during a power outage. Funding: FEMA, City sewer revenue, possibly SDC funding.	H	2-5 Years	$50-100k	City of Sublimity	New
2022-MH-2	Multi-Hazard	Install backup power at Well 3 at 1.5-million-gallon storage reservoir. City engineer to evaluate the fuel type and project design to ensure it is appropriate for this site. Funding: FEMA, water revenue, possibly SDC funding.	H	2-5 Years	$50-100k	City of Sublimity	New
2022-EQ-1	Earthquake	Improve the seismic resilience of the city's water storage by replacing 500k with a 750k water reservoir. The City has embarked upon a multi-year effort to improve water resilience to address growth and water reliability. The tank is elevated which will increase the pressure in the distribution system. Funding: ARPA, City SDC funding	H	1-3 Years	$1.3 million	City of Sublimity	New
2022-MH-3	Multi-Hazard	Install a backup generator and fuel storage at Sublimity Blvd Lift Station. Can go longer due to ability to surcharge into system; serves a smaller area. Funding: FEMA, City sewer revenue.	M	2-5 Years	$25-75k	City of Sublimity	New

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-4	Multi-Hazard	Develop debris storage capability at Public Works facility for winter storm debris storage. 542 NE Berry Street site recently expanded. 10.5-acre site, 1.5 acres are for PW use. This site would be developed to conduct staging and storing of materials. Debris management equipment needed.	M	2-5 Years	$50-100k	City of Sublimity	New
2022-MH-6	Multi-Hazard	Support Marion County Emergency Management in their work with Marion Estates to address backup power and other resilience activities. Marion Estates is the sole facility with a large population of potentially vulnerable community members; Marion Estates has several buildings that are unreinforced masonry. Assisted living facility with Alzheimer's unit.	M	2-5 Years	Staff Time	City of Sublimity	New

Source: City of Sublimity HMP Steering Committee, 3/29/22

16 City of Turner Addendum

16.1 Purpose

This document serves as the City of Turner's Addendum to the Marion County Multi-Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this addendum is to guide the implementation of mitigation actions by Turner to improve the resilience of the community. Please note that mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful. Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

16.2 Plan Process, Participation, and Adoption

In 2021 and early 2022, Marion County partnered with the Oregon Department of Land Conservation and Development (DLCD) and the Oregon Department of Emergency Management (OEM), and Marion County cities, including the City of Turner, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022.

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the Turner will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

The City of Turner joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on October 19, 2021. On October 5, 2021, Turner Fire District staff Rebecca Shivers Singleterry, Business Manager, and Jordan Donat, Fire Chief, joined Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting that included a Hazard Vulnerability Assessment ranking. The City of Turner provided a revision to their addendum on January 5, 2022. City staff met again with DLCD on June 15, 2022, to update this addendum.

The City of Turner Steering Committee is comprised of representatives from the following departments:

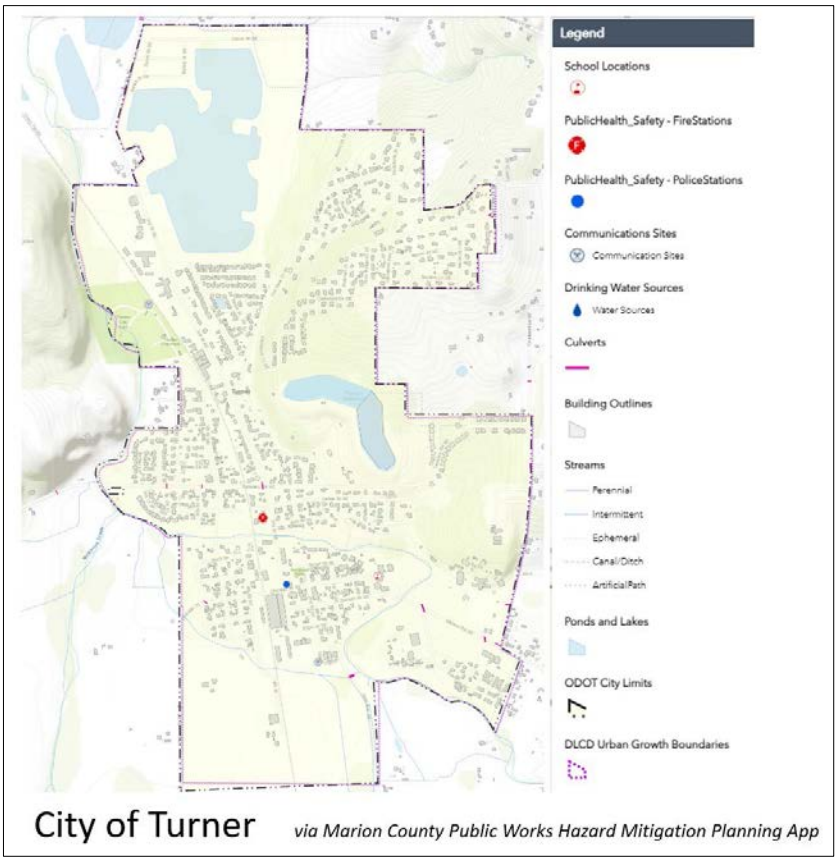
- Convener, City Administrator
- Mayor
- Turner Police Department
- Turner Fire District
- Community Emergency Response Team (CERT) Members
- Community Members
- Turner Public Works

Turner used multiple approaches to engage the public. First, the City established steering committee representatives from across the city. Next, the city actively participated in countywide community engagement activities described in Volume I, Section 4 and in Appendix B. City staff also presented the draft plan to the City Council during an open public council session. City of Turner staff attended HMP Steering Committee meetings in August, September, and November 2021. The City of Turner maintains a Hazard Mitigation webpage at https://www.cityofturner.org/hazard_mitigation.

16.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

Figure 16-1, City of Turner Map



16.4 Community Profile

This section provides information on city specific assets and populations. For additional information on the characteristics of the City of Turner, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

16.4.1 Community Characteristics

The City of Turner is in Marion County, about six miles south of Salem, and approximately 54 miles inland from the Pacific Ocean. The topography within the city is characterized by a flat landscape, with the exceptions of two hills to the east and west of the city, which reach a maximum elevation of about 600 feet above sea level.

Turner is bisected by Mill Creek, which is the primary stream that runs through the city's limits. Mill Creek has an average annual flow rate of about 180 cubic feet per second and flows north through the city. The stream meanders through or adjacent to the city's limits for nearly three miles. Additional waterways within the city include the Mill Creek Bypass and the Perrin Lateral, both of which are significantly smaller than Mill Creek.

Like most of the Willamette Valley, Turner experiences a modified marine climate with cool and wet winters and moderately warm and dry summers. The average annual precipitation is approximately 39.28 inches with the heaviest rainfall in late fall and winter. While major snow falls are rare, Turner experiences an average annual snowfall of approximately 7.1 inches.

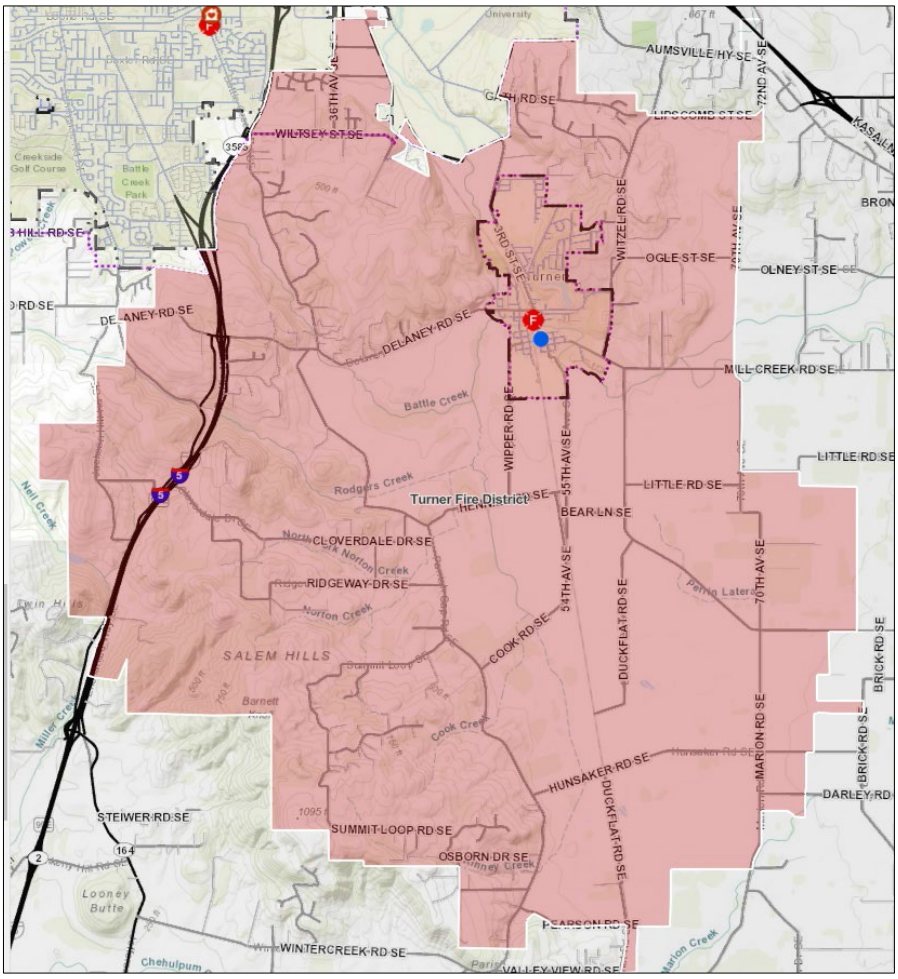
The Population Research Center at Portland State University lists Turner's 2020 population at 2,410. This represents a 107.8% increase from 2000 (Portland State University, Population Research Center, 2021). For more demographic information, refer to Appendix C.

16.4.2 Economy

Like most cities in Oregon, industry in Turner has fluctuated greatly since the founding of the city in the mid-1800s. In the late 1800s the primary industries were a flour mill and granaries (City of Turner, N.d.). However, these industries eventually gave way to the more dominant lumber industry that arose in the late 1900s. These early industries owe their success in large part to the construction of the railroad, which runs through the middle of the city.

Due to Turner's small population and the city's proximity to Salem, many of Turner's residents commute to work outside of the city. Median household income in Turner 2015-2019 was $82,689, a 45.2% increase from the previous 5-year period (U.S. Census Bureau, 2022).

Figure 16-2, Turner Fire District Map



Source: Marion Co. GIS

16.4.3 Turner Fire District

The Turner Fire District is in the Mid-Willamette Valley just southeast of the capital city of Salem and shares borders with the following fire agencies: Aumsville Fire District, Jefferson Fire District, Stayton Fire District, Salem Suburban Fire District, Salem Fire Department and Marion County Fire District #1. Our community is made up of fifty-six square miles of rural residential, farm and agricultural properties and includes the City of Turner which is located within the boundaries of our fire district. We serve a population of over 6,500 people (Turner Fire District, 2018).

16.5 Critical and Important Facilities

Critical facilities include buildings, their internal components, and trained personnel, and may also include certain mobile units, such as those of first responders. For example, many vehicles of the police department, fire department (including ambulances), and public works department are key and essential components of the functions provided by these critical facilities. The interruption or destruction of any of these facilities would have a debilitating effect on incident management and long-term recovery. Not all critical facilities are of equal importance and are therefore subject to prioritization of criticality. The steering committee identified key critical facilities, listed in the "Hazard Profile".

This plan also documents important infrastructure and facilities by lifelines, including transportation, energy, water, communication, emergency services, and cultural/historical resources. We also include a preliminary list of populations/locations that may be particularly vulnerable to hazards.

City of Turner Critical Facilities

Facility Name	Type
Turner Fire District	Emergency Services
Turner City Hall	Governance
Turner Police Department	Emergency Services
Turner Public Works	Emergency Services
Turner Retirement Homes	Care Facility
Cherriots Bus – Santiam Route 30X	Transportation
Turner Christian Church Food Bank	Food Services
Turner Elementary School	Miscellaneous
Cascade School District Office	Miscellaneous
Post Office	Communication
Aldersgate	Youth Camp

Source: City of Turner. http://cityofturner.org/

16.5.1 Transportation

- Delaney Rd is the link to I-5 – this would be under water in a major flood.
  - This road is the most vulnerable link – water on the road would be very destructive and block access.
- Third St (Turner Rd.) is the link to Hwy 22 – this would be under water in a major flood.
- Witzle Rd. would become the exit if the other roads were blocked.
- There are a few backroads that exist that don't involve bridges.
- Cherriots Bus – Santiam Route #30X provides public transportation services for residents.

Bridges:

Table 16-1, City of Turner Bridge Inventory

Turner Bridge Inventory								
Road	Over	Owner	Construction	Co-Located Utility				
				Sewer	Water	Electricity	Natural Gas	Telecomm
Mill Creek Rd. / Denver St.*	Mill Cr.	Marion County	Concrete continuous	Yes	Yes	No	Yes	No
Delaney Rd. SE	Mill Cr.	Marion County	Prestressed Concrete	No	No	No	No	No
Wipper Rd.**	Bypass Canal	Marion County	Prestressed Concrete	No	No	No	No	No
55th Ave. SE	Bypass Canal	Marion County	Wood Nail Laminated	No	No	No	No	No
3rd St. SE***	Mill Cr.	Marion County	Prestressed Concrete	No	Yes****	No	Yes	No
5th St. ***	Mill Cr.	City of Turner	Prestressed Concrete	Yes	Yes	No	No	No

*Source: City of Turner (2022). *Rebuilt in 2016; **Rebuilt in 2014; ***This bridge has a lower deck and debris collects on it during high water events; ****The water line is 8" diameter pipe; *****Rebuilt between 2021-2022.*

16.5.2 Energy

- PGE provides the city with power and has a sub-station on 5TH Street by Mill Creek.
- NW Natural provides the city with natural gas and has distribution mains connected to the Third street and Denver Street bridges.
- The city gets fuel in town from Pratum Co-op and from Pacific Pride (by I-5).
  - Fuel access could be difficult if Delaney Road were not passable.
- Fuel storage: there are tanks at the gas station at 5235 Denver Street.
- Back-up power and fuel storage:
  - Fire has two 6kw diesel generators on engines E955 and E957 and keeps 15 gallons of gas and diesel at the fire station.

- The city has a 2kw, 3kw and 7.5kw gas portable generators and keeps 15 gallons of gas stored.

Location	Owner	Fuel Type	Capacity (in gallons)
City Hall / Public Works – Fuel Storage	City	Above ground diesel tank	55 Gal.
Generators – Top of the hill pump station	City	Diesel	150 kw, 200 Gal.
Generator – Lower Pump	City	Diesel	100 kw, 150 Gal.
Generator – Main sewer pump station, in 5th St. Park	Salem	Diesel	35 kw, 50 Gal. tank
Generator – 1952 station generator	Fire	Diesel	60 kw
Mobile generator	Fire	Gas	(1) 2000 W portable on rescue unit

16.5.3 Water / Wastewater

Water:

- Turner purchases wholesale water from the City of Salem.
- The city has a storage and distribution system – 100,000-gallon water tank (redwood, that is in great shape); 400,000-gal water tank (only 6 years old and built with modern technology).
- The city currently does not have back-up water sources.
- Val View pump station can be accessed in two different ways.
- 3rd St pump station is on the main street so it should be accessible in an earthquake.

Wastewater:

- Turner contracts for the treatment of wastewater by the City of Salem.
  - Lift stations bring sewage to a forced main station on Kuebler Rd. – lift stations have emergency generators.
  - There are 2.5 miles of forced main sewer pipe that takes wastewater to the intersection of Kuebler and Turner Roads – this pipe would probably not withstand an earthquake.
  - If this pipe broke, there would be a sewer overflow into Mill Creek.
- Franzen Reservoir stores 100 million gallons of water for Salem. The reservoir is part natural, part constructed.
  - Salem was required by the Department of Water Resources to reevaluate the reservoir. As part of this, they had to do outreach about the inundation potential from the reservoir if it failed.

16.5.4 Communications

- The redwood water tank on Val View has some police radio equipment to connect with the dispatch center, METCOM.
- The police department has radio capabilities as a back-up if cell service is down.
- The water distribution system has its own radio system.
    - This system only requires a minimal amount of power, and it is possible to run the system without the radios.
- The city recently purchased a satellite phone (service provided by Global Star).
- The Fire station has a base radio, mobile in the trucks – dispatch connection infrastructure is outside the city – all of this is backed up.
- Wave Broadband provides cable internet.
- Turner Elementary School has fiber, and the new subdivision at Crawford Lake does have fiber provided by Viser, a fiber company based in Aumsville.
- Fiber optic cable runs along the railroad (the Seattle to San Francisco line).
- Cell towers:
    - AT&T Tower on private property – this has a generator.
    - Verizon and T-Mobile on the tower in 5th Street Park – this has a generator.

16.5.5 Emergency Services

Fire:

Turner Rural Fire Protection District, 7605 3rd St. Turner, Oregon (503) 743-2190. Also provides Emergency Medical Services that includes transport by ambulance.

Police / Public Works / City Hall:

City of Turner, 5255 Chicago St, SE Turner, Oregon (503) 743-2155

Emergency Operations Center:

7250 3rd St. Turner, Oregon, the City also has a local CERT team.

Medical:

- No medical locations within the City of Turner.
- Aumsville has a health clinic; Stayton has a hospital.

16.5.6 Cultural / Historical Resources

- Turner Memorial Tabernacle and Camp Meeting Grounds; Pioneer Lodge
- Masonic Hall
- Ball Brothers Grange and Dance Hall (old)
- Ball Brothers Grange (current)

- Davis Hall (at Turner Retirement Home)
- Events that may draw large crowds:
  - Lamb and Wool festival – 1st Saturday in June. This includes a parade with approximately 1,500 people passing through town.
  - 4th of July Fireworks drawing approximately 2000-3000 people.

16.5.7 Functional and Access Needs (Vulnerable Populations)

Schools:

- Turner Elementary School (Cascade School District)
- Aldersgate (youth camp)
- Cradle to Crayons (Daycare) at 7920 2nd St. – this is in the floodplain.

Assisted living:

- Turner Retirement Homes

Non-English speaking:

- There is still only a small non-English speaking community.
- Many Spanish speakers work at the local mill.

Access:

- People who live up the hill (in the Eastwood area) might find it hard to access in bad weather (for example, the roads were not passible during the last ice storm – too steep and slippery).
- Flooding impacts people in the lowlands.

See hazard sections below for potential hazard-related vulnerabilities to these facilities.

16.6 Plans and Policies

Table 16-2, City of Turner Plans and Policies

Document Name	Year
Water Systems Master Plan	2013
City of Turner Comprehensive Plan	
Turner Transportation System Plan	1999
Stormwater Master Plan	
Floodplain Ordinance	

16.7 Hazard Profile

Community Overview							
Community Name		Population		# Of Buildings	Critical Facilities[1]		Total Building Value ($)
Turner		2,410		1,365	3		421,185,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	596	24.7%	347	1	5,849,000	1.4%
Earthquake	Mt. Angel Mw 6.8 Deterministic	9	0.4%	55	0	11,885,560	2.8%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	300	13%	149	0	42,486,000	10%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	50	2.1%	28	0	6,515,452	1.5%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0%	0	0	0	0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Source: DOGAMI (2022)

16.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning[6]. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event.
2. Magnitude of event.
3. Expected warning time before event.
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 16-3, City of Turner, including Turner Fire District, Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary **City of Turner including Turner Fire District** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Flood (riverine)	4	4	3.5	2.5	3.7	**High**
Earthquake	3	4	3.5	4	3.4	**High**
Severe Weather/Storm	4	1	3	3	3.2	**High**
Flood*	3	2	2.5	2.5	2.7	**Moderate**
Wildland Interface Fire	3	2	2.5	2.5	2.65	**Moderate**
Drought	3	1	2.5	3	2.6	**Moderate**
Extreme Weather - High Temperature	3	1	2.5	3	2.6	**Moderate**
Tornado**	2	4	2	2	2.3	**Moderate**
Landslide	2	2	2	3	2.1	**Moderate**
Avalanche***	1	2	2	2.5	1.6	**Low**
Volcanic Eruption	1	1	2	2.5	1.5	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management, Turner Fire District, and DLCD on 10/5/21.*Includes dam failures; **Split from Severe Weather in 2021; ***New in 2021.

Table 16-4, City of Turner, including Turner Fire District, Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary **City of Turner including Turner Fire District** Using BOLD Planning Analysis Scoring						
Non-Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significance
Weight Factor	0.45	0.15	0.3	0.1		
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	3.5	4	3.0	**High**
Public Health	3	1	3.5	4	3.0	**High**
Terrorism/Active Shooter/Workplace Violence	2	4	3.5	4	3.0	**High**
Unauthorized Entry	2	4	3	3	2.7	**Moderate**
Cyberterrorism	2	4	2.5	4	2.7	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2.5	3.5	2.6	**Moderate**
Hazardous Materials - Non-Transportation	2	4	2.5	2.5	2.5	**Moderate**
Hazardous Materials Release - Transportation	2	4	2.5	2.5	2.5	**Moderate**
Agricultural Terrorism	2	1	2.5	2.5	2.1	**Moderate**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management, Turner Fire District, and DLCD on 10/5/21.

16.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Turner. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of natural hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to Turner, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

16.9.1 Avalanche

CPRI = 1.6, Risk Level: Low

Events: Not Reported

Vulnerability: Not Reported

16.9.2 Flood (Dam Failure)

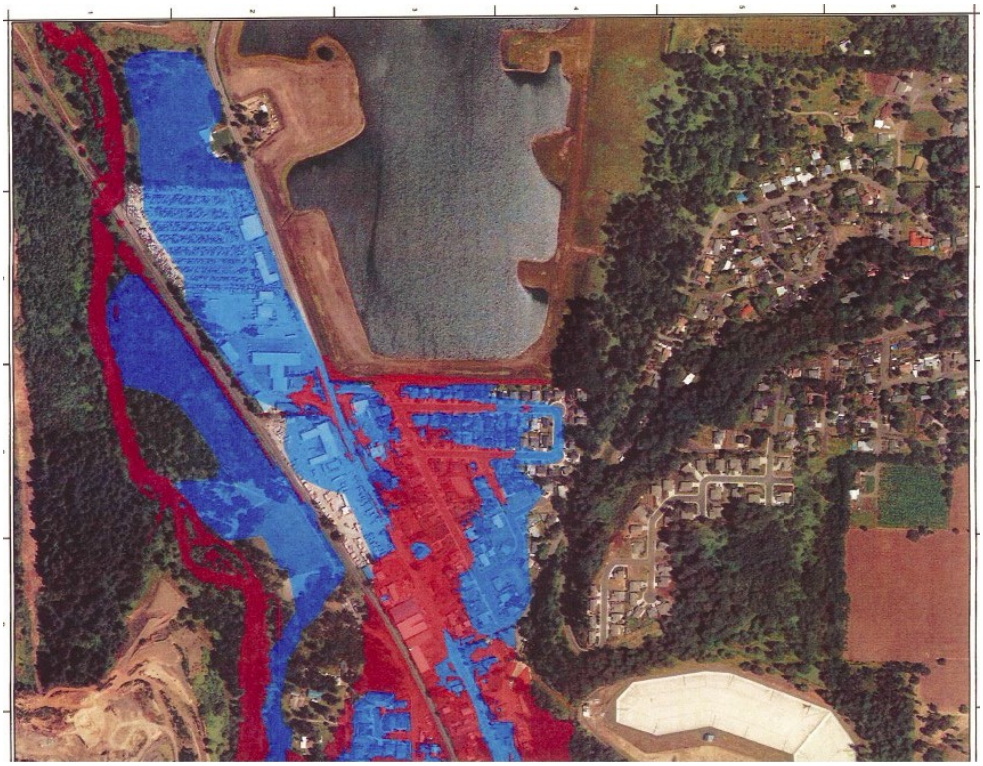
CPRI = 2.7, Risk Level: Moderate

Events: There is no history of dam failure in the City of Turner.

Vulnerability: Dams are impervious structures that block the flow of water in a river or stream, capturing water behind the dam. Dams can fail for a variety of reasons, such as erosion, overtopping, structural failure, ground motion or unusual hydrodynamic forcing.

The City of Salem has a water reservoir in Turner city limits—the Franzen Reservoir. Turner coordinates with City of Salem on development review for any projects near the reservoir.

Figure 16-3, Franzen Reservoir Partial Inundation Map



Source: City of Turner

The Franzen Reservoir poses a "high hazard" dam threat to the city of Turner. In 2014, the Oregon Dam Safety Program Engineer reclassified Franzen Reservoir as a HIGH hazard dam following a review by a local hydraulic engineer and US Army Corps of Engineers. The reservoir is 31-feet high and stores 300-acre feet of water. According to the Oregon Dam Safety Engineer, there are several dwellings located directly below the reservoir inundation area. In addition, the area of Delaney Road SE and North 3rd Street would be impacted by a reservoir breach.

The primary Army Corps of Engineers controlled dam threat to the City of Turner is the Detroit Dam. Contact the local Army Corps office for more information about specific dam failure and inundation impacts that could result from a failure at Detroit Dam.

16.9.3 Drought

CPRI = 2.6, Risk Level: Moderate

Events: Due to a cool, wet climate, past and present weather conditions have generally spared Marion County communities from the effects of drought; however, Marion County was included in Presidential Drought Declarations in 1992 and 2015.

Vulnerability: Turner receives water from the City of Salem under contract. Turner maintains two water tanks for local storage, with 100,000- and 400,000-gallon capacities respectively. The larger tank was constructed in 2011 using modern engineering and construction methods. The city also maintains a water distribution system. The city does not have a secondary water source. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

16.9.4 Earthquake

CPRI = 3.4, Risk Level: High

Events: The 1993 Scott Mills quake caused $28 million in damages to cities throughout Marion County. No damaging earthquake events occurred during the previous five years.

Vulnerability: Turner is about one mile from several active faults: a string of faults run to both the north and south of Turner.

Turner's probability for a Crustal Earthquake event is "possible" and their vulnerability to a Crustal Earthquake event is "limited". The county steering committee determined that the probability for a Cascadia Subduction Zone (CSZ) Earthquake event is "highly likely" and that the vulnerability to a Cascadia Earthquake event is "catastrophic". This hazard was not rated as distinct CSZ and crustal events in the previous HMP.

Earthquake-induced damages are difficult to predict, and depends on the size, type, and location of the earthquake, as well as site-specific building and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damage has primarily been caused by the behavior of the soil.

The Turner steering committee identified earthquake damage to bridges and nearby dams as a primary concern. Transportation isolation and inundation due to dam failure could both have significant impacts on the city. The City's priority actions reflect these concerns.

16.9.5 Flood

CPRI = 3.7, Risk Level: High

Floodplain Management: Turner conducts very active floodplain management. A floodplain permit is required for all applications for development; the city retains a floodplain manager on staff. In 2022, this is the City Manager. Recently an old building met the substantial improvement criteria and was removed and replaced with an elevated manufactured home. A local church in town bought a commercial building and they were required to elevate the floor. The city now owns "Turner Lake," a gravel pit deeded to the city, to which a park was added. However, this is not a flood risk, simply a change in development.

Events: The last large flood event in Turner was in 2012. In January of 2012, heavy rains caused extensive flooding throughout the city, with an estimated $500,000 in overall damage. During a five-day period starting on January 16th, the city received as much as 9.1inches of rain. Runoff from the heavy rainfall was intensified by the melting of three to six inches of snow that had fallen in higher elevations the previous week. On March 2, 2012, the President issued a major disaster declaration (DR-4055).

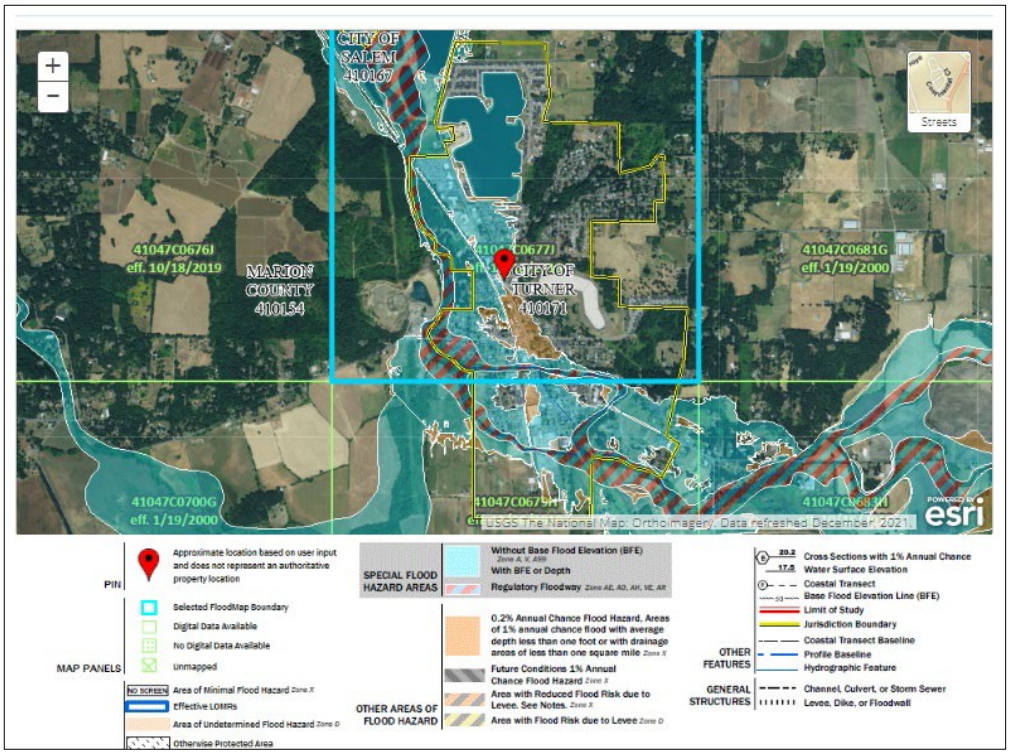
The preliminary damage assessment from the January 2012 flood revealed 13 residences and three businesses with major damage, 14 residences and three businesses with minor damage, and two residences with other damage. Later, the city documented more than 80 homes that had suffered flood damage. In addition, damage from the sewer system resulted in more than 100 households using portable toilets set up in the street.

The flood event stretched local resources well beyond capacity, putting the entire town at risk. Issues confronted included: fire hydrants and water valve box piping were destabilized by the flood and ready to break; structural damage to bridges and road shoulders making use of narrow road corridors dangerous; all of the roads in and out of Turner were closed at one point with 75% remaining closed for multiple days; hundreds of individual evacuations; heavy flood waters directly impacted two businesses forcing one to close permanently; all downtown businesses were closed off to customers due to road closures, including the major mill complex in town; shut-off and later re-activation of the natural gas system created risk for potential explosions and fires.

Since the major flood in January 2012, Turner has experienced other near-floods and high- water events. Mill Creek, which runs through the middle of town, presents the greatest flood risk to residents and travelers. Many residences and businesses are located within the 100-Year Floodplain.

Vulnerability: The very large floodplain of Mill Creek (near Salem) and its tributaries from City of Turner to Salem corresponds to high levels of urban development. This area is at high risk to flood hazard. In the City of Turner, nearly a third of the buildings exposed to flooding are elevated above the base flood elevation (State of Oregon, Department of Land Conservation and Development, N.d.).

Figure 16-4, Special flood hazard area



Source: FEMA Map Service Center, https://msc.fema.gov/

National Flood Insurance Program (NFIP)

The NFIP has two types of loss classifications, Repetitive Loss (RL) Property and Severe Repetitive Loss (SRL) Property. ***RL***, property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP. ***SRL,*** property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

FEMA modernized the Turner Flood Insurance Rate Maps (FIRMs) in January of 2003. Table shows that as of October 2016, Turner has 71 National Flood Insurance Program (NFIP) policies in force. Of those, 26 are for properties that were developed before the development of the initial FIRM. The last Community Assistance Visit (CAV) for Turner was on February 6, 2012. Turner is not a member of the Community Rating System (CRS). The table shows that most of the flood insurance policies are for single-family residential homes. There have been 21 paid flood claims in Turner totaling $588,084. The Community Repetitive Loss record for Turner identifies one Repetitive Loss Property (a residential parcel near Mill Creek) and no Severe Repetitive Loss Properties.

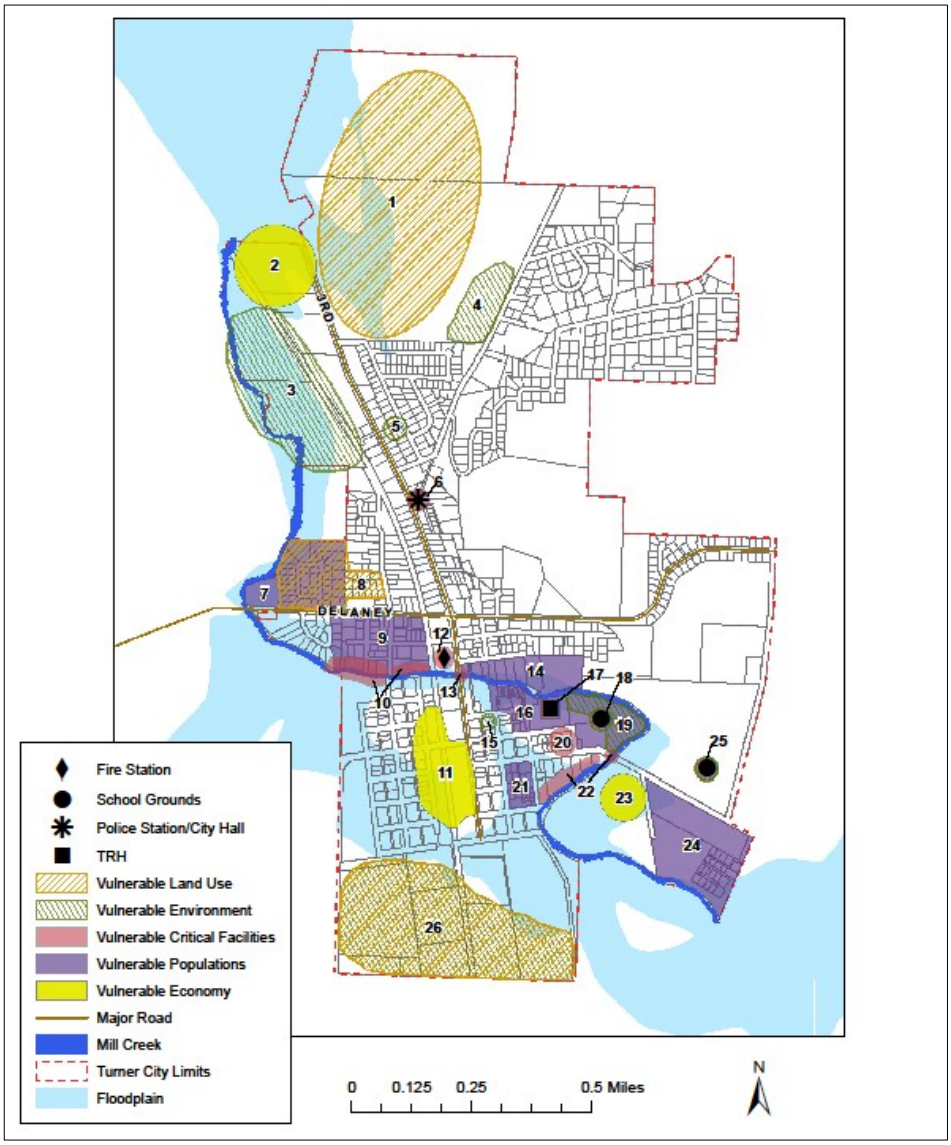
Table 16-5, Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type: Single Family	2 to 4 Family	Other Residential	Non-Residential	Minus Rated A Zone	Minus Rated V Zone
Marion County	-	-	2,067	1,239	1,614	115	105	232	97	0
Turner	1/2/2003	4/2/1979	71	26	65	3	0	3	1	0

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Structures	Severe Repetitive Loss	CRS Class Rating	Last Community Assistance
Marion County	$ 514,268,700	298	226	16	$ 5,732,543	11	2	-	-
Turner	$ 17,010,300	21	18	3	$ 588,084	1	0	N/A	2/6/2012

Source: Information compiled by Department of Land Conservation and Development, October 2016.

Figure 16-5, Turner's Flood Vulnerability



Source: City of Turner 2012 NHMP Steering Committee.

16.9.6 Landslide

CPRI = 2.1, Risk Level: Moderate

Events: n/a

Vulnerability: Turner has a relatively flat topography, except for the Eastwood area in the northeastern part of the town, near the Franzen Reservoir, and directly to the east between Turner and I-5. Turner's probability for landslide is unlikely and their vulnerability to landslide is limited.

16.9.7 Severe Weather

CPRI = 3.2, Risk Level: High

Windstorm:

The city's probability for windstorm is highly likely and their vulnerability to windstorm is critical.

Significant wind events occur in Turner each year, usually between October and March. Damaging wind events are only slightly less common; once or twice per year the city will experience a windstorm event that will interrupt services, experience downed trees, and cause power outages. The F-2 tornado that touched down in Aumsville in December 2010, only four miles from Turner, did not cause damage to Turner.

Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Winter Storm (Snow/Ice):

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

Major winter storms can and have occurred in the Turner area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. It becomes difficult to access the Eastwood area in the northeast of the city because ice can make the steep roads impassable. The most recent winter storms (December 2016 – January 2017 and February 2021) included snow and freezing rain and ice, transportation and power interruptions, loss of all internet service, loss of all cellular phone service and government office and school closures.

16.9.8 Tornado

CPRI = 2.3, Risk Level: Moderate

Events: The F-2 tornado that touched down in Aumsville in December 2010, only four miles from Turner, did not cause damage to Turner.

Vulnerability: Risk of damage to buildings, power outages, and road closures.

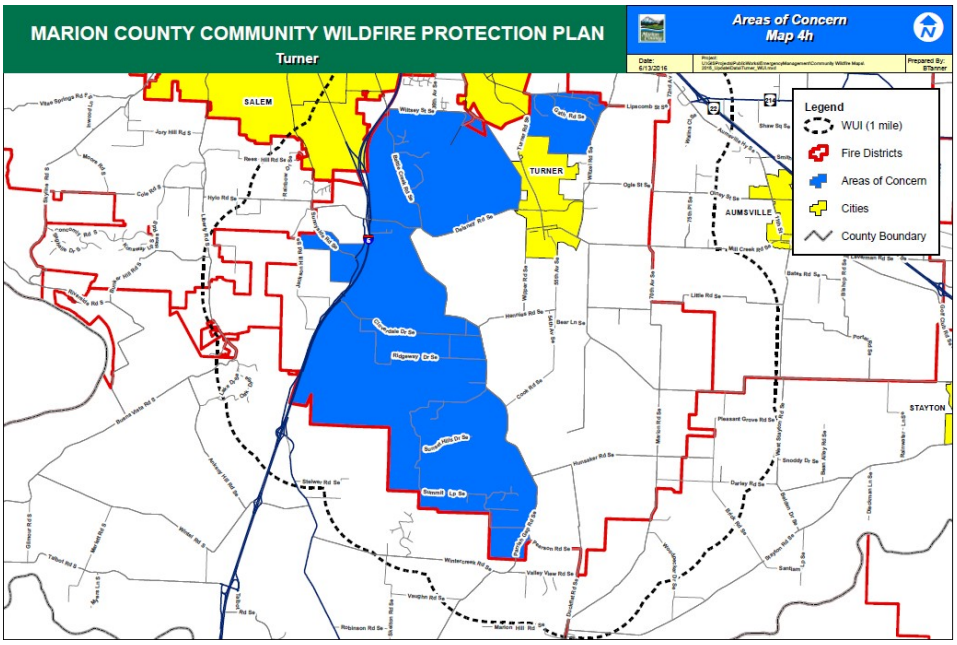
16.9.9 Wildfire

CPRI = 2.65, Risk Level: Moderate

Events: Turner is surrounded by open farmland, forests, or waterways. Although Turner has some forested areas within the city limits, there is no history of wildfire events in Turner.

Vulnerability: The County updated the Community Wildfire Protection Plan (CWPP) in 2016 and portions of Turner are listed as having wildland urban interface (WUI) with areas of concern. Figure depicts the areas near Turner that the CWPP identifies as areas of concern. These areas should be targeted for fire mitigation activities.

Figure 16-6, Wildfire areas of concern near Turner



Source: Marion County Community Wildfire Protection Plan (2016).

16.9.10 Volcanic Eruption

CPRI = 1.5, Risk Level: Low

Events: Not Reported

Vulnerability: Ashfall only

16.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan and Turner Addendum update process, Oregon Department of Land Conservation & Development and the City of Turner developed a list of priority actions. These actions were prioritized and then reviewed internally by staff and city council during the spring of 2022.

Mitigation Success Story: Regional Flood Mitigation Initiative

Starting with flood early warning system, the City of Turner has built a coalition of partners that are committed to implementing flood mitigation strategies. These partners include Marion County, the City of Salem, Aumsville, the Beaver Creek Watershed Board, the Santiam Water Control District, and the State of Oregon. In December, this coalition applied for a $400,000 grant to study flood detention possibilities in Mill Creek. In the future, these partners will continue working together to find and implement flood mitigation projects in the Middle Willamette watershed.

16.10.1 Mitigation Successes

- Stormwater Infrastructure Upgrades: The City has invested about $15,000 in building and upgrading storm water systems where rainwater has historically damaged property and threatened roadway stability.
- Turner Elementary School received $1.2 million for seismic retrofits from the State.
- The Mid-Willamette Valley High Water Watch https://hww.onerain.com/ is a live data tool which is the result of long-term coordination with Turner, regional partners, and the City of Salem who have a full-time staff person that maintains the website.
- Completed 17-MH-02: Implement an automated notification system for disaster alerts and preparedness.
- Regional flood mitigation initiative: Mill Creek flood detention study.
- PGE requires undergrounding of power lines so new development in Turner has reduced risk from power outages and wildfire.

Mitigation Success Story: Stormwater Infrastructure Upgrades

Since Turner's 2012 Hazard Mitigation Plan, the City has invested about $15,000 in building and upgrading storm water systems where rainwater has historically damaged property and threatened roadway stability. These projects have helped minimize localized flooding, improving the city's ability to remain functional during storm and high-water events.

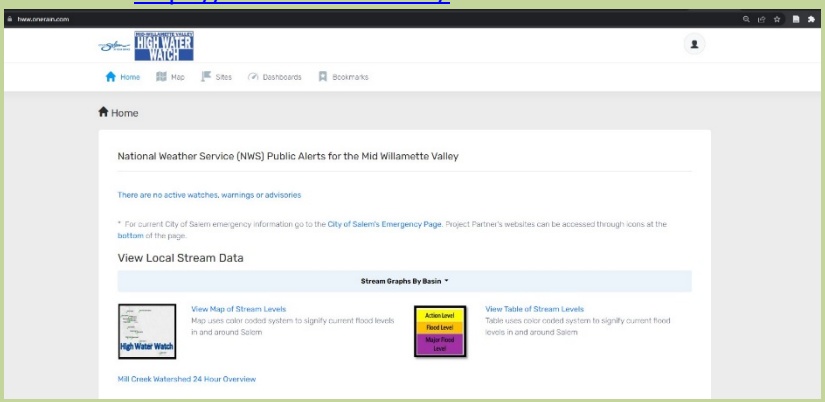
Mitigation Success Story: Flood Monitoring Infrastructure

After a 2012 storm caused a severe flood in Turner, the City partnered with the State and the City of Salem to implement a rain and stream gauge monitoring system to provide early warning for future floods.

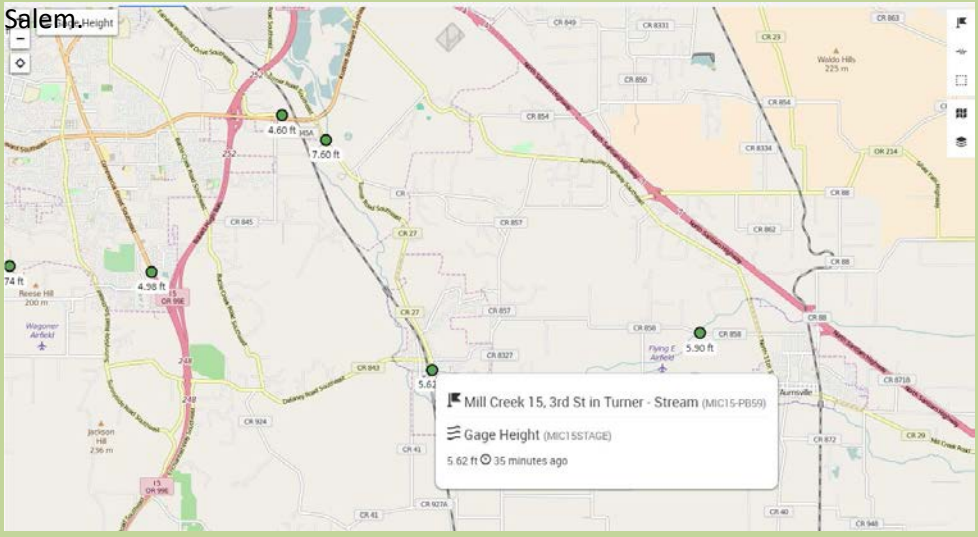


The jurisdictions used $200,000 from the Hazard Mitigation Grant Program to build the infrastructure and website that make up the early warning system.

As pictured below, residents can visit the Mid-Willamette Valley High Water Watch website at https://hww.onerain.com/



The website features a map with real-time data about stream levels in and around Salem.

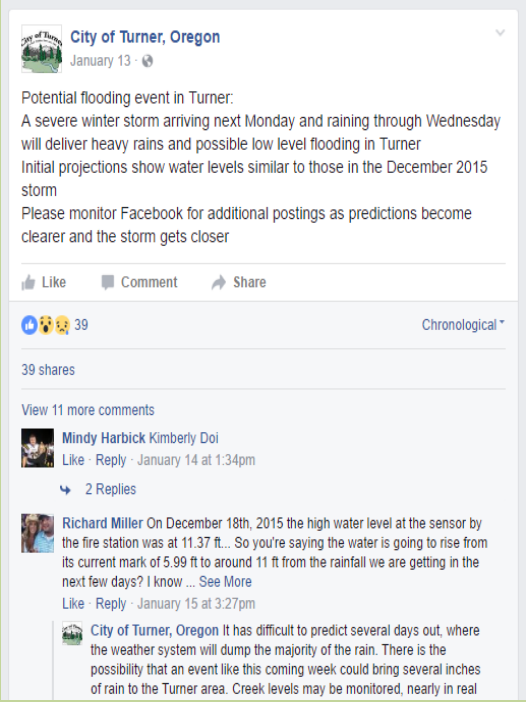


Mitigation Success Story: Flood Early Warning System

To complement the flood monitoring system (see Mitigation Success Story: Flood Monitoring Infrastructure), Turner has also been actively working to improve communication with residents regarding floods and other hazard events.

The City purchased a contract with Everbridge (an emergency mass communication tool) and has been collecting cell phone numbers for entire community. This "reverse 911" system allows the city to send out notifications about hazards. For example, the city can send a text alert about flood warnings when the flood monitoring systems indicates high water may be on the way.

In addition to the Everbridge system, the city actively uses Facebook for weather- and flood- related notices and advisories. Residents actively engage with the City's Facebook page, sharing notifications with their networks and quickly spreading the word about potential hazards that may affect the community. Additionally, the Facebook page helps the city advertise for upcoming preparedness events (see post below.)





16.10.2 Ongoing Actions

- Meet with City of Salem flood and emergency management staff on an annual basis to identify and implement collaborative flood mitigation project opportunities.
- Provide public outreach and education to vulnerable populations (such as Turner retirement homes, the Christian Convention, Aldersgate, and others, as identified in this plan) regarding hazards.
- Partner with existing community organizations to disseminate hazard preparedness information.
- Use existing city public engagement tools (such as monthly utility bills, public reader boards, Facebook pages, etc.) as means of disseminating information to residents regarding hazard preparedness.
- Support annual emergency management tabletop exercises that include hazardous material release scenarios (in addition to other hazard scenarios).
- Meet with the City of Salem each year to receive updates on the Franzen Reservoir and notify the public of any changes to safety.
- Maintain & cultivate partnerships with other government agencies, both local and regional, to plan for flood hazard events.
- Develop MOUs with private businesses and citizens around equipment and resource sharing during severe weather events.
- Monitor the trees in the public right-of-way and maintain to minimize damage during wind or winter storms.
- Support the wildfire prevention outreach to residents in areas where wildfire is a potential concern (e.g., hillside neighborhoods in NE Turner).

16.10.3 City of Turner Mitigation Action Table

The table below (Table 16.6) shows the City of Turner mitigation actions.

Table 16-6, City of Turner Priority Mitigation Actions

2023-2027 City of Turner Priority Mitigation Actions							
#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
20223-FL-1	Flood	Pursue and complete remapping of City floodplain. Turner was recently remapped, but as a part of their floodplain management plan it is possible the need for remapping will arise again. A new neighborhood was added due to uncertified railroad	M	2-5 Years	$100,000	City of Turner	Started
2022-FL-2	Flood	Widen the Perrin bypass and reinforce levee to accommodate flood flows. Funding: Advanced Assistance, FMA	H	2-5 Years	$2,000,000	City of Turner	New
2022-MH-1	Multi-Hazard	Purchase a portable water filtration device. Was 17- P-3 from the 2017 HMP	M	1-3 Years	$10k	City of Turner	Started
2022-MH-2	Multi-Hazard	Encourage documentation of the vulnerable populations listed in the Plan, including the creation and maintenance of a list of residents with special medical needs. Was 17 M-H 3 in the 2017 HMP	M	1-3 Years	Staff Time	City of Turner	Started
2022-MH-3	Multi-Hazard	Support the retrofit the fire station to withstand flood and earthquakes. Lead: Turner Fire. In the design stage. Plans in the works to elevate the station.	H	2-5 Years	Staff Time	Turner Fire District	Started
2022-LS-1	Landslide	Implement the Eastwood Drive Stabilization Plan and continue ongoing monitoring of conditions. Alternatives have been identified; the preferred containment option is being assessed. Additional work could include tree removal and bank stabilization using various methods. Funding: City budget for landslide barriers along the roadway in 2022.	H	2-5 Years	$50,000	City of Turner	Started

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-4	Multi-Hazard	Support annual emergency management tabletop exercises by Marion County that include hazardous material release scenarios (in addition to other hazard scenarios). Was 17-MH-5 in the 2017 HMP.	M	1-3 Years	Staff Time	City of Turner	Ongoing
2022-WF-1	Wildfire	Support fire mitigation outreach throughout the Fire District including defensible space and fire-resistant materials.	M	1-3 Years	Staff Time	City of Turner	New

2017-2022 City of Turner Action Items Status Update

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organization	Status
2017-P-1	Flood	Add water level monitoring equipment to the Marion Road Bridge, south of Mill Creek.	City of Turner	CERT, Mill Cr. Basin Flood Mgmt. agencies	Discontinue
2017-P-2	Flood	Meet with City of Salem flood and emergency management staff on an annual basis to identify and implement collaborative flood mitigation project opportunities. City of Salem stormwater/utility funded. Discuss and maintain monitoring equipment; frequent meetings	City of Turner	Turner Public Works, City of Salem, Marion Co., OEM, City of Aumsville, Beaver Cr WSC, Santiam WSC	Ongoing
2017-P-3	Multi-Hazard	Purchase a portable water filtration device.	City of Turner Public Works	City of Turner	Started
2017-P-4	Multi-Hazard	Provide public outreach and education to vulnerable populations (such as Turner retirement homes, the Christian Convention, Aldersgate, and others, as identified in this plan) regarding hazards.	City of Turner	Turner Police, Turner Fire District, Marion County	Ongoing
2017-P-5	Multi-Hazard	Partner with existing community organizations to disseminate hazard preparedness information.	City of Turner	Turner Police, Turner Fire, Turner Christian Church, Cascade School District, Church of God, Turning Point	Ongoing

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organization	Status
2017-MH-1	Multi-Hazard	Use existing city public engagement tools (such as monthly utility bills, public reader boards, Facebook pages, etc.) as means of disseminating information to residents regarding hazard preparedness.	City of Turner Police	City Administrator; Public Works; Turner Fire; Turner Christian Church, Portland General Electric; North Marion School District; MCEM	Ongoing
2017-MH-2	Multi-Hazard	Implement an automated notification system for disaster alerts and preparedness.	City of Turner	Turner Police Dept., Turner Fire District, Community Emergency Response Team (CERT), MCEM	Complete
2017-MH-3	Multi-Hazard	Encourage documentation of the vulnerable populations listed in the Plan, including the creation and maintenance of a list of residents with special medical needs.	City of Turner	Turner Police Dept., Turner Fire District	Started
2017-MH-4	Multi-Hazard	Retrofit the fire station to withstand flood and earthquakes or construct a new, seismically-sound fire station outside the flood zone in a location at minimal risk to natural and man-made hazards. Lead: Turner Fire. In the design stage. Plans in the works to elevate the station.	Turner Fire District	City Administrator, OEM, Business Oregon Seismic Rehab Grant Program	Started
2017-MH-5	Multi-Hazard	Support annual emergency management tabletop exercises that include hazardous material release scenarios (in addition to other hazard scenarios).	Turner Fire District	Community Emergency Response Team (CERT), MCEM, Union Pacific	Ongoing
2017-DF-1	Dam Failure	Coordinate with Marion County Emergency Management to develop an evacuation plan for the City of Turner in the event of a dam failure.	City of Turner	Marion County Emergency Management, Marion County Sheriff's Office	Started
2017-DF-2	Dam Failure	Coordinate with Marion County Emergency Management and the Army Corps of Engineers to develop a dam failure notification procedure for the City of Turner.	City of Turner		Started

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organization	Status
2017-DF-3	Dam Failure	Meet with the City of Salem each year to receive updates on the Franzen Reservoir and notify the public of any changes to safety.	City of Turner	City of Salem	Ongoing
2017-DF-4	Dam Failure	Actively engage with the County's efforts to work with the Army Corps of Engineers to assess dam failure likelihood and risks.	City of Turner Police	Turner Fire, City Administrator, Army Corps of Engineers, MCEM	Started
2017-EQ-1	Earthquake	Perform seismic assessments of critical infrastructure as resources become available.	City of Turner	N/A	Started
2017-EQ-2	Earthquake	Send city staff and other to the County's ATC 2.0 structural assessment training when the course is offered.	City of Turner	N/A	Started
2017-FL-1	Flood	Provide more training on flood insurance. Funded by City budget. Nearly complete. Brought in an insurance specialist to help community members understand the best way to improve their flood vents and other flood insurance reduction efforts.	City of Turner	Oregon DLCD, OEM, FEMA, FEMA trainers.	Completed
2017-FL-2	Flood	Identify and prioritize properties to be retrofitted against flood damage. Coordination with 17-FL-01	City of Turner	DLCD	Not Started
2017-FL-3	Flood	Have City Council evaluate pursuing certification in the Community Rating System (CRS).	City of Turner	DLCD, FEMA, City of Salem, Marion Co Public Works	Started
2017-FL-4	Flood	Implement annual flood vent inspection program for all residential properties in areas at risk of chronic flooding (inside and outside of the mapped floodplain). Continue if CERT is involved, maybe discontinue if not	City of Turner Planning/Building	CERT, DLCD	Started

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organization	Status
2017-FL-5	Flood	Work with owners of repetitive loss buildings in the city to identify cost effective mitigation strategies including consideration of elevation or buy-out.	City of Turner	DLCD, OEM	Not Started
2017-FL-6	Flood	Pursue and complete remapping of City floodplain. Turner was recently remapped, but as a part of their floodplain management plan it is possible the need for remapping will arise again. A new neighborhood was added due to uncertified railroad.	City of Turner	DLCD, OEM, FEMA	Started
2017-FL-7	Flood	Provide annual public information materials to Turner residents regarding flood safety practices, including detailed information about sandbagging. General public information on a regular basis. During events, targeted information and support for sandbagging stations is provided. Specific messaging to residents in the floodway to deter debris mobilizing in flood events.	City of Turner	City of Turner, CERT	Ongoing
2017-FL-8	Flood	Maintain & cultivate partnerships with other government agencies, both local and regional, to plan for flood hazard events.	City of Turner	Marion Co., Salem, MWVCOG, Mill Creek Basin flood mgmt. agencies.	Ongoing
2017-FL-9	Flood	Pursue hiring a flood coordinator to address flood-related action items. These duties are managed by the City Administrator.	City of Turner	MWVCOG	Discontinue
2017-LS-1	Landslide	Implement the Eastwood Drive Stabilization Plan and continue ongoing monitoring of conditions. Alternatives have been identified; the containment option is being implemented. Additional work could include tree removal and bank stabilization using various methods. Funding: City budget for	City of Turner Public Works		Started

		landslide barriers along the roadway ‘22.			
#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organization	Status
2017-SW-1	Severe Weather	Develop MOUs with private businesses and citizens around equipment and resource sharing during severe weather events. MOUs with Police, Fire, Marion Co. Public Works, local contractors. Refresh and keep up to date	City of Turner	Marion Co Public Works, Turner Public Works, Police, Fire	Ongoing
2017-SW-2	Severe Weather	Monitor the trees in the public right-of-way and maintain to minimize damage during wind or winter storms.	City of Turner Public Works	PGE, Turner Fire District	Ongoing
2017-WF-1	Wildfire	Support the wildfire prevention outreach to residents in areas where wildfire is a potential concern (e.g., hillside neighborhoods in NE Turner). As outlined in the Marion County Community Wildfire Protection Plan (CWPP), Marion County and Turner Fire are lead on wildfire outreach. Marion County CWPP update is underway; and Turner is participating. The city works closely with Turner RFPD.	Turner Fire District	Marion County Fire Defense Board, Marion County Emergency Management, Oregon State Fire Marshal’s Office	Ongoing
2017-WF-2	Wildfire	Support fire suppression mitigation outreach throughout the Fire District including defensible space and fire-resistant materials.	Turner Fire District	Marion County Fire Defense Board, Marion County Emergency Management, Oregon State Fire Marshal’s Office	Ongoing

Source: City of Turner, 1/5/22 and 6/15/2022

17 City of Woodburn and Woodburn Rural Fire Protection District Addendum

17.1 Purpose

This document serves as a shared addendum for the City of Woodburn and the Woodburn Rural Fire Protection District (Woodburn Fire District or WFD) to the Marion County Multi- Jurisdictional Hazards Mitigation Plan (HMP). The purpose of this shared addendum is to guide the implementation of mitigation actions by Woodburn and Woodburn Fire District to improve the resilience of the community. Mitigation planning is a long-term endeavor—one that requires broad internal involvement and community engagement to be successful.

Finally, please refer to the information contained in Volume I (Basic Plan) and Volume III (Appendices) of this HMP, which provides additional information (particularly regarding participation and mitigation strategy) and forms the basis of this addendum.

17.2 Plan Process, Participation, and Adoption

In the summer and fall of 2021 Marion County partnered with the Oregon Department of Land Conservation and Development and the Oregon Department of Emergency Management (OEM), and Marion County cities, including Woodburn and Woodburn Fire District, to update their addendum to the Marion County Hazard Mitigation Plan, which expired August 16, 2022. This project is funded through the Federal Emergency Management Agency's (FEMA) FY19 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2019-003).

By developing this addendum to the Marion County HMP, locally adopting it, and having it approved by FEMA, the Woodburn and Woodburn Fire District will gain eligibility for FEMA Hazard Mitigation Assistance (HMA) funding that includes three programs: Building Resilient Infrastructure & Communities (BRIC), formerly the Pre-Disaster Mitigation grant program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program.

Woodburn and Woodburn Fire District joined the Marion County HMP update by executing an intergovernmental agreement with DLCD on November 25, 2021, and January 30, 2022, respectively. On November 23, 2021, City of Woodburn Police Chief Marty Pilcher, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Tricia Sears conducted a risk assessment meeting with the City of Woodburn that included a Hazard Vulnerability Assessment ranking. On January 12, 2022, Woodburn Fire Chief Joe Budge, Marion County Emergency Preparedness Coordinator Mike Hintz, and DLCD Planner Pamela Reber conducted a risk assessment meeting with the Woodburn Fire District that included a Hazard Vulnerability Assessment ranking. Chief Pilcher and Chief Budge met again with DLCD Planner Pamela Reber on July 13, 2022, to update this addendum.

Woodburn and Woodburn Fire District staff attended HMP Steering Committee meetings in October 2021 and March 2022.

The City of Woodburn/ Woodburn Fire District Steering Committee is comprised of the following representatives:

- Co-Convener, City of Woodburn Police Chief
- Co-Convener, Woodburn Fire District Fire Chief
- City of Woodburn Public Works Director
- City of Woodburn Building Official
- City of Woodburn Community Development Director
- City of Woodburn Senior Planner
- City of Woodburn Associate Planner
- City of Woodburn Police Executive Assistant
- Woodburn Police Department Patrol Division
- Woodburn Fire District Fire Marshal
- Woodburn Fire District CERT Coordinator

Woodburn used multiple approaches to engage the public. First, the City established steering committee representatives from across the city. Next, the city actively participated in countywide community engagement activities such as the community hazards survey.

Both jurisdictions promoted the HMP survey and outreach efforts throughout the plan update, including public posts on the city's website, and messages sent out via the weekly e- blast in January 2022.Woodburn Fire District and their CERT volunteers shared and filled out the survey as well. City staff also presented the draft plan to the City Council during an open public council session. (See Appendix C for more information).

17.3 Risk Assessment

A risk assessment is intended to provide the "factual basis for activities proposed in the strategy to reduce losses from identified hazards" (Department of Homeland Security, Federal Emergency Management Agency, 2023). This section of the HMP addendum can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

17.4 Community Profile

This section provides information on city and district specific assets and populations. For additional information on the characteristics of Woodburn and Woodburn Fire District, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, Community Profile. Many of these community characteristics can affect how hazards impact communities and how communities choose to plan for hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for hazard mitigation.

Woodburn Fire District

The Woodburn Fire District was established in 1901. The current district contains 4 stations, 16 full time staff, and provides fire suppression, fire prevention services, and emergency medical assistance to residents located within its 75-square-mile boundary. The fire district boundary includes the city of Woodburn, the city of Gervais, and a large area of unincorporated northern Marion County (see figure 2 below).

Woodburn Fire District – Community Emergency Response Team (CERT)

Woodburn has a very active Community Emergency Response Team (CERT) of 40-70 members. Woodburn Fire District funds the CERT Coordinator and office for the chapter; the main fire station serves as a volunteer operations center. WFD CERT is organized under Woodburn Fire District.

WFD CERT provides the Woodburn, Gervais, Hubbard areas and portions of Marion County with an Emergency Operations Plan (EOP) based on a variety of volunteer skills for emergency tactical, administrative, communications and logistics among the Cities and their agencies, and among the Cities and county government (Operational Area). The purpose of the emergency operations plan is to provide authority for the participation of CERT in providing essential services during periods of national, state, or local emergency. The CERT COMTEAM is intended to augment agency and public safety operations. The number of participants is limited only by available, trained resources and will be based on the specific need and the availability of responders. A declaration of an emergency is not required to mobilize the CERT resources, but an activation will require approval from the WFD.

CERT provides many other services, including medical triage and first-aid, light search and rescue, damage assessment, firefighter rehabilitation, crowd control, flood response, spontaneous volunteer management, and other duties that fall within its scope of training and mandate. CERT also engages in community service work: food drives, deliveries, and Cascadia earthquake preparedness education.

17.4.1 Community Characteristics

The city of Woodburn is in the Willamette Valley in Marion County, Oregon, approximately 31 miles south of the city of Portland. Woodburn experiences a moderate climate with an average high temperature of 82 degrees and low of 54 degrees in August, and an average high temperature of 47 and low of 35 in January. The city receives an average annual precipitation of 40.7 inches.4 Major bodies of water in Woodburn include Senecal Creek and Mill Creek. Woodburn is located on a flat area, with farmland surrounding the city on all sides.

The Population Research Center at Portland State University lists Woodburn's 2020 population at 25,882. This represents a 24.1% increase from 2000 (Portland State University, Population Research Center, 2021). For more demographic information, refer to Volume III, Appendix B-Community Profile.

17.4.2 Economy

Historically, the city of Woodburn was a commercial, agricultural, and industrial community that grew around the railroad that currently runs through the center of town (City of Woodburn, N.d.). Today, Woodburn's economy is still largely based on manufacturing, agriculture, construction, and retail trade. Woodburn's proximity to I-5 allows for an auto-oriented service economy to exist along the interstate corridor. The Woodburn Premium Outlets are a large shopping attraction for out-of-town visitors. Changes in development include an Amazon distribution center coming in, necessitating city infrastructure improvements like a new fire hydrant system. Similarly, a 2,500 residential unit development has been proposed. If built, this would add 10% more housing to the city of Woodburn. Median household income in Woodburn from 2015 to 2019 was $50,093, a 7.3% increase from the previous period (U.S. Census Bureau, 2022). For more economic information, refer to Appendix C.

Figure 17-1, City of Woodburn Map

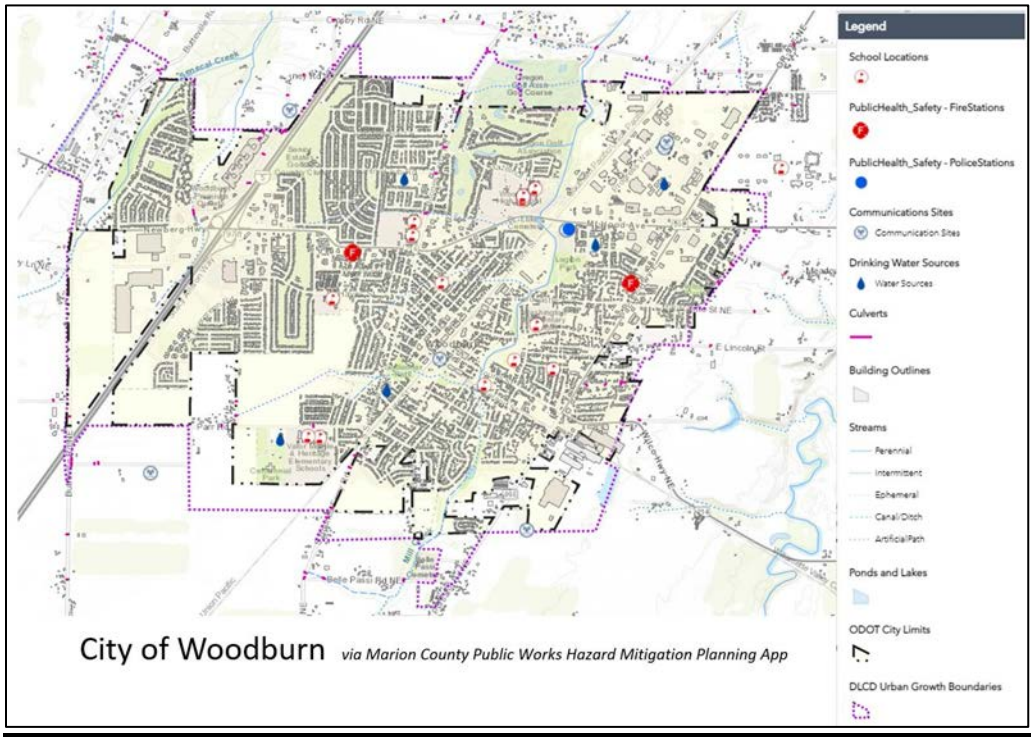
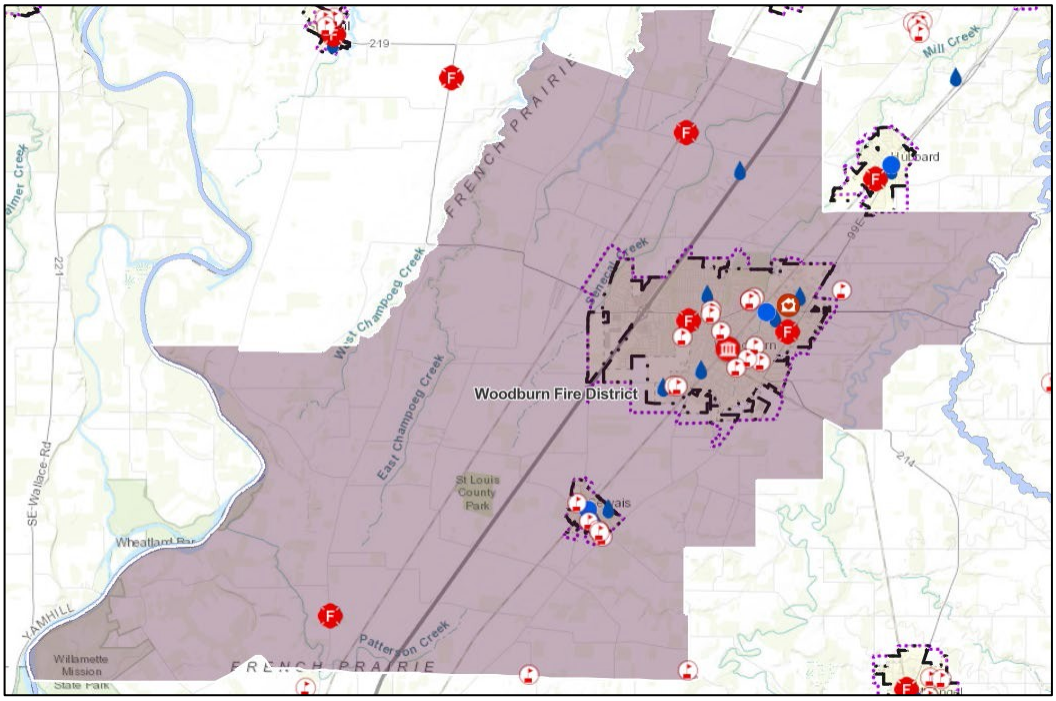


Figure 17-2, Woodburn Fire District



Source Marion County GIS

17.5 Critical and Important Facilities

Woodburn and Woodburn Fire District's critical and important facilities include the following:

17.5.1 Transportation

- Interstate-5 runs north-south through western Woodburn.
- Highway 99E runs parallel to I-5 through eastern Woodburn.
- Highway 214 runs east-west through Woodburn (Highway 211 also runs east-west and merges with Highway 214 when it reaches Woodburn)
- The Union Pacific Railroad runs parallel to I-5 through the middle of Woodburn.
- The Burlington Northern Santa Fe railroad runs north-south just west of Woodburn.
- Woodburn Transit Service.
- Woodburn Amtrak Station.

17.5.2 Energy

- PGE – electricity (2079 Progress Way)
    - PGE operates a maintenance facility and three sub-stations in or near Woodburn.

17.5.3 Water / Wastewater

Water:

- Above-ground storage tank: 750,000 gallons
- Underground storage reservoir: 4.7 million gallons
- Seven active wells (according to the 2005 Public Facilities Plan)
- Three water treatment plants (National Wy., Country Club Rd., and Parr Rd.)

Wastewater

- Wastewater Treatment Plant and Collection System (located off of Highway 211)
    - Approximately 140 acres of land
    - Ten lift stations for sanitary sewer services

17.5.4 Emergency Services

Police Department:

City of Woodburn, 1060 Mt. Hood Ave., Woodburn, Oregon (503) 982-2345

Fire Department:

Woodburn Fire District, 1776 Newberg Hwy., Woodburn, Oregon (503) 982-2360

Station 22 – 1650 James St., Woodburn, Oregon

Station 24 – 11484 River Rd., Gervais, Oregon 97026

Station 25 – 18676 Butteville Rd., Hubbard, Oregon 97032

Medical:

- BestMed Urgent Care (2902 Tom Tennant Dr.)
- Legacy Health / Woodburn Specialist Center (1475 Mount Hood Ave.)
- Salem Health Clinic (105 N. Arney Rd.)
- Salud Medical Center (1175 Mount Hood Ave.)
- Woodburn Pediatric Clinic (2050 Progress Way)
- Note: Major hospitals are in Silverton and Salem

City Administration: City Hall, Public Works, Finance, Planning, Municipal Court

City of Woodburn, 270 Montgomery St., Woodburn, Oregon (503) 982-5228

17.5.5 Cultural / Historical Resources

- Buildings listed on the National Register of Historic Places:
  - Bank of Woodburn
  - Old Woodburn City Hall
  - Jesse H. Settlemier House
- Woodburn also has an Historic Downtown district.
- Events/amenities that may have large crowds:
  - March and April: Woodburn Tulip Festival
  - Woodburn Premium Outlets (particularly around Black Friday and the holiday season)
  - Fiesta Mexicana in Legion Park
  - Relay for Life in July
  - Drag Racing NHRA (National Hot Rod Association) from March to November
  - Bauman's Fall Festival in Gervais (impacts traffic in Woodburn)
  - Oktober Fest in Mt. Angle (impacts traffic in Woodburn)
  - St. Paul Rodeo (impacts traffic in Woodburn)

17.5.6 Functional and Access Needs (Vulnerable Populations)

- Schools:
  - Heritage Elementary (440 Parr Rd.)
  - Lincoln Elementary (1041 N. Boones Ferry Rd.)
  - Nellie Muir Elementary (1800 W. Hayes St.)
  - Washington Elementary (777 E. Lincoln St.)
  - French Prairie Middle (1025 N. Boones Ferry Rd.)
  - Valor Middle (450 Parr Rd.)
  - Academy of International Studies (1785 N. Front St.) – high school
  - Success Alternative High School (610 Young Street)
  - Wellness, Business and Sports School (1785 N. Front Street) – high school
  - Woodburn Academy of Art, Science and Technology (1785 N. Front St.) – high school
  - Woodburn Arts and Communications Academy (1785 N. Front St.) – high school
  - St. Luke's Parochial School (529 Harrison St.)

- Head start (950 N. Boones Ferry Rd.)
- Oregon Child Development Coalition (OCDC) (540 North Settlemier Avenue)
- – Infant services
- Chemeketa Community College (120 E. Lincoln Street) – community college
- Pacific University Campus (24 W Lincoln St) – college
- Woodburn Arthur Academy (575 Gatch St.) – K- 5th Grade.

See hazard sections below and Section 2, Risk Assessment, for potential hazard vulnerabilities to these facilities.

17.6 Plans and Policies

Table 17-1, Plans and Policies of the City of Woodburn & Woodburn Fire District

Document Name with Hyperlink if the document is available online	**Year**
Woodburn Comprehensive Plan	2019
Woodburn Comp Plan Map Explorer (link here)	2022
Woodburn Transportation System Plan (TSP webpage)	2019
Woodburn Public Facilities Plan	2005
Woodburn Stormwater Master Plan (chapters 7 and 11)	1996
Woodburn Fire District CERT Emergency Operations Plan	2022

17.7 City of Woodburn Hazard Profile

Community Overview				
Community Name	Population	# Of Buildings	Critical Facilities[1]	Total Building Value ($)
Woodburn	25,185	7,332	17	3,446,910,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Lost Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	41	0.2%	8	0	266,000	0.0%
Earthquake	Mt. Angel Mw 6.8 Deterministic	4,595	18.2%	3,270	4	1,287,042,534	37.3%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	15	0.1%	5	0	1,224,000	0.0%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	87	0.3%	20	0	8,217,418	0.2%
Lahar	Medium Zone (1000 to 15000 – Year)	0	0.0%	0	0	0	0.0%

[1] Facilities with multiple buildings were consolidated into one building complex.
[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
French Prairie Middle School		X				
Gethsemane Christian Academy		X				
Heritage Elementary School		X				
Legacy Medial Group-Woodburn		X				
Lincoln Elementary School		X				
Nellie Muir Elementary School						
Salud Medical Center						
Silverton-Woodburn Immediate Care and Family Medicine						

Critical Facilities						
Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Silverton-Woodburn Internal Medicine						
St. Luke's School						
Valor Middle School						
Woodburn Arthur Academy						
Woodburn Family Medicine						
Woodburn High School						
Woodburn Police Department						
Woodburn Public Works						
Woodburn Fire District #21						
Woodburn Fire District #22						
Woodburn Success High School						

Source: DOGAMI (2022)

17.8 Hazard Analysis

The methodology for assessing risk was the same for all jurisdictions and a detailed description of the BOLD planning methodology can be found in Volume I, a brief description is below. To complete the risk assessment, the jurisdiction representatives first updated the description, type, location, and extent of each hazard. Next, they updated the Hazard Vulnerability Analysis based on each hazard's potential impact on the community using a calculated priority risk index (CPRI) methodology developed by BOLD Planning[6]. This assessment method ranks the following factors to determine risk from the range of hazards identified:

1. Probability (frequency) of event.
2. Magnitude of event.
3. Expected warning time before event.
4. Expected duration of event.

Score	Probability	Warning Time	Magnitude/Severity	Duration
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

The assessment identifies three levels of risk: High, Moderate and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

	Range Values	
IMPACT	Low CPRI	High CPRI
High	3.0	4.0
Moderate	2.0	2.9
Low	1.0	1.9

A summary of the risk assessment findings and rankings is presented below.

Table 17-2, Hazard Vulnerability Assessment – Natural Hazards

Hazard Profile Summary for the City of Woodburn/Woodburn Fire District Using Bold Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significanc
Weight Factor	0.45	0.15	0.3	0.1		
Earthquake	4	4	4	4	4.0	**High**
Severe Weather/Storm	4	1	3	4	3.3	**High**
Wildland Interface Fire	3	2	3	4	3.0	**High**
Drought	3	1	3	4	2.8	**Moderate**
Flood (including dam failure)	3	1	3	4	2.8	**Moderate**
Extreme Weather - High Temperature	3	1	3	3	2.7	**Moderate**
Tornado	1	4	3	3	2.3	**Moderate**
Avalanche (new in 2021)	1.5	1	2	3	1.7	**Low**
Volcanic Eruption	1.5	1	2	3	1.7	**Low**
Landslide	1	4	1	3	1.7	**Low**

Source: BOLD Planning Risk Assessment Method; Analysis by Marion County Emergency Management, the City of Woodburn, and Woodburn Fire District on 11/23/22 and 1/12/22.

Table 17-3, Hazard Vulnerability Assessment – Other Hazards

Hazard Profile Summary for the City of Woodburn/Woodburn Fire District Using Bold Planning Analysis Scoring						
Other Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	2022 Local Planning Significanc
Weight Factor	0.45	0.15	0.3	0.1		
Hazardous Materials – Non-Transportation	3	4	4	4	3.6	**High**
Hazardous Materials Release - Transportation	2.5	4	4	4	3.3	**High**
Terrorism/Active Shooter/Workplace Violence	2.5	4	3	4	3.0	**High**
Cyberterrorism	3	4	2.5	3	3.0	**High**
Chemical, Biological, Radiological, Nuclear, Explosive	2	4	3	4	2.8	**Moderate**
Public Health	3	1	3	4	2.8	**Moderate**
Agricultural Terrorism	2	2	3	4	2.5	**Moderate**
Fire - Residential / Commercial (Arson)	2	4	2	3	2.4	**Moderate**
Unauthorized Entry	2	4	2	3	2.4	**Moderate**

Source: Marion County Emergency Management the City of Woodburn, and Woodburn Fire District on 11/23/22 and 1/12/22.

17.9 Hazard Characteristics

Hazard History, Characteristics and Extent for Marion County apply also to the City of Woodburn and Woodburn Rural Fire Protection District. Volume I, Section 2, Risk Assessment, adequately describes the characteristics of hazards, as well as the location and extent of potential events. This section identifies vulnerabilities specific to the City of Woodburn and Woodburn Rural Fire Protection District, recent localized hazard events and impacts, and illustrates the basis for the city's HVA scores.

17.9.1 Avalanche

CPRI = 1.7, Risk Level: Low

Events: Not Reported

Vulnerability: Not Reported

17.9.2 Drought

CPRI = 2.8, Risk Level: Moderate

Events: Governor Kate Brown declared a drought emergency for all of Marion County in September 2015, but according to the steering committee, Woodburn has not implemented water curtailment measures.

Vulnerability: The City's water supply comes exclusively from subsurface sources, making vulnerability to drought moderate. Due to a cool, wet climate, past and present weather conditions have generally spared Marion County communities from the effects of drought. According to Woodburn's Public Facilities Plan, the city has seven active wells which pump water through three neighborhood treatment plants. This water is then pumped into two storage facilities – an above ground tank and a larger underground storage reservoir. From here, water is distributed out to residential, commercial, and industrial customers. Woodburn has a Water Management and Conservation Plan, released in January 2010. The Plan contains a "Water Curtailment Element."

17.9.3 Earthquake

CPRI = 4.0, Risk Level: High

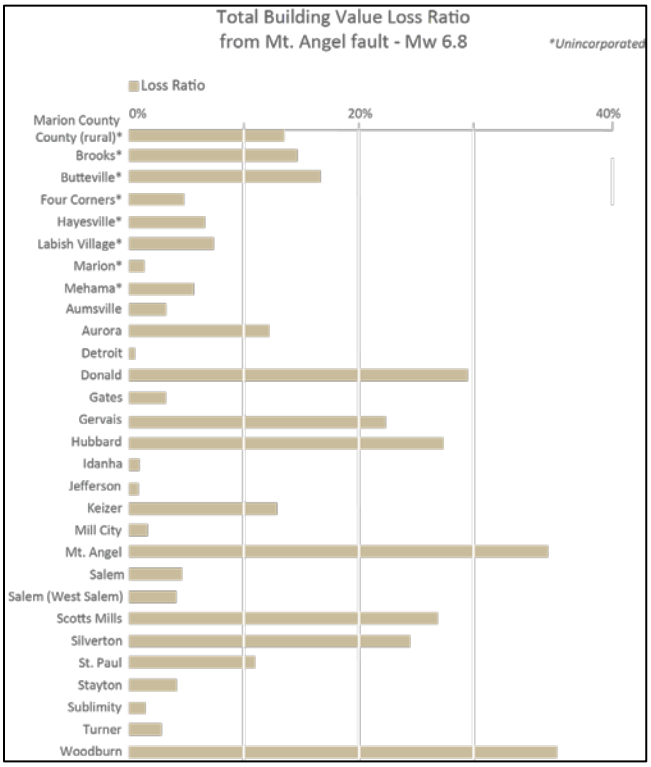
Events: On March 25, 1993, a Mw 5.7 earthquake occurred with an epicenter approximately 3 miles east of the City of Scotts Mills, Oregon. Many buildings were damaged from the event, including the capitol building in Salem. The many unreinforced buildings in the area were significantly damaged due to intense shaking. The preliminary damage estimate was $28.4 million ($50 million in 2022) (Black, 1996).

Vulnerability: The Mt. Angel Fault is an active fault located near the Cities of Mt. Angel, Woodburn, and Silverton.

The DOGAMI results indicate that Marion County could incur moderate to significant losses (11%) due to a Mt. Angel fault Mw 6.8 earthquake. These results are strongly influenced by proximity to the Mt. Angel Fault and ground deformation from liquefaction. The communities in the northeast part of the county (Gervais, Hubbard, Mt. Angel, Scotts Mills, Silverton, and Woodburn), close to the Mount Angel Fault all have

higher levels of estimated losses compared the rest of the county. This is consistent with the damage that occurred from the 1993 Scotts Mills earthquake. In addition, high liquefaction susceptibility exists within most of the floodplains throughout the county which increases the risk from earthquake. Areas near the epicenter of the simulated earthquake scenario are likely to incur a significant amount of damage. The communities of Mt. Angel, Scotts Mills, Silverton, and Woodburn have higher estimated loss ratios compared to other communities in the study due to the level of shaking likely to occur.

Figure 17-3, Earthquake Risk to Building Value



Source: DOGAMI (2022)

17.9.4 Severe Weather – Heat

CPRI = 2.7, Risk Level: Moderate

Events: The temperature in the summer of 2021 reach 116 degrees. This extreme heat emergency event resulted in the city developing temperature refuge capability.

Vulnerability: Seniors and low-income families are at risk of extreme heat events. City program work in this area has designated trigger temperatures and locations identified. CERT volunteers support these efforts.

17.9.5 Flood (Includes Dam Failure)

CPRI = 2.8, Risk Level: Moderate

Events: Not Reported

Vulnerability: Portions of Woodburn have areas of flood plains (special flood hazard areas). These include areas along Mill Creek and Senecal Creek (see Figure WB-4). The Pudding River, just to the east of Woodburn, is also a major source of flooding. Historically, Woodburn has experienced major floods in 1986 and 1996 on the Pudding River. Since then, no major floods have affected the population, but Woodburn continues to experience regular localized flooding during the wet season. According to the steering committee, localized flooding occurred in 2013 along several drainages. The steering committee also indicated that Boones Ferry Rd. regularly experiences localized flooding issues.

17.9.6 Landslide

CPRI = 1.7, Risk Level: Low

Events: Not Reported

Vulnerability: Landslide risk in Woodburn is low to moderate in most populated areas, with some small areas of high along Mill and Senecal Creeks.

17.9.7 Severe Weather / Storm

CPRI = 3.3, Risk Level: High

Events: In February 2021, Woodburn experienced a severe winter storm event – a 50-year ice storm. In some areas, power was out for two weeks, as it was the largest outage in the history of PGE. This event initiated closer coordination with local nursing homes by WFD. This event also identified the need for better fuel and water supply coordination.

Significant wind events occur in Woodburn each year, sometimes interrupting services, downing trees, and causing power outages. Since 1957, five reported tornadoes have struck Marion County, however none have touched down near Woodburn. More recently, two windstorms in 2015 toppled trees, with one tree causing damage to a house. According to the Woodburn steering committee, Woodburn experiences at least one severe wind event each year, often resulting in power outages. During a storm in May 2014, lightening caused an estimated $75,000 in damage to property, including a house. The most recent winter storms (December 2016 – January 2017) included snow and ice and resulted in transportation and power interruptions combined with government office and school closures.

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

Major winter storms can and have occurred in the Woodburn area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity.

17.9.8 Tornado

CPRI = 2.3, Risk Level: Moderate

Events: Since 1957, five reported tornadoes have struck Marion County, however none have touched down near Woodburn.

Vulnerability: According to the Woodburn steering committee, Woodburn experiences at least one severe wind event each year, often resulting in power outages.

17.9.9 Volcanic Eruption

CPRI = 1.7, Risk Level: Low

Events: Previous occurrences are well-documented within the county's plan. When Mt. Saint Helens erupted in 1980, the city was impacted only by ashfall.

Vulnerability: The causes and characteristics of a volcanic event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Woodburn is very unlikely to experience anything more than volcanic ash during a volcanic event.

17.9.10 Wildfire

CPRI = 3.0, Risk Level: High

Events: There is no history of wildfire events occurring within the City of Woodburn and the Woodburn Fire District. However, both jurisdictions provided support to Marion County jurisdictions during the 2020 wildfires.

Vulnerability: Due to Woodburn's isolation from the majority of at-risk areas, Woodburn is unlikely to be affected directly by wildfires. Should they occur nearby, however, the city could be affected by smoke, impacting people with respiratory problems, and potentially the elderly or very young.

17.10 Mitigation Strategy

During the 2022 Marion County Hazard Mitigation Plan Addendum update process, Oregon Department of Land Conservation & Development developed a list of priority actions in a joint meeting with the City of Woodburn and the Woodburn Fire District. The two jurisdictions are both plan holders in this update but are sharing an addendum due to the integrated nature of their local planning efforts that includes the school district, community- based organizations, and a very active CERT team coordinated by Woodburn Fire District.

17.10.1 Mitigation Success

- Woodburn Fire District (WFD) has been working with nursing homes and care facilities (12-15) to ensure these facilities have the proper equipment and supplies in an emergency. WFD coordination includes water, backup power, and fuel—both natural gas and liquid fuel. WFD CERT supports this with canvassing and volunteering.
- WFD applied for a SPIRE grant for refueling. The SPIRE grant will allow WFD to provide fuel to the cities of Gervais, Woodburn, Canby, and Hubbard (and the nursing homes mentioned above) by using a 500-gallon fuel tank on a trailer to refuel.
- WFD CERT has established a HAMM radio link with Marion County Emergency Management in Salem as a redundant emergency communication method.
- The city provides cold and hot weather shelters to address the risk of temperature extremes on community members. CERT volunteers provide support for this. In addition, the city is coordinating with Arches and setting aside $60k/yr to provide temperature refuge assistance for the houseless population.
- WFD has implemented a community CPR program since 2017 by providing first-aid and CPR classes to members of the public.
- Culvert widening projects for Wyffel Park and Gatch Street between Lincoln St. and Hardcastle Ave. were included in upcoming Capital Improvement Plans (2017-P-1).
- The Stormwater Master Plan was updated to include important flood mitigation projects (2017-P-2).
- Woodburn and Woodburn Fire have ensured that all critical facilities have backup power and emergency operations plans to deal with power outages (2017-MH-7).
- The city computer system, network, and website have been evaluated for the ability to function during an emergency (2017-MH-8).
- The city has completed and maintains an inventory of high-risk buildings, critical facilities, and infrastructure that may be particularly vulnerable to earthquake damage (2017-EQ-2).
- Update the city's Comprehensive Plan to reflect the latest information on seismic hazards(2017-EQ-7).

17.10.2 Ongoing Actions

- Coordination on improving communications is an ongoing action item that includes equipment costs—at a local and countywide scale. The countywide communications equipment upgrade will result in a significant success when implemented in 2024 (2017-P-3 and 2017-P-4).
- WFD use and maintenance of their fueling and water distribution trailers is an ongoing disaster resilience action item.
- Encourage residents to prepare and maintain 2-week survival kits through education, coordination, and training in preparation for a large regional disaster.
- Provide periodic first aid and CPR classes to members of the public.
- Participate in Marion County's post-disaster recovery planning efforts.
- Encourage residents and commercial businesses to purchase earthquake insurance (2017-EQ-8).
- Continue compliance with the National Flood Insurance Program through the enforcement of local floodplain ordinances (2017-FL-3).
- Educate homeowners about choosing ice and windstorm-resistant trees and landscaping practices to reduce tree-related hazards in future ice storms.
- Educate citizens about safe emergency heating equipment and the importance of installing carbon monoxide detectors (WFD).

17.10.3 City of Woodburn and Woodburn Fire District Mitigation Action Table

The table below (Table 17.4) shows the City of Turner mitigation actions.

Table 17-4, City of Woodburn and Woodburn Fire District Mitigation Action Items

City of Woodburn & Woodburn Fire District Priority Mitigation Actions 2022-2027							
#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-1	Multi-Hazard	Work to streamline the communication systems between all emergency responders. This might include purchasing additional equipment for some units. County-Wide 800 MHz Radio System; Subscriber cost will apply to Woodburn, but County is funding the majority.	H	2-5 Years	$100k	City of Woodburn Police Department	Ongoing
2022-MH-2	Multi-Hazard	Establish an emergency fuel site at the new Gervais Fire Station, just south of Woodburn. Purpose: Fuel for 10-14 days. In design/ pre- implementation phase in July 2022.	H	1-3 Years	$25k	Woodburn Fire District	New
2022-MH-3	Multi-Hazard	Establish a storage building for a 500-gallon portable fuel trailer and a 500-gallon portable water trailer in the Gervais area. Fuel trailer will be used to fill generators, fire apparatus and heavy equipment working in the field following a regional disaster. Water trailer will provide emergency potable water in the event of water system interruption.	H	1-3 Years	$250k	Woodburn Fire District	New
2022-MH-4	Multi-Hazard	Develop and equip emergency shelters to take care of residents and vulnerable populations such as the elderly, the medically fragile, children, people who speak English as a second language, low-income residents, etc. City Council allocated budget, contract with Arches, Inc. for houseless temperature refuge. Partners: CERT, WFD, Red Cross, Marion County, School Districts.	H	0-18 months	$60,000	Staff Time	Ongoing

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-MH-5	Multi-Hazard	Educate the community about the risk of ammonia release; work with Marion Co. to provide a series of trainings for emergency responders about dealing with hazardous materials. 2017-MH-10 revised Cold storage facilities have ammonia on site. Ammonia release risk education is a priority	H	1-3 Years	Staff Time and Training Budget	City of Woodburn and Woodburn Fire District	Started
2022-MH-6	Multi-Hazard	Create agreement to jointly access an emergency fuel site just south of the city; continue discussions to ensure adequate fuel supply in case of disaster. Woodburn vehicles have a lower need for diesel than WFD.	H	1-3 Years	Staff Time	City of Woodburn Police and Woodburn Fire District	New
2022-MH-7	Multi-Hazard	Develop a traffic management plan for redirecting traffic in the event of a major incident that cuts off roads. 2017-MH-9 Partners: Planning, WFD	M	1-3 Years	Staff Time	City of Woodburn Public Works	Not Started
2022-EQ-1	Earthquake	Require new city facilities to exceed the minimum structural requirements for seismic loading. 2017-EQ-1 Revised Partners: Emergency Manager, CERT, WFD	H	2-5 Years	Staff Time & Capital Budget	City of Woodburn Building Inspection & Permitting	Not Started
2022-EQ-2	Earthquake	Install automatic shut-off valves in all city facilities that use natural gas. Was 2017-EQ-9.	H	2-5 Years	Staff Time	Building Official	Started
2022-DR-1	Drought	Partner with Marion County to support local agencies' training on water conservation measures. Was 2017-DT-1 Partner: Environmental Services	M	2-5 Years	Staff Time	City of Woodburn	Not Started
2022-VC-1	Volcanic Eruption	Identify critical facilities and equipment that can be damaged by ashfall and develop mitigation activities to prevent damage to these facilities. Partners: Public Works, Marion County, DOGAMI, USGS	M	2-5 Years	Staff Time	City of Woodburn	Not Started

#	Hazard	Mitigation Action/Description	Priority	Timeline	Cost	Coordinating Organization	Status
2022-SW-1	Severe Weather	Require new city facilities to exceed the minimum structural requirements for wind loading.	M	2-5 Years	Staff Time	City of Woodburn Building Department	Not Started

2017-2022 City of Woodburn and Woodburn Fire District Action Status Updates

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organizations	Status
2017-P-1	Flood	Include culvert widening projects for Wyffel Park and Gatch Street between Lincoln St. and Hardcastle Ave. in upcoming Capital Improvement Plans.	City of Woodburn Public Works	Non-Reported	To be completed after item 2017-P-2 is completed
2017-P-2	Flood	Update the Stormwater Master Plan to include important flood mitigation projects.			Completion in 2023
2017-P-3	Multi-Hazard	Improve communication equipment in City Hall and in city vehicles and identify additional radio operators to serve as communication backup in an emergency.	City of Woodburn	City of Woodburn Police, Woodburn Fire District, Marion County Public Works	On-going
2017-P-4	Multi-Hazard	Work to streamline the communication systems between all emergency responders. This might include purchasing additional equipment for some units.	City of Woodburn	City of Woodburn Police, Woodburn Fire District, Marion County Public Works	On-going
2017-MH-1	Multi-Hazard	Develop a voluntary registry of populations that may need assistance in an emergency.		METCOM 911, Adult Family Services, Hospitals	Suspended
2017-MH-2	Multi-Hazard	Provide periodic first aid and CPR classes to members of the public.	City of Woodburn	Woodburn Fire District	Ongoing
2017-MH-3	Multi-Hazard	Participate in Marion County's post-disaster recovery planning efforts.		Marion County	Ongoing
2017-MH-4	Multi-Hazard	Continue development of CERT teams to ease the load on emergency services following a disaster.	Woodburn Fire District	Marion County	Ongoing

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organizations	Status
2017-MH-5	Multi-Hazard	Develop and equip emergency shelters to take care of residents and vulnerable populations such as the elderly, the medically fragile, children, people who speak English as a second language, low-income residents, etc.	City of Woodburn	CERT, Red Cross, Marion County, School Districts	Ongoing
2017-MH-6	Multi-Hazard	Educate businesses and governmental organizations about the importance of continuity of operations plans to make them more resilient to natural hazards.	City of Woodburn	Marion County, SEDCOR, Chamber of Commerce	Discontinue
2017-MH-7	Multi-Hazard	Ensure that all critical facilities have backup power and emergency operations plans to deal with power outages. WFD is ensuring that care facilities are addressed.	City of Woodburn	Woodburn Fire District	Completed
2017-MH-8	Multi-Hazard	Evaluate the city computer system, network, and website for the ability to function during an emergency.	City of Woodburn	Non-Reported	Completed
2017-MH-9	Multi-Hazard	Develop a traffic management plan for redirecting traffic in the event of a major incident that cuts off roads.	City of Woodburn Public Works	Marion County, Woodburn Fire District	Completed
2017-MH-10	Multi-Hazard	Work with Marion Co. to provide a series of trainings about dealing with hazardous material. Cold storage facilities have ammonia on site. Ammonia release risk education is a priority	City of Woodburn	Marion County, County Fire Defense Board, Woodburn Fire District	Discontinue
2017-DR-1	Drought	Partner with Marion County to support local agencies' training on water conservation measures.	City of Woodburn	Marion County	Not Started
2017-EQ-1	Earthquake	Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices through public education.	City of Woodburn	Woodburn Fire District including CERT	Ongoing

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organizations	Status
2017-EQ-2	Earthquake	Complete and maintain an inventory of high-risk buildings, critical facilities, and infrastructure that may be particularly vulnerable to earthquake damage.	City of Woodburn	Marion County	Completed
2017-EQ-3	Earthquake	Send city employees to the County's ATC 20 training.	City of Woodburn Building and Engineering	Non-Reported	Not Started
2017-EQ-4	Earthquake	Evaluate the structural integrity of city-owned buildings.	City of Woodburn Building and Engineering	Non-Reported	Not Started
2017-EQ-5	Earthquake	Require new city facilities to exceed the minimum structural requirements for seismic loading. Current code; Pending construction of new buildings	City of Woodburn Building Inspection	City Council	Not Started
2017-EQ-6	Earthquake	Seek funding to further assess the "probability of collapse" for Lincoln Elementary School, Washington Elementary School, French Prairie Middle School, Nellie Muir Elementary School, and Woodburn High School. Outside of City/WFD authority.	Woodburn School District	City of Woodburn	Discontinue
2017-EQ-7	Earthquake	Update the city's Comprehensive Plan to reflect the latest information on seismic hazards	City of Woodburn Planning	Non-Reported	Not Started
2017-EQ-8	Earthquake	Encourage residents and commercial businesses to purchase earthquake insurance.	City of Woodburn Building and Engineering	City's PIO	Ongoing
2017-EQ-9	Earthquake	Install automatic shut-off valves in all city facilities that use natural gas.	City of Woodburn Building	City Council	Not Started
2017-EQ-10	Earthquake	Encourage residents to prepare and maintain 2-week survival kits.	City of Woodburn	Woodburn Fire District, CERT, Marion County	Ongoing
2017-FL-1	Flood	Implement mitigation action items in the Public Facilities Plan.	City of Woodburn Public Works	Non-Reported	Complete

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organizations	Status
2017-FL-2	Flood	Partner with Marion County to conduct workshops for target audiences on National Flood Insurance Programs, mitigation activities, and potential assistance from FEMA's Flood Mitigation Assistance and Hazard Mitigation Grant Programs. The city ensures NFIP compliance and updated maps via their floodplain manager.	City of Woodburn	Marion County Public Works; DLCD NFIP Coordinator; FEMA	Not Started
2017-FL-3	Flood	Continue compliance with the National Flood Insurance Program through the enforcement of local floodplain ordinances.	City of Woodburn	Marion County Public Works; DLCD NFIP Coordinator; FEMA	Ongoing
2017-FL-4	Flood	Update the City's Flood Insurance Rage Maps (FIRMs) - FEMA should be releasing updates soon.	City of Woodburn	FEMA	Discontinue
2017-VC-1	Volcanic Eruption	Identify critical facilities and equipment that can be damaged by ashfall and develop mitigation activities to prevent damage to these facilities.	City of Woodburn	PIO, CERT	Ongoing
2017-SW-1	Severe Weather	Educate the public about the benefits of proper tree pruning and care in preventing damage during windstorms. Outreach outlets include Arbor Day and passing out tree maintenance brochures.	City of Woodburn	PIO, CERT	Ongoing
2017-SW-2	Severe Weather	Educate the community about the risk of downed power lines, aerial power lines in the vicinity of trees, and preparedness measures to take in the event of a power outage.	City of Woodburn	PGE, CERT	Ongoing
2017-SW-3	Severe Weather	Require new city facilities to exceed the minimum structural requirements for wind loading.	City of Woodburn Building Department	Non-Reported	Not Started

#	Hazard	Mitigation Action/Description	Coordinating Organization	Partnering Organizations	Status
2017-SW-4	Severe Weather	Educate homeowners about choosing ice and windstorm- resistant trees and landscaping practices to reduce tree-related hazards in future ice storms.	City of Woodburn	PIO, CERT	Ongoing
2017-SW-5	Severe Weather	Educate citizens about ways to weatherize their homes, as well as safe emergency heating equipment. WFD began educating about safe heating equipment during 2021 event; installed CO detectors during and after event.	City of Woodburn	Marion County, Woodburn Fire District, CERT, PGE	Ongoing

Source: Woodburn, Woodburn Fire District, and DLCD, July 13, 2022

18 References

City of Gervais. (2019). *Stormwater Master Plan.* Tetra Tech. Retrieved from http://nebula.wsimg.com/1e229ec1f511c1f70cb8105724aefa06?AccessKeyId=F062AE05BD597D7A5EB5&disposition=0&alloworigin=1

City of Mill City. (N.d.). City of Mill City Comprehensive Plan.

City of Turner. (N.d.). *Welcome to Turner*. Retrieved from Turner Oregon: https://turneroregon.gov/

City of Woodburn. (N.d.). *Comprhensive Plan*. Retrieved from Community Development Planning: https://www.woodburn-or.gov/dev-planning/page/comprehensive-plan

Department of Homeland Security, Federal Emeregncy Managemetn Agency. (2021, August 13). *National Risk and Capability Assessment*. Retrieved from FEMA.gov: https://www.fema.gov/emergency-managers/risk-management/risk-capability-assessment

Department of Homeland Security, Federal Emeregncy Managemetn Agency. (2022, November 4). *Hazard Mitigation Planning*. Retrieved from FEMA.Gov: https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning

Department of Homeland Security, Federal Emergency Management Agency. (2008). *Emergency Support Function #2 - Communications Annex*. Retrieved from FEMA.gov: https://www.fema.gov/pdf/emergency/nrf/nrf-esf-02.pdf.

Department of Homeland Security, Federal Emergency Management Agency. (2021, February 25). *Disaster Declarations for States and Counties*. Retrieved from FEMA.gov: https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Department of Homeland Security, Federal Emergency Management Agency. (2022, October 5). *Rehabilitation of High Hazard Potential Dams Grant Program Guidance & Resources*. Retrieved from FEMA.gov: https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams/resources

Department of Homeland Security, Federal Emergency Management Agency. (2023, January 11). *44 CFR 201.6 - Local Mitigaiton Plans, Subsection A.* Retrieved from Regulation and Guidance: https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning/regulations-guidance

Department of Homeland Security, Federal Emergency Managemetn Agency. (N.d.). *Emergency Support Function #1 - Transportation*. Retrieved from Emergency Support Functions: https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response#esf

Hubbard Rural Fire Protection District. (2022, April 6). *Hubbard Fire*. Retrieved from Hubbard Fire District: https://www.hubbardfire.com/hubbard-fire-district-overview/

National Oceanic and Atmospheric Administration. (N.d.). *Storm Event Database*. Retrieved from NOAA.gov: https://www.ncdc.noaa.gov/stormevents/

Oregon Encyclopedia. (2022, September 22). *"City of Mt. Angel"*. Retrieved from A Prjoect of the Oregon Historical Society: https://www.oregonencyclopedia.org/articles/city_of_mt_angel/#.Y-AZpy_MK3B

Portland State University, Population Research Center. (2021). *Coordinated Population Forecast for Marion County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2021-2071.* Retrieved from https://pdxscholar.library.pdx.edu/opfp/60/

State of Oregon, Business Oregon. (2022). *Distressed Counties, 2022*. Retrieved from Distressed

Areas in Oregon: https://www.oregon.gov/biz/reports/Pages/DistressedAreas.aspx
State of Oregon, Department of Land Conservation and Development. (N.d.). *Goal 7: Areas Subject to Natural Disasters and Hazards*. Retrieved from Oregon.gov: https://www.oregon.gov/lcd/OP/Pages/Goal-7.aspx
State of Oregon, Employment Department. (2022). *Mid-Valley Local Labor, Regional Herfindahl Index Scores*. Retrieved from State of Oregon Employment Department: https://www.qualityinfo.org/mid-valley
State of Oregon, Oregon Housing & Community Services. (N.d.). *Local Innovation and Task Force (LIFT) Housing Development*. Retrieved from Bond Financing & Loans: https://www.oregon.gov/ohcs/development/Pages/bond-financing-loans.aspx
State of Oregon, Oregon Water Resources Department. (N.d.). *Drought Declarations*. Retrieved from Oregon.gov: https://apps.wrd.state.or.us/apps/wr/wr_drought/declaration_status_report.aspx
Taylor, G., Hatton, R., & Taylor, G. H. (n.d.). The Oregon Weather Book: A State of Extremes. Oregon State University Press.
Turner Fire District. (2018). *About*. Retrieved from Turner Fire District: https://www.turnerfire.com/
U.S. Army Corps of Engineers. (2020). *Dams of The Nation*. Retrieved from National Inventory of Dams: https://nid.usace.army.mil/#/
U.S. Census. (2020). *Detroit City, Oregon*. Retrieved from U.S. Census: https://data.census.gov/profile?g=1600000US4119100
U.S. Census Bureau. (2020). *Housing*. Retrieved from Selected Housing Characteristics: 2020 American Community Survey 5-Year Estimates: https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047
U.S. Census Bureau. (2020). *Marion County, Oregon*. Retrieved from U.S. Census Bureau : https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047
U.S. Census Bureau. (2020). *Physical Housing Characteristics for Occupied Housing Units* . Retrieved from American Community Survey 5-Year Estimates: https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047
U.S. Census Bureau. (2021). *Selected Economic Characteristics*. Retrieved from American Community Survey: https://data.census.gov/table?q=Marion+County,+Oregon+Employment&tid=ACSDP1Y2021.DP03
U.S. Census Bureau. (2022, December 8). *American Community Survey 5-Year Data (2009-2021)*. Retrieved from U.S. Census Bureau: https://www.census.gov/data/developers/data-sets/acs-5year.html
U.S. Department of Commerce, National Oceanic and Atmospheric Administration. (N.d). *Drought Conditions for Marion County*. Retrieved from Drought.gov: https://www.drought.gov/states/Oregon/county/Marion



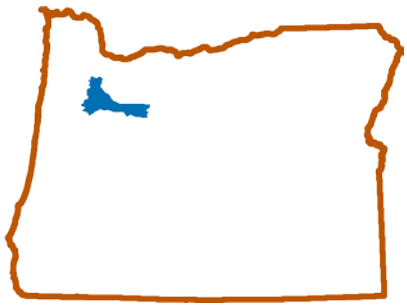




Marion County

MULTI-JURISDICTIONAL ALL- HAZARDS MITIGATION PLAN
VOLUME III: APPENDICES

- Marion County
- City of Aumsville
- City of Aurora
- City of Detroit
- City of Gervais
- City of Hubbard
- City of Idanha
- City of Jefferson
- City of Keizer
- Keizer Fire District



- City of Mill City
- City of Mt Angel
- Mt Angel Fire District
- City of Scotts Mills
- City of Stayton
- City of Sublimity
- City of Turner
- City of Woodburn/ Woodburn Fire District

FEMA

Effective Month X, 2022 through Month X, 2027

The 2023 Marion County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP)is a living document that will be reviewed and updated periodically to address the requirements contained in 44 CFR 201. It will be integrated with existing plans, policies, and programs. The Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved mitigation plan to receive federal funds for hazard mitigation grants. This plan meets those requirements as evidenced by FEMA approval which is effective per the cover date range of this plan.

Cover photos: (clockwise from top left): Marion County post-fire scene (2020); City of Detroit post-fire scene 10/20/2020; Tanker tipped on Hwy 22. Photos courtesy of Marion County.

Mission:
Create a more resilient Marion County by partnering with the whole community.

Comments, suggestions, corrections, and additions are encouraged to be submitted from all interested parties.

For further information and to provide comments, contact:

Marion County Emergency Management
5155 Silverton Road NE
Salem, OR 97305
Phone: 503-588-5108
Email: mcem@co.marion.or.us

Marion County
OREGON

Acknowledgements

The 2022 Marion County Hazard Mitigation Plan (HMP) update was conducted via a multi-jurisdictional partnership of Marion County and the Cities of Aumsville, Aurora, Detroit, Gates, Gervais, Hubbard, Idanha, Jefferson, Keizer, Mill City, Silverton, Stayton, Turner, and Woodburn, and the special districts of Keizer Fire District, Mt. Angel Fire District, and Woodburn Fire District.

2022 Marion County Hazard Mitigation Plan Steering Committee

Marion County
Adam Crateau, Alisa Zastoupil, Alyssa Schrems, Brandon Reich, Brian May, Brian Nicholas, Candace Jamison, Chris Eppley, Dain Thomas, Danielle Gonzalez, Dennis Mansfield, Eric Hlad, Kaylynn Gesner, Katrina Rothenberger, Kelly Weese, Jaden Emminger, Joaquin Ramos, Matt Knudsen, Matt Wilkinson, Scott Wilson

City of Aumsville
Matt Etzel, Richard Schmitz, Damian Flowers

City of Aurora
Stuart Rodgers, Mark Gunter

City of Detroit
Mayor Jim Trett, Kelly Galbraith, Christine Pavoni

City of Gervais
Susie Marston, Mark Chase

City of Hubbard
Melinda Olinger, Dave Rash

City of Idanha
Rebecca Stormer, Robyn Johnson, Mayor Rob Weikum

City of Jefferson
Sarah Cook, Kyle Ward

City of Keizer
Matt Reyes

City of Mill City
Gary Olson, Mayor Tim Kirsch

City of Mt. Angel
Mark Daniel

City of **Scotts Mills**
Robin Fournier, Mayor Paul Brakeman

City of Stayton
Alissa Angelo, Dave Frisendahl

City of Turner
Scott McClure, Don Taylor, Aaron Bales

City of Woodburn
Marty Pilcher, Andy Shadrin

Keizer Fire District
Jeff Cowan

Woodburn Fire District
Joe Budge

Mt. Angel Fire District
Jim Trierweiler

Interested Parties

Cherriots
Randy Navalinski

Linn County
Alyssa Boles, Ric Lentz

City of Silverton
Jim Anglemier

Aurora Fire District
Joshua Williams, Mike Corless

Jefferson Fire District
Levi Eckhardt

Pacific Gas & Electric
John Plechinger

Salem Health
Christina Bunnell, Nathan Streight

Santiam Hospital
Adam Mauer

Santiam Water Control District
Brett Stevenson

Consumer Power
Jeff Carlson, Kelley Bruneau, Billy Terry

METCOM 911
John Thompson, Mark Spross

Aumsville Fire District
Roy Hari, Brad McKenzie

Hubbard Fire District
Joe Budge, Michael Kahrmann

Marion County Fire District 1
Ron Lee, Sam Phillips

Salem Electric
JB Phillips, Britni Davidson-Cruikshank

Salem-Keizer School District
Ryan Mikesh

U.S. Forest Service
Shawn Rivera, Duane Bishop

Agency Partners

Oregon Department of Geology and Mineral Industries (DOGAMI)
Matt C. Williams, Ian P. Madin

Federal Guidance and Review Team

Federal Emergency Management Agency Region X, Mitigation Division
Edgar Gomez

Oregon Department of Emergency Management (OEM)
Stephen Richardson, Joseph Murray, Jason Gately

Project Managers

Marion County
Kathleen Silva, County Emergency Manager

Mike Hintz, Emergency Preparedness Coordinator

Oregon Department of Land Conservation and Development
Katherine Daniel, Natural Hazard Planner Pamela Reber, Natural Hazard Planner Tricia Sears, Natural Hazard Planner Marian Lahav, Natural Hazards Mitigation Planning Program Coordinator

In 2019, the Department of Land Conservation and Development (DLCD) applied for and received a Pre-Disaster Mitigation grant. PDMC-PL-10-OR-2019-005 from FEMA through the Oregon Department of Emergency Management (OEM) to assist Marion County.

This page intentionally left blank.

The Marion County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP) is comprised of four (4) volumes. These volumes include:

- Volume 1: Basic Plan
- Volume 2: City Addenda
- Volume 3: Appendices
- Volume 4: DOGAMI

To assist the viewer of this plan, each volume as its own table of contents.

Table of Contents

1 Appendix A: Marion County Priority Actions 1-1
1.1 2022-2027 Priority Action Item Forms 1-2
1.2 Mitigation Success 1-11
1.3 Marion County Ongoing Action Items 1-11
1.4 2022 Action Item Pool 1-11
1.4.1 Ongoing Action Items 1-12
1.4.2 Short-Term Action Items 1-13
1.4.3 Long-Term Action Items 1-15
1.5 Marion County 2017 Action Item Status 1-16
2 Appendix B: Community Profile 2-1
2.1 Community Profile 2-1
2.2 Geography and Climate 2-1
2.3 Population and Demographics 2-5
2.3.1 Employment and Economic Capacity 2-7
2.4 Regional Affordability 2-7
2.4.1 Median Family Income and Poverty Status 2-7
2.5 Housing Authority 2-9
2.6 Economic Diversity 2-9
2.7 Industry 2-9
2.7.1 Employment by Industry 2-10
2.8 Land Use and Development Patterns 2-12
2.8.1 Regulatory Context 2-12
2.9 Housing 2-13
2.10 Critical Facilities 2-14
2.11 Community Connectivity Capacity 2-14
2.12 Social Systems and Service Providers 2-14
2.13 Civic Engagement 2-16
2.14 Cultural Resources 2-17
2.14.1 Historic Places 2-17
2.14.2 Libraries and Museums 2-17
2.14.3 Cultural Events 2-18
2.15 Community Stability 2-18
2.15.1 Residential Geographic Stability 2-18

2.15.2 Homeownership 2-18
2.16 Political Capacity 2-19
2.17 Government Structure 2-19
2.18 Existing Plans and Policies 2-20
3 Appendix C: Planning and Public Process 3-1
3.1 Project Background 3-1
3.2 2022 Plan Update Matrix 3-1
3.3 2022 Plan Update Changes 3-3
3.3.1 Volume I: Basic Plan 3-3
3.3.2 Volume 2: 3-5
3.3.3 Volume 3: 3-5
4 2022 HMP Public Participation Process 4-1
4.1 Public Comment Matrix 4-1
4.2 Project Flyer 4-3
4.3 Plan Update Schedule 4-4
4.4 Steering Committee Meetings 4-7
4.5 Steering Committee Meeting Documentation 4-8
4.5.1 Meeting 1, August 3, 2021 4-8
4.5.2 Meeting 2, September 7, 2021 4-9
4.5.3 Meeting 3, October 5, 2021 4-10
4.5.4 Meeting 4, November 2, 2021 4-11
4.5.5 Meeting 5, December 7, 2021 4-12
4.5.6 Meeting 6, January 4, 2022 4-13
4.5.7 Meeting 7, March 1, 2022 4-16
4.5.8 Meeting 8, April 15, 2022 4-17
4.5.9 Meeting 9, May 4, 2022 4-19
4.5.10 Meeting 10, June 7, 2022 4-22
4.5.11 Meeting 11, July 5, 2022 4-24
4.6 Public Outreach 4-25
4.6.1 Outreach Documentation 4-25
4.6.2 Marion County Emergency Management, 9/14/21 4-26
4.6.3 Marion County Emergency Management 3/3/21 4-28
4.6.4 Marion County Emergency Management 12/5/21 4-29
4.6.5 City of Aumsville 12/2021 4-30

4.6.6 City of Detroit 3/31/2022 4-31
4.6.7 City of Gervais 1/18/2022 4-32
4.6.8 City of Hubbard 1/18/2022 and 2/10/22 4-33
4.6.9 City of Jefferson & Jefferson Fire District 1/20/2022 and 1/15/2022 4-34
4.6.10 Keizer Fire District 11/2/2021 and 1/25/2022 35
4.6.11 Mill City 11/2021 36
4.6.12 Mt. Angel Fire District 4/8/2022 37
4.6.13 City of Scotts Mills 4/14/2022 38
4.6.14 City of Stayton 2/2022 39
4.6.15 City of Turner 7/5/2022 40
4.6.16 City of Woodburn 1/5/2022 & 1/21/2022 41
4.6.17 Consumer Power 11/9/21 & 2/7/22 42
4.6.18 Marion County Public Health 11/3/21 4-43
5 Appendix D: Marion County Hazard Mitigation Vulnerability Survey 5-1
6 Appendix E: Economic Analysis of Natural Hazard Mitigation Projects 6-1
6.1 Why Evaluate Mitigation Strategies? 6-1
6.2 Mitigation Strategy Economic Analysis Approaches 6-2
6.2.1 Benefit / Cost Analysis 6-2
6.2.2 Cost-Effective Analysis 6-2
6.2.3 Invest in Public Sector Mitigation Activities 6-2
6.2.4 Investing in Private Sector Mitigation Activities 6-3
6.2.5 STAPLE / E Approach 6-3
6.3 When to use the Various Approaches 6-5
6.4 Implementing the Approaches 6-6
6.5 Economic Returns on Hazard Mitigation 6-8
6.6 Additional Costs from Hazards 6-8
6.7 Additional Considerations 6-9
6.8 Resources 6-9
7 Appendix F: Grant Programs 7-1
8 Appendix G: Hazard History 8-1
8.1 2022 NHMP Hazard Histories 8-1
8.2 History of Avalanche in Marion County 8-2
8.3 History of Dam Failure in Marion County 8-2
8.4 History of Drought in Marion County 8-4

8.5 History of Earthquakes in Marion County and Vicinity 8-6
8.5.1 Historical Earthquake Events 8-6
8.6 History of Extreme Heat in Marion County 8-9
8.7 History of Floods in Marion County 8-10
8.8 History of Landslides in Marion County 8-15
8.9 History of Severe Winter Storms in Marion County 8-16
8.10 History of Tornadoes in Marion County 8-20
8.11 History of Volcanic Eruption in Marion County 8-22
8.12 History of Wildfire in Marion County 8-25
8.13 History of Windstorms in Marion County 8-26
9 References 9-29

1 Appendix A: Marion County Priority Actions

The following list presents the 2022 priority mitigation actions for Marion County. The action item forms that follow present specific information for each priority action item. Also in this document are a list of ongoing mitigation actions, mitigation successes, the 2022 action item pool, and the 2017 priority action item status updates.

Action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. For a more strategic approach, Marion County is listing a set of high priority actions to focus attention on an achievable set of high leverage activities over the next five-years. Detailed implementation information for each priority action is listed in Appendix A-1. A pool of additional action items is presented in Appendix A-2. This plan identifies priority actions based on an evaluation of hazards, resource availability, and FEMA identified best practices.

- **Multi-Hazard # 1:** Develop a countywide evacuation plan through an approved FEMA grant.
- **Wildfire # 1:** Update/revise 2017 Community Wildfire Protection Plan.
- **Wildfire # 2:** Implement identified "Action/Tasks" within the 2022-2027 CWPP related to wildland fire reduction.
- **Multi-Hazard # 2:** Develop an all-hazard recovery plan.
- **Multi-Hazard # 3:** Begin preliminary process to examine the potential of adding an all-hazard siren warning system within the Santiam Canyon communities.
- **Drought #1:** Participate in the Drought Contingency Plan update.
- **Flood #1:** Identify flood prone areas and develop storm water plans to target specific drainage areas to encourage community floodplain management. These actions support the county's FEMA CRS (Community Rating System) rating.
- **Multi-Hazard # 4:** Provide and support all-hazard public outreach campaigns.
- **Earthquake #1:** Promote Great Oregon Shakeout Awareness month in October. Participate in activities for schools, business, and industry.

SPECIAL NOTE: There are many funding sources that might be available to assist in funding hazard mitigation projects. Funding sources include local government general budgets, state and federal grants, and foundations to name just a few. For additional information on the variety of grants visit https://www.grants.gov/web/grants/learn-grants/grants-101.html. FEMA's Building Resilient Infrastructure, and Communities (BRIC), Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and other Hazard Mitigation Specific Grants are the most common funding sources used for hazard mitigation projects.

1.1 2022-2027 Priority Action Item Forms

<table>
<tr><td colspan="2">Marion County Priority Action</td><td>1</td><td colspan="2">Alignment with Plan Goals:</td><td>1,2,3,5,7</td></tr>
<tr><td colspan="2">Hazard Classification:</td><td colspan="2">Multi-Hazard</td><td>Action Item Tracking #</td><td>2022-MH-1</td></tr>
<tr><td colspan="2">Proposed Action Title:</td><td colspan="4">Develop a countywide evacuation plan through an approved FEMA grant.</td></tr>
<tr><td colspan="6">Alignment with Existing Plans & Policies:</td></tr>
<tr><td colspan="6">Emergency Operations Plan and any other County Plan that pertains to Transportation Critical Infrastructure Systems.</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">Following the 2020 Beachie Creek Wildland Fire, the County realized that a county wide evacuation plan is needed. With 346,000 residents throughout Marion County, the evacuation plan would provide the guidance for the whole community should a mass evacuation is needed again. The plan would be developed using an all-hazard approach.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">Maps by unincorporated areas; identify assembly areas; inventory mass care capabilities and needs.</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="4">Marion County Emergency Management</td></tr>
<tr><td colspan="3">Internal Partners</td><td colspan="3">External Partners</td></tr>
<tr><td colspan="3">Emergency Management, Marion County Sheriff’s Office, Marion County Health and Human Services, Public Works, and GIS</td><td colspan="3">Cities, Special Districts (i.e., fire districts), State, Law Enforcement, Public Transportation, PSAPS, and Hospitals</td></tr>
<tr><td>Potential Funding Source:</td><td>Estimated Cost:</td><td colspan="4">Timeline:</td></tr>
<tr><td rowspan="4">FEMA BRIC and/or HMGP</td><td rowspan="4">$200k+</td><td>☐</td><td colspan="3">Ongoing</td></tr>
<tr><td>☐</td><td colspan="3">Short Term (0-2 Years)</td></tr>
<tr><td>☐</td><td colspan="3">Mid Term (2-5 Years)</td></tr>
<tr><td>√</td><td colspan="3">Long-Term (5+ Years)</td></tr>
<tr><td>Action Item Status:</td><td colspan="5">New in 2022</td></tr>
</table>

<table>
<tr><td colspan="2">Marion County Priority Action</td><td>2</td><td colspan="2">Alignment with Plan Goals:</td><td>1, 2, 3, 5, 7, 9, 10, 11</td></tr>
<tr><td colspan="2">Hazard Classification:</td><td colspan="2">Wildfire</td><td>Action Item Tracking #</td><td>2022-WF-1</td></tr>
<tr><td colspan="2">Proposed Action Title:</td><td colspan="4">Update Marion County Community Wildfire Protection Plan (CWPP)</td></tr>
<tr><td colspan="6">Alignment with Existing Plans & Policies:</td></tr>
<tr><td colspan="6">County HMP, EOP</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">Wildland fire is a high-risk hazard in Marion County. The development of the Community Wildfire Protection Plan (CWPP) provides information and guidance in helping residents and local governments in developing a community that is resistant to the impacts of wildland fires. The CWPP provides project ideas such as defensible space, fire reduction projects, development of Firewise communities, and possible funding sources to assist communities with mitigation actions.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">County NHMP, EOP</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="4">Marion County Emergency Management</td></tr>
<tr><td colspan="3">Internal Partners</td><td colspan="3">External Partners</td></tr>
<tr><td colspan="3">Sheriff’s Office, Public Works-Ops, GIS, Public Health</td><td colspan="3">Fire Defense Board, Fire Districts, Fire Departments, OSFM, USFS, BLM, Cities</td></tr>
<tr><td colspan="2">Potential Funding Source:</td><td>Estimated Cost $:</td><td colspan="3">Timeline:</td></tr>
<tr><td colspan="2" rowspan="4">General Fund, ODF & OSFM Grants</td><td rowspan="4">Staff Time</td><td>☐</td><td colspan="2">Ongoing</td></tr>
<tr><td>√</td><td colspan="2">Short Term (0-2 Years)</td></tr>
<tr><td>☐</td><td colspan="2">Mid Term (2-5 Years)</td></tr>
<tr><td>☐</td><td colspan="2">Long-Term (5+ Years)</td></tr>
<tr><td colspan="2">Action Item Status:</td><td colspan="4">Started in 2022</td></tr>
</table>

<table>
<tr><td colspan="2">Marion County Priority Action</td><td>3</td><td colspan="2">Alignment with Plan Goals:</td><td>1,2,3,5,7</td></tr>
<tr><td colspan="2">Hazard Classification:</td><td colspan="2">Wildfire</td><td>Action Item Tracking #</td><td>2022-WF-2</td></tr>
<tr><td colspan="2">Proposed Action Title:</td><td colspan="4">Implement identified "Action/Tasks" within the 2023-2028 CWPP related to wildland fire reduction.</td></tr>
<tr><td colspan="6">Alignment with Existing Plans & Policies:</td></tr>
<tr><td colspan="6">County AHHMP, EOP</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">The County has a history of wildland fires, and with the support of the 2023-2028 Marion County CWPP. Find and acquire grant funding to support wildland fire reduction projects throughout the County.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">Grant funding, working with community partners, working with CWPP Advisory Committee Members, Public Outreach</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="4">Marion County Emergency Management</td></tr>
<tr><td colspan="3">Internal Partners</td><td colspan="3">External Partners</td></tr>
<tr><td colspan="3">Sheriff’s Office, Public Health, GIS, PIO</td><td colspan="3">Fire Defense Board, Fire Districts, Fire Department, OSFM, BLM, USFS, Cities</td></tr>
<tr><td colspan="2">Potential Funding Source:</td><td>Estimated Cost $:</td><td colspan="3">Timeline:</td></tr>
<tr><td colspan="2" rowspan="4">ODF and OSFM Grant opportunities</td><td rowspan="4">TBD</td><td>√</td><td colspan="2">Ongoing</td></tr>
<tr><td>☐</td><td colspan="2">Short Term (0-2 Years)</td></tr>
<tr><td>☐</td><td colspan="2">Mid Term (2-5 Years)</td></tr>
<tr><td>☐</td><td colspan="2">Long-Term (5+ Years)</td></tr>
<tr><td>Action Item Status:</td><td colspan="5">Started in ‘22</td></tr>
</table>

Marion County Priority Action	4	**Alignment with Plan Goals:**	1, 2, 3, 4, 5, 7, 8, 9, 10, 11
Hazard Classification:	Multi-Hazard	**Action Item Tracking #**	2022-MH-2
Proposed Action Title:	Develop an all-hazard recovery plan.		
Alignment with Existing Plans & Policies:			
County HMP, Comprehensive Plan, Functional Plans, Infrastructure Plans, Emergency Operations Plan			
Rationale for Proposed Action Item:			
After the 2020 Wildland Fires and the 2021 Severe Winter storm, the after-action reports highlighted the importance of a County Recovery Plan. A future recovery plan would assist in providing the framework for assisting community members and businesses with their "New Normal" following a disaster or emergency. A recovery plan that provides guidance for economic, socio-economic, individual case management, long term mass care needs, building and planning innovative projects, debris management, damage assessment, and recovery funding strategies. Further, the NDRF is guided by eight principles: □Individual and Family Empowerment; □Leadership and Local Primacy; □Pre-Disaster Recovery Planning; □Engaged Partnerships and Inclusiveness; □Unity of Effort; □Timeliness and Flexibility; □Resilience and Sustainability; and □ Psychological and Emotional Recovery.			
Ideas for Implementation:			
Recovery Planning team, the BOC, Business Services, and Community Services leading this project			
Coordinating Organization:	Marion County Emergency Management		
Internal Partners		External Partners	
BOC, Community Services, GIS, Business Services		Whole Community (i.e., local cities, state, private, non-profit, and faith-based partners).	
Potential Funding Source:	**Estimated Cost $:**	**Timeline:**	
FEMA BRIC	150-200k	☐	Ongoing
		☐	Short Term (0-2 Years)
		☐	Mid Term (2-5 Years)
		√	Long-Term (5+ Years)
Action Item Status:	New Item 2022		

Marion County Priority Action	5	**Alignment with Plan Goals:**	1,3,5,10
Hazard Classification:	Multi-Hazard	**Action Item Tracking #**	2022-MH-3
Proposed Action Title:	Begin preliminary analysis to examine potential project to add an all-hazard siren warning system within the Santiam Canyon communities.		

Alignment with Existing Plans & Policies:
Emergency Operations Plan
Rationale for Proposed Action Item:
Santiam Canyon is an isolated part of Marion County where cell phone and internet are sporadic, resulting in challenging emergency alerts and warning notification systems. This project would support emergency alerts and notifications, by providing a redundancy alerting system for the communities within Santiam Canyon.
Ideas for Implementation:
Potentially partner with Fire Districts to either update district sirens, install/upgrade siren systems in preidentified locations to augment notification systems already in place, and/or install systems on local facilities such as schools, city hall, law enforcement, communication towers, and community centers.

Coordinating Organization:	Marion County Emergency Management

Internal Partners	**External Partners**
Board of Commissioners, Business Services, Public Works, Community Services, Sheriff's Office	Fire districts within the Santiam Canyon, whole community throughout the canyon area.

Potential Funding Source:	**Estimated Cost $:**	**Timeline:**	
FEMA BRIC and/or HMGP	$200k+	☐	Ongoing
		☐	Short Term (0-2 Years)
		☐	Mid Term (2-5 Years)
		√	Long-Term (5+ Years)

Action Item Status:	New, 2022

<table>
<tr><td colspan="2">Marion County Priority Action</td><td>6</td><td colspan="2">Alignment with Plan Goals:</td><td>1,2,3,5,10</td></tr>
<tr><td colspan="2">Hazard Classification:</td><td>Drought</td><td colspan="2">Action Item Tracking #</td><td>2022-DR-1</td></tr>
<tr><td colspan="2">Proposed Action Title:</td><td colspan="4">Participate with the North Santiam Water Control District to update the North Santiam Watershed Drought Contingency Plan.</td></tr>
<tr><td colspan="6">Alignment with Existing Plans & Policies:</td></tr>
<tr><td colspan="6">County HMP, EOP</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">The North Santiam Watershed Drought Contingency Plan (DCP) was developed to foster a collaborative approach to drought planning and response within the watershed. The document is intended to be a “living plan” and is under consideration to be updated in partnership with North Santiam Water Control District, City of Salem, and other community partners.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">The North Santiam Watershed Task Force is coordinating with partners; evaluating the potential for funding to support an update to the DCP in 2023.</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="4">North Santiam Watershed</td></tr>
<tr><td colspan="3">Internal Partners</td><td colspan="3">External Partners</td></tr>
<tr><td colspan="3">Board of Commissioners, Community Services, Public Works</td><td colspan="3">Whole Community (i.e., North Santiam Water Control District, City of Salem, USACE, Marion County Soil Water Conservation District,</td></tr>
<tr><td colspan="2">Potential Funding Source:</td><td>Estimated Cost $:</td><td colspan="3">Timeline:</td></tr>
<tr><td colspan="2" rowspan="4">General funds</td><td rowspan="4">TBD</td><td>√</td><td colspan="2">Ongoing</td></tr>
<tr><td>☐</td><td colspan="2">Short Term (0-2 Years)</td></tr>
<tr><td>☐</td><td colspan="2">Mid Term (2-5 Years)</td></tr>
<tr><td>☐</td><td colspan="2">Long-Term (5+ Years)</td></tr>
<tr><td colspan="2">Action Item Status:</td><td colspan="4">Started in Feb. 2023</td></tr>
</table>

Marion County Priority Action	7	**Alignment with Plan Goals:**	2,3,5,6,7,8,9,10
Hazard Classification:	Flood	**Action Item Tracking #**	2022-FL-1
Proposed Action Title:	Identify flood prone areas and develop storm water plans to target specific drainage areas to encourage community floodplain management. These actions support the county's FEMA CRS (Community Rating System) rating.		
Alignment with Existing Plans & Policies:			
County CSR, EOP, HMP			
Rationale for Proposed Action Item:			
Marion County is threatened by flooding that could occur from any of the numerous waterways the county. Marion County continues to participate in the Community Rating System (CRS) of the National Flood Insurance Program (NFIP). The CRS program recognizes the county's efforts that go beyond minimum floodplain management standards of the NFIP to protect properties from flooding by reducing flood insurance premiums for property owners in the county.			
Ideas for Implementation:			
Outreach, Surveys, economic data analysis, etc.			
Coordinating Organization:	Marion County Planning Division		

Internal Partners	**External Partners**
Emergency Management, Public Works, GIS	Mid-Willamette Valley Council of Governments

Potential Funding Source:	**Estimated Cost $:**	**Timeline:**	
FEMA BRIC, HMGP, and/or FMA	TBD	☐	Ongoing
		√	Short Term (0-2 Years)
		☐	Mid Term (2-5 Years)
		☐	Long-Term (5+ Years)

Action Item Status:	New in 2022

<table>
<tr><td colspan="2">Marion County Priority Action</td><td>8</td><td colspan="2">Alignment with Plan Goals:</td><td colspan="2">This action aligns with all goals</td></tr>
<tr><td colspan="2">Hazard Classification:</td><td colspan="2">Multi-Hazard</td><td>Action Item Tracking #</td><td colspan="2">2022-MH-4</td></tr>
<tr><td colspan="2">Proposed Action Title:</td><td colspan="5">Provide and support all-hazard public outreach campaigns.</td></tr>
<tr><td colspan="7">Alignment with Existing Plans & Policies:</td></tr>
<tr><td colspan="7">County CWPP, EOP, HMP</td></tr>
<tr><td colspan="7">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="7">An important aspect for any plan is public outreach. Public outreach is not just important for natural hazards, but all-hazards. Public outreach will provide the whole community the relative information needed to be informed about all-hazards that could impact our jurisdiction.</td></tr>
<tr><td colspan="7">Ideas for Implementation:</td></tr>
<tr><td colspan="7">Annual Public outreach campaign to community members and local partners.</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="5">Marion County Emergency Management</td></tr>
<tr><td colspan="3">Internal Partners</td><td colspan="4">External Partners</td></tr>
<tr><td colspan="3">PIO</td><td colspan="4">Whole Community (i.e., Health and Human Services, fire, law enforcement, schools, and local, state, and federal partners).</td></tr>
<tr><td colspan="2">Potential Funding Source:</td><td>Estimated Cost $:</td><td colspan="4">Timeline:</td></tr>
<tr><td colspan="2" rowspan="4">General Fund, State and non-profit (foundations) grant Opportunitys</td><td rowspan="4">Staff Time</td><td>√</td><td colspan="3">Ongoing</td></tr>
<tr><td>☐</td><td colspan="3">Short Term (0-2 Years)</td></tr>
<tr><td>☐</td><td colspan="3">Mid Term (2-5 Years)</td></tr>
<tr><td>☐</td><td colspan="3">Long-Term (5+ Years)</td></tr>
<tr><td colspan="2">Action Item Status:</td><td colspan="5">Ongoing</td></tr>
</table>

Marion County Priority Action		9	**Alignment with Plan Goals:**		This action aligns with all goals
Hazard Classification:	Earthquake		**Action Item Tracking #**		2022-EQ-1
Proposed Action Title:	Promote Great Oregon Shakeout Awareness month in October. Participate in activities with partners such as schools, business, and industry.				
Alignment with Existing Plans & Policies:					
County HMP					
Rationale for Proposed Action Item:					
Marion County participates in the National campaign Shakeout Day, which is always the third Thursday of October. We encourage our partners to participate in an earthquake drill (i.e., drop cover and hold) and share their experience on our Facebook account.					
Ideas for Implementation:					
Continue to promote the Great Oregon Shake Out drill.					
Coordinating Organization:	Marion County Emergency Management				
Internal Partners			**External Partners**		
All County Departments and PIO's			Whole Community		
Potential Funding Source:	**Estimated Cost $:**		**Timeline:**		
General Fund	Staff Time		√	Ongoing	
			☐	Short Term (0-2 Years)	
			☐	Mid Term (2-5 Years)	
			☐	Long-Term (5+ Years)	
Action Item Status:	Ongoing annual basis.				

1.2 Mitigation Success

- Flood Monitoring Infrastructure: The Mid-Willamette Valley High Water Watch https://hww.onerain.com/ is a live data tool which is the result of long-term coordination with Turner, regional partners, and the City of Salem who have a full-time staff person that maintains the website.
- Completion of the Quick Reference Guide to Emergency Management for:
  - Local Cities and Senior Elected
  - Local Partners'

1.3 Marion County Ongoing Action Items

- Develop All-Hazard and All County Evacuation Plan- POST DR4562 Hazard Mitigation Grant.
- Participate in updating the North Santiam Watershed, Drought Contingency Plan.
- Partner with Earthwise and local school districts (Salem, Keizer, Woodburn, and Stayton) to implement water conservation strategies to maximize water use in schools and educate students about water conservation.
- Continue implementing the 'Marion County Water Resource Management Plan' (portion of the Marion County Comprehensive Plan), with yearly review scheduled during the third quarter of the fiscal year.
- Continue to support Great Oregon Shakeout Awareness month in February. Participate in activities for schools, business, and industry. Participating with the Mid-Willamette Emergency Communications Collective on initiatives that are focused on household preparedness.

1.4 2022 Action Item Pool

The action item table below presents a pool of mitigation actions. Many of these actions carry forward from prior versions of this plan. This expanded list of actions is available for consideration as resources, capacity, technical expertise and/or political become available. The table includes the hazard, a hazard description, coordinating/partnering agencies, proposed timeline, and alignment with plan goals.

1.4.1 Ongoing Action Items

Table 1-1, Marion County Ongoing Action Items

Action Item	Proposed Action Title	Coordinating Organization	Partner Organizations	Timeline	Alignment with Plan Goals						
					Public Awareness	Education	Risk Reduction	Funding and Implementation	Partnerships and Coordination	Natural Resource Utilization	Plan Integration
Multi-Hazard #2	Continue the community education program for all- hazards	Emergency Management	Whole Community	On-going	X	X	X				X
Earthquake #1	Promote Great Oregon Shakeout Awareness month in October. Participate in activities for schools, business, and industry.	Emergency Management	Public Works, Safety Committee, Marion County Risk, Red Cross, OEM and Media	Ongoing every October	X	X			X		

1.4.2 Short-Term Action Items

Table 1-2, Marion County Short-Term Action Items

Action Item	Proposed Action Title	Coordinating Organization	Partner Organizations	Timeline	Alignment with Plan Goals						
					Public Awareness	Education	Risk Reduction	Funding and Implementation	Partnerships and Coordination	Natural Resource Utilization	Plan Integration
Drought #1	Participate in the process to update the North Santiam Water Control District, Drought Contingency Plan.	North Santiam Water Control District and the City of Salem	Marion County, North Santiam Water Council, Emergency Management, and participating agencies	12-36 months	X	X	X	X	X	X	X
Wildfire #	Implement action items contained in the 'Action Plan' section of the *Marion County Community Wildfire Protection Plan.*	Fire Defense Board	Emergency Management, Fire Marshal, Oregon Department of Forestry	12-36 months			X	X			X
Multi-Hazard #1	Develop countywide all-hazard evacuation plan through an approved FEMA grant	Emergency Management	Whole community	36-48 months	X	X	X	X	X	X	X

Action Item	Proposed Action Title	Coordinating Organization	Partner Organizations	Timeline	Alignment with Plan Goals						
					Public Awareness	Education	Risk Reduction	Funding and Implementation	Partnerships and Coordination	Natural Resource Utilization	Plan Integration
Wildfire #1	Update 2017 Community Wildfire Protection Plan to the 2022-2027 CWPP	Emergency Management	County Fire Defense Board, Firefighting partners, local government	12-24 months	X	X	X		X	X	X

1.4.3 Long-Term Action Items

Table 1-3, Marion County Long-Term Action Items

Action Item	Proposed Action Title	Coordinating Organization	Partner Organizations	Timeline	Alignment with Plan Goals						
					Public Awareness	Education	Risk Reduction	Funding and Implementation	Partnerships and Coordination	Natural Resource Utilization	Plan Integration
Multi-Hazard #1	Complete a disaster recovery plan for Marion County.	Emergency Management	Whole Community	60+ months	X		X				X
Flood #1	Identify flood prone areas and develop storm water plans to target specific drainage areas, which includes the FEMA CRS (Community Rating System), to encourage community floodplain management.	Planning Department	Emergency Management, Engineering Division, Public Works, Whole Community	60-120 months	X	X	X	X	X	X	

1.5 Marion County 2017 Action Item Status

Table 1-4, Marion County 2017 Action Item Status

#		Mitigation Action	Update	Coordinating Organization	Status
2017 MH-01	Multi-Hazard	Develop with private partners a critical infrastructure recovery task force that includes the four lifelines communication, transportation, energy, and water.	Continue to 22-27 Actions County has an established EMAC group that brings together partners from all	Marion County Emergency Management	Started
2017 MH-02	Multi-Hazard	Develop a community education program - such as an all-hazard community outreach forum.	Continue to 22-27 Actions County has an established EMAC group that brings together partners from all	Marion County Emergency Management	Not started/ Long term 10+ years
2017 MH-03	Multi-Hazard	Develop a community education program - such as an all-hazard community outreach forum.	Continue to 22-27 Actions	Marion County Emergency Management	Revised/ Started
2017 MH-04	Multi-Hazard	Conduct an assessment of the short and long term needs for sheltering access and functional needs populations for all hazards.	Continue to 22-27 Actions Completed a framework for mass care/shelter plan with 6 counties	Marion County Emergency Management	Completed first stage; 1-5 years
2017 MH-05	Multi-Hazard	Develop the capability to capture and analyze damage assessment data using GIS tools.		Marion County Emergency Management	Completed in 2020
2017 MH-06	Multi-Hazard	Develop an Energy Assurance Plan (Fuel Management)		Marion County Emergency Management	Completed in 2020
2017 MH-07	Multi-Hazard	Update the (EAS) Emergency Alert System Plan for 22-27 plan	Continue to 22-27 Actions; combined with MH-8 and changed to Marion-Polk Emergency Alerts System.	Marion County Emergency Management	Revised; 1–5- year timeline.
2017 MH-08	Multi-Hazard	Develop all-hazard pre-scripted messaging	Continue to 22-27 Actions; combined with MH-7 to create new action item ever the Marion-Polk Emergency Alert System for the 22-27 plan	Marion County Emergency Management	Revised/New; 1–5-year timeline.

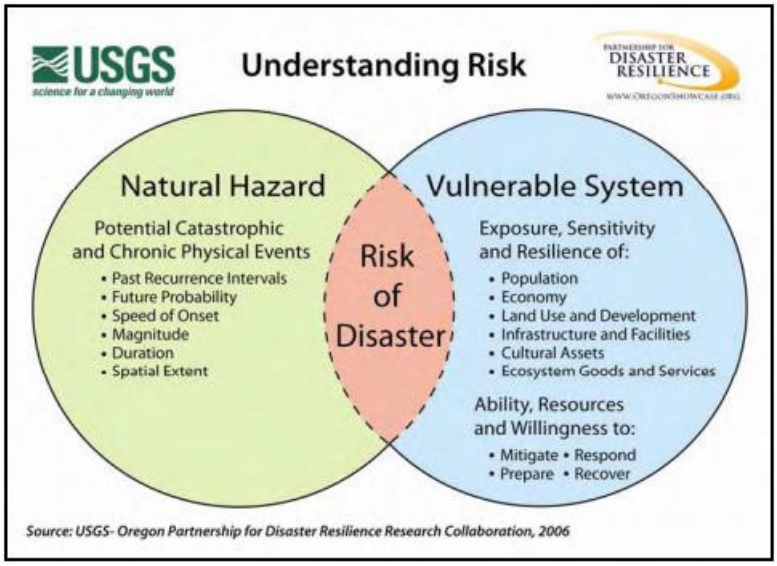
2 Appendix B: Community Profile

2.1 Community Profile

The following section provides a comprehensive description of Marion County's assets and context and helps define the county's sensitivity and resilience to hazards. Known as sensitivity factors, the community assets and characteristics listed in this section are important components and attributes of Marion County but have varying levels of vulnerability to potential hazards.

Community resilience is defined as a community's ability to manage risk and adapt to hazards. This includes government structure, agency missions and directives, and plans, policies, and programs. The information documented in this section, along with the hazard assessments located in Volume I, Section 2, is intended to support the risk reduction actions identified in Volume I, Section 3 – Mission, Goals, and Action Items.

Table 2-1, Understanding Risk



Source: Oregon Partnership for Disaster Resilience

2.2 Geography and Climate

Marion County is in northwest Oregon, covering over 1,000 square miles. The county has a diverse geography, ranging from the rainy Willamette Valley in the west to the Breitenbush Hot Springs in the east. The western half of the county, located in the Willamette Valley, is relatively flat. The eastern portion of the county has a mountainous topography and is bordered by the Cascade Mountain Range.

The average elevation for Marion County is 154 feet and elevations range from 100 feet near the Willamette River to 2400 feet in the foothills of the Cascade Mountains (Hemesath, Nunez, Roth, Burgoyne, & La Follette, 2002). Forestland covers almost half of the eastern portion of the county, and most of the water resources originate in this area (Marion County, Oregon, 2022).

Marion County spans a wide range of physiographic regions; thus, there is considerable variation in precipitation, with elevation as the largest factor in the amount of total precipitation. Marion County has a modified marine climate where winters are cool and wet, while summers are moderately warm and dry (U.S. Department of Commerce, N.d).

Table 2-2, Average Rainfall and Temperatures

Ecoregion	Mean Annual Rainfall Range (inches)	Mean Temperature Range (°F) January min/max	Mean Temperature Range (°F) July min/max
Willamette Valley			
Gallery Forrest	40-50	33/46	50/85
Prairie Terraces	40-50	33/46	51/85
Valley Foothills	45-60	32/46	50/80
Cascades			
Western Cascades Lowlands and Valleys	60-90	31/41	47/48
Western Cascades Montane Highlands	70-120	16/37	44/75
Cascade Crest Montane Forest	55-100	21/35	43/72
Cascade Subalpine/Alpine	75-140	16/31	38/65

Source, US EPA. Ecoregions of Oregon

From 1971 to 2000, the average annual precipitation in Marion County was approximately 40 inches, with the least amount of precipitation on the Willamette Valley floor, and greater amounts near the foothills of the Cascade Range. Table 2.2 shows the average annual precipitation in Marion County.

Several rivers are in Marion County, including the Willamette River, North Santiam River, Pudding River, Little Pudding River, and Mill Creek. The largest reservoir in Marion County is Detroit Reservoir, which is 50 miles east of Salem on the North Santiam River and covers 5.6 miles. The rivers and their sub-basins are depicted in Figure 3 and 4 below.

Figure 2-1, Marion County Physiography

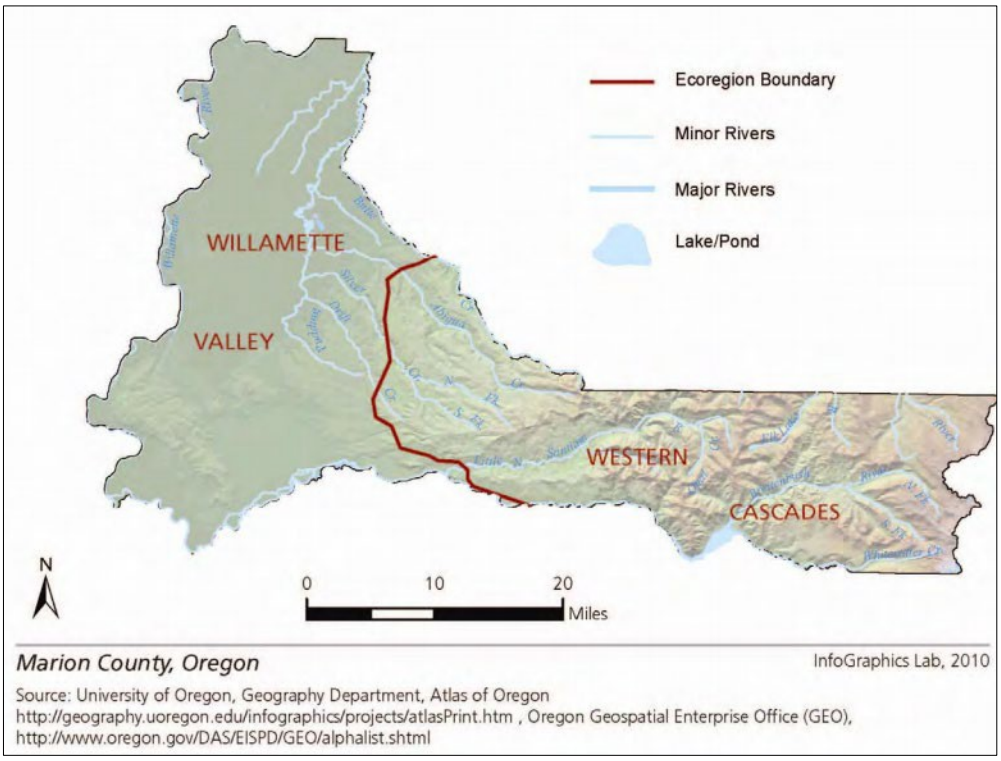


Figure 2-2, Marion County Average Annual Precipitation

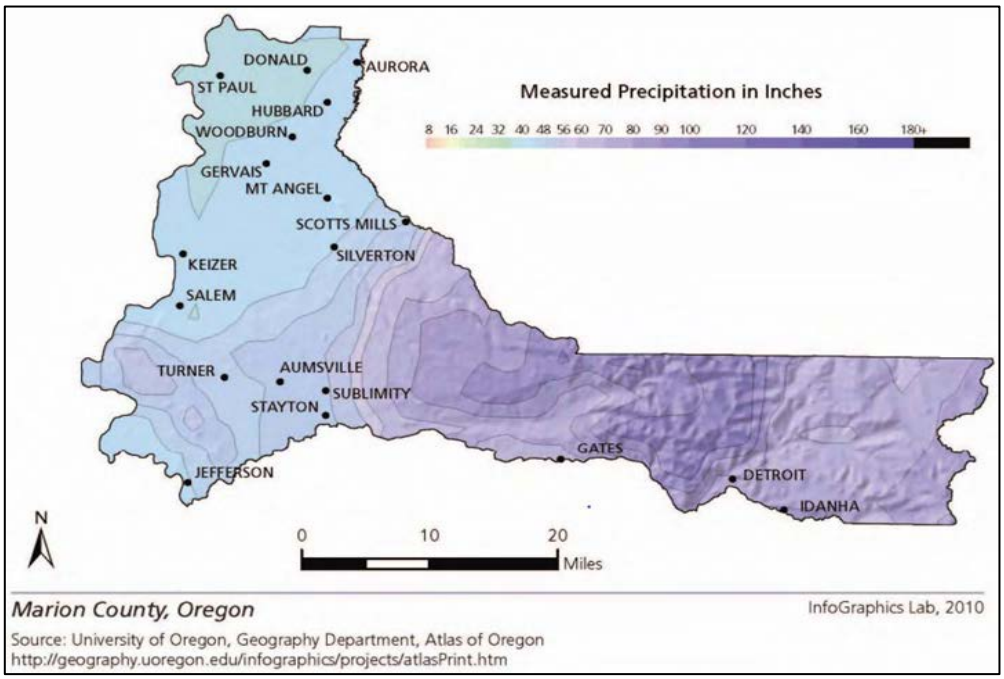
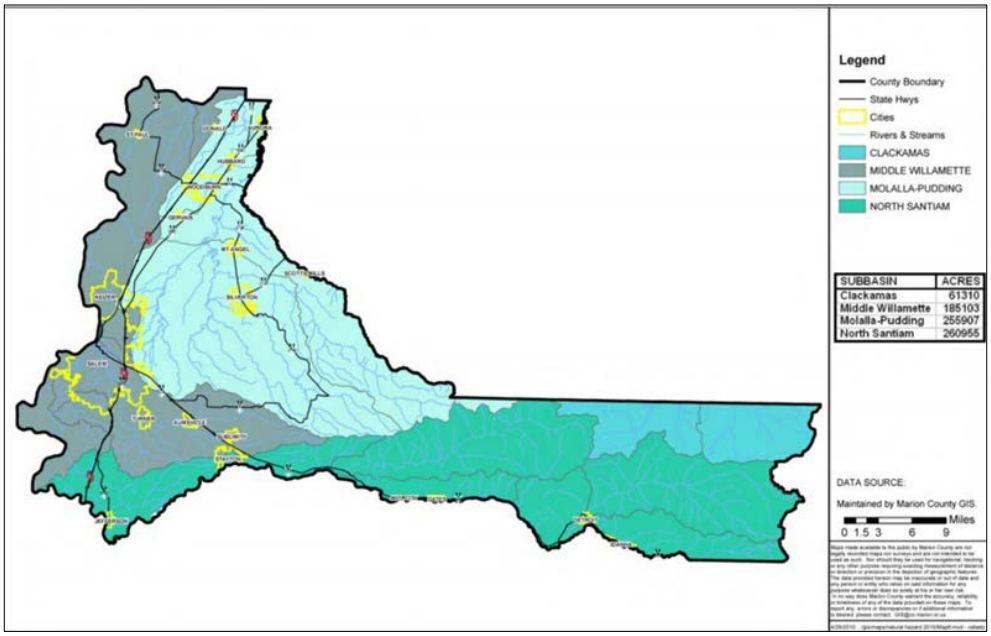


Figure 2-3, River Sub-Basins in Marion County



2.3 Population and Demographics

Marion County is the fifth most populous county in Oregon. Between 2010 and 2020 Marion County's population increased by slightly less than 10 percent. In 2020 the total population of Marion County was recorded as 345,920 (U.S. Census Bureau, 2020).

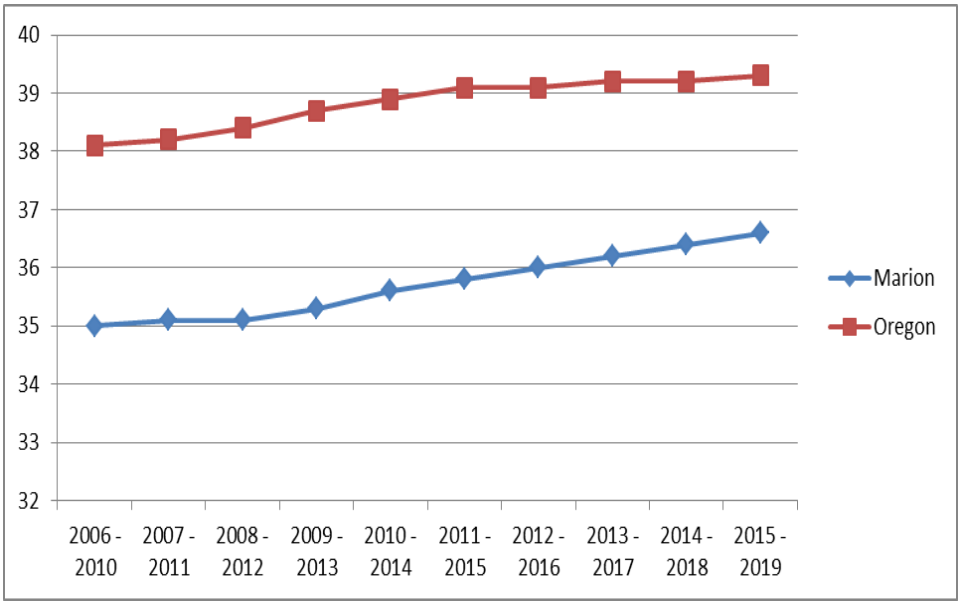
Table 2-3, Population Estimate and Forecast for Marion County Cities

	2000		2010		2020		Population Change 2000 - 2020		Average Annual Growth Rate
	Pop	% of County	Pop	% of County	Pop	% of County	Pop Change	% Change	
Marion County	284,834	100.0%	315,335	100.0%	349,121	100.0%	64,287	22.6%	1.1%
Outside Urban Growth Boundaries	46,237	16.2%	45,596	14.5%	61,285	17.6%	15,048	32.5%	1.6%
Larger Sub Areas									
Keizer	33,143	11.6%	37,335	11.8%	38,590	11.1%	5,447	16.4%	0.8%
Salem (part)*	149,299	52.4%	164,289	52.1%	177,362	50.8%	28,063	18.8%	0.9%
Silverton	8,215	2.9%	9,864	3.1%	11,050	3.2%	2,835	34.5%	1.7%
Stayton	7,260	2.5%	8,151	2.6%	8,159	2.3%	899	12.4%	0.6%
Woodburn	20,861	7.3%	25,377	8.0%	25,882	7.4%	5,021	24.1%	1.2%
Smaller Sub-Areas									
Aumsville	3,211	1.1%	3,771	1.2%	4,376	1.3%	1,165	36.3%	1.8%
Aurora	752	0.3%	1,015	0.3%	1,023	0.3%	271	36.0%	1.8%
Detroit	272	0.1%	209	0.1%	205	0.1%	-67	-24.6%	-1.2%
Donald	632	0.2%	1,013	0.3%	995	0.3%	363	57.4%	2.9%
Gates (part)*	446	0.2%	447	0.1%	498	0.1%	52	11.7%	0.6%
Gervais	2,078	0.7%	2,562	0.8%	2,624	0.8%	546	26.3%	1.3%
Hubbard	2,523	0.9%	3,393	1.1%	3,454	1.0%	931	36.9%	1.8%
Idanha (part)*	138	0.0%	80	0.0%	90	0.0%	-48	-34.8%	-1.7%
Jefferson	2,646	0.9%	3,278	1.0%	3,335	1.0%	689	26.0%	1.3%
Mill City (part)*	327	0.1%	336	0.1%	312	0.1%	-15	-4.6%	-0.2%
Mt. Angel	3,037	1.1%	3,359	1.1%	3,595	1.0%	558	18.4%	0.9%
Scotts Mills	334	0.1%	373	0.1%	387	0.1%	53	15.9%	0.8%
St. Paul	368	0.1%	413	0.1%	440	0.1%	72	19.6%	1.0%
Sublimity	1,896	0.7%	2,558	0.8%	3,050	0.9%	1,154	60.9%	3.0%
Turner	1,160	0.4%	1,918	0.6%	2,410	0.7%	1,250	107.8%	5.4%

Source: Population Research Center at the Portland State University College of Urban and Public Affairs. Coordinated Population Forecast for Marion County, its Urban Growth Boundaries (UGB), and area outside UGBs 2021 – 2071. June 30, 2021.

Marion County has a slightly younger population than the State of Oregon as a whole. Between 2015 and 2019 the median age in Marion County was 36.6, this is approximately 3 years younger than the state median of 39.3 in the same time frame (U.S. Census Bureau, 2022).

Graph: Median Age of Marion County Residents



Source: U.S. Census Bureau, American Community Survey 5-year estimates, 2006 – 2010, 2007 – 2011, 2008 – 2012, 2009 – 2013, 2010 – 2014, 2011 – 2015, 2012 – 2016, 2013 – 2017, 2014 – 2018, 2015 -

When compared to the 2000 and 2010 decennial census the portion of the population in the younger age group (e.g., those under 18) is projected to decrease in 2030 and 2040. The proportion of the population 85 and over increased about 2% in 2010. That same age range, 85 and over, is projected to increase slightly over the next two decades. The changes can be attributed to a variety of factors including longer life expectancy, lower fertility rate, and a higher net migration of the 65 and over population. The high net migration of the 65 and over population coupled with a relatively lower migration rate in the population that is between 35 and 50 years of age can in turn impact net migration for children under 18, as they often move with their parents, who tend to be in the 35 – 50 age range (Portland State University, Population Research Center, 2021).

Those under five are particularly vulnerable to natural hazards, as well as residents who are 85 years and older. Moreover, while residents between the ages of 55 and 64 are not currently as vulnerable to potential hazards, this large cohort will be far more susceptible in the next five to ten years. Therefore, it is imperative for Marion County to have policies in place that protect both young and old residents, as well as encourage them to prepare for potential hazards.

Vulnerability to natural disasters disproportionately impacts those with intellectual and/or physical disabilities, particularly children, the elderly, children, people of color, and low-income families and individuals. 24.3% of people in Marion County are under 18 years old. In general, children are more vulnerable to extreme weather, have fewer transportation options, and require assistance to access medical help and assistance. Furthermore, 17.6% of people in Marion County under the age of 65 are living with a disability, which may lead to fewer transportation options, limited access to medicine or medical assistance,

mobility impairment, and more.

In addition, 15.3% of people in Marion County are considered elderly (someone is considered elderly when they are 65 years old and over). Elderly individuals may require special consideration due to sensitivities to extreme weather, accessibility to medical care and medications, mobility impairment, and comparative difficulty in making home modifications that reduce risk to hazards. Addressing the needs of vulnerable groups through hazard mitigation is important to improve the community's overall resilience to natural hazards.

2.3.1 Employment and Economic Capacity

Economic capacity refers to the financial resources and revenue within a community that provide a higher quality of life for residents. Income equality, housing, affordability, economic diversification, employment, and industry are all measures of economic capacity. However, economic resilience to natural disasters is far more complex than merely restoring employment or income in the local community. Building a resilient economy requires an understanding of how employment sectors, workforce, resources, and infrastructure are interconnected within the existing economic picture.

2.4 Regional Affordability

The evaluation of regional affordability supplements the identification of socio-demographic capacity indicators (like median income) and is a critical tool for analyzing the economic status of a community. This information captures the likelihood of individuals' ability to prepare for hazards, such as retrofitting homes or purchasing insurance. If a community has high income inequality or housing cost burden levels, the potential for homeowners and renters to implement mitigation is drastically reduced. Therefore, regional affordability is a mechanism for generalizing the abilities of community residents to get back on their feet without significant public assistance.

2.4.1 Median Family Income and Poverty Status

The most recent median income in Marion County is $64,880 which is less than the median income of Oregon at $70,084 and the United States at$69,021 (U.S. Census Bureau, 2020) *Note: the median income listed here is different than the median income for Marion County in table three below, due to a difference in the years. The table below uses 5-year estimates from the American Community Survey from 2019-2015 and 2015-2019.* Based on 5-year estimates for 2010 – 2014 and 2015 – 2019 the median income for Marion County has for the most part increased since 2014. Marion County has seen its median income increase at a rate of 16.5% since 2014 which outstrips the median income growth rate of Oregon (15.0%) by 1.5%. Of the Marion County cities, only Detroit (-8.3%) had negative growth between 2014 and 2019 with the remaining 18 included in the table below having greater than 5% growth rate at the same time (U.S. Census Bureau, 2022).

Table 2-4, Median Household Income for Marion County Cities

Jurisdiction	Median Income 2010 - 2014	Median income 2015 - 2019	Percent Change
Aumsville	$50,319	$61,620	22.4%
Aurora	$72,656	$87,632	20.6%
Detroit	$45,000	$41,250	-8.3%
Donald	$63,015	$71,964	14.2%
Gates	$36,250	$42,250	16.5%
Gervais	$51,172	$74,191	44.9%
Hubbard	$48,479	$59,803	23.3%
Idanha	$33,438	$43,500	30.0%
Jefferson	$45,781	$61,935	35.2%
Keizer	$50,897	$64,638	26.4%
Mill City	$34,472	$53,243	54.4%
Mt. Angel	$41,984	$44,485	5.9%
St. Paul	$64,063	$90,179	40.7%
Salem	$46,273	$55,920	20.8%
Scotts Mills	$42,292	$51,563	20.1%
Silverton	$53,929	$64,296	19.2%
Stayton	$41,432	$63,995	54.4%
Sublimity	$53,611	$73,977	37.9%
Turner	$52,674	$82,689	56.9%
Woodburn	$43,114	$50,093	16.1%
Marion County	$47,360	$59,625	25.8%

Source: U.S. Census Bureau (n.d.). 2010-2014 & 2015-2019 S1901 American Community Survey 5-year estimates (in 2021 inflation-adjusted dollars).

In 2014 23.3% of households in Marion County received Food Stamp or SNAP benefits and 6.3% received cash public assistance. In 2019 the proportion of households receiving Food Stamps or SNAP benefits dropped to 18.2% while the proportion of households receiving cash public assistance decreased by 3% from 2014.

From 2010-2014, 19.1% of the residents in Marion County were below the poverty level. From 2015-2019, 14.2% of residents in Marion County were below the poverty level (U.S. Census Bureau, 2022).. The numbers indicate that between 2014 and 2019, according to the five-year estimates, the proportion of Marion County residents living below the poverty line decreased 4.9%.

2.5 Housing Authority

According to HUD, households that pay more than 30 percent of their income on housing are cost burdened. Between 2015 and 2019 there were a total of 46,937 households renting within Marion County. Between 2015 and 2019 there were a total of 21,145 renters who were more than 30% cost burdened, showing that nearly 45% of all renting households in Marion County were cost burdened (U.S Department of Housing and Urban Development, 2020). Within the same time frame, there were a total of 71,100 households that were homeowners. Among them 15,955 homeowners were more than 30% cost burdened. Twenty-two percent of all homeowning households in Marion County were cost burdened.

2.6 Economic Diversity

Economic diversity is a general indicator of an area's fitness for weathering difficult financial times. One method for measuring economic diversity is through use of the Herfindahl Index, a formula that compares the composition of individual county and regional economies with those of states or the nation. Using the Herfindahl Index, a diversity ranking of 1 indicates the Oregon County with the most diverse economic activity compared to the state, while a ranking of 36 corresponds with the least diverse county economy. Marion County ranks extremely high on this index, with an economy that is considered the third most diverse out of the 36 counties evaluated.

Table 2-5, Regional Herfindahl Index Scores

	2008			2013		
County	Employment	Number of Industries	State Rank	Employment	Number of Industries	State Rank
Benton	26,433	199	23	25,247	201	21
Lane	123,008	260	4	114,670	260	5
Lincoln	14,286	183	29	13,491	179	30
Linn	36,360	225	5	33,934	222	4
Marion	105,758	252	3	101,571	245	3
Polk	12,837	178	18	12,179	167	9
Yamhill	27,797	209	9	27,860	209	6

Source, Oregon Employment Department

2.7 Industry

Key industries are those that represent major employers and are significant revenue generators. Different industries face distinct vulnerabilities to natural hazards, which can impact the resiliency of certain sectors and the overall economy of a region. Identifying key industries in the region enables communities to target mitigation activities towards that industry's specific sensitivities.

This is of specific concern when the businesses belong to the "basic sector industry." Basic sector industries are those that are dependent on sales outside of the local community and bring revenue into a local community via employment. Agriculture, information and technology, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail, construction, and health services.

2.7.1 Employment by Industry

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

According to 2021 U.S. Census data, Marion County employes 154,291 civilians 16 years and older. The top five industry sectors in Marion County employing civilians 16 years and older are retail trade (16,941); manufacturing (16,567); professional scientific, and management, and administrative and waste management services (16,530); public administration (14,177); and arts, entertainment, and recreation and accommodation and food services (13,505). As of 2014, are 64.3% of civilians 16 years and older are employed by private companies, 3.7% are self-employed owning their own business, 7.1% are employed by private not-for profit wages or are salary workers, 18.2% are employed by either local, state, or the federal government, and 6.7% are self-employed, but do not own their own business and have unpaid family workers (U.S. Census Bureau, 2022)

The table below (Table 2.6) shows the revenue generated by economic sector (Note: not all sectors are reported). The top five industry sectors in Marion County with the most employees, as of 2014, are Managerial, Professional (30 percent); Sales and Office (24 percent); Education, Health, and Social Services (30 percent); Service (20 percent); and Production and Transport (13 percent).

While Marion County has some basic industries, such as natural resources and mining and manufacturing, none of their five largest employers are basic sector industries. Therefore, Marion County's economy is very dependent on local sales and revenue. The three sectors with the highest revenue were Retail Trade, Health Care and Social Assistance and Wholesale Trade. The table below shows the revenue generated by each economic sector (Note: not all sectors are reported). Together, these three sectors generate more than $10 billion in annual revenue for the county.

Table 2-6, Employment by Industry in Marion County

Sector	People employed	Employee of private company	Self-employed in own incorp. business	Private not-for-profit employee	Local, state, and federal government employees	Self-employed in own not incorporated business
Civilian employed population over the age of 16 in Marion County, Oregon 2020	157,530	66.1%	3.3%	7.9%	17.3%	5.4%
Agriculture, forestry, fishing and hunting, and mining	8,334	87.2%	6.6%	1.0%	1.1%	4.1%
Construction	14,021	79.1%	6.5%	0.9%	3.3%	10.3%
Manufacturing	15,722	95.1%	1.4%	1.1%	0.3%	2.15%
Wholesale Trade	3,596	94.6%	2.1%	0.9%	0.0%	2.3%
Retail Trade	19,984	92.4%	2.1%	1.6%	0.6%	3.4%
Transportation and Warehousing, and utilities	6,047	71.1%	6.4%	2.3%	16.4%	3.8%
Information	1,740	79.6%	2.4%	3.9%	5.7%	8.4%
Finance and insurance, and real estate and rental and leasing	8,452	71.4%	7.0%	12.0%	5.1%	4.6%
Professional, scientific, and management, administrative and waste management services	12,978	69.1%	7.8%	2.8%	6.8%	13.5%
Educational services, and health care and social assistance	33,753	41.8%	1.7%	21.3%	31.7%	3.6%
Arts, entertainment, and recreation, and accommodation and food services	13,476	86.4%	2.2%	3.1%	3.7%	4.5%
Other services, except public administration	6,537	39.1%	2.5%	37.5%	0.7%	20.3%
Public administration	12,890	0.0	0.0	0.0	100.0	0.0

If any of these primary sectors are impacted by a disaster, Marion County may experience a significant disruption of economic productivity. The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families, and the community to absorb disaster impacts for a quick recovery.

As education and social services, state government and public administration, and manufacturing are key to post-disaster recovery efforts, a region is bolstered by its key employment sectors. It is important to consider what might happen to the county economy if the largest revenue generators and employers are impacted by a disaster. Areas with high income equality, increased housing costs, and low economic diversity are factors that may contribute to slower recovery from a disaster.

2.8 Land Use and Development Patterns

Marion County is the fifth-most populous county in Oregon and contains the state capital, Salem, which is also the county seat. The county was originally named the Champooick District, after a meeting place on the Willamette River known as Champoeg. This meeting place refers to the Kalapuyan word for yampah (an important staple crop of Native Americans on the West coast of North American). In 1849, the legislation governing the growing territory renamed the county in honor of General Francis Marion, a native of South Carolina who served in the American Revolutionary War.

Marion County has the unique distinction of being one of the first districts of the Oregon Country, along with Tuality (now Washington County), Clackamas, and Yamhill counties.

The vast majority of Marion County is forestland, with smaller areas of agricultural lands. Forested lands are located along the western portion of the county, while the eastern portion of the county has a dry, Mediterranean climate. Agriculture is concentrated throughout the flat regions of the Willamette Valley. Cities and rural residential areas are heavily concentrated along the many rivers, creeks, and lakes that make up the county. Local and state policies currently direct growth away from rural lands into Urban Growth Boundaries and, to a lesser extent, into rural communities. Within the rural areas, development radiates outward from the urban areas along rivers in a pattern that is likely to continue.

2.8.1 Regulatory Context

Oregon land use laws require land outside Urban Growth Boundaries (UGBs) to be protected for farm, forest, and other resources. For the most part, this law limits the amount of development in rural areas. However, the land use designation can change from resource protection in one of two ways:

- The requested change could qualify as an exception to Statewide Planning Goals, in which case the city or county must demonstrate to the State that the change meets requirements for an exception. These lands, known as exception lands, are predominantly designated for residential use.

- Resource land can also be converted to non-resource use when a city or county demonstrates that the land is no longer suitable for farm or forest production.

Local and state policies currently direct growth away from rural lands into UGBs, and, to a lesser extent, into rural communities. If development follows historical development trends, urban areas will expand their UGBs, while rural unincorporated communities will continue to grow, and overall rural residential density will increase slightly. However, the bulk of rural lands will remain in farm and forest use. The existing pattern of development in the rural areas, which is radiating out from the urban areas along rivers and streams, is likely to continue. Most of the "easy to develop" land is already developed, in general leaving more constrained land such as land in the floodplains or on steep slopes to be developed in the future, perhaps increasing the rate at which development occurs in natural hazard areas.

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of that program is a set of 19 statewide planning goals that express the state's policies on land use and on related topics, such as citizen involvement, land use planning, and natural resources.

Most of the goals are accompanied by "guidelines," which are suggestions about how a goal may be applied. Oregon's statewide goals are achieved through local comprehensive planning. State law requires each county and city to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. The local comprehensive plans must be consistent with the statewide planning goals. Plans are reviewed for such consistency by the state's Land Conservation and Development Commission (LCDC). When LCDC officially approves a local government's plan, the plan is said to be "acknowledged." It then becomes the controlling document for land use in the area covered by that plan.

Goal 7

Goal 7: Areas Subject to Natural Disasters and Hazards intents to "protect people and property from natural hazards". Goal 7 requires local governments to adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards. Natural hazards include floods, landslides, earthquakes, tsunamis, coastal erosion, and wildfires.

As part of its compliance with Goal 7, Marion County has adopted land use codes that provide standards for development in hazard areas that seek to reduce the risk to life, and property for development in hazard areas and to minimize the impact of a hazard on property owners and businesses.

2.9 Housing

Housing type and age are important factors in hazard mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention.

Mobile homes, for example, are generally more prone to wind and water damage than standard wood-frame construction. Homes built before 1993 may also be more vulnerable to earthquakes because they were built prior to the incorporation of strict earthquake standards in Oregon's building codes. Structures built in Oregon after 1993 use earthquake

resistant designs and construction techniques (Wang & Burns, 2006). Additionally, in the 1970s, the Federal Emergency Management Agency (FEMA) began assisting communities with floodplain mapping and communities passed floodplain ordinances to regulate floodplain development.

Marion County has a variety of different housing types. In 2020, 63.2 percent were detached single family homes and 22.1 percent were multifamily (3 or more units). Single family attached dwelling units, such as townhouses comprised 3.6 percent of the Marion County housing stock. A slight increase to 8.3 percent of county residents live in mobile homes and less than one percent live in boats, RV, vans, or other forms of housing. Of these housing types, 68 percent were built prior to 1990 and therefore are not built to current earthquake standards (U.S. Census Bureau, 2020). Residents of Marion County who live in mobile homes are particularly vulnerable to natural hazards such as floods, earthquakes, and windstorms because they may not be secured by a foundation. Given the large percentage of County individuals and families who reside in mobile homes, public education and outreach efforts should be targeted to these groups.

In 2020, Marion County had 128,541 housing units. Of those, 4.6 percent were vacant (5,955 units). Slightly more than 60 percent of occupied units are owner occupied (73,190 units) and 39 percent are occupied by renters (47,284 units) (U.S. Census Bureau, 2020). Typically, renters are less likely than homeowners to prepare for natural hazard events. Renters are likely to have higher turnover rate, which limits their exposure to public education and outreach around hazards. This is exacerbated by the lack of targeted education and outreach on behalf of preparedness campaign that focuses specifically on renters, despite Marion County having almost equal numbers of renters and homeowners. Moreover, renters tend to have lower incomes and fewer resources to prepare for natural disasters, as well as a lack of capacity or knowledge to invest in or request mitigation measures for rented property.

2.10 Critical Facilities

Critical facilities are those facilities that are essential to government response and recovery activities (e.g., hospitals, police, fire and rescue stations, school districts and higher education institutions). The interruption or destruction of any of these facilities would have a debilitating effect on incident management.

Critical facilities in Marion County are identified within the Risk Assessment, which can be found in Volume I, Section 2, Risk Assessment.

2.11 Community Connectivity Capacity

Community connectivity capacity places strong emphasis on social structure, trust, norms, and cultural resources within a community. In terms of community resilience, these emerging elements of social and cultural capital are drawn upon to stabilize the recovery of the community. Social and cultural capitals are present in all communities; however, it may be dramatically different from one city to the next as they reflect the specific needs and composition of each community's residents.

2.12 Social Systems and Service Providers

Social systems include community organizations and programs that provide social and community-based services, such as employment, health, senior and disabled services,

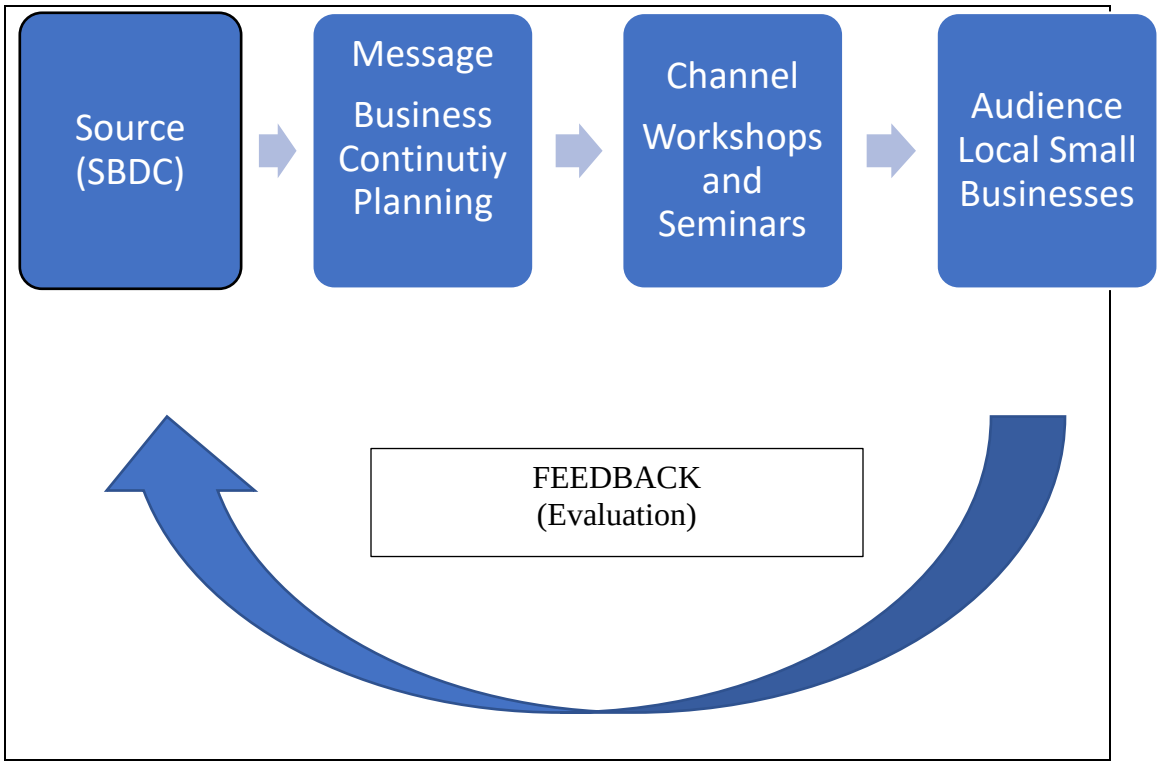
professional associations and veterans' affairs. When planning for hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public. Often, actions identified in a plan involve communicating with the public or specific subgroups of a population (e.g. elderly, children, low income, etc.). The County can use existing social systems as resources for implementing public education and outreach because these service providers typically have existing relationships with members of the public. While the presence of these services is predominantly in urbanized areas of the county, this is synonymous with the general urbanizing trend of residents.

The following is a brief explanation of how the communication process works and how the community's existing social service providers could be used to provide hazard related messages to their clients.

There are five essential elements for communicating effectively to a target audience:

- The source of the message must be credible.
- The message must be appropriately designed.
- The channel for communicating the message must be carefully selected;
- The audience must be clearly defined.
- The recommended action must be clearly stated, and a feedback channel established for questions, comments, and suggestions.

Figure 2-4, Communication Process



Source: Adapted from the U.S. Environmental Protection Agency Radon Division's outreach program

Three potential methods for public involvement include:

- Education and outreach – organization could partner with the community to educate the public or provide outreach assistance on hazard preparedness and mitigation.
- Information dissemination – organization could partner with the community to provide hazard related information to target audiences.
- Plan/ project implementation – organization may have plans and/ or policies that may be used to implement mitigation activities or the organization could serve as the coordinating or partner organization to implement mitigation actions.

2.13 Civic Engagement

Civic engagement and involvement in local, state and national politics are important indicators of community connectivity other indicators such as volunteerism, participation in formal community networks and community charitable contributions are examples of other civic engagement that may increase community connectivity.

2.14 Cultural Resources

2.14.1 Historic Places

Historic and cultural resources, such as historic structures and landmarks, help to define a community and potentially create tourism-related revenue. Protecting these resources from the impact of disasters is important because they have an important role in defining and supporting the community. According to the object adds to the historic associations, historic architectural qualities, or archeological values for which a property is significant because it was present during the period of significance, related to the documented significance of the property, and possesses historical integrity or is capable of yielding important information about the period; or it independently meets the National Register criteria" (U.S. National Parks, N.d.). If a structure does not meet these criteria, it's considered to be non-contributing.

There are 211 eligible/significant (ES) historical sites and 1818 eligible/contributing historical sites in Marion County. Overall, there are a total of 2,029 historical sites in Marion County. For more information, visit the link below.

(http://heritagedata.prd.state.or.us/historic/index.cfm?do=reports.dsp_reportMenu)

Marion County contains the ancestral homelands of the Ahantchuyuk band of the Kalapuya, the Molalla, and the Santiam band of the Kalapuya. Descendants of these communities include members of the Confederated Tribes of Grand Ronde and Confederated Tribes of Siletz Indians.

Marion County was the site of some of the earliest European occupation of the Willamette Valley. Resources related to this include sites related to the early French-Canadian fur trappers, Champoeg State Park and cemetery, St. Louis Catholic Church, Willamette Mission State Park, Willamette Post, and the community of Butteville.

Several locations in Marion County and the City of Salem are recognized for their contributions to Oregon's provisional government and early statehood. The Geer Fruit Farm was the site of meetings regarding statehood prior to 1859. The Aurora Colony was a Christian Communal Society Farming community founded in 1856 by William Keil and John Schmit, with many original buildings still remaining in and around the city of Aurora.

As of 2022, a search of the program database Marion County has added three more Century Farms for a total of 142 Century Farms and there are 8 Sesquicentennial (150 years) farms or ranches listed as part of the Oregon Century Farm & Ranch Program (Oregon Century Farm and Ranch Program, N.d.). A number of historic farmhouses are listed on the National Register of Historic Places for their distinctive architecture or their association with significant historical events.

2.14.2 Libraries and Museums

Libraries and museums develop cultural capacity and community connectivity because they are places of knowledge and recognition, have common spaces for the community to gather, and help maintain a sense of community during a disaster. They are recognized as safe places and reflect normalcy in times of distress. *In the City of Salem, the Salem Public Library's Main Branch recently completed a major seismic upgrade.

**Please Note: Even though the City of Salem is located in Marion County, they complete their own Hazard Mitigation Plan and is not a part of the County's.*

2.14.3 Cultural Events

Other such institutions that can strengthen community connectivity are the presence of festivals and organizations that engage diverse cultural interests. These events bring revenue into the community and have the potential to both improve cultural competence and enhance a sense of place and identity. Cultural connectivity is important to community resilience, as people may be more inclined to help their neighbors in an emergency if they feel part of the community and culture.

2.15 Community Stability

2.15.1 Residential Geographic Stability

Community stability is a measure of rootedness in place. It is hypothesized that resilience to a disaster stem in part from familiarity with place, not only for navigating the community during a crisis, but also accessing services and using other supports for economic or social challenges. (Cutter, Burton, & Emrich, 2010). Fifty-five percent of Marion County residents have moved within the last five years, which makes it difficult to conduct public outreach and stay in contact with residents. While this is only 2 percent above the statewide average, it demonstrates that Marion County is an area that shifts rapidly and lacks population stability. Therefore, having public education and outreach strategies that can meet these needs is essential.

2.15.2 Homeownership

Housing tenure describes whether residents rent or own the housing units they occupy. Homeowners are typically financially stable but are at risk of greater property loss after a disaster event. People may rent because they choose not to own, lack the financial resources necessary, or are transient.

Collectively, about 60.1 percent of the occupied housing units in Marion County are owner-occupied and 39 percent are renter occupied. About 4.6 percent of Marion County's homes are vacant. In addition, seasonal or recreational housing accounts for approximately a little over 1 percent of housing units, which is below the Oregon average of 3.5 percent (U.S. Census Bureau, 2020).

Wealth increases resiliency and recovery from disasters. Renters typically do not have personal financial resources or insurance to assist them post-disaster. On the other hand, renters tend to be more mobile and have fewer assets at risk of hazards (Cutter, Boruff, & Shirley, 2003). 27 In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or unaffordable post-disaster.

Marion County has distinct social and cultural resources that work in favor to increase community connectivity and resilience. Sustaining social and cultural resources, such as social services and cultural events, is essential to preserving community cohesion and identity. The presence of larger communities makes additional resources and services available to the public. However, it is important to consider that these amenities may not be equally distributed to the rural portions of the county, which produces implications for recovery in the event of a disaster.

In the long-term, it may be of specific interest to the county to evaluate community stability. A community experiencing instability and low homeownership may hinder the effectiveness of response and recovery mechanisms.

2.16 Political Capacity

Political capacity is recognized as the government and planning structures established within the community. In terms of hazard resilience, it is essential for government and non-government entities to collaborate; as disaster losses stem from a predictable result of interactions between the physical environments, social and demographic characteristics, and the built environment (Mileti, 1999). Resilient political capital seeks to involve various stakeholders in hazard planning and works towards integrating the Hazards Mitigation Plan with other community plans, so that all planning approaches are consistent.

2.17 Government Structure

Marion County's governing jurisdiction includes all unincorporated areas that are not governed by U.S. Forest Service, Bureau of Land Management, and state-owned land. Marion County has three (3) elected County Commissioners, as well as an elected sheriff and district attorney. County departments and divisions consist of the following:

Administrative Service: serves citizen needs by providing election services, recording property documents, collecting property taxes, issuing marriage and dog licenses, and engaging the community to make Marion County a healthy environment for children and families. Administrative Services supports the internal county organization by providing business support services including payroll and accounting, information technology, budget development and oversight, and human resources services.

Assessment: responsible for assessing all properties in Marion County. The assessment department is also responsible for maps, property information, and special tax exemption designations.

Community Services: ensures that the building and land use laws of the state of Oregon and Marion County are followed in a fair and equitable manner. A one- stop permit service coordinates the issuance of permits for other county departments involved in development activities.

Health Department: works to create and sustain the conditions in which all people in the community can be healthy. To that end, public health serves three core functions: to assess the health status of the entire population, to advise policy development, and to ensure that adequate, competent services are available throughout the community.

Natural Areas and Parks: serves the interests and pursuits of Marion County residents by providing access to natural, historic, and recreational areas and conserving, restoring and developing parkland investments.

Public Works: responsible for keeping the community accessible, safe, and environmentally responsible by providing citizens with efficient road and transportation systems, rural utility services, public facilities and land use services. The Planning and Zoning Division of the Public Works Department maintains the county Flood Insurance Rate Maps (FIRM), which are used in determining vulnerability and risk of flood.

2.18 Existing Plans and Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Such existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs (Burby, 1998).

The Marion County Hazards Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the county's vulnerability to hazards. Many of these recommendations are consistent with the goals and objectives of the county's existing plans and policies. Linking existing plans and policies to the Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the plan.

Implementing the hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated and maximizes the county's resources. In addition to the plans listed below the county and incorporated cities also have zoning ordinances (including floodplain development regulations) and building regulations.

Marion County's current plans and policies include the following:

Marion County Comprehensive Land Use Plan

- Date of Last Revision: 2010
- Author/ Owner: Marion County
- Description: The Comprehensive Plan is the official policy guide for decisions about growth, development, and conservation of natural resources in Marion County.
- Relationship to Natural Hazard Mitigation Planning: The Goal 7 Policies within Marion County's Comprehensive Plan are limited at best. The plan does not contain a specific section dedicated to natural hazards. Where they exist, hazard policies can provide the framework for evaluating land use actions for their exposure to potential harm from natural hazards. The policies can guide the identification of areas subject to natural hazards, regulation of development in those areas, and protection of citizens, property, and the environment from the effects of natural hazards. The protection methods prescribed by such policies include prevention and preparedness, land use regulation, use of natural systems to mitigate hazards, public education, and collaboration with other organizations. Such policies can also guide development of this natural hazards mitigation plan. Likewise, the risk assessment and mitigation action items identified within the Marion County Multi-jurisdictional Hazards Mitigation plan should also influence the comprehensive plan's findings and land use policies.

Marion County Community Wildfire Protection Plan (CWPP)

- **Date of Last Revision:** 2017 updated in 2023.
- **Author/ Owner**: Marion County Fire Defense Board, Oregon Department of Forestry, and Marion County Emergency Management
- **Description:** The mission of the Community Wildfire Protection Plan (CWPP) is to make Marion County residents, businesses, and resources less vulnerable to the negative effects of wildland fires. The vision of the CWPP is to promote awareness of the countywide wildland fire hazard and propose workable solutions to reduce the wildfire potential.
- **Relationship to Hazard Mitigation Planning**: The Community Wildfire Protection Plan (CWPP) is intended to be adopted for incorporation within the Marion County Hazards Mitigation Plan. The CWPP contains goals and actions that seek to minimize the county's risk to wildfire hazards.

Marion County Emergency Operations Plan (EOP)

- **Date of Last Revision**: 2019, revision completed and promulgated in 2020.
- **Author/ Owner**: Marion County Emergency Management
- **Description:** The Marion County Emergency Operations Plan (EOP) is based on a thorough analysis of the natural and human-made hazards that could affect the county. This analysis is the first step in planning for mitigation, response, and recovery actions. The method used in this analysis provides a sense of hazard priorities, or relative risk. It does not predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can then be focused where the risk is the greatest.
- **Relationship to Hazard Mitigation Planning**: the EOP includes information that is relevant to the Marion County Hazards Mitigation Plan and vice versa. Hazard rankings from the EOP were included in the Hazards Mitigation Plan's Hazard Chapters. Ideally, the EOP and Hazards Mitigation Plan will eventually share, and benefit from one risk assessment. As such, information from the HMP may be integrated into the EOP.

Marion County Storm Water Management Program for the Urbanized Area around Salem and Keizer

- **Date of Last Revision**: 2021
- **Author/ Owner**: Marion County Environmental Services
- **Description**: Outlines the different components of Marion County's Stormwater Management Program: (1) Public Education; (2) Public Involvement; (3) Illicit Discharge/Pollution); (4) Construction Erosion Control; (5) Post- Construction Runoff Control; (6) Municipal Operations/Pollution Prevention. The program is intended to meet the

requirements of the National Pollutant Discharge Elimination System (NPDES) Program as developed under the federal Clean Water Act.

- **Relation to Hazard Mitigation Planning**: Marion County's Stormwater Management Program develops and implements education and outreach strategies related to stormwater management. Existing connections with the public can be utilized to disseminate educational materials related to hazards mitigation. Additionally, mitigation actions that seek to reduce the hazards associated with urban flooding can be implemented through the county's Stormwater Management Program, or vice versa.

Marion County Rural Transportation System Plan (RTSP)

- **Date of Last Revision**: 2005
- **Author/ Owner**: Marion County
- **Description:** A Transportation System Plan (TSP) is required to provide a transportation system that accommodates the expected 20-year growth in population and employment resulting from implementation of the currently adopted Marion County comprehensive land use plan. In 2013, Marion County updated the Background, Goals, Facility Inventory, Traffic Projections, and Strategy sections.
- **Relation to Hazard Mitigation Planning**: Transportation systems are important in evacuating and responding to disasters. Mitigation actions that focus on strengthening the transportation system can be incorporated into the Transportation Systems Plan.

North Santiam Watershed Drought Contingency Plan (DCP)

- **Date of Development**: 2017, Update in 2023
- **Author/Owner:** Santiam Water Control District
- **Description**: The Santiam Water Control District (SWCD) has recently received funding through a Bureau of Reclamation Water SMART grant to develop and implement a Drought Contingency Plan for the North Santiam Watershed (http://www.usbr.gov/drought/). The effort includes an overall assessment of drought risk, a process for ongoing monitoring of drought in the region, and a set of mitigation strategies and recommendations to ensure coordinated management of water resources. Identified vulnerabilities by sector or asset category include agriculture, municipal water supplies (i.e., drinking water), energy, forestry, environmental (e.g. endangered species), recreation, and socio-economic (i.e. commercial, industrial and community uses).

- **Relation to Hazard Mitigation Planning**: Drought is a growing issue in Marion County. Water management trade-offs include drinking water, irrigation, recreation, habitat, flooding, wildfire, and water quality considerations. The Drought Contingency Plan will help the county prioritize and manage competing water related issue in the future.

3 Appendix C: Planning and Public Process

This section describes the public process used to update the 2022 Marion County Multi-Jurisdictional Hazard Mitigation Plan.

In 2019, Marion County accepted an invitation from the Oregon Department of Land Conservation and Development (DLCD) to participate in a grant application to the FEMA Pre- Disaster Mitigation (PDM 19) planning grant. In March 2021, DLCD started working with Marion County Emergency Management to launch the HMP update process. Because Marion County was recovering from the 2020 Beachie Creek and Lionshead wildfire disasters, there was an interest in a broad and inclusive recruitment process for the many impacted communities and special districts. This resulted in a large steering committee of plan holders and many interested parties. The project kickoff meeting occurred in August 2021 and occurred each month until July 2022, except one (Feb. 2022)—a few more meetings than originally planned due to staff changes and health-related delays as the update spanned the second year of the COVID-19 pandemic.

3.1 Project Background

Marion County partnered with the University of Oregon Community Service Center (CSC) to update their 2011 Marion County Hazards Mitigation Plan (HMP). The Disaster Mitigation Act of 2000 requires communities to update their mitigation plans every five years to remain eligible for Pre-Disaster Mitigation (PDM) program funding, Flood Mitigation Assistance (FMA) program funding, and Hazard Grant Mitigation Program (HMGP) funding. A Federal Emergency Management Pre-Disaster Mitigation grant funded the CSC work with non-federal match provided by Marion County.

A total of four lifeline sector analysis sessions were held in March 2016. This analysis was then presented to the Marion County HMP steering committee, which provided hazard history and information about critical infrastructures and facilities within the county, evaluated and approved action items as a result of earlier analysis, and developed an implementation and maintenance strategy for the plan. Cities included within the Marion County HMP include Aumsville, Aurora, Detroit, Gates, Idanha, Keizer, Mill City, Silverton, Stayton, Turner and Woodburn.

3.2 2022 Plan Update Matrix

The sections below discuss major changes made to the HMPs during the 2021-2022 plan update process. Major changes include the replacement or deletion of large portions of text, the addition of material sourced from the DOGAMI multi-hazard risk report and other resources, new mitigation action items, and the addition of city and district addenda to the plan. If a section is not addressed in this memo, then no significant changes occurred.

The plan's format and organization maintained the OPDR plan template. Table C-1 below lists the 2011 and 2016 Marion County NHMP plan section names and the corresponding 2022 section names, as updated. The table below uses the 2022 plan update section names to reference any changes, additions, or deletions within the plan.

Table 3-1, Changes to Plan Organization

Table C-1 Changes to Plan Organization

2011 Marion County MNHMP	2017 Marion County MJHMP	2022 Marion County MJHMP
Acknowledgements	Acknowledgements	Acknowledgements
Table of Contents	Table of Contents	Table of Contents
Approval Letter	Approval Letters and Resolutions	Approval Letters and Resolutions
	FEMA Review Tool	FEMA Review Tool
Volume I: Basic Plan	Volume I: Basic Plan	Volume I: Basic Plan
Executive Summary	Plan Summary	Plan Summary
Section 1: Introduction	Section 1: Introduction	Section 1: Introduction
Section 2: Community Overview	Appendix C: Community Profile	Appendix C: Community Profile
N/A	Section 2: Risk Assessment	Section 2: Risk Assessment
Section 3: Mission, Goals and Action Items	Section 3 Mitigation Strategy	Section 3 Mitigation Strategy
Section 4: Plan Implementation and Maintenance	Section 4: Implementation and Maintenance	Section 4: Implementation and Maintenance Section 5: Plan Review, Adoption, and Approval
Volume II: Hazard Analysis		
Dam Failure Drought Earthquake Flood Landslide Volcanic Eruption Wildfire Wind Storm Winter Storm	Volume II incorporated into Volume I, Section 2: Risk Assessment	Hazard Analysis occurs in Volume I, Section 2: Risk Assessment Hazard Analysis also occurs in Volume II, Jurisdictional Addenda. This is specific, local hazard vulnerability information, including localized hazard events and their impacts. It illustrates the basis for the city or district's HVA scores. Extreme heat, avalanche, and tornado are new hazards.
Volume II: City/Special District Addenda	Volume II: City Addenda	Volume II: City Addenda
	City of Aumsville	City of Aumsville
City of Aurora	City of Aurora	City of Aurora
	City of Detroit	City of Detroit
	City of Gates	
		City of Gervais
		City of Hubbard
	City of Idanha	City of Idanha
		City of Jefferson
		Keizer Fire District
City of Keizer	City of Keizer	City of Keizer
	City of Mill City	(City of) Mill City
		City of Mt. Angel
		Mt. Angel Fire District
		City of Scotts Mills
City of Silverton	City of Silverton	
	City of Stayton	City of Stayton
		City of Sublimity
	City of Turner	City of Turner
City of Woodburn	City of Woodburn	City of Woodburn
		Woodburn Fire District
Volume III: Resource Appendices	Volume III: Appendices	Volume III: Appendices
Appendix A: Action Item Forms	Appendix A: Action Items	Appendix A: Action Items
Appendix B: Planning and Public Process	Appendix B: Planning and Public Process	Appendix B: Planning and Public Process
Appendix C: Economic Analysis of Natural Hazard Mitigation Projects	Appendix C: Community Profile	Appendix C: Community Profile
Appendix D: Stakeholder Survey Report	Appendix D: Lifeline Sector Profile	Appendix D: Lifeline Sector Profile
Appendix E: Resource Directory	Appendix E: Economic Analysis of Hazard Mitigation Projects	Appendix E: Economic Analysis of Hazard Mitigation Projects
	Appendix F: Grant Programs	Appendix F: Grant Programs
		Appendix G: Hazard History

3.3 2022 Plan Update Changes

Due to the significant increase in plan holders for the 2022 plan update, the primary changes between the 2022 and the 2016 updates occurred in the incorporation of new technical data and new/revised jurisdictional addenda. The 2022 HMP focused the addenda by removing duplicative information, adding detailed information about each plan holder including specifics about critical facilities, mitigation action status, new and revised mitigation actions, and the incorporation of vulnerability information from the updated risk assessment report. There were six new cities and three new special districts participating the plan that did not participate in the 2016 NHMP; two cities did not have the capacity to participate in this update (cites of Gates and Silverton).

Front Pages

1. Plan cover date and style has been updated to the DLCD format.
2. Acknowledgements have been updated to include the 2022 project partners and planning participants.
3. The FEMA approval letter, review tool, and county and city resolutions of adoption are included. (will be included with the final version of the HMP)

3.3.1 Volume I: Basic Plan

Volume I provide the plan framework for the 2022 Multi-jurisdictional HMP update. Volume I include the following sections:

Plan Summary:

The 2022 HMP includes an updated plan summary that provides information about the purpose of natural hazards mitigation planning and describes how the plan will be implemented.

Section 1: Introduction

Section 1 introduces the concept of natural hazards mitigation planning and answers the question, “Why develop a mitigation plan?” it has been reformatted for efficiency and readability. The new text describes the federal requirements that the plan addresses and gives examples of the policy framework for natural hazards planning in Oregon. Section 1 summarizes the 2022 plan update process and provides an overview of how the plan is organized.

Section 2: Risk Assessment

Section 2, Risk Assessment, provides a focused assessment of hazards and vulnerabilities within a single section. The risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis. Hazard identification involves the identification of hazard geographic extent, its intensity, and probability of occurrence. The second phase attempts to predict how different types of property and population groups will be affected by the hazard. The third phase involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Changes to Section 2 include:

- Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. Outdated and extraneous information was removed and links to technical reports were added as a replacement. With this update the Oregon NHMP is cited heavily as a reference to the more technical hazard material.
- Two new technical reports that form the logic basis of the risk assessment were contracted as a part of the DLCD grant for the project.
    - Williams, M.C. and I.P. Madin. (2022). MULTI-HAZARD RISK REPORT FOR MARION COUNTY, OREGON INCLUDING THE CITIES OF AUMSVILLE, AURORA, DETROIT, DONALD, GATES, GERVAIS, HUBBARD, IDANHA, JEFFERSON, KEIZER, MILL CITY, MOUNT ANGEL, SALEM, SCOTTS MILLS, SILVERTON, ST PAUL, STAYTON, SUBLIMITY, TURNER, AND WOODBURN AND THE UNINCORPORATED COMMUNITIES OF BROOKS, BUTTEVILLE, FOUR CORNERS, HAYESVILLE, LABISH VILLAGE, MARION, AND MEHAMA. : The Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk assessment (Risk Report) for Marion County. The Risk Report will provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including earthquake). The data included in this plan is the best available data, outdated information has been removed. The county and cities incorporated the risk assessment information to provide greater detail to sensitivity and exposure to the profiled hazards.
- Links to specific hazard studies and data are embedded directly into the plan where relevant and available.
- NFIP information was updated.
- The hazard vulnerability analysis/ relative risk has been updated for the county and cities (city information is included with more detail within Volume II).

Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the HMP. Major changes to Section 3 include the following:

- The mission and goals were reviewed and revised to align with the updated 2020 State NHMP. The cities reviewed the revised mission and goals and agreed to replace their existing mission and goals with this version.
- Action items were reviewed, revised, and prioritized.

Section 4: Plan Implementation and Maintenance

Marion County Emergency Management will continue to convene and coordinate the county steering committee (documentation for the city conveners is contained within the jurisdictional addenda of Volume II).

3.3.2 Volume 2:

A significant focus of this planning effort has been to increase the involvement and participation of cities in Marion County. With 20 incorporated cities, the county is committed to a regional planning approach that emphasizes partnerships and local collaboration. DLCD spent much of their consulting time supporting the eighteen participating jurisdictions complete their jurisdictional addenda.

3.3.3 Volume 3:

Below is a summary of the appendices included in the 2022 HMP:

Appendix A: Marion County Priority Actions

Priority actions are listed in Appendix A-1. Priority action items are based upon continuous community needs, the identification of new hazards, and current needs based upon the community risk assessment. They are designed to be feasibly accomplished within the next five years. Action item forms were created for priority actions that formerly did not have them; others have been updated to account for new information. The action item forms reference the status of the action item, timeline, rationale, implementation measures, and funding sources. Coordinating and partner organizations, for Marion County, are listed in Table 3-2 within Section 3, Mitigation Strategy, and within the city addenda for each of the participating cities.

A list of other actions is provided within this appendix. These actions are not considered high priority; however, the steering committees have the option to consider all actions items for implementation at any time. This strategy allows the jurisdictions to prioritize actions that are most likely to be implemented under current circumstances yet still allows their mitigation strategies as new situations, resources, and capabilities arise (such as capitalizing on funding sources for an action item that is not currently listed as high priority). The steering committees will formally review the actions in this section during their semiannual or annual meetings. Action items may also be considered, or added, to the list of high priority actions at any time.

Appendix B: Community Profile

The community profile has been updated to conform to the OPDR template and consolidates information for Marion County and participating cities.

Appendix C: Planning and Public Process

The planning and public process appendix reflects changes made to the Marion County MJHMP and documents the 2022 planning and public process.

Appendix D: Marion County Hazard Vulnerability Survey Report

This section presents the survey and its results conducted during the 2022 HMP update process.

Appendix E: Economic Analysis of Natural Hazard Mitigation Projects

Updates are provided for the economic analysis of natural hazard mitigation projects.

Appendix F: Grant Programs

Some of the previously provided resources were deemed unnecessary since this material is covered within the Oregon NHMP and appropriate resources are provided within the Hazard Annexes of Volume II. Updates were made to the remaining grant programs and resources.

Appendix G: Hazard History

Past hazard events are listed, described, and documented in detail in this section.

4 2022 HMP Public Participation Process

The following mechanisms were used to engage the public, plan holders, and interested parties throughout the 2022 Marion County HMP update process. These methods are also used when the plan undergoes review on an annual basis.

- Project Schedule
- Steering Committee
- Project Website
- Community Hazards Survey
- Social media, newsletters, emails, and other outreach.

4.1 Public Comment Matrix

The following comments were provided by the community as a part of the Marion County Hazard Mitigation Plan update.

Table 4-1, Public Comment Matrix

Open-Ended Response Comments Do you have any additional concerns or comments about hazards in your community?			
#	Commenter	Comment	Response
1	Name, location/ jurisdiction		
2	Detroit City Council via Kelly Galbraith	City of Detroit Addendum draft dated 7/27/22 was reviewed by City Council. No comments.	Thank you for taking the time to review your jurisdiction's addendum in a timely manner. We understand that no changes are requested, and the addendum is approvable as written.
3	Hubbard City Council (via Melinda Olinger, P.W. Administrative Manager)	City of Hubbard Addendum draft dated 07/12/2022 was reviewed by City Council. No comments.	Thank you for taking the time to review your jurisdiction's addendum in a timely manner. We understand that no changes are requested, and the addendum is approvable as written.
4	Woodburn C.E.R.T. (via Ulrich Reich, C.E.R.T. Coordinator)	Edits provided on the Woodburn/ Woodburn Fire Addendum clarifying details about the role and operations of Woodburn C.E.R.T.	Thank you for taking the time to review the Woodburn/ Woodburn Fire Addendum for accuracy. The value of community-based organizations cannot be overstated—thank you for your service.
5	Aurora Community Preparedness (via Laurie Boyce, Coordinator/ Former City Recorder)	Edits provided: Aurora Community Preparedness is implementing priority action item 22-MH-03 by coordinating with Red Cross and other efforts.	Thank you for taking the time to review the Aurora Addendum and helping the community to prepare for a disaster. We have accepted your proposed revisions and indicated that Aurora Community Preparedness is the City's liaison for this action item.
6			
7			
8			
9			
10			
11			
13			

Open-Ended Response Comments Do you have any additional concerns or comments about hazards in your community?			
#	Commenter	Comment	Response
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
30			

4.2 Project Flyer



On August 3, 2021 Marion County is kicking off the update to the All-Hazard Mitigation Plan. Existing All-Hazard Mitigation Plans must be updated every five years.

Marion County is collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update the Multi-Jurisdictional Hazard Plan to cover all hazards.

The updates will ensure the county, cities, and special districts maintain eligibility to apply for disaster related grant funding through the Federal Emergency Management Agency (FEMA). The plan will be completed by August, 2022.

WHY ENGAGE IN HAZARD MITIGATION PLANNING?



TO AVOID DISASTERS
by reducing or eliminating long-term risk to people, property, and the environment from hazards.



TO INCREASE SAFETY
and resilience by integrating hazard mitigation into local plans, programs, and policies.



TO MAINTAIN ELIGIBILITY
for disaster-related funding.

FOR MORE INFORMATION, CONTACT
Mike Hintz | Emergency Preparedness Coordinator
mhintz@co.marion.or.us | 503.365.3136

To review the current Marion County Multi-Jurisdictional Hazard Mitigation Plan, please visit:
https://www.co.marion.or.us/PW/EmergencyManagement

Marion County
OREGON

4.3 Plan Update Schedule

Marion County Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP)

PROJECT SCHEDULE

FINAL

MONTH	ACTIVITY
Dec. 2019 – July 2021	**Project Initiation**
Steering Committee (SC): NA	• Initial project coordination conversations between DLCD and Marion County staff. • Letter of Intent from Marion County to DLCD 12/30/19. • DLCD Natural Hazards Planner/Project Manager for the Marion County NHMP reaches out to Marion County on 2/12/21 to begin focused PDM 19 pre-award work. • Discussion: grant pre- and post- award costs, Intergovernmental Agreement (IGA), Scope of Work (SOW), allocation of basic responsibilities and tasks, NHMP process, Steering Committee roster, risk assessment, critical facilities and infrastructure, project schedule, public engagement and outreach, communication protocol, and cost share. • Draft IGA, SOW, and project schedule provided from DLCD to Marion County on 4/7/21. • Continued revised copies IGA, SOW, and project schedule provided from DLCD to Marion County. • DLCD and Marion County discuss draft IGA, SOW, and project schedule. • DLCD provides example of NHMP outreach flyer, April - May 2021.
May - July 2021	**Organizational Meeting and Project Progress (Pre-Award)**
SC: NA	• DLCD provides final versions of IGA, SOW, and project schedule. Agreement between DLCD and Marian County is solidified on the allocation of basic responsibilities and tasks, communication protocol, public engagement and outreach plans. • Marion County provides: ○ Steering Committee roster; ○ Contact information for the person responsible for cost sharing tracking and reporting; ○ Contact information for the person responsible for website updates for the NHMP; and ○ Signed IGA. ○ NHMP update announcement on their website. • DLCD provides fully executed IGA on an ongoing basis as communities secure approval. • Draft NHMP outreach flyer received from Marion County to DLCD on 7/14/21. Finalized on 7/19/21. • Potentially host pre-award Steering Committee meeting.
July – August 2021	**Project Progress (Pre- to Post-Award)**
SC: 8/3/21 (in person & online)	• Pre-award work continues. Potentially host pre-award Steering Committee meeting. • DLCD and Marion County await obligation of funding from FEMA. After funds are obligated, PDM 19 post-award work can occur on the NHMP. • Cost share forms can be finalized once award is obligated. • DLCD Project Manager was notified on 9/10/21 that FEMA obligated the PDM 19 funds and the post-award period begins 9/7/21. The PDM 19 grant Period of Performance (POP) begins on the day of the acceptance of the award and ends no later than 36 months.

Marion County Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP)

PROJECT SCHEDULE

FINAL

MONTH	ACTIVITY
Sept. 2021 – March 2022	**Project Progress (Post-Award)**
SC: (all online, except 1 hybrid) 9/7/21, 10/5/21, 11/2/21, 12/7/21, 1/4/22, 3/1/22, 4/5/22, 5/4/22 (hybrid), 6/7/22, 7/5/22	• After funds are obligated from FEMA, PDM 19 post-award work can occur on the NHMP. • Monthly Steering Committee meetings will be held. • Drafts of the Risk Assessment, Mitigation Strategy, and the Implementation Plan and Plan Maintenance sections will be drafted and available for review to the SC and public. Comments received are collected, discussed, and addressed.
Sept. 2021 – March 2022	**Project Progress including Risk Assessment**
SC: (all online, except 1 hybrid) 9/7/21, 10/5/21, 11/2/21, 12/7/21, 1/4/22, 3/1/22, 4/5/22, 5/4/22 (hybrid), 6/7/22, 7/5/22	• DLCD and Marion County perform Hazard Vulnerability Analysis. • Discuss critical facilities and infrastructure and information available for the risk assessment. • DLCD provides Hazard Vulnerability Analysis Summary and NFIP-insured repetitive loss information. Discuss. Draft risk assessment. • Describe the process for integrating NHMP content into plans, policies, and programs. Describe NFIP participation and compliance. • Review mission statement and goals.
Sept. 2021 – March 2022	**Project Progress including Mitigation Strategy**
SC: (all online, except 1 hybrid) 9/7/21, 10/5/21, 11/2/21, 12/7/21, 1/4/22, 3/1/22, 4/5/22, 5/4/22 (hybrid), 6/7/22, 7/5/22	• Continue review of mission statement and goals as needed. • Review existing mitigation actions (status), retain as is or revise actions, delete actions, and add actions; and prioritize mitigation actions. • There will also be a discussion of the OCCRI Future Changing Conditions report, outreach, cost share, success stories from jurisdictions, and a review of the HVA Summary.
Sept. 2021 – March 2022	**Project Progress including Mitigation Strategy and Plan Maintenance**
SC: (all online, except 1 hybrid) 9/7/21, 10/5/21, 11/2/21, 12/7/21, 1/4/22, 3/1/22, 4/5/22, 5/4/22 (hybrid), 6/7/22, 7/5/22	• Describe the method and schedule for the NHMP maintenance during the five-year cycle. • Describe the participants' public outreach and participation during NHMP maintenance. • Continue to discuss the OCCRI Future Changing Conditions Report; cost share forms; and revisit of the timelines for the NHMP process.
Sept. 2021 – March 2022	**Project Progress including Documentation of the Planning Process**
SC: (all online, except 1 hybrid) 9/7/21, 10/5/21, 11/2/21, 12/7/21, 1/4/22, 3/1/22, 4/5/22, 5/4/22 (hybrid), 6/7/22, 7/5/22	• Continue Mitigation Strategy and Plan Maintenance draft review and discussion. • Revisit/review all topics: HVA, critical facilities list, mission statement and goals, mitigation actions, outreach activities, etc.
January – July 2022	**Project Progress**
SC: 7/5/22, 7/12/22, 8/5/22 (online/ in person)	• Draft NHMP available to Steering Committee and public for review and comment. • Comments addressed and final NHMP draft prepared.

Marion County Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP)

PROJECT SCHEDULE
FINAL

MONTH	ACTIVITY
August 2022	**Project Progress – Submittal to OEM**
SC: TBD (online/ in person)	• Submit NHMP and Local Mitigation Plan Review Tool form to OEM by 3/31/22.
Sept.-Oct 2022	**Project Progress – Review by OEM and Submittal to FEMA**
SC: As needed	• Make any changes, if requested, from OEM. If no changes are requested, submit to FEMA.
Sept.-Oct 2022	**Project Progress – Review by FEMA**
SC: As needed	• Make changes, if requested, from FEMA. • Once FEMA is ok with the NHMP, receive "Approvable Pending Adoption" (APA) from FEMA. • Schedule NHMP for adoption with County, City, Special District, and other authorities.
Oct.-Nov. 2022	**Project Progress - Adoption**
SC: As needed	• County, City, Special District and other authorities adopt the NHMP. DLCD provides copies of the resolutions to OEM and FEMA. • Receive the FEMA Final Approval letter. • DLCD provides final PDF copy of approved NHMP. • Final copy of approved NHMP is placed on the Marion County website by Marion County. Other jurisdictions may also place the NHMP on their websites.
Note 1	The Marion County MJNHMP expires on 8/16/22.
Note 2	The DLCD Project Manager, Tricia Sears, will host meetings by videoconferencing (e.g. Zoom) or in-person as conditions provide. The type of meeting will be noted on the Project Schedule as in-person or Zoom. The Project Schedule will be updated throughout the NHMP update.
Note 3	Throughout the project, the IGA and SOW tasks will be continuously discussed as needed. Outreach and public education efforts will be documented and included in the NHMP.

4.4 Steering Committee Meetings

The steering committee is directly involved in reaching out the public in the review and update of the hazard mitigation plan. Although members of the steering committee represent the public to some extent, the residents of Marion County and the participating cities are also given the opportunity to provide feedback about the HMP update.

For the 2021-2022 process with support of DLCD, Marion County Emergency Management convened the steering committee. These individual community members played a vital role in shaping the plan. The steering committee guided the update process through several steps, including updates to the hazard history, action item development and review, and determining a strategy for implementation and maintenance.

The steering committee met on the following dates:

- Meeting #1: August 3, 2021
- Meeting #2: September 7, 2021
- Meeting #3: October 5, 2021
- Meeting #4: November 2, 2021
- Meeting #5: December 7, 2021
- Meeting #6: January 4, 2022
- Meeting #7: March 1, 2022
- Meeting #8: April 5, 2022
- Meeting #9: May 4, 2022
- Meeting #10: June 7, 2022
- Meeting #11: July 5, 2022

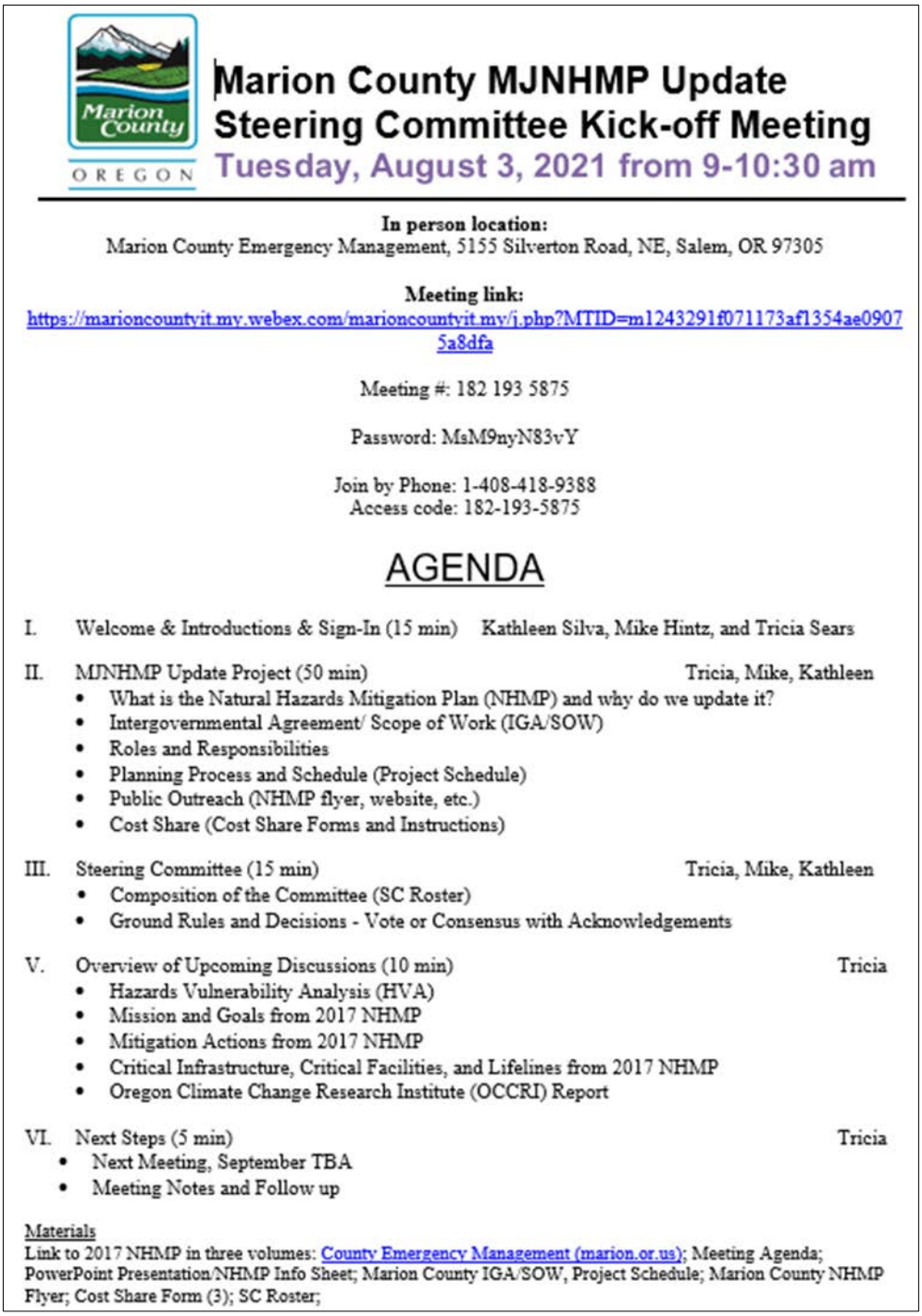
The steering committee formed under the guidance of Kathleen Silva, the Marion County Emergency Manager, and Mike Hintz, the Marion County Emergency Preparedness Coordinator. The steering committee invested considerable time into the mitigation plan. For a full list of steering committee members, see the Acknowledgments section and the table of steering committee representatives by jurisdiction in the Basic Plan of this HMP.

The following pages provide copies of meeting agendas and sign-in sheets or notes from the Marion County HMP Steering Committee meetings.

4.5 Steering Committee Meeting Documentation

4.5.1 Meeting 1, August 3, 2021

Figure 4-1, Steering Committee Meeting #1 Documentation



Marion County MJNHMP Update
Steering Committee Kick-off Meeting
Tuesday, August 3, 2021 from 9-10:30 am

In person location:
Marion County Emergency Management, 5155 Silverton Road, NE, Salem, OR 97305

Meeting link:
https://marioncountyit.my.webex.com/marioncountyit.my/j.php?MTID=m1243291f071173af1354ae09075a8dfa

Meeting #: 182 193 5875

Password: MsM9nyN83vY

Join by Phone: 1-408-418-9388
Access code: 182-193-5875

AGENDA

I. Welcome & Introductions & Sign-In (15 min) Kathleen Silva, Mike Hintz, and Tricia Sears

II. MJNHMP Update Project (50 min) Tricia, Mike, Kathleen
- What is the Natural Hazards Mitigation Plan (NHMP) and why do we update it?
- Intergovernmental Agreement/ Scope of Work (IGA/SOW)
- Roles and Responsibilities
- Planning Process and Schedule (Project Schedule)
- Public Outreach (NHMP flyer, website, etc.)
- Cost Share (Cost Share Forms and Instructions)

III. Steering Committee (15 min) Tricia, Mike, Kathleen
- Composition of the Committee (SC Roster)
- Ground Rules and Decisions - Vote or Consensus with Acknowledgements

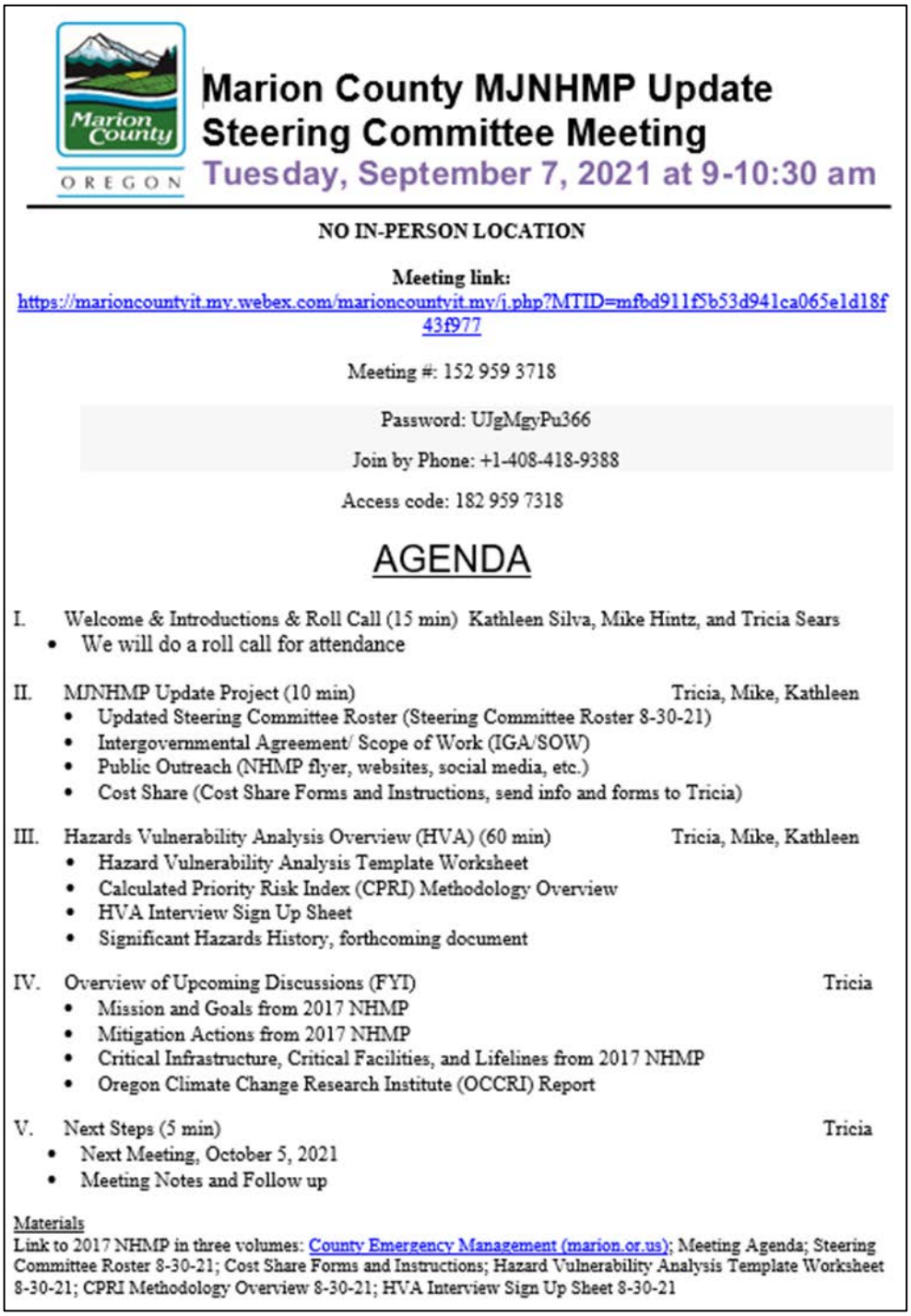
V. Overview of Upcoming Discussions (10 min) Tricia
- Hazards Vulnerability Analysis (HVA)
- Mission and Goals from 2017 NHMP
- Mitigation Actions from 2017 NHMP
- Critical Infrastructure, Critical Facilities, and Lifelines from 2017 NHMP
- Oregon Climate Change Research Institute (OCCRI) Report

VI. Next Steps (5 min) Tricia
- Next Meeting, September TBA
- Meeting Notes and Follow up

Materials
Link to 2017 NHMP in three volumes: County Emergency Management (marion.or.us); Meeting Agenda; PowerPoint Presentation/NHMP Info Sheet; Marion County IGA/SOW, Project Schedule; Marion County NHMP Flyer; Cost Share Form (3); SC Roster;

4.5.2 Meeting 2, September 7, 2021

Figure 4-2. Steering Committee Meeting #2 Documentation



Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, September 7, 2021 at 9-10:30 am

NO IN-PERSON LOCATION

Meeting link:
https://marioncountyit.my.webex.com/marioncountyit.my/j.php?MTID=mfbd911f5b53d941ca065e1d18f43f977

Meeting #: 152 959 3718

Password: UJgMgyPu366

Join by Phone: +1-408-418-9388

Access code: 182 959 7318

AGENDA

I. Welcome & Introductions & Roll Call (15 min) Kathleen Silva, Mike Hintz, and Tricia Sears
- We will do a roll call for attendance

II. MJNHMP Update Project (10 min) Tricia, Mike, Kathleen
- Updated Steering Committee Roster (Steering Committee Roster 8-30-21)
- Intergovernmental Agreement/ Scope of Work (IGA/SOW)
- Public Outreach (NHMP flyer, websites, social media, etc.)
- Cost Share (Cost Share Forms and Instructions, send info and forms to Tricia)

III. Hazards Vulnerability Analysis Overview (HVA) (60 min) Tricia, Mike, Kathleen
- Hazard Vulnerability Analysis Template Worksheet
- Calculated Priority Risk Index (CPRI) Methodology Overview
- HVA Interview Sign Up Sheet
- Significant Hazards History, forthcoming document

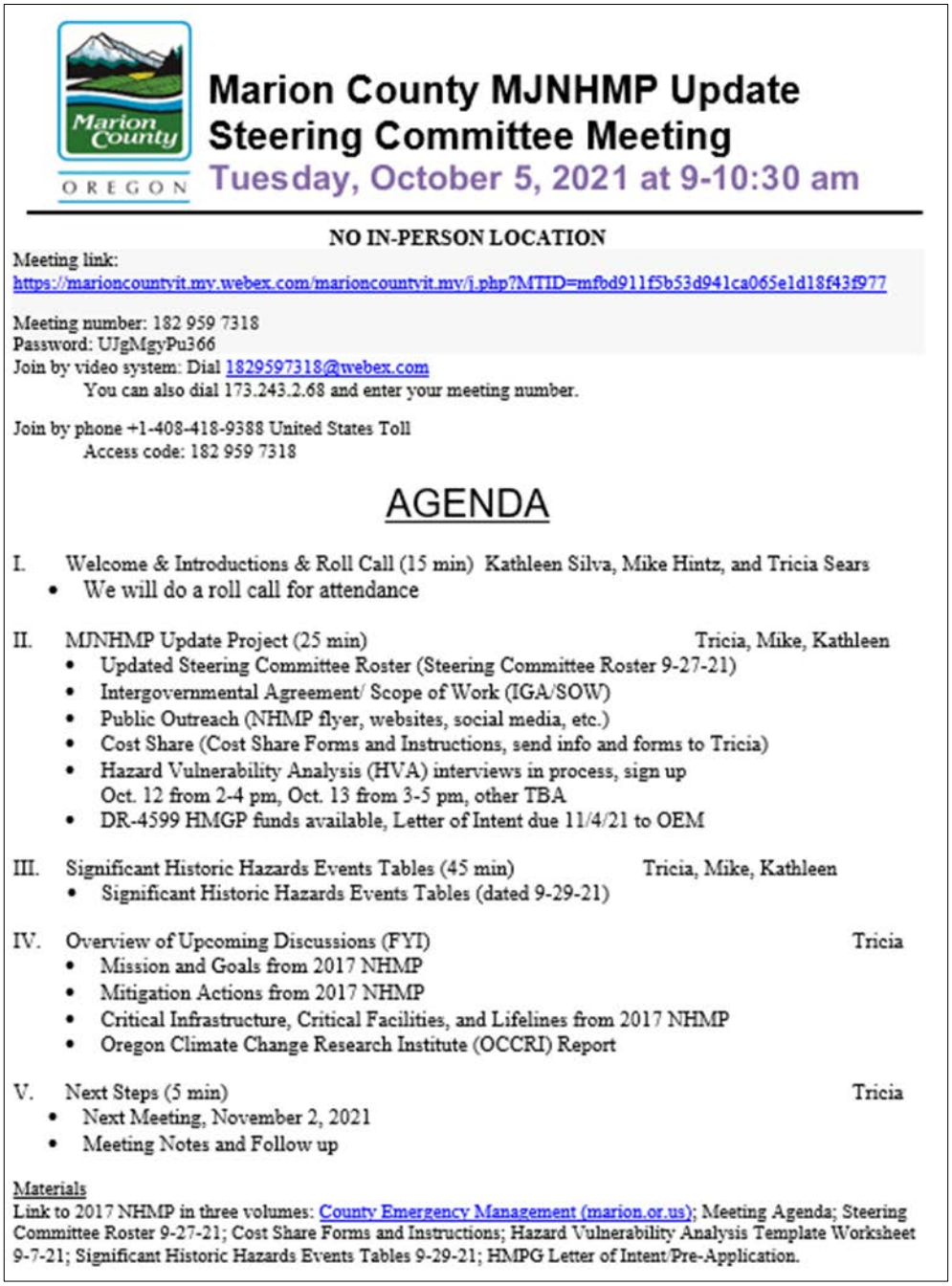
IV. Overview of Upcoming Discussions (FYI) Tricia
- Mission and Goals from 2017 NHMP
- Mitigation Actions from 2017 NHMP
- Critical Infrastructure, Critical Facilities, and Lifelines from 2017 NHMP
- Oregon Climate Change Research Institute (OCCRI) Report

V. Next Steps (5 min) Tricia
- Next Meeting, October 5, 2021
- Meeting Notes and Follow up

Materials
Link to 2017 NHMP in three volumes: County Emergency Management (marion.or.us); Meeting Agenda; Steering Committee Roster 8-30-21; Cost Share Forms and Instructions; Hazard Vulnerability Analysis Template Worksheet 8-30-21; CPRI Methodology Overview 8-30-21; HVA Interview Sign Up Sheet 8-30-21

4.5.3 Meeting 3, October 5, 2021

Figure 4-3, Steering Committee Meeting #3



Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, October 5, 2021 at 9-10:30 am

NO IN-PERSON LOCATION

Meeting link:
https://marioncountyit.my.webex.com/marioncountyit.my/j.php?MTID=mf0d911f5b53d941ca065e1d18f43f977

Meeting number: 182 959 7318
Password: UJgMgyPu366
Join by video system: Dial 1829597318@webex.com
You can also dial 173.243.2.68 and enter your meeting number.

Join by phone +1-408-418-9388 United States Toll
Access code: 182 959 7318

AGENDA

I. Welcome & Introductions & Roll Call (15 min) Kathleen Silva, Mike Hintz, and Tricia Sears
- We will do a roll call for attendance

II. MJNHMP Update Project (25 min) Tricia, Mike, Kathleen
- Updated Steering Committee Roster (Steering Committee Roster 9-27-21)
- Intergovernmental Agreement/ Scope of Work (IGA/SOW)
- Public Outreach (NHMP flyer, websites, social media, etc.)
- Cost Share (Cost Share Forms and Instructions, send info and forms to Tricia)
- Hazard Vulnerability Analysis (HVA) interviews in process, sign up Oct. 12 from 2-4 pm, Oct. 13 from 3-5 pm, other TBA
- DR-4599 HMGP funds available, Letter of Intent due 11/4/21 to OEM

III. Significant Historic Hazards Events Tables (45 min) Tricia, Mike, Kathleen
- Significant Historic Hazards Events Tables (dated 9-29-21)

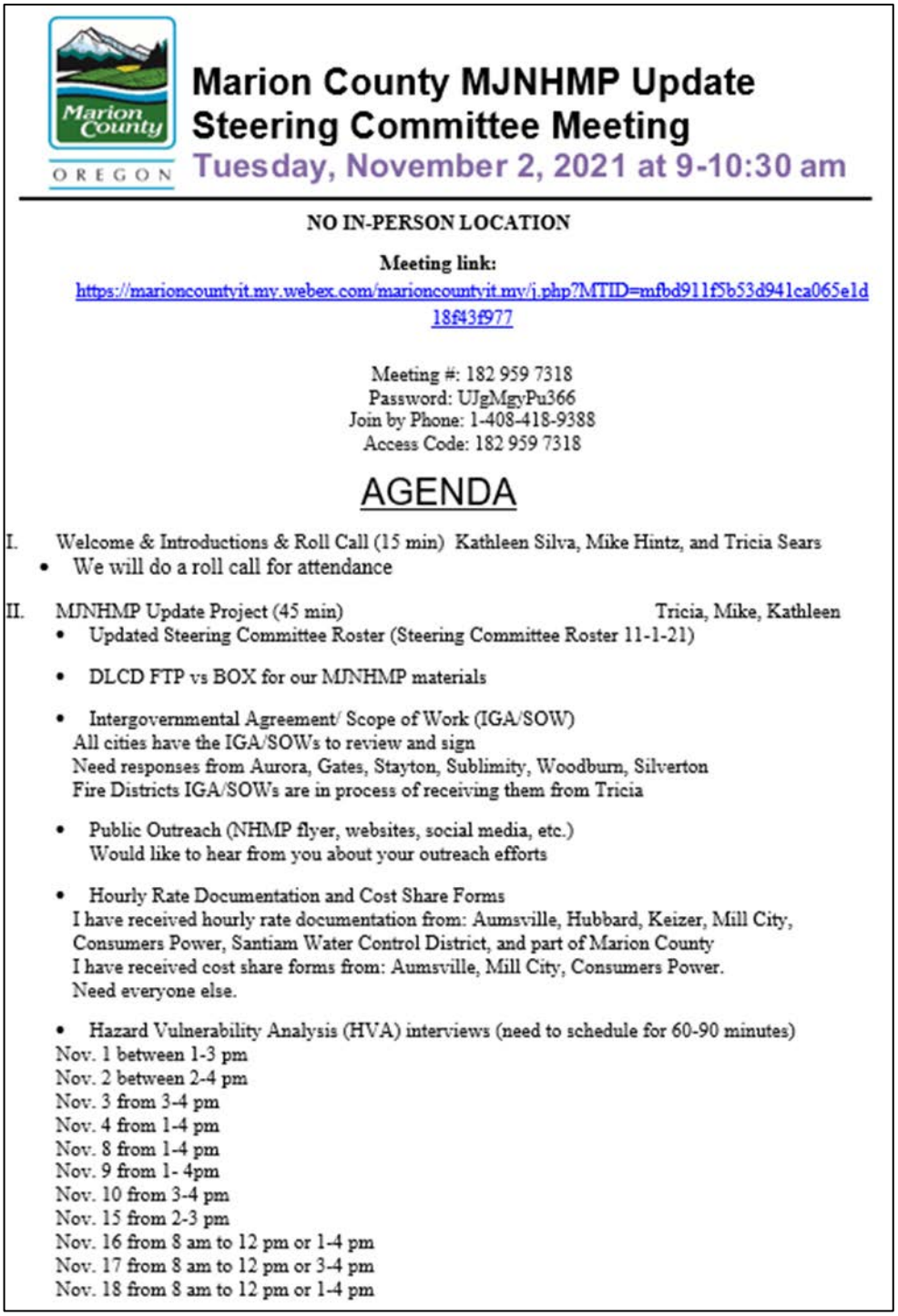
IV. Overview of Upcoming Discussions (FYI) Tricia
- Mission and Goals from 2017 NHMP
- Mitigation Actions from 2017 NHMP
- Critical Infrastructure, Critical Facilities, and Lifelines from 2017 NHMP
- Oregon Climate Change Research Institute (OCCRI) Report

V. Next Steps (5 min) Tricia
- Next Meeting, November 2, 2021
- Meeting Notes and Follow up

Materials
Link to 2017 NHMP in three volumes: County Emergency Management (marion.or.us); Meeting Agenda; Steering Committee Roster 9-27-21; Cost Share Forms and Instructions; Hazard Vulnerability Analysis Template Worksheet 9-7-21; Significant Historic Hazards Events Tables 9-29-21; HMPG Letter of Intent/Pre-Application.

4.5.4 Meeting 4, November 2, 2021

Figure 4-4, Steering Committee Meeting #4



Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, November 2, 2021 at 9-10:30 am

NO IN-PERSON LOCATION

Meeting link:
https://marioncountyit.my.webex.com/marioncountyit.my/j.php?MTID=mfbd911f5b53d941ca065e1d18f43f977

Meeting #: 182 959 7318
Password: UJgMgyPu366
Join by Phone: 1-408-418-9388
Access Code: 182 959 7318

AGENDA

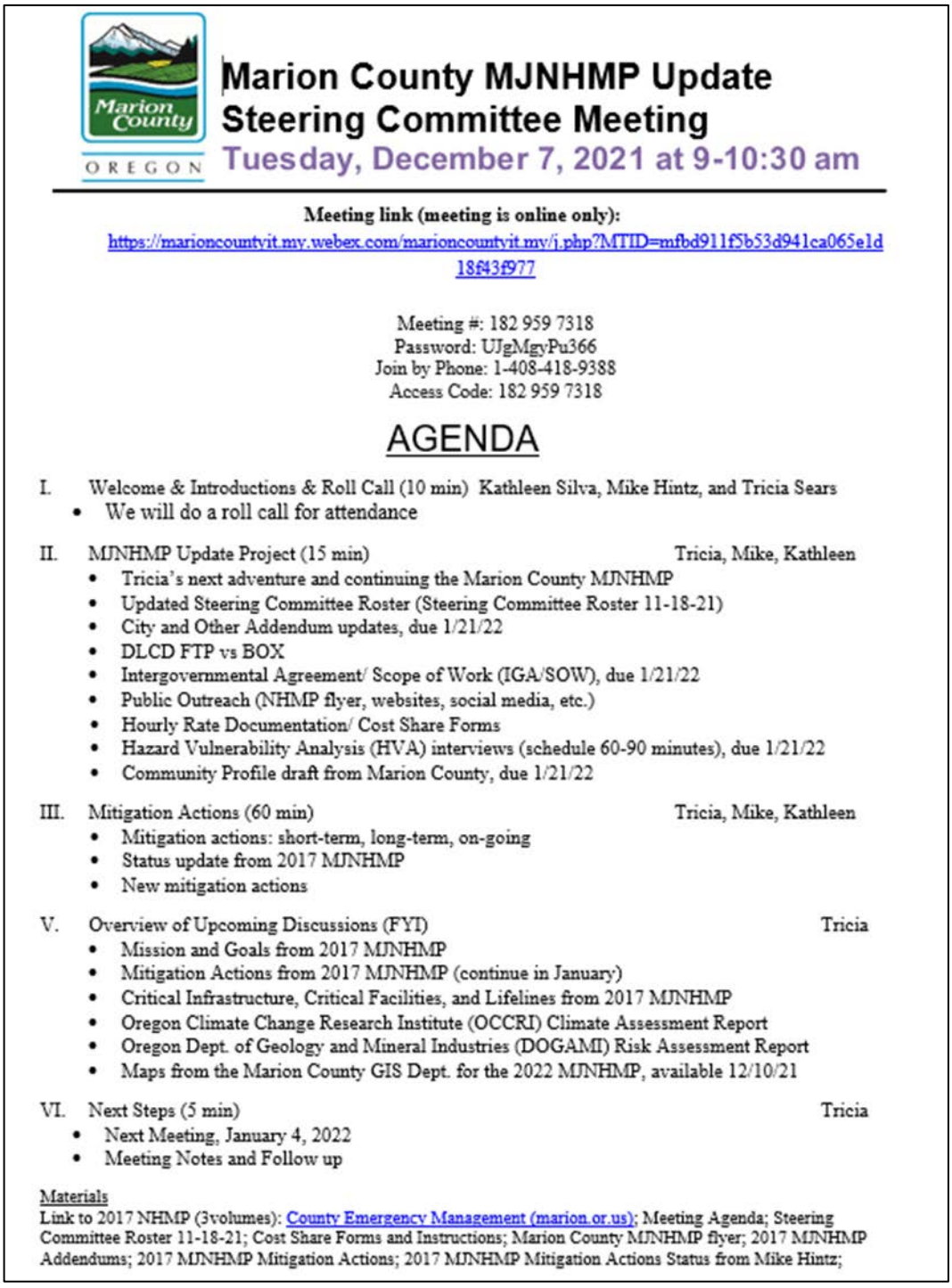
I. Welcome & Introductions & Roll Call (15 min) Kathleen Silva, Mike Hintz, and Tricia Sears
- We will do a roll call for attendance

II. MJNHMP Update Project (45 min) Tricia, Mike, Kathleen
- Updated Steering Committee Roster (Steering Committee Roster 11-1-21)
- DLCD FTP vs BOX for our MJNHMP materials
- Intergovernmental Agreement/ Scope of Work (IGA/SOW)
  All cities have the IGA/SOWs to review and sign
  Need responses from Aurora, Gates, Stayton, Sublimity, Woodburn, Silverton
  Fire Districts IGA/SOWs are in process of receiving them from Tricia
- Public Outreach (NHMP flyer, websites, social media, etc.)
  Would like to hear from you about your outreach efforts
- Hourly Rate Documentation and Cost Share Forms
  I have received hourly rate documentation from: Aumsville, Hubbard, Keizer, Mill City, Consumers Power, Santiam Water Control District, and part of Marion County
  I have received cost share forms from: Aumsville, Mill City, Consumers Power.
  Need everyone else.
- Hazard Vulnerability Analysis (HVA) interviews (need to schedule for 60-90 minutes)

Nov. 1 between 1-3 pm
Nov. 2 between 2-4 pm
Nov. 3 from 3-4 pm
Nov. 4 from 1-4 pm
Nov. 8 from 1-4 pm
Nov. 9 from 1- 4pm
Nov. 10 from 3-4 pm
Nov. 15 from 2-3 pm
Nov. 16 from 8 am to 12 pm or 1-4 pm
Nov. 17 from 8 am to 12 pm or 3-4 pm
Nov. 18 from 8 am to 12 pm or 1-4 pm

4.5.5 Meeting 5, December 7, 2021

Figure 4-5, Steering Committee Meeting #5



Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, December 7, 2021 at 9-10:30 am

Meeting link (meeting is online only):
https://marioncountyit.my.webex.com/marioncountyit.my/j.php?MTID=mfbd911f5b53d941ca065e1d18f43f977

Meeting #: 182 959 7318
Password: UJgMgyPu366
Join by Phone: 1-408-418-9388
Access Code: 182 959 7318

AGENDA

I. Welcome & Introductions & Roll Call (10 min) Kathleen Silva, Mike Hintz, and Tricia Sears
- We will do a roll call for attendance

II. MJNHMP Update Project (15 min) Tricia, Mike, Kathleen
- Tricia's next adventure and continuing the Marion County MJNHMP
- Updated Steering Committee Roster (Steering Committee Roster 11-18-21)
- City and Other Addendum updates, due 1/21/22
- DLCD FTP vs BOX
- Intergovernmental Agreement/ Scope of Work (IGA/SOW), due 1/21/22
- Public Outreach (NHMP flyer, websites, social media, etc.)
- Hourly Rate Documentation/ Cost Share Forms
- Hazard Vulnerability Analysis (HVA) interviews (schedule 60-90 minutes), due 1/21/22
- Community Profile draft from Marion County, due 1/21/22

III. Mitigation Actions (60 min) Tricia, Mike, Kathleen
- Mitigation actions: short-term, long-term, on-going
- Status update from 2017 MJNHMP
- New mitigation actions

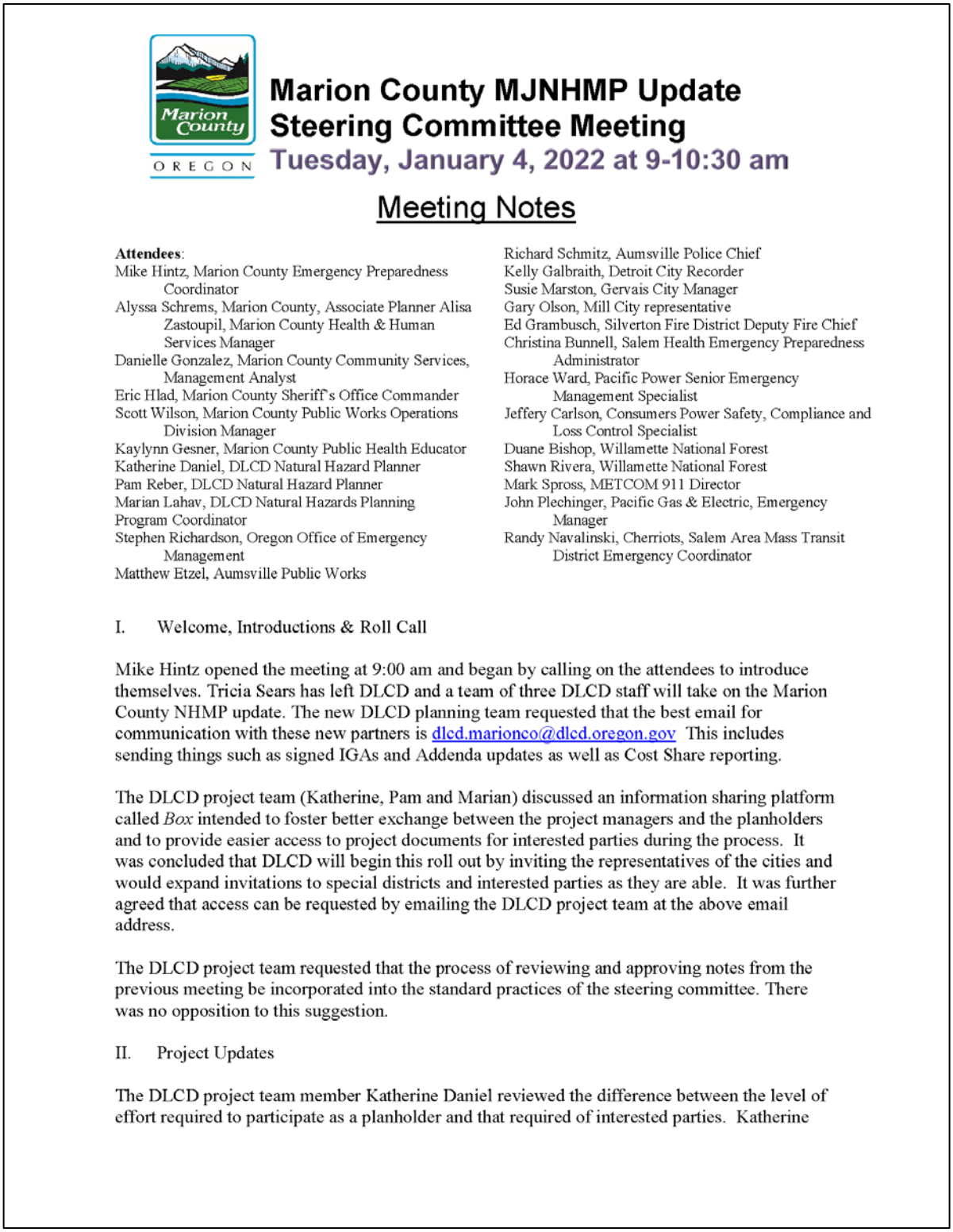
V. Overview of Upcoming Discussions (FYI) Tricia
- Mission and Goals from 2017 MJNHMP
- Mitigation Actions from 2017 MJNHMP (continue in January)
- Critical Infrastructure, Critical Facilities, and Lifelines from 2017 MJNHMP
- Oregon Climate Change Research Institute (OCCRI) Climate Assessment Report
- Oregon Dept. of Geology and Mineral Industries (DOGAMI) Risk Assessment Report
- Maps from the Marion County GIS Dept. for the 2022 MJNHMP, available 12/10/21

VI. Next Steps (5 min) Tricia
- Next Meeting, January 4, 2022
- Meeting Notes and Follow up

Materials
Link to 2017 NHMP (3volumes): County Emergency Management (marion.or.us); Meeting Agenda; Steering Committee Roster 11-18-21; Cost Share Forms and Instructions; Marion County MJNHMP flyer; 2017 MJNHMP Addendums; 2017 MJNHMP Mitigation Actions; 2017 MJNHMP Mitigation Actions Status from Mike Hintz;

4.5.6 Meeting 6, January 4, 2022

Figure 4-6, Steering Committee Meeting #6



Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, January 4, 2022 at 9-10:30 am

Meeting Notes

Attendees:
Mike Hintz, Marion County Emergency Preparedness Coordinator
Alyssa Schrems, Marion County, Associate Planner Alisa Zastoupil, Marion County Health & Human Services Manager
Danielle Gonzalez, Marion County Community Services, Management Analyst
Eric Hlad, Marion County Sheriff's Office Commander
Scott Wilson, Marion County Public Works Operations Division Manager
Kaylynn Gesner, Marion County Public Health Educator
Katherine Daniel, DLCD Natural Hazard Planner
Pam Reber, DLCD Natural Hazard Planner
Marian Lahav, DLCD Natural Hazards Planning Program Coordinator
Stephen Richardson, Oregon Office of Emergency Management
Matthew Etzel, Aumsville Public Works
Richard Schmitz, Aumsville Police Chief
Kelly Galbraith, Detroit City Recorder
Susie Marston, Gervais City Manager
Gary Olson, Mill City representative
Ed Grambusch, Silverton Fire District Deputy Fire Chief
Christina Bunnell, Salem Health Emergency Preparedness Administrator
Horace Ward, Pacific Power Senior Emergency Management Specialist
Jeffery Carlson, Consumers Power Safety, Compliance and Loss Control Specialist
Duane Bishop, Willamette National Forest
Shawn Rivera, Willamette National Forest
Mark Spross, METCOM 911 Director
John Plechinger, Pacific Gas & Electric, Emergency Manager
Randy Navalinski, Cherriots, Salem Area Mass Transit District Emergency Coordinator

I. Welcome, Introductions & Roll Call

Mike Hintz opened the meeting at 9:00 am and began by calling on the attendees to introduce themselves. Tricia Sears has left DLCD and a team of three DLCD staff will take on the Marion County NHMP update. The new DLCD planning team requested that the best email for communication with these new partners is dlcd.marionco@dlcd.oregon.gov This includes sending things such as signed IGAs and Addenda updates as well as Cost Share reporting.

The DLCD project team (Katherine, Pam and Marian) discussed an information sharing platform called *Box* intended to foster better exchange between the project managers and the planholders and to provide easier access to project documents for interested parties during the process. It was concluded that DLCD will begin this roll out by inviting the representatives of the cities and would expand invitations to special districts and interested parties as they are able. It was further agreed that access can be requested by emailing the DLCD project team at the above email address.

The DLCD project team requested that the process of reviewing and approving notes from the previous meeting be incorporated into the standard practices of the steering committee. There was no opposition to this suggestion.

II. Project Updates

The DLCD project team member Katherine Daniel reviewed the difference between the level of effort required to participate as a planholder and that required of interested parties. Katherine

described the benefit of becoming a planholder. Having a current, FEMA-approved NHMP is a key factor in establishing eligibility for certain FEMA grants that fund natural hazards mitigation planning and projects.

In order to complete the NHMP efficiently, the DLCD project team is anticipating submission by January 21, 2022 of materials from prospective planholders requested by Tricia Sears prior to her departure in a December 1, 2021 email. These include signed Intergovernmental Agreements, Hazard Vulnerability interviews scheduled, Addenda reviewed and updated.

DLCD project team member, Marian Lahav, addressed the quarterly cost share reporting required of planholders. Gary Olson of Mill City asked whether time spent discussing the project by City Council members at public meetings could be counted as cost share and whether that in-kind contribution of time could be reported collectively by the City Recorder. Marian responded that yes, their time would count for cost share, and she would check on whether it could be reported collectively by the City Recorder. All jurisdictions can do this as it is a responsibility of the Steering Committee members to keep decision makers informed throughout the planning process. Marian reviewed the elements of the cost share documentation form that need to be completed and emphasized that the activity description must include specific information. For example, a good description would be "Reviewed HVA and other risk assessment documents for the Mill City Addendum" rather than simply "Reviewed documents." The question was asked whether DLCD would be reviewing previously submitted cost share documentation and asking for refinement when necessary. Marian responded that she would.

DLCD project team member, Pam Reber, discussed the Hazard Vulnerability Analysis (HVA) interview purpose and content. HVAs are a local risk assessment that assist in targeting mitigation efforts to the most critical hazards, relative to the position of the jurisdiction evaluating them. Jurisdictions are encouraged to review and update the following information alongside the HVA: hazard history and recent events, staff/population served, and buildings/assets at risk, i.e., the HVA template subjects. Discussion included Aumsville noting that they were experiencing stormwater impacts from this week's winter storm and a question about how to aggregate the HVA information that will be addressed later in the update process.

A number of HVA interviews have taken place and the remaining HVAs will be completed as jurisdictions and district planholders schedule them with the Mike Hintz and the DLCD project team.

Danielle Gonzalez, Marion County Community Services highlighted Marion County's diverse geography and hazards profile and wants to better incorporate certain hazards. She asked if the County's HVA would be a roll-up of all the HVAs or separate. She indicated that we address drought, but not lack of water. Mike Hintz responded that there was a problem with cyanotoxins that was put into a Public Health section in the new Plan, and offered that could change if the Steering Committee wants more detail. However, since water districts and other utilities are anticipated to be new plan holders, this issue could be addressed in their addenda. He further indicated that there would be significant changes to the HVA in this plan update and that there would be a county-wide meeting scheduled to address mitigation actions flowing from the risk assessment.

The Department of Geology and Mineral Industries (DOGAMI) will provide the steering committee with a risk assessment for geologic hazards and wildfire hazard. This report is expected in March. The Oregon Climate Change Research Institute (OCCRI) will produce a

report on the impact of future climate projections on natural hazards. This report is not anticipated until May. These reports will be incorporated into the risk assessment and may require changes to it, to the mitigation strategy, and additional public review.

The DLCD project team led a discussion about developing a public engagement program for the NHMP update project. Flyers were identified as an effective way to inform the public, particularly for the Marion County Planning Department. DLCD will provide a flyer for jurisdictions to use following the Hazard Vulnerability Assessment phase of the NHMP update. Mike Hintz reported that the county is working on a survey that identifies where respondents live and asks for responses to assist in updating the natural hazard mitigation plan for the county. The County has also distributed surveys addressing issues around vulnerable populations.

Questions and comments were taken during the meeting, and general public comment was invited near the end of the meeting.

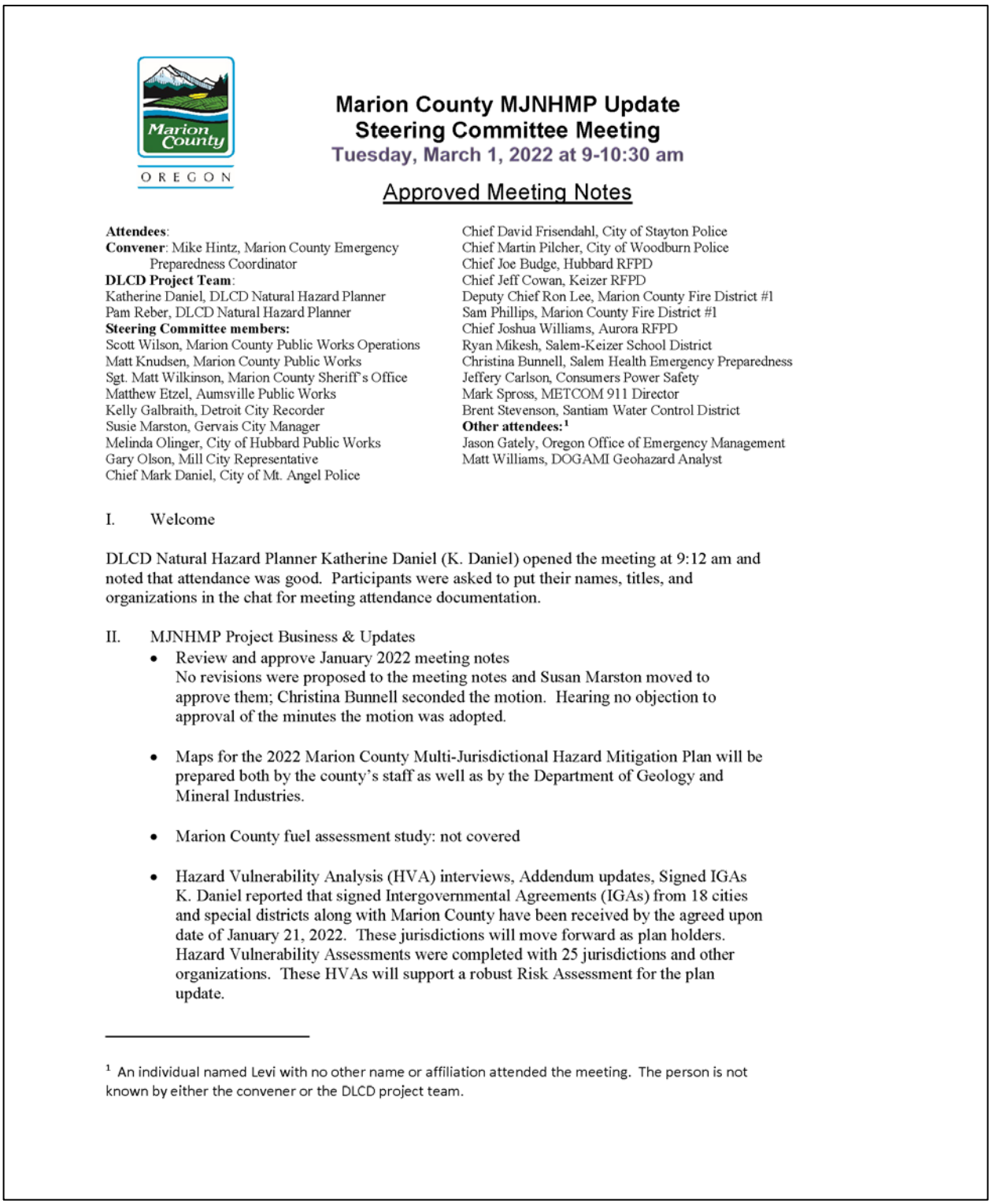
The next meeting is scheduled for February 1, 2022.

The meeting concluded at 10:15 am.

Materials
Link to 2017 NHMP in three volumes: County Emergency Management (marion.or.us);
Link to Box https://dlcd.box.com/s/urpbpxmvuj928xikygjknozz9fg3plet

4.5.7 Meeting 7, March 1, 2022

Figure 4-7, Steering Committee Meeting #7



Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, March 1, 2022 at 9-10:30 am

Approved Meeting Notes

Attendees:
Convener: Mike Hintz, Marion County Emergency Preparedness Coordinator
DLCD Project Team:
Katherine Daniel, DLCD Natural Hazard Planner
Pam Reber, DLCD Natural Hazard Planner
Steering Committee members:
Scott Wilson, Marion County Public Works Operations
Matt Knudsen, Marion County Public Works
Sgt. Matt Wilkinson, Marion County Sheriff's Office
Matthew Etzel, Aumsville Public Works
Kelly Galbraith, Detroit City Recorder
Susie Marston, Gervais City Manager
Melinda Olinger, City of Hubbard Public Works
Gary Olson, Mill City Representative
Chief Mark Daniel, City of Mt. Angel Police
Chief David Frisendahl, City of Stayton Police
Chief Martin Pilcher, City of Woodburn Police
Chief Joe Budge, Hubbard RFPD
Chief Jeff Cowan, Keizer RFPD
Deputy Chief Ron Lee, Marion County Fire District #1
Sam Phillips, Marion County Fire District #1
Chief Joshua Williams, Aurora RFPD
Ryan Mikesh, Salem-Keizer School District
Christina Bunnell, Salem Health Emergency Preparedness
Jeffery Carlson, Consumers Power Safety
Mark Spross, METCOM 911 Director
Brent Stevenson, Santiam Water Control District
Other attendees:[1]
Jason Gately, Oregon Office of Emergency Management
Matt Williams, DOGAMI Geohazard Analyst

I. Welcome

DLCD Natural Hazard Planner Katherine Daniel (K. Daniel) opened the meeting at 9:12 am and noted that attendance was good. Participants were asked to put their names, titles, and organizations in the chat for meeting attendance documentation.

II. MJNHMP Project Business & Updates

- Review and approve January 2022 meeting notes
  No revisions were proposed to the meeting notes and Susan Marston moved to approve them; Christina Bunnell seconded the motion. Hearing no objection to approval of the minutes the motion was adopted.

- Maps for the 2022 Marion County Multi-Jurisdictional Hazard Mitigation Plan will be prepared both by the county's staff as well as by the Department of Geology and Mineral Industries.

- Marion County fuel assessment study: not covered

- Hazard Vulnerability Analysis (HVA) interviews, Addendum updates, Signed IGAs
  K. Daniel reported that signed Intergovernmental Agreements (IGAs) from 18 cities and special districts along with Marion County have been received by the agreed upon date of January 21, 2022. These jurisdictions will move forward as plan holders. Hazard Vulnerability Assessments were completed with 25 jurisdictions and other organizations. These HVAs will support a robust Risk Assessment for the plan update.

[1] An individual named Levi with no other name or affiliation attended the meeting. The person is not known by either the convener or the DLCD project team.

4.5.8 Meeting 8, April 15, 2022

Figure 4-8,Steering Committee Meeting #8

Marion County MJNHMP Update
Steering Committee Meeting
Tuesday, April 5, 2022 at 9-10:30 am

Meeting Notes

Attendees
Convener: Mike Hintz, Marion County Emergency Preparedness Coordinator
DLCD Project Team:
Katherine Daniel, DLCD Natural Hazard Planner
Pam Reber, DLCD Natural Hazard Planner
Guest Speakers:
Meghan Dalton, OCCRI
Dominique Bachelet, OCCRI
Steering Committee members:
Robin Fournier, Scotts Mills City Manager
Susie Marston, Gervais City Manager
Chief Jeff Cowan, Keizer RFPD
Sam Phillips, Marion County Fire District #1
Deputy Chief Ron Lee, Marion County Fire District #1
Amanda Mathis, OEM Regional Mitigation and Recovery Manager
Mark Spross, METCOM 911 Director
Brent Stevenson, Santiam Water Control District
Alyssa Schrems, Marion County Planning
Dain Thomas, Marion County GIS
Adam Crateau, Marion County GIS
Alisa Zastoupil, Marion County Health and Human Services EH and PHEP program supervisor
Sgt. Matt Wilkinson, Marion County Sheriff's Office
Chief David Frisendahl, City of Stayton Police
David Solomon, WESD
Christina Bunnell, Salem Health Emergency Preparedness/ OEMA Vice President
Jeffery Carlson, Consumers Power Safety
Chief Joshua Williams, Aurora RFPD
Chief Mark Daniel, City of Mt. Angel Police

I. Welcome & Introductions

DLCD Natural Hazard Planner Katherine Daniel opened the meeting at 9:03 am and informed the meeting participants that Meghan Dalton and Dominique Bachelet from the Oregon Climate Change Research Institute (OCCRI) which is a part of OSU's College of Earth, Ocean, and Atmospheric Sciences. Participants were asked to put their names, titles, and organizations in the chat for meeting attendance documentation.

II. MJNHMP Project Business & Updates

- Review and approve March 2022 meeting notes
  Katherine asked if there were any revisions to the notes for the 3/1 meeting. None were offered. Susie Marston, moved to approve the minutes and Pam Reber seconded the motion. There were no objections, so the notes were approved as prepared.

- Addendum updates
  Katherine informed the participants that seven addendum update meetings had been held and that six more were scheduled. That left five jurisdictions that still needed to schedule meetings with the DLCD Project team for the purpose of reviewing or creating addenda.

- Public Outreach (Survey results)
  Mike shared that the survey has concluded and there had been 281 data points collected during the survey. He will compile and summarize the results and then share them with the Steering Committee members within a couple of weeks.

- Hourly Rate Documentation/ Cost Share Forms

III. Future Conditions Report for Marion County (25 min)
by the Oregon Climate Change Research Institute (OCCRI)

Meghan Dalton, Senior Research Assistant and Dominique Bachelet, Research Associate at OCCRI presented an overview of the climate change modeling that will form the basis of their report on future climate conditions in Marion County. The presentation is available in the project Box file sharing webservice. Meghan asked the participant for feedback on the approach presented and for specific areas of concern in Marion County.

There was a question about how the drought data aligned with the Willamette Water 2100 project by the Oregon Water Resources Dept. In response, Dominique from OCCRI shared:

- Meghan mentioned 3 models the project Willamette 2100 used: High Climate Change scenario (the HadGEM2−ES climate model run with RCP 8.5); the Reference Case scenario (the MIROC5 climate model run with RCP 8.5); and the Low Climate Change scenario (the GFDL−ESM2M climate model run with RCP 4.5).
- For Meghan's assessment reports she uses the ensemble of 20 downscaled climate model data by the same methods than Willamette 2100, the MACA method by John Abatzoglou.
- Link to W2100: https://inr.oregonstate.edu/ww2100/analysis-topic/future-climate
- Link to previously published assessment reports: https://blogs.oregonstate.edu/occri/projects/dlcd/

V. Mitigation Actions
Mitigation action development & examples

Pam discussed the development of problem statements as a way to develop SMART (Specific, Measurable, Actionable, Realistic and Time Sensitive) mitigation actions that would be fundable by FEMA HMA grant programs. Working outward from existing capacity and focusing on a few priority actions were points that Pam made during this agenda item topic. Pam identified several key areas of authority FEMA expects jurisdictions to utilize including those of the Emergency Management staff, Public Works and infrastructure authorities as well as Planning and growth management authorities within development code.

VI. Preparation for Next Meeting (10 min)

Prospective plan holders were asked to prepare to discuss each jurisdiction's top three mitigation priorities at the May meeting.

VI. Next Steps (5 min)

Pam and Katherine are working with each plan holder on updating or creating addenda to serve as each prospective plan holders' NHMP that identifies the particular features of the jurisdiction distinguishing it from the county and that identifies specific measurable mitigation actions addressing each of the hazards identified.

The May Steering Committee meeting will be an in-person event and is scheduled for 5/4/22 at 9:00-10:30 am. An online link will also be provided for those who are not able to attend in person. The jurisdictions will use this time to exchange ideas and information about their priorities for mitigation.

Marion County Box folder:
https://dlcd.box.com/s/urpbpxmvuj928xikygjknozz9fg3plet

4.5.9 Meeting 9, May 4, 2022

Figure 4-9. Steering Committee Meeting #9

Marion County MJNHMP Update
Steering Committee Meeting
Hybrid – Online and In-Person
Wednesday, May 4, 2022 at 9-10:30 am

Adopted Meeting Notes

Attendees
Convener: Mike Hintz, Marion County Emergency Preparedness Coordinator
DLCD Project Team:
Katherine Daniel, DLCD Natural Hazard Planner
Pam Reber, DLCD Natural Hazard Planner
Cynthia Smidt, DLCD Natural Hazard Planner

Steering Committee members:
In the meeting room:
Tim Kirsch, Mill City Mayor
Matt Etzel, Aumsville Public Works
Matt Reyes, Keizer Project Manager
Sam Phillips, Marion Co Fire District 1
Dain Thomas, Marion Co. GIS

Online Participants:
Robin Fournier, Scotts Mills City Manager
Susie Marston, Gervais City Manager
Mark Chase, Gervais Police Chief
Alissa Angelo, City of Stayton
Joaquin Ramos, Marion Co. HHS
Melinda Olinger, Hubbard City Manager
Kaylynn Gesner, Marion Co. PHEP Coordinator
Chief Mark Daniel, City of Mt. Angel Police
Brent Stevenson, manager Santiam Water Control District
Sgt. Damian Flowers, Aumsville Police Department
Levi Eckhardt, Jefferson Fire
Scott W. Wilson, Marion Co. Public Works
Christina Bunnell, Salem Health Emergency Preparedness
Jeffery Carlson, Consumers Power Safety
Jaden Emminger, Marion Co. EM AmeriCorps

I. Map Viewing: The meeting room was open at 8:45am for participants to view maps before the start of the meeting.

II. Welcome & Introductions

The meeting began at approximately 9:05am. DLCD Natural Hazard Planner Katherine Daniel and Marion County Emergency Preparedness Coordinator worked through the logistics of setting up a hybrid meeting and then introduced the participants in the room. Online participants were asked to document their meeting attendance in the chat feature of Teams.

II. MJNHMP Project Business & Updates

- Review and approve the April 5, 2022 meeting notes.
  Katherine asked if there were any revisions to the notes for the 4/5/22 meeting. None were offered. Robin Fournier of Scotts Mills moved to approve the meeting notes; Jeffrey Carlson seconded. All say aye.

- Hourly Rate Documentation/ Cost Share Forms
  Cost share – If you have not submitted rate documentation, you may have received an email from DLCD's Ashley Edwards. Please respond and also provide cost share reporting on a quarterly basis to Kathleen Silva.

- Addendum updates

Katherine and Pam have spoken with nearly every jurisdiction who will be plan holders. They are working through revising those or creating new updates for our new participants, and we will share with you those updates as we the drafts as we get them completed. Final edits continue as jurisdictions take their addendums to staff and decision makers to affirm mitigation actions and other details.

- Public Outreach (Survey results)
  Mike Hintz provided an update on the survey results, which included an example from one community. In January 2022, Marion Co. Emergency Management issued an electronic survey to the community about hazards. From January 10th to March 31st, 208 responses were received from various parts of the county on both natural and "non-natural" (technological, etc.) hazards. The survey found that there is more preparation for winter storm and wind storm than any other hazard.

- Contact ODF Grant Coordinator for fire mitigation action funding:
  Ben Sproul, Grant Coordinator, Oregon Department of Forestry
  ben.n.sproul@odf.oregon.or.us 971-275-4395

Survey Questions

- The following questions were developed and used in the survey:
  - Where do you live?
  - Which hazard are you most concerned about?
  - How much have your prepared for each hazard?
  - If money and other resources were made available, how could it be used to lessen vulnerabilities in your community or home from natural, man-made and technological hazards?

Number of Participants by Location



Participating Communities	Number of Responses	Participating Communities	Number of Responses
Aumsivlle	22	Sublimity	1
Auron	8	Woodburn	63
Detorit	1	Turner	5
Donald	1		
Gervais	6		
Jefferson	54		
Hubbard	7		
Lyons	1		
Mill City	6		
Mt. Angel	3		
Outside Marion County	3		
Salem	17		
Silverton	50		
St. Paul	1		
Stayton	13		

IV. Mitigation Actions

The intent of the May 2022 meeting was to provide an opportunity for sharing between the plan holder jurisdictions. The focus of this effort is mitigation actions so communities can move forward together in terms of capacity building and collaboration as opportunities arise. At this meeting, the following entities shared mitigation actions: Marion County, the City of Aumsville, Mill City, City of Gervais, and the City of Scotts Mills.

Mike Hintz, Marion County Emergency Services Coordinator provided an overview of the Marion Co. Hazard Mitigation Tasks 2022-2027.

- This includes implementation of a significant amount of FEMA funding to create a new evacuation plan for the county.

Damian Flowers, Police Sergeant, and Pam Reber presented the Mitigation Priorities for the City of Aumsville.

- Several water system resilience updates are being made in Aumsville, including an assessment of the water tower and a new seismically resilient 1-million-gallon water tank.

Tim Kirsch, Mill City Mayor, presented Mitigation Priorities for Mill City and highlighted:

- Portable generators are high priority—two portable generators on trailers (FEMA grant requests).
- Four MOUs with local fuel supply sources.
- Sheltering needs: Assess short and medium terms needs for sheltering access and functional needs populations for different potential hazards. MOU with Santiam School District 129J to use facilities during hazard events. Develop MOU with Canyon Senior Center and Santiam Outreach Community Center for short term heating/cooling station during hazard events / loss of power.
- Transportation and Early Warning System are two additional priorities.

Mark Chase and Susie Marston presented the Mitigation Priorities for the City of Gervais.

- 2019 Ice Storm impacted electricity and communications, so the city is prioritizing backup power.
- Constructing a Fire House in the community in partnership with Woodburn Fire.
- Coordination of evacuation planning and seismic retrofits.

V. Map Viewing and Updates

- Dain Thomas and Adam Crateau of Marion County GIS have prepared maps that are presented in the meeting room.
- Revisions and input regarding critical and essential facilities are requested at this meeting or in follow-up. Please provide update about locally important critical facilities

VI. Meeting Wrap up and Next Steps

Marion County Box folder:
https://dlcd.box.com/s/urpbpxmvuj928xikygjknozz9fg3plet

4.5.10 Meeting 10, June 7, 2022

Figure 4-10, Steering Committee Meeting #10

Marion County MJNHMP Update
Steering Committee Meeting
Online
Tuesday, June 7, 2022 at 9-10:30 am

Meeting Notes

Attendees
Convener: Mike Hintz, Marion County Emergency Preparedness Coordinator
DLCD Project Team:
Katherine Daniel, DLCD Natural Hazard Planner
Pam Reber, DLCD Natural Hazard Planner
OCCRI staff:
Dominique Bachelet, OCCRI Climate Researcher
Meghan Dalton, OCCRI Researcher/ Report Author

Steering Committee members:
Laurie Boyce Aurora Emergency Coordinator
Susie Marston, Gervais City Manager
Sam Phillips MCFD No. 1
Scott McClure Turner City Administrator
Ron Lee, Marion County Fire District
David Frisendahl, City of Stayton
Jim Trierweiler, Mt Angel Fire
Christina E. Bunnell

Dain Thomas, Marion Co. GIS
Joaquin Ramos, Marion Co. HHS
Melinda Olinger, Hubbard PW Admin Manager
Kaylynn Gesner, Marion Co. PHEP Coordinator
Jaden Emminger, Marion Co. EM AmeriCorps

I. Welcome & Introductions

The meeting began at approximately 9:05am. Online participants were asked to document their meeting attendance in the chat feature of Teams.

II. MJNHMP Project Business & Updates

- Meeting Notes: The committee affirmed the May 4, 2022 meeting notes.
  - Motion to affirm by Jim Trierweiler, Mt Angel Fire
  - Christine Bunnell, Salem Health seconds.
  - All say aye.
- Public Review and Survey Results
  - DLCD staff shared the importance of public websites and preparing them for public review.

III. OCCRI Future Conditions Report for Marion County

OCCRI staff presented the final Future Conditions Report to the Marion County HMP Committee. This and previous reports are available online:
www.blogs.oregonstate.edu/occri/projects/dlcd/

Meghan Dalton explained the importance of and comparability of the 30-year snapshot for a historical and a future perspective that is consistent for current and future reports. Black line with gray shading is an average across 20 models of historical data. Line is the average, and the

shading is the range. There are two emissions scenarios: 1. Lower emissions by mid-century, start to level off by the middle of this century and then by the end maybe slightly decrease. 2. Higher emission scenario that assumes that global emissions continue to increase throughout the 20th century. Reality is somewhere in between there right now, closer to the higher end, but not quite as high as the higher end. The 2050 projection is nearly a 5 degree increase from the historical baseline.
OCCRI staff also explained the metrics used in the report and the anticipated trends of those metrics. Example: Hot days is defined by the number of days with maximum temperature above 90 degrees Fahrenheit. This is the number of days above 90 is projected to increase by nearly 16 days. Under the higher emission scenario, we're looking at a change of an increase of about 7 degrees Fahrenheit. So whatever the average is, the hottest day of the year was in the historical baseline by the 2050s, that average hottest day is likely to be 7 degrees hotter than it was previously.

V. Next Steps

- Finish addenda with DLCD
- Submit cost share
- Plan to coordinate HMP review internally and with the public.
- Next meeting July 5th

Marion County Box folder:
https://dlcd.box.com/s/urpbpxmvuj928xikvgjknozz9fg3plet

4.5.11 Meeting 11, July 5, 2022

Figure 4-11, Steering Committee Meeting #11

Marion County MJNHMP Update
Steering Committee Meeting
Online
Tuesday, July 5, 2022 at 9-10:30 am

Draft Meeting Notes

Attendees
Convener: Mike Hintz, Marion County Emergency Preparedness Coordinator
DLCD Project Team:
Katherine Daniel, DLCD Natural Hazard Planner
Pam Reber, DLCD Natural Hazard Planner

Steering Committee members:
Stuart Rodgers, Aurora City Recorder
Kelly Galbraith, Detroit City Recorder
Susie Marston, Gervais City Manager
Gary Olson, Mill City
Mark Daniel, Mt. Angel Police Chief
Ron Lee, Marion County Fire District Deputy Chief
Jim Trierweiler, Mt Angel Fire Chief

Michael Kueler, Marion County Health & Human Services
Dain Thomas, Marion Co. GIS
Christina Bunnell, Salem Health

I. Welcome & Introductions

II. MJNHMP Project Business & Updates

- Meeting Notes: The committee affirmed the June 7, 2022 meeting notes.
  - All say aye.

III. Plan Draft Review & Approval

- Highlights of the key components of and changes to the three Volumes of the draft plan were reviewed by DLCD.
  - Volume I: Basic Plan
  - Volume II: Jurisdictional Addenda
- The Marion County HMP discussed and approved the plan upon final edits being completed by Marion County and DLCD.
- All say aye.

V. Next Steps

- Finish addenda with DLCD
- Submit cost share
- Plan to coordinate HMP review internally and with the public.

Marion County Box folder:
https://dlcd.box.com/s/urpbpxmvuj928xikygjknozz9fg3plet

4.6 Public Outreach

To engage the public, Marion County, cities, and special districts (plan holders) employed multiple strategies to engage the public and whole community, summarized below:

- Marion County Website
- Marion County HMP Community Survey
- Social Media Outreach: Survey responses informed the updated County THIRA.
- Email Outreach: Survey, Steering Committee meetings.
- Marion County Emergency Management provided regular briefings to the Marion County Emergency Management Advisory Council.
- Public meeting presentation to the Marion County Board of Commissioners on May 4, 2022.
- Twenty people attended a public presentation of Hazard Mitigation Actions by participating jurisdictions occurred in a hybrid online and in-person meeting at Marion County's offices, on May 4th, 2022.
- Public Comment: Distribution was made available by public link to the Steering Committee Box account for public comment by the nineteen jurisdictions and many interested parties. Jurisdictions also were encouraged to post and distribute the link internally and externally.
    - The DRAFT Volume I of the MJHMP was posted on July 5th and comments taken until August 5th.
    - The DRAFT Volume II of the MJHMP was posted on July 27th and comments taken until August 15th.
    - The DRAFT Volume III of the MJHMP was posted on August 10th and comments taken until August 15th.
    - A revised, final draft of Volumes I-III was provided to the jurisdictions and the public for final review September 26th through October 14th, 2022.

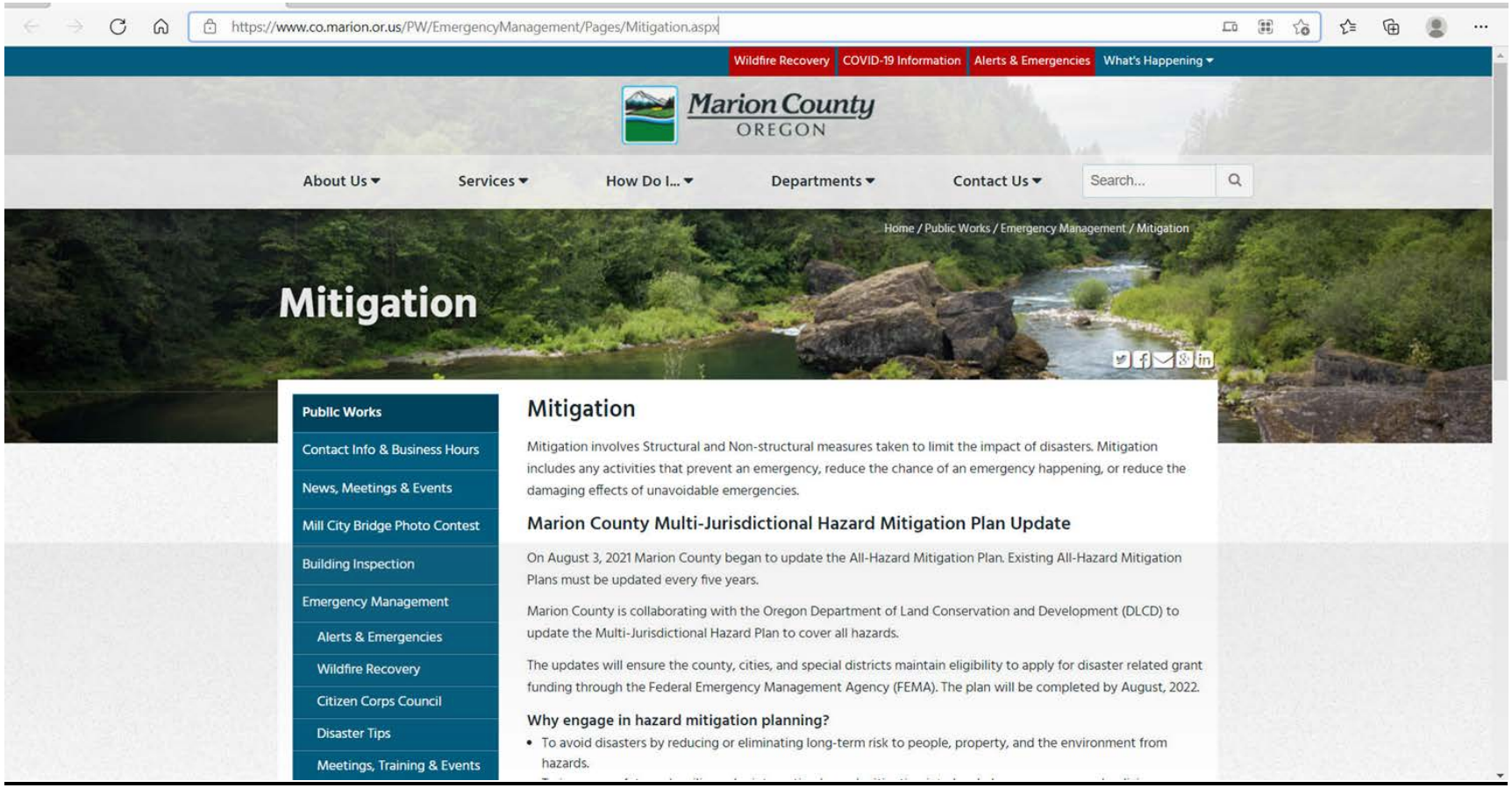
Throughout the process, Marion County collected input and feedback. Where applicable and appropriate, feedback is integrated into the document. MCEM has also considered feedback as part of ongoing enhancements to the Marion County Emergency Management program.

4.6.1 Outreach Documentation

The following pages document the web postings, newsletters, survey promotion, and social media outreach conducted by the plan holder jurisdictions and their partners.

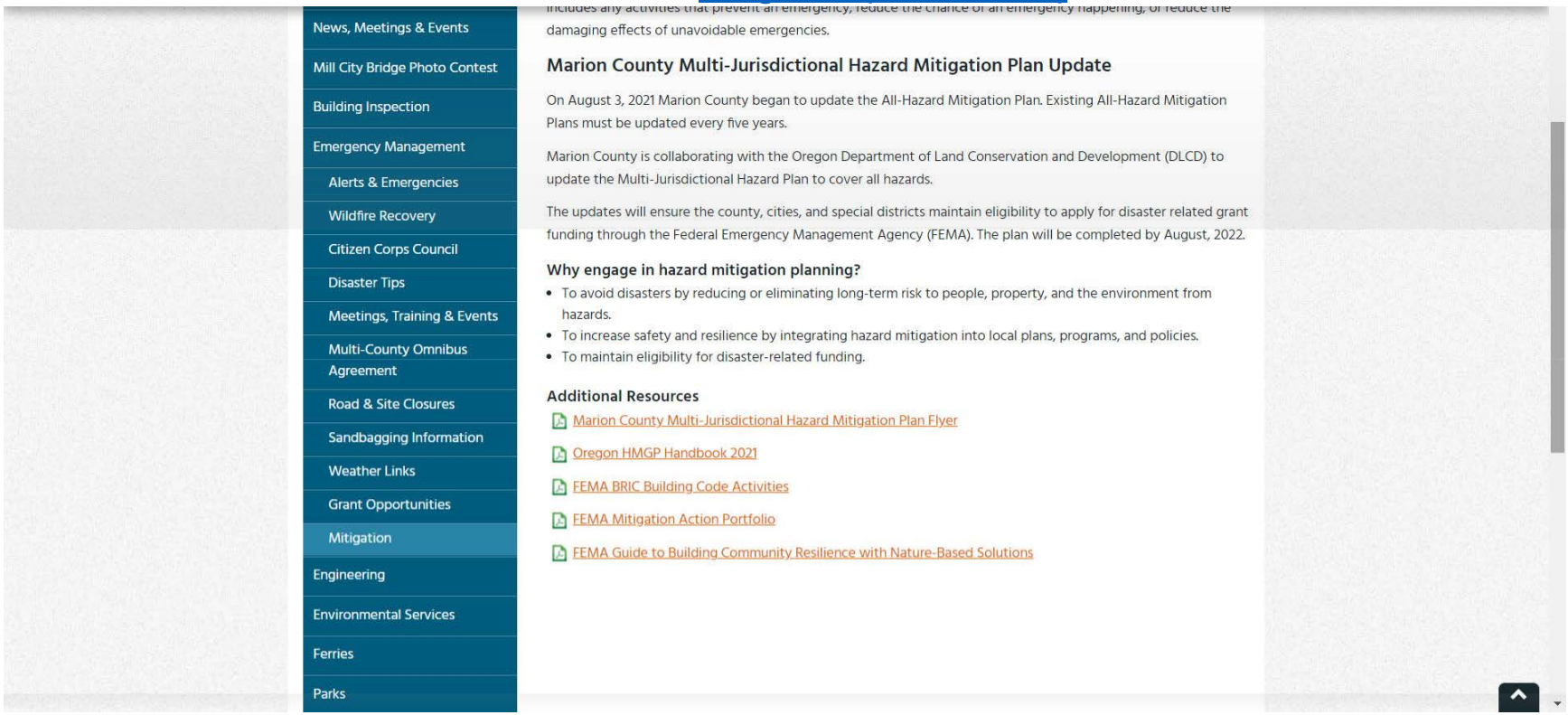
4.6.2 Marion County Emergency Management, 9/14/21

Marion County Emergency Management, 9/14/21,
Mitigation (marion.or.us)



Marion County Emergency Management 9/14/21

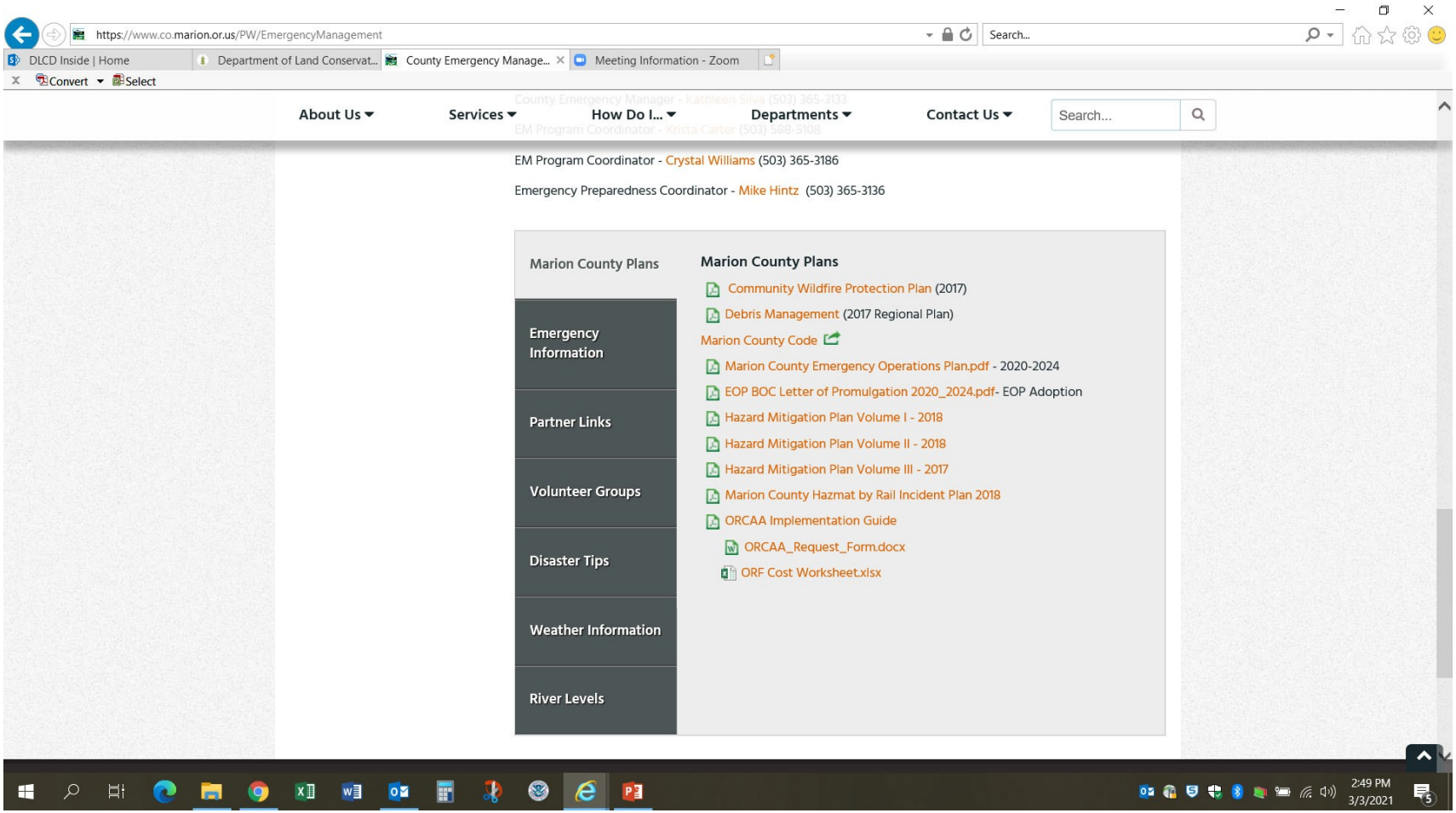
Mitigation (marion.or.us)



4.6.3 Marion County Emergency Management 3/3/21

Marion County Emergency Management Website 3/3/21

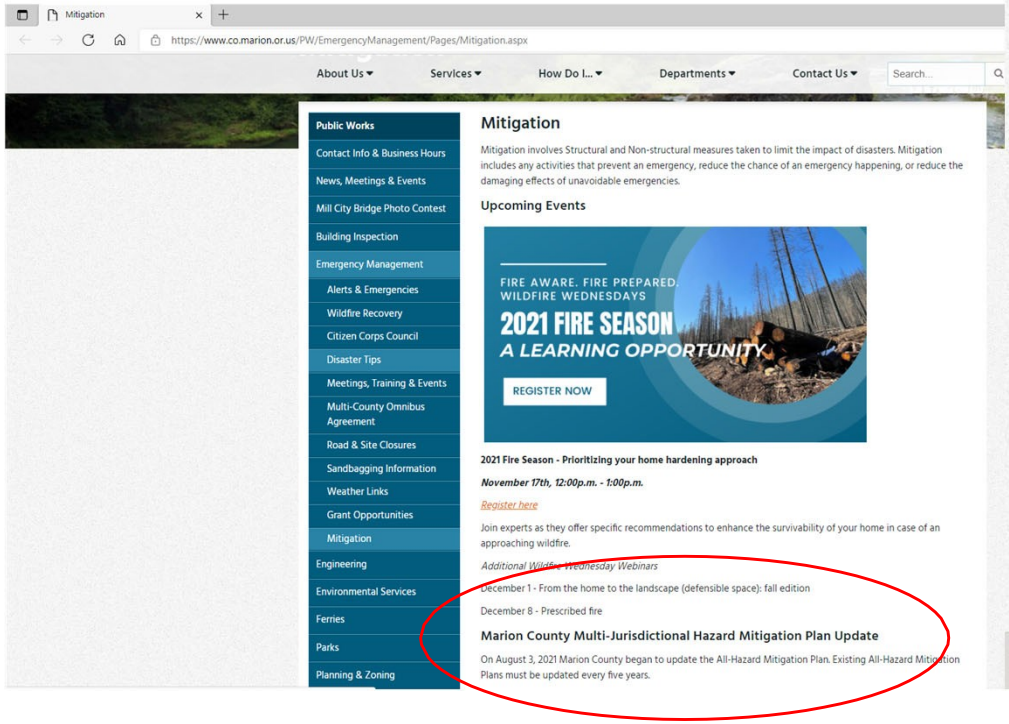
https://www.co.marion.or.us/PW/EmergencyManagement

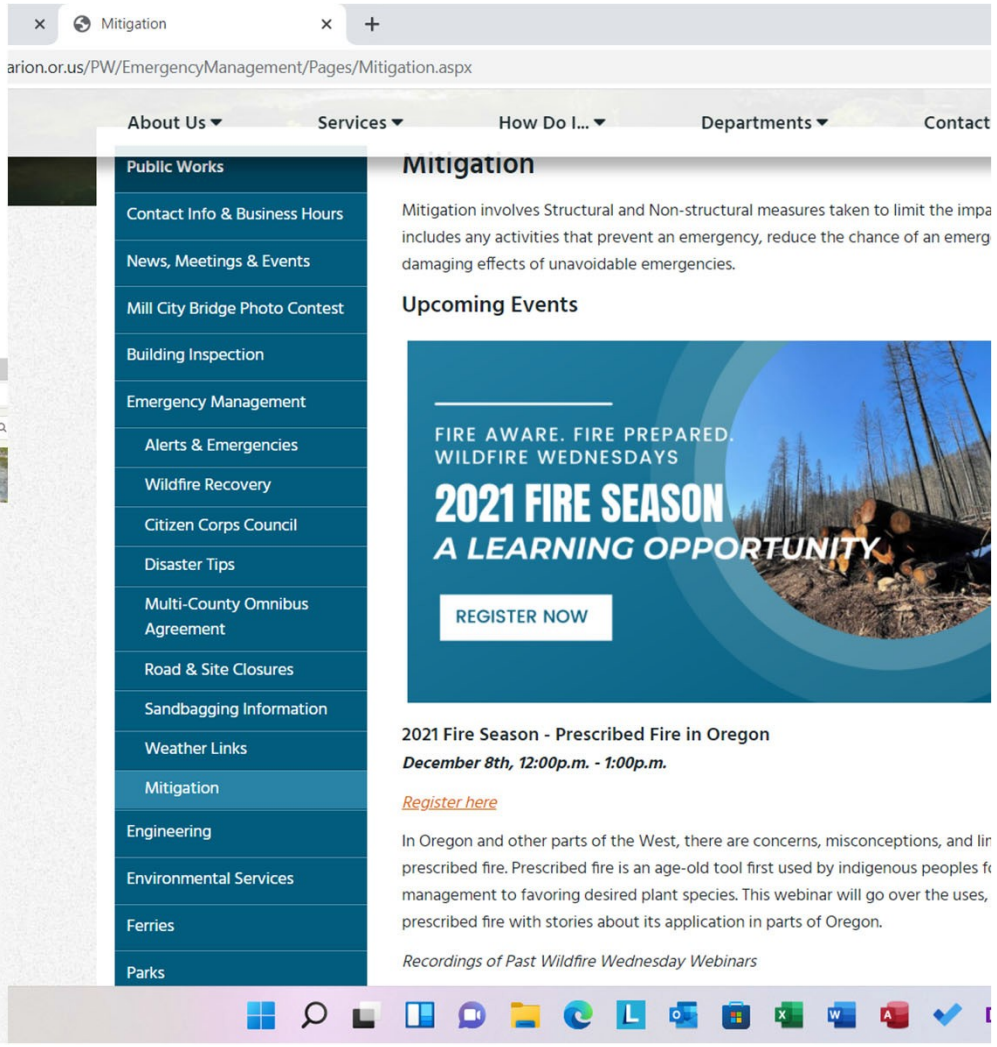


4.6.4 Marion County Emergency Management 12/5/21

Marion County Emergency Management 12/5/21

Mitigation (marion.or.us)





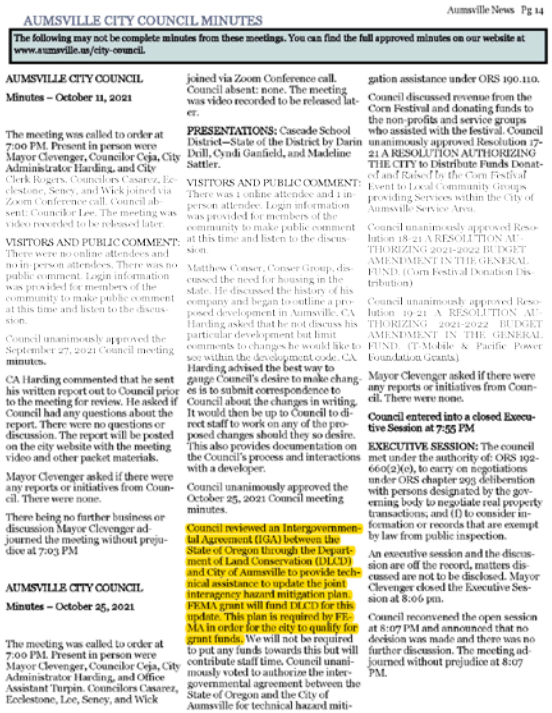
4.6.5 City of Aumsville 12/2021

City of Aumsville Newsletter 12/2021

https://www.co.marion.or.us/PW/EmergencyManagement







4.6.6 City of Detroit 3/31/2022

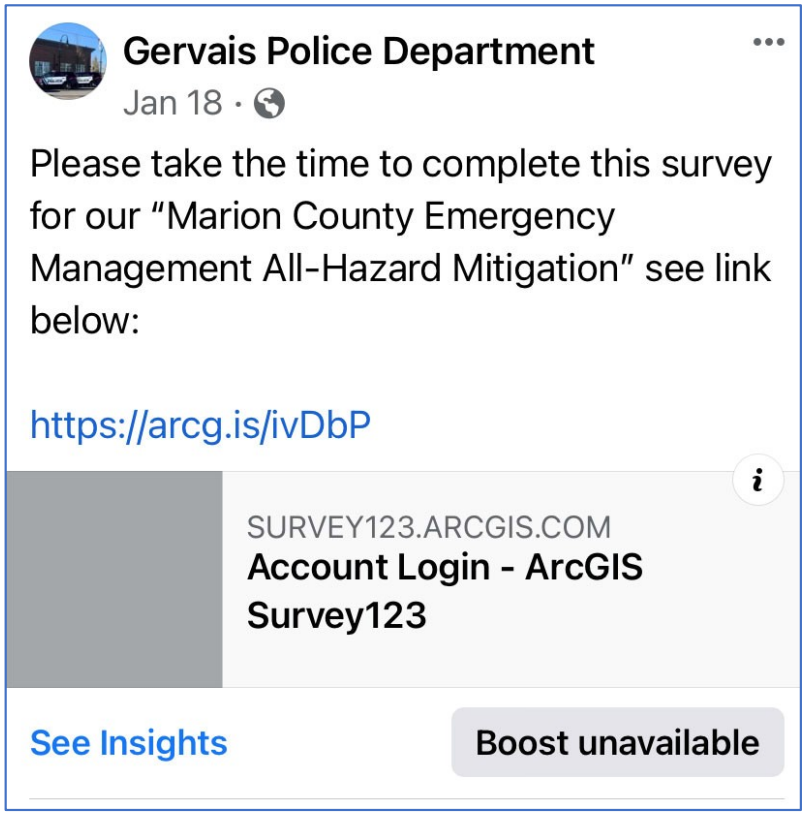
City of Detroit 3/31/2022
https://detroitoregon.us/

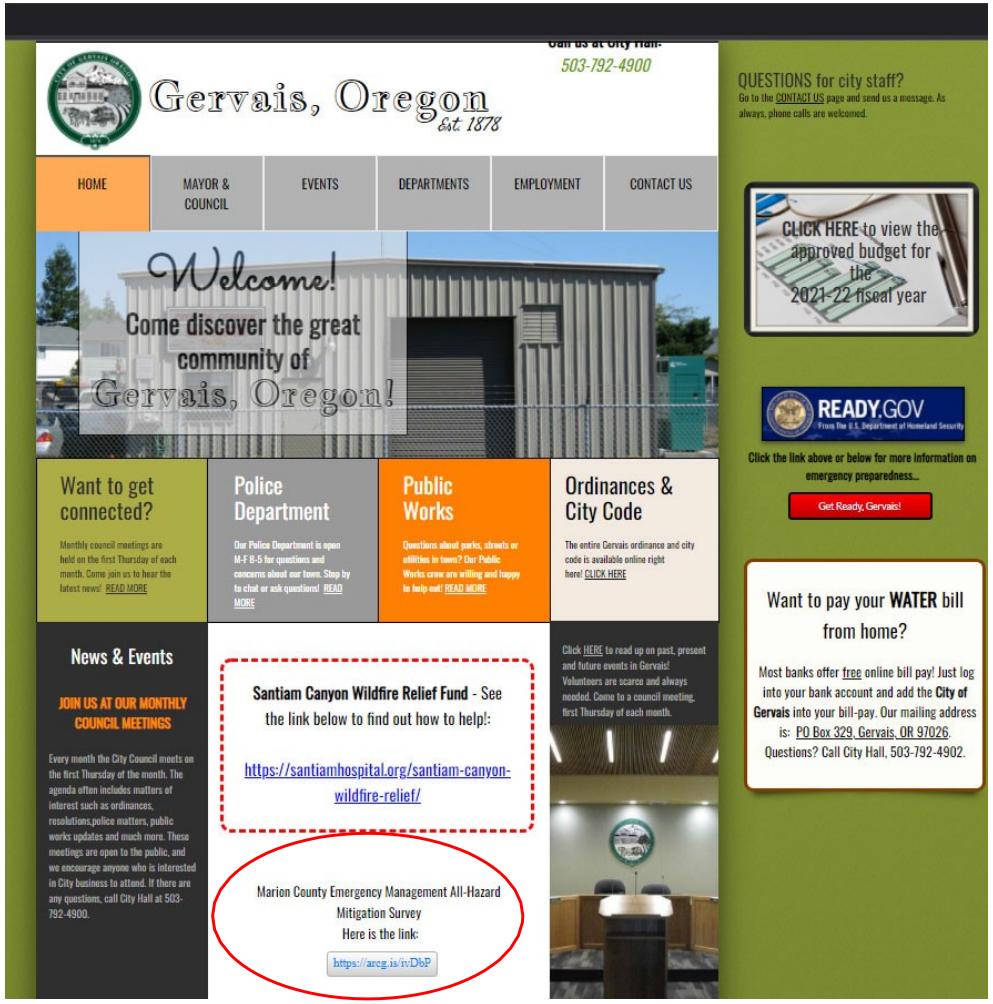




4.6.7 City of Gervais 1/18/2022

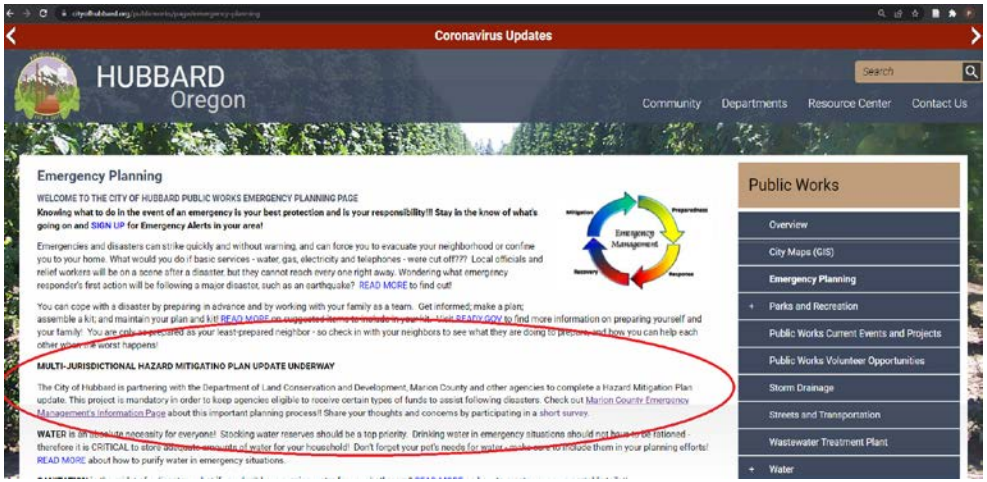
City of Gervais 1/18/2022
http://www.gervaisoregon.org/



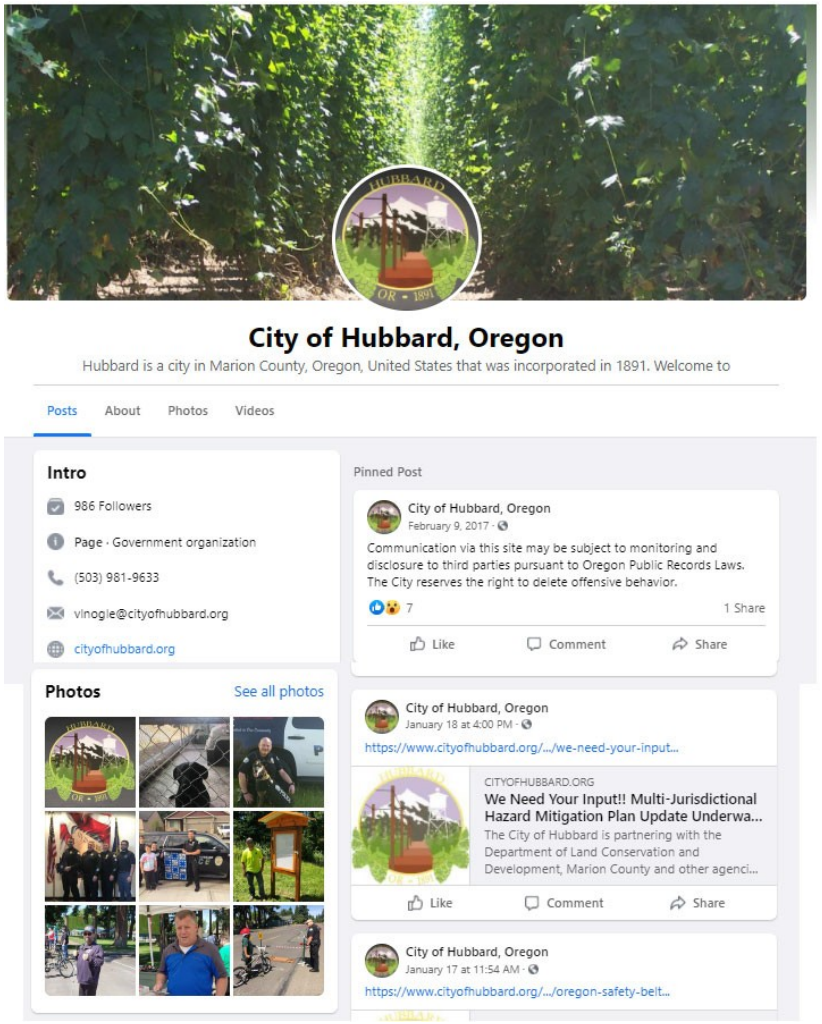


4.6.8 City of Hubbard 1/18/2022 and 2/10/22

City of Hubbard 1/18/2022 & 2/10/2022
https://www.cityofhubbard.org/

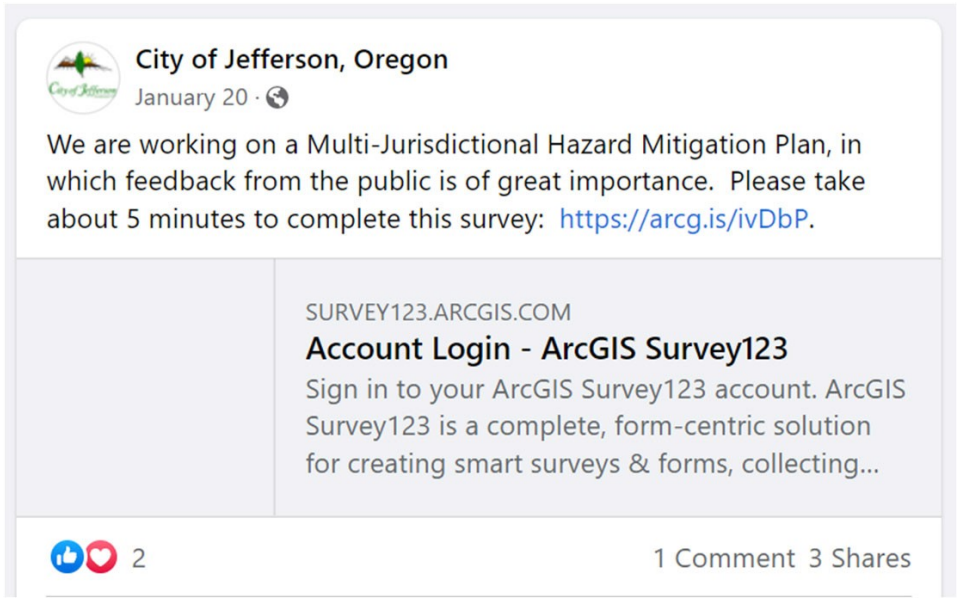


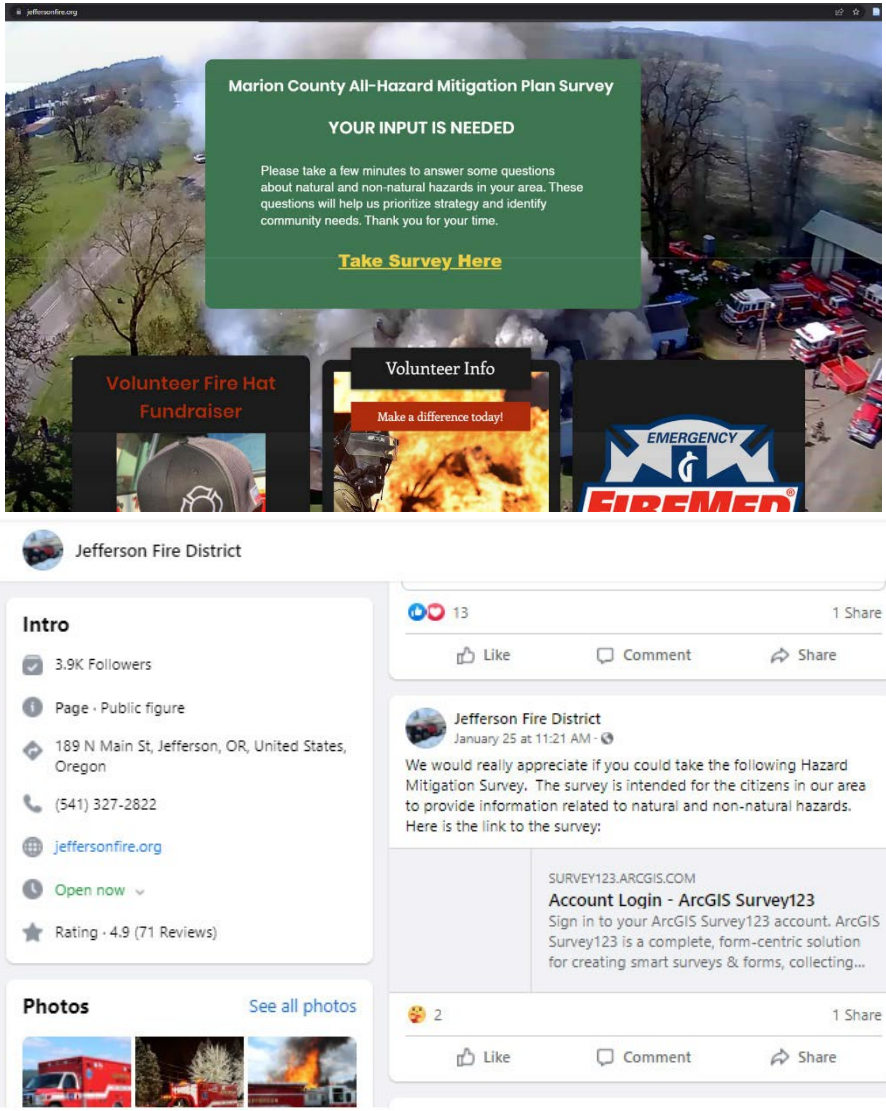




4.6.9 City of Jefferson & Jefferson Fire District 1/20/2022 and 1/15/2022

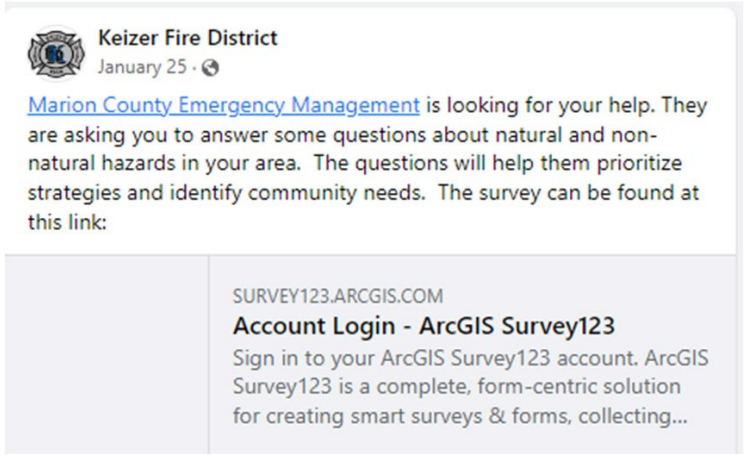
City of Jefferson 1/20/22
Jefferson Fire District 1/25/22
https://jeffersonoregon.org/
https://www.jeffersonfire.org/

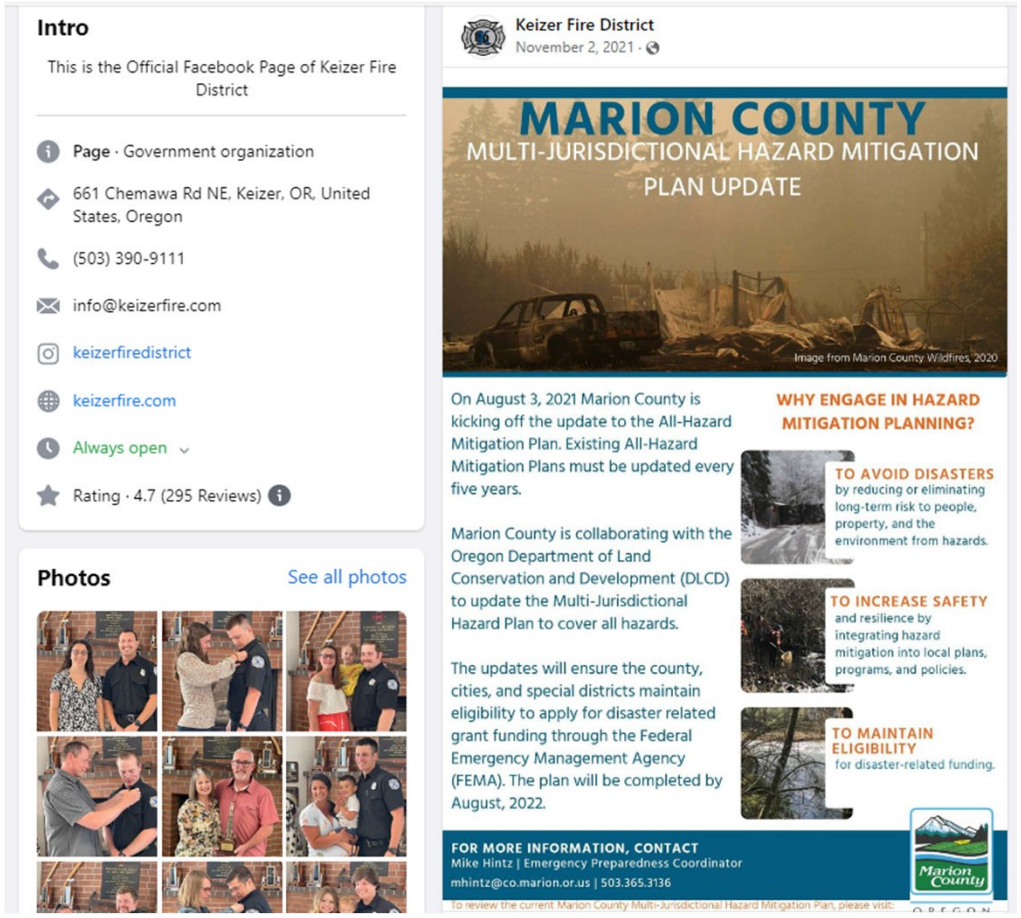




4.6.10 Keizer Fire District 11/2/2021 and 1/25/2022

Keizer Fire District 11/2/21 & 1/25/22 Facebook Posts
https://keizerfire.com/
https://www.facebook.com/KeizerFireDistrict/





4.6.11 Mill City 11/2021

Mill City Newsletter
Nov. 2021



Office Hours: M-F 8AM to 5PM
Council Meetings, Second and Fourth Tuesday of Each Month, 6:30PM
Planning Meetings, Third Friday of Each Month, 9:00AM—Hearings; Third Tuesday of Each Month, 6:30PM

CITY OF MILL CITY

444 S 1st Avenue
PO Box 256
Mill City, OR 97360

Phone: 503-897-2302
Fax: 503-897-3499
E-mail: millcity@ci.mill-city.or.us
Website: www.ci.mill-city.or.us
Facebook: City of Mill City, Oregon

Contacts

City Recorder Stacie Cook	scook@ci.mill-city.or.us
Finance Clerk Lacy Classen	lclassen@ci.mill-city.or.us
UB/Court Kimberley Johnson	kjohnson@ci.mill-city.or.us
City Clerk Tree Fredrickson	tfredrickson@ci.mill-city.or.us
Public Works Supervisor Russ Foltz	rfoltz@ci.mill-city.or.us

Mayor & Council

Tim Kirsch, Mayor	Brett N. Katlong, Water & Sanitation Commissioner
tkirsch@ci.mill-city.or.us	bkatlong@ci.mill-city.or.us
Dawn Plotts, Police Commissioner	Janet L. Zeyen-Hall, Parks Commissioner
dplotts@ci.mill-city.or.us	jzeyen-hall@ci.mill-city.or.us
Tony L. Trout Street Commissioner	Steven A. Winn, Building Commissioner
ttrout@ci.mill-city.or.us	swinn@ci.mill-city.or.us

Welcome to our Newest Team

The City of Mill City would like to welcome our newest team member, Kaitlyn Waid, who starts in our newly created Parks, Grounds & Facilities Maintenance position on February 1, 2022.

Kaitlyn resides in Mill City and is very excited about the opportunity to work in our parks system.

Say hello and give her a gracious welcome if you see her out and about.

Hazard Mitigation Survey

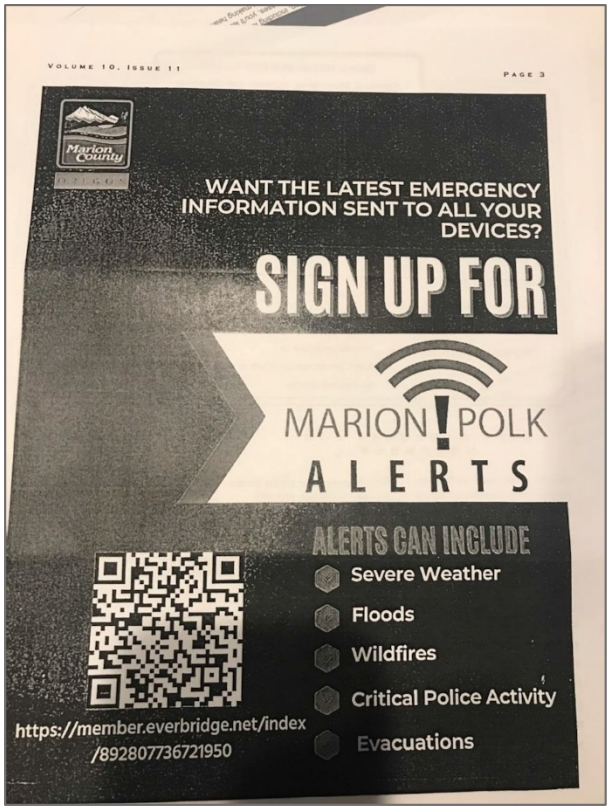
Marion County Emergency Management is updating the County's Multi-Jurisdictional All-Hazard Mitigation Plan and Mill City is partnering in the process. We need your input! Please take a few minutes to answer questions about natural and non-natural hazards in our area.

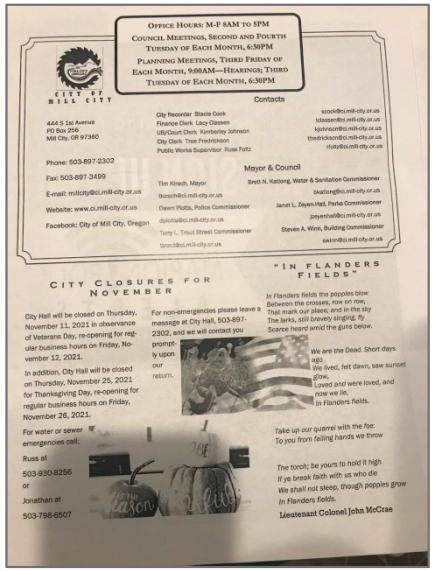
The survey can be accessed by visiting the City's website: www.ci.mill-city.or.us and using the "survey" link on the home page or by going directly to: https://arcg.is/ivDbP in your web browser.

Volunteer Opening—Park Host

City of Mill City. Seasonal to Year Round. Performs light maintenance; cleaning, debris removal, stock restrooms. Minimum 15 hr/week. Trade for free space rent, utilities. Background check required.

Application at: www.ci.mill-city.or.us. Return to City of Mill City, P.O. Box 256, Mill City, OR 97360.
(503) 897-2302. EOE.
Closing date: Open until filled.





Office Hours: M-F 8AM to 5PM
Council Meetings, Second and Fourth Tuesday of Each Month, 6:30PM
Planning Meetings, Third Friday of Each Month, 9:00AM—Hearings; Third Tuesday of Each Month, 6:30PM

CITY OF MILL CITY

444 S 1st Avenue
PO Box 256
Mill City, OR 97360

Phone: 503-897-2302
Fax: 503-897-3499
E-mail: millcity@ci.mill-city.or.us
Website: www.ci.mill-city.or.us
Facebook: City of Mill City, Oregon

Contacts

City Recorder Stacie Cook	scook@ci.mill-city.or.us
Finance Clerk Lacy Classen	lclassen@ci.mill-city.or.us
UB/Court Clerk Kimberley Johnson	kjohnson@ci.mill-city.or.us
City Clerk Tree Fredrickson	tfredrickson@ci.mill-city.or.us
Public Works Supervisor Russ Foltz	rfoltz@ci.mill-city.or.us

Mayor & Council

Tim Kirsch, Mayor	Brett N. Katlong, Water & Sanitation Commissioner
tkirsch@ci.mill-city.or.us	bkatlong@ci.mill-city.or.us
Dawn Plotts, Police Commissioner	Janet L. Zeyen-Hall, Parks Commissioner
dplotts@ci.mill-city.or.us	jzeyen-hall@ci.mill-city.or.us
Tony L. Trout Street Commissioner	Steven A. Winn, Building Commissioner
ttrout@ci.mill-city.or.us	swinn@ci.mill-city.or.us

City Closures for November

City Hall will be closed on Thursday, November 11, 2021 in observance of Veterans Day, re-opening for regular business hours on Friday, November 12, 2021.

In addition, City Hall will be closed on Thursday, November 25, 2021 for Thanksgiving Day, re-opening for regular business hours on Friday, November 26, 2021.

For water or sewer emergencies call:
Russ at 503-930-8256
or
Jonathan at 503-798-6507

For non-emergencies please leave a message at City Hall, 503-897-2302, and we will contact you promptly upon our return.

"In Flanders Fields"

In Flanders fields the poppies blow
Between the crosses, row on row,
That mark our place; and in the sky
The larks, still bravely singing, fly
Scarce heard amid the guns below.

We are the Dead. Short days ago
We lived, felt dawn, saw sunset glow,
Loved and were loved, and now we lie,
In Flanders fields.

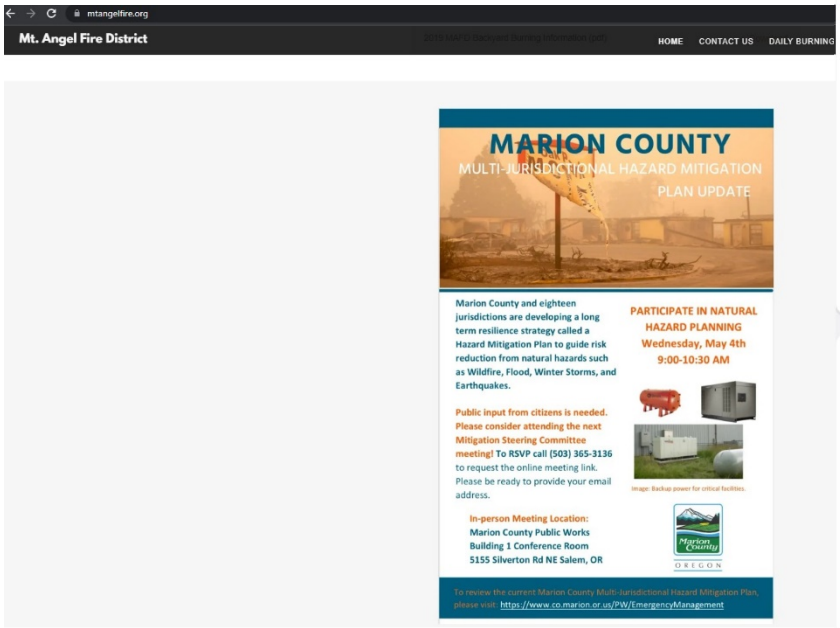
Take up our quarrel with the foe:
To you from failing hands we throw

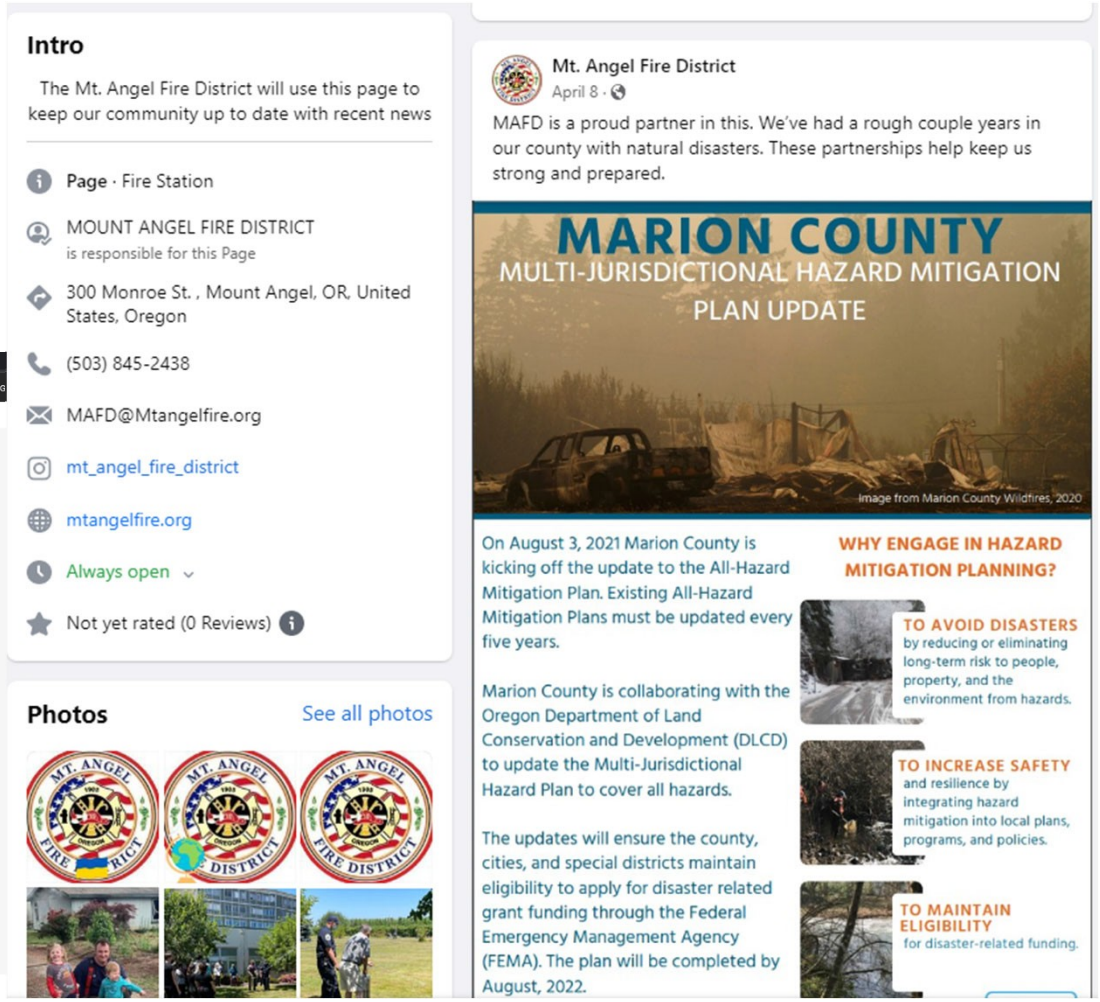
The torch; be yours to hold it high.
If ye break faith with us who die
We shall not sleep, though poppies grow
In Flanders fields.

Lieutenant Colonel John McCrae

4.6.12 Mt. Angel Fire District 4/8/2022

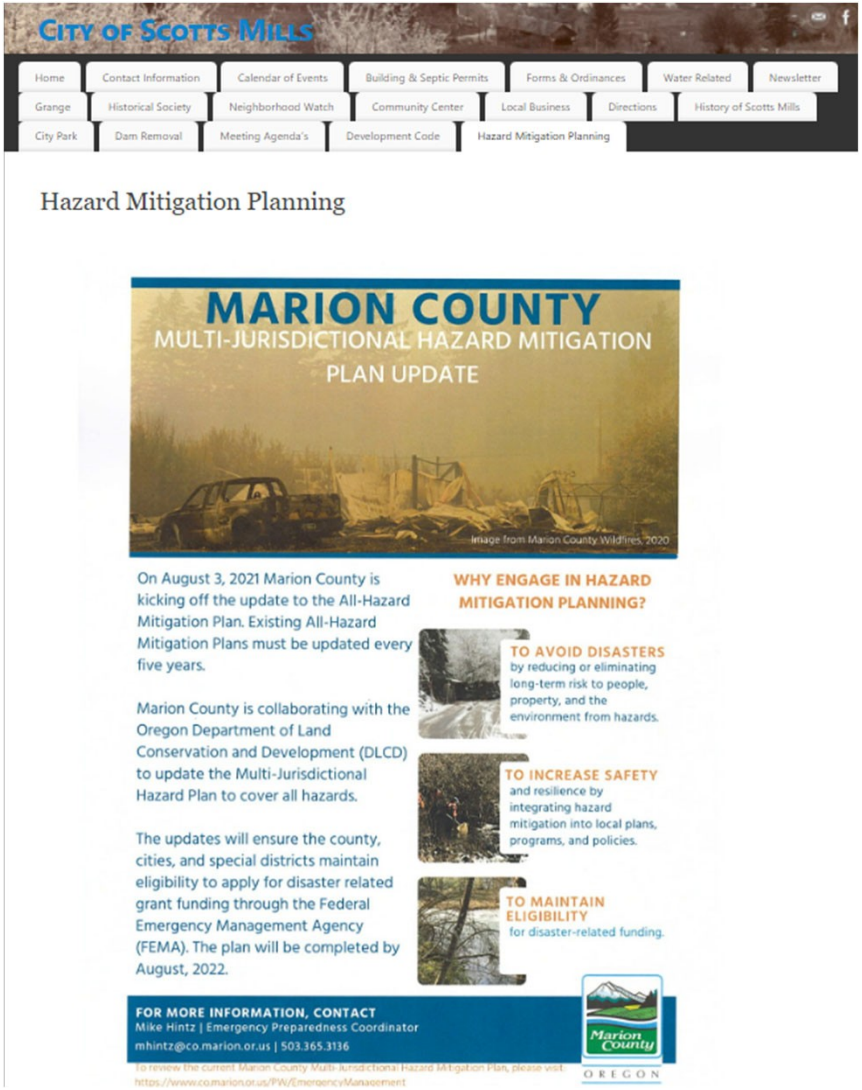
Mt. Angel Fire District
April 8, 2022
Website & Facebook
Post





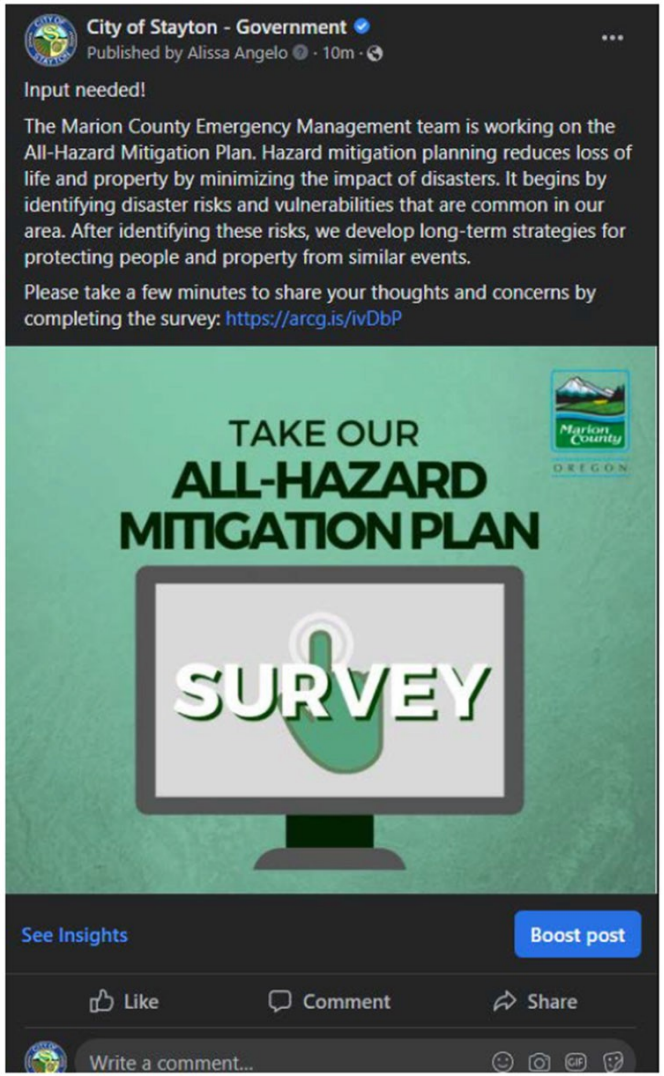
4.6.13 City of Scotts Mills 4/14/2022

City of Scotts Mills April 14, 2022, Webpage
http://www.scottsmills.org/

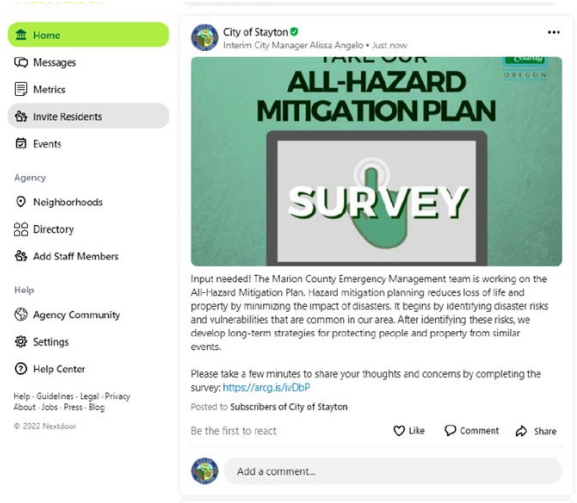


4.6.14 City of Stayton 2/2022

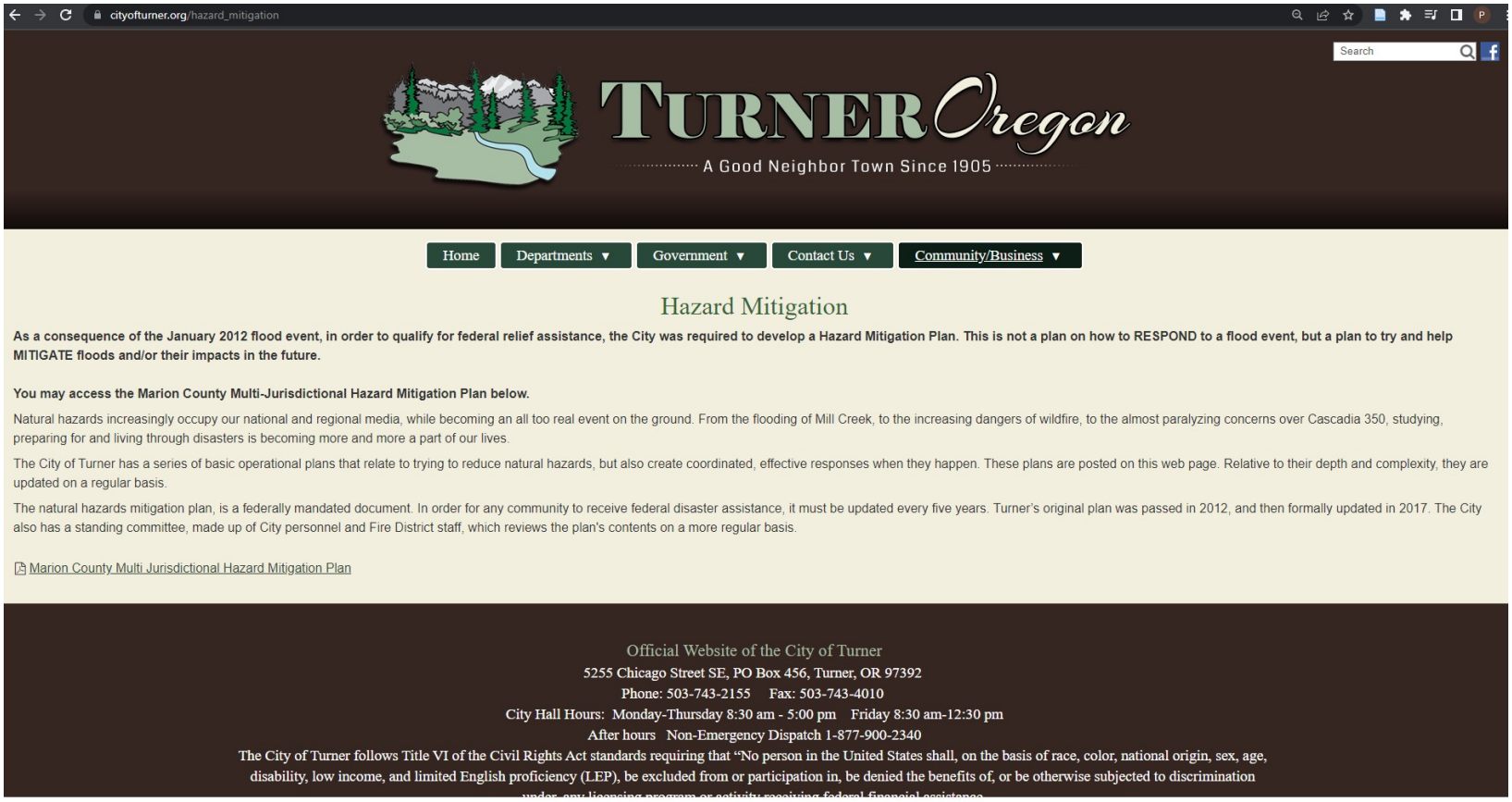
City of Stayton February 2022
Webpage: https://www.staytonoregon.gov/
Facebook and Nextdoor app posts





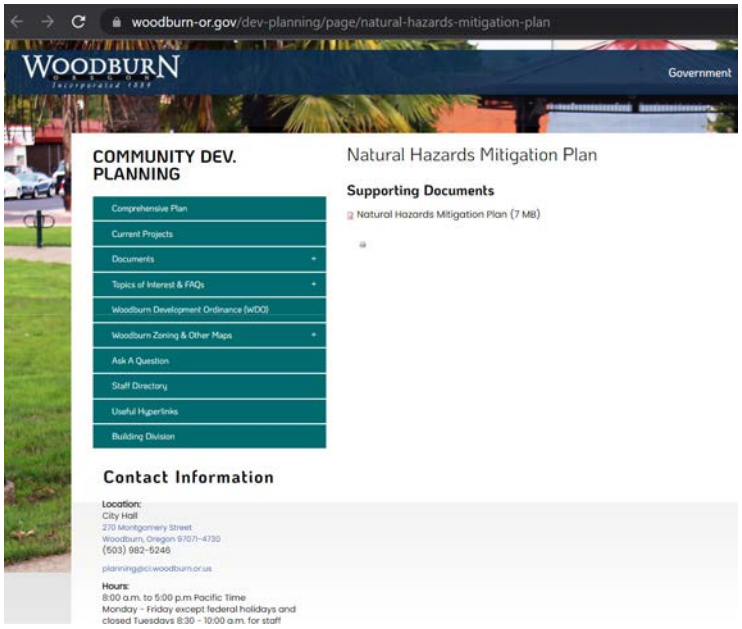


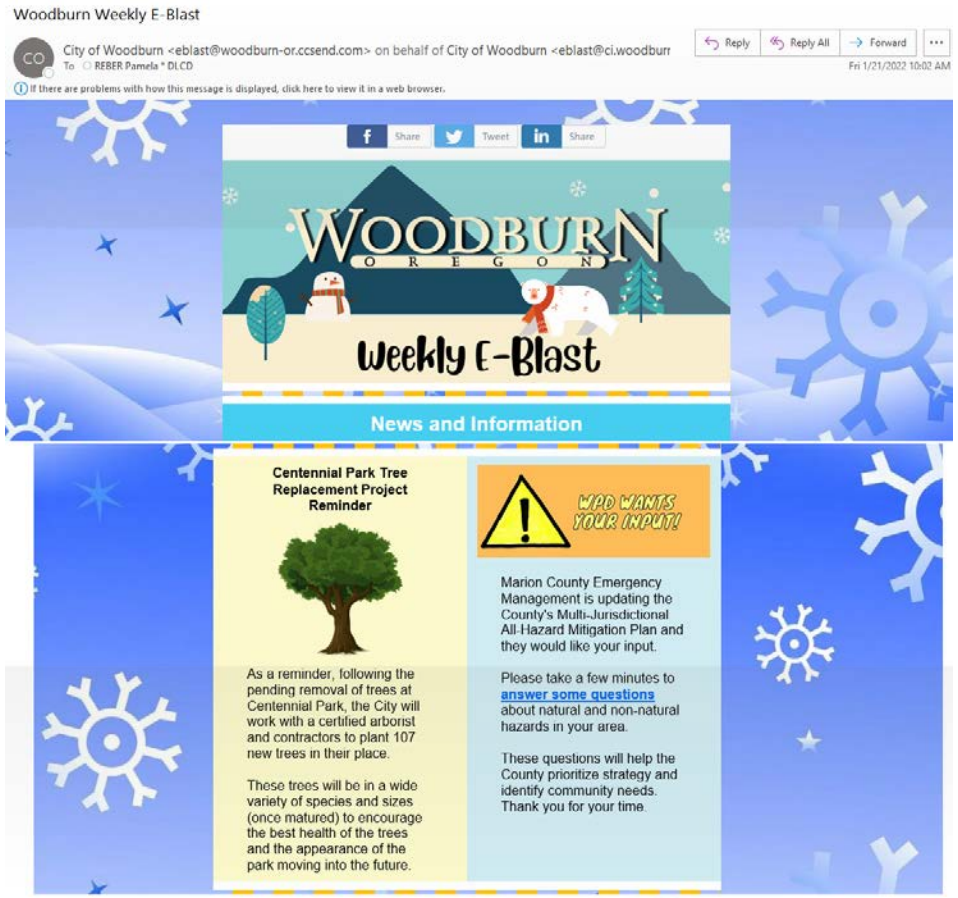
City of Turner July 5, 2022
Webpage https://www.cityofturner.org/



4.6.16 City of Woodburn 1/5/2022 & 1/21/2022

City of Woodburn
Webpage 1/5/22
https://www.woodburn-or.gov/
Weekly e-Blast 1/21/22

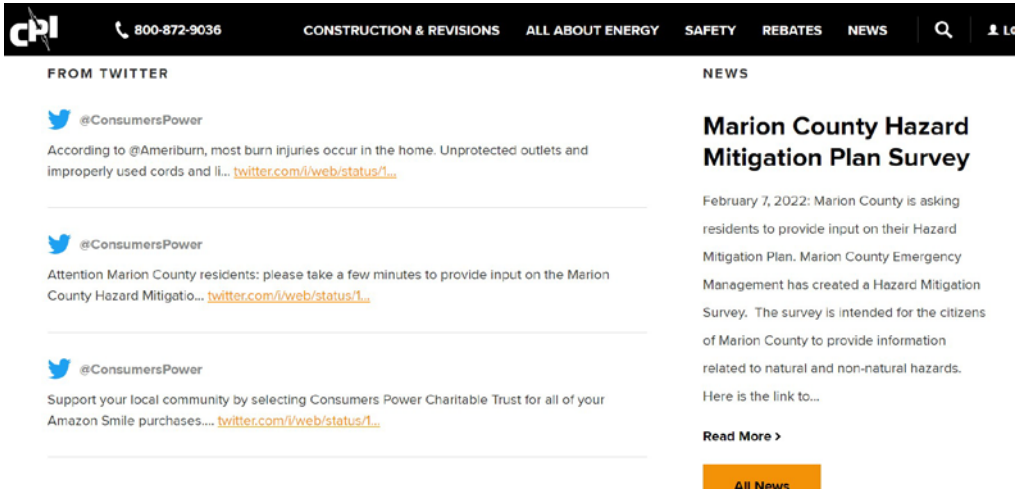


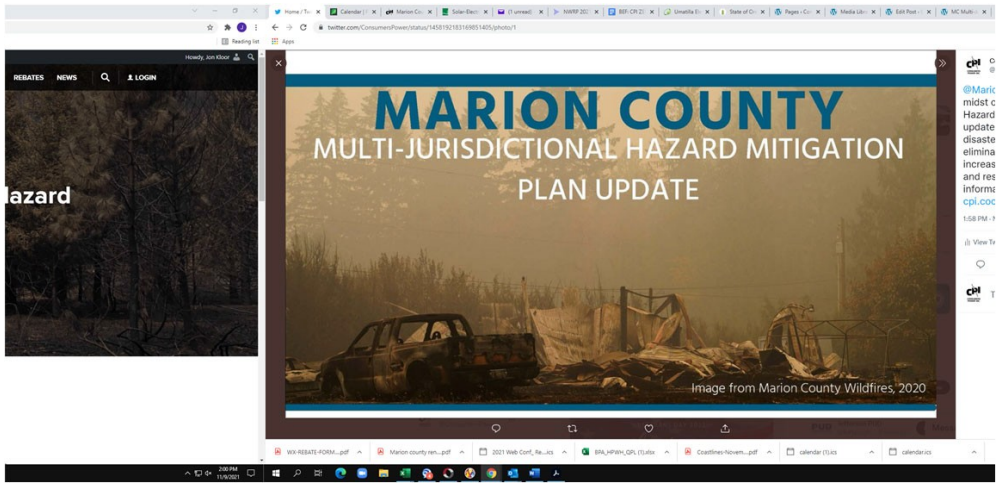


4.6.17 Consumer Power 11/9/21 & 2/7/22

Consumers Power Inc. 11/9/21 Website, Twitter 2/7/22



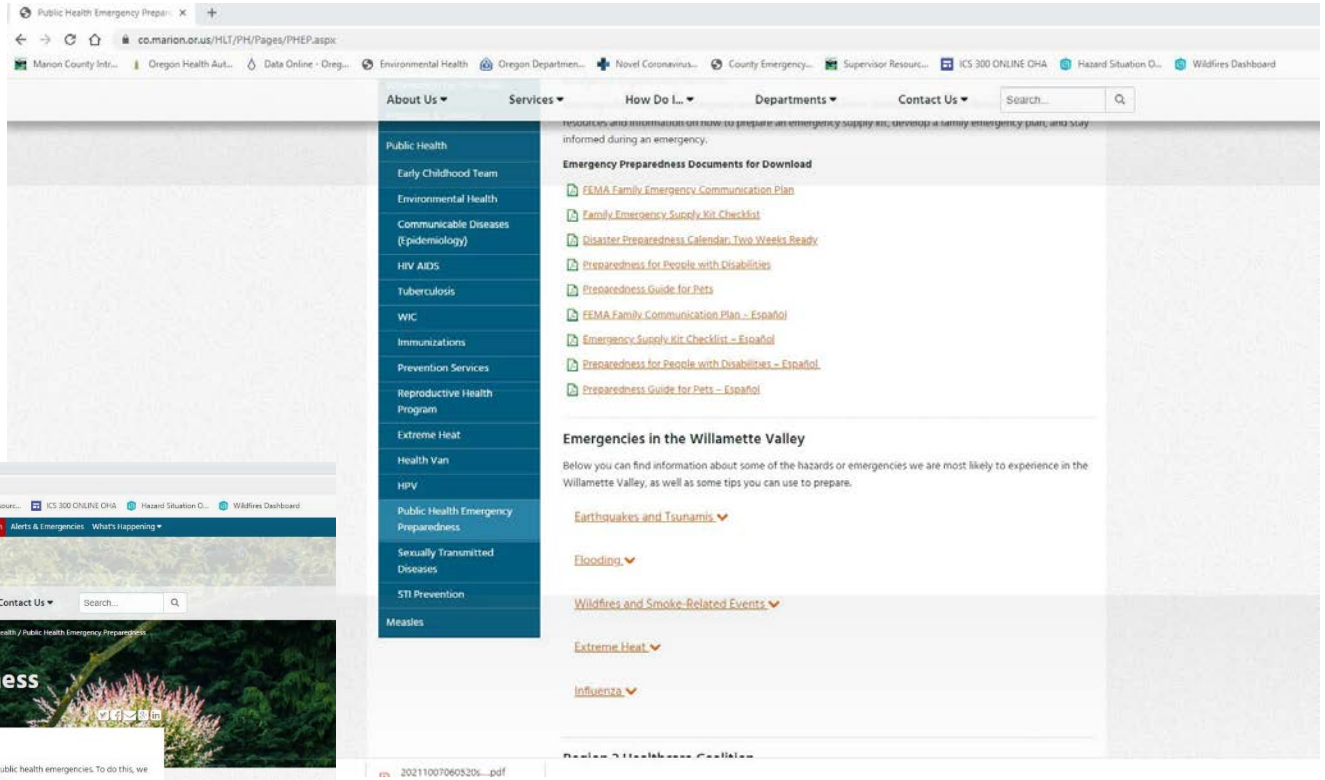






4.6.18 Marion County Public Health 11/3/21

Marion County Public Health 11/3/21
Preparedness Website





5 Appendix D: Marion County Hazard Mitigation Vulnerability Survey

The 108-page Marion County Hazard Mitigation Vulnerability Survey Report follows as a hyperlink:

https://arcg.is/ivDbP

6 Appendix E: Economic Analysis of Natural Hazard Mitigation Projects

This summary was originally developed by the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (now the Institute for Policy Research and Engagement or IPRE) and included in the 2016 Marion County HMP. It has been reviewed and accepted by the Federal Emergency Management Agency (FEMA) as a means of documenting how the prioritization of mitigation actions includes a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and associated costs. It was revised by DLCD during the 2022 Marion Co HMP update.

This appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects:

- Benefit/Cost Analysis,
- Cost-Effectiveness Analysis
- STAPLE/E Approach

The appendix describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: the Oregon Interagency Hazard Mitigation Team, State Hazard Mitigation Plan (Oregon Department of Emergency Management, 2000), and FEMA Publication 331, Report on Costs and Benefits of Natural Hazard Mitigation. The Economic Analysis is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

6.1 Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred. Evaluating possible hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, law enforcement, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value from a public policy perspective, in assessing the positive and negative impacts from mitigation activities and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

6.2 Mitigation Strategy Economic Analysis Approaches

The approaches used to identify the costs and benefits associated with hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the three methods is outlined below:

6.2.1 Benefit / Cost Analysis

Benefit/cost analysis is a key mechanism used by the state Oregon Department of Emergency Management (OEM), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, to avoid disaster-related damages later.

Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e., the net benefits will exceed the net costs) to be eligible for FEMA funding.

6.2.2 Cost-Effective Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

6.2.3 Invest in Public Sector Mitigation Activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions which involve a diverse set of beneficiaries and non-market benefits.

6.2.4 Investing in Private Sector Mitigation Activities

Private sector mitigation projects may occur based on one or two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies.
2. Dispose of the building or land either by sale or demolition.
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement.
4. Evaluate the most feasible alternatives and initiate the most cost-effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchases. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

6.2.5 STAPLE / E Approach

Considering detailed benefit/cost or cost-effectiveness analysis for every possible mitigation activity could be very time consuming and may not be practical. There are some alternate approaches for conducting a quick evaluation of the proposed mitigation activities which could be used to identify those mitigation activities that merit more detailed assessment.

One of those methods is the STAPLE/E approach.

Using STAPLE/E criteria, mitigation activities can be evaluated quickly by steering committees in a synthetic fashion. This set of criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLE/E) constraints and opportunities of implementing the mitigation item in your community. The second chapter in FEMA's How-To Guide "Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies" as well as the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process" outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E approach from the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process."

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical: The city or county public works staff and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

Administrative: Elected officials or the city or county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political: Consult the mayor, city council or city board of commissioners, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

Legal: Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

Economic: Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs considered?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private?)
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

Environmental: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

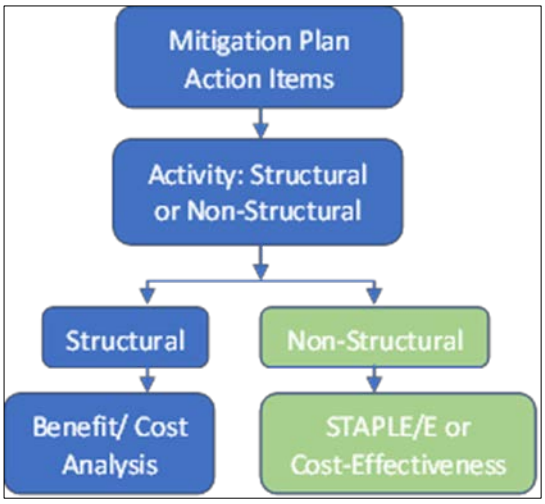
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed benefit/cost analyses.

6.3 When to use the Various Approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure (6-1) is to serve as a guideline for when to use the various approaches.

Figure 6-1, Economic Analysis Flowchart



Source: Oregon Partnership for Disaster Resilience. 2005; revised DLCD, 2021.

6.4 Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether to implement a mitigation activity. A framework for evaluating mitigation activities is outlined below. This framework should be used in further analyzing the feasibility of prioritized mitigation activities.

1. **Identify the Activities**

   Activities for reducing risk from hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation projects can assist in minimizing risk to hazards but do so at varying economic costs.

2. **Calculate the Costs and Benefits**

   Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate activities. Potential economic criteria to evaluate alternatives include:

   - *Determine the project cost*. This may include initial project development costs, and repair and operating costs of maintaining projects over time.
   - *Estimate the benefits*. Projecting the benefits or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues,

and commercial loans.

- *Consider costs and benefits to society and the environment*. These are not easily measured but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- *Determine the correct discount rate*. Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. **Analyze and Rank the Activities**

Once costs and benefits have been quantified, economic analysis tools can rank the possible mitigation activities. Two methods for determining the best activities given varying costs and benefits include net present value and internal rate of return.

- *Net present value*. Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today's dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- *Internal rate of return*. Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked based on economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

6.5 Economic Returns on Hazard Mitigation

The estimation of economic returns, which accrue to building or land owners as a result of hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided.
- Inventory damages avoided.
- Rental income losses avoided.
- Relocation and disruption expenses avoided.
- Proprietor's income losses avoided.

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period.

6.6 Additional Costs from Hazards

Property owners should also assess changes in a broader set of factors that can change because of a large disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices.
- Availability of resource supplies.
- Commodity and resource demand changes.
- Building and land values.
- Capital availability and interest rates.
- Availability of labor.
- Economic structure.
- Infrastructure.
- Regional exports and imports.
- Local, state, and national regulations and policies.
- Insurance availability and rates.

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact

models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

6.7 Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. Opportunity rises to develop strategies that integrate hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating hazard mitigation with other community projects can increase the viability of project implementation.

6.8 Resources

These items support the development and funding of hazard mitigation actions:

Federal Emergency Management Agency. (Mar. 2007). Appendix D: Determining Cost Effectiveness; From FEMA Publication 551, Selecting Appropriate Mitigation Measures for Flood prone Structures. Available at: https://www.fema.gov/sites/default/files/2020-08/fema_551.pdf

Federal Emergency Management Agency. (Jan. 2017). Benefit Cost Toolkit Version 6.0 Available at: https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis

Federal Emergency Management Agency. (Dec. 2018). DRRA - Section 1215 Management Costs FAQs. https://www.fema.gov/drra-1215-faq

Federal Emergency Management Agency. (2015). FY 2015 Hazard Mitigation Assistance Guidance and Addendum. https://www.fema.gov/media-library/assets/documents/103279

7 Appendix F: Grant Programs

The 38-page DR-4562-OR Resource Recovery Guide was compiled by Oregon Department of Emergency Management in August 2021 as part of the recovery process following the 2020 wildfires.

To view the guide, follow the link below (Double click the PDF):



DR-4562_OR
Recovery Resource C

8 Appendix G: Hazard History

8.1 2022 NHMP Hazard Histories

Local list of federal declared disasters since 2000

Oregon Winter Storm 02-13-2021 (DR-4599-OR) Incident Period: February 11, 2021 - February 15, 2021, Major Disaster Declaration declared on May 4, 2021

Oregon Wildfires and Straight-line Winds (DR-4562-OR) Incident Period: September 7, 2020 - November 3, 2020, Major Disaster Declaration declared on September 15, 2020

Oregon Covid-19 Pandemic (DR-4499-OR)
Incident Period: January 20, 2020, and continuing Major Disaster Declaration declared on March 28, 2020

Oregon Severe Winter Storm, Flooding, Landslides, and Mudslides (DR-4055-OR)
Incident Period: January 17, 2012 - January 21, 2012, Major Disaster Declaration declared on March 2, 2012

Oregon Severe Winter Storm, Record and Near Record Snow (DR-1824-OR)
Incident Period: December 13, 2008 - December 26, 2008, Major Disaster Declaration declared on March 2, 2009

Oregon Severe Winter Storms (DR-1510-OR)

Incident Period: December 26, 2003 - January 14, 2004, Major Disaster Declaration declared on February 19, 2004

8.2 History of Avalanche in Marion County

Marion County has experienced a single avalanche event since the year 2000 according to the NOAA Storm Events database (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022). On January 8-9, 2008 a strong and cold Pacific system brought copious amounts of new snow accumulations to the higher elevations of northwest Oregon. This system dropped snow levels considerably, leading to the first snow accumulation of the year in areas within the Columbia River Gorge and the Upper Hood River Valley. Over the course of about 18 hours, multiple avalanches occurred in the same area, over the Santiam Pass, near the intersection of Hwy. 20 and Hwy. 126. The avalanches were contributed to higher than average snow pack, and large amounts of plowed snow along the highways. The first set of avalanches occurred the morning of January 8th, the largest burying parts of US Hwy. 20 up to 15 feet deep. Three cars were trapped by the avalanche then later freed, with no injuries. The second round of avalanches occurred late at night on January 8th and wasn't cleared until the following morning. Eight commercial vehicles were trapped for a time under the snow, with no injuries reported. Both rounds closed the highways for an extended period for snow removal.

8.3 History of Dam Failure in Marion County

SPECIAL NOTE: Marion County does not own or operate any the dams that are in the county, including the three High Hazard Potential Dams.

Oregon experienced four major dam failures between 1874 and 2008 (Association of State Dam Safety Officials, 2023). The most significant event is the 1903 Willow Creek Dam failure, which nearly destroyed the town of Heppner and killed almost 250 people. Other failures within the state include Colombia River dike (1948), Simplot Wastewater Reservoir (2005), and the Geary Levee (2006).

Marion County has not experienced any dam failures. However, in 1996 Silver Creek flooded, threatening buildings on James Street and along Silver Creek in Silverton. Logs and debris threatened bridges and the base of Silver Creek dam was significantly eroded (Phillp Williams & Associates, 2000). The damage did not result in dam failure and the Silver Creek dam has since been repaired.

The National Inventory of Dams identifies three High Hazard Potential Dams in Marion County. Another such dam is in Linn County, the Detroit Dam, but is also relevant to dam safety for Marion County residents, as it divides Marion and Linn Counties. (U.S. Army Corps of Engineers, 2020).

A High Hazard Potential Dam (HHPD) is a dam located in an area where a failure may cause serious damage to inhabited homes, agricultural buildings, campgrounds, recreational facilities, industrial or commercial buildings, public utilities, main highways, or class I carrier railroads, or where environmental degradation would be significant, or

where danger to individuals exists with the potential for loss of life. It is not an assessment of the condition of the dam.

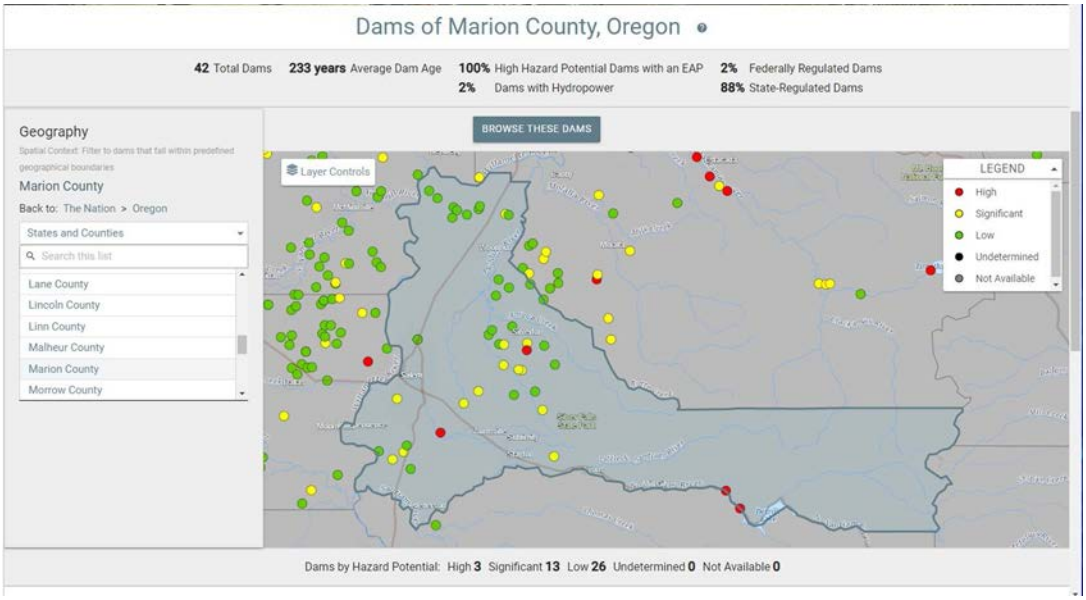
Marion County's HHPDs are listed in the table below, they are not operated nor owned by Marion County.

Table 8-1, High Hazard Dams that impact Marion County

Name	Year Completed	Storage (acre ft)	Height (ft)	Owner	Purpose	Type
Detroit Dam	1953	455,000	463	USACE	Flood Risk Reduction, Hydroelectric, Irrigation, Navigation, Recreation, Other	Gravity
Big Cliff Dam	1954	5,930	172	USACE	Hydroelectric	Gravity
Silver Creek Dam	1975	2,500	65	City of Silverton	Water Supply	Earth
Frazen Dam	1952	300	33	City of Salem	Water Supply	Earth, Rockfill

Source: National Inventory of Dams, consulted July 2022 https://nid.sec.usace.army.mil/#/

Figure 8-1, Location of all dams inventoried in the National Inventory of Dams for Marion County and vicinity.



Source: National Inventory of Dams, consulted July 2022 https://nid.sec.usace.army.mil/#/

8.4 History of Drought in Marion County

Determining Drought

Oregon Revised Statute (ORS) Chapter 536 identifies authorities available during a drought. To trigger specific actions from the Water Resources Commission and the Governor, a “severe and continuing drought” must exist or be likely to exist.

Oregon relies upon two inter-agency groups to evaluate water supply conditions, and to help assess and communicate potential drought-related impacts. The Water Supply Availability Committee (WSAC) is a technical committee chaired by the Water Resources Department. The other group—the Drought Readiness Council— is a coordinating body of state agencies co-chaired by the Water Resources Department and the Department of Emergency Management (State of Oregon, Department of Emergency Management, 2016).

Marion County experiences dry conditions annually during the summer months from June to September. The Drought Severity Index shows episodes of drought within the past five years occurring during the summer through the fall (U.S. Department of Commerece, National Ocenanic and Atmospheric Administration, N.d.). Periodically, Marion County experiences more significant drought conditions that affect the region or the state.

Disaster declarations due to drought conditions have been declared in Oregon in

Dates for significant drought events that affected Marion County include the following:

1928-1941

A significant drought affected all of Oregon from 1928 to 1941. The prolonged statewide drought created significant problems for the agriculture industry. The first of the three Tillamook Forest burns occurred during this drought in 1933 (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

1976-1981

During this drought period in western Oregon, low stream flows prevailed. The period between 1976 and 1977 was the single driest year of the century. The Portland Airport received only 7.19 inches of rain between October 1976 and February 1977. In the twelve-month period from September 1976 through August 1977, Corvallis received only 22.2 inches of precipitation, 52 percent of the "normal" of 42.7 inches. During the winter of that year, airborne dry ice seeding was used in Polk County as a means of enhancing winter precipitation for agricultural use.

1985-1994

A dry period lasting from 1985 to 1994 caused significant problems statewide. The peak year was 1992, when the state declared a drought emergency. Forests throughout Oregon suffered from a lack of moisture with fires common and insect pests flourishing (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes).

2005

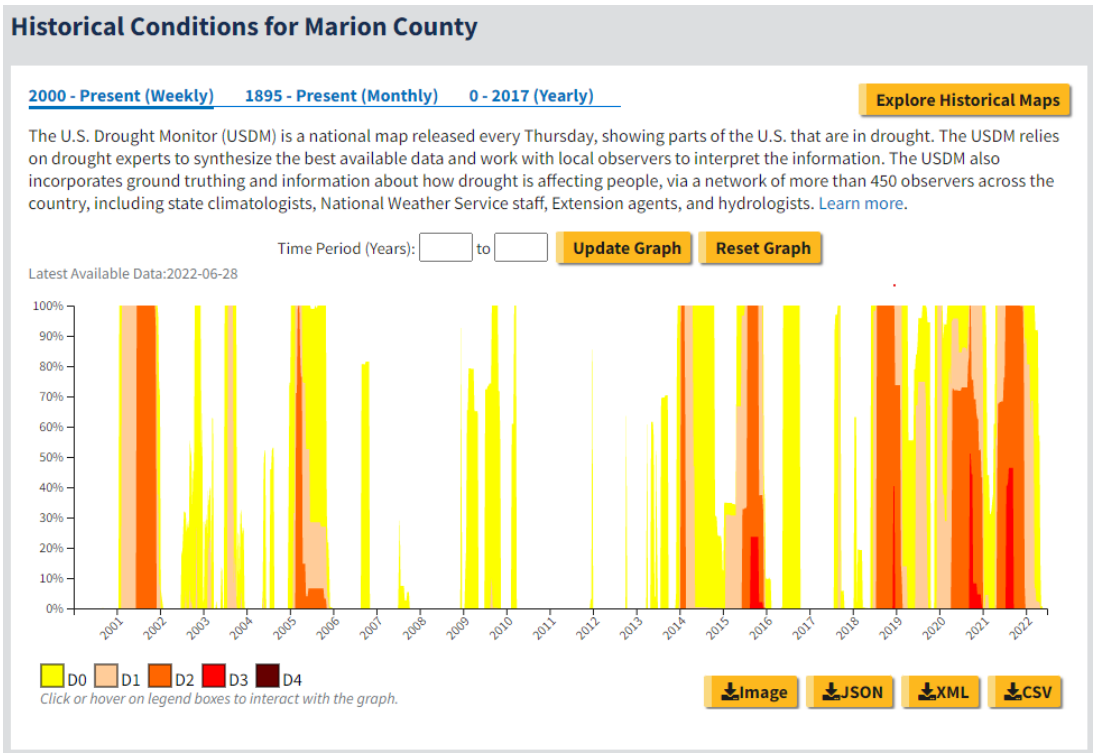
February 2005 was the driest February on record since 1977, surpassing 2001's conditions. Governor Ted Kulongoski's Office posted a State of Oregon Drought and Fire Web page. This page features weekly updates, drought and fire information, and agency links. Above normal temperatures contributed to decreased water availability for the summer. Stream and river levels dropped significantly and watermasters regulated live flow use by irrigators. Drought conditions also led to the use of stored water when it was available. However, water availability in the Willamette Valley was not as severely affected as with other parts of the state.

2015

The Marion County Board of Commissioners declared a drought emergency and requested that the Governor of Oregon declare a Drought Emergency due to low stream flow, and above normal temperatures. The most profound impacts were on recreation in the Detroit area which saw 25-30% decrease in business.

Although the county saw Severe Drought conditions in 2018, 2020 and 2021 as measured by the US Drought Monitor, no other drought emergency declarations were made by the Oregon Governor. The figure below shows the increase in drought conditions in the recent past.

Figure 8-2, Historical occurrence of drought in Marion County.



Source: Drought.gov, consulted July 2022. Home | Drought.gov

8.5 History of Earthquakes in Marion County and Vicinity

8.5.1 Historical Earthquake Events

Marion County has experienced multiple earthquakes of an estimated magnitude of four and greater, with major earthquakes felt in 1941 (magnitude 7.1), 1962 (magnitude 5.2), and 2001 (magnitude 6.8). Detailed descriptions of major recent earthquakes that affected Marion County are listed below.

April 13, 1949 – Olympia, Washington – Magnitude 7.1

On April 13, 1949, Marion County residents felt an earthquake that was centered near Olympia, Washington. In Washington, this quake caused eight deaths. While Marion County was shaken by the quake, damage was minimal, and no deaths occurred. The quake rocked northwestern Oregon, extending as far south as Eugene, Coos Bay, and Reedsport, and as far east as Prineville and La Grande. In downtown Salem and West Salem and in outlying areas buildings trembled, light- fixtures swayed, dishes rattle in cupboards. Most of those who were outside at the time reported no shock. Workers in the Marion County courthouse said that filing cabinets rocked back and forth.

November 16, 1957 – Salem, Oregon – Magnitude 5.0

A quake struck near Salem in late 1957, with damage intensity estimated at 5.0. Most reports indicated only one sharp jolt or a few seconds of shaking. The earthquake caused slight damage in Salem, including cracked walls and plaster in West Salem, and furnishings shifting around. Residents also reported temporary outages to TV and electricity. This earthquake was also felt in Portland and all the way to the Oregon Coast.

April 18, 1961 – Albany, Oregon – Magnitude 4.5

A quake in April of 1961 caused little damage to the county but startled many residents. The quake was centered just south of Salem and registered 4.6 on the Richter scale. Described by most as a double shock, it shook houses and rattled dishes, but damage was very limited. Albany reported some cracked plaster.

November 5, 1962 – Vancouver, Washington – Magnitude 5.2

Three and a half weeks after the devastating Columbus Day Storm, an earthquake that measured approximately 5.2 on the Richter scale shook the Portland area. It was the largest quake to be generated by a fault under Portland and Vancouver. Reports of the earthquake came from Eugene, 110 miles south of Portland, and from Seattle, 135 miles to the north. The heaviest damage report came from Tillamook on the Oregon coast where the quake, lasting only a few seconds, cracked open barn walls and broke out windows at a local ranch.

March 7, 1963 – Salem, Oregon – Magnitude 4.6

On March 7, 1963, a quake measuring 4.6 on the Richter scale shook Marion County. Despite the low magnitude of the quake, damage still occurred – especially to older

masonry buildings. A porch was loosened from its house south of Salem, and three instances of cracked plaster were reported.

March 25, 1993 – Scotts Mills, Oregon – Magnitude 5.7

The Scotts Mills Earthquake (also known as the "Spring Break Quake") was centered in Marion County, near Woodburn and Scotts Mills. The quake originated about two miles south of Scotts Mills and twelve to thirteen miles underground.

Because of its locality to Marion County, damage was more severe in the county than the Nisqually quake. In Salem, the rotunda of the state Capitol cracked, and the Golden Pioneer statue nearly rocked off its base. In Mount Angel, authorities closed the historic St. Mary Catholic Church for fear its 200-foot bell tower could collapse. Chunks of plaster fell from the walls at the Queen of Angels Monastery. Woodburn felt the strongest effects of the quake. Officials shut down four century-old brick and mortar buildings that began to crumble. At the Wal-Mart store, fumes overcame several employees when pesticides, paints and car batteries mixed.

February 28, 2001, Seattle, Washington – Magnitude 6.8

The most recent earthquake to be felt in Marion County was the Nisqually earthquake, on February 28, 2001. The earthquake hit at 10:54 a.m. and was centered 35 miles southwest of Seattle. The quake registered 6.8 on the Richter Scale. In the Puget Sound area, this quake caused 400 injuries, one quake-related death, and about $2 billion dollars in damage. While the quake caused little damage in Marion County, it did temporarily close businesses and schools to assess potential damage. About 300 Salem City Hall employees went outside after the quake. About 1,000 employees evacuated the state Department of Human Services building after an employee pulled a fire alarm. Tremors were also felt in the upper floors of the Oregon State Capitol, and legislators and staff said they could feel the building swaying. Schools in Marion County also felt the Nisqually Earthquake, although county school districts found little damage. The local schools that reported the strongest tremors were mostly in northern Marion County. St. Paul and North Marion High Schools, both north of Woodburn, briefly evacuated students. Even though the quake amounted to billions of dollars in damage in Washington, the cost there could have been much higher if not for seismic retrofitting of buildings and highways.

This HMP update focuses on an historic update since 2001. In that time multiple small earthquakes have occurred in Marion County. The table below is drawn from the USGS Earthquake Catalogue and includes only those earthquakes that registered greater than magnitude 2.5.

Table 8-2, Earthquakes greater than M 2.5 in Marion County and vicinity

Date and time	Depth	Magnitude	Place
2020-04-01T15:44:24.440Z	13.62	2.57	6 km ESE of Scotts Mills, Oregon
2018-09-17T00:08:26.690Z	40.89	2.83	6 km WNW of Gervais, Oregon
2018-08-30T23:38:18.160Z	3.78	2.57	11 km NNW of Detroit, Oregon
2018-04-15T03:45:41.250Z	18.38	3.08	6 km SSE of Silverton, Oregon
2017-12-14T01:24:26.830Z	17.37	3.96	5 km E of Scotts Mills, Oregon
2017-06-01T16:02:57.740Z	22.48	2.96	9 km NW of Keizer, Oregon
2016-10-04T04:29:22.630Z	23.70	3.03	4 km WNW of Woodburn, Oregon
2014-09-24T15:17:32.450Z	28.56	2.65	3 km WSW of Molalla, Oregon
2012-09-08T04:57:45.180Z	23.81	3.54	8 km N of Scotts Mills, Oregon
2009-08-06T07:41:58.940Z	18.362	2.80	12 km SE of Molalla, Oregon
2007-09-24T06:20:54.270Z	23.43	3.60	8 km NW of Brooks, Oregon
2006-12-24T23:39:30.360Z	14.43	2.50	13 km N of Mehama, Oregon
2006-04-26T14:24:06.620Z	19.521	3.00	8 km ESE of Scotts Mills, Oregon
2003-04-28T22:25:48.130Z	14.63	2.80	12 km ESE of Molalla, Oregon

Source: USGS Earthquake Catalogue, consulted July 2022. Search Earthquake Catalog (usgs.gov)

Since completion of this draft update to the Marion County HMP two earthquakes were felt in Marion County both with epicenters south of the county.

March 18, 2022, A 2-6 magnitude earthquake occurred 16 km east southeast of Lacomb, Oregon in Linn County at a depth of 12.1 km below the surface.

October 7, 2022, A 4.6 magnitude earthquake occurred in this same location 16 km east southeast of Lacomb, Oregon at a depth of 13.2 km below the surface. This earthquake was reported felt in nearby towns including Lebanon, Corvallis, and Salem.

8.6 History of Extreme Heat in Marion County

Marion County has experienced five extreme heat events since the year 2000 according to the NOAA Storm Events database. They are as follows:

June 26-28, 2015: A strong upper-level ridge of high pressure resulted in hot temperatures across Northwest Oregon. Afternoon temperatures were in the low to mid 90s which is around 20 degrees above normal. Nighttime temperatures were in the mid-60s to low 70s which is around 15 degrees above normal. There were several new daily records set for the warmest low temperatures. A man drowned while swimming in the Santiam River on June 28th.

June 2-5, 2016: Unseasonably strong ridge of high pressure resulted in a period of early-season hot temperatures across Northwest Oregon. Temperatures of 95 to 100 in early June led to people seeking relief at local rivers. Two river drownings were reported in the Central Willamette Valley during this hot spell.

August 1-4, 2017: A ridge of high pressure aloft with a surface thermal trough over the area lead to record-breaking high temperatures across NW Oregon. The record- breaking heat led people to seek relief at local rivers. One child drowned while swimming in the Willamette River near the Wallace Marine Park.

June 26-28, 2021: A high pressure heat dome over the region led to stretch of extreme heat, shattering records. In Marion County there were three consecutive days with maximum temperatures greater than 100 degrees measured at several stations. The hottest day was on June 28 where temperatures peaked around 112 degrees. The minimum temperatures were warm as well with nighttime temperatures in the 70s on June 27 and June 28. Two heat related deaths were reported.

August 11-12, 2021: Hot weather began to develop August 9, peaking August 11- 12, but temperatures continued above normal into the weekend. Peak afternoon temperatures of 100 to 105 degrees drove people to seek relief in or near bodies of water. Heat caused slowdowns on the MAX light rail (Portland metro area) systems, and some businesses did close due to the heat. Cooling shelters were opened in several counties. In Marion County a 22-year-old California man drowned at Scotts Mill City Park on Wednesday, August 11th. The high temperature at Salem (KSLE) was 103 degrees on the 11th and 12th.

8.7 History of Floods in Marion County

The Willamette River basin has a long history of flooding. The largest flood on record on the Willamette River occurred in 1861. In 1861, town of Champoeg disappeared in the flood. Since then, however, the construction of flood control dams in the 1940s and 1950s has changed the pattern of flooding significantly.

Marion County has seen two major floods and five lesser floods during the last 45 years. One of the most memorable floods during this time, the "Christmas" flood of 1964, was rated "approximately a 100-year flood" by FEMA and was probably the most damaging in Oregon's history. Table 8-3 provides an overview of flooding history in Marion County. Major floods are discussed in more detail below.

Table 8-3, Marion County Flood History

Date	Location	Comments
December-January, 1964	The State of Oregon was declared an emergency disaster area.	In Salem, the Willamette River crested nearly 10 feet above flood stage.
January, 1974	Willamette Watershed	Heavy snow and a series of storms caused flooding conditions. Nine counties were declared disaster areas.
February, 1986	Salem Area	Heavy rain and snowmelt caused high water levels in the Willamette and Pudding Rivers
February 1996	Willamette Watershed Rivers and Creeks	Snowpack, warm temperatures, and record-breaking rains caused the streams to rise to all-time flood record levels.
November, 1996	Salem-Keizer	The heavy rains swamped the Salem-Keizer area.
January, 1997	Mid-Willamette Valley	The Willamette River crested at 29 feet, one foot above flood level.
December, 2005	Willamette Watershed	Heavy rains caused rivers to crest above flood stage
January, 2006	Willamette Watershed	Heavy rains caused road closures and damage to agricultural lands.
January, 2007	Pacific Northwest	Pacific frontal system brought widespread steady rain.
January, 2009	Northwest Oregon	Heavy rainfall combined with snowmelt runoff caused flooding.

Date	Location	Comments
December, 2010	Willamette Valley	Heavy rainfall over the area caused the Pudding River to overtop its banks.
January, 2011	Santiam River	Heavy rain that combined with snowmelt runoff to produce flooding on the Santiam River.
January, 2012	Pacific Northwest	Cold air mass in place over the Pacific Northwest, two strong and very moist Pacific weather systems brought widespread heavy rains.
February, 2014	Pacific Northwest	A series of fronts resulted in a prolonged period of rain for Northwest Oregon.
February, 2017	Northwest Oregon	A series of fronts brought moderate to heavy rainfall across Northwest Oregon.
April, 2019	Northwest Oregon	Strong atmospheric river
December, 2020	Northwest Oregon	A series of strong Pacific fronts moved across the region.

Source: Region 3 Mid/Southern Willamette Valley Regional Profile. January 2009; NOAA Storm Event Database, consulted June 2022

December-January 1964

The "Christmas" flood of 1964 was the largest flood to occur since major dam construction occurred on the upper Willamette. This flood occurred because of two storms, one on December 19, 1964, and the other on January 31, 1965. These storms brought record-breaking rainfall that exacerbated near record early season snow depths. The flooding caused ten deaths, $5 million dollars of damage to state bridges and $10 million dollars of damage in Marion County. There were hundreds of landslides, bridges and roads washed out, houses were damaged or destroyed, and thousands of people were forced to evacuate their homes (National Oceanic and Atmospheric Administration, N.d.).

Governor Mark Hatfield declared the entire state an emergency disaster area, and called the flooding, "the worst disaster ever to hit the state" (U.S. Department of the Interior, Geological Suvey, 2014). Marion County Commissioners also declared the county a disaster area as the Willamette River crested at 29.7 feet in Salem; nearly 10 feet above flood stage, and

most other streams in Marion County overflowed their banks. The floodwaters rendered sewage treatment plants in Salem inoperable causing raw sewage to be channeled directly into the Willamette River. A significant portion of Keizer was inundated, and more than a thousand people were evacuated. One hundred and twenty-one patients were evacuated from the Salem Memorial Hospital and fifteen families in the Turner/Salem area were evacuated from their homes. In Independence, thirty people were temporarily housed in City Hall to escape the floods. Further east, the entire Detroit-Idanha-Marion Forks area was isolated by massive washouts near Detroit Dam and Marion Forks. Seven homes were washed away in Idanha, and a landslide destroyed one house.

January 1974

Heavy snow and freezing rain and a series of mild storms caused snowmelt and rapid runoff. The storms resulted in two fatalities and thirteen injuries in Oregon. Nine counties in Oregon were declared disaster areas, including Marion County (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999). In Marion County, the Willamette River crested at 32 feet, four feet above flood level and two bridges were washed away on Mill Creek. Many residents experienced power outages and four Turner residents were evacuated from their homes and more than twenty roads were closed due to high water. In Salem and other communities, wastewater treatment plants exceeded capacity resulting in millions of gallons of raw sewage being discharged into the Willamette River. Total damage to Marion County was approximately $1.75 million.

February 1986

This flood, caused by a combination of heavy rains and snowmelt, caused the Willamette River to crest at just over 29 feet and within ten inches of flooding. The Pudding River crested at 24½, two-and-one-half feet above flood levels. In Salem, Minto Brown Island was closed because of high water on roads.

February 1996

In February of 1996, a combination of snowpack, warm temperatures, and record- breaking rains caused streams to rise to all-time flood record levels. Statewide, there were five flood related deaths and 150 people were evacuated from their homes. During this 25 -year flood event, overflow from the Little Pudding River inundated secondary roads, homes, and farmlands. Two state parks along the Willamette River in Marion County suffered loss during the flood. Willamette Mission State Park is located on what is known as ‘Beaver Island,’ and suffered severe damage. A large chunk of riverbank in the park disappeared with the floods. Dikes collapsed upstream from Jefferson due to high water on the South Santiam River. Serious erosion problems occurred within the South Santiam drainage basin. Claggett Creek also presented flooding problems during the February floods and was described as a 100-year storm event for the creek. Three houses with

basements flooded in the Keizer area. These homes were later removed from the floodplain with FEMA funding assistance. Marion Soil & Water Conservation District acted as pass through for $3.5 million from USDA Natural Resources Conservation Service (NRCS) to get financial assistance to farmers, who provided a 25 percent match. Flood damage from this flood event was estimated at $2.6 million for the entire Pudding/Little Pudding River Basin. In Keizer, damages reached $4.2 million. Total damage within Marion County were approximately $24 million.

November 1996

Flooding occurred in November 1996 adding to that occurred because of the February 1996 flood. Like February's storm, the "pineapple express," a weather system that draws large amounts of moisture from an area near Hawaii and deposits it on the West Coast, caused the heavy rain. Salem received about six inches of rain over a 48-hour period. The heavy rains swamped the Salem-Keizer sewer system, sent raw sewage into the Willamette River, and caused smelly backups in some Salem residents' basements. Adding to the troubles of the Salem-Keizer area, eighteen inches of water flooded a Keizer subdivision damaging several homes. Rural areas of the county were also hit hard by November's deluge. Five rural homes were evacuated, and dozens of roads were closed. One such road was Parker Road near Independence. Floodwater wiped out a 70-foot section of this road and left a fifteen-foot hole filled with rushing waters (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

January 1997

Heavy rains from the January 1997 storm caused flooding throughout the county. The Willamette River crested at 29 feet, one foot above flood level. Five thousand Mid-Willamette Valley residents lost power as high winds that accompanied the rain blew down power lines. Fallen trees and debris backed up sewer lines in Salem, and subdivisions in northeast Keizer were flooded, causing damage estimated at hundreds of thousands of dollars (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

December 2005

Heavy rains caused rivers to crest above flood stage in Polk, Marion, Linn, Lane, and Benton Counties, as well as other counties in the Willamette Valley.

January 2006

Heavy rains in January, November and December caused many rivers to crest above flood stage in the Willamette Valley, causing road closures and damage to agricultural lands.

January 2007

A strong warm Pacific frontal system brought widespread steady rain to the forecast area over a period of 36 hours. This system brought between 2 to 4 inches of rain to the Coast Range, between 1 to 3 inches to the coast and Willamette Valley, and between 2 to 5 inches to the Cascades. The Pudding River at Aurora crested at 21.9 feet on January 5th. Flood stage for this river is 22.0 feet (National Oceanic and Atmospheric Administration, N.d.).

January 2009

Heavy rainfall drenched the region to begin the new year. The heavy rainfall combined with snowmelt runoff caused flooding along multiple rivers in northwest Oregon. Heavy rain caused the Santiam River near Jefferson to overflow its banks and flood low lying areas and caused the Pudding River to overtop its banks and flood farmland (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

December 2010

On both the 14th and the 30th of the month heavy rainfall over the area caused the Pudding River to overtop its banks and flood farmland.

January 2011

From the 16th through the 18th a series of storms brought heavy rain that combined with snowmelt runoff to produce flooding on the Santiam River. The Santiam River at Jefferson crested at 15.4 feet on January 17th at 04:27 PST. The Pudding River at Aurora crested at 23.3 feet on January 19th at 13:30 PST.

January 2012

From January 19-20 with a cold air mass in place over the Pacific Northwest, two strong and very moist Pacific weather systems brought widespread heavy rains to the Willamette Valley flooding many urban and small streams.

Widespread low-land flooding occurred in Marion County, resulting in considerable flood damage to homes in southeast Salem and Turner. Residents of 300 homes in Turner had to be evacuated, including 90 residents of the Turner Retirement Home (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

February 2014

From the 16th to the 18th a series of fronts resulted in a prolonged period of rain for Northwest Oregon, and minor flooding of several of the area's rivers from February 12th through February 17th.

The Pudding River at Aurora reached flood stage at 11:30 AM on February 16th, 2014. The river crested at 22.4 feet at 5:00 AM on February 17th and fell below flood level at 9:30 AM PST on February 18th (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

February 2017

A series of fronts brought moderate to heavy rainfall across Northwest Oregon, resulting flooding on many rivers across the area from the 6th to the 12th. Heavy rain caused the Pudding River near Aurora to flood. The river crested at 24.16 feet, which is 2.16 feet above flood stage (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

April 2019

From the 8th to the 9th a particularly strong atmospheric river took aim for the south Willamette Valley, sitting over areas south of Salem for two days, producing anywhere from 2.5 to 5 inches of rain over a 48-hour period. Some areas in the Cascades and Cascade Foothills saw 5 to 7 inches of rain over that 48-hour period. Heavy rain combined with snow melt from all the snow from a few weeks prior in this same area caused flooding along most of the rivers in the area as well as along the main-stem Willamette River up to around Oregon City.

The Santiam River at Jefferson crested at 15.8 feet around 11 PM on April 8th, which is 0.8 foot above flood stage. The Pudding River at Aurora crested at 22.7 feet around 4 AM on April 11th, which is 0.7 foot above flood stage (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

December 2020

From the 20th to the 21st a series of strong Pacific fronts moved across the region bringing high winds to the coast with heavy rain across much of the area. The heavy rains resulted in flooding of some coastal rivers as well as small stream flooding and a debris flow. The gage on the Santiam River at Jefferson (JFFO3) crested at 15.3 feet. Flood stage is 15.0 feet. No damage was reported.

8.8 History of Landslides in Marion County

A 1998 study of the western portion of the Salem Hills completed by the Department of Geology and Mineral Industries (DOGAMI) indicates that slopes nearest to the Willamette River contain the greatest risk of landslide in Marion County. This area is near a dense population and poses significant risks to life and property. While no recent landslides have occurred in the area, the geologic setting of the Salem Hills illustrates a historic pattern of landslides. Many prominent features that help identify the ancient landslide terrain are hummocky topography, disrupted drainage patterns, sag ponds, springs, back-tilted bedrock blocks, and subdued head scarps (Harvey & Peterson, 1998).

In the southeastern portion of the county, the Little North Fork Road experiences annual landslide events. The hillside where Highway 22 narrows near Mill City sloughs off three or four times a year, closing the highway for up to three hours until the Oregon Department of Transportation (ODOT) can clear the road of debris.

In February 1996, November 1996, and December 1996/January 1997 the Willamette Valley experienced heavy rainfall and snowmelt which led to widespread landslide events throughout the state. Disaster declarations were issued for Marion County for the February 1996 and December 1996/January 1997 storms. During these storms, many landslides occurred in the eastern portion of the state and are too numerous to list here. In 2000,

DOGAMI mapped the historical instances of landslide events throughout the Willamette Valley for the 1996-1997 storms, including Marion County.

In February 1996, November 1996, and December 1996/January 1997 the Willamette Valley experienced heavy rainfall and snowmelt which led to widespread landslide events throughout the state. Disaster declarations were issued for Marion County for the February 1996 and December 1996/January 1997 storms. During these storms, many landslides occurred in the eastern portion of the state and are too numerous to list here. In 2000, DOGAMI mapped the historical instances of landslide events throughout the Willamette Valley for the 1996-1997 storms, including Marion County.

8.9 History of Severe Winter Storms in Marion County

The State of Oregon has a long history of severe winter storms. The most significant storms which have affected Marion County are listed below.

December 1892

From December 20 to 23, 1892, substantial snow fell across most of northern Oregon, with the greatest snowfall reported over northwestern Oregon, where storm totals ranged from 15 to 30 inches (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes).

January 1916

This winter storm affected the entire state. On January 6 through January 10, heavy snow fell in mountainous areas. During the second storm of January 11 through 15, every reporting station in western Oregon, except for the southwestern interior and the coastal areas, recorded storm totals of at least five inches and most locations had eight inches or more. McMinnville had the most snow in one day, with eleven inches falling on January 12. Higher elevations in the Cascades received very heavy snowfall (State of Oregon, Department of Emergency Management, N.d.).

December 1919

The December 1919 snowstorm was recorded as the third heaviest snowfall- producing storm in Oregon. The Columbia River froze over, closing the river to navigation from the confluence with the Willamette River upstream. The snowstorm affected nearly every part of the state, with heavy snow falling over a widespread area (State of Oregon, Department of Emergency Management, N.d.).

December 1924

In December 1924, temperatures stayed near or below the freezing mark for eleven days. At the time it was the coldest December ever in Oregon. Most streams and rivers were frozen and blocked with ice. People drove their automobiles across the Willamette River. In addition to the cold weather, four inches of snow fell over much of the Willamette Valley. The weight of the snow downed 400 telephone lines in Salem, and this weather event caused 21 car accidents in Salem. The freezing temperatures formed ice in the Willamette River that crushed a steamboat and caused several thousand dollars of damage to the Dennison Bath House.

January 1937

The storms that hit Marion County in January 1937 broke an eighteen-year record for snowfall in Salem with 27 inches and caused $50,000 in property damage. Much of the damage occurred as structures collapsed from the weight of the snow. For example, in Salem, four storefront marquees collapsed, a shed fell on five vehicles in a lumberyard, the Salem Ferry Street Tabernacle collapsed and six structures at the Marion County Fairgrounds were damaged (National Oceanic and Atmospheric Administration, N.d.).

January 1950

The entire month of January 1950 was cold and frequent snowstorms occurred statewide. Snowfall and precipitation including freezing rain was heaviest from January 9th through the 18th. During this time, Marion County experienced wind gusts up to 80 mph and sustained winds up to 25 mph. Thirty-nine inches of snow fell on Salem over the course of the month, 54 inches fell in Detroit and 122 inches blanketed Detroit Dam. In Salem, Mill Creek flooded onto airport roads and in Detroit, a rod-and-gun club's roof collapsed under the weight of 20 inches of snow. The severe weather caused power outages in Mt. Angel and cut telephone service in Silverton. Schools throughout the county were sporadically closed and at least two weather-related traffic fatalities occurred in Oregon, one in Lyons (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

January 1957

The cold weather in January 1957 was the result of an arctic air mass that moved into Eastern Oregon and spread west toward the coast. The cold temperatures brought four inches of snow to Lyons and eleven inches to Detroit, as well as icy roads throughout Marion County. Temperatures in Marion County during this seven-day period were in the mid-teens, not considering the wind-chill created by 21 mph wind gusts. The cold snap cut electricity for 100 Salem residents and froze water pipes in many homes. Dozens of fires were reported in Salem from overheated chimneys and stoves, or from blowtorches used to thaw pipes. The cold temperatures also caused the Bonneville Power Authority to cut interruptible power to the regions' industrial customers because ice behind the dam slowed water flow and limited the ability to generate power (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

March 1960

The first week of March 1960 was marked by a winter storm that brought more snow to Marion County than any time since 1950. Salem received 8.5 inches of snow and higher elevations received as much as 11 inches. This storm was responsible for two fatalities in Oregon, and 100 storm-related accidents in Marion County. In addition, most schools throughout the county were closed for several days (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

January 1963

Cold temperatures and snow showers created hazardous driving conditions in Marion County during the last days of January 1963. Four inches of snow were recorded at McNary Field in Salem, Detroit recorded thirteen inches and Stayton reported that slush had frozen on area roadways.

January 1978

During the early days of January 1978, a layer of cold air was driven into the Willamette Valley from Eastern Oregon via the Columbia Gorge. Rain from a higher warm air mass fell through the cold air below causing it to freeze. The cold temperatures and freezing rain iced roads throughout Marion County and the Willamette Valley causing eight traffic fatalities and dozens of traffic accidents.

February 1989

The February 1989 storm dropped seven inches of snow on Marion County and saw temperatures as low as zero degrees Fahrenheit with a wind-chill factor dipping to 75 degrees below zero. The storm led to accidents on Interstate 5 that closed the highway between Salem and Albany. Near Woodburn, an overturned truck spilled 1,000 gallons of oil. There was also a storm related, four-vehicle accident on Highway 22 near Silverton. Hospitals in Salem reported 25 snow related injuries.

The Oregon Department of Transportation estimated $25,000 in additional costs were necessary for wages and supplies to deal with the storm's effects. In Salem, the adverse weather cost $40,000 to keep streets open, $10,000 more than the city budgeted for the storm. In addition, the extreme cold damaged 20 to 40 percent of the county's cranberry crop, forced mills to send home thousands of employees, and froze or burst 200 Salem residents' water pipes.

February 1993

This storm event dropped nearly twelve inches of snow in Salem between February 18th and 19th; the greatest amount of snowfall ever recorded in a 24- hour period in Salem. As a result of the storm 2,100 Silverton area residents and 1,500 residents on Highway 99E north of Salem lost power. There were also several minor, storm- related injuries reported by Salem hospitals.

February 1996

Like the 1978 event, this storm began with a mass of cold air trapped in western Oregon followed by a warmer front that blew over the top of the cold air mass. Once the two fronts collided, they created a severe ice storm. Traffic accidents and power outages plagued the Willamette Valley.

Freezing rain fell for two days, causing a 100-car pileup between Clackamas County and Salem, and a 22-car pile-up on Highway 22 near Eola. One fatality occurred in a different traffic accident (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

December 2003 – January 2004

The winter snowstorm that blew through northwest Oregon at the end of December turned into an ice storm in January. According to state climatologist George Taylor, snowstorms that swept through the region beginning December 26, 2003, resulted in the snowiest, coldest winter since 1923. The storm resulted from the collision of a mass of moisture from the Pacific with an arctic cold front. Climatologists considered this the worst storm to pelt the west side of Oregon's Cascade Range since 1992. According to the National Weather Service, Salem received three inches of snow on January 6th. The storm's impact at Portland International Airport had thousands of passengers stranded for several days after the freezing rain cancelled flights. The runway conditions were among the worst in recorded history (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022)

The hardest hit areas are the eastern and southern sections of the service territory, including east Multnomah County, Oregon City, Estacada, Molalla and Mulino, and the Salem area. Champoeg State Heritage Area lost historic trees i.e., oaks estimated to be around 200 years old. During the winter storm, campers at the Heritage Area were trapped for a day because trees fell across the road, and park staff could not get to the park. The Heritage Area qualified for FEMA funding, and it took four to five months to make repairs. Fir and filbert trees were decimated at Willamette Mission State Park, but walnut trees withstood the storm. Willamette Mission State Park suffered over $30,000 in damage (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

For the Cascades, this storm was a typical storm (versus on the valley floor where it was severe), although residents in the Santiam Canyon experienced problems with services (e.g., gas stations and stores closed) and power (e.g., disruption in electricity service). In the Cascades, a severe winter storm means that typically four to five feet of snow falls in a short period of time.

January-February 2008

Over several weeks in early 2008, the foothills of eastern Marion County received unusually high amounts of snow from a series of storms. While the Marion County towns of Idanha and Detroit commonly receive heavy snowfall each winter, they were both buried by 12 feet of snow over these two months. Three dozen National Guard soldiers, along with snow removal equipment, inmate crews, and engineers, were sent by the State into the towns to remove snow and help those in need (Salem-News, 2008).

December 2008

A prolonged snowstorm hit the region during the 2008-2009 winter season, with its worst effects felt from December 20-26, 2008. During this time, Salem received over a foot of snow. Lafayette, near the border of Marion County received almost two feet of snow, while Portland airport received a record 18.9 inches. A disaster for this snowstorm, and its associated landslides and mudslides, was declared on March 2, 2009. Per capita damages for Marion County were estimated at $43.94 (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

8.10 History of Tornadoes in Marion County

The following list describes known tornados occurring in Marion County from 1925 through present. The National Climate Data Center (NCDC) storm events database (https://www.ncdc.noaa.gov/stormevents/) was the primary source of information for this history. *Note*: that OPDR removed two tornados listed in the previously adopted version of the Marion County NHMP (the Sandy tornados) from the history as further review determined that neither event directly impacted Marion County. Between 1960 and 2006, tornados in Marion County caused approximately $50,000 in property damage collectively. The December 2010 Aumsville tornado event is expected to result in damages exceeding $1 million.

Salem area - November 11, 1925, 11:00 am

Tornado with estimated beginning lat/long 44°52'/123°11'116

NW Donald - October 26, 1984, 12:30 pm

Estimated beginning lat/long 45°14' 122°53'.

Aumsville – March 8, 1960, 5:15 pm

A small F1 tornado with an estimated beginning lat/long 45°01' 122°53' and width of seven yards traveled approximately one mile. There were no reports of injuries. The event resulted in $2,500 in property damage to several farms and uprooted several trees.

Aurora – October 26, 1984, 12:30 PM

A small F0 tornado reportedly struck six miles west of the town of Aurora. It had a path length of one-half mile and width of 67 yards. The tornado "destroyed a small machine shed on the Leighton Whitsett Case Road NE farm" and scattered its pieces over a half-mile area. Estimated damage from the storm was $4,000.

E Keizer - May 31, 1997, 10:10 am

An F0 tornado touched down approximately one mile east of Keizer. The 50-yard-wide funnel traveled approximately 1.5 miles to a point roughly three-miles east- south-east of Keizer. According to the NCDC report, several witnesses reported seeing the tornado on the ground for about two minutes. The storm uprooted 30- 40-foot-tall trees and damaged a barn resulting in $15,000 in repair costs.

SW Turner - September 17, 1997, 10:35 am

An F0 tornado touched down two miles southwest of Turner resulting in $10,000 in minor damage to a rural subdivision. Damage was limited to fences, windows, and trees. The tornado impacted an area 50-yards wide and one mile long.

N Aumsville - September 17, 1997, 11:05 am

A small tornado estimated at 10-yards wide, and a half-mile long touched down near Aumsville. There were no reports of injuries or property damage.

Silverton – November 12, 1997

This tornado damaged a barn. Several timber units tumbled down in the Detroit Ranger District of the Willamette National Forest during this windstorm, which was cyclonic in nature in the eastern portion of the Santiam Canyon.

Silverton October 3, 1998, 2:30 pm

A Silverton Police officer reported seeing a small tornado touch down near Silverton. There were no reports of damage or injury.

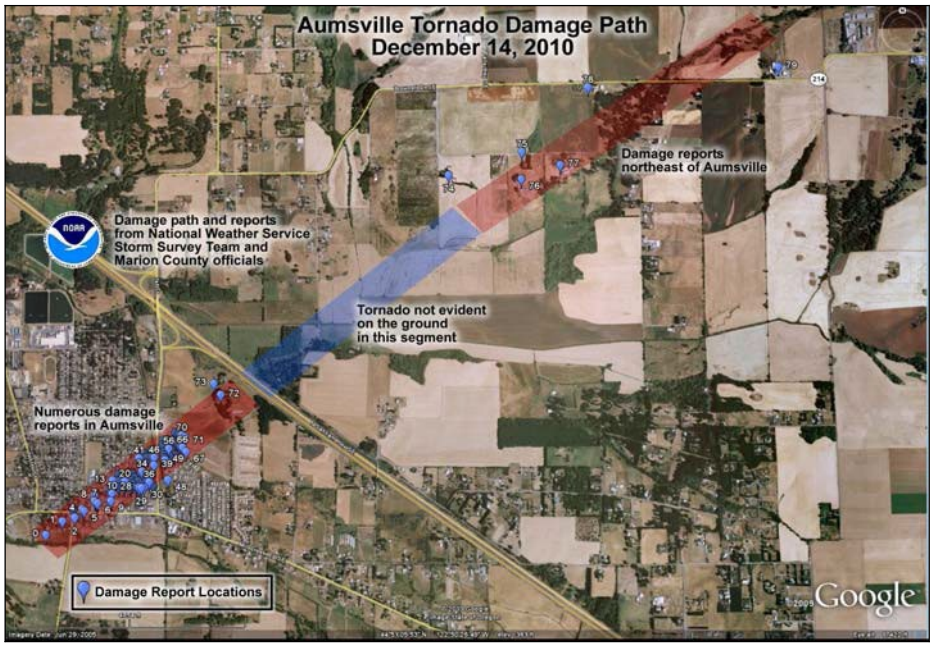
NE Salem December 16, 2006, 3:00 pm

Immediately following a thunderstorm with frequent lightning and small hail, an F0 tornado touched down approximately eight miles northeast of Salem. The 50-yard-wide funnel traveled approximately two-miles over rural agricultural land. Reports indicate that the tornado crossed an acre and a half of floodwater up to three feet deep and sucked all the water up into the funnel. The tornado then continued and picked up a 12-inch diameter cedar tree and tossed it into a barn. After changing direction, the tornado picked up an RV causing it to land on its side. There were no injuries reported.

Aumsville December 14, 2010, 11:44 am

An EF2 tornado with wind speeds between 110 and 120 mph touched down on Main Street near the southerly boundary of the City of Aumsville. This was the largest tornado recorded in Marion County to date and the second largest in the state since 1950. According to a December 23, 2010, NOAA storm survey report, the tornado traveled in a northeasterly direction and had a path length of approximately five miles. An on-sight ground assessment concluded that the tornado did not appear to be on the ground for the entire five-mile path length (refer to Figure 8-3 below). The tornado damaged numerous residential and commercial structures, downed power, and light poles uprooted or snapped of over 30 large (average 18–24-inch diameter breast height) trees and resulted in two minor injuries from flying debris. The initial damage assessment conducted by Marion County Emergency Management in collaboration with local and state partners estimate total losses from the storm at over $1.1 million. Damage included the destruction of two homes and one business and major damage to an additional six homes and one business. In all, 63 dwellings, seven business, eight outbuildings and several public facilities were impacted by this storm. At the time of this report, response and recovery activities in Aumsville are still underway; final damage reports and the extent of resources made available from local, state, and federal sources are pending.

Figure 8-3, Aumsville Tornado Damage Path



Aurora Airport October 12, 2017, 2:39 pm

An EF0 tornado 0.62 miles long and 50 yards wide. The tornado started on Boones Ferry Rd NE, west of the Aurora airport. Greenhouses in the area sustained damage, and the tornado continued to travel east across the airport property. Two planes were flipped at Willamette Aviation Services. The tornado ended near Airport Rd NE.

Jefferson, October 29, 2018, 2:30 pm

An EF0 tornado 0.1 miles long and 10 yards wide. There was damage to multiple small shrubby trees just north of the railroad track along Libby Ln. There was also a sign knocked over at the NW corner of Libby Ln and Jefferson-Marion Rd, but whether it was caused by a tornado could not be determined. The tornado was likely on the ground for one minute or less.

8.11 History of Volcanic Eruption in Marion County

There are five active volcanoes that could potentially impact Marion County. These include: Mount Jefferson, Three Sisters and Broken Top, Mount Hood, Mount St. Helens, and Mount Rainier. However, only one of these volcanoes, Mount St. Helens, has impacted Marion County within the past 30 years. The closest volcano to Marion County, Mount Jefferson, has the potential to impact Marion County directly, but it has not been active for at least the past 15,000 years.

Mount St. Helens

Mount St. Helens, located in southwestern Washington about 70 miles northeast of Marion County, is approximately 2,200 years old according to the U.S. Geology Survey. On May 18th, 1980, Mount St. Helens "exploded violently after two months of intense earthquake activity and intermittent, relatively weak eruptions, causing the worst volcanic disaster in the recorded history of the United States" (United States Department of the Interior, Geological Survey, N.d.). Damage to the built environment within the immediate hazard vicinity in Washington included twenty-seven bridges, about two hundred homes, more than 185 miles of highways and roads, and fifteen miles of railways. Ash from the eruption column and cloud spread across the United States in three days and circled around the Earth in fifteen days. Detectable amounts of ash were noted in an area covering 22,000 square miles. In Marion County, volcanic ash affected air filters on the RFPD No.1's equipment. No Oregon roads were closed, although fallout of volcanic ash restricted visibility and produced slippery roads and ash-clogged windshields. Debris flows from the eruption quickly filled the Toutle and Cowlitz Rivers and ultimately flowed into the Columbia River at Longview, Washington. The debris blocked the main shipping channel in the Columbia, stranded ships in port, and closed the ports of Portland, Vancouver, and Kalama for over a month. Several water and sewage treatment facilities were also damaged or destroyed. The estimated damage attributed to the eruption was $1.1 billion (United States Department of the Interior, Geological Survey, N.d.).

The May 18, 1980, eruption was preceded by about two months of precursor activity, including dome building, minor earthquakes, and venting of gasses. The lateral blast, debris avalanche, and mudflow associated with the eruptions caused extensive loss of life and widespread destruction of property. The eruption triggered a magnitude 5.1 earthquake about one mile beneath the volcano. In the six-year period after the initial eruption, hundreds of small ash emissions at Mount St. Helens occurred. The 1980 eruption of Mount St. Helens took the lives of 57 people and nearly 7,000 big game animals. All birds and most small mammals in the area were killed, as were twelve million Chinook and Coho salmon fingerlings that perished when their hatcheries were destroyed. The May 18, 1980, eruption was followed by five smaller explosive eruptions over a period of five months (U.S. Department of Interior, Geological Survey, N.d.).

A series of sixteen dome-building eruptions constructed the new, 880 foot high, lava dome in the crater formed by the May 18, 1980, eruption. An eruption occurring in 1480 A.D. was approximately five times larger than the May 18, 1980, event. On the night of March 8, 2005, a plume of ash and steam spewed nearly seven miles high into the air. Glowing tendrils of lava were spotted inside the mountain's crater following the explosion. The plume rose nearly twice as high as one produced by the last eruption in October 2004. Ten small earthquakes were measured in the area on Tuesday leading up to the eruption. The largest appeared to be a magnitude 2.5, according to the USGS (U.S. Department of Interior, Geological Survey, N.d.).

Three Sisters and Broken Top

The Three Sisters are located about 40 miles southeast of Marion County. Recently, volcanic activity has been found on the South Sister. Satellite images have indicated upward movement of land near the volcano. The surface moved toward the satellite (mostly upward) by as much as ten centimeters (about four inches) sometime between August 1996 and October 2000. The most likely cause is magma accumulation in the Earth's crust, a process that has been observed with radar interferometry at several other volcanoes worldwide. As of 2005 and 2006 USGS found that the rate of ground deformation in the South Sister has slowed There is no immediate danger of a volcanic eruption or other hazardous activity. The potential exists, however, that further activity could increase danger. South Sister, Middle Sister, and Broken Top are major composite volcanoes clustered southeast of Marion County in Deschutes County. These volcanoes have erupted repeatedly over tens of thousands of years and may erupt explosively in the future. In contrast, mafic volcanoes, which range from small cinder cones to large shield volcanoes like the North Sister, are typically short-lived (weeks to centuries) and erupt less explosively than do composite volcanoes (U.S. Department of Interior, Geology Survey, N.d.).

Mount Hood

Mount Hood is located about 60 miles northeast of Marion County. It has been recurrently active over the past 50,000 years. It has had two significant eruptive periods in geologically recent times, one about 1,500 years ago and another about 200 years ago. While Mount Hood has shown no recent signs of volcanic activity, scientists predict the next eruption will consist of small explosions generating pyroclastic flows, ash clouds, and lahars (mud and debris flows). In the event of an eruption, Marion County would likely be affected by ash fall (U.S. Department of Interior, Geology Survey, N.d.).

Mount Rainier

Mount Rainier is located approximately 100 miles north of Marion County. Mount Rainier stands at 14,410 feet and dominates the surrounding landscape as the tallest land feature. The primary hazard posed to Marion County is ash fallout from Mount Rainier. Mount Rainier is an active volcano that first erupted about half a million years ago. Because of Rainier's great height and northerly location, glaciers have cut deeply into its lavas, making it appear deceptively older than it is. Mount Rainier is known to have erupted as recently as in the 1840s, and large eruptions took place as recently as about 1,000 and 2,300 years ago. An eruption from Mount Rainier would likely impact Marion County only through ash fall (U.S. Department of Interior, Geology Survey, N.d.).

8.12 History of Wildfire in Marion County

Marion County has experienced three large fires since Euro-American settlement and several smaller fires that occur almost annually. The largest fire to date was the 1865 Silverton fire that burned 988,000 acres of forest near Silverton. However, due to the few settlements in Oregon at that time, there was little damage to property that occurred.

The B&B complex fire in 2003 caused extensive damage in eastern Marion County, Deschutes County, and Jefferson County. The B&B complex fire was characterized by extreme plume-dominated behavior grew to 80,000 acres in September 2003 as the Booth and Bear Butte fires merged. The entire community of Camp Sherman, approximately 300 residents, was evacuated twice to avoid the fire's danger and Highway 20 was temporarily closed. A total of 2,205 personnel, 82 fire engines and 10 helicopters were employed to battle the fire. Governor Kulongoski invoked the Conflagration Act for the east side of the B&B Complex. The B & B Complex fire burned into a portion of Marion County.

In September 2020, Marion County was impacted by the Beachie Creek and Lionshead fires with merged in Marion County and by the Riverside Fire in the northern part of the county. The Beachie Creek fire burned 193,565 acres of land in Linn, Marion and Clackamas counties including portions of the City of Mill City. The Beachie Creek wildfire started around 11:00 PDT on August 16, 2020, in the Opal Creek Wilderness, Marion County, OR at coordinates 44.821, -122.188. The fire remained in a remote location through the month then grew rapidly in September. It was not contained until December. The cause of the fire is unknown.

After a period of upper-level ridging brought a return to above normal temperatures in early September, very strong easterly downslope and offshore winds off the Cascades and Coastal Ranges occurred. Winds increased rapidly during the afternoon and evening of September 7 with the passage of an unseasonably strong backdoor cold front and persisted through much of the following day. This resulted in extremely critical fire weather conditions when the strong winds combined with extremely low relative humidity and exceptionally dry existing fuel conditions. The result was explosive growth of ongoing wildfires, and the new start and explosive spread of numerous new wildfires. Widespread wind gusts from 50-70 mph were common on ridge tops and numerous other in exposed areas, including portions of the greater Portland metro area, the Willamette Valley, and areas of the Oregon coast. Strong winds caused widespread damage to trees, and downed numerous power lines across the region, which started at least 13 additional wildfires. Large portions of the cities of Detroit, Mehama, and Gates were destroyed, and significant portions of Idanha, Mill City, and Lyons also burned (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

Resultant large wildfires included these named incidents - In Oregon: Beachie Creek, Chehalem Mountain/Bald Peak, Riverside, and Lionshead, and in Washington: Big Hollow. Rapidly spreading wildfires resulted in multiple fatalities, hundreds of displaced persons for many weeks, and billions of dollars in damage (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

During the wildfire, evacuation routes were restricted due to the wildfire movement. Following the wildfire, the impact of smoke and poor air quality affected residents who remained in the area. Long term impacts to the local economy persist.

Marion County commonly experiences smaller fires. Data available through ODF shows that of the 74 wildfires that occurred in Marion County from January 1, 2016, through December 31, 2021, thirty-six fires burned 0.25 acres or less, thirty-three fires burned between 0.26 acres and 10 acres. There were two fires that burned between 10 acres and 30 acres; the Stout Fire in 2018 burned 17.7 acres and the Silver Creek Fire in 2019 burned 27 acres. Also in 2019, the Santiam Park fire burned just over 184 acres. In 2020 two very large fires, Beachie Creek and Lionshead Fires burned nearly 400,000 acres (398,035 acres) in Marion County. An inventory in the prior plan showed that the majority of wildfires were human caused with only 8% attributable to lightning.

8.13 History of Windstorms in Marion County

Windstorms have historically been a threat to Marion County. The following storms, though not exclusive to Marion County, caused particularly severe damage to the county.

January 9, 1880

This windstorm was a major blow down event in the region and for Marion County and was the most severe windstorm to strike the region until the Columbus Day Windstorm in 1962. Winds in Salem gusted up to 80 mph, blowing down many acres of trees, and damaging the roof of the Statehouse, Willamette University, and many other buildings. The City of Hubbard, in the North part of Marion County, saw a 10 acre woodlot completely flattened. It was reported that almost all property owners in Salem likely lost at least some vegetation. There were several reports of injuries throughout western Oregon of injuries due to flying debris. Following the storm, seven inches of snow fell in Salem.

April 1931

This storm, with winds up to 40 mph and gales up to 75 mph, blew moving vehicles off roadways in Salem and Woodburn. The storm consisted of northeastern winds that blew tons of dust from Eastern Oregon down the Columbia Gorge where it then settled over much of the Willamette Valley. The dust reduced visibility to distances less than one mile. The sediment- filled winds also felled hundreds of trees causing road closures between Mill City and Detroit. The winds also caused several devastating fires. In Mehama, several buildings burned completely: including homes, a large store, and the Stayton Bank. There were 22 home fires in the Salem area and throughout the Willamette Valley forest fires, as large as 3,000 acres in Linn County, were whipped up by the winds.

December 1951

This mid-century storm with winds recorded at 57 mph and gusts up to 76 mph resulted in four Oregon deaths. Power outages for up to a day were recorded at Union Hill, Waldo Hill, Victor Point, Scotts Mills, Silverton Hills and Marquam. The North and South Santiam highways and the Siuslaw highway were closed due to fallen trees.

October 12, 1962 (The Columbus Day Storm)

The Columbus Day storm in 1962 produced sustained winds in Salem of 58 mph and gusts as high as 90 mph. It was the most destructive windstorm ever recorded in Oregon, both in terms of loss of life and property damage. Damage was most severe in the Willamette Valley where the storm killed 38 people and was responsible for two deaths in Salem and four injuries in Silverton. The storm caused upwards of $200 million in damage (over $800 million in today's dollars) statewide. Approximately $4 million (in 1962 dollars) in damage occurred in Salem, while that number doubled to $8 million worth of damage in Marion County as a whole. Hundreds of thousands of homes were without power for short periods of time, while others were without power for two to three weeks. More than 50,000 homes were seriously damaged, and nearly 100 were destroyed. In Salem, 40 schools were closed, and 7,000 residents lost phone service. The storm destroyed fruit and nut orchards and killed scores of livestock (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

March 25-26, 1971

This March windstorm produced winds up to 50 mph and hit the Hubbard and Scotts Mills area particularly hard while also causing power outages for approximately 60 homes in the Salem area.

November 13-15, 1981

November 1981 saw two successive windstorms on the 13th and 14th. Sustained winds in Salem reached 52 mph and gusts were recorded at 71 mph. Eleven people were killed and $50 million in damage was reported because of the two storms. Numerous injuries resulted from wind-blown debris in western Washington and Oregon. Across the Pacific Northwest, hundreds of downed trees and power lines caused massive power outages and roof damage. The storm caused 500,000 Oregon residents to lose power,163 20,000 in the Salem area alone. The storm toppled 23 power poles on the Silverton Road and power outages in Salem resulted in seven school closures (Taylor, Hatton, & Taylor, The Oregon Weather Book: A State of Extremes, 1999).

December 12, 1995

This windstorm caused such widespread damage from downed trees and power and communication outages that Governor Kitzhaber declared a state of emergency for all western Oregon and called 150 National Guard Troops to assist residents and public utility crews. The storm caused three deaths, one in Marion County. The windstorm resulted in $800,000 of damage in Marion County, $500,000 of which occurred in Woodburn alone. Some of this damage included environmental damage as "millions of gallons of raw sewage" flowed into Salem area creeks and the Willamette River.

In Salem, the National Weather Service reported average winds of 40 mph with gusts up to 59 mph. In the region between Salem and Corvallis, 7,500 people lost phone service. In the Salem area, including Silverton and Woodburn, 20,000 people lost power; in the Stayton and Mill City area, that number was 10,000. In addition to power and phone outages, Interstate 5 was shut down to truck traffic for several hours and Highway 22 at Valley Junction was closed.

February 7, 2002

The most recent of large windstorm events arrived in the Willamette Valley with wind gusts up to 70 mph causing 27,000 power outages statewide. The severity of this storm prompted President Bush to issue major disaster declarations for five Oregon counties. Nine other Oregon counties, including Marion County, were named contiguous counties, allowing family farmers to receive loans to address storm related damage. Eastern Marion County was one of the areas hardest hit by this storm. In Gates, the wind blew off the post office roof and Highway 22 east of Mehama was closed after trees blocked the roadway. A downed tree blocked Highway 99 near Jefferson and the Interstate 5 corridor between Salem and the Highway 34 exit experienced storm-related congestion (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

July 2003

A major windstorm in Marion County caused approximately $15,000 in property damage.

December 2004

A windstorm causes $6,250 in property damage in Marion, Lane, and Polk Counties (U.S. Department of Commerece, National Oceanic and Atmospheric Administration, 2022).

January 2005

Windstorms cause $6,000 worth of property damage in Linn and Marion Counties. A storm total of $15,000 in damages was spread out among Linn, Marion, Clackamas, Multnomah, and Washington Counties.

February 2006

A windstorm with gusts up to 77 mph caused $227,000 in damages in Linn, Lane, Marion, Benton, Polk, and Yamhill Counties.

May 2007

A hailstorm causes $5,000 in damages in Marion County.

March 2008

Heavy winds measured at 40 mph causes $15,000 in damage near Woodburn.

June 2009

A strong windstorm with 80 mph winds, and followed by a thunderstorm, brought down numerous trees along Highway 22 and caused approximately $2,000 in damage.

9 References

Association of State Dam Safety Officials. (2023). *Dam Failures and Incidents*. Retrieved from Awareness Center: https://damsafety.org/dam-failures#:~:text=The%20ASDSO%20Dam%20Failures%20website,be%20minimized%20in%20the%20future.

Burby, R. J. (1998). *Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.* Washington , DC: Joseph Henry Press. doi:https://doi.org/10.17226/5785

City of Gervais. (2019). *Stormwater Master Plan.* Tetra Tech. Retrieved from http://nebula.wsimg.com/1e229ec1f511c1f70cb8105724aefa06?AccessKeyId=F062AE05BD597D7A5EB5&disposition=0&alloworigin=1

City of Mill City. (N.d.). City of Mill City Comprehensive Plan.

City of Turner. (N.d.). *Welcome to Turner*. Retrieved from Turner Oregon: https://turneroregon.gov/

City of Woodburn. (N.d.). *Comprhensive Plan*. Retrieved from Community Development Planning: https://www.woodburn-or.gov/dev-planning/page/comprehensive-plan

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social Vulnerability to Environment Hazards. *Social Science Quarterly, 84*(2), 242-261. doi:http://www.jstor.org/stable/42955868

Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010, August 4). *Disaster Resilience Indicators for Benchmarking Baseline Conditions*. doi:https://doi.org/10.2202/1547-7355.1732

Department of Homeland Security, Federal Emeregncy Managemetn Agency. (2021, August 13). *National Risk and Capability Assessment*. Retrieved from FEMA.gov: https://www.fema.gov/emergency-managers/risk-management/risk-capability-assessment

Department of Homeland Security, Federal Emeregncy Managemetn Agency. (2022, November 4). *Hazard Mitigation Planning*. Retrieved from FEMA.Gov: https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning

Department of Homeland Security, Federal Emergency Management Agency. (2008). *Emergency Support Function #2 - Communications Annex*. Retrieved from FEMA.gov: https://www.fema.gov/pdf/emergency/nrf/nrf-esf-02.pdf.

Department of Homeland Security, Federal Emergency Management Agency. (2021, February 25). *Disaster Declarations for States and Counties*. Retrieved from FEMA.gov: https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Department of Homeland Security, Federal Emergency Management Agency. (2022, October 5). *Rehabilitation of High Hazard Potential Dams Grant Program Guidance & Resources.* Retrieved from FEMA.gov: https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams/resources

Department of Homeland Security, Federal Emergency Management Agency. (2023, January 11). *44 CFR 201.6 - Local Mitigaiton Plans, Subsection A.* Retrieved from Regulation and Guidance: https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning/regulations-guidance

Department of Homeland Security, Federal Emergency Managemetn Agency. (N.d.). *Emergency Support Function #1 - Transportation*. Retrieved from Emergency Support Functions: https://www.fema.gov/emergency-managers/national-

preparedness/frameworks/response#esf
Harvey, A., & Peterson, G. (1998). *Water-Induced Landslide Hazards, Western Portion of the Salem Hills, Marion County, Oregon*. Retrieved from Oregon Department of Geology and Mineral Industries: https://www.oregongeology.org/pubs/ims/IMS-006.pdf
Hemesath, L., Nunez, T., Roth, B., Burgoyne, C., & La Follette, C. (2002, January). *Pringle, Glenn-Gibson, Claggett and Mill Creeks Watershed Assessment*. Retrieved from Pringle Creek Watershed Council: http://pringlecreek.watershedcouncils.net/CoverTitleTOC.pdf
Hubbard Rural Fire Protection District. (2022, April 6). *Hubbard Fire*. Retrieved from Hubbard Fire District: https://www.hubbardfire.com/hubbard-fire-district-overview/
Marion County, Oregon. (2022, October). *Marion County Comprehensive Land Use Plan*. Retrieved from Marion County Code: https://www.codepublishing.com/OR/MarionCounty/#!/MarionCompNT.html
Mileti, D. (1999). *Disasters by Design: A Reassessment of Natural Hazards in the United States.* The National Academics Press.
National Oceanic and Atmospheric Administration. (N.d.). *Storm Event Database*. Retrieved from NOAA.gov: https://www.ncdc.noaa.gov/stormevents/
Oregon Century Farm and Ranch Program. (N.d.). *Honorees*. Retrieved from Oregon Farm Bureau: https://centuryfarm.oregonfb.org/
Oregon Encyclopedia. (2022, September 22). *"City of Mt. Angel"*. Retrieved from A Prjoect of the Oregon Historical Society: https://www.oregonencyclopedia.org/articles/city_of_mt_angel/#.Y-AZpy_MK3B
Phillp Williams & Associates. (2000, January 18). *Silver Creek Dam Break Analysis*. Retrieved from City of Silverton: http://www.97381.com/dam/dam01.html
Portland State University, Population Research Center. (2021). *Coordinated Population Forecast for Marion County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2021-2071*. Retrieved from https://pdxscholar.library.pdx.edu/opfp/60/
Salem-News. (2008, February 5). *Oregon National Guard Aids Detroit and Idanha Communities*. Retrieved from Salem-News.com: http://salem-news.com/articles/february052008/guard_detroit_2-5-08.php
State of Oregon, Business Oregon. (2022). *Distressed Counties, 2022*. Retrieved from Distressed Areas in Oregon: https://www.oregon.gov/biz/reports/Pages/DistressedAreas.aspx
State of Oregon, Department of Emergency Management. (2016, January). *Drought Annex*. Retrieved from State of Oregon Emeregncy Operations Plan: https://www.oregon.gov/oem/Documents/2015_OR_EOP_IA_01_drought.pdf
State of Oregon, Department of Emergency Management. (N.d.). *Volume I - Natural Hazard Mitigation Plan (NHMP)*. Retrieved from Comprhensive Emergency Management Plan: https://www.oregon.gov/oem/emresources/Plans_Assessments/Pages/CEMP.aspx
State of Oregon, Department of Land Conservation and Development. (N.d.). *Goal 7: Areas Subject to Natural Disasters and Hazards*. Retrieved from Oregon.gov: https://www.oregon.gov/lcd/OP/Pages/Goal-7.aspx
State of Oregon, Employment Department. (2022). *Mid-Valley Local Labor, Regional Herfindahl Index Scores*. Retrieved from State of Oregon Employment Department: https://www.qualityinfo.org/mid-valley
State of Oregon, Oregon Housing & Community Services. (N.d.). *Local Innovation and Task Force (LIFT) Housing Development*. Retrieved from Bond Financing & Loans: https://www.oregon.gov/ohcs/development/Pages/bond-financing-loans.aspx

State of Oregon, Oregon Water Resources Department. (N.d.). *Drought Declarations*. Retrieved from Oregon.gov: https://apps.wrd.state.or.us/apps/wr/wr_drought/declaration_status_report.aspx
Taylor, G., Hatton, R. R., & Taylor, G. H. (1999). *The Oregon Weather Book: A State of Extremes.* Oregon State University Press.
Taylor, G., Hatton, R., & Taylor, G. H. (n.d.). The Oregon Weather Book: A State of Extremes. Oregon State University Press.
Turner Fire District. (2018). *About*. Retrieved from Turner Fire District: https://www.turnerfire.com/
U.S Department of Housing and Urban Development. (2020). *Consolidated Planning / CHAS Data*. Retrieved from Dataset: https://www.huduser.gov/PORTAL/datasets/cp.html#2000
U.S. Army Corps of Engineers. (2020). *Dams of The Nation*. Retrieved from National Inventory of Dams: https://nid.usace.army.mil/#/
U.S. Census. (2020). *Detroit City, Oregon*. Retrieved from U.S. Census: https://data.census.gov/profile?g=1600000US4119100
U.S. Census Bureau. (2020). *Housing*. Retrieved from Selected Housing Characteristics: 2020 American Community Survey 5-Year Estimates: https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047
U.S. Census Bureau. (2020). *Marion County, Oregon*. Retrieved from U.S. Census Bureau : https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047
U.S. Census Bureau. (2020). *Physical Housing Characteristics for Occupied Housing Units* . Retrieved from American Community Survey 5-Year Estimates: https://data.census.gov/profile/Marion_County,_Oregon?g=0500000US41047
U.S. Census Bureau. (2021). *Selected Economic Characteristics*. Retrieved from American Community Survey: https://data.census.gov/table?q=Marion+County,+Oregon+Employment&tid=ACSDP1Y2021.DP03
U.S. Census Bureau. (2022, December 8). *American Community Survey 5-Year Data (2009-2021)*. Retrieved from U.S. Census Bureau: https://www.census.gov/data/developers/data-sets/acs-5year.html
U.S. Department of Commerce. (N.d). *Northwest River Forecase Center*. Retrieved from National Oceanic and Atmospheric Administration, National Weather Service: https://www.nwrfc.noaa.gov/rfc/
U.S. Department of Commerce, National Oceanic and Atmospheric Administration. (N.d). *Drought Conditions for Marion County*. Retrieved from Drought.gov: https://www.drought.gov/states/Oregon/county/Marion
U.S. Department of Commerce, National Oceanic and Atmospheric Administration. (2022, October). *Storm Events Database*. Retrieved from National Centers for Environmental Information: https://www.ncdc.noaa.gov/stormevents/
U.S. Department of Commerce, National Ocenanic and Atmospheric Administration. (N.d.). *Regional Climate Maps*. Retrieved from National Weather Service Climate Prediction Center: https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/
U.S. Department of Interior Geology Survey. (N.d.). *Modern Deformation and Uplift in the Sister Region*. Retrieved from Three Sisters: https://www.usgs.gov/volcanoes/three-sisters

U.S. Department of Interior, Geological Survey. (N.d.). *Volcanic Hazards at Mount St. Helens*. Retrieved from Mount St. Helens: https://www.usgs.gov/volcanoes/mount-st.-helens/volcanic-hazards-mount-st-helens

U.S. Department of Interior, Geology Survey. (N.d.). *Mount Hood*. Retrieved from Cascade Volcano Observatory - Volcanoes: https://www.usgs.gov/volcanoes/mount-hood

U.S. Department of Interior, Geology Survey. (N.d.). *Mount Rainer*. Retrieved from Cascades Volcano Observatory - Volcanoes: https://www.usgs.gov/volcanoes/mount-rainier

U.S. Department of Interior, Geology Survey. (N.d.). *Three Sisters*. Retrieved from Cascade Volcano Observatory - Volcanoes: https://www.usgs.gov/volcanoes/three-sisters

U.S. Department of the Interior, Geological Suvey. (2014, January 11). *The Christmas Flood of 1964*. Retrieved from USGS: https://www.usgs.gov/news/featured-story/christmas-flood-1964#:~:text=The%20Christmas%20flood%20of%201964%20was%20driven%20by,frozen%20ground%20caused%20extreme%20runoff%2C%20erosion%20and%20flooding.

U.S. National Parks. (N.d.). *National Register Forms*. Retrieved from National Register of Historic Places: https://www.nps.gov/subjects/nationalregister/national-register-forms.htm

United States Department of the Interior, Geological Survey. (N.d.). *Volcano Hazards*. Retrieved from USGS Programs: https://www.usgs.gov/programs/VHP

Wang, Y., & Burns, B. (2006). CASE HISTORY ON THE OREGON GO BOND TASK FORCE: PROMOTING. *8th National Earthquake Conference.* San Fransico, CA. Retrieved from https://www.oregongeology.org/rvs/EERI-GO-Bond-text.pdf





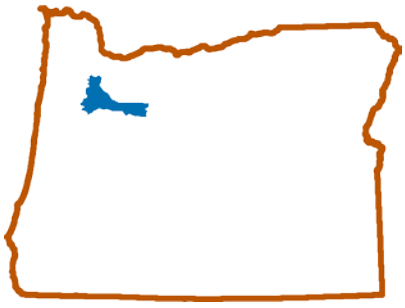


Marion County

MULTI-JURISDICTIONAL ALL- HAZARDS MITIGATION

PLAN VOLUME IV: DOGAMI REPORTS

- Marion County
- City of Aumsville
- City of Aurora
- City of Detroit
- City of Gervais
- City of Hubbard
- City of Idanha
- City of Jefferson
- City of Keizer
- Keizer Fire District



- City of Mill City
- City of Mt Angel
- Mt Angel Fire District
- City of Scotts Mills
- City of Stayton
- City of Sublimity
- City of Turner
- City of Woodburn/ Woodburn Fire District

FEMA

Effective Month X, 2022 through Month X, 2027

The 2022 Marion County Multi-Jurisdictional Hazards Mitigation Plan is a living document that will be reviewed and updated periodically to address the requirements contained in 44 CFR 201. It will be integrated with existing plans, policies, and programs. The Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved mitigation plan in order to receive federal funds for hazard mitigation grants. This plan meets those requirements as evidenced by FEMA approval which is effective per the cover date range of this plan.

Cover photos: (clockwise from top left): Marion County post-fire scene (2020); City of Detroit post-fire scene 10/20/2020; Tanker tipped on Hwy 22. Photos courtesy of Marion County.

Mission:

Create a more resilient Marion County by partnering with the whole community.

Comments, suggestions, corrections, and additions are encouraged to be submitted from all interested parties.

For further information and to provide comments, contact:

Kathleen Silva
Marion County Emergency Management
5155 Silverton Road NE
Salem, OR 97305
Phone: 503- 391-7294 (office)
Email: mcem@co.marion.or.us

Mike Hintz
Marion County Emergency Management
5155 Silverton Road NE
Salem, OR 97305
Phone: 503- 391-7294 (office)
Email: mcem@co.marion.or.us

Acknowledgements

The 2022 Marion County Hazard Mitigation Plan (HMP) update was conducted via a multi-jurisdictional partnership of Marion County and the Cities of Aumsville, Aurora, Detroit, Gates, Gervais, Hubbard, Idanha, Jefferson, Keizer, Mill City, Silverton, Stayton, Turner, and Woodburn, and the special districts of Keizer Fire District, Mt. Angel Fire District, and Woodburn Fire District.

2022 Marion County Hazards Mitigation Plan Steering Committee

Marion County
Adam Crateau, Alisa Zastoupil, Alyssa Schrems, Brandon Reich, Brian May, Brian Nicholas, Candace Jamison, Chris Eppley, Dain Thomas, Danielle Gonzalez, Dennis Mansfield, Eric Hlad, Kaylynn Gesner, Katrina Rothenberger, Kelly Weese, Jaden Emminger, Joaquin Ramos, Matt Knudsen, Matt Wilkinson, Scott Wilson

City of Aumsville
Matt Etzel, Richard Schmitz, Damian Flowers

City of Aurora
Stuart Rodgers, Mark Gunter

City of Detroit
Jim Trett, Kelly Galbraith, Christine Pavoni

City of Gervais
Susie Marston, Mark Chase

City of Hubbard
Melinda Olinger, Dave Rash

City of Idanha
Rebecca Stormer, Robyn Johnson, Mayor Rob Weikum

City of Jefferson
Sarah Cook, Kyle Ward

City of Keizer
Matt Ryes

City of Mill City
Gary Olson, Mayor Tim Kirsch

City of Mt. Angel
Mark Daniel

City of Scotts Mills
Robin Fournier, Paul Brakeman

City of Silverton
Jim Anglemier

City of Stayton
Alissa Angelo, Dave Frisendahl

City of Sublimity
Alan Frost, Jason Devine

City of Turner
Scott McClure, Don Taylor

City of Woodburn
Marty Pilcher, Andy Shadrin

Aumsville RFPD
Roy Hari, Brad McKenzie

Aurora RFPD
Joshua Williams, Mike Corless

Hubbard RFPD
Joe Budge, Michael Kahrmann

Jefferson Fire District
Levi Eckhardt

Keizer RFPD
Jeff Cowan

Marion County Fire District #1
Ron Lee, Sam Phillips

Woodburn Fire District
Joe Budge

Interested Parties

Cherriots
Randy Navalinski

Consumers Power
Jeff Carlson, Kelley Bruneau, Billy Terry

Linn County
Alyssa Boles, Ric Lentz

METCOM 911
John Thompson, Mark Spross

Pacific Gas & Electric
John Plechinger

Salem Electric
JB Phillips, Britni Davidson-Cruikshank

Salem Health
Christina Bunnell, Nathan Streight

Salem-Keizer School District
Ryan Mikesh

Santiam Hospital
Adam Maurer

Santiam Water Control District
Brett Stevenson

US Forest Service
Shawn Rivera, Duane Bishop

Agency Partners

Oregon Climate Change Research Institute (OCCRI)
Meghan Dalton, Erica Fleishman, Dominque Bachelet

Oregon Department of Geology and Mineral Industries (DOGAMI)
Matt C. Williams, Ian P. Madin

Federal Guidance and Review Team

Federal Emergency Management Agency Region X, Mitigation Division
Edgar Gomez

Oregon Department of Emergency Management (OEM)
Stephen Richardson, Joseph Murray, Jason Gately

Project Managers

Marion County
Kathleen Silva, Emergency Manager
Mike Hintz, Emergency Preparedness Coordinator

Oregon Department of Land Conservation and Development
Katherine Daniel, Natural Hazard Planner
Pamela Reber, Natural Hazard Planner
Tricia Sears, Natural Hazard Planner
Marian Lahav, Natural Hazards Mitigation Planning Program Coordinator

In 2019, the Department of Land Conservation and Development (DLCD) applied for and received a Pre-Disaster Mitigation grant PDMC-PL-10-OR-2019-005 from FEMA through the Oregon Department of Emergency Management (OEM) to assist Marion County.

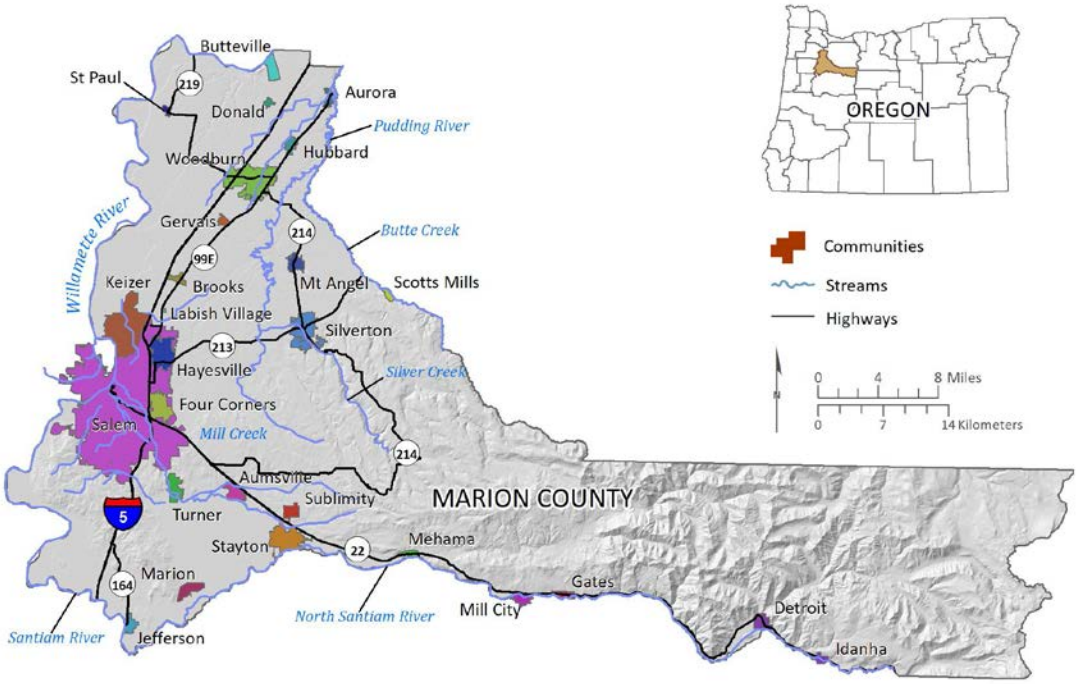
This page intentionally left blank.

State of Oregon
Oregon Department of Geology and Mineral Industries
Ruarri Day-Stirrat, State Geologist

OPEN-FILE REPORT O-22-05

MULTI-HAZARD RISK REPORT FOR MARION COUNTY, OREGON

INCLUDING THE CITIES OF AUMSVILLE, AURORA, DETROIT, DONALD, GATES, GERVAIS, HUBBARD, IDANHA, JEFFERSON, KEIZER, MILL CITY, MT. ANGEL, SALEM, SCOTTS MILLS, SILVERTON, ST. PAUL, STAYTON, SUBLIMITY, TURNER, AND WOODBURN AND THE UNINCORPORATED COMMUNITIES OF BROOKS, BUTTEVILLE, FOUR CORNERS, HAYESVILLE, LABISH VILLAGE, MARION, MEHAMA, AND WEST SALEM



by Matt C. Williams and Ian P. Madin

2022

DISCLAIMER

This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication.

Cover image: Study area of the Marion County Risk Report. Map depicts Marion County, Oregon and communities included in this report.

WHAT'S IN THIS REPORT?

This report describes the methods and results of natural hazard risk assessments for Marion County communities. The risk assessments can help communities better plan for disaster.



Expires: 6/30/23

Oregon Department of Geology and Mineral Industries Open-File Report O-22-05
Published in conformance with ORS 516.030

For additional information:
Administrative Offices
800 NE Oregon Street, Suite 965
Portland, OR 97232
Telephone (971) 673-1555
http://www.oregongeology.org
http://oregon.gov/DOGAMI/

TABLE OF CONTENTS

Executive Summary **1**

1.0 Introduction **3**

1.1 Purpose 3
1.2 Study Area 4
1.3 Project Scope 5
1.4 Previous Studies 7

2.0 Methods **7**

2.1 Hazus-MH Loss Estimation 8
2.2 Exposure 9
2.3 Building Inventory 10
2.4 Population 15

3.0 Assessment Overview and Results **16**

3.1 Earthquake 17
3.2 Flooding 21
3.3 Landslide Susceptibility 26
3.4 Channel Migration 29
3.5 Wildfire 32
3.6 Volcano Hazard – Lahar 35

4.0 Conclusions **38**

5.0 Limitations **40**

6.0 Recommendations **41**

6.1 Awareness and Preparation 41
6.2 Planning 41
6.3 Emergency Response 41
6.4 Mitigation Funding Opportunities 42
6.5 Hazard-Specific Risk Reduction Actions 42

7.0 Acknowledgments **43**

8.0 References **43**

9.1 Appendices **47**

Appendix A. Community Risk Profiles 48
Appendix B. Detailed Risk Assessment Tables 84
Appendix C. Hazus-MH Methodology 101
Appendix D. Acronyms and Definitions 107
Appendix E. Map Plates 109

LIST OF FIGURES

Figure 1-1. Study area: Marion County with communities in this study identified....5
Figure 2-1. 100-year flood zone and building loss estimates example in city of Salem, Oregon....9
Figure 2-2. Landslide susceptibility areas and building exposure example in the city of Mill City, Oregon....10
Figure 2-3. Example of building occupancy types, city of Mt. Angel, Oregon....11
Figure 2-4. Community building value in Marion County by occupancy class....13
Figure 2-5. Population by Marion County community....16
Figure 3-1. Mt. Angel Fault Mw-6.8 earthquake loss ratio by Marion County community....18
Figure 3-2. Mt. Angel deterministic Mw-6.8 earthquake loss ratio in Marion County, with simulated seismic building code upgrades....21
Figure 3-3. Flood depth grid example in the city of Turner, Oregon....23
Figure 3-4. Ratio of flood loss estimates by Marion County community....25
Figure 3-5. Landslide susceptibility exposure by Marion County community....28
Figure 3-6. Example diagram of the components of a channel migration zone (CMZ) map in Marion County, including the active channel (AC) in dark blue, historical migration area (HMA) in light blue, avulsion hazard area (AHA) with hatched lines, 30-year and 100-year erosion hazard areas (EHA) in dark and light green, flagged streambanks with yellow and orange lines, and CMZ boundary outlined in magenta (from Appleby and others, 2021).....30
Figure 3-7. Channel migration zone exposure by Marion County community.....31
Figure 3-8. Wildfire risk exposure by Marion County community....34
Figure 3-9. Lahar exposure by study area community....36

Figure C-1. Seismic design level by Marion County community....105

LIST OF TABLES

Table 1-1. Hazard data sources for Marion County 7
Table 2-1. Marion County building inventory 12
Table 2-2. Marion County critical facilities inventory 14

Table A-1. Unincorporated Marion County (rural) hazard profile 49
Table A-2. Unincorporated Marion County (rural) critical facilities 50
Table A-3. Unincorporated community of Brooks hazard profile 52
Table A-4. Unincorporated community of Brooks critical facilities 52
Table A-5. Unincorporated community of Butteville hazard profile 53
Table A-6. Unincorporated community of Four Corners hazard profile 54
Table A-7. Unincorporated community of Four Corners critical facilities 54
Table A-8. Unincorporated community of Hayesville hazard profile 55
Table A-9. Unincorporated community of Hayesville critical facilities 55
Table A-10. Unincorporated community of Labish Village hazard profile 56
Table A-11. Unincorporated community of Marion hazard profile 57
Table A-12. Unincorporated community of Marion critical facilities 57
Table A-13. Unincorporated community of Mehama hazard profile 58
Table A-14. Unincorporated community of Mehama critical facilities 58
Table A-15. City of Aumsville hazard profile 59
Table A-16. City of Aumsville critical facilities 59
Table A-17. City of Aurora hazard profile 60
Table A-18. City of Aurora critical facilities 60
Table A-19. City of Detroit hazard profile 61
Table A-20. City of Detroit critical facilities 61
Table A-21. City of Donald hazard profile 62
Table A-22. City of Donald critical facilities 62
Table A-23. City of Gates hazard profile 63
Table A-24. City of Gates critical facilities 63
Table A-25. City of Gervais hazard profile 64
Table A-26. City of Gervais critical facilities 64
Table A-27. City of Hubbard hazard profile 65
Table A-28. City of Hubbard critical facilities 65
Table A-29. City of Idanha hazard profile 66
Table A-30. City of Idanha critical facilities 66
Table A-31. City of Jefferson hazard profile 67
Table A-32. City of Jefferson critical facilities 67
Table A-33. City of Keizer hazard profile 68
Table A-34. City of Keizer critical facilities 68
Table A-35. City of Mill City hazard profile 69
Table A-36. City of Mill City critical facilities 69
Table A-37. City of Mt. Angel hazard profile 70
Table A-38. City of Mt. Angel critical facilities 70
Table A-39. City of Salem hazard profile 71

Table A-40. City of Salem critical facilities....72
Table A-41. City of Salem (West Salem) hazard profile....74
Table A-42. City of Salem (West Salem) critical facilities....75
Table A-43. City of Scotts Mills hazard profile....76
Table A-44. City of Scotts Mills critical facilities....76
Table A-45. City of Silverton hazard profile....77
Table A-46. City of Silverton critical facilities....77
Table A-47. City of St. Paul hazard profile....78
Table A-48. City of St. Paul critical facilities....78
Table A-49. City of Stayton hazard profile....79
Table A-50. City of Stayton critical facilities....79
Table A-51. City of Sublimity hazard profile....80
Table A-52. City of Sublimity critical facilities....80
Table A-53. City of Turner hazard profile....81
Table A-54. City of Turner critical facilities....81
Table A-55. City of Woodburn hazard profile....82
Table A-56. City of Woodburn critical facilities....83
Table B-1. Marion County building inventory....85
Table B-2. Earthquake loss estimates....87
Table B-3. Flood loss estimates....89
Table B-4. Flood exposure....91
Table B-5. Landslide exposure....93
Table B-6. Channel migration zone exposure....95
Table B-7. Wildfire exposure....97
Table B-8. Volcanic lahar - lahar exposure....99
Table C-1. Marion County seismic design level benchmark years....103
Table C-2. Seismic design level in Marion County....104

LIST OF MAP PLATES

Appendix E

Plate 1. Building Distribution Map of Marion County, Oregon 110
Plate 2. Population Density Map of Marion County, Oregon 111
Plate 3. Mt. Angel Fault Magnitude 6.8 Earthquake Shaking Map of Marion County, Oregon 112
Plate 4. Flood Hazard Map of Marion County, Oregon 113
Plate 5. Landslide Susceptibility Map of Marion County, Oregon 114
Plate 6. Channel Migration Hazard Map of Marion County, Oregon 115
Plate 7. Wildfire Hazard Map of Marion County, Oregon 116
Plate 8. Lahar Hazard Map of Marion County, Oregon 117

GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA

See the digital publication folder for files.
Geodatabase is Esri® version 10.7 format. Metadata are embedded in the geodatabase and are also provided as separate .xml format files.

Marion_County_Risk_Report_Data.gdb

Feature dataset: Asset_Data

feature classes:

- Building_footprints (polygons)
- Communities (polygons)
- UDF_points (points)

Metadata in .xml file format:

Each dataset listed above has an associated, standalone .xml file containing metadata in the Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata format

EXECUTIVE SUMMARY

This report was prepared for the communities of Marion County, Oregon, with funding provided by the Federal Emergency Management Agency (FEMA). It describes the methods and results of the natural hazard risk assessments performed in 2021 and 2022 by the Oregon Department of Geology and Mineral Industries (DOGAMI) within the study area. The purpose of this project is to provide communities with detailed risk assessment information to enable them to compare hazards and act to reduce their risk. The risk assessments contained in this project quantify the impacts of natural hazards to these communities and enhances the decision-making process in planning for disasters.

We arrived at our findings and conclusions by completing three main tasks for each community: compiling an asset database, identifying and using the best available hazard data, and performing natural hazard risk assessments.

- In the first task, we created a comprehensive asset database for the entire study area by synthesizing assessor data, U.S. Census information, FEMA Hazus®-MH general building stock information, and building footprint data. This work resulted in a single dataset of building points and their associated building characteristics. With these data we were able to represent accurate spatial locations and vulnerabilities on a building-by-building basis.
- The second task was to identify and use the most current and appropriate hazard datasets for the study area. Most of the hazard datasets used in this report were created by DOGAMI and were produced using high-resolution, lidar topographic data. Although not all the data sources used in the report provide complete, countywide information, each hazard dataset used was the best available at the time of the analysis.
- In the third task, we performed risk assessments using Esri® ArcGIS Desktop® software. We took two risk assessment approaches: (1) estimated loss (in dollars) to buildings from flood (recurrence intervals) and earthquake scenarios using the Hazus-MH methodology, and (2) calculated the number of buildings, their value, and associated populations exposed to earthquake, and flood scenarios, or susceptible to varying levels of hazard from landslides, channel migration, wildfire, and volcanic lahar.

The findings and conclusions of this report show the potential impacts of hazards in communities within Marion County. Earthquakes: Although earthquake damage will occur throughout the entire county, extensive damage and losses are more probable in the northeastern portion of the county near the Mt. Angel Fault and areas with liquefaction-prone soils. Our findings indicate that most of the critical facilities in the study area are at High risk from an earthquake. We used multiple Hazus-MH earthquake simulations to illustrate the potential reduction in earthquake damage through seismic retrofits. Flooding: Some communities in the study area have moderate risk from flooding and we found only a small percentage (<1%) of flood exposed buildings were elevated above the 100-year flood elevation. Landslides: Our analysis shows that areas with moderate to steep slopes or at the base of steep hillsides are at greatest risk from landslide hazards, such as along the North Santiam River, the communities of Mt. Angel and Scotts Mills, and southwestern portions of Salem. Channel migration zone hazards: Nearly 826 buildings along the Pudding River and Santiam and North Santiam Rivers were exposed to channel migration hazard. Wildfires: The wildfire hazard data used in this study were created prior to the unprecedented 2020 Labor Day Wildfires, however the results corresponded to the actual impacts of the 2020 Labor Day Wildfires in the county. Volcanic-lahar hazards: Lahar hazard is a potential risk and could have significant impact for areas and the communities along the North Santiam River.

The information presented in this report is designed to increase awareness of natural hazard risk, to support public outreach efforts, and to aid local decision-makers in developing comprehensive plans and natural hazard mitigation plans. This study can help emergency managers identify vulnerable critical facilities and develop contingencies in their response plans. The results of this study are designed to be used to help communities identify and prioritize mitigation actions that will improve community resilience.

Results were broken out for the following geographic areas:

- Unincorporated Marion County (rural)
- Community of Hayesville
- Community of Brooks
- Community of Marion
- City of Aumsville
- City of Detroit*
- City of Gates*
- City of Hubbard
- City of Jefferson
- City of Mill City*
- City of St. Paul
- City of Salem (West Salem)*
- City of Scotts Mills
- City of Sublimity
- City of Woodburn
- Community of Four Corners
- Community of Butteville
- Community of Labish Village
- Community of Mehama
- City of Aurora
- City of Donald
- City of Gervais
- City of Idanha
- City of Keizer
- City of Mt. Angel
- City of Salem
- City of Silverton
- City of Stayton
- City of Turner

*Portions of the cities of Detroit, Gates, and Mill City that were within Linn County are included in this report. The City of Salem that was within Polk County was examined individually and designated as City of Salem (West Salem).

Selected countywide results
Total buildings: 170,562
Total estimated building value: $62 billion

Mt. Angel Deterministic Magnitude 6.8 Earthquake Scenario
Red-tagged buildings[a]: 7,479
Yellow-tagged buildings[b]: 17,028
Loss estimate: $6.7 billion

100-year Flood Scenario
Number of buildings damaged: 2,552
Loss estimate: $126 million

Landslide Exposure (High and Very High-Susceptibility)
Number of buildings exposed: 7,470
Exposed building value: $2.7 billion

Channel Migration Zone (Erosion Hazard Area – 30-year):
Number of buildings exposed: 826
Exposed building value: $300 million

Wildfire Exposure (High and Moderate Risk):
Number of buildings exposed: 2,819
Exposed building value: $814 million

Lahar Exposure (1,000 to 15,000-year):
Number of buildings exposed: 1,789
Exposed building value: $415 million

[a]Red-tagged buildings are considered uninhabitable due to complete damage
[b]Yellow-tagged buildings are considered limited habitability due to extensive damage

1.1 INTRODUCTION

A natural hazard is an environmental phenomenon that can negatively impact humans, and risk is the likelihood that a hazard will result in harm. A natural hazard risk assessment analyzes and quantifies how different types of hazards could affect the built environment, population, and the cost of recovery, and identifies potential risk. Risk assessments are one basis for developing mitigation plans, strategies, and actions, so that steps can be taken to prepare for a potential hazard event.

Key Terms:

- *Vulnerability:* Characteristics that make people or assets more susceptible to a natural hazard.
- *Risk:* Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of a natural hazard.

Although previous multi-hazard risk studies have been completed (Burns and others, 2008), this is the first multi-hazard risk assessment analyzing individual buildings and the resident population in Marion County. It is therefore the most detailed and comprehensive analysis to date of natural hazard risk and provides a comparative perspective never before available. In this report, we describe our assessment results, which quantify the various levels of risk that each hazard presents to Marion County communities.

Marion County is situated in the northwestern part of Oregon in the Willamette Valley and is subject to natural hazards, including: earthquake, riverine flooding, landslides, channel migration, wildfire, and lahar. This region of the state is moderately to heavily developed, composed of dense urban areas transitioning to suburban development in unincorporated parts of the study. There are also large uninhabited areas where the county jurisdiction extents into the Cascade Mountains within national forestland. Where natural hazards have the potential to damage assets or harm people, the result is natural hazard risk. The primary goal of the risk assessment is to inform communities of the risk posed by various natural hazards and to be a resource for risk reduction actions.

1.2 Purpose

The purpose of this project is to help communities in the study area better understand their risk and increase resilience to earthquakes (including liquefaction and site amplification), riverine flooding, landslides, channel migration, and wildfire natural hazards that are present in their communities. This is accomplished by the best available, most accurate and, detailed information about these hazards to assess the number of people and buildings at risk.

The main objectives of this study are to:

- compile and/or create a database of critical facilities, tax assessor data, buildings, and population distribution data,
- incorporate and use existing data from previous geologic, hydrologic, and wildfire hazard studies,
- perform exposure and Hazus–based risk analysis, and
- share this report widely so that all interested parties have access to its information and data.

The body of this report describes our methods and results. Two primary methods (Hazus-MH and exposure), depending on the type of hazard, were used to assess risk. Results for each hazard type are reported on a countywide basis within each hazard section, and community based results are reported in detail in **Appendix A: Community Risk Profiles**. **Appendix B** contains detailed risk assessment tables. **Appendix C** is a more detailed explanation of the Hazus-MH methodology. **Appendix D** lists acronyms

and definitions of terms used in this report. **Appendix E** contains tabloid-size maps showing countywide hazard maps.

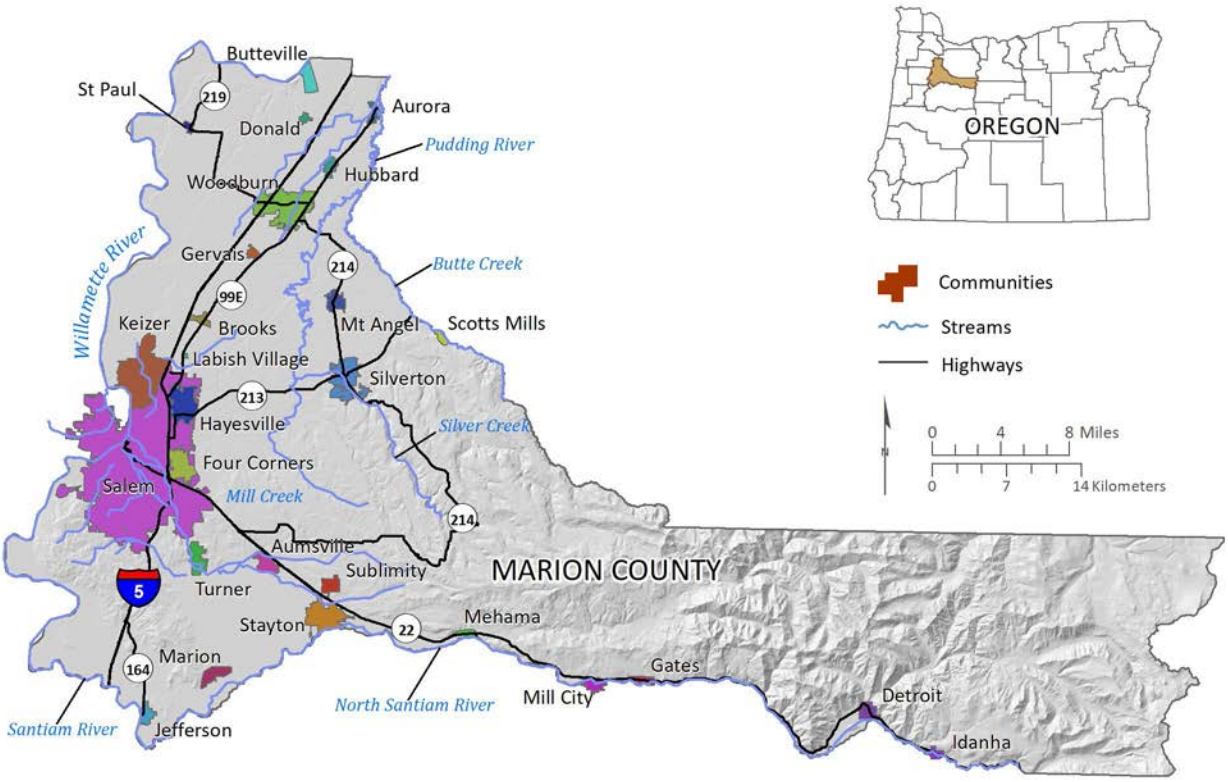
1.3 Study Area

The study area for this project includes the entirety of Marion County, Oregon. To make the report more functional, the study extent was expanded to include portions of the cities of Salem, Mill City, Gates, and Idanha that extend into neighboring counties (**Figure 1-1**). The study area is located in the northwestern portion of the state; the county is bordered by Clackamas County to the north, Wasco County and Jefferson County to the east, Linn County to the south, and Yamhill County and Polk County to the west. The entire western boundary of Marion County with Polk County and Yamhill County is defined by the Willamette River. The total area of Marion County is 3,070 square kilometers (1,184 square miles). Starting in the east, the study area transitions from timberland, to farmland, to suburbs, and then to urban development in the west.

The geography of the county's eastern half consists of the heavily forested Cascade Range. Mount Jefferson, a stratovolcano in the Cascade Range, is located at the southeastern corner of Marion County. The Willamette National Forest makes up a significant portion of the county's eastern half. The western half of the county transitions from the heavily forested mountains to gently rolling farmland and then onto the broad flat bottom of the Willamette Valley.

The population of the study area is approximately 349,000 based on an estimated population for each community in 2020 from the Portland State University (PSU) Population Research Center https://www.pdx.edu/population-research/population-estimate-reports. The study area includes the city of Salem, which is the state capital and the second-largest city in Oregon with a population of approximately 175,000. Most of the residents in the study area live in the western half of the county. The incorporated communities of the study area are Aumsville, Aurora, Detroit, Donald, Gates, Gervais, Hubbard, Idanha, Jefferson, Keizer, Mill City, Mt. Angel, St. Paul, Salem, Scotts Mills, Silverton, Stayton, Sublimity, Turner, and Woodburn (**Figure 1-1**). The portion of Salem that is within Polk County is included in this study and is designated as Salem (West Salem). Portions of the incorporated communities of Detroit, Gates, and Mill City that are within Linn County are included in this study. The unincorporated communities that were individually examined in this study were Brooks, Butteville, Four Corners, Hayesville, Labish Village, Marion, and Mehama.

Figure 1-1. Study area: Marion County with communities in this study identified.



1.4 Project Scope

For this risk assessment, we limited the project scope to buildings and population because of data availability, the strengths and limitations of the risk assessment methodology, and funding availability. We did not analyze impacts to the local economy, land values, infrastructure (transportation, power, water, gas, communication, and sewage), or the environment. Depending on the natural hazard, we used one of two methodologies: loss estimation or exposure. Loss estimation was modeled using methodology from Hazus®-MH (FEMA, 2012a, 2012b, 2012c), a tool developed by FEMA for calculating damage to buildings from flood and earthquake. Exposure is a simpler methodology, in which buildings are categorized based on their location relative to various hazard zones. To account for impacts on population (permanent residents only), 2010 U.S. Census data (U.S. Census Bureau, 2010a) was used to distribute people into residential structures on a census block basis. Permanent resident counts were then adjusted to current estimates from the PSU Population Research Center.

A critical component of this risk assessment is a countywide building inventory developed from building footprint data and the Marion County tax assessor database (acquired 2021). The other key component is a suite of datasets that represent the currently best available science for a variety of natural hazards. The geologic hazard scenarios were selected by DOGAMI staff based on their expert knowledge of the datasets; most datasets are DOGAMI publications. In addition to geologic hazards, we included wildfire hazard in this risk assessment. The following is a list of the risk assessment methodologies that were applied. See **Table 1-1** for data sources.

Earthquake Risk Assessment

- Hazus-MH loss estimation from a Mount Angel Fault magnitude (Mw) 6.8 scenario. Includes earthquake-induced or "coseismic" liquefaction, soil amplification class, and landslides.

Flood Risk Assessment

- Hazus-MH loss estimation to four recurrence intervals (10%, 2%, 1%, and 0.2% annual chance)
- Exposure to 1% annual chance recurrence interval

Landslide Risk Assessment

- Exposure based on Landslide Susceptibility Index and landslide deposit mapping (Low to Very High)

Wildfire Risk Assessment

- Exposure based on Overall Wildfire Risk (Low to High)

Channel Migration Risk Assessment

- Exposure based on the erosion hazard area—30-year (exposed, not exposed)

Volcanic Lahar Risk Assessment

- Exposure to three potential lahar scenarios (Small to Large)

Table 1-1. Hazard data sources for Marion County.

Hazard	Scenario or Classes	Scale/Level of Detail	Data Source
Earthquake	Mount Angel deterministic Mw-6.8	Countywide	FEMA (Hazus-MH 5.0 fault database)
- Coseismic landslide	Susceptibility – wet (3-10 hazard classes)	Statewide	DOGAMI (Madin and others, 2021)
- Coseismic liquefaction	Susceptibility (1-5 classes)	”	”
- Coseismic Soil amplification	NEHRP (A-F classes)	”	”
Flood	Depth Grids: 10% (10-yr) 2% (50-yr) 1% (100-yr) 0.2% (500-yr)	Countywide	DOGAMI (Appleby and others, 2021) – derived from FEMA (2019) data
Landslide	Susceptibility (Low, Moderate, High, Very High)	Statewide, Countywide	DOGAMI (Burns and others, 2016), DOGAMI (Calhoun and others, 2020)
Channel Migration	Susceptibility (Not Exposed, Exposed)	Pudding and North Santiam Rivers and tributaries	DOGAMI (Appleby and others, 2021)
Wildfire	Overall Wildfire Risk (Low, Moderate, High)	Regional (Pacific Northwest, US)	ODF (Gilbertson-Day and others, 2018)
Lahar	Size and frequency: Small (100 to 1,000-year) Medium (1,000 to 15,000-year) Large (>15,000-year)	Mount Jefferson and surrounding areas	USGS (Walder and others, 1999)

1.5 Previous Studies

Wang (1998) used Hazus-MH to estimate the impact from a Mw-8.5 Cascadia Subduction Zone (CSZ) earthquake scenario on the state of Oregon. The results of that study were arranged into individual counties. Marion County was estimated to experience a 3.5% loss ratio in the Mw-8.5 CSZ scenario (Wang, 1998).

Burns and others (2008) developed earthquake and landslide hazard maps and used Hazus-MH to estimate future earthquake damage for the Mid/Southern Willamette Valley which included Marion County. The earthquake scenarios used in the Hazus-MH analysis were the Mt. Angel Fault, magnitude (Mw) 6.9 and the CSZ, Mw-9.0. Both scenarios aggregated results at the census tract level using the default Hazus-MH general building stock database. Estimated loss ratios for Marion County were 43% for the Mt. Angel Fault and 25% for the CSZ scenarios.

We did not compare the results of this projects with the results of these previous studies because the level of detail and accuracy of the building information and site-specific earthquake inputs were not comparable. Comparative analysis was not part of the scope of this project.

2.1 METHODS

Where there is interaction between people and natural hazards there is risk. We used a quantitative approach through two modes of analysis, Hazus-MH loss estimation and exposure, to assess the level of risk to buildings and people from natural hazards.

2.2 Hazus-MH Loss Estimation

According to FEMA (FEMA, 2012a, p. 1-1), "Hazus provides nationally applicable, standardized methodologies for estimating potential wind, flood, and earthquake losses on a regional basis. Hazus can be used to conduct loss estimation for floods and earthquakes […]. The multi-hazard Hazus is intended for use by local, state, and regional officials and consultants to assist mitigation planning and emergency response and recovery preparedness. For some hazards, Hazus can also be used to prepare real-time estimates of damages during or following a disaster."

Key Terms:

- *Loss estimation:* Damage in terms of value that occurs to a building in an earthquake or flood scenario, as modeled with Hazus-MH methodology. This is measured as the cost to repair or replace the damaged building in US dollars.
- *Loss ratio:* Percentage of estimated loss relative to the total value.

Hazus-MH can be used in different modes depending on the level of detail required. Given the high spatial precision of the building inventory data and quality of the natural hazard data available for this study, we chose the user-defined facility (UDF) mode. This mode makes loss estimations for individual buildings relative to their "cost," which we then aggregate to the community level to report loss ratios. Cost used in this mode are associated with rebuilding using new materials, also known as replacement cost. Replacement cost is determined using a method called RSMeans valuation (Charest, 2017) and is calculated by multiplying the building area (in square feet) by a standard cost per square foot. These standard rates per square foot are in tables within the default Hazus-MH database.

Damage functions are at the core of Hazus-MH. The damage functions stored within the Hazus-MH data model were developed and calibrated from the observed results of past disasters. We estimated damage and loss by intersecting building locations with natural hazard layers and applying damage functions based on the hazard severity (e.g., depth of flooding) and building characteristics (e.g., first floor height). **Figure 2-1** illustrates the range of building loss estimates from Hazus-MH flood analysis by showing the percentage of building loss from flood and in some cases (in yellow) where a building's first floor height is above the level of flooding.

We used Hazus-MH version 5.0 (FEMA, 2021), which was the latest version available when we began this risk assessment.

Figure 2-1. 100-year flood zone and building loss estimates example in city of Salem, Oregon.

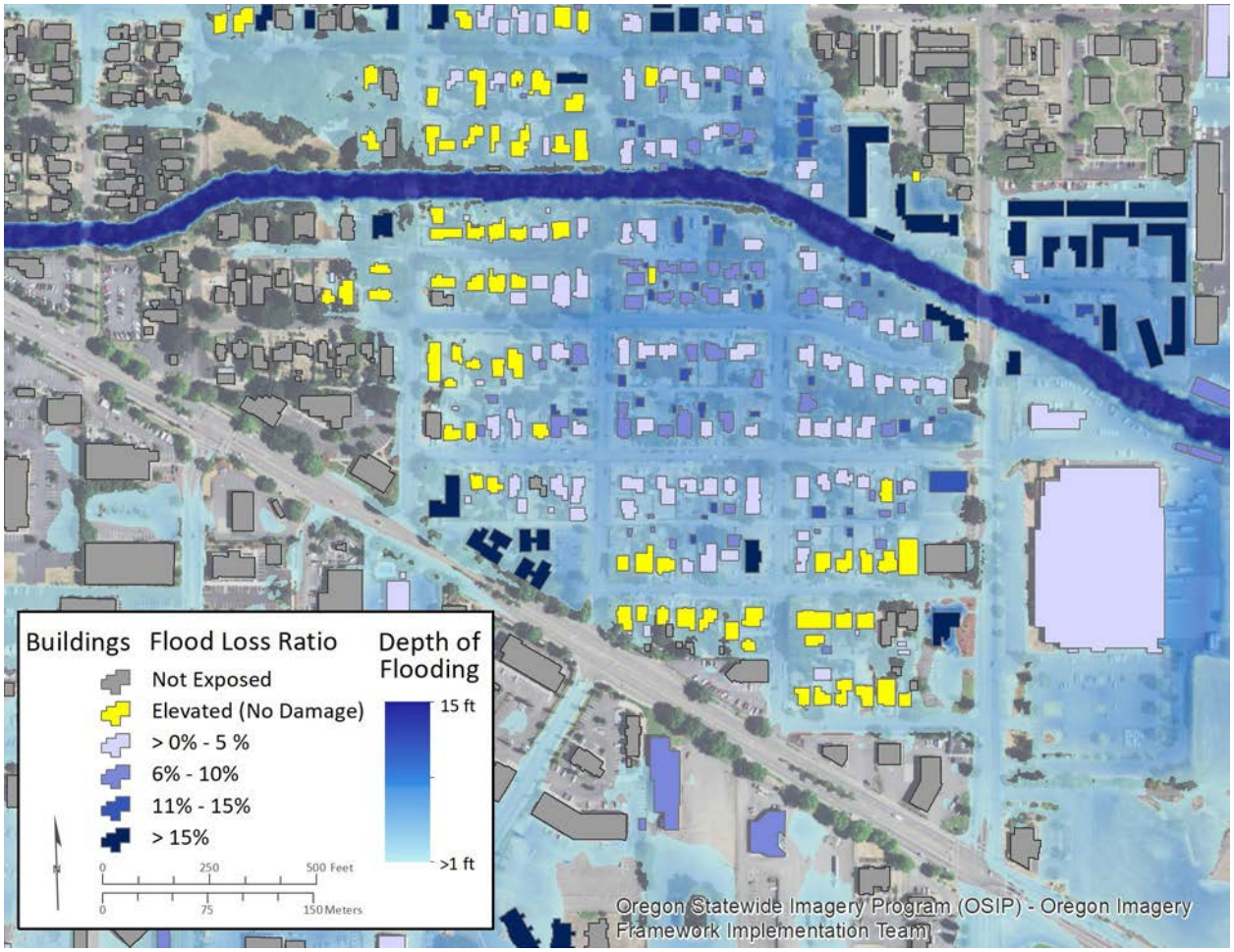


Image source: Oregon Statewide Imagery Program, 2018

Depth grid: Derived from the effective FEMA Flood Insurance Rate Map data for Marion County, 2019

2.3 Exposure

Since loss estimation using Hazus-MH is not available for all types of hazards, we used exposure analysis to assess the level risk for Marion County for landslide, channel migration, wildfire, and lahar hazards. Exposure methodology identifies the buildings and population that are within a particular natural hazard zone. This is an alternative for natural hazards that do not have available damage models like those in Hazus. It provides a way to easily quantify what is and what is not threatened. Exposure results are communicated in terms of total building value exposed, rather than a loss estimate. For example, **Figure 2-2** shows buildings that are exposed to different areas of landslide susceptibility where building footprints are colored based on what susceptibility zone the center of the building is within.

Key Terms:

- *Exposure:* Determination of whether a building is within or outside of a hazard zone. No loss estimation is modeled.
- *Building value:* Total monetary value of a building. This term is used in the context of exposure.

Exposure is used for landslide, wildfire, channel migration, and volcanic lahar. For comparison with loss estimates, exposure is also used for the 1% annual chance flood.

Figure 2-2. Landslide susceptibility areas and building exposure example in the city of Mill City, Oregon.

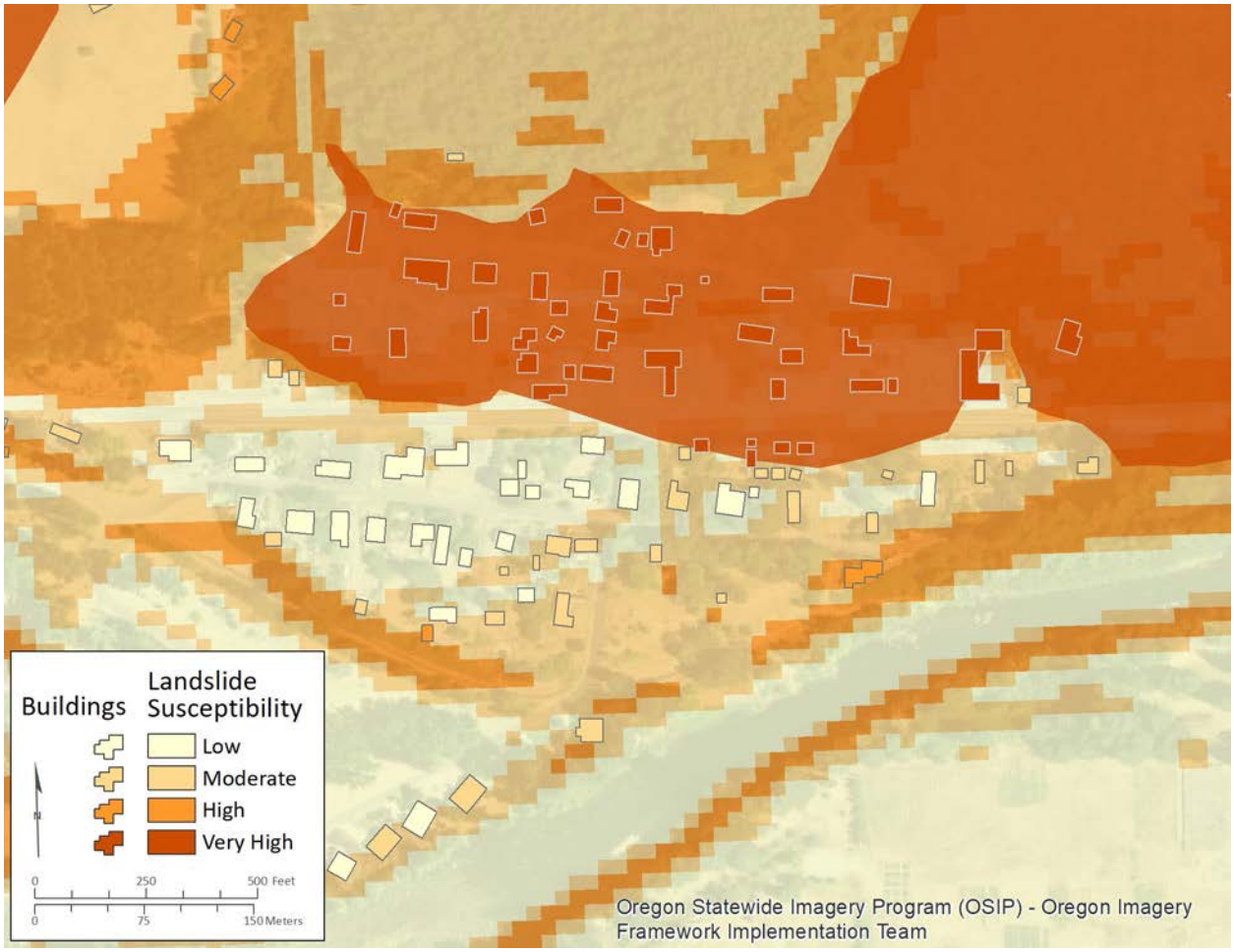


Image source: Oregon Statewide Imagery Program, 2018

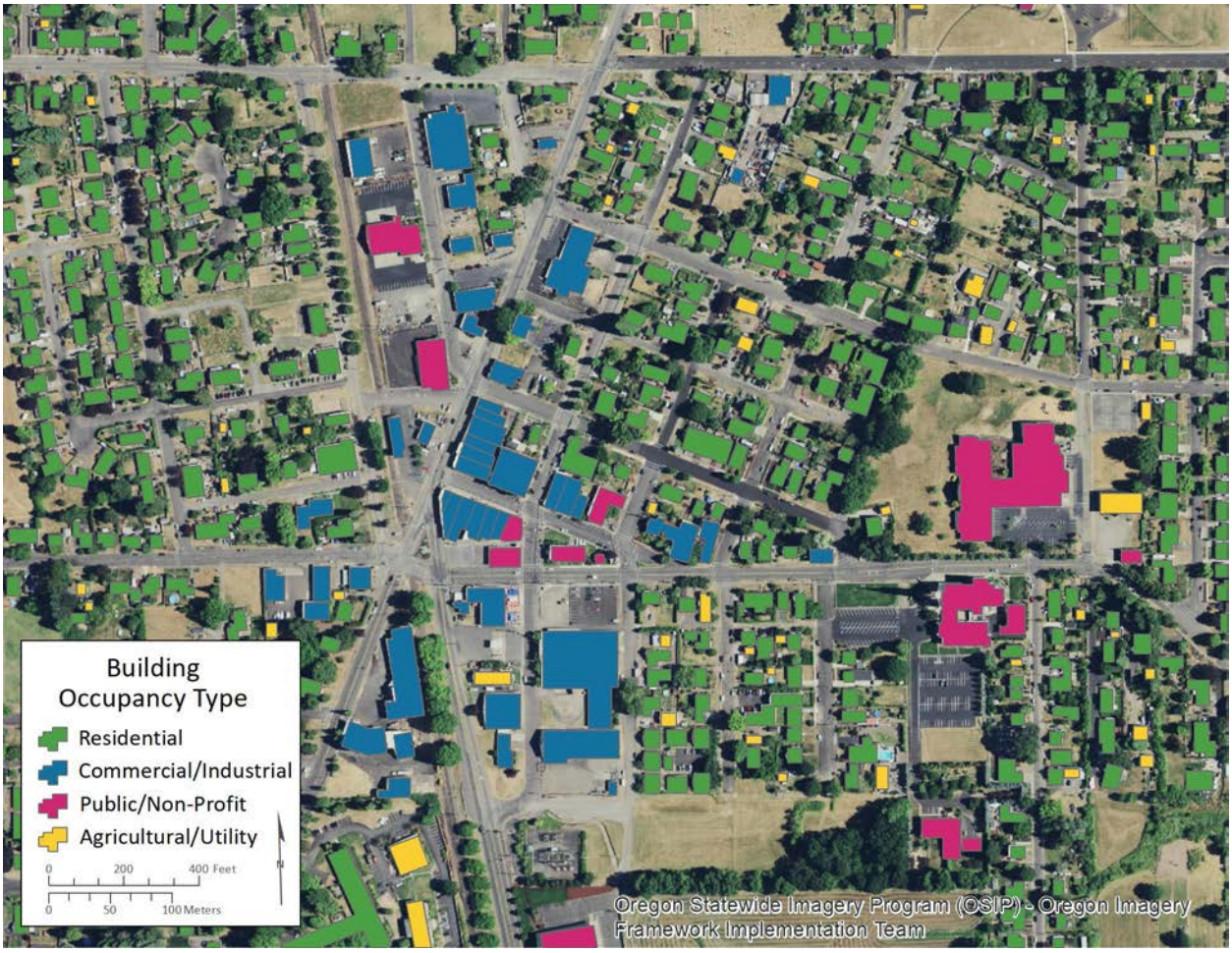
Landslide data source: Landslide susceptibility overview map of Oregon, (Burns and others, 2016)

2.4 Building Inventory

A key piece of the risk assessment is the countywide building inventory. This inventory consists of all buildings larger than 9.3 square meters (100 square feet), as determined from existing building footprints (Williams, 2021). **Figure 2-3** shows an example of building inventory occupancy types used in the Hazus-MH and exposure analyses in Marion County. See also **Appendix B: Table B-1** and **Appendix E**: **Plate 1** and **Plate 2.**

To use the building inventory within the Hazus-MH methodology, we converted the building footprints to points and migrated them into a UDF database with standardized field names and attribute domains. The UDF database formatting allows for the correct damage function to be applied to each building. Hazus-MH version 2.1 technical manuals (FEMA, 2012a, 2012b, 2012c) provide references for acceptable field names, field types, and attributes. The fields and attributes used in the UDF database (including building seismic codes) are discussed in more detail in **Appendix C.2.2**.

Figure 2-3. Example of building occupancy types, city of Mt. Angel, Oregon.



The distribution of building count and value per community in Marion County ranges from 159 buildings and $35 million for Idanha to 58,163 buildings and $22.5 billion for Salem (**Table 2-1**). A table detailing the occupancy class distribution by community is included in **Appendix B: Detailed Risk Assessment Tables**.

Table 2-1. Marion County building inventory.

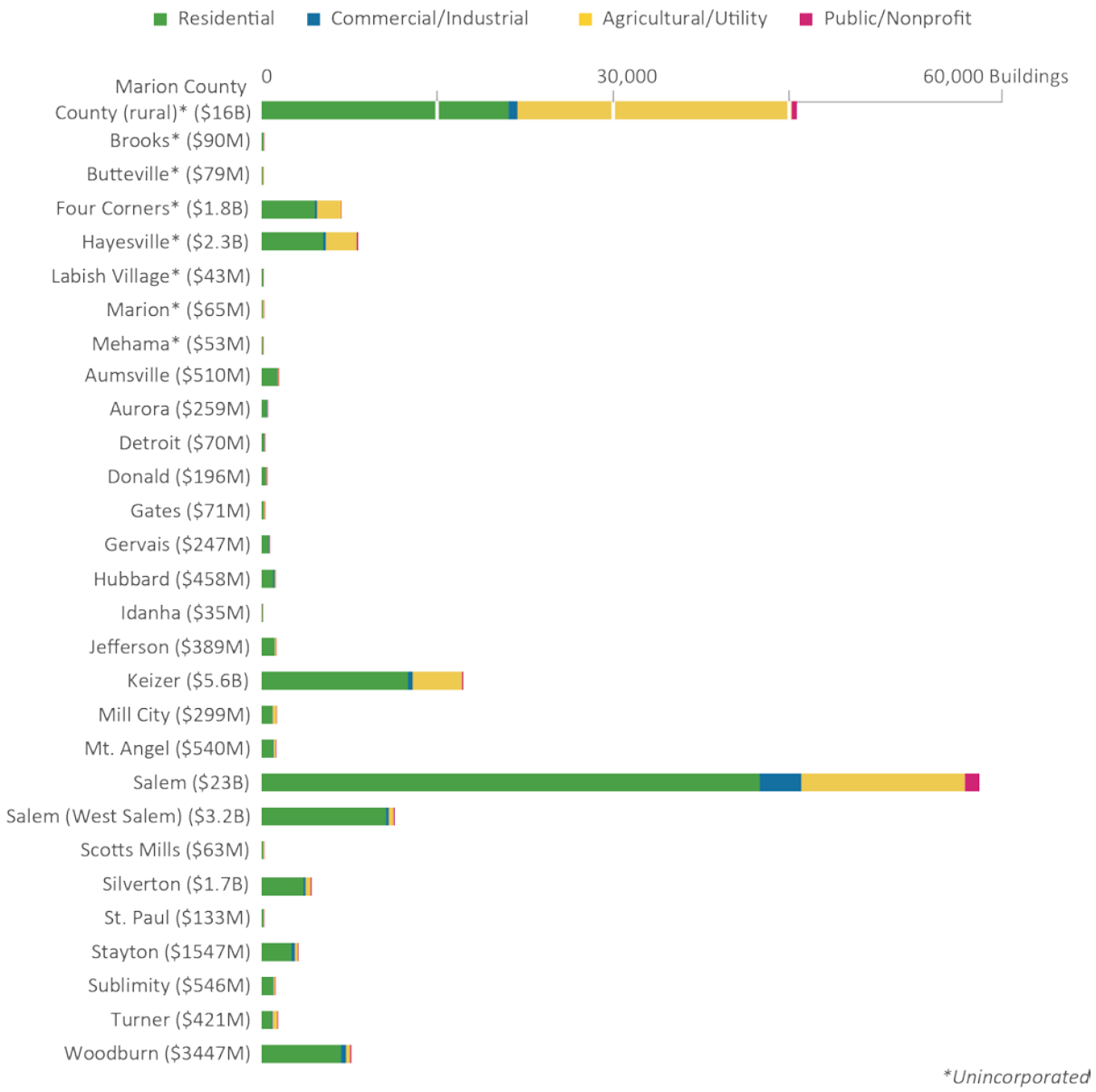
Community	Total Number of Buildings	Percentage of Total Buildings	Estimated Total Building Value ($)	Percentage of Total Building Value
Unincorp. Marion Co (rural)	43,387	25.4%	16,042,238,000	26%
Brooks	249	0.1%	89,505,000	0.1%
Butteville	193	0.1%	78,691,000	0.1%
Four Corners	6,508	3.8%	1,801,596,000	2.9%
Hayesville	7,876	4.6%	2,382,452,000	3.8%
Labish Village	167	0.1%	43,407,000	0.1%
Marion	244	0.1%	64,728,000	0.1%
Mehama	189	0.1%	53,460,000	0.1%
Total Unincorporated County	58,813	34.5%	20,556,077,000	33%
Aumsville	1,459	0.9%	509,635,000	0.8%
Aurora	560	0.3%	258,763,000	0.4%
Detroit	315	0.2%	69,925,000	0.1%
Donald	490	0.3%	195,528,000	0.3%
Gates	326	0.2%	71,352,000	0.1%
Gervais	719	0.4%	247,297,000	0.4%
Hubbard	1,187	0.7%	458,199,000	0.7%
Idanha	159	0.1%	35,338,000	0.1%
Jefferson	1,243	0.7%	389,441,000	0.6%
Keizer	16,380	9.6%	5,592,798,000	8.9%
Mill City	1,269	0.7%	299,237,000	0.5%
Mt. Angel	1,219	0.7%	539,815,000	0.9%
Salem	58,163	34.1%	22,532,083,000	36%
Salem (West Salem)	10,797	6.3%	3,194,904,000	5.1%
Scotts Mills	242	0.1%	63,043,000	0.1%
Silverton	4,077	2.4%	1,740,060,000	2.8%
St. Paul	247	0.1%	132,631,000	0.2%
Stayton	3,043	1.8%	1,546,547,000	2.5%
Sublimity	1,157	0.7%	546,449,000	0.9%
Turner	1,365	0.8%	421,185,000	0.7%
Woodburn	7,332	4.3%	3,446,910,000	5.5%
Total Study Area	170,562	100%	62,847,216,000	100%

The building inventory was developed from a building footprints dataset developed in 2021 called the Statewide Building Footprints for Oregon, release 1 (SBFO-1) (Williams, 2021). The SBFO-1 data of Marion County was modified from a building footprints dataset maintained by the city of Salem (obtained June 2020). The building footprints provide a spatial location and 2D representation of a structure. The total number of buildings within the study area was 170,562.

Marion County supplied assessor data and we formatted them for use in the risk assessment. The assessor data contains an array of information about each improvement (i.e., building). Tax lot data, which contains property boundaries and other information regarding the property, were obtained from the county assessor and were used to link the buildings with assessor data. The linkage between the two datasets resulted in a database of UDF points that contain attributes for each building. These points are used in the risk assessments for both loss estimation and exposure analysis. The majority of buildings are

within the jurisdictions of the unincorporated county, Salem, and Keizer, and the most common building usage in the study area is residential (**Figure 2-4**).

Figure 2-4. Community building value in Marion County by occupancy class.



Critical facilities are important to note because these facilities play a crucial role in emergency response efforts. We embedded identifying characteristics into the critical facilities in the UDF database so they could be highlighted in the results. Critical facilities data came from the DOGAMI Statewide Seismic Needs Assessment (SSNA; Lewis, 2007). We updated the SSNA data by reviewing Google Maps™ data. The critical facilities we identified include hospitals, schools, fire stations, police stations, emergency operations, and military facilities. In addition, we included other buildings based on specific community input and structures that would be essential during a natural hazard event, such as public works and

water treatment facilities. Communities that have critical facilities that can function during and immediately after a natural disaster are more resilient than those with critical facilities that are inoperable after a disaster. Critical facilities are present throughout the county with most in unincorporated county and Salem (**Table 2-2**). Critical facilities are listed for each community in **Appendix A**.

Table 2-2. Marion County critical facilities inventory.

	Hospital & Clinic		School		Police/Fire		Emergency Services		Military		Other*		Total	
Community	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)
						(all dollar amounts in thousands)								
Uninc Marion Co (rural)	0	0	32	222,199	17	26,342	1	3,645	0	0	8	110,070	58	362,256
Brooks	0	0	2	10,380	0	0	0	0	0	0	0	0	2	10,380
Butteville	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Four Corners	0	0	3	37,353	0	0	0	0	0	0	0	0	3	37,353
Hayesville	0	0	6	60,750	1	2,994	0	0	0	0	0	0	7	63,744
Labish Village	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marion	0	0	0	0	1	306	0	0	0	0	0	0	1	306
Mehama	0	0	0	0	1	791	0	0	0	0	0	0	1	791
Total Uninc. County	0	0	43	330,682	20	30,433	1	3,645	0	0	8	110,070	72	474,830
Aumsville	0	0	2	38,868	2	4,462	0	0	0	0	1	1,071	5	44,401
Aurora	0	0	0	0	2	2,918	0	0	0	0	0	0	2	2,918
Detroit	0	0	0	0	1	473	0	0	0	0	0	0	1	473
Donald	0	0	0	0	1	1,430	0	0	0	0	0	0	1	1,430
Gates	0	0	0	0	1	1,227	0	0	0	0	0	0	1	1,227
Gervais	0	0	2	43,279	0	0	0	0	0	0	1	1,697	3	44,976
Hubbard	0	0	0	0	2	3,754	0	0	0	0	1	336	3	4,090
Idanha	0	0	0	0	1	760	0	0	0	0	0	0	1	760
Jefferson	0	0	1	11,888	1	1,657	0	0	0	0	0	0	2	13,545
Keizer	1	4,557	12	163,943	3	25,017	0	0	0	0	0	0	16	193,517
Mill City	0	0	2	24,319	1	2,319	0	0	0	0	0	0	3	26,638
Mt. Angel	1	891	3	37,489	2	3,671	0	0	0	0	1	837	7	42,888
Salem	7	148,614	53	750,052	10	47,524	1	19,038	4	33,228	5	236,483	80	1,234,939
Salem (West Salem)	1	2,578	9	145,936	2	2,694	0	0	0	0	0	0	12	151,208
Scotts Mills	0	0	1	5,687	1	1,742	0	0	0	0	0	0	2	7,429
Silverton	5	32,651	5	100,286	2	6,532	0	0	0	0	1	1,654	13	141,123
St. Paul	0	0	3	23,762	1	3,095	0	0	0	0	0	0	4	26,857
Stayton	1	16,142	6	93,544	2	9,115	1	2,238	0	0	2	4,840	12	125,879
Sublimity	0	0	2	9,733	1	2,557	0	0	0	0	1	717	4	13,007
Turner	0	0	1	7,729	2	4,980	0	0	0	0	0	0	3	12,709
Woodburn	5	32,796	10	153,206	3	16,683	0	0	0	0	1	1,452	19	204,137
Total Study Area	21	238,229	155	1,940,403	61	173,043	3	24,921	4	33,228	22	359,157	266	2,768,981

Note: Facilities with multiple buildings were consolidated into one building.

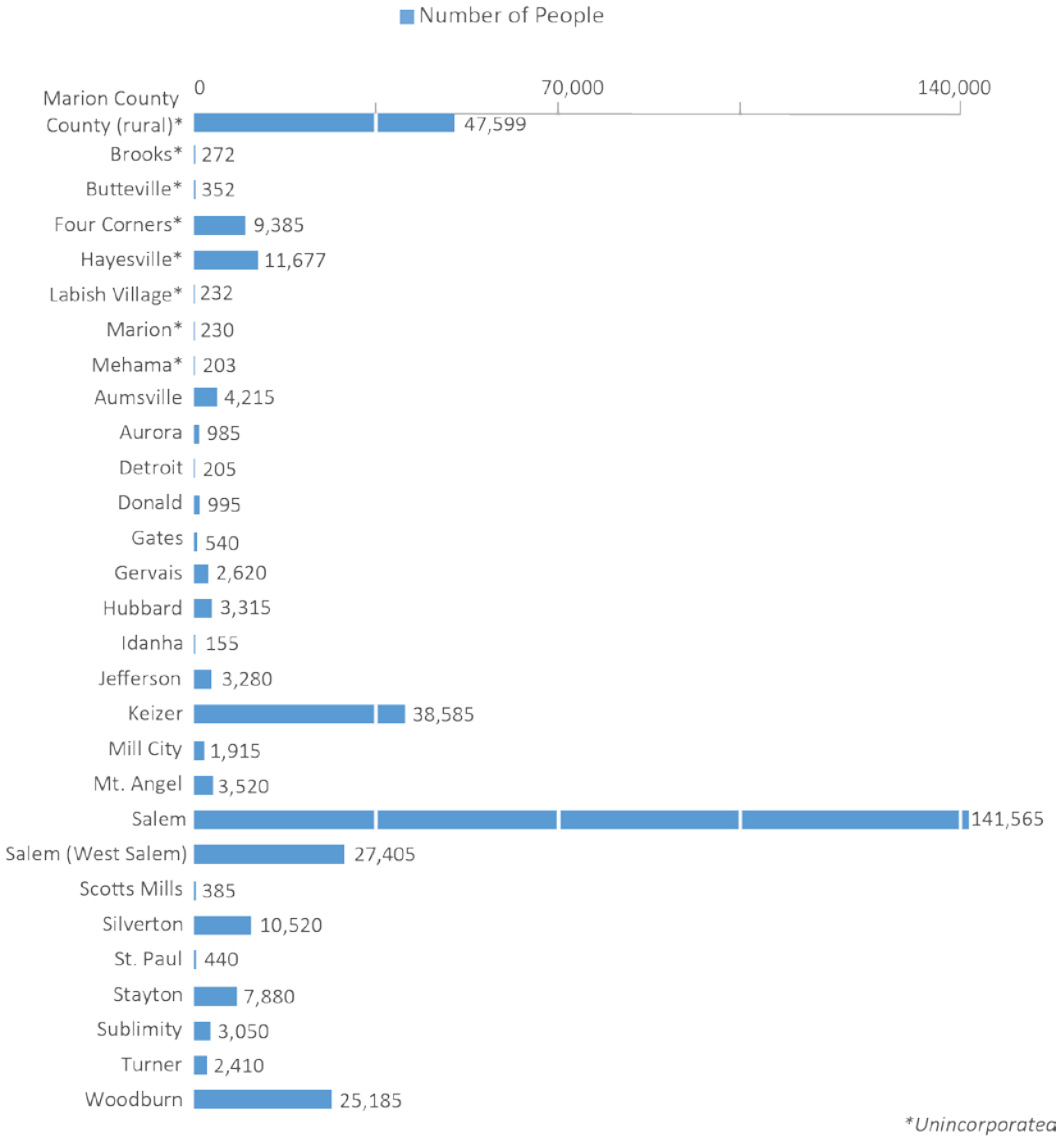
* Category includes buildings that are not traditional (emergency response) critical facilities but considered critical during an emergency based on input from local stakeholders (e.g., water treatment facilities or airports).

2.5 Population

One purpose of the UDF database design was so that we could estimate the number of people at risk from natural hazards. Within the UDF database, the population of permanent residents reported per census block was distributed among residential buildings and pro-rated based on building area derived from 2010 U.S. Census data. This census block-based distribution was further adjusted with the PSU Population Research Center estimates for 2021 (**Figure 2-5**). We did not examine the impacts of natural hazards on nonpermanent populations (e.g., tourists), whose total numbers fluctuate seasonally. Due to lack of information within the assessor and census databases, the distribution includes vacation homes, which in many communities make up a small portion of the residential building stock. From information reported in the 2010 U.S. Census regarding vacation rentals within the county, it is estimated that approximately 4% of residential buildings are vacation rentals in Marion County (U.S. Census Bureau, 2010b).

From the Census and PSU Population Research Center data, we assessed the risk of the 349,120 residents within the study area that could be affected by a natural hazard scenario. For each natural hazard, with the exception of the earthquake scenario, a simple exposure analysis was used to find the number of potentially displaced residents within a hazard zone. For the earthquake scenario the number of potentially displaced residents was based on residents in buildings estimated to be significantly damaged by the earthquake.

Figure 2-5. Population by Marion County community.



3.1 ASSESSMENT OVERVIEW AND RESULTS

In these risk assessments, we considered six natural hazards (earthquake, flood, landslide, wildfire, channel migration, and volcanic lahar) that pose a risk to Marion County. The assessment describes both localized vulnerabilities and the widespread challenges that impact all communities. While results of this risk assessment do not typically represent singular hazard events, they do quantify the potential overall level of risk present for assets and residents. The loss estimation and exposure results, as well as the rich dataset included with this report, can lead to greater understanding of the potential impact of disasters. Communities can become more resilient to future disasters by utilizing the results in plan updates and developing future action items for risk reduction.

In this section, results are presented for the entire study area. The study area includes all unincorporated areas and cities within Marion County. Individual community results are in **Appendix A: Community Risk Profiles.**

3.2 Earthquake

An earthquake is a sudden movement of rock on each side of a fault in the earth's crust, which abruptly releases strain that has accumulated. The movement along the fault produces waves of shaking that spread in all directions. If an earthquake occurs near populated areas, it may cause causalities, economic disruption, and extensive property damage (Madin and Burns, 2013).

Two earthquake-induced hazards, also called coseismic hazards, are liquefaction and landslides. Liquefaction occurs when saturated soils substantially lose bearing capacity due to ground shaking, causing the soil to behave like a liquid; this action can be a source of tremendous damage. Coseismic landslides are mass movement of rock, debris, or soil induced by ground shaking. All earthquake damages in this report include damages derived from shaking and from liquefaction and landslide factors.

3.2.1 Data sources

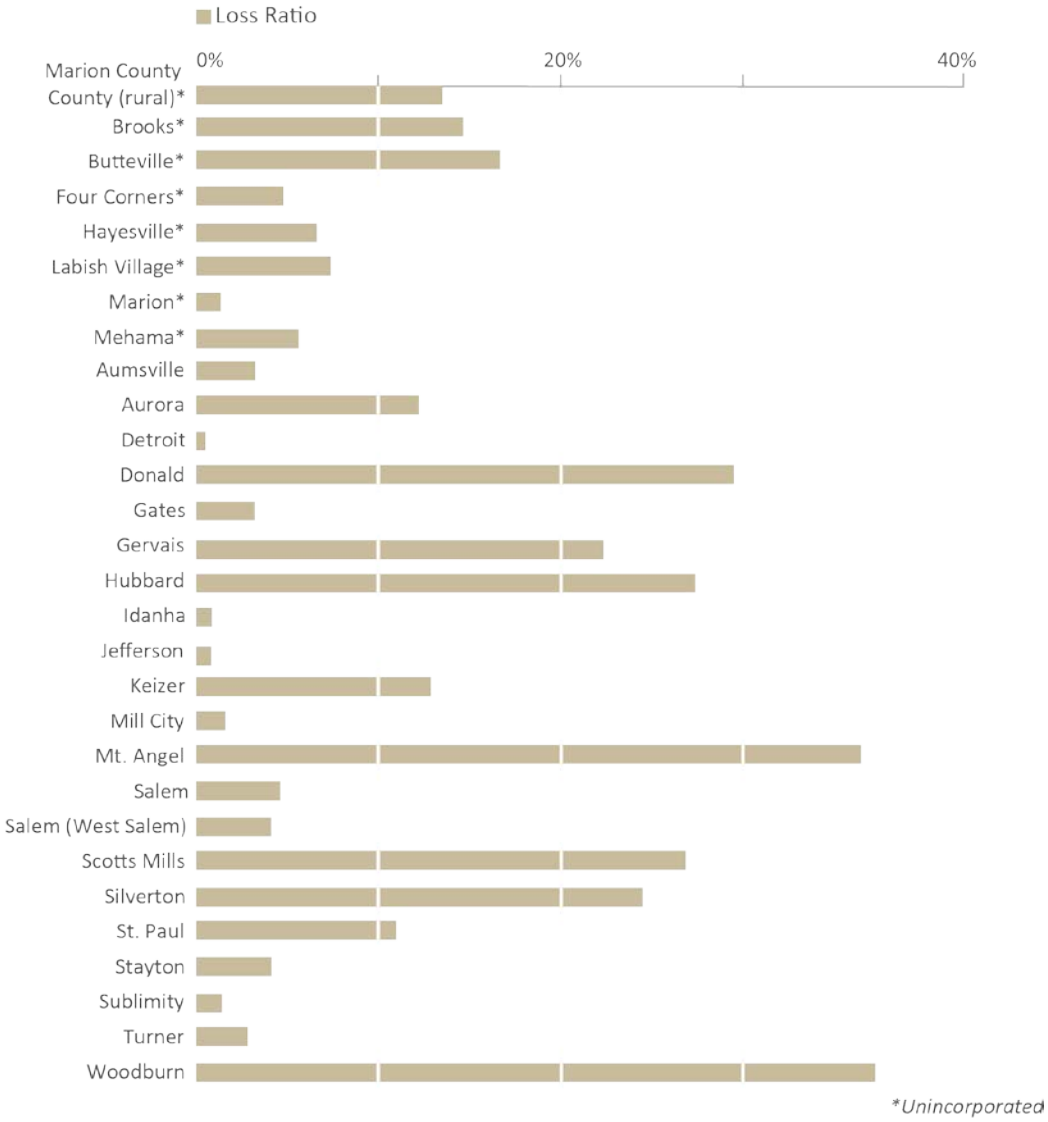
Hazus-MH offers two scenario methods for estimating loss from earthquake: probabilistic and deterministic (FEMA Hazus-MH, 2012b). A probabilistic scenario uses U.S. Geological Survey (USGS) National Seismic Hazard Maps, which are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions as a result of all possible earthquake sources (USGS, 2017). A deterministic scenario is based on a specific seismic event, such as a CSZ Mw-9.0 event. We used the deterministic scenario method for this study along with the UDF database so that loss estimates could be calculated on a building-by-building basis.

The Mt. Angel Fault is an active fault located near the cities of Mt. Angel, Woodburn, and Silverton. On March 25, 1993, a Mw-5.7 earthquake occurred with an epicenter approximately 5 kilometers (about 3 miles) east of the city of Scotts Mills, Oregon. Many buildings were damaged from the event, including the Capitol building in Salem. Many unreinforced masonry buildings in the area were significantly damaged due to intense shaking. The preliminary damage estimate was $28.4 million ($50 million in 2022) (Black, 1996).

The Mt. Angel Fault deterministic scenario was selected as the most appropriate for communicating earthquake risk for Marion County. We based this decision on several factors, such as previous Hazus-MH earthquake analyses in the region, location of the active fault relative to nearby structures, local familiarity from the 1993 event, and available seismic data. The default Hazus-MH database contained the location and orientation of the fault and provided a recommended magnitude for use in a simulated earthquake event.

The following hazard layers used for our loss estimation are derived from work conducted by Madin and others (2021): National Earthquake Hazard Reduction Program (NEHRP) soil classification, landslide susceptibility (wet), and liquefaction susceptibility. The liquefaction and landslide susceptibility layers were used by the Hazus-MH tool to calculate the probability and magnitude of permanent ground deformation caused by these factors. Hazus-MH uses a characteristic magnitude value to calculate the impacts of liquefaction and landslides. For this study, we followed the details provided in the default Hazus-MH database and used Mw-6.8 as the characteristic event.

Figure 3-1. Mt. Angel Fault Mw-6.8 earthquake loss ratio by Marion County community.



3.2.2 Countywide results

Because an earthquake can affect a wide area, it is unlike other hazards in this report—every building in Marion County, to some degree, will be shaken by a Mt. Angel Fault Mw-6.8 earthquake. Hazus-MH loss estimates (**Table B-2)** for each building are based on a formula where coefficients are multiplied by each of the five damage state percentages (none, low, moderate, extensive, and complete). These damage states are correlated to loss ratios that are then multiplied by the building dollar value to obtain a loss estimate (FEMA, 2012b). Loss estimates from the earthquake scenario described in this report vary widely by community in Marion County (**Figure 3-1**).

In keeping with earthquake damage reporting conventions, we used the ATC-20 post-earthquake building safety evaluation color-tagging system to represent damage states (Applied Technology Council, 2015). Red-tagged buildings correspond to a Hazus-MH damage state of "complete," which means the building is uninhabitable. Yellow-tagged buildings are in the "extensive" damage state, indicating limited

habitability. The number of red or yellow-tagged buildings we report for each community is based on an aggregation of the probabilities for individual buildings (FEMA, 2012b).

We considered critical facilities nonfunctioning if the Hazus-MH earthquake analysis showed that a building or complex of buildings had a greater than 50% chance of being at least moderately damaged (FEMA, 2012b). Because building specific information is more readily available for critical facilities and due to their importance after a disaster, we chose to report the results of these buildings individually.

The probability of damage state was determined by Hazus-MH earthquake analysis, and we reviewed the damage states in the results. The number of potentially displaced residents from an earthquake scenario described in this report was based on the formula: ([Number of Occupants] * [Probability of Complete Damage]) + (0.9 * [Number of Occupants] * [Probability of Extensive Damage]) (FEMA, 2012b). The probability of damage state was determined in the Hazus-MH earthquake analysis results.

Marion countywide Mt. Angel Fault Mw-6.8 earthquake results:

- Number of red-tagged buildings: 7,479
- Number of yellow-tagged buildings: 17,028
- Loss estimate: $6,671,977,000
- Loss ratio: 11%
- Non-functioning critical facilities: 85
- Potentially displaced population: 15,064

The results indicate that Marion County could incur moderate to significant losses (11%) due to a Mt. Angel Fault Mw-6.8 earthquake. These results are strongly influenced by proximity to the Mt. Angel Fault and ground deformation from liquefaction. The communities in the northeast part of the county (Gervais, Hubbard, Mt. Angel, Scotts Mills, Silverton, and Woodburn), close to the Mount Angel Fault, all have higher levels of estimated losses compared with the rest of the county. This is consistent with the damage that occurred from the 1993 Scotts Mills earthquake. In addition, high liquefaction susceptibility exists within most of the floodplains throughout the county which increases the risk from earthquakes. A large portion of Keizer and developed areas along the North Santiam River are built on highly liquefiable soils have higher estimates of damage from this earthquake scenario than other communities in the study area.

Although the impacts of coseismic landslides were included in the Hazus earthquake results, we did not perform an analysis that specifically isolated damage caused by coseismic landslides. It is worth noting that coseismic landslides likely contribute a small percentage of the overall estimated damage from the earthquake hazard in Marion County. Landslide exposure results show that 4.3% of buildings in Marion County are within a Very High or High susceptibility zone. This indicates that a similar percentage of the loss estimated in this study may be due to coseismic landslide.

Building vulnerabilities such as the age of the building stock and building type are also contributing factors in damage estimates. The first seismic buildings codes were implemented in Oregon in the 1970s (Judson, 2012) and by the 1990s modern seismic building codes were being enforced. Nearly 66% of Marion County's buildings were built before the 1990s. Certain building types are known to be more vulnerable than others in earthquakes, such as manufactured homes. In Hazus-MH, manufactured homes are one occupancy type that performs poorly in earthquake damage modeling. Communities that are composed of an older building stock and more vulnerable occupancy types are expected to experience more damage from earthquake than communities with fewer of these vulnerabilities.

If buildings could be seismically retrofitted to Moderate or High code standards, earthquake risk would be greatly reduced. In this study, a simulation in Hazus-MH earthquake analysis shows that loss ratios drop from 11% to 7%, when all buildings are upgraded to at least Moderate code level. While retrofits can decrease earthquake vulnerability, for areas of High landslide or liquefaction hazard, additional geotechnical mitigation may be necessary to have an effect on losses. Two simulations of a deterministic Mw-6.8 earthquake where all buildings are upgraded to Moderate code standards or to High code standards show a reduction in loss estimates (**Figure 3-2**).

Key Terms:

- *Seismic retrofit:* Structural modification to a building that improves its resilience to earthquake.
- *Design level:* Hazus-MH terminology referring to the quality of a building's seismic building code (i. e. Pre, Low, Moderate, and High). Refer to **Appendix C.2.3** for more information.

As a means of comparison, we also ran a CSZ Mw-9.0 scenario in Hazus for the same building dataset. While the overall damages and number of potentially displaced population are fewer than the Mt. Angel scenario, the damage is more widespread throughout the county. Emergency response could be more difficult in this scenario because emergency services would not be concentrated in a specific area of the county. In addition to a thinned-out response within the county itself, the regional impact may further exacerbate the level of demand for these services.

Marion countywide CSZ Mw-9.0 earthquake results:

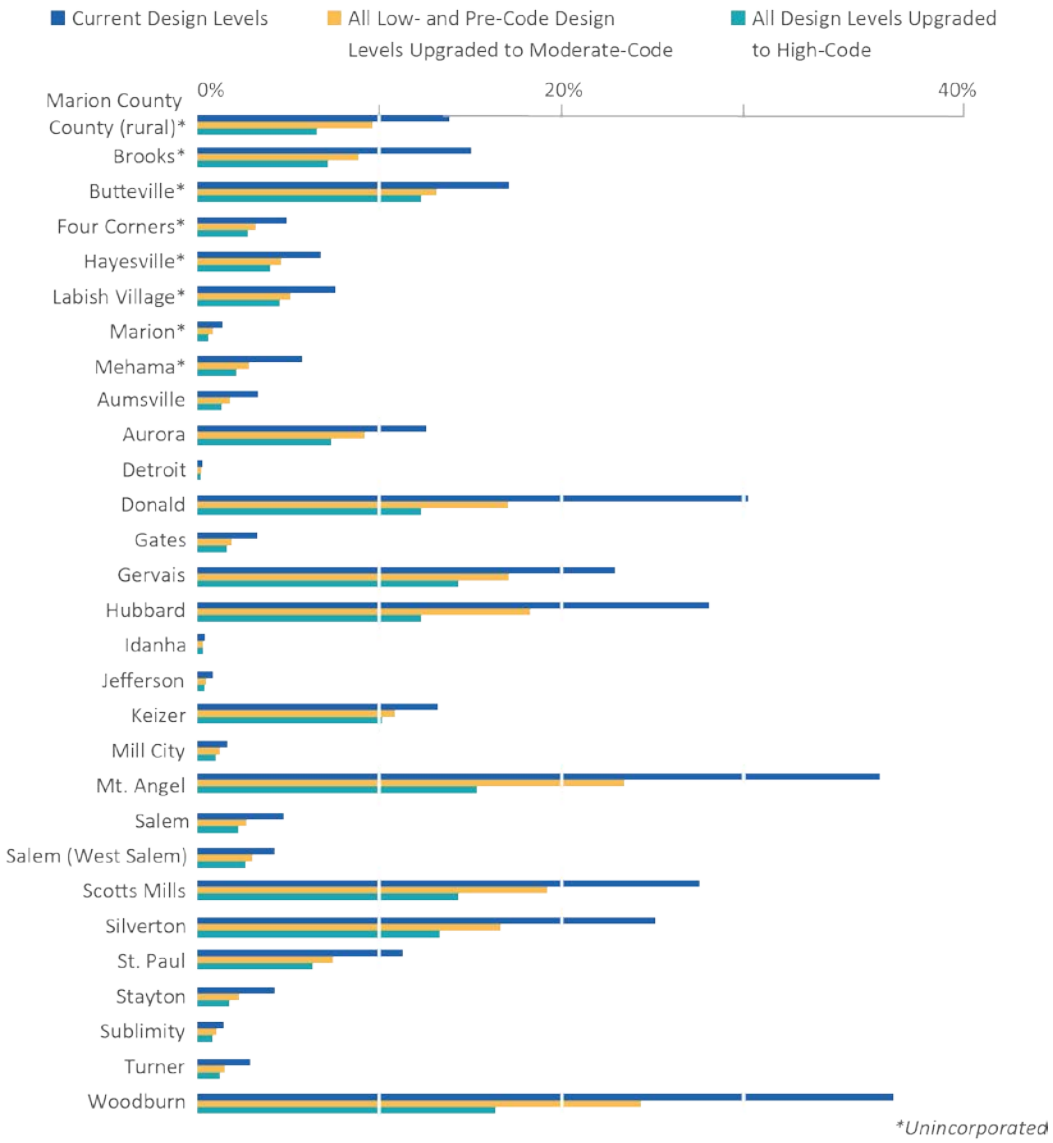
- Number of red-tagged buildings: 4,040
- Number of yellow-tagged buildings: 9,294
- Loss estimate: $2,820,655,000
- Loss ratio: 4.5%
- Non-functioning critical facilities: 44
- Potentially displaced population: 8,086

3.2.3 Areas of significant risk

We identified locations within the study area that are comparatively at greater risk to earthquake hazard:

- Areas near the epicenter of the simulated earthquake scenario are likely to incur a significant amount of damage. The communities of Mt. Angel, Scotts Mills, Silverton, and Woodburn have higher estimated loss ratios compared to other communities in the study due to the level of shaking likely to occur.
- Buildings along the Willamette, the Santiam, and North Santiam Rivers are at higher risk from earthquake damage due to significant exposure to liquefaction.
- Unreinforced masonry buildings in the older downtown portions of Salem, Silverton, and Stayton are more vulnerable to substantial damage during an earthquake compared to other nearby structures built to modern standards. The Molalla Union High School, an unreinforced masonry building, was significantly damaged during the 1993 Scotts Mills earthquake (Dewey and others, 1994).
- 82 of the 236 critical facilities in the study area are estimated to be nonfunctioning due to an earthquake similar to the one simulated in this study.

Figure 3-2. Mt. Angel deterministic Mw-6.8 earthquake loss ratio in Marion County, with simulated seismic building code upgrades.



3.3 Flooding

The frequency and severity of flooding may change over time due to changes in climate and precipitation patterns, land use, and how we manage our waterways. This study represents our current understanding of flood hazards and flood risk, but we recognize that flood models and risk assessments will need to be updated with time and changing conditions.

In its most basic form, a flood is an accumulation of water over normally dry areas. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Floods are a commonly occurring natural hazard in Marion County and have the potential to create public health hazards and public safety concerns, close and damage major highways, destroy railways, damage structures, and cause major economic disruption. Flood issues such as flash flooding, ice jams, post-wildfire floods, and dam safety were not examined in this report.

A typical method for determining flood risk is to identify the probability and impact of flooding. The annual probabilities calculated for flood hazard used in this report are 10%, 2%, 1%, and 0.2%, henceforth referred to as 10-year, 50-year, 100-year, and 500-year scenarios, respectively. The ability to assess the probability of a flood, and the level of accuracy of that assessment is influenced by modeling methodology advancements, better knowledge, and longer periods of record for the stream or water body in question.

The major rivers and creeks within the county are the Mill Creek (near Salem), the Mill Creek (near Woodburn), Butte Creek and Silver Creek, and the Pudding, North Santiam, Santiam, and Willamette Rivers. In addition, there are several tributaries to these major streams that have mapped flood zones. All the mapped streams are subject to flooding and damaging buildings within the floodplain.

The impacts of flooding are determined by adverse effects to human activities within the natural and built environment. Through strategies such as flood hazard mitigation these adverse impacts can be reduced. Examples of common mitigating activities are elevating structures above the expected level of flooding or removing the structure through FEMA's property acquisition ("buyout") program.

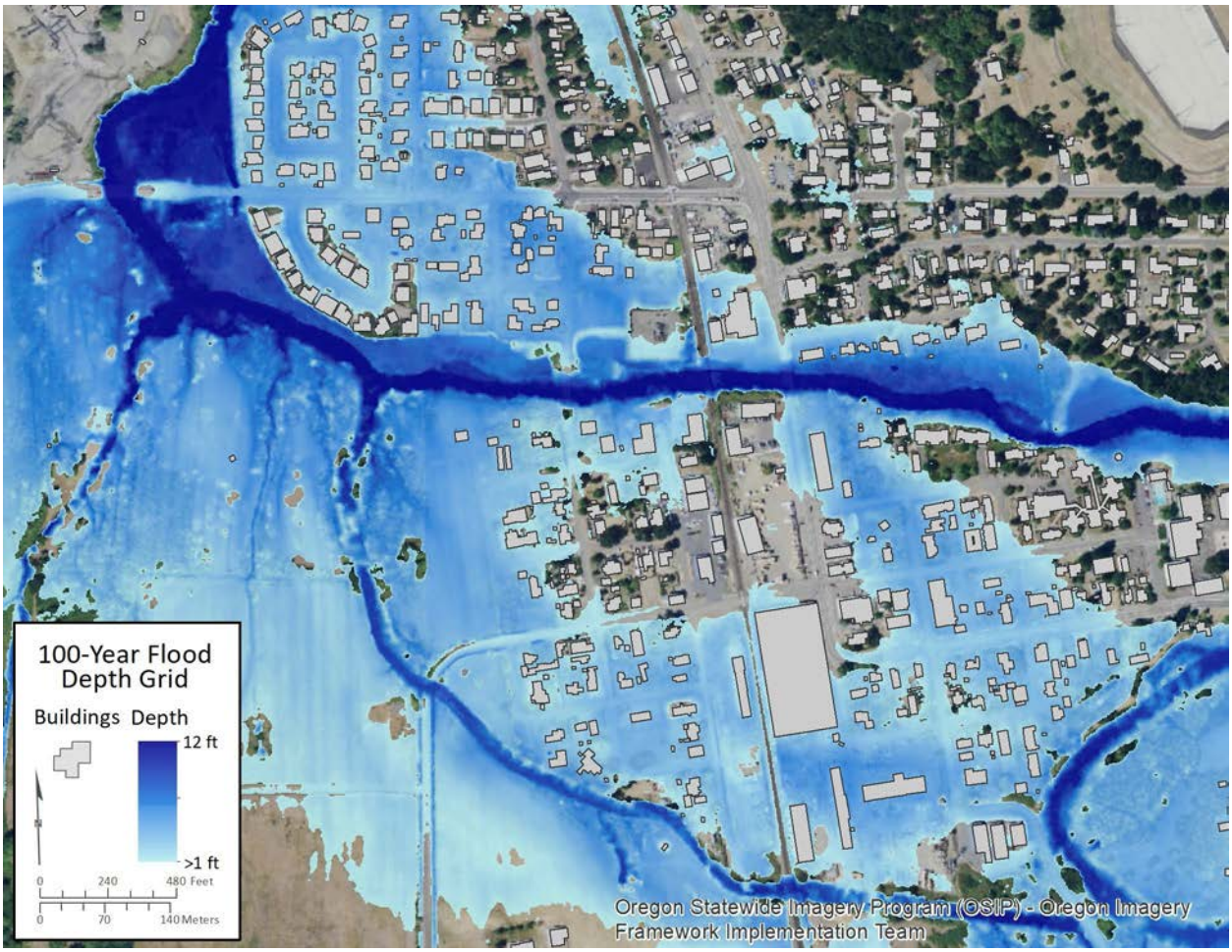
3.3.1 Data sources

The Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) for the study area were updated and made effective in 2019 (FEMA, 2019); these were the primary data sources for the flood risk assessment. Further information regarding NFIP related statistics can be found at FEMA's website: https://www.fema.gov/policy-claim-statistics-flood-insurance. These were the only flood data sources that we used in the analysis, but flooding does occur in areas outside of the detailed mapped areas.

DOGAMI developed the 10-, 50-, 100-, and 500-year depth grids from detailed stream model information within the study area (Appleby and Williams, 2021). DOGAMI used high-resolution lidar collected in 2009, 2013, and 2018 to create the depth grids (Willamette Valley 2009 project, Clackamol 2013 project, and Santiam 2018 project - Oregon Lidar Consortium; see http://www.oregongeology.org/lidar/collectinglidar.htm). The set of depth grids were used in this risk assessment to determine the level to which buildings are impacted by flooding.

Depth grids are raster GIS datasets in which each digital pixel value represents the depth of flooding at that location within the flood zone **(Figure 3-3)**. Depth grids for four riverine flooding scenarios (10-, 50-, 100-, and 500-year) were used for loss estimations and, for comparative purposes, exposure analysis.

Figure 3-3. Flood depth grid example in the city of Turner, Oregon.



Building loss estimates are determined in Hazus-MH by overlaying building data on a depth grid. Hazus-MH uses individual building information, specifically the first-floor height above ground and the presence of a basement, to calculate the loss ratio from a particular depth of flood.

For Marion County, occupancy type and basement presence attributes were available from the assessor database for most buildings. Where individual building information was not available from assessor data, we used oblique imagery and street-level imagery to estimate these important building attributes. Only buildings in a flood zone or within 152 meters (500 feet) of a flood zone were examined closely to attribute buildings with more accurate information for first-floor height and basement presence. Because our analysis accounted for building first-floor height, buildings that have been elevated above the flood level were not given a loss estimate—but we did count residents in those structures as displaced. We did not look at the duration that residents would be displaced from their homes due to flooding. For information about structures exposed to flooding but not damaged, see the **Exposure analysis** section.

3.3.2 Countywide results

For this risk assessment, we imported the countywide UDF data and depth grids into Hazus-MH and ran a flood analysis for four flood scenarios (10-, 50-, 100-, and 500-year). We used the 100-year flood

scenario as the primary scenario for reporting flood results (also see **Appendix E, Plate 4**). The 100-year flood has traditionally been used as a reference level for flooding and is the standard probability that FEMA uses for regulatory purposes. See **Table B-4** for multi-scenario cumulative results.

Marion countywide 100-year flood loss:

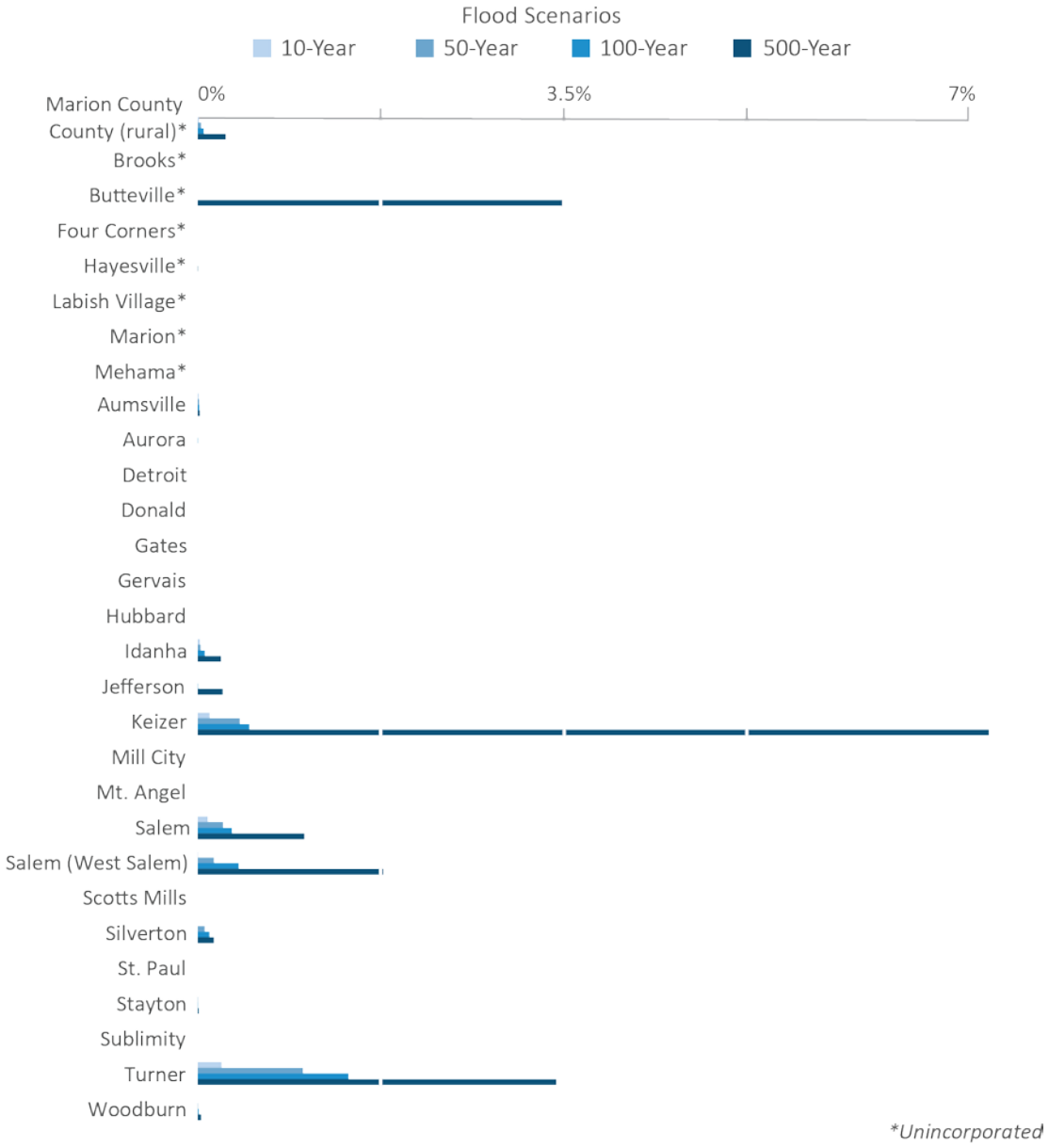
- Number of buildings damaged: 2,552
- Loss estimate: $126,324,000
- Loss ratio: 0.2%
- Damaged critical facilities: 10
- Potentially displaced population: 4,568

3.3.3 Hazus-MH analysis

The Hazus-MH loss estimate for the 100-year flood scenario for the entire county is more than $126 million. While the loss ratio of flood damage for the entirety of Marion County is 0.2%, the impact to areas of development near flood-prone streams is significant (**Figure 3-4**). In situations with communities where most residents are not within flood designated zones, the loss ratio may not be as helpful as the actual replacement cost and number of residents displaced to assess the level of risk and impact from flooding. The Hazus-MH analysis also provides useful flood data on individual communities so that planners can identify problems and consider which mitigating activities will provide the greatest resilience to flooding.

The main flooding problems within Marion County are primarily in the areas of Turner and Salem near the Mill Creek floodplain. The community of Keizer also has a high level of estimated damage from the Willamette River and its tributaries that flow through the community. (**Figure 3-4**). There are few areas of concentrated flood damage in the study area. The small amount of damage that is estimated is scattered across the county at various places along the mapped streams.

Figure 3-4. Ratio of flood loss estimates by Marion County community.



3.3.4 Exposure analysis

Separate from the Hazus-MH flood analysis, we did an exposure analysis by overlaying building locations on the 100-year flood extent. We did this to estimate the number of buildings that are elevated above the level of flooding and the number of displaced residents. This was done by comparing the number of non-damaged buildings from Hazus-MH with the number of exposed buildings in the flood zone. A small proportion (2%) of Marion County's buildings were found to be within designated flood zones. Of the 3,053 buildings that are exposed to flooding, we estimate that 501 are above the height of the 100-year flood. This evaluation also estimates that 4,568 residents might have mobility or access issues due to surrounding water. See **Appendix B: Table B-5** for community-based results of flood exposure.

3.3.5 Areas of significant risk

We identified locations within the study area that are comparatively at greater risk from flood hazard:

- The very large floodplain of Mill Creek (near Salem) and its tributaries from the city of Turner to Salem correspond to high levels of urban development. This area is at high risk from flood hazard.
- Many buildings in the city of Keizer along Labish Ditch are at risk of the estimated 500-year flood.
- Buildings within the Willamette River floodplain, particularly in the city of Salem, including West Salem, are at risk from flood hazard.

3.3 Landslide Susceptibility

This study represents our current understanding of landslide susceptibility within this study area. However, changing climate, precipitation patterns, land use, wildfire events, and land and forest management strategies may increase or decrease the susceptibility to landslides.

Landslides are mass movements of rock, debris, or soil most commonly downhill. There are many different types of landslides in Oregon. In Marion County, the most common are debris flows and shallow- and deep-seated landslides. Landslides can occur in many sizes, at different depths, and with varying rates of movement. Generally, they are large, deep, and slow moving or small, shallow, and rapid. Factors that influence landslide type include slope steepness, water content, and geology. Many triggers can cause a landslide: intense rainfall, earthquakes, or human-induced factors like water concentration, excavation along a landslide toe or loading at the top. Landslides can cause severe damage to buildings and infrastructure. Fast-moving landslides may pose life safety risks and can occur throughout Oregon (Burns and others, 2016).

3.3.1 Data sources

The Statewide Landslide Information Layer for Oregon (SLIDO), release 3.2 (Burns and Watzig, 2014) is an inventory of mapped landslides in the state of Oregon. SLIDO is a compilation of past studies; some studies were completed very recently using new technologies, like lidar-derived topography, and some studies were performed more than 50 years ago. Consequently, SLIDO data vary greatly in scale, scope, and focus and thus in accuracy and resolution across the state.

Burns and others (2016) used SLIDO 3.2 inventory data along with maps of generalized geology and slope to create a landslide susceptibility overview map of Oregon that shows zones of relative susceptibility: Very High, High, Moderate, and Low. Landslide inventory data directly define the Very High landslide susceptibility zone, whereas the landslide inventory data coupled with statistical results from generalized geology and slope maps define the other relative susceptibility zones (Burns and others, 2016). Statewide landslide susceptibility map data have the inherent limitations of SLIDO and of the generalized geology and slope maps used to create the map. Therefore, the Statewide Landslide Susceptibility Map varies significantly in quality across the state, depending on the quality of the input datasets. Another limitation is that susceptibility mapping does not include some aspects of landslide hazard, such as runout, where the momentum of the landslide can carry debris beyond the zone deemed to be a high hazard area.

Burns and Mickelson (2012) published detailed landslide inventory and susceptibility maps for the city of Silverton. DOGAMI (Harvey and Peterson, 1998; 2000; Hofmeister and others, 2000; Hofmeister and Wang, 2000) produced several landslide hazard maps in the city of Salem region approximately 20 years ago (IMS-6, IMS-5, IMS-17, IMS-18). These maps are currently part of the city of Salem's

development building code. This report did not use either of these datasets and thus results in this report are different than one would obtain if these datasets were used.

Recent landslide inventory mapping in Marion County (Calhoun and others, 2020) based on lidar using methods outlined in DOGAMI Special Paper Special Paper 42 (SP-42: Burns and Madin, 2009) was published in 2020 and was not incorporated into the 2016 Statewide Landslide Susceptibility Map. For this risk assessment, we took a conservative approach and overlaid this new landslide inventory (Calhoun and others, 2020), which is equivalent to Very High susceptibility, and replaced the susceptibility zones in the Statewide Landslide Susceptibility Map (Burns and others, 2016). Areas that were previously mapped as Very High but were outside of the new landslide mapping were changed to High zones.

We used the data from the combined Statewide Landslide Susceptibility Map (Burns and others, 2016) and new landslide mapping (Calhoun and others, 2020) in this report to identify the general level of susceptibility of a given area to landslide hazards, primarily shallow and deep landslides. We overlaid building and critical facilities data on landslide susceptibility zones to assess the exposure for each community (**Table B-6**). The total dollar value of exposed buildings was summed for the study area and is reported below. We also estimated the number of people threatened by landslides. Land value losses due to landslides and potentially hazardous unmapped areas that may pose real risk to communities were not examined for this report.

3.3.2 Countywide results

Communities that developed in terrain with moderate to steep slopes or at the base of steep hillsides may be exposed to landslides. We found that communities along the North Santiam and Santiam Rivers and Scotts Mills have a high level of exposure to landslide hazard. The percentage of building value exposed to very high and high landslide susceptibility is approximately 4.3% for the entire study area.

We combined High and Very High susceptibility zones as the primary scenarios to provide a general sense of community risk for planning purposes (**Appendix E: Plate 6**). It was useful to combine exposure for both susceptibility zones to best communicate the level of landslide risk to communities. These susceptibility zones represent areas most susceptible to landslides with the highest impact to the community.

For this risk assessment we compared building locations to geographic extents of the landslide susceptibility zones (**Figure 3-5**). The exposure results shown below are for the High and Very High susceptibility zones. See **Appendix B: Detailed Risk Assessment Tables** for exposure analysis results of all susceptibility categories.

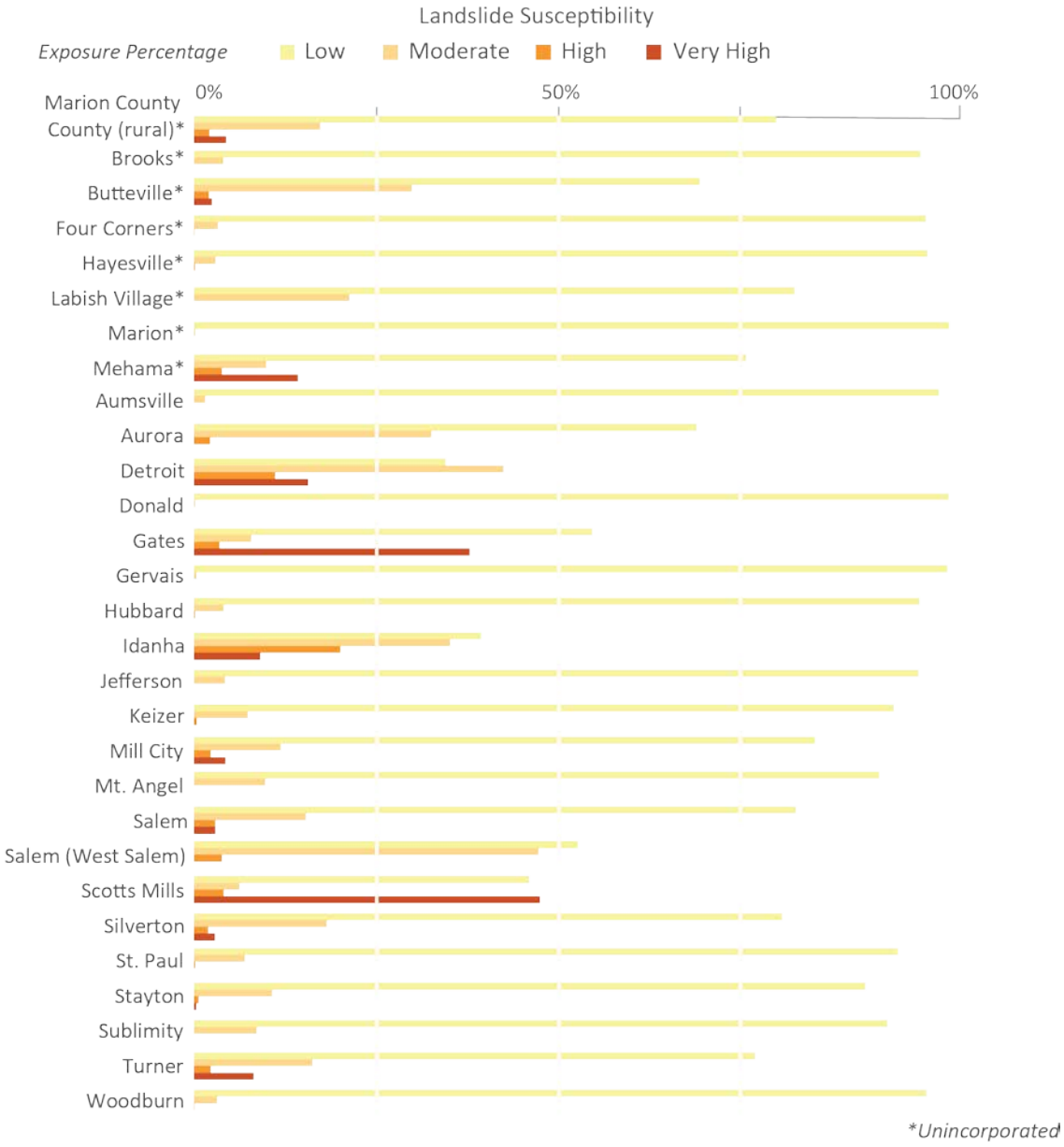
Marion countywide landslide exposure (High and Very High susceptibility):

- Number of buildings: 7,470
- Value of exposed buildings: $2,663,045,000
- Percentage of total county value exposed: 4.3%
- Critical facilities exposed: 3
- Potentially displaced population: 18,538

Most of the developed land in Marion County is located on the gentle terrain found in the Willamette River Valley, which is typically Low susceptibility landslide zones. However, there are developed areas in the southwest part of Salem, large portion of Scotts Mills, and communities along the North Santiam River that are highly susceptible to landslide hazard. Landslide hazard is ubiquitous in the eastern panhandle portion of Marion County, which may present challenges for planning and mitigation efforts. Awareness

of nearby areas of landslide hazard is beneficial to reducing risk for every community and rural area of Marion County.

Figure 3-5. Landslide susceptibility exposure by Marion County community.



3.3.3 Areas of significant risk

We identified locations within the study area that are comparatively at greater risk to landslide hazard:

- Buildings in the unincorporated county along the North Santiam River are exposed to High and Very High landslide hazard.
- Many buildings in the cities of Scotts Mills and Silverton have significant exposure to High and Very High landslide hazard.
- The residential neighborhoods in the southwestern portions of Salem and just outside of Salem are built on existing landslides (mapped as Very High susceptibility).

3.4 Channel Migration

The frequency and severity of channel migration may change over time due to changes in climate and precipitation patterns, land use, and how we manage our waterways. This study represents our current understanding of channel migration hazards and risk, but we recognize that channel migration mapping and risk assessments will need to be updated with time and changing conditions.

Channel migration is a dynamic process by which a stream's location changes over time. This process includes channel bed and bank erosion, sediment deposition, and channel avulsion, a process in which the stream abruptly moves to a new location on the floodplain. Many factors influence channel movement, including the local geology, size, and quantity of sediment within the river, discharge of water, vegetation, channel shape, and slope. Human changes to the channel, such as the construction of dams and levees, also has a major impact on how a channel changes its course. In combination, these factors affect how a river's energy and erosive power is dispersed. Straight, steep streams have highly concentrated erosive power; by contrast, curving channels that flow across wide and flat floodplains allow the river to dissipate its energy over a wider area and for sediment to be deposited (Rapp and Abbe, 2003).

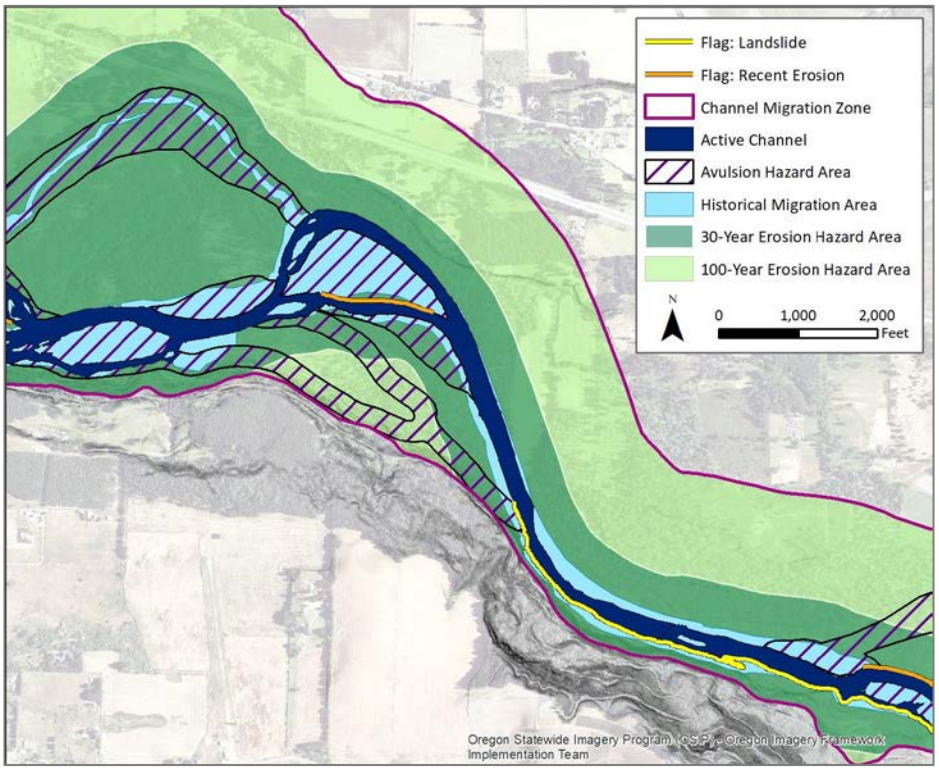
The area in which a stream channel moves laterally over a given time is known as a channel migration zone (CMZ). In places where development has occurred within the CMZ, structures are at risk for severe damage to foundations and infrastructure. The CMZ typically extends beyond the limits of the regulatory floodplain, but little consideration is given to this potential hazard. This factor contributes greatly to the level of risk that exists for many developed areas along streams (Rapp and Abbe, 2003).

3.4.1 Data sources

The channel migration zones used for this report were developed by Appleby and others (2021) for the Pudding River and the Santiam and North Santiam Rivers. The CMZ includes the areas of historical channel migration, potential erosion, and channel avulsion; these areas are mapped based on geology, historical aerial imagery, lidar topography, limited field work, and measured rates of historical channel migration. The methodology for developing the related zones and how they are combined are described in Appleby and others (2021). The CMZ is subdivided into seven subcomponents: the active channel, historical migration area, 30-year and 100-year erosion hazard areas, the avulsion hazard area, and flagged streambanks that are actively eroding or adjacent to landslides (**Figure 3-6**).

To assess the exposure within each community, we overlaid buildings and critical facilities on the 30-year erosion hazard area within the CMZ. While there is risk throughout the CMZ, we chose to examine the structures within the 30-year erosion hazard area, because it represents the area of greatest probability of being at risk from channel migration during the next 30 years. We estimated the total dollar value of exposed buildings and the number of people potentially displaced from the 30-year CMZ and reported these values in the following section. Land value losses due to CMZ were not examined for this report.

Figure 3-6. Example diagram of the components of a channel migration zone (CMZ) map in Marion County, including the active channel (AC) in dark blue, historical migration area (HMA) in light blue, avulsion hazard area (AHA) with hatched lines, 30-year and 100-year erosion hazard areas (EHA) in dark and light green, flagged streambanks with yellow and orange lines, and CMZ boundary outlined in magenta (from Appleby and others, 2021).



3.4.2 Countywide results

Mapped channel migration areas along the North Santiam, Santiam, and Pudding Rivers show a very high level of risk from this hazard for many communities along these watercourses. To quantify risk, the exposure analysis was conducted by determining which buildings were within or outside of the CMZ (see **Appendix E: Plate 8**). Due to the frequency of shifting channel patterns in these streams, channel migration hazard presents a significant risk compared to other hazards in the county.

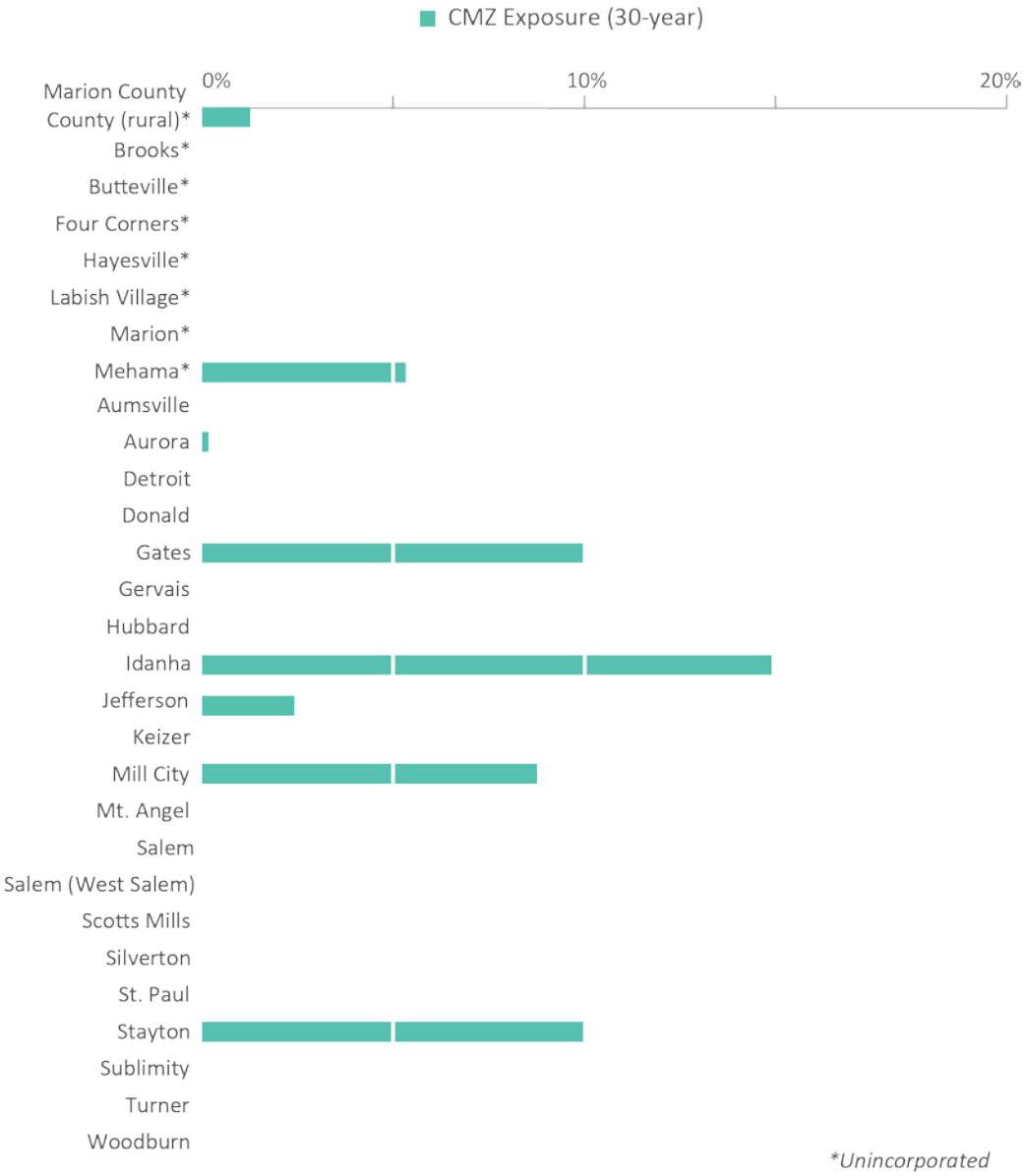
Marion countywide channel migration exposure (30-year Erosion Hazard Area):

- Number of buildings: 826
- Value of exposed buildings: $295,868,000
- Percentage of total county value exposed: 0.5%
- Critical facilities exposed: 2
- Potentially displaced population: 1,475

A significant number of buildings in the unincorporated county and cities along the Santiam and North Santiam Rivers are within areas where channel migration is likely to occur. Nearly half of the buildings in

the city of Stayton are mapped within the potential channel migration zone. **Figure 3-7** illustrates the distribution of exposed building value due to channel migration with the different communities of Marion County. See **Appendix B: Detailed Risk Assessment Tables** for complete analysis results.

Figure 3-7. Channel migration zone exposure by Marion County community.



3.4.3 Areas of significant risk

We identified locations within the study area that are comparatively at greater risk to channel migration hazard:

- The portions of the communities of Marion, Gates, Idanha, Jefferson, Mill City, and Mehama located along the Santiam and North Santiam Rivers have areas of potential risk from channel migration hazard.

- Many residential and commercial buildings are exposed to channel migration hazard in the southern portion of Stayton along the Santiam River.

3.5 Wildfire

The frequency, intensity, and severity of wildfires may change over time due to changes in climate, drought conditions, urbanization, and how we manage our forested lands. This study represents our current understanding of wildfire hazards and wildfire risk, but we recognize that wildfire models and risk assessments will need to be updated with time and changing conditions.

Wildfires are a natural part of the ecosystem in Oregon. However, wildfires can present a substantial hazard to life and property in growing communities. The most common wildfire conditions include hot, dry, and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, its behavior is influenced by numerous conditions, including fuel, topography, weather, drought, and development (Gilbertson-Day and others, 2018). Post-wildfire geologic hazards can also present risk. These usually include flood, debris flows, and landslides. Post-wildfire geologic hazards were not evaluated in this project.

The Marion County Community Wildfire Protection Plan (WCCWPP), from 2017, recommended that the county develop policies that address fire restriction enforcement, wildland urban interface standards, and building code enforcement related to emergency access. Forests cover large portions of the study area and play an important role in the local economy, but also surround homes and businesses (MCCWPP, 2017). Contact the Marion County Planning Division for specific requirements related to the county's comprehensive plan.

As previously mentioned, Marion County was impacted by the 2020 Labor Day Fires, specifically the Beachie Creek and Lionshead Wildfires. These fires are termed "megafires" because they were greater than 100,000 acres in size. The Beachie Creek wildfire burned nearly 194,000 acres and the Lionshead wildfire burned 205,000 acres (Northwest Interagency Coordination Center website, accessed 2/25/2022). The fires resulted in severe impacts to the built and natural environment in Marion County and directly demonstrate the level of wildfire risk in the county. The Oregon Department of Emergency Management estimates that more than 1,500 structures, including 700 homes were destroyed within the study area from these wildfires.

3.5.1 Data sources

The Pacific Northwest Quantitative Wildfire Risk Assessment (PNRA): Methods and Results (Gilbertson-Day and others, 2018) is a comprehensive report that includes a database of spatial information related to wildfire hazard developed by the United States Forest Service (USFS) for the states of Oregon and Washington. The steward of this database in Oregon is the Oregon Department of Forestry (ODF). The database was created to assess the level of risk residents and structures have to wildfire. For this project, the burn probability dataset, a dataset included in the PNRA database, was used to measure the risk to communities in Marion County.

Using guidance from ODF, we categorized the Overall Wildfire Risk dataset into low, moderate, and high-hazard zones for the wildfire exposure analysis. Overall Wildfire Risk was developed as a combination of burn probability and the presence of infrastructure and assets. The range of values in the risk dataset describe the level of potential impact and are characterized by very high negative values that

indicate very high risk down to zero which indicates low risk. The risk dataset also includes positive values that represents uninhabited areas that benefit from wildfire, but these were combined into the low-risk category (Gilbertson-Day and others, 2018).

Overall Wildfire Risk values were grouped into three hazard categories:

- Low wildfire hazard (-0.000011 to 0.005)
- Moderate wildfire hazard (-0.000119 to -0.000011)
- High wildfire hazard (-0.203 to -0.000119)

We overlaid the buildings layer and critical facilities on each of the wildfire hazard zones to determine exposure. In certain areas no wildfire data are present which indicates areas that have minimal risk to wildfire hazard (see **Appendix B: Table B-8**). The total dollar value of exposed buildings in the study area is reported in the following section. We also estimated the number of people threatened by wildfire. Land value losses, infrastructure, and environmental impacts due to wildfire were not examined for this project.

3.5.2 Countywide results

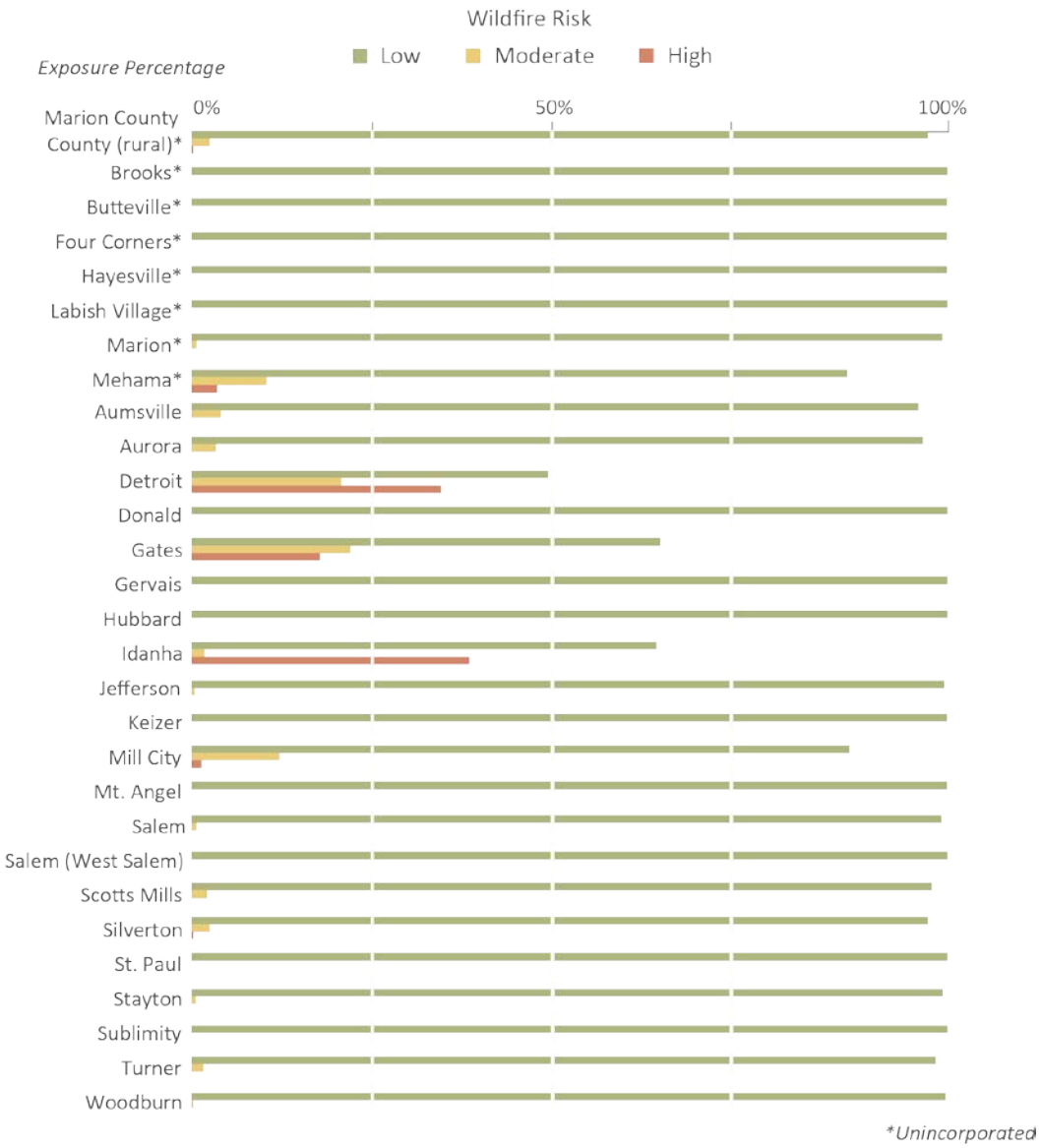
The High hazard category was chosen as the primary scenario for this report because that category represents areas that have the highest potential for losses. However, Low hazard is not the same as no hazard. Moderate wildfire risk is included with high risk in the assessment of exposure to wildfire, because under certain conditions moderate risk zones can be very susceptible to burn. In combining the High and Moderate risk categories within Marion County, we can emphasize areas where lives and property are most at risk.

Marion countywide wildfire exposure (High or Moderate risk):

- Number of buildings: 2,819
- Value of exposed buildings: $813,993,000
- Percentage of total county value exposed: 1.3%
- Critical facilities exposed: 7
- Potentially displaced population: 4,754

For this risk assessment, the building locations were compared to the geographic extent of the wildfire risk categories. More than 1,000 buildings in along the North Santiam River are exposed to High or Moderate wildfire hazard. These are the primary areas of greatest risk to this hazard, especially in heavily forested areas along state Highway 22 (**Appendix E: Plate 7**). The communities of Detroit, Idanha, Gates, and Mill City have the highest percentage of exposure to high and moderate wildfire hazard within the study area. **Figure 3-8** illustrates the level of risk from wildfire for the different communities of Marion County. See **Appendix B: Detailed Risk Assessment Tables** for multiscenario analysis results.

Figure 3-8. Wildfire risk exposure by Marion County community.



3.5.3 Areas of significant risk

We identified locations within the study area that are comparatively at greater risk from wildfire hazard:

- While the Beachie Creek, Lionshead, and P-515 wildfires that occurred in the fall of 2020 caused widespread and devastating damage to areas along the North Santiam River, those wildfires were not specifically examined in this report. However, the areas that burned will be at risk to indirect hazards such as post-wildfire debris flows, rock falls, and flash flooding. The data used in this risk assessment, both asset and hazard information, originated prior to the date of these fires. The areas most at risk based on the data used in this study correspond to areas impacted by the 2020 wildfires.
- Exposure to wildfire risk is highest for communities in the forested areas along state Highway 22 that follows along the North Santiam River.

3.6 Volcano Hazard – Lahar

A lahar is a water-saturated mixture of muddy debris and rock fragments that originates from a volcano and flows down channels at a rapid speed. Lahars are typically generated from a volcanic eruption but can be initiated during heavy rains or by a sudden outburst of glacial melt. They are most common when a volcano that is covered with heavy loads of snow and ice erupts. When water mixes with materials from eruptions, a lahar or volcanic debris flow can occur (Driedger and Scott, 2008).

Distal volcanic hazards, as opposed to proximal volcanic hazards affect areas away from the center of geologic activity. A lahar is considered a distal volcanic hazard because a lahar can travel long distances and cause damage (Burns and others, 2011). Because a lahar moves like flowing concrete, it has the capacity to destroy most things in its path. Lahar deposits tend to exacerbate flooding and channel migration risk in the river valleys they affect (Driedger and Scott, 2008). For additional detailed information on the volcanic hazards and potential impacts, Walder and others (1999) Volcano Hazards in the Mount Jefferson Region, Oregon, USGS Open-File Report 99-24 should be reviewed. This report discusses the risk from lahars to the Detroit Dam and Detroit Lake. If lahars entered this lake, they could cause large waves that could overtop the dam and possibly cause dam failure, with catastrophic effects downstream. Such events have very low probabilities but great potential consequences (Walder and others, 1999).

3.6.1 Data sources

The lahar zones used in this report were created by Walder and others (1999) and were based on previous volcanic eruptions to estimate the extent of potential lahars on Mount Jefferson. Three nested lahar zones were computed based on an estimated volume of debris that could suddenly flow from Mount Jefferson. The largest and least likely scenario (>15,000-year annual recurrence) is designed at a volume of 500 million cubic meters (650 million cubic yards) and would correspond to volcanic activity or a low-probability landslide event involving large flank failures not caused by magmatic intrusion (Walder and others, 1999). The intermediate and small lahar scenarios are based on more likely events ranging from small eruptions, stream explosion, or rain-on-snow events. Such events are estimated to produce volumes of debris smaller than the largest scenario. The intermediate scenario, categorized in this report as "Medium," has an estimated volume of 100 million cubic meters (130 million cubic yards) with an annual recurrence of 1,000 to 15,000 years. The smallest scenario, categorized as "Small," has an estimated volume of 20 million cubic meters (25 million cubic yards) with an annual recurrence of 100 to 1,000 years.

For this risk assessment, we compared the locations of buildings and critical facilities to the geographic extent of the lahar inundation zones to assess the exposure for each community (**Appendix B: Table-B**, and **Appendix E: Plate 8**). The exposure results shown below are for only the Medium scenario. We also estimated the number of people at risk from lahar hazard.

3.6.2 Countywide results

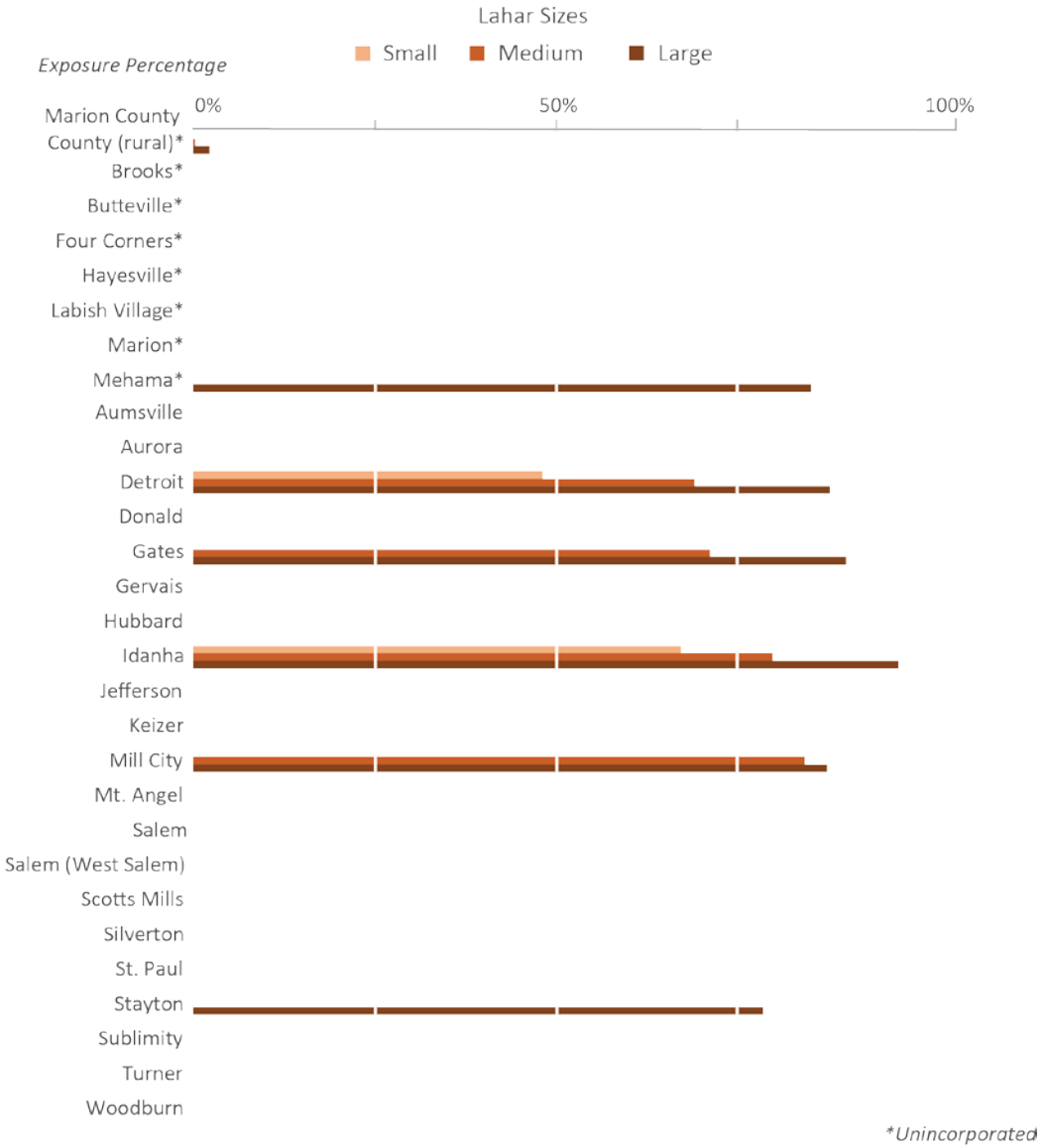
Most of the 350,000 residents in the study area are not exposed to lahar hazard, but the hazard poses significant concerns for those closer to Mount Jefferson and those within the distal riverine valley.

The total dollar value of exposed buildings was summed for the study area and is shown in **Figure 3-9**. The communities most threatened from a volcanic eruption and lahar event are Gates, Detroit, Idanha, and Mill City. See **Appendix B: Detailed Risk Assessment Tables** for cumulative multiscenario analysis results.

Marion countywide lahar exposure (Medium scenario):

- Number of buildings: 1,789
- Exposure value: $414,766,000
- Percentage of exposure value: 0.7%
- Critical facilities exposed: 3
- Potentially displaced population: 2,401

Figure 3-9. Lahar exposure by study area community.



Note that "Salem (West Salem)" is the portion of the city of Salem within Polk County. Values for "Salem" and "Salem (West Salem)" can be summed to calculate the total value for the city of Salem.

3.6.3 Areas of vulnerability or risk

We identified locations within the study area that are comparatively more vulnerable or at greater risk to lahar hazard:

- Lahar risk is present for all buildings near the North Santiam River along state Highway 22.
- The 100–1,000-year return interval is a significant threat for residents closer to Mt. Jefferson. Detroit has 47% exposure and Idanha has 66% exposure to this hazard.

4.0 CONCLUSIONS

The purpose of this study is to provide a better understanding of potential impacts from multiple natural hazards at the community scale. We accomplished this by using the latest natural hazard mapping and loss estimation tools or exposure analysis to quantify risk to buildings and potential displacement of permanent residents. This detailed approach provides new context for the county's risk reduction efforts. We note several important findings based on the results of this study:

- **Extensive damage and losses for some areas in Marion County can occur from an earthquake**—Based on the results of a Mt. Angel Fault Mw-6.8 earthquake, some communities in Marion County will experience at least some impact and disruption. Results show that this earthquake could cause building value losses of 30% to 35% to all communities in the northeastern portion of Marion County. The damages in this part of the county are primarily from earthquake shaking, while damage to other buildings along the Willamette, Santiam, and North Santiam Rivers could also be due to ground deformation related to liquefaction. High vulnerability within the building inventory (unreinforced masonry) also contributed to losses expected in the county.
- **Retrofitting buildings to modern seismic building codes can reduce damages and losses from earthquake shaking**—Seismic building codes have a major influence on earthquake shaking damage estimated in this study. We found that retrofitting to at least Moderate code was a very effective mitigation strategy because the additional benefit from retrofitting to High code was minimal. In our simulation of upgrading buildings to at least Moderate code, the estimated loss for the entire study area was reduced from 11% to 7%. We found further reduction in estimated loss in our simulation to 5.2% by upgrading all buildings to High code. Communities with older buildings, that were constructed below the Moderate seismic code standards, are both the most vulnerable and have the greatest potential for risk reduction. For example, the city of Mt. Angel could reduce losses from 37% to 13% by retrofitting all buildings to at least moderate code. This stands in contrast to areas with newer building stock, such as the city of Keizer, which would see small reductions in damage estimates. Although seismic retrofits are an effective strategy for reducing earthquake shaking damage, it should be noted that earthquake-induced landslide and liquefaction hazards will also be present in some areas, and these hazards require different geotechnical mitigation strategies.
- **Some communities in the study area are at moderate risk from flooding**—Many buildings within the floodplain are vulnerable to significant damage from flooding. At first glance, Hazus-MH flood loss estimates may give a false impression of lower risk because they show lower damages within individual communities relative to other hazards we examined. This is likely due to the difference between the type of results from loss estimation and exposure analysis, as well as the limited area impacted by flooding. Flooding is one of the most frequently occurring natural hazards and thus commonly has repetitive losses that occur with recurrence intervals of 10s to 100s of years versus volcanic hazards with recurrence intervals of 100s to thousands of years. We estimate that an average of 13% building value loss occurs for buildings within the 100-year flood zone. The areas that are most vulnerable from flood hazard within the study are buildings along the Mill Creek (near Salem) between Turner and Salem and along Labish Ditch in Keizer.
- **Elevating structures in the flood zone reduces vulnerability**—We used flood exposure analysis in addition to Hazus-MH loss estimation to identify buildings that were not damaged but were within the area expected to experience a 100-year flood. By using both analyses in this way,

we quantified the number of elevated structures within the flood zone. This showed possible mitigation needs in flood loss prevention and the effectiveness of past activities. For example, in the city of Turner nearly a third of the buildings exposed to flooding are elevated above the base flood elevation. Based on the number of buildings exposed to flooding throughout the county, many would benefit from elevating above the level of flooding.

- **Landslide risk is significant for steeper areas in the county**—The recent landslide mapping used in this study was created using lidar and modern mapping methods to develop very accurate landslide hazard maps. We used exposure analysis to assess the threat from landslide hazards. The developed areas in the southwest part of Salem, a large portion of Scotts Mills, and communities along the North Santiam River are highly susceptible to landslide hazards. Nearly 50% of the buildings in Scotts Mills are exposed to Very High or High landslide hazard.
- **Exposure analysis show that buildings in the riverine valleys of the study area are at risk from channel migration hazard**—Exposure analysis shows that channel migration hazard is a threat to communities and buildings along the Pudding, Santiam, and North Santiam Rivers. The city of Stayton has very high risk from channel migration hazard, with nearly 400 buildings exposed to the hazard.
- **Results from the wildfire risk assessment correspond to the 2020 Labor Day Wildfires along the North Santiam River**—Exposure analysis based on data prior to the 2020 wildfires show that buildings along state Highway 22 are significantly more vulnerable to wildfire hazard than the rest of the county. Hazards that are related to post-wildfire conditions, such as post-wildfire debris flow, rockfalls, and flash flooding, are likely to be present in burned areas. Post-wildfire damage assessments were not within the scope of this study, but such activities could offer a better understanding to limit future risk.
- **Exposure analysis shows that communities along the North Santiam River are at risk to lahar hazard**—Exposure analysis shows that volcanic lahar hazard is a minor threat to some communities in the study area. Structures near the North Santiam River along state Highway 22 are most at risk to lahar compared to other parts of the study area. In the community of Detroit and Idanha there are 47% and 66%, respectively, of buildings exposed to the 100- to 1,000-year return interval of lahar hazard.
- **Many of the study area's critical facilities are at significant risk to earthquake and channel migration**—Critical facilities were identified and were specifically examined within this report. We have estimated that 35% (85 of 236) of Marion County's critical facilities will be non-functioning after a Mt. Angel Fault Mw-6.8 earthquake. Additionally, 8% (20 of 236) of critical facilities are exposed to channel migration hazard and 4% (11 of 236) to flood hazard. We found little exposure of critical facilities to landslide, wildfire, and lahar hazards.
- **The biggest causes of displacement to population are earthquake and landslide hazards**—Potential displacement of permanent residents from natural hazards was estimated within this report. We estimated that there is risk to 5.3% of the population in the county from landslide hazard (not a single hazard event) and 4.3% from an earthquake. Channel migration hazard is a potential threat to 1.8% of permanent residents. A small percentage of residents are vulnerable to displacement from flood, wildfire, and lahar hazards.
- **The results allow communities the ability to compare across hazards and prioritize their needs**—Each community within the study area was assessed for natural hazard exposure and loss. This allowed for comparison of risk for a specific hazard between communities. It also allows for a comparison between different hazards, though care must be taken to distinguish loss

estimates and exposure results. The loss estimates and exposure analyses can assist in developing plans that address the concerns for those individual communities.

5.0 LIMITATIONS

There are several limitations to keep in mind when interpreting the results of this risk assessment.

- **Spatial and temporal variability of natural hazard occurrence** – With the exception of earthquakes, other hazards like flood, landslide, channel migration, and wildfire are extremely unlikely to occur across the fully mapped extent of the hazard zones. For example, areas mapped in the 100-year flood zone will be prone to flooding on occasion in certain watersheds during specific events, but not all at once throughout the entire county or even the entire community. While we report the overall impacts of a given hazard scenario, the losses from a single hazard event probably will not be as severe and widespread.
- **Loss estimation for individual buildings** – Hazus-MH is a model, not reality, which is an important factor when considering the loss ratio of an individual building. On-the-ground mitigation, such as elevation of buildings to avoid flood loss, has been only minimally captured. Also, due to a lack of building material information, assumptions were made about the distribution of wood, steel, and unreinforced masonry buildings. Loss estimation is most insightful when individual building results are aggregated to the community level because it reduces the impact of data outliers.
- **Loss estimation versus exposure** – We recommend careful interpretation of exposure results. This is due to the spatial and temporal variability of natural hazards (described above) and the inability to perform loss estimations due to the lack of Hazus-MH damage functions. Exposure is reported in terms of total building value, which could imply a total loss of the buildings in a particular hazard zone, but this is not the case. Exposure is simply a calculation of the number of buildings and their value and does not make estimates about the level to which an individual building could be damaged.
- **Population variability** – Some of the communities in Marion County have a number of vacation homes and rentals, which are typically occupied during the summer. Our estimates of potentially displaced people rely on permanent populations published in the 2010 U.S. Census (United States Census Bureau, 2010b) and adjusted for population growth based on PSU Population Research Center data. As a result, we are slightly underestimating the number of people that may be in harm's way on a summer weekend.
- **Data accuracy and completeness** – Some datasets in our risk assessments had incomplete coverage or lacked high-resolution data within the study area. We used lower-resolution data where there was incomplete coverage or where high-resolution data were not available. We made assumptions to amend areas of incomplete data coverage based on reasonable methods described within this report. Data layers in which assumptions were made to fill gaps are building footprints, population, some building specific attributes, and landslide susceptibility. Many of the datasets included known or suspected artifacts, omissions and errors, however repairing these problems was beyond the scope of the project and are areas needing additional research. We are aware that some uncertainty has been introduced from these data amendments at an individual building scale, but at community-wide scales the effects of the uncertainties are slight.

6.1 RECOMMENDATIONS

The following areas of implementation are needed to better understand hazards and reduce risk to natural hazard through mitigation planning. These implementation areas, while not comprehensive, touch on all phases of risk management and focus on awareness and preparation, planning, emergency response, mitigation funding opportunities, and hazard-specific risk reduction activities.

6.2 Awareness and Preparation

Awareness is crucial to lowering risk and lessening the impacts of natural hazards. When community members understand their risk and know the role that they play in preparedness, the community becomes a safer place to live. Awareness and preparation not only reduce the initial impact from natural hazards, but they also reduce the amount of recovery time for a after a disaster—this ability is commonly referred to as "resilience."

This report is intended to provide local officials with a comprehensive and authoritative profile of natural hazard risk to underpin their public outreach efforts.

Messaging can be tailored to stakeholder groups. For example, outreach to homeowners could focus on actions they can take to reduce risk to their property. The DOGAMI Homeowners Guide to Landslides (https://www.oregongeology.org/Landslide/ger_homeowners_guide_landslides.pdf) provides a variety of risk reduction options for homeowners who live in high landslide susceptibility areas. This guide is one of many existing resources. Agencies and local community organizations that partner with local officials in the development of additional effective resources could help this information reach a wider audience.

6.3 Planning

Local decision-makers can make plans based on the geohazard and risk information presented in this report. The primary framework for accomplishing this is through the comprehensive planning process. A comprehensive plan sets the long-term trajectory of capital improvements, zoning, and urban growth boundary expansion, all of which are planning tools that can be used to reduce natural hazard risk.

Another framework is the natural hazard mitigation plan (NHMP) process. NHMP plans focus on characterizing natural hazard risk and identifying actions to reduce risk. The information presented in this report is a key resource because it directly informs the vulnerability assessment section of the NHMP plan.

While there are many similarities between this report and an NHMP, the hazards or critical facilities in the two reports can vary. Differences between the reports may be due to data availability or limited methodologies for specific hazards. The critical facilities considered in this report may not be identical to those listed in a typical NHMP due to the lack of damage functions in Hazus-MH for non-building structures and to different considerations about emergency response during and after a disaster.

6.4 Emergency Response

Critical facilities play a major role during and immediately after a natural disaster. This study can help emergency managers identify vulnerable critical facilities and develop contingencies in their response plans. Additionally, detailed mapping of potentially displaced residents can be used to reevaluate evacuation routes and identify vulnerable populations to assist with early warning.

The building database that accompanies this report can guide predisaster mitigation, emergency response, and community resilience improvements. Vulnerable areas can be identified and supported through awareness campaigns. These campaigns can be aimed at predisaster mitigation actions, such as seismic retrofitting. Emergency response entities can benefit from the use of the building dataset through identification of potential hazards and populated buildings before and during a disaster. Reduction of the magnitude of the disaster, emergency planning, and improved response time contribute to a community's natural hazard resilience.

6.5 Mitigation Funding Opportunities

Several funding sources are available to communities that are susceptible to natural hazards and have specific mitigation projects they wish to accomplish. State and federal funds are available for projects that demonstrate cost effective natural hazard risk reduction. The Oregon Department of Emergency Management (OEM) State Hazard Mitigation Officer (SHMO) can provide communities assistance in determining eligibility, finding mitigation grants, and navigating the mitigation grant application process. At the time of writing this report, FEMA has three programs that assist states, local communities, tribes, and territories with natural hazard mitigation funding: Hazard Mitigation Grant Program (HMGP) Building Resilient Infrastructure and Communities (BRIC), and Pre-Disaster Mitigation (PDM) Grant Program. FEMA also has a grant program specifically for flooding called Flood Mitigation Assistance (FMA). The SHMO can help with finding further opportunities for earthquake and tsunami assistance and funding.

6.6 Hazard-Specific Risk Reduction Actions

6.6.1 Earthquake

- Evaluate critical facilities for seismic preparedness by identifying structural deficiencies and vulnerabilities to dependent systems (e.g., water, fuel, power).
- Evaluate vulnerabilities of critical facilities. We estimate that 35% of critical facilities (**Appendix A: Community Risk Profiles**) will be damaged by an earthquake scenario described in this report, which will have many direct and indirect negative effects on first-response and recovery efforts.
- Identify communities and buildings that would benefit from seismic upgrades.

6.6.2 Flood

- Map areas of potential floodwater storage areas.
- Identify structures that have repeatedly flooded in the past and would be eligible for FEMA's "buyout" program.
- Additional risk reduction strategies may be found on FEMA's website at https://www.ready.gov/floods.

6.6.3 Landslide

- Create modern landslide inventory and susceptibility maps.
- Monitor ground movement in high susceptibility areas.

- Evaluate risks to transportation networks and land value losses due to landslide in future risk assessments.
- Study the risk from landslides that are experience channel erosion at the toe of the landslide.
- Additional risk reduction strategies may be found on FEMA's website at https://www.ready.gov/landslides-debris-flow.

6.6.4 Channel migration

- Future development in areas with the largest CMZs, particularly Pudding River, the Santiam, and North Santiam Rivers, should include CMZ mitigation strategies into plans and designs.
- Evaluate the losses in land value or productivity due to channel migration.
- Evaluate risks to transportation networks and bridges due to channel migration.
- Identify areas suitable for conservation corridors along rivers that are at risk from channel migration. These can be multipurpose including areas that provide or improve floodwater storage, riparian and aquatic habitat restoration, and climate change resilience, and water quality.

6.6.5 Wildfire-related geologic hazards

- Evaluate post-wildfire geologic hazards including flood, debris flows, and landslides.
- Additional risk reduction strategies may be found on FEMA's website at https://www.ready.gov/wildfires.

7.0 ACKNOWLEDGMENTS

This natural hazard risk assessment was conducted by the Oregon Department of Geology and Mineral Industries (DOGAMI) in 2021 and 2022. It was funded by FEMA Region 10 through its Risk Mapping, Assessment, and Planning (Risk MAP) program (Cooperative Agreement EMS-2021-CA-00011). In addition to FEMA, DOGAMI worked closely with the Marion County Emergency Management and the Oregon Department of Land Conservation and Development (DLCD) to complete the risk assessment and produce this report. DLCD is coordinating with communities on the next Natural Hazard Mitigation Plan (NHMP) update, which will incorporate the findings from this risk assessment.

Many people contributed to this report at different points during the analysis phase and during the writing phase and at various levels. We are grateful to everyone who contributed, especially the following from DOGAMI: William Burns, Christina Appleby, Nancy Calhoun, and Robert Hairston-Porter.

Additionally, we would like to thank people from other agencies and entities who also assisted on this project – from FEMA: Rynn Lamb; from DLCD: Marian Lahav, Katherine Daniel, and Pam Reber.

8.0 REFERENCES

Appleby, C. A., Williams, M. C., Anthony, L. H., and Madin, I. P., 2021, Flood depth and channel migration zone maps, Benton, Marion, Morrow, and Washington Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-21-15, 72 p. https://www.oregongeology.org/pubs/ofr/o-21-15/o-21-15.htm

Applied Technology Council, 2015, Rapid visual screening of buildings for potential seismic hazards: A handbook (3rd ed.): Redwood City, Calif., FEMA Publication 154. https://www.fema.gov/sites/default/files/2020-07/fema_earthquakes_rapid-visual-screening-of-buildings-for-potential-seismic-hazards-a-handbook-third-edition-fema-p-154.pdf

Bauer, J. M., 2018, ArcGIS Python script alternative to the Hazus-MH Flood Model for User-Defined Facilities: Oregon Department of Geology and Mineral Industries Open-File Report O-18-04, 28 p. https://www.oregongeology.org/pubs/ofr/p-O-18-04.htm

Black, G. L., 1996, Earthquake intensity maps, Scotts Mills earthquake: Oregon Department of Geology and Mineral Industries, Oregon Geology, v. 58, no. 2, p. 35. https://www.oregongeology.org/pubs/OG/OGv58n02.pdf

Burns, W. J., Hofmeister, R. J., and Wang, Y., 2008, Geologic hazards, earthquake and landslide hazard maps, and future earthquake damage estimates for six counties in the Mid/Southern Willamette Valley including Yamhill, Marion, Polk, Benton, Linn, and Lane Counties, and the City of Albany, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map IMS-24, 121 p. https://www.oregongeology.org/pubs/ims/p-ims-024.htm

Burns, W. J. and Madin, I. P., 2009, Protocol for Inventory Mapping of Landslide Deposits from Light Detection and Ranging (Lidar) Imagery: Oregon Department of Geology and Mineral Industries Special Paper 42, 30 p. https://www.oregongeology.org/pubs/sp/p-SP-42.htm

Burns, W. J., Hughes, K. L. B., Olson, K. V., McClaughry, J. D., Mickelson, K. A., Coe, D. E., English, J. T., Roberts, J. T., Smith, R. R. L., and Madin, I. P., 2011, Multi-hazard and risk study for the Mount Hood region, Multnomah, Clackamas, and Hood River counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-11-16, 179 p., 7 pl. http://www.oregongeology.org/pubs/ofr/p-O-11-16.htm

Burns, W. J. and Mickelson, K. A., 2012, Regional hazard maps of the City of Silverton, Marion County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-12-05, 21 p. 2 pl. https://www.oregongeology.org/pubs/ofr/p-O-12-05.htm

Burns, W. J., Mickelson, K. A., Duplantis, S., and Williams, K. J., 2012, Landslide inventory maps of the Scholls quadrangle, Marion County, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map IMS-37. https://www.oregongeology.org/pubs/ims/p-ims-037.htm

Burns, W. J., and Watzig, R. J., 2014, Statewide landslide information layer for Oregon, release 3 [SLIDO-3.0]: Oregon Department of Geology and Mineral Industries, 35 p., 1:750,000, geodatabase.

Burns, W. J., Mickelson, K. A., and Madin, I. P., 2016, Landslide susceptibility overview map of Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-16-02, 48 p. https://www.oregongeology.org/pubs/ofr/p-O-16-02.htm

Business Oregon, 2015, Oregon benefit-cost analysis tool for evaluation of seismic rehabilitation grant program applications: User's guide: Salem, Oreg., Infrastructure Finance Authority Division, 34 p. https://www.oregon.gov/biz/Publications/SRGP%20Application%20Documents/UserGuide.pdf

Calhoun, N., Madin, I. P., and Appleby, C. A., 2020, Landslide inventory for a portion of Marion County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-20-12, 5 p. https://www.oregongeology.org/pubs/ofr/p-O-20-12.htm

Charest, A. C. (ed.), 2017, Square foot costs with RSMeans® data (38th annual edition): Rockland, Md., Gordian Group, Inc., 563 p. https://www.rsmeans.com/products/books/2017-cost-databooks/2017-square-foot-costs-book.aspx

Dewey, J. W., Reagor, B. G., Johnson, D.A., Choy, G. L., Baldwin, F. W., 1994, The Scotts Mills, Oregon, earthquake of March 25, 1993; intensities, strong-motion data, and teleseismic data: United States Geological Survey Open-File Report 94-163, 28 p. https://pubs.usgs.gov/of/1994/0163/report.pdf

Driedger, C. L., and Scott, W. E., 2008, Mount Rainier; living safely with a volcano in your backyard: U.S. Geological Survey Fact Sheet 2008-3062 http://pubs.usgs.gov/fs/2008/3062/

Federal Emergency Management Agency, 2012a, Hazus®-MH 2.1 User manual, Flood model: Washington, D.C., 382 p. https://www.fema.gov/flood-maps/tools-resources/flood-map-products/hazus/user-technical-manuals

Federal Emergency Management Agency, 2012b, Hazus®-MH 2.1 Technical manual, Earthquake model: Washington, D.C., 718 p. https://www.fema.gov/flood-maps/tools-resources/flood-map-products/hazus/user-technical-manuals

Federal Emergency Management Agency, 2012c, Hazus®-MH 2.1, Technical manual, Flood model: Washington, D.C., 569 p. https://www.fema.gov/flood-maps/tools-resources/flood-map-products/hazus/user-technical-manuals

Federal Emergency Management Agency, 2019, Flood insurance study: Marion County, Oregon and incorporated areas: Washington D.C., Flood Insurance Study Number 41047V001B, v. 1, 87 p. https://map1.msc.fema.gov/data/41/S/PDF/41047CV001B.pdf?LOC=5032f3c8c8c468a202735c15a5381b33

Federal Emergency Management Agency, 2021, Hazus-MH software: FEMA's tool for estimating potential losses from natural disasters, version 5.0. https://www.fema.gov/sites/default/files/documents/fema_hazus-5.0-release-notes.pdf

Gilbertson-Day, J. W., Stratton, R. D., Scott, J. H., Vogler, K. C., and Brough, A., 2018, Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results, final report, report to Oregon Department of Forestry and others, 86 p. http://oe.oregonexplorer.info/externalcontent/wildfire/reports/20170428_PNW_Quantitative_Wildfire_Risk_Assessment_Report.pdf

Harvey, A. F., and Peterson, G. L., 1998, Water-induced landslide hazards, western portion of the Salem Hills, Marion County, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map Series 6, 13 p., 1 pl. https://www.oregongeology.org/pubs/ims/IMS-006.pdf

Harvey, A. F., and Peterson, G. L., 2000, Water-induced landslide hazards, eastern portion of the Eola Hills, Polk County, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map Series 5, 18 p., 1 pl. https://www.oregongeology.org/pubs/ims/IMS-005.pdf

Hofmeister, J. R., and Wang, Y., 2000, Earthquake-induced slope instability; relative hazard map, eastern portion of the Eola Hills, Polk County, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map Series 18, 1 pl. https://www.oregongeology.org/pubs/ims/IMS-018.pdf

Hofmeister, J. R., Wang, Y., and Keefer, D. K., 2000, Earthquake-induced slope instability; relative hazard map, western portion of the Salem Hills, Marion County, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map Series 17, 1 pl. https://www.oregongeology.org/pubs/ims/IMS-017.pdf

Judson, S., 2012, Earthquake design history: A summary of requirements in the State of Oregon: State of Oregon, Building Codes Division, Feb. 7, 2012, 7 p. http://www.oregon.gov/bcd/codes-stand/Documents/inform-2012-oregon-sesmic-codes-history.pdf

Lewis, D., 2007, Statewide seismic needs assessment: Implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings: Oregon Department of Geology and Mineral Industries Open-File Report O-07-02, 140 p. Available from https://www.oregongeology.org/rvs/default.htm.

Madin, I. P., and Burns, W. J., 2013, Ground motion, ground deformation, tsunami inundation, coseismic subsidence, and damage potential maps for the 2012 Oregon Resilience Plan for Cascadia subduction zone earthquakes: Oregon Department of Geology and Mineral Industries Open-File Report O-13-06, 36 p. 38 pl., GIS data. https://www.oregongeology.org/pubs/ofr/p-O-13-06.htm

Madin, I. P., Franczyk, J. J., Bauer, J. M., and Azzopardi, C. J. M., 2021, Oregon Seismic Hazard Database, release 1.0: Oregon Department of Geology and Mineral Industries Digital Data Series OSHD-1. https://www.oregongeology.org/pubs/dds/p-OSHD-1.htm

Marion County Community Wildfire Protection Plan Planning Committee, 2017, Marion County Community Wildfire Protection Plan, 166 p. https://www.co.marion.or.us/PW/EmergencyManagement/Documents/Community%20Wildfire%20Protection%20Plan.pdf

Northwest Interagency Coordination Center, accessed on February 25, 2022, Northwest Large Fire Interactive Web Map: Northwest Interagency Coordination Center. https://nwccinfo.blogspot.com/

Oregon Building Codes Division, 2002, Oregon manufactured dwelling and park specialty code, 2002 ed.: Oregon Manufactured Housing Association and Oregon Building Codes Division, Department of Consumer and Business Services, 176 p. http://www.oregon.gov/bcd/codes-stand/Documents/md-2002-mdparks-code.pdf

Oregon Building Codes Division, 2010, 2010 Oregon manufactured dwelling installation specialty code: Department of Consumer and Business Services, Building Codes Division, 67 p. http://www.oregon.gov/bcd/codes-stand/Documents/md-2010omdisc-codebook.pdf

Rapp, C. F., and Abbe, T. B., 2003, A framework for delineating channel migration zones: Olympia, Wash., Washington State Department of Ecology Publication 03-06-027, 65 p.

U.S. Census Bureau, 2010a, Master Address File/Topologically Integrated Geographic Encoding and Referencing system or database: Oregon census block: United States Census Bureau. https://www2.census.gov/geo/tiger/TIGER2010/TABBLOCK/2010/

U.S. Census Bureau, 2010b, American FactFinder: Profile of General Population and Housing Characteristics: United States Census Bureau. Web. 2 February 2018. https://data.census.gov/cedsci/all?q=housing

U.S. Geological Survey, 2017, Earthquake hazards 101 — the basics. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science/earthquake-hazards-101-basics

Wang, Y., 1998, Earthquake damage and loss estimate for Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-98-3, 10 p. 2 app. https://www.oregongeology.org/pubs/ofr/O-98-03.pdf

Walder, J. S., Gardner, C. A., Conrey, R. M., Fisher, B. J., and Schilling, S. P., 1999, Volcano hazards in the Mount Jefferson region, Oregon: U. S. Geological Survey Open-File Report O-99-24, 18 p. https://pubs.usgs.gov/of/1999/0024/pdf/of1999-0024.pdf

Williams, M. C., 2021, Statewide Building Footprints for Oregon, release 1.0: Oregon Department of Geology and Mineral Industries Digital Data Series SBFO-1. https://www.oregongeology.org/pubs/dds/p-SBFO-1.htm

9.0 APPENDICES

Appendix A. Community Risk Profiles **48**
Appendix B. Detailed Risk Assessment Tables **84**
Appendix C. Hazus-MH Methodology **101**
Appendix D. Acronyms and Definitions **107**
Appendix E. Map Plates **109**

APPENDIX A. COMMUNITY RISK PROFILES

A risk analysis summary for each community is provided in this section to encourage ideas for natural hazard risk reduction. Increasing disaster preparedness, public hazards communication, and education, ensuring functionality of emergency services, and ensuring access to evacuation routes are actions that every community can take to reduce their risk. This appendix contains community specific data to provide an overview of the community and the level of risk from each natural hazard analyzed. In addition, for each community a list of critical facilities and assumed impact from individual hazards is provided.

A.1 Unincorporated Marion County (Rural) 49
A.2 Unincorporated Community of Brooks 52
A.3 Unincorporated Community of Butteville 53
A.4 Unincorporated Community of Four Corners 54
A.5 Unincorporated Community of Hayesville 55
A.6 Unincorporated Community of Labish Village 56
A.7 Unincorporated Community of Marion 57
A.8 Unincorporated Community of Mehama 58
A.9 City of Aumsville 59
A.10 City of Aurora 60
A.11 City of Detroit 61
A.12 City of Donald 62
A.13 City of Gates 63
A.14 City of Gervais 64
A.15 City of Hubbard 65
A.16 City of Idanha 66
A.17 City of Jefferson 67
A.18 City of Keizer 68
A.19 City of Mill City 69
A.20 City of Mt. Angel 70
A.21 City of Salem 71
A.22 City of Salem (West Salem) 74
A.23 City of Scotts Mills 76
A.24 City of Silverton 77
A.25 City of St. Paul 78
A.26 City of Stayton 79
A.27 City of Sublimity 80

A.28 City of Turner.....81
A.29 City of Woodburn.....82

A.1 Unincorporated Marion County (Rural)

Table A-1. Unincorporated Marion County (rural) hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Unincorporated Marion County (rural)		47,599	43,387		54	16,042,238,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	205	0.4%	247	1	9,060,000	0.1%
Earthquake	Mt. Angel Mw-6.8 Deterministic	1,794	3.8%	7,868	25	2,169,985,170	14%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	4,282	9.0%	3,132	2	1,000,718,000	6.2%
Channel Migration	Channel Migration Zone	263	0.6%	288	0	90,300,000	0.6%
Wildfire	High and Moderate Risk	1,671	3.5%	1,550	3	416,940,000	2.6%
Lahar	Medium Zone (1,000 to 15,000-year)	152	0.3%	175	0	43,913,000	0.3%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with “First floor height” above the level of flooding (base flood elevation).

Table A-2. Unincorporated Marion County (rural) critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
Abiqua School						
Ames Municipal Airport						
Aurora Sewage Treatment Plant						
Aurora State Airport		X				
Bethany Charter School		X				
Bethel Elementary School		X				
Brooks Sewage Treatment Plant		X				
Cascade JR/SR High School						
Central Howell Elementary School		X				
Cloverdale Elementary School						
Crosshill Christian School						
Detroit Ranger Station			X		X	
Drakes Crossing RFPD		X				
Drift Creek Station						
Elkhorn Station			X		X	
Evergreen Elementary School		X				
Fruitland Elementary School		X				
Harchenko Industrial Airport						
Holy Family Academy		X				
Jefferson Christian School						
Jefferson High School						
Jefferson Middle School						
Jefferson Sewage Water Treatment	X					
Lake Labish Elementary School						
Livingstone Adventist Academy						
Marion County Emergency Operations Center						
Marion County Fire District 1 - Brooklake Station 5						
Marion County Fire District 1 - Four Corners Station 1		X				
Marion County Fire District 1 - Labish Station 7		X				
Marion County Fire District 1 - Macleay Station 4						
Marion County Fire District 1 - Pratum Station 3						
Marion County Public Works						
Monitor Elementary School						
Monitor RFPD 58						
Mt Angel Sewage Treatment Plant						
North Marion Intermediate School						
North Marion Middle School						

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
North Marion Primary School						
North Marion SR High School						
Pioneer Elementary School						
Pratum Elementary School						
St. John Bosco High School		X				
St. Paul Substation		X				
Sacred Heart Catholic School						
Silver Crest Elementary School						
Silverton RFPD - Abiqua Station						
Silverton RFPD - Crooked Finger Station					X	
Silverton RFPD - Victor Point Station						
Talbot Station						
Valley Inquiry Charter School						
Victor Point Elementary						
William P Lord High School		X				
Woodburn RFPD 6 - Station 24 Waconda						
Woodburn RFPD 6 - Station 25 Broadacres						

A.2 Unincorporated Community of Brooks

Table A-3. Unincorporated community of Brooks hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Brooks		272	249		2	89,505,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	14	5.1%	61	0	13,149,525	14.7%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-4. Unincorporated community of Brooks critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
Brooks School						
Willamette Valley Christian School						

A.3 Unincorporated Community of Butteville

Table A-5. Unincorporated community of Butteville hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Butteville		352	193		0	78,691,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	18	5.2%	56	0	13,144,000	17%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	15	4.2%	10	0	3,393,000	4.3%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

A.4 Unincorporated Community of Four Corners

Table A-6. Unincorporated community of Four Corners hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Four Corners		9,385	6,508		3	1,801,596,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	199	2.1%	558	1	86,297,683	4.8%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-7. Unincorporated community of Four Corners critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
Auburn Elementary School						
Four Corners Elementary School		X				
Mary Eyre Elementary School						

A.5 Unincorporated Community of Hayesville

Table A-8. Unincorporated community of Hayesville hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Hayesville		11,677	7,876		7	2,382,452,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	333	2.8%	954	2	158,024,983	6.6%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	14	0.1%	6	0	2,218,000	0.1%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	7	0%	7	0	1,209,000	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-9. Unincorporated community of Hayesville critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
Early College High School						
Grace Academy		X				
Hayesville Elementary School		X				
Lamb Elementary School						
Marion County Fire District 1 - Chemeketa Station 8						
Middle Grove Elementary School						
Scott Elementary School						

A.6 Unincorporated Community of Labish Village

Table A-10. Unincorporated community of Labish Village hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Labish Village		232	167		0	43,407,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	4	1.9%	18	0	3,210,885	7.4%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

A.7 Unincorporated Community of Marion

Table A-11. Unincorporated community of Marion hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Marion		230	244		0	64,728,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	0	0.1%	4	0	875,700	1.4%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	3	1.3%	1	0	408,000	0.6%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-12. Unincorporated community of Marion critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Marion Fire Station						

A.8 Unincorporated Community of Mehama

Table A-13. Unincorporated community of Mehama hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Mehama		203	189		1	53,460,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	3	1.3%	17	0	3,014,033	5.6%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	42	21%	29	0	9,312,000	17%
Channel Migration	Channel Migration Zone	8	3.9%	12	0	3,051,000	5.7%
Wildfire	High and Moderate Risk	36	18%	28	0	7,074,000	13%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	1	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-14. Unincorporated community of Mehama critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Mehama Fire Station						X

A.9 City of Aumsville

Table A-15. City of Aumsville hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Aumsville		4,215	1,459		5	509,635,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	6	0	76,000	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	36	0.9%	93	2	16,580,652	3.3%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-16. City of Aumsville critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Aumsville Elementary School						
Aumsville Police Department						
Aumsville RFPO		X				
Aumsville Sewage Treatment Plant		X				
Willamette Valley Baptist School						

A.10 City of Aurora

Table A-17. City of Aurora hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Aurora		985	560		2	258,763,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	2	0	7,000	0%
Earthquake	Mt. Angel Mw-6.8 Deterministic	32	3.3%	100	2	31,708,988	12%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	27	2.7%	15	0	5,511,000	2.1%
Channel Migration	Channel Migration Zone	0	0%	1	0	118,000	0.05%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-18. City of Aurora critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Aurora Police Department		X				
Aurora RFPD - Aurora Station		X				

A.11 City of Detroit

Table A-19. City of Detroit hazard profile.

Community Overview							
Community Name		Population	Number of Buildings	Critical Facili		uilding Value ($)	
Detroit		205	315	1		69,925,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	0	0%	2	0	186,986	0.3%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	52	26%	78	0	18,032,000	26%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	120	59%	185	0	36,915,258	53%
Lahar	Medium Zone (1,000 to 15,000-year)	128	62%	198	0	47,132,000	67%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-20. City of Detroit critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Detroit Fire Station						

A.12 City of Donald

Table A-21. City of Donald hazard profile.

Community Overview							
Community Name		Population	Number of Buildings	Critical Facili			uilding Value ($)
Donald		995	490	1			195,528,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	181	18%	221	1	57,784,232	30%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-22. City of Donald critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Aurora RFPD - Donald Station		X				

A.13 City of Gates

Table A-23. City of Gates hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili		uilding Value ($)
Gates	540	326	1		71,352,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	6	1.1%	20	0	2,291,112	3.2%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	231	43%	151	0	28,397,000	40%
Channel Migration	Channel Migration Zone	53	10%	27	0	7,145,000	10%
Wildfire	High and Moderate Risk	212	39%	124	1	27124398	38%
Lahar	Medium Zone (1,000 to 15,000-year)	369	68%	216	1	49,569	70%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-24. City of Gates critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Gates Main Station					X	X

A.14 City of Gervais

Table A-25. City of Gervais hazard profile.

Community Overview							
Community Name		Population	Number of Buildings	Critical Facili			uilding Value ($)
Gervais		2,620	719	3			247,297,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	397	15%	266	4	55,400,740	22%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-26. City of Gervais critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
City Hall		X				
Gervais High School		X				
Gervais Middle School		X				

A.15 City of Hubbard

Table A-27. City of Hubbard hazard profile.

Community Overview							
Community Name		Population	Number of Buildings	Critical Facili			uilding Value ($)
Hubbard		3,315	1,187	3			458,199,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	379	11%	466	3	125,813,507	28%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	6	0.2%	2	0	594,000	0.1%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	0	0	0	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-28. City of Hubbard critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Hubbard Police Department		X				
Hubbard RFPD		X				
Hubbard Sewage Treatment Plant		X				

A.16 City of Idanha

Table A-29. City of Idanha hazard profile.

Community Overview							
Community Name		Population	Number of Buildings	Critical Facili		uilding Value ($)	
Idanha		155	159	1		35,338,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	3	1.7%	2	0	23,000	0.1%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	0	0.1%	1	0	149,000	0.4%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	28	18%	39	0	9,935,000	28%
Channel Migration	Channel Migration Zone	23	15%	21	0	4,094,000	15%
Wildfire	High and Moderate Risk	79	51%	66	0	13610108	39%
Lahar	Medium Zone (1,000 to 15,000-year)	141	91%	127	0	27,525,000	78%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-30. City of Idanha critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Idanha-Detroit RFPD						

A.17 City of Jefferson

Table A-31. City of Jefferson hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facili		uilding Value ($)
Jefferson		3,280	1,243		2		389,441,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	5	0.1%	2	0	8,000	0.0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	2	0.1%	12	0	3,211,000	0.8%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Channel Migration	Channel Migration Zone	62	1.9%	25	0	8,146,000	2.1%
Wildfire	High and Moderate Risk	15	0.5%	4	0	1,626,000	0.4%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-32. City of Jefferson critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Jefferson Elementary School						
Jefferson Main Station				X		

A.18 City of Keizer

Table A-33. City of Keizer hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili	uilding Value ($)
Keizer	38,585	16,380	15	5,592,798,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	704	1.8%	336	0	26,571,000	0.5%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	2,479	6.4%	3,994	5	722,048,109	13%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	142	0.4%	62	0	18,852,000	0.3%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	17	0.0%	6	0	2190893	0.0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-34. City of Keizer critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Centennial School		X				
Claggett Creek Middle School						
Clear Lake Elementary						
Cummings Elementary School		X				
Forest Ridge Elementary School						
Gubser Elementary						
Keizer Elementary		X				
Keizer Fire District		X				
Keizer Police Department		X				
Kennedy Elementary School						
Clearlake Station 6						
McNary High School						
Urgent Care Inland Shores						
Weddle Elementary School						
Whiteaker Middle School						

A.19 City of Mill City

Table A-35. City of Mill City hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili	uilding Value ($)
Mill City	1,915	1,269	3	299,237,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	5	0.3%	17	0	4,876,531	1.6%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	126	6.6%	78	0	19,040,000	6.4%
Channel Migration	Channel Migration Zone	196	10%	72	0	25,451,000	8.5%
Wildfire	High and Moderate Risk	260	14%	171	2	38745652	13%
Lahar	Medium Zone (1,000 to 15,000-year)	1,604	84%	1,069	3	245,855	82%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-36. City of Mill City critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Mill City Main Station					X	X
Santiam Elementary					X	X
Santiam JR SR High School						X

A.20 City of Mt. Angel

Table A-37. City of Mt. Angel hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili		uilding Value ($)
Mt. Angel	3,520	1,219	7		539,815,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	613	17%	553	1	197,469,572	37%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0%	2	0	87,000	0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0%	0	0	0	0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-38. City of Mt. Angel critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
John F Kennedy SR High School		X				
Mount Angel Fire Department						
Mount Angel Police Department						
Mount Angel Public Works						
Mt Angel Middle School						
Silverton - Mt Angel Family Medicine						
St Mary's Public School						

A.21 City of Salem

Table A-39. City of Salem hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Salem		141,565	58,163		80	22,532,083,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	2,571	1.8%	1,431	8	70,473,000	0.3%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	1,924	1.4%	3,591	5	1,044,527,904	4.6%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	11,252	7.9%	2,927	1	1,261,015,000	5.6%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	1,555	1.1%	432	0	170035265	0.8%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with “First floor height” above the level of flooding (base flood elevation).

Table A-40. City of Salem critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Armed Forces Reserve Center						
Baker Elementary School						
Battle Creek Elementary	X					
Blanchet Catholic School						
Bush Elementary School		X				
Candalara Elementary School						
Chavez Elementary						
Chemawa Indian School		X				
Crossler Middle School						
Eagle Charter School						
Englewood Elementary School		X				
Grant Community School						
Hallman Elementary School						
Hammond Elementary School		X				
Heritage School						
Highland Elementary School						
Hoover Elementary School						
Houck Middle School						
Immanuel Evangelical Lutheran School						
Judson Middle School						
Lee Elementary School						
Leslie Middle School						
Liberty Elementary School						
Marion County Community Corrections		X				
McKay High School						
McKinley Elementary School						
McNary Army Aviation Hangars	X					
McNary Field	X					
MG George A White Building						
Military Department						
Miller Elementary School						
Montessori Discovery Center						
Morningside Elementary School						
North Salem High School	X					
Oregon Dept of Transportation	X					
Oregon Emergency Management						
Oregon State Hospital						
Oregon State Police	X					
Oregon State Police – Capitol Office						

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
Oregon Youth Authority - Hillcrest Youth Corrections						
Parrish Middle School						
Pringle Elementary School						
Queen of Peace School						
Richmond Elementary School						
Roberts High School						
St John Lutheran School						
St Joseph School						
Salem Academy Christian School						
Salem Child Development Center						
Salem Clinic Main						
Salem Clinic South						
Salem Emergency Services						
Salem Fire Dept - Station 01						
Salem Fire Dept - Station 02						
Salem Fire Dept - Station 03						
Salem Fire Dept - Station 04						
Salem Fire Dept - Station 07						
Salem Fire Dept - Station 09						
Salem Fire Dept - Station 10						
Salem Heights Elementary School						
Salem Hospital	X					
SALEM KINDERCARE						
Salem Montessori School						
Salem Police Department						
Salem Public Works	X					
Schirle Elementary School						
SONSHINE CHRISTIAN SCHOOL						
South Salem High School			X			
Sprague High School						
St Vincent Depaul School						
Stephens Middle School						
Sumpter Elementary School						
Swegle Elementary School						
Urgent Care Clinic South						
Waldo Middle School						
WASHINGTON ELEMENTARY SCHOOL						
Wright Elementary School						
Yakima Valley Farm Workers Clinic						
Yoshikai Elementary School						
Zoom Care Salem						

A.22 City of Salem (West Salem)

Table A-41. City of Salem (West Salem) hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Salem (West Salem)		27,405	10,797		12	3,194,904,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	361	1.3%	157	0	12,098,000	0.4%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	758	2.8%	580	1	132,316,114	4.1%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	1,104	4.0%	424	0	117,055,000	3.7%
Channel Migration	Channel Migration Zone	4	0.0%	1	0	428,000	0.0%
Wildfire	High and Moderate Risk	0	0.0%	0	0	0	0.0%
Lahar	Medium Zone (1,000 to 15,000-year)	7	0.0%	4	0	772	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-42. City of Salem (West Salem) critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Brush College Elementary School		X				
Chapman Hill Elementary School						
Harrit Elementary School						
Kalapuya Elementary School						
Myers Elementary School						
Riviera Christian School						
Salem Fire Dept - Station 05						
Salem Fire Dept - Station 11						
Straub Middle School						
Walker Middle School						
West Salem Clinic						
West Salem High School						

A.23 City of Scotts Mills

Table A-43. City of Scotts Mills hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili	uilding Value ($)
Scotts Mills	385	242	2	63,043,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	96	24.9%	118	0	16,983,461	26.9%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	234	61%	140	0	31,315,000	50%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	15	3.9%	7	0	1280323	2.0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-44. City of Scotts Mills critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Scotts Mills Elementary School						
Silverton RFPD - Scotts Mills Station						

A.24 City of Silverton

Table A-45. City of Silverton hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili		uilding Value ($)
Silverton	10,520	4,077	13		1,740,060,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	81	0.8%	12	0	1,861,000	0.1%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	1,107	10.5%	1,406	1	427,198,866	24.6%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	568	5.4%	188	0	80,361,000	4.6%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	336	3.2%	106	0	44651351	2.6%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-46. City of Silverton critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Evergreen Surgeons - Walter Harris						
Family Medical Group Silverton		X				
Mark Twain JR High School						
Northwest Family Medicine						
Robert Frost Elementary School						
Silverton - McClaine Street Clinic						
Silverton Christian School						
Silverton High School						
Silverton Hospital						
Silverton Middle School						
Silverton Police Department						
Silverton Public Works						
Silverton RFPD - Headquarters						

A.25 City of St. Paul

Table A-47. City of St. Paul hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili		uilding Value ($)
St. Paul	440	247	4		132,631,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	10	2.2%	40	0	14,607,033	11.0%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	1	0.3%	1	0	220,000	0.2%
Channel Migration	Channel Migration Zone	0	0%	0	0	0	0%
Wildfire	High and Moderate Risk	0	0.0%	0	0	0	0.0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-48. City of St. Paul critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
St Paul Elementary School						
St Paul High School						
St Paul Parochial School						
St Paul RFPD						

A.26 City of Stayton

Table A-49. City of Stayton hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili	uilding Value ($)
Stayton	7,880	3,043	12	1,546,547,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	1	0.0%	2	0	33,000	0.0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	62	0.8%	150	0	64,342,531	4.2%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	97	1.2%	32	0	13,290,000	0.9%
Channel Migration	Channel Migration Zone	866	11%	379	2	157,134,000	10%
Wildfire	High and Moderate Risk	50	0.6%	22	2	9113578	0.6%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-50. City of Stayton critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
Regis High School					X	
Santiam Memorial Hospital - Stayton						
St Mary's Catholic School						
Stayton Christian School						
Stayton City Shops						
Stayton Elementary School						
Stayton Emergency Services						
Stayton High School					X	
Stayton Middle School						
Stayton Police Department				X		
Stayton RFPD						
Stayton Water Treatment Plant				X		

A.27 City of Sublimity

Table A-51. City of Sublimity hazard profile.

Community Overview							
Community Name		Population	Number of Buildings	Critical Facili			uilding Value ($)
Sublimity		3,050	1,157	4			546,449,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	6	0.2%	19	0	7,850,753	1.4%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	0	0.0%	0	0	0	0.0%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-52. City of Sublimity critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Sublimity Elementary School						
Sublimity Middle School						
Sublimity Public Works						
Sublimity RFPD						

A.28 City of Turner

Table A-53. City of Turner hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili		uilding Value ($)
Turner	2,410	1,365	3		421,185,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	596	24.7%	347	1	5,849,000	1.4%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	9	0.4%	55	0	11,885,560	2.8%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	300	13%	149	0	42,486,000	10%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	50	2.1%	28	0	6515452	1.5%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-54. City of Turner critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Channel Migration Zone	Wildfire High or Moderate Risk	Lahar Medium Hazard Zone
	Exposed	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Turner Elementary School						
Turner Fire Department	X					
Turner Police Department						

A.29 City of Woodburn

Table A-55. City of Woodburn hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facili		uilding Value ($)
Woodburn	25,185	7,332	17		3,446,910,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	41	0.2%	8	0	266,000	0.0%
Earthquake*	Mt. Angel Mw-6.8 Deterministic	4,595	18.2%	3,270	4	1,287,042,534	37.3%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	15	0.1%	5	0	1,224,000	0.0%
Channel Migration	Channel Migration Zone	0	0.0%	0	0	0	0.0%
Wildfire	High and Moderate Risk	87	0.3%	20	0	8217418	0.2%
Lahar	Medium Zone (1,000 to 15,000-year)	0	0.0%	0	0	0	0.0%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with “First floor height” above the level of flooding (base flood elevation).

Table A-56. City of Woodburn critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Channel Migration Zone Exposed	Wildfire High or Moderate Risk Exposed	Lahar Medium Hazard Zone Exposed
French Prairie Middle School		X				
Gethsemane Christian Academy		X				
Heritage Elementary School		X				
Legacy Medical Group - Woodburn		X				
Lincoln Elementary School		X				
Nellie Muir Elementary School						
Salud Medical Center						
Silverton - Woodburn Immediate Care and Family Medicine						
Silverton - Woodburn Internal Medicine						
St Luke's School						
Valor Middle School						
Woodburn Arthur Academy						
Woodburn Family Medicine						
Woodburn High School						
Woodburn Police Department						
Woodburn Public Works						
Woodburn RFPD 6 - Station 21 HQ						
Woodburn RFPD 6 - Station 22 James Street						
Woodburn Success High School						

APPENDIX B. DETAILED RISK ASSESSMENT TABLES

Table B-1. Marion County building inventory 85
Table B-2. Earthquake loss estimates 87
Table B-3. Flood loss estimates 89
Table B-4. Flood exposure 91
Table B-5. Landslide exposure 93
Table B-6. Channel migration zone exposure 95
Table B-7. Wildfire exposure 97
Table B-8. Volcanic lahar - lahar exposure. 99

Table B-1. Marion County building inventory.

(all dollar amounts in thousands)

	Residential			Commercial and Industrial			Agricultural			Public and Nonprofit			All Buildings			
Community	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Number of Buildings per Watershed Total	Building Value ($)	Value of Buildings per Watershed Total
Unincorp. Marion Co (rural)	20,033	7,206,367	45%	719	858,042	5.3%	22,199	7,441,292	46%	436	536,537	3.3%	43,387	25%	16,042,238	26%
Brooks	156	37,487	42%	27	17,240	19.3%	58	14,603	16%	8	20,175	22.5%	249	0.1%	89,505	0.1%
Butteville	116	55,557	71%	1	474	0.6%	74	21,203	26.9%	2	1,456	1.9%	193	0.1%	78,691	0.1%
Four Corners	4,336	1,449,611	80%	177	200,238	11.1%	1,967	96,170	5.3%	28	55,578	3.1%	6,508	3.8%	1,801,596	2.9%
Hayesville	5,038	1,848,581	78%	207	197,850	8%	2,502	121,144	5.1%	129	214,877	9.0%	7,876	4.6%	2,382,452	3.8%
Labish Village	138	36,978	85%	9	3,475	8.0%	19	2,158	5.0%	1	796	1.8%	167	0%	43,407	0%
Marion	125	35,697	55%	2	597	0.9%	114	24,616	38.0%	3	3,817	6%	244	0.1%	64,728	0.1%
Mehama	114	30,536	57%	18	10,838	20%	55	10,609	20%	2	1,476	3%	189	0.1%	53,460	0.1%
Total Unincorp County	30,056	10,700,813	52%	1,160	1,288,755	6%	26,988	7,731,795	37.6%	609	834,713	4%	58,813	34.5%	20,556,076	32.7%
Aumsville	1,283	384,099	75%	50	43,934	9%	104	28,682	6%	22	52,919	10%	1,459	0.9%	509,635	0.8%
Aurora	428	169,434	65%	60	37,293	14%	65	45,575	18%	7	6,460	2.5%	560	0.3%	258,763	0.4%
Detroit	242	54,049	77%	11	4,215	6%	55	7,943	11.4%	7	3,718	5%	315	0%	69,925	0%
Donald	359	82,831	42%	32	80,527	41%	94	29,610	15%	5	2,560	1.3%	490	0%	195,528	0%
Gates	206	48,934	69%	6	3,639	5%	112	18,036	25%	2	743	1%	326	0%	71,352	0%
Gervais	637	182,425	74%	13	13,617	6%	46	4,930	2%	23	46,325	19%	719	0%	247,297	0%
Hubbard	962	293,470	64%	141	150,652	4%	75	7,476	2%	9	6,602	1%	1,187	1%	458,199	1%
Idanha	94	19,141	54%	14	9,160	26%	46	6,000	17%	5	1,037	3%	159	0%	35,338	0%
Jefferson	1,060	321,719	83%	35	19,728	5%	130	26,216	7%	18	21,778	6%	1,243	1%	389,441	1%
Keizer	11,877	4,758,762	85%	393	360,465	6%	3,993	210,603	4%	117	262,968	5%	16,380	10%	5,592,798	9%
Mill City	884	233,300	78%	27	11,726	4%	339	21,704	7%	19	32,507	11%	1,269	1%	299,237	0%
Mt. Angel	941	345,131	64%	69	87,703	16%	153	22,087	4%	56	84,893	16%	1,219	1%	539,815	1%
Salem	40,365	14,640,969	65%	3,364	5,133,496	23%	13,261	733,938	3%	1,173	2,023,679	9%	58,163	34%	22,532,083	36%

(all dollar amounts in thousands)

	Residential		Commercial and Industrial			Agricultural			Public and Nonprofit			All Buildings			
Community	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Number of Buildings per Watershed Total	Building Value ($)	Value of Buildings per Watershed Total
Salem (West Salem)	10,106	2,784,458	87%	220	174,429	5%	407	21,552	1%	64	214,465	7%	10,797	6%	3,194,904	5%
Scotts Mills	149	39,987	63%	5	1,226	2%	78	12,337	20%	10	9,494	15%	242	0%	63,043	0%
Silverton	3,426	1,285,699	74%	186	235,685	14%	385	53,125	3%	80	165,551	10%	4,077	2%	1,740,060	3%
St. Paul	155	65,091	49%	14	13,122	10%	63	25,634	19%	15	28,784	22%	247	0%	132,631	0%
Stayton	2,463	963,861	62%	243	401,864	26%	256	48,559	3%	81	132,263	9%	3,043	2%	1,546,547	2%
Sublimity	979	486,698	89%	35	25,793	5%	128	16,869	3%	15	17,089	3%	1,157	1%	546,449	1%
Turner	822	287,771	68%	99	66,333	16%	383	27,530	7%	61	39,552	9%	1,365	1%	421,185	1%
Woodburn	6,469	2,223,170	64%	388	887,455	26%	352	77,309	2%	123	258,975	8%	7,332	4%	3,446,910	5%
Total Study Area	113,963	40,371,813	64%	6,565	9,050,817	14%	47,513	9,177,510	15%	2,521	4,247,075	7%	170,562	100%	62,847,215	100%

Table B-2. Earthquake loss estimates.

(all dollar amounts in thousands)

			Total Earthquake Damage							
			Buildings Damaged				All Buildings Changed to At Least Moderate Code			
	Total Number of Buildings	Total Estimated Building Value ($)	Yellow-Tagged Buildings	Red-Tagged Buildings	Sum of Economic Loss	Loss Ratio	Yellow-Tagged Buildings	Red-Tagged Buildings	Sum of Economic Loss	Loss Ratio
Unincorp. Marion Co (rural)	43,387	16,042,238	5,262	2,605	2,169,985	13.5%	4,114	1,252	1,508,735	9.0%
Brooks	249	89,505	46	15	13,150	14.7%	33	6	7,740	9.0%
Butteville	193	78,691	40	15	13,144	16.7%	33	8	10,102	13.0%
Four Corners	6,508	1,801,596	466	92	86,298	4.8%	250	49	56,715	3.0%
Hayesville	7,876	2,382,452	777	176	158,025	6.6%	447	90	107,487	5.0%
Labish Village	167	43,407	15	3	3,211	7.4%	10	2	2,169	5.0%
Marion	244	64,728	3	0	876	1.4%	1	0	533	1.0%
Mehama	189	53,460	14	3	3,014	5.6%	6	1	1,485	3.0%
Total Unincorporated County	58,813	20,556,076	6,625	2,911	2,447,702	11.9%	4,893	1,408	1,694,966	8.0%
Aumsville	1,459	509,635	78	15	16,581	3.3%	25	2	8,869	2.0%
Aurora	560	258,763	76	24	31,709	12.3%	57	13	23,240	9.0%
Detroit	315	69,925	1	0	187	0.3%	1	0	134	0.0%
Donald	490	195,528	130	91	57,784	30.0%	118	33	32,604	17.0%
Gates	326	71,352	17	3	2,291	3.0%	7	1	1,305	2.0%
Gervais	719	247,297	151	115	55,401	22.0%	155	58	41,279	17.0%
Hubbard	1,187	458,199	279	186	125,814	27.0%	253	77	81,760	18.0%
Idanha	159	35,338	1	0	149	0.0%	1	0	104	0.0%
Jefferson	1,243	389,441	11	1	3,211	1.0%	4	0	1,869	0.0%
Keizer	16,380	5,592,798	3,017	977	722,048	13.0%	2,546	613	591,976	11.0%
Mill City	1,269	299,237	14	2	4,877	2.0%	7	1	3,577	1.0%
Mt. Angel	1,219	539,815	300	253	197,470	37.0%	273	135	123,614	23.0%
Salem	58,163	22,532,083	2,965	626	1,044,528	5.0%	1,600	309	595,384	3.0%

(all dollar amounts in thousands)

			Total Earthquake Damage							
			Buildings Damaged				All Buildings Changed to At Least Moderate Code			
	Total Number of Buildings	Total Estimated Building Value ($)	Yellow-Tagged Buildings	Red-Tagged Buildings	Sum of Economic Loss	Loss Ratio	Yellow-Tagged Buildings	Red-Tagged Buildings	Sum of Economic Loss	Loss Ratio
Salem (West Salem)	10,797	3,194,904	456	124	132,316	4.0%	328	76	94,315	3.0%
Scotts Mills	242	63,043	53	65	16,983	27.0%	52	38	11,827	19.0%
Silverton	4,077	1,740,060	867	539	427,199	25.0%	754	303	282,972	16.0%
St. Paul	247	132,631	31	8	14,607	11.0%	22	5	9,671	7.0%
Stayton	3,043	1,546,547	126	23	64,343	4.0%	63	12	34,658	2.0%
Sublimity	1,157	546,449	18	2	7,851	1.0%	8	1	5,678	1.0%
Turner	1,365	421,185	47	8	11,886	3.0%	18	3	6,218	1.0%
Woodburn	7332	3,446,910	1764	1506	1,287,043	37.0%	1610	772	820,194	24.0%
Total Study Area	170,562	62,847,215	17,028	7,479	6,671,977	11.0%	12,796	3,860	4,466,215	7.0%

Table B-3. Flood loss estimates.

(all dollar amounts in thousands)

Community	Total Number of Buildings	Total Estimated Building Value ($)	10% (10-yr)			2% (50-yr)			1% (100-yr)			0.2% (500-yr)		
			Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio
Unincorp. Marion Co (rural)	43,387	16,042,238	97	1,650	0.0%	180	4,923	0.0%	247	9,060	0.1%	559	41,213	0.3%
Brooks	249	89,505	0	0	0.00%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Butteville	193	78,691	0	0	0.00%	0	0	0.00%	0	0	0.00%	31	2,646	3.36%
Four Corners	6,508	1,801,596	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Hayesville	7,876	2,382,452	0	0	0.0%	0	0	0.0%	0	0	0.0%	1	2	0.0%
Labish Village	167	43,407	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Marion	244	64,728	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Mehama	189	53,460	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Total Unincorp County	58,813	20,556,076	97	1,650	0.0%	180	4,923	0.0%	247	9,060	0.0%	591	43,861	0.2%
Aumsville	1,459	509,635	4	43	0.0%	6	63	0.0%	6	76	0.0%	6	94	0.0%
Aurora	560	258,763	0	0	0.0%	0	0	0.0%	2	7	0.00%	0	0	0.00%
Detroit	315	69,925	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Donald	490	195,528	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Gates	326	71,352	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Gervais	719	247,297	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Hubbard	1,187	458,199	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Idanha	159	35,338	1	7	0.0%	1	9	0.0%	2	23	0.1%	3	76	0.2%
Jefferson	1,243	389,441	0	0	0.0%	0	0	0.0%	2	8	0.0%	50	892	0.2%
Keizer	16,380	5,592,798	230	6,150	0.1%	320	21,726	0.4%	336	26,571	0.5%	4,908	408,198	7.3%
Mill City	1,269	299,237	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Mt. Angel	1,219	539,815	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Salem	58,163	22,532,083	489	20,961	0.1%	1,065	52,786	0.2%	1,431	70,473	0.3%	3,924	221,657	1.0%
Salem (West Salem)	10,797	3,194,904	3	6	0.0%	64	4,790	0.1%	157	12,098	0.4%	635	54,672	1.7%
Scotts Mills	242	63,043	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Silverton	4,077	1,740,060	0	0	0.0%	6	1,099	0.1%	12	1,861	0.1%	27	2,615	0.2%

			(all dollar amounts in thousands)											
			10% (10-yr)			**2% (50-yr)**			**1% (100-yr)**			**0.2% (500-yr)**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**
St. Paul	247	132,631	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Stayton	3,043	1,546,547	0	0	0.0%	2	10	0.0%	2	33	0.0%	5	153	0.0%
Sublimity	1,157	546,449	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Turner	1,365	421,185	93	928	0.2%	282	4,084	1.0%	347	5,849	1.4%	534	13,929	3.3%
Woodburn	7,332	3,446,910	0	0	0.0%	1	10	0.0%	8	266	0.0%	17	1,074	0.0%
Total Study Area	170,562	62,847,215	917	29,744	0.0%	1,927	89,501	0.1%	2,552	126,324	0.2%	10,700	747,221	1.2%

Table B-4. Flood exposure.

Community	Total Number of Buildings	Total Population	1% (100-yr) Potentially Displaced Residents From Flood Exposure	1% (100-yr) % Potentially Displaced Residents From Flood Exposure	1% (100-yr) Number of Flood Exposed Buildings	1% (100-yr) % of Flood Exposed Buildings	1% (100-yr) Number of Flood Exposed Buildings Without Damage
Unincorp. Marion Co (rural)	43,387	47,599	205	0.4%	313	0.7%	66
Brooks	249	272	0	0.0%	0	0.0%	0
Butteville	193	352	0	0.0%	0	0.0%	0
Four Corners	6,508	9,385	0	0.0%	0	0.0%	0
Hayesville	7,876	11,677	0	0.0%	0	0.0%	0
Labish Village	167	232	0	0.0%	0	0.0%	0
Marion	244	230	0	0.0%	0	0.0%	0
Mehama	189	203	0	0.0%	0	0.0%	0
Total Unincorporated County	58,813	69,950	205	0.0%	313	1.0%	66
Aumsville	1,459	4,215	0	0.0%	6	0.0%	0
Aurora	560	985	0	0.0%	2	0.0%	0
Detroit	315	205	0	0.0%	0	0.0%	0
Donald	490	995	0	0.0%	0	0.0%	0
Gates	326	540	0	0.0%	0	0.0%	0
Gervais	719	2,620	0	0.0%	0	0.0%	0
Hubbard	1,187	3,315	0	0.0%	0	0.0%	0
Idanha	159	155	3	2.0%	3	2.0%	1
Jefferson	1,243	3,280	5	0.0%	3	0.0%	1
Keizer	16,380	38,585	704	2.0%	347	2.0%	11
Mill City	1,269	1,915	0	0.0%	0	0.0%	0
Mt. Angel	1,219	3,520	0	0.0%	0	0.0%	0
Salem	58,163	141,565	2,571	2.0%	1,726	3.0%	295

			1% (100-yr)				
Community	Total Number of Buildings	Total Population	Potentially Displaced Residents From Flood Exposure	% Potentially Displaced Residents From Flood Exposure	Number of Flood Exposed Buildings	% of Flood Exposed Buildings	Number of Flood Exposed Buildings Without Damage
Salem (West Salem)	10,797	27,405	361	1.0%	174	2.0%	17
Scotts Mills	242	385	0	0.0%	0	0.0%	0
Silverton	4,077	10,520	81	1.0%	19	0.0%	7
St. Paul	247	440	0	0.0%	0	0.0%	0
Stayton	3,043	7,880	1	0.0%	2	0.0%	0
Sublimity	1,157	3,050	0	0.0%	0	0.0%	0
Turner	1,365	2,410	596	25.0%	448	33.0%	101
Woodburn	7332	25185	41	0.0%	10	0.0%	2
Total Study Area	170,562	349,120	4568	1.0%	3053	2.0%	501

Table B-5. Landslide exposure.

(all dollar amounts in thousands)

Community	Total Number of Buildings	Total Estimated Building Value ($)	Very High Susceptibility			High Susceptibility			Moderate Susceptibility		
			Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed
Unincorp. Marion Co (rural)	43,387	16,042,238	2,019	676,155	4.2%	1,113	324,563	2.0%	8,651	2,680,246	17%
Brooks	249	89,505	0	0	0%	0	0	0%	17	3,460	4%
Butteville	193	78,691	6	1,851	2%	4	1,542	2.0%	58	22,666	29%
Four Corners	6,508	1,801,596	0	0	0%	2	78	0%	176	56,831	3%
Hayesville	7,876	2,382,452	0	0	0%	6	2,218	0.1%	235	68,187	3%
Labish Village	167	43,407	0	0	0%	0	0	0%	33	8,921	21%
Marion	244	64,728	0	0	0.0%	0	0	0%	1	89	0%
Mehama	189	53,460	19	7,351	14%	10	1,962	3.7%	21	5,100	10%
Total Unincorp. County	58,813	20,556,076	2,044	685,357	3.3%	1,135	330,362	1.6%	9,192	2,845,499	14%
Aumsville	1,459	509,635	0	0	0%	0	0	0%	26	7,372	1%
Aurora	560	258,763	0	0	0%	15	5,511	2.1%	192	81,235	31%
Detroit	315	69,925	54	10,546	15%	24	7,485	10.7%	134	28,616	41%
Donald	490	195,528	0	0	0%	0	0	0%	1	314	0%
Gates	326	71,352	141	26,006	36%	10	2,391	3.4%	20	5,402	7.6%
Gervais	719	247,297	0	0	0%	0	0	0%	2	748	0.3%
Hubbard	1,187	458,199	0	0	0%	2	594	0.1%	53	17,912	3.9%
Idanha	159	35,338	20	3,092	8.8%	19	6,843	19%	60	11,972	34%
Jefferson	1,243	389,441	0	0	0%	0	0	0%	56	15,970	4.1%
Keizer	16,380	5,592,798	0	0	0%	62	18,852	0.3%	1,107	396,935	7.1%
Mill City	1,269	299,237	45	12,464	4.2%	33	6,576	2.2%	155	34,342	12%
Mt. Angel	1,219	539,815	0	0	0%	0	0	0%	108	50,742	9.4%
Salem	58,163	22,532,083	1,531	633,172	2.8%	1,396	627,843	2.8%	8,647	3,333,449	15%

			(all dollar amounts in thousands)								
			Very High Susceptibility			**High Susceptibility**			**Moderate Susceptibility**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Salem (West Salem)	10,797	3,194,904	0	0	0%	424	117,055	3.7%	4,759	1,455,158	46%
Scotts Mills	242	63,043	132	28,843	46%	8	2,471	3.9%	12	3,784	6.0%
Silverton	4,077	1,740,060	115	47,778	2.7%	73	32,583	1.9%	737	305,763	18%
St. Paul	247	132,631	0	0	0%	1	220	0.2%	27	8,898	6.7%
Stayton	3,043	1,546,547	9	4,227	0.3%	23	9,063	0.6%	338	159,959	10%
Sublimity	1,157	546,449	0	0	0%	0	0	0%	92	45,157	8.3%
Turner	1,365	421,185	113	33,157	7.9%	36	9,329	2.2%	199	66,040	16%
Woodburn	7,332	3,446,910	0	0	0%	5	1,224	0%	312	104,945	4.2%
Total Study Area	170,562	62,847,215	4,204	1,484,643	2.4%	3,266	1,178,402	1.9%	26,229	8,980,211	14%

Table B-6. Channel migration zone exposure.

(all dollar amounts in thousands)

				Channel Migration Hazard				
Community	Total Number of Buildings	Total Population	Total Estimated Building Value ($)	Potentially Displaced Residents From Channel Migration Exposure	% Potentially Displaced Residents From Channel Migration Exposure	Number of Buildings Exposed	Building Value ($)	Ratio of Exposure Value
Unincorp. Marion Co (rural)	43,387	47,599	16,042,238	263	0.6%	288	90,300	0.6%
Brooks	249	272	89,505	0	0.0%	0	0	0.0%
Butteville	193	352	78,691	0	0.0%	0	0	0.0%
Four Corners	6,508	9,385	1,801,596	0	0.0%	0	0	0.0%
Hayesville	7,876	11,677	2,382,452	0	0.0%	0	0	0.0%
Labish Village	167	232	43,407	0	0.0%	0	0	0.0%
Marion	244	230	64,728	0	0.0%	0	0	0.0%
Mehama	189	203	53,460	8	3.9%	12	3,051	5.7%
Total Unincorporated	58,813	69,950	20,556,076	271	0.4%	300	93,351	0.5%
Aumsville	1,459	4,215	509,635	0	0.0%	0	0	0.0%
Aurora	560	985	258,763	0	0.0%	1	118	0.1%
Detroit	315	205	69,925	0	0.0%	0	0	0.0%
Donald	490	995	195,528	0	0.0%	0	0	0.0%
Gates	326	540	71,352	53	10.0%	27	7,145	10.0%
Gervais	719	2,620	247,297	0	0.0%	0	0	0.0%
Hubbard	1,187	3,315	458,199	0	0.0%	0	0	0.0%
Idanha	159	155	35,338	23	15.0%	21	4,094	15.0%
Jefferson	1,243	3,280	389,441	62	1.9%	25	8,146	2.1%
Keizer	16,380	38,585	5,592,798	0	0.0%	0	0	0.0%
Mill City	1,269	1,915	299,237	196	10.0%	72	25,451	8.5%
Mt. Angel	1,219	3,520	539,815	0	0.0%	0	0	0.0%
Salem	58,163	141,565	22,532,083	0	0.0%	0	0	0.0%

				(all dollar amounts in thousands)				
				Channel Migration Hazard				
Community	**Total Number of Buildings**	**Total Population**	**Total Estimated Building Value ($)**	**Potentially Displaced Residents From Channel Migration Exposure**	**% Potentially Displaced Residents From Channel Migration Exposure**	**Number of Buildings Exposed**	**Building Value ($)**	**Ratio of Exposure Value**
Salem (West Salem)	10,797	27,405	3,194,904	4	0.0%	1	428	0.0%
Scotts Mills	242	385	63,043	0	0.0%	0	0	0.0%
Silverton	4,077	10,520	1,740,060	0	0.0%	0	0	0.0%
St. Paul	247	440	132,631	0	0.0%	0	0	0.0%
Stayton	3,043	7,880	1,546,547	866	11.0%	379	157,134	10.0%
Sublimity	1,157	3,050	546,449	0	0.0%	0	0	0.0%
Turner	1,365	2,410	421,185	0	0.0%	0	0	0.0%
Woodburn	7,332	25,185	3,446,910	0	0.0%	0	0	0.0%
Total Study Area	170,562	349,120	62,847,215	1,475	0.4%	826	295,868	0.5%

Table B-7. Wildfire exposure.

			(all dollar amounts in thousands)					
			High Hazard			**Moderate Hazard**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Unincorp. Marion Co (rural)	43,387	16,042,238	154	38,350	0.0%	1,396	378,590	2.0%
Brooks	249	89,505	0	0	0.0%	0	0	0.0%
Butteville	193	78,691	0	0	0.0%	0	0	0.0%
Four Corners	6,508	1,801,596	0	0	0.0%	0	0	0.0%
Hayesville	7,876	2,382,452	0	0	0.0%	7	1,209	0.0%
Labish Village	167	43,407	0	0	0.0%	0	0	0.0%
Marion	244	64,728	0	0	0.0%	1	408	1.0%
Mehama	189	53,460	9	1,787	3.3%	19	5,288	10.0%
Total Unincorp. County	58,813	20,556,076	163	40,137	0.0%	1,423	385,496	1.9%
Aumsville	1,459	509,635	0	0	0.0%	46	19,823	4.0%
Aurora	560	258,763	0	0	0.0%	14	8,339	3.0%
Detroit	315	69,925	111	23,075	33.0%	74	13,841	20.0%
Donald	490	195,528	0	0	0.0%	0	0	0.0%
Gates	326	71,352	52	12,128	17.0%	72	14,997	21.0%
Gervais	719	247,297	0	0	0.0%	0	0	0.0%
Hubbard	1,187	458,199	0	0	0.0%	0	0	0.0%
Idanha	159	35,338	62	13,003	36.8%	4	607	1.7%
Jefferson	1,243	389,441	0	0	0.0%	4	1,626	0.4%
Keizer	16,380	5,592,798	0	0	0.0%	6	2,191	0.0%
Mill City	1,269	299,237	13	3,993	1.3%	158	34,753	11.6%
Mt. Angel	1,219	539,815	0	0	0.0%	2	173	0.0%
Salem	58,163	22,532,083	67	26,292	0.1%	365	143,743	0.6%
Salem (West Salem)	10,797	3,194,904	0	0	0.0%	0	0	0.0%

			(all dollar amounts in thousands)					
			High Hazard			**Moderate Hazard**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Scotts Mills	242	63,043	0	0	0.0%	7	1,280	2.0%
Silverton	4,077	1,740,060	11	3,764	0.2%	95	40,887	2.3%
St. Paul	247	132,631	0	0	0.0%	0	0	0.0%
Stayton	3,043	1,546,547	0	0	0.0%	22	9,114	0.6%
Sublimity	1,157	546,449	0	0	0.0%	0	0	0.0%
Turner	1,365	421,185	0	0	0.0%	28	6,515	1.5%
Woodburn	7332	3,446,910	0	0	0.0%	20	8,217	0.2%
Total Study Area	170,562	62,847,215	479	122,391	0.2%	2,340	691,602	1.1%

Table B-8. Volcanic lahar - lahar exposure.

Community	Total Number of Buildings	Total Estimated Building Value ($)	Small: 1%-0.1% (100 to 1,000-yr)			Medium: 0.1%-0.007% (1,000 to 15,000-yr)			Large: >0.007% (>15,000-yr)		
			Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio
Unincorp. Marion Co (rural)	43,387	16,042,238	73	13,604	0.1%	175	43,913	0.30%	1,107	344,288	2.0%
Brooks	249	89,505	0	0	0.0%	0	0	0.00%	0	0	0.0%
Butteville	193	78,691	0	0	0.0%	0	0	0.00%	0	0	0.0%
Four Corners	6,508	1,801,596	0	0	0.0%	0	0	0.00%	0	0	0.0%
Hayesville	7,876	2,382,452	0	0	0.0%	0	0	0.00%	0	0	0.0%
Labish Village	167	43,407	0	0	0.0%	0	0	0.00%	0	0	0.0%
Marion	244	64,728	0	0	0.0%	0	0	0.00%	0	0	0.0%
Mehama	189	53,460	0	0	0.0%	0	0	0.00%	156	44,399	83.0%
Total Unincorp. County	58,813	20,556,076	73	13,604	0.1%	175	43,913	0.20%	1,263	388,686	1.9%
Aumsville	1,459	509,635	0	0	0.0%	0	0	0.00%	0	0	0.0%
Aurora	560	258,763	0	0	0.0%	0	0	0.00%	0	0	0.0%
Detroit	315	69,925	131	32,835	47.0%	198	47,132	67%	260	59,862	86.0%
Donald	490	195,528	0	0	0.0%	0	0	0.00%	0	0	0.0%
Gates	326	71,352	0	0	0.0%	216	49,569	70%	280	62,651	88.0%
Gervais	719	247,297	0	0	0.0%	0	0	0.00%	0	0	0.0%
Hubbard	1,187	458,199	0	0	0.0%	0	0	0.00%	0	0	0.0%
Idanha	159	35,338	108	23,151	66.0%	127	27,525	78%	151	33,496	95.0%
Jefferson	1,243	389,441	0	0	0.0%	0	0	0.00%	0	0	0.0%
Keizer	16,380	5,592,798	0	0	0.0%	0	0	0.00%	0	0	0.0%
Mill City	1,269	299,237	0	0	0.0%	1,069	245,855	82%	1,103	255,078	85.0%
Mt. Angel	1,219	539,815	0	0	0.0%	0	0	0.00%	0	0	0.0%
Salem	58,163	22,532,083	0	0	0.0%	0	0	0.00%	0	0	0.0%
Salem (West Salem)	10,797	3,194,904	0	0	0.0%	4	772	0.00%	4	772	0.0%

Community	Total Number of Buildings	Total Estimated Building Value ($)	Small: 1%-0.1% (100 to 1, 000-yr)			Medium: 0.1% -0.007% (1,000 t o 15,000-yr)			Large: >0.007% (>15,000-yr)		
			Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio
Scotts Mills	242	63,043	0	0	0.0%	0	0	0.00%	0	0	0.0%
Silverton	4,077	1,740,060	0	0	0.0%	0	0	0.00%	0	0	0.0%
St. Paul	247	132,631	0	0	0.0%	0	0	0.00%	0	0	0.0%
Stayton	3,043	1,546,547	0	0	0.0%	0	0	0.00%	2,228	1,184,906	77.0%
Sublimity	1,157	546,449	0	0	0.0%	0	0	0.00%	0	0	0.0%
Turner	1,365	421,185	0	0	0.0%	0	0	0.00%	0	0	0.0%
Woodburn	7,332	3,446,910	0	0	0.0%	0	0	0.00%	0	0	0.0%
Total Study Area	170,562	62,847,215	312	69,591	0.1%	1,789	414,766	0.70%	5,289	1,985,452	3.2%

APPENDIX C. HAZUS-MH METHODOLOGY

C.1 Software

We performed all loss estimations using Hazus®-MH 4.2 and ArcGIS® Desktop® 10.2.2.

C.2 User-Defined Facilities (UDF) Database

A UDF database was compiled for all buildings in Marion County for use in both the flood and earthquake modules of Hazus-MH. The Marion County assessor database (acquired in 2021) was used to determine which taxlots had improvements (i.e., buildings) and how many building points should be included in the UDF database.

C.2.1 Locating buildings points

The Oregon Department of Geology and Mineral Industries (DOGAMI) used the SBFO-1 (Williams, 2021) dataset to help precisely locate the centroid of each building. Extra effort was spent to locate building points along the 1% and 0.2% annual chance inundation fringe. When buildings were partially within the inundation zone, the building point was moved to the centroid of the portion of the building within the inundation zone. An iterative approach was used to further refine locations of building points for the flood module by generating results, reviewing the highest value buildings, and moving the building point over a representative elevation on the lidar digital elevation model to ensure an accurate first floor height.

C.2.2 Attributing building points

Populating the required attributes for Hazus-MH was achieved through a variety of approaches. The Marion County assessor database was used whenever possible, but in many cases that database did not provide the necessary information. The following is list of attributes and their sources:

- **Longitude** and **Latitude** – Location information that provides Hazus-MH the x and y-position of the UDF point. This allows for an overlay to occur between the UDF point and the flood or earthquake input data layers. The hazard model uses this spatial overlay to determine the correct hazard risk level that will be applied to the UDF point. The format of the attribute must be in decimal degrees. A simple geometric calculation using GIS software is done on the point to derive this value.
- **Occupancy class** – An alphanumeric attribute that indicates the use of the UDF (e.g. 'RES1' is a single family dwelling). The alphanumeric code is composed of seven broad occupancy types (RES = residential, COM = commercial, IND = industrial, AGR = agricultural, GOV = public, REL = non-profit/religious, EDU = education) and various suffixes that indicate more specific types. This code determines the damage function to be used for flood analysis. It is also used to attribute the Building Type field, discussed below, for the earthquake analysis. The code was interpreted from "Stat Class" or "Description" data found in the Marion County assessor database. When data was not available, the default value of RES1 was applied throughout.
- **Cost** – The replacement cost of an individual UDF. Loss ratio is derived from this value. Replacement cost is based on a method called RSMeans valuation (Charest, 2017) and is calculated by multiplying the building square footage by a standard cost per square foot. These standard rates per square foot are in tables within the default Hazus database.

- **Year built** – The year of construction that is used to attribute the Building Design Level field for the earthquake analysis (see "Building Design" below). The year a UDF was built is obtained from Marion County assessor database. When not available, the year of "1900" was applied.
- **Square feet** – The size of the UDF is used to pro-rate the total improvement value for taxlots with multiple UDFs. The value distribution method will ensure that UDFs with the highest square footage will be the most expensive on a given taxlot. This value is also used to pro-rate the **Number of People** field for Residential UDFs within a census block. The value was obtained from DOGAMI's building footprints; where (RES) footprints were not available, we used the Marion County assessor database.
- **Number of stories** – The number of stories for an individual UDF, along with Occupancy Class, determines the applied damage function for flood analysis. The value was obtained from the Marion County assessor database when available. For UDFs without assessor information for number of stories that are within the flood zone, closer inspection using Google Street View™ or available oblique imagery was used for attribution.
- **Foundation type** – The UDF foundation type correlates with First Floor Height values in feet (see Table 3.11 in the Hazus-MH Technical Manual for the Flood Model [FEMA Hazus-MH, 2012a]). It also functions within the flood model by indicating if a basement exists or not. UDFs with a basement have a different damage function from UDFs that do not have one. The value was obtained from the Marion County assessor database when available. For UDFs without assessor information for basements that are within the flood zone, closer inspection using Google Street View™ or available oblique imagery was used to ascertain if one exists or not.
- **First floor height** – The height in feet above grade for the lowest habitable floor. The height is factored during the depth of flooding analysis. The value is used directly by Hazus-MH, where Hazus-MH overlays a UDF location on a depth grid and using the **first floor height** determines the level of flooding occurring to a building. It is derived from the Foundation Type attribute or observation via oblique imagery or Google Street View™ mapping service.
- **Building type** – This attribute determines the construction material and structural integrity of an individual UDF. It is used by Hazus-MH for estimating earthquake losses by determining which damage function will be applied. This information was unavailable from the Marion County assessor data, so instead it was derived from a statistical distribution based on **Occupancy class**.
- **Building design level** – This attribute determines the seismic building code for an individual UDF. It is used by Hazus-MH for estimating earthquake losses by determining which damage function will be applied. This information is derived from the **Year Built** attribute (Marion County Assessor) and state/regional Seismic Building Code benchmark years.
- **Number of people** – The estimated number of permanent residents living within an individual residential structure. It is used in the post-analysis phase to determine the amount of people affected by a given hazard. This attribute is derived from default Hazus database (United States Census Bureau, 2010a) of population per census block and distributed across residential UDFs and adjusted based on population growth estimates from PSU Population Research Center.
- **Community** – The community that a UDF is within. These areas are used in the post-analysis for reporting results. The communities were based on incorporated area boundaries; unincorporated community areas were based on building density.

C.2.3 Seismic building codes

Oregon initially adopted seismic building codes in the mid-1970s (Judson, 2012). The established benchmark years of code enforcement are used in determining a "design level" for individual buildings. The design level attributes (pre code, low code, moderate code, and high code) are used in the Hazus-MH earthquake model to determine what damage functions are applied to a given building (FEMA, 2012b). The year built or the year of the most recent seismic retrofit are the main considerations for an individual design level attribute. Seismic retrofitting information for structures would be ideal for this analysis but was not available for Marion County. **Table C-1** outlines the benchmark years that apply to buildings within Marion County.

Table C-1. Marion County seismic design level benchmark years.

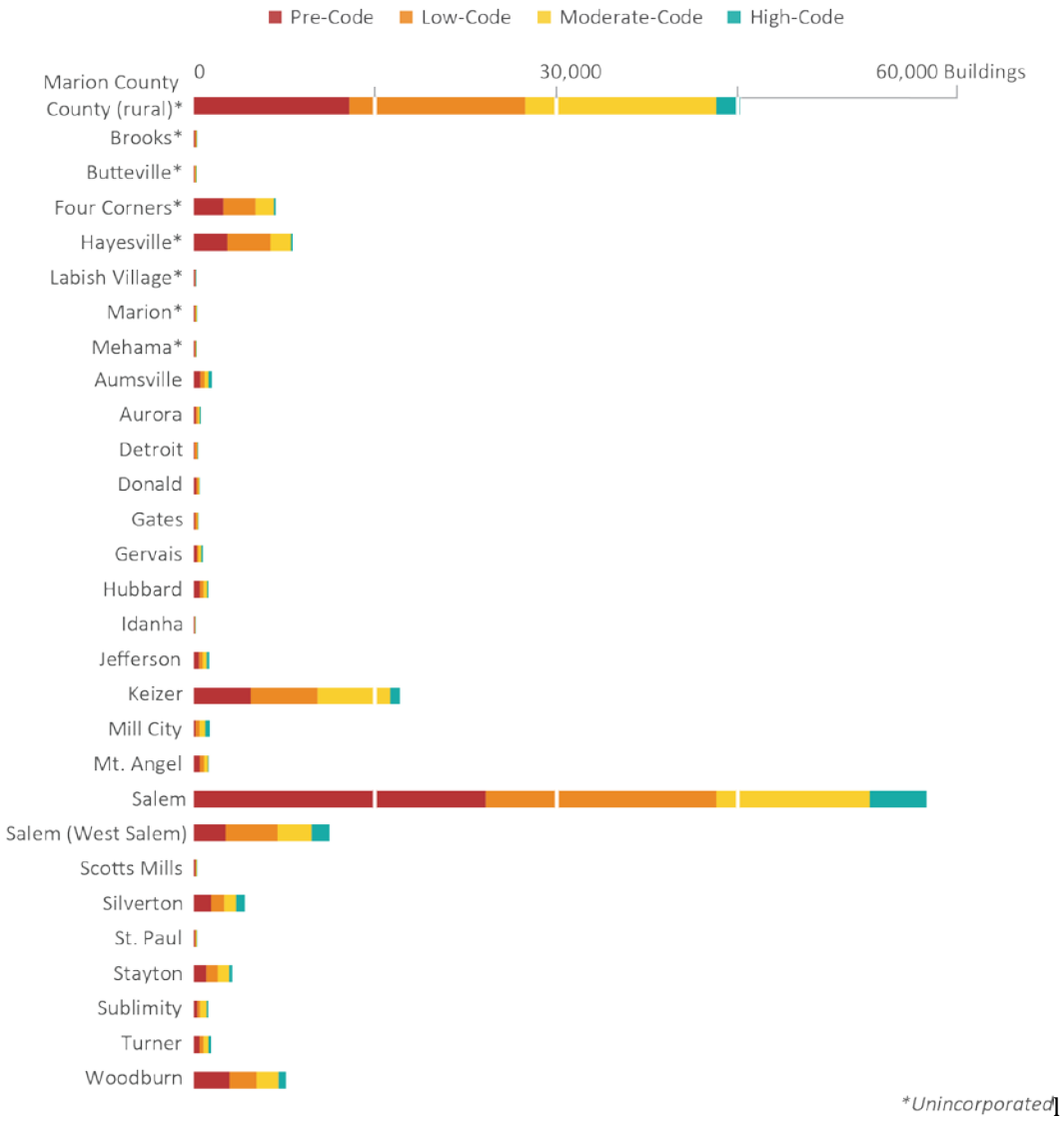
Building Type	Year Built	Design Level	Basis
Single-Family Dwelling (includes Duplexes)	prior to 1976	Pre Code	Interpretation of Judson (Judson, 2012)
	1976–1991	Low Code	
	1992–2003	Moderate Code	
	2004–2016	High Code	
Manufactured Housing	prior to 2003	Pre Code	Interpretation of OR BCD 2002 Manufactured Dwelling Special Codes (Oregon Building Codes Division, 2002)
	2003–2010	Low Code	
	2011–2016	Moderate Code	Interpretation of OR BCD 2010 Manufactured Dwelling Special Codes Update (Oregon Building Codes Division, 2010)
All other buildings	prior to 1976	Pre Code	Business Oregon 2014-0311 Oregon Benefit-Cost Analysis Tool, p. 24 (Business Oregon, 2015)
	1976–1990	Low Code	
	1991–2016	Moderate Code	

Table C-2 and corresponding **Figure C-1** illustrate the current state of seismic building codes for the county.

Table C-2. Seismic design level in Marion County.

		Pre Code		Low Code		Moderate Code		High Code	
Community	Total Number of Buildings	Number of Buildings	Percentage of Buildings	Number of Buildings	Percentage of Buildings	Number of Buildings	Percentage of Buildings	Number of Buildings	Percentage of Buildings
Unincorp. Marion Co (rural)	43,387	12,333	28%	13,978	32%	15,162	35%	1,914	4.4%
Brooks	249	100	40%	76	30.5%	56	22.5%	17	6.8%
Butteville	193	54	28%	56	29%	70	36%	13	6.7%
Four Corners	6,508	2,338	36%	2,575	40%	1,472	23%	123	1.9%
Hayesville	7,876	2,661	34%	3,393	43.1%	1,660	21.1%	162	2.1%
Labish Village	167	84	50%	58	35%	18	11%	7	4.2%
Marion	244	95	39%	45	18.4%	82	33.6%	22	9.0%
Mehama	189	81	43%	65	34%	33	17%	10	5.3%
Total Unincorporated County	58,813	17,746	30%	20,246	34%	18,553	32%	2,268	3.9%
Aumsville	1,459	526	36%	312	21.4%	316	22%	305	21%
Aurora	560	161	29%	126	22.5%	161	28.8%	112	20.0%
Detroit	315	55	17%	217	68.9%	24	7.6%	19	6.0%
Donald	490	199	41%	118	24.1%	119	24%	54	11.0%
Gates	326	101	31%	149	46%	60	18%	16	5%
Gervais	719	219	30%	109	15%	260	36%	131	18%
Hubbard	1,187	462	39%	303	26%	277	23%	145	12%
Idanha	159	55	35%	48	30%	37	23%	19	12%
Jefferson	1,243	390	31%	307	25%	296	24%	250	20%
Keizer	16,380	4,513	28%	5,268	32%	5,773	35%	826	5%
Mill City	1,269	110	9%	328	26%	466	37%	365	29%
Mt. Angel	1,219	453	37%	334	27%	314	26%	118	10%
Salem	58,163	23,168	40%	18,285	31%	12,217	21%	4,493	8%
Salem (West Salem)	10,797	2,498	23%	4,129	38%	2,735	25%	1,435	13%
Scotts Mills	242	116	48%	43	18%	61	25%	22	9%
Silverton	4,077	1,395	34%	997	24%	964	24%	721	18%
St. Paul	247	78	32%	68	28%	89	36%	12	5%
Stayton	3,043	980	32%	903	30%	933	31%	227	7%
Sublimity	1,157	254	22%	256	22%	488	42%	159	14%
Turner	1,365	432	32%	340	25%	369	27%	224	16%
Woodburn	7,332	2,850	39%	2,135	29%	1,730	24%	617	8%
Total Study Area	170,562	56,761	33%	55,021	32%	46,242	27%	12,538	7%

Figure C-1. Seismic design level by Marion County community.



C.3 Flood Hazard Data

Depth grids for "Zone A" designated flood zones, or approximate 100-year flood zones, were developed by the Strategic Alliance for Risk Reduction (STARR) in 2015 to revise the Marion County FIRMs (FEMA, 2018). DOGAMI developed depth grids from detailed stream model information within the study area. Both sets of depth grids were used in this risk assessment to determine the level to which buildings are impacted by flooding.

A study area-wide, 2-meter, lidar-based depth grid was developed for each of the 10-, 50-, 100-, and 500-year annual chance flood events. The depth grids were imported into Hazus-MH for determining the depth of flooding for areas within the FEMA flood zones.

Once the UDF database was developed into a Hazus-compliant format, the Hazus-MH methodology was applied using a Python (programming language) script developed by DOGAMI (Bauer, 2018). The analysis was then run for a given flood event, and the script cross-referenced a UDF location with the depth grid to find the depth of flooding. The script then applied a specific damage function, based on a UDF's

Occupancy Class [OccCls], which was used to determine the loss ratio for a given amount of flood depth, relative to the UDF's first-floor height.

C.4 Earthquake Hazard Data

The following hazard layers used for our loss estimation are derived from work conducted by Madin and others (2021): National Earthquake Hazard Reduction Program (NEHRP) soil classification, liquefaction susceptibility and wet landslide susceptibility. The liquefaction and landslide susceptibility layers together with NEHRP were used by the Hazus-MH tool to calculate ground motion layers and permanent ground deformation and associated probability. The default value of 5 feet was used for the water table depth value.

During the Hazus-MH earthquake analysis, each UDF was analyzed given its site-specific parameters (ground deformation) and evaluated for loss, expressed as a probability of a damage state. Specific damage functions based on Building type and Building design level were used to calculate the damage states given the site-specific parameters for each UDF. The output provided probabilities of the five damage states (None, Slight, Moderate, Extensive, Complete) from which losses in dollar amounts were derived.

C.5 Post-Analysis Quality Control

Ensuring the quality of the results from Hazus-MH flood and earthquake modules is an essential part of the process. A primary characteristic of the process is that it is iterative. A UDF database without errors is highly unlikely, so this part of the process is intended to limit and reduce the influence these errors have on the final outcome. Before applying the Hazus-MH methodology, closely examining the top 10 largest area UDFs and the top 10 most expensive UDFs is advisable. Special consideration can also be given to critical facilities due to their importance to communities.

Identifying, verifying, and correcting (if needed) the outliers in the results is the most efficient way to improve the UDF database. This can be done by sorting the results based on the loss estimates and closely scrutinizing the top 10 to 15 records. If corrections are made, then subsequent iterations are necessary. We continued checking the "loss leaders" until no more corrections were needed.

Finding anomalies and investigating possible sources of error are crucial in making corrections to the data. A wide range of corrections might be required to produce a better outcome. For example, floating homes may need to have a first-floor height adjustment or a UDF point position might need to be moved due to issues with the depth grid. Incorrect basement or occupancy type attribution could be the cause of a problem. Commonly, inconsistencies between assessor data and taxlot geometry can be the source of an error. These are just a few of the many types of problems addressed in the quality control process.

APPENDIX D. ACRONYMS AND DEFINITIONS

D.1 Acronyms

CRS	Community Rating System
CSZ	Cascadia subduction zone
DLCD	Oregon Department of Land Conservation and Development
DOGAMI	Department of Geology and Mineral Industries (State of Oregon)
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FRI	Fire Risk Index
GIS	Geographic Information System
NFIP	National Flood Insurance Program
NHMP	Natural hazard mitigation plan
NOAA	National Oceanic and Atmospheric Administration
ODF	Oregon Department of Forestry
OEM	Oregon Emergency Management
OFR	Open-File Report
OPDR	Oregon Partnership for Disaster Resilience
PGA	Peak ground acceleration
PGD	Permanent ground deformation
PGV	Peak ground velocity
Risk MAP	Risk Mapping, Assessment, and Planning
SHMO	State Hazard Mitigation Officer
SLIDO	State Landslide Information Layer for Oregon
UDF	User-defined facilities
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WUI	Wildland-urban interface
WWA	West Wide Wildfire Risk Assessment

D.2 Definitions

1% annual chance flood – The flood elevation that has a 1-percent chance of being equaled or exceeded each year. Sometimes referred to as the 100-year flood.

0.2% annual chance flood – The flood elevation that has a 0.2-percent chance of being equaled or exceeded each year. Sometimes referred to as the 500-year flood.

Base flood elevation (BFE) – Elevation of the 1-percent-annual-chance flood. This elevation is the basis of the insurance and floodplain management requirements of the NFIP.

Critical facilities – Facilities that, if damaged, would present an immediate threat to life, public health, and safety. As categorized in HAZUS-MH, critical facilities include hospitals, emergency operations centers, police stations, fire stations and schools.

Exposure – Determination of whether a building is within or outside of a hazard zone. No loss estimation is modeled.

Flood Insurance Rate Map (FIRM) – An official map of a community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – Contains an examination, evaluation, and determination of the flood hazards of a community and, if appropriate, the corresponding water-surface elevations.

Hazus-MH – A GIS-based risk assessment methodology and software application created by FEMA and the National Institute of Building Sciences for analyzing potential losses from floods, hurricane winds, and earthquakes.

Lidar – A remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. Lidar is popularly used as a technology to make high-resolution maps.

Liquefaction – Describes a phenomenon whereby a saturated soil substantially loses strength and stiffness in response to an applied stress, usually an earthquake, causing it to behave like liquid.

Loss Ratio – The expression of loss as a fraction of the value of the local inventory (total value/loss).

Magnitude – A scale used by seismologists to measure the size of earthquakes in terms of energy released.

Risk – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of a natural hazard. Sometimes referred to as vulnerability.

Risk MAP – The vision of this FEMA strategy is to work collaboratively with State, local, and tribal entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property.

Riverine – Of or produced by a river. Riverine floodplains have readily identifiable channels.

Susceptibility – Degree of proneness to natural hazards that is determined based on physical characteristics that are present.

Vulnerability – Characteristics that make people or assets more susceptible to a natural hazard.

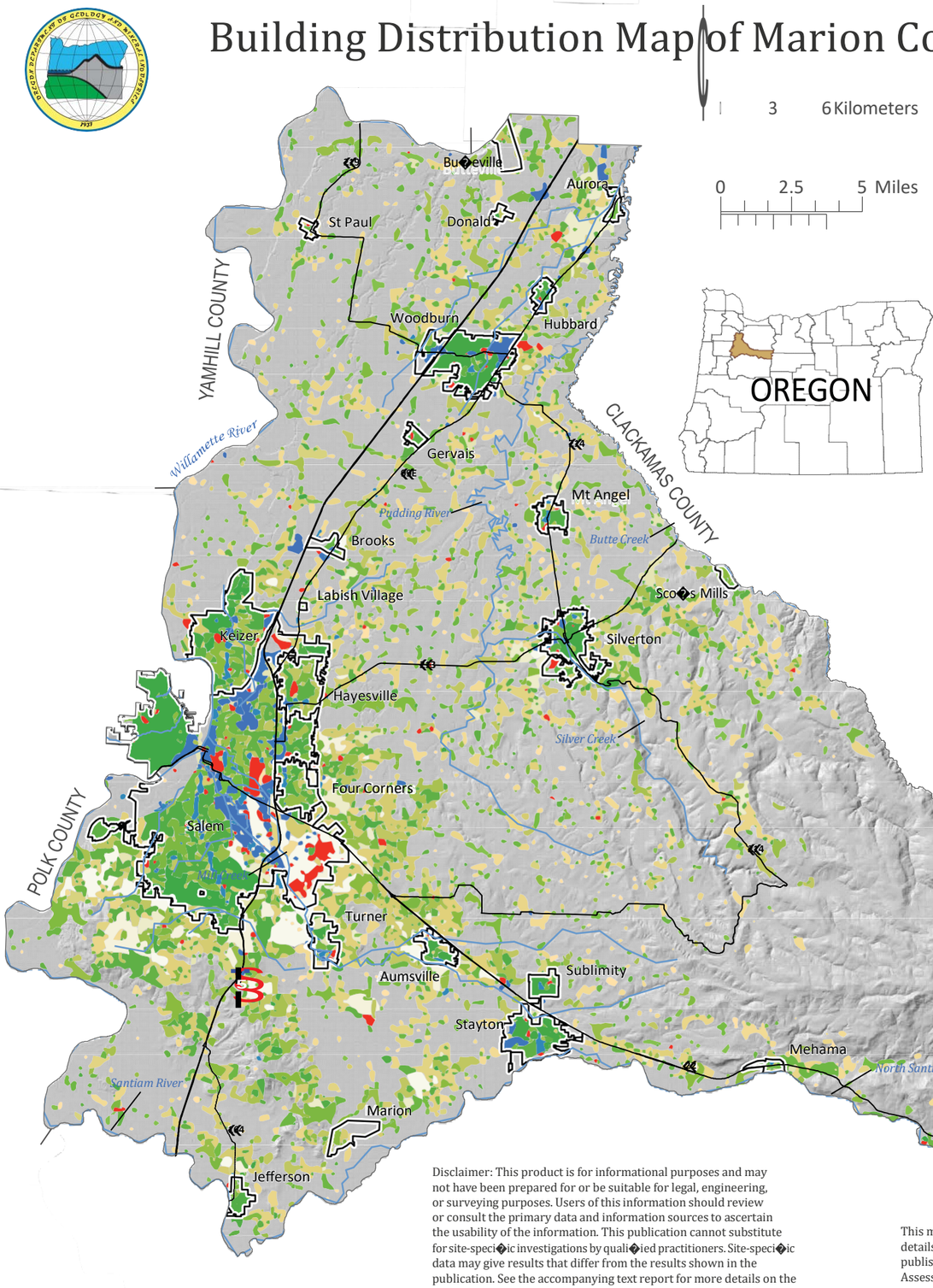
APPENDIX E. MAP PLATES

See appendix folder for individual map PDFs.

Plate 1. Building Distribution Map of Marion County, Oregon 110
Plate 2. Population Density Map of Marion County, Oregon 111
Plate 3. Mt. Angel Fault Magnitude 6.8 Earthquake Shaking Map of Marion County, Oregon 112
Plate 4. Flood Hazard Map of Marion County, Oregon 113
Plate 5. Landslide Susceptibility Map of Marion County, Oregon 114
Plate 6. Channel Migration Hazard Map of Marion County, Oregon 115
Plate 7. Wildfire Hazard Map of Marion County, Oregon 116
Plate 8. Lahar Hazard Map of Marion County, Oregon 117

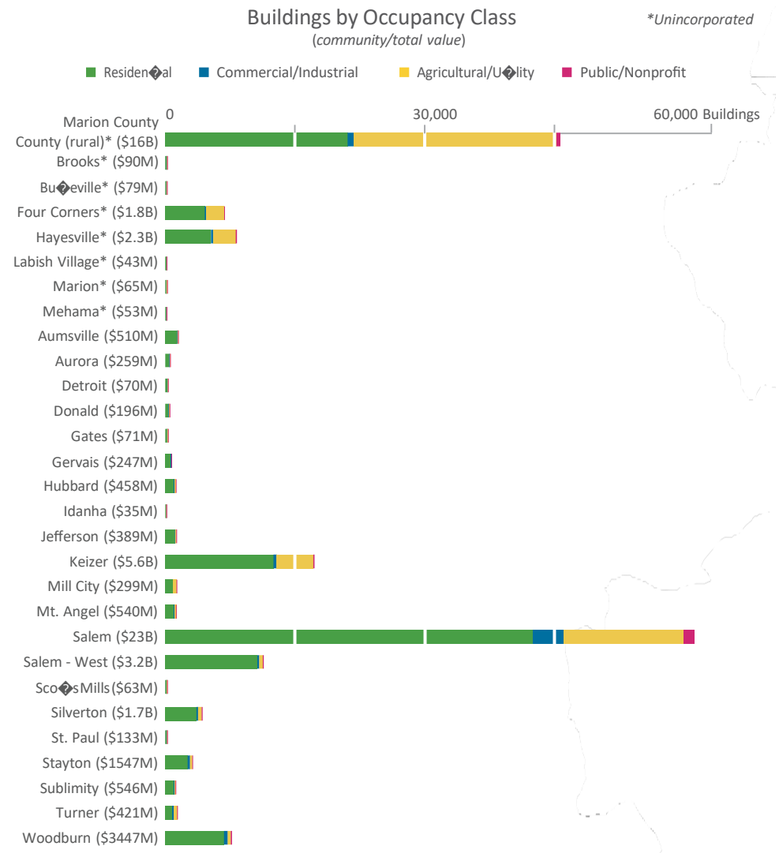
Building Distribution Map of Marion County, Oregon

PLATE 1



Building Occupancy

- Agricultural / U□lity
- Commercial / Industrial
- Public / Nonprofit
- Residen□al



Data Sources:

Building footprints: Statewide Building Footprints for Oregon, release 1.0 (2021)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri□ ArcMap 10, Adobe□ Illustrator CC

Cartography by: Matt C. Williams, 2021

Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci□ic investigations by quali□ied practitioners. Site-speci□ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Population Density Map of Marion County, Oregon

PLATE 2

3 0 3 6 Kilometers

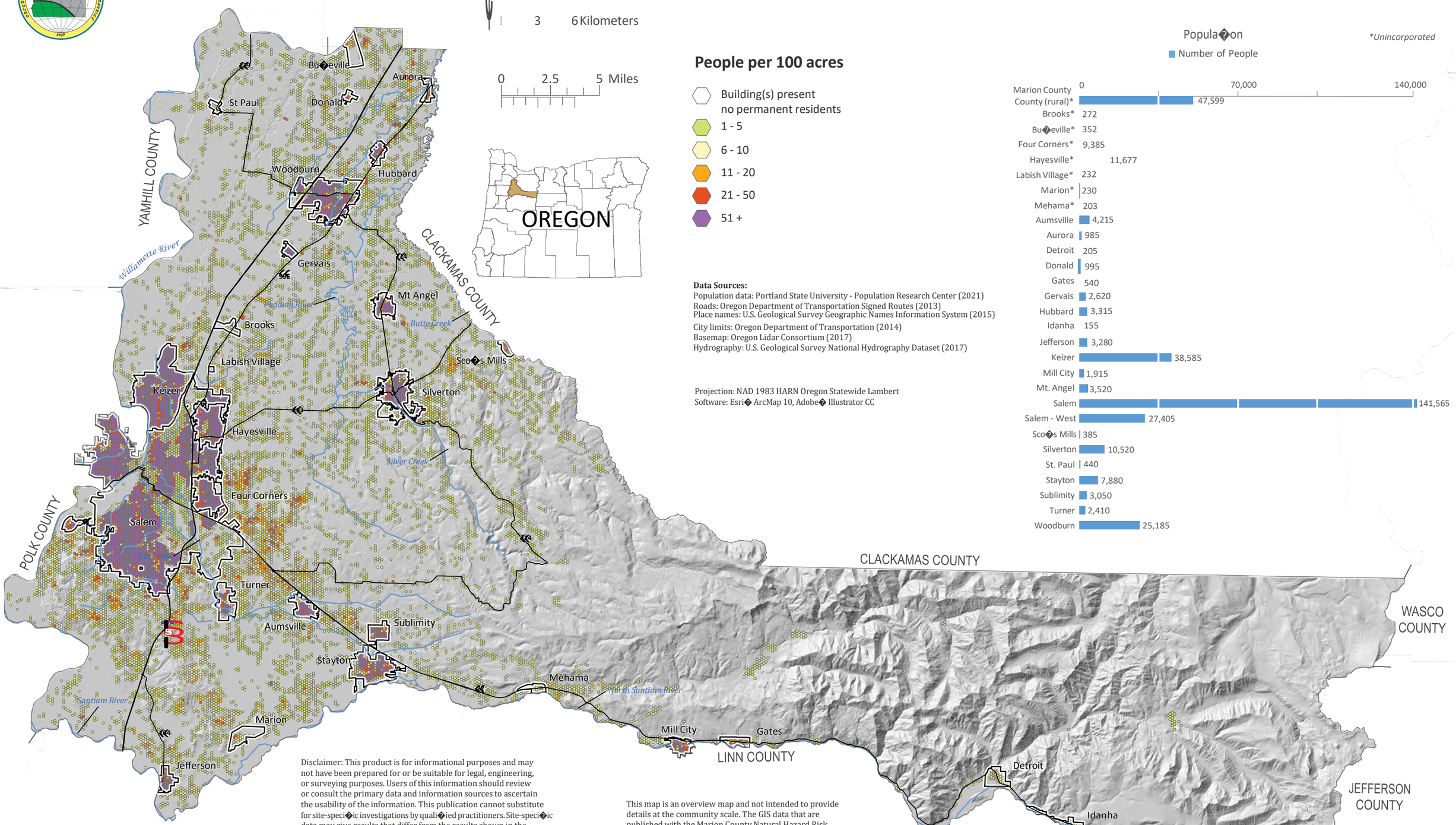
0 2.5 5 Miles

People per 100 acres

- Building(s) present no permanent residents
- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- 51 +

Data Sources:
Population data: Portland State University - Population Research Center (2021)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri® ArcMap 10, Adobe® Illustrator CC



Cartography by: Matt C. Williams, 2021

Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci®ic investigations by quali®ied practitioners. Site-speci®ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Mt. Angel Fault Magnitude-6.8 Earthquake Shaking Map of Marion County, Oregon

PLATE 3



0 2.5 5 Miles

0 3 6 Kilometers

OREGON

CLACKAMAS COUNTY

WASCO COUNTY

Earthquake Peak Ground Accelera□on

(Modified Mercalli Intensity Scale)
Moderate Severe

Peak Ground Acceleration (PGA) is the maximum acceleration in a given location, or rather, how hard the ground is shaking during an earthquake. It is one measurement of ground motion, which is closely associated with the level of damage that occurs from an earthquake.

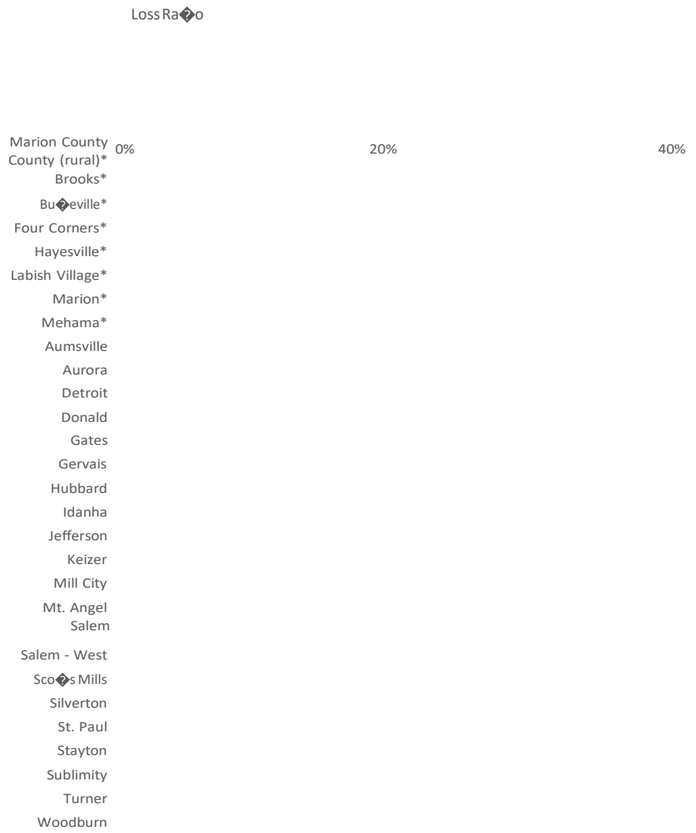
Data Sources:
Peak ground acceleration: Oregon Department of Geology and Mineral Industries (2019)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri□ ArcMap 10, Adobe□ Illustrator CC

Cartography by: Matt C. Williams, 2021

Total Building Value Loss Ra□o from Mt. Angel Fault - Mw-6.8

*Unincorporated

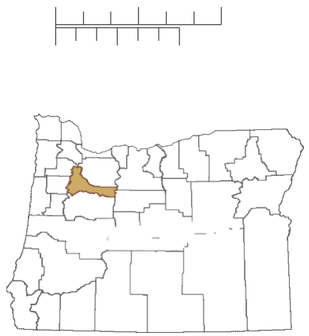


Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci□ic investigations by quali□ied practitioners. Site-speci□ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

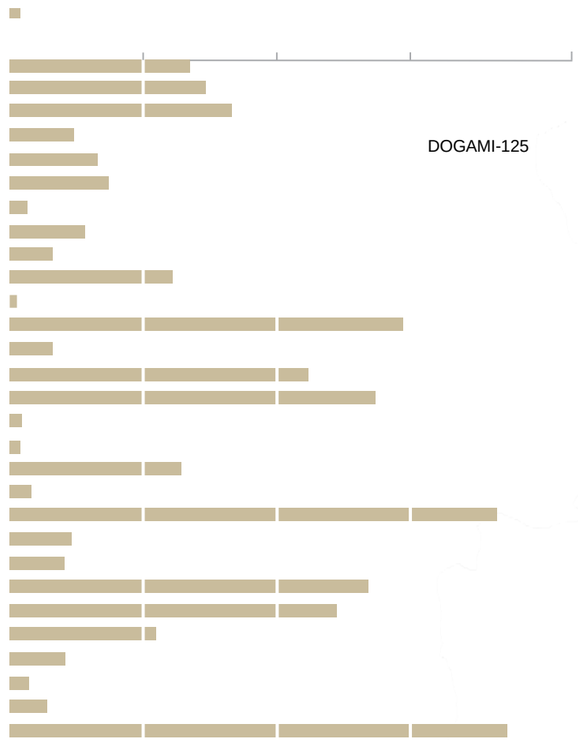
Oregon Department of Geology and Mineral Industries Open-File Report O-22-05

Marion County HMP



2022

JEFFERSON COUNTY



DOGAMI-125

Detroit
Idanha
Butteville
Aurora
St Paul
Donald
Woodburn
Hubbard
Gervais
Mt Angel
Brooks
Labish Village
Scotts Mills
Keizer
Silverton
Hayesville
Four Corners
Salem
Turner
Aumsville
Sublimity
Stayton
Mehama
Marion
Mill City
Gates
Jefferson
Detroit
Idanha

PLATE 4

Flood Hazard Map of Marion County, Oregon





0 3 6 Kilometers

0 2.5 5 Miles

(1% annual chance)

Flood Hazard Zone

100-Year Flood

The flood hazard data show areas expected to be inundated during a 100-year flood event. Flooding sources are riverine in origin. Areas are consistent with the regulatory flood zones depicted in Marion County's Flood Insurance Rate Maps.

Data Sources:
Flood hazard zone (100-year): Marion County FEMA Flood Insurance Rate Maps (2019)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri ArcMap 10, Adobe Illustrator CC

tography by: Matt C. Williams, 2021

Ca
r

Ra o of Es mated Loss to Flooding

**Unincorporated*

Flood Scenarios

	10-Year	50-Year	100-Year	500-Year
rooks*				
Marion County (rural)*	0%	3.5%		7%
B				
Bu eville*				
Four Corners*				
Hayesville*				
Labish Village*				
Marion*				
Mehama*				
Aumsville				
Aurora				
Detroit				
Donald				
Gates				
Gervais				
Hubbard				
Idanha				
Jefferson				
Keizer				
Mill City				
Mt. Angel				
Salem				
Salem (West Salem)				
Sco s Mills				
Silverton				
St. Paul				
Stayton				
Sublimity				
Turner				
Woodburn				

Dis
clai
mer
:
Thi
s product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci ic investigations by quali ied practitioners. Site-speci ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the

methods and data used to prepare this publication.

ity scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

This map is an overview map and not intended to provide details at the commun

Detroit

Idanha

JEFFERSON COUNTY

Oregon Department of Geology and Mineral Industries Open-File Report O-22-05

Marion County HMP

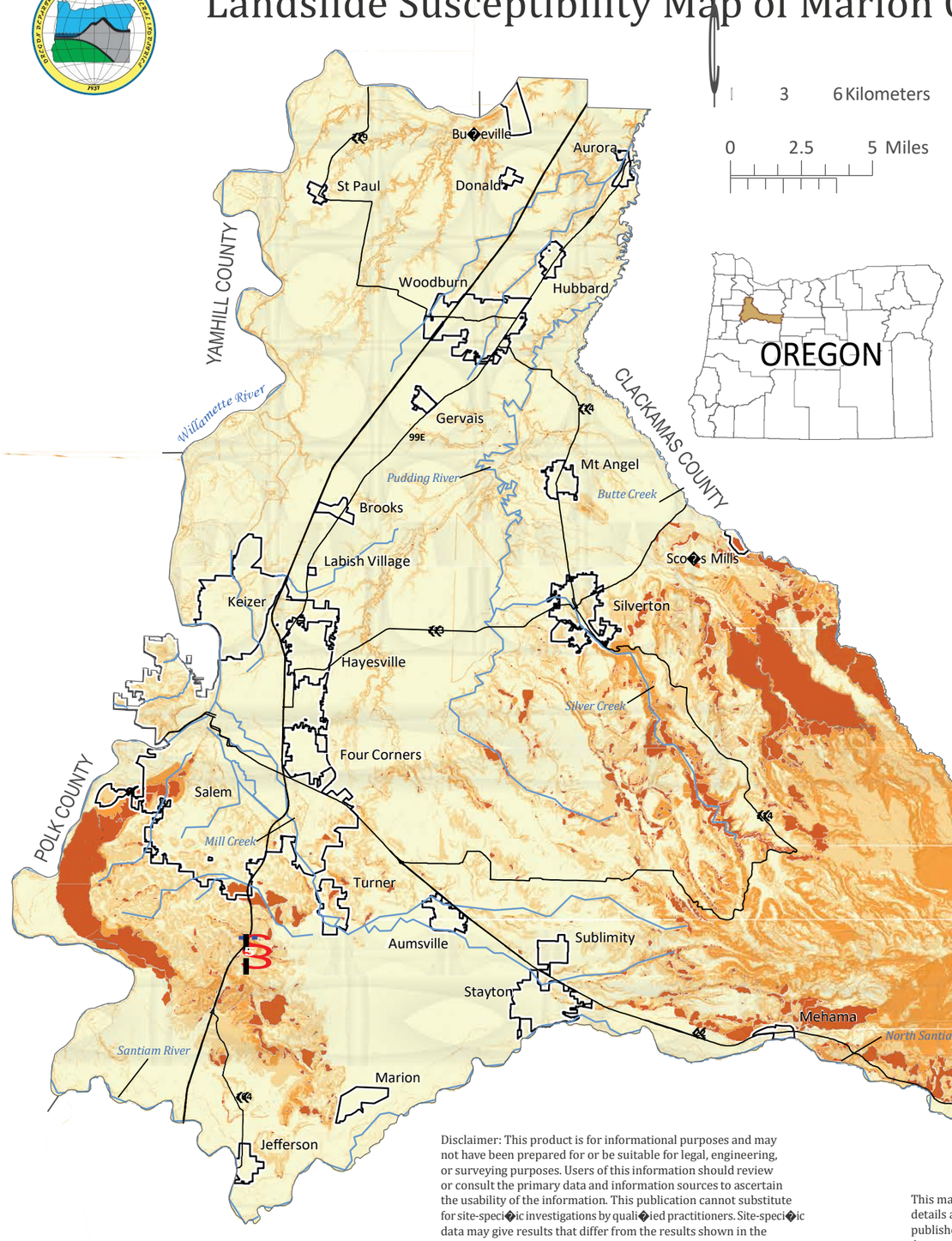
2022

DOGAMI-126



PLATE 5

Landslide Susceptibility Map of Marion County, Oregon



Landslide Susceptibility

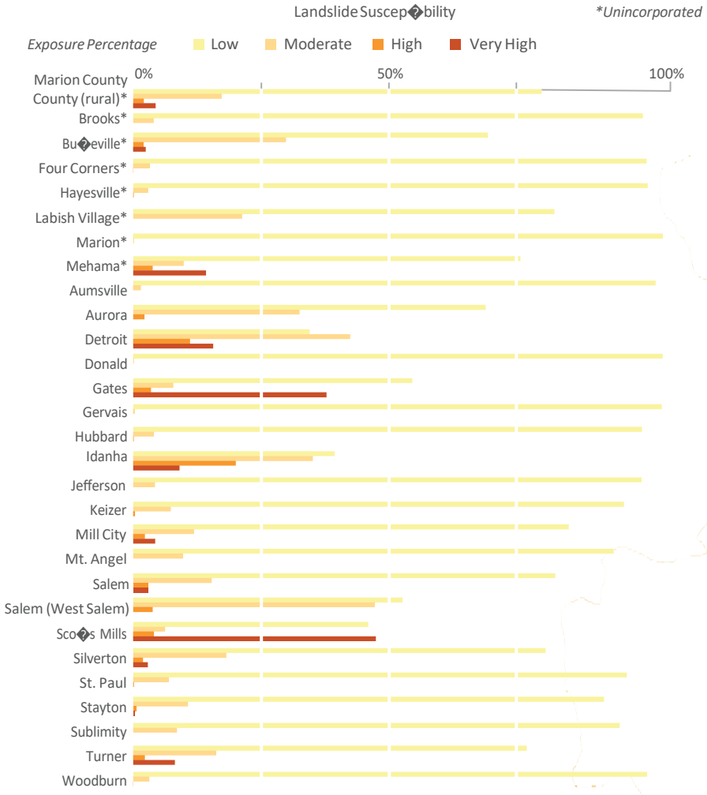
- Low
- Moderate
- High
- Very High

Landslide susceptibility is categorized as Low, Moderate, High, and Very High which describes the general level of susceptibility to landslide hazard. The dataset is an aggregation of three primary sources: landslide inventory (SLIDO), generalized geology, and slope.

Data Sources:
Landslide susceptibility: Oregon Department of Geology, Burns and others (2016) & Hairston-Porter and others (2021)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri◆ ArcMap 10, Adobe◆ Illustrator CC

Percentage of Building Value Exposed to Landslide



Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci◆ic investigations by quali◆ied practitioners. Site-speci◆ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Cartography by: Matt C. Williams, 2021

Channel Migration Zone Map of Marion County, Oregon

PLATE 6



Channel Migra□on Zone

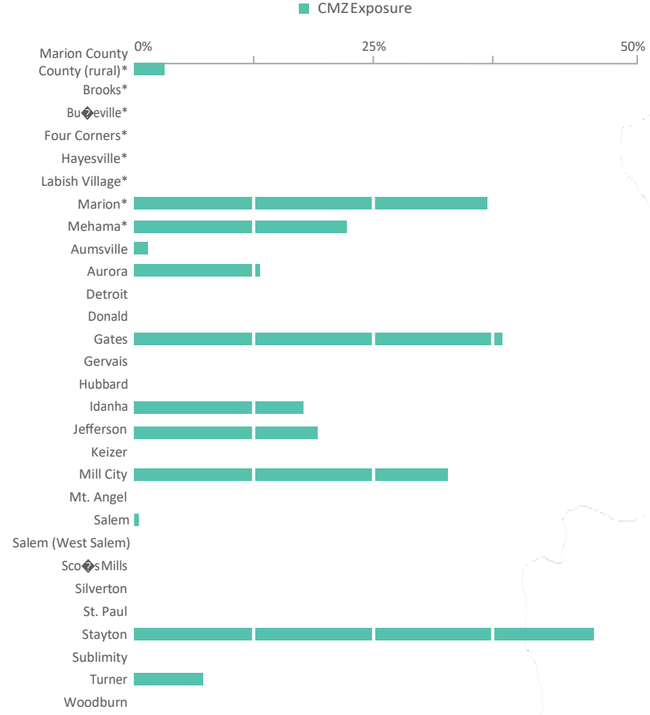
The channel migration hazard data show areas expected to be exposed in a 100-year period. The Pudding River and the Santiam and North Santiam Rivers were mapped for channel migration hazard. Some mapped areas indicate severe channel migration potential.

Data Sources:
Channel migration hazard: Oregon Department of Geology and Mineral Industries (2021)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri□ ArcMap 10, Adobe□ Illustrator CC

Ra□o of Building Value Exposed to Channel Migra□on

*Unincorporated



Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci□ic investigations by quali□ied practitioners. Site-speci□ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Cartography by: Matt C. Williams, 2021

Wild?ire Risk Map of Marion County, Oregon



Wildfire Risk

Low

Moderate

High

Overall Wild?ire Risk is categorized as Low, Moderate, and High and indicates the level of risk a location has to wild?ire hazard. The Overall Wild?ire Risk data layer is derived from a combination of the burn probability (?ire history and behavior) and ?ire impacts (infrastructure and assets).

Data Sources:

Wild?ire risk data: Oregon Department of Forestry, Pyrologix, LCC. (2018)

Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri?ArcMap 10, Adobe?Illustrator CC

Percentage of Building Value Exposed to Wildfire

Wildfire Risk

Exposure Percentage	Low	Moderate	High	**Unincorporated*
Marion County County (rural)*	0%		50%	100%
Brooks*				
Bu?eville*				
Four Corners*				
Hayesville*				
Labish Village*				
Marion*				
Mehama*				
Aumsville				
Aurora				
Detroit				
Donald				
Gates				
Gervais				
Hubbard				
Idanha				
Jefferson				
Keizer				
Mill City				
Mt. Angel				
Salem				
Salem - West				
Sco?s Mills				
Silverton				
St. Paul				
Stayton				
Sublimity				
Turner				
Woodburn				

Jefferson

Detroit

Idanha

JEFFERSON COUNTY

DOGAMI-129

Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

2022

Cartography by: Matt C. Williams, 2021

Oregon Department of Geology and Mineral Industries Open-File Report O-22-05

Marion County NHMP

St Paul

Woodburn

Gervais

Mt Angel

Aumsville

Scotts Mills

Silverton

Four Corners

Salem

Turner

Aumsville

Sublimity

Stayton

Mehama

Mill City

Gates

Detroit

Idanha

Marion

Lahar Exposure Map of Marion County, Oregon

PLATE 8



Lahar Hazard Zone

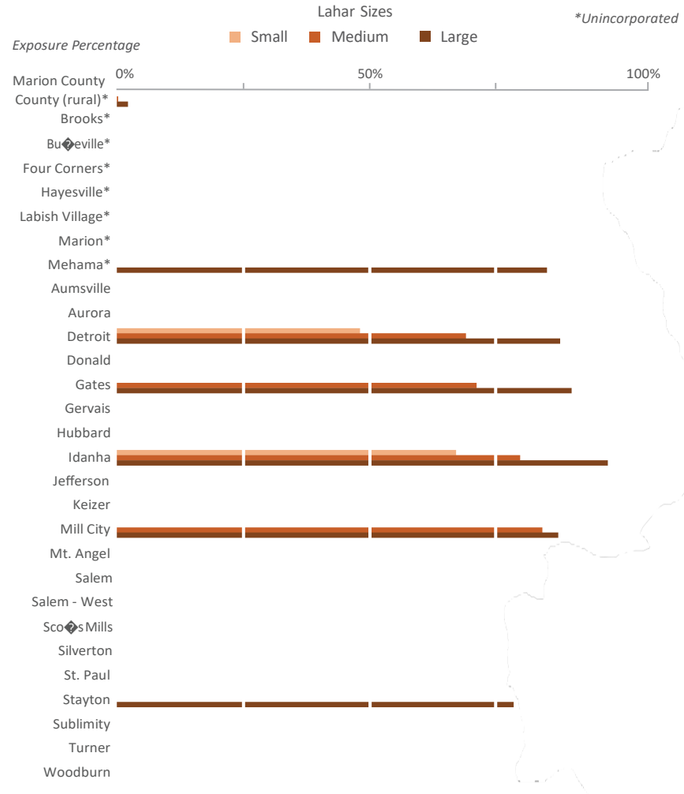
- Small
- Medium
- Large

The lahar hazard data show areas of expected exposure from several local lahar scenarios produced from a volcanic event on Mt. Jefferson. The scenarios were categorized based on three sizes, ranging from Small to Large.

Data Sources:
Lahar hazard zones: U. S. Geological Survey (Walder and others 1999)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: NAD 1983 HARN Oregon Statewide Lambert
Software: Esri◆ ArcMap 10, Adobe◆ Illustrator CC

Percentage of Building Value Exposed to Lahar



Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-speci◆ic investigations by quali◆ied practitioners. Site-speci◆ic data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

This map is an overview map and not intended to provide details at the community scale. The GIS data that are published with the Marion County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Cartography by: Matt C. Williams, 2021

References

Abatzoglou JT, Battisti DS, Williams AP, Hansen WD, Harvey BJ, Kolden CA. 2021a. Projected increases in western US forest fire despite growing fuel constraints. *Communications Earth & Environment*, 2(1): 1–8. https://doi.org/10.1038/s43247-021-00299-0.

Abatzoglou JT, Brown TJ. 2012. A comparison of statistical downscaling methods suited for wildfire applications. *International Journal of Climatology*, 32: 772–780. https://doi.org/10.1002/joc.2312.

Abatzoglou JT, Rupp DE, O'Neill LW, Sadegh M. 2021b. Compound Extremes Drive the Western Oregon Wildfires of September 2020. *Geophysical Research Letters*, 48(8): e2021GL092520. https://doi.org/10.1029/2021GL092520.

Abatzoglou JT, Williams AP. 2016. Impact of anthropogenic climate change on wildfire across western US forests. *Proceedings of the National Academy of Sciences*, 113: 11770–11775. https://doi.org/10.1073/pnas.1607171113.

Anderegg WRL, Abatzoglou JT, Anderegg LDL, Bielory L, Kinney PL, Ziska L. 2021. Anthropogenic climate change is worsening North American pollen seasons. *Proceedings of the National Academy of Sciences*, 118(7): e2013284118. https://doi.org/10.1073/pnas.2013284118.

Anderson RC, Anderson MR, Bauer JT, Loebach C, Mullarkey A, Engelhardt M. 2021. Response of the invasive *Alliaria petiolata* to extreme temperatures and drought. *Ecosphere*, 12(5): e03510. https://doi.org/10.1002/ecs2.3510.

Bai P, Liu X, Zhang Y, Liu C. 2018. Incorporating vegetation dynamics noticeably improved performance of hydrological model under vegetation greening. *Science of The Total Environment*, 643: 610–622. https://doi.org/10.1016/j.scitotenv.2018.06.233.

Baker JP, Hulse DW, Gregory SV, White D, Van Sickle J, Berger PA, Dole D, Schumaker NH. 2004. Alternative futures for the Willamette River Basin, Oregon. *Ecological Applications*, 14: 313–324. https://doi.org/10.1890/02-5011.

Balch JK, Abatzoglou JT, Joseph MB, Koontz MJ, Mahood AL, McGlinchy J, Cattau ME, Williams AP. 2022. Warming weakens the night-time barrier to global fire. *Nature*, 602: 442–448. https://doi.org/10.1038/s41586-021-04325-1.

Balch JK, Bradley BA, Abatzoglou JT, Nagy RC, Fusco EJ, Mahood AL. 2017. Human-started wildfires expand the fire niche across the United States. *Proceedings of the National Academy of Sciences*, 114: 2946–2951. https://doi.org/10.1073/pnas.1617394114.

Baxendale VJ, Tessier JT. 2015. Duration of freezing necessary to damage the leaves of *Fallopia japonica* (Houtt.) Ronse Decraene. *Plant Species Biology*, 30: 279–284. https://doi.org/10.1111/1442-1984.12068.

Berghuijs WR, Woods RA, Hutton CJ, Sivapalan M. 2016. Dominant flood generating mechanisms across the United States. *Geophysical Research Letters*, 43: 4382–4390. https://doi.org/10.1002/2016GL068070.

Bernert JA, Eilers JM, Eilers BJ, Blok E, Daggett SG, Bierly KF. 1999. Recent wetlands trends (1981/82–1994) in the Willamette Valley, Oregon, USA. *Wetlands*, 19: 545–559. https://doi.org/10.1007/BF03161692.

Blossey B, Nuzzo V, Dávalos A. 2017. Climate and rapid local adaptation as drivers of germination and seed bank dynamics of *Alliaria petiolata* (garlic mustard) in North America. *Journal of Ecology*, 105: 1485–1495. https://doi.org/10.1111/1365-2745.12854.

Blumenthal D, Chimner RA, Welker JM, Morgan JA. 2008. Increased snow facilitates plant invasion in mixedgrass prairie. *New Phytologist*, 179: 440–448. https://doi.org/10.1111/j.1469-8137.2008.02475.x.

Boughton DA. 1999. Empirical evidence for complex source–sink dynamics with alternative states in a butterfly metapopulation. *Ecology*, 80: 2727–2739. https://doi.org/10.1890/0012-9658(1999)080[2727:EEFCSS]2.0.CO;2.

Bowman DMJS, Kolden CA, Abatzoglou JT, Johnston FH, van der Werf GR, Flannigan M. 2020. Vegetation fires in the Anthropocene. *Nature Reviews Earth and Environment*, 1: 500–515. https://doi.org/10.1038/s43017-020-0085-3.

Brown EK, Wang J, Feng Y. 2021. US wildfire potential: a historical view and future projection using high-resolution climate data. *Environmental Research Letters*, 16(3): 034060. https://doi.org/10.1088/1748-9326/aba868.

Buchholz RR, Park M, Worden HM, Tang W, Edwards DP, Gaubert B, Deeter MN, Sullivan T, Ru M, Chin M, Levy RC, Zheng B, Magzamen S. 2022. New seasonal pattern of pollution emerges from changing North American wildfires. *Nature Communications*, 13(1): 2043. https://doi.org/10.1038/s41467-022-29623-8.

Cascio WE. 2018. Wildland fire smoke and human health. *Science of The Total Environment*, 624: 586–595. https://doi.org/10.1016/j.scitotenv.2017.12.086.

Chang E. 2018. CMIP5 projected change in northern hemisphere winter cyclones with associated extreme winds. *Journal of Climate*, 31: 6527–6542. https://doi.org/10.1175/JCLI-D-17-0899.1.

Chegwidden OS, Rupp DE, Nijssen B. 2020. Climate change alters flood magnitudes and mechanisms in climatically-diverse headwaters across the northwestern United States. *Environmental Research Letters*, 15(9): 094048. https://doi.org/10.1088/1748-9326/ab986f.

Chen J, Burns E, Fleming M, Patterson E. 2020. Impact of climate change on population dynamics and herbicide resistance in kochia (*Bassia scoparia* (L.) A. J. Scott). *Agronomy*, 10(11): 1700. https://doi.org/10.3390/agronomy10111700.

Chiodi AM, Potter BE, Larkin NK. 2021. Multi-decadal change in western US nighttime vapor pressure deficit. *Geophysical Research Letters*, 48(15): e2021GL092830. https://doi.org/10.1029/2021GL092830.

Christy JA, Alverson ER. 2011. Historical vegetation of the Willamette Valley, Oregon, circa 1850. *Northwest Science*, 85: 93–107. https://doi.org/10.3955/046.085.0202.

Clements DR, DiTommaso A. 2012. Predicting weed invasion in Canada under climate change: evaluating evolutionary potential. *Canadian Journal of Plant Science*, 92: 1013–1020. https://doi.org/10.4141/cjps2011-280.

Colautti RI, Ågren J, Anderson JT. 2017. Phenological shifts of native and invasive species under climate change: insights from the Boechera–Lythrum model. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 372(1712): 20160032. https://doi.org/10.1098/rstb.2016.0032.

Colautti RI, Barrett SCH. 2013. Rapid adaptation to climate facilitates range expansion of an invasive plant. *Science (New York, N.Y.)*, 342: 364–366. https://doi.org/10.1126/science.1242121.

Colautti RI, Eckert CG, Barrett SCH. 2010. Evolutionary constraints on adaptive evolution during range expansion in an invasive plant. *Proceedings of the Royal Society B: Biological Sciences*, 277: 1799–1806. https://doi.org/10.1098/rspb.2009.2231.

Daggett S, Boulé M, Bernert JA, Eilers JM, Blok E, Peters D, Morlan JC. 1998. *Wetland and land use change in the Willamette Valley, Oregon: 1982 to 1994.* Oregon Division of State Lands: Salem, Oregon.

Dalton M, Fleishman E. 2021. *Fifth Oregon Climate Assessment*. Oregon Climate Change Research Institute, Oregon State University: Corvallis, Oregon.

Dalton MM, Dello KD, Hawkins L, Mote PW, Rupp DE. 2017. *The Third Oregon Climate Assessment Report*. Oregon Climate Change Research Institute, Oregon State University: Corvallis, Oregon.

D'Amato G, Chong-Neto HJ, Monge Ortega OP, Vitale C, Ansotegui I, Rosario N, Haahtela T, Galan C, Pawankar R, Murrieta-Aguttes M, Cecchi L, Bergmann C, Ridolo E, Ramon G, Gonzalez Diaz S, D'Amato M, Annesi-Maesano I. 2020. The effects of climate change on respiratory allergy and asthma induced by pollen and mold allergens. *Allergy*, 75: 2219–2228. https://doi.org/10.1111/all.14476.

De Frenne P, Kolb A, Verheyen K, Brunet J, Chabrerie O, Decocq G, Diekmann M, Eriksson O, Heinken T, Hermy M, Jõgar Ü, Stanton S, Quataert P, Zindel R, Zobel M, Graae BJ. 2009.

Unravelling the effects of temperature, latitude and local environment on the reproduction of forest herbs. *Global Ecology and Biogeography*, 18: 641–651. https://doi.org/10.1111/j.1466-8238.2009.00487.x.

Dech JP, Nosko P. 2004. Rapid growth and early flowering in an invasive plant, purple loosestrife (*Lythrum salicaria* L.) during an El Niño spring. *International Journal of Biometeorology*, 49: 26–31. https://doi.org/10.1007/s00484-004-0210-x.

Dennison PE, Brewer SC, Arnold JD, Moritz MA. 2014. Large wildfire trends in the western United States, 1984–2011. *Geophysical Research Letters*, 41: 2014GL059576. https://doi.org/10.1002/2014GL059576.

Dodson EK, Root HT. 2015. Native and exotic plant cover vary inversely along a climate gradient 11 years following stand-replacing wildfire in a dry coniferous forest, Oregon, USA. *Global Change Biology*, 21: 666–675. https://doi.org/10.1111/gcb.12775.

Drake SA, Rupp DE, Thomas CK, Oldroyd HJ, Schulze M, Jones JA. 2022. Increasing daytime stability enhances downslope moisture transport in the subcanopy of an even-aged conifer forest in western Oregon, USA. *Journal of Geophysical Research: Atmospheres*, 127(9): e2021JD036042. https://doi.org/10.1029/2021JD036042.

Dukes JS, Chiariello NR, Loarie SR, Field CB. 2011. Strong response of an invasive plant species (*Centaurea solstitialis* L.) to global environmental changes. *Ecological Applications*, 21: 1887–1894. https://doi.org/10.1890/11-0111.1.

Dwire KA, Mellmann-Brown S, Gurrieri JT. 2018. Potential effects of climate change on riparian areas, wetlands, and groundwater-dependent ecosystems in the Blue Mountains, Oregon, USA. *Climate Services*, 10: 44–52. https://doi.org/10.1016/j.cliser.2017.10.002.

Fann N, Brennan T, Dolwick P, Gamble JL, Ilacqua V, Kolb L, Nolte CG, Spero TL, Ziska L. 2016. Air quality impacts. In: Crimmins A, Balbus J, Gamble JL, Beard CB, Bell JE, Dodgen D, Eisen RJ, Fann N, Hawkins MD, Herring SC, Jantarasami L, Mills DM, Saha S, Sarofim MC, Trtanj J and Ziska L (eds) *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. US Global Change Research Program: Washington, DC, 69–98.

Fickas KC, Cohen WB, Yang Z. 2016. Landsat-based monitoring of annual wetland change in the Willamette Valley of Oregon, USA from 1972 to 2012. *Wetlands Ecology and Management*, 24: 73–92. https://doi.org/10.1007/s11273-015-9452-0.

Ficklin DL, Novick KA. 2017. Historic and projected changes in vapor pressure deficit suggest a continental-scale drying of the United States atmosphere. *Journal of Geophysical Research: Atmospheres*, 122: 2061–2079. https://doi.org/10.1002/2016JD025855.

Fleishman E, Murphy DD. 2012. Minimizing uncertainty in interpreting responses of butterflies to climate change. In: Beever E and Belant J (eds) *Ecological consequences of*

climate change: mechanisms, conservation, and management. Taylor & Francis: London, 55–66.

Footitt S, Huang Z, Ölcer-Footitt H, Clay H, Finch-Savage WE. 2018. The impact of global warming on germination and seedling emergence in *Alliaria petiolata*, a woodland species with dormancy loss dependent on low temperature. *Plant Biology (Stuttgart, Germany)*, 20: 682–690. https://doi.org/10.1111/plb.12720.

Fox N, Jönsson AM. 2019. Climate effects on the onset of flowering in the United Kingdom. *Environmental Sciences Europe*, 31: 89. https://doi.org/10.1186/s12302-019-0271-4.

Gao P, Terando AJ, Kupfer JA, Morgan Varner J, Stambaugh MC, Lei TL, Kevin Hiers J. 2021. Robust projections of future fire probability for the conterminous United States. *Science of the Total Environment*, 789: 147872. https://doi.org/10.1016/j.scitotenv.2021.147872.

Gergel DR, Nijssen B, Abatzoglou JT, Lettenmaier DP, Stumbaugh MR. 2017. Effects of climate change on snowpack and fire potential in the western USA. *Climatic Change*, 141: 287–299. https://doi.org/10.1007/s10584-017-1899-y.

Greaver TL, Clark CM, Compton JE, Vallano D, Talhelm AF, Weaver CP, Band LE, Baron JS, Davidson EA, Tague CL, Felker-Quinn E, Lynch JA, Herrick JD, Liu L, Goodale CL, Novak KJ, Haeuber RA. 2016. Key ecological responses to nitrogen are altered by climate change. *Nature Climate Change*, 6: 836–843. https://doi.org/10.1038/nclimate3088.

Halofsky JE, Peterson DL, Ho JJ. 2019. *Climate change vulnerability and adaptation in south-central Oregon*. General Technical Report PNW-GTR-974. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: Portland, OR.

Hausfather Z, Marvel K, Schmidt GA, Nielsen-Gammon JW, Zelinka M. 2022. Climate simulations: recognize the 'hot model' problem. *Nature*, 605: 26–29. https://doi.org/10.1038/d41586-022-01192-2.

Henderson SB. 2020. The COVID-19 pandemic and wildfire smoke: potentially concomitant disasters. *American Journal of Public Health*, 110: 1140–1142. https://doi.org/10.2105/AJPH.2020.305744.

IPCC. 2013. Summary for policymakers. In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V and Midgley PM (eds) *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press: Cambridge and New York.

IPCC. 2021. Summary for policymakers. In: Masson-Delmotte V, Zhai P, Pirani, Connors SL, Péan C, Berger, Caud N, Chen Y, Goldfarb L, Gomis MI, Huang M, Leitzell K, Lonnoy E, Matthews JBR, Maycock TK, Waterfield T, Yelekçi R, Yu R and Zhou B (eds) *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. In Press.

Jolly WM, Cochrane MA, Freeborn PH, Holden ZA, Brown TJ, Williamson GJ, Bowman DMJS. 2015. Climate-induced variations in global wildfire danger from 1979 to 2013. *Nature Communications*, 6: 7537. https://doi.org/10.1038/ncomms8537.

Juang CS, Williams AP, Abatzoglou JT, Balch JK, Hurteau MD, Moritz MA. 2022. Rapid growth of large forest fires drives the exponential response of annual forest-fire area to aridity in the western United States. *Geophysical Research Letters*, 49(5): e2021GL097131. https://doi.org/10.1029/2021GL097131.

Kalashnikov DA, Schnell JL, Abatzoglou JT, Swain DL, Singh D. 2022. Increasing co-occurrence of fine particulate matter and ground-level ozone extremes in the western United States. *Science Advances*, 8(1): eabi9386. https://doi.org/10.1126/sciadv.abi9386.

Konrad CP, Dettinger MD. 2017. Flood runoff in relation to water vapor transport by atmospheric rivers over the western United States, 1949–2015. *Geophysical Research Letters*, 44: 11,456-11,462. https://doi.org/10.1002/2017GL075399.

Kossin JP, Hall T, Knutson T, Kunkel KE, Trapp RJ, Waliser DE, Wehner MF. 2017. Extreme storms. In: Wuebbles DJ, Fahey DW, Hibbard KA, Dokken DJ, Stewart BC and Maycock TK (eds) *Climate Science Special Report: Fourth National Climate Assessment Volume I*. US Global Change Research Program: Washington, DC, 257–276.

Kumar D, Mishra V, Ganguly AR. 2015. Evaluating wind extremes in CMIP5 climate models. *Climate Dynamics*, 45: 441–453. https://doi.org/10.1007/s00382-014-2306-2.

Lee S-Y, Ryan ME, Hamlet AF, Palen WJ, Lawler JJ, Halabisky M. 2015. Projecting the hydrologic impacts of climate change on montane wetlands. *PLoS ONE*, 10(9): e0136385. https://doi.org/10.1371/journal.pone.0136385.

Li J, Ren L, Bai Y, Lecain D, Blumenthal D, Morgan J. 2018. Seed traits and germination of native grasses and invasive forbs are largely insensitive to parental temperature and CO2 concentration. *Seed Science Research*, 28: 303–311. https://doi.org/10.1017/S0960258518000314.

Liang X, Lettenmaier DP, Wood EF, Burges SJ. 1994. A simple hydrologically based model of land surface water and energy fluxes for general circulation models. *Journal of Geophysical Research*, 99: 14415–14428.

Liu JC, Mickley LJ, Sulprizio MP, Dominici F, Yue X, Ebisu K, Anderson GB, Khan RFA, Bravo MA, Bell ML. 2016. Particulate air pollution from wildfires in the western US under climate change. *Climatic Change*, 138: 655–666. https://doi.org/10.1007/s10584-016-1762-6.

Luís M de, Raventós J, González-Hidalgo JC, Luís M de, Raventós J, González-Hidalgo JC. 2005. Fire and torrential rainfall: effects on seedling establishment in Mediterranean gorse shrublands. *International Journal of Wildland Fire*, 14: 413–422. https://doi.org/10.1071/WF05037.

MacDonald GM. 2010. Global warming and the Arctic: a new world beyond the reach of the Grinnellian niche? *Journal of Experimental Biology*, 213: 855–861. https://doi.org/10.1242/jeb.039511.

MacDonald GM, Bennett KD, Jackson ST, Parducci L, Smith FA, Smol JP, Willis KJ. 2008. Impacts of climate change on species, populations and communities: palaeobiogeographical insights and frontiers. *Progress in Physical Geography: Earth and Environment*, 32: 139–172. https://doi.org/10.1177/0309133308094081.

Maurer EP, Kayser G, Gabel L, Wood AW. 2018. Adjusting flood peak frequency changes to account for climate change impacts in the western United States. *Journal of Water Resources Planning and Management*, 144(3): 05017025. https://doi.org/10.1061/(ASCE)WR.1943-5452.0000903.

Mote P, Brekke L, Duffy PB, Maurer E. 2011. Guidelines for constructing climate scenarios. *Eos, Transactions American Geophysical Union*, 92: 257–258. https://doi.org/10.1029/2011EO310001.

Mote PW, Abatzoglou JT, Dello KD, Hegewisch K, Rupp DE. 2019. *Fourth Oregon Climate Assessment Report*. Oregon Climate Change Research Institute, Oregon State University: Corvallis, Oregon.

Mote PW, Abatzoglou JT, Kunkel KE. 2013. Climate: variability and change in the past and the future. In: Dalton MM, Mote PW and Snover AK (eds) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press: Washington, DC, 25–40.

Musselman KN, Lehner F, Ikeda K, Clark MP, Prein AF, Liu C, Barlage M, Rasmussen R. 2018. Projected increases and shifts in rain-on-snow flood risk over western North America. *Nature Climate Change*, 8: 808–812. https://doi.org/10.1038/s41558-018-0236-4.

Najafi MR, Moradkhani H. 2015. Multi-model ensemble analysis of runoff extremes for climate change impact assessments. *Journal of Hydrology*, 525: 352–361. https://doi.org/10.1016/j.jhydrol.2015.03.045.

Naz BS, Kao S-C, Ashfaq M, Rastogi D, Mei R, Bowling LC. 2016. Regional hydrologic response to climate change in the conterminous United States using high-resolution hydroclimate simulations. *Global and Planetary Change*, 143: 100–117. https://doi.org/10.1016/j.gloplacha.2016.06.003.

Nolte CG, Dolwick PD, Fann N, Horowitz LW, Naik V, Pinder RW, Spero TL, Winner DA, Ziska LH. 2018. Air quality. In: Reidmiller DR, Avery CW, Easterling DR, Kunkel KE, Lewis KLM, Maycock TK and Stewart BC (eds) *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. U.S. Global Change Research Program: Washington, DC, 512–538.

NWCG. 2019. *NWCG standards for fire weather stations*. National Wildfire Coordinating Group: Washington, DC.

Oregon DEQ. 2016. *2015 Oregon Air Quality Data Summaries*. Oregon Department of Environmental Quality: Portland, Oregon.

Parepa M, Fischer M, Bossdorf O. 2013. Environmental variability promotes plant invasion. *Nature Communications*, 4(1): 1604. https://doi.org/10.1038/ncomms2632.

Parker LE, Abatzoglou JT. 2016. Spatial coherence of extreme precipitation events in the northwestern United States. *International Journal of Climatology*, 36: 2451–2460. https://doi.org/10.1002/joc.4504.

Parks SA, Abatzoglou JT. 2020. Warmer and drier fire seasons contribute to increases in area burned at high severity in western US forests from 1985 to 2017. *Geophysical Research Letters*, 47(22): e2020GL089858. https://doi.org/10.1029/2020GL089858.

Paudel B, Chu T, Chen M, Sampath V, Prunicki M, Nadeau KC. 2021. Increased duration of pollen and mold exposure are linked to climate change. *Scientific Reports*, 11(1): 12816. https://doi.org/10.1038/s41598-021-92178-z.

Pearson DE, Ortega YK, Maron JL. 2017. The tortoise and the hare: reducing resource availability shifts competitive balance between plant species. *Journal of Ecology*, 105: 999–1009. https://doi.org/10.1111/1365-2745.12736.

Queen LE, Mote PW, Rupp DE, Chegwidden O, Nijssen B. 2021. Ubiquitous increases in flood magnitude in the Columbia River basin under climate change. *Hydrology and Earth System Sciences*, 25: 257–272. https://doi.org/10.5194/hess-25-257-2021.

Rao K, Williams AP, Diffenbaugh NS, Yebra M, Konings AG. 2022. Plant-water sensitivity regulates wildfire vulnerability. *Nature Ecology & Evolution*, 6: 332–339. https://doi.org/10.1038/s41559-021-01654-2.

Raymondi RR, Cuhaciyan JE, Glick P, Capalbo SM, Houston LL, Shafer SL, Grah O. 2013. Water resources: implications of changes in temperature and precipiptation. In: Dalton MM, Mote PW and Snover AK (eds) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press: Washington, DC, 41–66.

Redmond KT. 2002. The depiction of drought: a commentary. *Bulletin of the American Meteorological Society*, 83: 1143–1148. https://doi.org/10.1175/1520-0477-83.8.1143.

Reilly MJ, Dunn CJ, Meigs GW, Spies TA, Kennedy RE, Bailey JD, Briggs K. 2017. Contemporary patterns of fire extent and severity in forests of the Pacific Northwest, USA (1985–2010). *Ecosphere*, 8(3): n/a-n/a. https://doi.org/10.1002/ecs2.1695.

Safeeq M, Grant GE, Lewis SL, Staab B. 2015. Predicting landscape sensitivity to present and future floods in the Pacific Northwest, USA. *Hydrological Processes*, 29: 5337–5353. https://doi.org/10.1002/hyp.10553.

Salathé E, Mauger G, Steed R, Dotson B. 2015. *Final project report: regional modeling for windstorms and lightning. Prepared for Seattle City Light.* Climate Impacts Group, University of Washington: Seattle, Washington.

Salathé EP, Hamlet AF, Mass CF, Lee S-Y, Stumbaugh M, Steed R. 2014. Estimates of twenty-first-century flood risk in the Pacific Northwest based on regional climate model simulations. *Journal of Hydrometeorology*, 15: 1881–1899. https://doi.org/10.1175/JHM-D-13-0137.1.

Seager R, Hooks A, Williams AP, Cook B, Nakamura J, Henderson N. 2015. Climatology, variability, and trends in the U.S. vapor pressure deficit, an important fire-related meteorological quantity. *Journal of Applied Meteorology and Climatology*, 54: 1121–1141. https://doi.org/10.1175/JAMC-D-14-0321.1.

Sedano F, Randerson JT. 2014. Multi-scale influence of vapor pressure deficit on fire ignition and spread in boreal forest ecosystems. *Biogeosciences*, 11: 3739–3755. https://doi.org/10.5194/bg-11-3739-2014.

Seiler C, Zwiers FW. 2016. How will climate change affect explosive cyclones in the extratropics of the Northern Hemisphere? *Climate Dynamics*, 46: 3633–3644. https://doi.org/10.1007/s00382-015-2791-y.

Sheehan T, Bachelet D, Ferschweiler K. 2015. Projected major fire and vegetation changes in the Pacific Northwest of the conterminous United States under selected CMIP5 climate futures. *Ecological Modelling*, 317: 16–29. https://doi.org/10.1016/j.ecolmodel.2015.08.023.

Singer MC. 2017. Shifts in time and space interact as climate warms. *Proceedings of the National Academy of Sciences*, 114: 12848–12850. https://doi.org/10.1073/pnas.1718334114.

Skelly DK, Joseph LN, Possingham HP, Freidenburg LK, Farrugia TJ, Kinnison MT, Hendry AP. 2007. Evolutionary responses to climate change. *Conservation Biology*, 21: 1353–1355.

Stevenson S, Coats S, Touma D, Cole J, Lehner F, Fasullo J, Otto-Bliesner B. 2022. Twenty-first century hydroclimate: a continually changing baseline, with more frequent extremes. *Proceedings of the National Academy of Sciences*, 119(12): e2108124119. https://doi.org/10.1073/pnas.2108124119.

Surfleet CG, Tullos D. 2013. Variability in effect of climate change on rain-on-snow peak flow events in a temperate climate. *Journal of Hydrology*, 479: 24–34. https://doi.org/10.1016/j.jhydrol.2012.11.021.

Thomas JW, Maser C, Rodiek JE. 1979. *Wildlife habitats in managed rangelands—the Great Basin of southeastern Oregon: riparian zones.* U.S. Department of Agriculture Forest Service, Pacific Northwest Research Station: Portland, Oregon.

Thorne JH, Morgan BJ, Kennedy JA. 2008. Vegetation change over sixty years in the central Sierra Nevada, California, USA. *Madroño*, 55: 223–237. https://doi.org/10.3120/0024-9637-55.3.223.

Tohver IM, Hamlet AF, Lee S-Y. 2014. Impacts of 21st-century climate change on hydrologic extremes in the Pacific Northwest region of North America. *Journal of the American Water Resources Association*, 50: 1461–1476. https://doi.org/10.1111/jawr.12199.

Touma D, Stevenson S, Swain DL, Singh D, Kalashnikov DA, Huang X. 2022. Climate change increases risk of extreme rainfall following wildfire in the western United States. *Science Advances*, 8(13): eabm0320. https://doi.org/10.1126/sciadv.abm0320.

Vose RS, Applequist S, Bourassa MA, Pryor SC, Barthelmie RJ, Blanton B, Bromirski PD, Brooks HE, DeGaetano AT, Dole RM, Easterling DR, Jensen RE, Karl TR, Katz RW, Klink K, Kruk MC, Kunkel KE, MacCracken MC, Peterson TC, Shein K, Thomas BR, Walsh JE, Wang XL, Wehner MF, Wuebbles DJ, Young RS. 2014. Monitoring and understanding changes in extremes: extratropical storms, winds, and waves. *Bulletin of the American Meteorological Society*, 95: 377–386. https://doi.org/10.1175/BAMS-D-12-00162.1.

Vose RS, Easterling DR, Kunkel KE, LeGrande AN, Wehner MF. 2017. Temperature changes in the United States. In: Wuebbles DJ, Fahey DW, Hibbard KA, Dokken DJ, Stewart BC and Maycock TK (eds) *Climate Science Special Report: Fourth National Climate Assessment, Volume 1*. U.S. Global Change Research Program: Washington, DC, 185–206.

Walsworth TE, Schindler DE, Colton MA, Webster MS, Palumbi SR, Mumby PJ, Essington TE, Pinsky ML. 2019. Management for network diversity speeds evolutionary adaptation to climate change. *Nature Climate Change*, 9: 632–636. https://doi.org/10.1038/s41558-019-0518-5.

Wang J, Stern MA, King VM, Alpers CN, Quinn NWT, Flint AL, Flint LE. 2020. PFHydro: a new watershed-scale model for post-fire runoff simulation. *Environmental Modelling & Software*, 123: 104555. https://doi.org/10.1016/j.envsoft.2019.104555.

Westerling AL. 2016. Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. *Philosophical Transactions of the Royal Society B*, 371(1696): 20150178. https://doi.org/10.1098/rstb.2015.0178.

Williams AP, Abatzoglou JT. 2016. Recent advances and remaining uncertainties in resolving past and future climate effects on global fire activity. *Current Climate Change Reports*, 2(1): 1–14. https://doi.org/10.1007/s40641-016-0031-0.

Williams AP, Livneh B, McKinnon KA, Hansen WD, Mankin JS, Cook BI, Smerdon JE, Varuolo-Clarke AM, Bjarke NR, Juang CS, Lettenmaier DP. 2022. Growing impact of wildfire

on western US water supply. *Proceedings of the National Academy of Sciences*. Proceedings of the National Academy of Sciences, 119(10): e2114069119. https://doi.org/10.1073/pnas.2114069119.

Williams AP, Seager R, Berkelhammer M, Macalady AK, Crimmins MA, Swetnam TW, Trugman AT, Buenning N, Hryniw N, McDowell NG, Noone D, Mora CI, Rahn T. 2014. Causes and implications of extreme atmospheric moisture demand during the record-breaking 2011 wildfire season in the southwestern United States. *Journal of Applied Meteorology and Climatology*, 53: 2671–2684. https://doi.org/10.1175/JAMC-D-14-0053.1.

Willis KJ, MacDonald GM. 2011. Long-term ecological records and their relevance to climate change predictions for a warmer world. *Annual Review of Ecology, Evolution, and Systematics*, 42: 267–287. https://doi.org/10.1146/annurev-ecolsys-102209-144704.

Willis SG, Hulme PE. 2002. Does temperature limit the invasion of *Impatiens glandulifera* and *Heracleum mantegazzianum* in the UK? *Functional Ecology*, 16: 530–539. https://doi.org/10.1046/j.1365-2435.2002.00653.x.

Winter M, Fiedler W, Hochachka WM, Koehncke A, Meiri S, De la Riva I. 2016. Patterns and biases in climate change research on amphibians and reptiles: a systematic review. *Royal Society Open Science*, 3(9): 160158. https://doi.org/10.1098/rsos.160158.

Xie Y, Lin M, Decharme B, Delire C, Horowitz LW, Lawrence DM, Li F, Séférian R. 2022. Tripling of western US particulate pollution from wildfires in a warming climate. *Proceedings of the National Academy of Sciences*, 119(14): e2111372119. https://doi.org/10.1073/pnas.2111372119.

Zhuang Y, Fu R, Santer BD, Dickinson RE, Hall A. 2021. Quantifying contributions of natural variability and anthropogenic forcings on increased fire weather risk over the western United States. *Proceedings of the National Academy of Sciences*, 118(45): e2111875118. https://doi.org/10.1073/pnas.2111875118.

Ziska LH, Epstein PR, Schlesinger WH. 2009. Rising CO2, climate change, and public health: exploring the links to plant biology. *Environmental Health Perspectives*, 117: 155–158. https://doi.org/10.1289/ehp.11501.