

**BEFORE THE BOARD OF COUNTY COMMISSIONERS  
FOR THE STATE OF OREGON, FOR THE COUNTY OF BENTON**

**In the Matter of Adopting Updates to the            )**  
**Benton County Multi-Jurisdictional                )**       **RESOLUTION R2016-060**  
**Natural Hazards Mitigation Plan                 )**

WHEREAS, Benton County recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

WHEREAS, an adopted Natural Hazards Mitigation Plan (NHMP) is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEREAS, Benton County fully participated in the FEMA prescribed mitigation planning process to prepare this Natural Hazards Mitigation Plan; and

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the Benton County Multi-Jurisdictional Natural Hazard Mitigation Plan and pre-approved it (dated, June 3, 2016) contingent upon this official adoption of the participating governments and entities;

WHEREAS, the NHMP is comprised of four main elements: Basic Plan, Hazard Annex, City Addenda, and Mitigation Resources, collectively referred to herein as the NHMP; and

WHEREAS, the NHMP is in an on-going cycle of development and revision to improve its effectiveness; and

WHEREAS, Benton County adopts the NHMP and directs the Chief Operating Officer to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.


NOW, THEREFORE, BE IT RESOLVED, that Benton County adopts the Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that Benton County will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan.

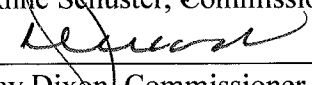
Adopted this 19<sup>th</sup> day of July, 2016.

Signed this 19<sup>th</sup> day of July, 2016.

BENTON COUNTY BOARD OF COMMISSIONERS

  
\_\_\_\_\_  
Annabelle Jaramillo, Chair

  
\_\_\_\_\_  
Anne Schuster, Commissioner

  
\_\_\_\_\_  
Jay Dixon, Commissioner

# Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan

**Benton County and the Cities of:  
Adair Village, Corvallis, Monroe, and Philomath**



Photo Credits Gary Halvorson, Oregon State Archives

**April 2016**

**Volume I: Basic Plan**

**Prepared for:**  
Benton County Emergency Management

**Prepared by:**  
University of Oregon  
Community Service Center  
Oregon Partnership for Disaster Resilience



UNIVERSITY OF OREGON



This Natural Hazard Mitigation Plan was prepared by:



With support from:



UNIVERSITY OF OREGON



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# **SPECIAL THANKS & ACKNOWLEDGEMENTS**

Benton County developed this Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) through a regional partnership funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Competitive Grant Program: EMS-2014-PC-0011, Sub-grant Application Reference: PDMC-PL-10-OR-2014-002. The City of Corvallis developed their addendum to this NHMP through a regional partnership funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Competitive Grant Program: EMS-2014-PC-0005, Sub-grant Application Reference: PDMC-PL-10-OR-2013-001. This updated Natural Hazard Mitigation Plan is a collaboration between Benton County and the Cities of Adair Village, Corvallis, Monroe, and Philomath. The county utilized a four-phased planning process, plan templates and plan development support provided by the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center.

Special thanks to Jaimi Glass, Benton County Emergency Services Planner and Robyn Bassett, Corvallis Public Works Project Manager for their leadership in convening the committee and to Mary King, Benton County Emergency Services, for her vision and support.

## **Benton County NHMP Update Steering Committee**

### Benton County

- Convener, Jaimi Glass, Benton County Sheriff's Office, Emergency Services Planner
- Michael Bamberger, Oregon State University Emergency Manager
- Sarah Bates, Linn County Public Health
- Chris Bentley, Benton County Senior Planner (CWPP Coordinator)
- Brian Cooke, Benton County Health Department
- Cheri Damitio, Blodgett-Summit Rural Fire Protection District
- Lacey Duncan, Benton County Sheriff's Office, Emergency Services
- Bill Emminger, Benton County Health Department, Division Manager
- David Feinberg, Blodgett-Summit Rural Fire Protection District
- Josh Foster, OSU, Oregon Climate Change Research Institute
- Randy Hart, Alsea Area Interests
- Kevin Higgins, Benton County Sheriff's Office, Emergency Services Program Manager
- Karen Kennedy, Wren Emergency Planning Committee
- Mary King, Benton County Emergency Services
- Ken Kurth, Linn County Public Health
- Toby Lewis, CFM, Benton County Associate Planner
- Rick Osborn, Benton County
- Phil Plaza, Alsea Emergency Preparedness Council

- Anne Schuster, Benton County Board of Commissioners, Vice Chair
- Frank Spangler, American Red Cross
- Rebecca Taylor, Benton County Community Development, Code Compliance Specialist
- Darrel Tedisch, Albany, Emergency Management Specialist
- Josh Wheeler, Benton County Public Works Director
- Pat Wray, American Red Cross

#### City of Adair Village

- Pat Hare, City Administrator
- Matt Lydon, Public Works Supervisor
- Chuck Harris, Adair Rural Fire Protection District, Chief

#### City of Corvallis

- Convener, Robyn Bassett, Public Works Project Manager
- Douglas Baily, Corvallis Fire Planning and Administration Division Chief
- Dan Carlson, Corvallis Community Development, Development Services Division Manager. City Building Official
- Bob Fenner, Corvallis Public Works, Buildings and Fleet Supervisor
- Jaimi Glass, Benton County Sheriff's Office, Emergency Services Planner
- Jude Geist, Corvallis Parks, Parks Supervisor
- John Kelker, Corvallis Public Works, Water Operations Supervisor
- Aaron Manley, Corvallis Public Works, Development Review Supervisor
- Stan Miller, Corvallis Public Works, Wastewater Operations Supervisor
- Bruce Moser, Corvallis Public Works, Transportation Maintenance Supervisor
- Jon Pywell, Corvallis Parks, Urban Forester
- Chad Wolfe, Corvallis Public Works, Wastewater/ Stormwater Collections Supervisor
- Jason Yaich, Corvallis Community Development, Senior Planner

#### City of Monroe

- Convener, Jim Minard, C.O.O/ Planner
- Rick Smith, Monroe Rural Fire Department, Chief
- Matthew Thompson, Monroe Rural Fire Department, Lieutenant

#### City of Philomath

- Convener, Chris Workman, City Manager
- Garry Black, Public Works, Operations Supervisor
- Tom Phelps, Philomath Fire and Rescue, Former Chief
- Rich Saalsaa, Philomath Fire and Rescue, Fire & Life Safety Lieutenant

## **Community Service Center Team**

- Robert Parker, Director

- Josh Bruce, Director OPDR
- Michael Howard, Assistant Program Manager
- Julie Foster, Grant's Administrator
- Nick Meltzer, Project Assistant

## **Additional Thanks:**

To the Department of Geology and Mineral Industries for assistance with hazard data; the Department of Land Conservation and Development staff in the hazards for flood data, mapping and process support; to the Oregon Military Department Office of Emergency Management for grant administration and process support.

## **About the Community Service Center**

The Community Service Center (CSC), a research center affiliated with the Department of Planning, Public Policy, and Management at the University of Oregon, is an interdisciplinary organization that assists Oregon communities by providing planning and technical assistance to help solve local issues and improve the quality of life for Oregon residents. The role of the CSC is to link the skills, expertise, and innovation of higher education with the transportation, economic development, and environmental needs of communities and regions in the State of Oregon, thereby providing service to Oregon and learning opportunities to the students involved.

## **About the Oregon Partnership for Disaster Resilience**

The Oregon Partnership for Disaster Resilience (OPDR) is a coalition of public, private, and professional organizations working collectively toward the mission of creating a disaster-resilient and sustainable state. Developed and coordinated by the Community Service Center at the University of Oregon, the OPDR employs a service-learning model to increase community capacity and enhance disaster safety and resilience statewide.

## **Plan Template Disclaimer**

This Natural Hazards Mitigation Plan is based in part on a plan template developed by the Oregon Partnership for Disaster Resilience. The template is structured to address the requirements contained in 44 CFR 201.6; where language is applicable to communities throughout Oregon, OPDR encourages the use of standardized language. As part of this regional planning initiative, OPDR provided copies of the plan templates to communities for use in developing or updating their natural hazards mitigation plans. OPDR hereby authorizes the use of all content and language provided to Benton County in the plan template.

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# TABLE OF CONTENTS

## Volume I: Basic Plan

Plan Summary.....	i-1
Section 1: Introduction.....	1-1
Section 2: Risk Assessment.....	2-1
Section 3: Mitigation Strategy .....	3-1
Section 4: Implementation and Maintenance .....	4-1

## Volume II: City Addenda

Adair Village .....	AVA-1
Corvallis.....	CA-1
Monroe .....	MA-1
Philomath.....	PA-1

## Volume III: Appendices

Appendix A: Action Items.....	A-1
Appendix B: Planning and Public Process.....	B-1
Appendix C: Community Profile.....	C-1
Appendix D: Economic Analysis of Natural Hazard Mitigation Projects.....	D-1
Appendix E: Grant Programs .....	E-1
Appendix F: Community Survey .....	F-1



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# PLAN SUMMARY

Benton County updated this Multi-jurisdictional Natural Hazards Mitigation Plan (NHMP, MNHMP, or Plan) in an effort to prepare for the long-term effects resulting from natural hazards. It is impossible to predict exactly when these hazards will occur, or the extent to which they will affect the community. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to create a resilient community that will benefit from long-term recovery planning efforts.

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.” Said another way, natural hazard mitigation is a method of permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through long and short-term strategies. Example strategies include policy changes, such as updated ordinances, projects, such as seismic retrofits to critical facilities; and education and outreach to targeted audiences, such as Spanish speaking residents or the elderly. Natural hazard mitigation is the responsibility of the “Whole Community” - individuals, private businesses and industries, state and local governments, and the federal government.

*44 CFR 201.6 – The local mitigation plan is the representation of the jurisdiction’s commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. . . .*

## Why Develop this Mitigation Plan?

In addition to establishing a comprehensive community-level mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved Natural Hazard Mitigation Plan (NHMP) in order to receive federal funds for mitigation projects. Local and federal approval of this Plan ensures that the county and listed jurisdictions will remain eligible for pre- and post-disaster mitigation project grants.

*44 CFR 201.6(a)(1) – A local government must have a mitigation plan approved pursuant to this section in order to receive HMGP project grants . . .*

**What is Mitigation?**

“Any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.”

- U.S. Federal Emergency Management Agency

## Who Participated in Developing the Plan?

The Benton County NHMP is the result of a collaborative effort between the county, cities, special districts, citizens, public agencies, non-profit organizations, the private sector and regional organizations. County and City steering committees guided the plan development process.

The County Steering Committee included representatives from the following jurisdictions and agencies:

- Benton County
- City of Adair Village
- City of Corvallis
- City of Monroe
- City of Philomath
- Oregon State University (OSU)
- Oregon Climate Change Research Institute, OSU
- Linn County
- City of Albany (Linn County)
- Alsea Emergency Preparedness Council
- Wren Disaster Preparedness Network
- American Red Cross
- Adair Rural Fire Protection District
- Blodgett-Summit Rural Fire Protection District
- Monroe Rural Fire Department
- Philomath Fire and Rescue

*44 CFR 201.6(c)(1) – Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

The Benton County Emergency Service Planner and Corvallis Public Works Project Manager convened the planning process for their respective jurisdictions and will take the lead in implementing, maintaining and updating the plan. Benton County is dedicated to directly involving the public in the continual review and update of the natural hazards mitigation plan. Although members of the Steering Committee represent the public to some extent, the public will also have the opportunity to continue to provide feedback about the plan throughout the implementation and maintenance period. Notably, the county invited additional participation in the planning process.

## How Does this Mitigation Plan Reduce Risk?

The NHMP is intended to assist Benton County reduce the risk from natural hazards by identifying resources, information, and strategies for risk reduction. It is also intended to guide and coordinate mitigation activities throughout the county. A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic.

44 CFR 201.6(c)(2) – A Risk Assessment that provides the factual basis for activities proposed in the strategy

**Figure PS-I Understanding Risk**



Source: Oregon Partnership for Disaster Resilience.

By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capacity, Benton County is better equipped to identify and implement actions aimed at reducing the overall risk to natural hazards.

## What is Benton County's Overall Risk to Hazards?

Benton County reviewed and updated their risk assessment to evaluate the probability of each hazard as well as the vulnerability of the community to that hazard. Scores are based on the Benton County Hazard Analysis submitted to the Oregon Office of Emergency Management (2009) and updated by the steering committee in 2015. Table PS-1 below summarizes hazard probability and vulnerability as determined by the county steering committee (for more information see Section 2, Risk Assessment).

**Table PS-I Risk Assessment Summary**

Hazard	Probability	Vulnerability	Total Threat Score	Hazard Rank
Earthquake (Cascadia)	Moderate	High	211	# 1
Earthquake (Crustal)	Moderate	Moderate	190	# 2
Flood	High	Moderate	175	# 3
Wildfire	High	Moderate	170	# 4
Winter Storm	High	Moderate	170	# 4
Windstorm	High	Moderate	165	# 6
Landslide	High	Low	151	# 7
Drought	Moderate	Low	100	# 8
Volcano	Moderate	Low	92	# 9

Source: Benton County NHMP Steering Committee

At the end of this executive summary, hazard briefs provide summary information for priority hazards in Benton County.

## What is the Plan’s Mission?

The mission of the Benton County NHMP is to:

**Mission:** *To make the community less vulnerable to the negative effects of natural hazards by coordinating efforts among government, public, and private sectors.*

*44 CFR 201.6(c)(3)(i) – A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

## What are the Plan Goals?

The plan goals describe the overall direction that the participating jurisdiction’s agencies, organizations, and citizens can take toward mitigating risk from natural hazards. Below is a list of the plan goals (Note: although numbered the goals are not prioritized):

**Goal 1:** *Coordinate mitigation activities between government agencies*

**Goal 2:** *Educate residents and businesses on the potential impacts of natural hazards as well as mitigation opportunities, in the community*

**Goal 3:** *Identify and protect critical public facilities*

**Goal 4:** *Increase connections between jurisdictions in an effort to collaborate on mitigation opportunities.*

**Goal 5:** *Increase resilience in areas of the county which currently have no emergency assistance*

## How are the Action Items Organized?

The action items are organized within an action matrix included within Section 3, Mitigation Strategy (full descriptions are provided in Appendix A, *Action Item Forms*).

*44 CFR 201.6(c)(3)(ii) – A section that identifies and analyzes a comprehensive range of specific mitigation actions . . .*

Data collection, research and the public participation process resulted in the development of the action items. The Action Item Matrix portrays the overall Plan framework and identifies linkages between the plan goals and actions. The matrix documents the title of each action along with, the coordinating organization, timeline, and the plan goals addressed. Action items particular to each of the participating cities are included at the end of the action item matrix in Section 3, Mitigation Strategy and in the addenda.

## Comprehensive Action Plan

The following table summarizes specific **priority** NHMP actions. Refer to the Mitigation Strategy section for a complete list of actions. Volume II, Appendix A contains detailed information for all action items, including potential partners, implementation ideas, proposed timeline and estimated budget.

*Action ID Key: MH = Multi-Hazard, DR = Drought, EQ = Earthquake, FL = Flood, LS = Landslide, WF = Wildfire, WT = Winter Storm*

**Table PS-2 Benton County High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County
MH #11	Assess vulnerability, determine, and then implement appropriate mitigation measures for Alsea area bridges and access routes.
EQ #3	Seismically retrofit the historic Benton County Courthouse, a vital public building. Consider both structural and non-structural retrofit options.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #6	Improve remote draft site at Daisy Drive in Marys River Estates.
FL #7	Identify all structures with floors below the Base Flood Elevation and prioritize mitigation based on flood risk and type of required mitigation.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Benton County NHMP Steering Committee (2015)

**Table PS-3 Adair Village High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
DR #2	Identify and develop a larger/ alternative water supply.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.
WT #1	Ensure that all critical facilities have backup power and emergency operations plans to deal with power outages.

Source: Adair Village NHMP Steering Committee (2015)



**Table PS-4 Corvallis High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County
MH #13	Construct a raw water intake system to reduce risk and improve reliability in the case of a natural disaster.
MH #14	Construct finished water transmission main from the Rock Creek Water Treatment Plant to the Baldy Water Reservoir.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
EQ #4	Abandon water transmission lines on Marys River Bridge and bore new water transmission lines under Marys River.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
LS #2	Complete geotechnical analysis of the slope on NW Witham Hill Drive from NW Canary Drive to NW Walnut Boulevard and implement rehabilitation strategies to stabilize the slope.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Corvallis NHMP Steering Committee (2015)

**Table PS-5 Monroe High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
DR #1	Develop a drought impact assessment for Benton County.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Monroe NHMP Steering Committee (2015)

**Table PS-6: Philomath High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #5	Mitigate flooding of South 13th Street area.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Philomath NHMP Steering Committee (2015)

## How will the plan be implemented?

The plan maintenance section of this Plan details the formal process that will ensure that the Benton County NHMP remains an active and relevant document. The plan will be implemented, maintained, and updated by a designated convener. The Benton County Emergency Services Planner is the designated convener (Plan Convener) and is responsible for overseeing the review and implementation processes (see city addenda for city conveners).

The plan maintenance process includes a schedule for monitoring and evaluating the plan semi-annually and producing a plan revision every five years. This section also describes how the communities will integrate public participation throughout the plan maintenance process.

*44 CFR 201.6(c)(3)(iii) – An action plan describing how the actions . . . will be prioritized, implemented and administered . . .*

*44 CFR 201.6(c)(4) – A plan maintenance process . . .*

## Plan Adoption

Once the plan is locally reviewed and deemed complete the plan Convener submits it to the State Hazard Mitigation Officer at the Oregon Military Department – Office of Emergency Management (OEM). OEM reviews the plan and submits it to the Federal Emergency Management Agency (FEMA – Region X) for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201.6. Once the plan is pre-approved by FEMA, the county and cities formally adopt the plan via resolution. The Benton County Plan Convener will be responsible for ensuring local adoption of the Benton County NHMP and providing the support necessary to ensure plan implementation. Once the resolution is executed at the local level and documentation is provided to FEMA, the plan is formally acknowledged by FEMA and the county (and participating cities) will re-establish eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and the Flood Mitigation Assistance program funds.

*44 CFR 201.6(c)(5) – Documentation that the plan has been formally adopted by the governing body of the jurisdiction . . .*

*44 CFR 201.6(d) – Plan review [process] . . .*

The accomplishment of the NHMP goals and actions depends upon regular Steering Committee participation and adequate support from county and city leadership. Thorough familiarity with this Plan will result in the efficient and effective implementation of appropriate mitigation activities and a reduction in the risk and the potential for loss from future natural hazard events.

The Steering Committees for Benton County and participating cities each met to review the plan update process and their governing bodies adopted the NHMP as shown below:

Benton County adopted the plan on **[DATE], 2016**

The City of Adair Village adopted the plan on **[DATE], 2016**

The City of Corvallis adopted the plan on **[DATE], 2016**

The City of Monroe adopted the plan on **[DATE], 2016**

The City of Philomath adopted the plan on **[DATE], 2016**

FEMA Region X approved the Benton County NHMP on **[DATE], 2016**. With approval of this Plan, the entities listed above are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act’s hazard mitigation project grants through **[DATE], 2016**.

# **Volume I: Basic Plan**

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# SECTION I: INTRODUCTION

Section I: Introduction provides a general introduction to natural hazard mitigation planning in Benton 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.

## What is Natural 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.”<sup>1</sup> Said another way, natural hazard mitigation is a method of permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through long and short-term strategies. Example strategies include policy changes, such as updated ordinances, projects, seismic retrofits to critical facilities, and education and outreach to targeted audiences, such as Spanish speaking residents or the elderly. Natural hazard mitigation is the responsibility of the “Whole Community”; individuals, private businesses and industries, state and local governments, and the federal government.

Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

## Why Develop a Mitigation Plan?

Benton County developed this Natural Hazards Mitigation Plan (NHMP or Plan) in an effort to reduce future loss of life and damage to property resulting from natural hazards. It is impossible to predict exactly when natural hazard events will occur, or the extent to which they will affect community assets. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

In addition to establishing a comprehensive community-level mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201, require that jurisdictions maintain an approved NHMP in order to receive federal funds for mitigation projects. Local and federal approval of this plan ensures that the county and listed cities will remain eligible for pre- and post-disaster mitigation project grants.

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<sup>1</sup> FEMA, *What is Mitigation?* <http://www.fema.gov/what-mitigation>

## What Federal Requirements Does This Plan Address?

DMA2K is the latest federal legislation addressing mitigation planning. It reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. As such, this Act established the Pre-Disaster Mitigation (PDM) grant program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Section 322 of the Act specifically addresses mitigation planning at the state and local levels. State and local jurisdictions must have approved mitigation plans in place in order to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that State and local jurisdictions' proposed mitigation measures are based on a sound planning process that accounts for the risk to the individual and State and local jurisdictions' capabilities.

Chapter 44 Code of Federal Regulations (CFR), section 201.6, also requires a local government to have an approved mitigation plan in order to receive HMGP project grants.<sup>2</sup> 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.<sup>3</sup> 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.<sup>4</sup> Lastly, the Natural Hazard Mitigation Plan must be submitted to Oregon Military Department – Office of Emergency Management (OEM) for initial plan review, and then federal approval.<sup>5</sup> Additionally, a recent change in the way OEM administers the Emergency Management Performance Grant (EMPG), which helps fund local emergency management programs, also requires a FEMA-approved NHMP.

## What is the Policy Framework for Natural Hazards Planning in Oregon?

Planning for natural hazards is an integral element of Oregon's statewide land use planning program, which began in 1973. All Oregon cities and counties have comprehensive plans (Comprehensive Plans) and implementing ordinances that are required to 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.

Statewide land use planning Goal 7: Areas Subject to Natural Hazards calls for local plans to include inventories, policies and ordinances to guide development in or away from hazard areas. 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 the jurisdiction's Comprehensive Plan, and helps each jurisdiction meet the requirements of statewide land use planning Goal 7.

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<sup>2</sup> Code of Federal Regulations, Chapter 44. Section 201.6, subsection (a), 2015

<sup>3</sup> *ibid*, subsection (b). 2015

<sup>4</sup> *ibid*, subsection (c). 2015

<sup>5</sup> *ibid*, subsection (d). 2015



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 Military Department – Office 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).

## **How was the Plan Developed?**

The plan was developed by the Benton County Natural Hazard Mitigation Plan Steering Committee and the Steering Committees for the cities of Adair Village, Corvallis, Monroe, and Philomath. The Benton County Steering Committee formally convened on three occasions to discuss and revise the plan. Each of the participating city Steering Committees met at least once formally. Steering Committee members contributed data and maps, and reviewed and updated the community profile, risk assessment, action items, and implementation and maintenance plan.

An open public involvement process is essential to the development of an effective plan. In order to develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the plan during review.<sup>6</sup> OPDR provided a publicly accessible project website for the general public to provide feedback on the draft NHMP via a web form. In addition, Benton County provided a press release on their websites to encourage the public to offer feedback on the plan update.

In addition, OPDR administered a public opinion survey to obtain input from the public regarding the county's risks, vulnerabilities, hazards history, and mitigation strategies. See Appendix F for more information. The survey was provided via an on-line English language version and a printed Spanish language version. The results of the survey were used to inform the steering committee prior to the completion of their mitigation strategies. Survey results concerning public perception of natural hazards as well as how best to outreach to the public was used to inform their education and outreach mitigation strategy (MH #2) as well as to inform the prioritization of other mitigation strategies. Additionally, the Benton County Health Department has, and will continue to utilize the survey results to inform their outreach and education activities, including outreach to the Spanish speaking population and other non-English speaking population (primarily associated with Oregon State University). The County and city websites continue to be a focal point for distribution natural hazard information through the use of hazard viewers, emergency alerts, hazard preparation, and annual natural hazard progress reports.

## **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

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<sup>6</sup> Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

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 and their property from hazards and their effects. This plan structure enables stakeholders to use the section(s) of interest to them.

## **Volume I: Basic Plan**

### **Plan Summary**

The plan summary provides an overview of the FEMA requirements, planning process, and highlights the key elements of the risk assessment, mitigation strategy, and implementation and maintenance strategy.

### **Section 1: Introduction**

The Introduction briefly describes the countywide mitigation planning efforts and the methodology used to develop the plan.

### **Section 2: Risk Assessment**

Section 2 provides the factual basis for the mitigation strategies contained in Section 3. (Additional information is included within Appendix C, which contains an overall description of Benton County and the cities of Adair Village, Corvallis, Monroe, and Philomath.) This section includes a brief description of community sensitivities and vulnerabilities. The Risk Assessment allows readers to gain an understanding of each jurisdiction’s vulnerability and resilience to natural hazards.

A hazard summary is provided for each of the hazards addressed in the plan. The summary includes hazard history, location, extent, vulnerability, impacts, and probability. This NHMP addresses the following hazards:

- Drought
- Earthquake
- Flood
- Landslide
- Volcano
- Wildfire
- Windstorm
- Winter Storm

Additionally, this section provides information on the jurisdictions’ participation in the National Flood Insurance Program (NFIP).

### **Section 3: Mitigation Strategy**

This section documents the plan vision, mission, goals, and actions (mitigation strategy) and also describes the components that guide implementation of the identified actions. Actions are based on community sensitivity and resilience factors, and the risk assessments in Section 2 and Volume II (City Addenda).

### **Section 4: Plan Implementation and Maintenance**

This section provides information on the implementation and maintenance of the plan. It describes the process for prioritizing projects, and includes a suggested list of tasks for updating the plan, to be completed at the semi-annual and five-year review meetings.

## **Volume II: Jurisdictional Addenda**

Volume II of the plan is reserved for any city or special district addenda developed through this multi-jurisdictional planning process. Each of the cities within the county participated in the NHMP process and created an addendum. The cities of Adair Village, Monroe, and Philomath created their first addendum to the Benton NHMP, while Corvallis opted to combine their stand-alone NHMP as an addendum within the Benton NHMP. As such, the five-year update cycle will be the same for all of the cities and the county. The City of Albany is the only incorporated city within Benton County that is not included within this MNHMP; the majority of Albany is located within neighboring Linn County and has a stand-alone NHMP.

The plan includes city addenda for the following jurisdictions:

- City of Adair Village (new)
- City of Corvallis (update, previously a stand-alone NHMP)
- City of Monroe (new)
- City of Philomath (new)

## **Volume III: Mitigation Resources**

The resource appendices are designed to provide the users of the Benton County NHMP with additional information to assist them in understanding the contents of the mitigation plan, and provide them with potential resources to assist with plan implementation.

### **Appendix A: Action Items**

This appendix contains the detailed action item forms for each of the mitigation strategies identified in this Plan. Appendix A-1 includes the priority actions for the county and cities, while Appendix A-2 provides a listing of the non-priority actions that the county and cities may opt to include as priority actions during their semi-annual maintenance. Appendix A-3 is a blank action item form to be used as new actions are identified.

### **Appendix B: Planning and Public Process**

This appendix includes documentation of all the countywide public processes utilized to develop the plan. It includes invitation lists, agendas, sign-in sheets, and summaries of Steering Committee meetings as well as any other public involvement methods.

### **Appendix C: Community Profile**

The community profile describes the county and participating cities from a number of perspectives in order to help define and understand the region's sensitivity and resilience to natural 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.

### **Appendix D: Economic Analysis of Natural Hazard Mitigation Projects**

This appendix describes the Federal Emergency Management Agency's (FEMA) requirements for benefit cost analysis in natural hazards mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities.

## **Appendix E: Grant Programs and Resources**

This appendix lists state and federal resources and programs by hazard.

## **Appendix F: Community Survey (2015)**

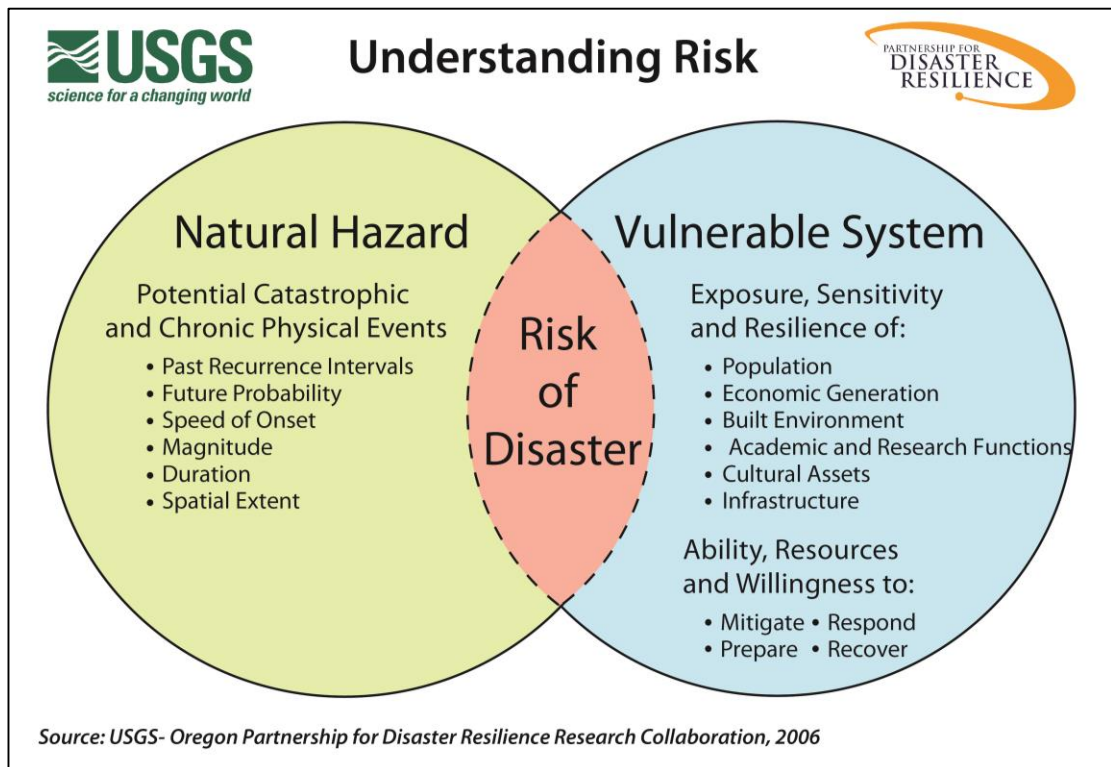
Appendix F includes the survey instrument and results from the preparedness survey implemented by OPDR.

## SECTION 2: RISK ASSESSMENT

This section of the NHMP addresses 44 CFR 201.6(b)(2) - Risk Assessment. The Risk Assessment applies to Benton County and the Cities of Adair Village, Corvallis, Monroe, and Philomath. 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, along with hazard specific information presented in the Hazard Annexes and community characteristics presented in the Community Profile Appendix, is 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**



Source: Oregon Partnership for Disaster Resilience.

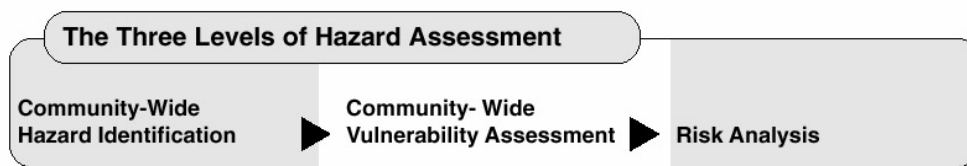
# What is a Risk Assessment?

A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis.

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The following figure illustrates the three-phase risk assessment process:

**Figure 2-2 Three Phases of a Risk Assessment**



Source: Planning for Natural Hazards: Oregon Technical Resource Guide, 1998

This three-phase approach to developing a risk assessment should be conducted sequentially because each phase builds upon data from prior phases. However, gathering data for a risk assessment need not occur sequentially.

## Hazard Identification

Benton County identifies eight natural hazards that could have an impact on the county and each of the participating jurisdictions. Summary information for each hazard is presented below; additional information pertaining to the types and characteristics of each hazard is available in the State of Oregon Natural Hazard Mitigation Plan Region 3 Risk Assessment. Table 2-1 lists the hazards identified in the county in comparison to the hazards identified in the State of Oregon NHMP for the Mid/ Southern Willamette Valley (Region 3), which includes Benton County.

**Table 2-1 Benton County Hazard Identification**

Benton County	State of Oregon NHMP Region 3: Mid/ Southern Willamette Valley
Drought	Drought
Earthquake	Earthquake
Flood	Flood
Landslide	Landslide
Volcano	Volcano
Wildfire	Wildfire
Windstorm	Windstorm
Winter Storm	Winter Storm

Source: Benton County NHMP Steering Committee (2015) and State of Oregon NHMP, Region 3: Mid/ Southern Willamette Valley (2015)

The following subsections briefly describe relevant information for each hazard. For additional background on the hazards, vulnerabilities and general risk assessment information for hazards in the Mid/ Southern Willamette Valley (Region 3) refer to the [State of Oregon NHMP, Region 3: Mid/ Southern Willamette Valley Risk Assessment \(2015\)](#).

## Drought

### Significant Changes Since Previous Plan:

The Drought Hazard was not assessed in the 2008 (Corvallis) & 2011 (Benton) Plans, therefore, this section provides new content.

## Characteristics

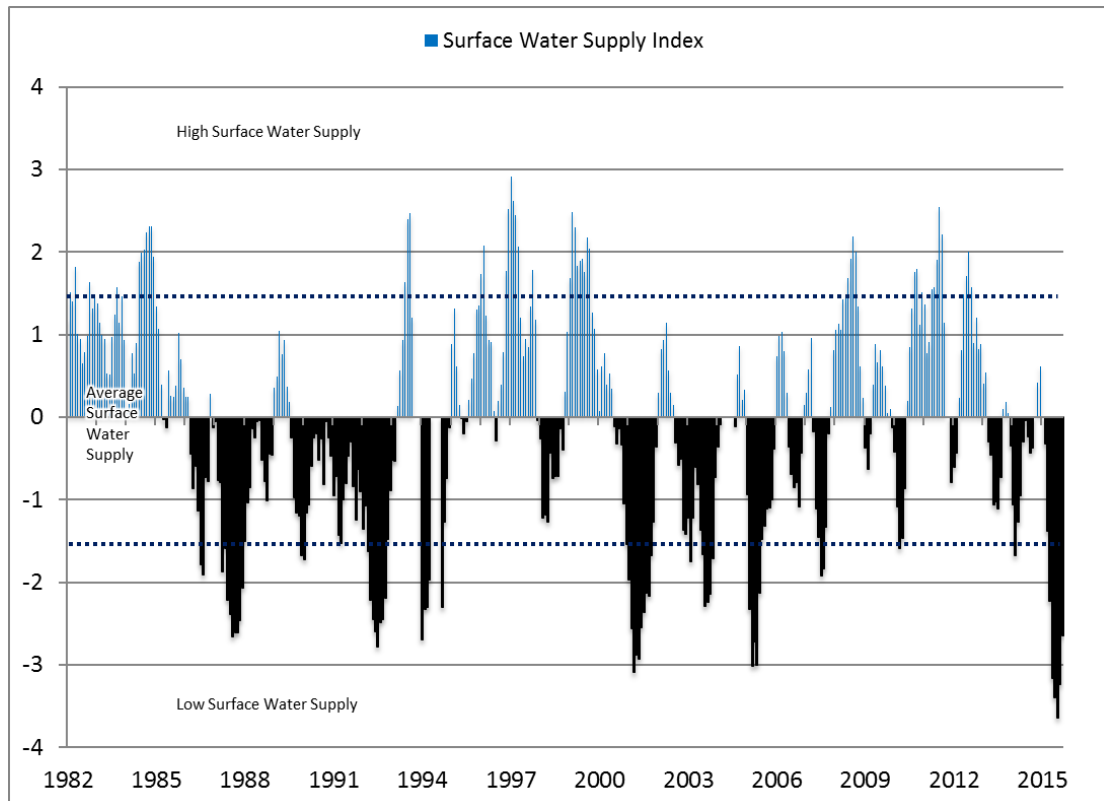
A drought is a period of drier than normal conditions. Drought occurs in virtually every climatic zone, but its characteristics vary significantly from one region to another. Drought is a temporary condition; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature 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.

## Location and Extent

Droughts occur in every climate zone, and can vary from region to region. Drought may occur throughout Benton County and may have profound effects on the economy, particularly the agricultural and hydro-power 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.

The Surface Water Supply Index (SWSI) from the Natural Resources Conservation Service is an index of current water conditions throughout the state. 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 2-3 below shows the monthly history of SWSI values from February 1982 to October 2015 for the Willamette Basin which includes Benton County. Research shows that the periods of drought have fluctuated; recent drought periods occurred in 1987, 1992, 1994, 2001, 2003, 2005, and 2015.

**Figure 2-3 SWSI Values for the Willamette Basin (1982-2015)**



Source: Department of Agriculture-Natural Resources Conservation Service, "Surface Water Supply Index, Upper Deschutes Basin" [www.or.nrcs.usda.gov](http://www.or.nrcs.usda.gov). Accessed February 2016.

## History

Drought conditions are not uncommon in Benton County.

One recent drought event, and one previously omitted drought event, have been added to the hazard history since the previous plan (as shown in *italics* below):

- 1904-1905: A statewide drought period of about 18 months
- 1917-1931: A very dry period throughout Oregon, punctuated by brief wet spells in 1920-21 and 1927
- 1939-1941: A three-year intense drought in Oregon
- 1976-1981: Intense drought in western Oregon; 1976-1977 single driest year of century (eclipsed only by 2015 water-year)
- 1986: Drought conditions in Benton County open eligibility for USDA loans
- 1987: Drought conditions contribute to job losses in Pacific Northwest timber industry
- 1990-1991: Drought conditions lead to USDA payments to impacted farmers
- *1992: Formal Governor Declared Determination of State of Drought includes Benton County*
- 1999: Drought conditions open eligibility to non-farm businesses and agricultural cooperatives to receive low-interest loans to assist with financial obligations



- 2000-2001: Klamath drought intensifies; low snowpack in mountains worsens conditions. Due to lack of water Bonneville Power Administration asked some consumers (industrial and residential) to limit power use
- 2005: Due to water rationing some farmers are cutting back production of certain crops including wheat and hay
- 2007: Farmers in Oregon allowed to use USDA Conservation Reserve Program to expand available land outside of drought stricken counties
- *August 2015: Federal Drought Declaration due low snow pack levels, and low water conditions*

## El Niño

El Niño Southern Oscillation (ENSO) weather patterns can increase the frequency and severity of drought. During El Niño periods, alterations in atmospheric pressure in equatorial regions yield an increase in the surface temperature off the west coast of North America. This gradual warming sets off a chain reaction affecting major air and water currents throughout the Pacific Ocean. In the North Pacific, the Jet Stream is pushed north, carrying moisture laden air up and away from its normal landfall along the Pacific Northwest coast. In Oregon, this shift results in reduced precipitation and warmer temperatures, normally experienced several months after the initial onset of the El Niño. These periods tend to last nine to twelve months, after which surface temperatures begin to trend back towards the long-term average. El Niño periods tend to develop between March and June, and peak from December to April. ENSO generally follows a two to seven-year cycle, with El Niño or La Niña periods occurring every three to five years. However, the cycle is highly irregular, and no set pattern exists. The last major El Niño was during 1997-1998, current conditions indicate that 2015-2016 may be a large El Niño weather pattern.

## Future Climate Variability<sup>1</sup>

In Oregon, future regional climate changes include increases in temperature around 0.2-1°F per decade in the 21st Century, along with warmer and drier summers, and some evidence that extreme precipitation will increase in the future. Increased droughts may occur in the Willamette Valley under various climate change scenarios as a result of various factors, including reduced snowpack, rising temperatures, and likely reductions in summer precipitation. Climate models suggest that as the region warms, winter snow precipitation will likely shift to higher elevations and snowpack will be diminished as more precipitation falls as rain altering surface flows.

## Probability Assessment

Droughts are not uncommon in the State of Oregon, nor are they just an “east of the mountains” phenomenon. They occur in all parts of the state, in both summer and winter. Oregon’s drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8 and 12 years. Based on the available data and research for Benton County the NHMP Steering Committee

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<sup>1</sup> Oregon Climate Change Research Institute (OCCRI), Oregon Climate Assessment Report (2010) and Northwest Climate Assessment Report (2013). <http://occri.net/reports>

assessed the **probability of experiencing a locally severe drought as “moderate,”** meaning one incident is likely within the next 75-year period; *this rating has not changed since the previous plan.*

## Vulnerability Assessment

The environmental and economic consequences can be significant, especially for the agricultural sector. Drought also increases the probability of wildfires. Drought can affect all segments of Benton County’s population, particularly those employed in water-dependent activities (e.g., agriculture, hydroelectric generation, recreation, etc.). Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) as per the county’s water management plan and could be faced with significant increases in electricity rates.

All parts of Benton County are susceptible to drought, however, the following areas and issues are of particular concern:

- Drinking water system
- Power and water enterprises
- Residential and community wells in rural areas (including Alsea and Cascade View Service Districts)
- Fire response capabilities
- Fish and wildlife

Potential impacts to community water supplies and farming are the greatest threats. Additionally, long-term drought periods of more than a year can impact forest conditions and set the stage for potentially destructive wildfires. The NHMP Steering Committee rated the county as having a **“low” vulnerability to drought hazards**, meaning less than 1% of the region’s population or assets would be affected by a major drought emergency or disaster; *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

## Earthquake

### Significant Changes Since Previous Plan:

The Earthquake Hazard section was reformatted since the 2008 (Corvallis) & 2011 (Benton) Plans. There has not been any new data, or history, as such the material has remained largely the same. However, the Oregon Resilience Plan (2013) has been cited and incorporated where applicable. The probability and vulnerability ratings were updated to distinguish between a Cascadia Subduction Zone event and a crustal event. Large areas of Benton County fall within 2 of the zones identified in the Oregon Resilience Plan as having significantly different probabilities and vulnerabilities in a Cascadia Subduction Zone event. These differences have been incorporated throughout this section.

## 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.

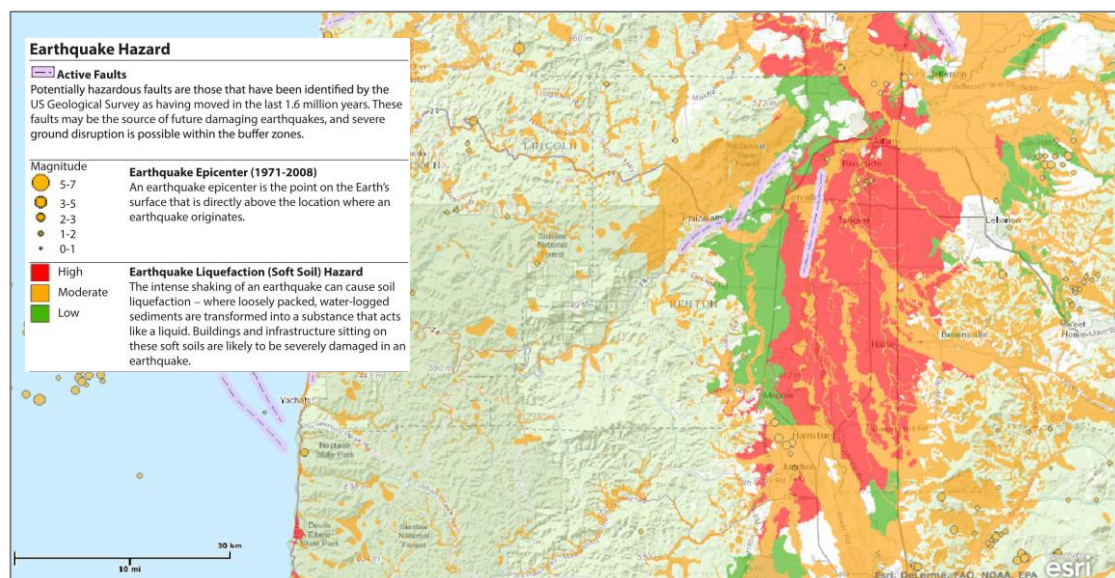
All types of earthquakes in the region have some tie to the subducting, or diving, of the dense, oceanic Juan de Fuca Plate under the lighter, continental North American Plate. There is also a link between the subducting plate and the formation of volcanoes some distance inland from the offshore subduction zone.

## Location and Extent

There have been several significant recent earthquakes in the region; however, all significant events have been located in Klamath and Lake Counties in southern Oregon. The region has also been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered outside Central Oregon. All considered, there is good reason to believe that the most devastating future earthquakes would probably originate along shallow crustal faults in the region, or along the offshore Cascadia Subduction Zone.

Figure 2-4 shows a generalized geologic map of Benton County and includes the Corvallis Fault (west of Corvallis), the Owl Creek Fault (east of Corvallis), and the Mill Creek Fault (north of Albany). The earthquakes shown in the figure below are relatively insignificant events below M 2.0. The larger events may have been slightly felt but little to no structural/property damage resulted. Thus, the seismic hazard for Benton County arises predominantly from major earthquakes on the Cascadia Subduction Zone. Smaller, crustal earthquakes in or near Benton County could be locally damaging, but would not be expected to produce widespread or major damage.

**Figure 2-4 Earthquake Epicenters (1971-2008), Active Faults, and Soft Soils**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(HazVu\)](#)

The Oregon Department of Geology and Mineral Industries (DOGAMI), in partnership with other state and federal agencies, has undertaken a rigorous program in Oregon to identify seismic hazards, including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. DOGAMI has published a number of seismic hazard maps that are available for communities to use. The maps show liquefaction, ground motion amplification, landslide susceptibility, and relative earthquake hazards. OPDR used the DOGAMI Statewide Geohazards Viewer to present a visual map of recent earthquake activity, active faults, and liquefaction; ground shaking is generally expected to be higher in the areas marked by soft soils in the map above. The severity of an earthquake is dependent upon a number of factors including: 1) the distance from the earthquake's source (or epicenter); 2) the ability of the soil and rock to conduct the earthquake's seismic energy; 3) the degree (i.e., angle) of slope materials; 4) the composition of slope materials; 5) the magnitude of the earthquake; and 6) the type of earthquake.

For more information, see the following reports:

[Open-File-Report: O-2001-05 - Preliminary earthquake hazard and risk assessment and water-induced landslide hazard in Benton County, Oregon, 2001](#)

[Open-File-Report: O-2003-02 – Map of Selected earthquakes for Oregon \(1841-2002\), 2003](#)

[Open-File-Report: O-2007-02 - Statewide seismic needs assessment: Implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings, 2007](#)

[Interpretive Map Series: IMS-024 - 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, 2008](#)

[Open-File-Report: O-2013-22 - Cascadia Subduction Zone earthquakes: A magnitude 9.0 earthquake scenario, 2013](#)

[Special Papers: SP-29, Earthquake damage in Oregon Preliminary estimates of future earthquake losses \(1999\)](#)

Additional reports are available via DOGAMI's Publications Search website:  
<http://www.oregongeology.org/pubs/search.php>

Other agency/ consultant reports:

Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase II (2001)

[Oregon Seismic Safety Policy Advisory Commission Reports:](#)

[Oregon Resilience Plan \(2013\)](#)

## History

Benton County has not experienced any major earthquake events in recent history. Seismic events do, however, pose a significant threat. In particular, a Cascadia Subduction Zone (CSZ) event could produce catastrophic damage and loss of life in Benton County.

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 314 years ago in January of 1700. The probability of a 9.0+ CSZ event occurring in the next 50 years ranges from 7 - 15%. 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%.

While Benton County has not experienced any significant earthquakes in recent history, earthquakes in Oregon that have affected the county are listed below<sup>2</sup> (there have not been any significant earthquake events since the previous plan):

- January 1700: Offshore, Cascadia Subduction Zone (CSZ)- Approximate 9.0 magnitude earthquake generated a tsunami that struck Oregon, Washington, and Japan; destroyed Native American villages along the coast (additional CSZ events occurred approximately in 1400 BCE, 1050 BCE, 600 BCE, 400, 750, and 900)
- November 1896: McMinnville, 4.0 magnitude
- July 1930: Perrydale, 4.0 magnitude
- April 1949: Olympia, WA, 7.1 magnitude, significant damage in Washington, minor damage in NW Oregon
- August 1961: Albany, 4.5 magnitude, minor damage in Albany
- November 1962: Portland area, 5.5 magnitude, shaking lasted up to 30 seconds; chimneys cracked; windows broken; furniture moved
- March 1963: Salem, 4.6 magnitude, minor damage in Salem
- November 1962: Portland- A 5.2-5.5 magnitude earthquake caused damage to many homes (chimneys, windows, etc); the earthquake was a crustal event
- March 1993: Scotts Mills- A 5.6 magnitude earthquake caused \$27-\$30 million in damages to homes, schools, businesses, state buildings (Salem). Crustal Event (FEMA-985-DR-OR)
- September 1993: Klamath Falls- Two earthquakes (5.9-6.0) caused two deaths and extensive damage. \$7.5 million in damage to homes, commercial, and government buildings. Crustal event (FEMA-1004-DR-OR)
- February 2001: Nisqually, WA, 6.8 magnitude, felt in region, no local damage reported

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<sup>2</sup> Ivan Wong and Jacqueline D.J. Bolt, 1995, “A Look Back at Oregon’s Earthquake History, 1841-1994”, Oregon Geology, pp. 125-139.

The Pacific Northwest Seismic Network: Notable Pacific Northwest Earthquakes since 1993

## Probability Assessment

Benton County is susceptible to deep intraplate events within the Cascadia Subduction Zone (CSZ), where the Juan de Fuca Plate is diving beneath the North American Plate, and shallow crustal events within the North American Plate.

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 314 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%.

Establishing a probability for crustal earthquakes is difficult given the small number of historic events in the region. Earthquakes generated by volcanic activity in Oregon’s Cascade Range are possible, but likewise unpredictable. For more information see DOGAMI reports linked above.

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing a Cascadia Subduction Zone (CSZ) or a crustal earthquake is “moderate”**, meaning one incident is likely within the next 50-year period. *The previous NHMP rated the earthquake probability as “moderate” but did not distinguish between the crustal and CSZ events.*

### Cascadia Subduction Zone

Paleoseismic studies along the Oregon coast indicate that the state has experienced seven Cascadia Subduction Zone (CSZ) events possibly as large as M9 in the last 3,500 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1,000 years. The last CSZ event occurred approximately 300 years ago. Scientists estimate the chance in the next 50 years of a great subduction zone earthquake is between 10 and 20 percent, assuming that the recurrence is on the order of 400 +/- 200 years.

New research from Oregon State University suggests that the CSZ has at least 4 segments that sometimes rupture independently of one another. Magnitude-9 ruptures affecting the entire subduction zone have occurred 19 times in the past 10,000 years. Over that time, shorter segments have ruptured farther south in Oregon and Northern California, producing magnitude-8 quakes. As such, the risks of a subduction zone quake may differ from north to south. Quakes originating in the northern portion of the CSZ tend to rupture the full length of the subduction zone. In southern Oregon and Northern California, quakes along the subduction zone appear to strike more frequently.

### Benioff (Deep) Zone

Deep intraplate earthquakes may have magnitudes up to 7.5, with probable recurrence intervals of about 500 to 100 years (recurrence intervals are poorly determined by current geologic data).

### Crustal Zone

Based on the historical seismicity in Western Oregon and on analogies to other geologically similar areas, small to moderate earthquakes up to M5 or M5.5 are possible almost anywhere in Western Oregon, including Benton County. Although the possibility of larger crustal earthquakes in the M6+ range cannot be ruled out, the probability of such events is likely to be very low.

## Vulnerability Assessment

The local faults, the county's proximity to the Cascadia Subduction Zone, potential slope instability, and the prevalence of certain soils subject to liquefaction and amplification combine to give the county a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places Benton County predominately within the "Willamette Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades), however, portions of the county are within the "Coastal Zone" (the area outside of the tsunami zone, from the Oregon coastline to the summit of the Coast Range)<sup>3</sup>. Within the Valley Zone damage and shaking is expected to be widespread but moderate, an event will be disruptive to daily life and commerce, and the main priority is expected to be restoring services to business and residents.<sup>4</sup> Within the Coastal Zone damage and shaking is expected to be severe and communities will be isolated, the main priority after an event will be to keep the population sheltered, fed, and healthy.<sup>5</sup>

Figure 2-5 below shows the expected shaking/ damage potential for Benton County as a result of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the county will experience "very strong" to "severe shaking" that will last two to four minutes. The strong shaking will be extremely damaging to lifeline transportation routes including Highway 34. For more information on expected losses due to a CSZ event see the [Oregon Resilience Plan](#) (note, several of the county and City mitigation actions utilize the analysis within the ORP as justification and to inform their rationale).

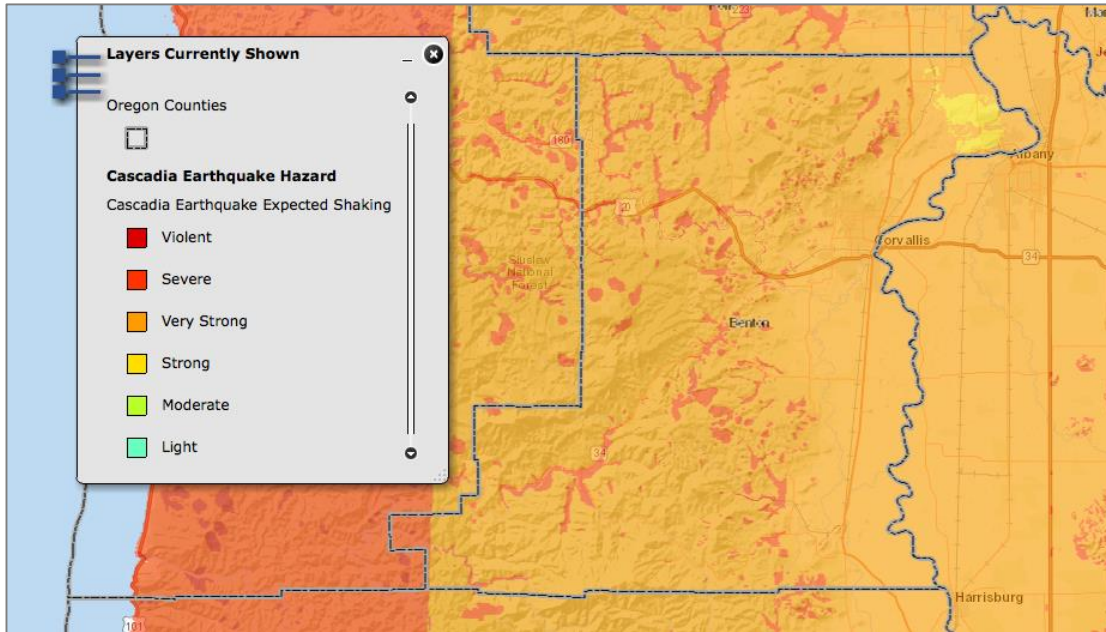
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<sup>3</sup> Oregon Seismic Safety Policy Advisory Commission, *Oregon Resilience Plan* (2013)

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

**Figure 2-5 Cascadia Subduction Zone Damage Potential**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(HazVu\)](#)

The NHMP Steering Committee rated the county as having a **“high” vulnerability to the Cascadia Subduction Zone (CSZ) earthquake hazard**, meaning that more than 10% of the region’s population or assets would be affected by a major CSZ emergency or disaster and a **“moderate” vulnerability to crustal earthquakes**, meaning that less than 10% of the region’s population or assets would be affected by a major crustal earthquake emergency or disaster. *The previous NHMP rated the earthquake vulnerability as “high” but did not distinguish between the crustal and CSZ events.*

## 1999 Assessment

Factors included in an assessment of earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the county due to an earthquake event in a specific location.

Seismic activity can cause great loss to businesses, either a large-scale corporation or a small retail shop. Losses not only result in rebuilding cost, but fragile inventory and equipment can be destroyed. When a company is forced to stop production for just a day, business loss can be tremendous. Residents, businesses, and industry all suffer temporary loss of income when their source of finances is damaged or disrupted.

The potential losses from an earthquake in Benton County extend beyond those to human life, homes, property and the landscape. A recent earthquake damage model has not been conducted for Benton County, however, based upon data from a 1999 DOGAMI report rough loss estimates are available. The economic base in Benton County is estimated at \$3.693 billion (in 1999 dollars; \$5.251 billion in 2015 dollars, ranking it 10 of 36 Oregon



counties); it is expected that the county will incur total direct losses valuing \$632 million (in 1999 dollars, \$899 million in 2015 dollars) for the Cascadia model and \$1.1 billion (in 1999 dollars, \$1.6 billion in 2015 dollars) for the 500-year model. The CSZ event direct losses amount to a loss ratio of 10-percent, while the 500-year model event direct losses amount to a loss ratio of 17-percent.<sup>6</sup> Table 2-2 on the next page adjusts the economic loss estimates from DOGAMI’s 1999 report to account for inflation and reflect potential economic loss in 2015 dollars.

While the expected losses have increased due to increased development in the county, as well as inflation, the loss ratio and relative damage for the county is expected to be similar. See table on the following page for more information on expected losses. Local business economies are at substantial risk if an earthquake damages or otherwise necessitates the closure of any of the major transportation routes.

For more information, see: [Special Papers: SP-29, Earthquake damage in Oregon Preliminary estimates of future earthquake losses \(1999\)](#)

**Table 2-2 Benton County Earthquake Damage Summary**

Benton County	8.5 Cascadia Subduction Zone Event	500-year model	
Injuries	398	682	<p>These figures have a high degree of uncertainty and should be used only for general planning purposes. Because of rounding, numbers may not add up to 100%.</p> <p>Because the 500 year model includes several earthquakes, the number of facilities operational the "day after" cannot be calculated.</p>
Death	8	15	
Displaced households	1,223	2,082	
Short-term shelter needs	1,122	1,855	
Economic losses for buildings	\$632 million/ \$899 million*	\$1.1 billion/ \$1.6 billion*	
<b>Operational the day after the quake</b>			
Fires Stations	46%	n/a	
Police Stations	38%	n/a	
Schools	40%	n/a	
Bridges	61%	n/a	
<b>Economic losses to</b>			
Highways	\$5 million/ \$7.1 million*	\$11 million/ \$15.6 million*	
Airports	\$5 million/ \$7.1 million*	\$11 million/ \$15.6 million*	
<b>Communication Systems</b>			
Economic losses	\$4 million/ \$5.7 million*	\$10 million/ \$14.2 million*	
Operating the day of the quake	52%	n/a	
Debris generated ( <i>thousands of tons</i> )	544	802	

Source: Y. Wang & J.L. Clark, Special Paper 29, Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses. 1999. DOGAMI.

<sup>6</sup> Ibid. The loss ratio is determined as a percentage of the expected losses to the county’s economic base.

Note: \* - 1999 dollars were adjusted for inflation to represent estimated economic loss in 2015 dollars (Source: State of Oregon Employment Department Inflation Calculator)

## 2007 Rapid Visual Survey

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI ranked each building surveyed with a 'low,' 'moderate,' 'high,' or 'very high' potential for collapse in the event of an earthquake. It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore approximate rankings. To fully assess a building's potential for collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to survey.

DOGAMI surveyed 43 buildings in Benton County. Buildings with a 'high' or 'very high' potential for collapse are listed below. Additional information can be found within the [RVS study](#) on DOGAMI's website ([www.oregongeology.org](http://www.oregongeology.org)).

### 'Very High' Collapse Potential

- Monroe RFPDMonroe High School (Monroe School District 1J)

### 'High' Collapse Potential

- Oregon State Police – OSU Campus (Corvallis)
- Crescent Valley High School (Corvallis School District 509J)
- Franklin School (Corvallis School District 509J)
- Wilson Elementary School (Corvallis School District 509J)
- Inavale School (Corvallis School District 509J)
- Monroe Grade School (Monroe School District 1J)
- Fir Grove Primary School (Greater Albany School District 8J)North Albany Elementary School (Greater Albany School District 8J)
- North Albany Middle School (Greater Albany School District 8J)Oak Grove Intermediate (Greater Albany School District 8J)

Note: College Hill High School (formerly Harding Elementary) was not assessed in 2007 by DOGAMI.

## Mitigation Successes

Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)<sup>7</sup> have been funded to retrofit Corvallis Fire Station #2 (2014 grant award, \$300,896), Corvallis Fire

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<sup>7</sup> The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Station #3 (2014 grant award, \$300,896), and Philomath Fire Station (2014 grant award, \$863,080); retrofits are expected to be complete in 2016.

In addition, the following structures have also had some structural and/ or non-structural seismic retrofitting:

- *Philomath Elementary School (Philomath School District 17J), structural retrofits per a voter approved bond in 2010 (completed between 2011-2015).*
- *Philomath Middle School (Philomath School District 17J), retrofitted per SRGP 2010-11 grant (2010-11 grant, \$284,920)*
- *Philomath High School (Philomath School District 17J), structural retrofits per a voter approved bond in 2010 (completed between 2011-2015) which included the pool area.*
- Benton County Sheriff's Office and Corvallis Police Department (Corvallis), retrofitted in 1998 (prior to RVS)
- Lincoln Elementary School (Corvallis School District 509J), retrofitted in 2008 per 2002 voter approved Facilities Improvement Bond
- Adams Elementary School (Corvallis School District 509J), retrofitted in 2008 per 2002 voter approved Facilities Improvement Bond
- Cheldelin Middle School (Corvallis School District 509J), retrofitted in 2008 per 2002 voter approved Facilities Improvement Bond
- Garfield Elementary School (Corvallis School District 509J), retrofitted in 2008 per 2002 voter approved Facilities Improvement Bond
- Jefferson Elementary School (Corvallis School District 509J), retrofitted in 2008 per 2002 voter approved Facilities Improvement Bond
- Mt. View Elementary School (Corvallis School District 509J), retrofitted in 2008 per 2002 voter approved Facilities Improvement Bond

Specific retrofits for the school facilities include:

- Lincoln Elementary School: constructed sheer walls to improve lateral stability, tied roof diaphragm to wall structures, and conducted non-structural mitigation of building contents (securing shelving, file cabinets, evaluation of exist points to ensure egress in a seismic event)
- Adams, Cheldelin, Garfield, Jefferson, and Mt. View: tied roof diaphragm to wall structures, and conducted non-structural mitigation of building contents (securing shelving, file cabinets, evaluation of exit point to ensure egress in a seismic event)

For more information, see: [Open-File-Report: O-2007-02 - Statewide seismic needs assessment: Implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings, 2007](#), and

[DOGAMI Statewide Seismic Needs Assessment Using Rapid Visual Screening \(RVS\)](#)

## 2008 Assessment

In 2008, the Oregon Department of Geology and Mineral Industries (DOGAMI) developed regional earthquake hazard information to assess potential damages and losses for various earthquake scenarios in the Mid-Willamette Valley<sup>8</sup>. More specifically, DOGAMI:

- Identified the primary geologic hazards of Yamhill, Marion, Polk, Benton, Linn, and Lane Counties and the City of Albany;
- Developed countywide earthquake and landslide hazard maps for each county; and
- Developed future earthquake damage estimates for each community.

Damage and loss estimates for each community were analyzed for two earthquake scenarios:

- A magnitude ~6.5 crustal fault earthquake
- A magnitude 9.0 Cascadia Subduction Zone earthquake

Information was consolidated into the Hazards U.S. Multi-Hazard methodology and computer application (HAZUS – MH), which is a federally developed program used to model various earthquake scenarios and estimate associated damage and loss. The following is a brief summary of damage and loss estimates for Benton County in a magnitude 9.0 Cascadia Subduction Zone earthquake scenario:

- Estimated fatalities during late afternoon business hours: 120
- Injuries from minor to life threatening: 1,560
- Households displaced: 2,370
- People needing shelter: 660
- Injuries requiring hospitalization: 420

*Note: Benton County has one hospital with 188 beds (up to 209); daily average is 120 to 150. The hospital is expected to withstand earthquake impacts in the HAZUS M9.0 CSZ scenario*

For more information, see: [Interpretive Map Series: IMS-024 - 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, 2008](#)

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

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<sup>8</sup> Burns, William J., R. Jon Hofmeister, and Yumei Wang. 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 Series IMS-24. 2008.

## Flood

### Significant Changes Since Previous Plan:

The Flood Hazard section includes updated National Flood Insurance Program (NFIP), FIRMs/ FIS (2011), maps, and history information since the 2008 (Corvallis) and 2011 (Benton) Plans. This section has also been reformatted.

## Characteristics

Flooding results when rain and snowmelt creates water flow that exceed 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.<sup>9</sup> The principal types of flood that occur in Benton County include: riverine floods, shallow area floods, and urban floods.

Floods frequently occur in Benton County during periods of heavy rainfall. The primary sources of riverine flooding include the Willamette River, and the Marys River and their tributaries within the Willamette River Basin and the Alsea River and its tributaries within the North Coast Basin.

## Location and 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 1 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 NFIP. 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.

Areas with significant development in the mapped floodplains include North Albany, North Corvallis, Corvallis (Dixon Creek Floodplain), Corvallis (Marys River Floodplain), the southern portion of Philomath, and the area southwest of Philomath between Greasy Creek and the Alsea Highway (US 34). Portions of the following smaller communities are also within FEMA-mapped floodplains: Alsea, Monroe, Blodgett, Summit, and Wren. For more information,

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<sup>9</sup> Taylor, George H. and Chris Hannan. *The Oregon Weather Book*. Corvallis, OR: Oregon State University Press. 1999

refer to the following Flood Insurance Study (FIS) and associated Flood Insurance Rate Maps (FIRM):

- [Benton County Flood Insurance Study \(June 2, 2011\)](#)

Refer to the following DOGAMI report for additional information:

- [BF-15-02 Base Flood Elevation Determination for Reaches of Frazier Creek and Mountain View Creek, Benton County, Oregon](#)

Additional reports are available via DOGAMI's Publications Search website:

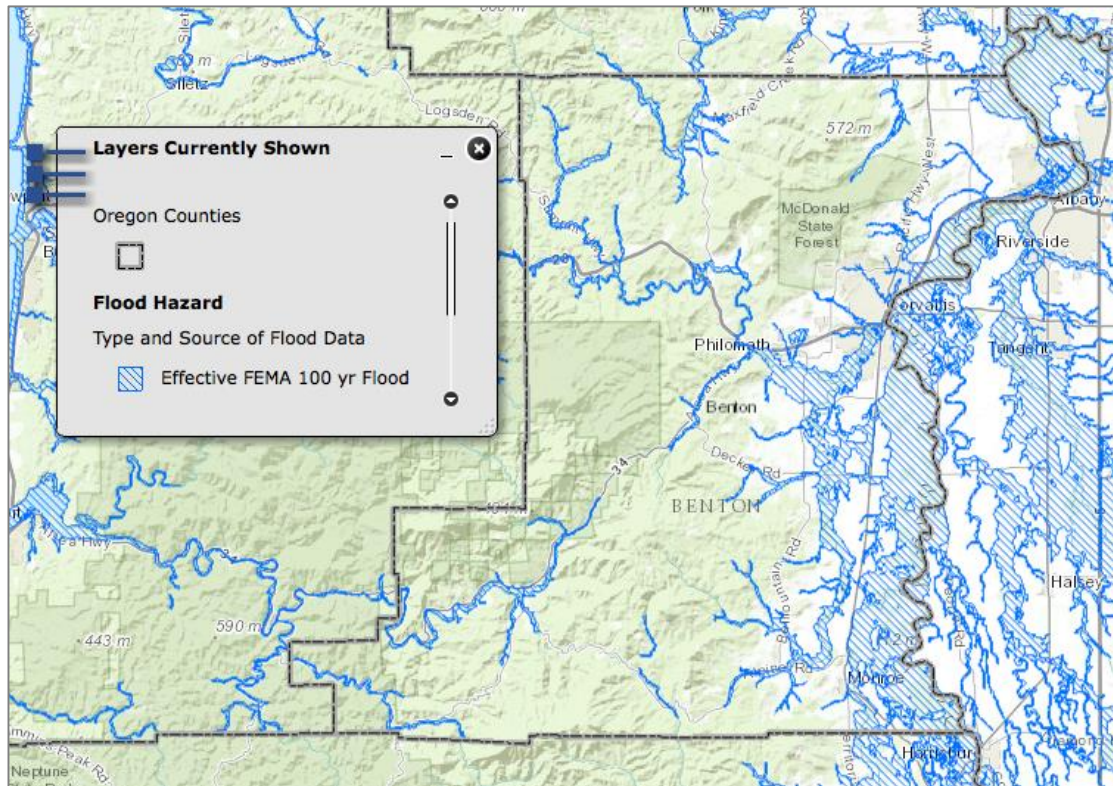
<http://www.oregongeology.org/pubs/search.php>

Other agency/ consultant reports:

[Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase I \(1998\)](#)

In 1971, the Army Corps of Engineers mapped the 100-year floodplain for the Willamette and Marys rivers. In the 1970s, FEMA mapped the 100-year and 500-year floodplains in Benton County (the initial Flood Insurance Rate Map panels (FIRMs) were effective August 5, 1986); additional flood insurance studies were created for Corvallis (1985), and Philomath (1981). In 2008 (effective 2011), FEMA updated the FIRM panels. No new studies were performed by FEMA during this update. Modifications included: combining the flood insurance rate maps and flood insurance studies for Benton County and incorporated cities into the countywide format; better topographic data where available was used, and incorporated letters of map revision (see Section 10.0 of the FIS). In general the update refined the edges of floodplains and revised the floodplain along Soap Creek, Dixon Creek (Corvallis), and the East Fork of Newton Creek (Philomath). These additions and clarifications result in a more accurate definition of the floodplain that will assist the county as it continues to implement the development ordinances that restrict and monitor development within the floodplain. The 2011 Benton County FIS incorporates and supersedes all earlier studies. Since the 2011 FIS became effective, FEMA has approved two Letters of Map Revision (LOMRs). The Philomath LOMR (Case No. 13-10-0260P) changed a large portion of the 100-year floodplain for the Marys River (lowering BFEs and adjusting edges) and significantly changed the West Fork Newton Creek 100-year floodplain. The Oak Creek LOMR (Case No. 14-10-0472P) made some significant changes to a section of Oak Creek (mostly within the City of Corvallis. In addition, FEMA is currently completing a major Physical Map Revision (PMR) of the North Albany area floodplains (both inside and outside of city limits in Benton County). The special flood hazard that identifies the location and extent of the flood hazard is included as Figure 2-6, for more detailed mapping see the [2011 FIS](#) or the community profile for Benton County located on the [Oregon Risk MAP website](#). The [Benton County Website](#) also has a hazards viewer that includes the SFHA and the extent of the 1996 flood. Corvallis also maintains a [natural hazards map](#) available on their [website](#).

**Figure 2-6 Special Flood Hazard Area**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(HazVu\)](#)

## History

Between the 1850's and the present, human activity significantly changed the hydrology of the Willamette watershed, including changes to Hydroelectric dams and flood control systems were constructed throughout the drainage basin. Private and public organizations engaged in the dewatering of wetlands, the draining of floodplains, and diking along some sections of the river. More recently, increasing urbanization has contributed to changes in basin hydrology. Prior to human alteration of the river system, rivers in the region flooded larger areas more often. According to the National Weather Service (NWS) flood stage on the Marys River at their gage near Philomath is 20.0 feet, and major flood stage is 20.7 feet; according to NWS records there have been 43 flood stage crests (including 13 major flood stages, the largest occurred on Jan. 19, 2012 at 21.53 feet) since 1938<sup>10</sup>. Along the Willamette River at the Corvallis river gage, flood stage begins at 30.0 feet, moderate flood stage at 33.0 feet, and major flood stage at 36.0 feet; there have been 22 flood stage events including 12 moderate and seven (7) high (the largest of which occurred on Dec. 1, 1861)<sup>11</sup>.

<sup>10</sup> National Weather Service, Advanced Hydrologic Prediction Service: Marys River near Philomath, <http://water.weather.gov/ahps2/hydrograph.php?wfo=pqr&gage=phio3>, Accessed February 24, 2016.

<sup>11</sup> National Weather Service, Advanced Hydrologic Prediction Service: Willamette River at Corvallis, <http://water.weather.gov/ahps2/hydrograph.php?wfo=pqr&gage=coro3>, Accessed February 24, 2016.

Flood stage on the Long Tom River at Monroe is 9.0 feet (12.0 feet major flood stage); there have been 11 flood crests since 1964 (no major flood stage crests)<sup>12</sup>.

Listed below are historical flooding events that affected the Willamette and Marys river basins; little historical knowledge is available for the remaining streams within the study area.

Two significant flood events have been added since the previous plan (shown in *italics below*):<sup>13</sup>

- Dec. 1861: Willamette Basin and Coastal Rivers - Preceded by two weeks of heavy rain. Every town on the Willamette was flooded or washed away. 635,000 cfs at Portland (greatest known flood on Willamette River, prior to the creation of a stream-gaging network for recording flood heights).
- Feb. 1890: Willamette Basin and Coastal Rivers - Second largest known flood in the Willamette Basin. Almost every large bridge washed downstream.
- Dec. 1937: Western Oregon - Flooding followed heavy rains. Considerable highway flooding; landslides.
- Jan. 1953: Western Oregon - Widespread flooding in western Oregon accompanied by wind storm.
- Dec. 1964-Jan. 1965: Willamette Basin - Highest recorded flooding throughout Willamette Basin. Two intense storms. Near-record early season snow depths. Largest flood in Oregon since dam construction on upper Willamette (1940s-50s); peak discharge of 320,000 cubic feet per second (cfs) was regulated to a peak of 186,000 cfs. Most damage in unincorporated Benton County was limited to agricultural lands, however, residential developments near Stewart Lake and North Albany suffered extensive damage. Throughout the Willamette Valley, it caused \$157 million in damages and 20 people lost their lives.
- Jan. 1974: Western Oregon - Flooding followed heavy wet snow and freezing rain. Nine counties received Disaster Declaration; Marys River basin recorded 4.42 inches of rain on Jan. 15, 1974. Severe flooding of area east of the Southern Pacific Railroad embankment to between 100 and 500 feet east of the millrace and in the area from Tunison Avenue to the Willamette River; damage to mobile homes, residences, and industrial buildings. (FEMA-413-DR-OR)
- Dec. 1978: Western Oregon - Intense heavy rain, snowmelt, saturated ground. One fatality in Benton County.
- Feb. 1986: Entire State - Severe statewide flooding. Rain and melting snow. Numerous homes flooded and highways closed.
- Feb. 1987: Western Oregon - Willamette River and tributaries. Mudslides damaged highways and homes.

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<sup>12</sup> National Weather Service, Advanced Hydrologic Prediction Service: Long Tom River at Monroe, <http://water.weather.gov/ahps2/hydrograph.php?wfo=pqr&gage=mnro3>, Accessed February 24, 2016.

<sup>13</sup> Benton County Flood Insurance Study (2011); Taylor, George and Raymond Hatton, 1999, The Oregon Weather Book; National Climatic Data Center Storm Events, Benton County Community Development Department.



- Feb. 1996: Entire State - Deep snow pack, warm temperatures, record-breaking rains. Flooding, landslides, power-outages. (FEMA-1099-DR-OR)
- Nov. – Dec. 1996: Entire State - Record-breaking precipitation; local flooding / landslides (FEMA-1107-DR-OR and FEMA-1149-DR-OR, *did not include Benton County*). The flood on the Willamette River in Salem was recorded as a 44-year flood event. All highways surrounding Corvallis were closed due to flood water over the road (except for Highway 99W going north). Benton County Emergency Management stated that damage to Benton County residences was estimated at \$1.2 million. FEMA-funded repair and response costs for eligible public entities totaled nearly \$600,000. These costs were for Benton County, city of Corvallis, Corvallis School District and seven other FEMA-eligible applicants.
- Dec. 2005-Jan. 2006: A very wet series of Pacific systems moved through northwest Oregon and southwest Washington dropping copious amounts of rainfall over the area. During the period of time, between 2-3 inches of precipitation fell over the Willamette Valley, and between 4-5 inches fell over parts of the Coast and Cascade Ranges. This period of heavy rainfall pushed many rivers above bank, and most of those above flood stage. Many roads around the area were reported closed due to high water, and road workers were busy battling several landslides.
- Jan. 10, 2006: Monroe and Philomath - A series of wet Pacific storms brought heavy rains to the area, causing flooding and damage. Low-lying areas and agricultural lands saw the most damage, while multiple road closures were due to flooding over local roads. Oregon Governor Ted Kulongoski declared a state of emergency in 24 of Oregon's 36 counties that included Benton County.
- Jan. 17, 2006: Corvallis, Monroe, and Philomath - A strong, moisture-laden storm brought heavy rains and flooding to northwest Oregon. Flooding affected widespread low-lying areas and agricultural lands. Flooding was also the cause of multiple road closures around the area.
- Dec. 14, 2006: Philomath - The Marys River near Philomath crested at 20.4 feet on the 15th; flood stage for this river is 20.0 feet.
- Dec. 3, 2007: Philomath - The Marys River flooded near Philomath, causing extensive flooding and flood damage in the City of Philomath and surrounding areas.
- Jan. 1, 2009: Philomath - Heavy rain combined with snowmelt runoff from the Coast Range and caused the Marys River to overflow its banks and flood the lowlands.
- Jan. 2012: Heavy rain, landslides, downed trees, roads closed included Highway 99W south of Corvallis, OSU closed for a day, delays for other school districts, 24-hour rainfall of over 4-inches. (FEMA-4055-DR-OR).
- Dec. 2015: Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides; Marys River reached flood levels, approximately 20 road closures in the county, downed trees and landslides. (FEMA-4258-DR-OR, Benton County not included)

## Probability Assessment

The Federal Emergency Management Agency (FEMA) has mapped the 10, 50, 100, and 500-year floodplains in portions of Benton County (see Figure 2-5 and referenced FIS for more information). This corresponds to a 10%, 2%, 1% and 0.2% chance of a certain magnitude

flood in any given year. The 100-year flood is the benchmark upon which the National Flood Insurance Program (NFIP) is based.

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing a flood is “high”**, meaning one incident is likely within the next 10-year period; *this rating has not changed since the previous plan.*

## Vulnerability Assessment

Flooding can occur every year depending on rainfall, snowmelt, or how runoff from development impacts streams and rivers. Surveys by the Department of Geology & Mineral Industries (DOGAMI), the county, and FEMA have established the 100-year floodplain.

Changes to development patterns since 2008/2011 have the potential to incur increased risk of flooding. However, County development regulations restrict, but does not prohibit, new development in areas identified as floodplain. This reduces the impact of flooding on future buildings. As new land has been brought into the regional Urban Growth Boundary the applicable development codes have been written to prevent the siting of new structures in flood prone areas.

The floodplains in Benton County are generally located along the Willamette and Marys river basins and their tributaries. Table 2-3 shows the known critical facilities located in the floodplain (where known it is indicated if they are in a known 100-year or 500-year floodplain).

**Table 2-3 Critical Facilities within 100-year and 500-year Floodplains**

Community	Facility	100-Year (1% SFHA)	500-year (0.2% SFHA)
Alsea	Water Treatment	X	
Benton	Avery Land Services Building (360 SW Avery Ave)	X	X
Benton	Kings Valley Charter School (38840 Kings Valley Hwy)	X	
Corvallis	Fire Department Drill Tower (1245 NE 3rd St)	X	
Corvallis	Public Works Building (1245 NE 3rd St)		X
Corvallis	Fire Station #4 (365 SW Tunison Ave)		X
Corvallis	Corvallis High (1400 NW Buchanan Ave)	X	
Corvallis	Parks and Recreation Office (1310 SW Avery Park Dr)	X	
Corvallis	KLOO/ KFAT Radio Transmitter (1221 SW 15th St)	X	
Corvallis	Waste Water Reclamation Plant (1304 NE 2nd St)	X	
Corvallis	Tunison Community Center (365 SW Tunison)		X
Monroe	Sewage Treatment Facility (East of Long Tom River)	X	
Philomath	City Hall (980 Applegate Street)	X	
Philomath	Library (1050 Applegate Street)	X	
Philomath	Police Department (1010 Applegate Street)	X	
Philomath	Public Works (1515 Willow Street)	X	
Philomath	Sewage Treatment Facility (West of Bellfountain)	X	
Philomath	Water Treatment Facility (South 9th Street)	X	

Source: Benton County NHMP Steering Committee (2011), revised 2016

In addition, the following facilities have property (but not structures) within the 100-year or 500-year floodplains.

**Table 2-4 Critical Facilities near the 100-year and 500-year Floodplains**

Community	Facility	100-Year (1% SFHA)	500-year (0.2% SFHA)
Alsea	Alsea Community Schools (301 S 3rd St)	X	X
Corvallis	Crescent Valley High School (4444 NW Highland Dr)	X	X
Corvallis	Hoover Elementary School (3838 NW Walnut Blvd)	X	
Corvallis	Jefferson Elementary School (1825 NW 27th St)	X	
Corvallis	Lincoln Elementary School (110 Se Alexander Ave)		X

Source: Benton County NHMP Steering Committee (2016)

Damage estimates have been completed for Benton County in the past, but are no longer accurate. Consequently, estimations of potential dollar losses to vulnerable structures are not currently available. FEMA recommends that communities use HAZUS software (HAZUS = Hazards United States; a geographic information system-based natural hazard loss estimation software package) to produce loss estimates that accurately reflect local conditions. The HAZUS-MH Flood Model allows planners and other practitioners to carry out a wide range of flood hazard analyses, including:

- Studies of specific return intervals of floods (e.g., 100-year return interval)
- Studies of discharge frequencies, including analysis of discharges from specific streams and the exposure to buildings and population from the resultant flooding.
- Studies of annualized losses from flooding.
- ‘Quick look’ assessments, which allow the user to quickly evaluate potential flooding from specific flood depths at specific locations.
- ‘What if’ scenarios, which allow users to evaluate the consequences of specific actions, such as the introduction of flow regulation devices, acquisition of flood-prone properties, and other mitigation measures.

The flood loss estimation methodology consists of two modules that carry out basic analytical processes: flood hazard analysis and flood loss estimation analysis. The flood hazard analysis module uses characteristics, such as frequency, discharge, and ground elevation to estimate flood depth, flood elevation, and flow velocity. The flood loss estimation module calculates physical damage and economic loss from the results of the hazard analysis.

As such, the NHMP Steering Committee rated the county as having a **“moderate” vulnerability to flood hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major flood event; *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

## Landslide

### Significant Changes Since Previous Plan:

The occurrence history for this hazard has been updated as well as the probability rating, new landslide susceptibility information based on updated Lidar data provided by DOGAMI (O-16-02) has also been included since the 2008 (Corvallis) and 2011 (Benton) Plans. This section has also been reformatted.

## 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.

Benton County is subject to landslides or debris flows (mudslides), especially in the Coast Range, which may affect buildings, roads, and utilities.

Additionally, landslides often occur together with other natural hazards, thereby exacerbating conditions, as described below:

- Shaking due to earthquakes can trigger events ranging from rockfalls and topples to massive slides.
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides.
- Landslides into a reservoir can indirectly compromise dam safety, and a landslide can even affect the dam itself.
- Wildfires can remove vegetation from hillsides, significantly increasing runoff and landslide potential.

## Location and Extent

The characteristics of the minerals and soils present in Benton County indicate the potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether or not an area will be prone to geologic hazards such as landslides.

Landslides and debris flows are possible in any of the higher slope portions of Benton County, including much of the western portion of the county. Landslide prone areas also include portions of the hilly areas west of Corvallis and limited portions of the North Albany area (see Figure 2-7).



**Table 2-5 Landslide Susceptibility Exposure**

Jurisdiction	Area, ft <sup>2</sup>	Low	Moderate	High	Very High
Benton County	18,898,991,855	26.4%	36.2%	33.4%	4.0%
Adair Village	6,502,473	74.3%	25.4%	0.3%	0.0%
Corvallis	398,128,460	64.2%	33.7%	2.1%	0.0%
Monroe	13,254,822	75.0%	25.2%	0.8%	0.0%
Philomath	56,547,689	70.4%	26.9%	2.7%	0.0%

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

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.

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

- [Open File Report: O-16-02, Landslide Susceptibility Overview Map of Oregon](#)
- [Open File Report: O-15-01, Landslide Susceptibility analysis of lifeline routes in the Oregon Coast Range \(2015\)](#)
- [Open-File Report: O-12-07, Lidar data and landslide inventory maps of the North Fork Siuslaw River and Big Elk Creek watersheds, Lane, Lincoln, and Benton Counties, Oregon](#)
- [Open-File Report: O-10-03, Digital geologic map of the southern Willamette Valley, Benton, Lane, Linn, Marion, and Polk Counties, Oregon](#)
- [Open-File-Report: O-2001-05 - Preliminary earthquake hazard and risk assessment and water-induced landslide hazard in Benton County, Oregon, 2001](#)
- [Special Paper 34: Slope failures in Oregon: GIS inventory for three 1996/97 storm events, 2000](#)

Additional reports are available via DOGAMI's Publications Search website:  
<http://www.oregongeology.org/pubs/search.php>

Other agency/ consultant reports:

[Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase I \(1998\)](#)

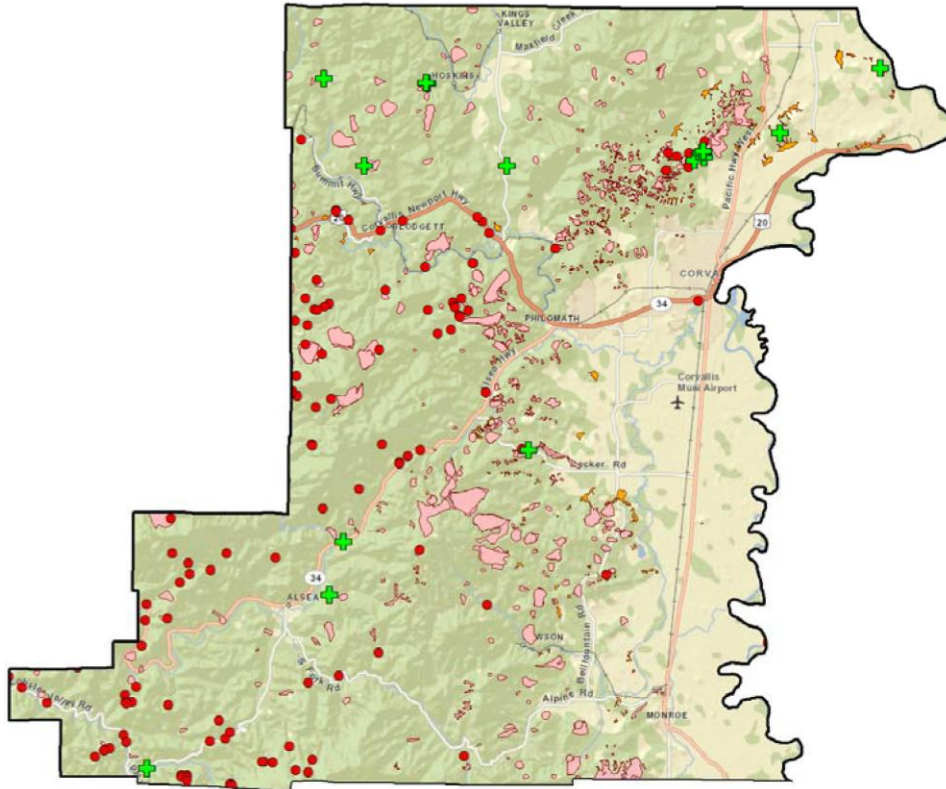
## History

Landslides may happen at any time of the year. In addition to landslides triggered by a combination of slope stability and water content, earthquakes may also trigger landslides. Areas prone to seismically triggered landslides are generally the same as those prone to ordinary (i.e., non-seismic) landslides. As with ordinary landslides, seismically triggered landslides are more likely for earthquakes that occur when soils are saturated with water.

Debris flows and landslides are a very common occurrence in hilly areas of Oregon, including portions of Benton County. Many landslides occur in undeveloped areas and thus may go unnoticed or unreported. For example, DOGAMI conducted a statewide survey of landslides from four winter storms in 1996 and 1997 and found 9,582 documented landslides, with the

actual number of landslides estimated to be many times the documented number. For the most part, landslides become a problem only when they impact developed areas and have the potential to damage buildings, roads, or utilities. Figure 2-8 shows the landslide inventory for Benton County, for additional information see the [Statewide Landslide Information Database for Oregon](#).

**Figure 2-8 Landslide Inventory**



Source: DOGAMI Memo to Benton County, February 2, 2012

Notes: Historic landslide events (red dots), mapped landslides and fans (pink and orange polygons), recent slides (green plus symbol)

Below are listed the most severe landslide events, two (2) landslide event/s have been added since the previous plan (as shown in *italics* below):

- Feb. 1996: Entire State - Deep snow pack, warm temperatures, record-breaking rains. Flooding, landslides, power-outages. (FEMA-1099-DR-OR)
- Nov. – Dec. 1996: Entire State - Record-breaking precipitation; local flooding / landslides (FEMA-1107-DR-OR and FEMA-1149-DR-OR, *did not include Benton County*). The flood on the Willamette River in Salem was recorded as a 44-year flood event. Benton County Emergency Management stated that damage to Benton County residences was estimated at \$1.2 million. FEMA-funded repair and response costs for eligible public entities totaled nearly \$600,000. These costs were for Benton County, city of Corvallis, Corvallis School District and seven other FEMA-eligible applicants.

- *January, 2012: Heavy rain, landslides, downed trees, 24-hour rainfall of over 4-inches, there were 16 landslides in Benton County (FEMA-4055-DR-OR).*
- *December 2015: Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides (FEMA-4258-DR-OR)*

For additional history see flood section above for events that included landslides.

## Probability Assessment

The probability of rapidly moving landslides occurring depends on a number of factors; these include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows). Given the correlation between precipitation / snow melt and rapidly moving landslides, it would be feasible to construct a probability curve. Many slower moving slides present in developed areas have been identified and mapped; however, the probability and timing of their movement is difficult to quantify. The installation of slope indicators or the use of more advanced measuring techniques could provide information on these slower moving slides.

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing a flood is “high”**, meaning at least one incident is likely within the next 35-year period; *this rating has increased since the previous plan.*

## Vulnerability Assessment

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

Roads and bridges are subject to closure during landslide events. Because many Benton County residents are dependent on roads and bridges for travel to work, delays and detours are likely to have an economic impact on county residents and businesses. To evaluate landslide mitigation for roads, the community can assess the number of vehicle trips per day, detour time around a road closure, and road use for commercial traffic or emergency access. Particular vulnerabilities include major routes including Highway 20 and Highway 34.

Lifelines and critical facilities should remain accessible if possible during a natural hazard event. The impact of closed transportation arteries may be increased if the closed road or bridge is a critical lifeline to hospitals or other emergency facilities. Therefore, inspection and repair of critical transportation facilities and routes is essential and should receive high priority. Losses of power and phone service are also potential consequences of landslide events. Due to heavy rains, soil erosion in hillside areas can be accelerated, resulting in loss of soil support beneath high voltage transmission towers in hillsides and remote areas. Flood events can also cause landslides, which can have serious impacts on gas lines.



A quantitative landslide hazard assessment requires overlay of landslide hazards (frequency and severity of landslides) with the inventory exposed to the hazard (value and vulnerability) by considering:

1. Extent of landslide susceptible areas;
2. Inventory of buildings and infrastructure in landslide susceptible areas;
3. Severity of earthquakes or winter storm event (inches of rainfall in 24 hours);
4. Percentage of landslide susceptible areas that will move and the range of movements (displacements) likely; and
5. Vulnerability (amount of damage for various ranges of movement).

Currently, data does not allow for specific estimates of life and property losses during a given scenario.

As such, the NHMP Steering Committee rated the county as having a **“low” vulnerability to landslide hazards**, meaning that less than 1% of the region’s population or assets would be affected by a major disaster; *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

## Volcano

### Significant Changes Since Previous Plan:

The Volcano Hazard section was reformatted since the 2008 (Corvallis) & 2011 (Benton) Plans. There has not been any new data, or history, as such the material has remained largely the same.

## Characteristics

The Pacific Northwest, lie 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 blast site.

## Location and Extent

Volcanic eruption is not an immediate threat to the residents of Benton County, as there are no active volcanoes within the county. Nevertheless, the secondary threats caused by

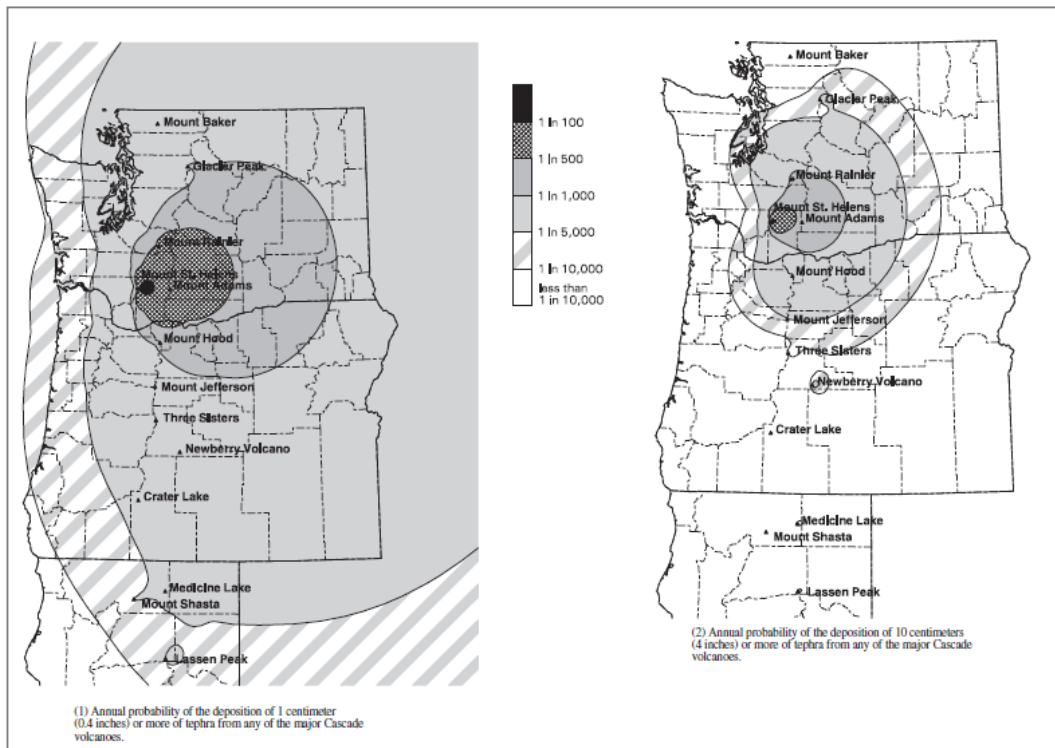
volcanoes in the Cascade region must be considered. Volcanic ash can contaminate water supplies, cause electrical storms, create health problems, and collapse roofs.

Benton County is located on the Pacific Rim. Tectonic movement within the earth's crust can renew nearby dormant volcanoes resulting in ash fallout. Volcanic activity is possible from Mount Hood and Mount Saint Helens, Three Sisters, Mount Bachelor, and the Newberry Crater areas. Because the distance to these potentially active volcanic areas is so great, the only adverse effect that would impact areas of Benton County is ash fallout, with perhaps some impact on water supplies. The area affected by ash fallout depends upon the height attained by the eruption column and the atmospheric conditions at the time of the eruption.

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](http://vulcan.wr.usgs.gov/Publications/hazards_reports.html).

Scientists use wind direction to predict areas that might be affected by volcanic ash; during an eruption that emits ash, the ash fall deposition is controlled by the prevailing wind direction. The predominant wind pattern over the Cascades originates from the west, and previous eruptions seen in the geologic record have resulted in most ash fall drifting to the east of the volcanoes. Regional tephra fall shows the annual probability of ten centimeters or more of ash accumulation from Pacific Northwest volcanoes. Figure 2-9 depicts the potential and geographical extent of volcanic ash fall in excess of ten centimeters from a large eruption of Mt. St. Helens.

**Figure 2-9 Regional Tephra-fall Maps**



Source: USGS "Volcano Hazards in the Mount Jefferson Region, Oregon"

## History

Mount Hood and Mount St. Helens are two active volcanoes in the vicinity of Benton County. Mount Hood is northeast of the county and is more than 500,000 years old. It has had two significant eruptive periods, one about 1,500 years ago and another about 200 years ago. Mount St. Helens is located in southern Washington State and has been active throughout its 50,000-year lifetime. In the past 200 years, seven of the Cascade volcanoes have erupted, including (from north to south): Mt. Baker, Glacier Peak, Mt. Rainier, Mount St. Helens (Washington); Mt. Hood (Oregon); Mt. Shasta, and Mt. Lassen (California).

There has been no recent volcanic activity in close proximity to the county. The 1980 explosion of Mount Saint Helens in southern Washington State is the latest on record; both Mount St. Helens and Mount Hood remain listed as active volcanoes.

## Probability Assessment

The United States Geological Survey-Cascades Volcano Observatory (CVO) produced volcanic hazard zonation reports for Mount St. Helens and Mount Hood in 1995 and 1997. The reports include a description of potential hazards that may occur to immediate communities. The CVO created an updated annual probability of tephra (ash) fall map for the Cascade region in 2001, which could be a rough guide for Benton County in forecasting potential tephra hazard problems. The map identifies the location and extent of the hazard.

The CVO Volcanic tephra fall map is based on the combined likelihood of tephra-producing eruptions occurring at Cascade volcanoes. Probability zones extend farther east of the range because winds blow from westerly directions most of the time. The map shows annual probabilities for a fall of one centimeter (about 0.4 inch). The patterns on the map show the dominating influence of Mount St. Helens as a tephra producer. Because small eruptions are more numerous than large eruptions, the probability of a thick tephra fall at a given locality is lower than that of a thin tephra fall. The annual probability of a fall of one centimeter or more of tephra is about 1 in 10,000 for Benton County. This is small when compared to other risks faced by the county. The USGS map on the previous page illustrates potential tephra fall in the region.

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing volcanic activity is “moderate**, meaning one incident is likely within the next 75-year period; *this rating has not changed since the previous plan.*

## Vulnerabilities

Risks for Benton County associated with regional volcanic activity would be ash fall, air quality, and possible economic or social disruption due to air traffic issues due to the ash cloud.

At the time of this update, sufficient data was not available to determine volcanic eruption vulnerability in terms of explicit types and numbers of existing and future buildings, infrastructure, or critical infrastructure.

Though unlikely, the impacts of a significant ash fall are substantial. Persons with respiratory problems are endangered, transportation, communications, and other lifeline services are interrupted, drainage systems become overloaded/ clogged, buildings can become structurally threatened, and the economy takes a major hit. Any future eruption of a nearby volcano (e.g., Hood, St. Helens, or Adams) occurring during a period of easterly winds would likely have adverse consequences for the county.

As such, the NHMP Steering Committee rated the county as having a “**low**” **vulnerability to volcanic activity**, meaning that less than 1% of the region’s population or assets would be affected by a major disaster (volcanic ash); *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

## Wildfire

### Significant Changes Since Previous Plan:

The occurrence history for this hazard has been updated as well as the probability rating since the 2008 (Corvallis) & 2011 (Benton) Plans. The existing Community Wildfire Protection Plan (2009) is scheduled to be updated in 2016; when the CWPP is updated it should be incorporated into this plan. In addition, the format of the section and minor content changes have occurred.

## 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 is 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 following three factors contribute significantly to Wildfire behavior and can be used to identify Wildfire hazard areas.

**Topography:** As slope increases, the rate of Wildfire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying Wildfire behavior. However, ridgetops may mark the end of Wildfire spread, since fire spreads more slowly or may even be unable to spread downhill.

**Fuel:** The type and condition of vegetation plays a significant role in the occurrence and spread of Wildfires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the “fuel load”). The ratio of living to dead

plant matter is also important. The risk of fire is increased significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel's continuity, both horizontally and vertically, is also an important factor.

**Weather:** The most variable factor affecting Wildfire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme Wildfire activity. By contrast, cooling and higher humidity often signals reduced Wildfire occurrence and easier containment.

The frequency and severity of Wildfires is also dependent upon other hazards, such as lightning, drought, equipment use, railroads, recreation use, arson, and infestations. If not promptly controlled, Wildfires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties. In addition to affecting people, Wildfires may severely affect livestock and pets. Such events may require emergency watering/feeding, evacuation, and shelter.

The indirect effects of Wildfires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thereby enhancing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards, as described above.

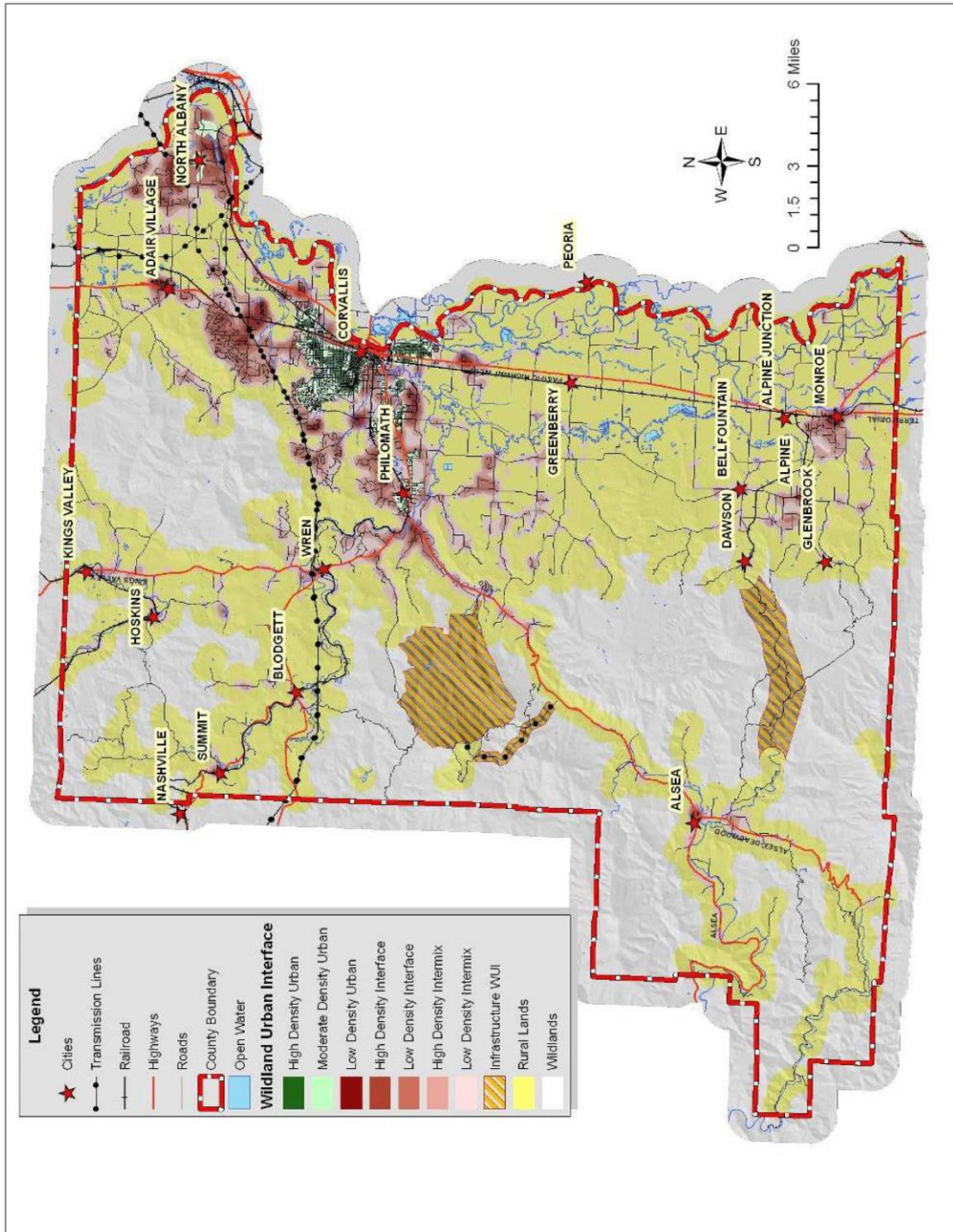
## Location and Extent

Wildfire hazard areas are commonly identified in regions of the Wildland Urban Interface. 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. One challenge Benton County faces is from the increasing number of houses being built in the urban/rural fringe as compared to twenty years ago. The "interface" between urban or suburban areas and the resource lands has significantly increased the threat to life and property from fires. Responding to fires in the expanding Wildland Urban Interface area may tax existing fire protection systems beyond original design or current capability.

Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control, such as the surrounding fuel load, weather, topography, and property characteristics.

Fire susceptibility throughout the county dramatically increases in late summer and early autumn as summer thunderstorms with lightning strikes increases and vegetation dries out, decreasing plant moisture content and increasing the ratio of dead fuel to living fuel. However, various other factors, including humidity, wind speed and direction, fuel load and fuel type, and topography can contribute to the intensity and spread of wildland. In addition, common causes of Wildfires include arson and negligence from industrial and recreational activities.

**Figure 2-10 Wildfire-Urban Interface**



Source: Benton County CWPP (2009)

## History

Benton County has not directly experienced a large wildfire event in the last 20 years; however, this does not mean that the county is at low risk. The last big fire event near Benton County was the Tillamook Burn from 1933 to 1951, which burned a combined total of 355,000 acres in the counties of Washington, Yamhill, and Tillamook north of Benton County. If Benton County experienced a fire event similar to any of the Tillamook Fires today, it would have a much more severe impact on the present community.

There has been one significant wildfire event since the previous plan (as shown in *italics* below):

- 1933-1951: The Tillamook burn was a series of large fires that struck at six-year intervals and burned a combined total of 355,000 acres.
- 1987: Shady Lane Fire, burned 1,140 acres, caused \$280,000 in damages, and suppression costs totaled more than \$400,000. (FM-2066, 10/10/1987)
- 1987: Rockhouse Creek Fire burned through the Dallas watershed including a portion of the Black Rock Experimental State Forest; two camps and 24 homes in the Black Rock community were evacuated. More than 5,000 acres burned, causing more than \$5 million in damages, and suppression costs exceeded \$2.6 million.
- *2014: Timber Hill, ignition cause was arson, charred 86 acres and a house near Chip Ross Park (Corvallis), cost to fight was approx. \$50,000.*

## Probability Assessment

Certain conditions must be present for significant interface fires to occur. The most common are hot, dry, and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel, topography, weather, drought, and development.

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing a Wildfire is “high”**, meaning one incident is likely within the next 35-year period; *this rating has not changed since the previous plan.*


## Vulnerability Assessment

The [2009 Benton County Community Wildfire Protection Plan](#) profiles five (5) strategic planning areas (urban zone, farm zone, northern forest zone, western forest zone, coastal range zone). Each zone is distinguished based on similar fuel conditions that would require similar initial attack techniques.

The CWPP development process included an analysis of Benton County’s fire hazard risk. Field visits and discussions with area residents and fire control specialists provided insights into forest health issues and treatment options. This information was mapped and evaluated to develop an assessment of Wildfire risk in the region. Table 2-6 from the CWPP inventories the fire prone landscapes in the county to identify the location and extent of the wildfire hazard.

The risk category values developed in this analysis should be considered ordinal data, that is, while the values presented have a meaningful ranking, they neither have a true zero point nor scale between numbers. Rating in the “40” range is not necessarily twice as “risky” as rating in the “20” range. These category values also do not correspond to a rate of fire spread, a fuel loading indicator, or measurable potential fire intensity. Each of those scales is greatly influenced by weather, seasonal and daily variations in moisture (relative humidity), solar radiation, and other factors. The risk rating presented here serves to identify where certain constant variables are present, aiding in identifying where fires typically spread into the largest fires across the landscape.

**Table 2-6 Relative Fire Risk Assessment for Benton County**

Color Code	Value	Total Acres	Percent of Total Area
	0	4,038	1%
	1	41,616	10%
	2	26,232	6%
	3	43,835	10%
	4	77,738	18%
	5	75,963	17%
	6	58,475	13%
	7	48,906	11%
	8	42,533	10%
	9	14,745	3%
	10	4,038	1%

Source: Benton County CWPP (2009)

The [Benton County Community Wildfire Protection Plan](#) (CWPP, 2009) is scheduled to be updated in 2016. The update of the CWPP will include updates to the Risk Assessment, mitigation activities, and highest priority areas. When complete, the updated CWPP shall be incorporated into this NHMP by reference. For more information on wildfire risk and fuels reduction projects see the Benton County CWPP (in addition, there are four other CWPPs within the county including the [Marys River Estates CWPP](#) (Philomath vicinity, 2007), [Pioneer Village CWPP](#) (Philomath vicinity, 2011), [Vineyard Mountain Community CWPP](#) (Corvallis vicinity, 2007), and [Ridgewood Estates CWPP](#) (Corvallis vicinity, 2012).

As such, the NHMP Steering Committee rated the county as having a “**moderate**” **vulnerability to Wildfire hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major disaster; *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).



## Windstorm

### Significant Changes Since Previous Plan:

The Windstorm Hazard has been edited to reference new history since the 2008 (Corvallis) and 2011 (Benton) Plans. This section has also been reformatted.

## Characteristics

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. The most persistent high winds take place along the Oregon Coast and in the Columbia River Gorge. High winds in the Columbia Gorge are well documented. The Gorge is the most significant east-west gap in the Cascade Mountains between California and Canada. Wind conditions in central Oregon are not as dramatic as those along the coast or in the Gorge yet can cause dust storms or be associated with severe winter conditions such as blizzards. A majority of the destructive surface winds striking Oregon are from the southwest. Some winds blow from the east but most often do not carry the same destructive force as those from the Pacific Ocean.

Though tornadoes are not common in Oregon, these events do occasionally occur and sometime produce significant property damage and even injury. Tornadoes are the most concentrated and violent storms produced by earth's atmosphere, and can produce winds in excess of 300 mph. They have been reported in most of the regions throughout the state since 1887. Most of them are caused by intense local thunderstorms common between April and October.

## Location and Extent

The most common type of wind pattern affecting Benton County is straight-line winds, which originate as a downdraft of rain-cooled air, and reach the ground and spread out rapidly. Straight-line winds can produce gusts of up to 100 mph. For Benton County, the wind hazard levels are generally highest near the Willamette River and then fairly uniform across most of the rest of the county. In the mountainous areas, however, the level of wind hazard is strongly determined by local specific conditions of topography and vegetation cover. Mountainous terrain slows down wind movement, which is why Oregon's sheltered valley areas have the slowest wind speed in the state. However, in the foothills, the wind speeds may increase due to down-sloping winds from the mountains.

Although windstorms can affect the entirety of the county, they are especially dangerous in developed areas with significant tree stands and major infrastructure, especially above ground utility lines. A windstorm will frequently knock down trees and power lines, damage homes, businesses, public facilities, and create tons of storm related debris.

## History

Windstorms occur yearly; more destructive storms occur once or twice per decade, most recently in December 2015. The following windstorms have occurred within, and/or near

Benton County, four (4) windstorm events were added to this hazard history section since the previous plan (shown in *italics* below)<sup>14</sup>:

- Jan. 1880: Coast and Willamette Valley, In Portland, sustained south wind speeds of 60 mph were observed. Elsewhere, south winds were reported as high as 65 mph with gusts to 80 mph. Thousands of trees, many five to eight feet in diameter, were easily toppled in the high winds. Buildings throughout the Willamette Valley were destroyed. Hundreds more, including numerous large public buildings, were severely damaged.
- Jan. 1921: Coast and Willamette Valley, Hurricane-force winds were reported along the entire Oregon and Washington coasts. 113 mph was officially recorded at the north head of the mouth of the Columbia River on the Washington side. Very strong winds were also reported in the Willamette Valley. Widespread damage to buildings and standing timber.
- Apr. 1931: Western Oregon, unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber.
- Nov. 10-11, 1951: Statewide, widespread damage; transmission and utility lines; Wind speed 40-60 mph; Gusts 75-80 mph
- Dec. 1951: Statewide, wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
- Jan. 20, 1953: Corvallis, a “miniature tornado” (F0-F1) touched down in Corvallis destroying one building before moving into agricultural fields across the river. Rain and hail fell in sheets during this event, causing more damage estimated at \$500,000.
- Dec. 1955: Statewide, Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines
- Nov. 1958: Statewide, Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees
- Oct. 1962: Statewide, *Columbus Day Storm*; Oregon’s most destructive storm to date. 116 mph winds in Willamette Valley. Estimated 84 houses destroyed, with 5,000 severely damaged. Total damage estimated at \$170 million
- Oct. 1967, Statewide, Significant widespread damage occurred to agriculture, timber, power and telephone utilities, and homes. Portland airport recorded a fastest mile of 70 mph. Wind speeds of 100 to 115 mph were unofficially recorded along the Oregon coast. There was one fatality and about 15 persons were seriously injured.
- Mar. 1971: Most of Oregon, Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees.
- Nov. 1981: Most of Oregon, Highest winds since 1962. Wind speed 71 mph in Salem. Marinas, airports and bridges severely damaged.

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<sup>14</sup> Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book; The Spatial Hazard Events and Losses Database for the United States*, [Online Database]. Columbia, SC: University of South Carolina. Available at <http://www.sheldus.org>; U.S. Department of Commerce. National Climatic Data Center. Available at <http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.dll?wwevent~storms>; National Weather Service Forecast Office. Available at <http://www.wrh.noaa.gov/pqr/paststorms/wind.php>

- Jan. 1990: Statewide, Heavy rain with winds exceeding 75 mph. Significant damage, and one fatality.
- Dec. 1996: Statewide, Followed path of Columbus Day Storm. Wind speeds 62 mph in Willamette Valley. Damage to trees (saturated soil a factor) and homes. (FEMA-1107-DR-OR)
- Nov. 1997: Western Oregon, Wind speed 52 mph in Willamette Valley. Trees uprooted. Considerable damage to small airports.
- Feb. 2002: Western Oregon, Strongest storm to strike western Oregon in several years. Many downed power lines (trees); damage to buildings; water supply problems (lack of power). Estimated damage costs: \$6.14 million. (FEMA-1405-DR-OR, *declaration does not include Benton County*)
- Dec. 15, 2005: Willamette Valley, a decent windstorm moved up the Willamette Valley bringing strong winds to the central and southern valley. Affected electric utilities with significant damage to Consumer's Power Inc.
- Feb. 2006: Linn, Marion, Lane, Benton, Polk, Yamhill, windstorms with gusts up to 77 mph causes \$227,000 in damages in Linn, Lane, Marion, Benton, Polk, and Yamhill Counties.
- Dec. 1-3, 2007: Oregon and Washington, a relentless storm pummeled the Oregon and Washington Coasts for 3 days bringing the strongest winds the area has seen since the Columbus Day storm.
- *Jun. 2009: Willamette Valley, series of storms brought high winds, thunderstorms, rain, and hail.*
- *Jan. 2012: Severe winter storm, landslides, mudslides, flooding, including high winds (FEMA-4055-DR-OR)*
- *Feb. 2014: Coast and Willamette Valley, severe winter storm including high winds (FEMA-4169-DR-OR)*
- *Dec. 2015: Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides; Marys River reached flood levels, approximately 20 road closures in the county, downed trees and landslides. (FEMA-4258-DR-OR, Benton County not included)*

Several additional, small windstorm events have occurred since the previous plan, see the [Storm Events Database](#) provided by the National Oceanic and Atmospheric Administration for more information.

## Probability Assessment

Windstorms in the county usually occur in the winter from October to March, and their extent is determined by their track, intensity (the air pressure gradient they generate), and local terrain. Summer thunderstorms may also bring high winds along with heavy rain and/or hail. The National Weather Service uses weather forecast models to predict oncoming windstorms, while monitoring storms with weather stations in protected valley locations throughout Oregon.

The table below shows the wind speed probability intervals that structures 33 feet above the ground would expect to be exposed to within a 25, 50 and 100-year period. The table shows that structures in Region 3, which includes the county, can expect to be exposed to 60 mph winds in a 25-year recurrence interval (4% annual probability).

**Table 2-7 Probability of Severe Wind Events (Region 3)**

	25-Year Event (4% annual probability)	50-Year Event (2% annual probability)	100-Year Event (1% annual probability)
<b>Region 3:</b> Mid/Southern Willamette Valley	60 mph	68 mph	75 mph

Source: Oregon State Natural Hazard Mitigation Plan, 2009

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing a windstorm is “high”**, meaning one incident is likely within the next 35-year period; *this rating has not changed since the previous plan.*

## Vulnerabilities

Many buildings, utilities, and transportation systems within Benton County are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands. It is also true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels where trees have been planted or left for aesthetic purposes. Structures most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair.

Fallen trees are especially troublesome. They can block roads and rails for long periods of time, impacting emergency operations. In addition, up-rooted or shattered trees can down power and/or utility lines and effectively bring local economic activity and other essential facilities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. In Benton County, trees are more likely to blow over during the winter (wet season).

As such, the NHMP Steering Committee rated the county as having a **“moderate” vulnerability to windstorm hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major disaster; *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

## Winter Storm

### Significant Changes Since Previous Plan:

The Winter Storm hazard has been edited to reference new history since the 2008 (Corvallis) and 2011 (Benton) Plans. This section has also been reformatted.

## Characteristics

Winter storms affecting Benton County are generally characterized by a combination of heavy rains and high winds throughout the county, sometimes with snowfall, especially at higher elevations. Heavy rains can result in localized or widespread flooding, as well as debris slides and landslides. High winds commonly result in tree falls which primarily affect the electric power system, but which may also affect roads, buildings and vehicles. This chapter deals primarily with the snow and ice effects of winter storms.

The winter storms that affect Benton County are typically not local events affecting only small geographic areas. Rather, the winter storms are usually 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.

Ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation which may include freezing rain, sleet and hail. Of these, freezing rain can be the most damaging of ice formations.

Outside of mountainous areas, significant snow accumulations are much less likely in western Oregon than on the east side of the Cascades. However, if a cold air mass moves northwest through the Columbia Gorge and collides with a wet Pacific storm, then a larger than average snow fall may result.

## Location and Extent

Ice storms occasionally occur in northern areas of Oregon, resulting from cold air flowing westward through the Columbia Gorge. Freezing rain can be the most damaging of ice formations. While sleet and hail can create hazards for motorists when it accumulates, freezing rain can cause the most dangerous conditions within a community. Ice buildup can bring down trees, communication towers, and wires creating hazards for property owners, motorists, and pedestrians alike. The most common freezing rain problems occur near the Columbia Gorge. The Gorge is the most significant east-west air passage through the Cascades. Rain arriving from the west can fall on frozen streets, cars, and other sub-freezing surfaces, creating dangerous conditions.

The National Climatic Data Center has established climate zones in the United States for areas that have similar temperature and precipitation characteristics. Oregon's latitude, topography, and proximity to the Pacific Ocean give the state diversified climates. Benton County is located within Zone 2: Willamette Valley. The climate in Zone 2 generally consists

of cool, wet winters and warm, dry summers.<sup>15</sup> These wet winters result in potentially destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds.

**Figure 2-11 Oregon Climate Divisions**



Source: Oregon Climate Service,

The principal types of winter storms that occur include:

- **Snowstorms:** require three ingredients: cold air, moisture, and air disturbance. The result is snow, small ice particles that fall from the sky. In Oregon, the further inland and north one moves, the more snowfall can be expected. Blizzards are included in this category.
- **Ice storms:** are a type of winter storm that forms when a layer of warm air is sandwiched by two layers of cold air. Frozen precipitation melts when it hits the warm layer, and refreezes when hitting the cold layer below the inversion. Ice storms can include sleet (when the rain refreezes before hitting the ground) or freezing rain (when the rain freezes once hitting the ground).
- **Extreme Cold:** Dangerously low temperatures accompany many winter storms. This is particularly dangerous because snow and ice storms can cause power outages, leaving many people without adequate heating.

Unlike most other hazards, it is not simple to systematically map winter storm hazard zones. The entire County is susceptible to damaging severe weather. Winter storms that bring snow and ice can impact infrastructure, business, and individuals. Those resources that exist at higher elevations will experience more risk of snow and ice, but the entire County can face damage from winter storms and, for example, the hail or life threateningly cold temperatures that winter storms bring.

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<sup>15</sup> Oregon Climate Service, "Climate of Benton County,"

## History

Winter storms occur yearly; more destructive storms occur once or twice per decade, most recently in December 2015. The following winter storms have occurred within, and/or near Benton County, six (6) winter storm events were added to this hazard history section since the previous plan (shown in *italics* below)<sup>16</sup>:

- Dec. 1861: Statewide, Snowfall varied between 1 and 3 feet. Did not leave Willamette Valley floor until late February
- Dec. 1864: Willamette Valley and Columbia Basin, Heavy snowfall. Albany (Linn County) received 16 inches in 1 day.
- Dec. 1884: Columbia River Basin and Willamette Valley, Most of the heavy snow fell over the Columbia River Basin from Portland to The Dalles and along the Cascades foothills in the Willamette valley. Albany received 19 inches.
- Dec. 1892: Northwest Oregon, Substantial snow fell across most of northern Oregon, with the greatest snowfall reported over northwestern Oregon. Corvallis received 18 inches of snow.
- Jan. 1916: Statewide, two snow storms, each totaling 5 inches or more
- Dec. 1919: Benton County, Corvallis received 22 inches of snow and set an all-time low temperature record of 14 degrees F
- Jan.- Feb. 1937: Statewide, Heavy snow throughout the Willamette Valley. Corvallis received 18 inches of snow.
- Jan. 1950: Statewide, Heaviest snowfall since 1890. Many highway closures. Considerable property damage. Corvallis received 52 inches in snowfall for the month of January.
- Jan. 1956: Western Oregon, Packed snow became ice. Many automobile accidents throughout the region
- Mar. 1960: Statewide, Snowfall: 3-12 inches, depending on location. More than 100 snow related accidents in Marion County
- Jan. 1969: Statewide, For many areas, this was the most extreme storm on record. Snowfall over the state was much above normal, mostly in part due to a very cold January. Eugene had a total snow depth of 47 inches. Losses in livestock were heavy. Many communities were completely isolated for close to a week. At times, traffic on nearly every major highway west of the Cascades was halted. Three to \$4 million in property damage statewide.
- Jan. 1980: Statewide, a series of storms bringing snow, ice, wind, and freezing rain. Six fatalities.
- Feb. 1985: Statewide, Western valleys received between 2-4 inches of snow; Massive power failures (tree limbs broke power lines)
- Dec. 1985: Willamette Valley, Heavy snowfall throughout valley
- Mar. 1988: Statewide, Strong winds and heavy snow

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<sup>16</sup> Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book; The Spatial Hazard Events and Losses Database for the United States*, [Online Database]. Columbia, SC: University of South Carolina. Available at <http://www.sheldus.org>; U.S. Department of Commerce. National Climatic Data Center. Available at <http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.dll?wwevent~storms>; National Weather Service Forecast Office. Available at <http://www.wrh.noaa.gov/pqr/paststorms/wind.php>

- Feb. 1989: Statewide, Heavy snowfall and record low temperatures. Salem received 9 inches. Extensive power failures as well as considerable home and business damage resulting from frozen plumbing throughout the state.
- Feb. 1990: Statewide, The Willamette Valley was coated with 2 to 4 inches except the higher hills around Portland received up to 1 foot.
- Dec. 1992: Western Oregon, Heavy snow. Interstate Highway closed.
- Feb. 1993: Western Oregon, Record snowfall at Salem airport
- Winter 1998-9: Statewide, Series of storms. One of the snowiest winters in Oregon history
- Dec. 2003 – Jan. 2004: Statewide, Wet snow blanketed highways in the Willamette Valley, causing power lines and trees to topple. Oregon 34 east of Philomath was closed for 30 hours January 5 and 6 while crews removed trees. Critical services were disrupted, 10,000 customers without power for 3 to 4 days; one person died as a result of power outage. Presidential disaster declaration for 30 of Oregon’s 36 counties (*FEMA-1510-DR-OR*).
- Dec. 2008: Willamette Valley, a series of storms dropped feet of snow over portions of the Willamette Valley. The onset of cold air moved in around December 14 and lingered through Christmas morning (*FEMA-1824-DR-OR, Benton County not included*)
- Nov. 2011: Benton County, heavy snow, accumulations between 5 and 7 inches
- Jan. 2012: Severe winter storm, landslides, mudslides, flooding, including high winds (*FEMA-4055-DR-OR*)
- Mar.2012: mixture of snow, rain, wind throughout much of the coast and Willamette Valley, snow accumulations up to 7-inches, trees down, roads closed.
- Dec. 2013: Willamette Valley, snow accumulations up to 9-inches
- Feb. 2014: coast and Willamette Valley, severe winter storm including high winds, snow accumulations up to 12-inches in Benton County (*FEMA-4169-DR-OR*)
- Dec. 2015: Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides; Marys River reached flood levels, approximately 20 road closures in the county, downed trees and landslides. (*FEMA-4258-DR-OR, Benton County not included*)

## Probability Assessment

The recurrence interval for a severe winter storm is about every 13 years; however, there can be many localized storms between these periods. Severe winter storms occur in western Oregon regularly from November through February. Benton County experiences winter storms a couple times every year, to every other year.

Based on the available data and research for Benton County the NHMP Steering Committee determined the **probability of experiencing a winter storm is “high”**, meaning one incident is likely within the next 35-year period; *this rating has not changed since the previous plan.*

## Vulnerabilities

Given current available data, no quantitative assessment of the risk of winter storm was possible at the time of this NHMP update. However, assessing the risk to the county from winter storms should remain an ongoing process determined by community characteristics



and physical vulnerabilities. Weather forecasting can give County resources (emergency vehicles, warming shelters) time to prepare for an impending storm, but the changing character of the county population and resources will determine the impact of winter storms on life and property in Benton County.

The most likely impact of snow and ice events on Benton County are road closures limiting access/egress to/from some areas, especially roads to higher elevations. Winter storms with heavy wet snow or high winds and ice storms may also result in power outages from downed transmission lines and/or poles.

Winter storms which bring snow, ice and high winds can cause significant impacts on life and property. Many severe winter storm deaths occur as a result of traffic accidents on icy roads, heart attacks may occur from exertion while shoveling snow, and hypothermia from prolonged exposure to the cold. The temporary loss of home heating can be particularly hard on the elderly, young children and other vulnerable individuals.

Property is at risk due to flooding and landslides that may result if there is a heavy snowmelt. Additionally, ice, wind and snow can affect the stability of trees, power and telephone lines and TV and radio antennas. Down trees and limbs can become major hazards for houses, cars, utilities and other property. Such damage in turn can become major obstacles to providing critical emergency response, police, fire and other disaster recovery services.

Severe winter weather also can cause the temporary closure of key roads and highways, air and train operations, businesses, schools, government offices and other important community services. Below freezing temperatures can also lead to breaks in un-insulated water lines serving schools, businesses, industries, and individual homes. All of these effects, if lasting more than several days, can create significant economic impacts for the affected communities, surrounding region, and region. In the rural areas of Oregon severe winter storms can isolate small communities, farms, and ranches.

At the time of this update, sufficient data was not available to determine winter storm vulnerability in terms of explicit types and numbers of existing and future buildings, infrastructure, or critical infrastructure.

As such, the NHMP Steering Committee rated the county as having a **“moderate” vulnerability to winter storm hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major disaster; *this rating has not changed since the previous plan.*

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015).

Other reports:

[Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase I \(1998\)](#)

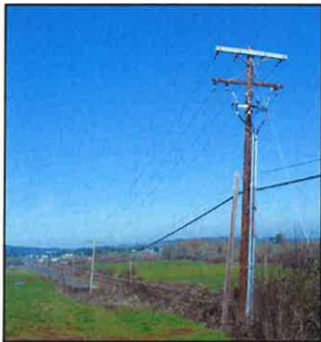
Disaster avoided through mitigation measures

## Protecting a Critical Function: Medical Care

*Corvallis Medical Hill System Mitigation Project, Sub grantee: Consumers Power, Inc.  
Hazard Mitigation Grant Program, FEMA DR-1405-OR, Project 1405.0003*

**BENTON COUNTY, OREGON**— Hazard identification and risk assessment are the first steps in successful mitigation projects. Consumers Power, Inc., the Good Samaritan Hospital, the Corvallis Clinic and the Benton County Emergency Management Council formed a partnership to investigate what could be done to increase electrical service reliability on Medical Hill. Consumers Power Inc. recognized the facilities' vulnerability from potential wind damage to a narrow band of unsheltered trees that paralleled about 1400 feet of its main transmission line.

**Problem:** Removing the tree hazard was not an option. The City of Corvallis required a small strip of trees in order to provide a visual and noise buffer from the adjacent highway. This restriction meant that the only cost-effective solution was to under-ground the line.



Overhead electrical line along Hwy 99 transitions from pole into conduit (at right foreground) and then underground at Medical Hill property line.

The new underground routing significantly improves system reliability for the Medical Hill complex of hospitals, clinics and labs. The chance of voltage fluctuations and power outages associated with wind damage have been greatly reduced and this means less interruption to treatment schedules and loss of revenue.

Project Costs: \$58,890

**Losses avoided:**

- Annual maintenance: \$4,800
- Estimated Corvallis Clinic loss of revenue per day with out power: \$200,000



**Solution:** Converted overhead power source to underground in conduit where only the overhead phone line remains along outside of required tree buffer zone for hospital facility.

Termination boxes and switches along new underground cable route.



## 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 as a result of natural hazard related events. As of March 2016, FEMA has approved a total of 31 major disaster declarations, 64 fire management assistance declarations, and two (2) emergency declarations in Oregon.<sup>17</sup> 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 2-8 summarizes the major disasters declared in Oregon that affected Benton County, since 1955. The table shows that there have been nine (9) major disaster declarations for the county (two since the previous plan). All of which were related to weather events resulting primarily in flooding, landslides, and wind related 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. Benton County has only one recorded Emergency Declaration related to the 2005 Hurricane Katrina evacuation.

Fire Management Assistance may be provided after a State submits a request for assistance to the FEMA Regional Director at the time a "threat of major disaster" exists. There are no fire management assistance declarations on record for the county.

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<sup>17</sup> FEMA, *Declared Disasters by Year or State*, [http://www.fema.gov/news/disaster\\_totals\\_annual.fema#markS](http://www.fema.gov/news/disaster_totals_annual.fema#markS). Accessed March 2, 2016.

**Table 2-8 FEMA Major Disaster (DR), and Emergency (EM), and Fire Management Assistance (FMA) Declarations for Benton County**

Declaration Number	Declaration Date	Incident Period		Incident	Individual Assistance	Public Assistance Categories
		From	To			
DR-184	12/24/1964	12/24/1964	12/24/1964	Heavy rains and flooding	Yes	A, B, C, D, E, F, G
DR-413	1/25/1974	1/25/1974	1/25/1974	Severe Storms, Snowmelt, Flooding	Yes	A, B, C, D, E, F, G
DR-1099	2/9/1996	2/4/1996	2/21/1996	Severe Storms/Flooding	Yes	A, B, C, D, E, F, G
DR-1107	3/19/1997	12/10/1996	12/12/1996	Severe Storms/High Winds	None	A, B, C, D, E, F, G
DR-1510	2/19/2004	12/26/2003	1/14/2004	Severe Winter Storm	None	A, B, C, D, E, F, G
DR-1632	3/20/2006	12/18/2005	1/21/2006	Severe Storms, Flooding, Landslides, and Mudslides	None	A, B, C, D, E, F, G
DR-1683	2/22/2007	12/14/2006	12/15/2006	Severe Winter Storm and Flooding	None	A, B, C, D, E, F, G
DR-4055	3/2/2012	1/17/2012	1/21/2012	Severe Winter Storm, Flooding, Landslides, and Mudslides	None	A, B, C, D, E, F, G
DR-4169	4/4/2014	2/6/2014	2/10/2014	Severe Winter Storm	None	A, B, C, D, E, F, G
EM-3228	9/7/2005	8/29/2005	10/1/2005	Hurricane Katrina Evacuation	None	B

Source: FEMA, Oregon Disaster History. Major Disaster Declarations.

## Vulnerability Summary

Community vulnerabilities are an important component of the NHMP risk assessment. For more in-depth information regarding specific community vulnerabilities, reference Volume II, Hazard Annexes and Appendix C: Community Profile. Data sources for the following community vulnerability information can be found in Appendix C – *Community Profile*, unless otherwise noted below.

## 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. Historically, 80 percent of the disaster burden falls on the public.<sup>18</sup> Of this number, a disproportionate

<sup>18</sup> Hazards Workshop Session Summary #16, *Disasters, Diversity, and Equity*, University of Colorado, Boulder (2000).

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.

## Population Vulnerabilities

- As of 2014, approximately 13% of Benton County's population is over the age of 64; that number is projected to rise to about 18% (or roughly 7,000 individuals) by 2035.
- The Benton County age dependency ratio<sup>19</sup> is 37.2, which is lower than that of the State of Oregon (48.6); the age dependency figure for the county is expected to increase to 45.4 by the year 2035.
- Approximately 9.4% of Benton County population over age 64 lives alone; this percentage is greatest in Corvallis.
- Approximately 18% of Adair Village households are single-parent.
- Benton County's real median income is decreasing, with the largest decreases in Adair Village and Philomath (although both of these communities are above the county median income).
- Approximately 22.7% of the total Benton County population lived at or below the poverty line in 2014, with 14.4% of children. Corvallis has the highest percentage of total population in poverty (29.5%, 14,720).
- While over 94% of the population over 25 has graduated high school or higher and more than 50% have a bachelor's degree or higher, the City of Monroe has a lower percentage of high school graduates or those with bachelor's degrees.
- Approximately 10% of the Benton County population is estimated to have a disability. Of that, 3,611 individuals over 64 (32.0%) are disabled.
- Nearly 50% of Benton County renters spend more than 35% of their income on housing. For the cities, those percentages are: 38% in Adair Village, 52% in Corvallis, 17% in Monroe, and 43% in Philomath.

## 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 component parts 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.

## Economic Vulnerabilities

- According to the Oregon Employment Department, Benton County unemployment has decreased from 7.5% in 2010 to less than 4% in 2016.
- The largest sectors of employment in Benton County are State Government, mainly Educational Services (18%), Education and Health Services (16%), Trade,

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<sup>19</sup> Dependency Ratio: the ratio of population typically not in the work force (less than 15, greater than 64)

Transportation, and Utilities (12%), Professional and Business Services (11%), and Leisure and Hospitality (11%).

- The largest revenue sectors in Benton County are Retail Trade (\$731.0 million), Wholesale Trade (\$452.5 million), and Manufacturing (\$412.7 million).
- The Construction sector is expected to have the most growth from 2012 to 2022 at 26%. Professional and Business Services (24%) and Education and Health Services (17%) are the next closest growth sectors.

## 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.<sup>20</sup> 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.

### Environmental Vulnerabilities

- Forest ecosystems are vulnerable to drought, wildfire, and severe storm impacts.

## Built Environment, Critical Facilities, and Infrastructure

Critical facilities (i.e. police, fire, and government facilities), housing supply 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.

### Housing Vulnerabilities

- Mobile home and other non-permanent residential structures account for 6.8% of the housing in Benton County. In Monroe mobile homes account for 16.3%. These structures are particularly vulnerable to certain natural hazards, such as earthquake, windstorms, and heavy flooding events.
- Based on U.S. Census data, approximately one-third of the residential housing in Benton County was built after the current seismic building standards of 1990.<sup>21</sup>
- Approximately one-third of residential structures were constructed prior to the local implementation of the flood elevation requirements of the 1970's (county Flood

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<sup>20</sup> Mayunga, J. "Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer Academy for Social Vulnerability and Resilience Building," (2007).

<sup>21</sup> Ibid.

Insurance Rate Maps –FIRMs- were not completed until the late 1970s and early 1980s).

- The housing vacancy rate in Benton County was estimated at just under 8% in 2014. Approximately 13% of the housing units in Monroe (43 units), and 10% in Corvallis (2,271 units) were estimated to be vacant.

## Critical Facilities and Infrastructure Vulnerabilities

- Virtually all state and county roads and bridges in Benton County are vulnerable to multiple hazards including flood, landslide, and earthquake. Impacts to the transportation system can result in the isolation of vulnerable populations, limit access to critical facilities such as hospitals and adversely impact local commerce, employment and economic activity.
- There is one general hospital in the county with 24/7 emergency room and inpatient services, located in Corvallis.
- All of Benton County’s power is generated outside the region; there is no redundancy in power transmission and only limited redundancy in the power distribution network.
- There is one (1) “high threat potential” dam (North Fork Dam) and one (1) “significant threat potential” dam (Thompson Dam); the county has 15 dams categorized as “low threat potential.

## National Flood Insurance Program (NFIP) Vulnerability

FEMA modernized the Benton County Flood Insurance Rate Maps (FIRMs) in June 2011; Corvallis was modernized in May 2012. The table below shows that as of April 2016, Benton County (including NFIP participating incorporated cities) has 763 National Flood Insurance Program (NFIP) policies in force. Of those, 569 are for properties that were developed before development of the initial FIRM. The last Community Assistance Visit (CAV) for Benton County was on March 2, 2016 (the most recent CAV for Corvallis was February 18, 2015). The county and Corvallis are members of the Community Rating System (CRS) and each have a Class 6 rating; the cities of Adair Village, Monroe, and Philomath are not CRS members (Adair Village is not an NFIP community because a flood insurance study has not been completed for the city and the entire city is within Zone D). The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes.

**Table 2-9 Flood Insurance Detail**

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Benton County	-	-	763	569	570	44	30	115	35
Unincorporated	6/2/2011	8/5/1986	301	220	253	5	3	40	12
Corvallis	5/1/2012	1/3/1985	399	313	262	34	27	72	10
Monroe	6/2/2011	9/26/1975	4	2	4	0	0	0	0
Philomath	6/2/2011	6/15/1982	59	34	51	5	0	3	13

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Benton County	\$ 169,841,900	44	31	2	\$ 582,669	3	0	-	-
Unincorporated	\$ 60,066,100	23	13	2	\$ 230,961	1	0	6	3/2/2016
Corvallis	\$ 96,968,800	19	16	0	\$ 326,310	2	0	6	2/18/2015
Monroe	\$ 758,800	0	0	0	\$ -	0	0	NP	1/1/1987
Philomath	\$ 12,048,200	2	2	0	\$ 25,398	0	0	NP	1/26/1998

Source: Information compiled by Department of Land Conservation and Development, April 2016.

Note 1: NP – Not Participating; Adair Village is not participating in the NFIP and is entirely within Zone D.

Note 2: The data in this table differs from the data in Figure 2-12 due to the date of the underlying data.

There have been 44 paid claims in the county totaling just over \$580,000; 31 Pre-FIRM claims paid and two (2) substantial damage claims paid to date. In addition, there is one (1) Repetitive Loss (RL) Property<sup>22</sup> located in Benton County, two (2) RL properties located in Corvallis, and there are no Severe Repetitive Loss Properties (see Figure 2-12 below)<sup>23</sup>.

## Mitigation Successes

A dwelling on Alpine Road northwest of Monroe in unincorporated Benton County was mitigated in 2011. The dwelling site now has a lowest adjacent grade (LAG) that is higher than the base flood elevation (BFE).

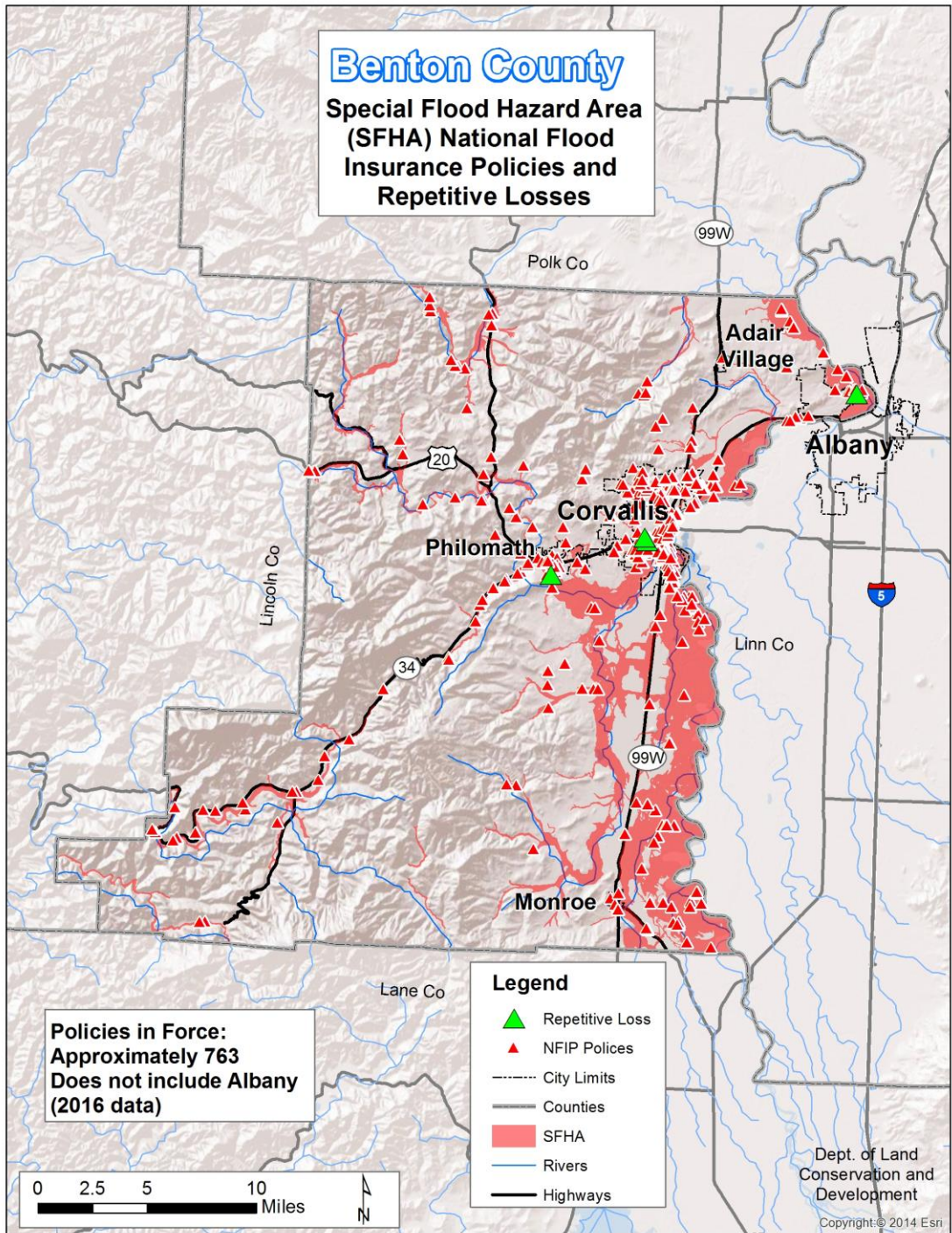
A dwelling on Soap Creek Road west of Adair Village in unincorporated Benton County was flooded twice in 2012 (January and November). The dwelling then qualified for a HMGP grant to relocate it to a new site (still on the property) that is entirely outside of the 100-year and 500-year floodplains. The work was completed in 2014.

<sup>22</sup> A Repetitive Loss (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.

<sup>23</sup> A Severe Repetitive Loss (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.



**Figure 2-12 NFIP Policies, Repetitive Loss, & Severe Repetitive Loss Properties**



Source: Department of Land Conservation and Development, April 2016.

## 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.

Adair Village, Corvallis, Monroe, and Philomath participated in County Steering Committee meetings and/or worked with OPDR to complete a jurisdiction specific hazard analysis; for more information on the process see Appendix B. City specific information is presented in Volume II, *City Addenda*.

## Probability Summary

The table below presents the probability scores for each of the natural hazards present in Benton County for which descriptions are provided herein, and in Volume III with detail for the participating cities. As shown in the table with **bold text**, several hazards are rated with high probabilities.

**Table 2-10 Natural Hazard Probability Assessment Summary**

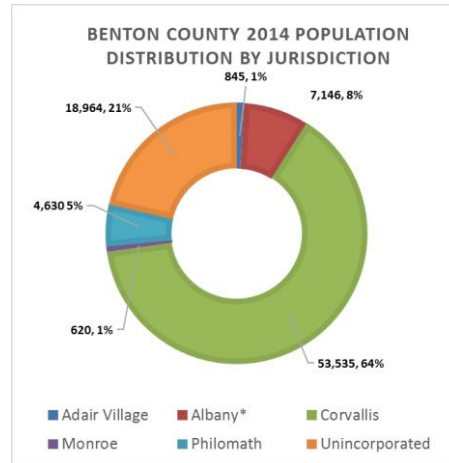
Hazard	Benton County	Adair Village	Corvallis	Monroe	Philomath
Drought	Moderate	Moderate	Moderate	Moderate	Moderate
Earthquake (Cascadia)	Moderate	Moderate	Moderate	Moderate	Moderate
Earthquake (Crustal)	Moderate	Moderate	Moderate	Moderate	Moderate
Flood	<b>High</b>	Low	<b>High</b>	<b>High</b>	<b>High</b>
Landslide	<b>High</b>	Low	<b>High</b>	Low	Moderate
Volcano	Moderate	Moderate	Moderate	Moderate	Moderate
Wildfire	<b>High</b>	Moderate	<b>High</b>	Moderate	Moderate
Windstorm	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>
Winter Storm	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>

Source: Benton County and City NHMP Steering Committees 2015.

## Vulnerability Summary

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.

Vulnerability includes the percentage of population and property likely to be affected under an “average” occurrence of the hazard. Benton County evaluated the best available vulnerability data to develop the vulnerability scores presented below. For the purposes of this NHMP, the county and cities utilized the Oregon Military Department – Office of Emergency Management (OEM) Hazard Analysis methodology vulnerability definitions to determine hazard probability.



The table below presents the vulnerability scores for each of the natural hazards present in Benton County and for participating cities. As shown in the table with **bold text**, the Cascadia Subduction Earthquake event is the only hazard that is rated with a high vulnerability.

**Table 2-11 Community Vulnerability Assessment Summary**

Hazard	Benton County	Adair Village	Corvallis	Monroe	Philomath
Drought	Low	Low	Low	Low	Low
Earthquake (Cascadia)	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>
Earthquake (Crustal)	Moderate	Moderate	Moderate	Moderate	Moderate
Flood	Moderate	Low	Moderate	Moderate	Moderate
Landslide	Low	Low	Low	Low	Low
Volcano	Low	Low	Low	Low	Low
Wildfire	Moderate	Low	Moderate	Low	Low
Windstorm	Moderate	Moderate	Moderate	Moderate	Moderate
Winter Storm	Moderate	Moderate	Moderate	Moderate	Moderate

Source: Benton County and City NHMP Steering Committees 2015.

For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

## Hazard Analysis Matrix

The hazard analysis matrix involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through the vulnerability assessment (assessed in the previous sections), and (2) the likelihood or probability of the harm occurring. The table below presents the entire updated hazard analysis matrix for Benton County. The hazards are listed in rank order from high to low. The table shows that hazard scores are influenced by each of the four categories combined. With considerations for past historical events, the probability or likelihood of a particular hazard event occurring, the vulnerability to the community, and the maximum threat or worst-case scenario, earthquake (Cascadia), earthquake (crustal), and flood events rank as the top hazard threats

to the county (top tier). Wildfire, winter storm, and windstorm events rank in the middle (middle tier). Landslide, Drought, and Volcano (volcanic ash) comprise the lowest ranked hazards in the county (bottom tier).

**Table 2-12 Hazard Analysis Matrix – Benton County**

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Earthquake (Cascadia)	12	49	50	100	211	# 1	<i>Top Tier</i>
Earthquake (Crustal)	6	49	35	100	190	# 2	
Flood	20	70	25	60	175	# 3	
Wildfire	20	70	30	50	170	# 4	<i>Middle Tier</i>
Winter Storm	20	70	20	60	170	# 4	
Windstorm	20	70	25	50	165	# 6	
Landslide	20	56	15	60	151	# 7	<i>Bottom Tier</i>
Drought	10	35	5	50	100	# 8	
Volcano	2	35	5	50	92	# 9	

Source: Benton County Steering Committee (2015); Analysis and Ranking by OPDR

For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with a sense of hazard priorities, but does not predict the occurrence of a particular hazard.

## 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.

The four participating cities in Benton County: Adair Village, Corvallis, Monroe, and Philomath held local Steering Committee meetings and completed a jurisdiction specific hazard analysis. The multi-jurisdictional risk assessment information is located herein and within the Risk Assessment section of each city’s addendum, which is located in Volume II of this NHMP.

## Hazard Analysis Methodology

The hazard analysis methodology in Oregon (primarily to inform Emergency Operations Planning) was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department’s Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%. We include the hazard analysis summary here to ensure consistency between the EOP and NHMP.

The Oregon method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't 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 first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as demonstrated below.

#### History (Weight Factor = 2)

History is the record of previous occurrences. Events to include in assessing history of a hazard in your jurisdiction are events for which the following types of activities were required:

- The Emergency Operations Center (EOC) or alternate EOC was activated;
- Three or more Emergency Operations Planning (EOP) functions were implemented, e.g., alert & warning, evacuation, shelter, etc.;
- An extraordinary multi-jurisdictional response was required; and/or
- A "Local Emergency" was declared.

**LOW** = 0 to 1 event in the past 100 years, scores between 1 and 3 points

**MODERATE** = 2 to 3 event in the past 100 years, scores between 4 and 7 points

**HIGH** = 4+ events in the past 100 years, scores between 8 and 10 points

#### Probability (Weight Factor = 7)

Probability is the likelihood of future occurrence within a specified period of time.

**LOW** = one incident likely within 75 to 100 years, scores between 1 and 3 points

**MODERATE** = one incident likely within 35 to 75 years, scores between 4 and 7 points

**HIGH** = one incident likely within 10 to 35 years, scores between 8 and 10 points

#### Vulnerability (Weight Factor = 5)

Vulnerability is the percentage of population and property likely to be affected under an "average" occurrence of the hazard.

**LOW** = < 1% affected, scores between 1 and 3 points

**MODERATE** = 1 - 10% affected, scores between 4 and 7 points

**HIGH** = > 10% affected, scores between 8 and 10 points

#### Maximum Threat (Weight Factor = 10)

Maximum threat is the highest percentage of population and property that could be impacted under a worst-case scenario.

**LOW** = < 5% affected, scores between 1 and 3 points

**MODERATE** = 5 - 25% affected, scores between 4 and 7 points

**HIGH** = > 25% affected, scores between 8 and 10 points

## SECTION 3: MITIGATION STRATEGY

Section 3 outlines Benton 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 CFR 201.6(c). The NHMP Steering Committee reviewed and updated the mission, goals and action items documented in this plan. Additional planning process documentation is in Appendix B.

### Mitigation Plan Mission

The plan mission states the purpose and defines the primary functions of Benton County's NHMP. 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 Benton County NHMP is:

***To make the community less vulnerable to the negative effects of natural hazards by coordinating efforts among government, public, and private sectors.***

The 2015/16 NHMP Steering Committee reviewed the previous plans mission statement and agreed to modify it as shown above to more accurately describe the overall purpose and intent of this Plan (see Appendix B for more information). The Steering Committee believes the concise nature of the mission statement allows for a comprehensive approach to mitigation planning.

### Mitigation Plan Goals

Mitigation plan goals are more specific statements of direction that Benton County citizens, and public and private partners can take while working to reduce the county's risk from natural hazards. These statements of direction form a bridge between the broad mission statement and particular action items. The goals listed here serve as checkpoints as agencies and organizations begin implementing mitigation action items.

Stakeholder participation was a key aspect in developing the plan goals. Meetings with the project Steering Committee, stakeholder interviews and public workshops all served as methods to obtain input and priorities in developing goals for reducing risk and preventing loss for natural hazards in Benton County.

The 2015/16 Benton County NHMP Steering Committee reviewed the 2011 plan goals in comparison to the State Natural Hazard Mitigation Plan (2015) goals and determined they would modify their goals to better align with the State Natural Hazard Mitigation Plan goals, as well as current conditions in the county.

All the plan goals are important and are listed below in no particular order of priority. Establishing community priorities within action items neither negates nor eliminates any

goals, but it establishes which action items to consider to implement first, should funding become available.

Below is a list of the plan goals:

**Goal 1:** *Coordinate mitigation activities between government agencies*

**Goal 2:** *Educate residents and businesses on the potential impacts of natural hazards as well as mitigation opportunities, in the community*

**Goal 3:** *Identify and protect critical public facilities*

**Goal 4:** *Increase connections between jurisdictions in an effort to collaborate on mitigation opportunities.*

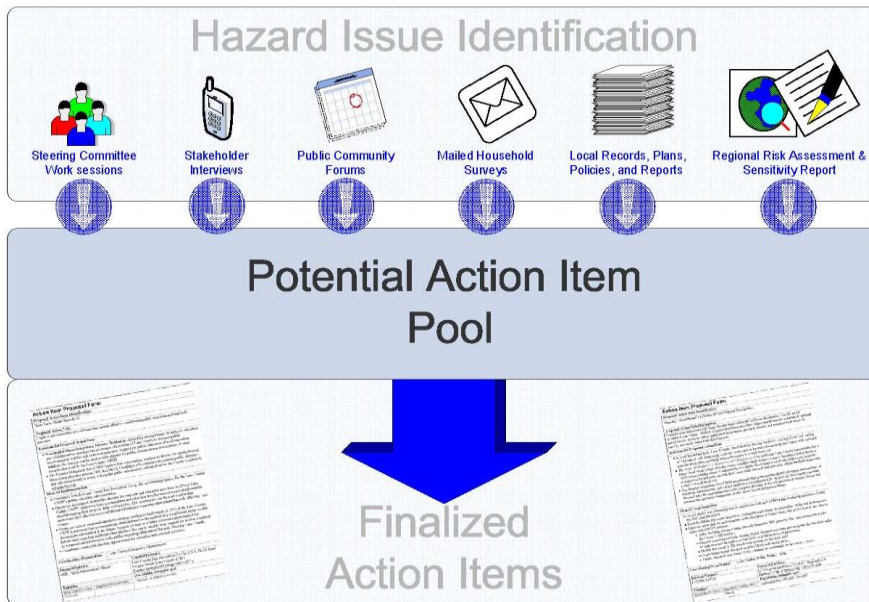
**Goal 5:** *Increase resilience in areas of the county which currently have no emergency assistance*

During the meetings on May 27, 2015 and June 17, 2015 the Benton County NHMP steering committee reviewed and revised the Benton County mission and goal statements. The cities of Adair Village, Corvallis, Monroe, and Philomath all agreed to adopt the plan mission and goal statements as revised (see Volume III and Appendix B for more information).

## 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 a number of sources. The figure below illustrates some of these sources.

**Figure 3-1 Development of Action Items**



Copyright 2008 The Partnership for Disaster Resilience – Community Service Center, University of Oregon

The majority of the action items were first created during the previous NHMP planning processes. During these processes, steering committees developed maps of local vulnerable populations, facilities, and infrastructure in respect to each identified hazard. Review of these maps generated discussion around potential actions to mitigate impacts to the vulnerable areas. The Oregon Partnership for Disaster Resilience (OPDR) provided guidance in the development of action items by presenting and discussing actions that were used in other communities. OPDR also took note of ideas that came up in Steering Committee meetings and drafted specific actions that met the intent of the Steering Committee. All actions were then reviewed by the Steering Committee, discussed at length, and revised as necessary before becoming a part of this document.

## Priority 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. Due to resource constraints, Benton County and participating cities are listing a set of high priority actions (Table 3-2) in an effort 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. This plan identifies priority actions based on an evaluation of high impact hazards, resource availability and FEMA identified best practices.

**Note 1: See Volume II, *City Addenda*, for the Priority Actions for each participating city.**

## Action Item Matrix

The action item matrix (Table 3-3) presents a pool of mitigation actions. The majority of these actions carry forward from prior versions of this plan. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available. Appendix A-1, *Priority Action Items*, and Appendix A-2, *Action Item Pool*, provide detailed information about each of the priority action items (and some of the other actions). A blank action item form is included for use by the NHMP committee as additional action items are considered for implementation.

Note 2: See Volume II, *City Addenda*, for the Action Item Matrix for each participating city.

Note 3: Jurisdictional review and identification of additional priority action items will take place during the quarterly meeting immediately following finalization of the DOGAMI Multi-Hazard Risk Report (currently being funded through FEMA's Risk Map program).



**Table 3-2 Benton Priority Action Items**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Benton County Public Works	<u>Internal:</u> Benton County Community Development, Emergency Management, GIS; <u>External:</u> Public Utility Commission, Consumers Power, Inc., Pacific Power	Ongoing
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	Benton County Community Development	<u>Internal:</u> Benton County Emergency Management, Public Works, County Commissioners, <u>External:</u> FEMA, APA, DLCD, OEM	Ongoing
MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County	Benton County Steering Committee (or subgroup thereof)	<u>Internal:</u> Benton County Community Development, Health Department, Corvallis Community Development and Public Works <u>External:</u> State Interagency Hazard Mitigation Team, DLCD, OSU, OCCRI	Ongoing
MH #11	Assess vulnerability, determine, and then implement appropriate mitigation measures for Alsea area bridges and access routes.	Public Works	<u>Internal:</u> Benton County Emergency Management; Alsea Emergency Preparedness Council, Alsea School District, Alsea Rural Clinic, Alsea Library, Alsea Rural Fire Department <u>External:</u> ODOT, OEM	Short-Term (1-2 Years)
EQ #3	Seismically retrofit the historic Benton County Courthouse, a vital public building. Consider both structural and non-structural retrofit options.	Benton County Commissioners	<u>Internal:</u> Benton County Public Works Department; Benton County District Attorney's Office, <u>External:</u> Oregon Judicial Department	Mid-Term (3-5 Years)

Source Benton County NHMP Steering Committee, updated 2016

**Table 3-2 Benton Priority Action Items (continued)**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.	Benton County Community Development	<u>Internal</u> : Maps & GIS, and Assessment Offices <u>External</u> : DLCD, DOGAMI, FEMA	Short-Term (1-2 Years)
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.	Benton County Community Development	<u>Internal</u> : Benton County Emergency Management, Public Works, Public Information Office, Board of Commissioners <u>External</u> : DLCD, FEMA	Ongoing
FL #6	Improve remote draft site at Daisy Drive in Marys River Estates.	Philomath Fire & Rescue	<u>Internal</u> : Benton County Planning, Public Works, Emergency Management <u>External</u> : Marys River Estates residents	Mid-Term (3-5 Years)
FL #7	Identify all structures with floors below the Base Flood Elevation and prioritize mitigation based on flood risk and type of required mitigation.	Benton County GIS	<u>Internal</u> : Benton County Community Development, Emergency Management <u>External</u> : DLCD, DOGAMI, FEMA	Mid-Term (3-5 Years)
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Benton County Community Development	<u>Internal</u> : Benton County GIS Department, Emergency Management, <u>External</u> : DOGAMI, DLCD	Short-Term (1-2 Years)
WF #1	Implement actions identified in the Community Wildfire Protection Plan.	Various (see CWPP)	Support identified in CWPP	Ongoing

Source Benton County NHMP Steering Committee, updated 2016

**Table 3-2 Benton Action Item Pool**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
<b>Multi-Hazard</b>				
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.	Benton County Emergency Management	<u>Internal:</u> Benton County Community Development, Public Works; <u>External:</u> Community organizations; cities and special districts; established community preparedness groups	Ongoing
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	Benton County Community Development	<u>Internal:</u> Benton County Public Works, Emergency Management, and GIS <u>External:</u> FEMA, DOGAMI, OSSPAC	Short-Term (1-2 Years)/ Ongoing
MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Benton County Natural Hazards Mitigation Steering Committee	<u>Internal:</u> Benton County Emergency Management, Community Development, Public Works, LBVPop; <u>External:</u> FEMA, OEM, DLCD	Long-Term (5+ Years)
MH #12	Rebuild the railroad crossing on SW 53rd Street south of SW Reservoir Avenue.	Benton County Public Works	<u>Internal:</u> Community Development <u>External:</u> Willamette & Pacific Railroad, Union Pacific Railroad	Long-Term (5+ Years)
<b>Drought</b>				
DR #1	Develop a drought impact assessment for Benton County.	Benton County Community Development	<u>Internal:</u> Benton County Public Works, Emergency Management, Water Resources, and Health departments; <u>External:</u> OSU Extension; Benton County Soil and Water Conservation District; Marys River Watershed Council; Oregon Climate Change Research Institute	Long-Term (5+ Years)

Source Benton County NHMP Steering Committee, updated 2015

**Table 3-2 Benton Action Item Pool (continued)**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
<b>Earthquake</b>				
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.	Benton County Emergency Management	<u>Internal</u> : Benton County GIS, Community Development; <u>External</u> : Special Districts in Benton County	Mid-Term (3-5 Years)
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.	Benton County Community Development	<u>Internal</u> : Benton County Assessment Office, GIS, Emergency Management; <u>External</u> : cities and special districts in Benton County; IBHS, Benton County Home Builders Association	Mid-Term (3-5 Years)
<b>Flood</b>				
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches	Benton County Public Works – Road Maintenance Division	<u>Internal</u> : Benton County Emergency Management, Community Development <u>External</u> : Marys River Watershed, DLCD	Ongoing
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.	Benton County Community Development	<u>Internal</u> : Benton County Emergency Management, Public Works, <u>External</u> : DLCD, FEMA	Short Term (1-2 Years)/ Ongoing
<b>Landslide</b>				
<i>The only landslide action is located in the priority action item section.</i>				
<b>Wildfire</b>				
<i>The only wildfire action is located in the priority action item section.</i>				
<b>Volcano, Windstorm, Winter Storm</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				

Source Benton County NHMP Steering Committee, updated 2015

## 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 grant funding. The form components are described below and the priority action item forms are located in Appendix A-1, *Priority Action Items* and Appendix A-2, *Action Item Pool* (not all actions in the pool have a form).

### Action Item

Each action item includes a brief description of the proposed action.

### 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.

### Priority

High priority action items are designated in order to clarify the importance of these mitigation actions for the affected jurisdictions; jurisdictions that have designated an action as a priority are responsible to show progress towards these actions (mitigation efforts) during the next update cycle. If an action is prioritized at one of the semi-annual meetings the participating jurisdiction will also show progress towards newly prioritized actions.

### Participating Jurisdiction

The list of actions provided in the plan is comprehensive, however, not every jurisdiction is participating in each action. Each city identified as a “participating jurisdiction” will contribute to accomplishing the specified action at a local level. The matrices above (Table 3-2 to 3-6) and the action item forms in Appendix A-1 and A-2 provide more detailed information.

### Alignment with Existing Plans / 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.

### Rationale for Proposed Action Item

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 a number of 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 elsewhere in this plan.

## Ideas for Implementation

For each action item, the form is designed to solicit ideas for implementation, which serve as the starting point for taking action. Ideas for implementation could include: (1) collaboration with relevant organizations, (2) alignment with the community priority areas, and (3) applications to new grant programs.

The ideas for implementation offer a transition from theory to practice and serve as a starting point for this Plan. This component of the action item is dynamic, since some ideas may prove to not be feasible, and new ideas may be added during the plan maintenance process. Ideas for implementation include such things as: collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and physical manipulation of buildings and infrastructure. When an action is implemented, more work will probably be needed to determine the exact course of action.

The Benton County NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the county. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Benton 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. To the extent possible, the jurisdictions will work to incorporate the mitigation action items into existing programs and procedures.

Many of the recommendations contained in the Benton County NHMP are consistent with the goals and objectives of the existing plans and policies. Where possible, Benton County and the participating cities will implement the recommendations and actions contained in the NHMP through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.<sup>1</sup> Implementing the action items contained in the NHMP through such plans and policies increases their likelihood of being supported and implemented.

## 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.

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<sup>1</sup> Ibid

## Internal and External Partners

The internal and external partner organizations listed in the Action Item Worksheets are potential partners recommended by the project Steering Committee but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the county or other participating jurisdiction 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.

## Potential Funding Sources

The steering committee has identified potential funding sources for each priority action item (listed on Action Item Form within Appendix A). Example funding sources can include: the federal Pre-Disaster Mitigation and Flood Mitigation Assistance Programs; state funding sources such as the Oregon Seismic Rehabilitation Grant Program; or local funding sources such as capital improvement or general funds. An action item may also have multiple funding sources.

## Estimated Cost

Where possible, an estimate of the cost for implementing the action item is included.

## Timeline

Action items include both short and long-term activities. Each action item includes an estimate of the timeline for implementation. *Short-term action items* (ST) are activities that may be implemented with existing resources and authorities in one to two years. *Mid-Term action items* (MT) may require new or additional resources and/or authorities, and may take from three to five years to implement. *Long-term action items* (LT) will require new or additional resources and/or authorities and likely will occur after the next update cycles (five or more years to implement). *Ongoing* action items signify that work has begun and will either exist over an indefinite timeline, or an extended timeline.

## Action Item 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, deferred, 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. *Deferred* action items have yet to see any significant work begin on the particular action.

## **SECTION 4:**

# **PLAN IMPLEMENTATION AND MAINTENANCE**

The plan Implementation and Maintenance section details the formal process that will ensure that the NHMP remains an active and relevant document. The plan 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 plan maintenance and implementation process.

## **Implementing the Plan**

The success of the Benton County NHMP depends on how well the outlined action items are implemented. In an effort to ensure that the activities identified are implemented, the following steps will be taken: 1) the plan will be formally adopted, 2) a coordinating body will be assigned, 3) a convener shall be designated, 4) the identified activities will be prioritized and evaluated, and 5) the plan will be implemented through existing plans, programs, and policies.

## **Plan Adoption**

The Benton County NHMP was developed and will be implemented through a collaborative process. After the plan is locally reviewed and deemed complete, the Benton County Emergency Services Planner submits it to the State Hazard Mitigation Officer (SHMO) at the Oregon Military Department – Office of Emergency Management (OEM). OEM submits the plan to FEMA-Region X for review. This review addresses the federal criteria outlined in the FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, the county will adopt the plan via resolution. At that point the county will gain eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds. Following adoption by the county, the participating jurisdictions should convene local decision makers and adopt the Benton County Multijurisdictional NHMP.

## **Convener**

The Benton County Emergency Services Planner will take responsibility for plan implementation and will facilitate the Hazard Mitigation Coordinating Body meetings and will assign tasks such as updating and presenting the plan to the rest of the members of the Coordinating Body (see City Addenda for city conveners). Plan implementation and evaluation will be a shared responsibility among all of the assigned Hazard Coordinating Body Members. The Convener's responsibilities include:

- Coordinate Steering Committee meeting dates, times, locations, agendas, and member notification;
- Document the discussions and outcomes of committee meetings;



- Serve as a communication conduit between the Steering Committee and the public/stakeholders;
- Identify emergency management-related funding sources for natural hazard mitigation projects; and
- Utilize the Risk Assessment as a tool for prioritizing proposed natural hazard risk reduction projects.

## Coordinating Body

The Benton County Convener will form a Natural Hazard Coordinating Body for updating and implementing the NHMP. The Coordinating Body responsibilities include:

- Attend future plan maintenance and plan update meetings (or designating a representative to serve in your place);
- Serve as the local evaluation committee for funding programs such as the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds;
- Prioritize and recommend funding for natural hazard risk reduction projects;
- Evaluate and update the NHMP in accordance with the prescribed maintenance schedule;
- Develop and coordinate ad hoc and/or standing subcommittees as needed; and
- Coordinate public involvement activities.

## Members

The following jurisdictions, agencies, and/ or organizations were represented and served on the Steering Committee during the development of the Benton County NHMP (for a list of individuals see Appendix B - *Acknowledgements*):

- Benton County
- City of Adair Village
- City of Corvallis
- City of Monroe
- City of Philomath
- Oregon State University (OSU)
- Oregon Climate Change Research Institute, OSU
- Linn County
- City of Albany (Linn County)
- Alsea residents
- Wren Disaster Preparedness Network
- American Red Cross
- Adair Rural Fire District
- Blodgett-Summit Rural Fire Protection District
- Monroe Rural Fire Department
- Philomath Fire and Rescue

To make the coordination and review of the Benton County NHMP as broad and useful as possible, the Coordinating Body will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items.

Specific organizations have been identified as either internal or external partners on the individual action item forms found in Appendix A.

## Implementation through Existing Programs

The NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the county. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Benton County, and the participating cities, currently addresses statewide planning goals and legislative requirements through their comprehensive land use plans, capital improvement plans, mandated standards and building codes. To the extent possible, Benton County, and participating cities, will work to incorporate the recommended mitigation action items into existing programs and procedures.

Many of the recommendations contained in the NHMP are consistent with the goals and objectives of the participating city and county's existing plans and policies. Where possible, Benton County, and participating cities, should implement the recommended actions contained in the NHMP through existing plans and policies. Plans and policies already in existence often have support from local 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 NHMP through such plans and policies increases their likelihood of being supported and implemented.

Examples of plans, programs or agencies that may be used to implement mitigation activities include:

- City and County Budgets
- Community Wildfire Protection Plans
- Comprehensive Land Use Plans
- Economic Development Action Plans
- Zoning Ordinances and Building Codes

For additional examples of plans, programs or agencies that may be used to implement mitigation activities refer to list of plans in Appendix C, *Community Profile*.

## Plan Maintenance

Plan maintenance is a critical component of the NHMP. Proper maintenance of the plan ensures that this plan will maximize the county and participating city's efforts to reduce the risks posed by natural hazards. This section was developed by OPDR and includes a process to ensure that a regular review and update of the plan occurs. The coordinating body and local staff are responsible for implementing this process, in addition to maintaining and updating the plan through a series of meetings outlined in the maintenance schedule below.

## Meetings

The Coordinating Body will meet on a **semi-annual basis** (twice per year) to complete the following tasks. During the first meeting, prior to the wildfire/ irrigation season, the Coordinating Body will:

- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general;
- Identify issues that may not have been identified when the plan was developed; and
- Prioritize potential mitigation projects using the methodology described below.

The second meeting of the year will take place in early fall, following the wildfire/ irrigation season. During the second meeting the Coordinating Body will:

- Review existing and new risk assessment data;
- Discuss methods for continued public involvement; and
- Document successes and lessons learned during the year.

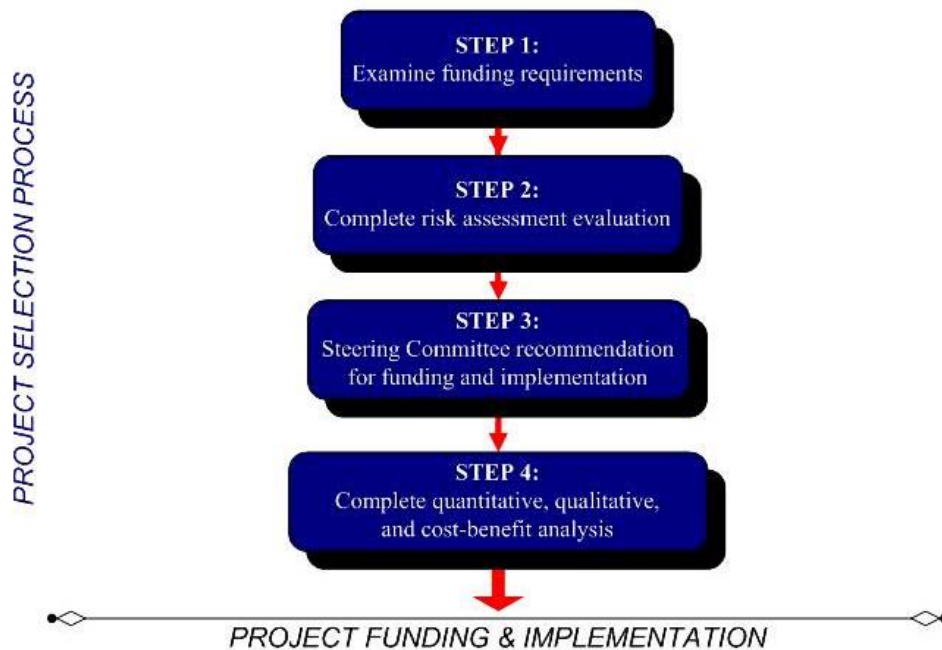
These meetings are an opportunity for the cities to report back to the county on progress that has been made towards their components of the NHMP.

The convener will be responsible for documenting the outcome of the semi-annual meetings in Appendix B. The process the Coordinating Body will use to prioritize mitigation projects is detailed in the section below. 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 NHMP that remains current and relevant to the participating jurisdictions.

## **Project Prioritization Process**

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, other planning documents, or the risk assessment may be the source 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, 2008.

## Step 1: Examine funding requirements

The first step in prioritizing the plan’s action items is to determine which funding sources are open for application. Several funding sources may be appropriate for the county’s proposed mitigation projects. 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 E, *Grant Programs and Resources* for a more comprehensive list of potential grant programs.

Because grant programs open and close on differing schedules, the Coordinating Body will examine upcoming funding streams’ requirements to determine which mitigation activities would be eligible. The Coordinating Body may consult with the funding entity, Oregon Military Department – Office of Emergency Management (OEM), or other appropriate state or regional organizations about project eligibility requirements. This examination of funding sources and requirements will happen during the Coordinating Body’s semi-annual Plan maintenance meetings.

## 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 Coordinating Body will determine whether or not the plan’s risk assessment supports the implementation of eligible mitigation activities. This determination will be

based on the location of the potential activities, their proximity to known hazard areas, and whether community assets are at risk. The Coordinating Body will additionally consider whether the selected actions mitigate hazards that are likely to occur in the future, or are likely to result in severe / catastrophic damages.

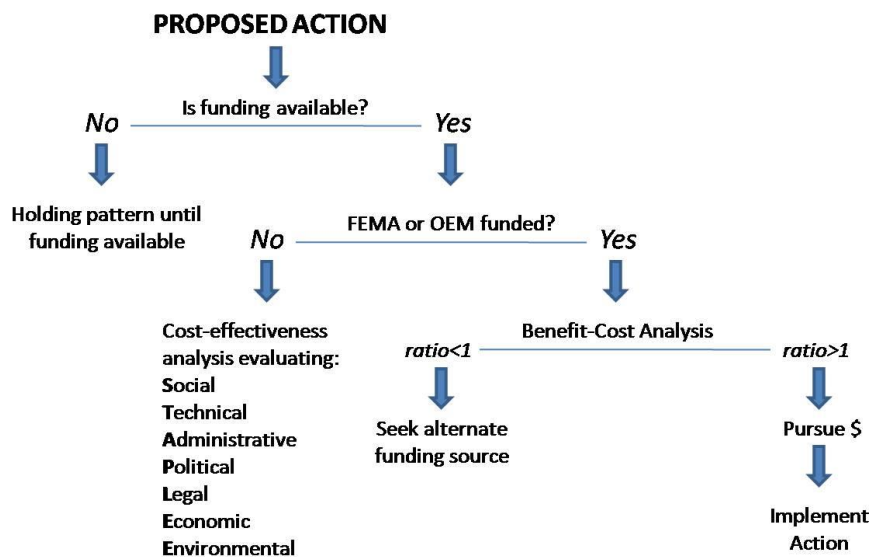
### Step 3: Coordinating Body Recommendation

Based on the steps above, the Coordinating Body will recommend which mitigation activities should be moved forward. If the Coordinating Body decides to move forward with an action, the coordinating organization designated on the action item form will be responsible for taking further action and, if applicable, documenting success upon project completion. The Coordinating Body will convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process will afford greater coordination and less competition for limited funds.

### Step 4: Complete quantitative and qualitative assessment, and economic analysis

The fourth step is to identify the costs and benefits associated with the selected natural 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, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards 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 Benefit Cost Decision Criteria**



Source: Oregon Partnership for Disaster Resilience, 2010.

If the activity requires federal funding for a structural project, the Coordinating Body will use 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 in order to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project's cost effectiveness. The Coordinating Body 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 can help define a project's qualitative cost effectiveness. OPDR at the University of Oregon's Community Service Center has tailored the STAPLE/E technique for use in natural hazard action item prioritization.

## Continued Public Involvement and Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Benton County NHMP. Although members of the Coordinating Body represent the public to some extent, the public will also have the opportunity to continue to provide feedback about the plan.

To ensure that these opportunities will continue, the County and participating jurisdictions will:

- Post copies of their plans on corresponding websites;
- Place articles in the local newspaper directing the public where to view and provide feedback; and
- Use existing newsletters such as schools and utility bills to inform the public where to view and provide feedback.

In addition to the involvement activities listed above, Benton County will ensure continued public involvement by posting the Benton County NHMP on the county's website (<http://www.Benton.org/>). The plan will also be archived and posted on the University of Oregon Libraries' Scholar's Bank Digital Archive (<https://scholarsbank.uoregon.edu>).

## Five-Year Review of Plan

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. **The Benton County NHMP is due to be updated by [MONTH] [DATE], 2021.** The Convener will be responsible for organizing the coordinating body to address plan update needs. The Coordinating Body will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements.

The following 'toolkit' can assist the Convener in determining which plan update activities can be discussed during regularly-scheduled plan maintenance meetings, and which activities require additional meeting time and/or the formation of sub-committees.

**Table 4-I 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, 2010.

**Volume II:  
City Addenda**



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# CITY OF ADAIR VILLAGE ADDENDUM

## Purpose

This document serves as the City of Adair Village's Addendum to the the Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum seeks to supplement information contained in Volume I (Basic Plan) of this multi-jurisdictional NHMP which serves as the foundation for this jurisdiction's addendum and Volume III (Appendices) which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

## Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the summer of 2015, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM) and Benton County and cities, including Adair Village, to update their NHMP, which expired February 8, 2016. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Benton County NHMP, locally adopting it, and having it approved by FEMA, Adair Village will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Benton County NHMP, and Adair Village addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements, Plan Summary, and Plan Process* (Appendix B).

The Adair Village City Administrator is the designated convener of the NHMP and will take the lead in implementing, maintaining, and updating the addendum to the Benton NHMP in collaboration with the designated convener of the Benton NHMP (County Emergency Service Planner).

Representatives from the City of Adair Village steering committee met formally on one occasion: December 8, 2015 (see Appendix B for more information).

The city's addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Adair Village Steering Committee was comprised of the following representatives:

- Convener, Pat Hare, City Administrator
- Matt Lydon, Public Works Supervisor
- Chuck Harris, Adair Rural Fire Protection District, Chief

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors including members of the Adair Village Fire and Rescue. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan's development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix B for more information) and a survey regarding community perceptions of natural hazards was administered (see Appendix F details of the survey).

**The Benton County NHMP was approved by FEMA on [Month] [Day], 2016 and the Adair Village addendum was adopted via resolution on [Month] [Day], 2016. This NHMP is effective through [Month] [Day], 2021.**

## Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3)(iv), *Mitigation Strategy*.

During the 2015/ 2016 Benton County and Corvallis update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review, the actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix B for more information). Each jurisdiction developed a list of priority actions (Appendix A-1), any actions that were not prioritized were placed in the Action Item Pool (Appendix A-2) and will be considered during the semi-annual meetings.

### Priority Actions

The city 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. The city's priority actions are listed below in the following table. Detailed implementation information for each action is listed in Appendix A-1.

### Action Item Pool

The following table also 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.

Appendix A-1, *Priority Action Items*, and Appendix A-2, *Action Item Pool*, provide detailed information about each of the priority action items (and some of the other actions). The majority of these actions carry forward from prior versions of this plan (Benton County and/or Corvallis NHMPs). A blank action item form is included for use by the NHMP committee as additional action items are considered for implementation.

**Table AVA-1 Adair Village Priority Action Items**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Public Works	<u>Internal</u> : Benton County Community Development, Emergency Management, GIS; <u>External</u> : Public Utility Commission, Consumers Power, Inc., Pacific Power	Ongoing
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.	Public Works	<u>Internal</u> : Benton County Community Development, Emergency Management; <u>External</u> : Community organizations; cities and special districts; established community preparedness groups	Ongoing
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	Benton County Community Development	<u>Internal</u> : Benton County Emergency Management, Public Works, County Commissioners, <u>External</u> : FEMA, APA, DLCD, OEM	Ongoing
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	Public Works	<u>Internal</u> : Community Development <u>External</u> :	Short-Term (1-2 Years)/ Ongoing
DR #2	Identify and develop a larger/ alternative water supply.	Public Works	<u>Internal</u> : Civil West <u>External</u> : OSU, Benton County, Adair Rural Fire and Rescue	Mid-Term (3-5 Years)
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.	Public Works	<u>Internal</u> : Benton County GIS, Community Development; <u>External</u> : Special Districts in Benton County	Mid-Term (3-5 Years)
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Benton County Community Development	<u>Internal</u> : Benton County GIS Department, Emergency Management, <u>External</u> : DOGAMI, DLCD	Short-Term (1-2 Years)
WF #1	Implement actions identified in the Community Wildfire Protection Plan.	Various (see CWPP)	Support identified in CWPP	Ongoing
WT #1	Ensure that all critical facilities have backup power and emergency operations plans to deal with power outages	Public Works	<u>Internal</u> : Public Safety <u>External</u> : Benton County Community Development, Private Owners	Long-Term (5+ Years)

Source: City of Adair Village NHMP Steering Committee, 2015.

**Table AVA-2 Adair Village Action Item Pool**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
<b>Multi-Hazard</b>				
<i>The multi-hazard actions are located in the priority action item section.</i>				
<b>Drought</b>				
<i>The only drought action is located in the priority action item section.</i>				
<b>Earthquake</b>				
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.	Public Works	Internal: Community Development External: Benton County	Mid-Term (3-5 Years)
<b>Flood</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Landslide</b>				
<i>The only landslide action is located in the priority action item section.</i>				
<b>Volcano</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Wildfire</b>				
<i>The only wildfire action is located in the priority action item section.</i>				
<b>Windstorm</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Winter Storm</b>				
<i>The only winter storm action is located in the priority action item section.</i>				

Source: City of Adair Village NHMP Steering Committee, 2015.

## Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Adair Village addendum to the Benton County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Adair Village addendum on a semi-annual schedule; the county is also meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Administrator will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for identifying new risk assessment data, reviewing status of mitigation actions, identifying new actions, and seeking funding to implement the city's mitigation strategy (actions). The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume IV, Appendix D: Economic Analysis of Natural Hazard Mitigation Projects for more information).

### Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Adair Village will implement the NHMP's recommended actions through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Adair Village's acknowledged comprehensive plan is the Adair Village Comprehensive Plan. The city last completed a major update of the plan in 2006. The city implements the plan through the Adair Village Land Use Development Code, which was amended in August 2010.

Adair Village currently has the following plans that relate to natural hazard mitigation. For a complete list visit the city [website](#):

- Comprehensive Plan
- Land Use Development Code
- Benton County Transportation System Plan (*Adair Village Appendix proposed for update*)

### Continued Public Participation

Keeping the public informed of the city's efforts to reduce the city's risk to future natural hazards events is important for successful plan implementation and maintenance. The city is

committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

## Plan Maintenance

The Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state, or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the plan was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community's demographics that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the plan accurately address the impacts of this event?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

## Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix C, *Community Profile*. The risk assessment process is graphically depicted in Figure AVA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

**Figure AVA-I Understanding Risk**



## Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department's Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't 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 first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

## Hazard Analysis

The Adair Village steering committee developed their hazard vulnerability assessment (HVA), with guidance provided by OPDR, using the county's HVA as a reference. Changes from the county's HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Adair Village, which are discussed throughout this addendum.



Table AVA-3 shows the HVA matrix for Adair Village showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake, and crustal earthquakes) and two chronic hazards (windstorm and winter storm) rank as the top four hazard threats to the city (Top Tier). The drought and wildfire hazards comprise the next two highest ranked hazards (Middle Tier), while landslide, volcano, and flood hazards comprise the lowest ranked hazards (Bottom Tier).

**Table AVA-3 Hazard Analysis Matrix – Adair Village**

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Earthquake (Cascadia)	12	49	50	100	211	#1	<i>Top Tier</i>
Earthquake (Crustal)	6	49	35	100	190	#2	
Windstorm	20	70	25	50	190	#2	
Winter Storm	20	70	20	60	190	#2	
Drought	10	35	5	50	112	#5	<i>Middle Tier</i>
Wildfire	20	70	30	50	93	#6	
Landslide	20	56	15	60	88	#7	<i>Bottom Tier</i>
Volcano	2	35	5	50	72	#8	
Flood	6	21	15	20	62	#9	

Source: Adair Village NHMP Steering Committee, 2015.

Table AVA-4 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Benton County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). The city ranked probability of landslide and wildfire lower than the county. They also ranked the vulnerability to wildfire lower than the county.

**Table AVA-4 Probability and Vulnerability Comparison**

Hazard	Adair Village		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	Moderate	Low
Earthquake (Cascadia)	Moderate	High	Moderate	High
Earthquake (Crustal)	Moderate	Moderate	Moderate	Moderate
Flood	<b>Low</b>	<b>Low</b>	High	Moderate
Landslide	<b>Low</b>	Low	High	Low
Volcano	Moderate	Low	Moderate	Low
Wildfire	<b>Moderate</b>	<b>Low</b>	High	Moderate
Windstorm	High	Moderate	High	Moderate
Winter Storm	High	Moderate	High	Moderate

Source: Adair Village NHMP Steering Committee and Benton County NHMP Steering Committee, 2015.

## Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Adair Village, 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 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.

## Community Characteristics

Adair Village is located in the mid-Willamette Valley, in northern Benton County and north of Corvallis and is the second least populous city in Benton County. The city is located on the site of former Camp Adair and covers about 0.23 square miles. The climate of Adair Village is moderate; the average monthly temperatures range from 51 – 81 degrees in July and August, and 33-46 degrees in December and January, and the city receives approximately 43 inches of rain each year. Monthly precipitation is about 6-7 inches during the wetter months of November – January, and about .04 inches during the drier months of June - August. The city's topography is generally flat with some steeper sloped areas along the western edge of the city.

## Economy

Adair Village benefits from its location to Corvallis which is a regional center for higher education (Oregon State University), industrial technology, engineering, research, commerce, and health care. Adair Village has some local businesses, however, most employment is outside of the city.

## Critical and Important Facilities

Critical and important facilities include the following:

- Adair Village Rural Fire Protection District (6021 Marcus Harris Ave NE)
- City Hall/ Community Center (6030 NE William R Carr Ave)
- Water Treatment Facility
- Wastewater System
- Military Buildings
- Historic Church
- Santiam Christian School

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

## Hazard Characteristics

### Drought

The steering committee determined that the city's probability for drought is **moderate** (which is the same as the county's rating) and that their vulnerability to drought is **low** (which is the same as the county's rating). The city did not assess the drought hazard in the previous version of their NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Benton County communities from the effects of drought; however, Benton County was included in Presidential Drought Declarations in 1992 and 2015.

Adair Village's primary water supply comes from the Willamette River and Hyak Park. The city has two water storage reservoirs. In general, water supply is available and sufficient, however, the town lacks redundancy and could add resilience by improving the existing water system. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

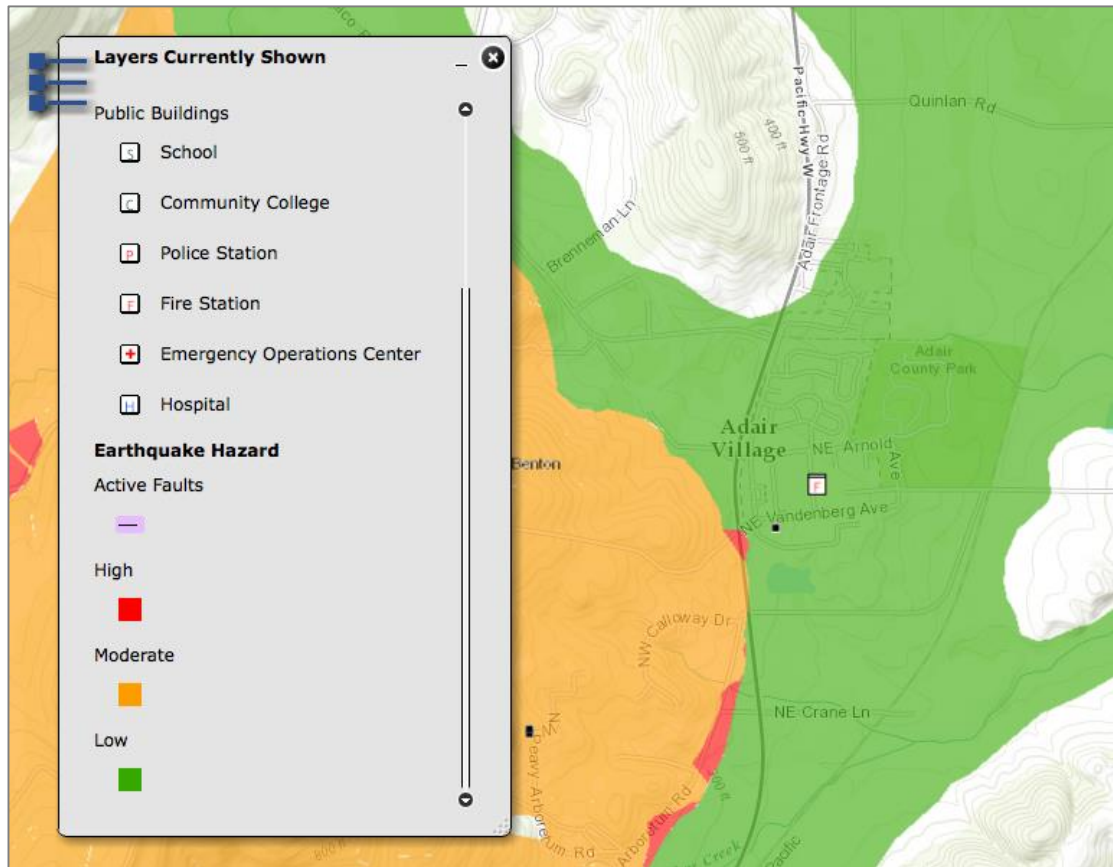
### Earthquake

The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is the same as the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county's rating). This hazard was not rated as distinct CSZ and crustal events in the previous NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Adair Village as well. The causes and characteristics of an earthquake event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Adair Village as well.

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 particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure AVA-2 displays active faults and soft soils in Adair Village.

**Figure AVA-2 Active Faults and Soft Soils**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 60% of residential buildings were built prior to 1990, which increases the city's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table AVA-5; each "X" represents one building within that ranking category. The one facility evaluated by DOGAMI using RVS does not have Very High (100% chance) or High (greater than 10%) collapse potential. The Santiam Christian private school may potentially be vulnerable to earthquake, however, an assessment was not performed by DOGAMI in 2007.

**Table AVA-5 Rapid Visual Survey Scores**

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
<b>Public Safety</b>					
Adair RFPD (6021 Marcus Harris Ave NE)	Bent_fir09		XX		

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

“\*” – Site ID is referenced on the [RVS Benton County Map](#)

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. The city’s reservoirs are potentially vulnerable to earthquake.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.<sup>1</sup>

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Flood

The steering committee determined that the city’s probability for riverine flood is **low** (which is lower than the county’s rating) and that their vulnerability to flood is **low**(which is lower than the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Benton County’s Natural Hazards Mitigation Plan. Adair Village does not have any special flood hazard areas. Other portions of Adair Village, outside of mapped floodplains, may also be subject to significant, repetitive flooding from local stormwater drainage.

### National Flood Insurance Program (NFIP)

Adair Village does not have any mapped special flood hazard areas and does not participate in the National Flood Insurance Program (NFIP).

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

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<sup>1</sup> Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase II (2001)

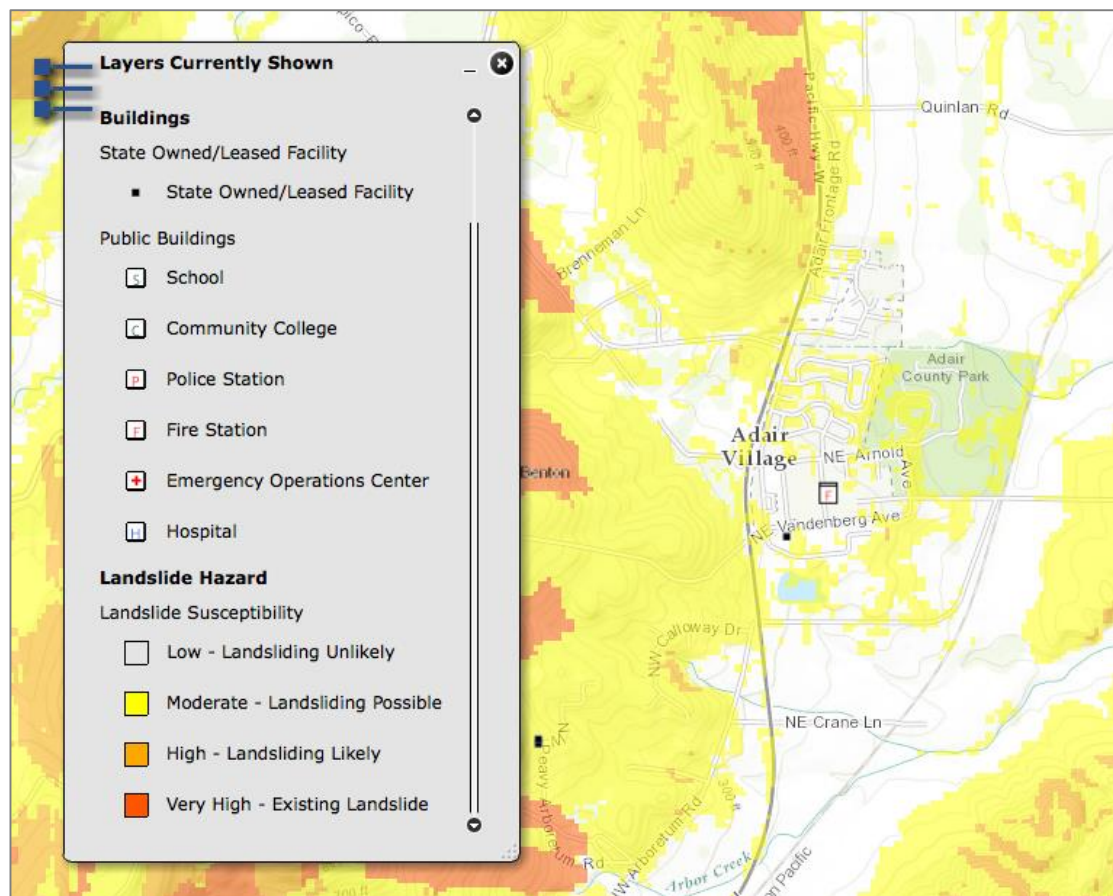
## Landslide

The steering committee determined that the city's probability for landslide is **low** (which is lower than the county's rating) and that their vulnerability to landslide is **low** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of landslides, and appropriately identifies previous landslide occurrences within the region.

Landslide susceptibility exposure for Adair Village is shown in Figure AVA-3. Approximately 0.3% of Adair Village has High, and approximately 25% has Moderate, landslide susceptibility exposure<sup>2</sup>.

**Figure AVA-3 Landslide Susceptibility Exposure**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Potential landslide-related impacts are adequately described within the county's plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides

<sup>2</sup> DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

and debris flows can potentially occur during any winter in Benton County, and thoroughfares beyond city limits are susceptible to obstruction as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Volcano

The steering committee determined that the city's probability for volcanic event is **moderate** (which is the same as the county's rating) and that their vulnerability to volcanic event is **low** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Adair Village's risk to volcanic events. Generally, an event that affects the county is likely to affect Adair Village as well. 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. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Adair Village as well. Adair Village 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 this hazard.*

## Wildfire

The steering committee determined that the city's probability for wildfire is **moderate** (which is lower than the county's rating) and that their vulnerability to wildfire is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Adair Village. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Benton County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk. The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates (an update is scheduled for 2016).

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Windstorm

The steering committee determined that the city's probability for windstorm is **high** (which is the same as the county's rating) and that their vulnerability to windstorm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Benton County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. 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 Adair Village area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

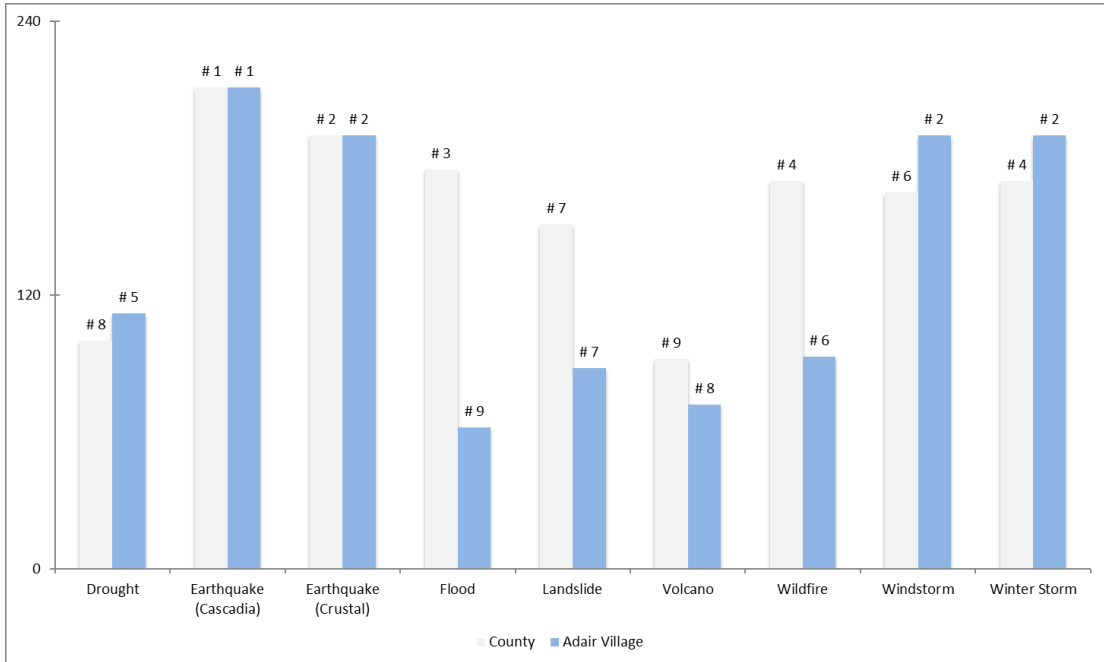
## Summary

The figure below presents a summary of the hazard analysis for the City of Adair Village and compares the results to the assessment completed by Benton County.

The city rated their threat to the drought, windstorm, and winter storm hazards higher than the county. The top four hazards for the city are the Cascadia Subduction Zone earthquake, crustal earthquakes, windstorms, and winter storms.



**Figure AVA-4 Overall Hazard Analysis Comparison – Adair Village/ Benton County**



Source: City of Adair Village NHMP Steering Committee and Benton County NHMP Steering Committee

# CITY OF CORVALLIS ADDENDUM

## Purpose

This addendum serves as an update for the City of Corvallis' stand alone Natural Hazards Mitigation Plan (NHMP). With this update of their plan the city opted to include their plan as an addendum to the Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). The City of Corvallis' previous NHMP was completed and approved by FEMA in 2008. This addendum seeks to supplement information contained in Volume I (Basic Plan) of this multi-jurisdictional NHMP which serves as the foundation for this jurisdiction's addendum and Volume III (Appendices) which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

Updates to Corvallis' city addendum are further discussed throughout the plan and within Appendix B (*Planning and Public Process*), which provides an overview of alterations to the document that took place during the update process.

## Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*. In 2007, Corvallis developed their first stand-alone Natural Hazard Mitigation Plan. The plan was approved by FEMA on January 25, 2008. To maintain compliance with the Disaster Mitigation Act of 2000 (DMA2K), the plan required an update by January 25, 2013 (the plan expired prior to this update). Prior to developing their stand alone NHMP, Corvallis actively participated in the 2006 Benton County NHMP process.

In the summer of 2015, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM) and Corvallis to update their NHMP, which expired January 25, 2013. This project is funded through the Federal Emergency Management Agency's (FEMA) FY13 Pre-Disaster Mitigation Competitive Grant Program (PDMC – PL-10-OR-2013-001). The Benton County NHMP was updated during a parallel process funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002). Members of the Corvallis NHMP update steering committee also participated in the county NHMP update process (see Appendix B for details).

By updating the plan, locally adopting it, and having it re-approved by FEMA, Corvallis will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Benton County NHMP, and Corvallis addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements, Plan Summary, and Plan Process* (Appendix B).

The Corvallis Public Works Project Manager served as the designated convener of the NHMP update and will take the lead in implementing, maintaining, and updating the addendum to the Benton NHMP in collaboration with the designated convener of the Benton NHMP (County Emergency Service Planner).

Representatives from the City of Corvallis steering committee met on several occasions to discuss updates to their addendum (see Appendix B for more information). The steering committee reviewed and revised the city's addendum, with particular focus on the plan's risk assessment and mitigation strategy (action items).

The current version of the addendum reflects changes decided upon at the plan update meetings and during subsequent work and communication with OPDR. The changes are highlighted with more detail throughout this document and within Appendix B, *Planning and Public Process* of the Benton County NHMP. Other documented changes include a revision of the city's Risk Assessment and Hazard Identification sections, Plan Goals and Action Items (Section 3, *Mitigation Strategy*), and Community Profile (Appendix C, *Community Profile*).

The Corvallis Steering Committee was comprised of the following representatives:

- Convener, Robyn Bassett, Public Works Project Manager
- Douglas Baily, Corvallis Fire Planning and Administration Division Chief
- Dan Carlson, Corvallis Community Development, Development Services Division Manager. City Building Official
- Bob Fenner, Corvallis Public Works, Buildings and Fleet Supervisor
- Jaimi Glass, Benton County Sheriff's Office, Emergency Services Planner
- Jude Geist, Corvallis Parks, Parks Supervisor
- John Kelker, Corvallis Public Works, Water Operations Supervisor
- Aaron Manley, Corvallis Public Works, Development Review Supervisor
- Stan Miller, Corvallis Public Works, Wastewater Operations Supervisor
- Bruce Moser, Corvallis Public Works, Transportation Maintenance Supervisor
- Jon Pywell, Corvallis Parks, Urban Forester
- Chad Wolfe, Corvallis Public Works, Wastewater/ Stormwater Collections Supervisor
- Jason Yaich, Corvallis Community Development, Senior Planner

Public participation was achieved with the establishment of the steering committee, which was comprised of city and county officials representing different organizations and sectors. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan's development. In addition, community

members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix B for more information). In addition, a survey regarding community perceptions of natural hazards was administered (see Appendix F details of the survey).

**The Benton County NHMP was approved by FEMA on [Month] [Day], 2016 and the Corvallis addendum was adopted via resolution on [Month] [Day], 2016. This NHMP is effective through [Month] [Day], 2021.**

## Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3)(iv), *Mitigation Strategy*. The city's action items were first developed during the 2007 NHMP development. During this process the city facilitated a work session with the steering committee to discuss the city's risk and to identify potential issues. During a subsequent meeting the steering committee developed potential actions based on the hazards and the issues identified by the steering committee in previous meetings. Several of the Corvallis action items developed out of actions in the Benton County NHMP.

During the 2015/ 2016 update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review the actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix B for more information). Each jurisdiction developed a list of priority actions (Appendix A-1), any actions that were not prioritized were placed in the Action Item Pool (Appendix A-2) and will be considered during the semi-annual meetings.

### Priority Actions

The city 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. The city's priority actions are listed below in the following table. Detailed implementation information for each action is listed in Appendix A-1.

### Action Item Pool

The following table also 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.

Appendix A-1, *Priority Action Items*, and Appendix A-2, *Action Item Pool*, provide detailed information about each of the priority action items (and some of the other actions). The majority of these actions carry forward from prior versions of this plan (Benton County and/or Corvallis NHMPs). A blank action item form is included for use by the NHMP committee as additional action items are considered for implementation.

**Table CA-I Corvallis Priority Action Items**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Public Works	<u>Internal:</u> GIS, Community Development, Emergency Management <u>External:</u> Public Utility Commission, Consumers Power, Inc., Pacific Power	Ongoing
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	Community Development	<u>Internal:</u> Benton County Emergency Management, Public Works, County Commissioners, <u>External:</u> FEMA, APA, DLCD, OEM	Ongoing
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	Public Works	<u>Internal:</u> Community Development <u>External:</u>	Short-Term (1-2 Years)/ Ongoing
MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County	Benton County Steering Committee (or subgroup thereof)	<u>Internal:</u> Benton County Community Development, Health Department, Corvallis Community Development and Public Works <u>External:</u> State Interagency Hazard Mitigation Team, DLCD, OSU, OCCRI	Ongoing
MH #13	Construct a raw water intake system to reduce risk and improve reliability in the case of a natural disaster.	Corvallis Public Works	<u>Internal:</u> - <u>External:</u> Corps of Engineers, Fish and Wildlife, DEQ	Mid-Term (3-5 Years)
MH #14	Construct finished water transmission main from the Rock Creek Water Treatment Plant to the Baldy Water Reservoir.	Corvallis Public Works	<u>Internal:</u> - <u>External:</u> City of Philomath	Mid-Term (3-5 Years)
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.	Public Works	<u>Internal:</u> Community Development; <u>External:</u> Community Partners, ODOT, Private Utilities	Mid-Term (3-5 Years)/ Long-Term (5+ Years)
EQ #4	Abandon water transmission lines on Marys River Bridge and bore new water transmission lines under Marys River.	Public Works	<u>Internal:</u> Community Development <u>External:</u>	Short-Term (1-2 Years)

Source: City of Corvallis NHMP Steering Committee, 2015.

**Table CA-I Corvallis Priority Action Items (continued)**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.	Community Development	<u>Internal:</u> Maps & GIS, and Assessment Offices <u>External:</u> DLCD, DOGAMI, FEMA	Short-Term (1-2 Years)
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.	Community Development	<u>Internal:</u> Public Works <u>External:</u> DLCD, FEMA	Ongoing
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Community Development	<u>Internal:</u> GIS Department, Benton County Emergency Management <u>External:</u> DOGAMI, DLCD	Short-Term (1-2 Years)
LS #2	Complete geotechnical analysis of the slope on NW Witham Hill Drive from NW Canary Drive to NW Walnut Boulevard and implement rehabilitation strategies to stabilize the slope.	Public Works	<u>Internal:</u> Community Development <u>External:</u> DOGAMI, DLCD	Short-Term (1-2 Years)
WF #1	Implement actions identified in the Community Wildfire Protection Plan.	Various (see CWPP)	Support identified in CWPP	Ongoing

Source: City of Corvallis NHMP Steering Committee, 2015.

**Table CA-2 Corvallis Action Item Pool**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
<b>Multi-Hazard</b>				
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.	Public Works	<u>Internal:</u> Community Development, Benton County Emergency Management; <u>External:</u> Community organizations; special districts; established community preparedness groups	Ongoing
MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Steering Committee	<u>Internal:</u> Community Development, Public Works, Benton County Emergency Management, LBVPop; <u>External:</u> FEMA, OEM, DLCD	Long-Term (5+ Years)
MH #7	Inventory and remove high-risk trees in City right of way	Public Works	<u>Internal:</u> Parks <u>External:</u>	Ongoing
MH #8	Periodically update the inventory of locations in Corvallis subject to repetitive tree fall problems.	Public Works	<u>Internal:</u> Parks <u>External:</u>	Ongoing
MH #9	Update website to include mitigation activities, opportunities, and success stories	Community Development	<u>Internal:</u> Public Works, Information Services <u>External:</u>	Ongoing
MH #10	Develop invasive pest action plan for Emerald Ash Borer (and others impacting municipal trees).	Parks	<u>Internal:</u> Public Works, Community Development <u>External:</u>	Mid-Term (3-5 Years)
<b>Drought</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Earthquake</b>				
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.	Public Works	<u>Internal:</u> Community Development <u>External:</u> Benton County	Mid-Term (3-5 Years)
<b>Flood</b>				
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches	Public Works	<u>Internal:</u> <u>External:</u> DLCD, Benton County	Ongoing

Source: City of Corvallis NHMP Steering Committee, 2015.

**Table CA-2 Corvallis Action Item Pool (continued)**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.	Community Development	<u>Internal:</u> Public Works, Benton County Emergency Management <u>External:</u> DLCDC, FEMA	Short Term (1-2 Years)/ Ongoing
<b>Landslide</b>				
LS #3	Complete a detailed inventory of locations where critical facilities and infrastructure are subject to landslides	Public Works	<u>Internal:</u> Community Development <u>External:</u>	Mid-Term (3-5 years)
<b>Volcano</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Wildfire</b>				
<i>The only wildfire action is located in the priority action item section.</i>				
<b>Windstorm</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Winter Storm</b>				
WT #1	Ensure that all critical facilities in Corvallis have backup power and emergency operations plans to deal with power outages	Public Works	<u>Internal:</u> - <u>External:</u> Benton County Emergency Management, Community Development, Private Owners	Short-Term (1-2 Years)

Source: City of Corvallis NHMP Steering Committee, 2015.



## Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Corvallis addendum to the Benton County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Corvallis addendum on a semi-annual schedule; the county is also meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The city's Public Works Project Manager will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for identifying new risk assessment data, reviewing status of mitigation actions, identifying new actions, and seeking funding to implement the city's mitigation strategy (actions). The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume IV, Appendix D: Economic Analysis of Natural Hazard Mitigation Projects for more information).

### Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Corvallis will implement the NHMP's recommended actions through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Corvallis' acknowledged comprehensive plan is the Corvallis Comprehensive Plan. The Oregon Land Conservation and Development Commission first acknowledged the plan in 1981. The city last completed a major update of the plan in 2000. Since that time, the city has updated Article 4, which concerns Statewide Planning Goal 7, *Natural Hazards*, in 2006. The city implements the plan through the Corvallis Land Development Code, which was amended in December 2014.

Corvallis currently has the following plans that relate to natural hazard mitigation. For a complete list visit the city's [website](#):

- Comprehensive Plan
- Land Development Code/ Zoning Ordinance
- Area Plans (North Corvallis, South Corvallis, West Corvallis)
- Corvallis Transportation Plan
- Stormwater Master Plan
- South Corvallis Drainage Master Plan
- Water Master Plan

- Wastewater Master Plan
- Historic Inventory Information

## Continued Public Participation

Keeping the public informed of the city’s efforts to reduce the city’s risk to future natural hazards events is important for successful plan implementation and maintenance. The city is committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

## Plan Maintenance

The Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state, or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the plan was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community’s demographics that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the plan accurately address the impacts of this event?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

## Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.

- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix C, *Community Profile*. The risk assessment process is graphically depicted in Figure CA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

**Figure CA-1 Understanding Risk**



## Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department’s Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't 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 first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

## Hazard Analysis

The Corvallis steering committee developed their hazard vulnerability assessment (HVA), using the county’s HVA as a reference. Changes from the county’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Corvallis, which are discussed throughout this addendum.

Table CA-3 shows the HVA matrix for Corvallis showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake, and crustal earthquakes) and one chronic hazard (flood) rank as the top three hazard threats to the city (Top Tier). The wildfire, winter storm, and windstorm hazards comprise the next three highest ranked hazards (Middle Tier), while landslide, wildfire, and volcano hazards comprise the lowest ranked hazards (Bottom Tier).

**Table CA-3 Hazard Analysis Matrix – Corvallis**

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Earthquake (Cascadia)	12	49	50	100	211	# 1	<i>Top Tier</i>
Earthquake (Crustal)	6	49	35	100	190	# 2	
Flood	20	70	25	60	175	# 3	
Wildfire	20	70	30	50	170	# 4	<i>Middle Tier</i>
Winter Storm	20	70	20	60	170	# 4	
Windstorm	20	70	25	50	165	# 6	
Landslide	20	56	15	60	151	# 7	<i>Bottom Tier</i>
Drought	10	35	5	50	100	# 8	
Volcano	2	35	5	50	92	# 9	

Source: Corvallis NHMP Steering Committee, 2015.

Table CA-4 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Benton County NHMP Steering Committee (the city and county share identical ratings for all rated hazards).

**Table CA-4 Probability and Vulnerability Comparison**

Hazard	Corvallis		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	Moderate	Low
Earthquake (Cascadia)	Moderate	High	Moderate	High
Earthquake (Crustal)	Moderate	Moderate	Moderate	Moderate
Flood	High	Moderate	High	Moderate
Landslide	High	Low	High	Low
Volcano	Moderate	Low	Moderate	Low
Wildfire	High	Moderate	High	Moderate
Windstorm	High	Moderate	High	Moderate
Winter Storm	High	Moderate	High	Moderate

Source: Corvallis NHMP Steering Committee and Benton County NHMP Steering Committee, 2015.

## Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Corvallis, 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 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.

### Community Characteristics

Corvallis is a compact city located along the Willamette River in western Oregon, covering about 14 square miles and is the most populous city in Benton county. The climate of Corvallis is moderate; the average monthly temperatures range from 51 – 81 degrees in July and August, and 33-46 degrees in December and January, and the city receives approximately 43 inches of rain each year. Monthly precipitation is about 6-7 inches during the wetter months of November – January, and about .04 inches during the drier months of June - August. The city’s topography is both a mix of relatively flat areas and steeper sloped areas such as those along the western edge of the city.

### Economy

Corvallis is a regional center for higher education, industrial technology, engineering, research, commerce, and health care. Corvallis is the home of Oregon State University, the states land grant university. The top ten employers in Corvallis are shown below in Table CA-5:

**Table CA-5 Major Employers**

Employers	Number of Employees
Oregon State University	10,430
Samaritan Health Services	2,632
Hewlett-Packard Company	1,550
Corvallis Clinic	620
Corvallis School District	550
City of Corvallis	427
CH2M Hill	400
Benton County	381
Fiserv	247
ATS Systems	190

Source: Corvallis-Benton Chamber Coalition

## Critical and Important Facilities

Primary important and critical facilities are shown in Table CA-6, Table CA-7, and Figure CA-4. Additional city facilities can be found via the [City Facility Map](#)

**Table CA-6 Important Facilities**

Important Facilities	
Art Center	Group Shelters
City Hall Annex	Senior Residential Care Facilities
Parks and Recreation Admin Building	Transit Mall
Parks and Recreation Maintenance Compound	Corvallis-Benton County Public Library
Osborne Aquatic Center	
County, State, Federal Facilities in Corvallis	
Benton County Courthouse	OSU Cascade Hall (Public Safety and OSP)
Benton County Public Works	Benton County Public Service Building
Benton County Sheriff's Office/ Emergency Services	Benton County Fairgrounds
Benton County Correctional Facility	OSU Reser Stadium (football)

Source: City of Corvallis

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

**Table CA-7 Critical Facilities**

Critical Facilities	
<b>City Buildings and Facilities</b>	<b>Medical and Care Facilities</b>
City Hall	Boyer's Golden Horizon, Inc.
Corvallis Municipal Airport	Conifer House Nursing Home
Corvallis Public Schools (see Table CA-8)	Corvallis Care Center
Corvallis Senior Center	Corvallis Clinic
Fire Stations 1, 2, 3, 4, 5 (closed), and 6 (see Table CA-8)	Corvallis Manor
Madison Building	Good Samaritan Hospital
Majestic Theater	OSU Health Center
Public Works Maintenance Facility	Regent Retirement Center
Corvallis Municipal Court	Samaritan Heart of the Valley
Law Enforcement Building	Stoney Brook Assisted Living
	West Hills Assisted Living Community
<b>City Water System</b>	<b>City Wastewater System</b>
Rock Creek Water Treatment Facility	Wastewater Lift Stations
Taylor Water Treatment Facility	Wastewater Treatment Facility
Water Reservoirs	
Water Pump Stations	
Marys River Bridge Crossings (Water Transmission Pipes)	
<b>Utility Systems</b>	<b>Benton County Buildings</b>
Consumers Power, Inc facilities	Law Enforcement Building
Northwest Natural Gas	Benton County Courthouse
Pacific Power & Light Co facilities	Benton County Public Works
Qwest Telecommunications	Benton County Health Department

Source: City of Corvallis

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

## Hazard Characteristics

### Drought

The steering committee determined that the city's probability for drought is **moderate** (which is the same as the county's rating) and that their vulnerability to drought is **low** (which is the same as the county's rating). The city did not assess the drought hazard in the previous version of their NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Benton County communities from the effects of drought; however, Benton County was included in Presidential Drought Declarations in 1992 and 2015.

Corvallis's primary water supply comes from two surface water rights: three creeks (north and south forks of Rock Creek and Griffith Creek) within the Rock Creek Watershed supply water for the Rock Creek Water Treatment Plant (supplies 32% of city drinking water, 848 million gallons), and the Willamette River supplies water for the Taylor Water Treatment Plant (supplies 68% of city drinking water, 1.83 billion gallons) in South Corvallis. The city has eight (8) storage reservoirs for a total of 21 million gallons of treated water storage capacity. The city completed a water system facility plan in 1998 and has since developed a new pump station at the Baldy Reservoir to improve service to west Corvallis, and the installation of generators at key booster stations throughout the city to help maintain service in the event of a power outage. In general, water supply is available and sufficient, however, wells in the skyline west neighborhood, and within Crystal Lake are not recharging quickly enough to keep up with demand during periods of drought. Additionally, a water intake in the Willamette is affected by migrating gravel, an alternate intake to the south or east may be necessary to provide water during periods of drought. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Earthquake

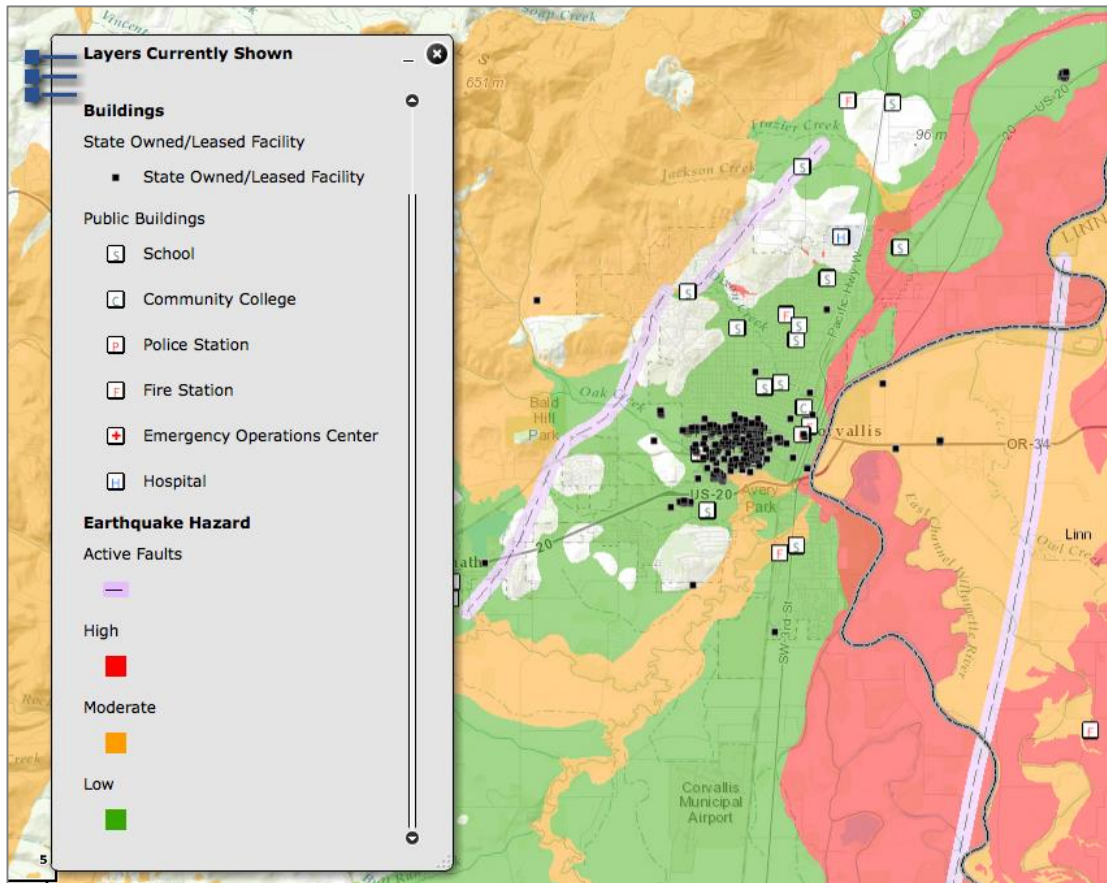
The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is the same as the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county's rating). This hazard was not rated as distinct CSZ and crustal events in the previous NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Corvallis as well. The causes and characteristics of an earthquake event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Corvallis as well.

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 particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure CA-2 displays relative liquefaction hazards. As shown in each of the maps, the area of greatest concern within the city of Corvallis (darker areas) is along the Willamette River where the concentration of soft soils is the highest.



**Figure CA-2 Active Faults and Soft Soils**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately two-thirds of residential buildings were built prior to 1990, which increases the city's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table CA-8; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using RVS, one (1) has a very high (100% chance) collapse potential, and 11 have a high (greater than 10% chance) collapse potential. In addition, two facilities, Corvallis Fire Stations #2 and #3, received [Seismic Rehabilitation Grant Programs](#) funds in 2014 to retrofit their structures, retrofits are expected to be complete on these structures in 2016.

Additionally, Corvallis has identified 199 buildings to evaluate for seismic and other hazards, 62 buildings were constructed with seismic codes and 120 that were not constructed with seismic codes. Of these buildings 55 are considered high priority buildings that were not constructed with seismic codes. This list of buildings, and their evaluations will be used to inform the steering committee to prioritize future seismic retrofit projects as per the Earthquake actions identified in Appendix A.

**Table CA-8 Rapid Visual Survey Scores**

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
<b>Schools</b>					
Adams Elementary (Corvallis SD 509J) (1615 SW 35th St)	Bent_sch01	<b>Mitigated in 2008 per voter approved Facilities Improvement</b>			
Cheldelin Middle (Corvallis SD 509J) (987 Conifer Blvd NE)	Bent_sch02	<b>Mitigated in 2008 per voter approved Facilities Improvement</b>			
Corvallis High (Corvallis SD 509J) (1400 NW Buchanan Ave)	Bent_sch12	<b>Mitigated prior to RVS in 2005</b>			
Crescent Valley High (Corvallis SD 509J) (4444 NW Highland Dr)	Bent_sch09			X	
Franklin School (Corvallis SD 509J) (750 NW 18th St)	Bent_sch11			X	
Garfield Elementary (Corvallis SD 509J) (1205 NW Garfield Ave)	Bent_sch03	<b>Mitigated in 2008 per voter approved Facilities Improvement</b>			
Hoover Elementary (Corvallis SD 509J) (3838 NW Walnut Blvd)	Bent_sch04		X		
Jefferson Elementary (Corvallis SD 509J) (1825 NW 27th St)	Bent_sch05	<b>Mitigated in 2008 per voter approved Facilities Improvement</b>			
Lincoln Elementary (Corvallis SD 509J) (110 SE Alexander Ave)	Bent_sch06	<b>Mitigated in 2008 per voter approved Facilities Improvement</b>			
Linus Pauling Middle (Corvallis SD 509J) (1111 NW Cleveland Ave)	Bent_sch08	X			
Mt View Elementary (Corvallis SD 509J) (340 NE Granger Ave)	Bent_sch07	<b>Mitigated in 2008 per voter approved Facilities Improvement</b>			
Wilson Elementary (Corvallis SD 509J) (2701 NW Satinwood)	Bent_sch14			X	
<b>Community College</b>					
Benton Center (Linn-Benton CC) (1757 NW Polk Ave)	Bent_coco01	X			
<b>Public Safety</b>					
Corvallis Police Department (180 NW 5th St)	Bent_pol04	<b>Mitigated prior to RVS in 1998</b>			
OSP-OSU Campus (200 Cascade Hall)	Bent_pol03			X	
County Sheriff-EOC-Public Safety Answering Point (180 NW 5th St)	Bent_pol01	<b>Mitigated prior to RVS in 1998</b>			
Corvallis Fire Station #1 (400 NW Harrison)	Bent_fir08	X			
Corvallis Fire Station #2 (500 SW 35th St)	Bent_fir07	<b>Mitigation expected in 2016 per 2014 SRGP award</b>			
Corvallis Fire Station #3 (1310 NW Circle Blvd)	Bent_fir04	<b>Mitigation expected in 2016 per 2014 SRGP award</b>			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

\*\* – Site ID is referenced on the [RVS Benton County Map](#)

**Table CA-8 Rapid Visual Survey Scores (continued)**

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
<b>Public Safety (continued)</b>					
Corvallis Fire Station #4 (365 SW Tunison)	Bent_fir05	X			
Corvallis Locke Fire Station (544 NW Lewisburg Ave)	Bent_fir06	X			
<b>Hospital</b>					
Good Samaritan Regional Medical Center - Corvallis (3600 NW Samaritan Dr)	Bent_hos01	X			
<b>Oregon State University</b>					
<i>Various (see OSU NHMP)</i>					

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

“\*” – Site ID is referenced on the [RVS Benton County Map](#)

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. The potential impacts of major earthquakes on Corvallis are summarized below in Table CA-9. In addition, there is a low probability that a major earthquake will result in failure of upstream dams.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water and wastewater treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.<sup>1</sup>

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<sup>1</sup> Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase II (2001)

**Table CA-9 Potential Impacts of Major Earthquakes on Corvallis**

Inventory	Probable Impacts
Portion of Corvallis affected	Entire City of Corvallis and surrounding areas
Buildings	Many buildings will have no damage or light to moderate damage, with heavy damage concentrated in vulnerable buildings (wood frame buildings with cripple walls, unreinforced masonry, etc.). Total building damage estimated to be about \$300 million.
Streets within Corvallis	Minor road damage possible in areas of soft soils. Many bridges may have significant damage, 3% to 5% may be in complete damage state.
Roads to/from Corvallis	Minor road damage possible in areas of soft soils. Many bridges may have significant damage, 3% to 5% may be in complete damage state.
Electric Power	Widespread outages for about 8 to 24 hours. Outlying areas may have outages up to 72 hours.
Water Utilities	About 10 days with no water to about 25% of customers in urban areas, about 20 days to restore water service to 99% of customers. Failure of the major water transmission lines on the Marys River bridge crossings would result in almost complete loss of water to Corvallis, with a high likelihood of long duration water outages.
Other Utilities	Loss of function to wastewater treatment plant. Natural gas system damages and outages similar to water systems. Phone systems (land and cellular) will have system overload for about 72 hours, then most customers will have normal service.
Emergency Shelter needs	Approximately 3,000 people may need emergency shelter.
Casualties	About 10 deaths for daytime earthquake or about 1 death for nighttime earthquake. Daytime injuries about 500; nighttime injuries about 130.

Source: Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase II (2001)

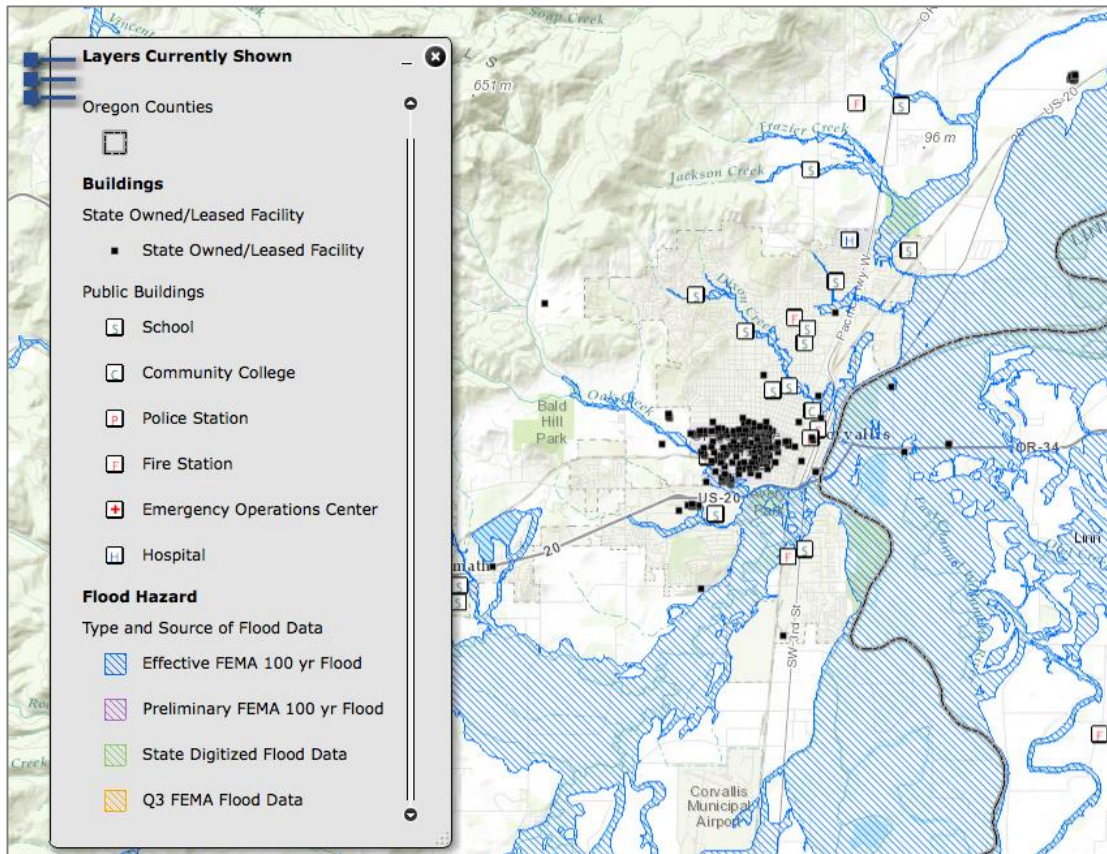
*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Flood

The steering committee determined that the city’s probability for riverine flood is **high** (which is the same as the county’s rating) and that their vulnerability to flood is **moderate** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Benton County’s Natural Hazards Mitigation Plan. Portions of Corvallis have areas of flood plains (special flood hazard areas, SFHA). These include areas along the Willamette River, as well as areas along smaller tributary creeks (see Figure CA-3). There are over 3,000 buildings located within the footprint of these FEMA-mapped floodplains. Furthermore, other portions of Corvallis, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage. Corvallis maintains a [natural hazards map](#) available on their [website](#) that includes areas mapped in the SFHA.

**Figure CA-3 Special Flood Hazard Area**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Corvallis has mapped their critical facilities in relation to the flood hazard, Figure CA-4. Buildings that are potentially vulnerable to the 100-year flood (1% annual chance) are:

- Waste Water Reclamation Plan (1304 2nd Street),
- Parks and Recreation Office (1310 SE Avery), and
- Corvallis High (1400 NW Buchanan Ave)
- Avery Complex, west (360 SW Avery)

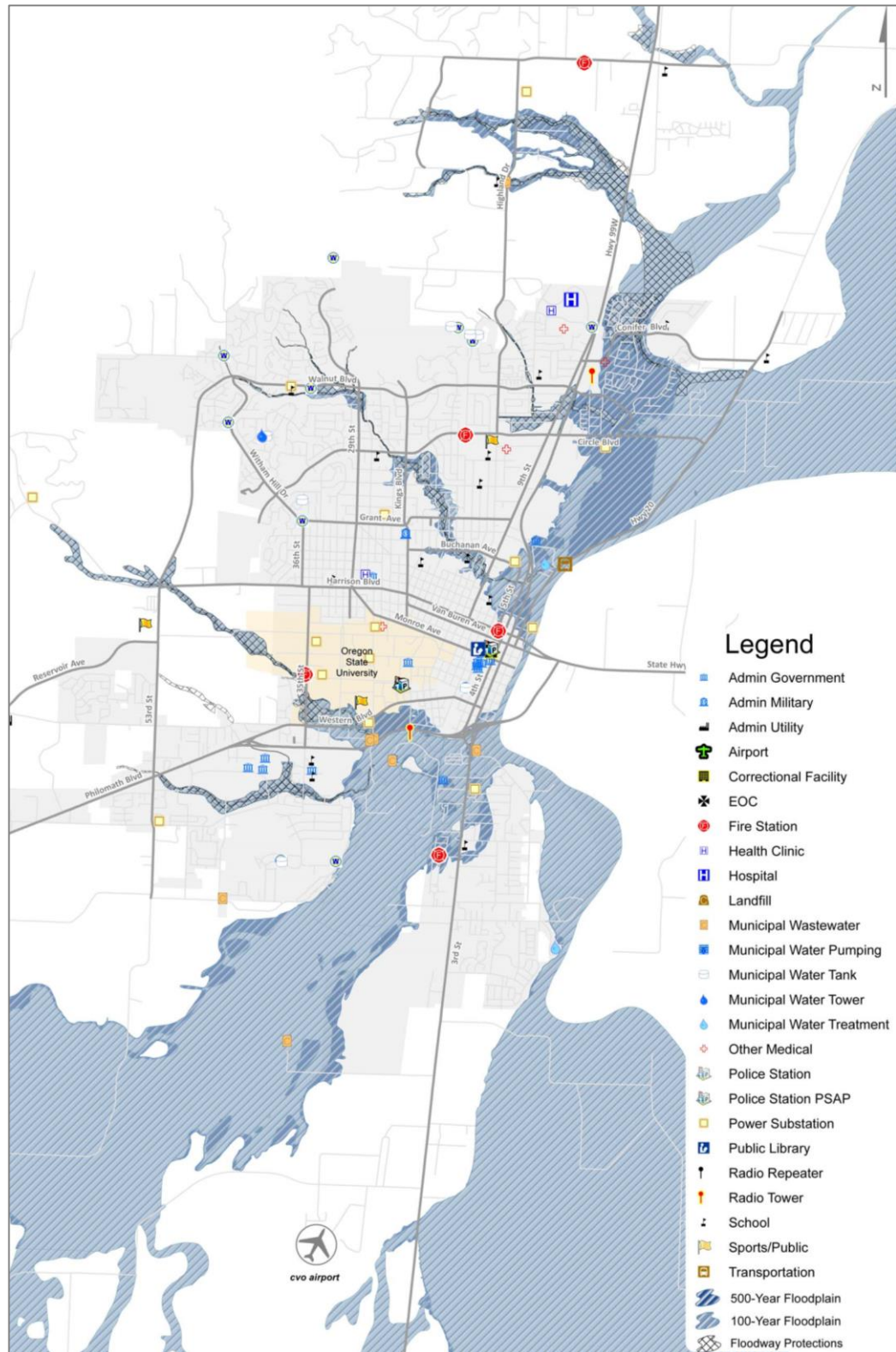
Facilities potentially vulnerable to the 500-year flood (0.2% annual chance) include:

- Avery Complex, east (360 SW Avery),
- Public Works building (1245 NE 3rd,
- Tunison Community Center (365 SW Tunison), and
- Fire Station #4 (365 SW Tunison)

Additional facilities that are potentially vulnerable include telephone companies, KLOO/ KFAT Radio Transmitter (1221 SW 15<sup>th</sup> Street), Northwest Natural Gas (Highway 20 and Garden), and fiber optics communications.

See Table 2-3 in Section 2, *Risk Assessment*, for additional potentially vulnerable structures.

**Figure CA-4 Critical Facilities and Special Flood Hazard Areas (1% and 0.2%)**



Source: City of Corvallis

## National Flood Insurance Program (NFIP)

FEMA modernized the Corvallis Flood Insurance Rate Maps (FIRMs) in May 2012. The table below shows that as of February 2016, Corvallis has 399 National Flood Insurance Program (NFIP) policies in force. Of those, 313 are for properties that were developed before development of the initial FIRM. The last Community Assistance Visit (CAV) for Corvallis was on February 18, 2015. Corvallis is a member of the Community Rating System (CRS) and has a Class 6 rating. The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes. There have been a total of 19 paid claims for \$326,310.

The Community Repetitive Loss record for Corvallis identifies two (2) Repetitive Loss Properties<sup>2</sup> and no Severe Repetitive Loss Properties<sup>3</sup>.

**Table CA-10 Flood Insurance Detail**

Jurisdiction	Current FIRM Date	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Benton County	-	-	763	569	570	44	30	115	35
Corvallis	5/1/2012	1/3/1985	399	313	262	34	27	72	10

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Benton County	\$ 169,841,900	44	31	2	\$ 582,669	3	0	-	-
Corvallis	\$ 96,968,800	19	16	0	\$ 326,310	2	0	6	2/18/2015

Source: Information compiled by Department of Land Conservation and Development, April 2016.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Landslide

The steering committee determined that the city's probability for landslide is **high** (which is the same as the county's rating) and that their vulnerability to landslide is **low** (which is the same as the county's rating).

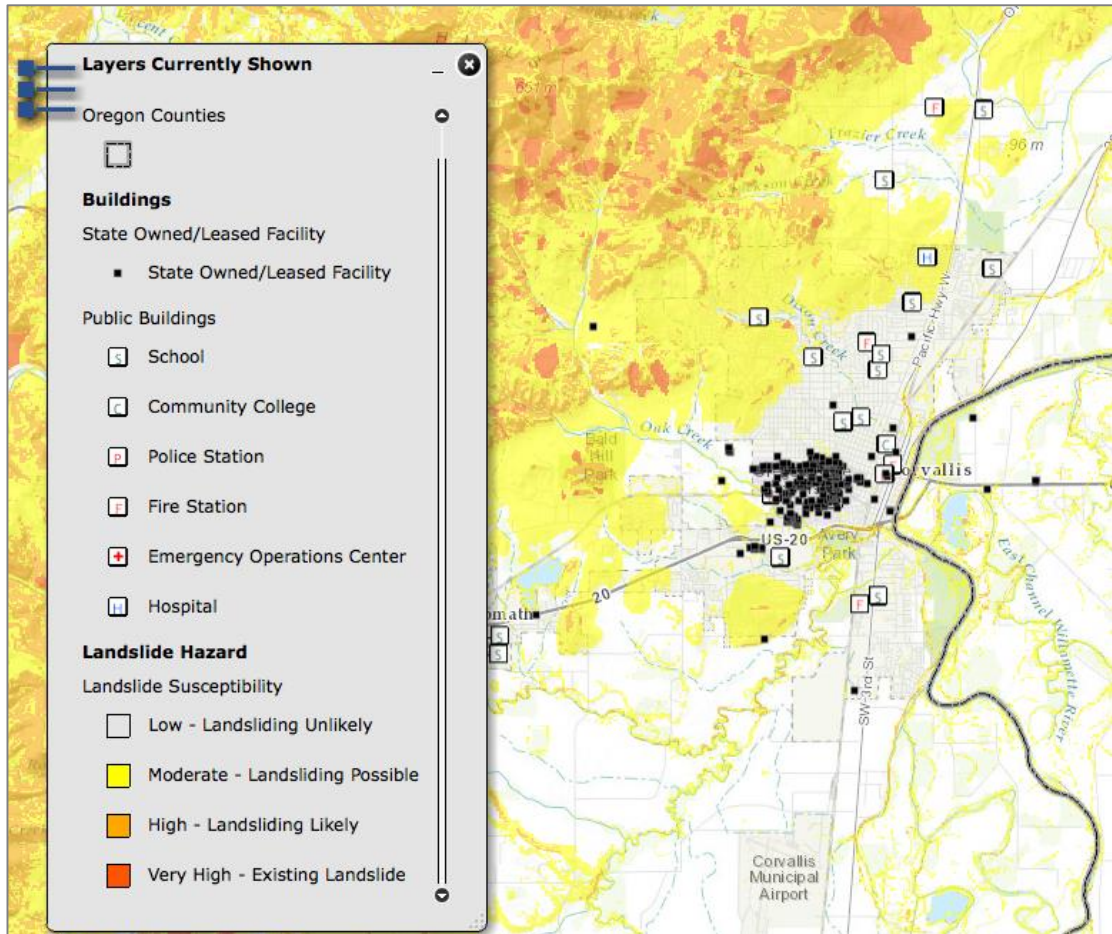
Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of landslides, and appropriately identifies previous landslide occurrences within the region. The City of Corvallis occasionally sees minor landslides in the west hills (particular areas of concern include Witham Hill). Small slides tend to occur during the rainy season.

<sup>2</sup> A Repetitive Loss (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.

<sup>3</sup> A Severe Repetitive Loss (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.

Landslide susceptibility exposure for Corvallis is shown in Figure CA-5. Approximately 2% of Corvallis has High, and approximately 34% Moderate, landslide susceptibility exposure<sup>4</sup>. Note that even if a county or city has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard and assets.

**Figure CA-5 Landslide Susceptibility Exposure**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

To address the risk for landslide Corvallis includes provisions for Landslide Hazard and Hillside Development (Chapter 4.14 of the Land Development Code). In addition, Corvallis maintains a [Natural Hazards Map](#) that identifies areas of high landslide risk, the map will be updated to include the landslide susceptibility information provided in [DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon](#).

Potential landslide-related impacts are adequately described within the county’s plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides

<sup>4</sup> DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)



and debris flows can potentially occur during any winter in Benton County, and thoroughfares beyond city limits are susceptible to obstruction as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Volcano

The steering committee determined that the city's probability for volcanic event is **moderate** (which is the same as the county's rating) and that their vulnerability to volcanic event is **low** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Corvallis's risk to volcanic events. Generally, an event that affects the county is likely to affect Corvallis as well. 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. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Corvallis as well. Corvallis 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 this hazard.*

## Wildfire

The steering committee determined that the city's probability for wildfire is **high** (which is the same as the county's rating) and that their vulnerability to wildfire is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There have been few large wildfire events in Corvallis. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Benton County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk. The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates (an update is scheduled for 2016).

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Windstorm

The steering committee determined that the city's probability for windstorm is **high** (which is the same as the county's rating) and that their vulnerability to windstorm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Benton County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. 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 Corvallis area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road closures on Highway 34 due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

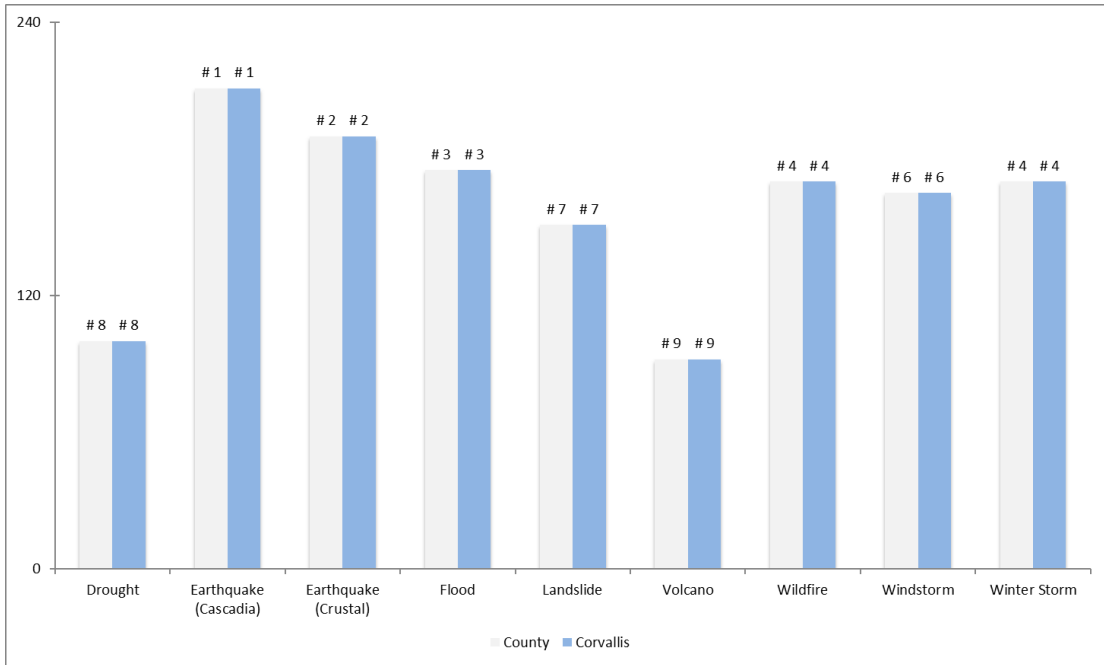
*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Summary

The figure below presents a summary of the hazard analysis for the City of Corvallis and compares the results to the assessment completed by Benton County.

The city rated their threat to all hazards the same as did the county. The top three hazards for the city and the county are the Cascadia Subduction Zone earthquake, crustal earthquakes, and flood, followed closely by wildfire, winter storm, and windstorm.

**Figure CA-6 Overall Hazard Analysis Comparison – Corvallis/ Benton County**



Source: City of Corvallis NHMP Steering Committee and Benton County NHMP Steering Committee

# CITY OF MONROE ADDENDUM

## Purpose

This document serves as the City of Monroe's Addendum to the the Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum seeks to supplement information contained in Volume I (Basic Plan) of this multi-jurisdictional NHMP which serves as the foundation for this jurisdiction's addendum and Volume III (Appendices) which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

## Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the summer of 2015, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM) and Benton County and cities, including Monroe, to update their NHMP, which expired February 8, 2016. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Benton County NHMP, locally adopting it, and having it approved by FEMA, Monroe will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Benton County NHMP, and Monroe addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements, Plan Summary, and Plan Process* (Appendix B).

The Monroe C.O.O./ Planner is the designated convener of the NHMP and will take the lead in implementing, maintaining, and updating the addendum to the Benton NHMP in collaboration with the designated convener of the Benton NHMP (County Emergency Service Planner).

Representatives from the City of Monroe steering committee met formally on one occasion: December 8, 2015 (see Appendix B for more information).

The city's addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Monroe Steering Committee was comprised of the following representatives:

- Convener, Jim Minard, C.O.O./ Planner
- Rick Smith, Monroe Rural Fire Department, Chief
- Matthew Thompson, Monroe Rural Fire Department, Lieutenant

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors including members of the Monroe Fire and Rescue. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan's development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix B for more information) and a survey regarding community perceptions of natural hazards was administered (see Appendix F details of the survey).

**The Benton County NHMP was approved by FEMA on [Month] [Day], 2016 and the Monroe addendum was adopted via resolution on [Month] [Day], 2016. This NHMP is effective through [Month] [Day], 2021.**

## Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3)(iv), *Mitigation Strategy*.

During the 2015/ 2016 Benton County and Corvallis update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review, the actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix B for more information). Each jurisdiction developed a list of priority actions (Appendix A-1), any actions that were not prioritized were placed in the Action Item Pool (Appendix A-2) and will be considered during the semi-annual meetings.

### Priority Actions

The city 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. The city's priority actions are listed below in the following table. Detailed implementation information for each action is listed in Appendix A-1.

### Action Item Pool

The following table also 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.

Appendix A-1, *Priority Action Items*, and Appendix A-2, *Action Item Pool*, provide detailed information about each of the priority action items (and some of the other actions). The majority of these actions carry forward from prior versions of this plan (Benton County and/or Corvallis NHMPs). A blank action item form is included for use by the NHMP committee as additional action items are considered for implementation.

**Table MA-I Monroe Priority Action Items**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Public Works	<u>Internal:</u> Planning; <u>External:</u> Public Utility Commission, Consumers Power, Inc., Pacific Power	Ongoing
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	Planning	<u>Internal:</u> Public Works, Finance <u>External:</u> FEMA, APA, DLCDD, OEM	Ongoing
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	Public Works	<u>Internal:</u> Planning, Finance <u>External:</u>	Short-Term (1-2 Years)/ Ongoing
DR #1	Develop a drought impact assessment for Benton County.	Planning	<u>Internal:</u> Public Works; <u>External:</u> Benton County; OSU Extension; Benton County Soil and Water Conservation District; Marys River Watershed Council; Oregon Climate Change Research Institute	Long-Term (5+ Years)
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.	Public Works	<u>Internal:</u> Planning; Benton County GIS, Benton County Emergency Management; <u>External:</u> Special Districts in Benton County	Mid-Term (3-5 Years)
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.	Public Works	<u>Internal:</u> Planning <u>External:</u> Benton County	Mid-Term (3-5 Years)
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.	Planning	<u>Internal:</u> Maps & GIS, and Assessment Offices <u>External:</u> DLCDD, DOGAMI, FEMA	Short-Term (1-2 Years)
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.	Planning	<u>Internal:</u> Public Works <u>External:</u> DLCDD, FEMA	Ongoing
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches	Public Works	<u>Internal:</u> <u>External:</u> DLCDD, Benton County	Ongoing
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Planning	<u>Internal:</u> Benton County GIS Department, Emergency Management, <u>External:</u> DOGAMI, DLCDD	Short-Term (1-2 Years)
WF #1	Implement actions identified in the Community Wildfire Protection Plan.	Various (see CWPP)	Support identified in CWPP	Ongoing

Source: City of Monroe NHMP Steering Committee, 2015.

**Table MA-2 Monroe Action Item Pool**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
<b>Multi-Hazard</b>				
<i>The multi-hazard actions are located in the priority action item section.</i>				
<b>Drought</b>				
<i>The only drought action is located in the priority action item section.</i>				
<b>Earthquake</b>				
<i>The earthquake actions are located in the priority action item section.</i>				
<b>Flood</b>				
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.	Benton County Community Development	<u>Internal</u> : Benton County Emergency Management, Public Works, <u>External</u> : DLCD, FEMA	Short Term (1-2 Years)/ Ongoing
<b>Landslide</b>				
<i>The only landslide action is located in the priority action item section.</i>				
<b>Volcano</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Wildfire</b>				
<i>The only wildfire action is located in the priority action item section.</i>				
<b>Windstorm</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				
<b>Winter Storm</b>				
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>				

Source: City of Monroe NHMP Steering Committee, 2015.

## Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Monroe addendum to the Benton County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Monroe addendum on a semi-annual schedule; the county is also meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The city's C.O.O./ Planner will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for identifying new risk assessment data, reviewing status of mitigation actions, identifying new actions, and seeking funding to implement the city's mitigation strategy (actions). The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume IV, Appendix D: Economic Analysis of Natural Hazard Mitigation Projects for more information).

### Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Monroe will implement the NHMP's recommended actions through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Monroe's acknowledged comprehensive plan is the Monroe Comprehensive Plan. The City last completed a major update of the plan in 1986 (digitized in 2005). The City implements the plan through the Monroe Land Development Code, which was amended in February 2010.

Monroe currently has the following plans that relate to natural hazard mitigation. For a complete list visit the city website for [planning](#):

- Comprehensive Plan
- Land Use Development Code
- Benton County Transportation System Plan (*Monroe Appendix proposed for update*)

### Continued Public Participation

Keeping the public informed of the city's efforts to reduce the city's risk to future natural hazards events is important for successful plan implementation and maintenance. The city is



committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

## Plan Maintenance

The Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state, or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the plan was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community's demographics that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the plan accurately address the impacts of this event?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

## Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix C, *Community Profile*. The risk assessment process is graphically depicted in Figure MA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

**Figure MA-1 Understanding Risk**



## Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department's Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't 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 first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

## Hazard Analysis

The Monroe steering committee developed their hazard vulnerability assessment (HVA), with guidance provided by OPDR, using the county's HVA as a reference. Changes from the county's HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Monroe, which are discussed throughout this addendum.

Table MA-3 shows the HVA matrix for Monroe showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in

planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake, and crustal earthquakes) and two chronic hazards (windstorm and winter storm) rank as the top four hazard threats to the city (Top Tier). The flood and drought hazards comprise the next two highest ranked hazards (Middle Tier), while wildfire, landslide, and volcano hazards comprise the lowest ranked hazards (Bottom Tier).

**Table MA-3 Hazard Analysis Matrix – Monroe**

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Earthquake (Cascadia)	12	49	50	100	211	#1	<i>Top Tier</i>
Earthquake (Crustal)	6	49	35	100	190	#2	
Windstorm	20	70	25	50	190	#2	
Winter Storm	20	70	20	60	190	#2	
Flood	20	70	25	60	180	#5	<i>Middle Tier</i>
Drought	10	35	5	50	112	#6	
Wildfire	20	70	30	50	93	#7	<i>Bottom Tier</i>
Landslide	20	56	15	60	88	#8	
Volcano	2	35	5	50	72	#9	

Source: Monroe NHMP Steering Committee, 2015.

Table MA-4 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Benton County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). The city ranked probability of landslide and wildfire lower than the county. They also ranked the vulnerability to wildfire lower than the county.

**Table MA-4 Probability and Vulnerability Comparison**

Hazard	Monroe		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	Moderate	Low
Earthquake (Cascadia)	Moderate	High	Moderate	High
Earthquake (Crustal)	Moderate	Moderate	Moderate	Moderate
Flood	High	Moderate	High	Moderate
Landslide	<b>Low</b>	Low	High	Low
Volcano	Moderate	Low	Moderate	Low
Wildfire	<b>Moderate</b>	<b>Low</b>	High	Moderate
Windstorm	High	Moderate	High	Moderate
Winter Storm	High	Moderate	High	Moderate

Source: Monroe NHMP Steering Committee and Benton County NHMP Steering Committee, 2015.

## Community Asset Identification

This section provides information on city specific assets.. For additional information on the characteristics of Monroe, 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 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.

## Community Characteristics

Monroe is located in the mid-Willamette Valley, in southern Benton County and south of Corvallis and is the least populous city in Benton County. The City is located adjacent to the Long Tom River covering about 0.5 square miles. The climate of Monroe is moderate; the average monthly temperatures range from 51 – 81 degrees in July and August, and 33-46 degrees in December and January, and the city receives approximately 43 inches of rain each year. Monthly precipitation is about 6-7 inches during the wetter months of November – January, and about .04 inches during the drier months of June - August. The city's topography is generally flat with some steeper sloped areas along the western edge of the city.

## Economy

Monroe benefits from its location to Corvallis and Eugene which are regional centers for higher education (Oregon State University and University of Oregon), industrial technology, engineering, research, commerce, and health care. Monroe has some local businesses, however, most employment is outside of the city. Anchor institutions include the Monroe Fire Department, the Monroe School District, and Hull-Oakes Lumber Company.

## Critical and Important Facilities

- Critical and important facilities include the following:
- Monroe Rural Fire Protection District (680 Commercial Street)
- City Hall (668 Commercial Street)
- Municipal Court (664 Commercial Street)
- Monroe Branch, Corvallis-Benton County Public Library (380 N 5<sup>th</sup> Street)
- Benton County Sheriff (180 S 5<sup>th</sup> Street)
- Monroe Grade (600 Dragon Drive)
- Monroe High (365 N 5<sup>th</sup> Street)
- Water Treatment Facility and reservoir tank (west end of Commercial Street)
- Wastewater System (east of Long Tom River, north of Highway 99W)
- South Benton Community Museum (140 S 5<sup>th</sup> Street)

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

## Hazard Characteristics

### Drought

The steering committee determined that the city's probability for drought is **moderate** (which is the same as the county's rating) and that their vulnerability to drought is **low**

(which is the same as the county's rating). The City did not assess the drought hazard in the previous version of their NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Benton County communities from the effects of drought; however, Benton County was included in Presidential Drought Declarations in 1992 and 2015.

Monroe's primary water supply comes from an infiltration gallery from the Long Tom River, Kyle, and Belknap Springs. The city has one water storage reservoir tank (capacity of 1 million gallons). In general, water supply is available and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

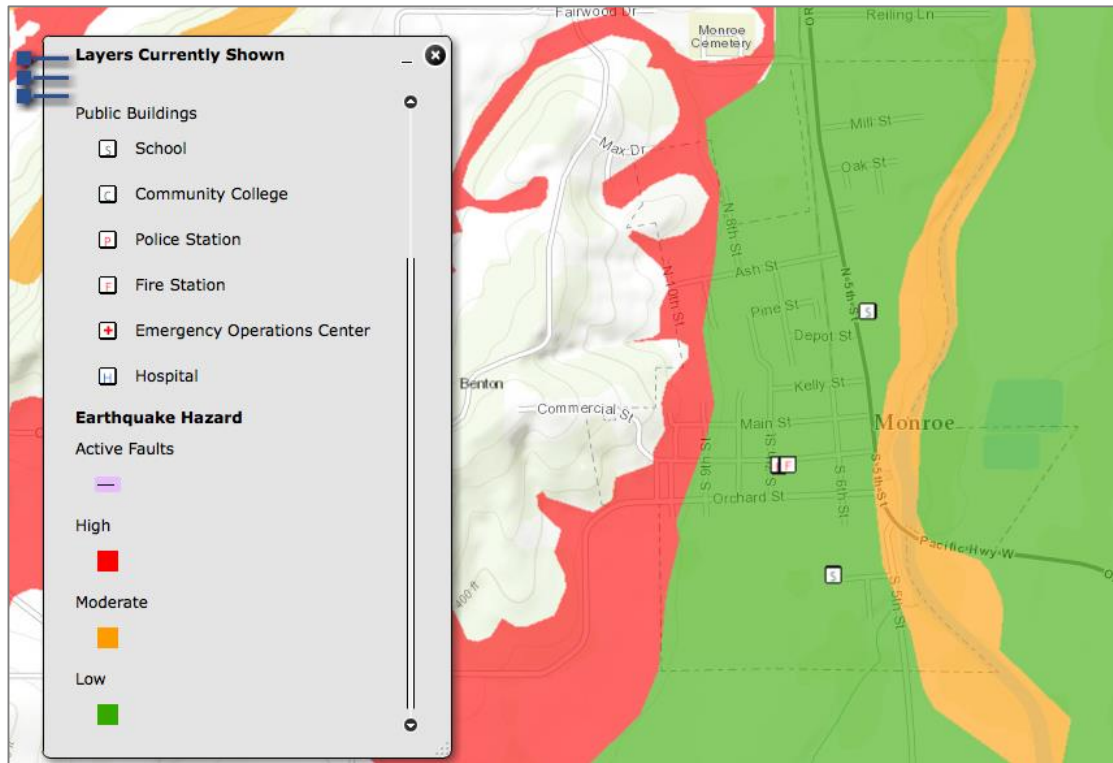
## Earthquake

The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is the same as the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county's rating). This hazard was not rated as distinct CSZ and crustal events in the previous NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Monroe as well. The causes and characteristics of an earthquake event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Monroe as well.

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 particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure MA-2 displays relative liquefaction hazards. As shown, the area of greatest concern within the city of Monroe (darker areas) is along the hilly western portion.

**Figure MA-2 Active Faults and Soft Soils**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 70% of residential buildings were built prior to 1990, which increases the city's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table MA-5; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using RVS, two (2) have a very high (100% chance) collapse potential.

**Table MA-5 Rapid Visual Survey Scores**

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
<b>Schools</b>					
Monroe Grade (Monroe SD 1J) (600 Dragon Dr)	Bent_sch10			X	
Monroe High (Monroe SD 1J) (365 N 5th St)	Bent_sch19				X
<b>Public Safety</b>					
Monroe RFPD (680 Commercial St)	Bent_fir12	X			X

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

“\*” – Site ID is referenced on the [RVS Benton County Map](#)

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. The Highway-99 bridge is particularly susceptible due to liquefaction potential of the clay beneath the bridge.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.<sup>1</sup>

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

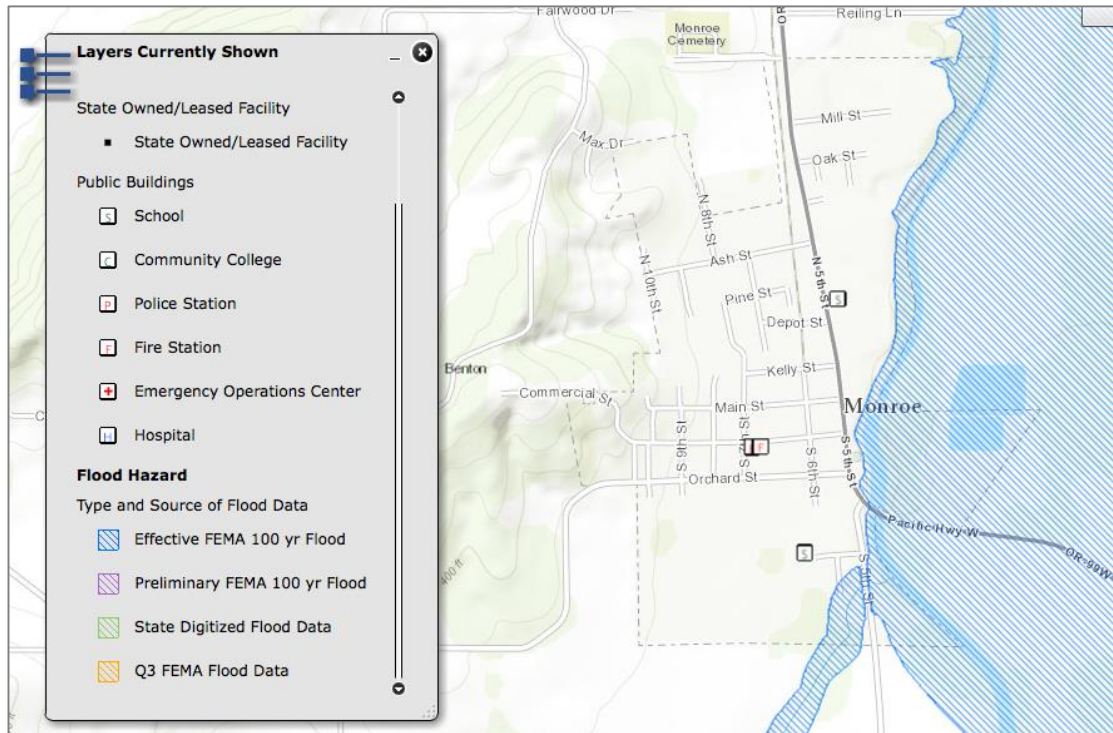
## Flood

The steering committee determined that the city’s probability for riverine flood is **high** (which is the same as the county’s rating) and that their vulnerability to flood is **moderate** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Benton County’s Natural Hazards Mitigation Plan. Portions of Monroe have areas of flood plains (special flood hazard areas). These include areas along the Willamette River (see Figure MA-3). Furthermore, other portions of Monroe, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage.

<sup>1</sup> Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase II (2001)

**Figure MA-3 Special Flood Hazard Area**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

The most recent severe flooding to occur in Monroe happened in 1996/1997 (also the flood of 1964) isolated the town from Eugene and Corvallis. As such the Irish Bend area (northeast of Monroe) is considered a high risk.

### National Flood Insurance Program (NFIP)

FEMA modernized the Monroe Flood Insurance Rate Maps (FIRMs) in June 2011. The table below shows that as of February 2016, Monroe has four (4) National Flood Insurance Program (NFIP) policies in force. Of those, two (2) are for properties that were developed before development of the initial FIRM. The last Community Assistance Visit (CAV) for Monroe was on January 1, 1987. Monroe is not a member of the Community Rating System (CRS). The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes. There have not been any paid flood insurance claims.

The Community Repetitive Loss record for Monroe identifies no Repetitive Loss Properties<sup>2</sup> and no Severe Repetitive Loss Properties<sup>3</sup>.

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<sup>2</sup> A Repetitive Loss (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.

<sup>3</sup> A Severe Repetitive Loss (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



**Table MA-6 Flood Insurance Detail**

Jurisdiction	Current FIRM Date	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Benton County	-	-	763	569	570	44	30	115	35
Monroe	6/2/2011	9/26/1975	4	2	4	0	0	0	0

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Benton County	\$ 169,841,900	44	31	2	\$ 582,669	3	0	-	-
Monroe	\$ 758,800	0	0	0	\$ -	0	0	NP	1/1/1987

Source: Information compiled by Department of Land Conservation and Development, April 2016.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Landslide

The steering committee determined that the city’s probability for landslide is **low** (which is lower than the county’s rating) and that their vulnerability to landslide is **low** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, describes the causes and characteristics of landslides, and appropriately identifies previous landslide occurrences within the region. The city of Monroe occasionally sees minor landslides in the west hills during the rainy season.

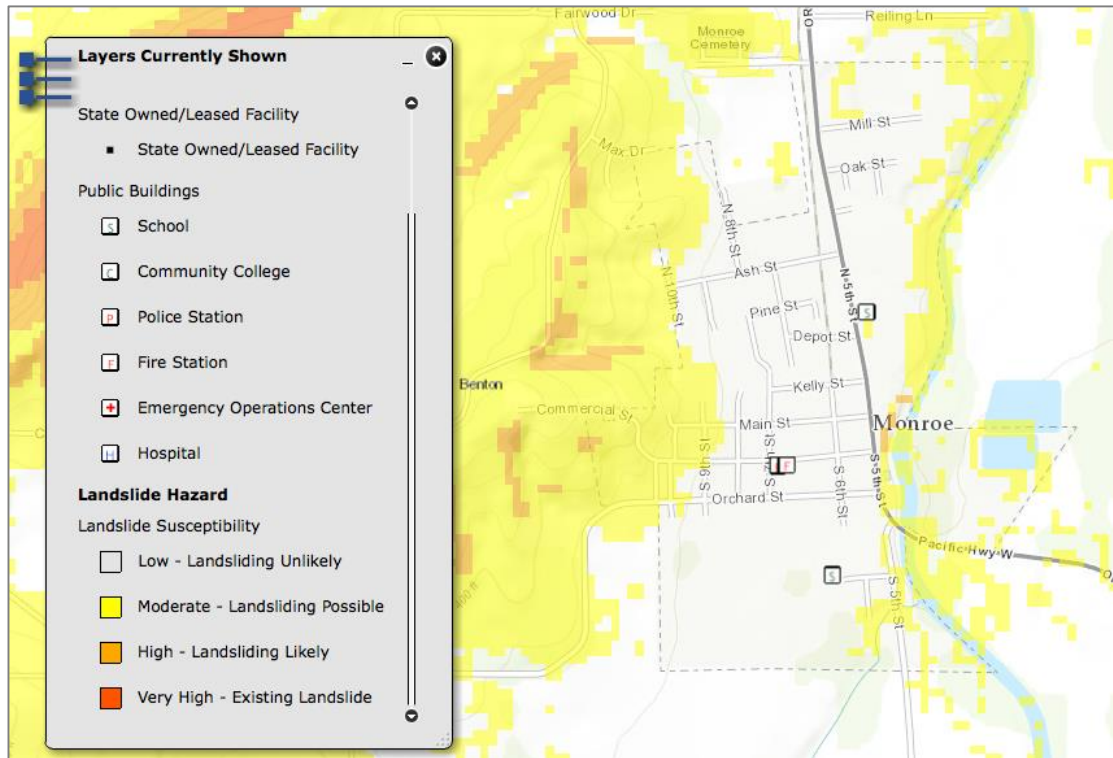
Landslide susceptibility exposure for Monroe is shown in Figure MA-5. Approximately 0.8% of Monroe has High, and approximately 25% has Moderate, landslide susceptibility exposure<sup>4</sup>.

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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.

<sup>4</sup> DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

**Figure MA-5 Landslide Susceptibility Exposure**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Potential landslide-related impacts are adequately described within the county's plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Benton County, and thoroughfares beyond city limits are susceptible to obstruction as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Volcano

The steering committee determined that the city's probability for volcanic event is **moderate** (which is the same as the county's rating) and that their vulnerability to volcanic event is **low** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Monroe's risk to volcanic events. Generally, an event that affects the county is likely to affect Monroe as well. 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. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Monroe as well. Monroe 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 this hazard.*

## Wildfire

The steering committee determined that the city's probability for wildfire is **moderate** (which is lower than the county's rating) and that their vulnerability to wildfire is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Monroe. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Benton County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk. The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates (an update is scheduled for 2016).

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Windstorm

The steering committee determined that the city's probability for windstorm is **high** (which is the same as the county's rating) and that their vulnerability to windstorm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

About once or twice per year the city will experience a windstorm event that will interrupt services, experience downed trees, and cause power outages. In 2004, power was out for 5-7 days and the community was isolated from Eugene and Corvallis.

Benton County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. 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 Monroe area, 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: the 2010 ice storm hindered transportation for 8 to 10 hours, and the 2012/ 2013 snow events included extensive snow that engulfed the town for several days, closing school for an extended period. Road closures on Highway 99 due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

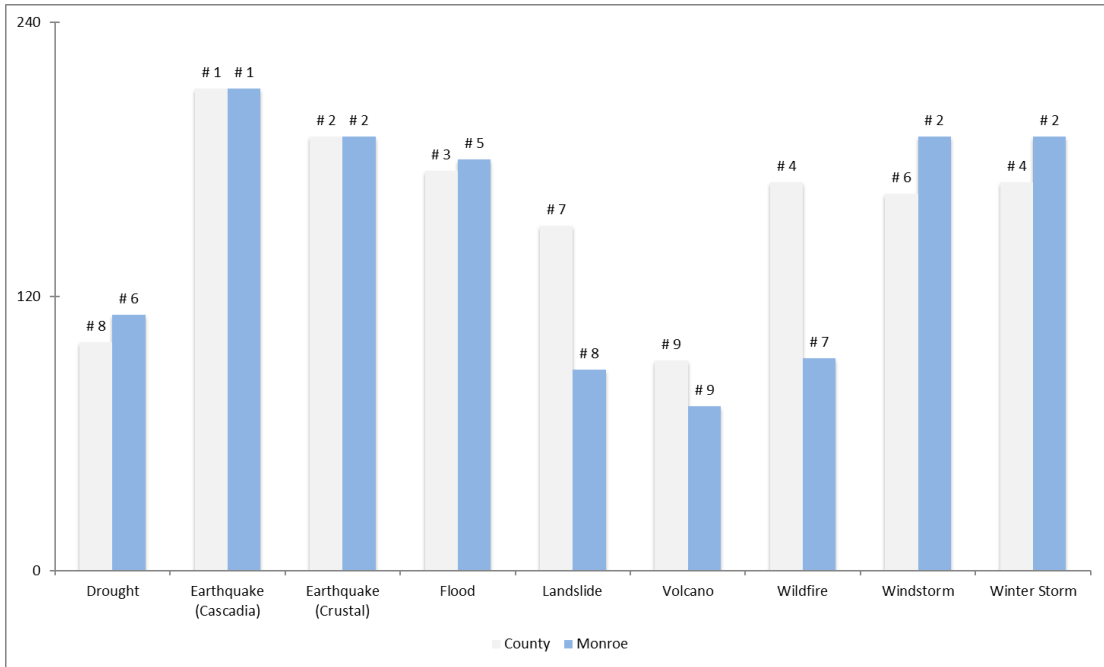
*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Summary

The figure below presents a summary of the hazard analysis for the City of Monroe and compares the results to the assessment completed by Benton County.

The city rated their threat to the drought, flood, windstorm, and winter storm hazards higher than the county. The top four hazards for the city are the Cascadia Subduction Zone earthquake, crustal earthquakes, windstorms, and winter storms.

**Figure MA-6 Overall Hazard Analysis Comparison – Monroe/ Benton County**



Source: City of Monroe NHMP Steering Committee and Benton County NHMP Steering Committee

# CITY OF PHILOMATH ADDENDUM

## Purpose

This document serves as the City of Philomath's Addendum to the the Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum seeks to supplement information contained in Volume I (Basic Plan) of this multi-jurisdictional NHMP which serves as the foundation for this jurisdiction's addendum and Volume III (Appendices) which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

## Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the summer of 2015, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM) and Benton County and cities, including Philomath, to update their NHMP, which expired February 8, 2016. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Benton County NHMP, locally adopting it, and having it approved by FEMA, Philomath will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Benton County NHMP, and Philomath addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements, Plan Summary, and Plan Process* (Appendix B).

The Philomath City Manger is the designated convener of the NHMP and will take the lead in implementing, maintaining, and updating the addendum to the Benton NHMP in collaboration with the designated convener of the Benton NHMP (County Emergency Service Planner).

Representatives from the City of Philomath steering committee met formally on one occasion: December 8, 2015 (see Appendix B for more information).

The city's addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Philomath Steering Committee was comprised of the following representatives:

- Convener, Chris Workman, City Manager
- Tom Miller, Philomath Fire and Rescue, Chief
- Tom Phelps, Philomath Fire and Rescue, Former Chief
- Garry Black, Operations Supervisor, City of Philomath Public Works
- Rich Saalsaa, Fire and Life Safety Lieutenant, Philomath Fire and Rescue

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors including members of Philomath Fire and Rescue and the Wren Emergency Planning Committee. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan's development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix B for more information) and a survey regarding community perceptions of natural hazards was administered (see Appendix F details of the survey).

**The Benton County NHMP was approved by FEMA on [Month] [Day], 2016 and the Philomath addendum was adopted via resolution on [Month] [Day], 2016. This NHMP is effective through [Month] [Day], 2021.**

## Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3(iv), *Mitigation Strategy*.

During the 2015/ 2016 Benton County and Corvallis update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review the actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix B for more information). Each jurisdiction developed a list of priority actions (Appendix A-1), any actions that were not prioritized were placed in the Action Item Pool (Appendix A-2) and will be considered during the semi-annual meetings.

### Priority Actions

The city 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. The city's priority actions are listed below in the following table. Detailed implementation information for each action is listed in Appendix A-1.

### Action Item Pool

The following table also 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.

Appendix A-1, *Priority Action Items*, and Appendix A-2, *Action Item Pool*, provide detailed information about each of the priority action items (and some of the other actions). The

majority of these actions carry forward from prior versions of this plan (Benton County and/or Corvallis NHMPs). A blank action item form is included for use by the NHMP committee as additional action items are considered for implementation.



**Table PA-I Philomath Priority Action Items**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Priority Actions</b>				
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.	Philomath Fire & Rescue	<u>Internal</u> : Public Works, Planning; Benton County Community Development, Emergency Management; <u>External</u> : Community organizations; established community preparedness groups; ODF, FEMA, OSFM	Ongoing
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	Planning	<u>Internal</u> : Public Works, Finance <u>External</u> : FEMA, APA, DLCD, OEM	Ongoing
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	Public Works	<u>Internal</u> : Planning, Finance <u>External</u> :	Short-Term (1-2 Years)/ Ongoing
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.	Public Works	<u>Internal</u> : Planning; Benton County GIS, Benton County Emergency Management; <u>External</u> : Special Districts in Benton County	Short-Term (1-2 Years)
FL #1	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.	Planning	<u>Internal</u> : Maps & GIS, and Assessment Offices <u>External</u> : DLCD, DOGAMI, FEMA	Short-Term (1-2 Years)
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.	Planning	<u>Internal</u> : Public Works <u>External</u> : DLCD, FEMA	Ongoing
FL #5	Mitigate flooding of South 13th Street area.	Public Works	<u>Internal</u> : Planning <u>External</u> : Corvallis, DLCD, USACE, Silver Jackets	Long-Term (5+ Years)
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Planning	<u>Internal</u> : Benton County GIS Department, Emergency Management, <u>External</u> : DOGAMI, DLCD	Short-Term (1-2 Years)
WF #1	Implement actions identified in the Community Wildfire Protection Plan.	Various (see CWPP)	Support identified in CWPP	Ongoing

Source: City of Philomath NHMP Steering Committee, 2015.

**Table PA-2 Philomath Action Item Pool**

Action Item ID	Action Item	Coordinating Organization	Partner Organizations	Timeline
<b>Action Item Pool</b>				
<b>Multi-Hazard</b>				
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Public Works	<u>Internal:</u> Planning; <u>External:</u> Public Utility Commission, Consumers Power, Inc., Pacific Power	Ongoing
MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Steering Committee	<u>Internal:</u> Planning Public Works; Benton County Emergency Management, LBVPop; <u>External:</u> FEMA, OEM, DLCDCD	Long-Term (5+ Years)
MH #7	Inventory and remove high-risk trees in City right of way	Public Works	<u>Internal:</u> Parks <u>External:</u>	Ongoing
<b>Earthquake</b>				
<i>The only earthquake action is located in the priority action item section.</i>				
<b>Flood</b>				
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches	Public Works	<u>Internal:</u> <u>External:</u> DLCDCD, Benton County	Ongoing
FL #4	Ensure the accurate locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RFL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.	Planning	<u>Internal:</u> Public Works; Benton County Emergency Management; <u>External:</u> DLCDCD, FEMA	Short Term (1-2 Years)/ Ongoing
<b>Landslide</b>				
<i>The only landslide action is located in the priority action item section.</i>				
<b>Wildfire</b>				
<i>The only wildfire action is located in the priority action item section.</i>				
<b>Drought, Volcano, Windstorm, and Winter Storm</b>				
<i>No actions identified for these hazards. See multi-hazard actions for associated actions.</i>				

Source: City of Philomath NHMP Steering Committee, 2015.

## Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Philomath addendum to the Benton County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Philomath addendum on a semi-annual schedule; the county is also meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Manager will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for identifying new risk assessment data, reviewing status of mitigation actions, identifying new actions, and seeking funding to implement the city's mitigation strategy (actions). The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume IV, Appendix D: Economic Analysis of Natural Hazard Mitigation Projects for more information).

### Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Philomath will implement the NHMP's recommended actions through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Philomath's acknowledged comprehensive plan is the Philomath Comprehensive Plan. The Oregon Land Conservation and Development Commission first acknowledged the plan in 1983. The City last completed a major update of the plan in 2003 (revised September 2015). The City implements the plan through the Philomath Land Development Code, which was amended in December 2011.

Philomath currently has the following plans that relate to natural hazard mitigation. For a complete list visit the city website for [planning](#) and [public works](#):

- Comprehensive Plan
- Zoning Code
- Philomath Transportation System Plan
- Stormwater Master Plan
- Water Master Plan
- Water Management and Conservation Plan
- Wastewater Master Plan

## Continued Public Participation

Keeping the public informed of the city's efforts to reduce the city's risk to future natural hazards events is important for successful plan implementation and maintenance. The city is committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

## Plan Maintenance

The Benton County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state, or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the plan was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community's demographics that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the plan accurately address the impacts of this event?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

## Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix C, *Community Profile*. The risk assessment process is graphically depicted in Figure PA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

**Figure PA-1 Understanding Risk**



## Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department’s Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't 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 first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

## Hazard Analysis

The Philomath steering committee developed their hazard vulnerability assessment (HVA), using the county’s HVA as a reference. Changes from the county’s HVA were made where

appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Philomath, which are discussed throughout this addendum.

Table PA-3 shows the HVA matrix for Philomath showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake, and crustal earthquakes) and two chronic hazards (windstorm and winter storm) rank as the top four hazard threats to the city (Top Tier). The flood and drought hazards comprise the next two highest ranked hazards (Middle Tier), while wildfire, volcano, and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

**Table PA-3 Hazard Analysis Matrix – Philomath**

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Earthquake (Cascadia)	12	49	50	100	211	#1	<i>Top Tier</i>
Earthquake (Crustal)	6	49	35	100	190	#2	
Windstorm	20	70	25	50	190	#2	
Winter Storm	20	70	20	60	190	#2	
Flood	20	70	25	60	180	#5	<i>Middle Tier</i>
Drought	10	35	5	50	112	#6	
Wildfire	20	70	30	50	93	#7	<i>Bottom Tier</i>
Volcano	2	35	5	50	92	#8	
Landslide	20	56	15	60	75	#9	

Source: Philomath NHMP Steering Committee, 2015.

Table PA-4 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Benton County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). The city ranked probability of landslide and wildfire lower than the county. They also ranked the vulnerability to wildfire lower than the county.

**Table PA-4 Probability and Vulnerability Comparison**

Hazard	Philomath		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	Moderate	Low
Earthquake (Cascadia)	Moderate	High	Moderate	High
Earthquake (Crustal)	Moderate	Moderate	Moderate	Moderate
Flood	High	Moderate	High	Moderate
Landslide	<b>Moderate</b>	Low	High	Low
Volcano	Moderate	Low	Moderate	Low
Wildfire	<b>Moderate</b>	<b>Low</b>	High	Moderate
Windstorm	High	Moderate	High	Moderate
Winter Storm	High	Moderate	High	Moderate

Source: Philomath NHMP Steering Committee and Benton County NHMP Steering Committee, 2015.

## Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Philomath, 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 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.

### Community Characteristics

Philomath is located in the mid-Willamette Valley, at the base of Mary’s Peak and west of Corvallis and is the second most populous city in Benton County (behind Corvallis). The city is located on the north bank of the Marys River – a tributary of the Willamette River – covering about two square miles. The climate of Philomath is moderate; the average monthly temperatures range from 51 – 81 degrees in July and August, and 33-46 degrees in December and January, and the city receives approximately 43 inches of rain each year. Monthly precipitation is about 6-7 inches during the wetter months of November – January, and about .04 inches during the drier months of June - August. The city’s topography is both a mix of relatively flat areas and steeper sloped areas along the western edge of the city.

### Economy

Philomath benefits from its location to Corvallis which is a regional center for higher education (Oregon State University), industrial technology, engineering, research, commerce, and health care. Philomath has some manufacturing businesses, however, most employment is outside of the city.

### Critical and Important Facilities

Critical and important facilities include the following:

- Water Treatment Plant (South Ninth Street)
- Wastewater Treatment Facility (South of Marys River, West of Bellfountain Road) and Pump Stations
- Philomath Fire and Rescue (1035 Main Street)
- Police Department (1010 Applegate Street)
- City Hall (980 Applegate Street)
- Philomath Public Works (1515 Willow Street)
- Philomath Elementary (239 S 16<sup>th</sup> Street)
- Clemens Primary (535 S 19<sup>th</sup> Street)
- Philomath Middle (2021 Chapel Drive)
- Philomath High (2054 Applegate Street)
- Community Library (1050 Applegate)
- Benton County Historical Museum (1101 Main Street)

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

## Hazard Characteristics

### Drought

The steering committee determined that the city's probability for drought is **moderate** (which is the same as the county's rating) and that their vulnerability to drought is **low** (which is the same as the county's rating). The City did not assess the drought hazard in the previous version of their NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Benton County communities from the effects of drought; however, Benton County was included in Presidential Drought Declarations in 1992 and 2015.

Philomath's primary water supply comes from the Marys River (187.3 million gallons, 95% of drinking water comes from the city's water treatment plant, 1% comes from a backup well system, and 4% comes from an intertie system with Corvallis). The city has one (1) storage reservoir for a total of 1.25 million gallons of treated water storage capacity. The city completed a water master plan in 2005. In general, water supply is available and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

### Earthquake

The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is the same as the county's rating). The steering committee determined that the city's probability for a Crustal

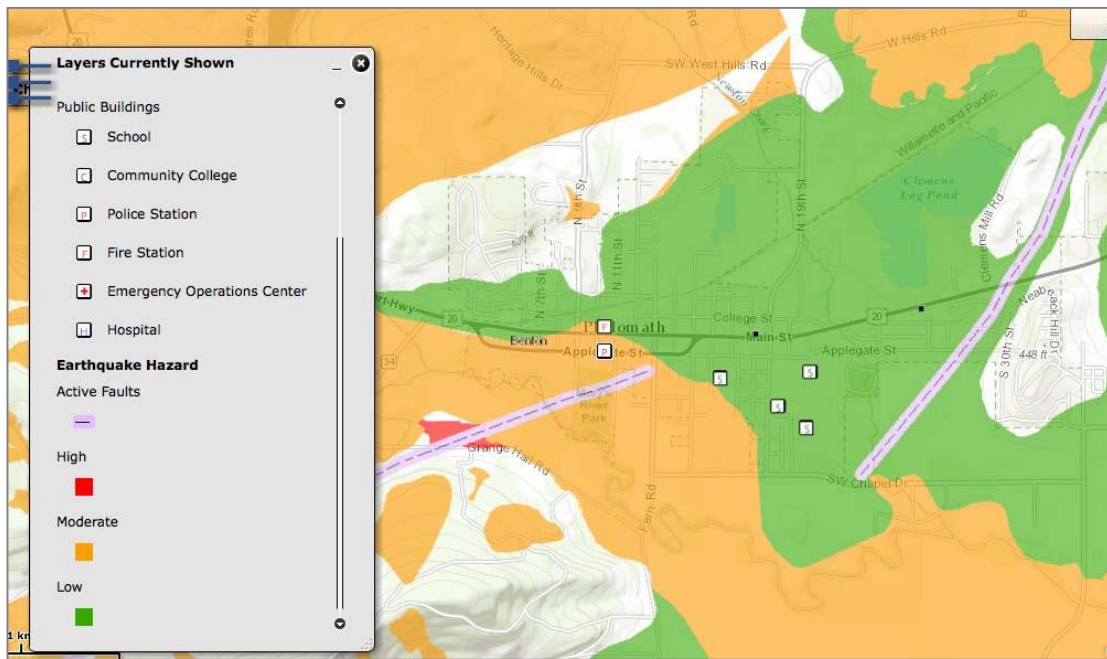


Earthquake event is **moderate** (which is the same as the county’s rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county’s rating). This hazard was not rated as distinct CSZ and crustal events in the previous NHMP.

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Philomath as well. The causes and characteristics of an earthquake event are appropriately described within the county’s plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county’s plan, and the community impacts described by the county would generally be the same for Philomath as well.

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 particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure PA-2 displays relative liquefaction hazards. As shown, the area of greatest concern within the city of Philomath (darker areas) is along the Marys River where the concentration of soft soils is the highest.

**Figure PA-2 Active Faults and Soft Soils**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 60% of residential buildings were built prior to 1990, which increases the city’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table PA-5; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using RVS, two (2) have a high (greater than 10% chance) collapse potential. In addition, two facilities, Philomath

Middle School and Philomath Fire and Rescue, received [Seismic Rehabilitation Grant Program](#) funds in 2010-2011 and 2014 to retrofit their structures.

**Table PA-5 Rapid Visual Survey Scores**

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
<b>Schools</b>					
Clemens Primary (Philomath SD 17J) (535 S 19th St)	Bent_sch18	X			
Philomath Elementary (Philomath SD 17J) (239 S 16th St)	Bent_sch15			X	
Philomath Middle (Philomath SD 17J) (2021 Chapel Dr)	Bent_sch13	<b>Miitgated per 2010-11 SRGP</b>			
Philomath High (Philomath SD 17J) (2054 Applegate St)	Bent_sch16			X	
<b>Public Safety</b>					
Philomath RFPD (1035 Main St)	Bent_fir10	<b>Miitgation expected in 2016 per 2014 SRGP award</b>			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

\*\* – Site ID is referenced on the [RVS Benton County Map](#)

Note 1: The Philomath Police Department was not assessed in 2007, however, it was built under existing seismic standards in 2005.

Note 2: Philomath Elementary, Middle, and High schools received structural seismic upgrades as a result of a 2010 voter approved bond (2011-2015). The current post-upgrade collapse potential is not known.

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.<sup>1</sup>

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

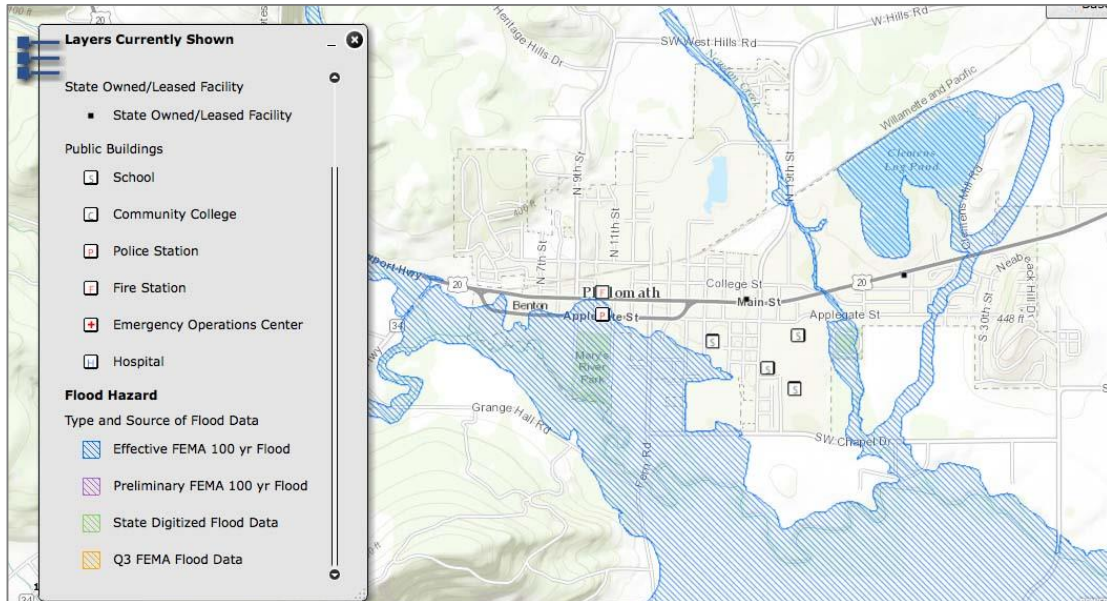
## Flood

The steering committee determined that the city’s probability for riverine flood is **high** (which is the same as the county’s rating) and that their vulnerability to flood is **moderate** (which is the same as the county’s rating).

<sup>1</sup> Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties: Phase II (2001)

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Benton County’s Natural Hazards Mitigation Plan. Portions of Philomath have areas of flood plains (special flood hazard areas). These include areas along the Marys River (see Figure PA-3). Furthermore, other portions of Philomath, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage.

**Figure PA-3 Special Flood Hazard Area**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

The most recent severe flooding to occur in Philomath occurred in 1996/1997 when a large portion of the town was under water and isolated; sewage overflowed from the wastewater treatment plant (located south of the Marys River and west of Bellfountain Road). Additional flooding of significance occurred in January 2012 and December 2015 when major flooding occurred that closed streets and damage city facilities. The 2012 event included damage to approximately 15 homes on 13<sup>th</sup> street and to the city park. Table 2-3 in Section 2, *Risk Assessment*, shows potentially vulnerable buildings to the flood hazard which include: city hall, library, police department, public works, sewage treatment facility, and water treatment facility.

**National Flood Insurance Program (NFIP)**

FEMA modernized the Philomath Flood Insurance Rate Maps (FIRMs) in June 2011. The table below shows that as of February 2016, Philomath has 59 National Flood Insurance Program (NFIP) policies in force. Of those, 34 are for properties that were developed before development of the initial FIRM. The last Community Assistance Visit (CAV) for Philomath was on January 26, 1998. Philomath is not a member of the Community Rating System (CRS). The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes. There have been a total of two (2) paid claims for \$25,398.

The Community Repetitive Loss record for Philomath identifies no Repetitive Loss Properties<sup>2</sup> and no Severe Repetitive Loss Properties<sup>3</sup>.

**Table PA-6 Flood Insurance Detail**

Jurisdiction	Current FIRM Date	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Benton County	-	-	763	569	570	44	30	115	35
Philomath	6/2/2011	6/15/1982	59	34	51	5	0	3	13

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Benton County	\$ 169,841,900	44	31	2	\$ 582,669	3	0	-	-
Philomath	\$ 12,048,200	2	2	0	\$ 25,398	0	0	NP	1/26/1998

Source: Information compiled by Department of Land Conservation and Development, April 2016.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Landslide

The steering committee determined that the city’s probability for landslide is **moderate** (which is lower than the county’s rating) and that their vulnerability to landslide is **low** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of landslides, and appropriately identifies previous landslide occurrences within the region. The city of Philomath occasionally sees minor landslides in the west hills during the rainy season.

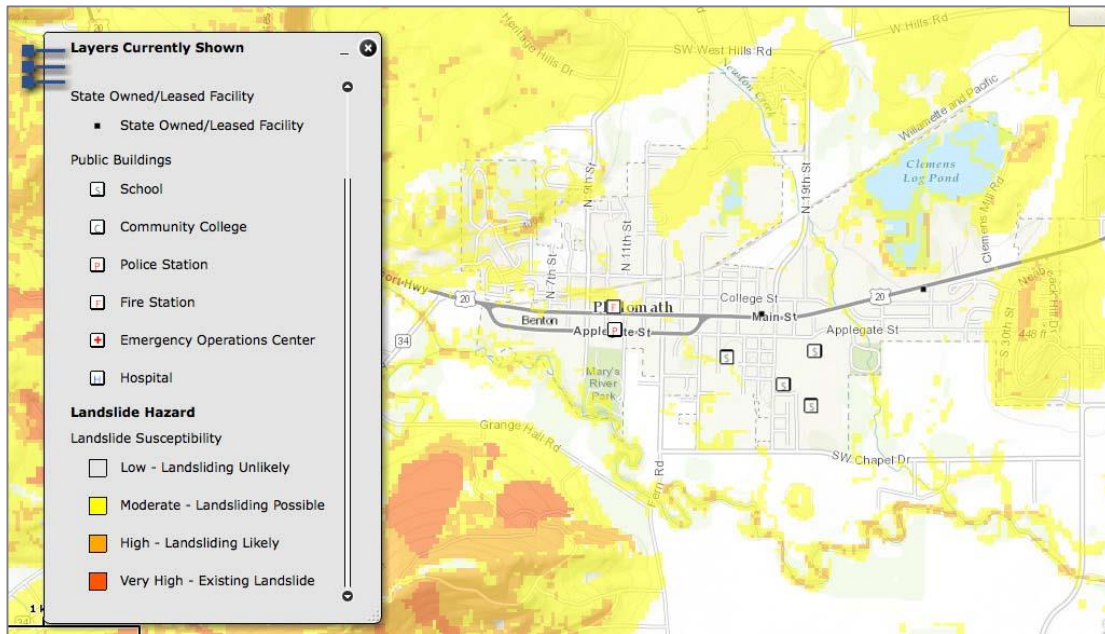
Landslide susceptibility exposure for Philomath is shown in Figure PA-5. Approximately 3% of Philomath has High, and approximately 27% Moderate, landslide susceptibility exposure<sup>4</sup>.

<sup>2</sup> A Repetitive Loss (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.

<sup>3</sup> A Severe Repetitive Loss (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.

<sup>4</sup> DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

**Figure PA-4 Landslide Susceptibility Exposure**



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Potential landslide-related impacts are adequately described within the county's plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Benton County, and thoroughfares beyond city limits are susceptible to obstruction as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Volcano

The steering committee determined that the city's probability for volcanic event is **moderate** (which is the same as the county's rating) and that their vulnerability to volcanic event is **low** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Philomath's risk to volcanic events. Generally, an event that affects the county is likely to affect Philomath as well. 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. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Philomath as well. Philomath 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 this hazard.*

## Wildfire

The steering committee determined that the city's probability for wildfire is **moderate** (which is lower than the county's rating) and that their vulnerability to wildfire is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Philomath. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Benton County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk. The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates (an update is scheduled for 2016).

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Windstorm

The steering committee determined that the city's probability for windstorm is **high** (which is the same as the county's rating) and that their vulnerability to windstorm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

About once or twice per year the city will experience a windstorm event that will interrupt services, experience downed trees, and cause power outages.

Benton County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. 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 Philomath area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. The most recent winter storm (2012/ 2013) included extensive snow that engulfed the town for several days, closing school for an extended period. Road closures on Highway 34 due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

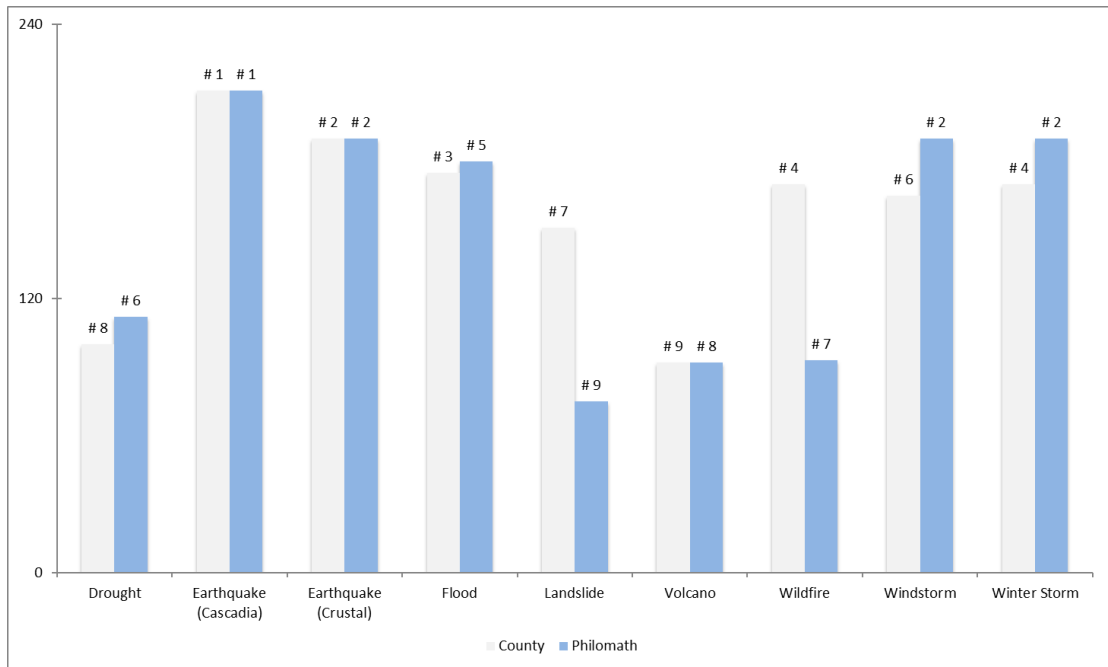
*Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.*

## Summary

The figure below presents a summary of the hazard analysis for the City of Philomath and compares the results to the assessment completed by Benton County.

The city rated their threat to the drought, flood, windstorm, and winter storm hazards higher than the county. The top four hazards for the city are the Cascadia Subduction Zone earthquake, crustal earthquakes, windstorms, and winter storms.

**Figure PA-5 Overall Hazard Analysis Comparison – Philomath/ Benton County**



Source: City of Philomath NHMP Steering Committee and Benton County NHMP Steering Committee



# **Volume III: Appendices**

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# **Appendix A: Action Items**

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## APPENDIX A-I: PRIORITY ACTION ITEMS

The following tables (A-1 through A-5) list priority actions for the 2016 Benton County Multi-Jurisdictional Natural Hazard Mitigation Plan. Each jurisdiction reviewed the updated actions from the previous plan and opted to participate in each action, and/ or create additional new actions. The actions are numbered consecutively under each hazard and show which jurisdictions opted to participate in that action.

The action item forms that follow Table A-1 to A-5 present specific information for each action item. Additional action items and forms are located within Appendix A-2: Action Item Pool. Note: See Section 3, *Mitigation Strategy*, and Volume II, *City Addenda*, for jurisdiction specific information for each identified action item.

**Table A-I Benton County High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County
MH #11	Assess vulnerability, determine, and then implement appropriate mitigation measures for Alsea area bridges and access routes.
EQ #3	Seismically retrofit the historic Benton County Courthouse, a vital public building. Consider both structural and non-structural retrofit options.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #6	Improve remote draft site at Daisy Drive in Marys River Estates.
FL #7	Identify all structures with floors below the Base Flood Elevation and prioritize mitigation based on flood risk and type of required mitigation.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Benton County NHMP Steering Committee (2015)

**Table A-2 Adair Village High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
DR #2	Identify and develop a larger/ alternative water supply.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.
WT #1	Ensure that all critical facilities have backup power and emergency operations plans to deal with power outages.

Source: Adair Village NHMP Steering Committee (2015)

**Table A-3 Corvallis High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County
MH #13	Construct a raw water intake system to reduce risk and improve reliability in the case of a natural disaster.
MH #14	Construct finished water transmission main from the Rock Creek Water Treatment Plant to the Baldy Water Reservoir.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
EQ #4	Abandon water transmission lines on Marys River Bridge and bore new water transmission lines under Marys River.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
LS #2	Complete geotechnical analysis of the slope on NW Witham Hill Drive from NW Canary Drive to NW Walnut Boulevard and implement rehabilitation strategies to stabilize the slope.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Corvallis NHMP Steering Committee (2015)

**Table A-4 Monroe High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
DR #1	Develop a drought impact assessment for Benton County.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Monroe NHMP Steering Committee (2015)



**Table A-5 Philomath High Priority NHMP Actions**

Item ID	Action Item
<b>Priority Actions</b>	
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.
MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
FL #1	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #5	Mitigate flooding of South 13th Street area.
LS #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
WF #1	Implement actions identified in the Community Wildfire Protection Plan.

Source: Philomath NHMP Steering Committee (2015)

## Priority Action Item Forms

Action Item: Multi-Hazard #1		Alignment with Plan Goals:	High Priority?
Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions</b>			
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
Benton County Transportation Plan, Community Wildfire Protection Plan			
<b>Rationale for Proposed Action Item:</b>			
<p>Downed power lines result in power failures and block critical transportation routes. The loss of electric power for a long period of time (more than 72 hours) can lead to failures of multiple critical systems including health care, water filtration, wastewater treatment, communications, transportation, and others. Impassable roadways from downed lines also inhibit emergency response and restoration of critical services, such as drinking water and health care, and is particularly problematic if fuel for backup generators cannot be delivered. The hazards most likely to impair surface transportation and disrupt electric service are severe winter storm (snow, ice, downed trees, utility pole, and wire failures) and earthquake (downed trees, utility pole and wire failures).</p>			
<b>Ideas for Implementation:</b>			
<p>Over the next five years:</p> <p>a) Develop a list of key backbone transmission and distribution routes that serve critical customers and enable efficient restoration to the broader distribution system;</p> <p>b) Develop a long-term plan to underground, relocate, or “harden” key electric distribution lines along critical corridors (including feasibility assessment and prioritization);</p> <p>c) Seek funds and opportunities to relocate power poles and power lines, or harden existing facilities, where feasible and appropriate, to reduce blockage of roadways and to reduce risk of outages from natural disasters; and</p> <p>d) Continue to enhance wind and winter storm resistant construction methods where possible to reduce damage to utilities and critical facilities.</p>			
<b>Coordinating Organization:</b>	Benton County Public Works		
<b>Internal Partners:</b>		<b>External Partners:</b>	
Benton County Community Development, Emergency Management, GIS		Public Utility Commission, Consumers Power, Inc., Pacific Power	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
HMGP, PDM, Electric Utilities, Local Funding Resources			Short-Term (1-2 years)
		X	Mid-Term (3-5 years)
			Long-Term (5+ years)
		X	Ongoing

<b>Form Submitted by:</b>	Benton County NHMP Steering Committee
<b>Action Item Status:</b>	Deferred, revised from 2010 version of the NHMP

Action Item: Multi-Hazard #2	Alignment with Plan Goals:	High Priority?
Deliver education programs aimed at mitigating the risk posed by hazards.	<input type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
N/A		
<b>Rationale for Proposed Action Item:</b>		
<p>Public education is a very effective (as well as cost-effective) strategy for reducing risk in a community. Engaging in public outreach and educational efforts should be an ongoing endeavor that has dedicated support from natural hazards mitigation steering committee members, elected officials, and county staff.</p>		
<b>Ideas for Implementation:</b>		
<p>There are several opportunities for public education and outreach in Benton County. The following is a subset of many possible ideas.</p> <p>Heighten public awareness of fire dangers, especially during high danger periods. Additionally, provide education about fire safe practices, such as careful disposal of smoking materials, and adhering to restrictions on burning of rubbish and debris.</p> <p>Promote insurance coverage for catastrophic hazards (when available). Educate the public about wind storm-resistant trees and landscaping practices, and the role of proper tree pruning and care in preventing damage during wind storms.</p> <p>Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices through public education.</p> <p>Encourage earthquake safety promotion and drills by community groups. FEMA contains a number of publications about earthquake safety, such as Earthquake Safety Activities for Children and Teachers (FEMA 527) and FEMA’s “Are You Ready?” guides available at: <a href="http://www.fema.gov/areyouready/earthquakes.shtm">http://www.fema.gov/areyouready/earthquakes.shtm</a></p> <p>Educate citizens about ways to weatherize their homes, as well as safe emergency heating equipment.</p> <p>Encourage citizens to prepare and maintain 2-week kits.</p> <p>Educate businesses and governmental organizations about the importance of developing continuity of operations plans. Host an Open for Business training workshop, developed by the Institute for Business and Home Safety (IBHS), to educate businesses about the importance of continuity of operations plans and how to develop a plan for their business.</p>		

Accomplish these tasks, in part, through the Benton County CERT program training events and other public events.			
<b>Coordinating Organization:</b>		Benton County Emergency Management	
<b>Internal Partners:</b>		<b>External Partners:</b>	
Community Development, Public Works		Community organizations; cities and special districts; established community preparedness groups; Philomath Fire & Rescue	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
EMPG, Local Funding Resources			<input type="checkbox"/> Short-Term (1-2 years)
			<input type="checkbox"/> Mid-Term (3-5 years)
			<input type="checkbox"/> Long-Term (5+ years)
			<input checked="" type="checkbox"/> Ongoing
<b>Form Submitted by:</b>		Benton County NHMP Steering Committee	
<b>Action Item Status:</b>		Ongoing, revised from 2006 version of the NHMP	

Action Item: Multi-Hazard #3	Alignment with Plan Goals:	High Priority?
Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	<input checked="" type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
Action proposes integration with relevant existing plans and policies.		
<b>Rationale for Proposed Action Item:</b>		
<p>The federal Disaster Mitigation Act of 2000 requires communities to describe a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, when appropriate. In Appendix C and the City Addenda (Volume III) of the Natural Hazards Mitigation Plan, there is a list of existing planning or regulatory documents.</p> <p>Every five years, natural hazards mitigation plans must be updated and resubmitted for approval in order to continue to be eligible for mitigation project grant funding. The updated plan must explain how the local government incorporated the mitigation plan into other planning mechanisms, when appropriate, as a demonstration of progress in local mitigation efforts. This action item serves as a reminder to the county and city Natural Hazards Mitigation Plan steering committees that efforts must be made to integrate the requirements of the mitigation plan into other planning mechanisms.</p>		
<b>Ideas for Implementation:</b>		
<p>Local government functions provide a myriad of methods in which to implement actions identified in the mitigation strategy. Among them is the comprehensive plan. Others include, but are not limited to, the following: sustainability plans, capital improvement plans, redevelopment plans, post-disaster redevelopment or recovery plans, regional development plans, flood mitigation plans, college campus plans, etc. (see Federal Emergency Management Agency Local Mitigation Planning Guidance, July 2008).</p> <p>Conduct an ‘audit’ of each jurisdiction’s Comprehensive Plan (specifically, Goal 7). Determine whether information needs to be (or can be) updated by content within the natural hazards mitigation plan or otherwise. Develop a strategy and timeline for updating Goal 7 content. Ideally, integration should happen as a dedicated component of future comprehensive plan or natural hazards mitigation plan updates.</p> <p>Inventory and review other local plans to identify gaps, weaknesses, or opportunities for enhancing plan integration.</p> <p>The American Planning Association (APA) developed a report entitled <a href="#">Hazard Mitigation: Integrating Best Practices into Planning</a>. The report identifies where local planning activities could benefit from better integration of hazard mitigation concerns.</p>		

The Federal Emergency Management Agency (FEMA) developed a guidebook entitled [Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan](#). The guidebook includes case studies of Benton County and Corvallis NHMP integration efforts.

<b>Coordinating Organization:</b>	Benton County Community Development		
<b>Internal Partners:</b>	<b>External Partners:</b>		
Benton County Emergency Management, Public Works, County Commissioners	FEMA, American Planning Association, DLCDC, OEM		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
Local Funding Resources, DLCDC Technical Assistance Grant		<input type="checkbox"/>	Short-Term (1-2 years)
		<input type="checkbox"/>	Mid-Term (3-5 years)
		<input type="checkbox"/>	Long-Term (5+ years)
		<input checked="" type="checkbox"/>	Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Ongoing, from 2006 version of the NHMP		

Action Item: Multi-Hazard #4	Alignment with Plan Goals:	High Priority?
Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
Completion of this action will result in more detailed information that can be used in the comprehensive planning process.		
<b>Rationale for Proposed Action Item:</b>		
<p>The Disaster Mitigation Act of 2000 recommends that communities describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas [<i>Requirement 20.6(c)(2)(ii)(B)</i>]. The structure description should also include construction characteristics (e.g., year built, building materials, freeboard, and foundation types). Additionally, the Disaster Mitigation Act of 2000 recommends that communities describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures [<i>Requirement 20.6(c)(2)(ii)(B)</i>]. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on vulnerable structures. A monetary estimate should be provided for each hazard, and should include, when resources permit, structure, contents, and function losses to present a full picture of the total loss for each asset.</p> <p>Currently, Benton County’s NHMP does not identify specific buildings or infrastructure that are at risk to natural hazards, with the exception of the following structures that may be vulnerable to earthquake hazards: K-12 public school buildings, college buildings with a capacity of 250 or more persons, hospital buildings with acute inpatient care facilities, fire stations, police stations, sheriffs’ offices and other law enforcement agency buildings. Similar inventories are needed for the remaining hazards. See Section 2, Risk Assessment and City Addenda (Volume III) for more information.</p> <p>Additionally, Benton County’s NHMP provides a risk analysis (i.e., estimate of potential dollar losses to vulnerable structures) for the earthquake hazard <i>only</i>. Similar analyses are needed for the remaining hazards, and would be helpful in prioritizing mitigation actions – especially for critical facilities.</p>		
<b>Ideas for Implementation:</b>		



Over the next five years, a) develop a prioritized list of critical public facilities, consistent with the Critical Infrastructure and Key Resources developed by the Federal Emergency Management Agency (FEMA), such as underground wastewater and stormwater collection and conveyance systems, regional 9-1-1 and radio communication systems, fire stations, schools and other buildings to be inspected for hazard vulnerability, b) develop a prioritization of facilities to be evaluated for hazard risk, c) seek funding for evaluations, d) develop a prioritized list of facilities/ services to be retrofitted, relocated, or replaced, e) secure funding for 2-3 mitigation/ retrofit projects per year.

While HAZUS is not required in local mitigation plans, communities are encouraged to use HAZUS to form a scientific basis from which the mitigation strategy is developed. The most important purpose of HAZUS is the ability to estimate losses from natural hazards. Descriptions of losses include both social and economic considerations and they describe both the location and extent of losses. For a step-by-step method for estimating losses, see:

- [Understanding Your Risks \(FEMA 386-2\), Step 4](#)
- HAZUS-MH at <https://www.fema.gov/hazus>
- [Multi-Jurisdictional Mitigation Planning \(FEMA 386-8\), p. 27](#)
- [Integrating Manmade Hazards into Mitigation Planning \(FEMA 386-7\), Phase 2, Step 4.](#)

<b>Coordinating Organization:</b>	Benton County Community Development		
<b>Internal Partners:</b>	<b>External Partners:</b>		
Benton County Public Works, Emergency Management, GIS	FEMA, DOGAMI, Oregon Seismic Safety Policy Advisory Board (OSSPAC)		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
Local Funding Resources, Risk MAP, SRGP		X	Short-Term (1-2 years)
			Mid-Term (3-5 years)
			Long-Term (5+ years)
		X	Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Ongoing, from 2006 version of the NHMP		

<b>Action Item: Multi-Hazard #6</b>	<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County.	<input checked="" type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
Benton County Health Department Climate Change Health Adaptation Plan		
<b>Rationale for Proposed Action Item:</b>		
<p>Climate change has been identified as an important issue in Oregon by the Governor, the State Legislature, various state departments (e.g. DLCD, DEQ, DOE among others), and local jurisdictions throughout the state. Additionally, the Oregon Climate Assessment Report (OCAR, 2010) and Northwest Climate Assessment Report (NWCAR, 2013) provide impacts information for this region, state, and locality, including specifically the Willamette Valley (<a href="http://occri.net/reports">http://occri.net/reports</a>). In Oregon, future regional climate changes include increases in temperature around 0.2-1°F per decade in the 21st Century, along with warmer and drier summers, and some evidence that extreme precipitation will increase in the future. Increased droughts and decreased groundwater recharge may occur in the Willamette Valley under various climate change scenarios as a result of declining snowpack in the Cascade Mountains, along with rising temperatures and changing summer precipitation patterns. Climate models suggest that as the region warms, winter snow precipitation will likely shift to higher elevations and snowpack will be diminished as more precipitation falls as rain altering surface flows.</p> <p>In 2007, the Intergovernmental Panel on Climate Change (IPCC), observed that, “. . . evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.” Numerous scientifically reputable reports (the IPCC reports chief among them) find that this observable rise in global temperature can be linked to a similar rise in human-induced greenhouse gas emissions.</p> <p>According to the Climate Impacts Group at the University of Washington’s Center for Science in the Earth System, “The Earth’s climate is primarily controlled by the balance of incoming energy from the sun and outgoing energy from the Earth’s surface. [While] no significant trend has been observed in incoming solar radiation since the late 1970s when satellite measurements became available . . . atmospheric concentrations of all well-mixed heat trapping greenhouse gases are far greater now than at anytime [sic] during the last 650,000 years.”</p> <p>In 2007, the IPCC concluded that, “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” Such an increase in global air and</p>		

ocean temperatures will most certainly lead to changes in Oregon. For example, as a direct result of climate change, the Oregon Department of Energy is forecasting problems with:

- **Rain and Snow Patterns**

*Rainstorms and snowstorms could increase in severity, but less snow would build up in the mountains. Snowpack might melt faster, increasing flooding. Less water would be available for recreation, irrigation, drinking and fish habitat. The concentration of pollutants in the water could increase during summer and fall.*

- **Sea Level Rise**

*A rise in sea level could threaten beaches, sandy bluffs and coastal wetlands. Coast towns could experience more flooding, causing increased damage to roads, buildings, bridges and water and sewer systems.*

- **Diminished Water Supplies and Crop Productivity**

*Oregon's crops and livestock could be affected by warmer temperatures, less water availability and drier soils. Some crops, such as wheat, might thrive in warmer temperatures, while others, such as potatoes, could be harmed. Less water available for irrigation would harm agriculture.*

- **Forest Fires and Pests**

*A warmer climate would change forests used to specific climate conditions. Different trees would flourish and grasslands might replace some forest land. Trees stressed by climatic changes would be more susceptible to pests, disease and fire damage. Industries that rely on forests could decline.*

- **Human Health**

*Heat waves could increase, causing a rise in heat-related illnesses and deaths. Some scientific models show Oregon average temperatures could increase by 5 degrees in winter and 4 degrees in summer. Insects carrying tropical diseases such as malaria and dengue fever could spread into a warmer Oregon.*

- **Ecosystems**

*Native species adapted to Oregon's climate could suffer if temperatures rise. Warmer streams and rivers would harm salmon and other native species and non-native species could replace them. The cultural practices of Oregon's tribes could be affected, as could the businesses and recreation practices of those who rely on the state's native species.*

Based on a growing body of literature, there is a clear nexus between changes in the natural environment resulting from human-induced climate change and the incidents and/or impacts of many natural hazards (refer to attachment). For example, the IPCC projects:

*In a warmer future climate, most Atmosphere-Ocean General Circulation Models project increased summer dryness and winter wetness in most parts of the northern middle and high latitudes. Summer dryness indicates a greater risk of drought. Along with the risk of drying, there is an increased chance of intense precipitation and flooding due to the greater water-holding capacity of a warmer atmosphere. This has already been observed and is projected to continue because in a warmer world, precipitation tends to be concentrated into more intense events, with longer periods of little precipitation in between. Therefore, intense and heavy downpours would be interspersed with longer relatively dry periods. Another aspect of these projected changes is that wet extremes are projected to become more severe in many areas where mean precipitation is expected to*

<i>increase, and dry extremes are projected to become more severe in areas where mean precipitation is projected to decrease.<sup>1</sup></i>		
<b>Ideas for Implementation:</b>		
Considering the potential impacts that climate change will likely have on natural hazards affecting Oregon and the mitigation thereof, Benton County’s natural hazards mitigation plan steering committee will continually assess the impacts of climate change on the characteristics and frequency of natural hazards in Benton County.		
<b>Coordinating Organization:</b>	Benton County Steering Committee (or subgroup thereof)	
<b>Internal Partners:</b>	<b>External Partners:</b>	
Benton County Community Development, Health Department, Corvallis Community Development and Public Works	State Interagency Hazard Mitigation Team, Department of Land Conservation and Development, Oregon State University, Oregon Climate Change Research Institute	
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>
Local Funding Resources		<input type="checkbox"/> Short-Term (1-2 years)
		<input type="checkbox"/> Mid-Term (3-5 years)
		<input type="checkbox"/> Long-Term (5+ years)
		<input checked="" type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee	
<b>Action Item Status:</b>	Ongoing, from 2010 version of the NHMP	

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<sup>1</sup> Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver and Z.-C. Zhao, 2007: Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Action Item: Multi-Hazard #11	Alignment with Plan Goals:	High Priority?
Assess risk and determine and implement appropriate mitigation measures for Alsea area bridges and access routes.	<input checked="" type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
2016 Alsea Plan for emergency preparedness		
<b>Rationale for Proposed Action Item:</b>		
<p>Benton County has (and the Alsea Community) has a high probability and moderate vulnerability to Flooding and Winter Storms, and a moderate probability to the Cascadia Subduction Zone Earthquake and high vulnerability. There are several bridges that are single access transportation routes both in and out of Alsea. From Lobster Valley, South Fork, East of Alsea and West of Alsea there are bridges that come under the category of “vulnerable” to undercutting the support structures. This information can be found in the following link:  <a href="ftp://ftp.odot.state.or.us/Bridge/bridge_website_chittirat/2009_Seismic_Vulnerability_final.pdf">ftp://ftp.odot.state.or.us/Bridge/bridge_website_chittirat/2009_Seismic_Vulnerability_final.pdf</a>.</p> <p>These bridges are also potentially vulnerable to collapse during an earthquake and are on a seismic lifeline (Highway 34). See EQ #1 for additional earthquake related actions.</p> <p>(For additional information about Benton County’s hazard assessment – and implicit rationale for this action, see the Earthquake, Flood, and Winter Storm Hazard Sections, as well as the Risk Assessment Chapter of the State of Oregon’s Natural Hazards Mitigation Plan)</p>		
<b>Ideas for Implementation:</b>		
Perform risk analysis and subsequent mitigation measures.		
<b>Coordinating Organization:</b>	Public Works	
<b>Internal Partners:</b>	<b>External Partners:</b>	
Alsea Emergency Preparedness Council, Alsea School District, Alsea Rural Clinic, Alsea Library, Alsea Rural Fire Department	ODOT, OEM	
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>
Local Funding Resources, Pre-Disaster		<input checked="" type="checkbox"/> Short-Term (1-2 years) <input type="checkbox"/> Mid-Term (3-5 years)

Mitigation (PDM); Hazard Mitigation Grant Program (HMGP)			Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Benton NHMP Steering Committee (Alsea Emergency Preparedness Council)		
<b>Action Item Status:</b>	New, 2016 version of the NHMP		

<b>Action Item: Multi-Hazard #13</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Construct a raw water intake system to reduce risk and improve reliability in the case of a natural disaster.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
The plan is part of the existing preliminary planning process for providing water to the citizens of Corvallis due to a shift in the Willamette River.			
<b>Rationale for Proposed Action Item:</b>			
<p>Installation of a raw water intake system was identified in the 2001 Taylor Water Treatment Plant Intake Long Term Maintenance Study. The study identified alternative strategies to the rivers natural shift and included, constructing a new raw water intake, and a Ranney Collector system that would span the Willamette River with a network of pipes. Part of the overall strategy is to incorporate design standards to resist the affects of a natural disaster, and reduce the impact of drought and gravel buildup caused by flooding events.</p> <p>The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying existing public infrastructure with exposure to flood/ drought risk will allow the implementation of mitigation measures to reduce this risk.</p>			
<b>Ideas for Implementation:</b>			
Conduct an engineering study to identify location and alternative concepts to circumvent an interruption of water supply to the citizens of Corvallis and surrounding communities. After the study is complete a funding mechanism will be identified, preliminary design conducted, permits for construction secured, and system constructed.			
<b>Coordinating Organization:</b>	Corvallis Public Works		
<b>Internal Partners:</b>		<b>External Partners:</b>	
		Corps of Engineers, Fish and Wildlife, DEQ	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
SRF, Bonding Agencies		\$5,500,000	<input type="checkbox"/> Short-Term (1-2 years) <input checked="" type="checkbox"/> Mid-Term (3-5 years) <input type="checkbox"/> Long-Term (5+ years) <input type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	Corvallis NHMP Steering Committee (Public Works)		

**Action Item Status:**

New, 2016 version of the NHMP



<b>Action Item: Multi-Hazard #14</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Construct finished water transmission main from the Rock Creek Water Treatment Plant to the Baldy Water Reservoir.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
This action is identified in the City of Corvallis Water Management and Conservation Plan.			
<b>Rationale for Proposed Action Item:</b>			
<p>The current transmission main is 80 years old. Installation of a new water transmission main will incorporate design standards for earthquake reinforcement and will provide for a more reliable water supply into the future. The Rock Creek Water Treatment Plant provides about 30% of the City's annual water needs and is vital as a redundant source of water to the community in the event of drought or flood impacts to the Willamette River.</p> <p>The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying existing public infrastructure with exposure to earthquake/ drought risk will allow the implementation of mitigation measures to reduce this risk.</p>			
<b>Ideas for Implementation:</b>			
Conduct an engineering study and design for the construction of the transmission main. After the study is complete a funding mechanism will be identified, permits secured and project constructed.			
<b>Coordinating Organization:</b>	Corvallis Public Works		
<b>Internal Partners:</b>	<b>External Partners:</b>		
	City of Philomath		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
SRF, Bonding Agencies.	\$20,000,000		Short-Term (1-2 years)
		X	Mid-Term (3-5 years)
			Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Corvallis NHMP Steering Committee (Public Works)		
<b>Action Item Status:</b>	New, 2016 version of the NHMP		

Action Item: Drought #1	Alignment with Plan Goals:	High Priority?
Develop a drought impact assessment for Benton County.	<input checked="" type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
N/A		
<b>Rationale for Proposed Action Item:</b>		
<p>In order to reduce vulnerability to drought, it is important to first understand the impacts that drought causes within Benton County. Each drought produces a unique set of impacts, depending not only on the drought’s severity, duration, and spatial extent but also on ever-changing social conditions. These impacts are often symptoms of other underlying problems (vulnerabilities). Although Benton County can list the impacts that drought causes within the county, the Natural Hazards Mitigation Plan does not fully explain (or show specific understanding of) the cause of those impacts (i.e., the underlying problems, or vulnerabilities). In order to fully mitigate vulnerabilities, it is important to first develop a full impact assessment.</p>		
<b>Ideas for Implementation:</b>		
<p>An impact assessment highlights sectors, populations, or activities that are vulnerable to drought. Drought impact assessments begin by identifying direct consequences of drought, such as reduced crop yields, livestock losses, and reservoir depletion. These direct outcomes can then be traced to secondary consequences (often social effects), such as the forced sale of household assets or land, dislocation, or physical and emotional stress. This initial assessment identifies drought impacts but does not identify the underlying reasons for these impacts.</p> <p>Drought is typically associated with a number of potential impacts. For practical purposes, the drought impacts can be classified as economic, environmental, or social, even though several of the impacts may actually span more than one sector. Using an impact checklist is one easy way to help categorize drought impacts that affect your activities.</p> <p>Impacts should be examined for their relevance in past or recent droughts, but consideration should also be given to the question “What drought impacts will be seen in the future?” This last question is crucial as populations shift and water demands change.</p> <p>Understanding the changing nature of drought impact is an essential step in the process of reducing drought risk. Once this is done, the next step is to rank the impacts that most affect the county. Then, investigate the underlying causes of the drought impacts and begin the process of identifying and implementing appropriate drought mitigation actions. [Resource: <a href="http://drought.unl.edu/">http://drought.unl.edu/</a>]</p>		
<b>Coordinating Organization:</b>	Benton County Community Development	
<b>Internal Partners:</b>	<b>External Partners:</b>	

Benton County Public Works, Emergency Management, and Health departments		Water Resources Department; OSU Extension; Benton County Soil and Water Conservation District; Marys River Watershed Council, Oregon Climate Change Research Institute	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Local funding resources			Short-Term (1-2 years)
			Mid-Term (3-5 years)
			Long-Term (5+ years)
			X Ongoing
<b>Form Submitted by:</b>	Benton County Steering Committee		
<b>Action Item Status:</b>	Ongoing, from the 2010 version of the NHMP		

Action Item: Drought #2		Alignment with Plan Goals:	High Priority?								
Identify and develop a larger/ alternative water supply.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath								
<b>Participating Jurisdictions:</b>											
<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath											
<b>Alignment with Existing Plans/Policies:</b>											
Water Management and Conservation Plan											
<b>Rationale for Proposed Action Item:</b>											
There is currently one mainline to city.											
<b>Ideas for Implementation:</b>											
Develop a new water tank, possibly on Hospital Hill.											
<b>Coordinating Organization:</b>		Public Works									
<b>Internal Partners:</b>		<b>External Partners:</b>									
Civil West		OSU, Benton County, Adair Rural Fire and Rescue									
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>									
IFA, Water sales											
		<table border="1"> <tr> <td></td> <td>Short-Term (1-2 years)</td> </tr> <tr> <td>X</td> <td>Mid-Term (3-5 years)</td> </tr> <tr> <td></td> <td>Long-Term (5+ years)</td> </tr> <tr> <td></td> <td>Ongoing</td> </tr> </table>			Short-Term (1-2 years)	X	Mid-Term (3-5 years)		Long-Term (5+ years)		Ongoing
	Short-Term (1-2 years)										
X	Mid-Term (3-5 years)										
	Long-Term (5+ years)										
	Ongoing										
<b>Form Submitted by:</b>	Adair Village NHMP Steering Committee (Pat Hare)										
<b>Action Item Status:</b>	New, 2016 version of the NHMP										

<b>Action Item: Earthquake #1</b>	<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/ response facilities.	<input checked="" type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
N/A		
<b>Rationale for Proposed Action Item:</b>		
<p>Oregon Senate Bill 2 (2005) directed the Oregon Department of Geology and Mineral Industries (DOGAMI), in consultation with project partners, to develop a statewide seismic needs assessment that included seismic safety surveys of K-12 public school buildings and community college buildings that have a capacity of 250 or more persons, hospital buildings with acute inpatient care facilities, fire stations, police stations, sheriffs’ offices and other law enforcement agency buildings (see Earthquake Hazard Chapter for more information). However, a few schools in Benton County were not assessed. Those include: Alsea, and Kings Valley. The Benton County steering committee hopes to complete seismic assessments for those particular buildings. Others [currently unidentified] may be assessed as part of this project’s implementation as well.</p> <p>According to the RVS (2007) results there are a total of 16 structures rated with a ‘High’ collapse potential and 5 rated with a ‘Very High’ collapse potential; of these four have been mitigated through the Oregon Seismic Rehabilitation Grant Program (Corvallis Fire Stations #2 and #3, Philomath Fire Station, and Philomath Middle School). Note: College Hill High School was not assessed in 2007, future seismic vulnerability analyses should be considered for this school</p> <p>The Alsea Rural Fire Department (emergency equipment and first responders stationed here), the Alsea School (mass care facility), and Library (triage center and ICC designated site) are facilities that should be evaluated and retrofitted.</p> <p>(For additional information about Benton County’s earthquake hazard – and implicit rationale for this action, see the Earthquake Hazard Section, as well as the Earthquake Chapter of the State of Oregon’s Natural Hazards Mitigation Plan)</p>		
<b>Ideas for Implementation:</b>		

- A) Utilize a seismic rapid visual screening program for public buildings;
- B) Seek funding to support screening program;
- C) Begin implementing screening to inform local mitigation, response, continuity of operations, and recovery, planning efforts.

Partner with the Department of Geology and Mineral Industries to survey the Alsea and Kings Valley school buildings.

Apply for funding to retrofit (structural and non-structural); prioritize buildings with a 'high' or very high' risk of collapse.

<b>Coordinating Organization:</b>	Public Works/ County Emergency Management		
<b>Internal Partners:</b>	<b>External Partners:</b>		
Benton County GIS, Community Development	Special Districts in Benton County, Community Partners		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
Local Funding Resources, Seismic Rehabilitation Grant Program (SRGP); Pre-Disaster Mitigation (PDM); Hazard Mitigation Grant Program (HMGP)			Short-Term (1-2 years)
		X	Mid-Term (3-5 years)
			Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Corvallis NHMP Steering Committee		
<b>Action Item Status:</b>	Partially complete; revised from 2006 (Benton) and 2007 (Corvallis) versions of the NHMP		

<b>Action Item: Earthquake #2</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.		<input checked="" type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
N/A			
<b>Rationale for Proposed Action Item:</b>			
<p>Wood frame buildings with cripple wall perimeter systems are highly vulnerable to seismic damage. Cripple wall perimeter systems are short wooden walls that raise the first floor elevation above grade by typically 2 to 4 feet. Unbolted sill plates and cripple wall construction are common in pre-World War II construction. Visual inspection and the general vintage of building stock in Benton County suggest that there are likely significant numbers of buildings in Benton County with cripple wall foundations or with unbolted sill plates.</p> <p>(For additional information about Benton County’s earthquake hazard – and implicit rationale for this action, see the Earthquake Hazard Section, as well as the Earthquake Chapter of the State of Oregon’s Natural Hazards Mitigation Plan)</p>			
<b>Ideas for Implementation:</b>			
If resources allow, identify homes with cripple wall perimeter systems, and develop targeted education and outreach towards homeowners. If resources do not allow, disseminate general information to all Benton County residents about 1) how to identify a cripple wall perimeter system; 2) why cripple wall perimeter systems are highly vulnerable to seismic damage; and 3) how to retrofit cripple wall perimeter systems.			
<b>Coordinating Organization:</b>	Benton County Community Development		
<b>Internal Partners:</b>		<b>External Partners:</b>	
Benton County Assessment Office, GIS & Emergency Management		Cities and special districts in Benton County; IBHS, Benton County Home Builders Association	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Local Funding Resources			
			X
<b>Form Submitted by:</b>		Benton County NHMP Steering Committee	
<b>Action Item Status:</b>		Deferred, revised from 2006 version of the NHMP	

Action Item: Earthquake #3	Alignment with Plan Goals:	High Priority?								
Seismically retrofit the historic Benton County Courthouse, a vital public building. Consider both structural and non-structural retrofit options.	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath								
<b>Participating Jurisdictions:</b>										
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath										
<b>Alignment with Existing Plans/Policies:</b>										
Benton County Continuity of Operations Plan, Benton County Courthouse Emergency Action Plan										
<b>Rationale for Proposed Action Item:</b>										
<p>Benton County courthouse was constructed in 1888, and is the oldest courthouse in Oregon still in use. Roughly one hundred personnel have daily work stations inside, and the building is a critical structure for judicial, municipal, and law enforcement functions in the county. Furthermore, records of property ownership, elections, and vital statistics are also archived and maintained in the courthouse.</p> <p>The courthouse adjoins the Benton County Corrections Facility, which houses forty prisoners and ten corrections staff. Collapse of the courthouse would cause significant damage to the corrections facility and potentially jeopardize the safety of the community by releasing prisoners. An analysis of the seismic stability was completed in 2016; BOC will evaluate funding options.</p>										
<b>Ideas for Implementation:</b>										
Supplement current information with a complete, formal engineering study of seismic vulnerability. Seismically retrofit Benton County Courthouse to necessary standards.										
<b>Coordinating Organization:</b>	Benton County Commissioners									
<b>Internal Partners:</b>		<b>External Partners:</b>								
Benton County Public Works Department; Benton County District Attorney's Office		Oregon Judicial Department								
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>								
Pre-Disaster Mitigation (PDM) program; Seismic Rehabilitation Grant Program (SRGP), Local funding resources		<table border="1"> <tr> <td></td> <td>Short-Term (1-2 years)</td> </tr> <tr> <td>X</td> <td>Mid-Term (3-5 years)</td> </tr> <tr> <td></td> <td>Long-Term (5+ years)</td> </tr> <tr> <td></td> <td>Ongoing</td> </tr> </table>		Short-Term (1-2 years)	X	Mid-Term (3-5 years)		Long-Term (5+ years)		Ongoing
	Short-Term (1-2 years)									
X	Mid-Term (3-5 years)									
	Long-Term (5+ years)									
	Ongoing									
<b>Form Submitted by:</b>	Benton County Emergency Management									
<b>Action Item Status:</b>	Partially Complete, revised from 2010 version of the NHMP									



<b>Action Item: Earthquake #4</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Abandon water transmission lines on Marys River Bridge and bore new water transmission lines under Marys River.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
N/A			
<b>Rationale for Proposed Action Item:</b>			
<p>The Marys River bridge water transmission lines are considered critical facilities for the City of Corvallis and are vulnerable to earthquake damage.</p> <p>(For additional information about Benton County’s earthquake hazard – and implicit rationale for this action, see the Earthquake Hazard Section, as well as the Earthquake Chapter of the State of Oregon’s Natural Hazards Mitigation Plan)</p>			
<b>Ideas for Implementation:</b>			
Apply for funding to structurally retrofit the water transmission lines.			
<b>Coordinating Organization:</b>	Public Works		
<b>Internal Partners:</b>		<b>External Partners:</b>	
Community Development			
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Local Funding Resources, Seismic Rehabilitation Grant Program (SRGP); Pre-Disaster Mitigation (PDM); Hazard Mitigation Grant Program (HMGP)			<input checked="" type="checkbox"/> Short-Term (1-2 years)
			<input type="checkbox"/> Mid-Term (3-5 years)
			<input type="checkbox"/> Long-Term (5+ years)
			<input type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	Corvallis NHMP Steering Committee		
<b>Action Item Status:</b>	Partially complete; revised from 2007 version of the NHMP		

Action Item: Flood #1	Alignment with Plan Goals:	High Priority?
Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.	<input checked="" type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
Flood Insurance Study (completed by the Federal Emergency Management Agency); Comprehensive Plan, Goal 7		
<b>Rationale for Proposed Action Item:</b>		
<p>Benton County’s Flood Insurance Rate Maps were revised in 2011 (Flood Insurance Study effective June 2, 2011). The revision combined the Flood Insurance Rate Maps and Flood Insurance Study reports for Benton County and incorporated communities into the countywide format. Flood elevations were converted from NGVD 29 to NAVD 88. Detailed study areas were revised using topographic mapping (see FIS for more information).</p>		
<p><b>BFE for all approximate Zone A areas:</b> Benton County has approximately 365 river miles of Special Flood Hazard Areas (SFHAs) designated as approximate Zone A areas on the FIRM panels, the majority of which are located within the unincorporated areas of the county. This element would define BFE information for all of the approximate Zone A areas as well as refine the boundaries of these areas to more accurately reflect the actual flood hazard. Additional benefits of this element are that the resultant SFHAs would fully include all of the waterways that they are associated with (such as Greasy Creek and the Tum Tum River) and that there would be fewer instances of the SFHA being equally distant from the centerline of a waterway even regardless of the elevation differences between the banks on either side (in some cases, the elevation difference has been found to be as much as 40 feet).</p>		
<b>Ideas for Implementation:</b>		
Coordinate with the State Risk MAP Coordinator and State NFIP Coordinator (both at DLCD) and DOGAMI to assess new mapping needs.		
<b>Coordinating Organization:</b>	Benton County Community Development	
<b>Internal Partners:</b>	<b>External Partners:</b>	
Maps & GIS, and Assessment Offices	Department of Land Conservation and Development, Department of Geology and Mineral	

	Industries, FEMA		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
Risk MAP, Local funding resources (CIP Committee)	BFE determination: approximately \$70,000 (1 year timeline)	X	Short-Term (1-2 years)
			Mid-Term (3-5 years)
			Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Ongoing, revised from 2010 version of the NHMP		

Action Item: Flood #2	Alignment with Plan Goals:	High Priority?
Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.	<input type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
The Benton County Comprehensive Plan includes policies related to development in the floodplain. Additional policies (that potentially raise CRS ranking) may be added to the Comprehensive Plan.		
<b>Rationale for Proposed Action Item:</b>		
<p>The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:</p> <ol style="list-style-type: none"> <li>1. Reduce flood losses;</li> <li>2. Facilitate accurate insurance rating; and</li> <li>3. Promote the awareness of flood insurance.</li> </ol> <p>For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount (a Class 10 is not participating in the CRS and receives no discount).</p>		
<b>Ideas for Implementation:</b>		
<p>Currently, Benton County and Corvallis have a <u>CRS rating of 6</u>, which equals a 20% discount for special-flood hazard areas (SFHA), and a 10% discount for non-SFHA (Adair Village, Monroe, and Philomath are not participating).</p> <p>The CRS grants credit for 18 different activities that are organized within four categories:</p> <ol style="list-style-type: none"> <li>1. Public Information,</li> <li>2. Mapping and Regulations,</li> <li>3. Flood Damage Reduction, and</li> <li>4. Flood Preparedness.</li> </ol> <p>Communities receive a number of points for completion of different activities. The county should review the list of activities and determine a plan of action for reducing its CRS ranking from 6 to 5</p>		

(and then 4, 3, 2, and 1 if possible). Discounts to properties in SFHA can amount to 45% with a CRS ranking of 1.

<b>Coordinating Organization:</b>		Benton County Community Development	
<b>Internal Partners:</b>		<b>External Partners:</b>	
Benton County Emergency Management, Public Works, Public Information Officer, Board of Commissioners		Department of Land Conservation and Development, Federal Emergency Management Agency	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Pre-Disaster Mitigation Grant Program Hazard Mitigation Grant Program Flood Mitigation Assistance, local funding resources		Varies	
			X
<b>Form Submitted by:</b>		Benton County NHMP Steering Committee	
<b>Action Item Status:</b>		Ongoing, from 2010 version of the NHMP	

Action Item: Flood #3	Alignment with Plan Goals:	High Priority?
For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
<p>The Benton County Comprehensive Plan includes policies related to development in the floodplain. Action aligns with (and reinforces) existing policies.</p> <p>Action should be incorporated into the Benton County Public Works list of Bridge and Culverts Projects</p>		
<b>Rationale for Proposed Action Item:</b>		
<p>Benton County’s Comprehensive Plan states that floodplain management policies and actions will continue to emphasize more preventative than corrective measures. Maintaining ditches to avoid obstructed water flow and flooding is a very effective (and also cost-effective) preventative measure.</p> <p>Throughout Benton County, there are localized areas that are at risk of flooding, but are not included in the FEMA mapped floodplains. In many cases, local storm water drainage flooding occurs along unnamed gullies or simply in low spots. Unlike FEMA-mapped floodplains for larger rivers and creeks, areas subject to stormwater drainage are not systematically mapped. In lower population density areas, stormwater drainage systems are generally open drainage ditches. As such, flooding is likely to occur in areas that are obstructed by debris or vegetation. Regular clearing and maintenance of these ditches can prevent unforeseen flooding.</p>		
<b>Ideas for Implementation:</b>		
Incorporate regular maintenance activities into list of bridge & culvert projects.		
<b>Coordinating Organization:</b>	Benton County Public Works – Road Maintenance Division	
<b>Internal Partners:</b>	<b>External Partners:</b>	
Benton County Emergency Management, Community Development	Marys River Watershed	
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>
Local funding resources (General funds), HMGP, FMA		<input type="checkbox"/> Short-Term (1-2 years)
		<input type="checkbox"/> Mid-Term (3-5 years)
		<input type="checkbox"/> Long-Term (5+ years)
		<input checked="" type="checkbox"/> Ongoing

<b>Form Submitted by:</b>	Benton County NHMP Steering Committee
<b>Action Item Status:</b>	Ongoing, revised from the 2010 version of the NHMP

Action Item: Flood #5	Alignment with Plan Goals:	High Priority?
Mitigate flooding of South 13th Street area.	<input type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
<p>The Philomath Comprehensive Plan includes policies related to development in the floodplain. Action aligns with (and reinforces) existing policies.</p> <p>Action should be incorporated into the Public Works CIP.</p>		
<b>Rationale for Proposed Action Item:</b>		
<p>Philomath’s Comprehensive Plan states that floodplain management policies and actions will continue to emphasize more preventative than corrective measures. Maintaining ditches to avoid obstructed water flow and flooding is a very effective (and also cost-effective) preventative measure.</p> <p>Throughout Philomath, there are localized areas that are at risk of flooding, but are not included in the FEMA mapped floodplains. In many cases, local storm water drainage flooding occurs along unnamed gullies or simply in low spots. Unlike FEMA-mapped floodplains for larger rivers and creeks, areas subject to stormwater drainage are not systematically mapped. In lower population density areas, stormwater drainage systems are generally open drainage ditches. As such, flooding is likely to occur in areas that are obstructed by debris or vegetation. Regular clearing and maintenance of these ditches can prevent unforeseen flooding.</p> <p>The nature of the flood problem is due to the fact the Marys River fills up and crests it’s banks and floods out lower areas of town mainly S 13th Street up to Cedar Street. One of the contributing factors to the Marys River cresting is due to the fact that the receiving river (Willamette) usually crests around the same time.</p> <p>When the Marys River crests, approximately 20 to 30 homes are surrounded by rising water. A major truck route is impassable and many residents that live on the other side of the river are denied access to getting into town without a 20 to 30-minute detour.</p>		
<b>Ideas for Implementation:</b>		
<p>Develop flood mitigation plan and mitigate at-risk buildings and infrastructure (consider low-impact development options).</p> <p>Work with USACE (Oregon Silver Jackets), to assist with flooding of Marys River (redirect, dredge, dam).</p>		
<b>Coordinating Organization:</b>	Public Works	
<b>Internal Partners:</b>	<b>External Partners:</b>	



Planning		Corvallis, DLCD, USACE, Silver Jackets	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Local funding resources (General funds), HMGP, FMA, PDM, Silver Jackets			Short-Term (1-2 years)
			Mid-Term (3-5 years)
		X	Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Philomath NHMP Steering Committee		
<b>Action Item Status:</b>	New, 2016 version of the NHMP		

Action Item: Flood #6		Alignment with Plan Goals:	High Priority?
Improve remote draft site at Daisy Drive in Marys River Estates.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
<b>Rationale for Proposed Action Item:</b>			
<p>Pump at remote draft site needs to be removed 2-3 times a year due to flooding. Removal of pump leaves local community without water source for fire fighting.</p> <p>The pump itself sits about 10' up and 80' distant from the inlet buried in the Mary's River. The low summer months are taken into account to be able to reach the water and still get adequate supplies. During the winter, when the river runs near flood stage, is when the housing where the pump sits floods, and the pump has to be taken out so it does not get damaged. When the water recedes it takes a couple of weeks (if not longer) to dry out. The original plan was to only have the pump there during the summer months to augment the wildland fire season. Philomath Fire &amp; Rescue started leaving the pump there year-round, except for periods of flooding – but the community is now expecting the pump to be in place 24x7. To resolve the winter flooding issue and also provide for summertime water access will take an engineering study, and likely a new pumping system.</p>			
<b>Ideas for Implementation:</b>			
Build a second building (pump house) at higher elevation outside of flood area.			
<b>Coordinating Organization:</b>		Philomath Fire and Rescue	
<b>Internal Partners:</b>		<b>External Partners:</b>	
Benton County Public Works, Planning, Emergency Management		Marys River Estates residents	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Local funding resources (General funds)			<input type="checkbox"/> Short-Term (1-2 years) <input checked="" type="checkbox"/> Mid-Term (3-5 years) <input type="checkbox"/> Long-Term (5+ years) <input type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	NHMP Steering Committee (Philomath Fire & Rescue)		
<b>Action Item Status:</b>	New, 2016 version of the NHMP		

Action Item: Flood #7	Alignment with Plan Goals:	High Priority?
Identify all structures with floors below the Base Flood Elevation and prioritize mitigation based on flood risk and type of required mitigation.	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
The Benton County Comprehensive Plan includes policies related to development in the floodplain. Action aligns with (and reinforces) existing policies.		
<b>Rationale for Proposed Action Item:</b>		
<p>Benton County's Comprehensive Plan states that floodplain management policies and actions will continue to emphasize more preventative than corrective measures.</p> <p>To quantify the level of flood hazard for buildings and other facilities or infrastructure within mapped floodplains, it is necessary to determine both the elevations of these structures and the Base Flood Elevations (BFEs) at the structure locations. Only by determining these two elevations for each potentially flood-prone structure, can the level of flood hazard (frequency and severity of flooding) be calculated accurately. Similarly, acquiring elevation data for additional structures within the 500-year flood plain as well as for structures in other flood-prone areas outside of mapped floodplains would greatly increase the accuracy of hazard, inventory, and vulnerability assessments for floods in Benton County.</p>		
<b>Ideas for Implementation:</b>		
<ul style="list-style-type: none"> <li>• Identify all of the structures in the floodplain, as well as the structure types (i.e. dwelling, accessory structure, commercial structure, etc.)</li> <li>• Identify (at a minimum) the floor, adjacent grade, and flood elevations for all dwellings and commercial/industrial structures.</li> <li>• Identify the best method of mitigation (i.e. relocation, replacement, elevation, demolition, etc.) for each structure from step 2.</li> <li>• Create two prioritization lists: one list based on which structures are at most risk of damage due to flood events, the other list based on which type of mitigation is required. That way, should funding become available, we would know immediately where to start.</li> </ul>		
<b>Coordinating Organization:</b>	Benton County GIS	
<b>Internal Partners:</b>		<b>External Partners:</b>
Benton County Emergency Management, Community Development		DLCD, FEMA, DOGAMI
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>
Local funding resources (General funds),		Short-Term (1-2 years)

HMGP, FMA		X	Mid-Term (3-5 years)
			Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Partially Complete, revised from the 2010 version of the NHMP		

<b>Action Item: Landslide #1</b>	<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	<input type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
Comprehensive plans, Lidar data available from DOGAMI		
<b>Rationale for Proposed Action Item:</b>		
<p>The Landslide Annex of Benton County’s risk assessment identified the potential for landslides to cause damage to buildings and infrastructure within the county; landslides may cause road closures and interruptions to utility services. The annex also identified previous incidents of landslides that affected the county. Road closures sometimes force residents to find alternate transportation routes. Reviewing and monitoring existing public infrastructure to identify specific exposure to landslide risk.</p> <p>The Alsea Rural Health Clinic sits beneath a potential landslide area. No landslide/seismic event analysis has been completed. The Benton County Health Department has designated the Library, just across Highway 34 from the clinic, as a triage center during a disaster. These two structures would be severely impacted if a landslide were to occur. The Library is also designated as an ICC. Alsea’s water supply is stored in tanks sitting at the top of the potential landslide area. A landslide which will disrupt the water supply will certainly be a severe effect upon the community of Alsea.</p> <p>The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying existing public infrastructure with exposure to landslide risk will allow the implementation of mitigation measures to reduce this risk.</p>		
<b>Ideas for Implementation:</b>		
Utilize the Landslide Susceptibility Map and Data (DOGAMI O-16-02) to perform landslide risk analysis. Use the new information to prioritize risk reduction actions. Perform risk reduction. Update/ develop Landslide Ordinances as applicable		
<b>Coordinating Organization:</b>	Benton County Community Development	
<b>Internal Partners:</b>		<b>External Partners:</b>
Benton County GIS Department, Emergency Management		DOGAMI, DLCD
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>

Risk MAP, PDM, HMGP, Local Funding Resources		X	Short-Term (1-2 years)
			Mid-Term (3-5 years)
			Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Partially Complete, revised from the 2010 version of the NHMP		

<b>Action Item: Landslide #2</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Complete geotechnical analysis of the slope on NW Witham Hill Drive from NW Canary Drive to NW Walnut Boulevard and implement rehabilitation strategies to stabilize the slope.		<input checked="" type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
<b>Rationale for Proposed Action Item:</b>			
<p>The Landslide annex of Corvallis’s risk assessment identified the potential for landslides to cause damage to buildings and infrastructure within the Witham Hill area; landslides may cause road closures and interruptions to utility services. The annex also identified previous incidents of landslides that affected the area. Road closures sometimes force residents to find alternate transportation routes. Reviewing and monitoring existing public infrastructure to identify specific exposure to landslide risk.</p> <p>The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying existing public infrastructure with exposure to landslide risk will allow the implementation of mitigation measures to reduce this risk.</p>			
<b>Ideas for Implementation:</b>			
Perform a geotechnical investigation to determine the cause and extent of the settlement and movement of NW Witham Hill Drive from NW Canary Drive to NW Walnut Boulevard. Develop and implement rehabilitation strategies base on investigation results.			
<b>Coordinating Organization:</b>	Public Works		
<b>Internal Partners:</b>		<b>External Partners:</b>	
Community Development		DOGAMI, DLCD	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Local Funding Resources, PDM, HMGP			<input checked="" type="checkbox"/> Short-Term (1-2 years) <input type="checkbox"/> Mid-Term (3-5 years) <input type="checkbox"/> Long-Term (5+ years) <input type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	Corvallis NHMP Steering Committee		
<b>Action Item Status:</b>	New, 2016 version of the NHMP		

Action Item: Wildfire #1	Alignment with Plan Goals:	High Priority?
Implement actions identified in the Community Wildfire Protection Plan.	<input checked="" type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
<p>The goals of the CWPP include integration with the National Fire Plan, the Healthy Forests Restoration Act, and the Disaster Mitigation Act.</p> <p>The CWPP builds on and supplements the wildfire chapter of the Benton County Natural Hazards Mitigation Plan.</p>		
<b>Rationale for Proposed Action Item:</b>		
<p>The Benton County Community Wildfire Protection Plan (CWPP) was developed in 2009 and is being updated in 2016. The CWPP expanded on the 2006 version of Benton County’s Natural Hazards Mitigation Plan’s wildfire chapter. Although published in 2009 as a separate document, the CWPP is intended to supplement this Natural Hazards Mitigation Plan. As such, and to reduce duplicative efforts, Benton County’s Natural Hazards Mitigation Plan steering committee recommended that the CWPP replace the Wildfire Hazard Chapter.</p> <p>Critical to implementation of the CWPP are the identification and implementation of an integrated schedule of action items targeted at achieving a reduction in the number of human caused fires and the impact of wildland fires in Benton County. The CWPP includes actions that are categorized as follows:</p> <ul style="list-style-type: none"> <li>• Policy and Planning Efforts</li> <li>• Infrastructure Enhancements</li> <li>• Resource and Capability Enhancements</li> <li>• Public Works Access Improvement Projects</li> </ul>		
<b>Ideas for Implementation:</b>		
<p>The CWPP will be reviewed at least annually at special meetings of the planning committee, open to the public and involving all municipalities / jurisdictions, where action items, priorities, budgets, and modifications can be made or confirmed. The Benton County Community Development Department (or other designee of the Benton County Commissioners) is responsible for scheduling, publicizing, and leading the review meetings. During these meetings, participating jurisdictions will report on their respective projects and identify needed changes and updates to the existing plan.</p> <p>Incorporate the Benton County CWPP into this NHMP at one of the two semi-annual meetings following the adoption of the 2015-16 update.</p>		
<b>Coordinating Organization:</b>	Various (see CWPP)	



<b>Internal Partners:</b>		<b>External Partners:</b>	
Support identified in CWPP		Support identified in CWPP	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
National Fire Plan, Healthy Forest Restoration Act, FEMA, ODF Community Assistance Grant			Short-Term (1-2 years)
			Mid-Term (3-5 years)
			Long-Term (5+ years)
			X Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Ongoing, from 2010 version of the NHMP		

<b>Action Item: Winter Storm #1</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Ensure that all critical facilities have backup power and emergency operations plans to deal with power outages.		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input type="checkbox"/> Benton County <input checked="" type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
<b>Rationale for Proposed Action Item:</b>			
Power outages are at best an inconvenience and at worst a serious public safety concern. Critical facilities such as hospitals, schools, high-rise buildings, and senior centers pose various risks if deprived of electricity for extended periods. Power outages can mean people trapped in elevators, intersection lights that don't work, no air conditioning for elderly residents on a hot day, and numerous other problems that require emergency response personnel.			
<b>Ideas for Implementation:</b>			
Use GIS to identify critical facilities potentially affected by power outages and track where those outages occur. Obtain a generator for the Adair Village Wastewater Treatment Plant. Determine which additional facilities need backup power, and assist in obtaining funding or power supply. Develop continuity of operations plan templates (or emergency operation plan templates) for critical facilities. Train personnel to develop and implement plans.			
<b>Coordinating Organization:</b>	Public Works		
<b>Internal Partners:</b>		<b>External Partners:</b>	
		Benton County Emergency Management, Community Development; Private Owners	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
IFA, Water sales			<input checked="" type="checkbox"/> Short-Term (1-2 years) <input type="checkbox"/> Mid-Term (3-5 years) <input type="checkbox"/> Long-Term (5+ years) <input type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	Benton/ Corvallis/ Adair Village NHMP Steering Committee		
<b>Action Item Status:</b>	Partially Complete, revised from 2010 version of the Benton NHMP		

## APPENDIX A-2: ACTION ITEM POOL

Tables A-6 to A-10, below, and the subsequent action item forms, are the complete list of non-priority actions for the 2016 Benton County NHMP (Action Item Pool). Each jurisdiction reviewed the updated actions from the previous plan and opted to participate in specific actions as shown in the following tables. *Note: If an action item listed below is a prioritized action for at least one jurisdiction it will have a form within Appendix A-1.*

**Table A-6 Benton County Action Item Pool**

Action Item ID	Action Item
<b>Action Item Pool</b>	
<b>Multi-Hazard</b>	
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.
MH #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.
MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.
MH #12	Rebuild the railroad crossing on SW 53rd Street south of SW Reservoir Avenue.
<b>Drought</b>	
DR #1	Develop a drought impact assessment for Benton County.
<b>Earthquake</b>	
EQ #1	Expand and complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/response facilities.
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.
<b>Flood</b>	
FL #2	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.

**Table A-7 Adair Village Action Item Pool**

Action Item ID	Action Item
<b>Action Item Pool</b>	
<b>Earthquake</b>	
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.

**Table A-8 Corvallis Action Item Pool**

Action Item ID	Action Item
<b>Action Item Pool</b>	
<b>Multi-Hazard</b>	
MH #2	Deliver education programs aimed at mitigating the risk posed by hazards.
MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.
MH #7	Inventory and remove high-risk trees in City right of way
MH #8	Periodically update the inventory of locations in Corvallis subject to repetitive tree fall problems.
MH #9	Update website to include mitigation activities, opportunities, and success stories
MH #10	Develop invasive pest action plan for Emerald Ash Borer (and others impacting municipal trees).
<b>Earthquake</b>	
EQ #2	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.
<b>Flood</b>	
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.
<b>Landslide</b>	
LS #3	Complete a detailed inventory of locations where critical facilities and infrastructure are subject to landslides
<b>Winter Storm</b>	
WT #1	Ensure that all critical facilities in Corvallis have backup power and emergency operations plans to deal with power outages

**Table A-9 Monroe Action Item Pool**

Action Item ID	Action Item
<b>Action Item Pool</b>	
<b>Flood</b>	
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.

**Table A-10 Philomath Action Item Pool**

Action Item ID	Action Item
<b>Action Item Pool</b>	
<b>Multi-Hazard</b>	
MH #1	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.
MH #7	Inventory and remove high-risk trees in City right of way
<b>Flood</b>	
FL #3	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches
FL #4	Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.

The action item forms that follow are for the non-priority actions that were identified in a previous NHMP (Benton County NHMP or Corvallis NHMP). Actions from Table A-6 through A-10 (above) that do not have an Action Item Form will have one created by the steering committee if and when they become a prioritized action item.

Action Item: Multi-Hazard #5	Alignment with Plan Goals:	High Priority?
<p>List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.</p>	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
The recovery plan should work in conjunction with the Natural Hazards Mitigation Plan		
<b>Rationale for Proposed Action Item:</b>		
<p>Achieving sustainability, which, in a disaster-related context, means the ability to survive future natural disasters with minimum loss of life and property, is the overarching goal of planning for post-disaster reconstruction. (Source: FEMA, "Policies for Guiding Planning for Post-Disaster Recovery and Reconstruction")</p> <p>Public decisions taken in the heat of the emergency period immediately following a disaster often compromise significant opportunities to rebuild a safer community for the future. The pressure exerted by residents and property owners to have their disaster-stricken community rebuilt to its pre-disaster form and condition as quickly as possible remains a powerful factor in local, state, and federal emergency management to this day. There are ways to restrain such pressures and maintain mitigation and other post-disaster goals as high priorities during the process of long-term reconstruction even as the ashes, the rubble, and the water are receding or being cleared away. The secret lies in identifying in advance those decisions that will need to be made after a disaster that are most likely to have long-term repercussions for hazard mitigation. (Source: FEMA, "Policies for Guiding Planning for Post-Disaster Recovery and Reconstruction")</p> <p>Pre-disaster and post-disaster mitigation should be two parts of a seamless whole in a sound plan for post-disaster recovery and reconstruction. The only difference, although it is often a major difference, is one of scale, of accelerating the pace with which existing mitigation plans are implemented, as a result of the influx of outside assistance. What is important about planning for post-disaster hazard mitigation is that the additional resources that facilitate local hazard mitigation in the aftermath of a disaster do not materialize by accident. Local governments manage to secure such resources in large part because they have planned to do so. (Source: FEMA, "Policies for Guiding Planning for Post-Disaster Recovery and Reconstruction")</p>		
<b>Ideas for Implementation:</b>		

Utilize the county’s natural hazards mitigation plan as a starting point for developing a long-term post-disaster recovery plan. Both plans should work from the same risk assessment, mission, and goals.

Designate a recovery management team that is empowered to monitor the process and implement the community’s post-disaster recovery policies. This team should also serve as the post-disaster recovery planning team, and can/should include persons involved in pre-disaster mitigation planning efforts. Involve a wide range of stakeholders and community leaders/volunteers. Discuss post-disaster recovery planning at future mitigation plan maintenance / implementation meetings.

Seek funding sources and/or outside assistance to help facilitate this process and the development of a post-disaster recovery plan.

<b>Coordinating Organization:</b>	Benton County Natural Hazards Mitigation Steering Committee		
<b>Internal Partners:</b>	<b>External Partners:</b>		
Benton County Emergency Management, Community Development, Public Works, Linn-Benton Vulnerable Populations Group	FEMA, Oregon Emergency Management, DLCD		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
Homeland Security Grant Program (2016-17)			Short-Term (1-2 years)
			Mid-Term (3-5 years)
		X	Long-Term (5+ years)
			Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	Ongoing, from 2010 version of the NHMP		

<b>Action Item: Multi-Hazard #12</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Rebuild the railroad crossing on SW 53 <sup>rd</sup> Street south of SW Reservoir Avenue		<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
Benton County Transportation System Plan/ CIP			
<b>Rationale for Proposed Action Item:</b>			
<p>Currently, 53<sup>rd</sup> St crosses under the rail line in a sunken grade. The section of 53rd Street that passes under the railroad trestle is a known high water area that routinely gets closed during flood/significant rain events. Building a safe crossing would reduce this substantial traffic hazard for a major collector in one of the most rapidly growing residential and business areas in Benton County.</p> <p>Right-of-way to be purchased in 2016, design phase may follow; unknown funding amount/ timeline, significant grant funds will be required.</p> <p>The Willamette &amp; Pacific Railroad (WPRR) provides local freight rail service on lines that are leased from the Union Pacific Railroad (UP).</p>			
<b>Ideas for Implementation:</b>			
Modify 53 <sup>rd</sup> St crossing of the railroad track, including all necessary safety and warning equipment and signs.			
<b>Coordinating Organization:</b>	Benton County Public Works		
<b>Internal Partners:</b>	<b>External Partners:</b>		
Community Development	Willamette & Pacific Railroad, Union Pacific Railroad		
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>	
Local Funding Resources, bridge grants, safety funds		<input type="checkbox"/>	Short-Term (1-2 years)
		<input type="checkbox"/>	Mid-Term (3-5 years)
		<input checked="" type="checkbox"/>	Long-Term (5+ years)
		<input type="checkbox"/>	Ongoing
<b>Form Submitted by:</b>	Benton County Public Works		
<b>Action Item Status:</b>	Ongoing, revised from the 2010 version of the NHMP		



<b>Action Item: Flood #4</b>		<b>Alignment with Plan Goals:</b>	<b>High Priority?</b>
Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.		<input checked="" type="checkbox"/> Goal 1 <input checked="" type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>			
<input checked="" type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input checked="" type="checkbox"/> Corvallis <input checked="" type="checkbox"/> Monroe <input checked="" type="checkbox"/> Philomath			
<b>Alignment with Existing Plans/Policies:</b>			
Flood Insurance Study, FIRMs, Comprehensive Plan, Development Code			
<b>Rationale for Proposed Action Item:</b>			
<p>Concentrations of pre-FIRM structures in areas subject to flooding are present in several areas along the County's major rivers. Experience with the floods of the late 1990s showed that properly elevated structures in the floodplain performed well during major flood events, most suffering minimal if any, damage. Especially in areas that may be subject to damage during relatively high frequency flood events, elevating structures in conformance with the County's flood hazard area codes (lowest floor at least 12-inches above the base flood elevation for Corvallis, Monroe, and Philomath and 18-inches for Benton County) is a cost effective way to reduce risk.</p>			
<b>Ideas for Implementation:</b>			
<p>Seek grant funding for mitigation projects including structure elevation and relocation. Establish eligibility criteria, focusing on repetitive loss properties and structures located at the lowest elevations.</p> <p>Implement public outreach and information campaigns to identify and inform property owners of the program.</p>			
<b>Coordinating Organization:</b>	Benton County Community Development		
<b>Internal Partners:</b>		<b>External Partners:</b>	
Benton County Emergency Management, Public Works		Department of Land Conservation and Development, FEMA	
<b>Potential Funding Sources:</b>		<b>Estimated cost:</b>	<b>Timeline:</b>
Flood Mitigation Assistance Pre-Disaster Mitigation (PDM) Program Hazard Mitigation Grant Program (HMGP), Local funding resources			<input checked="" type="checkbox"/> Short-Term (1-2 years)
			<input type="checkbox"/> Mid-Term (3-5 years)
			<input type="checkbox"/> Long-Term (5+ years)
			<input checked="" type="checkbox"/> Ongoing
<b>Form Submitted by:</b>	Benton County NHMP Steering Committee		
<b>Action Item Status:</b>	New, 2015		

## APPENDIX A-3: ACTION ITEM FORM

Action Item: [Hazard] [#]	Alignment with Plan Goals:	High Priority?
	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 5	<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath
<b>Participating Jurisdictions:</b>		
<input type="checkbox"/> Benton County <input type="checkbox"/> Adair Village <input type="checkbox"/> Corvallis <input type="checkbox"/> Monroe <input type="checkbox"/> Philomath		
<b>Alignment with Existing Plans/Policies:</b>		
<b>Rationale for Proposed Action Item:</b>		
<b>Ideas for Implementation:</b>		
<b>Coordinating Organization:</b>		
<b>Internal Partners:</b>	<b>External Partners:</b>	
<b>Potential Funding Sources:</b>	<b>Estimated cost:</b>	<b>Timeline:</b>
		<input type="checkbox"/> Short-Term (1-2 years) <input type="checkbox"/> Mid-Term (3-5 years) <input type="checkbox"/> Long-Term (5+ years) <input type="checkbox"/> Ongoing
<b>Form Submitted by:</b>		
<b>Action Item Status:</b>		

# APPENDIX B: PLANNING AND PUBLIC PROCESS

## Plan Update Changes

This memo describes the changes made to the 2007 Corvallis NHMP and 2011 Benton County Natural Hazards Mitigation Plan (NHMP) during the 2015-2016 plan update process. Major changes are documented by plan section.

## Project Background

Benton County and incorporated cities partnered with the Oregon Partnership for Disaster Resilience (OPDR) to update the stand alone 2007 Corvallis NHMP and the stand alone 2011 Benton County Natural Hazards Mitigation Plans (NHMP). 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. OPDR met with members of the Benton County and Corvallis steering committee to update portions of their NHMPs. During this update cycle the cities of Adair Village, Monroe, and Philomath opted to participate; as such the 2016 plan is multi-jurisdictional. In addition, Corvallis opted to merge its stand alone plan into the multi-jurisdictional plan. OPDR and the committees made several changes to the previous NHMPs. Major changes are documented and summarized in this memo.

## 2016 Plan Update Changes

The sections below only discuss *major* changes made to the NHMPs during the 2015-2016 plan update process. Major changes include the replacement or deletion of large portions of text, changes to the plan's organization, new mitigation action items, and the addition of city addenda to the plan. If a section is not addressed in this memo, then it can be assumed that no significant changes occurred.

The plan's format and organization have been altered to fit within OPDR's plan templates. Table B.1 below lists the 2011 Benton County NHMP plan section names and the corresponding 2016 section names, as updated (major Volumes are highlighted). This memo will use the 2016 plan update section names to reference any changes, additions, or deletions within the plan.

**Table B-1 Changes to Plan Organization**

2011 Benton County Stand-Alone NHMP	2016 Benton County Multi-jurisdictional NHMP
Acknowledgements	Acknowledgements
Approval Letters and Resolutions	Table of Contents
FEMA Review Tool	Approval Letters and Resolutions
Table of Contents	FEMA Review Tool
<b>Volume I: Basic Plan</b>	<b>Volume I: Basic Plan</b>
Executive Summary	Plan Summary
Section 1: Introduction	Section 1: Introduction
Section 2: Community Overview	Section 2: Risk Assessment and Appendix C: Community Profile
Section 3: Mission, Goals, and Action Items	Section 3: Mitigation Strategy
Section 4: Plan Implementation and Maintenance	Section 4: Plan Implementation and Maintenance
<b>Volume II: Hazard Chapters</b>	<b>Volume I: Basic Plan</b>
Drought	Section 2: Risk Assessment and Appendix C: Community Profile
Earthquake	
Flood	
Landslide	
Volcano	
Wildfire	
Windstorm	
Winter Storm	
<b>Volume III: City/ Special District Addendums</b>	<b>Volume II: City Addenda</b>
None provided. Corvallis created a stand alone plan following their participation in the 2006 NHMP process.	Adair Village Corvallis Monroe Philomath
<b>Volume IV: Resource Appendices</b>	<b>Volume IV: Appendices</b>
Appendix A: Action Item Forms	Appendix A: Action Items
Appendix B: Planning and Public Process	Appendix B: Planning and Public Process
Appendix C: Economic Analysis of Natural Hazard Mitigation Projects	Appendix D: Economic Analysis of Natural Hazard Mitigation Projects
Appendix D: Benton County Hazard Analysis	Section 2: Risk Assessment
-	Appendix E: Grant Programs
-	Appendix F: Community Survey

Several new sections were added and formatting was changed throughout the 2015 Benton County Multi-jurisdictional NHMP.

Note: The Corvallis NHMP (2007) has been incorporated throughout this 2016 multi-jurisdictional NHMP. Hazard sections provided in that plan have been included within Section 2, *Risk Assessment*, and the Corvallis Addendum. The previous Corvallis NHMP

included extensive information on Dam Safety and Disruption of Utility and Transportation Systems, this information has been provided in Appendix C: Community Profile as applicable.

## Front Pages

1. The plan's cover has been updated.
2. Acknowledgements have been updated to include the 2016 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 NHMP)*

## Volume I: Basic Plan

Volume I provides the overall plan framework for the 2016 Multi-jurisdictional NHMP update. Volume I includes the following sections:

### Plan Summary

The 2016 NHMP 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?" Additionally, Section 1 summarizes the 2016 plan update process, and provides an overview of how the plan is organized. Major changes to Section 1 include the following:

- Most of Section 1 includes new information that replaces out of date text found in the 2011 NHMP. 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 of the 2016 update, outlines the entire layout of the plan update, which has been altered as described above.

### Section 2: Risk Assessment

Section 2, 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:

- The hazard chapters of the previous Benton NHMP and Corvallis NHMP have been integrated into this section and within Appendix C, *Community Profile*.
- Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. Information previously provided in the Hazard Chapters is placed in this section. Extraneous information was removed and links to technical reports were added as a replacement.

- Links to specific hazard studies and data are embedded directly into the plan where relevant and available.
- National Flood Insurance Program (NFIP) information was updated.
- Updated hazard assessment (history, maximum threat, probability, and vulnerability scores) for the county (city information is included in this section and with more detail within the City Addenda of Volume II).

### Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the NHMP. Major changes to Section 3 include the following:

- The section name changed from “Mission, Goals, Actions” to “Mitigation Strategy”
- Updated goals, reviewed and revised to align with the State NHMP.
- The revision of existing actions, lead agency and partner designations (as shown in Table 3-2, tables within the city addenda, and Appendix A).
- A list of prioritized actions for each jurisdiction (including new action item forms in Appendix A).
- The Benton County and Corvallis steering committees met to review the previous NHMP action items. Steering Committee members and stakeholders provided updates and edits to the actions where applicable.
- New action items are based upon continuous community needs, the identification of new hazards, deferred action items, and current needs based upon the community risk assessment. They are designed to be feasibly accomplished within the next five years, and can be found in Appendix A.
- The cities of Adair Village, Monroe, and Philomath met following the county and Corvallis meetings to review the updates and to add their own action items.

### Section 4: Plan Implementation and Maintenance

The steering committee did not formally meet since the previous version of this NHMP. Progress towards action items is documented in the action item section below (Appendix A). The steering committee agreed to meet semi-annually and the Benton County Emergency Services Planner will be the plan convener (documentation for the city conveners is within the jurisdictional addenda of Volume II). The steering committees will discuss options to integrate the NHMP into other planning documents (including the comprehensive plan) during their semi-annual meetings.

### **Volume II: Jurisdictional Addenda**

The cities of Adair Village, Monroe, and Philomath in the 2016 version of the NHMP for the first time. Corvallis was included with an addendum (previously Corvallis had a stand alone NHMP). Changes to Corvallis’ NHMP are shown within the appropriate plan section in this document.

### **Volume III: Appendices**

Below is a summary of the appendices included in the 2016 NHMP:

#### Appendix A: Action Item Forms

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 Benton County, are listed in Table 3-2 within Section 3, *Mitigation Strategy*, and within the city addenda for each of the participating cities. The lists below track progress made towards previous plans’ actions. Benton County progress is listed first, followed by Corvallis (*in the list below the previous action item number is listed first, followed by the 2016 action item number as applicable*).

**Table B-2 Action Item Status and Changes**

2016 Action Item ID	Previous Action Item ID	2016 Action Item	Status	Notes	Benton	Adair	Corvallis	Monroe	Philomath
<b>Multi-Hazard</b>									
MH #1	Benton WD #1/ Benton WS #2/ Corvallis WT LT #2	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Deferred	The revised action includes identification, prioritization, and mitigation of critical transmission and community water systems. Consumer power undergrounds utility lines when possible. There has not been a deliberate county led effort to identify the critical transmission lines and harden the infrastructure.	P	P	P	P	X
MH #2	Benton MH #2/ Corvallis MH LT #1	Deliver education programs aimed at mitigating the risk posed by hazards.	Ongoing	The Benton County Emergency Management website includes information aimed at mitigating the risk posed by hazards as do the area fire departments. The Benton County CERT program is used in the implementation of education and outreach programs. Corvallis: Wildfire information provided on request, earthquake information also available via FEMA brochure. Nothing specific to local hazards has been developed.	X	P	X		
MH #3	Benton MH #3	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	Ongoing	Corvallis and Benton County have integrated the NHMP into their Comprehensive Plans.	P	P	P	P	P
MH #4	Benton MH #4/ Benton LS #1/ Benton FL #3/ Corvallis MH ST #4	Develop detailed inventories of at-risk public buildings and infrastructure and prioritize mitigation actions, especially for critical facilities.	Ongoing	Public buildings and infrastructure are mostly inventoried, some projects have occurred to retrofit (see actions below for more information). County and Corvallis will continue to prioritize and retrofit.	X	P	P	P	P
MH #5	Benton MH #5	List and prioritize the hazards likely to warrant recovery plans. Develop appropriate and necessary community recovery plans starting with the highest priority hazards. Continue to integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Ongoing	Seeking grant funds from Homeland Security in 2016-2017.	X		X		X
MH #6	Benton MH #6	Continue to evaluate the impacts of climate change on the characteristics and frequency of natural hazards in Benton County	Ongoing	Corvallis has done some climate change evaluations; county health plans include impacts of climate change.	X		X		
MH #7	Corvallis WS ST #1	Inventory and remove high-risk trees in City right of way	Ongoing	Corvallis maintains an inventory and routinely removes high-risk trees.			X		X
MH #8	Corvallis WS ST #2	Improve coordination between Public Works and Parks on tree failures. Acquire new software that would allow for streamlined communication between offices to get all tree work (storm cleanup) completed by PW into tree database.	Ongoing	City currently working to purchase mobile ready software for more rapid data management and more efficient in field real time tree inventory updates. This will lead to better data on tree failures.			X		
MH #9	Corvallis WS ST #1/ Corvallis MH LT #4/ Corvallis UT ST #1	Update website to include mitigation activities, opportunities, and success stories	Ongoing	NHMP is on website, provide messaging about storm events on city/ county websites. City has hired 1 FTE to serve as PIO.			X		



**Table B-2 Action Item Status and Changes (continued)**

2016 Action Item ID	Previous Action Item ID	2016 Action Item	Status	Notes	Benton	Adair	Corvallis	Monroe	Philomath
MH #10		Develop invasive pest action plan for Emerald Ash Borer (and others impacting municipal trees).	New	Jon Pywell (Parks) and Iris Benson (PW) coordinating to develop inventory of vulnerable tree stands as well as cost estimates for removal of hazard trees/ replanting of trees necessary for erosion control/creek shading.			X		
MH #11		Assess vulnerability, determine, and then implement appropriate mitigation measures for Alsea area bridges and access routes.	New	Identified in 2016 by the Alsea Emergency Preparedness Council.	P				
MH #12	Benton EQ #6	Rebuild the railroad crossing on SW 53rd Street south of SW Reservoir Avenue.	Revised	This project was first conceived in the mid-80s. It is slowly coming along, county will purchase needed right-of-way in 2016. Design state is next, funding is an issue and would require significant grant funds. This is a long-term, non-priority project. Changed to multi-hazard since 53rd Street also has flooding issues at this location.	X				
MH #13		Construct a raw water intake system to reduce risk and improve reliability in the case of a natural disaster.	New	Identified in 2016 by Corvallis steering committee.			P		
MH #14		Construct finished water transmission main from the Rock Creek Water Treatment Plant to the Baldy Water Reservoir.	New	Identified in 2016 by Corvallis steering committee.			P		
<b>Drought</b>									
DR #1	Benton DR #2	Develop a drought impact assessment for Benton County.	Ongoing	Has partly been accomplished through climate change planning efforts including the Benton County Health Department's "Climate Change Health Adaptation Plan" (2013). Climate change adaptation tool under development with participation of emergency management and community development.	X				P
DR #2		Identify and develop a larger/ alternative water supply.	New	Identified in 2015 by Adair Village steering committee.		P			
<b>Earthquake</b>									
EQ #1	Benton EQ #1/ Benton EQ #3/ Corvallis EQ ST #1/ Corvallis EQ LT #1/ Corvallis EQ ST #4/ Corvallis EQ ST #5	Complete seismic vulnerability analyses of critical public facilities with significant seismic vulnerabilities, lifeline utility (water and wastewater) and transportation systems, including fire, police, medical, and other emergency communication/ response facilities.	Partially Complete	Seismic vulnerability studies ongoing. Corvallis has inventoried 199 public facilities, 120 were not built under existing seismic code. 61 buildings have been evaluated, 67 are considered high priority. Evaluations pending on additional buildings. Corvallis Water Treatment Plant received analysis, as have the Rock Creek and Taylor water treatment plants. ODOT performs seismic evaluations of state bridges.	X	P	P	P	P
EQ #2	Benton EQ #2/ Benton EQ #4/ Corvallis EQ ST #6	Explore the possibility of developing a home seismic upgrade/retrofit (structural and non-structural) program. Consider an education/ marketing program.	Ongoing	ATC ran six (pre-event) classes.	X	X	X	P	
EQ #3	Benton EQ #5	Seismically retrofit the historic Benton County Courthouse, a vital public building. Consider both structural and non-structural retrofit options.	Partially Complete	Courthouse analysis completed January 31, 2016. At that point, BOC needs to decide how to fund.	P				
EQ #4	Corvallis EQ ST #1	Abandon water transmission lines on Marys River Bridge and bore new water transmission lines under Marys River.	Partially Complete	Complete for City Hall (2011), not complete for Marys River bridge crossing. Revised per new strategy.			P		

**Table B-2 Action Item Status and Changes (continued)**

2016 Action Item ID	Previous Action Item ID	2016 Action Item	Status	Notes	Benton	Adair	Corvallis	Monroe	Philomath
<b>Flood</b>									
FL #1	Benton FL #2	Coordinate with FEMA and state agencies to maintain and update Benton County Flood Insurance Rate Maps as necessary. Prioritize the determination of Base Flood Elevations (BFE) for all approximate Zone A areas.	Ongoing	The county received digitized maps in 2011. There are areas in the county that still need Base Flood Elevations (BFE) for approximate A-Zones (there are about 365 river miles without BFEs). DOGAMI is actively mapping (2016).	P		P	P	P
FL #2	Benton FL #4	Take steps to participate, maintain, or improve Community Rating System (CRS) rating, as applicable.	Ongoing	Benton County and Corvallis currently participate and have a Class 6 rating.	P		P	P	P
FL #3	Benton FL #5/ Corvallis FL LT #1 (outside SFHA)/ Corvallis WT LT #1	For locations that experience regular flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches	Ongoing	This occurs as a part of normal operations for Benton County and Corvallis. Corvallis maintains permanent high water signs at locations throughout the city.	X		X	P	X
FL #4		Ensure the locations of Repetitive Loss Properties have been accurately registered with FEMA and work with affected RL, and other flood prone, property owners to remove, relocate, or elevate non-conforming, pre-FIRM structures in flood hazard areas.	New	Identified in 2015.	X		X	X	X
FL #5		Mitigate flooding of South 13th Street area.	New	Identified in 2015 by Philomath Steering Committee.					P
FL #6		Improve remote draft site at Daisy Drive in Marys River Estates.	New	Identified in 2015 by Philomath Steering Committee.					P
FL #7	Benton FL #1/ Benton FL #3	Identify all structures with floors below the Base Flood Elevation and prioritize mitigation based on flood risk and type of required mitigation.	Partially Complete	Portion of Albany within Benton county has flood elevation certificates. Benton County maintains this information which is mapped and updated with new events.	P				
<b>Landslide</b>									
LS #1	Benton LS #1/ Benton LS #2/ Corvallis LS ST #1	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Partially Complete	DOGAMI completed a landslide susceptibility assessment in 2016. The County and cities will continue to work on landslide risk reduction efforts.	P	P	P	P	P
LS #2	Corvallis LS ST #2	Complete geotechnical analysis of the slope on NW Witham Hill Drive from NW Canary Drive to NW Walnut Boulevard and implement rehabilitation strategies to stabilize the slope.	New	Ongoing, activity has taken place see action for details.			P		

**Table B-2 Action Item Status and Changes (continued)**

2016 Action Item ID	Previous Action Item ID	2016 Action Item	Status	Notes	Benton	Adair	Corvallis	Monroe	Philomath
<b>Volcano</b>									
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>									
<b>Wildfire</b>									
WF #1	Benton WF #1/ Corvallis WF ST #3	Implement actions identified in the Community Wildfire Protection Plan.	Ongoing	Benton County completed a CWPP and is updating the plan in 2016. Corvallis and the other incorporated cities participate in the plan.	P	P	P	P	P
<b>Windstorm</b>									
<i>No actions identified for this hazard. See multi-hazard actions for associated actions.</i>									
<b>Winter Storm</b>									
WT #1	Benton WS #3/ Corvallis WT ST #5/ Corvallis UT ST #3	Ensure that all critical facilities have backup power and emergency operations plans to deal with power outages	Ongoing	<p>Complete for Benton County (Law Enforcement Building, Benton County Jail facility, Benton County Courthouse, Benton County Public Services Building).</p> <p>All of these units are permanent installations with automatic transfer switches. They are set up on a maintenance schedule in accordance with the manufactures requirements. The maintenance is conducted by the motor pool shop facility however they are under contract for the emergency repair and full load testing requirements. These units are exercised weekly via automated DDC controls within the building mechanical system, which alerts the maintenance technicians of any failures or alarms. Several portable units are also available.</p> <p>Alsea Service District, Alsea OR: There is a portable 35 KW unit dedicated for both the Alsea Sewer and Alsea water Plants in the event of power failures. This unit currently resides in the Community and the county has an intergovernmental agreement for the community to store and perform minor routine maintenance on this unit so it is available at a moment's notice.</p> <p>All the portable units are again maintained by the motor pool shop facilities and are on the service contract for annual maintenance and full load bank testing, by and independent contractor.</p> <p>Corvallis: Rock Creek and Taylor WTPs have portable generators. Additional generators needed to operate 150 hp pumps at Taylor WTP.</p>			P	X	

**Table B-3 Completed Action Items**

Previous Action Item ID	Previous Action Item	Status	Notes
<b>COMPLETED ACTIONS</b>			
Benton MH #1/ Corvallis WUI ST #2	Emergency Access Routes	Complete	As part of CWPP emergency access routes were determined for wildfire prone areas.
Benton DR #1	Incorporate the results of Benton County's Water Project into the Natural Hazards Mitigation Plan.	Complete/ Deleted	Relevant county work has been completed. Applicable information incorporated.
Benton WS #1	Complete the inventory of locations in Benton County subject to frequent storm water flooding.	Complete	Part of storm water planning.
Corvallis MH LT #3	Integrate hazard, vulnerability and risk Mitigation Plan findings into enhanced Emergency Operations planning.	Complete	Completed EOP in 2009.
Corvallis EQ ST #2	Complete seismic retrofit for North Hill 1st Level East Reservoir	Complete	Completed in 2012.
Corvallis EQ ST #5	Support/steer a project using outside support/consultants to complete an inventory of public buildings that may be particularly vulnerable to earthquake damage	Complete	Completed for public buildings.
Corvallis FL ST #1 (inside SFHA)	Inventory critical facilities (if any) within mapped floodplains or other high flood risk areas and identify mitigation options if such facilities are identified.	Complete	Occurred in 2012 with map updates. City has record based on insurance needs; GIS has mapped. Mapping information is available on city website.
Corvallis FL ST #2 (inside SFHA)	Survey elevation data for buildings within the mapped floodplains, evaluate flood risk quantitatively, and explore mitigation options with property owners.	Complete	Occurred in 2012 with map updates. City has record based on insurance needs; GIS has mapped. Mapping information is available on city website.
Corvallis FL ST #1 (outside SFHA)	Complete the inventory of locations in Corvallis subject to frequent storm water flooding	Complete	Inventoried areas of concern include: Brooklane @ Mill Race/Dunawi Creek, Sycamore & Janssen, Circle & Janssen, Lancaster Dr E. of Conifer, Conifer and Cambridge Circle, Highland and Sycamore/Sequoia, and South 3rd and Lily.
Corvallis LS LT #2	Limit future development in high landslide potential areas	Complete	Chapter 4.14 of the LDC accomplishes this action. Updates will be made with new data as applicable.
Corvallis VO ST #1	Update public emergency notification procedures for ash fall events	Complete	Complete as per EOPs.
Corvallis VO ST #2	Update emergency response planning for ash fall events	Complete	Complete as per EOPs.

**Table B-3 Completed Action Items (continued)**

Previous Action Item ID	Previous Action Item	Status	Notes
Corvallis WF ST #1	Identify specific parts of Corvallis at high risk for urban/wildland interface fires because of fuel loading, topography, and prevailing construction practices	Complete	Part of Benton County CWPP.
Corvallis WF LT #1	Encourage fire-safe construction practices for existing and new construction in high risk areas	Complete	Considered a part of the State Building Code. Defensible space techniques are encouraged through Firewise and development codes.
Corvallis WT ST #3	Enhance tree trimming efforts especially for transmission lines and trunk distribution lines and consider tree trimming ordinance	Complete	Utilities perform inspections and trimming. The ordinance was not considered necessary.
Corvallis UT ST #2	Review and update emergency response plans for disruptions of utilities or roads	Complete	Complete per Benton/ Corvallis EOPs. Also, ERPs are created for the following facilities: wastewater collections, wastewater treatment, and for the flood hazard.
Corvallis UT ST #4	Write procedures for maintaining water supply during extended power outages	Complete	The city has a water curtailment plan, including procedures for dealing with extended power outages.

**Table B-4 Deleted Action Items**

Previous Action Item ID	Previous Action Item	Status	Notes
<b>DELETED ACTIONS</b>			
Benton DR #3	Investigate the underlying causes of drought impacts.	Deleted	This is not a function of the county. OCCRI and other research groups have this information and make it available.
Benton FL #6	Elevate Highway 34 on the east side of the Willamette River.	Deleted	Consider for Albany NHMP.
Benton FL #7	Elevate Highway 20 outside the city of Albany.	Deleted	Project was considered recently, elevating road is not feasible.
Benton WD #2	Identify hazardous trees for failure potential.	Deleted	Not applicable. Part of normal operations.
Corvallis MH ST #1	Establish a formal role for the Corvallis Hazard Mitigation Steering Committee to develop a sustainable process to encourage, implement, monitor, and evaluate citywide mitigation actions	Deleted	Function of NHMP.
Corvallis MH ST #2	Identify and pursue funding opportunities to implement mitigation actions	Deleted	Function of NHMP.
Corvallis MH ST #3	Participate in public and private sector partnerships to foster hazard mitigation activities	Deleted	Function of NHMP.
Corvallis VO ST #3	Evaluate capability of water treatment plants to deal with high turbidity from ash falls and upgrade treatment facilities and emergency response plans to deal with ash falls	Deleted	No significant concern for ash, applicable aspects covered in MH #5 (2016)
Corvallis VO ST #4	Prepare/pre-script public messages about protection from and disposing of volcanic ash	Deleted	No significant concern for ash, applicable aspects covered in MH #9 (2016)
Corvallis WT ST #4	Encourage property owners to trim trees near service drops to individual customers	Deleted	Not considered a city function (function of utility companies).
Corvallis DS ST #1	Prepare high resolution maps of the dam failure inundation areas and update emergency response plans, including public notification and evacuation routes.	Deleted	Emergency management function.
Corvallis DS ST #2	Encourage the Corps of Engineers to undertake a though seismic risk evaluations for dams upstream of Corvallis and to make seismic and/or flood improvements as necessary	Deleted	Not considered a city function. ACOE regularly monitors dams.

#### Appendix B: Planning and Public Process

This planning and public process appendix reflects changes made to the Benton County and Corvallis NHMPs and documents the 2016 planning and public process.

#### Appendix C: Community Profile

The community profile has been updated to conform with the OPDR template and includes information for Benton County, and the cities of Adair Village, Corvallis, Monroe, and Philomath.

#### Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

Updates are provided for the economic analysis of natural hazard mitigation projects.

#### Appendix E: Grant Programs and Resources

Grant programs and resources were previously listed in the NHMP's hazard profiles. 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 F: Benton County Natural Hazards Community Survey

This survey was conducted with the 2015 update of the NHMP and was utilized to inform the development of mitigation strategies and identification of community vulnerabilities. It is provided herein as documentation and to serve as a resource for future planning efforts.

# 2015 NHMP PUBLIC PARTICIPATION PROCESS

## 2015 NHMP Update

Benton County is dedicated to directly involving the public in the review and update of the natural hazard mitigation plan. Although members of the steering committee represent the public to some extent, the residents of Benton County, Adair Village, Corvallis, Monroe, and Philomath are also given the opportunity to provide feedback about the Plan. The Plan will undergo review on a semi-annual basis.

Benton County made the Plan available via the Oregon Partnership for Disaster Resilience's website for public comment from March 29, 2016 through the FEMA review period. The cities of Adair Village, Corvallis, Monroe, and Philomath were included within the press release that was provided in local newspapers.

## Public Involvement Summary

Benton County provided a [news release on September 29, 2015](#) to inform the public that an update to the NHMP was occurring and to provide an opportunity for the public to learn more about the update and comment (see next page).

On March 29, 2016 the County provided a press release to allow the public to view and comment on the updated plan (see below). There were no comments received during the public review period via the OPDR project page for the Benton County NHMP update. Members of the steering committee provided edits and updates to the NHMP during this period as reflected in the final document.



## News Release

# County releases natural hazard progress report

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### NEWS RELEASE

September 29, 2015

**For further information, contact:**

**Rick Osborn, Public Information Officer, Benton County Board of Commissioners**

**(541) 766-6082, [rick.osborn@co.benton.or.us](mailto:rick.osborn@co.benton.or.us)**

CORVALLIS, Ore. – A report outlining Benton County's progress regarding natural hazard mitigation and response is available for public review.

The Benton County Multi-Jurisdictional Natural Hazard Mitigation Plan – a summary of progress made toward completing goals to improve functionality during a hazard event – is available online at <https://www.co.benton.or.us/sheriff/page/emergency-plans>.

The Natural Hazard Mitigation Plan, adopted by a resolution of the Benton County Board of Commissioners in January 2012, is the product of a community effort that included steering committee discussions and examining potential natural hazards and ways to mitigate them. Topics include multi-hazard response, earthquakes, flooding, landslides, winter storms, wind storms, wildfire and drought.

Benton County's Hazard Mitigation Workgroup, working in partnership with Oregon Partnership for Disaster Resilience, has begun the process of updating the Natural Hazard Mitigation Plan this year in accordance with the standard five year renewal cycle required by FEMA. Actions taken in previous years to incorporate activities called for in the plan are outlined in the recently released Progress Report. They include the following:

- Continuing to assess vulnerable population data;
- Prioritizing mitigation actions for at-risk buildings and infrastructure; and
- Ensuring all critical facilities in Benton County have backup power and emergency operations plans in case of power outages.

Benton County submits this report annually and continues to take steps outlined in the Natural Hazard Mitigation Plan to maintain and improve its Community Rating System ranking. Currently Benton County has a Class 6 rating with CRS, which is among the highest in the state and results in a 20-percent discount to county property owners for flood insurance within a Special Flood Hazard Area.

The complete adopted Natural Hazard Mitigation Plan can be viewed online at <https://www.co.benton.or.us/sheriff/page/emergency-plans>.

## Press Release

### **BENTON COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN UPDATE -- NOTICE AND OPPORTUNITY FOR PUBLIC COMMENT**

News Release from **Benton County Sheriff's Office**  
*Posted on FlashAlert: March 29th, 2016 1:26 PM*

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Benton County seeks additional public input on update to Natural Hazards Mitigation Plan

(Corvallis, OR) -- Benton County is currently in the process of updating their existing Natural Hazards Mitigation Plan (NHMP). This work is being performed in cooperation with the University of Oregon's Community Service Center - Oregon Partnership for Disaster Resilience and the Oregon Military Department's Office of Emergency Management utilizing funds obtained from the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan, Benton County will maintain its eligibility to apply for federal funding towards natural hazard mitigation projects. This local planning process includes a wide range of representatives from city and county government, emergency management personnel, and outreach to members of the public in the form of an electronic survey. This NHMP also affects the cities of Adair Village, Corvallis, Monroe, and Philomath.

A natural hazards mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Benton County MNHMP will be available for formal public comment beginning March 29, 2016. To view the draft please visit [http://opdr.uoregon.edu/benton\\_corvallis](http://opdr.uoregon.edu/benton_corvallis)

If you have any questions regarding the Benton County NHMP or the update process in general, please contact: Jaimi Glass Benton County Emergency Services Planner at (541) 766-6864 or [jaimi.glass@co.benton.or.us](mailto:jaimi.glass@co.benton.or.us); or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or [mrhoward@uoregon.edu](mailto:mrhoward@uoregon.edu).

---

## Benton County Steering Committee

Steering committee members possessed familiarity with the Benton County community and how it's affected by natural hazard events. The steering committee guided the update process through several steps including goal confirmation and prioritization, action item review and development and information sharing to update the plan and to make the plan as comprehensive as possible. The steering committee met on the following dates:

- **Meeting #1: Kickoff**, May 13, 2015
- **Meeting #2:** Public Outreach/ Hazard Inventory/ Assets and Vulnerabilities, May 27, 2015
- **Meeting #3:** Hazard Vulnerability Assessment, June 17, 2015
- **Meeting #4:** Mitigation Strategies, Implementation and Maintenance, September 29, 2015
- **Meeting #5:** City Addenda (Adair Village, Monroe, and Philomath)

In addition to the meetings listed above there was a landslide hazard meeting held on July 22, 2015 and a presentation to the Fire Defense Board on August 20, 2015.

The following pages provide copies of meeting agendas and sign-in sheets from county and city steering committee meetings.

# Benton County Meeting #1



## Agenda

**Meeting:** Benton County Natural Hazard Mitigation Plan Update: Kick off Meeting  
**Date:** May 13, 2015  
**Time:** 1:00 – 2:30 PM  
**Location:** Sunset Building, 4077 SW Research Way, Corvallis, OR 97333

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- |  |                   |
|--|-------------------|
| <b>I. Introduction and Background</b>              | <b>5 minutes</b>  |
| a. Community Service Center                        |                   |
| b. Project Context                                 |                   |
| c. Committee Introductions                         |                   |
| <b>II. Natural Hazard Mitigation Planning</b>      | <b>10 minutes</b> |
| a. Emergency Management Overview                   |                   |
| b. Natural Hazard Mitigation Plans (NHMP) Overview |                   |
| c. Project Timeline                                |                   |
| <b>III. Review of Updated Documents</b>            | <b>20 minutes</b> |
| a. Community Profile                               |                   |
| b. Mission   |                   |
| c. State and County Goals                          |                   |
| <b>IV. Action Item Progress and Review</b>         | <b>30 minutes</b> |
| <b>V. Hazard History Update</b>                    | <b>15 minutes</b> |
| <b>VI. Wrap Up and Next Steps</b>                  | <b>5 minutes</b>  |
| a. Next Steps                                      |                   |
| b. Future Meetings                                 |                   |



**Meeting Sign-In**

Benton County NHMP Update: Meeting #1: Kickoff May 13<sup>th</sup>, 2015

Name	Email	Representing
DOUGLAS BAILY	DOUGLAS.BAILY @ CORVALLIS OREGON. GOV	CFD
Toby Lewis Chris Bentley	Toby.A.Lewis @ co.benton.or.us Chris.bentley@co.benton.or.us	CD (Hoodplain) CWPP
MIKE BAMBEGER	Michael.Bambeger @ oregonstate.edu	OSU
Sarah Bates	sbates @ co.linn.or.us	Linn Co. Public Health
Brian Cooke	brian.cooke@co.benton.or.us	Benton County HD
FRANK SPANGLER	FRANK.SPANGLER @ REDCROSS.ORG	RED CROSS
SAT WRAY	SWRAY @ COMCAST.NET	Red Cross.

Name	Email	Representing
Lacey Duncan	lacey.duncan @ co.benton.or.us	BCSO
Mary King	mary.king @ co.benton.or.us	BCSO

# Benton County Meeting #2



## Agenda

**Meeting:** Benton County Natural Hazard Mitigation Plan Update: Second Meeting  
**Date:** May 27, 2015  
**Time:** 1:00 – 3:00 PM  
**Location:** Sunset Building, 4077 SW Research Way, Corvallis, OR 97333

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I.	Welcome and Introduction	5 minutes
II.	Meeting #1 Review	20 minutes
	a. Action Items	
	b. Mission and Goals	
III.	Public Outreach Strategy	10 minutes
IV.	Hazard History Update	20 minutes
V.	Community Assets and Vulnerabilities	30 minutes
VI.	Hazard Vulnerability Assessment	30 minutes
VII.	Wrap Up and Next Steps	5 minutes
	a. Next Steps	
	b. Future Meetings	

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**Meeting Sign-In**

Benton County NHMP Update: Meeting #2: May 27, 2015  
Corvallis, Oregon

Name	Representing	Email	Roundtrip mileage (if applicable)
MAKIZ KING	BCSO ES		
DOUGLAS BAILY	CITY OF CORVALLIS FD	DOUGLAS-BAILY@CORVALLISOREGON.GOV	
Robyn Bassett	Corvallis PW	Robyn.Bassett@corvallisoregon.gov	
Jimi Glass	RCSO Emergency Services		
BOB FERRER	City of Corvallis Public Works	Bob.Ferrera@corvallisoregon.gov	
MIKE BAMBERGER	OSU	Michael.Bamberger@oregonstate.edu	
Brian Cook	BCHD	Brian.Cook@co.benton.or.us	

Name	Representing	Email	Roundtrip mileage (if applicable)
Josh Wheeler	BCPW	joshua.wheeler@co.benton.or.us	
Toby Lewis	BC-Comm. Dev.	toby.a.lewis@co.benton.or.us	
Chris Bentley	Benton Com Dev	chris.bentley@co.benton.or.us	
PAT WRAY	AMERICAN RED CROSS	patwray@comcast.net	

# Benton County Meeting #3



## Agenda

**Meeting:** Benton County Natural Hazard Mitigation Plan Update: Second Meeting  
**Date:** June 17, 2015  
**Time:** 1:00 – 2:30 PM  
**Location:** Sunset Building, 4077 SW Research Way, Corvallis, OR 97333

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- |  |                   |
|--|-------------------|
| <b>I. Welcome and Introduction</b>         | <b>5 minutes</b>  |
| <b>II. Meeting #2 Review</b>               | <b>10 minutes</b> |
| a. Mission and Goals – Handout             |                   |
| b. Hazard History Update                   |                   |
| c. Assets and Vulnerabilities              |                   |
| <b>III. Public Outreach Strategy</b>       | <b>25 minutes</b> |
| <b>IV. Hazard Vulnerability Assessment</b> | <b>45 minutes</b> |
| <b>V. Wrap Up and Next Steps</b>           | <b>5 minutes</b>  |
| a. Next Steps                              |                   |
| b. Future Meetings                         |                   |

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**Meeting Sign-In**

Benton County NHMP Update: Meeting #3: HVA June 17, 2015

Name	Email	Representing
Anne Schuster	anneschuster@co.benton.or.us	Commissioner
Pat Dray	patdray@comcast.net	Red Cross
Kevin Higgins	Kevin.Higgins@CO.Benton.OR.US	Benton County Sheriff's Office EMERGENCY Management
Jinni Glass	jinni.glass@co.benton.or.us	BCSO EM planner
Darrel Tedisch	Darrel.Tedisch@City of Albany.net	C. of Albany
MIKE Bamberger	no change	OSU
Robyn Bassett	" "	Covallis PW

Name	Email	Representing
BAILY	N/A	CFD-COC
Toby Lewis	toby.a.lewis@co.benton.or.us	BC CD
Rebecca Taylor	rebecca.taylor@co.benton.or.us	BC CD
Dr. Gold	gold@oc.e.orst.edu	OSU
Mary King	mary.king@co.benton.or.us	BCSO
Josh Wheeler	joshua.wheeler@co.benton.or.us	BCPW
Brian Cooke	brian.cooke@co.benton.or.us	BCAD

# Benton County Meeting #4



## Agenda

**Meeting:** Benton County Natural Hazard Mitigation Plan Update: Mitigation Strategy  
**Date:** September 29, 2015  
**Time:** 2:00 – 4:00 PM  
**Location:** Sunset Building, 4077 SW Research Way, Corvallis, OR 97333  
Mary's Peak Room (sharp right after exiting elevator)

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<b>I. Welcome and Introduction</b>	<b>5 minutes</b>
<b>II. Review of Previous Meetings</b>	<b>10 minutes</b>
a. Mission/ Goals	
b. Hazard Vulnerability Assessment	
<b>III. Survey Results</b>	<b>15 minutes</b>
<b>IV. Mitigation Strategies</b>	<b>60 minutes</b>
a. Vulnerability themes	
b. Review of existing actions	
c. New actions	
d. Prioritization	
<b>V. Implementation and Maintenance</b>	<b>25 minutes</b>
<b>VI. Wrap Up and Next Steps</b>	<b>5 minutes</b>
a. Next Steps	
b. City addenda meetings	



**Meeting Sign-In**

Benton County NHMP Update: Meeting #6: Actions September 29, 2015

Name	Email	Representing
BAILY, D. E.	<del>Doan</del>	CFD / CITY
Karen Kennedy	wintem@peak.org	When Disaster Prep. Network
RANDY HART	RANDY_HART@ORST.EDU	AUSEA AREA INTERESTS
Seah Bates	Sbates@co.linn.or.us	LC PH
Tom Phelps	tom.phelpse@philomathfire.com	Philomath Fire
RICH SAALSAA	rich.saalsaa@philomathfire.com	PHILOMATH FIRE: RESCUE
Kev Kurth	kkurth@co.linn.or.us	Linn County Public Health

Name	Email	Representing
Toby Lewis	toby.a.lewis@co.benton.or.us	BCCD, Floodplain management
Brian Cooke	brian.cooke@co.benton.or.us	BCHD
Jamie Glass	jaimie.glass@co.benton.or.us	BCSD Emergency Management
Josh Foster	jfoster@coas.oregonstate.edu	OSU / OCCRI
Rick Osborn	rick.osborn@co.benton.or.us	Benton County
Bill Emminger	bill.emminger@co.benton.or.us	Benton Co. Env. Health

# Benton County Meeting #5



## Agenda

**Meeting:** Benton County Natural Hazards Mitigation Plan Update: City Addenda  
**Date:** December 8, 2015  
**Time:** 1:00 – 4:00 PM  
**Location:** Sunset Building, 4077 SW Research Way, Corvallis, OR 97333  
Mary's Peak Room (sharp right after exiting elevator)

- 
- I. **Welcome and Introductions** (10 minutes)
    - a. Overview of NHMP process
  - II. **Hazard Identification** (30 minutes)
    - a. Review County Hazard Identification
    - b. Complete Jurisdiction Specific Hazard Inventories – **Attachment A**
  - III. **Review Existing Vulnerability Information** (30 minutes)
    - a. Review County Identified Vulnerabilities
    - b. identify Jurisdiction Specific Assets and Vulnerabilities – **Attachment B: Part 1 (assets) & 2 (vulnerabilities)**
  - IV. **Jurisdiction Specific Risk Assessment** (30 minutes)
    - a. Review 2015 County Hazard Vulnerability Assessment (HVA)
    - b. Complete Jurisdiction Specific HVA – **Attachment C**
  - V. **Review NHMP Mission and Goals** (10 minutes)
    - a. Review NHMP Mission and Goals - **Attachment D**
  - VI. **Jurisdiction Specific Mitigation Strategy** (45 minutes)
    - a. Review Process and County Strategy - **Attachment E**
    - b. Develop Jurisdiction Specific Actions - **Attachment F**
    - c. Prioritize Actions
  - VII. **Overview of Implementation and Maintenance** (20 minutes)
  - VIII. **Next Steps** (5 minutes)
    - a. Prepare final draft of the NHMP for County and City Review
    - b. Provide the OMD-Office of Emergency Management a Review Opportunity
    - c. Submit updated plan to FEMA for review

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**Meeting Sign-In**

Benton County NHMP Update: Meeting #7: City Addenda December 8, 2015

Name	Email	Representing
David Feinberg	BldgettDave@AOL.COM	Bldgett - Summit RFPD
Pat Hare	pat.hare@adairvillage.org	Adair Village
Matt Lyden	matt.lyden@adairvillage.org	Adair Village
Rick Smith	RSmith@monroe firedept.org	Monroe Fire
Matthew Thompson	Monroefireresident@hotmail.com	Monroe Fire
Tom Phelps	tom.phelps@philomathfire.com	Philomath Fire
Chuck Harris	adair@adair-rural-fire.com	Adair Rural Fire

Name	Email	Representing
Cheri Damitio	cdamitio@samhealth.org cheridamitio@gmail.com	Bldgett - Summit RFPD
GARY BLACK	gblack@ci.philomath.or.us	CITY OF PHILMATH
Phil Plaza	philplaza@hotmail.com	ALSOA
Lacey Duncan	lacey.duncan@co.benton.or.us	BCSO

## Corvallis Steering Committee

Steering committee members possessed familiarity with the Corvallis community and how it's affected by natural hazard events. The steering committee guided the update process through several steps including goal confirmation and prioritization, action item review and development and information sharing to update the plan and to make the plan as comprehensive as possible. The steering committee met on the following dates:

- **Meeting #1:** Kickoff, July 16, 2015
- **Meeting #2:** Public Outreach/ Hazard Inventory/ Assets and Vulnerabilities/ Hazard Vulnerability Assessment, August 20, 2015
- **Meeting #3:** Mitigation Strategies, Implementation and Maintenance, October 06, 2015

In addition to the meetings listed above there was a scoping meeting held on September 18, 2014.

The following pages provide copies of meeting agendas and sign-in sheets from county and city steering committee meetings.

# Corvallis Meeting #1



## Agenda

**Meeting:** Corvallis Natural Hazard Mitigation Plan Update: Kick off Meeting  
**Date:** July 16, 2015  
**Time:** 3:00 – 5:00 PM  
**Location:** City Hall, 501 SW Madison Ave, Planning Room

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- |  |                      |
|--|----------------------|
| <b>I. Introduction and Background</b>              | <b>5 minutes</b>     |
| a. Community Service Center                        |                      |
| b. Project Context                                 |                      |
| c. Committee Introductions                         |                      |
| <b>II. Natural Hazard Mitigation Planning</b>      | <b>15 minutes</b>    |
| a. Emergency Management Overview                   |                      |
| b. Natural Hazard Mitigation Plans (NHMP) Overview |                      |
| c. Project Timeline                                |                      |
| <b>III. Review of Updated Documents</b>            | <b>15 minutes</b>    |
| a. Community Profile                               |                      |
| b. Mission   |                      |
| c. State and County Goals                          |                      |
| <b>IV. Hazard History Update</b>                   | <b>30-45 minutes</b> |
| <b>V. Action Item Progress and Review</b>          | <b>30-45 minutes</b> |
| <b>VI. Wrap Up and Next Steps</b>                  | <b>5 minutes</b>     |
| a. Next Steps                                      |                      |
| b. Future Meetings                                 |                      |

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**Meeting Sign-In**

Corvallis NHMP Update: Meeting #1: Kickoff  
July 16, 2015

Name	Email	Representing
Jude Geist	jude.geist@corvallisoregon.gov	Parks & Recreation
Ron Rampenthal	ron.rampenthal@corvallisoregon.gov	Public Works
John Keiser	john.keiser@corvallis.gov	PW.
Kent Weiss	kent.weiss@corvallisoregon.gov	CD
Robyn Bassett	Same	PW
Jamie Glass	jamie.glass@co.benton.or.us	City Planning & BCSO
Chad Wolfe	chad.wolfe@corvallisoregon.gov	PW-WW/SW
Bob Fenner	bob.fenner@corvallisoregon.gov	PW

Name	Email	Representing
Stan Miller	stan.miller@corvallisoregon.gov	PW
DOUGLAS BAILY	DOUGLAS.BAILY@CORVALLISOREGON.GOV	CFD
DAN CARLSON	dan.carlson@corvallisoregon.gov	CITY OF CORVALLIS COMMUNITY DEPT.
Aaron Manley	aaron.manley@corvallisoregon.gov	PW



# Corvallis Meeting #2



## Agenda

**Meeting:** Corvallis Natural Hazard Mitigation Plan Update: Second Meeting  
**Date:** August 20, 2015  
**Time:** 3:00 – 5:00 PM  
**Location:** MAMR, 500 SW Madison Ave.

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<b>I. Welcome and Introduction</b>	<b>5 minutes</b>
<b>II. Meeting #1 Review</b>	<b>20 minutes</b>
a. Action Items	
b. Hazard History	
c. Community Profile	
d. Survey Status	
<b>III. Community Assets and Vulnerabilities</b>	<b>30 minutes</b>
<b>IV. Hazard Vulnerability Assessment</b>	<b>30 minutes</b>
<b>V. Other Items</b>	<b>30 minutes</b>
<b>VI. Wrap Up and Next Steps</b>	<b>5 minutes</b>
a. Next Steps	
b. Future Meetings	



**Meeting Sign-In**

Corvallis NHMP Update: Meeting #2: Kickoff  
August 20, 2015

Name	Email	Representing
JERMI KELLER	jerm.keller@corvallis.oregon.gov	EAC
Chad Wolfe	chad.wolfe@corvallis.oregon.gov	City of Corvallis Utilities Division
Jermi Glass	jermi.glass@co.benton.or.us	BCSO emergency management
Stan Miller	stan.miller@corvallis.oregon.gov	WW Corvallis
Jon Pywell	jonathan.pywell@corvallis.oregon.gov	Parks, Corvallis
Bruce Moser		PUBLIC WORKS Corvallis
DAN CARLSON	dan.carlson@corvallis.oregon.gov	Corvallis Community Development

Name	Email	Representing
Aaron Manley	aaron.manley@corvallis.oregon.gov	PW
Jason Yaich	jason.yaich@corvallis.oregon.gov	CD

# Corvallis Meeting #3



## Agenda

**Meeting:** Corvallis Natural Hazard Mitigation Plan Update: Mitigation Strategy/ Actions  
**Date:** October 6, 2015  
**Time:** 9:00 – 11:00 AM  
**Location:** MAMR, 500 SW Madison Ave.

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<b>I. Welcome and Introduction</b>	<b>5 minutes</b>
<b>II. Review of Previous Meetings</b>	<b>10 minutes</b>
a. Hazard Vulnerability Assessment	
<b>III. Survey Results</b>	<b>15 minutes</b>
<b>IV. Mitigation Strategies</b>	<b>60 minutes</b>
a. Vulnerability themes	
b. Review of existing actions	
c. New actions	
d. Prioritization	
<b>V. Implementation and Maintenance</b>	<b>25 minutes</b>
<b>VI. Wrap Up and Next Steps</b>	<b>5 minutes</b>
a. Next Steps	

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**Meeting Sign-In**

Corvallis NHMP Update: Meeting #3: Actions  
October 6, 2015

Name	Email	Representing
BALW, D E.		C FD
Kari Glass		Corvallis E. EMMA
Jon Pywell	jonathan.pywell@corvallis.oregon.gov	Parks & Recreation
John KELKER	john.kelker@corvallis.oregon.gov	PW.
Robyn Bassett		PW
Jason Yaich	jason.yaich@corvallisoregon.gov	CD (CITY)
DAN CARLSON		CD

Name	Email	Representing
Jude Geist		PER
Bob FARNER	bob.farner@corvallis.oregon.gov	P.W Building & Fleet
BRUCE MOSER	BRUCE.MOSER@CORVALLISOREGON.GOV	P.W. TRANSPORTATION

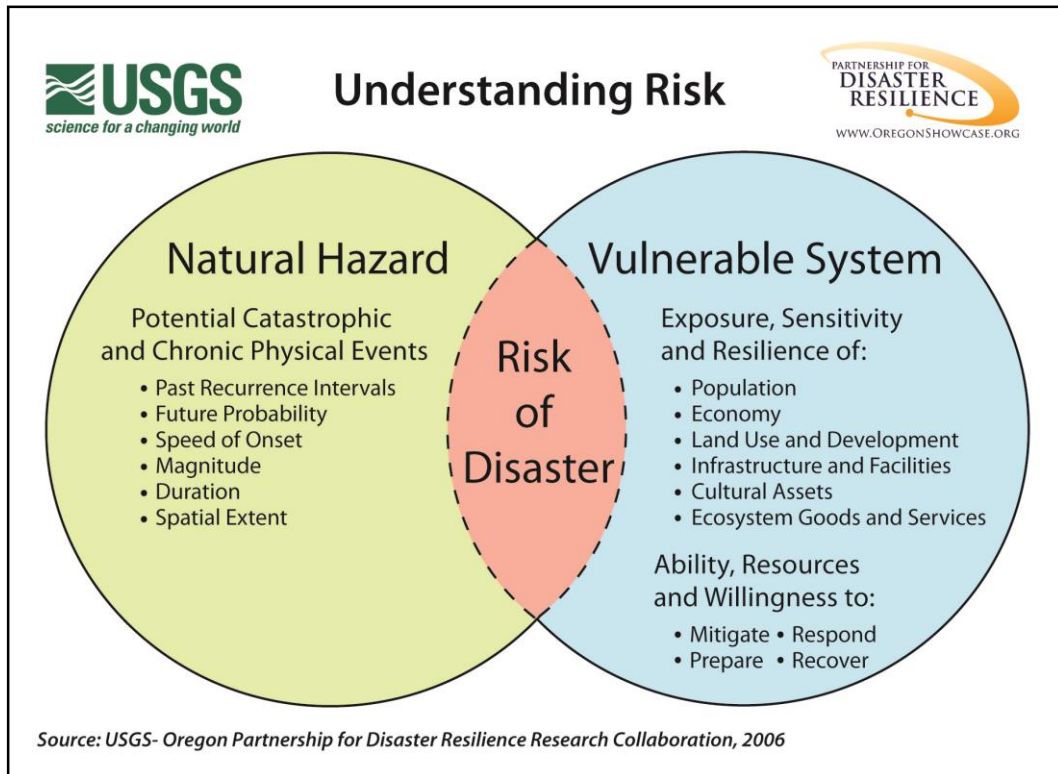
# APPENDIX C: COMMUNITY PROFILE

Community resilience can be defined as the community’s ability to manage risk and adapt to natural hazard impacts. In order to help define and understand the county’s sensitivity and resilience to natural hazards, the following capacities must be examined:

- **Natural Environment**
- **Socio-Demographic**
- **Economic**
- **Built Environment**
- **Community Connectivity**
- **Political**

The Community Profile describes the sensitivity and resilience to natural hazards of Benton County, and its incorporated cities, as they relate to each capacity. It provides a snapshot in time when the plan was developed and will assist in preparation for a more resilient county. The information in this section, along with the hazard assessments located in the Hazard Annex, should be used as the local level rationale for the risk reduction actions identified in Section 3 – Mitigation Strategy. The identification of actions that reduce the county’s sensitivity and increase its resiliency assist in reducing overall risk of disaster, the area of overlap in the figure below.

**Figure C-1 Understanding Risk**



Source: Oregon Partnership for Disaster Resilience

# Natural Environment Capacity

Natural environment capacity is recognized as the geography, climate, and land cover of the area such as, urban, water and forested lands that maintain clean water, air and a stable climate.<sup>1</sup> Natural resources 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. However, natural systems are often impacted or depleted by human activities adversely affecting community resilience.

## Geography and Climate

Benton County is located in western Oregon and covers about 669 square miles. The geography, topography, climate, and other natural attributes such as vegetation vary significantly with location in Benton County. The geographic diversity of Benton County is an important factor to consider in mitigation planning for natural and human-caused hazards.

For hazard mitigation planning, we consider two main physiographic regions within Benton County, based on nomenclature commonly used by the National Weather Service:

- The Coast Range in the western Benton County has a relatively small population, and is characterized by steep slopes, forestland, and the highest levels of annual precipitation in the county.
- The Willamette Valley in eastern Benton County is characterized by flat or gently hilly topography. This is the most populated area of Benton County.

The average annual rainfall in Benton County is about 43 inches. Average annual snowfall in the valley is about 7 inches. At higher elevations in the Coast Range, temperatures are typically lower, with much higher levels of precipitation (see Table C-1 and Figure C-2 below). Additionally, major rivers in Benton County include the Willamette River, the Alsea River and the Marys River.

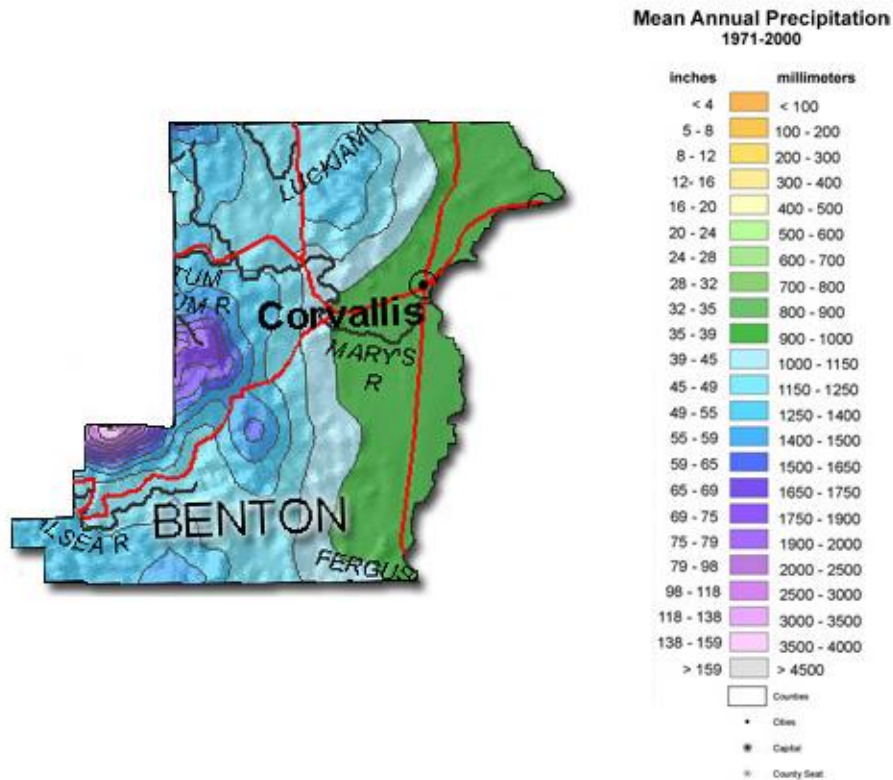
**Table C-1 Average Rainfall and Temperatures**

Ecoregion	Mean Annual Rainfall Range (inches)	Mean Temperature Range (°F) January min/max	Mean Temperature Range (°F) July min/max
<b>Coast Range</b>			
Volcanics	70-200	30/46	50/76
Mid-Coastal Sedimentary	60-130	32/48	48/78
<b>Willamette Valley</b>			
Gallery Forest	40-50	33/46	50/85
Prairie Terraces	40-50	33/46	51/85
Valley Foothills	45-60	32/46	50/80

Source: US EPA. Ecoregions of Oregon

<sup>1</sup> Mayunga, J. 2007. Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer Academy for Social Vulnerability and Resilience Building.

**Figure C-2 Benton County Average Annual Precipitation**



Source: The Oregon Climate Service, NOAA Climate Stations. "1971-2000 Climate of Benton County"

Total precipitation in the Pacific Northwest region may remain similar to historic levels but climate projections indicate the likelihood of increased winter precipitation and decreased summer precipitation.<sup>2</sup>

Increasing temperatures affects hydrology in the region. Spring snowpack has substantially decreased throughout the Western part of the United States, particularly in areas with milder winter temperatures, such as the Cascade Mountains.<sup>3</sup>

## Synthesis

The physical geography, weather, climate and land cover of an area represent various interrelated systems that affect overall risk and exposure to natural hazards. The projected climate models representing the Willamette Valley indicate the potential for increased effects of hazards, particularly drought and wildfire. The Willamette Valley is projected to have warmer and drier summers with less precipitation. In addition, winter temperatures will be warmer, which means a decrease in mountain snowpack. These factors combined with periods of population growth and development intensification can lead to increasing

<sup>2</sup> Ibid.

<sup>3</sup> Mote, Philip W., et. al., "Variability and trends in Mountain Snowpack in Western North America," <http://cses.washington.edu/db/pdf/moteetalvarandtrends436.pdf>

risk of hazards, threatening loss of life, property and long-term economic disruption if land management is inadequate.

## Social/ Demographic Capacity

Social/ demographic capacity is a significant indicator of community hazard resilience. The characteristics and qualities of the community population such as language, race and ethnicity, age, income, educational attainment, and health are significant factors that can influence the community's ability to cope, adapt to and recover from natural disasters. Population vulnerabilities can be reduced or eliminated with proper outreach and community mitigation planning.

## Population

Corvallis accounts for just under two-thirds of the county's population, another 20% live in unincorporated areas, while the remaining 15% is spread among the remaining three incorporated cities. Between 2010 and 2014, Benton County experienced a 3.5% increase in population. The County Coordinated Population Forecast projects that by 2035 Benton County's population will increase to 101,848, an 14.8% increase from the 2014 estimate.<sup>4</sup>

### C-2 Population Estimate and Forecast for Benton County Cities

Jurisdiction	2010		2014		Population Change 2010-2014		Average Annual Growth Rate
	Population	Percent of County	Population	Percent of County	Population Change	Percent Change	
Adair Village	840	1.0%	845	1.0%	5	0.6%	0.1%
Albany*	6,587	7.7%	7,146	8.1%	559	8.5%	2.1%
Corvallis	54,460	63.5%	56,535	63.7%	2,075	3.8%	0.9%
Monroe	615	0.7%	620	0.7%	5	0.8%	0.2%
Philomath	4,590	5.4%	4,630	5.2%	40	0.9%	0.2%
<i>Sub-Total</i>	<i>67,092</i>	<i>78.3%</i>	<i>69,776</i>	<i>78.6%</i>	<i>2,684</i>	<i>4.0%</i>	<i>1.0%</i>
<b>Unincorporated</b>	<b>18,643</b>	<b>21.7%</b>	<b>18,964</b>	<b>21.4%</b>	<b>321</b>	<b>1.7%</b>	<b>0.4%</b>
<b>Benton Total</b>	<b>85,734</b>	<b>100%</b>	<b>88,740</b>	<b>100%</b>	<b>3,006</b>	<b>3.5%</b>	<b>0.9%</b>

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2014.

\* The majority of Albany's population is within Linn County.

Population size itself is not an indicator of vulnerability. More important is the location, composition, and capacity of the population within the community. Research by social scientists demonstrates that human capital indices such as language, race, age, income, education and health can affect the integrity of a community. Therefore, these human capitals can impact community resilience to natural hazards. As an example, Benton County's trend towards urbanization suggests that the population may be becoming less self-reliant and more reliant on external goods and services.

## Tourists

Tourists are not counted in population statistics; and are therefore considered separately in

<sup>4</sup> Office of Economic Analysis. Long Term County Forecast.



this analysis. The table below shows the estimated number of person nights in private homes, hotels and motels, and other types of accommodations. The table shows that, between 2012-2014, just under two-thirds of visitors in Benton County lodge in private homes, with just under one-third staying in hotels/ motels, the remaining visitors stay on other accommodations (vacation homes/ campgrounds). Tourists' lodging in private homes suggests these visitors are staying with family and friends. For hazard preparedness and mitigation purposes, outreach to residents in Benton County will likely be transferred to these visitors in some capacity. Visitors staying at hotel/ motels are less likely to benefit from local preparedness outreach efforts aimed at residents.

### C-3 Annual Visitor Estimates in Person Nights

	2012		2013		2014	
	Person-Nights (1,000's)	Percent	Person-Nights (1,000's)	Percent	Person-Nights (1,000's)	Percent
<b>Benton</b>	1,381	100%	1,401	100%	1,387	100%
Hotel/Motel	421	30%	442	32%	434	31%
Private Home	879	64%	875	62%	869	63%
Other	80	6%	83	6%	84	6%

Source: Oregon Tourism Commission, Oregon Travel Impacts: 1991-2014, Dean Runyan Associates

Tourists are specifically vulnerable due to the difficulty of locating or accounting for travelers within the region. Tourists are often at greater risk during a natural disaster because of unfamiliarity with evacuation routes, communication outlets, or even the type of hazard that may occur. Knowing whether the region's visitors are staying in friends/ relatives homes in hotels/ motels, or elsewhere can be instructive when developing outreach efforts.<sup>5</sup>

## Language

Special consideration should be given to populations who do not speak English as their primary language. Language barriers can be a challenge when disseminating hazard planning and mitigation resources to the general public, and it is less likely they will be prepared if special attention is not given to language and culturally appropriate outreach techniques.

There are various languages spoken across Benton County; the primary language is English. Overall, 3.5% of the total population in Benton County is not proficient in English. Corvallis (2,574) has the largest population of residents who do not speak English "very well"; while Monroe (6.7%) has the greatest percentage of its population that does not speak English "very well". Outreach materials used to communicate with, plan for, and respond to non-English speaking populations, and those who do not speak English very well, should take into consideration the language needs of these populations.

<sup>5</sup> MDC Consultants (n.d.). When Disaster Strikes – Promising Practices. Retrieved March 18, 2014, from <http://www.mdcinc.org/sites/default/files/resources/When%20Disaster%20Strikes%20-%20Promising%20Practices%20-%20Tourists.pdf>

**Table C-4 Benton County Language Barriers**

	Population 5 years and over Estimate	Speak English less than "very well"	
		Estimate	Percent
<b>Benton</b>	82,342	2,914	3.5%
<b>Adair Village</b>	793	11	1.4%
<b>Albany*</b>	47,880	1,721	3.6%
<b>Corvallis</b>	52,474	2,574	4.9%
<b>Monroe</b>	720	48	6.7%
<b>Philomath</b>	4,261	42	1.0%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP02

\* The majority of Albany's population is within Linn County.

## Race

The impact in terms of loss and the ability to recover may also vary among minority population groups following a disaster. Studies have shown that racial and ethnic minorities can be more vulnerable to natural disaster events. This is not reflective of individual characteristics; instead, historic patterns of inequality along racial or ethnic divides have often resulted in minority communities that are more likely to have inferior building stock, degraded infrastructure, or less access to public services. The table below describes Benton County's population by race and ethnicity.

The majority of the population in Benton County is racially white (88%); Corvallis has the largest percentage of non-white population (14.5%). Approximately 7% of the population is Hispanic or Latino; the cities of Monroe (13.9%) and Philomath (9.9%) have the highest percentages while Corvallis (4,222) has the largest population of Hispanics or Latinos.

**Table C-5 Benton Race and Hispanic or Latino Origin**

	Benton County	Adair Village	Albany*	Corvallis	Monroe	Philomath
Total Population	86,034	881	51,210	54,735	746	4,577
White	87.9%	89.0%	89.2%	85.5%	86.2%	92.6%
Black or African American	1.0%	1.2%	0.8%	1.0%	0.0%	1.0%
American Indian and Alaska Native	0.6%	1.0%	1.8%	0.5%	2.1%	0.9%
Asian	6.0%	2.3%	2.3%	8.6%	0.0%	1.4%
Native Hawaiian and Other Pacific Islander	0.3%	0.0%	0.0%	0.2%	0.0%	0.0%
Some Other Race	1.1%	1.1%	2.6%	1.1%	5.4%	0.4%
Two or More Races	3.1%	5.3%	3.3%	3.0%	6.3%	3.6%
Hispanic or Latino (of any race)	5,788	40	6,127	4,222	104	453
Percent Hispanic or Latino (of any race)	6.7%	4.5%	12.0%	7.7%	13.9%	9.9%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP05

\* The majority of Albany's population is within Linn County.

It is important to identify specific ways to support all portions of the community through hazard mitigation, preparedness, and response. Culturally appropriate, and effective outreach can include both methods and messaging targeted to diverse audiences. For example, connecting to historically disenfranchised populations through already trusted

sources or providing preparedness handouts and presentations in the languages spoken by the population will go a long way to increase overall community resilience.

## Gender

Benton County has slightly more males than females (Male: 50.2%, Female 49.8%); Adair Village and Monroe have the highest percentages of females with over 53%.<sup>6</sup> It is important to recognize that women tend to have more institutionalized obstacles than men during recovery due to sector-specific employment, lower wages, and family care responsibilities.<sup>7</sup>

## Age

Of the factors influencing socio-demographic capacity, the most significant indicator in Benton County may be age of the population. As depicted in the table below, as of 2014, 13.2% of the county population is over the age of 64, a percentage that is projected to rise to 17.9% by 2035. The Benton County age dependency ratio<sup>8</sup> is 37.2; Adair Village has the highest ratio for the cities at 54.3 (Corvallis has the lowest ratio, 29.5). The age dependency ratio indicates a higher percentage of dependent aged people to that of working age.

**Table C-6 Benton Population by Vulnerable Age Groups**

Jurisdiction	Total	< 15 Years Old		> 64 Years Old		15 to 64 Years Old	Age Dependency Ratio
		Number	Percent	Number	Percent		
Benton County	86,034	11,975	13.9%	11,347	13.2%	62,712	37.2
Adair Village	881	256	29.1%	54	6.1%	571	54.3
Albany*	51,210	11,007	21.5%	6,826	13.3%	33,377	53.4
Corvallis	54,735	6,590	12.0%	5,874	10.7%	42,271	29.5
Monroe	746	99	13.3%	107	14.3%	540	38.1
Philomath	4,577	926	20.2%	444	9.7%	3,207	42.7
<b>2035</b>							
Oregon	4,995,200	865,889	17.3%	1,082,781	21.7%	3,046,530	64.0
Benton County	101,846	13,589	13.3%	18,220	17.9%	70,037	45.4

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP05; Office of Economic Analysis, Department of Administrative Services, Long Term County Forecast, "State and County Population Forecasts by Age and Sex, 2000-2040".

\* The majority of Albany's population is within Linn County.

The age profile of an area has a direct impact both on what actions are prioritized for mitigation and how response to hazard incidents is carried out. School age children rarely make decisions about emergency management. Therefore, a larger youth population in an area will increase the importance of outreach to schools and parents on effective ways to teach children about fire safety, earthquake response, and evacuation plans. Furthermore,

<sup>6</sup> U.S. Census Bureau, 2010-2014 American Community Survey, Table DP05

<sup>7</sup> Ibid.

<sup>8</sup> The age dependency ratio is derived by dividing the combined under 15 and 65-and-over populations by the 15-to-64 population and multiplying by 100. A number close to 50 indicates about twice as many people are of working age than non-working age. A number that is closer to 100 implies an equal number of working age population as non-working age population. A higher number indicates greater sensitivity.

children are more vulnerable to the heat and cold, have few transportation options and require assistance to access medical facilities. Older populations may also have special needs prior to, during and after a natural disaster. Older populations may require assistance in evacuation due to limited mobility or health issues. Additionally, older populations may require special medical equipment or medications, and can lack the social and economic resources needed for post-disaster recovery.<sup>9</sup>

## Families and Living Arrangements

Two ways the census defines households are by type of living arrangement and family structure. A householder may live in a “family household” (a group related to one another by birth, marriage or adoption living together); in a “nonfamily household” (a group of unrelated people living together); or alone. Benton County is predominately comprised of family households (55.6%). Of all households, 28.6% are one-person non-family households (householder living alone). Corvallis (6,872, 32.3%) has the highest percentage, and largest population, of householders living alone. Corvallis (2,183, 10.3%) also has the highest percentage, and largest population, of people 65 years or older living alone.

**Table C-7 Householder Living Alone**

	Total Households Estimate	Householder Living Alone		Householder Living Alone > 64	
		Estimate	Percent	Estimate	Percent
<b>Benton County</b>	33,376	9,547	28.6%	3,148	9.4%
<b>Adair Village</b>	267	26	9.7%	7	2.6%
<b>Albany*</b>	19,512	5,328	27.3%	2,048	10.5%
<b>Corvallis</b>	21,251	6,872	32.3%	2,183	10.3%
<b>Monroe</b>	294	88	29.9%	19	6.5%
<b>Philomath</b>	1,732	468	27.0%	89	5.1%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP02

\* The majority of Albany’s population is within Linn County.

The table below shows household structures for families with children. Nearly 22% of all households within the county are family households that have children; Adair Village has the highest percentage of family households with children (63.7%) and Corvallis has the largest number (4,292). There are about four times as many single parent households that are headed by females than by males; Adair Village (18.0%) has the highest percentage of single parent households, while Corvallis (861) has the largest number (excluding Albany). These populations will likely require additional support during a disaster and will inflict strain on the system if improperly managed.

<sup>9</sup> Wood, Nathan. Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon. U.S. Geological Survey, Reston, VA, 2007.

**Table C-8 Family Households with Children by Head of Household**

	Total Households Estimate	Family Households with Children		Single Parent (male)		Single Parent (female)	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
<b>Benton County</b>	33,376	7,313	21.9%	335	1.0%	1,238	3.7%
<b>Adair Village</b>	267	170	63.7%	12	4.5%	36	13.5%
<b>Albany*</b>	19,512	6,167	31.6%	544	2.8%	1,988	10.2%
<b>Corvallis</b>	21,251	4,292	20.2%	178	0.8%	861	4.1%
<b>Monroe</b>	294	40	13.6%	3	1.0%	10	3.4%
<b>Philomath</b>	1,732	492	28.4%	15	0.9%	56	3.2%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP02

Note: The table shows the percent of total households represented by each family household structure category.

\* The majority of Albany's population is within Linn County.

## Income

Household income and poverty status are indicators of socio-demographic capacity and the stability of the local economy. Household income can be used to compare economic areas as a whole, but does not reflect how the income is divided among the area residents. The 2014 median household income across Benton County is \$49,338; this is lower than the inflation adjusted 2010 figure, representing a 5.6% decline in real incomes. Adair Village (\$58,542) and Philomath (\$55,176) have the highest median household incomes, while Monroe (\$37,576) and Corvallis (\$40,425) have the lowest median household incomes. The table below shows decreases in real incomes across Benton County and cities (except for Corvallis which held stable).

**Table C-9 Median Household Income**

	Median Household Income			Percent Change
	2010 <sup>^</sup>	2014		
<b>Benton County</b>	\$ 52,125	\$ 49,338		-5.6%
<b>Adair Village</b>	\$ 65,627	\$ 58,542		-12.1%
<b>Albany*</b>	\$ 48,282	\$ 45,478		-6.2%
<b>Corvallis</b>	\$ 40,406	\$ 40,425		0.0%
<b>Monroe</b>	\$ 37,890	\$ 37,576		-0.8%
<b>Philomath</b>	\$ 59,801	\$ 55,176		-8.4%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP03.

<sup>^</sup> 2010 dollars are adjusted for 2014 using the State of Oregon Employment Department's Inflation Calculator.

\* The majority of Albany's population is within Linn County.

The table below identifies the percentage of individuals and children under 18 that are below the poverty level in 2014. It is estimated that 22.7% of individuals and 14.1% of children under 18 live below the poverty level across the county. Corvallis (29.5%, 14,720) has the highest rate, and total population, in poverty, while also having the largest population of children under 18 in poverty, 1,345 (excluding Albany). Philomath (18.1%) and Adair Village (17.5%) have the highest poverty rates for children (excluding Albany).

**Table C-10 Poverty Rates**

	Total Population in Poverty		Children Under 18 in Poverty	
	Number	Percent	Number	Percent
<b>Benton County</b>	18,380	22.7%	2,102	14.4%
<b>Adair Village</b>	112	12.7%	57	17.5%
<b>Albany*</b>	10,843	21.4%	4,317	33.5%
<b>Corvallis</b>	14,720	29.5%	1,345	16.9%
<b>Monroe</b>	108	14.5%	17	15.9%
<b>Philomath</b>	792	17.4%	199	18.1%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table S1701.

\* The majority of Albany’s population is within Linn County.

Cutter’s research suggests that lack of wealth contributes to social vulnerability because individual and community resources are not as readily available. Affluent communities are more likely to have both the collective and individual capacity to more quickly rebound from a hazard event, while impoverished communities and individuals may not have this capacity –leading to increased vulnerability. Wealth can help those affected by hazard incidents to absorb the impacts of a disaster more easily. Conversely, poverty, at both an individual and community level, can drastically alter recovery time and quality.<sup>10</sup>

Federal assistance programs such as food stamps are another indicator of poverty or lack of resource access. Statewide social assistance programs like the Supplemental Nutritional Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) provide assistance to individuals and families. In Benton County, TANF reaches approximately 274 families per month and SNAP helps to feed about 4,200 people (2,300 households) per month.<sup>11</sup> Those reliant on federal assistance are more vulnerable in the wake of disaster because of a lack of personal financial resources and reliance on government support.

## Education

Educational attainment of community residents is also identified as an influencing factor in socio-demographic capacity. Educational attainment often reflects higher income and

<sup>10</sup> Cutter, S. L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*.

<sup>11</sup> Sabatino, J. (2016). *Oregon TANF Caseload FLASH, “One and Two Parent Families Combined”*, District 4, Corvallis; February 2016 data, and Sabatino, J. (2016). *Oregon SNAP Program Activity, “SSP, APD and AAA Combined”*, District 4, Corvallis; February 2016 data. Retrieved from State of Oregon Office of Business Intelligence website: <http://www.oregon.gov/DHS/ASSISTANCE/Pages/Data.aspx>, March 2016.

therefore higher self-reliance. Widespread educational attainment is also beneficial for the regional economy and employment sectors as there are potential employees for professional, service and manual labor workforces. An oversaturation of either highly educated residents or low educational attainment can have negative effects on the resiliency of the community.

According to the U.S. Census, 94.6% of the Benton County population over 25 years of age has graduated from high school or received a high school equivalency, with 51.4% going on to earn a Bachelor’s Degree. Monroe (88.4%) has the lowest percentage of high school graduates. Corvallis has the highest percentage of their population with a Bachelor’s degree or higher, and Monroe (6.2%) has the lowest percentage.

**Table C-11 Educational Attainment**

Jurisdiction	Benton					
	County	Adair Village	Albany*	Corvallis	Monroe	Philomath
Population 25 years and over	51,458	508	33,616	29,028	483	2,984
Less than 9th grade	2.0%	1.0%	3.0%	1.8%	6.0%	2.0%
9th to 12th grade, no diploma	3.4%	1.0%	7.6%	2.4%	5.6%	2.7%
High school graduate or GED	15.0%	18.5%	25.1%	11.5%	44.9%	19.6%
Some college, no degree	21.2%	24.2%	30.2%	19.5%	28.8%	25.7%
Associate's degree	7.0%	12.6%	10.5%	6.2%	8.5%	8.8%
Bachelor's degree	28.0%	33.7%	15.5%	31.3%	5.4%	23.3%
Graduate or professional degree	23.4%	9.1%	8.0%	27.2%	0.8%	17.8%
Percent without Highschool Degree	5.4%	2.0%	10.6%	4.2%	11.6%	4.7%
Percent High School Graduate or Higher	94.6%	98.1%	89.3%	95.7%	88.4%	95.2%
Percent Bachelor's Degree or Higher	51.4%	42.8%	23.5%	58.5%	6.2%	41.1%

Source: U.S. Census Bureau, 2008-2012 American Community Survey, Table DP02.

\* The majority of Albany’s population is within Linn County.

## Health

Individual and community health play an integral role in community resiliency, as indicators such as health insurance, people with disabilities, dependencies, homelessness and crime rate, paint an overall picture of a community’s well-being. These factors translate to a community’s ability to prepare, respond to, and cope with the impacts of a disaster.

The Resilience Capacity Index recognizes those who lack health insurance or are impaired with sensory, mental or physical disabilities, have higher vulnerability to hazards and will likely require additional community support and resources. Monroe (21.7%) has the highest percentage of population in Benton County without health insurance. The percentage of uninsured changes with age; the highest rates of uninsured are within the 18 to 64 year category. Monroe has the highest rate of this age group that is uninsured and Corvallis (5,305) has the largest number (excluding Albany). Monroe (11.2%) has the highest percentage of individuals under 18 without health insurance, while Corvallis (327) has the largest number (excluding Albany). The ability to provide services to the uninsured populations may burden local providers following a natural disaster. Between 2012 and 2014 there was a drop in the percent of uninsured Benton County residents, declining from 12.9% to 4.8% uninsured (approximately 4,200 uninsured); presumably this is a result of

enrollment in health care coverage through the Affordable Care Act (ACA) coverage expansion.<sup>12</sup>

**Table C-12 Health Insurance Coverage**

Jurisdiction	Population <sup>^</sup>	Without Health Insurance							
		Total Population		Under 18		18 to 64		65+	
		Number	Percent	years	Percent	years	Percent	years	Percent
<b>Benton County</b>	85,782	8,618	10.0%	654	4.4%	7,875	13.2%	89	0.8%
<b>Adair Village</b>	881	80	9.1%	8	2.5%	72	14.3%	0	0.0%
<b>Albany*</b>	50,579	6,758	13.4%	670	5.2%	6,037	19.5%	51	0.8%
<b>Corvallis</b>	54,559	5,678	10.4%	327	4.1%	5,305	13.0%	46	0.8%
<b>Monroe</b>	746	162	21.7%	12	11.2%	150	28.2%	0	0.0%
<b>Philomath</b>	4,563	418	9.2%	25	2.3%	393	13.0%	0	0.0%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table S2701.

<sup>^</sup>Non-institutionalized population

\* The majority of Albany's population is within Linn County.

The table below describes disability status of the population. As of 2014, 10.4% of the Benton County non-institutionalized population identifies with one or more disabilities. Monroe has the highest percentage of its total population with a disability (17.7%) and also the highest percentage of individuals 65 years and over with a disability (36.4%). The highest percentage (excluding Albany) of individuals under 18 years with a disability are in Adair Village (7.1%), while the largest number (excluding Albany) are in Corvallis (254).

**Table C-13 Disability Status**

	Total Population <sup>^</sup> Estimate	With a disability		Under 18 years with a disability		65 years and over with a disability	
		Estimate	Percent	Estimate	Percent <sup>^^</sup>	Estimate	Percent <sup>^^</sup>
<b>Benton County</b>	85,782	8,883	10.4%	551	3.7%	3,611	32.0%
<b>Adair Village</b>	881	90	10.2%	23	7.1%	17	31.5%
<b>Albany*</b>	50,579	8,216	16.2%	1,005	7.7%	2,650	39.9%
<b>Corvallis</b>	54,559	4,993	9.2%	254	3.1%	2,004	34.6%
<b>Monroe</b>	746	132	17.7%	3	2.8%	39	36.4%
<b>Philomath</b>	4,563	569	12.5%	65	5.9%	122	27.7%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP02.

<sup>^</sup>Non-institutionalized population, <sup>^^</sup>Percent of age group

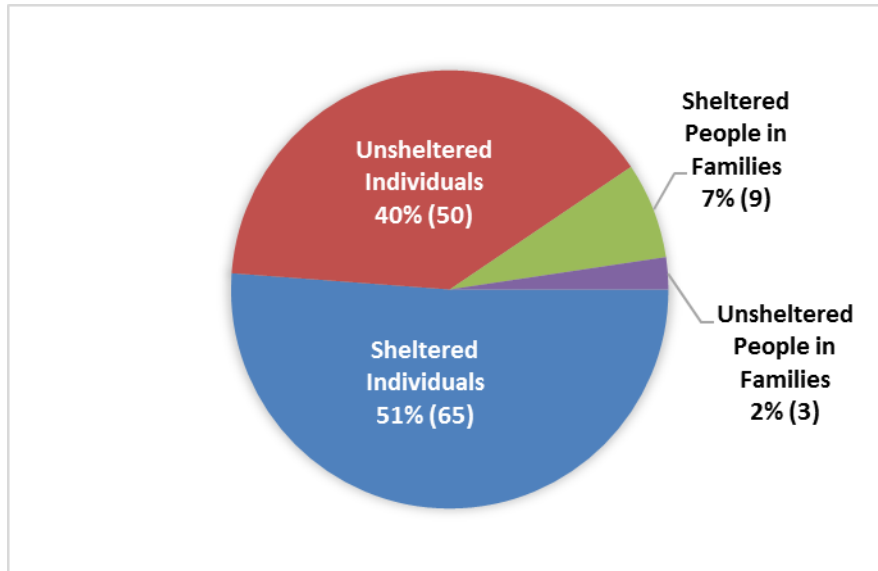
\* The majority of Albany's population is within Linn County.

In 2015, Oregon Housing and Community Services (OHCS) conducted a point-in-time homeless count to identify the number of homeless, their age and their family type. The OHCS study found that 127 individuals in Benton County identify as homeless; 74 were sheltered (9 in families), 53 were unsheltered (3 in families).

<sup>12</sup> Oregon Health Authority, Impacts of the Affordable Care Act on Health Insurance Coverage in Oregon: County Results/ Statewide Update. February 2015, <https://www.ohsu.edu/xd/research/centers-institutes/center-for-health-systems-effectiveness/upload/Health-Insurance-Coverage-in-Oregon-County-Results.pdf>



**Figure C-3 Benton County PIT Homeless Count (2015)**



Source: Oregon Housing and Community Services, 2015 Point-in-Time Homeless Count

The homeless have little resources to rely on, especially during an emergency. It will likely be the responsibility of the county and local non-profit entities to provide services such as shelter, food and medical assistance. Therefore, it is critical to foster collaborative relationships with agencies that will provide additional relief such as the American Red Cross and homeless shelters. It will also be important to identify how to communicate with these populations, since traditional means of communication may not be appropriate or available.

## Synthesis

For planning purposes, it is essential Benton County consider both immediate and long-term socio-demographic implications of hazard resilience. Immediate concerns include the growing elderly population and language barriers associated with a culturally diverse community. Even though the vast majority of the population is reported as proficient in English, there is still a segment of the population not proficient in English. These populations would serve to benefit from mitigation outreach, with special attention to cultural, visual and technology sensitive materials. The current status of other socio-demographic capacity indicators such as graduation rate, poverty level, and median household income can have long-term impacts on the economy and stability of the community ultimately affecting future resilience.

## Economic Capacity

Economic capacity refers to the financial resources present and revenue generated in the community to achieve a higher quality of life. Income equality, housing affordability, 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 component parts of employment sectors, workforce, resources and infrastructure are interconnected in the existing economic picture. Once any inherent

strengths or systematic vulnerabilities become apparent, both the public and private sectors can take action to increase the resilience of the local economy.

## Regional Affordability

The evaluation of regional affordability supplements the identification of socio-demographic capacity indicators, i.e. median income, and is a critical analysis tool to understanding the economic status of a community. This information can capture the likelihood of individuals' ability to prepare for hazards, through retrofitting homes or purchasing insurance. If the community reflects high-income inequality or housing cost burden, the potential for homeowners and renters to implement mitigation can be drastically reduced. Therefore, regional affordability is a mechanism for generalizing the abilities of community residents to get back on their feet without Federal, State or local assistance.

## Income Equality

Income equality is a measure of the distribution of economic resources, as measured by income, across a population. It is a statistic defining the degree to which all persons have a similar income. The table below illustrates the county and city level of income inequality. The Gini index is a measure of income inequality. The index varies from zero to one. A value of one indicates perfect inequality (only one household has any income). A value of zero indicates perfect equality (all households have the same income).<sup>13</sup>

The cities within the county vary with the greatest income equality within the City of Corvallis, while the smaller cities have greater income inequality. Based on social science research, the region's cohesive response to a hazard event may be affected by the distribution of wealth in communities that have less income equality<sup>14</sup>.

**Table C-14 Regional Income Equality**

Jurisdiction	Income Inequality Coefficient
Benton County	0.485
Adair Village	0.353
Albany*	0.419
Corvallis	0.521
Monroe	0.395
Philomath	0.388

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table B19083

\* The majority of Albany's population is within Linn County.

<sup>13</sup>University of California Berkeley. Building Resilient Regions, Resilience Capacity Index. <http://brr.berkeley.edu/rci/>.

<sup>14</sup>Susan Cutter, Christopher G. Burton, and Christopher T. Emrich. 2010. "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management* 7, no.1: 1-22

## Housing Affordability

Housing affordability is a measure of economic security gauged by the percentage of an area’s households paying less than 35% of their income on housing.<sup>15</sup> Households spending more than 35% are considered housing cost burdened. The table below displays the percentage of homeowners and renters reflecting housing cost burden across the region.

Among homeowners without a mortgage, Adair Village has the greatest rate of households with housing cost burdens. Amongst homeowners with a mortgage, Monroe, Adair Village, and Philomath have the highest rates of housing cost burden. Among renters, Corvallis, Philomath, and Adair Village renters have the greatest rates of households with housing cost burdens. In general, the population that spends more of their income on housing has proportionally fewer resources and less flexibility for alternative investments in times of crisis.<sup>16</sup> This disparity imposes challenges for a community recovering from a disaster as housing costs may exceed the ability of local residents to repair or move to a new location. These populations may live paycheck to paycheck and are extremely dependent on their employer; in the event their employer is also impacted, it will further the detriment experienced by these individuals and families.

**Table C-15 Households Spending > 35% of Income on Housing**

Jurisdiction	Owners		Renters
	With Mortgage	Without Mortgage	
<b>Benton County</b>	23.4%	8.5%	49.2%
<b>Adair Village</b>	33.8%	20.0%	37.6%
<b>Albany*</b>	21.0%	12.2%	48.8%
<b>Corvallis</b>	22.3%	9.6%	52.0%
<b>Monroe</b>	38.5%	0.0%	16.8%
<b>Philomath</b>	31.0%	6.0%	43.0%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Tables B25070 and B25091

\* The majority of Albany’s population is within Linn County.

## Economic Diversity

Economic diversity is a general indicator of an area’s fitness for weathering difficult financial times. Business activity in the Willamette Valley region is fairly homogeneous and consists mostly of small businesses.

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 county and regional economies with those of states or the nation as a whole. Using the Herfindahl Index, a diversity ranking of 1 indicates the Oregon County with the most diverse economic activity compared to the state as a

<sup>15</sup> University of California Berkeley. Building Resilient Regions, Resilience Capacity Index. <http://brr.berkeley.edu/rci/>.

<sup>16</sup> Ibid.

whole, while a ranking of 36 corresponds with the least diverse county economy. The table below describes the Herfindahl Index Scores for counties in the region.

Table C-16 shows that Benton County has an economic diversity rank of 21, this is on a scale between all 36 counties in the state where 1 is the most diverse economic county in Oregon and 36 is the least diverse.

**Table C-16 Regional Herfindahl Index Scores**

County	2008			2013		
	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

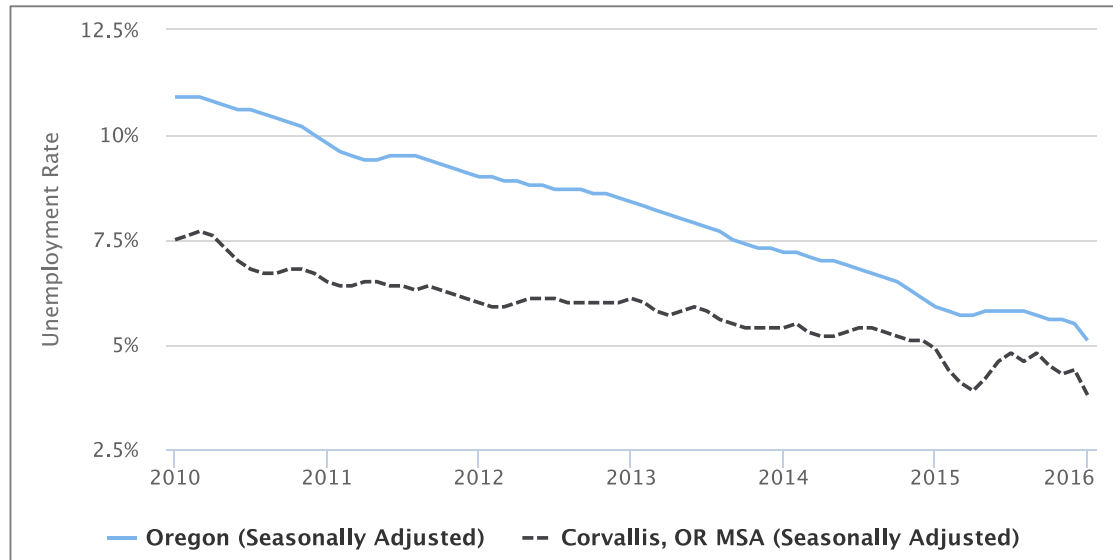
While illustrative, economic diversity is not a guarantor of economic vitality or resilience. Benton County, as of 2015, is listed as an economically non-distressed community as prescribed by Oregon Law. The economic distress measure is based on indicators of decreasing new jobs, average wages and income, and is associated with an increase of unemployment.<sup>17</sup>

<sup>17</sup> Business Oregon – Oregon Economic Data “Distressed Communities List”, <http://www.oregon4biz.com/Publications/Distressed-List/>

## Employment and Wages

According to the Oregon Employment Department, unemployment has declined since 2010 and remains lower than the rate for Oregon.

**Figure C-4 Unemployment Rate**



Source: Oregon Employment Department, "Local Area Employment Statistics".

Table C-17 (below) displays the payroll and employee figures for Benton County. As of 2014, there were 35,106 individuals employed in the county, with an average wage of \$46,281.

## Industry

Key industries are those that represent major employers and are significant revenue generators. Different industries face distinct vulnerabilities to natural hazards, as illustrated by the industry specific discussions below. Identifying key industries in the region enables communities to target mitigation activities towards those industry's specific sensitivities. It is important to recognize that the impact a natural hazard event has on one industry can reverberate throughout the regional economy.

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; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health services.

## 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, such that employment is affected, the impact will be 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.

The table below identifies Employment by industry. The top five industry sectors in Benton County with the most employees, as of 2014, are state government (18%, 6,211), education and health services (16%, 5,703), trade, transportation and utilities (4,316), professional and business services (3,948), and leisure and hospitality (3,820). While Benton County has some basic industries, such as natural resources and mining and manufacturing; four out of their five largest employers are of the non-basic nature and thus they rely on local sales and services. Trending towards basic industries can lead to higher community resilience.

**Table C-17 Total Employment by Industry 2014, Expected Growth 2022**

Jurisdiction	2014				Change in Employment (2009-2013)	Employment Forecast^ (2012-2022)
	Firms	Employment	Percent Employment	Average Wage		
Total Payroll Employment	2,473	35,106	100%	\$ 46,281	2%	12%
Total Private	2,365	25,815	74%	\$ 43,580	2%	13%
Natural Resources and Mining	103	1,072	3%	\$ 35,217	-20%	15%
Construction	173	849	2%	\$ 42,361	-2%	26%
Manufacturing	105	3,015	9%	\$ 77,661	-10%	5%
Durable goods	61	941	3%	-	6%	7%
Trade, Transportation & Utilities	383	4,316	12%	\$ 30,822	2%	9%
Wholesale Trade	88	407	1%	\$ 79,056	-14%	9%
Retail Trade	243	3,431	10%	\$ 24,154	6%	9%
Information	51	612	2%	\$ 67,491	-27%	1%
Financial Activities	198	975	3%	\$ 44,660	-2%	13%
Professional and Business Services	422	3,948	11%	\$ 54,212	11%	24%
Education and Health Services	306	5,703	16%	\$ 50,380	2%	17%
Health Care and Social Assistance	269	5,239	15%	\$ 52,775	1%	-
Leisure and Hospitality	241	3,820	11%	\$ 15,073	13%	13%
Other Services	379	1,500	4%	\$ 26,895	22%	10%
Government	108	9,290	26%	\$ 53,794	4%	7%
Federal	17	505	1%	\$ 69,677	-14%	-5%
State	17	6,211	18%	\$ 57,584	13%	9%
State Government Educational Services	4	6,064	17%	\$ 57,682	14%	-
Local	74	2,573	7%	\$ 41,550	-10%	5%
Local Government Educational Services	34	1,367	4%	\$ 36,518	-15%	5%

Source: Oregon Employment Department, "2010 and 2014 Covered Employment and Wages Summary Reports" and "Regional Employment Projections by Industry & Occupation 2012-2022". <http://www.qualityinfo.org>. Accessed March 2016.

## High Revenue Sectors

In 2012, the three sectors with the highest revenue were Retail Trade, Wholesale Trade, and Manufacturing. The table below shows the revenue generated by each economic sector (Note: not all sectors are reported). All of the sectors combined generated more than \$2 billion in revenue for the county.

Benton County relies on both basic and non-basic sector industries and it is important to consider the effects each may have on the economy following a disaster. Basic sector businesses have a multiplier effect on a local economy that can spur the creation of new jobs, some of which may be non-basic. The presence of basic sector jobs can help speed the local recovery; however, if basic sector production is hampered by a natural hazard event, the multiplier effect could be experienced in reverse. In this case, a decrease in basic sector

purchasing power results in lower profits and potential job losses for the non-basic businesses that are dependent on them.

**Table C-18 Revenue of Top Sectors in Benton County (Employer)**

Sector Meaning (NAICS code)	Sector Revenue (\$1,000)	Percent of Total Revenue
Manufacturing	\$ 412,712	20.6%
Wholesale trade	\$ 452,541	22.6%
Retail trade	\$ 731,042	36.4%
Transportation and warehousing (104)	\$ 152,496	7.6%
Real estate and rental and leasing	\$ 53,257	2.7%
Administrative and support and waste management and remediation services	\$ 61,272	3.1%
Accommodation and food services	\$ 142,802	7.1%
Total	\$ 2,006,122	100%

Source: U.S. Census Bureau, 2012 Economic Census, Table EC1200A1.

The *Retail Trade* sector generated \$731.0 million, making it the largest earning sector in Benton County. The *Retail Trade* sector typically relies on local residents and tourists and their discretionary spending ability. Residents' discretionary spending diminishes after a natural disaster when they must pay to repair their homes and properties. In this situation, residents will likely concentrate their spending on essential items that would benefit some types of retail (e.g., grocery) but hurt others (e.g., gift shops). The potential income from tourists also diminishes after a natural disaster as people are deterred from visiting the impacted area. Retail trade is also largely dependent on wholesale trade and the transportation network for the delivery of goods for sale. Disruption of the transportation system could have severe consequences for retail businesses. In summary, depending on the type and scale, a disaster could affect specific segments of retail trade, or all segments.

*Wholesale Trade* generated nearly about \$452.5 million. Wholesale Trade is closely linked with retail trade but it has a broader client base, with local and non-local businesses as the typical clientele. Local business spending will be likely to diminish after a natural disaster, as businesses repair their properties and wait for their own retail trades to increase. Distanced clients may have difficulty reaching the local wholesalers due to transportation disruptions from a natural disaster.

The *Manufacturing* sector was the third largest revenue generator, generating \$412.7 million. It is highly dependent upon the transportation network in order to access supplies and send finished products to outside markets. As a base industry, manufacturers are not dependent on local markets for sales, which contribute to the economic resilience of this sector.

In the event that any of these primary sectors are impacted by a disaster, Benton County may experience a significant disruption of economic productivity.

## Future Employment in Industry

Sectors that are anticipated to be major employers in the future also warrant special attention in the hazard mitigation planning process. As shown in Table C-17, between 2012 and 2022, the largest employment growth is anticipated within construction (26%),

professional and business services (24%), and education and health services (17%).<sup>18</sup> Retail trade and wholesale trade are expected to increase by 9% each, while manufacturing is expected to increase by 5%.

## Synthesis

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. Because education and health services, state government, and manufacturing are key to post-disaster recovery efforts, the region is bolstered by its major employment sectors. The county's economy is expected to grow by 2022, with much of the growth within the industries of construction, professional and business services, and education and health services. 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 less income equality, particularly in the smaller cities, higher housing costs, and overall low economic diversity are factors that may contribute to slower recovery from a disaster.

## Built Environment Capacity

Built Environment capacity refers to the built environment and infrastructure that supports the community. The various forms, quantity, and quality of built capital mentioned above contribute significantly to community resilience. Physical infrastructures, including utility and transportation lifelines, are critical 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.

## Land Use and Development Patterns

Benton County was created from Polk County in 1847 from an area originally inhabited by the Klickitat and Calapooia Native Americans. When created, Benton County extended from the Willamette River to the coast and south to the California border. Lane, Douglas, Jackson, Lincoln, Josephine, Curry and Coos Counties were later created from portions of the original Benton County.

The city of Marysville, which became the county seat in 1851, was renamed Corvallis in 1853. Corvallis was incorporated as a city in 1857. Oregon State University was founded in Corvallis in 1862 as the Oregon State Agricultural College and has since become a major educational institution with more than 20,000 students. Oregon State University continues to serve as an important presence in Benton County.

The vast majority of Benton County is forestland, with smaller areas of agricultural lands. Forested lands are located along the western portion of the county and comprise part of the

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<sup>18</sup> Oregon Employment Department, "Employment Projections by Industry and Occupations: 2012-2022 Oregon and Regional Summary", <http://qualityinfo.org/pubs/projections/projections.pdf>, accessed October 2014.



Coast Range of Oregon. Agriculture is concentrated throughout the flat regions of the Willamette Valley. Cities and rural residential areas are heavily concentrated along the rivers (Willamette River and Marys River) in the eastern part of 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.

## Regulatory Context

Oregon land use laws require land outside Urban Growth Boundaries (UGBs) to be protected for farm, forest, and aggregate resource values. For the most part, this law limits the amount of development in the 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 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 it can be demonstrated to Corvallis 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, rural unincorporated communities will continue to grow, and overall rural residential density will increase slightly with the bulk of rural lands kept 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 has the overriding purpose 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.

To comply with Goal 7, local governments are required to respond to new hazard inventory information from federal or state agencies. The local government must evaluate the hazard risk and assess the:

- a) frequency, severity, and location of the hazard;
- b) effects of the hazard on existing and future development;
- c) potential for development in the hazard area to increase the frequency and severity of the hazard; and
- d) types and intensities of land uses to be allowed in the hazard area.

Local governments must adopt or amend comprehensive plan policies and implementing measures to avoid development in hazard areas where the risk cannot be mitigated. In addition, the siting of essential facilities, major structures, hazardous facilities and special occupancy structures should be prohibited in hazard areas where the risk to public safety cannot be mitigated. The state recognizes compliance with Goal 7 for coastal and riverine flood hazards by adopting and implementing local floodplain regulations that meet the minimum National Flood Insurance Program (NFIP) requirements.

In adopting plan policies and implementing measures for protection from natural hazards local governments should consider:

- a) the benefits of maintaining natural hazard areas as open space, recreation, and other low density uses;
- b) the beneficial effects that natural hazards can have on natural resources and the environment; and
- c) the effects of development and mitigation measures in identified hazard areas on the management of natural resources.

Local governments should coordinate their land use plans and decisions with emergency prevention, protection, mitigation, response, and recovery programs. Given the numerous waterways and forested lands throughout Corvallis, special attention should be given to problems associated with river bank erosion and potential for wildland/ urban interface fires.

Goal 7 guides local governments to give special attention to emergency access when considering development in identified hazard areas, including:

- a) Consider programs to manage stormwater runoff as a means to address flood and landslide hazards;
- b) Consider non-regulatory approaches to help implement the goal;
- c) When reviewing development requests in high hazard areas, require site specific reports, appropriate for the level and type of hazards. Site specific reports should evaluate the risk to the site, as well as the risk the proposed development may pose to other properties; and

- d) Consider measures exceeding the National Flood Insurance Program.

## Housing

In addition to location, the characteristics of the housing stock affect the level of risk posed by natural hazards. The table below identifies the types of housing most common throughout the county. Of particular interest are mobile homes, which account for about 6.8% of the housing in Benton County (16.3% in Monroe). Mobile homes are particularly vulnerable to certain natural hazards, such as windstorms, and special attention should be given to securing the structures, because they are more prone to wind damage than wood-frame construction.<sup>19</sup> In other natural hazard events, such as earthquakes and floods, moveable structures like mobile homes are more likely to shift on their foundations and create hazardous conditions for occupants.

**Table C-19 Housing Profile**

	Housing Units	Single Family		Multi-Family		Mobile Homes <sup>^</sup>	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
<b>Benton County</b>	36,701	23,115	63.0%	11,105	30.3%	2,481	6.8%
<b>Adair Village</b>	276	244	88.4%	32	11.6%	0	0.0%
<b>Albany*</b>	20,988	14,506	69.1%	5,312	25.3%	1,170	5.6%
<b>Corvallis</b>	23,765	12,455	52.4%	10,546	44.4%	764	3.2%
<b>Monroe</b>	337	204	60.5%	78	23.1%	55	16.3%
<b>Philomath</b>	1,867	1,364	73.1%	336	18.0%	167	8.9%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table DP04

\* The majority of Albany's population is within Linn County.

<sup>^</sup> Also includes boats, RVs, vans, etc. that are used as a residence.

Note: the percentages listed in the table above do not reflect the number of structures that are built within special flood hazard areas, or that are at risk of seismic damage.

Aside from location and type of housing, the year structures were built has implications. Seismic building standards were codified in Oregon building code starting in 1974; more rigorous building code standards were passed in 1993 that accounted for the Cascadia earthquake fault.<sup>20</sup> Therefore, homes built before 1993 are more vulnerable to seismic events. Also, in the 1970's, FEMA began assisting communities with floodplain mapping as a response to administer the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Upon receipt of floodplain maps, communities started to develop floodplain management ordinances to protect people and property from flood loss and damage.

The table below illustrates the number and percent of homes built between 1970 and 2014. Regionally about one-third of the housing stock was built prior to 1970, before the implementation of floodplain management ordinances; however, Adair Village has over half of its housing units built prior to 1970 (Adair Village does not have property within a special flood hazard area). Countywide, about two-thirds of the housing stock was built before 1990 and the codification of seismic building standards. Approximately one-third of the county's

<sup>19</sup> Ibid.

<sup>20</sup> State of Oregon Building Codes Division. *Earthquake Design History: A summary of Requirements in the State of Oregon*, February 7, 2012. [http://www.oregon.gov/OMD/OEM/osspace/docs/history\\_seismic\\_codes\\_or.pdf](http://www.oregon.gov/OMD/OEM/osspace/docs/history_seismic_codes_or.pdf)

housing stock was built after 1990; Adair Village (41.3%) and Philomath (40.9%) have the highest percentage of housing units built after 1990.

**Table C-20 Year Structure Built**

	Total Housing Units	Pre 1970		1970 to 1989		1990 or later	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
<b>Benton County</b>	36,701	12,672	34.5%	12,200	33.2%	11,829	32.2%
<b>Adair Village</b>	276	141	51.1%	21	7.6%	114	41.3%
<b>Albany*</b>	20,988	6,947	33.1%	6,634	31.6%	7,407	35.3%
<b>Corvallis</b>	23,765	8,534	35.9%	7,927	33.4%	7,304	30.7%
<b>Monroe</b>	337	134	39.8%	105	31.2%	98	29.1%
<b>Philomath</b>	1,867	641	34.3%	462	24.7%	764	40.9%

Source: U.S. Census Bureau, 2008-2012 American Community Survey, Table DP04

\* The majority of Albany’s population is within Linn County.

The National Flood Insurance Program’s (NFIP’s) Flood Insurance Rate Maps (FIRMs) delineate flood-prone areas. They are used to assess flood insurance premiums and to regulate construction so that in the event of a flood, damage is minimized. The table below shows the initial and current FIRM effective dates for Benton County communities. For more information about the flood hazard, NFIP, and FIRMs, please refer the Flood Hazard Chapter and Risk Assessment (Volume II).

**Table C-21 Community Flood Map History**

	Initial FIRM	Current FIRM
<b>Benton</b>	August 5, 1986	June 2, 2011
<b>Adair Village</b>	N/A	N/A
<b>Albany*</b>	see Linn County	see Linn County
<b>Corvallis</b>	January 3, 1985	June 2, 2011
<b>Monroe</b>	September 26, 1975	June 2, 2011
<b>Philomath</b>	June 15, 1982	June 2, 2011

Source: Federal Emergency Management Agency, Community Status Book Report\*

The majority of Albany’s population is within Linn County.

## 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 Benton County are identified below and within the City Addenda of Volume II.

### Hospital:

- Good Samaritan Regional Medical Center (Corvallis), 134 beds (188 licensed), Level II Trauma
- Ambulance service is provided by Corvallis Fire Department and Albany Fire Department

#### Law Enforcement:

- Benton County Sheriff (offices in Corvallis, and Monroe), Jail (Corvallis)
- Philomath Police Department
- Corvallis Police Department

#### Fire Districts:

- Adair Rural Fire Protection
- Alsea Rural Fire Protection
- Albany Fire Department
- Blodgett-Summit Rural Fire Protection
- Corvallis Rural Fire Protection
- Hoskins-Kings Rural Fire Protection
- Monroe Rural Fire Protection
- North Albany Rural Fire Protection
- Palestine Rural Fire Protection
- Philomath Fire and Rescue

#### School Districts:

- Alsea School 7J
- Central School 13J
- Corvallis School 509J
- Greater Albany Public School 8J (three schools are in Benton County)
- Harrisburg School 7
- Monroe School 1J
- Philomath School 17J
- Santiam Christian School District

## **Infrastructure Profile**

Physical infrastructure such as dams, levees, roads, bridges, railways and airports support Benton County communities and economies. Due to the fundamental role that physical infrastructure plays both in pre and post-disaster, they deserve special attention in the context of creating resilient communities.

Utility systems such as potable water, wastewater, natural gas, telecommunications, and electric power are all networked systems. That is, they consist of nodes and links. Nodes are centers where something happens - such as a pumping plant, a treatment plant, a substation, a switching office and the like. Links are the connections (pipes or lines) between nodes.

### **Potable Water**

Water treatment plants are often located in flood prone areas and are subject to inundation when raw water enters the filters, sedimentation or flocculation basins, resulting in loss of capability to treat incoming raw water properly. Water system control buildings and pump stations may also be subject to flood damages. Public or private water systems with wells as

the water source are subject to outages when flood waters contaminate well heads; this is a common problem for smaller water systems.

For Corvallis, neither the Taylor nor Rock Creek Water Treatment Plants are within the mapped 100-year floodplains, although they could experience flooding in events significantly larger than a 100-year flood.

Water transmission or distribution pipes are rarely damaged by flood waters, unless there are soil settlements or major erosion, because the lines are sufficiently pressurized (for water quality) to prevent intrusion of flood waters. Water transmission or distribution pipes are, however, subject to breakage when they cross landslide areas or in earthquakes. Water treatment plants are also subject to earthquake damages to the building and to process and control equipment.

Water systems, including Corvallis' water systems, are also highly vulnerable to electric power outages. Many water systems include pumped storage systems where water is pumped to storage tanks which are typically located 60 to 200 feet above the elevation of water system customers. Such tanks generally contain no more than 1 or 2 days of storage beyond typical daily usage (for reasons of water quality). Thus, electric power outages of more than 1 or 2 days may result in loss of potable water due to the inability of pumping plants to pump water. The most logical mitigation projects to minimize such outages are to provide back-up generators at key pumping plants or to provide quick connects so that portable generators (if available) can be quickly installed. Water treatment plants are also subject to outages due to loss of electric power.

For Corvallis, both water treatment plants have one commercial power source (CPI or PP&L). The Rock Creek plant has sufficient generator capacity to operate without commercial power. However, the generator at the Taylor plant provides only minimal backup power and the facility cannot operate without commercial power. This limitation poses significant risk to Corvallis for events which result in prolonged power outages. Four of the critical booster stations have on-site generators with enough capacity to operate the pumps. All of the other booster stations are pre-wired for quick connection of portable generators in the event of loss of commercial power.

For the Corvallis water system, seismic upgrades have been done for both water treatment plants and most of the reservoirs. Water pipes almost inevitably suffer damage in earthquakes regardless of their materials, although older cast-iron pipes typically have higher failure rates than ductile iron, welded steel or PVC pipes. Upgrades of pipes are rarely feasible from an economic perspective for seismic reasons alone, except for critical locations for transmission pipes where failure may result in prolonged outages for many customers. Critical locations include bridge crossings, liquefaction areas, landslide areas, and any other areas where the probability of failure is high.

## Wastewater Systems

Wastewater systems are often highly vulnerable to flood impacts. Rising water may cause collection pipes to backup and overflow. Intrusion of storm water into collection systems may result in flows that exceed treatment plant capacities, resulting in release of untreated or only partially treated flows. Treatment plants are often located in floodplains, at low elevations, to facilitate gravity flow. However, such locations also facilitate flood damages.

Lift stations and treatment plants are also subject to loss of function due to electric power outages, with resulting overflows or releases. Collection pipes are also subject to breakage due to landslides. However, such impacts are not particularly common, since most wastewater collection systems are in more urbanized areas with only selected areas subject to slides. Wastewater pipes are, however, subject to breakage in earthquakes. Wastewater treatment plants are also subject to earthquake damages to the building and to process and control equipment.

The Corvallis Wastewater Reclamation Plant is located within the 100-year floodplain. A seismic evaluation and retrofit have been completed. The plant's electric power is provided by two PP&L feeds, which provides some redundancy. There are two very small generators at the plant, which provide only minimal power. The plant cannot operate without commercial power. All but one of the wastewater lift stations have on-site backup generators with enough capacity to operate the pumps.

## Natural Gas Systems

Natural gas transmission and distribution pipes are not usually affected by flooding, because the pipes are pressurized. However, compressor stations may be subject to inundation damage or loss of electrical power to run electrical and mechanical equipment.

Transmission and distribution pipes are also subject to rupture in slide areas and in earthquakes. Buried utility pipes are very subject to failure in small ground movements. Movements as small as an inch or two are often sufficient to break the pipes, especially for older cast-iron pipe which is more brittle than welded steel or polyethylene pipe. Possible mitigation actions include pipe upgrades for a few critical locations and nonstructural seismic mitigation for control equipment.

## Telecommunications Systems

Telephone (land lines and cellular) systems, broadcast radio and TV systems, and cable TV systems may all be vulnerable to damages and services outages from hazards. However, in general, such systems have proved to be somewhat less vulnerable to service outages than other utility systems. System nodes (broadcast studios, switching offices and such) are subject to flooding if located in flood-prone areas. However, because of the importance of such facilities, few are located in highly flood-prone sites.

Similarly, few such facilities are likely to be located in landslide prone areas. Cellular towers in hilly areas, however, may be more subject to landslide hazards.

Buried communications (copper and fiber optic) and cable television cables are usually flexible enough to accommodate several feet of ground movement before failure. While major landslides may rupture such cables, minor settlements or small slides are not nearly as likely to impact such cables as they are to break buried gas or water pipes. Such lines typically perform relatively well in earthquakes.

Above ground communications and cable television cables are subject to wind- induced failures from tree falls and pole failures. However, such failures are a less common than failures of electric power lines. The better performance of communications cables arises in part because the electrical cables are always highest on the poles, thus a falling branch is

usually first resisted by the power cables. Also, because the voltage levels in communications cables are much lower than those in power cables, the communication cables are not subject to “burn down” or shorting if wind-swayed cables touch each other or get too close.

Some telecommunications facilities are subject to failure as a result of loss of electric power. However, key facilities almost always have backup battery power and/ or generators. Therefore, telecommunications facilities are generally much less vulnerable to outages from loss of electric power than are water or wastewater systems.

## Dams

Dams are manmade structures built to impound water. Dams are built for many purposes including water storage for potable water supply, livestock water supply, irrigation, or fire suppression. Other dams are built for flood control, recreation, navigation, hydroelectric power or to contain mine tailings. Dams may also be multifunction, serving two or more of these purposes.

The National Inventory of Dams, NID, which is maintained by the United States Army Corps of Engineers, is a database of approximately 76,000 dams in the United States. The NID does not include all dams in the United States. Rather, the NID includes dams that are deemed to have a high or significant hazard potential and dams deemed to pose a low hazard if they meet inclusion criteria based on dam height and storage volume. Low hazard potential dams are included only if they meet either of the following selection criteria:

- exceeds 25 feet in height and 15 acre-feet of storage, or
- exceeds 6 feet in height and 50-acre feet of storage.

There are many thousands of dams too small to meet the NID selection criteria. However, these small dams are generally too small to have significant impacts if they fail and thus are generally not considered for purposes of risk assessment or mitigation planning.

This NID potential hazard classification is solely a measure of the probable impacts if a dam fails. Thus, a dam classified as High Potential Hazard does not mean that the dam is unsafe or likely to fail. The level of risk (probability of failure) of a given dam is not even considered in this classification scheme. Rather, the High Potential Hazard classification simply means that there are people at risk downstream from the dam in the inundation area, if the dam were to fail.

Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/ or environmental losses. Losses are principally limited to the dam owner’s property.

Dams assigned to the significant hazard potential classification are those where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities. Significant hazard potential dams are often located in predominantly rural or agricultural areas.

Dams assigned to the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life. Failure of dams in the high classification



will generally also result in economic, environmental or lifeline losses, but the classification is based solely on probable loss of life.

Dam failures can occur at any time in a dam's life; however, failures are most common when water storage for the dam is at or near design capacity. At high water levels, the water force on the dam is higher and several of the most common failure modes are more likely to occur. Correspondingly, for any dam, the probability of failure is much lower when water levels are substantially below the design capacity for the reservoir.

For embankment dams, the most common failure mode is erosion of the dam during prolonged periods of rainfall and flooding. When dams are full and water inflow rates exceed the capacity of the controlled release mechanisms (spillways and outlet pipes), overtopping may occur. When overtopping occurs, scour and erosion of either the dam itself and/ or of the abutments may lead to partial or complete failure of the dam. Especially for embankment dams, internal erosion, piping or seepage through the dam, foundation, or abutments can also lead to failure. For smaller dams, erosion and weakening of dam structures by growth of vegetation and burrowing animals is a common cause of failure.

For embankment dams, earthquake ground motions may cause dams to settle or spread laterally. Such settlement does not generally lead, by itself, to immediate failure. However, if the dam is full, relatively minor amounts of settling may cause overtopping to occur, with resulting scour and erosion that may progress to failure. For any dam, improper design, construction, or inadequate preparation of foundations and abutments can also cause failures. Improper operation of a dam, such as failure to open gates or valves during high flow periods can also trigger dam failure. For any dam, unusual hydrodynamic (water) forces can also initiate failure. Landslides into the reservoir, which may occur on their own or be triggered by earthquakes, may lead to surge waves which overtop dams or hydrodynamic forces which cause dams to fail under the unexpected load. Earthquakes can also cause seiches (waves) in reservoirs that may overtop or overload dam structures. In rare cases, high winds may also cause waves that overtop or overload dam structures.

Concrete dams are also subject to failure due to seepage of water through foundations or abutments. Dams of any construction type are also subject to deliberate damage via sabotage or terrorism. For waterways with a series of dams, downstream dams are also subject to failure induced by the failure of an upstream dam. If an upstream dam fails, then downstream dams also fail due to overtopping or due to hydrodynamic forces.

Dam failures can occur rapidly and with little warning. Fortunately, most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage still exists. The Oregon Water and Resources Department has inventoried all dams located in Oregon and Benton County. There is one dam categorized as high hazard; North Fork Dam located on the North Fork of Rock Creek (near Philomath); this dam is the reservoir for Corvallis' Rock Creek Water Treatment Plant and is owned by Corvallis. There is also one dam categorized as significant hazard; Thompson Dam located on Bark Creek.

**Table C-22 Benton County Dam Inventory**

Threat Potential	Number of Dams	Rivers
High	1	North Fork of Rock Creek (North Fork Dam)
Significant	1	Bark Creek (Thompson Dam)
Low	15	Burgett Creek, Reese Creek, Marys River, tributaries to Bummer, Oliver and Soap Creek. Tributaries to Willamette River and Two Springs. Acres Pond Dam, Stewart Reservoir, McFadden Reservoir
<b>Total</b>	<b>17</b>	-

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

Benton County is also potentially at risk from dams upstream along the Willamette River and its tributaries, including nine (9) federally owned and operated dams in Lane County which are in the High Potential Hazard Category:

- Cottage Grove (Coast Fork Willamette River, 50,000 acre feet)
- Dorena (Row River, 131,000 acre feet)
- Fern Ridge (Long Tom River, 121,000 acre feet)
- Dexter (Middle Fork Willamette River, 29,900 acre feet)
- Lookout Point (Middle Fork Willamette River, 477,700 acre feet)
- Hills Creek (Middle Fork Willamette River, 356,000 acre feet)
- Fall Creek (Fall Creek, 125,000 acre feet)
- Blue River Dam (Blue River, 89,000 acre feet)
- Cougar (South Fork McKenzie River, 219,000 acre feet)

## Electric Power Systems

There are no power plants located within Benton County. The county is served by several investor-owned, public, and cooperative and municipal utilities. The Bonneville Power Administration is the area's wholesale electricity distributor. Pacific Power and Light (Pacific Power) is the primary investor-owned utility company serving Benton County. The county is also served by Consumers Power, Inc.

The electric power system is central to the functioning of a modern society. The impacts of loss of electric power are large: residential, commercial and public customers are all heavily dependent on electric power for normal functioning. Furthermore, as discussed above, other utility systems, especially water and wastewater systems, are heavily dependent on electric power for normal operations. Loss of electric power, therefore, may have large impacts on affected communities, especially if outages are prolonged.

Electric power for Corvallis is provided by Pacific Power and by Consumers Power. Electric power systems have somewhat complex operating characteristics, which are briefly summarized here. Electric power systems have three main parts: generation, transmission, and distribution.

Generation is the production of electric power. Generating plans can be hydroelectric, fossil fuel (oil, gas, or coal), nuclear, or various renewable fuels (wind, solar, biomass, etc.). Most

of the electric power consumed within Corvallis is produced elsewhere and transmitted via high-voltage transmission lines into the county. The Bonneville Power Administration (BPA) is the primary source of power for Corvallis. BPA's power comes from hydroelectric facilities (57%) operated by the Corps of Engineers or the Bureau of Reclamation, from a nuclear plant (3%), from interchanges and wheeling (37%) of power transmitted by BPA but not owned by BPA and from other sources (3%). Through the Pacific Interties (high voltage AC or DC transmission lines) power is moved back and forth between California, the Pacific Northwest and western Canada.

The transmission system is a network of high voltage lines (500 kV and 230 kV) and substations which transmit power between generation plants and the local distribution system. The distribution system is a network of lower voltage lines and substations which carries power from transmission system substations to neighborhoods and eventually to individual customers.

#### Power Outages due to wind/ winter storm events

Power outages in Benton County are may result from disruption of the transmission lines carrying power from outside Benton County or from damage to the local distribution lines within Benton County. The generating plant system has sufficient redundancy so that failures of one or more plants do not usually lead to significant power outages. However, because of the absence of generating capacity within Benton County, major disruptions in the transmission system would result in substantial curtailment of available power. A major ice storm in the Columbia River area could conceivably result in failure of most of the 500 kV transmission lines feeding Benton County.

Furthermore, a severe ice storm with 2" to 4" of ice over much of Benton County could result in failure of most 500 kV and 230 kV transmission lines to and within Benton County. Such a failure, which is unlikely, but certainly not impossible, would probably entail widespread power outages in Benton County for at least 2 to 5 days.

The most frequent power outages, however, are due to failure of the local subtransmission or distribution system lines. Winter storms are the most frequent cause of significant electric power outages, with wind being the primary culprit. Electric distribution lines, the low voltage lines that deliver power to neighborhoods, are the most vulnerable electric system component in winter storms. Failures most commonly result from tree falls or from "burn downs" when wind-swayed cables touch or get too close to each other and short circuit. Distribution system failures may also be due to utility pole failures. Distribution lines may also fail due to ice loading in excess of design specifications or from landslides or debris flows or flooding which knock out utility poles.

Once a portion of a power distribution circuit fails, all customers, in all or part of the circuit, lose power, pending on the circuit's design. The duration of the power outage depends on the number of outages and the number of repair crews available for repairs. A typical power utility repair crew (2 or 3 people with a cherry picker) can restore power to a distribution circuit with common types of damage in 1 or 2 hours after arriving at the damage site.

Electric transmission lines (110 kV and higher) are less vulnerable to winter storm damage because of more robust design specifications. These lines are usually higher above the ground and much less prone to tree branches falling on lines. Furthermore, because of the

higher voltage (compared to distribution lines), power utilities must diligently pursue tree trimming programs to avoid flashovers from lines being too close to trees. Nevertheless, transmission lines do sometimes fail due to large tree falls, rapid growth of trees near lines, unusually high winds or heavy ice loads.

Benton County is subject to outages of electric power primarily due to line failures. One possible failure mode would be the transmission lines that feed Benton County from the north. More common failure modes would be failures of the trunk distribution lines within Benton County and failures of distribution circuits or service drops from distribution lines to individual buildings. The local failures are most likely due to tree falls during wind storm events.

## Transportation

Transportation networks, systems for power transmission, and critical facilities such as hospitals and law enforcement stations are all vital to the functioning of the region. Due to the fundamental role that infrastructure plays both pre-and post-disaster, it deserves special attention in the context of creating more resilient communities. The information documented in this section of the profile can provide the basis for informed decisions about how to reduce the vulnerability of Benton County's infrastructure to natural hazards.

Communities in Benton County are linked by State Highway 99W, U.S. Highway 20, State Highway 34, State Highway 223, State Highway 200 and a network of rural highways and county roads. Highway 99W runs north to south, providing connections to Salem, Monroe, and Eugene. Highway 20 runs east to west, providing access to the coast and rural areas of Benton County. According to the U.S. Census, 78 percent of Benton County's population commutes by personal vehicle; 67 percent drive alone and 11 percent carpool, and about 1.7 percent of the commuters use public transit.

Public transportation providers include the Linn-Benton Loop Bus and Corvallis Transit Systems. Railroads and airports provide other modes of transportation in the county. Rail service within Benton County is provided by the Willamette & Pacific Railroad (WPRR) and the Portland & Western Railroad (PNWR). Facilities that support air travel include one public airport, nine private airstrips, and one helipad.

## Bridges

Because of earthquake risk, the seismic vulnerability of the county's bridges is an important issue. Non-functional bridges can disrupt emergency operations, sever lifelines, and disrupt local and freight traffic. These disruptions may exacerbate local economic losses if industries are unable to transport goods. The county's bridges are part of the state and interstate highway system, which is maintained by the Oregon Department of Transportation (ODOT), or are part of regional and local systems, maintained by the region's counties and cities.

The bridges in Benton County require ongoing management and maintenance due to the age and types of bridges. Modern bridges, which require minimum maintenance and are designed to withstand earthquakes, consist of pre-stressed reinforced concrete structures set on deep steel piling foundations. Currently, there are 12 pre-stressed reinforced concrete bridges in Benton County that have been constructed since 1990.

**Table C-23 Bridge Inventory**

	Oregon	Region 3	Benton
State Owned	Di	610	118
	ST	2,718	610
	%D*	22%	19%
County Owned	De	633	194
	ST	3,420	942
	%D	19%	21%
City Owned	De	160	44
	ST	614	208
	%D	26%	21%
Other Owned	De	40	6
	ST	115	24
	%D	35%	25%
Area Total	D	1,443	362
	T	6,769	1,741
	%D	21%	21%
Historic Covered	334	71	12

Source: Oregon Department of Transportation, 2014; Oregon Department of Transportation (2013), Oregon’s Historic Bridge Field Guide

Note: Di = ODOT bridges Identified as distressed with structural or other deficiencies; De = Non-ODOT bridge Identified with a structural deficiency or as functionally obsolete; D = Total od Di and De bridges; ST = Jurisdictional Subtotal; %D = Percent distressed (ODOT) and/ or deficient bridges; \* = ODOT bridge classifications overlap and total (ST) is not used to calculate percent distressed, calculation for ODOT distressed bridges accounts for this overlap.

The table above shows the structural condition of bridges in the region. A distressed bridge (Di) is a condition rating used by the Oregon Department of Transportation (ODOT) indicating that a bridge has been identified as having a structural or other deficiency, while a deficient bridge (De) is a federal performance measure used for non-ODOT bridges; the ratings do not imply that a bridge is unsafe.<sup>21</sup> The table shows that the county has a lower percentage of bridges that are distressed and/ or deficient (17%), than does the state (21%). About 26% of the county and city owned bridges are distressed, compared to 27% of State Owned (ODOT) bridges.

The county’s bridge maintenance and engineering divisions work in coordination to inspect and maintain the bridges within the county. All bridges within Benton County are inspected at two-year intervals or more frequently if special conditions exist. Bridges that are found to be in critical condition during an inspection are prioritized for immediate replacement.

The Willamette River separates Linn and Benton County, and there are no land connections between the two counties. Only five bridges link the two counties; two are on Highway 20 in Albany and three are on Highway 34 in Corvallis.

## Utility Lifelines

Utility lifelines are the resources the public relies on daily, (i.e., electricity, fuel and communication lines). If these lines fail or are disrupted, the essential functions of the

<sup>21</sup> Oregon. Bridge Engineering Section (2012). 2012 Bridge Condition Report. Salem, Oregon: Bridge Section, Oregon Department. of Transportation.

community can become severely impaired. Utility lifelines are closely related to physical infrastructure, (i.e., dams and power plants) as they transmit the power generated from these facilities.

Benton County receives oil and gas from Alaska by way of the Puget Sound through pipelines and tankers. Most of the natural gas Oregon uses originates in Alberta, Canada. Northwest Natural Gas owns the main natural gas transmission pipeline. The network of transmission lines running through the county may be vulnerable to severe, but infrequent natural hazards, such as windstorm, winter storms, and earthquakes.

Seismic lifeline routes help maintain transportation facilities for public safety and resilience in the case of natural disasters. Following a major earthquake, it is important for response and recovery agencies to know which roadways are most prepared for a major seismic event. The Oregon Department of Transportation has identified lifeline routes to provide a secure lifeline network of streets, highways, and bridges to facilitate emergency services response after a disaster.<sup>22</sup>

System connectivity and key geographical features were used to identify a three-tiered seismic lifeline system. Routes identified as Tier 1 are considered to be the most significant and necessary to ensure a functioning statewide transportation network. The Tier 2 system provides additional connectivity to the Tier 1 system; it allows for direct access to more locations and increased traffic volume capacity. The Tier 3 lifeline routes provide additional connectivity to the systems provided by Tiers 1 and 2. The figure below shows Tiers 1, 2, and 3 seismic lifeline routes.<sup>23</sup>

The Lifeline Routes in the Mid/ Southern Willamette Valley affecting Benton County consists of the following:

- Tier I: Interstate 5
- Tier II: Highway 99W
- Tier III: OR34

A generalized summary of the probable impacts of utility disruptions and road closures in Benton County is given in Table C-24.

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<sup>22</sup> CH2MHILL, Prepared for Oregon Department of Transportation. Oregon Seismic Lifeline Routes Identification Project, *Lifeline Selection Summary Report*, May 15 2012.

<sup>23</sup> Ibid.

**Table C-24 Probable Impacts of Utility Disruptions and Road Closures**

Inventory	Probable Impacts
Portion of County affected	Impacts may be localized for damage to local utility distribution systems or street closures, or effect the entire county/ city for damage to transmission lines or closures of major highways.
Buildings	Negligible impacts to buildings, but loss of utilities may substantially affect function of buildings.
Streets within County/ Cities	Some incidents may include temporary street closures.
Roads to/from County/ Cities	Some incidents may include temporary road closures.
Electric Power	Some incidents may include temporary loss of electric power in localized parts of cities or for the entire County. Duration of disruptions can range from an hour to up to a probable maximum outage of 1 or 2 days for most wind/ice events. Longer outages are possible for extreme wind/ice events or for major earthquakes.
Water Utilities	Failure of the major water transmission lines on the Marys River bridge crossings would result in almost complete loss of water to Corvallis, with a high likelihood of long duration water outages. Prolonged power outages may also result in widespread water outages throughout the county.
Wastewater	Power outages affecting treatment plants would result in nearly complete loss of treatment capability.
Natural Gas	Localized loss of service from pipe breaks in earthquakes is expected.
Telecommunications	Prolonged power outages would likely affect some modes. Seismic damage to the telephone central offices might impact nearly all telephone communications.
Casualties	Low potential for direct casualties, but some incidents such as loss of electric power during cold weather may require evacuations and displacement of people (especially fragile or special needs population) to temporary shelters.

Source: Adapted by OPDR from the Regional All Hazard Mitigation Master Plan for Benton, Lane, and Linn Counties (Phase I, II)

## Synthesis

The planning considerations seemingly most significant for the county are contingency planning for medical resources and lifeline systems due to the imminent need for these resources. As mentioned above, functionality of hospitals and dependent care facilities are a significant priority in providing for Benton County residents. One factor that is critical to consider in planning is the availability of medical beds in local hospitals and dependent care facilities. In the event of a disaster, medical beds may be at a premium providing not just for the growing elderly population, but the entire county. Some of these facilities may run at almost full capacity on a daily basis, hospitals should consider medical surge planning and develop memorandums with surrounding counties for medical transport and treatment. Other facilities to consider are utility lifelines and transportation lifelines such as, airports, railways, roads and bridges with surrounding counties to acquire utility service and infrastructure repair.

While these elements are traditionally recognized as part of response and recovery from a natural disaster, it is essential to start building relationships and establishing contractual agreements with entities that may be critical in supporting community resilience.

## **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 will be 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 these capitals reflect the specific needs and composition of the community residents.

## **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 for the public. In planning for natural 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 by the plan involve communicating with the public or specific subgroups within the population (e.g. elderly, children, low income, etc.). The County can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues, one of which could be natural hazard preparedness and mitigation. The presence of these services are more predominantly located in urbanized areas of the county, this is synonymous with the general urbanizing trend of local residents.

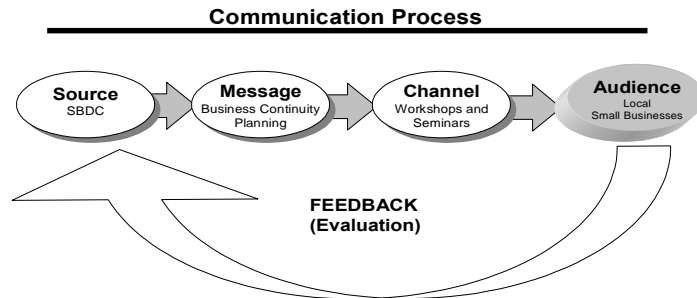
The following is a brief explanation of how the communication process works and how the community's existing social service providers could be used to provide natural hazard related messages to their clients.



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; and
- The recommended action must be clearly stated and a feedback channel established for questions, comments and suggestions.

**Figure C-5 Communication Process**



Source: Adapted from the U.S. Environmental Protection Agency Radon Division’s outreach program

The following table provides a list of existing social systems within Benton County. The table provides information on each organization or program’s service area, types of services offered, populations served, and how the organization or program could be involved in natural hazard mitigation. The three involvement methods identified in the table are defined below:

- Education and outreach – organization could partner with the community to educate the public or provide outreach assistance on natural 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.

The information provided in the table can also be used to complete action item worksheets by identifying potential coordinating agencies and internal and external partners.

## Civic Engagement

Civic engagement and involvement in local, state and national politics are important indicators of community connectivity. Those who are more invested in their community may have a higher tendency to vote in political elections. The 2012 Presidential General Election resulted in 80.7% voter turnout in the county as of November 16<sup>th</sup>, 2012.<sup>24</sup> These results are

<sup>24</sup> Daily Ballot Return, <http://www.Bentonco.org/dailyballotreturn>, accessed March 2013.

relatively equal to voter participation reported across the State (82.8%).<sup>25</sup> 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.

## Cultural Resources

### Historic Places

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources for tourism 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 National Register Bulletin, “a contributing resource is a building, site, structure, or 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.”<sup>26</sup> If a structure does not meet these criteria, it is considered to be non-contributing.

The table below identifies the number of eligible/ significant (ES) and eligible/ contributing (EC) historical sites in Benton County. Overall, there are a total of 1,474 historically places in Benton County.

**Table C-25 Benton County Historic Places**

Eligible Sites	Total Sites	Listed on the National Register
ES-Significant	67	60
EC-Contributing	1,407	348
Total	1,474	408

Source: Oregon Historic Sites Database

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

The following individually listed eligible and significant properties are listed on the National Register of Historic Places:

- Avery—Helm Historic District, Corvallis, Oregon
- Belknap, Ransom A., House, west of Monroe, Oregon
- Benton County Courthouse, Corvallis, Oregon
- Benton County State Bank Building (Madison Building), Corvallis, Oregon

<sup>25</sup> Oregon Blue Book, Voter Participation. <http://bluebook.state.or.us/state/elections/elections04.htm>

<sup>26</sup> U.S. Department of the Interior, National Park Service, Cultural Resources, National Register Bulletin 16A: "How to Complete the National Register Registration Form".

- Benton Hotel, Corvallis, Oregon
- Bethers, George W., House (Wyatt, William, House), Philomath, Oregon
- Bexell, John, House, Corvallis, Oregon
- Bosworth, Dr. Ralph Lyman, House, Corvallis, Oregon
- Bryson, J.R., House, Corvallis, Oregon
- Burnap-Rickard, House, Corvallis, Oregon
- Caton, Jesse H., House, Corvallis, Oregon
- College Hill West Historic District, Corvallis, Oregon
- Corvallis Hotel, Corvallis, Oregon
- Crystal Lake Cemetery, Corvallis, Oregon
- Episcopal Church of the Good Samaritan (Corvallis Arts Center), Corvallis, Oregon
- Fairbanks, J. Leo, House, Corvallis, Oregon
- Farra, Dr. George R., House, Corvallis, Oregon
- Fiechter, John, House (Failing Cottage), William L. Finley National Wildlife Refuge, Oregon
- First Congregational Church (DeMass-Durdan Mortuary), Corvallis, Oregon
- Fort Hoskins Site, Kings Valley, Oregon
- Gaylord, Charles, House, Corvallis, Oregon
- Hadley-Locke House, Corvallis, Oregon
- Harris Bridge, west of Wren, Oregon
- Hayden Bridge, west of Alsea, Oregon
- Helm-Hout House, Corvallis, Oregon
- Hull-Oakes Lumber Company, Monroe, Oregon
- Irish Bend Bridge, northeast of Monroe, Oregon
- Irwin, Richard S., Barn (Cheadle Barn), Corvallis, Oregon
- Julian Hotel, Corvallis, Oregon
- Kappa Alpha Theta Sorority House, Old (Pi Kappa Alpha Fraternity House), Corvallis, Oregon
- King, Charles, House, Philomath, Oregon
- King, Isaac, House and Barn, north of Philomath, Oregon
- Kline, Lewis G., Building, Corvallis, Oregon
- Kline, Lewis G., House, Corvallis, Oregon
- Lewisburg Hall and Warehouse Company (Mountain View Grange No. 429), Corvallis, Oregon
- Monroe State Bank Building, Monroe, Oregon
- North College Hill District, Corvallis, Oregon
- Pernot, Dr. Henry S., House, Corvallis, Oregon
- Philomath College, Philomath, Oregon
- Pi Beta Phi Sorority House (Phi Kappa Theta Fraternity House), Corvallis, Oregon
- Rickard, Peter, Farmstead, Corvallis, Oregon
- Schuster, Charles L., House, Corvallis, Oregon
- Soap Creek School, Corvallis, Oregon
- Starr, Edwin and Anna, House, Monroe, Oregon
- Taylor, George, House (Oliver George House), Corvallis, Oregon
- Taylor, Jack, House, Corvallis, Oregon
- Watson—Price Farmstead, Philomath, Oregon

- Willamette Valley and Coast Railroad Depot—Corvallis, Corvallis, Oregon
- Wilson, James O., House, Corvallis, Oregon
- Woodward, Elias, House, Corvallis, Oregon

## Libraries and Museums

Libraries and museums develop cultural capacity and community connectivity as they are places of knowledge and recognition, they are common spaces for the community to gather, and can serve critical functions in maintaining the sense of community during a disaster. They are recognized as safe places and reflect normalcy in times of distress.

## Cultural Events

Other such institutions that can strengthen community connectivity are the presence of festivals and organizations that engage diverse cultural interests. Not only do these events bring revenue into the community, they have potential to improve cultural competence and enhance the sense of place. Cultural connectivity is important to community resilience, as people may be more inclined to remain in the community because they feel part of the community and culture.

## Community Stability

### Residential Geographic Stability

Community stability is a measure of rootedness in place. It is hypothesized that resilience to a disaster stems in part from familiarity with place, not only for navigating the community during a crisis, but also accessing services and other supports for economic or social challenges.<sup>27</sup> The table below estimates residential stability across the region. It is calculated by the number of people who have lived in the same house and those who have moved within the same county a year ago, compared to the percentage of people who have migrated into the region. Benton County overall has geographic stability rating of about 87.5% (i.e., 87.5% of the population lived in the same house or moved within the county). The figures of community stability are relatively consistent across the region with the smaller cities having greater geographic stability. County wide 7.2% of residents in 2014 lived in a different Oregon County one year before (11.8% of Corvallis residents); 5.4% lived outside of Oregon one year before (7.2% of Corvallis residents).

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<sup>27</sup> Cutter, Susan, Christopher Burton, Christopher Emrich. "Disaster Resilience Indicators for Benchmarking Baseline Conditions". *Journal of Homeland Security and Emergency Management*.

**Table C-26 Regional Residential Stability**

Jurisdiction	Population	Geographic Stability	From Different County in Oregon	From Outside Oregon
<b>Benton County</b>	85,323	87.5%	7.2%	5.4%
<b>Adair Village</b>	860	96.6%	1.7%	1.6%
<b>Albany*</b>	50,720	93.0%	12.0%	2.0%
<b>Corvallis</b>	54,289	82.9%	11.8%	7.2%
<b>Monroe</b>	746	95.3%	2.3%	2.4%
<b>Philomath</b>	4,497	94.8%	2.4%	2.8%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Table B07003.

\* The majority of Albany's population is within Linn County.

## Homeownership

Housing tenure describes whether residents rent or own the housing units they occupy. Homeowners are typically more financially stable but are at risk of greater property loss in a post-disaster situation. People may rent because they choose not to own, they do not have the financial resources for home ownership, or they are transient.

Collectively, about 57% of the occupied housing units in Benton County are owner-occupied; about 43% are renter occupied. Corvallis (55.7%) has the highest rate of renter-occupied units. Corvallis (9.6%) and Monroe (12.8%) have the highest vacancy rates within the county; Corvallis (2,271) also has the greatest number of vacant units. In addition, seasonal or recreational housing accounts for approximately 1.2% of the county's housing stock (1.0% in Corvallis).<sup>28</sup>

**Table C-27 Housing Tenure and Vacancy**

	Occupied Units	Owner-occupied		Renter-occupied		Vacant <sup>^</sup>	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
<b>Benton County</b>	33,376	19,168	57.4%	14,208	42.6%	2,885	7.9%
<b>Adair Village</b>	267	182	68.2%	85	31.8%	9	3.3%
<b>Albany*</b>	19,512	11,519	59.0%	7,993	41.0%	1,399	6.7%
<b>Corvallis</b>	21,251	9,419	44.3%	11,832	55.7%	2,271	9.6%
<b>Monroe</b>	294	175	59.5%	119	40.5%	43	12.8%
<b>Philomath</b>	1,732	1,227	70.8%	505	29.2%	135	7.2%

Source: U.S. Census Bureau, 2010-2014 American Community Survey, Tables DP04 & B25004.

<sup>^</sup> = Functional vacant units, computed after removing seasonal, recreational, or occasional housing units from vacant housing units.

\* The majority of Albany's population is within Linn County.

According to Cutter, wealth increases resiliency and recovery from disasters. Renters often 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 natural

<sup>28</sup> U.S. Census Bureau, 2010-2014 American Community Survey, Table DP04 and Table B25004.

hazards.<sup>29</sup> In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or unaffordable post-disaster.

## Synthesis

Benton 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, may be essential to preserving community cohesion and a sense of place. The presence of larger communities makes additional resources and services available for the public. However, it is important to consider that these amenities may not be equally distributed to the rural portions of the county and may produce 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 social and cultural resources, distressing community coping and response mechanisms.

## 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 political capital to encompass diverse government and non-government entities in collaboration; as disaster losses stem from a predictable result of interactions between the physical environment, social and demographic characteristics and the built environment.<sup>30</sup> Resilient political capital seeks to involve various stakeholders in hazard planning and works towards integrating the Natural Hazards Mitigation Plan with other community plans, so that all planning approaches are consistent.

## Government Structure

Benton County's governing jurisdiction includes all unincorporated areas that are not governed by the Siuslaw Nation Forest, William L. Finley Wildlife Refuge, U.S. Forest Service, Bureau of Land Management land, and state owned land. Benton 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 Benton 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.

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<sup>29</sup> Cutter, S. L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*.

<sup>30</sup> Mileti, D. 1999. Disaster by Design: a Reassessment of Natural Hazards in the United States. Washington D.C.: Joseph Henry Press.

**Assessment:** responsible for assessing all properties in Benton County. The assessment department is also responsible for maps, property information, and special tax exemption designations.

**Community Development:** ensures that the building and land use laws of the state of Oregon and Benton 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. The community development department also maintains the county Flood Insurance Rate Maps (FIRM), which are used in determining vulnerability and risk of flood.

**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 Benton 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.

Incorporated communities have the following government structures as illustrated in the table below.

## 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 local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.<sup>31</sup>

The Benton County Natural Hazards Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the county's vulnerability to natural 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 Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the plan. Implementing the natural 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.

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<sup>31</sup> Burby, Raymond J., ed. 1998. Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.

Benton County's current plans and policies include the following:

#### **Benton County Comprehensive Plan**

- Date of Last Revision: 2014
- Author/ Owner: Benton County
- Description: The Comprehensive Plan is the official policy guide for decisions about growth, development, and conservation of natural resources in Benton County.
- Relationship to Natural Hazard Mitigation Planning: The Goal 7 Policies within Benton County's Comprehensive Plan provide the framework for evaluating land use actions for their exposure to potential harm from natural hazards. The policies 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 these policies include prevention and preparedness, land use regulation, use of natural systems to mitigate hazards, public education, and collaboration with other organizations. These policies also guide development of this natural hazards mitigation plan. Likewise, the risk assessment and mitigation action items identified within this natural hazards mitigation plan should also influence the comprehensive plan's findings and land use policies.

#### **Benton County Community Wildfire Protection Plan**

- Date of Last Revision: 2009 (2016 revision in process)
- Author/ Owner: Benton County Fire Defense Board, Oregon Department of Forestry, and the Benton County Community Development Department/ Benton County Community Development Department
- Description: The mission of the Community Wildfire Protection Plan (CWPP) is to make Benton 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 Natural Hazard Mitigation Planning: The Community Wildfire Protection Plan (CWPP) is intended to be adopted for incorporation within the Benton County Natural Hazards Mitigation Plan. The CWPP contains goals and actions that seek to minimize the county's risk to wildfire hazards.

#### **Benton County Hazard Analysis – Emergency Operations Plan**

- Date of Last Revision: 2012 (2016 revision in process)
- Author/ Owner: Benton County
- Description: The Benton 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 Natural Hazard Mitigation Planning: the EOP includes information that is relevant to the Benton County Natural Hazards Mitigation Plan and vice versa. Hazard rankings from the EOP were included in the Natural Hazards Mitigation Plan's Hazard Chapters. Ideally, the EOP and Natural Hazards Mitigation Plan will eventually share, and benefit from one risk assessment. As such, information from the NHMP may be integrated into the EOP.

#### **Benton County Stormwater Management Program for the Corvallis Urbanized Area**

- Date of Last Revision: 2011
- Author/ Owner: Benton County
- Description: Outlines the different components of Benton County's Stormwater Management Program: (1) Public Education and Outreach; (2) Public Participation/ Involvement; (3) Unlawful Discharge Detection and Elimination (Illicit Discharge); (4) Construction Site Runoff Control; (5) Post-Construction Runoff Control; (6) Pollution Prevention / Good Housekeeping. 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 Natural Hazard Mitigation Planning: Benton 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 natural 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.

#### **Benton County Transportation Systems Plan**

- Date of Last Revision: 2002 (*grant secured in 2016 to update*)
- Author/ Owner: Benton County
- Description: The 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 Benton County comprehensive land use plan.
- Relation to Natural Hazard Mitigation Planning: Transportation systems are important in evacuating and responding to natural disasters. Mitigation actions that focus on strengthening the transportation system can be incorporated into the Transportation Systems Plan.

Other plans (including a debris management plan) via the [county website](#) or by contacting staff.

# Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center. It has been reviewed and accepted by the Federal Emergency Management Agency 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.

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It 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 Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon Military Department – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation*. This section 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 an economic analysis can be used to evaluate mitigation projects.

## 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 natural 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.

# Mitigation Strategy Economic Analyses Approaches

The approaches used to identify the costs and benefits associated with natural 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:

## Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by the state Oregon Military Department – Office 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 natural 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, in order 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.

## Cost-Effectiveness 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 natural 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.

## Investing 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.

## Investing in Private Sector Mitigation Activities

Private sector mitigation projects may occur on the basis of 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; or
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.

## **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 particular 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 taken into account?
- 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.

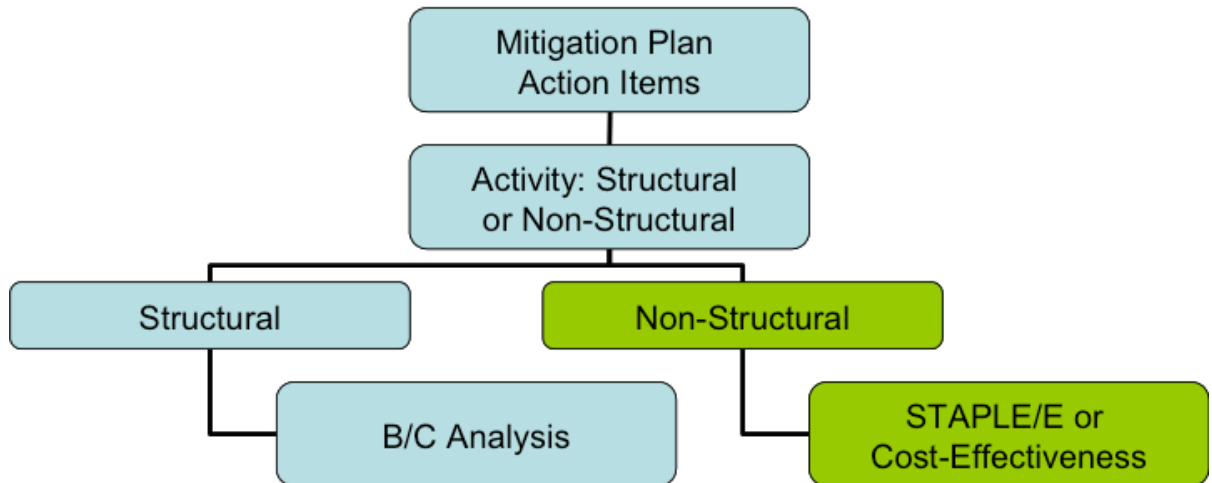
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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.

## When to use the Various Approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

**Figure D-1 Economic Analysis Flowchart**



Source: Oregon Partnership for Disaster Resilience. 2005.

## Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether or not 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 natural 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 natural 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 on the basis of 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.

## Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or land owners as a result of natural 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 of time.

## Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural 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 natural 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.

## **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 natural 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 natural 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. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

## **Resources**

CUREe Kajima Project, *Methodologies for Evaluating the Socio-Economic Consequences of Large Earthquakes*, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates, Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation Projects*, Riverine Flood, Version 1.05, Hazard Mitigation Economics, Inc., 1996

Federal Emergency Management Agency, *Report on the Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

Goettel & Horner Inc., *Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in the City of Portland*, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects Volume V, Earthquakes*, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures*, Robert Olsen Associates, Prepared for Oregon Military Department – Office of Emergency Management, July 1999.

Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon State Police – Office of Emergency Management, 2000.)

Risk Management Solutions, Inc., *Development of a Standardized Earthquake Loss Estimation Methodology*, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., *A Benefit/Cost Model for the Seismic Rehabilitation of Buildings*, Volumes 1 & 2, Federal Emergency management Agency, FEMA Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects*, 1993.

VSP Associates, Inc., *Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model*, Volume 1, Federal Emergency Management Agency, FEMA Publication Number 255, 1994.

# APPENDIX E: GRANT PROGRAMS AND RESOURCES

## Introduction

There are numerous local, state and federal funding sources available to support natural hazard mitigation projects and planning. The Oregon Natural Hazard Mitigation Plan includes a comprehensive list of funding sources (refer to Oregon NHMP Chapter 2 Section F(1)). The following section includes an abbreviated list of the most common funding sources utilized by local jurisdictions in Oregon. Because grant programs often change, it is important to periodically review available funding sources for current guidelines and program descriptions.

## Post-Disaster Federal Programs

### Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

<http://www.fema.gov/hazard-mitigation-grant-program>

### Physical Disaster Loan Program

When physical disaster loans are made to homeowners and businesses following disaster declarations by the U.S. Small Business Administration (SBA), up to 20% of the loan amount can go towards specific measures taken to protect against recurring damage in similar future disasters. <http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans>

## Pre-Disaster Federal Programs

### Pre-Disaster Mitigation Grant Program

The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. <http://www.fema.gov/pre-disaster-mitigation-grant-program>

## Flood Mitigation Assistance Program

The overall goal of the Flood Mitigation Assistance (FMA) Program is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other National Flood Insurance Program (NFIP) insurable structures. This specifically includes:

- Reducing the number of repetitively or substantially damaged structures and the associated flood insurance claims;
- Encouraging long-term, comprehensive hazard mitigation planning;
- Responding to the needs of communities participating in the NFIP to expand their mitigation activities beyond floodplain development activities; and
- Complementing other federal and state mitigation programs with similar, long-term mitigation goals.

<http://www.fema.gov/flood-mitigation-assistance-program>

Detailed program and application information for federal post-disaster and pre-disaster programs can be found in the FY13 Hazard Mitigation Assistance Unified Guidance, available at: <https://www.fema.gov/media-library/assets/documents/33634>. Note that guidance regularly changes. Verify that you have the most recent edition.

For Oregon Military Department, Office of Emergency Management (OEM) grant guidance on Federal Hazard Mitigation Assistance, visit:

[http://www.oregon.gov/OMD/OEM/pages/all\\_grants.aspx - Hazard\\_Mitigation\\_Grants](http://www.oregon.gov/OMD/OEM/pages/all_grants.aspx - Hazard_Mitigation_Grants)

Contact: Dennis Sigrist, [dennis.sigrist@oem.state.or.us](mailto:dennis.sigrist@oem.state.or.us)

## State Programs

### Seismic Rehabilitation Grant Program

The Seismic Rehabilitation Grant Program (SRGP) provides state funds to strengthen public schools and emergency services buildings so they will be less damaged during an earthquake. Reducing property damage, injuries, and casualties caused by earthquakes is the goal of the SRGP. <http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/>

### Community Development Block Grant Program

The Community Development Block Grant Program promotes viable communities by providing: 1) decent housing; 2) quality living environments; and 3) economic opportunities, especially for low and moderate income persons. Eligible activities most relevant to natural hazards mitigation include: acquisition of property for public purposes; construction/reconstruction of public infrastructure; community planning activities. Under special circumstances, CDBG funds also can be used to meet urgent community development needs arising in the last 18 months which pose immediate threats to health and welfare.

[http://portal.hud.gov/hudportal/HUD?src=/program\\_offices/comm\\_planning/communitydevelopment/programs](http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs)

## **Oregon Watershed Enhancement Board**

While OWEB's primary responsibilities are implementing projects addressing coastal salmon restoration and improving water quality statewide, these projects can sometimes also benefit efforts to reduce flood and landslide hazards. In addition, OWEB conducts watershed workshops for landowners, watershed councils, educators, and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees, and other sources. OWEB awards approximately \$20 million in funding annually. More information at: <http://www.oregon.gov/OWEB/Pages/index.aspx>

## **Federal Mitigation Programs, Activities & Initiatives**

### **Basic & Applied Research/Development**

National Earthquake Hazard Reduction Program (NEHRP), National Science Foundation.

Through broad based participation, the NEHRP attempts to mitigate the effects of earthquakes. Member agencies in NEHRP are the US Geological Survey (USGS), the National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute for Standards and Technology (NIST). The agencies focus on research and development in areas such as the science of earthquakes, earthquake performance of buildings and other structures, societal impacts, and emergency response and recovery. <http://www.nehrp.gov/>

Decision, Risk, and Management Science Program, National Science Foundation.

Supports scientific research directed at increasing the understanding and effectiveness of decision making by individuals, groups, organizations, and society. Disciplinary and interdisciplinary research, doctoral dissertation research, and workshops are funded in the areas of judgment and decision making; decision analysis and decision aids; risk analysis, perception, and communication; societal and public policy decision making; management science and organizational design. The program also supports small grants for exploratory research of a time-critical or high-risk, potentially transformative nature. [http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=5423](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423)

### **Hazard ID and Mapping**

National Flood Insurance Program: Flood Mapping; FEMA

Flood insurance rate maps and flood plain management maps for all NFIP communities. <http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping>

## National Digital Orthophoto Program, DOI – USGS

Develops topographic quadrangles for use in mapping of flood and other hazards.  
<http://www.ndop.gov/>

## Mapping Standards Support, DOI-USGS

Expertise in mapping and digital data standards to support the National Flood Insurance Program. <http://ncgmp.usgs.gov/standards.html>

## Soil Survey, USDA-NRCS

Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes. [http://soils.usda.gov/survey/printed\\_surveys/](http://soils.usda.gov/survey/printed_surveys/)

# Project Support

## Coastal Zone Management Program, NOAA.

Provides grants for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration.  
<http://coastalmanagement.noaa.gov/>

## Community Development Block Grant Entitlement Communities Program, US Department of Housing and Urban Development

Provides grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate- income persons.  
[http://portal.hud.gov/hudportal/HUD?src=/program\\_offices/comm\\_planning/communitydevelopment/programs/entitlement](http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/entitlement)

## National Fire Plan (DOI – USDA)

The NFP provides technical, financial, and resource guidance and support for wildland fire management across the United States. This plan addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.  
<http://www.forestsandrangelands.gov/>

## Assistance to Firefighters Grant Program, FEMA

FEMA AFGM grants are awarded to fire departments to enhance their ability to protect the public and fire service personnel from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER).  
<http://www.fema.gov/welcome-assistance-firefighters-grant-program>

## Emergency Watershed Protection Program, USDA-NRCS

Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas

damaged by severe natural hazard events.

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp>

#### **Rural Development Assistance – Utilities, USDA**

Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.

[http://www.rurdev.usda.gov/Utilities\\_Programs\\_Grants.html](http://www.rurdev.usda.gov/Utilities_Programs_Grants.html)

#### **Rural Development Assistance – Housing, USDA.**

The RDA program provides grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary. <http://www.rurdev.usda.gov/HAD-HCFPGrants.html>

#### **Public Assistance Grant Program, FEMA.**

The objective of the Federal Emergency Management Agency's (FEMA) Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.

<http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit>

#### **National Flood Insurance Program, FEMA**

The NFIP makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements. <http://www.fema.gov/national-flood-insurance-program>

#### **HOME Investments Partnerships Program, HUD**

The HOME IPP provides grants to states, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons. <http://www.hud.gov/offices/cpd/affordablehousing/programs/home/>

#### **Disaster Recovery Initiative, HUD**

The DRI provides grants to fund gaps in available recovery assistance after disasters (including mitigation).

[http://portal.hud.gov/hudportal/HUD?src=/program\\_offices/comm\\_planning/communitydevelopment/programs/dri](http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/dri)

#### **Emergency Management Performance Grants, FEMA**

EMPG grants help state and local governments to sustain and enhance their all-hazards emergency management programs. <http://www.fema.gov/fy-2012-emergency-management-performance-grants-program>

### Partners for Fish and Wildlife, DOI – FWS

The PFW program provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.

<http://www.fws.gov/partners/>

### North American Wetland Conservation Fund, DOI-FWS

NAWC fund provides cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats.

<http://www.fws.gov/birdhabitat/Grants/index.shtm>

### Federal Land Transfer / Federal Land to Parks Program, DOI-NPS

Identifies, assesses, and transfers available federal real property for acquisition for State and local parks and recreation, such as open space.

<http://www.nps.gov/ncrc/programs/flp/index.htm>

### Wetlands Reserve program, USDA-NCRS

The WR program provides financial and technical assistance to protect and restore wetlands through easements and restoration agreements.

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands>

### Secure Rural Schools and Community Self-Determination Act of 2000, US Forest Service.

Reauthorized for FY2012, it was originally enacted in 2000 to provide five years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. Funds have been used for improvements to public schools, roads, and stewardship projects. Money is also available for maintaining infrastructure, improving the health of watersheds and ecosystems, protecting communities, and strengthening local economies. <http://www.fs.usda.gov/pts/>



# APPENDIX F: BENTON COUNTY NHMP COMMUNITY SURVEY

## Survey Purpose and Use

The purpose of this survey was to gauge the overall perception of natural disasters, determine a baseline level of loss reduction activity for residents in the community, and assess citizen's support for different types of individual and community risk reduction activities.

Data from this survey directly informs the natural hazards mitigation planning process. Benton County can use this survey data to enhance action item rationale and ideas for implementation. Other community organizations can also use survey results to inform their own outreach efforts. Data from the survey provides the county and cities with a better understanding of desired outreach strategies (sources and formats), and a baseline understanding of community perceptions of natural hazards and resilience.

## Background

Citizen involvement is a key component in the NHMP planning process. Citizens should have the opportunity to voice their ideas, interests and concerns about the impact of natural disasters on their communities.

According to Bierle<sup>1</sup>, the benefits of citizen involvement include the following: (1) educate and inform public; (2) incorporate public values into decision making; (3) substantially improve the quality of decisions; (4) increase trust in institutions; (5) reduce conflict; and (6) ensure cost effectiveness.

The NHMP planning process provided opportunities for the public to engage through an on-line survey disseminated by Benton County and through an in-person Spanish language version of the survey.

## Methodology

In the summer of 2015, the Oregon Partnership for Disaster Resilience (OPDR) administered the survey via an on-line survey that was distributed via the county's emergency manager and placed on city and county websites; a Spanish language version of the survey was provided for participants of a soccer tournament on August 28-30, 2015. A total of 169 surveys were completed, 272 were initiated and a total of 254 surveys were either completed or partially completed (including 19 in-person Spanish language surveys).

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<sup>1</sup> Bierle, T. 1999. "Using social goals to evaluate public participation in environmental decisions." *Policy Studies Review*. 16(3/4), 75-103.

The survey consisted of 11 questions. OPDR designed the survey to determine public perceptions and opinions regarding natural hazards.

The intent of this survey was not to be statistically valid but instead to gain the perspective and opinions of residents regarding natural hazards in the region. Our assessment is that the results reflect a range attitudes and opinions of residents throughout the county.

## Survey Results

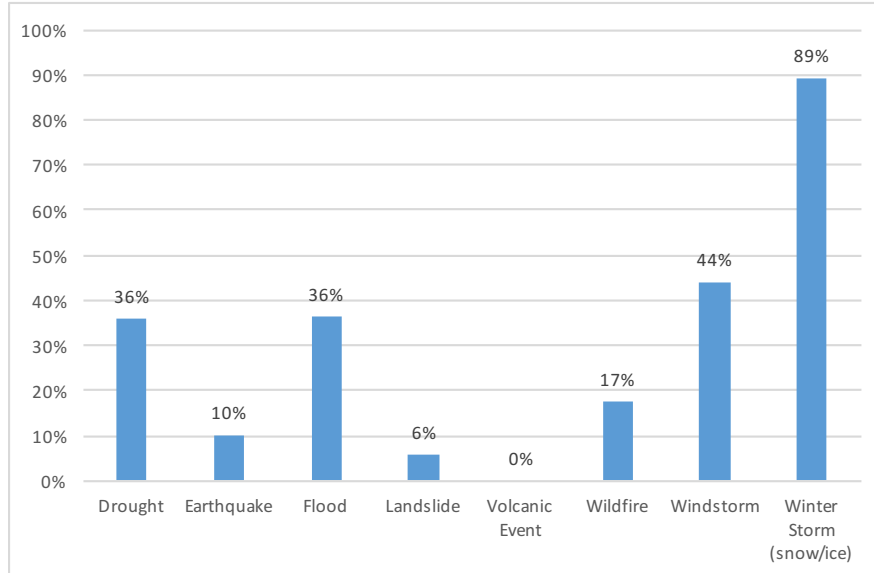
This section presents the compiled data and analysis for the 2015 Benton County NHMP Public Opinion Survey. We provide a copy of the survey instrument raw data in Attachment A.

### Natural Hazard Information

This section reports the experiences of survey respondents involving natural hazards, and their exposure to preparedness information.

The survey asked respondents to indicate which natural hazards they, or a member of their household, has experienced in the past ten (10) years. Figure F-1 shows that almost 90% of respondents have experienced a winter storm (snow/ ice) event in the previous 10 years, while substantial percentages of respondents have experienced windstorms (44%), floods (36%), droughts (36%). Fewer respondents have experienced wildfires (17%), earthquakes (10%), or landslides (6%). No respondents experienced a volcanic event.

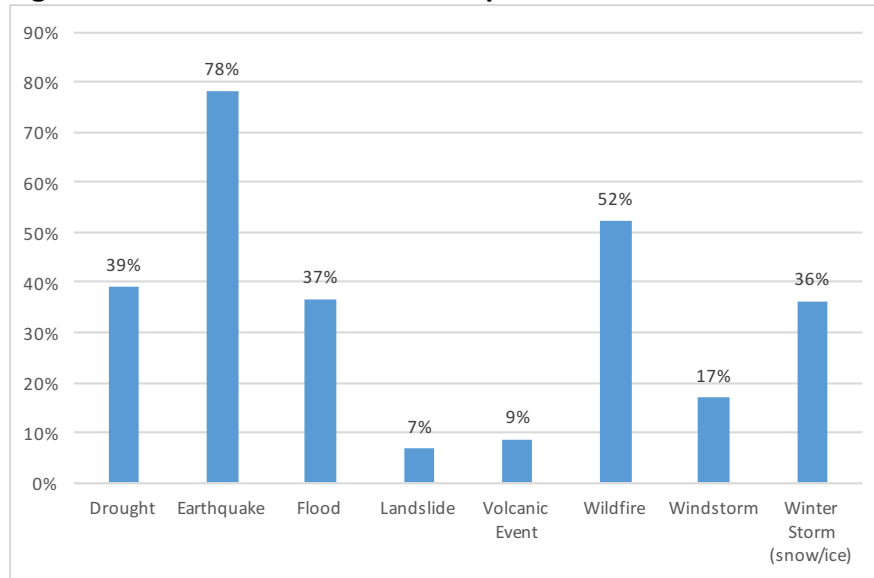
**Figure F-1 Household Natural Hazard Experience previous 10 Years**



Source: 2015 NHMP Public Opinion Survey

The survey asked respondents to indicate which hazards concern them the most. Figure F-2 shows that the hazards of highest concern for respondents include earthquakes (78%) and wildfires (52%). Respondents also demonstrated concern for droughts (39%), floods (37%), and winter storms (snow/ ice, 36%). Of lesser concern were windstorms (17%), volcanic events (9%), and landslides (7%).

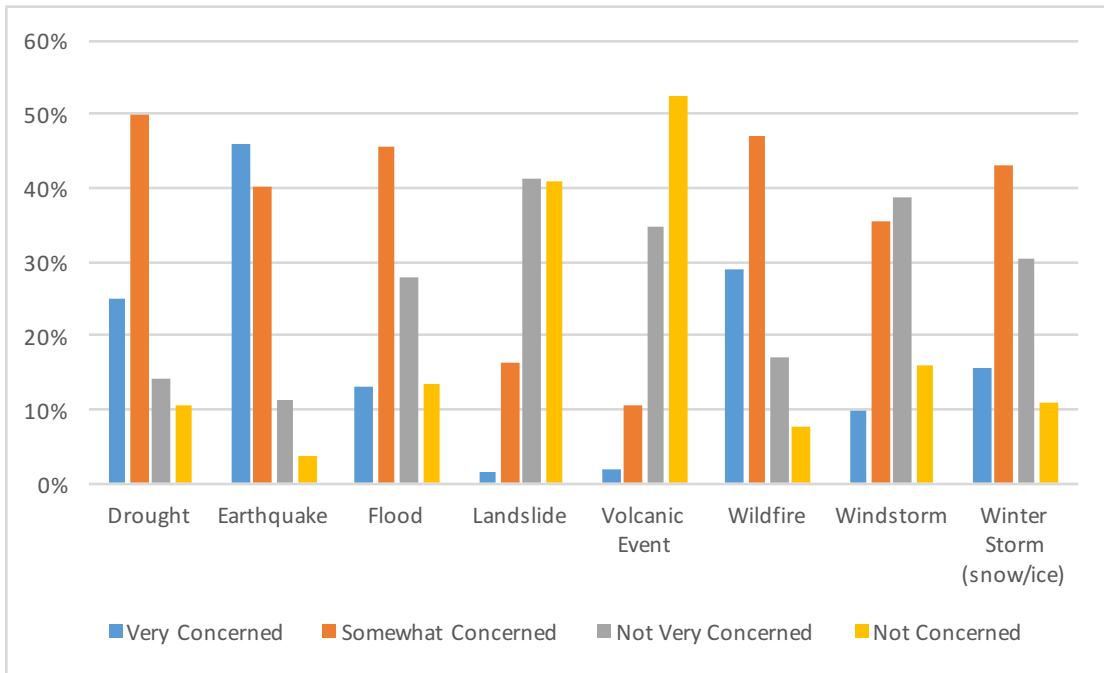
**Figure F-2 Hazards that Concern Respondent the Most**



Source: 2015 NHMP Public Opinion Survey

The survey asked respondents to rank their personal level of concern for specific natural disasters affecting their community. Figure F-3 shows that the hazards of highest concern for respondents include earthquakes, wildfires, and droughts with roughly 75 to 85-percent of respondents marking the “very concerned” or “somewhat concerned” choices. Respondents also demonstrated a high level of concern over floods and winter storms (roughly 60% marked the “very concerned” or “somewhat concerned” choices. Of lesser concern were windstorms. Volcanic events and landslides are the hazards respondents are least concerned about with more than 80-percent of respondents marking the “not very concerned” or “not concerned” choices.

**Figure F-3 Level of Concern About Natural Disasters Affecting Respondent County**



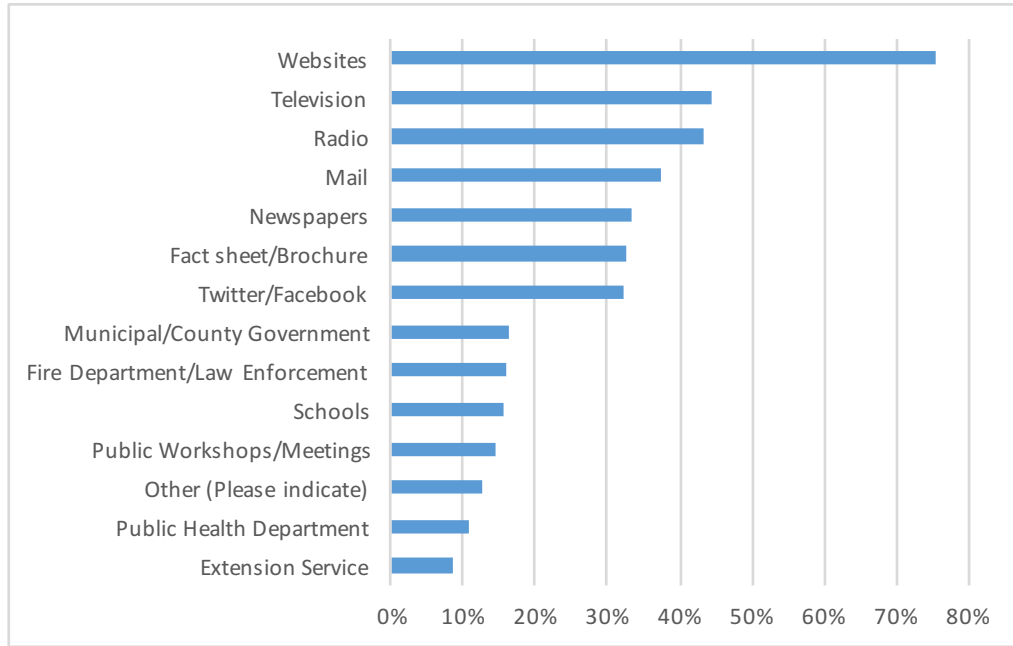
Source: 2015 NHMP Public Opinion Survey

## Communication

The survey asked respondents to indicate which form of communication is most effective for them to receive information on how to protect their household and property from damage due to natural hazards. As shown in Figure F-4, over 75-percent of respondents indicated that websites are the most effective. About 40% indicated that television, radio, and mail were also effective, followed by newspapers, fact sheets/ brochures, and Twitter/ Facebook (social media). Among the most common “other” options were emails and text messages. Respondents had the following responses to “other”:

- Email
- Text message
- CERT training
- Employer
- Weather alert
- Emergency Management App for phones
- Direct calls
- State Forestry Department
- Face-to-face/ in-person communication
- Federal Government
- Library and Google
- Neighbors

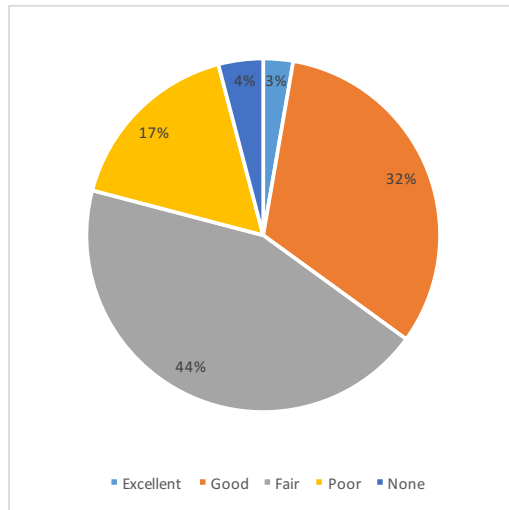
**Figure F-4 Respondent Most Effective Hazard Communication Method**



Source: 2015 NHMP Public Opinion Survey

The survey asked the respondents to indicate how well the community (city, county) is doing to educate people of the natural hazards they may face. Figure F-5 shows that survey respondents believe their community is doing a “good” (32%) or fair (44%) job educating the public about natural hazards; 20% of respondents indicated the the community is doing a “poor” job or “None”.

**Figure F-5 Respondent Perception of Community Natural Hazard Education Performance**



Source: 2015 NHMP Public Opinion Survey

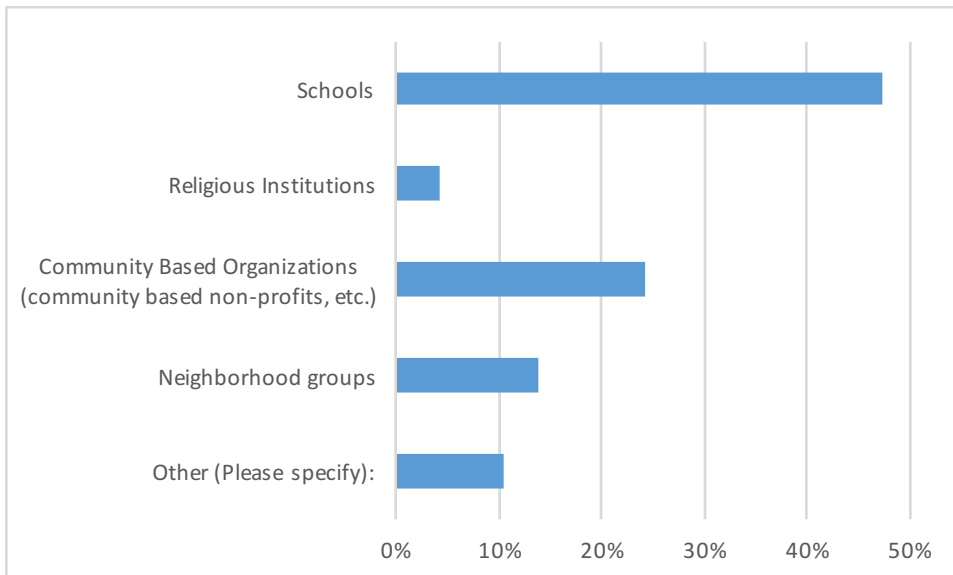
## Key Social Groups/ Social Resilience

The survey asked respondents to identify the key social groups within their community that provide social resiliency (provide for the sustainability, continuity, vitality of the community). Overwhelmingly, the respondents indicated that schools (47%) were the most important organization, followed by community based organizations (24%), and neighborhood groups (14%).

Among the most common “other” options were government (local) and friends/ family. Respondents had the following responses to “other” (for a full list see Attachment A):

- Government (local)
- Friends/ Family
- Employer
- Interest based groups
- Sheriff’s Office Emergency Management
- Food Co-op
- Media

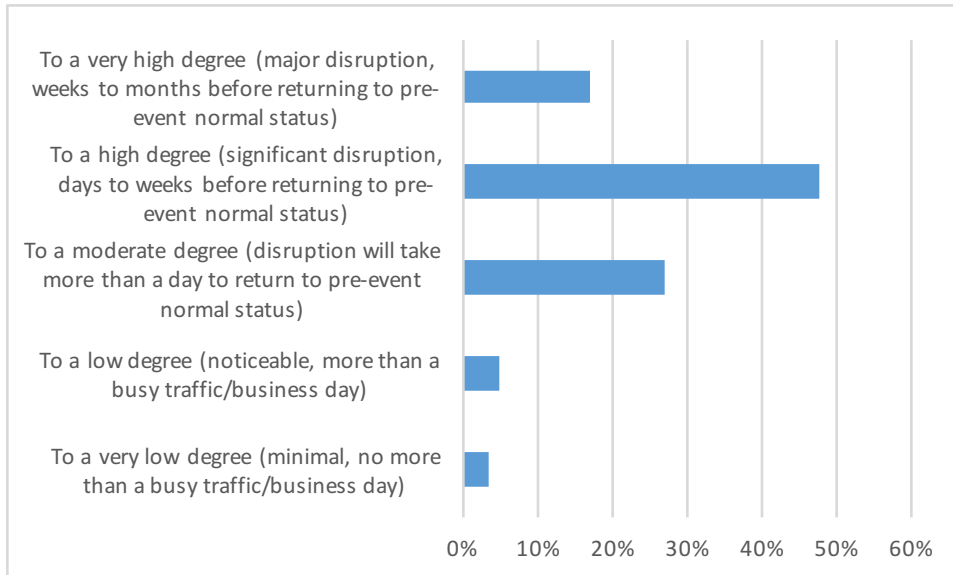
**Figure F-6 Respondent Perception of Most Important Community Group**



Source: 2015 NHMP Public Opinion Survey

Next the respondents were asked to what degree the group/ social organization identified in the previous question would be impacted by a disaster. Nearly two-thirds of respondents indicated that they think the group/ social organization they identified would be either impacted to a “high” or “very high” degree; about one-quarter responded that the group would be impacted to a “moderate” degree.

**Figure F-7 Respondent Perception of Hazard Impact Upon the Most Important Community Group**



Source: 2015 NHMP Public Opinion Survey

Figure F-8 summarizes the results for ranking of specific activities that promote social resilience to disaster according to their level of importance to the respondent. The figure shows that, among the listed options, *“Hav[ing] plans to relocate displaced residents from emergency shelters to temporary housing after a disaster”*, *“Hav[ing] mechanisms (systems, protocols, contact databases, etc.) in place to ensure communication between members of vulnerable populations and the partner organizations that support them”*, and *“Identify[ing] emergency shelters that are suitable and appropriate for members of vulnerable populations (youth, elderly, disabled, etc.)”* were considered the “Most Important”. The “Other” category also garnered many of the respondents “Most Important” ranking. Respondents had the following responses to “other” (for a full list see Attachment A):

- A[c]quire needed equipment and supplies prior to emergency situation
- Establish continuity of government/enforcement in the event of a large scale disaster
- Have sufficient stores of emergency supplies within the neighborhood
- Construct a new county courthouse that meets basic building codes for safety.
- Disaster restoration team
- Have a plan for replacing essential services provided by Sheriff's Dept. while the unincorporated community (located in the coast range) is completely isolated for 3 weeks to 3 months after a Cascadia quake
- Assess city plans to determine best placement of critical infrastructure like highways, bridges and hospitals, churches.
- All populations, not only vulnerable
- Integrate planning across all agencies
- All are critical and will be needed
- Have equipment ready to use

- Plans for mental health counseling
- Train CERTs
- Implement police/fire assistance plans for emergencies and strive for communications with the affected by the disasters.

*Note: There was a technical problem with this survey that did not allow some respondents to choose rankings properly; the error was fixed but not before several respondents completed the survey. As such, there were a number of respondents that could not accurately report their preferences.*

**Figure F-8 Importance of Social Resilience to Disaster Activity to Respondents (1 = Most Important, 7 = Least Important)**



Source: 2015 NHMP Public Opinion Survey

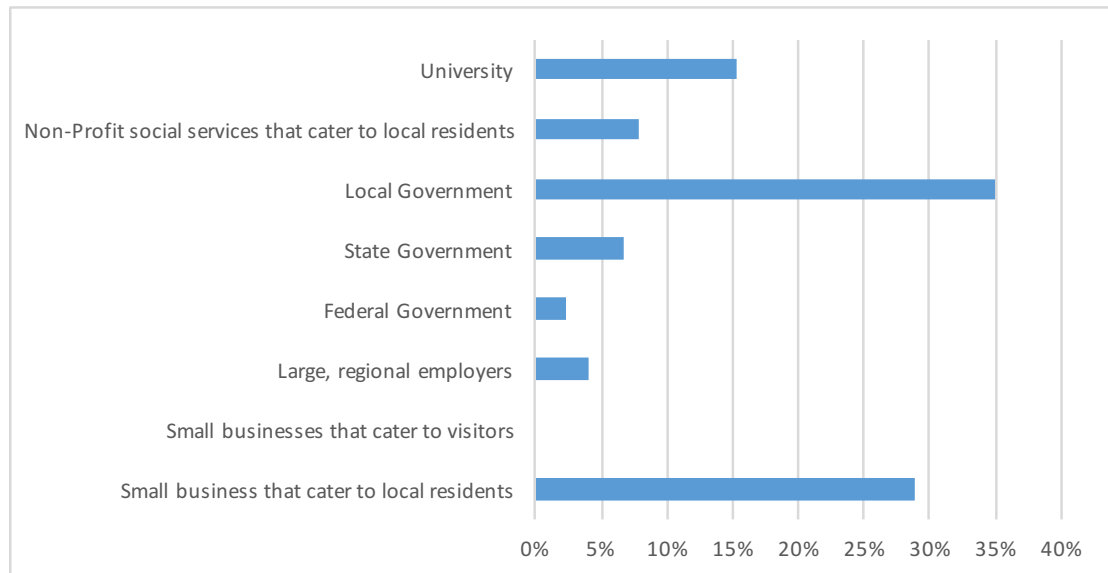


## Local Businesses/ Economy

The next set of questions asked respondents about local businesses and the economy. Large disaster events like Hurricane Katrina, the Tohoku Earthquake and Tsunami in Japan, and more recently Super Storm Sandy, have illustrated the importance of involving the business community in planning for the ability to quickly recover from a disaster. Where pre-event planning has not taken place, small businesses often close and the local economy suffers. Conversely, where businesses are involved with disaster recovery and preparedness efforts, economic activity tends to return to communities more quickly.

Respondents were asked to identify which community entity was most important to them. Figure F-9 shows respondents indicated that local government (35%), followed by small businesses that cater to local residents (29%), and the university (15%) were the most important.

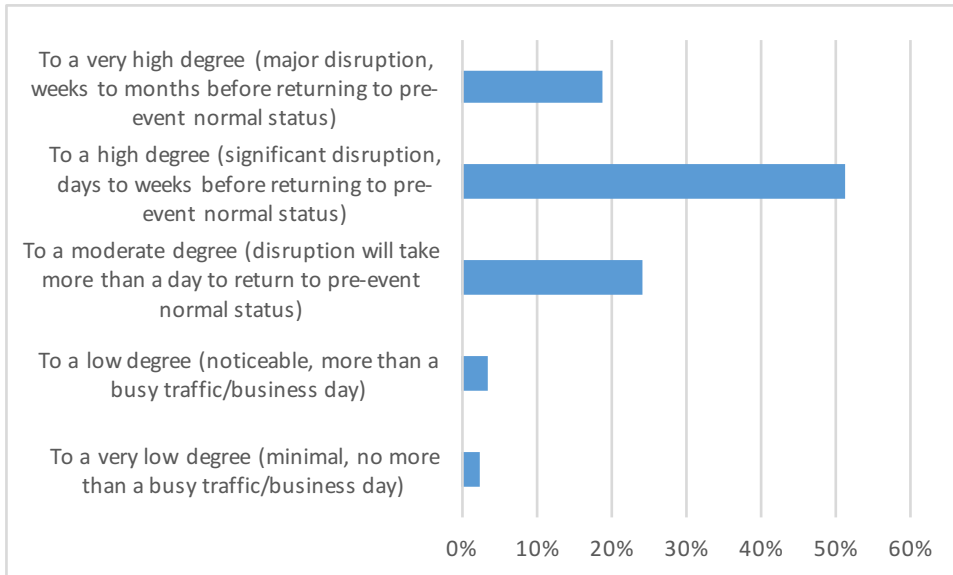
**Figure F-9 Respondent Perception of Most Important Community Entity**



Source: 2015 NHMP Public Opinion Survey

Next the respondents were asked to what degree the community entity identified in the previous question would be impacted by a disaster. More than two-thirds of respondents indicated that they think the community entity they identified would be either impacted to a “high” or “very high” degree; about one-quarter responded that the community entity would be impacted to a “moderate” degree.

**Figure F-10 Respondent Perception of Hazard Impact Upon the Most Important Community Entity**



Respondents were next asked to identify business planning activities related to resilience that they were aware of (Question 11), however, the overwhelming majority of respondents noted that they were not aware of any activities. The question and the results are provided in Attachment A.

## Text Responses

We received the following comments in response to the following:

“Benton County and participating municipalities are currently updating the Benton County Multijurisdictional Natural Hazards Mitigation Plan. The Plan will help you and Benton County better understand your risk to natural hazards and help to reduce that risk. To see a copy of the existing plan visit: <http://www.co.benton.or.us/sheriff/ems/hazard/index.php>. Please describe any questions or comments that you have about the Plan or the process?”

### Responses:

*Will need to read before I have a question*

*Benton County focuses solely on Corvallis leaving rural residents with no services or representation. The rural towns will have to fend for themselves in the event of a disaster.*

*I would like to see a condensed (more reader friendly) version that gets to the heart of what every community member needs to be doing to prepare.*

*It won't do any good unless people see it, and there is little interest in seeing such a thing before it's needed. Good luck!*

*After I read the plan (I only have a few minutes right now)...*

*The Plan should be updated more often than every 5 years. I have never even heard of this - Public involvement should be more widely advertised and give people time to review all of this, and more chances to be involved in forums and committees. This is the only way to get people to cooperate ahead of a disaster.*

*Does Linn County have a similar plan?*

*How will this be communicated to the community? I would find it helpful to receive notifications about this plan via the public schools.*

*This is unknown to me*

*Planning is a start, but really in the first 24 to 48 hours after a disaster, everyone (including safety personnel) are more concerned about their families than "the public."*

*I would like to see the plan publicly accessible with an interactive map through a digital library and archive.*

*How will vulnerable populations be helped in getting their medications? Especially if the Health Department supplies them and they cannot get around during a winter storm.*

*I would like to see community-wide CERT training*

*Is there a more digestible version or chunked version for social media?*

*I have observed that you don't get any help except from your neighbors in times of disasters, even in Corvallis.*

*Did not address poor Fern Ridge Dam control which results in flooding my property when open late and full*