



Jefferson County

Multi-Jurisdictional Natural Hazards Mitigation Plan

Prepared for: Culver, Madras, and Metolius



Jefferson County

Multi-Jurisdictional Natural Hazards Mitigation Plan

Report for:

Jefferson County, Oregon

And the Cities of Culver, Madras, and
Metolius

Prepared by:

**Oregon Partnership for
Disaster Resilience**

1209 University of Oregon
Eugene, OR 97403

September, 2008



Special Thanks & Acknowledgements

This Natural Hazard Mitigation Plan was developed through a regional partnership funded by the Federal Emergency Management Agency's Pre-Disaster Mitigation Competitive Grant Program. The Southeast Oregon Region grant was awarded to support the development of natural hazard mitigation plans for the region. The region's planning process utilized a four-phased planning process, plan templates and plan development support provided by the Partnership for Disaster Resilience at the University of Oregon.

Regional partners include:

- Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center
- Oregon Emergency Management
- Federal Emergency Management Agency, Region X
- Department of Geology and Mineral Industries

Project Steering Committee:

- Jefferson County Community Development Department
- Jefferson County Public Works Department
- Crooked River Ranch Homeowners Association
- Central Electric Cooperative
- Warm Springs Tribe
- Federal Grasslands
- 509J School District
- US Forest Service
- Fire Department Agencies from Crooked River Ranch, Three Rivers, and the County
- City of Culver
- City of Metolius
- City of Madras

Project Managers:

- Margaret Boutell, Jefferson County Community Development Department
- Gregoor Passchier, Oregon Partnership for Disaster Resilience
- Megan Findley, Oregon Partnership for Disaster Resilience

Community Service Center Staff:

Andre LeDuc, Director, Oregon Partnership for Disaster Resilience

Krista Dillon, Associate Director, Oregon Partnership for Disaster Resilience

Megan Findley, Program Manager, Oregon Partnership for Disaster Resilience

Gregoor Passchier, Graduate Research Intern, Oregon Partnership for Disaster Resilience

**Jefferson County
Natural Hazards Mitigation Plan**

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Executive Summary

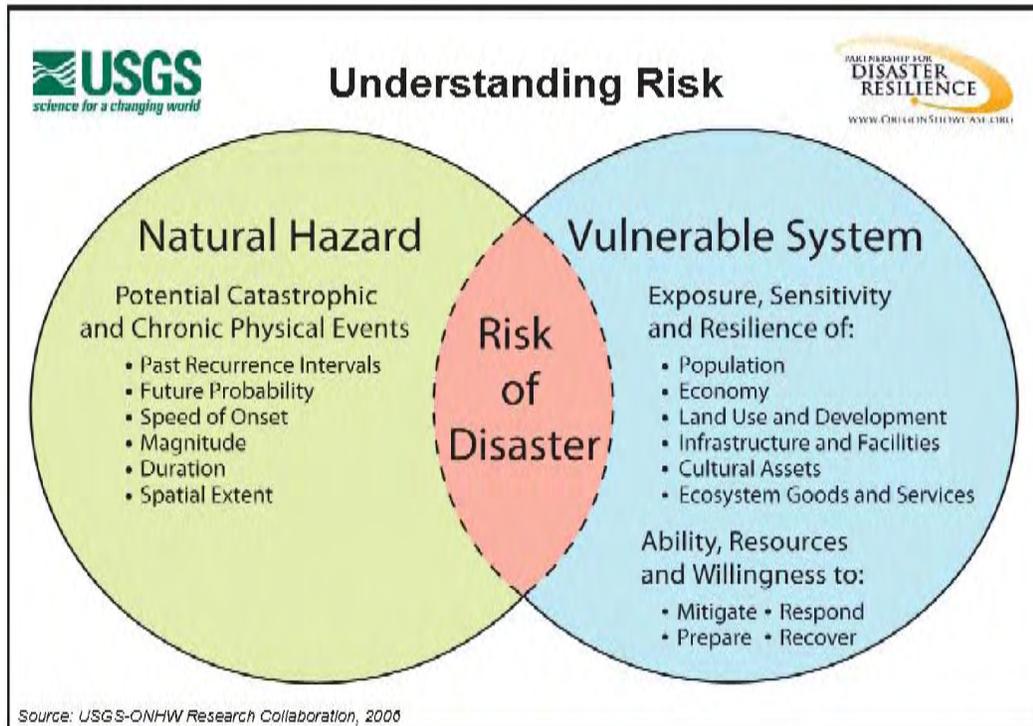
Jefferson County developed this multi-jurisdictional Natural Hazard Mitigation Plan in an effort to reduce future loss of life and damage to property resulting from natural hazards. This plan was developed with and for the following jurisdictions: Jefferson County, Culver, Madras, and Metolius. It is 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 minimize the losses that can result from natural hazards.

Natural hazard mitigation is defined as 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 individuals, private businesses and industries, state and local governments, and the federal government.

Why Develop this Mitigation Plan?

This natural hazard mitigation plan is intended to assist Jefferson County, Culver, Madras, and Metolius in reducing the risk from natural hazards by identifying resources, information, and strategies for risk reduction. It will also help guide and coordinate mitigation activities throughout the County. The figure below is utilized throughout the plan to illustrate the concept of risk reduction.

Figure i.1 Understanding Risk



Source: USGS-Partnership for Disaster Resilience Research Collaborative, 2006

A natural hazard mitigation plan can assist jurisdictions in understanding what puts the community at risk. By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capacity, communities in Jefferson County become better equipped to identify and implement actions aimed at reducing the overall risk to natural hazards.

Who Participated in Developing the Plan?

In Fall 2005, the Oregon Partnership for Disaster Resilience (Partnership / OPDR) at the University of Oregon's Community Service Center partnered with the Department of Geology and Mineral Industries (DOGAMI) and the Southeast Oregon Region (Harney and Malheur as well as Jefferson and Lake) counties to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined the Partnership for Disaster Resistance and Resilience (The Partnership) by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Southeast Oregon Region a grant to support the development of the natural hazard mitigation plans for the four counties in the region. OPDR, DOGAMI, and the participating communities were awarded the grant in the Fall of 2005 and local planning efforts in this region began in the Fall of 2006. Jefferson County began its local planning process in September, 2007.

The Jefferson County Natural Hazard Mitigation Plan 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. A project steering committee guided the plan development process, and OPDR developed, facilitated, and led the overall planning process. OPDR additionally drafted Jefferson County's final Natural Hazard Mitigation Plan. The steering committee was comprised of representatives from the following organizations.

- Jefferson County Community Development Department
- Jefferson County Public Works Department
- Crooked River Ranch Homeowners Association
- Central Electric Cooperative
- Warm Springs Tribe
- Federal Grasslands
- 509J School District
- US Forest Service
- Fire Department Agencies from Crooked River Ranch, Three Rivers, and the County
- City of Culver
- City of Metolius
- City of Madras

The Jefferson County Community Development Department was designated as the plan's convener and will take the lead in implementing, maintaining and updating the plan. Public participation played a key role in the development of goals and action items. Public involvement in the planning process was achieved by including members from different organizations to provide representation in the steering committee meetings. In addition, as part of the regional Pre-Disaster Mitigation grant, *The Partnership* implemented a region-wide household preparedness survey in January 2007 to engage the public in disaster planning. The survey gauged household knowledge of mitigation tools and techniques and assessed household disaster preparedness. The survey results improve public/private coordination of mitigation and preparedness for natural hazards by obtaining more accurate information on household understanding and needs. While the survey gathered information on community members' attitudes of household risks to natural hazards, the survey also served to remind residents of the need to prepare for natural hazard events. Results of the survey are documented in an independent report in Appendix D.

What is the Plan's Mission?

The mission of the Jefferson County multi-jurisdictional Natural Hazards Mitigation Plan is *to create a disaster-resilient Jefferson County.*

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.

- Save lives and reduce injuries.
- Minimize and prevent damage to public and private buildings and infrastructure.
- Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.
- Increase education, outreach, and awareness.
- Protect natural and cultural resources.

How are the Action Items Organized?

The action items are organized within an action matrix (located at the end of this Summary), which lists all the multi-hazard and hazard-specific action items included in the mitigation plan. Data collection and research and the public participation process resulted in the development of these 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.

How will the plan be implemented?

The plan maintenance section of this plan details the formal process that will ensure that the Jefferson County Natural Hazards Mitigation Plan remains an active and relevant document. The plan will be implemented, maintained and updated by a designated convener. The convener is responsible for overseeing annual review processes. Cities and special districts developing addendums to the County plan will also designate a convener and will work closely with the County convener to keep the plans coordinated. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This section describes how the communities will integrate public participation throughout the plan maintenance process.

Plan Adoption

After the Plan is locally reviewed and deemed complete the Jefferson County Community Development Department will be responsible for submitting it to the State Hazard Mitigation Officer at Oregon Emergency

Management. Oregon Emergency Management will then submit the Plan 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. Upon acceptance by FEMA the County will adopt the plan via resolution. The individual jurisdiction’s conveners will be responsible for ensuring local adoption of the Jefferson County multi-jurisdictional Natural Hazards Mitigation Plan and providing the support necessary to ensure plan implementation. At that point the County will gain eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and the Flood Mitigation Assistance program funds.

The accomplishment of the Natural Hazards Mitigation Plan goals and actions depends upon the maintenance of a competent Steering Committee and adequate support from the County and city departments reflected in the plan in incorporating the outlined action items into existing County plans and procedures. It is hereby directed that the appropriate County departments and programs implement and maintain the concepts in this plan. 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.

Jefferson County NHMP Action Item Matrix

Action Item	Proposed Action Title	Coordinating Organization	Partner Organizations	Timeline	Alignment with Plan Goals				
					Save lives and reduce injuries.	Minimize and prevent damage to public and private buildings and infrastructure.	Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.	Increase education, outreach, and awareness.	Protect natural and cultural resources.
Earthquake #1	Identify critical and essential facilities for seismic retrofit.	Community Development	Public Works, County Commissioners, OEM, DOGAMI	LT (ongoing)	X	X			X
Flood #1	Develop flood mitigation strategies for critical facilities located in the floodplain.	Community Development	Public Works, FEMA, OEM	LT	X	X			X
Flood #2	Explore coordination and support strategies to minimize the negative impact of upstream development on rivers and streams.	Community Development	Public Works, GIS, FEMA, DLCD	LT		X			X
Flood #3	Upgrade culverts in unincorporated areas in Jefferson County to reduce flooding events on roads and bridges.	Public Works	Buildings and Grounds, ODFW, ODOT	ST	X	X			
Flood #4	Develop erosion prevention strategies for gravel roads in Jefferson County.	Public Works	Community Development, Buildings and Grounds	ST		X			
Flood #5	Educate citizens in Jefferson County about flood issues and actions they can implement to mitigate the flood risk.	Public Works	Community Development, FEMA, ODM	LT	X	X		X	
Flood #6	Explore the possibility of updating the County's FEMA Flood Insurance Rate Map.	Community Development	GIS, FEMA	LT	X	X	X	X	X
Flood #7	Encourage ODOT to develop an emergency bypass route through Madras.	County Commissioners	Public Works, Community Development, Emergency Services, ODOT, OEM, OPDR, IHMT	LT	X		X		
Flood #8	Take steps to begin participating in the Community Rating System.	Community Development	Public Works, FEMA	LT	X	X	X		
Flood #9	Continue compliance with the National Flood Insurance Program (NFIP).	Community Development	County Commission, Public Works, FEMA	LT (ongoing)	X	X			
Landslide #1	Identify areas vulnerable to landslides and develop mitigation strategies to reduce the likelihood of potentially hazardous events.	GIS	Community Development, Public Works	LT	X	X			X
Landslide #2	Adopt development standards that specify maximum cuts and fills and do not allow major alterations of drainage patterns.	Community Development	County Commission, DLCD	LT	X	X			X

Wildfire #1	Implement actions identified in the Jefferson County Community Wildfire Protection Plan.	Jefferson County Fire Chief and County Planner	Community Development, GIS, ODF, Three Rivers Volunteer FD, The Confederated Tribes of Warm Springs, Crooked River Ranch RFD, State Fire Marshall	LT	X	X	X	X	X
Wildfire #2	Encourage communities to incorporate fire prevention materials and programs, such as Firewise, to help in fire prevention.	Jefferson County Fire Department	Jefferson County Search & Rescue, Chamber of Commerce, Boys & Girls Club, COIC, Extension Service	LT	X	X		X	X
Drought #1	Coordinate with fire district agencies to identify areas in need of additional water resources.	Jefferson County Fire Department	Public Works, Emergency Services, ODFW, ODF, BLM	ST	X	X	X		X
Volcano #1	Include volcanic ash fall in the Health Department's public outreach efforts to address respiration hazards, targeting specific vulnerable populations such as the elderly and youth.	Public / Mental Health	Emergency Services, Law Enforcement, USGS, Cascades Volcano Observatory	LT	X			X	
Windstorm #1	Educate property owners on how to properly maintain trees to prevent power loss on power lines off the right of way.	Public Works	Central Oregon Electric Cooperative	ST		X		X	
Winter Storm #1	Explore improvements for adequately heating schools and other critical facilities in extreme cold events by improving insulation and heating systems.	509J School District	Public Works, Central Electric Cooperative	LT	X				X
Winter Storm #2	Explore funding options to obtain equipment, such as power generators and plowing and pumping equipment, to help respond to winter storm events.	Public Works	Buildings and Grounds	ST	X	X			
Multi-Hazard #1	Continue monitoring blue-green algae in reservoirs and other bodies of water in drought conditions to avoid harm to recreation and the environment.	Public Works	Water District	LT	X				X
Multi-Hazard #2	Develop an education and outreach program to educate residents about all the natural hazard events in Jefferson County and to provide them with mitigation activities they can take to reduce the impact of natural hazards.	Community Development	Boy Scouts, Jefferson County Extension Office, Search & Rescue, MaCAT, Salvation Army	LT	X			X	
Multi-Hazard #3	Inventory historic and cultural resources, with an emphasis on unreinforced masonry buildings, and identify their vulnerabilities to natural hazards to develop mitigation actions for their protection.	Community Development	Economic Development of Central Oregon, State Historic Preservation Officer	LT	X	X			X

Multi-Hazard #4	Explore emergency response and preparedness measures to address response and preparedness needs for natural hazard events.	Emergency Services	OEM, DHS	LT	X				
Multi-Hazard #5	Work with local businesses to develop business continuity plans.	Madras-Jefferson Chamber of Commerce	IBHS	ST		X		X	X
Multi-Hazard #6	Develop continuity of operations plans for Jefferson County to ensure continued operation in the event of a natural hazard emergency.	County Commissioners	Assessor, Treasurer, Clerk	LT	X	X			
Multi-Hazard #7	The Jefferson County Steering Committee will be the coordinating body responsible for implementing the Jefferson County Natural Hazards Mitigation Plan.	Community Development	Jefferson County Natural Hazards Mitigation Steering Committee	LT			X		
Multi-Hazard #8	Coordinate mitigation planning activities with existing planning activities, such as emergency response tabletops, to discuss mitigation actions and avoid duplicating efforts.	Emergency Services	Community Development, Public Works, OEM, DLCD, DHS, OPDR, OPRD	LT			X	X	
Multi-Hazard #9	Develop strategies for collaborating and coordinating with other entities to improve mitigation and emergency management activities in Jefferson County.	Emergency Services	Mountain View Hospital, Jefferson County Department of Health, USFS, BLM, USFWS, CWPP Core Team	LT			X		

Section1

Introduction

What is Natural Hazard Mitigation?

Natural hazard mitigation is defined as 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; education and outreach to targeted audiences, such as Spanish speaking residents, or the elderly. Mitigation is the responsibility of individuals, private businesses and industries, state and local governments, and the federal government.

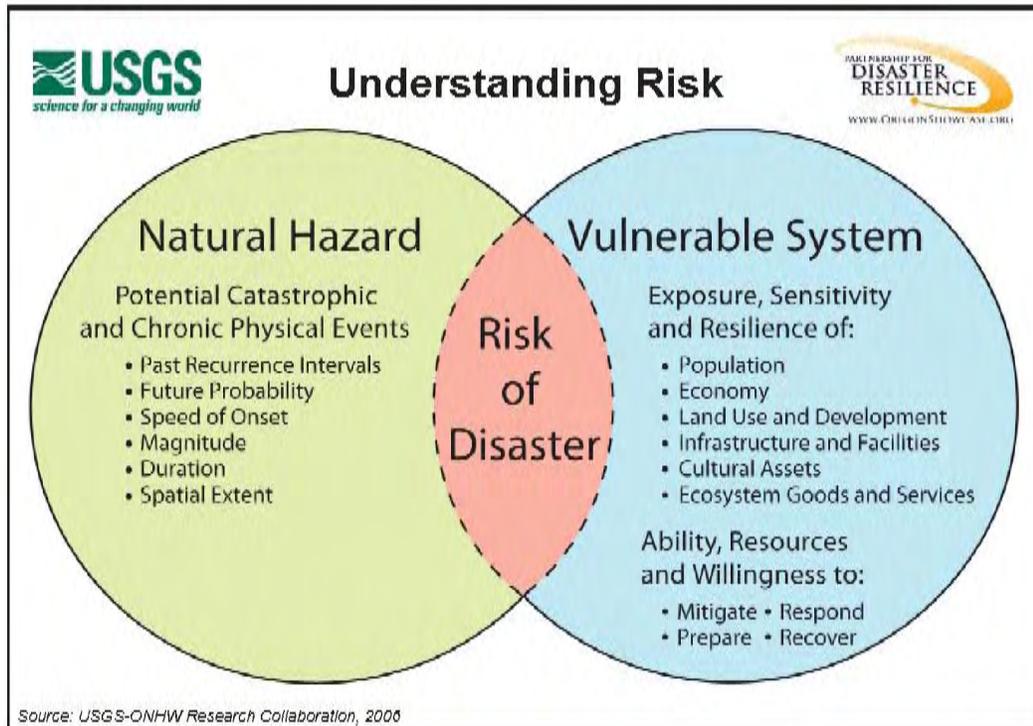
Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within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

Why Develop a Mitigation Plan?

Jefferson County and the Partnership for Disaster Resilience developed this multi-jurisdictional Natural Hazards Mitigation Plan in an effort to reduce future loss of life and damage to property resulting from natural hazards. This plan was developed with and for the following jurisdictions: Jefferson County, Culver, Madras, and Metolius. It is impossible to predict exactly when disasters will occur, or the extent to which they will affect the County. 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.

The figure below is utilized throughout the plan to illustrate the concepts of risk reduction.

Figure 1.1 Understanding Risk



Source: USGS – The Partnership for Disaster Resilience Research Collaborative, 2006

A natural hazard mitigation plan can assist the community in understanding what puts the community at risk. By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capabilities, communities in Jefferson County become better equipped to identify and implement actions aimed at reducing the overall risk of hazards.

This plan focuses on the primary natural hazards that could affect Jefferson County, Oregon, which include drought, earthquake, flood, landslide, volcano, wildfire, windstorm, and winter storm. The dramatic increase in the costs associated with natural disasters over the past decades has fostered interest in identifying and implementing effective means of reducing vulnerability. A report submitted to Congress by the National Institute of Building Science’s Multi-hazard Mitigation Council (MMC) highlights that for every dollar spent on mitigation, society can expect an average savings of \$4.¹ This multi-jurisdictional Natural Hazards Mitigation Plan is intended to assist all participating jurisdictions in reducing its risk from natural hazards by identifying resources, information, and strategies for risk reduction.

The plan is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the County; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements

and qualifying for assistance programs. The mitigation plan works in conjunction with other County and City plans and programs including the Jefferson County Comprehensive Plan, Jefferson County Transportation Systems Plan, Jefferson County Zoning Ordinance, Jefferson County Community Wildfire Protection Plan (CWPP), City of Madras Flood Damage Prevention Ordinance, City of Madras Zoning Ordinance, Madras Transportation System Plan, as well as the State of Oregon Natural Hazards Mitigation Plan.

The plan provides a set of actions to prepare for and reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, coordination among different entities, and the implementation of preventative activities such as land use or watershed management programs. The actions described in the plan are intended to be implemented through existing plans and programs within the County and/or cities.

Policy Framework for Natural Hazards 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 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.

The primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions. However, resources exist at the state and federal levels. Some of the key agencies in this area include Oregon 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 (DLCDD).

The Disaster Mitigation Act of 2000 (DMA 2000) 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 their proposed mitigation measures are based on a sound planning process that accounts for the risk to the individual and their capabilities.

How was the Plan Developed?

In Fall 2005, the Oregon Partnership for Disaster Resilience (Partnership / OPDR) at the University of Oregon's Community Service Center partnered with the Department of Geology and Mineral Industries (DOGAMI) and the Southeast Oregon Region (Harney and Malheur as well as Jefferson and Lake) counties to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined the Partnership for Disaster Resistance and Resilience (The Partnership) by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Southeast Oregon Region a grant to support the development of the natural hazard mitigation plans for the four counties in the region. OPDR, DOGAMI, and the participating communities were awarded the grant in the Fall of 2005 and local planning efforts in this region began in the Fall of 2006. Jefferson County began its local planning process in September, 2007.

The Partnership provided participating communities with print and web-based resources and facilitated a quarterly series of plan development work sessions that focused on the four phases of the mitigation planning process. In addition, The Partnership also provided communities with a number of regional mitigation products to be utilized in the local process. Those products include:

- Plan Templates;
- Training Manual;
- Regional Profile and Risk Assessment; and
- Household Preparedness Survey Report.

Each community was responsible for facilitating the mitigation planning process locally, utilizing the resources provided by The Partnership, OEM and other state partners. Participating jurisdictions reviewed the resources provided by the various organizations and applied local knowledge, information and data about community characteristics, assets and resources in order to identify potential mitigation actions aimed at reducing overall risk.

The planning process and associated resources used to create Jefferson County's multi-jurisdictional Natural Hazards Mitigation Plan were

developed by The Partnership. The planning process was designed to: (1) result in a plan that is DMA 2000 compliant; (2) coordinate with the State's plan and activities of The Partnership; and (3) build a network of jurisdictions and organizations that can play an active role in plan implementation. The planning process included the review and incorporation, if appropriate, of existing plans, studies, reports and technical information. In general, the following regional resources were reviewed and local resources have been cited throughout the plan.

- State of Oregon Natural Hazard Mitigation Plan – Regional Profiles and Hazard Assessments;
- Oregon Technical Resource Guide;
- Oregon Natural Hazards Workgroup Training Manual;
- The Oregon Atlas;
- The Oregon Weather Book;
- Jefferson County Comprehensive Land Use Plan;
- Jefferson County Community Wildfire Protection Plan; and
- City of Madras Flood Mitigation Plan.

The following is a summary of major activities included in the planning process.

Phase I: Getting Started

In September 2007 the Oregon Partnership for Disaster Resilience hired a Research Intern, or Graduate Teaching Fellow (GTF) to manage the planning process for developing the Jefferson County Natural Hazards Mitigation Plan. The GTF worked closely with the Jefferson County Community Development Director to develop a steering committee. Steering committee members included individuals from the following organizations:

- Jefferson County Community Development Department
- Jefferson County Public Works Department
- Crooked River Ranch Homeowners Association
- Central Electric Cooperative
- Warm Springs Tribe
- Federal Grasslands
- 509J School District
- US Forest Service
- Fire Department Agencies from Crooked River Ranch, Three Rivers, and the County
- City of Culver

- City of Metolius
- City of Madras

The Steering Committee first met with the Partnership on November 16, 2007 to kickoff the mitigation planning process. The November 16 meeting described: (1) the role that the Partnership would play in the process, (2) the overall goal of the project, (3) the major components of a natural hazards mitigation plan, (4) the expectations for the Partnership and for the Steering Committee, and (5) a project timeline. An agenda and a sign-in sheet for the November 16 meeting can be found in Appendix B, Public Process.

Public involvement in the planning process was achieved by including members from different organizations to provide representation in the Steering Committee meetings. In addition, as part of the regional Pre-Disaster Mitigation grant, *The Partnership* implemented a region-wide household preparedness survey in January 2007 to engage the public in disaster planning. The survey gauged household knowledge of mitigation tools and techniques and assessed household disaster preparedness. The survey results improve public/private coordination of mitigation and preparedness for natural hazards by obtaining more accurate information on household understanding and needs. While the survey gathered information on community members' attitudes of household risks to natural hazards, the survey also served to remind residents of the need to prepare for natural hazard events. Results of the survey are documented in an independent report in Appendix D.

The County's project webpage located on *The Partnership* website (www.OregonShowcase.org) also served as an outreach tool to the communities. The webpage was used to provide local contact information and updates on the planning process. The final adopted and approved plan will be posted on the University of Oregon Libraries' Scholar's Bank Digital Archive.

Phase II: Risk Assessment

Phase II of the planning process focused on identifying and understanding the relationship between natural hazards, vulnerable systems within the community, and existing capabilities. To begin the risk assessment process, the Partnership reviewed existing research concerning the causes and characteristics of potential natural hazards, as well as their probabilities of occurrence and potential impacts. Resources included Oregon's Technical Resource Guide, and reports produced by the Department of Geology and Mineral Industries (DOGAMI) among others. Please see Volume II, Hazard Annexes, for hazard-specific resources and information.

The Partnership's Graduate Teaching Fellow (GTF) developed and facilitated a risk assessment workshop with the Jefferson County Steering Committee on March 20, 2008. In addition to discussing the effects of

previous hazard events, the committee identified community assets and potential vulnerabilities within the County. Staff from the Department of Geology and Mineral Industries (DOGAMI) also attended the meeting, and provided geologic information for the earthquake, flood, landslide, and volcanic hazards. The GTF documented information provided by the Steering Committee and created the Hazard Annexes found in Volume II. Steering Committee members reviewed and edited the Hazard Annexes during the months of July and August, 2008. An agenda and minutes from the March 20th meeting can be found in Appendix B, Public Process.

Phase III: Developing a Mission, Goals and Action Items

The Plan's mission statement and goals direct the Plan's action items and reflect the priorities found in the community. OPDR, in consultation with the Jefferson County Steering Committee, developed a mission statement and goals for the plan. On May 29, 2008, OPDR facilitated the Mission, Goals, and Action Items Steering Committee Meeting, where Steering Committee members conducted a final review and approved the stated goals and action items. (For an agenda and participant list, see Appendix B: Public Process). The mission statement for the Plan, while simple, is intended to be a timeless statement that can withstand any changes the plan may undergo over time. The goals reflect the broad needs found within the community.

In addition to the mission and goals, the Mitigation Plan also includes action items which are specific mitigation activities the County can implement to reduce its vulnerability to natural hazards. OPDR, in consultation with the Jefferson County Steering Committee, identified actions based on the County's risk assessment meeting and stakeholder interviews. At the May 29, 2008 meeting, OPDR and Steering Committee members reviewed each action item and approved them after necessary changes. The action items for the Jefferson County Natural Hazard Mitigation Plan address all major natural hazards identified in the plan and include a comprehensive range of activities to be completed. The approved action items are found in Appendix A of the Plan.

Phase IV: Plan Implementation and Maintenance

During the May 29, 2008 Mission, Goals, and Action Item Meeting, the Steering Committee also discussed plan implementation and maintenance strategies. The Steering Committee identified the Jefferson County Community Development Director as the Plan's Convener. Additionally, all members of the Steering Committee agreed to serve as the approved Plan's Coordinating Body. The Committee identified additional agencies and persons to serve on the Coordinating Body as well. Please see Section 4, Plan Implementation & Maintenance, for a description of Convener and Coordinating Body roles and responsibilities. Finally, the Committee agreed that the Coordinating Body should meet on a semi-annual basis to review and update the Plan, and to implement mitigation strategies within the community. The Coordinating Body will additionally work to update

the Plan within a five year cycle. More information regarding the plan maintenance schedule can be found in Section 4.

The Cities of Madras, Metolius, and Culver developed City Addenda to the Jefferson County Natural Hazard Mitigation Plan during Phase IV of the planning process. OPDR staff developed, facilitated, and documented city-specific work sessions in July, 2008 to discuss how the cities' risks differ from the County's. City staff members reviewed and edited OPDR's drafts during the month of August, 2008.

How is the Plan Organized?

Each volume of the mitigation plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing County citizens, businesses, and the environment. Combined, the sections work in synergy to create a mitigation plan that furthers the community's mission to create a disaster resilient Jefferson County. This plan structure enables stakeholders to use the section(s) of interest to them.

Volume I: Multi-Jurisdictional Natural Hazard Mitigation Plan

Section 1: Introduction

The Introduction briefly describes the countywide mitigation planning efforts and the methodology used to develop the plan. City specific planning efforts are documented in Volume III: City/Special District Addendums.

Section 2: Community Overview

This section provides an overall description of Jefferson County. The section includes a brief community profile, discussion of the government structure, listing of existing plans, policies, and programs, listing of community organizations, summary of existing mitigation actions, and an overview of the hazards addressed in the plan. This section allows readers to gain an understanding of the County's sensitivities – those community assets and characteristics that may be impacted by natural hazards, as well as the County's resilience – the ability to manage risk and adapt to hazard event impacts. A Community Overview for each participating city and special district is located in Volume III: City/Special District Addendums.

Section 3: Mission, Goals and Action Items

This section documents the plan, vision, mission, goals, and actions and also describes the components that guide implementation of the identified mitigation strategies. Actions are based on community sensitivity and resilience factors and the hazard assessments in Section 2 and the Hazard Annexes. City and special district - specific action items are located in Volume III: City/Special District Addendums.

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 5-year review meetings. The participating cities and special districts will utilize this implementation and maintenance process as well.

Volume II: Hazard-Specific Annexes

The hazard annexes describe the risk assessment process and summarizes the best available local hazard data. 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.

The hazard specific annexes included with this plan are the following:

- Drought;
- Earthquake;
- Flood;
- Landslide;
- Volcanic Event;
- Wildfire;
- Windstorm; and
- Winter Storm

Volume III: City/Special District Addendums

Volume III of the plan is reserved for any city or special district addendums developed through this multi-jurisdictional planning process.

Volume IV: Resource Appendices

The resource appendices are designed to provide the users of the Jefferson County multi-jurisdictional Natural Hazards Mitigation Plan 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 Item Forms

This appendix contains the detailed action item forms for each of the mitigation strategies identified in this plan.

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: Economic Analysis of Natural Hazards 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. This appendix was developed by *The Partnership*. 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.

Appendix D: Regional Household Preparedness Survey

This appendix includes the survey instrument and results from the regional household preparedness survey implemented by *The Partnership*. The survey aims to gauge household knowledge of mitigation tools and techniques to assist in reducing the risk and loss from natural hazards, as well as assessing household disaster preparedness.

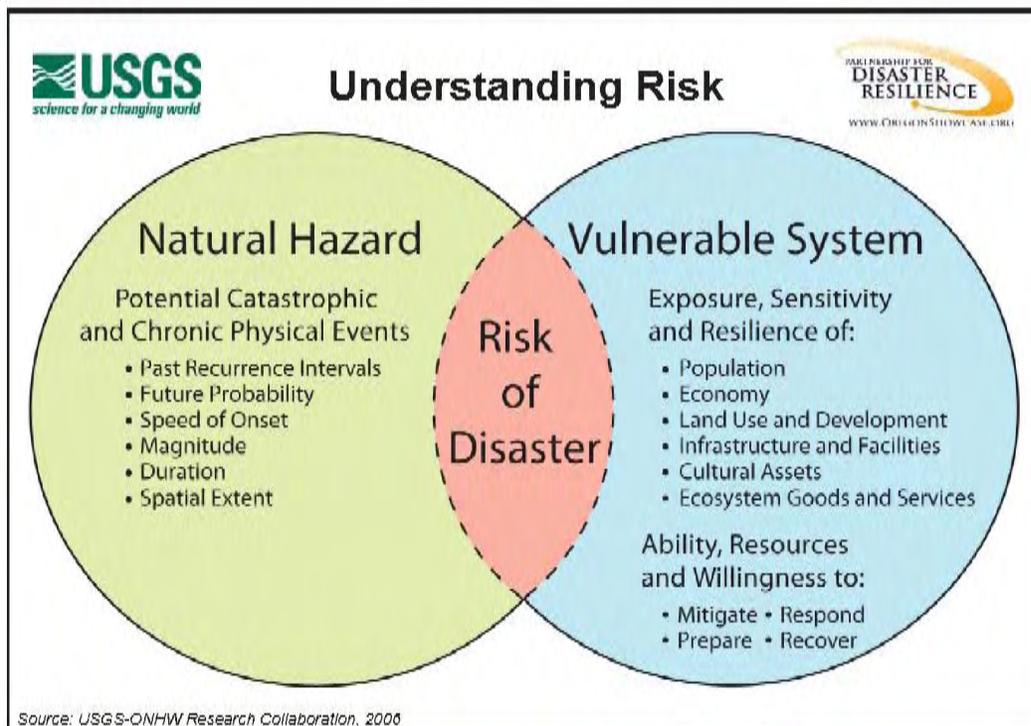
ⁱ National Institute of Building Science's Multi-hazard Mitigation Council. "Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities" 2005.

Section 2

Community Overview

The following section describes the County from a number of perspectives in order to help define and understand the County's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the County when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Annexes, should be used as the local level rationale for the risk reduction actions identified in Section 3 – Mission, Goals, and Action Items. The identification of actions that reduce the County's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 2.1 below.

Figure 2.1 Understanding Risk



Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

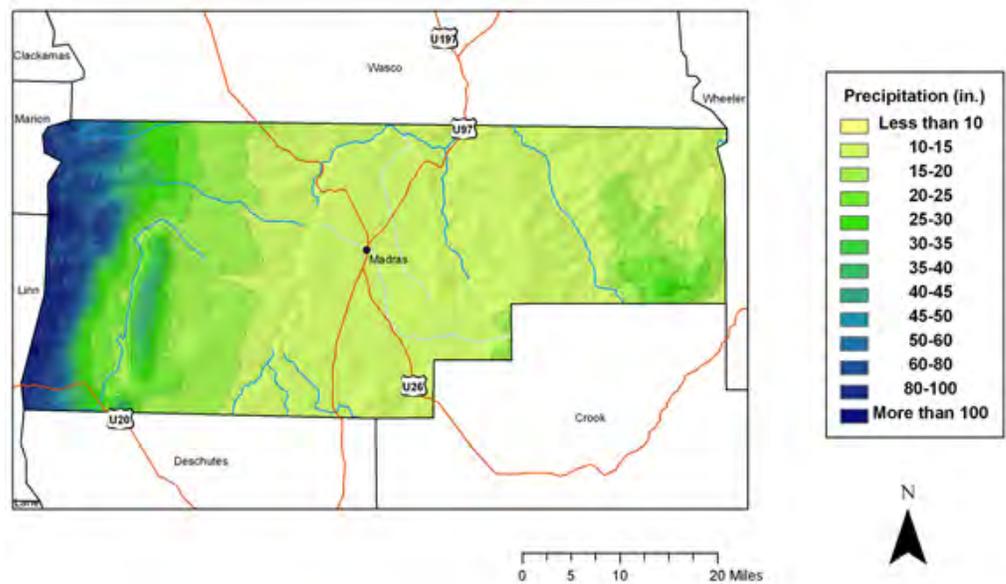
Community Profile

Jefferson County is located in the Central Oregon region and encompasses 1791 square miles. The county is bounded to the north by Wasco County, to the west by Linn and Marion Counties, to the south by Deschutes County, and to the east by Wheeler and Crook Counties. The northwest corner of Jefferson County is administered by the Confederated Tribes of Warm Springs and is part of the large Warm Springs reservation. On the western border of the County is Mount Jefferson; at 10,497 feet, it is Oregon’s second highest mountain, and Jefferson County’s highest elevation.

Geography & Climate

Jefferson County has a diverse climate and geography. The western third of the County receives adequate rainfall to support Douglas fir and ponderosa pine forests. Moving east from Mount Jefferson the elevation drops, and the vegetation turns from forest into Juniper/grass/sagebrush at 3000 feet. The central and eastern parts of Jefferson County are considered high desert, and characterized by hilly and broken terrain covered in sagebrush and grassland. The central and eastern parts receive significantly less rainfall than the western third of the County (See Figure 2.2 below). The average annual precipitation for the County is 10.2".¹

Figure 2.2 Jefferson County Average Annual Precipitation



Source: Oregon Climate Center, Jefferson County Climate Data.

Several major rivers and reservoirs are located in Jefferson County. Major rivers and streams include the Metolius River, Deschutes River, Trout Creek, and Willow Creek. The largest reservoir in Jefferson County is the Lake Billy Chinook Reservoir west of Metolius, covering 6.2 square miles.

Population & Demographics

Jefferson County is currently undergoing changes in its population. In 2007 the County's population was 22,030, an increase of 15.9% from the 2000 Census population of 19,009.² Rapid population growth can potentially occur within hazardous areas if not properly managed.

Jefferson County is also experiencing rapid demographic changes in terms of age. From 2000 to 2006, the 20 - 24 age group increased by 26.1%, and the 55 - 59 age range increased by 23.7%. See Table 2.1 below.

Table 2.1 Jefferson County Population by Age, 2000, 2006

Age Range	2000	2006	% Change
Under 5	1,467	1,542	5.1%
5 to 9	1,588	1,515	-4.6%
10 to 14	1,687	1,555	-7.8%
15 to 19	1,362	1,500	10.1%
20 to 24	1,017	1,282	26.1%
25 to 34	2,431	2,518	3.6%
35 to 44	2,680	2,729	1.8%
45 to 54	2,439	2,756	13.0%
55 to 59	1,012	1,252	23.7%
60 to 64	963	1,040	8.0%
65 to 74	1,438	1,598	11.1%
75 to 84	698	833	19.3%
85 and over	227	232	2.2%
Total	19,009	20,352	7.1%

Source: US Census 2000, Jefferson County, OR, "Age groups and Sex," 2006 Population Estimates

Disaster impacts (in terms of loss and the ability to recover) vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. Above, Table 2.1 also shows that from 2000 to 2006 the elderly population (75 - 84) has grown by 19.3%. Elderly individuals may require special consideration due to sensitivities to heat and cold, reliance upon transportation for medications, and comparative difficulty in making home modifications that reduce risk to hazards. Additionally, Table 2.2 shows that 23% of Jefferson County's population is between the ages of 0 and 14. In general, children are more vulnerable to heat and cold, have fewer transportation options, and require assistance to access medical facilities.

Table 2.2 Jefferson County Youth and Senior Populations, 2006

Age Range	Number	%
0-14	4,742	23%
65-74	1,438	7%
75+	9,25	5%

Source: US Census 2006 Population Estimates

While the majority of Jefferson County is Caucasian, the County also has a large number of Native American residents (see Table 2.3 below). This is due to the large Warm Springs Reservation that occupies the northwest corner of the county and is administered by the Confederated Tribes of Warm Springs.

Table 2.3 Jefferson County Population by Race, 2006

Race	Number	%
White alone	16,478	81.0%
Black or African American alone	146	0.7%
American Indian and Alaska Native alone	3,149	15.5%
Asian alone	81	0.4%
Native Hawaiian and Other Pacific Islander alone	51	0.3%
Two or more races	447	2.2%
Total	20,352	

Source: US Census 2006 Population Estimates

Housing

Housing type and age are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard stick-built homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960's in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970's, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

As seen in Table 2.4 below, 56% of Jefferson County's homes were single-family residences in 2000; 29% were mobile homes; 11% were multi-family homes, and 4% were boats/RV's, vans, etc.

Table 2.4 Jefferson County Housing Characteristics

Single-Family	Multi-Family	Mobile homes	Boat, RV, Van, etc.
56%	11%	29%	4%

Source: US Census Bureau, Profile of Housing Characteristics, 2000.

Employment & Economics

Jefferson County has one of the least-diversified economies in the State. According to the Oregon Employment Department, Jefferson County's 1999 economic diversity rating was 29 (with 1 being the most diverse, and 36 being the least). An economy that is heavily dependent upon a few key industries may have a more difficult time recovering after a natural disaster than one with a more diverse economic base.

Economic resilience to natural disasters is particularly important for the major employment sectors in the region. If these sectors are negatively impacted by a natural hazard, such that employment is affected, the impact will be felt throughout the regional economy. In Jefferson County, as shown in Table 2.5 below, government is the largest employer, and provides 28% of the County's jobs. Manufacturing is the second largest employer in the County. *Government* is projected to grow more than any other economic sector by 2014. In the event of a natural disaster, the government sector may not be as vulnerable as other sectors, since employees will be called upon to provide support and structure for their communities and will have outside funding sources.

Table 2.5 Jefferson County Employment by Major Industry, 2005

Government	Health Care	Retail	Farm	Manufacturing	Accommodation and Food Services
28%	n/a	8%	9%	20%	6%

Source: Bureau of Economic Analysis, 2005, *Total Full-time and Part-time Employment by NAICS Industry*.

The *accommodations* sector includes hotels, motels, recreational accommodation, and boarding houses. *Food services* include places that prepare food and/or drink for immediate consumption. Accommodation businesses are predominantly dependant on people who come to the area as tourists, on business, or simply passing through, and many food service businesses also serve this clientele. The industry relies on an open transportation network both for customers and for supplies and is particularly sensitive to road closures (e.g., from wildfires or winter storms). The businesses that primarily cater to tourists and recreationalists are also dependant on an unimpaired physical environment. Restaurants and other food providers that rely on local customers may also suffer the same fate as other non-essential retail services; after a disaster, the local population may lack the funds to spend it on "luxury" services such as eating at restaurants.

Median income can be used as an indicator of the strength of the region's economic stability. In 2000, the median household income in Jefferson County was \$36,028. This is almost \$5,000 below the 2000 national median household income of \$41,994. Likewise, in 2005, the County's median household income was about \$7,000 below the nation's. The County's median household income changed between 2000 and 2005, however, at about the same rate as the nation's 10% increase (see Table 2.6 below). Although median household income can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Table 2.6 Jefferson County Median Household Income 2000 to 2005

Area	2000	2005	% Change
United States	\$41,990	\$46,242	10%
Oregon	\$41,662	\$43,065	3%
Jefferson County	\$36,028	\$39,123	9%

Source: US Census, Small Area Income and Poverty Estimates, *Estimates for Oregon Counties, Household Median Income*, 2000, 2005.

While Jefferson County's population and income are increasing, Table 2.7 shows the poverty rate is also growing among all ages. Low income populations may require additional assistance following a disaster because they may not have the savings to withstand economic setbacks, and if work is interrupted, housing, food, and necessities become a greater burden. Additionally, low-income households are more reliant upon public transportation, public food assistance, public housing, and other public programs, all of which can be impacted in the event of a natural disaster.

Table 2.7 Jefferson County Poverty 2000 and 2005

Ages	2000		2005	
	Total Persons	% of Population	Total Persons	% of Population
All Ages in Poverty	2,692	13.9	3,124	15.8
Under 18 in Poverty	1,264	22.3	1,343	24.6

Source: US Census, Small Area Income and Poverty Estimates, *Estimates for Oregon Counties*, 2000, 2005.

Historic and Cultural Resources

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 County has three buildings listed on the National Register of Historic Places:

- Camp Sherman Community Hall, Camp Sherman
- Lueddemann, Max and Ollie, House, Madras, OR
- Oregon Trunk Passenger and Freight Station, Metolius, OR

Additional historic resources with local significance include the following:

- Old Santiam Pass. Hand-built wagon road used from 1860 on. *Location: closely following existing Highway 20.*
- Oregon Trunk Railroad. Rail line built to compete in the race to build railroad to Bend. *Location: Along Deschutes and Willow Creek canyons.*
- Herb Keeney Cellar. Stone and sod root cellar built into slope. *Location: Map 12-13-32, east slope of Juniper Butte.*
- Gray Butte Cemetery. Cemetery dating from 1890s. *Location: Map 13-14-6.*

- Horse Heaven Mine. Turn of century mercury mine. *Location:* Map 10-18-12, on Road 817 east of Ashwood.
- Crooked River Trail Crossing. River ford used in 1845, now gone but trail into canyon still passable by foot. *Location:* Map 13-13-33, one mile upstream from Hwy 97 bridge.
- Peter Skene Ogden Landmark. Plaque on Crooked River bridge commemorating exploration of area by Ogden in 1825. *Location:* Map 13-13-32 at Peter Skene Ogden State Wayside.
- Crooked River Railroad Bridge. Bridge over Crooked River constructed in 1910 – 1911. *Location:* Map 13-13-32 at Peter Skene Ogden State Wayside.
- Campbell Ferry. Location of old cable ferry. Exact location unknown. *Location:* Deschutes River, about ¼ mile upstream from Highway 26.
- Pioneer Homestead at fairground. One and ½ story residence, windmill and storage barn. *Location:* County fairgrounds in Madras.
- Jefferson County Courthouse #1. Two story brick building circa 1917. *Location:* Fifth and D Street in Madras.
- (Former) Madras Conservative Baptist Church. One story building with high pitch gable roof and bell tower. *Location:* 802 D Street in Madras.
- Jefferson County Jail. One story concrete building with dome roof, iron door and three small windows. Circa 1918. *Location:* Sixth and D Street in Madras.
- Suttle Lake Picnic Shelter. Log structure with gable roof, split shakes, lava stone fireplace. *Location:* Suttle Lake Park.
- J.M. Robinson House. One story cabin circa 1880. *Location:* Carl King ranch.
- Carl King Barn. Frame barn circa 1917. *Location:* Opal City area, King Ranch.
- Carl King House. One and ½ story building, shiplap exterior, circa 1912. *Location:* Opal City area, King Ranch.
- Hay Creek Ranch Horse Barn. Barn, board and batten siding, two cupolas, circa 1880s. *Location:* Map 11-15-16. Ranch headquarters area.
- Hay Creek Ranch Cemetery. Cemetery for as many as 150 ranch employees, dating from 1870s. *Location:* Map 11-15-8. Northwest of ranch headquarters area.
- Hay Creek Ranch Dairy Barn. Sixteen-sided barn with octagon cupola and silo, circa 1916. *Location:* Map 11-15-16. Ranch headquarters area.
- Hay Creek Ranch Silo. Octagonal silo constructed of horizontal 2' x 4's stacked to about 35 feet. *Location:* Map 11-15-16. Ranch headquarters area.

- Hay Creek Ranch Commissary. Wood frame building with long roofed front porch. *Location:* Map 11-15-16. Ranch headquarters area.
- Gates Ranch House. Two and ½ story building with bellcast hip roof, built 1913. *Location:* Map 13-12-14 on Crooked River Ranch common land.

Infrastructure & Critical Facilities

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

There are two primary modes of transportation in the County: highways and railroad. There are also many small airports. State Highway 26 runs east-west through the County, and U.S. 97 runs north-south. Highway 97 is the most important north-south corridor east of the Cascades, and it provides a connection between I-84, the major east-west route in Oregon, and northern California. Additionally, the Burlington Northern Santa Fe Railroad (BNSF) connects Jefferson County to Southern California. Rails are sensitive to icing from winter storms that are common in Jefferson County.

Many commercial entities make use of the highways in Jefferson County. Trucks on the section of U.S. 97 between Klamath Falls and Madras transported approximately 10 million tons of freight in 2002. Truck volume averaged between 500 and 1,499 trucks per day for most sections of U.S. 97, while averaging over 3,000 trucks per day outside the larger cities like Madras. U.S. 97 also serves as an important alternative route to I-5.

Highways are also heavily utilized by local traffic. Between 1996 and 2005, average daily volume increased by 15% near the Highway 360 Madras - Prineville junction. Additionally, average daily traffic counts increased by 9% on U.S. 26, 10 miles southeast of Warm Springs. Judging from the trends, traffic levels will continue to increase. A large increase of automobiles can place stress on roads, bridges, and infrastructure within the cities, and also in rural areas where there are fewer transit roads. Natural hazards can disrupt automobile traffic and shut down local transit systems across the area and make evacuations difficult.

The condition of bridges in the County is also a factor that affects risk from natural hazards. Most bridges are not seismically retrofitted, which is a particularly important issue because of the County's risk from earthquakes. Impacted bridges can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to

clients. Jefferson County has 14 state highway bridges, 12 state highway culverts, 34 county highway bridges, 0 county highway culverts, 3 municipal highway bridges, and 0 municipal highway culverts or historic covered bridges.

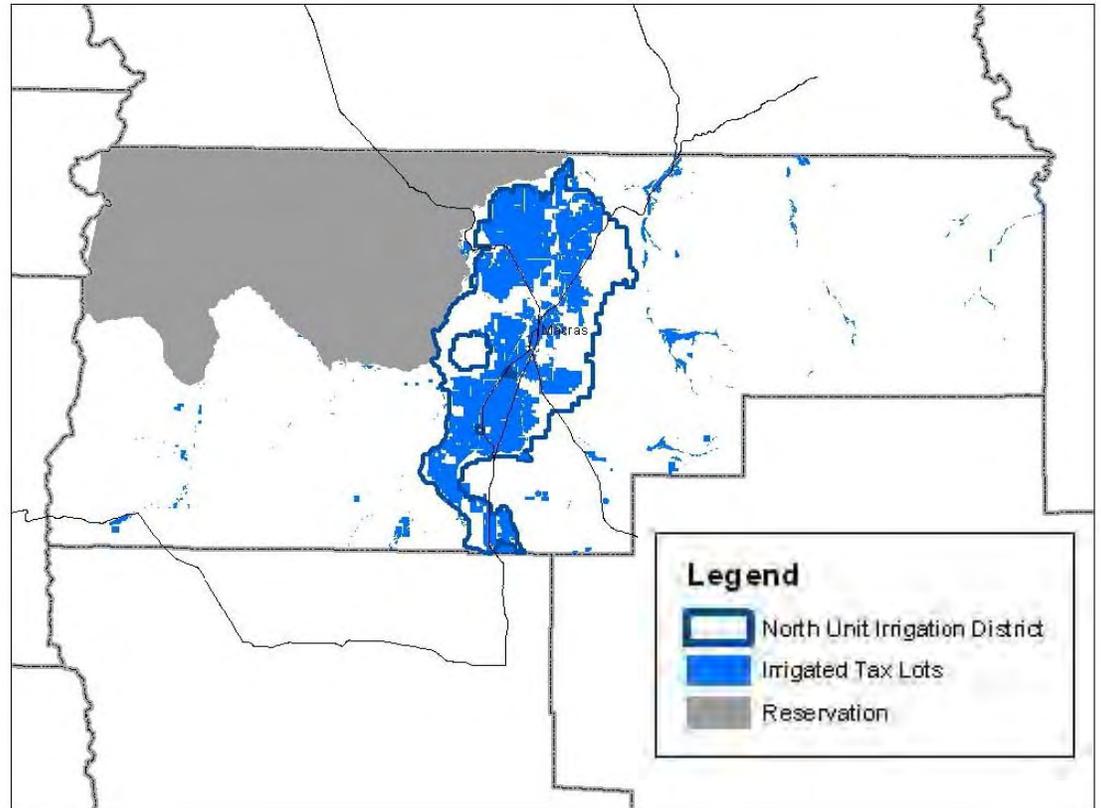
Critical facilities are those facilities that are essential to government response and recovery activities (e.g., police and fire stations, public hospitals, public schools). Jefferson County has 1 hospital with 36 beds, 4 police stations, and 3 fire & rescue stations. The County also has 4 school districts and 1 community college. Additional critical facilities include correctional institutions, public service buildings, law enforcement centers, courthouses, juvenile services buildings, public works facilities, etc.

Dam failures can occur at any time and are quite common. Fortunately, most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage and fatalities does exist. Jefferson County has 17 state dams and 15 national dams.³

Land Use & Development

Land use in Jefferson County is closely related to the geography and climate. The western third of the County consists of timber lands in the Deschutes National Forest and the Warm Springs Reservation. The forested lands are used for timber harvesting, recreation, and wilderness preservation. The central third of the County is irrigated farmland, and contains the major population centers of Madras, Culver, and Metolius. The amount of irrigated farmland is extensive, as shown in Figure 2.3 below, and is responsible for the majority of the agriculture production in Jefferson County. The eastern third of the County is dry, non-irrigated land, and is used for grazing and dry-land wheat farming.⁴

Figure 2.3 Jefferson County Irrigated Lands



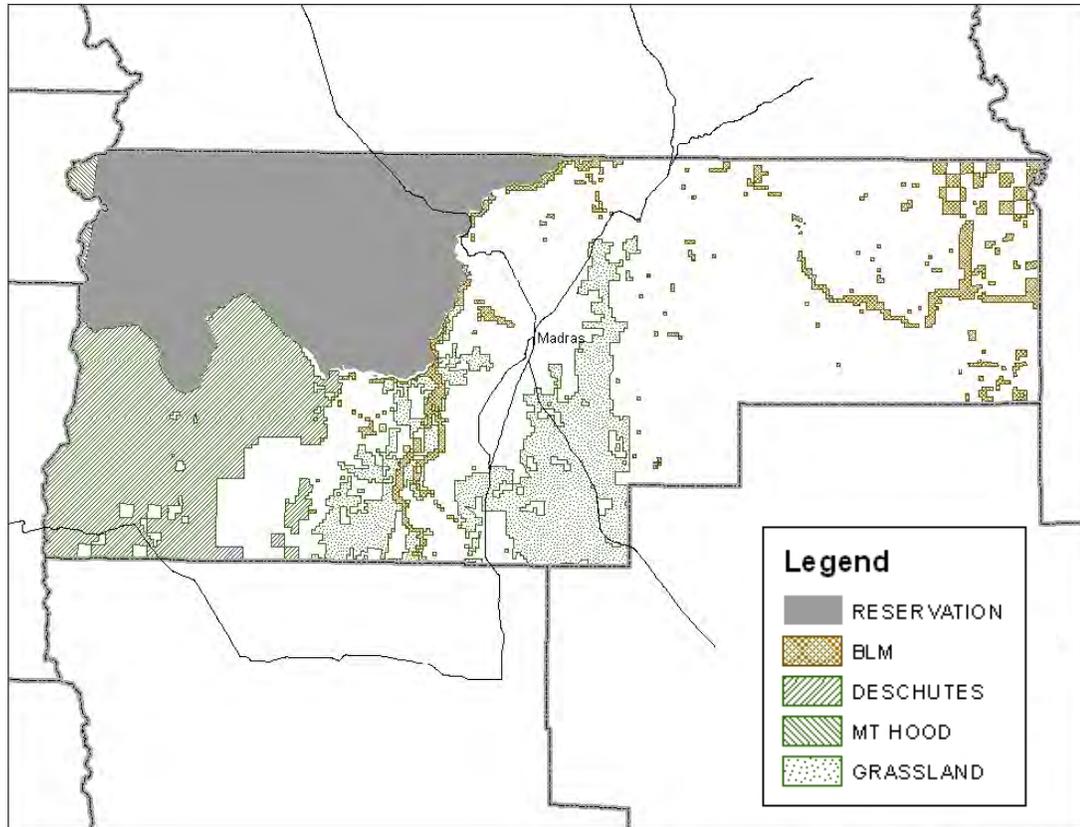
Source: Jefferson County Comprehensive Plan

As shown in Table 2.8 and Figure 2.4 below, over half of the land in Jefferson County is either publicly owned or is part of the Confederated Tribes of the Warm Springs Reservation of Oregon. The amount of privately owned lands is 570,238 acres.

Table 2.8 Jefferson County Publicly Owned Lands

Public Agency	Acres
Warm Springs Reservation	257,109
Deschutes National Forest	159,593
Mt. Hood National Forest	4,220
Crooked River National Grasslands	112,683
Bureau of Land Management	42,534
State of Oregon	1,783
Total County Acreage	577,922

Map 2.4 Jefferson County Land Ownership



In addition to the three incorporated communities of Madras, Metolius, and Culver, Jefferson County also has a large unincorporated population. Unincorporated communities are settlements located outside urban growth boundaries that are primarily residential, but have at least two other commercial, industrial or public land uses. Camp Sherman and Crooked River Ranch are two of Jefferson County's larger unincorporated areas. Camp Sherman is a resort community, and Crooked River Ranch is a rural community.⁵ Table 2.9 below depicts the percentage of Jefferson County's population living outside of incorporated areas in 2000 and 2006.

Table 2.9 Jefferson County Urban/Rural Populations

Incorporated Population		% Change
2000	2006	2000-2006
34%	38%	3%

Source: Portland State University Population Estimates, 2000, 2006.

Government Structure

Jefferson County's governing jurisdiction includes all areas not governed by the US Forest Service, the Bureau of Land Management, the Warm Springs Reservation, and the incorporated communities of Culver, Madras, and Metolius. The County has three commissioners, elects an assessor, clerk, surveyor, and treasurer, and consists of the following departments:

Buildings and Grounds: responsible for the operation and care of Mt. Jefferson Memorial Park Cemetery, Gray Butte Cemetery, Juniper Hills Park, Panorama Park, and the County RV Park.

Community Development: responsible for land use planning, zoning administration, and building inspection. The Community Development Department administers the Comprehensive Plan, Zoning Ordinance, and other county codes relative to planning issues.

GIS: offers data and mapping services for Jefferson County.

Human Resources: responsible for the advertising of any job openings in the different departments within Jefferson County, for the distribution of the applications to the appropriate department, the orientation and in-processing for the individuals who have been selected to fill the positions. All Personnel Records are maintained in the Human Resources Office and are updated as necessary. Human Resources Department frequently participates in wage/benefit surveys and compares job descriptions with other agencies.

Law Enforcement: The Jefferson County Sheriff's office provides non-discriminatory, effective and efficient law enforcement services. The Sheriff's office protects the life and property of Jefferson County citizens, and ensures that the constitutional rights of all persons are protected. The Sheriff's office has 24 full-time corrections staff, 6 dispatchers, 6 patrol deputies, 1 investigator, and 1 school resource officer. Each division is supervised by either a Lieutenant or Sergeant and the entire Office is augmented by numerous Reserve and volunteer Search and Rescue volunteers.

Public/Mental Health: comprised of the Commission on Children and Families, Developmental Disabilities, Health Department and Mental Health.

Public Works: consists of five departments: administration, roads, maintenance, box canyon transfer station, and dog control.

Veteran's Services: provides assistance to Jefferson County veterans, their dependents and survivors in obtaining local, state and federal veterans' benefits to which they are entitled.

Existing Plan & 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.⁶

The Jefferson County multi-jurisdictional 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.

The following plans and policies already in place in Jefferson County.

Name: Jefferson County Comprehensive Plan

Date of Last Revision: Fall 2006

Author / Owner: Jefferson Community Development Department

Description: This comprehensive plan presents the official goals and policies concerning land use in Jefferson County. It addresses all phases of land use and resource utilization, and addresses all applicable Oregon Planning Goals adopted by the Land Conservation and Development Commission.

Relation to Natural Hazard Mitigation: Quoted from the plan: "There are few natural hazards in Jefferson County which threaten the safety of the county's inhabitants. However, there are many landforms or potential occurrences designated by federal and state agencies as hazards." The plan then outlines the following hazards: flood plains, unstable soils, earthquake potential, landslides, volcanic hazard, and fire.

Name: Jefferson County Transportation Systems Plan

Date of Last Revision: Summer 2006

Author / Owner: Jefferson County Community Development Department

Description: Makes transportation system and service recommendations for the county and is designed to be responsive to changes in ridership demand and population growth.

Relation to Natural Hazard Mitigation: Transportation systems assist in evacuation and response in the event of a natural hazard. Action items in

the County's Natural Hazard Plan that are aimed at making the County's transit system more disaster resistant to reduce potential damage and risk can be linked to this Plan.

Name: Jefferson County Zoning Ordinance

Date of Last Revision: December 2006

Author / Owner: Jefferson County Community Development Department

Description: Guides growth and development by establishing the County's authority to govern land use zoning and by providing conditions for sustainable land use practices.

Relation to Natural Hazard Mitigation: Guides growth and development; can be linked to action items that shape growth and development so that they do not increase the county's risk to natural hazards; can be linked to action items that protect natural and historic areas and areas subject to natural hazards; can be linked to action items for how the County will implement Oregon's Statewide Planning Goal 7 requirements.

Name: Jefferson County Community Wildfire Protection Plan

Date of Last Revision: June 2006

Author / Owner: Jefferson County Community Development Department

Description: Sets forth action plan for addressing prioritized fuel reduction, treatment of structural ignitability, and increased collaboration to reduce the impact of wildland urban interface fires.

Relation to Natural Hazard Mitigation: A CWPP can serve as the wildfire hazard annex of an all-hazard mitigation plan. Actions documented in a CWPP should be included in the local mitigation plan as well.

Community Organizations and Programs

Social systems can be defined as community organizations and programs that provide social and community-based services, such as health care or housing assistance, to 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). 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 following table lists organizations that are active within the community and may be potential partners for implementing mitigation actions. The table includes 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 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.

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation	
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income		
Alpha Omicron Madras, OR 97741 Phone: 541-475-2863	Alpha Omicron Pi is an international women's fraternity promoting friendship for a lifetime, inspiring academic excellence and lifelong learning, and developing leadership skills through service to the fraternity and community.	Jefferson County		✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Information dissemination
American Legion 555 SW 3rd Street Madras, OR 97232 Phone: 541-475-2410	Condensed Mission Statement: to inculcate a sense of individual obligation to the community, state and nation; to combat the autocracy of both the classes and the masses; to make right the master of might; to promote peace and goodwill on earth; to safeguard and transmit to posterity the principles of justice, freedom and democracy; to consecrate and sanctify our comradeship by our devotion to mutual helpfulness.	Jefferson County		✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Aspen Court 470 NE Oak Street Madras OR, 97741 Phone: 541-475-6425 Fax: 541-475-6001	Adult Care Facility	Jefferson County			✓	✓					<ul style="list-style-type: none"> • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation	
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income		
Big Brothers, Big Sisters of Central Oregon 678 NE HWY 97 Suite B Madras, OR 97741 Phone: 541-475-2292 E 351	Big Brothers and Sisters volunteer a few hours each week as mentors, role models and friends who help youth face the challenges of growing up.	Jefferson County		✓							<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Boy Scouts of America PO Box 668 Madras, OR 97741 Phone: 541-475-4590	To provide numerous volunteer services to community members in addition to preparing boys and young men for active participation in community life.	Jefferson County		✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Boys & Girls Club of Madras 410 SW 4th Street Madras, OR 97741 Phone: 541-475-7028 Fax: 541-325-5514	To inspire and enable all young people, especially those from disadvantaged circumstances, to realize their full potential as productive, responsible, and caring citizens	Jefferson County		✓						✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Buff Boosters 727 NE Fir Phone: 541-475-6422	The group meets at 7:30 p.m. the first Monday of the month during the school year at the Madras High School Library. The group does a variety of fund raising activities benefiting students within the district.	Jefferson County		✓							<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation	
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income		
Central Oregon Intergovernmental Council 2363 SW Glacier Place Redmond, OR 97756 Phone: 541-548-8163 Fax: 541-548-9548	To provide education, retraining and economic development services	Crook, Deschutes and Jefferson counties and the cities of Bend, Culver, Madras, Metolius, Prineville, Redmond and Sisters								✓	<ul style="list-style-type: none"> • Information dissemination
Children's Learning Center 650 NE A St. Madras, OR 97741 Phone: 541-475-3628 Fax: 541-475-2583	Oregon Head Start PreKindergarten	Jefferson County		✓						✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
COCAAN 645 SW Marshall Street Madras, OR 97741 Phone: 541-475-7017 Fax: 541-475-7017	Offers financial and other resources to help stabilized lives of people who are suffering from financial instability. It also supports Head Start and other child care resources	Jefferson County		✓						✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Crooked River Ranch Chamber of Commerce 5200 SW Badger Rd Crooked River, OR 97760 Phone: 541-923-2679	Provide economic development assistance to local businesses.	Crooked River Ranch	✓								<ul style="list-style-type: none"> • Education and outreach • Information dissemination • Plan/project implementation

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income	
East Cascade Assisted Living Center 385 NE Hillcrest Madras, OR 97741 Phone: 541-475-2273 Fax: 541-475-2663	Adult Care Facility	Jefferson County			✓	✓				<ul style="list-style-type: none"> • Information dissemination
Eastern Stars 2071 SE Madras Road Phone: 541-475-7221	The group contributes to cancer and other medical research, care for approximately 90 elderly people in need at the care home in Forest Grove, and scholarships for religious education	Jefferson County		✓		✓				<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Economic Development for Central Oregon (EDCO) 109 NW Greenwood Ave Suite 102 Bend, OR 97701 Phone: 541-388-3236	EDCO is a private non-profit organization dedicated to building a vibrant and thriving regional economy by attracting new investment and jobs through marketing, recruitment and working with existing employers.	Jefferson County, Crook, Deschutes	✓						✓	Coordinating mitigation activities with economic development in Jefferson County.

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation	
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income		
Girl Scouts 6489 NE Quaaale Road Phone: 541-475-2049	To provide numerous volunteer services to community members in addition to preparing girls and young women for active participation in community life.	Jefferson County	✓	✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
High Lookee Lodge 2321 Ollallie Lane Warm Springs, R 97761 Phone: 541-553-1182 Fax: 541-553-1186	Adult Care Facility	Jefferson County			✓	✓					<ul style="list-style-type: none"> • Information dissemination
Jefferson County Extension Office 34 SE D St. Madras, OR 97741 Phone: 541-475-3808 Fax: 541-475-4204	Provides research-based knowledge and education that focus on strengthening communities and economies, sustaining natural resources, and promoting healthy families and individuals.	Jefferson County	✓								<ul style="list-style-type: none"> • Education and outreach • Information dissemination • Plan/project implementation
Jefferson County Food Bank 346 Old Culver Hwy Madras, OR 97741 Phone: 541-475-3105	Food Bank	Jefferson County							✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income	
Jefferson County Rotary 727 NE Fir Phone: 541-475-7204	Rotary is a worldwide organization of business and professional leaders that provides humanitarian service, encourages high ethical standards in all vocations, and helps build goodwill and peace in the world.	Jefferson County	✓	✓	✓	✓		✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Jefferson County Search & Rescue 675 NW Cherry Lane Phone: 541-475-6520	Helping search for individuals who appear to be lost away from civilization for any number of reasons, and helping rescue such individuals if they are discovered to be in need of assistance	Jefferson County		✓	✓	✓		✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination • Plan/project implementation
Jefferson County Senior Center 860 SW Madison Street Madras, OR 97741 Phone: 541-475-1148	Senior care facility and location for seniors to gather with peers for recreation and entertainment	Jefferson County		✓	✓	✓				<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Jericho Adult Foster Care 3019 SW Jericho lane Culver, OR 97734 Phone: 541-546-2481 Fax: 541-546-2481	Adult Care Facility	Jefferson County			✓	✓				<ul style="list-style-type: none"> • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation	
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income		
Juniper Rebekah Lodge 16 SE D Street Madras, OR 97741 Phone: 541-546-4373	The group is involved in a variety of activities benefiting the community, and is sponsor of the United Nations Pilgrimage, a program through which a Central Oregon high school sophomore or junior takes a month-long trip to New York City, including a visit to the United Nations, and to Washington, D.C.	Jefferson County		✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
KIWANIS 49 NE 12th Street Phone: 541-475-0505	Some of Kiwanis' focuses are: <ul style="list-style-type: none"> • Evaluating both children's issues and community needs on an ongoing basis • Conducting service projects to respond to those identified needs • Maintaining an active membership roster of professional business people who have both the desire and the ability to serve their community 	Jefferson County		✓					✓		<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Ladies of the Elks PO Box 609 Phone: 541-475-6046	The group, made up of woman who have relatives who are members of the Elks Lodge, raises money for a variety of charities and special community projects.	Jefferson County		✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income	
Madras Area Community Action Team 221 SE 7th Street Madras, OR 97741 Phone: 541-475-0301 Fax: 541-475-0318	The Madras Area Community Action Team (MaCAT) is a member of the Central Oregon Partnership. Its mission is to reduce the root causes of poverty in the Madras area. The values that guide MaCAT in this effort are inclusiveness, knowledge and collaboration. MaCAT's primary focus to act as a	Jefferson County								<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Madras Chamber of Commerce 274 SW 4th St. Madras, OR 97741 Phone: 541-475-2350	Provide economic development assistance to local businesses.	Madras	✓							<ul style="list-style-type: none"> • Education and outreach • Information dissemination • Plan/project implementation
Madras Elks Lodge #2017 262 SW 2nd St Madras, OR 97741 Phone: 541-475-6046	Quoted from the mission statement: the Benevolent and Protective Order of Elks of the United States of America will serve the people and communities through benevolent programs, demonstrating that <i>Elks Care and Elks Share</i> .	Jefferson County		✓	✓	✓		✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation		
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income			
Madras Employment Department 243 SW 3rd Street, Suite B Madras, OR 97741 Phone: 541-475-2382 E 21 Fax: 541-475-3821	Employment service	Jefferson County								✓	<ul style="list-style-type: none"> • Information dissemination 	
Mid Oregon Personnel Services, INC. 29 SE "D" St Madras, OR 97741 Phone: 541-475-7640 Fax: 541-475-7656	Employment Service	Jefferson County									✓	<ul style="list-style-type: none"> • Information dissemination
Mid Columbia Children's Council, Inc. 1100 E. Marina Way, Ste. 215 Hood River, OR 97031-2344	Early childhood program	Hood River, Jefferson and Wasco Counties		✓								<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Mountain View Hospital District 470 NE "A" Street Madras, OR 97741-1844 Phone: 541-475-3882 Fax: 541-475-0615 Email: mvhd@mvhd.org	Mountain View Hospital District provides a complete range of inpatient and outpatient services. As an affiliate of St. Charles Medical Center, we also offer greater access to resources and advanced technologies than the typical community hospital.	Jefferson County		✓	✓	✓				✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation	
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income		
Mud Springs Grange 5661 SW Elbe Dr. Culver, OR 97734 Phone: 541-546-3892	Grange/community center	Jefferson County		✓	✓	✓			✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Opportunity Foundation of Central Oregon 835 E. Hwy 126 Madras, OR 97741 Phone: 541-548-2611 Fax: 541-548-9573	The Opportunity Foundation of Central Oregon (OFCO) is a benchmark organization that is a leader in providing services to people in Central Oregon with disabilities.	Jefferson County			✓						<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Oregon Child Development Coalition of Jefferson County P.O. Box 736 Madras, OR 97741 Phone: 541-475-4252	Oregon Head Start PreKindergarten (Migrant)	Jefferson County		✓					✓	✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination
Oregon Council for Hispanic Advancement 2600 NW College Way Bend, OR 97701 Phone: 541-330-4363 Fax: 541-317-3070	OCHA is a champion for Hispanics in Oregon, ensuring equity in education and economic opportunity by empowering Latino youth. OCHA's educational and advocacy activities empower Hispanics to make positive changes in their lives to optimize their future success.	Jefferson County						✓		✓	<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Jefferson County
Existing Community Organizations

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	English Second Language	Families	Low Income	
Salvation Army 66 SE D Street, Suite A Madras, OR 97741 Phone: 541-475-2449	The group provides emergency assistance to people in need.	Jefferson County								<input checked="" type="checkbox"/> <ul style="list-style-type: none"> • Education and outreach • Information dissemination
Warm Springs Tribal Head Start PO Box C Warm Springs, OR 97761 Phone: 541-553-3241	Early Head Start and Oregon Head Start PreKindergarten (Tribal)	Jefferson County	<input checked="" type="checkbox"/>							<ul style="list-style-type: none"> • Education and outreach • Information dissemination

Existing Mitigation Activities

Existing mitigation activities include current mitigation programs and activities that are being implemented by the community in an effort to reduce the community's overall risk to natural hazards. Documenting these efforts can assist participating jurisdictions better understand risk and can assist in documenting successes.

Drought: Jefferson County currently addresses the drought hazard through water conservation measures and water monitoring. The North Unit Irrigation District has water conservation measures to limit water allocation to farmers and communities. The City of Metolius also has a water conservation ordinance to limit water use in drought conditions.

Earthquake: The most significant mitigation activity Jefferson County is implementing for the earthquake hazard is through adoption of the International Building Code that includes amendments to seismically retrofit new buildings. However, while new buildings include seismic retrofits, older buildings are still vulnerable.

Flood: Communities in Jefferson County have taken a number of measures to mitigation against floods. The most significant mitigation activity is the 2005 Madras Flood Mitigation Plan funded by Flood Mitigation Assistance (FMA) program funding. The mitigation plan outlines the flood vulnerability in Jefferson County's largest city, and what mitigation activities the city can implement to reduce the impact of flood hazards.

The City of Culver upgraded the culvert on 9th Street, reducing the impact on what had been a 10-year event in the city. The County also has standard floodplain ordinances that require a floodplain permit for new development.

Volcano: During the Mt. Saint Helens eruption in 1980, residents placed nylons over intake areas to keep the ash from damaging equipment.

Ash from wildfires, much like from volcanoes, negatively impacts residents' health. The microclimates found in Jefferson County and the prevalent winds play a large role in depositing ash from wildfires around the county. When wildfires reach certain levels, communities are properly notified in terms of health and safety concerns. Presumably, the same could be true for volcanic events as well.

Wildfire: Jefferson County completed a Community Wildfire Protection Plan (CWPP) in November of 2005. The CWPP identifies communities at risk, and recommends strategies for reducing those risks.

Windstorm: The Oregon Building Code sets standards for structures to withstand 80 mph winds.

Winter Storm: Studded tires can be used in Oregon from November 1 to April 1. They are defined under Oregon Law as a type of traction tire. Research shows that studded tires are more effective than all-weather tires on icy roads, but can be less effective in most other conditions.

Highway maintenance operations are guided by local level of service (LOS) requirements. In general, classifications of highways receive more attention. Routes on the National Highway System network, primary interstate expressways and primary roads, will be cleared more quickly and completely. Critical areas like mountain passes will have snow-chain requirements for vehicles, and many local streets are “snow emergency routes” that will be cleared of parked cars. Parking lot and sidewalk snow removal is mostly the responsibility of property owners, sometimes by local ordinance.

Oregon Department of Transportation (ODOT) spends about \$16 million per year on snow and ice removal from the state highway system.

TripCheck provides traffic incident, weather, and highway condition reports, as well as useful links to bus, rail, airport, and truck information. It contains images from approximately 140 road cameras, including over 40 in rural areas such as mountain passes where knowing road conditions can be crucial to safety: <http://www.TripCheck.com/>.

Hazard Summary

The following is a brief overview of the hazards that can impact Jefferson County. Each of the hazards is described in more detail in the Hazard Annexes of the plan.

Drought: Drought conditions are not uncommon in Jefferson County. The environmental and economic consequences can be significant, especially for Jefferson County’s agricultural and recreational employment sectors. The County had three gubernatorial drought declarations from 1970 – 2007, and the average recurrence interval for severe droughts is somewhere between 8 and 12 years. The probability of a drought occurring in Jefferson County is *high*, and the County’s vulnerability to drought is *high* as well.

Earthquake: Jefferson County has not experienced any major earthquake events in recent history. Seismic events do, however, pose a threat. In particular, a Cascadia Subduction Zone (CSZ) event could produce devastating damage and loss of life in Jefferson County. Additionally, fault maps show areas of crustal seismicity northwest of Madras. Jefferson County’s probability of experiencing an earthquake is *moderate*, and the County’s vulnerability to an earthquake event is *high*.

Flood: Flooding is frequent in Jefferson County. Riverine flooding, in particular, is the leading cause of flooding events, and occurs when warm winter rain melts mountain snow. Willow Creek, in particular, floods the City of Madras during warm rain on snow events. The probability that

Jefferson County will experience a major flood event is *high*, and the County's vulnerability is *high* as well.

Landslide: Areas subject to landslide events in Jefferson County include: 1) Pelton Reservoir; 2) northwest roads leading to Crooked River Ranch; 3) Camp Sherman's southern access routes; 4) Jordan Road, near the bridge to Three Rivers; and 5) Highway 26 as the road descends into the canyon and on the approach into Warm Springs. 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.⁷ The probability that Jefferson County will experience a landslide event is *low*, and County's vulnerability to a major event is *moderate*.

Volcano: The Cascade Range of the Pacific Northwest has more than a dozen active volcanoes. Mt. Jefferson poses the greatest risk to County residents. Volcano-related hazards from Mt. Jefferson would include tephra (volcanic ash), lahar, lava flow, debris flow / avalanche, and pyroclastic flow. The volcano is not extinct, and it's capable of large explosive eruptions. Jefferson County's probability of experiencing a volcanic event is *low*, and the County's vulnerability to a volcanic event is *high*.

Wildfire: Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property, particularly in the state's growing rural communities. The Jefferson County Community Wildfire Protection Plan identified sixteen communities "at risk" to the effects of wildfire, and twelve "at-risk" infrastructure. Jefferson County has a *high* probability of experiencing wildfire, and the County's vulnerability to a wildfire event is also *high*.

Windstorm: Windstorms affect Jefferson County on nearly a yearly basis, especially in the Crooked River Ranch area where winds can reach 65 mph. More destructive events on the order of the 1962 Columbus Day storm are thought to have a 100-year recurrence interval. Jefferson County has a *high* probability of experiencing windstorms. Many buildings, utilities, and transportation systems in the county are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands, and it is also true in forested areas along tree-lined roads where electrical transmission lines are frequently damaged. The County is *moderately* vulnerable to windstorms.

Winter Storm: Destructive winter storms that produce heavy snow, ice, rain, freezing rain, and high winds typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March. The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods. Jefferson County has a *high* level of probability for winter storms. Perhaps the most advantageous aspect of

Central Oregon's cold and snowy winters is the fact that the region is typically prepared, and those visiting the region usually come prepared. Extreme cold and heavy snow can, however, disrupt farming practices. Likewise, schools may have trouble heating their buildings, and cities have trouble clearing side streets. The County, therefore, is *highly* vulnerable to winter storms.

¹ Oregon Bluebook, "Jefferson County"

<http://bluebook.state.or.us/local/counties/counties16.htm>

² Population Research Center, Portland State University, *2007 Certified Oregon Population Estimates*,

http://www.pdx.edu/media/p/r/prcCertifiedRelease_07_web_state_co.pdf, accessed January 16, 2008.

³ Oregon Department of Energy, 2006 National Inventory of Dams.

⁴ Jefferson County Comprehensive Plan.

⁵ Jefferson County Comprehensive Plan.

⁶ Burby, Raymond J., ed. 1998. *Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*.

⁷ State of Oregon Natural Hazard Mitigation Plan. Part 3: Hazard Chapters. "Landslides – Debris Flows," p. LS-2. March, 2006.

Section 3

Mission, Goals, and Action Items

The information provided in Section 2 and the Hazard Annexes provide the basis and justification for the mitigation actions identified in this plan. This section describes the components that guide implementation of the identified mitigation strategies and is based on strategic planning principles. This section provides information on the process used to develop a mission, goals and action items. This section also includes an explanation of how the County intends to incorporate the mitigation strategies outlined in the plan into existing planning mechanisms and programs such as the County comprehensive land use planning process, capital improvement planning process, and building codes enforcement and implementation.

- **Mission** – The mission statement is a philosophical or value statement that answers the question “Why develop a plan?” In short, the mission states the purpose and defines the primary function of the County’s multi-jurisdictional Natural Hazards Mitigation Plan. The mission is an action-oriented statement of the plan’s reason to exist. It is broad enough that it need not change unless the community environment changes.
- **Goals** – Goals are designed to drive actions and they are intended to represent the general end toward which the County effort is directed. Goals identify how the County intends to work toward mitigating risk from natural hazards. The goals are guiding principles for the specific recommendations that are outlined in the action items.
- **Action Items** – The action items are detailed recommendations for activities that local departments, citizens and others could engage in to reduce risk.

Mitigation Plan Mission

The mission statement for the Jefferson County Mitigation Plan is intended to be a timeless statement that is adaptable to any future changes made to the plan. The Oregon Partnership for Disaster Resilience (OPDR), together with the Jefferson County Steering Committee members, developed the following mission statement for the plan:

To create a disaster-resilient Jefferson County.

Steering committee members agreed at the May 29, 2008 Steering Committee meeting that this was an appropriate statement for the

mitigation plan and that it adequately defines why Jefferson County is developing the plan.

Mitigation Plan Goals

The plan goals help guide the direction of future activities aimed at reducing risk and preventing loss from natural hazards. OPDR, in partnership with the Jefferson County Steering Committee, developed the following goals for the Jefferson County Natural Hazard Mitigation Plan.

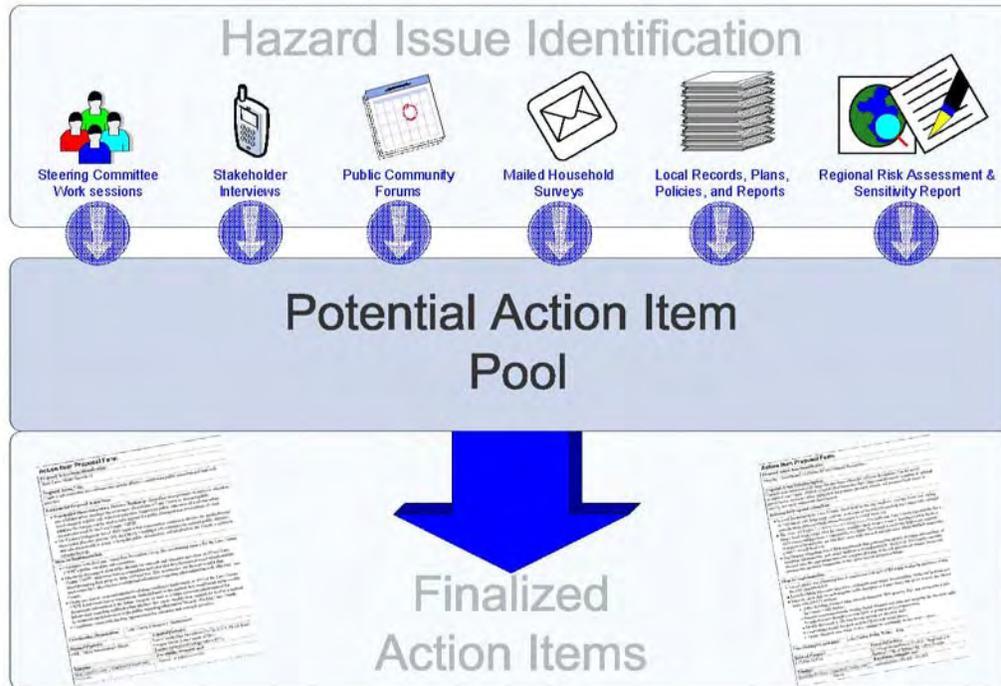
- Save lives and reduce injuries.
- Minimize and prevent damage to public and private buildings and infrastructure.
- Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.
- Increase education, outreach, and awareness.
- Protect natural and cultural resources.

The goals were agreed upon and approved at the May 29, 2008 Steering Committee Meeting, and serve as checkpoints as agencies and organizations begin implementing mitigation action items.

Mitigation Plan Action Items

Short and long-term 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. They address both multi-hazard (MH) and hazard-specific issues. Action items can be developed through a number of sources. The figure below illustrates some of these sources. A description of how the plan's mitigation actions were developed is provided below.

Figure 3.1 Action Item Sources



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

Source: Partnership for Disaster Resilience, 2006

The action items presented in this plan were developed by OPDR together with Steering Committee members and are derived from a variety of different sources. The action items address the following natural hazards found in Jefferson County:

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

In addition, the plan includes actions that address Plan Implementation. Most of the actions were derived using information gathered from the risk assessment meeting on March 20, 2008 as well as from individual steering committee members. Local information, as well as federal and state sources, was used to support each action item. The actions items found in

this plan were reviewed by the Jefferson County Mitigation Steering Committee at the May 29, 2008 meeting, as well as individually by steering committee members.

Each action item has a corresponding action item worksheet describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item worksheets can assist the community in pre-packaging potential projects for grant funding. The worksheet components are described below. These action item worksheets are located in Appendix A.

Rationale or Key Issues Addressed

Action items should be fact-based and tied directly to issues or needs identified throughout the planning process. Action items can be developed at any time during the planning process and can come from 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 2 and the Hazard Annexes.

Ideas for Implementation:

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.

Implementation through Existing Programs

The Jefferson County multi-jurisdictional Natural Hazard Mitigation Plan 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. Jefferson County currently addresses statewide planning goals and legislative requirements through its comprehensive land use plan, capital improvements plan, mandated standards and building codes. To the extent possible, Jefferson County will work to incorporate the recommended mitigation action items into existing programs and procedures.

Many of the County's multi-jurisdictional Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the County's existing plans and policies. Where possible, Jefferson County should implement the Natural Hazard Mitigation Plan'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, and can adapt easily to changing conditions and needs.ⁱ Implementing the Natural Hazard Mitigation Plan's action items through such plans and policies increases their likelihood of being supported and implemented.

Plans that can incorporate mitigation action items include the Jefferson County Comprehensive Plan, the Jefferson County Transportation Systems Plan, the Jefferson County Zoning Ordinance, and the Jefferson County Community Wildfire Protection Plan (CWPP). Because these plans are used on a regular basis, incorporating mitigation actions into these plans will likewise facilitate their implementation.

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.

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.

Plan Goals Addressed:

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.

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. *Long-term action items* (LT) may require new or additional resources and/or authorities, and may take from one to five years to implement.

ⁱ Burby, Raymond J., ed. 1998. *Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*.

Section 4

Plan Implementation and Maintenance

This section details the formal process that will ensure that the Jefferson County multi-jurisdictional Natural Hazards Mitigation Plan remains an active and relevant document. The plan implementation and maintenance process includes a schedule for monitoring and evaluating the Plan annually, as well as producing an updated plan every five years. Finally, this section describes how the County and participating jurisdictions will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

After the Plan is locally reviewed and deemed complete, the Jefferson County Community Development Department submits it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management submits the plan to the Federal Emergency Management Agency (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, and Flood Mitigation Assistance program funds. Following County adoption, the participating jurisdictions should adopt their addendums.

Convener

On May 29, 2008 the Jefferson County Mitigation Steering Committee identified the Jefferson County Community Development Director as the convener for the Jefferson County Natural Hazards Mitigation Plan. Responsibilities of the convener include the following:

- Coordinate Steering Committee meeting dates, times, locations, agendas, and member notification;
- Document outcomes of Committee meetings;
- Serve as a communication conduit between the Steering Committee and key plan stakeholders;
- Identify emergency management-related funding sources for natural hazard mitigation projects;
- Incorporate, maintain, and update the County's natural hazard risk GIS data elements; and

- Utilize the Risk Assessment as a tool for prioritizing proposed natural hazard risk reduction projects.

Coordinating Body

On May 29, 2008, the Jefferson County Mitigation Steering Committee identified itself as the coordinating body for the mitigation plan. Roles and responsibilities for the coordinating body include the following:

- Serving 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;
- Prioritizing and recommending funding for natural hazard risk reduction projects;
- Documenting successes and lessons learned;
- Evaluating and updating the Natural Hazards Mitigation Plan following a disaster;
- Evaluating and updating the Natural Hazards Mitigation Plan in accordance with the prescribed maintenance schedule; and
- Developing and coordinating ad hoc and/or standing subcommittees as needed.

Members

The following organizations were represented and served on the Steering Committee during the development of the Jefferson County multi-jurisdictional Natural Hazards Mitigation Plan:

- Jefferson County Community Development Department
- Jefferson County Public Works Department
- Crooked River Ranch Homeowners Association
- Central Electric Cooperative
- Warm Springs Tribe
- Federal Grasslands
- 509J School District
- US Forest Service
- Fire Department Agencies from Crooked River Ranch, Three Rivers, and the County
- City of Culver
- City of Metolius
- City of Madras

Additionally, the Committee recommended that representatives from the following groups and organizations be invited to participate in future meetings and/or serve as members of the Coordinating Body:

- Oregon Department of Forestry
- Jefferson County Sheriff
- Jefferson County Chamber of Commerce
- Jefferson County Fire District
- Three Rivers Fire Department
- Three Rivers Homeowners Association
- Camp Sherman Homeowners Association
- Crooked River Ranch Fire Department

To make the coordination and review of the Jefferson County multi-jurisdictional Natural Hazard Mitigation Plan as broad and useful as possible, the Steering Committee will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items. Specific organizations have been identified as either internal or external partners on the individual action item forms found in Appendix A.

Plan Maintenance

Plan maintenance is a critical component of the natural hazard mitigation plan. Proper maintenance of the plan ensures that this plan will maximize the County's and cities' efforts to reduce the risks posed by natural hazards. This section was developed by the University of Oregon's Partnership for Disaster Resilience and includes a process to ensure that a regular review and update of the plan occurs. The Steering Committee 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.

Semi-Annual Meetings

The Committee will meet on a semi-annual basis to complete the following tasks. During the first meeting the Committee 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.

During the second meeting of the year the Committee will:

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

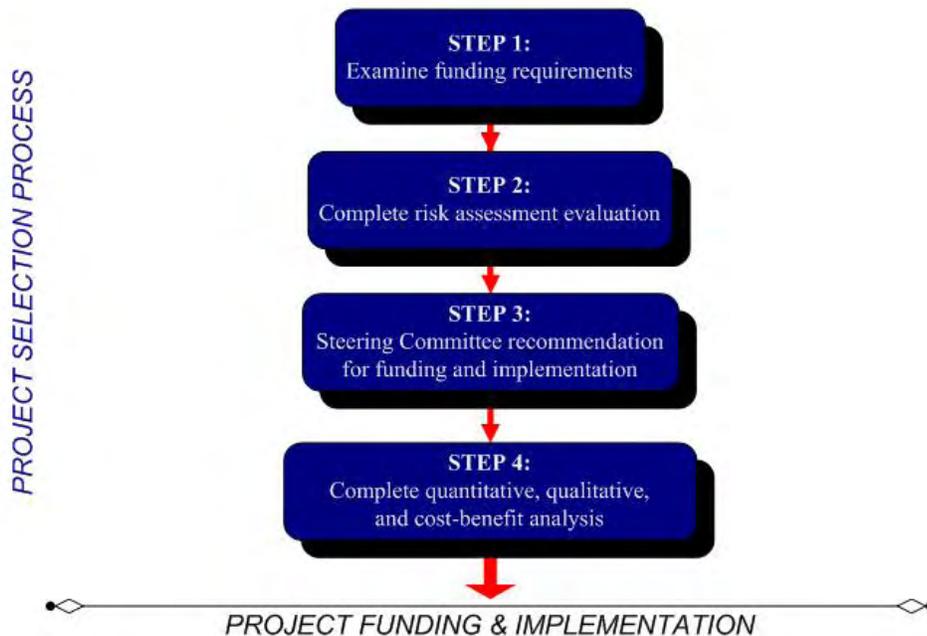
The convener will be responsible for documenting the outcome of the semi-annual meetings in Appendix B. The process the Committee will use to prioritize mitigation projects is detailed in the section below. The plan's format allows the County and participating jurisdictions to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains current and relevant to the participating jurisdictions.

Project Prioritization Process

The Disaster Mitigation Act of 2000 (via the Pre-Disaster Mitigation Program) 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. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment. Figure 4.1 illustrates the project development and prioritization process.

Figure 4.1: Project Prioritization Process

Action Item and Project Review Process



Source: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2008.

Step 1: Examine funding requirements

The Steering Committee will identify how best to implement individual actions within the appropriate existing plans, policies, or programs. The committee will examine the selected funding stream's requirements to ensure that the mitigation activity would be eligible through the funding source. The Committee may consult with the funding entity, Oregon Emergency Management, or other appropriate state or regional organizations about the project's eligibility.

Depending on the potential project's intent and implementation methods, several funding sources may be appropriate. Examples of mitigation funding sources include, but are not limited to: FEMA's Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance program (FMA), National Fire Plan (NFP), Community Development Block Grants (CDBG), local general funds, and private foundations.

Step 2: Complete risk assessment evaluation

The second step in prioritizing the plan's action items is to examine which hazards they are associated with and where these hazards rank in terms of community risk. The Committee will determine whether or not the plan's risk assessment supports the implementation of the mitigation activity. This determination will be based on the location of the potential activity and the proximity to known hazard areas, historic hazard occurrence, vulnerable community assets at risk, and the probability of future occurrence documented in the plan.

Step 3: Committee Recommendation

Based on the steps above, the committee will recommend whether or not the mitigation activity should be moved forward. If the committee decides to move forward with the 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 Committee 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.

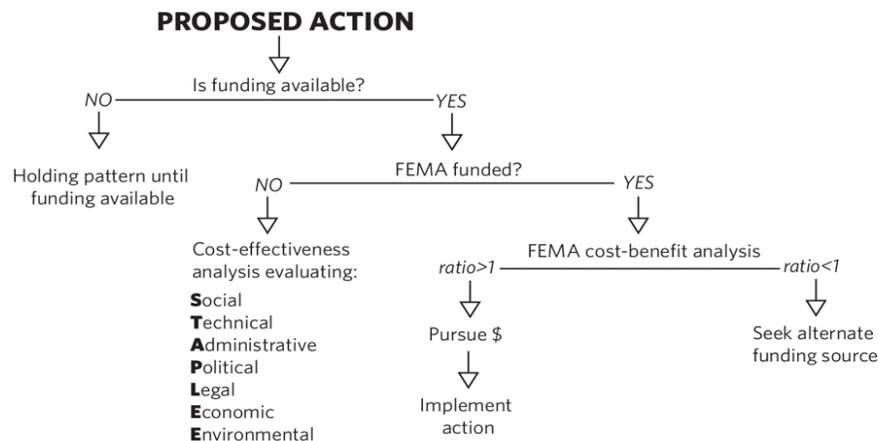
The Committee and the community's leadership have the option to implement any of the action items at any time, (regardless of the prioritized order). This allows the Committee to consider mitigation strategies as new opportunities arise, such as funding for action items that may not be of the highest priority. This methodology is used by the Committee to prioritize the plan's action items during the annual review and update process.

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

The fourth step is to identify the costs and benefits associated with 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: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2006.

If the activity requires federal funding for a structural project, the Committee will use a Federal Emergency Management Agency-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 committee will use a multivariable assessment technique called STAPLE/E to prioritize these actions. STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables can help define a project's qualitative cost effectiveness. The STAPLE/E technique has been tailored for use in natural hazard action item prioritization by the Partnership for Disaster Resilience at the University of Oregon's Community Service Center. See Appendix C for a description of the STAPLE/E evaluation methodology.

Continued Public Involvement & Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Jefferson County multi-jurisdictional 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.

During plan development, public participation was incorporated into every stage of the plan and development process. To ensure that these opportunities will continue, the County and participating jurisdictions will open future meetings to the public, and continue to conduct stakeholder interviews for input on plan content and ideas for action items.

Stakeholders identified for interview include the Jefferson County Emergency Manager (retired); Jefferson County Sheriff; 509J School District; Crooked River National Grasslands; North Unit Irrigation; Chamber of Commerce; Mountain View Hospital; Jefferson County Public Works Department; Aspen Court; East Cascade Assisted Living Center; Jefferson County Senior Center; and the Jefferson County Public Health Department. Additional stakeholders will be identified at future meetings.

In addition to the involvement activities listed above, the County's multi-jurisdictional Natural Hazard Mitigation Plan has been archived and posted on the Partnership website via the University of Oregon Libraries' Scholar's Bank Digital Archive.

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. During this plan update, the following questions will be asked to determine what actions are necessary to update the plan. The convener will be responsible for convening the Committee to address the questions outlined below.

- Are the plan's goals still applicable?
- Do the plan's priorities align with State priorities?
- 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?
- Do existing actions need to be reprioritized for implementation?
- Are the actions still appropriate, given current resources?

- Have there been any changes in development patterns 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?

The questions above will help the Committee determine what components of the mitigation plan need updating. The Committee will be responsible for updating any deficiencies found in the plan based on the questions above.

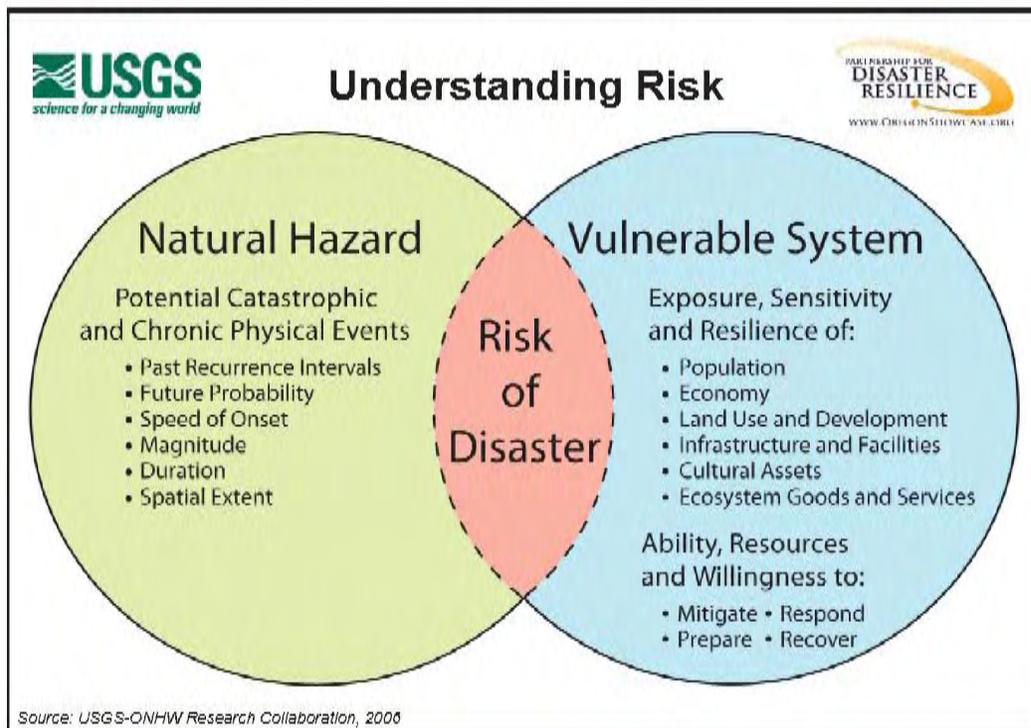
Volume II: Hazard Annex

Introduction

The foundation of the Jefferson County multi-jurisdictional Natural Hazards Mitigation Plan is the risk assessment. Risk assessments provide information about the areas where the hazards may occur, the value of existing land and property in those areas, and an analysis of the potential risk to life, property, and the environment that may result from natural hazard events.

This section identifies and profiles the location, extent, previous occurrences, and future probability of natural hazards that can impact the participating jurisdictions, as highlighted in Figure II.1 below. The information in this section was paired with the information in Section 2 – Community Overview during the planning process in order to identify issues and develop actions aimed at reducing overall risk, or the area of overlap in the figure below.

Figure II.1. Understanding Risk



Source: USGS – The Partnership for Disaster Resilience Research Collaborative, 2006

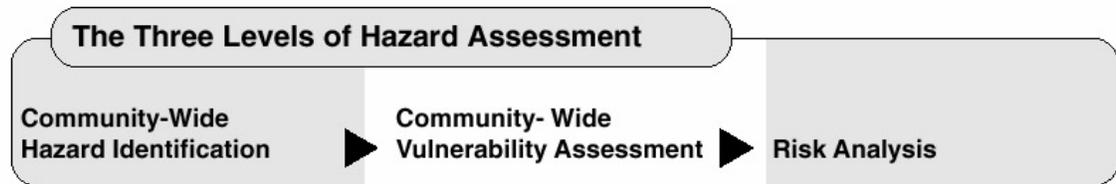
This section drills down to local level information and results in an understanding of the risks the communities face. In addition to local data,

the information here relies upon the Regional Risk Assessment in the State Natural Hazard Mitigation.

What is a Risk Assessment?

A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic.

Figure 3.1 The Three Phases of a Risk Assessment



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

The first phase, hazard identification, involves the identification of the geographic extent of a hazard, its intensity, and its probability of occurrence. This level of assessment typically involves producing a map. The outputs from this phase can also be used for land use planning, management, and regulation; public awareness; defining areas for further study; and identifying properties or structures appropriate for acquisition or relocation.ⁱ

The second phase, vulnerability assessment, combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, and attempts to predict how different types of property and population groups will be affected by the hazard. This step can also assist in justifying changes to building codes or development regulations, property acquisition programs, policies concerning critical and public facilities, taxation strategies for mitigating risk, and informational programs for members of the public who are at risk.ⁱⁱ

The third phase, risk analysis, 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, and (2) the likelihood or probability of the harm occurring. An example of a product that can assist communities in completing the risk analysis phase is HAZUS, a risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes. In HAZUS-MH current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs.

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.

ⁱ Burby, R. 1998. Cooperating with Nature. Washington, DC: Joseph Henry Press. Pg. 126.

ⁱⁱ Burby, R. 1998. Cooperating with Nature. Washington DC: Joseph Henry Press. Pg. 133.

Volume II: Hazard Annex

Drought

Causes and Characteristics of Drought

Drought can be defined in several ways. The American Heritage Dictionary defines drought as "a long period with no rain, especially during a planting season." Another definition of drought is a deficiency in surface and sub-surface water supplies. In socioeconomic terms, drought occurs when a physical water shortage begins to affect people, individually and collectively and the area's economy.

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. The Oregon Drought Severity Index is the most commonly used drought measurement in the state because it incorporates both local conditions and mountain snow pack. The Oregon Drought Severity Index categorizes droughts as mild, moderate, severe, and extreme.

History of the Hazard in Your Community

Significant dates for drought include the following:

1904-1905: A statewide drought period of about 18 months.

1917-1931: Very dry period throughout Oregon, punctuated by brief wet spells in 1920-21 and 1927.

1939-1941: A three-year intense drought.

1985-1997: A dry period, capped by statewide droughts in 1992 and 1994.

1994: Drought conditions in Jefferson County, prompting executive order EO-94-09 (July 26, 1994) declaring a state of emergency in Jefferson County.

2000-2001: Extreme drought conditions in Jefferson County, prompting executive order 01-03 to declare a state of emergency in Jefferson County.

Risk Assessment

According to the Jefferson County Hazard Analysis, drought conditions are not uncommon in Jefferson County. The environmental and economic consequences can be significant, especially for Jefferson County's agricultural and recreational employment sectors. The County had three gubernatorial drought declarations from 1970-2007. The average recurrence interval for severe droughts is somewhere between eight and twelve years.ⁱ

How are Hazard Areas Identified?

Hazard areas for droughts usually extend County-wide when they do occur, although the cities in Jefferson County are rarely affected. All three cities are served by the Opal Springs aquifer, and supply is reliably abundant. Outside city limits, droughts affect recreational and agricultural operations. Typically, droughts occur regionally, and affect more than one county. The data for this risk assessment comes from the Region 6 Central Oregon Profile and Risk Assessment as well as from gubernatorial executive orders.

Probability of Future Occurrence

Historically, severe droughts have occurred in Jefferson County between 8 and 12 years as shown in the hazard history above. The Jefferson County Steering Committee rated the probability of a drought occurring as 'high,' meaning one incident is likely within a 10-35 year period. The high ranking is consistent with the Jefferson County Hazard Analysis completed by the Jefferson County Sheriff's Office in 2008.

Vulnerability Assessment

The effects of drought typically extend across the County, and there are a number of community sectors that are vulnerable to drought which are explained further in the following section, Community Hazard Issues.

The Jefferson County Steering Committee estimates a 'high' vulnerability to drought events, meaning more than 10% of the region's assets are likely to be affected by a severe drought. This ranking is consistent with the Jefferson County Hazard Analysis completed by the Jefferson County Sheriff's office.

Risk Analysis

The Jefferson County Sheriff's Office completed a hazard analysis for the County in 2008. The hazard analysis addresses the vulnerability, maximum threat, probability, and history for each natural hazard and attributes a final hazard analysis score. The scores range from 20 to 240, and are only meant to evaluate risk based on past information and to assist future mitigation and emergency management planning efforts. The Jefferson County hazard analysis score for drought is 240, the highest score, meaning drought has a high probability, vulnerability, maximum threat, and frequent history. Estimations for losses of life and property are not available at this time.

Community Hazard Issues

What is susceptible to damage during a drought event?

During drought events, a number of different community sectors are affected. All these sectors depend on local water resources which can be significantly diminished in droughts.

The agriculture economy depends on well water and irrigated water from reservoirs and rivers for watering crops, and the lower water levels that result from drought means less water available for agriculture. Often, farmers have to choose between spending more money for water, or suffer from a reduced yield. Weeds also become a problem

Forests in Jefferson County are more vulnerable to wildfires in drought conditions because trees become more stressed and their resistance to wildfires and disease is diminished. Dead fuel in forests is also higher than in the past, resulting in more available fuel that can lead to larger wildfire events.

Infrastructure can also be negatively affected by drought, especially the canal beds managed by the North Unit Irrigation District. Canal beds can dry up during drought periods affecting water allocation and replenishing of groundwater resources.

Local fish stocks and salmon restoration efforts are also hampered due to less water in their habitat and the warming of water.

Finally, local reservoirs experience a higher level of evaporation in drought conditions. Water in reservoirs also becomes warmer, encouraging the growth of blue-green algae which can affect water quality for drinking, recreation, and wildlife.

Existing Hazard Mitigation Activities

Jefferson County currently addresses the drought hazard through water conservation measures and water monitoring. The North Unit Irrigation District has water conservation measures to limit water allocation to farmers and communities. The City of Metolius also has a water conservation ordinance to limit water use in drought conditions.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of drought in Jefferson County. Please see full action item worksheets in Appendix A.

Drought # 1: Coordinate with fire district agencies to identify areas in need of additional water resources.

Multi-Hazard # 1: Continue monitoring blue-green algae in reservoirs and other bodies of water in drought conditions to avoid harm to recreation and the environment.

ⁱ *Jefferson County Hazard Analysis*, Jefferson County Sheriff's Office, March 2008.

Volume II: Hazard Annex

Earthquake

Causes and Characteristics of the Hazard

Seismic events were once thought to pose little or no threat to Oregon communities. However, recent earthquakes and scientific evidence indicate that the risk to people and property is much greater than previously thought. Oregon and the Pacific Northwest in general are susceptible to earthquakes from three sources: 1) the off-shore Cascadia Subduction Zone; 2) deep intra-plate events within the subducting Juan de Fuca Plate; and 3) shallow crustal events within the North American Plate.

While all three types of quakes possess the potential to cause major damage, Subduction zone earthquakes pose the greatest danger. The source for such events lies off the Oregon coast and is known as the Cascadia Subduction Zone (CSZ). A major CSZ event could generate an earthquake with a magnitude of 9.0 or greater resulting in devastating damage and loss of life. Communities east of the Cascades can expect a lower level of shaking, but they will feel economic effects from the regional damage.ⁱ

The most likely earthquake event to occur in Jefferson County is a crustal event which can produce earthquakes up to a magnitude 7.0 and can cause extensive damage. Crustal events tend to be localized to the area of slippage.

The specific hazards associated with an earthquake include the following:

Ground Shaking

Ground shaking is defined as the motion or seismic waves felt on the Earth's surface caused by an earthquake. Ground shaking is the primary cause of earthquake damage.

Ground Shaking Amplification

Ground shaking amplification refers to the soils and soft sedimentary rocks near the surface that can modify ground shaking from an earthquake. Such factors can increase or decrease the amplification (i.e., strength) as well as the frequency of the shaking.

Surface Faulting

Surface faulting are planes or surfaces in Earth materials along which failure occurs. Such faults can be found deep within the earth or on the surface. Earthquakes occurring from deep lying faults usually create only ground shaking.

Earthquake-Induced Landslides

These landslides are secondary hazards that occur from ground shaking.

Liquefaction

Liquefaction takes place when ground shaking causes granular soils to turn from a solid into a liquid state. This in turn causes soils to lose their strength and their ability to support weight.

History of the Hazard in Your Community

Pre-historic earthquakes have probably occurred in Oregon as offshore Cascadia Subduction Zone earthquakes of approximately 8-9 magnitude. Approximate years for the earthquakes are the following:

- 1400 BCE
- 1050 BCE
- 600 BCE
- 400 CE
- 750 CE
- 900 CE

Oral records from Native Americans and geologic evidence have shown that the most recent Cascadia subduction zone earthquake occurred in January 1700 with an approximate magnitude of 9.0 which generated a tsunami that struck Oregon, Washington and Japan and destroyed Native American villages along the coast.

Since recorded history, the following earthquakes have occurred in the Central Oregon Region:

April 1906: North of Lakeview, magnitude V with three felt aftershocks.

April 1920: Crater Lake, magnitude V

January 1923: Lakeview, magnitude VI

March 1958: SE of Adel, magnitude 4.5

May-June 1968: Adel, magnitude 4.7 to 5.1, damage to homes with 20 earthquakes of magnitude 4.0 or greater recorded between 05/28/68 and 06/24/68. They were all shallow crustal earthquakes.

September 1993: Klamath Falls, magnitude 5.9 and 6.0, a series of earthquakes, the largest being a magnitude 6.0 with considerable damage in and around Klamath Falls. Two earthquake-related fatalities.

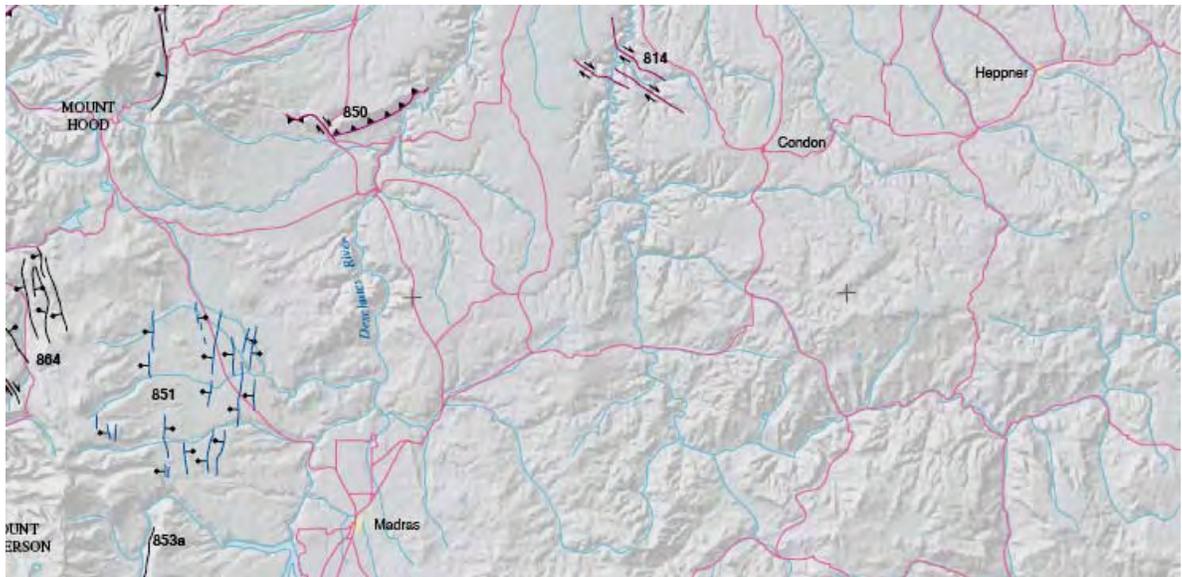
Risk Assessment

Jefferson County has not experienced any major earthquake events in recent history. The most recent event was in 2007 in the Maupin area north of Madras where there were several swarms. Most of the historic earthquake events occurred in the counties surrounding Jefferson County, the closest being in 1993 in Klamath Falls.

How are Hazard Areas Identified?

The earthquake hazard and its effects, especially for a subduction zone earthquake, are prevalent over the entire county. However, fault maps do show there are some areas northwest of Madras with existing faults which can produce crustal earthquake events. Figure 1 shows the earthquake faults in the Jefferson County region.

Figure 1. Map of Quaternary Faults and Folds, Jefferson County area.



Source: Earthquake Regional Profile, prepared by DOGAMI, 2007.

Probability of Future Occurrence

The 2006 Region 6 Community Profile lists the probability of a future earthquake occurring as low, however given the location of numerous faults in Jefferson County and the 2007 swarms near the Maupin area, the Jefferson County Natural Hazards Mitigation Steering Committee rated Jefferson County as having a moderate probability of recurrence. A 'moderate' ranking indicates that one incident is likely within a 35-75 year period.

Vulnerability Assessment

There are a number of community assets vulnerable to earthquakes in Jefferson County. The following section, Community Hazard Issues, discusses the major vulnerabilities to earthquake hazards. Given the high

number of community assets vulnerable to earthquakes, the Jefferson County Natural Hazards Mitigation Steering Committee rated Jefferson County as having a high vulnerability should an earthquake occur. This vulnerability rating is supported by the 2006 Region 6 Community Profile which also rates Jefferson County's vulnerability as high. A 'high' rating indicates that more than 10% of the population or regional assets would be affected by a major earthquake event.

Risk Analysis

HAZUS

In 2007 the Department of Geologic and Mineral Industries (DOGAMI) completed a HAZUS study of Jefferson County for a magnitude 6.5 arbitrary crustal earthquake and a 2500 year mean return probabilistic earthquake scenario. The HAZUS study is a regional earthquake loss estimation model developed by the Federal Emergency Management Agency (FEMA) to develop earthquake losses at a regional scale. The HAZUS model estimates damages to buildings, critical facilities, and transportation and utility systems. The model also estimates the induced earthquake damage from fires and debris, the social impact, and the potential economic loss.

This section provides a summary of both the 6.5 arbitrary crustal earthquake and the 2500 year mean return probabilistic earthquake scenarios. Please see HAZUS tables at the end of this section for further reference.

Magnitude 6.5 Arbitrary Crustal Earthquake

The HAZUS model estimates that approximately 1,113 buildings will be at least moderately damaged, which is at least 15% of the total number of buildings in the region. The model estimates that 98 buildings will be damaged beyond repair.

For essential facilities, the HAZUS model estimates that the hospital, police stations, and fire stations will not be functional on the first day of an earthquake, and only two of the seven schools will have greater than 50% functionality in the event of an earthquake.

Of the 22 highway segments, 72 bridges, 20 railroad segments, and 5 airport facilities located in Jefferson County, the HAZUS model estimates that all will have greater than 50% functionality in the event of an earthquake and will suffer only slight damage.

The HAZUS model estimates total economic losses to be \$102.4 million which includes building and lifeline related losses.

2500 Year Probable Scenario Magnitude 6.5 Earthquake

For the 2500-Year Probable Scenario earthquake, the HAZUS model estimates that approximately 1,602 buildings will be at least moderately

damaged, representing 22% of all buildings in the region. An estimated 42 buildings will be damaged beyond repair.

For essential facilities, the HAZUS model estimates that on the first day of an earthquake, the hospital will not have greater than 50% functionality, however all the schools, police stations, and fire stations will have greater than 50% functionality.

Of the 22 highway segments, 72 bridges, 20 railroad segments, and 5 airport facilities located in Jefferson County, the HAZUS model estimates that all will have greater than 50% functionality in the event of an earthquake and will suffer only slight damage

The HAZUS model estimates that the economic loss will total approximately \$86.95 million, which includes building and lifeline losses.

HAZUS Summary

According to the two HAZUS scenarios, buildings will sustain the most damage from earthquake events, but impacts to critical facilities vary depending on the type of event. The transportation systems will likely not be impacted severely from an earthquake event. Finally, estimated economic losses from an earthquake event will likely not exceed \$102 million.

Oregon Seismic Needs Assessment

In 2007 DOGAMI completed a Statewide Seismic Needs Assessment that used Rapid Visual Screening (RVS) to assess the seismic risk, also known as collapse potential, of schools, hospitals, and critical facilities such as police and fire stations in the state of Oregon. The RVS assessment is based on the maximum considered earthquake for the location being assessed, and rates buildings by a Very High, High, Moderate, or Low seismic risk.

The Seismic Needs Assessment assessed a total of 35 buildings in Jefferson County. The results are summarized below, and the full data set can be found on DOGAMI's website:

<http://www.oregongeology.com/sub/projects/rvs/SSNA-abridged-data.pdf>

Schools

Very High Seismic Risk-11 buildings
High Seismic Risk-8 buildings
Moderate Seismic Risk-1 building
Low Seismic Risk-7 buildings

Police Stations

Very High Seismic Risk-1 building
High Seismic Risk-1 building
Low Seismic Risk-2 buildings

Hospitals

High Seismic Risk-3 buildings

Fire Stations

Low Seismic Risk-2 buildings

Community Hazard Issues

What is susceptible to damage during a hazard event?

The Jefferson County Natural Hazards Mitigation Steering Committee identified a number of community assets that are vulnerable to earthquake hazards. Although the probability of an earthquake recurring is moderate, the vulnerability is fairly high. Vulnerable community assets include vulnerable infrastructure, critical facilities, communities, populations, and economic vulnerabilities.

Infrastructure

One of the most vulnerable community assets in Jefferson County is the infrastructure found in the County. The High Bridge over the Crooked River and the Deschutes River Bridge are vulnerable to earthquakes, and if damaged, could significantly isolate the community. The bridges serve as the major links to the surrounding counties, and if rendered inoperable, there would only be a few ways in and out of the County. Other important bridges include the bridge on the road to Prineville on Highway 20 and the suspension bridges over Lake Billy Chinook.

Jefferson County contains a number of dams that could be potentially vulnerable to earthquakes. These dams include the Round Butte regulation dam that has electrical substation equipment, gas lines, and irrigation equipment. If damaged, the secondary effects to the economy could be significant. Other vulnerable dams include the Felton and Haystack dams which provide irrigation water to the surrounding farmers.

The Opal Springs water station near Madras provides water to Jefferson County, and if damaged could restrict water distribution to the County.

Finally, water collection and treatment systems are also vulnerable to earthquake events.

Critical Facilities

Jefferson County also has a number of vulnerable critical facilities in the County. The DOGAMI Statewide Seismic Needs Assessment summarized above lists the seismic risk associated with many of the critical facilities in Jefferson County. Other County buildings not assessed in the Seismic Needs Assessment include the County Courthouse which is an unreinforced masonry building and the Jefferson County office buildings which are also unreinforced masonry buildings.

One building that may be significantly impacted by an earthquake event is the Mountain View Hospital which may be overwhelmed with mass casualties having only 24 to 44 beds to house patients. The HAZUS study completed by DOGAMI and summarized above further supports the assertion that mass casualties could overwhelm the hospital in the event of an earthquake.

Communities

Jefferson County has a number of communities vulnerable to earthquake events. The City of Madras is one of the most isolated large communities in Central Oregon, and should an earthquake damage the County's transportation systems and bridges, connections to the outside world would be limited. The unincorporated community of Crooked River Ranch only has one entrance road, and should it be compromised, could isolate the community from the rest of the county. Residents that have built their homes near canyon walls are also vulnerable to earthquake-induced landslides. Another vulnerable community is the unincorporated community of Three Rivers. The community is only accessible by a gravel road through the Deschutes National Forest or over suspension bridges crossing Lake Billy Chinook. Should these roads and bridges become impassible due to an earthquake, the Three Rivers area will likewise be isolated from the rest of the county.

Population

Jefferson County also has a number of vulnerable populations. The Crooked River Ranch has a 70% elderly population who may be particularly vulnerable to earthquake events. The assisted living/nursing facilities in Jefferson County may also be vulnerable because the facilities range from 5 to 18 years old and may not meet current seismic standards.

Economy

Jefferson County's buildings and transportation infrastructure are also vulnerable to earthquake events and could negatively impact the County's economy. As the HAZUS study summarized above, a large number of buildings could be negatively impacted in the event of an earthquake. These buildings include residential as well as commercial facilities.

If an earthquake were to close Highway 97, a major north-south transportation route, the economic impacts could be significant. Highway 97 connects Jefferson County with the surrounding counties, and the route is a major trucking line that gets an average of 400 trucks a day. When I-5 closed in December 2007 due to flooding, the daily number of trucks averaged 1,000.

Finally, Jefferson County also has a number of railroad trestles that span large canyons in the County. The canyons include the Crooked River Gorge and over Willow Creek. North-south railroad travel through eastern Oregon could be negatively impacted if these railroad lines were damaged.

Existing Hazard Mitigation Activities

The most significant mitigation activity Jefferson County is implementing for the earthquake hazard is through adoption and enforcement of the International Building Code that includes amendments to seismically retrofit new buildings. However, while new buildings include seismic retrofits, older buildings are still vulnerable.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of earthquakes in Jefferson County. Please see full action item worksheets in Appendix A.

Earthquake # 1: Identify critical and essential facilities for seismic retrofit.

Multi-Hazard # 2: Develop an education and outreach program to educate residents all about the natural hazard events in Jefferson County and provide them with mitigation activities they can take to reduce the impact of natural hazards.

Multi-Hazard # 3: Inventory historic and cultural resources, with an emphasis on unreinforced masonry buildings, and identify their vulnerabilities to natural hazards to develop mitigation actions for their protection.

Multi-Hazard # 4: Explore emergency response and preparedness measures to address response and preparedness needs for natural hazard events.

Multi-Hazard # 5: Work with local businesses to develop business continuity plans.

Multi-Hazard # 6: Develop continuity of operations plans for Jefferson County to ensure continued operation in the event of a natural hazard emergency.

ⁱ CREW Cascadia Subduction Zone Earthquakes: A Magnitude 9.0 Earthquake Scenario, 2005.

HAZUS-MH: Earthquake Event Report



Region Name: *Jefferson County*

Earthquake Scenario: *Jefferson Arbitrary Crustal M6.5*

Print Date: *May 31, 2007*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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Appendix B: Regional Population and Building Value Data	

General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Oregon

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,786.82 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 19,009 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 7 thousand buildings in the region with a total building replacement value (excluding contents) of 1,009 (millions of dollars). Approximately 99.00 % of the buildings (and 87.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,185 and 200 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 7 thousand buildings in the region which have an aggregate total replacement value of 1,009 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 66% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 102 beds. There are 7 schools, 1 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 12 dams identified within the region. Of these, 5 of the dams are classified as 'high hazard'. The inventory also includes 1 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 1,385.00 (millions of dollars). This inventory includes over 153 kilometers of highways, 72 bridges, 10,250 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	72	426.40
	Segments	22	493.90
	Tunnels	0	0.00
	Subtotal		920.30
Railways	Bridges	0	0.00
	Facilities	1	2.50
	Segments	20	56.60
	Tunnels	0	0.00
	Subtotal		59.10
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	5	30.80
	Runways	5	175.60
	Subtotal		206.40
		Total	1,185.80

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	102.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	102.50
Waste Water	Distribution Lines	NA	61.50
	Facilities	1	75.30
	Pipelines	0	0.00
		Subtotal	136.80
Natural Gas	Distribution Lines	NA	41.00
	Facilities	1	1.20
	Pipelines	0	0.00
		Subtotal	42.20
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	0.00
Electrical Power	Facilities	1	124.30
		Subtotal	124.30
Communication	Facilities	1	0.10
		Subtotal	0.10
		Total	405.90

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Jefferson Arbitrary Crustal M6.5
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-121.23
Latitude of Epicenter	44.63
Earthquake Magnitude	6.50
Depth (Km)	10.00
Rupture Length (Km)	18.20
Rupture Orientation (degrees)	150.00
Attenuation Function	WUS Shallow Crustal Event - Extensional

Building Damage

Building Damage

HAZUS estimates that about 1,113 buildings will be at least moderately damaged. This is over 15.00 % of the total number of buildings in the region. There are an estimated 98 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	17	0.35	5	0.39	6	0.74	3	1.26	1	1.45
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	1	0.01	0	0.02	0	0.02	0	0.02	0	0.00
Industrial	6	0.12	1	0.05	0	0.04	0	0.03	0	0.01
Other Residential	1,361	27.61	406	33.93	430	55.49	178	74.20	53	53.54
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	3,544	71.90	785	65.61	339	43.71	59	24.51	44	45.00
Total	4,929		1,196		776		240		98	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	3,558	72.19	795	66.51	340	43.90	56	23.48	43	43.71
Steel	8	0.17	2	0.16	3	0.40	2	0.76	1	0.70
Concrete	6	0.13	2	0.19	3	0.37	1	0.60	0	0.44
Precast	4	0.09	1	0.06	1	0.13	1	0.30	0	0.22
RM	1	0.01	0	0.01	0	0.03	0	0.08	0	0.05
URM	35	0.70	11	0.91	11	1.43	6	2.57	4	3.91
MH	1,317	26.71	385	32.16	417	53.74	173	72.20	50	50.97
Total	4,929		1,196		776		240		98	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 102 hospital beds available for use. On the day of the earthquake, the model estimates that only 18 hospital beds (18.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 47.00% of the beds will be back in service. By 30 days, 86.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	1	0	0
Schools	7	0	0	2
EOCs	0	0	0	0
PoliceStations	4	0	0	0
FireStations	1	0	0	0

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	22	0	0	22	22
	Bridges	72	0	0	72	72
	Tunnels	0	0	0	0	0
Railways	Segments	20	0	0	20	20
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	5	1	0	5	5
	Runways	5	0	0	5	5

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	0	1
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	1	0	0	1	1

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	5,125	34	11
Waste Water	3,075	27	9
Natural Gas	2,050	29	10
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	6,727	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.02 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 6 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 49.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 137 households to be displaced due to the earthquake. Of these, 35 people (out of a total population of 19,009) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	19	4	0	1
	Single Family	14	3	0	0
	Total	34	7	1	1
2 PM	Commercial	17	5	1	1
	Commuting	0	0	0	0
	Educational	8	2	0	1
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	4	1	0	0
	Single Family	3	1	0	0
	Total	34	9	1	2
5 PM	Commercial	16	4	1	1
	Commuting	0	0	1	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	7	1	0	0
	Single Family	6	1	0	0
	Total	30	8	2	2

Economic Loss

The total economic loss estimated for the earthquake is 102.40 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 60.48 (millions of dollars); 10 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 73 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.13	1.61	0.03	0.07	1.83
	Capital-Related	0.00	0.05	1.42	0.02	0.02	1.51
	Rental	0.78	1.08	0.78	0.01	0.02	2.67
	Relocation	0.09	0.04	0.04	0.00	0.01	0.18
	Subtotal	0.87	1.30	3.85	0.05	0.11	6.19
Capital Stock Losses							
	Structural	4.26	2.52	2.41	0.13	0.28	9.60
	Non_Structural	18.08	9.75	5.22	0.37	0.68	34.10
	Content	5.37	2.02	2.44	0.23	0.33	10.39
	Inventory	0.00	0.00	0.14	0.05	0.01	0.20
	Subtotal	27.71	14.29	10.21	0.78	1.30	54.29
	Total	28.58	15.60	14.06	0.83	1.42	60.48

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	493.88	\$0.40	0.08
	Bridges	426.41	\$11.80	2.77
	Tunnels	0.00	\$0.00	0.00
	Subtotal	920.30	12.20	
Railways	Segments	56.62	\$0.01	0.01
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.46	\$0.74	30.23
	Subtotal	59.10	0.80	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	30.79	\$5.71	18.53
	Runways	175.60	\$0.08	0.05
	Subtotal	206.40	5.80	
	Total	1185.80	18.70	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	102.50	\$0.18	0.18
	Subtotal	102.50	\$0.18	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	75.30	\$11.29	15.00
	Distribution Line	61.50	\$0.14	0.23
	Subtotal	136.76	\$11.44	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	1.20	\$0.11	9.09
	Distribution Line	41.00	\$0.15	0.37
	Subtotal	42.23	\$0.27	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	124.30	\$11.30	9.09
	Subtotal	124.30	\$11.30	
Communication	Facilities	0.10	\$0.01	4.69
	Subtotal	0.11	\$0.01	
	Total	405.91	\$23.19	

Table 15. Indirect Economic Impact with outside aid
 (Employment as # of people and Income in millions of \$)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.77
Second Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-2.33
Third Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-3.00
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-3.00
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-3.00
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(2)	-3.00

Appendix A: County Listing for the Region

Jefferson,OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon	Jefferson	19,009	882	127	1,009
Total State		19,009	882	127	1,009
Total Region		19,009	882	127	1,009

HAZUS-MH: Earthquake Event Report



Region Name: *Jefferson County*

Earthquake Scenario: *2500yr Probable Scenario M6.5 Driving*

Print Date: *March 22, 2007*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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The replacement value of the transportation and utility lifeline systems is estimated to be 1,185 and 200 (millions of dollars) , respectively.

Building and Lifeline Inventory

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In terms of building construction types found in the region, wood frame construction makes up 66% of the building inventory. The remaining percentage is distributed between the other general building types.

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For essential facilities, there are 1 hospitals in the region with a total bed capacity of 102 beds. There are 7 schools, 1 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 12 dams identified within the region. Of these, 5 of the dams are classified as 'high hazard'. The inventory also includes 1 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 1,385.00 (millions of dollars). This inventory includes over 153 kilometers of highways, 72 bridges, 10,250 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	72	426.40
	Segments	22	493.90
	Tunnels	0	0.00
	Subtotal		920.30
Railways	Bridges	0	0.00
	Facilities	1	2.50
	Segments	20	56.60
	Tunnels	0	0.00
	Subtotal		59.10
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	5	30.80
	Runways	5	175.60
	Subtotal		206.40
		Total	1,185.80

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	102.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	102.50
Waste Water	Distribution Lines	NA	61.50
	Facilities	1	75.30
	Pipelines	0	0.00
		Subtotal	136.80
Natural Gas	Distribution Lines	NA	41.00
	Facilities	1	1.20
	Pipelines	0	0.00
		Subtotal	42.20
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	0.00
Electrical Power	Facilities	1	124.30
		Subtotal	124.30
Communication	Facilities	1	0.10
		Subtotal	0.10
		Total	405.90

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	2500yr Probable Scenario M6.5 Driving
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	2,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	6.50
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

HAZUS estimates that about 1,602 buildings will be at least moderately damaged. This is over 22.00 % of the total number of buildings in the region. There are an estimated 42 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	12	0.31	7	0.38	8	0.68	4	1.15	1	2.35
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.01	0	0.01	0	0.03	0	0.05	0	0.13
Industrial	4	0.09	1	0.08	1	0.12	0	0.15	0	0.23
Other Residential	713	18.56	592	32.98	806	65.88	281	83.47	37	85.48
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	3,114	81.03	1,194	66.55	407	33.30	51	15.18	5	11.81
Total	3,842		1,794		1,223		337		43	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	3,137	81.65	1202	67.02	404	33.00	47	13.91	3	7.73
Steel	6	0.15	3	0.15	5	0.37	2	0.71	1	1.49
Concrete	4	0.11	3	0.16	4	0.32	2	0.55	0	0.72
Precast	3	0.07	1	0.06	2	0.15	1	0.38	0	0.50
RM	0	0.01	0	0.01	0	0.03	0	0.08	0	0.08
URM	24	0.62	16	0.90	16	1.34	8	2.28	3	6.48
MH	668	17.39	569	31.71	792	64.79	277	82.10	36	82.98
Total	3,842		1,794		1,223		337		43	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 102 hospital beds available for use. On the day of the earthquake, the model estimates that only 29 hospital beds (29.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 62.00% of the beds will be back in service. By 30 days, 95.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	0
Schools	7	0	0	7
EOCs	0	0	0	0
PoliceStations	4	0	0	4
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	22	0	0	22	22
	Bridges	72	2	0	70	71
	Tunnels	0	0	0	0	0
Railways	Segments	20	0	0	20	20
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	5	0	0	5	5
	Runways	5	0	0	5	5

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	1	0	0	1	1

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	5,125	145	37
Waste Water	3,075	114	30
Natural Gas	2,050	122	32
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	6,727	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 50.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 55 households to be displaced due to the earthquake. Of these, 14 people (out of a total population of 19,009) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	17	3	0	0
	Single Family	7	1	0	0
	Total	26	4	0	0
2 PM	Commercial	15	4	1	1
	Commuting	0	0	0	0
	Educational	4	1	0	0
	Hotels	0	0	0	0
	Industrial	3	1	0	0
	Other-Residential	4	1	0	0
	Single Family	2	0	0	0
	Total	27	6	1	2
5 PM	Commercial	16	4	1	1
	Commuting	0	0	1	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	2	0	0	0
	Other-Residential	6	1	0	0
	Single Family	3	0	0	0
	Total	27	6	1	1

Economic Loss

The total economic loss estimated for the earthquake is 86.95 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 54.58 (millions of dollars); 11 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 70 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.16	1.68	0.07	0.09	2.01
	Capital-Related	0.00	0.07	1.60	0.04	0.01	1.73
	Rental	0.61	0.82	0.83	0.02	0.02	2.30
	Relocation	0.07	0.04	0.05	0.00	0.01	0.16
	Subtotal	0.68	1.09	4.15	0.14	0.14	6.19
Capital Stock Losses							
	Structural	3.28	2.58	2.38	0.30	0.29	8.83
	Non_Structural	16.24	7.81	4.47	0.77	0.54	29.82
	Content	5.42	1.34	1.96	0.50	0.26	9.49
	Inventory	0.00	0.00	0.10	0.14	0.01	0.25
	Subtotal	24.94	11.73	8.92	1.71	1.09	48.39
	Total	25.61	12.82	13.07	1.85	1.23	54.58

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	493.88	\$0.00	0.00
	Bridges	426.41	\$10.81	2.53
	Tunnels	0.00	\$0.00	0.00
	Subtotal	920.30	10.80	
Railways	Segments	56.62	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.46	\$0.36	14.76
	Subtotal	59.10	0.40	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	30.79	\$4.41	14.31
	Runways	175.60	\$0.00	0.00
	Subtotal	206.40	4.40	
	Total	1185.80	15.60	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	102.50	\$0.66	0.65
	Subtotal	102.50	\$0.66	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	75.30	\$5.08	6.75
	Distribution Line	61.50	\$0.52	0.85
	Subtotal	136.76	\$5.60	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	1.20	\$0.10	7.93
	Distribution Line	41.00	\$0.56	1.37
	Subtotal	42.23	\$0.66	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	124.30	\$9.86	7.93
	Subtotal	124.30	\$9.86	
Communication	Facilities	0.10	\$0.01	5.22
	Subtotal	0.11	\$0.01	
	Total	405.91	\$16.79	

Table 15. Indirect Economic Impact with outside aid
 (Employment as # of people and Income in millions of \$)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.68
Second Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-2.06
Third Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-2.66
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-2.66
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-2.66
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(2)	-2.66

Appendix A: County Listing for the Region

Jefferson,OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon	Jefferson	19,009	882	127	1,009
Total State		19,009	882	127	1,009
Total Region		19,009	882	127	1,009

Volume II: Hazard Annex

Flood

Causes and Characteristics of the Hazard

Oregon has a detailed history of flooding with flood records dating back to the 1860s. There are over 250 flood-prone communities in Oregon.

The principal types of flood that occur in the community include:

Riverine floods

Riverine floods occur when water levels in rivers and streams overflow their banks. Most communities located along such water bodies have the potential to experience this type of flooding after spring rains, heavy thunderstorms or rapid runoff from snow melt. Riverine floods can be slow or fast-rising, but usually develop over a period of days.

The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with melting of snow in the Cascade and Coast Ranges. In Jefferson County, riverine floods occur with warm winter rain on snow and are the leading cause of flooding events in the County.

Flash floods

Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods usually occur in the summer during thunderstorm season, appear with little or no warning and can reach full peak in only a few minutes. They are most common in the arid and semi-arid central and eastern areas of the state where there is steep topography, little vegetation and intense but short-duration rainfall. Flash floods can occur in both urban and rural settings, often along smaller rivers and drainage ways. Flash flooding can occur in canyons in Jefferson County in the summer, with usually one warning issued per year. These flash flooding events occur most frequently along the highway 26 corridor and on highway 97.

In flash flood situations, waters not only rise rapidly, but also generally move at high velocities and often carry large amounts of debris. In these instances a flash flood may arrive as a fast moving wall of debris, mud, water or ice. Such material can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back in such a manner can cause flooding both upstream and then later downstream if the obstruction is removed or breaks free.

Shallow area floods

These floods are a special type of riverine flooding. FEMA defines a shallow area flood hazard as an area that is inundated by a 100-year flood with a flood depth between one to three feet. Such areas are generally flooded by low velocity sheet flows of water. The City of Madras is located in the Willow Creek floodway and often experiences shallow flooding in the City during warm rain on snow events.

Urban floods

Urban flooding occurs where land has been converted from fields or woodlands to developed areas consisting of homes, parking lots, and commercial, industrial and public buildings and structures. In such areas the previous ability of water to filter into the ground is often prevented by the extensive impervious surfaces associated with urban development. This in turn results in more water quickly running off into watercourses which causes water levels to rise above pre-development levels. During periods of urban flooding streets can rapidly become swift moving rivers and basements and backyards can quickly fill with water. Storm drains often may back up with yard waste or other flood debris leading to further localized flooding. Another source of urban flooding is grading associated with development. In some cases, such grading can alter changes in drainage direction of water from one property to another.

History of the Hazard in Your Community

Flooding occurs in Jefferson County approximately every ten years. The principle riverine flood sources include Willow Creek, an unnamed creek north of Culver, and Muddy Creek.

December 1964- Extensive flooding in Willow Creek and in the City of Madras causing an estimated \$1.5 million in damage.

1976-Flash flood destroyed buildings in Ashwood area.

February 1979- Flooding in Madras caused over \$1 million in damages.

February 1996- Executive Order EO 96-15 declared a State of Emergency in Jefferson County due to flooding.

December 2005- Warm spell followed by rain on snow led to flooding in Culver and Madras. Flooding led to 3 to 4 feet of water on the side streets in Madras and 18 inches of water flowing on Highway 97, with costs numberings in the hundreds of thousands.

January 2006- Willow Creek spilled onto local roads, threatening homes and businesses. Madras Sheriff and Police Chief began notifying home owners in the flood by going door to door. The City distributed about 1,000 bags, and Les Schwab Tire Center lent another 1,000 bags to volunteers. Water flooded into the high school stadium, near the Lutheran Church of the Good Shepherd, on N. Ninth St, and the intersections of 4th

and 5th streets and A and B streets. Both the north and south lanes of Highway 97 were shut down. The Willow Creek foot bridge near the Lutheran Church was knocked off its foundation. Businesses flooded as well.

Sources: Region 6 Central Oregon Profile & Risk Assessment, March 2006; the Madras Pioneer Archives.

Risk Assessment

How are Hazard Areas Identified?

The Region 6 Community Profile for Jefferson County lists the major riverine flood sources, similar to what is listed in the Jefferson County Hazard Analysis completed in 2008. In addition, the City of Madras completed a Flood Mitigation Plan in 2005 which provided additional information regarding flooding events in the City of Madras. Much of downtown Madras is located in the Willow Creek floodplain and floodway, and suffers from occasional flooding events.

Jefferson County is a participant in the National Flood Insurance Program, as are Culver and Madras. Jefferson County's Flood Insurance Rate Map (FIRM) was completed on July 17, 1989, and no updates have occurred since then. Culver's latest FIRM is dated September 4, 1987, and Madras's FIRM is dated July 17, 1989.

Probability of Future Occurrence

Flooding events occur on a regular basis in Jefferson County, the most recent being in 2006 in the City of Madras. Given this information, the Jefferson County Natural Hazards Steering Committee rated the probability of a flooding event recurring as 'high,' meaning one incident is likely within a 10-35 year period. This rating is supported by the 2008 Jefferson County Hazard Analysis that assigns the probability of a flooding event recurring as an 8 on a scale of 1 to 10.

Vulnerability Assessment

There are a number of community assets that are vulnerable to flooding events, which are listed below in Community Hazard Issues section. In addition, the City of Madras, where most of Jefferson County's vulnerable property is located, completed a flood mitigation plan in 2005. The plan valued the total private property in the floodway at \$4,784,000 (2004) and public property at \$3,002,000 (2004). The plan also identified the number and type of buildings in the floodway. However, additional data assessing the flood vulnerability for the entire County (in addition to the City of Madras) is needed. As of June, 2008, no repetitive losses have been recorded in Jefferson County.ⁱ

The 2008 Jefferson County Hazard Analysis gave Jefferson County a 'moderate' vulnerability score of 6 on a scale from 1 to 10. However, given the regular frequency of flooding, the infrastructure vulnerable to flooding such as highway 97, and the number of County buildings located in the

floodway, the Jefferson County Natural Hazard Steering Committee rated Jefferson County's flood vulnerability as 'high.' A 'high' rating indicates that more than 10% of the County's population or regional assets would be affected by a major flooding event.

Risk Analysis

A risk analysis has not been completed for Jefferson County or for the City of Madras due to insufficient information. Given the high level of probability and vulnerability of flooding events, a risk analysis should be completed for the entire County to determine the level of risk on the entire community.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The Jefferson County Steering Committee identified a number of community assets that are vulnerable to flooding events, especially critical facilities and vulnerable infrastructure.

Critical Facilities

There are a number of County facilities that are vulnerable to damage in a flood. The County Courthouse and the County offices are located in a floodway in Madras. This includes the County Administrative Offices and Jefferson County Public Works.

A number of facilities in the City of Madras are also located in the Willow Creek floodplain. These include Madras City Hall, Madras Police, Madras Public Works, Madras schools, including the elementary, middle, and high schools. For a more detailed description of the buildings that can be affected by flooding in Madras, reference the Madras Flood Mitigation Plan.

Infrastructure

Infrastructure is also significantly impacted by flooding events in Jefferson County. Steering Committee members noted that a number of culverts in unincorporated areas in Jefferson County need further upgrading from 24 inch culverts to 32 inch.

Flash flooding that occurs along roadways can also wash out roads. Gravel roads found throughout the county are susceptible to flooding events, such as in the Crooked River Ranch area and in the Three Rivers area.

Existing Hazard Mitigation Activities

Communities in Jefferson County have taken a number of measures to mitigation against floods. The most significant mitigation activity is the 2005 Madras Flood Mitigation Plan funded by Flood Mitigation Assistance (FMA) program funding. The mitigation plan outlines the flood

vulnerability in Jefferson County's largest city, and identifies mitigation activities the city can implement to reduce the impact of flood hazards.

The City of Culver upgraded the culvert on 9th Street, reducing the impact on what had been a 10-year event in the city.

The County also has standard floodplain ordinances that require a floodplain permit for new development.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of earthquakes in Jefferson County. Please see full action item worksheets in Appendix A.

Flood # 1: Develop flood mitigation strategies for critical facilities located in the floodplain.

Flood # 2: Explore coordination and support strategies to minimize the negatives impact of upstream development on rivers and streams.

Flood # 3: Upgrade culverts in unincorporated areas in Jefferson County to reduce flooding events on roads and bridges.

Flood # 4: Develop erosion prevention strategies for gravel roads in Jefferson County.

Flood # 5: Educate citizens in Jefferson County about flood issues and actions they can implement to mitigate the flood risk.

Flood # 6: Coordinate with other entities to explore the possibility of updating the County's FEMA Flood Insurance Rate Map.

Flood # 7: Encourage ODOT to develop an emergency bypass route through Madras.

Flood # 8: Take steps to begin participating in the Community Rating System.

Flood # 9: Continue compliance with the National Flood Insurance Program (NFIP).

ⁱ Department of Land Conservation and Development, June 2008 Repetitive Loss Summary.

Volume II: Hazard Annex

Landslide

Causes and Characteristics of the Hazard

Landslides are a major geologic threat in almost every state in the United States. In Oregon, a significant number of locations are at risk from dangerous landslides and debris flows. While not all landslides result in property damage, many landslides do pose serious risk to people and property. Increasing population in Oregon and the resultant growth in home ownership has caused the siting of more development in or near landslide areas. Often these areas are highly desirable owing to their location along the coast, rivers and on hillsides.

Landslides are fairly common, naturally occurring events in various parts of Oregon. In simplest terms, 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 understanding 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.

Landslides can be grouped as “on-site” and “off-site” hazards. An “on-site” slide is one that occurs on or near a development site and is slow moving. It is slow moving slides that cause the most property damage in urban areas. On-site landslide hazards include features called slumps, earth flows and block slides. “Off-site” slides typically are rapid moving and begin on steep slopes at a distance from homes and development. A 1996 “off-site” slide in southern Oregon began a long distance away from homes and road, traveled at high velocity and killed five people and injured a number of others.

Landslides are classified based on causal factors and conditions and exist in three basic categories.

Falls

This type of landslide involves the movement of rock and soil which detaches from a steep slope or cliff and falls through the air and/or bounces or rolls down slope. This type of slide is termed a rock fall and is very common along Oregon highways where they have been cut through bedrock in steep canyons and along the coast. Most rock fall events in

Jefferson County have occurred along cliffs, and after major wildfire events.

Slides

This kind of landslide exists where the slide material moves in contact with the underlying surface. Here the slide moves along a plane and slumps by either moving along a curved surface (called a rotational slide) or along a flat surface (called a translational slide). While slow-moving slides can occur on relatively gentle slopes and are less likely to cause serious injuries or fatalities, they can result in significant property damage.

Flows

In this case the landslide is characterized as plastic or liquid in nature in which the slide material breaks up and flows during movement. This type of landslide occurs when a landslide moves down slope as a semi-fluid mass scouring or partially scouring rock and soils from the slope along its path. A flow landslide is typically rapid moving and tends to increase in volume as it moves down slope and scours out its channel.

Rapidly moving flow landslides are often referred to as debris flows. Other terms given to debris flows are mudslides, mudflows, or debris avalanches. Debris flows frequently take place during or following an intense rainfall on previously saturated soil. Debris flows usually start on steep hillsides as slumps or slides that liquefy, accelerate to speeds as high as 35 miles per hour or more, and travel down slopes and channels onto gentle sloping or flat ground. Most slopes steeper than 70 percent are risk from debris flows.

The consistency of a debris flow ranges from watery mud to thick, rocky, mud-like, wet cement which is dense enough to carry boulders, trees and cars. Separate debris flows from different starting points sometimes combine in canyons and channels where their destructive energy is greatly increased. Debris flows are difficult for people to outrun or escape from and present the greatest risk to human life. Debris flows have caused most of their damage in rural areas and were responsible from most of landslide-related deaths and injuries during the 1996 storm in Oregon.

Conditions Affecting Landslides

Natural conditions and human activities can both play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. Locations with steep slopes are at the greatest risk of slides. However, the incidence of landslides and their impact on people and property can be accelerated by development. Developers who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

There are four principle factors that affect or increase the likelihood of landslides:

- Natural conditions and processes including the geology of the site, rainfall, wave and water action, seismic tremors and earthquakes and volcanic activity.
- Excavation and grading on sloping ground for homes, roads and other structures.
- Drainage and groundwater alterations that are natural or human-caused can trigger landslides. Human activities that may cause slides include broken or leaking water or sewer lines, water retention facilities, irrigation and stream alterations, ineffective storm water management and excess runoff due to increased impervious surfaces.
- Change or removal of vegetation on very steep slopes due to timber harvesting, land clearing and wildfire.

History of the Hazard in Your Community

In recent events, particularly noteworthy landslides accompanied storms in 1964, 1982, 1966, and 1996. Two major landslide producing winter storms occurred in Oregon during November 1996. Intense rainfall on recently and past logged land as well as previously un-logged areas triggered over 9,500 landslides and debris flows that resulted directly or indirectly in eight fatalities. Highways were closed and a number of homes were lost. The fatalities and losses resulting from the 1996 landslide events brought about the passage of Oregon Senate Bill 12, which set site development standards, authorized the mapping of areas subject to rapidly moving landslides and the development of model landslide (steep slope) ordinances.

In Jefferson County, rock falls have occurred near Pelton Reservoir in the Warm Springs Reservation. As a result, Pelton Park was closed from visitors for a period of time. Additionally, the Camp Sherman wildfires in 2003 led to a series of landslides in the County.

Risk Assessment

How are Hazard Areas Identified?

The Department of Land Conservation and Development (DLCD) requires local governments to address geologically unstable areas as part of their comprehensive plans through Statewide Land Use Planning Goal 7 (Areas Subject to Natural Hazards). In Jefferson County, little planning has been done concerning landslide hazards. Goal 7 envisions a process whereby new hazard inventory information generated by federal and state agencies is first reviewed by DLCD. DLCD then notifies the County of the new information, and the County has three years to respond to the information by evaluating the risk, obtaining citizen input, and adopting or amending implementation measures to address the risk. Jefferson County has not received notice of new inventory information concerning landslides.ⁱ

According to the Jefferson County Natural Hazards Mitigation Steering Committee, areas subject to landslide events include: 1) Pelton Reservoir; 2) northwest roads leading to Crooked River Ranch; 3) Camp Sherman's southern access routes; 4) Jordan Road, near the bridge to Three Rivers; and 5) Highway 26 as the road descends into the canyon and on the approach into Warm Springs.

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.ⁱⁱ

Probability of Future Occurrence

The probability of a rapidly moving landslide 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); consequently, the Oregon Department of Forestry tracks storms during the rainy season, monitors rain gages and snow melt, and issues warnings as conditions warrant.

Geo-engineers with the Oregon Department of Forestry estimate widespread landslide activity about every 20 years; in western Oregon, landslides at a local level can be expected every 2 or 3 years. The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a low level of probability for landslides, meaning one incident is likely within a 75 - 100 year period. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.ⁱⁱⁱ The low ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Vulnerability Assessment

According to the Jefferson County Natural Hazard Mitigation Steering Committee, none of the County's critical facilities are located within landslide hazard areas. Vulnerable communities and infrastructure, however, exist within the County. The Crooked River Ranch, for example, has single-route access, and roads between Madras and Crooked River Ranch are susceptible to landslide hazards. In the event that a landslide blocks the road between Madras and Crooked River Ranch, Crooked River Ranch could be isolated from access to critical facilities, medical services, and food supplies.

Similarly, Camp Sherman is vulnerable to landslide events. Poor road conditions and wildfire events frequently lead to slides along potential evacuation routes.

The Three Rivers Bridge is subject to landslide events along Jordan Road, and landslides have occurred along Highway 26 where the road descends into the canyon and also ascends into Warm Springs.

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a moderate level of vulnerability for landslides, meaning 1-10% of the population or region assets would likely be affected by a major emergency or disaster. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.^{iv} The moderate ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Risk Analysis

The State Department of Geology and Mineral Industries (DOGAMI) is responsible for conducting hazard assessments, including the identification and mapping of landslide hazards, estimating potential consequences and likelihood of occurrence, and monitoring and assessing potential hazardous geological activity. At this time, DOGAMI has not completed a risk analysis for Jefferson County's landslide hazards. As such, data currently does not allow for estimates of hazard damages. See "Vulnerability Assessment" above for a greater understanding of landslides' potential impacts to life and property in Jefferson County.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. Landslides can damage or temporarily disrupt utility services, roads and other transportation systems and critical lifeline services such as police, fire, medical, utility and communication systems, and emergency response. In addition to the immediate damage and loss of services, serious disruption of roads, infrastructure and critical facilities and services may also have longer term impacts on the economy of the community and surrounding area.

Increasing the risk to people and property from the effects of landslides are the following three factors:

- Improper excavation practices, sometimes aggravated by drainage issues, can reduce the stability of otherwise stable slopes.
- Allowing development on or adjacent to existing landslides or known landslide-prone areas raises the risk of future slides regardless of excavation and drainage practices. Homeowners and developers should understand that in many potential landslide settings that there are no development practices that can completely assure slope stability from future slide events

- Building on fairly gentle slopes can still be subject to landslides that begin a long distance away from the development. Sites at greatest risk are those situated against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels. Home siting practices do not cause these landslides, but rather put residents and property at risk of landslide impacts. In these cases, the simplest way to avoid such potential effects is to locate development out of the impact area, or construct debris flow diversions for the structures that are at risk.

For more information on the landslide hazard, please visit the state plan's Landslide chapter or the Oregon Technical Resource Guide.

Existing Hazard Mitigation Activities

At this time, Jefferson County has not completed any landslide – related mitigation activities.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of landslides in Jefferson County. Please see full action item worksheets in Appendix A.

Landslide # 1: Identify areas vulnerable to landslides and develop mitigation strategies to reduce the likelihood of potentially hazardous events.

Landslide # 2: Adopt development standards that specify maximum cuts and fills and do not allow major alterations of drainage patterns.

Multi-Hazard # 4: Explore emergency response and preparedness measures to address response and preparedness needs for natural hazard events.

ⁱ Jefferson County Comprehensive Plan, Goal 7: Areas Subject to Natural Hazards, p. 45. December 27, 2006.

ⁱⁱ State of Oregon Natural Hazard Mitigation Plan. Part 3: Hazard Chapters. "Landslides – Debris Flows," p. LS-2. March, 2006.

ⁱⁱⁱ Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

^{iv} Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Volume II: Hazard Annex

Volcano

Causes and Characteristics of the Hazard

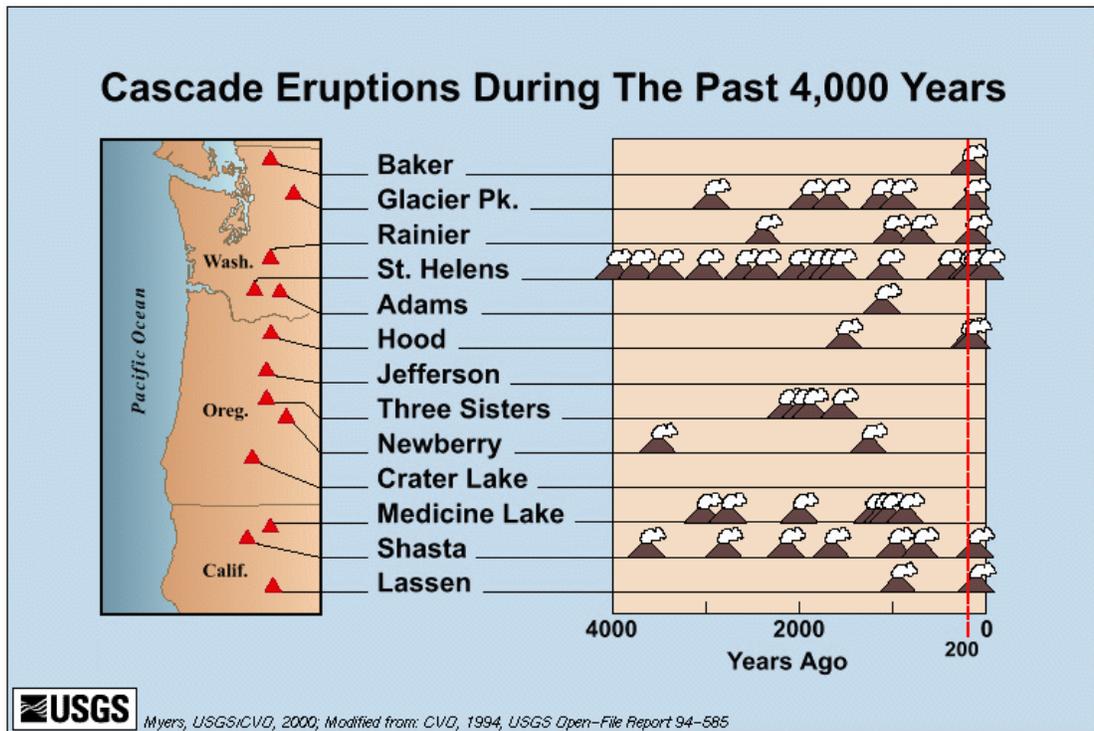
The Cascade Range of the Pacific Northwest has more than a dozen active volcanoes. These familiar snow-clad peaks are part of a 1,000 mile-long chain of mountains which extend from southern British Columbia to northern California. Cascades volcanoes tend to erupt explosively, and have occurred at an average rate of 1-2 per century during the last 4,000 years. Future eruptions are certain. Seven Cascades volcanoes have erupted since the first U.S. Independence Day slightly more than 200 years ago. Four of those eruptions would have caused considerable property damage and loss of life had they occurred today without warning. The most recent events were Mt. St. Helens in Washington (1980-86) and Lassen Peak in California (1914-1917). The existence, position and recurrent activity of Cascades volcanoes are generally thought to be related to the convergence of shifting crustal plates. As population increases in the Pacific Northwest, areas near volcanoes are being developed and recreational usage is expanding. As a result more and more people and property are at risk from volcanic activity.

The effects of a major volcanic event can be widespread and devastating. The Cascade Range in Washington, Oregon and northern California is one of the most volcanically active regions in the United States. Volcanoes produce a wide variety of hazards that can destroy property and kill people. Large explosive eruptions can endanger people and property hundreds of miles away and even affect the global climate. Some volcano hazards such as landslides can occur even when a volcano is not erupting.

History of the Hazard in Your Community

The history of volcanic activity in the Cascade Range is contained in its geologic record, and the age of the volcanoes vary considerably. Figure 1 below, shows the history of Cascade Range eruptions. Some lava flows on Washington's Mt. Rainier are thought to be older than 840,000 years. Mt. St. Helens, a volcano in Washington State, is the most active volcano in the Cascade Range. Its last major eruption occurred on May 18th, 1980 when a large landslide and powerful explosive eruption created a large crater, and ended 6 years later after more than a dozen extrusions of lava built a dome in the craterⁱ. Larger, longer lasting eruptions have occurred in the volcano's past and are likely to occur in the future.

Figure 1 Cascade Range Eruptions in the past 4,000 Years



Source: W.E. Scott et al., 1997,
http://vulcan.wr.usgs.gov/Volcanoes/Cascades/EruptiveHistory/cascades_eruptions_4000yrs.html

Risk Assessment

How are Hazard Areas Identified?

To identify the areas that are likely to be affected by future events, pre-historic rock deposits are mapped and studied to learn about the types and frequency of past eruptions at each volcano. This information helps scientists to better anticipate future activity at a volcano, and provides a basis for preparing for the effects of future eruptions through emergency planning.

Scientists also use wind direction to predict areas that might be affected by volcanic ash; during an eruption that emits ash, the ashfall deposition is controlled by the prevailing wind direction. The predominant wind pattern over the Cascades is from the west, and previous eruptions seen in the geologic record have resulted in most ashfall drifting to the east of the volcanoes. The potential and geographical extent of volcanic ashfall from Mt. Hood and Mt. St. Helens are depicted in Figures 3 and 4, respectively.

Figure 3. Map showing annual probability of 10 cm (~4 inches) or more tephra accumulation in Oregon and Washington from eruptions throughout the Cascade Range.

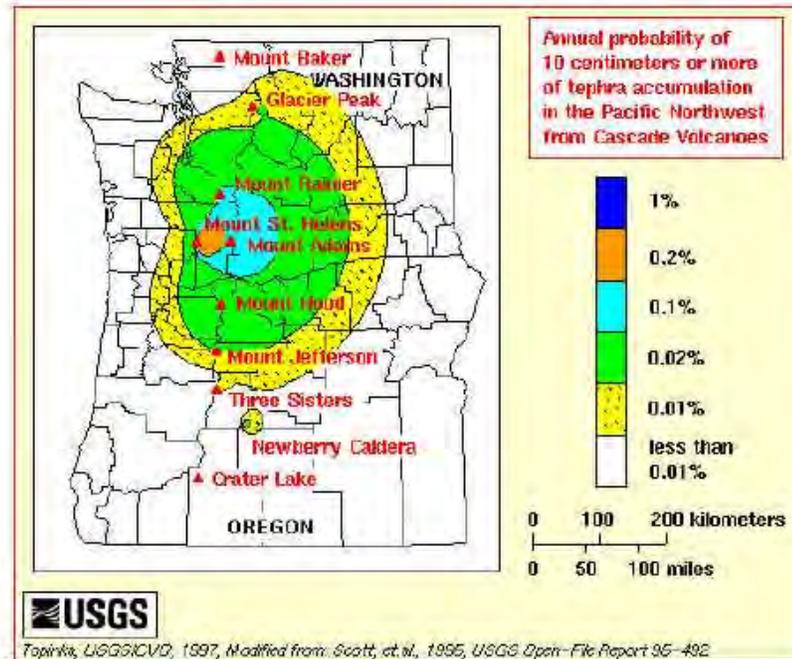
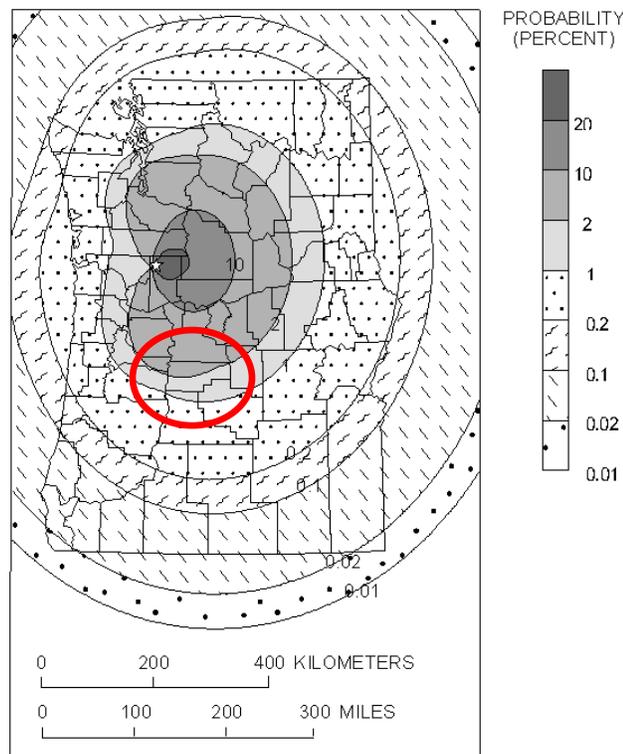


Figure 4. Map of Washington and Oregon showing the percentage probability of accumulation of ten or more centimeters (four or more inches) of tephra from a large eruption of Mount St. Helens.



Source: USGS. <<http://vulcan.wr.usgs.gov/Images/Gif/MSH/OFR95-497/figure2.gif>>

In Jefferson County, Mt. Jefferson poses the greatest risk to County residents. Volcano-related hazards from Mt. Jefferson would include tephra (volcanic ash), lahar, lava flow, debris flow / avalanche, and pyroclastic flow.ⁱⁱ The volcano is not extinct, and it's capable of large

explosive eruptions. In addition to Mt. Jefferson, several prominent volcanoes surround the western side of Jefferson County. Table 1, below, provides a further description of the region's volcanoes.

Table 1. Prominent Volcanoes

NAME	ELEVATION	TYPE	REMARKS
Mt. Jefferson	10,495 ft.	Composite	Capable of large explosive eruptions. Not extinct. Partly on Warm Springs Reservation. Lahar inundation zones on Shitike Creek; Warm Springs settlement endangered. Lahars could enter Lake Billy Chinook via the White River, overtop dam and create damage below. (USGS OFR 99-24)
Mt. Washington	7,796 ft.	Mafic volcano	Popular recreation area. Information on Mt. Washington is very limited. Best source: USGS Cascade Volcano Observatory (CVO) web sites. No report on potential hazards. Mafic volcanoes are less explosive than composite volcanoes.
North Sister	10,085 ft.	Mafic volcano	
Middle Sister	10,047 ft.	Composite volcano	May erupt explosively in the future (USGS OFR 99-437)
South Sister	10,358 ft.	Composite volcano	May erupt explosively in the future. Carver Lake on mountain is formed by a natural debris dam. Dam failure, for any reason, could send flood water down Squaw Creek toward City of Sisters (Ref. USGS OFR 87-41 and Deschutes Co. Flood Insurance Study) City of Sisters (pop. 900 plus many tourists) also subject to possible lahars (USGS OFR 99-437, Plate 1). Recent uplift detected near the South Sister (about 1 in./yr), but no indication of pending eruption.
Broken Top	9,152 ft.	Composite volcano	Popular hiking destination; Source of Bend water supply
Mt. Bachelor	9,065 ft.	Mafic volcano	All-season recreation area. Mt. Bachelor ski resort.
Newberry Crater	7,984 ft.	Composite volcano	Popular recreation area. Less than 25 miles from Bend. Violent eruptions in past. Will erupt in future. Lahars could reach residential areas in the vicinity of Sun River via Little Deschutes River (USGS OFR 99-437)
Mt. Thielsen	9,187 ft.	Basalt/andesite Shield volcano	Popular hiking / climbing destination
Crater Lake (Mt. Mazama)	8,926 ft. (Mt. Scott)	Overlapping shield and composite volcanoes	Popular destination.
Mt. McLaughlin	9,496 ft.	Mafic volcano	Less explosive than composite volcanoes

Source: USGS/Cascades Volcano Observatory, web site information

Probability of Future Occurrence

The probability of volcanic activity can be very difficult to predict, unless there are obvious precursors. The precursors might include increased seismic activity, temperature and chemical changes in groundwater, etc. Probability is especially difficult when the volcano has been inactive for many thousands of years and lacks a clear geologic record of past events. Also, the knowledge of volcanoes is too limited to know how long a dormant period at any volcano can last, and this probably is the case for most Cascade volcanoes. Eruption probabilities generated by the USGS for the Oregon Cascades are largely based on the position of volcanic rocks in the geologic record. There is a considerable opportunity for error.ⁱⁱⁱ

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a low level of probability for volcanoes, meaning one incident is likely within a 75 - 100 year period. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.^{iv} The low ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Vulnerability Assessment

The Jefferson County Natural Hazards Mitigation Steering Committee believes that the County's vulnerability to volcano-related hazards is high, meaning more than 10% of the population or region assets would likely be affected by a major emergency or disaster. The Region 6 Oregon Profile and Risk Assessment, however, describes Jefferson County as having a moderate level of vulnerability to volcano-related hazards, meaning 1-10% of the population or region assets would likely be affected by a disaster. Although the latter ranking is based on an analysis of risk conducted by county emergency managers,^v the Steering Committee felt that the County's description of its vulnerability to volcano-related hazards should be greater. Additional data is needed to describe the number of acres, property, and critical facilities in the hazard area.

Risk Analysis

The effects of a major volcanic event can be widespread and devastating. Specific estimates for life and property losses are not available at this time.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The effects of a major volcanic event can be widespread and devastating. The Cascade Range in Washington, Oregon and northern California is one of the most volcanically active regions in the United States. Volcanoes produce a wide variety of hazards that can destroy property and kill people. Large explosive eruptions can endanger people and property hundreds of miles away and even affect the global climate. Some volcano hazards such as landslides can occur even when a volcano is not erupting.

The specific hazards produced by volcanic activity include the following:

Eruption Columns and Clouds

An explosive eruption blasts solid and molten rock fragments called tephra and volcanic gases into the air with tremendous force. The largest rock fragments called bombs usually fall back to the ground within two miles of the vent. Small fragments (less than 0.1 inch across) of volcanic glass, mineral and rock (ash) rise high into the air forming a huge, billowing eruption column. Eruption columns creating an eruption cloud can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes. Volcanic ash clouds can pose serious hazards to aviation. Several commercial jets have nearly crashed because of engine failure from inadvertently flying into ash clouds.

Large eruption clouds can extend hundreds of miles downwind resulting in ash fall over enormous areas. Ash from the May 18, 1980 Mt. St. Helens eruption fell over an area of 22,000 square miles in the western U.S. Heavy ash fall, particularly when mixed with rain, can collapse buildings and even a minor ash fall can damage crops, electronics and machinery. Ash fall additionally hurts tourist-reliant businesses and logging operations, and can damage fish populations and vulnerable plant life.

Volcanic Gases

Volcanoes emit gases during eruptions. Even when a volcano is not erupting, cracks in the ground allow gases to reach the surface through small openings called fumaroles. More than ninety percent of all gas emitted by volcanoes is water vapor (steam), most of which is heated ground water. Other common volcanic gases are carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen and fluorine. In higher concentrations, these gases can cause corrosion, contaminate domestic water supplies and harm or even kill vegetation, livestock and people.

Lava Flows and Domes

Molten rock (magma) that pours or oozes onto the earth's surface is called lava and forms lava flows. The higher a lava's content of silica the less easily it flows. Low-silica basalt lava can form fast-moving (10 to 30 miles per hour) streams or can spread out into broad thin sheets up to several miles wide.

Pyroclastic Flows

High-speed avalanches of hot ash, rock fragments and gas can move down the sides of a volcano during explosive eruptions or when the steep side of a growing lava dome collapses and breaks apart. Pyroclastic flows can be as hot as 1,500 degrees Fahrenheit and move at speeds of 100 to 150 miles per hour. Such flows tend to follow valleys and are capable of knocking down and burning everything in their paths. Lower-density pyroclastic flows called pyroclastic surges can easily overflow ridges hundreds of feet high. The climatic eruption of Mt. St. Helens generated a series of explosions that formed a huge pyroclastic surge which destroyed an area

of 230 square miles and leveled trees six feet in diameter as far as 15 miles from the volcano.

Volcano Landslides

A volcanic landslide or debris avalanche is a rapid downhill movement of rocky material, snow and/or ice. Volcano landslides range in size from small movements of loose debris on the surface of a volcano to massive collapses of the entire summit or sides of a volcano. Landslides on volcano slopes are triggered when eruptions, heavy rainfall or large earthquakes cause these materials to break free and move downhill.

Lahars

Lahars are mudflows or debris flows composed mostly of volcanic materials on the flanks of a volcano. These flows of mud, rock and water can rush down valley and stream channels at speeds of 20 to 40 miles per hour and can travel more than 50 miles. Some lahars contain so much rock debris (60 to 90% by weight) that they look like fast-moving rivers of wet concrete. Historically, lahars have been one of the deadliest volcano hazards. Close to their source, these flows are powerful enough to rip up and carry trees, houses and huge boulders miles downstream. Farther downstream they can entomb in mud everything in their path. Lahars can occur during an eruption and when a volcano is quiet. The water that creates lahars can come from melting snow and ice (especially water from a glacier melted by a pyroclastic flow or surge), intense rainfall, or the breakout of a summit crater lake. Large lahars are potential hazard to many communities downstream from glacier-clad volcanoes.

For more information on the volcanic hazard, please visit the state plan's Volcano chapter.

Existing Hazard Mitigation Activities

During the Mt. Saint Helens eruption in 1980, residents placed nylons over intake areas to keep the ash from damaging equipment.

Ash from wildfires, much like from volcanoes, negatively impacts residents' health. The microclimates found in Jefferson County and the prevalent winds play a large role in depositing ash from wildfires around the county. When wildfires reach certain levels, communities are properly notified in terms of health and safety concerns. Presumably, the same could be true for volcanic events as well.

Hazard Mitigation Action Items

The following action has been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and is recommended for mitigating the potential effects of volcanoes in Jefferson County. Please see full action item worksheets in Appendix A.

Volcano #1: Include volcanic ash fall in the Health Department's public outreach efforts to address respiration hazards, targeting specific vulnerable populations such as the elderly and youth.

ⁱ USGS. Mt. St. Helens Volcano.

<http://vulcan.wr.usgs.gov/Volcanoes/MSH/framework.html>.

ⁱⁱ USGS Open File Reports 99-24, 99-437, 97-513.

ⁱⁱⁱ State of Oregon Natural Hazard Mitigation Plan. Regional Risk Assessment, Region 6: Central Oregon, "Volcano-Related Hazards," p. 24-28. March, 2006.

^{iv} Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

^v Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Volume II: Hazard Annex

Wildfire

Causes and Characteristics of the Hazard

Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property particularly in the state's growing rural communities. Wildfires are fires occurring in areas having large areas of flammable vegetation that require a suppression response. Areas of wildfire risk exist throughout the state with areas in central, southwest and northeast Oregon having the highest risk. The Oregon Department of Forestry has estimated that there are about 200,000 homes in areas of serious wildfire risk.

The impact on communities from wildfire can be huge. In 1990, Bend's Awbrey Hall Fire destroyed 21 homes, causing \$9 million in damage and costing over \$2 million to suppress. The 1996 Skeleton fire in Bend burned over 17,000 acres and damaged or destroyed 30 homes and structures. Statewide that same year, 218,000 acres were burned, 600 homes threatened and 44 homes were lost. The 2002 Biscuit fire in southern Oregon affected over 500,000 acres and cost \$150 million to suppress.

Wildfire can be divided into three categories: interface, wildland, and firestorms.

Interface Fires

Essentially an interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel. The wildland/urban interface (sometimes called rural interface in small communities or outlying areas) can be divided into three categories.

- The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas.
- The mixed wildland/urban interface is more typical of the problems in areas of exurban or rural development: isolated homes, subdivisions, resorts and small communities situated in predominantly in wildland settings.
- The occluded wildland/urban interface where islands of wildland vegetation exist within a largely urbanized area.

Wildland Fires

A wildland fire's main fuel source is natural vegetation. Often referred to as forest or rangeland fires, these fires occur in national forests and parks,

private timberland, and on public and private rangeland. A wildland fire can become an interface fire if it encroaches on developed areas.

Firestorms

Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms often occur during dry, windy weather and generally burn until conditions change or the available fuel is consumed. The disastrous 1991 East Bay Fire in Oakland, California is an example of an interface fire that developed into a firestorm.

Conditions Contributing to Wildfires

Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, and recreational activities or from an industrial accident. Once started, four main conditions affect the fire's behavior: fuel, topography, weather and development.

Fuel is the material that feeds a fire. Fuel is classified by volume and type. As a western state, Oregon is prone to wildfires due to its prevalent conifer, brush and rangeland fuel types. Most of the wildland-urban interface areas in Jefferson County occur in areas dominated by Juniper/sage/grass sites.ⁱ

Topography influences the movement of air and directs a fire's course. Slope and hillsides are key factors in fire behavior. Unfortunately, hillsides with steep topographic characteristics are also desirable areas for residential development.

Weather is the most variable factor affecting wildfire behavior. High risk areas in Oregon share a hot, dry season in late summer and early fall with high temperatures and low humidity.

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.

History of the Hazard in Your Community

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

urban/wildland interface, and 4) provides a means for establishing an integrated fire protection system. The following is a list of wildfires that have occurred in Jefferson County:

- 1984: Crooked River Ranch.
- 1985: Crooked River Ranch.
- 1994: LaClair
- 1996: Little Cabin; 2,438 acres burned.
- 1996: Simnasho.
- 1996: Ash Wood Donneybrook.
- 2002: Eyerly; 23,573 acres burned; 37 structures destroyed.
- 2006: Geneva I, II, III, and UV wildfires burned less than a mile from Three Rivers.
- 2006: Black Crater Fire.
- 2007: A fire near the Crooked River Ranch burned 330 acres on BLM land, destroying 15 homes and threatening 80 others.
- 2007: Baker Canyon Fire.
- 2008: Warm Springs (small).

Additionally, during the B&B Fire of 2003, Santiam Pass closed and significantly impacted transportation through Highway 20. The B&B Complex is a 95,000 acre area of forestland that burned along the crest of the Cascade Mountain Range between Mount Jefferson and Mount Washington during August and September, 2003.

Risk Assessment

How are Hazard Areas Identified?

The western part of Jefferson County contains the most coniferous forests in the County; the central part of the County is the flattest area, and contains most of the population as well as the majority of agricultural activities; and the eastern part of the county is largely comprised of rolling hills with grass, juniper, and sagebrush.ⁱⁱ The entire County is susceptible to wildfire and the extent of a wildfire can extend county-wide. The Jefferson County Community Wildfire Protection Plan (CWPP) identifies the following communities as “at risk” to the effects of wildfire.

- Three Rivers
- Crooked River Ranch
- Ashwood
- Gateway
- Round Butte
- North Madras Heights
- Juniper Crest

- Madras Ranchos / Canyon View
- High Chaparral
- Forest, Rim, & Air Parks
- Shamrock Estates
- Juniper Butte
- High Chaparral
- See's
- Warm Springs
- County Line

The Jefferson County CWPP additionally identifies “at-risk” critical infrastructure as follows:

- Lake Simtustus RV Park
- Lake Billy Chinook Campground
- Haystack Reservoir
- The Cove State Park
- Pelton Park
- Montgomery Shores / Robinson Headwaters / Monty Campground area
- Cyrus Horse Camp
- Skull Hollow Camp
- Transmission lines from Pelton / Round Butte hydroelectric facilities
- Madras Natural Gas compressor station
- Grizzly Electric Substation
- Opal Springs domestic water source

Probability of Future Occurrence

The natural ignition of forest fires is largely a function of weather and fuel; human-caused fires add another dimension to probability. Dry and diseased forests can be mapped accurately and some statement can be made about the probability of lightning strikes. Each forest is different and consequently has different probability/recurrence estimates.

Wildfires have always been a natural part of forest, brush, or grassland ecosystems, sometimes with devastating effects. Wildfires result from natural causes (e.g., lightning strikes), a mechanical failure (Oxbow Fire), or human-caused (unattended campfire, debris burning, or arson).

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a high level of probability for wildfire, meaning one incident is likely within a 10-35 year period. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.ⁱⁱⁱ The high ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Vulnerability Assessment

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

Each year a significant number of people build homes within or on the edge of the forest (urban/wildland interface), thereby increasing wildfire hazards. In Oregon, many communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards. Such development has greatly complicated firefighting efforts and significantly increased the cost of fire suppression.^v See listing of interface communities in the section above labeled "how are hazard areas identified?"

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a high level of vulnerability to wildfires, meaning more than 10% of the population would be affected by a major emergency or disaster. This rating is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.^{vi} The high ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Risk Analysis

Jefferson County completed a Community Wildfire Protection Plan (CWPP) in November of 2005. The CWPP is meant to serve as the wildfire chapter for the Jefferson County Natural Hazards Mitigation Plan. As such, the CWPP includes a county-wide risk assessment, a description of communities "at risk," and recommendations for mitigating wildfire hazards. The Jefferson County CWPP is located within the Wildfire Hazard Annex at the end of this section.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The effects of fire on ecosystem resources can include damages, benefits, or some combination of both. Ultimately, a fire's effects depend largely on the characteristics of the fire site, the severity of the fire, its duration and the value of the resources affected by the fire.

The ecosystems of most forest and wildlands depend upon fire to maintain various functions. These benefits can include, depending upon location and other circumstances, reduced fuel load, disposal of slash and thinned tree stands, increased forage plant production, and improved wildlife

habitats, hydrological processes and aesthetic environments. Despite these potential benefits, fire has historically been suppressed for years because of its effects on timber harvest, loss of scenic and recreational values and the obvious threat to property and human life.

At the same time, the effects of a wildfire on the built environment, particularly in the face of a major wildfire event, can be devastating to people, homes, businesses and communities. As noted above, fuel, topography, weather and the extent of development are the key determinants for wildfires. A number of other factors also have been identified which affect the degree of risk to people and property in identified wildfire interface areas. These include:

- Combustible roofing material (for example cedar shakes)
- Wood construction
- Homes and other structures with no defensible space
- Roads and streets with substandard width, grades, weight-load and connectivity standards making evacuation and fire response more difficult
- Subdivisions and homes surrounded by heavy natural fuel types
- Structures on steep slopes covered with flammable vegetation
- Limited on-site or community water supply
- Locations with normal prevailing winds over 30 miles per hour

For more information on the wildfire hazard, please visit the state plan's Wildfire chapter or the Oregon Technical Resource Guide.

Existing Hazard Mitigation Activities

Jefferson County completed a Community Wildfire Protection Plan (CWPP) in November of 2005. The CWPP identifies communities at risk, and recommends strategies for reducing those risks.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of wildfires in Jefferson County. Please see full action item worksheets in Appendix A.

Wildfire #1: Implement actions identified in the Jefferson County Community Wildfire Protection Plan.

Wildfire #2: Encourage communities to incorporate fire prevention materials and programs, such as Firewise, to help in fire prevention.

-
- ⁱ Jefferson County Community Wildfire Protection Plan, November 2005.
 - ⁱⁱ Jefferson County Community Wildfire Protection Plan, November 2005.
 - ⁱⁱⁱ Oregon Emergency Management, July 2003, County Hazard Analysis Scores.
 - ^{iv} State of Oregon Natural Hazard Mitigation Plan. Regional Risk Assessment, Region 6: Central Oregon, "Volcano-Related Hazards," p. 24-28. March, 2006.
 - ^v State of Oregon Natural Hazard Mitigation Plan. Regional Risk Assessment, Region 6: Central Oregon, "Volcano-Related Hazards," p. 24-28. March, 2006.
 - ^{vi} Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Jefferson County

**Community Wildfire
Protection Plan**

November 2005

**Jefferson County
Community Wildfire Protection Plan**

As required by the Healthy Forest Restoration Act, the undersigned representatives of Jefferson County, Jefferson County Fire Chief, and Oregon Department of Forestry acknowledge that they have reviewed and approve the contents of this plan.

Jefferson County

Chris Gannon, Jefferson County Planner

Date

Jefferson County Fire Chief

Earl Cordes, Jefferson Co. Fire Chief

Date

Oregon Department of Forestry

Robert Young, Central Oregon District Mgr., ODF

Date

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1.0 Introduction

1.1 Purpose:

Wildland fire is not new or novel in Oregon (see Map 1 in Appendix E). Like many of our neighboring states, it is quite common for large wildfires to move across the landscape--- like they have done for thousands of years. In the early 1900's, European settlers began to suppress these fires, resulting in an unnatural fuels buildup. In the last 25 years the wildfires have impacted communities to an increasing degree. The communities in Oregon are growing at a rapid rate, each year pushing farther and farther into the wildland. The result has been an increase in the number of homes lost each decade to wildfire. Most of these losses have occurred in or adjacent to the Wildland-Urban Interface (WUI)--- an area where wildland fuels and residences are intermixed.

Congress recently passed two significant pieces of legislation to address the growing problem of people living in the WUI, often away from structural and wildland response to fires. The Healthy Forest Initiative (HFI) of 2002 reduces the amount of administrative delays for accomplishing hazardous fuels reduction projects. The Healthy Forests Restoration Act (HFRA) of 2003 improves statutory processes for hazardous fuel reduction projects on federal and private land, especially where communities are "at risk" from the effects of wildland fire. The HFRA invites communities to develop Community Wildfire Protection Plans (CWPP) in collaboration with local governments, local fire departments and state foresters in consultation with their federal partners. The purpose of the CWPP is to identify communities at risk, identify what constitutes the risk, and develop an action plan to mitigate the risk thereby providing for a community that is more resilient to the effects of wildland fire.

In March of 2005, Jefferson County decided to complete a CWPP. The CWPP for Jefferson County will cover the entire county except for the area covered by the Greater Sisters Country CWPP in the southwest corner of Jefferson County. It also includes that portion of Crooked River Ranch that is in northern Deschutes County. The CWPP that covers northern Deschutes County is expected to be developed in late 2005 or early 2006.

1.2 Collaboration:

This plan was developed in collaboration with representatives from Jefferson County Government, Jefferson County Fire District #1, Jefferson County Sheriff's Office, Three Rivers Volunteer Fire Department, Crooked River Ranch Rural Fire Department, Oregon Department of Forestry, Crooked River National Grasslands, Bureau of Land Management, Central Oregon Fire Management Service, Confederated Tribes of Warm Springs (CTWS), a representative from the community of Ashwood, and other private landowners.

Additionally, the CWPP team held 5 community meetings in order to obtain Jefferson County citizen input to the planning process. These meetings were held prior to development of the Draft plan. Comments from the meetings can be found in Appendix A, of this document.

1.3 The CWPP Format & Framework

Following passage of the Healthy Forests Restoration Act, a variety of planning framework models developed throughout the country. At the same time, many agencies were also developing or completing Natural Hazard Mitigation Plans (NHMP) which include a wildland fire component where wildfire is a threat, to meet FEMA guidelines. Of the two predominate CWPP models being used in Oregon, one provides a mechanism to also address the wildland fire component of the NHMP process as well as the CWPP requirements. The other model is entitled “Preparing a Community Wildfire Protection Plan-A Handbook for Wildland-Urban Interface Communities”. This framework was developed by the National Association of State Foresters, National Association of Counties, Society of American Foresters and others. This framework, known as the “NASF” model, was chosen for the Jefferson County CWPP process. Figure 1-1 provides a summary of the steps identified in the process.

<u>SUMMARY-NASF</u>
COMMUNITY WILDFIRE PROTECTION PLAN
Step 1: Convene Decision makers
Step 2: Involve Federal Agencies
Step 3: Engage Interested Parties
Step 4: Establish a Community Base Map
Step 5: Develop a Community Risk Assessment
Step 6: Establish Community Priorities and Recommendations
Step 7: Develop an Action Plan and Assessment Strategy
Step 8: Finalize Community Wildfire Protection Plan

Figure 1-1 NASF Model-Community Wildfire Protection Plan

A complete copy of the NASF framework is included in Appendix E: Reference Documents & Maps.

Step 4 of the framework (Figure 1-1 above) calls for the development of a base map. The base map is also attached in Appendix E, and is labeled as Map 2.

1.4 The Goals of the Jefferson County CWPP:

- Protect against losses to life, property and natural resources from the threat of wildfire.
- Instill a sense of personal responsibility for taking preventative actions regarding wildfire.

- Strengthen partnerships to build and maintain active participation in mitigation and suppression of wildfire from each fire protection agency and unprotected area.
- Increase the ability to prepare for, respond to and recover from wildfires within the County.
- Increase public understanding of living in a fire prone ecosystem.
- Reintroduce fire in fire adapted ecosystems.
- Develop and distribute easy-to-use, self-help guides for property owners living in fire prone areas, or building homes in fire prone areas.
- Generate site development standards to enhance structural survivability in fire-prone areas.

It is intended that the Jefferson County CWPP be viewed as a county-wide, strategic assessment of the risks, hazards, and mitigation and prevention opportunities associated with wildfire in our communities.

Additionally, this plan is intended to be a living document which is reviewed, updated, amended as needed and distributed as needed, on a biannual basis.

2.0 Jefferson County Community Profile

As is the case with much of central Oregon, Jefferson County is experiencing a period of rapid growth. Between the years 2000 and 2004, Jefferson County experienced a 4.5% population increase. This trend is expected to continue in the foreseeable future.

There has been a corresponding growth in residential development within the urban growth boundary, rural areas and in portions of the county traditionally occupied by natural vegetation. This trend is expanding Jefferson County's wildland-urban interface, exposing more residents to the potential impact of wildland fire.

2.1 Geography & Environment

Jefferson County is located in Central Oregon. Jefferson County's topography is varied with its highest point being the top of Mt. Jefferson at 10,497 feet. The lowest elevation in the county is 1300 feet where the Deschutes River crosses into Wasco County. The Northwest corner of the county is the Warm Springs Indian Reservation. The southwest corner is public land managed by the Deschutes National Forest. From the coniferous forests on the west, the elevation decreases as you move to the east, finally reaching the Deschutes River. The city of Madras is located on the Deschutes-Umatilla plateau with an elevation of approximately 2000 feet. From Madras to the east, the elevation gradually increases again and the terrain becomes hilly and broken.

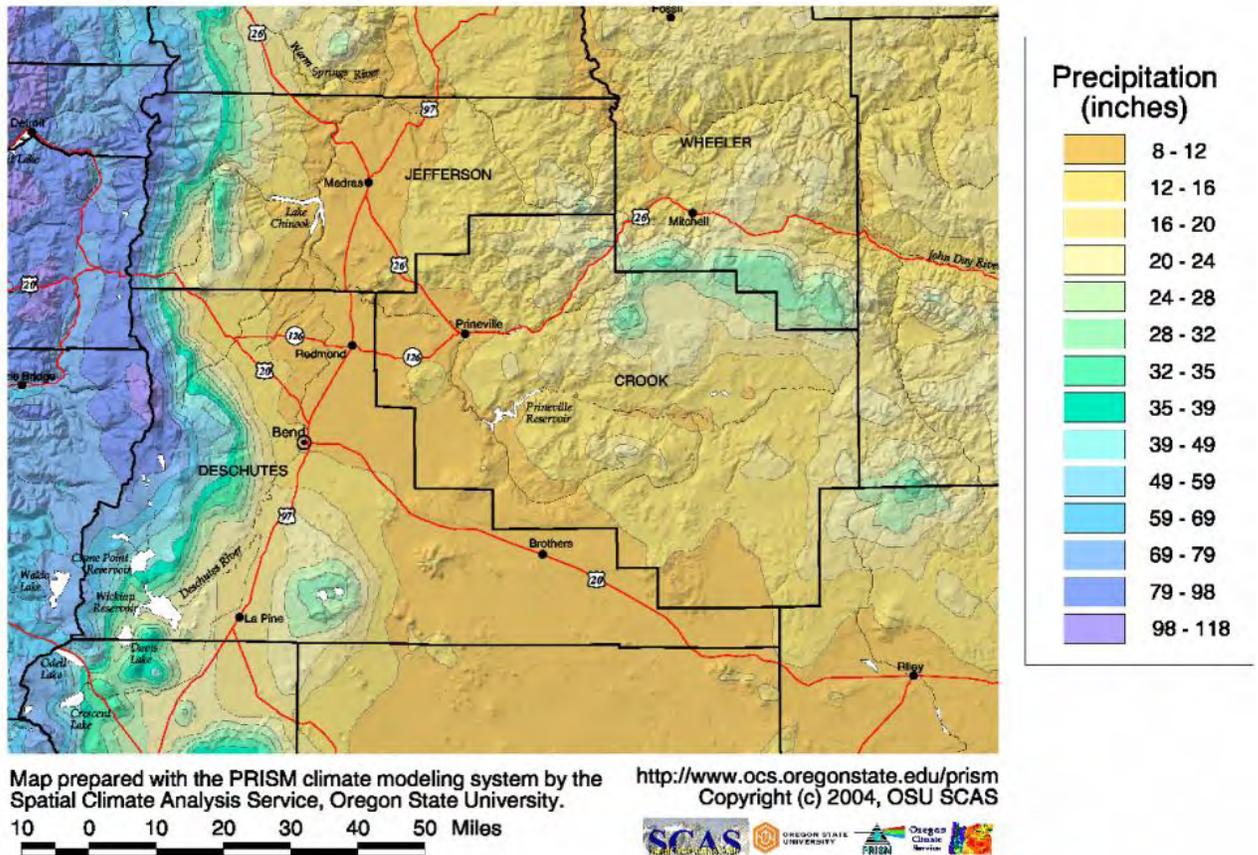
Precipitation amounts for Jefferson County are varied with the western (mountainous) portion receiving amounts of 28 to 60 inches annually, primarily in the form of snow.

The rest of the region is classified as high desert, and generally receives 8-12 inches of precipitation each year.

Vegetation in the county is as varied as its precipitation amounts. The higher elevation mountains are mostly covered with coniferous forests. At about 3000 feet elevation, the vegetation changes to Juniper/grass/sagebrush. The central portion of the county is occupied by sagebrush, but a significant portion of this land has been converted to agricultural lands that support a variety of crops such as mint, potatoes, alfalfa, grass, barley, and oats.

Most of the wildland-urban interface (WUI) areas of the county occur in areas dominated by Juniper/sage/grass sites.

Figure 2-1 below, illustrates Jefferson County precipitation patterns, and the rain shadow effect from the Cascades.



Central Oregon Annual Average Precipitation Map (1961-1990). Map prepared by Oregon State University, Spatial Climate Analysis Service.

2.2 Communities & Critical Infrastructure

The Healthy Forests Restoration Act (HFRA) requires that as communities develop Community Wildfire Protection Plans (CWPPs) that the focus be placed on fire-safety considerations of both communities and critical infrastructure. Traditionally, most concentrations of community development in the county were located in valley areas, near water and grazing for livestock. Over the last two decades, development has moved outward into areas of drier vegetation, farther from main roads, with more wide-spread utility systems to support residential development.

As a result, the analysis of a community's ability to withstand the destructive effects of wildfire must address not only actual fire threat to residences, but also the impacts of fire on utilities, including electrical service, telephone, water systems and communications systems used by emergency personnel. Road systems must be adequate to accommodate both residential/recreational evacuation and ingress for emergency responders. Hazardous vegetation must be treated not only around homes, but along travel routes. Travel routes must not only be adequate for effective two-way travel, but also must provide enough extra width to accommodate significant amounts of evacuation traffic while still remaining functional to support ingress for responding emergency responders.

As measures are identified to improve the county's ability to respond to and recover from wildfire, hazardous fuel treatments and standards for adequate access must be considered. These standards need to be applicable to future as well as existing development, and incorporated into the development planning for areas of new growth.

2.3 Communities "At Risk"

The CWPP Team identified the following communities as "at risk" to the effects of wildfire:

- Three Rivers
- Crooked River Ranch
- Ashwood
- Gateway
- Round Butte
- North Madras Heights
- Juniper Crest
- Madras Ranchos/Canyon View
- High Chaparral
- Forest, Rim, & Air Parks
- Shamrock Estates
- Juniper Butte
- High Chaparral
- See's

- Seekseequa
- Warm Springs
- County Line

Critical infrastructure that has also been identified as “at risk” includes:

- Lake Simtustus RV Park
- Lake Billy Chinook Campground
- Haystack Reservoir
- The Cove State Park
- Pelton Park
- Montgomery Shores/Robinson Headwaters/Monty Campground area
- Cyrus Horse Camp
- Skull Hollow Camp
- Transmission lines from Pelton/Round Butte hydroelectric facilities
- Madras Natural Gas compressor station
- Grizzly Electric Substation
- Opal Springs domestic water source

2.4 Fire Protection

Portions of Jefferson County receive fire protection (*See figure 2.4 below*) from one or more of the following:

- Jefferson County Fire District #1
- Crooked River Ranch Fire Department
- Three Rivers Fire Department
- Confederated Tribes of Warm Springs
- Bureau of Indian Affairs
- Oregon Department of Forestry (ODF-Central Oregon District)
- United States Forest Service-- Crooked River National Grasslands and Deschutes National Forest*
- Bureau of Land Management-Prineville District*

 * The fire management functions of the Ochoco N.F. and Prineville BLM have been merged with that of the Deschutes N.F under Central Oregon Fire Management Service (COFMS).

Jefferson County Fire District #1 provides responses to structural and wildland fires within Jefferson County Fire District, which generally covers the central 200 square miles of the county.

Crooked River Ranch Fire Department responds to structural and wildland fires within the Ranch.

Three Rivers Volunteer Fire Department provides responses to wildland fires within the subdivision. (Will fight structure fires from the outside of the structure)

Oregon Department of Forestry (ODF) provides wildland fire response for fires burning on or threatening state forest land and private forestlands paying Forest Patrol Assessment within the ODF-Central Oregon District. There are some wildland-urban interface areas that receive dual protection from ODF and JCFD because they are located within the rural fire protection district and are also classified as forest land within the ODF district.

Central Oregon Fire Management Services (COFMS) provides wildland fire response for fires burning on, or threatening, all U.S. Forest Service, National Grasslands and Bureau of Land Management managed lands within the county.

The Confederated Tribes of Warm Springs provides structural fire response to fires burning on tribal lands, and the BIA provides wildland fire protection on the reservation.

In addition, all of the above-listed agencies are signatory to the Central Oregon Cooperative Wildland Fire Agreement that provides for mutual aid wildland fire support among all of the wildland and structural agencies and departments in Crook, Deschutes and Jefferson counties. The multiple agency structural/wildland agency fire response in Central Oregon has been recognized as one of the most efficient and best coordinated in the state.

**Figure 2-4
Jefferson County Fire Protection
Statistics**

		% of Jeff. Co.
Jefferson County	1,139,840 ac.	100%
Warm Springs I.R.	255,805 ac	22.40%
Jefferson FD #1 protection	94,720 ac.	8.30%
COFMS protection	311,680 ac.	27.30%
Three Rivers VFD	3,840 ac.	0.30%
Crooked River Ranch RFD	10,240 ac.	0.80%
ODF protection	271,360 ac.	23.80%
Unprotected land	286,080 ac.	25.00%

Note: some areas in the County receive protection from multiple agencies. Approximately 350,000 acres have overlapping protection.

See Map 3 in Appendix E, for display of protection jurisdictions.

2.5 Unprotected Lands

As can be seen in Figure 2-4 (above) there are extensive areas of private land within the county that receive no wildland fire protection and no structural fire protection.

Please refer to the Jurisdictional Map in Appendix E, labeled as Map 3. Areas colored grey are unprotected and cover about 286,000 acres within the county. This map is current as of March, 2005 and as additional areas are annexed into cities, the picture may change.

The unprotected lands issue has remained unresolved legislatively for more than a decade. In early 2004, as an outcome of an ODF agency-wide protection review, a “Fire Protection Coverage Working Group” was formed with leadership provided by representatives of the Oregon State Fire Marshal’s Office and Oregon Department of Forestry. The working group membership reflected a broad representation of interested parties with the intent of exploring opportunities to address the unprotected lands issue in Oregon. One of the short-term recommendations of the working group was that this issue be incorporated into the Community Wildfire Protection planning process. The options for potential development of fire response capacity and increasing resiliency to wildland fire in the unprotected area of the county is discussed further in Section 3.4.04 of this plan.

3.0 The Risk Assessment

The most critical portion of the CWPP process is the Risk Assessment. The Team used an ODF model entitled “Identifying and Assessment of Communities at Risk in Oregon” which was developed in 2004. Use of this Risk Assessment is compatible with “The Oregon Forestland-Urban Interface Fire Protection Act of 1997.”

3.1 Risk Assessment Process

Early in the development of the plan, an inventory of existing natural resource data was developed from all participating agencies. The analysis process then proceeded in a series of progressive steps.

1. Review, screen and consolidate appropriate GIS natural resource data layers from land management agencies. Produce county base maps.
2. Screen GIS data layers through the ODF assessment model, *Identifying and Assessment of Communities at Risk in Oregon*. Incorporate fire occurrence data from all fire service agency records and transportation infrastructure data. Identify unique operational and tactical challenges based on topography and transportation infrastructure limitations.
3. Identify those communities which are “at risk” from the threat of wildfire.
4. Develop draft recommendations for wildland-urban interface (WUI) boundaries.

5. Incorporate input from community meetings and presentations.
6. Identify mitigation priorities and recommendations for each community using the ODF Risk Assessment Model.
7. Finalize WUI boundary (Map 4 in Appendix E), mitigation and priority recommendations.
8. Finalize action plan and further assessment needs.

Upon completing steps 1 through 3 (above), the Jefferson County CWPP committee began evaluating the wildland urban interface according to the general guidelines outlined in the Central Oregon Fire Management Service Fire Management Plan and direction for creating a Community Wildfire Protection Plan. This evaluation included identifying neighborhood groups into “communities,” and considering a buffer area that, if treated, would result in flame lengths manageable by ground-based suppression forces. These communities were analyzed to determine the relative level of risk to life, property, and natural resources. In addition to these communities, however, the committee evaluated the potential for wildfire to damage lives, property and infrastructure in these community groups and in other parts of the county.

Although the density of residences in the areas outside the communities was too low to evaluate, this plan increased the WUI boundary to account for the presence of critical and valuable infrastructure scattered throughout the county. While these areas will not be specifically analyzed according to the Statewide Risk Assessment model, they will be incorporated into an overall WUI boundary and will have general treatment and protection recommendations. These areas include low density residential sites, communication sites, power stations, power lines, critical ingress/egress roads, private resources (such as livestock watering facilities), and historic sites and high-use recreation sites.

Title I of the Healthy Forest Restoration Act provides flexibility for communities when identifying wildland urban interface (WUI) areas. The Act states that a WUI area is “an area within or adjacent to an at-risk community that is identified in a community wildfire protection plan.” The presence of key infrastructure either located adjacent to the communities or providing service to the communities enables the overall WUI boundary to extend farther than the traditional 1 ½ miles.

The checkerboard pattern of land ownership throughout much of Jefferson County means that many residences can be found on small private parcels of land scattered throughout the Crooked River National Grassland. These properties rely on the utility lines crossing the Grassland, as well as on the roads through the Grasslands for ingress and egress. Specifically, many sites in Jefferson County are served by the communication sites on Gray Butte, Grizzly Mountain, Juniper Butte and Highway 20 near Devine Well. Although the utilities on Grizzly Mountain are in Crook County and are covered under the Crook County CWPP, the potential for wildfire to move from the Jefferson County side of Grizzly and up to these sites is a concern.

In addition to communication sites, many residents are served by the Grizzly Electric Substation and the Madras Natural Gas Compressor Station. Roads on the west side of the Grassland provide escape routes for residents evacuating from such areas as Stevens Canyon and Fremont Canyon. Extending the WUI boundary to cover these areas also provides the flexibility to address future developments west of the Grassland.

There are also many private resources that have the potential to be impacted by a wildfire. These resources include private timberlands (primarily east of the Grassland), livestock forage, agricultural and dry crop fields, and remote businesses such as Opal Springs (which, in addition to bottling Earth H₂O, provides drinking water to the greater Madras area and the cities of Culver and Metolius).

Residents move to and recreate in central Oregon and value the many outdoor activities that are possible. In addition to planning for peak-use days on Lake Billy Chinook, this plan also recognizes the need to plan for and address the wildfire hazard around other recreation areas. Key camping areas include Rimrock Springs, Skull Hollow, Cyrus Horse Camp, Haystack Reservoir and Alder Springs. Concerns in these areas not only include potential evacuation needs in the event of an emergency, but also the potential for recreationists to inadvertently start wildfires through improper campfire use, smoking or ATV use.

Finally, many people chose to live in central Oregon for the cultural interest and aesthetic values. This CWPP also recognizes the need to protect key historic sites such as the Grassland Headquarters, McCain Orchards, Cyrus Orchards, Eddelman's Plots and the Gray Butte Cemetery.

Those areas not covered by the community assessments have general issues including, but not limited to, the absence of formal fire protection and extended response times, dense vegetation capable of causing flame lengths greater than four feet, insufficient water supply, insufficient ingress/egress, and combustible structures. Recommendations to address these issues include improving local fire response capabilities, improving and maintaining ingress/egress routes, implementing programs such as Fire Free or Fire Wise to improve owner responsibility for creating defensible space, thinning or removing vegetation to reduce potential flame lengths, and implementing education programs and efforts to encourage or require use of fire-resistant building materials and methods for existing and future construction.

3.2 The Risk Assessment Format

- **Risk**-What is the likelihood of a fire occurring (either lightning or human caused)?
 - a. Fire Occurrence (number of fires per 1000 acres per decade) 0 to .1=5 points, 0.1 to 1.1=10 points, 1.1+ = 20 points.
 - b. Ignition risk (number of homes per 10 acres) 0-.9 = 0 points, 1-5 = 5 points, 5.1+ = 10 points

- c. Other factors that could start fires. (Industrial sites, logging areas, recreational sites, railroads, etc) 11 activities = 0 points, 12-22 activities = 5 points, 23 or more activities = 10 points.
Maximum number of *Risk* points possible = 40 Minimum number = 5
- **Hazard**-What is the resistance to control once a wildfire starts, including weather, topography and fuels?
 - a. Weather (the entire East side of the Cascade Range gets 40 points)
 - b. Topography (slope) 0-25% = 0 points, 26-40% = 2 points, 41%+ = 3 points.
 - c. Aspect (the direction a slope faces) N,NW,NE = 0 points, W or E = 3 points, S/SW or SE = 5 points
 - d. Elevation--- above 5001' = 0 points, 3501 to 5000 = 1 point, 0-3500 = 2 points.
 - e. Vegetation (based on the vegetation, what is the anticipated fire behavior-- specifically what is the anticipated flame length?) Fuels producing flame lengths of less than 5 feet = 5 points, fuels producing flame lengths of 5-8 feet = 15 points, fuels producing flame lengths over 8 feet = 20 points
Maximum number of points possible for *Hazard* = 70 points
Minimum number = 45 points
 - **Protection Capabilities**-What are the risks associated with wildfire protection capabilities, including capacity and resources to undertake fire prevention measures?
 - a. Is there an organized structural or wildland fire response?
 - Both structure/wildland response = 5 points
 - Wildland response only = 15 points
 - No response = 40 points
 - b. Response times.
 - Organized structural response in less than 10 minutes = 0 points.
 - Structural response in more than 10 minutes = 8 points
 - Wildland response only in less than 20 minutes = 15 points
 - No response or a wildland response of more than 20 minutes = 36 points
 - c. How well prepared is the community for a large fire?
 - Organized stakeholder group, community fire plan, phone tree, etc = 0 points.
 - Primarily agency efforts (mailings, fire free, etc) = 2 points
 - No efforts = 4 points

Maximum number of points possible for *Protection Capabilities* = 80 points
Minimum number = 5 points
 - **Values Protected**-What are the human and economic values associated with communities or landscapes?
 - a. Home density (number of homes per 10 acres)
 - 0.1 to 0.9 = 2 points

1 to 5 = 15 points

5.1+ = 30 points

- b.** How much infrastructure is present? (includes power lines, transportation corridors, cell towers, recreational/cultural sites, etc.)

None = 0 points

One = 10 points

More than one = 20 points

Maximum points possible for *Values Protected* = 50 points

Minimum points = 2 points

- **Structural Vulnerability**-What is the likelihood that structures will be destroyed by wildfire?
 - a.** How combustible is the roofing?
 - Class A = 0 points
 - Class B = 5 points
 - Class C = 10 points
 - Non-rated roof = 20 points
 - b.** How combustible is the siding and decks?
 - Fire resistant siding, eaves, and deck = 0 points
 - Fire resistant siding, but eaves and deck are combustible = 5 points
 - Combustible siding and deck = 10 points
 - c.** How far back from a slope is the building set back?
 - 0 to 30 feet = 1 point
 - More than 30 feet = 5 points
 - d.** Does the home have adequate defensible space? (the space between the home and wildland fuels)
 - More than 100 feet = 1 points
 - 71 to 100 feet = 3 points
 - 30 to 70 feet = 10 points
 - Less than 30 feet = 25 points
 - e.** What is the distance between structures?
 - More than 100 feet apart = 0 points
 - 60-100 feet apart = 3 points
 - Less than 60 feet apart = 5 points
 - f.** Is there adequate ingress/egress?
 - Two or more roads in/out = 0 points
 - One road in/out = 7 points
 - g.** Is road width adequate to permit fire equipment to get to the home?
 - More than 24 feet wide = 0 points
 - 20 to 24 feet wide = 2 points
 - Less than 20 feet wide = 4 points
 - h.** What is the condition of the road?
 - Surfaced road with a grade of less than 5% = 0 points
 - Surfaced road with a grade of more than 5% = 1 point
 - Non-surfaced road with a grade less than 5% = 1 point
 - Non-surfaced road with a grade of more than 5% = 3 points

Other than all-season road = 4 points
Maximum points possible for *Structural Vulnerability* = 80 points
Minimum points = 2 points

3.3 County-wide Risk Assessment

For the purposes of looking at the county in a very broad sense, we divided the county into three geographical zones: West, Central, and East. The West Zone contains most of the coniferous forests in the county. The Central Zone is the flattest zone and contains most of the population as well as the majority of the agricultural activities. The East Zone is largely comprised of rolling hills with grass, juniper and sagebrush and is sparse in population.

For these zones, we only considered “risk” and “hazard” and performed the risk assessment based on these two items (see Maps 5 and 6 in Appendix E).

It should be noted that the reason the East Zone is rated as a “moderate” risk is due to the fact that it lacks population and has fewer industrial and recreational activities, thus fewer human caused fires than the West and Central Zones.

3.4 Community Risk Assessments

After the county wide assessment was complete, the CWPP Team then completed risk assessments (as described in 3.2 above) on each of the communities identified as “at risk”. The results of the assessment are summarized below followed by a tabular format including a list of action items as identified by each community.

3.4.01 Summary Sheet

The chart below (Figure 3-4) summarizes the information for each community and provides an opportunity to compare the communities within Jefferson County. The adjective rating for each community is for relative comparison purposes *only* as the Oregon Risk Assessment Model does not provide information for overall adjective ratings.

The CWPP team developed point breaks so that an adjective rating could be established. The Team felt that an adjective rating would help us to focus on the communities that were most “at risk”. Those breaks are as follows:

170 points + = High
130 to 169 = Moderate
Less than 130 = Low

Again, the adjective ratings are for comparison purposes only. Use of these adjective ratings in any other way may be misleading.

Figure 3-4
Jefferson County CWPP Risk Assessment -- Summary Sheet

Community Name	Risk	Hazard	Protection	Values	Str.Vuln.	Total Pts.	Rating
Three Rivers	25	67	15	12	40	159	Moderate
Crooked River Ranch	25	67	8	22	58	180	High
Ashwood	15	70	36	22	51	194	High
Gateway	30	57	40	30	32	189	High
Round Butte	30	69	12	30	42	183	High
North Madras Heights	30	65	4	30	60	189	High
Juniper Crest	30	67	4	30	38	169	Moderate
Mad Ranchos/Canyon View	30	65	4	22	32	153	Moderate
Forest, Rim, & Air Parks	30	67	39	2	83	221	High
Shamrock Estates	30	62	4	30	36	162	Moderate
Juniper Butte	30	64	12	30	38	174	High
High Chaparral	30	64	12	30	28	164	Moderate
See's	30	62	12	30	44	178	High
Seekseequa	35	54	10	35	21	155	Moderate
Warm Springs	35	61	2	35	46	179	High
County Line	35	62	10	35	21	163	Moderate

3.4.02 Three Rivers

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	0	5	40	0	5	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
15	0	2	10

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
5	5	1	13	16

Total Points = 159

Adjective Rating = Moderate

Three Rivers is a remote community that has been impacted by wildfire in the last decade. Since the community is within a high fire occurrence area, residents should expect additional wildfire events in the future and prepare accordingly.

The priority items for Three Rivers are;

1. **Fuels Reduction.** Three Rivers is at risk from fire spreading through fuels within the boundaries of the subdivision and from adjacent lands that are owned by PGE, Crooked River National Grasslands, BLM, CTWS and privately owned parcels. Fuels need to be reduced in all these areas, especially in the canyon areas near residences and around safety zones. Failure to implement fuels reduction in these areas could result in loss of life or property.
2. **Access.** Evacuation and fire apparatus response are hindered by a lack of access routes and driveways which are too narrow to maneuver larger pieces of fire equipment.
3. **Defensible Space.** Residents need to continue to widen and maintain the space between wildland fuels and adjacent homes & structures.

3.4.03 Crooked River Ranch

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	0	5	40	2	3	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	0	2	20

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0,10,5,10	10,5,10,10	5,1,5,5	25,28,25,30	7,10,12,14

Note: the four numbers appearing in each box of *structural vulnerability* depict the four zones of the ranch. See Chief Langley for additional information.

Total Points = 180 (average for the four zones)

Adjective Rating = High

The priority items for Crooked River Ranch are:

1. Fuels reduction. The ranch is at risk from fuels on adjacent lands managed by Crooked River National Grasslands and BLM, and by privately owned lands, some of which are owned by the Ranch. These fuels need to be reduced to assist with structure protection and wildland fire suppression activities.
2. Access and egress. There is a need to improve existing evacuation routes and develop additional evacuation routes on the Ranch.
3. Defensible space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
4. Establish “Safe Zones” within CRR boundaries. Safe Zones are areas where humans can survive a passing wildfire front within the confines of their car. Safe zones need to be pre-identified, signed and maintained.

3.4.04 Ashwood

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
15	0	5	40	3	5	2	15

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
36	0	2	20

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
10	10	5	13	13

Total Points = 194

Adjective Rating = High

The priorities for Ashwood:

1. Develop additional water sources. Water supply opportunities are limited in the Ashwood area.

Editor's note:

In honoring the Ashwood community's individuality need, we have captured the one need (additional water sources) that was brought to the Team's attention. At some point in the future, the Ashwood residents may want to consider the formation of a Rangeland Protection Association (RPA). An RPA is simply an association of local residents providing wildland fire protection to an area—the size of which would be identified by the RPA membership. The Board of Directors of the RPA (people from Ashwood) would determine the assessment amount for each landowner that they protect. This assessment could vary and could be as little as zero dollars. Because an RPA is acknowledged by the State as a legitimate fire protection association, there could be some distinct advantages to the Ashwood residents:

1. Obtaining help from State and Federal agencies during severe fire situations through the use of "Mutual Aid Agreements".
2. The RPA would have access to fire equipment through FEP (Federal Excess Program).
3. Fire training could be obtained from other agencies in conjunction with a Mutual Aid Agreement.

Additional information is available at the Central Oregon ODF office in Prineville. Contact Bob Young at (541) 447-5658.

3.4.05 Gateway

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	0	0	2	15

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
36	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	10	11

Total Points = 189

Adjective Rating = High

The priority items for Gateway:

1. Fire Protection. The homeowners need to consider alternatives for providing fire protection to their neighborhoods.
2. Defensible Space. Homeowners need to continue to work on widening the space between themselves and combustible fuels.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.

3.4.06 Round Butte

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	2	5	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
10	10	5	10	7

Total Points = 183

Adjective Rating = High

The priorities for Round Butte Subdivision:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private, BLM, and National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.

3.4.07 North Madras Heights

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	0	3	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
0	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
10	10	5	25	10

Total Points = 189

Adjective Rating = High

The priorities for North Madras Heights:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private land owners/managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.
4. Develop additional escape routes. This will be especially important with future development that is likely to occur in this area.

3.4.08 Juniper Crest

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	0	5	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
0	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	5	13	10

Total Points = 169

Adjective Rating = High

The priorities for Juniper Crest:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.

3.4.09 Madras Ranchos/Canyon View

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20,20	10,5	0,0	40,40	0,0	3,3	2,2	20,20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
0,0	4,4	30,15	0,0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
10,0	10,10	1,1	13,10	4,4

Total Points = 153 (Average)

Adjective Rating = Moderate

The priorities for Ranchos and Canyon View:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.

3.4.10 Forest, Rim, & Air Parks

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20 all	5 all	5 all	40all	0 all	5 all	2 all	20 all

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
15 all	4 all	2 all	0 all

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
5 all	10,5,5	5,1,5	28,30,30	22 all

Total Points = 221

Adjective Rating = High

The priorities for Forest Park, Rim Park and Air Park:

1. Fuels Reduction: Private, BLM and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
2. Access and Egress: Roads need to be improved and/or added to provide for a safe evacuation route for local residents to escape an on-coming wildfire while firefighting vehicles are trying to make their way into the area to protect the structures. Additionally, driveways need to be improved so as to permit the passage of structural protection vehicles.
3. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
4. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.
5. Fire Protection. The homeowners need to consider alternatives for providing fire protection to their neighborhoods.

3.4.11 Shamrock Estates

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	0	0	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
0	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	13	12

Total Points = 162

Adjective Rating = Moderate

The priorities for Shamrock Estates:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private, BLM, and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.

3.4.12 Juniper Butte

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	2	0	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
5	10	5	10	8

Total Points = 174

Adjective Rating = High

The priorities for Juniper Butte Subdivision:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.
4. Access and Egress: Roads need to be improved and/or added to provide for a safe evacuation route for local residents to escape an on-coming wildfire while firefighting vehicles are trying to make their way into the area to protect the structures. Additionally, driveways need to be improved so as to permit the passage of structural protection vehicles.

3.4.13 High Chaparral

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	2	0	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	13	4

Total Points = 164

Adjective Rating = Moderate

The priorities for High Chaparral:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private, State, BLM, and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.

3.4.14 See's

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	10	0	40	0	0	2	20

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	4	30	0

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	13	20

Total Points = 178

Adjective Rating = High

The priorities for See's Subdivision:

1. Defensible Space. Homeowners need to continue to work on widening the space between structures and combustible fuels.
2. Fuels Reduction: Private, State, BLM and Crooked River National Grasslands land managers need to take action to reduce fuels on their lands when they are adjacent to Wildland Urban Interface areas. The fuels need to be reduced so that firefighters can fight the fires on the ground. Fuel loads need to be altered and maintained so that no more than a 5 foot flame length is produced on the average worst day in fire season.
3. Public Education. Homeowners and the recreating public need to understand that they are living and playing in a fire-prone environment. They need to know where to go and what to do when a fire occurs in their vicinity. They need to understand what building materials should be used and what kind of access is necessary for firefighters to adequately protect their homes.
4. Access and Egress: Roads need to be improved and/or added to provide for a safe evacuation route for local residents to escape an on-coming wildfire while firefighting vehicles are trying to make their way into the area to protect the structures. Additionally, driveways need to be improved so as to permit the passage of structural protection vehicles

3.4.15 Seekseequa

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	5	10	40	2	5	2	5

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	2	15	20

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	10	0

Total Points = 155

Adjective Rating = Moderate

The priorities for Seekseequa are:

1. Mapping the location of homes.
2. Prevention education programs.
3. Maintaining fuel breaks.
4. Brushing and limbing of trees in and around housing.

3.4.16 Warm Springs

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	5	10	40	0	5	1	15

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
0	2	15	20

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	30	5

Total Points = 179

Adjective Rating = High

The priorities for Warm Springs:

1. Mapping of houses by name and numbers.
2. Defensible space around homes.
3. Brushing and limbing of trees in and around housing developments.

3.4.17 County Line

Risk			Hazard				
Fire Occurrence	Ignition Risk	Other Factors	Weather	Slope	Aspect	Elevation	Vegetation
20	5	10	40	0	5	2	15

Protection Capability		Values Protected	
Fire Response	Community Prep.	Home Density	Infrastructure
8	2	15	20

Structural Vulnerability				
Roofing	Building Mat.	Setback	Def. Space	Access
0	10	1	10	0

Total Points = 163

Adjective Rating = Moderate

The priority projects for County Line:

1. Fuels reduction projects and development of fuel breaks.
2. Limb trees adjacent to homes.
3. Develop fire education programs directed to area problems.
4. Maintenance of fuel breaks.
5. Provide for defensible space around homes.

4.0 County Hazard Reduction Priorities

Each of the communities listed above have specific measures that would reduce their overall score, indicating less susceptibility to the effects of wildland fire. The priorities listed for each community should be pursued to make that community more resilient to the effects of a wildfire. Additionally, some serious problems surfaced during the risk assessment process that should be considered for accomplishment within the next calendar year:

- 1) Forest Park/Rim Park/Air Park. These communities are most “at risk” in Jefferson County. Federal and private land owners need to begin to reduce fuels within the WUI. Crown fire potential should be eliminated and fuels altered and maintained to produce no more than a 4-foot flame length during the height of the fire season. Homeowners in these communities need to provide defensible space around their structures and consider replacing existing flammable building materials with fire resistant materials.
- 2) Crooked River Ranch, Three Rivers, & Forest/Rim/Air Park. These communities presently have a lack of adequate evacuation routes. The county needs to work with ODOT, private landowners and federal land managers in establishing alternate or additional evacuation routes, and designated safe zones within the communities.
- 2) General comments:
 - a. All Communities. A common problem that was found during the risk assessments was a lack of safe zones for residents to go to instead of clogging the roads with evacuation traffic. All communities in Jefferson County need to identify, develop, sign and maintain areas in which residents can survive a wildfire simply by staying inside of their vehicles.
 - b. The County. The CWPP team identified a number of items that the county could undertake in order to assist with some of the problems noted in the risk assessment process. These are:
 - Review building codes to ensure that citizens living in fire prone areas are not contributing to an existing problem.
 - Engage federal and private landowners in reducing wildland fuels on the land they manage in order to protect adjacent communities.
 - Establish a public education program that will educate local citizens regarding:
 - a. living in a fire prone environment,
 - b. evacuation routes and “safe” areas,
 - c. fire resistant building and roofing materials, and
 - d. the need to provide defensible space around homes and other structures.

- Explore ways to provide safe access and egress during wildfire events,
- Look for opportunities to provide structure protection to communities that need it, and
- Support development of infrastructure protection. This includes key recreation sites that have not been included in established communities. (See “Critical Infrastructure” below).

5.0 Recommendations to Reduce Structural Ignitability

Landowners need to share responsibility in protecting their homes from the effects of wildfire. This can be accomplished by:

1. Installing and maintaining a fire resistant roof.
2. Install and maintain fire resistant siding and decking.
3. Establish and maintain defensible space around structures.
4. Limb up trees to reduce ladder fuels.
5. Use only fire resistant vegetation next to buildings.
6. Practice aggressive debris management, particularly on roofs, eaves and gutters, under decks, and around structures.
7. Plan for, install and maintain access/egress to their property for structure protection vehicles.

The county should develop an aggressive fire safety public education program, should provide pamphlets and other educational materials to property owners applying for building permits, and adopt regulations that require the landowner to make new structures fire resistant.

6.0 Critical Infrastructure

In addition to the “at risk” communities, the CWPP committee also had discussions regarding critical infrastructure. Communication sites, electrical transmission lines, gas lines, highways, state parks, campgrounds, bridges, and railroad lines are located in Jefferson County. Of the critical infrastructure considered, no one item deserves more attention than evacuation routes from recreational sites. First and foremost among these is the evacuation route from The Cove State Park which receives approximately one million visitors annually. The CWPP committee encourages the county to look more closely at this potential problem so as to avoid life-threatening situations when the time comes to evacuate that particular area. The steep, narrow, winding road that provides access and egress to this popular spot could easily be made impassable during a critical situation. Hundreds of lives could be at risk during one fire episode. In addition to the recommendations contained in previous sections, the CWPP Team recommends the following item for accomplishment with regards to critical infrastructure by June of 2006:

Coordinated efforts by County Roads Department, ODOT, Jefferson County Sheriffs Office, and Oregon State Parks to develop additional evacuation routes or improve existing routes. The priorities for this task are the Cove State Park, Three Rivers, and Crooked River Ranch.

7.0 Action Plan

It is the recommendation of the CWPP Team that, as a minimum, the following actions take place in 2006.

1. Develop short and long-range fuels treatment plans on private and federal land near Air Park/Rim Park/Forest Park to reduce the hazard near that community. Implement those plans as soon as possible.

Recommended Lead: Bryan Scholz and Rena Thompson

Recommended Support Group: Crooked River National Grasslands Manager, COFMS Fire Management Officer, Prineville BLM District Manager, Ochoco National Forest Supervisor, Three Rivers VFD Chief, and Homeowners groups.

2. Reduce fuels created by the Eyerly fire in Three Rivers. The evacuation routes are unsafe due to the number of standing dead trees. These trees need to be felled and removed so as not to contribute to an existing problem.

Recommended Lead: Gary Cook and Rena Thompson

Recommended Support Group: PGE Manager, WS Tribe FMO, Three River VFD Chief, and Homeowners Association.

3. Improve evacuation routes/add evacuation routes for Three Rivers, Crooked River Ranch, and The Cove Pallisades State Park.

Recommended Lead: Jefferson County Sheriff Emergency Operations

Recommended Support Group: ODOT Manager, State Parks District Manager, Jefferson County Road Manager, and Jefferson County Sheriff.

8.0 Monitoring & Annual Review

An effective monitoring process for the CWPP is important to ensure that resources are being utilized effectively, efforts from various agencies are well coordinated and complimentary, and that duplication of effort is minimized.

Biannual Review

Not less than biannually, the Jefferson County CWPP Steering Committee will conduct a review of the overall CWPP effort. They will identify changes or updates needed in the Plan, evaluate effectiveness of coordination between cooperating agencies, community groups and neighborhoods, evaluate progress in meeting specific performance measures,

and adjust any established monitoring protocols as needed. Coordination and communication will be the critical operative requirements.

The CWPP Steering Committee will be made up of the following at a minimum:

- Fire Chief, Jefferson County Fire District #1.
- Emergency Management Director, Jefferson County Sheriff's Office
- Unit Forester, Oregon Department of Forestry
- Representatives from Three Rivers, Crooked River Ranch, and Ashwood.
- Recommended additional representation would include as a minimum, *ex officio* representation from Central Oregon Fire Management Services (Ochoco National Forest Service and Prineville District, Bureau of Land Management).

Recommended performance measures for the steering committee include the following:

1. Understand the scope of the wildfire problem and potential in Jefferson County.

Performance measures:

- Communities and at-risk infrastructure identified and mapped. Updates completed, documented and incorporated into the CWPP.
- Wildland-urban-interface (WUI) identified and mapped. Any need for updates is evaluated and documented.
- Fire Atlas compiled and updated annually.

2. Reduce hazardous fuels.

Performance measures:

- Lowered risk assessment scores for communities within the county as assessed by local fire departments.
- Reduction in potential flame lengths. In areas where the potential flame lengths exceed 5', reducing the fuels so that the potential flame length is 5 feet or less. This needs to be accomplished on federal lands, tribal, state and private lands and should be measured in acres. Accomplishment reporting to be submitted at annual CWPP review meeting.
- Total number of acres treated through fuel reduction measures. Accomplishment to be reported at the annual CWPP review meeting.

3. Reduce structural ignitability.

Performance measures:

- Number of acres/local community areas where defensible space is established around individual homes or clusters of homes. Assessment and reporting to be accomplished by local fire departments.
- Number of structures lost to wildland fire. Report to come from appropriate wildland protection agency.

4. Coordinate WUI treatment activities on adjoining public and private lands.

Performance measures:

- Number or percentage of WUI areas where complementary treatments occurred (within two years). Report to come from land manager or land owner and submitted at annual CWPP review meeting.
- Number or percentage of WUI treatment areas where public and private mitigation measures were conducted simultaneously or under a unified plan. Report to be submitted by appropriate land manager or land owner and presented at annual CWPP meeting.

5. Provide for safety of public during wildfire incidents.

Performance measures:

- County-wide and local community evacuation processes developed. Progress report to come from Jefferson County Sheriffs Office and submitted at the annual CWPP review meeting.
- Number of fire response or evacuation drill exercises performed. Jefferson County Sheriffs Office would submit accomplishment report at annual CWPP review meeting.
- Number of “safe zones” that have been established within a community. Local Homeowners Groups in coordination with local fire departments would report accomplishments at annual CWPP review meeting.

6. Promote community involvement and awareness

Performance measures:

- Number of outreach or education events held. Each local fire department or homeowner group would record and report this information at the annual CWPP review meeting.
- Assessment of overall participation in neighborhood fuels treatment initiatives. This would be assessed by the local fire departments or homeowners group and would be reported annually at the CWPP review meeting.

The ability to predict fire behavior based on treatment effects and levels could be a powerful tool in gaining community understanding, acceptance and support for engaging in fuels treatments around homes. This approach could be used to enhance community involvement.

Appendix A: Summary of Public Comments

-Madras meeting 8/11/2005 held at Jefferson Co. FD#1 Fire Station:

{3 citizens attending}

Comment 1: *The County needs to ban the use of burn barrels in communities that are high risk to wildfire.*

Comment 2: *The County needs to ban the use of fireworks.*

-Crooked River Ranch meeting 8/15/2005 held at CRRRFPD main station:

{12 citizens attending}

Comment 1: *The Ranch needs to pursue alternate evacuation routes.*

-Three Rivers meeting 8/17/2005 held at Three Rivers Recreation Hall:

{22 citizens attending}

Comment 1: *PGE & The Tribe adjoins our land. It burned in the Eyerly Fire. Their trees are falling across our road and we had reps come up. They will do nothing about the trees and only seemed to be interested in the past that the grass was growing. This afternoon I watched kids on an ATV drive right by the “No Trespassing” sign that we had put up and drive through that tall dry grass. Why can’t we have a buffer zone?*

Comment 2: *Multiple ownership on multiple lots only being charged for one lot of fire protection—should be a lot-by-lot charge.*

Comment 3: *Concern about parties on lands outside of 3 Rivers and not being adequately patrolled by themselves (BLM).*

Comment 4: *Possibly involve large landowners such as PGE to see what they would be able to do to help make fuel break or buffer adjacent to 3 Rivers.*

Comment 5: *(Need) siren system or larger flag on pole if fire (occurs).*

Comment 6: *What about evacuation of folks w/disabilities?*

Comment 7: *Clean up of burned trees from past fires.*

Comment 8: *Grant \$ for older/disabled residents to help with defensible space.*

Comment 9: *Weekend ATV use and party fires—(Need) County planner’s involvement (to develop) potential for punitive results. Where are the “teeth” (for dealing with) weekenders and non-residents?*

Comment 10: *(Need) handouts and prevention materials.*

Comment 11: *Reducing fuels on the outside (areas that are out of control).*

Comment 12: *Quarterly newsletter submissions.*

Comment 13: *Need to analyze/remove hazard trees along main roads or evacuation routes.*

Comment 14: *We are concerned about evacuation routes for Crooked River Ranch, also.*

-Warm Springs I.R. Meeting 8/22/2005 held at Fire Center:

{No citizens attended the meeting}

-Ashwood meeting 8/24/2005 held at Ashwood School:

{8 citizens attending}

Comment: *The idea of developing a WUI boundary is not significant to this group as the majority of the land in the area is privately-owned. Since this area is unprotected, most fire response is neighbor helping neighbor. Developing water sources would help improve this effort and the water sources would also be available to other agencies as needed to suppress wildland fires.*

Appendix B: Core Team Members

Jefferson County CWPP Core Team:

Earl Cordes, Fire Chief, Jefferson County FD#1
Larry Langley, Fire Chief, Crooked River Ranch Rural FD
Rena Thompson, Assistant Fire Chief, Three Rivers VFD
Chris Gannon, Jefferson County Planning
John Marston, Resident of Ashwood
Bryan Scholz, Crooked River National Grasslands
Lisa Clark, COFMS
Rock Gerke, Oregon Dept. of Forestry, Central Oregon District
Allison Waite, Jefferson County Emergency Services
Gary Cook, Confederated Tribes of Warm Springs FMO
Ken Lydy, Confederated Tribes of Warm Springs
Mike Skeels, Crooked River Ranch RFD
Ann Walker, Oregon Dept. of Forestry, Salem,

Jefferson County CWPP Writers/Editors:

Writer: Rock Gerke
Lisa Clark
Editors: Earl Cordes
Chris Gannon
Ann Walker

Appendix C: Documentation of Biannual Review

This section will contain future documentation of the biannual review process including, but not limited to:

- a- meeting notes
- b- attendance records
- c- task assignments
- d- due dates & time lines, and
- e- reports & recommendations

Appendix D: Glossary of Terms and Acronyms

Aspect – the direction a slope faces (e.g., a slope that faces north has a northern aspect).

BLM – Bureau of Land Management.

Community at Risk – a community that has significant amount of wildland fuels. Untreated, these fuels pose a threat to the safety of the residents and a danger to the homes occupied by the residents.

COFMS – Central Oregon Fire Management Service. Comprised of Prineville BLM, Ochoco National Forest, Deschutes National Forest, Crooked River National Grasslands.

CRNG – Crooked River National Grasslands.

Flame Height – the vertical distance between the bottom of the flame and the top of the flame.

Flame Length – the length of the flame from where it occurs on the lowest portion of a fuel to the very tip of the flame.

Fuel – anything that will burn when exposed to the combustion process.

Hazard – for the purposes of this CWPP, hazard is comprised of the fuels present on a site, the topography, and the weather. Also considered is the flame length that a fuel or forested area will produce during the driest portion of the fire season.

ODF – Oregon Dept. of Forestry.

OHV – off highway vehicle.

Risk – for the purposes of this CWPP, risk is defined as the likelihood of a fire occurring and considers both natural ignitions (lightning) as well as any human activity that could cause an ignition.

Safety Zone – an area where a wildland firefighter can go to escape an oncoming fire without needing to deploy his/her fire shelter.

Safe Zone – (for the purposes of this CWPP) a large area that is free of combustible fuel that is designated, signed, and maintained in a condition where humans in automobiles may park and survive a passing wildfire. The person(s) would stay in their automobile during the passage of the wildfire.

Unprotected land – Land that has no organized fire suppression response when a fire—either structural or wildland—occurs.

Wildland – areas that have natural occurring vegetation and are, for the most part, not groomed or cultivated.

Wildland fuel – all dead and/or living vegetative matter which will combust and contribute to the spread of a fire.

Appendix E: Reference Documents & Maps

This section contains all the reference documents and maps referred to throughout the main document. These are found on the following pages and labeled for ease of use.

Volume II: Hazard Annex

Windstorm

Causes and Characteristics of the Hazard

Extreme winds occur throughout Oregon. 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 southeast 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.

The Columbus Day storm in 1962 was the most destructive windstorm ever recorded in Oregon in terms of both loss of life and property. Damage from this event was the greatest in the Willamette Valley. The storm killed 38 people and left over \$200 million in damage. Hundreds of thousands of homes were without power for short periods, while others were without power for two to three weeks. More than 50,000 homes suffered some damage and nearly 100 were destroyed. Entire fruit and nut orchards were destroyed and livestock killed as barns collapsed and trees blew over. In Portland, the highest gusts were 116 miles per hour.

Although rare, tornados can and do occur in Oregon. In 1996, a small, short-lived tornado touched down near Forest Grove in Washington County. It uprooted several dozen fruit trees and left a path of damage one-quarter mile long and nearly 60 yards in width at its widest point.

History of the Hazard in Your Community

Wind storms occur yearly; more destructive storms occur once or twice per decade, most recently in December 2007. The following wind storms have occurred and/or affected Jefferson County:

- April, 1931: N. Central Oregon; unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber.
- November 10-11, 1951: Statewide; widespread damage; transmission and utility lines; wind speeds 40-60 mph; gusts 75-80mph.
- December 1951: Statewide; wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
- December 1955: Statewide; wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines.

- November 1958: Statewide; wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees.
- October 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.
- March 1971: Most of Oregon; greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane County.
- November 1981: Statewide; severe wind storm.
- December 1991: North Central Oregon; severe wind storm; blowing dust. Damage reported in Bend (Deschutes County).
- December 1995: Statewide; severe wind storm.
- 1996 - 2005: Undocumented wind storms (average one per year).
- May 2006: Jefferson County; sustained winds caused extensive tree damage.
- December 2007: Statewide; severe wind storm, especially for the coast.

Risk Assessment

How are Hazard Areas Identified?

All of Jefferson County is at risk for wind storms. Due to the multitude of variables, such as wind speed, direction, and temperature, each storm is capable of causing extensive damage in any part of the County.

Probability of Future Occurrence

Windstorms affect Jefferson County on nearly a yearly basis, especially in the Crooked River Ranch area where winds can reach 65 mph. More destructive storms occur once or twice per decade. High wind events on the order of the 1962 Columbus Day storm are thought to have a 100-year recurrence interval.

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a high level of probability for wind storms, meaning one incident is likely within a 10 - 35 year period. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.¹ The high ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Vulnerability Assessment

Many buildings, utilities, and transportation systems within Jefferson 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 Jefferson County, trees are more likely to blow over during the winter (wet season). Also, irrigation wheel lines frequently get tangled in wind storms, and ultimately affect the agriculture economy.

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a moderate level of vulnerability for wind storms, meaning 1-10% of the population or region assets are likely be affected by a major emergency or disaster. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.ⁱⁱ The moderate ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Risk Analysis

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

Community Hazard Issues

What is susceptible to damage during a hazard event?

Windstorms can have significant impacts on life and property. Debris carried along by extreme winds can contribute directly to injury and loss of life and indirectly through the failure of protective structures (i.e., buildings) and infrastructure. Windstorms have the ability to cause damage more than 100 miles from the center of storm activity. High winds can topple trees and break limbs which in turn can result in power outages and disrupt telephone, computer, and TV and radio service.

In addition to the immediate effects of wind damage, the loss of power due to windstorms can have widespread impacts on business and economic activity. A sustained loss of power can also seriously strain provision of emergency services and the operation of water and sewer facilities and transportation systems.

For more information on the windstorm hazard, please visit the state plan's Windstorm chapter.

Existing Hazard Mitigation Activities

The Oregon Building Code sets standards for structures to withstand 80 mph winds.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of windstorms in Jefferson County. Please see full action item worksheets in Appendix A.

Windstorm #1: Educate property owners on how to properly maintain trees to prevent power loss on power lines off the right of way.

Multi-hazard #2: Develop an education and outreach program to educate residents about all the natural hazard events in Jefferson County and to provide them with mitigation activities they can take to reduce the impact of natural hazards.

ⁱ Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

ⁱⁱ Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Volume II: Hazard Annex

Winter Storm

Causes and Characteristics of the Hazard

Destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds have a long history in Oregon. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. 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 eastside 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.

An example of this type of snowstorm occurred in January 1980 when snow, ice, wind and freezing rain struck Oregon statewide. In the Portland area alone, 200,000 utility customers were left without power and phone service for several days.

History of the Hazard in Your Community

December 1861: Entire state; storm produced between 1 and 3 feet of snow.

December 1893: Northern counties; between 15 and 30 inches of snow fell throughout the northern counties.

January 1916: Entire state; two storms. Heavy snowfall, especially in mountainous areas.

January, February 1937: Entire state; deep snow drifts.

January 1950: Entire state; record snow falls; property damage throughout state. 28 inches of snow in Madras.

March 1960: Entire state; many automobile accidents; two fatalities.

January 1969: Entire state; heavy snowfall throughout state.

January 1980: Entire state; series of string storms across state. Many injuries and power outages.

February 1985: Entire state; two feet of snow in northeast mountains; downed power lines. Fatalities.

February 1986: Central / Eastern Oregon; heavy snow in Deschutes Basin. Traffic accidents; broken power lines.

March 1988: Entire state; strong winds; heavy snow.

February 1990: Entire state; heavy snow throughout state.

November 1993: Cascade Mountains; heavy snow throughout region.

Winter 1998-99: Entire state; one of the snowiest winters in Oregon history (snowfall at Crater Lake: 586 inches).

December 28, 2003 – January 9, 2004: Most of Oregon. Preliminary damage assessments from this event estimated almost \$16 million dollars in impacts to state and local agencies across most of Oregon.

November 2005: Snow fall and dropping temperatures halted road extension projects on J Street.

January, 2006: Rainfall on top of heavy snow in late December resulted in flooding problems.

November 28, 2006: Heavy snow causes school sport cancellations.

January, 2008: heavy snow and single digit weather

Sources: Region 6 Central Oregon Profile & Risk Assessment, March 2006; the Madras Pioneer Archives.

Risk Assessment

How are Hazard Areas Identified?

Winter storms occur in all parts of the County. The extent depends upon air temperatures, and the level of moisture in the atmosphere. Between December and February, snow storms regularly occur over eastern Oregon, including parts of central Oregon and Jefferson County. Average annual snowfall in Bend, just south of Jefferson County, is 34.8 inches.

Probability of Future Occurrence

The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods. The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a high level of probability for winter storms, meaning one incident is likely within a 10-35 year period. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.ⁱ The high ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Vulnerability Assessment

Perhaps the most advantageous aspect of Central Oregon's cold and snowy winters is the fact that the region is typically prepared, and those visiting the region usually come prepared. As can be expected, however, there are occasions when preparation cannot meet the challenge. In Jefferson

County, extreme cold and heavy snow can disrupt farming practices. Likewise, schools have trouble heating their buildings. During heavy snow events, the limited numbers of snow plows are unable to clear side streets. As a result, school buses sometimes cannot run. The constant freezing and melting of snow around manholes often lead to potholes, and power outages can be frequent in adverse weather. Finally, extreme cold can cause water breaks when temperatures drop below 10 F. Specific estimates of property and infrastructural damages for winter storm events are not available at this time. See 'Community Hazard Issues' below for a greater description of the County's vulnerabilities to winter storms.

The Region 6 Central Oregon Profile and Risk Assessment describes Jefferson County as having a high level of vulnerability for winter storms, meaning more than 10% of the population or region assets would likely be affected by a major emergency or disaster. This score is based on an analysis of risk conducted by county emergency managers, usually with the assistance of a team of local public safety officials.ⁱⁱ The high ranking is additionally supported by members of the Jefferson County Natural Hazards Mitigation Steering Committee.

Risk Analysis

Estimates for losses given specific hazard events (i.e., impacts to life and property in hazard prone areas) are not available at this time.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Severe winter weather can be a deceptive killer. 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 which 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.

As was noted above under windstorms, 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 uninsulated water lines serving schools, businesses, and industry and individual homes. If lasting more than several days, all of these effects can

create significant economic impacts for the communities affected as well as the surrounding region, and even outside of Oregon. In the rural areas of Oregon severe winter storms can isolate small communities, farms and ranches and create serious problems for open range cattle operations such as those in southeastern Oregon.

For more information on the winter storm hazard, please visit the state plan's Winter Storm chapter.

Existing Hazard Mitigation Activities

Studded tires can be used in Oregon from November 1 to April 1. They are defined under Oregon Law as a type of traction tire. Research shows that studded tires are more effective than all-weather tires on icy roads, but can be less effective in most other conditions.

Highway maintenance operations are guided by local level of service (LOS) requirements. In general, classifications of highways receive more attention. Routes on the National Highway System network, primary interstate expressways and primary roads, will be cleared more quickly and completely. Critical areas like mountain passes will have snow-chain requirements for vehicles, and many local streets are "snow emergency routes" that will be cleared of parked cars. Parking lot and sidewalk snow removal is mostly the responsibility of property owners, sometimes by local ordinance.

Oregon Department of Transportation (ODOT) spends about \$16 million per year on snow and ice removal from the state highway system.

TripCheck provides traffic incident, weather, and highway condition reports, as well as useful links to bus, rail, airport, and truck information. It contains images from approximately 140 road cameras, including over 40 in rural areas such as mountain passes where knowing road conditions can be crucial to safety: <http://www.TripCheck.com/>.

All "existing hazard mitigation activities" information comes from the "Winter Storm" Chapter of Oregon's State Natural Hazard Mitigation Plan.

Hazard Mitigation Action Items

The following actions have been identified by the Jefferson County Natural Hazards Mitigation Steering Committee, and are recommended for mitigating the potential effects of winter storms in Jefferson County. Please see full action item worksheets in Appendix A.

Winter Storm #1: Educate property owners on how to properly maintain trees to prevent power loss on power lines off the right of way.

Winter Storm #2: Explore funding options to obtain equipment, such as power generators and plowing and pumping equipment, to help respond to winter storm events.

ⁱ Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

ⁱⁱ Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Volume III: City Addenda

Culver

Overview

The City of Culver developed this addendum to the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Culver, Oregon, which include drought, earthquake, flood, landslide, volcano, wildfire, windstorm, and winter storm. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the City. 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.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or flood mitigation programs. The actions described in the addendum are intended to be implemented through existing plans and programs within the City.

The addendum is comprised of the following sections: 1) How was the Addendum Developed? 2) Community Profile; 3) Risk Assessment; 4) Action Items.

How was the Addendum Developed?

In the Fall of 2005, the Oregon Partnership for Disaster Resilience (Partnership / OPDR) at the University of Oregon's Community Service Center partnered with the Department of Geology and Mineral Industries (DOGAMI) and the Southeast Oregon Region (Harney and Malheur as well as Jefferson and Lake Counties) to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined the Partnership by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Southeast Oregon Region a grant to support the development of the natural hazard mitigation plans for the four counties in the region. OPDR, DOGAMI, and the participating communities were awarded the grant in the Fall of 2005 and Jefferson County began its local planning process in September, 2007.

In September 2007 the Partnership hired a Research Intern to manage the planning process for developing the County Multi-Jurisdictional Natural Hazards Mitigation Plan. The Intern worked closely with the Jefferson County Community Development Director to develop a steering

committee. The City of Culver's Public Works Director served on the Countywide Steering Committee which helped guide the development the development of the County's Plan. A work session was held with the City of Culver staff on July 16, 2008 to develop this city-specific addendum. OPDR facilitated this work session to gather information for the City's risk assessment. The following representatives attended the work session:

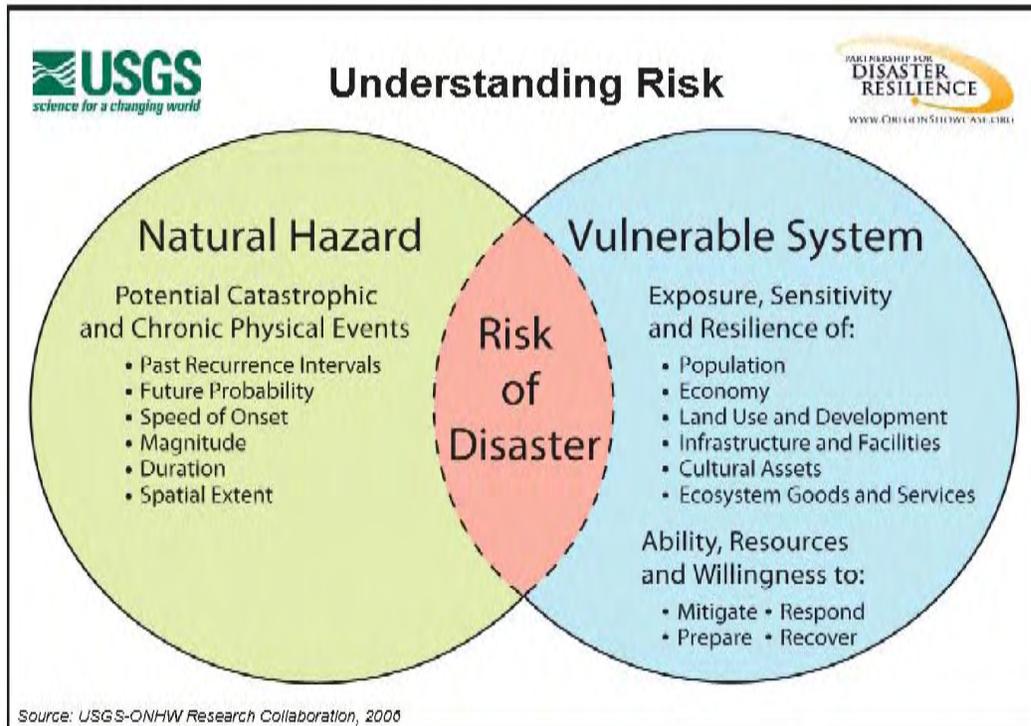
- City Mayor
- Four City Councilors
- 509J School District Facilities Manager
- City Fire Department (2 Representatives)

The City of Culver adopted the Jefferson County Multi-Jurisdictional Natural Hazard Mitigation Plan via resolution on **Insert Date, Year**.

Community Profile

The following section describes the City of Culver from a number of perspectives in order to help define and understand the City's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Summary, should be used as the local level rationale for the City's risk reduction actions. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 2.1 below.

Figure 2.1 Understanding Risk



Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

Community Profile

This section provides information on the characteristics of the City of Culver, Oregon, in terms of geography, and demographics as well as economic base, development trends, housing, and transportation. Many of these community characteristics can affect how natural hazards impact communities, and how communities choose to plan for natural hazard mitigation. Considering these characteristics during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Geography and Climate

Culver is located in the center of Jefferson County. The central portion of Jefferson County is considered high desert, and is characterized by flat and broken terrain covered in sagebrush and grassland. The climate in the City of Culver is dry. Temperatures range from average highs around 84 degrees in July and August and average lows around 23 degrees in December and January. The City of Culver receives approximately 10.5 inches of rain annually.ⁱ

Population & demographics

Since the City of Culver was incorporated in 1946, the population has been steadily growing. In 2007 the City of Culver's population was 1,315 - an increase of 64% from the 2000 population of 802.ⁱⁱ Table 2.1 shows the City's population since 2000.

Table 2.1 City of Culver Population Change, 2000-2007

Year	Madras Population	% Change
2000	802	X
2007	1315	64.0%

Source: Portland State Population Research Center

Disaster impacts (in terms of loss and the ability to recover) vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. Portions of the City of Culver's residents fall into these special needs populations. Over 15.6% of the City's population speaks English less than "very well." In 2000, 16.1% of families and 18.4% of all individuals in the City of Culver were living below the federal poverty levelⁱⁱⁱ. Additionally, 11.1% of the City's residents are 65 years of age or older (see Table 2.3 below).

Table 2.2 City of Culver Poverty Status, 2000

Type	Total Persons	% of Population
Families	31	16.1%
Individuals	148	18.4%

Source: US Census 2000, Culver City, OR, "Profile of General Demographic Characteristics: 2000"

Table 2.3 City of Culver Population by Age, 2000

Age Range	Total Persons	%
Under 5	80	10.0%
5 to 9	89	11.1%
10 to 14	96	12.0%
15 to 19	58	7.2%
20 to 24	43	5.4%
25 to 34	112	14.0%
35 to 44	132	16.5%
45 to 54	59	7.4%
55 to 59	29	3.6%
60 to 64	15	1.9%
65 to 74	56	7.0%
75 to 84	22	2.7%
85 and over	11	1.4%
Total	5078	100%

Source: US Census 2000, Madras City, OR, "Profile of General Demographic Characteristics: 2000"

Employment and Economics

The economy of Culver has been largely based on the manufacturing industry. Currently, Seaswirl Boats, a boat manufacturing company is the primary employer in the City of Culver, employing a total of 172 employees.^{iv} Culver has also been greatly influenced by the agriculture, service, and health and education sectors.

Table 2.4 City of Culver Employment by Major Industry, 2000

Occupation	Total Persons	% of Population
Production, transportation, and material moving occupations	90	28.3%
Service occupations	73	23.0%
Sales and office occupations	62	19.5%
Management, professional, and related occupations	49	15.4%
Farming, fishing, and forestry occupations	23	7.2%
Construction, extraction, and maintenance occupations	21	6.6%

Source: US Census 2000, Culver City, OR, "Profile of Selected Economic Characteristics: 2000"

Median income can be used as an indicator of the strength of the region's economic stability. In 1999, the median household income in Culver was \$31,667.^v This is about \$10,000 below the 1999 national median household income of \$41,994, and about \$5,000 below the \$36,028 median household income for Jefferson County.^{vi} Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Housing

Housing type and year-built dates are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard stick-built homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

In 2000, Culver had 275 housing units. Of those, 92.4% were occupied (254), and 7.6% (21) were vacant.^{vii} Of those occupied housing units 72.8% (185) were owner occupied, and 27.2% (69) were renter occupied.^{viii} Nearly 58% of the City's housing stock was built prior to 1980, before stronger seismic building codes were put into place^{ix} (see Table 2.5 below). Additionally, housing types (i.e., single units, mobile homes, etc.) are shown in Table 2.6 below.

Table 2.5 City of Culver Housing Structure Age, 2000

Year Built	Total Structures	% of Structures
1980-2000	115	42.1%
1960-1979	87	31.9%
Before 1960	71	26.0%

Source: US Census 2000, Culver, OR, "Profile of Selected Housing Characteristics: 2000"

Table 2.6 City of Culver Housing Type, 2000

Housing Type	Total Structures	% of Structures
Single Unit	203	74.3%
Multi Unit	26	9.5%
Mobile Home	44	16.1%
Boat, RV, Van	0	0.3%

Source: US Census 2000, Culver, OR, "Profile of Selected Housing Characteristics: 2000"

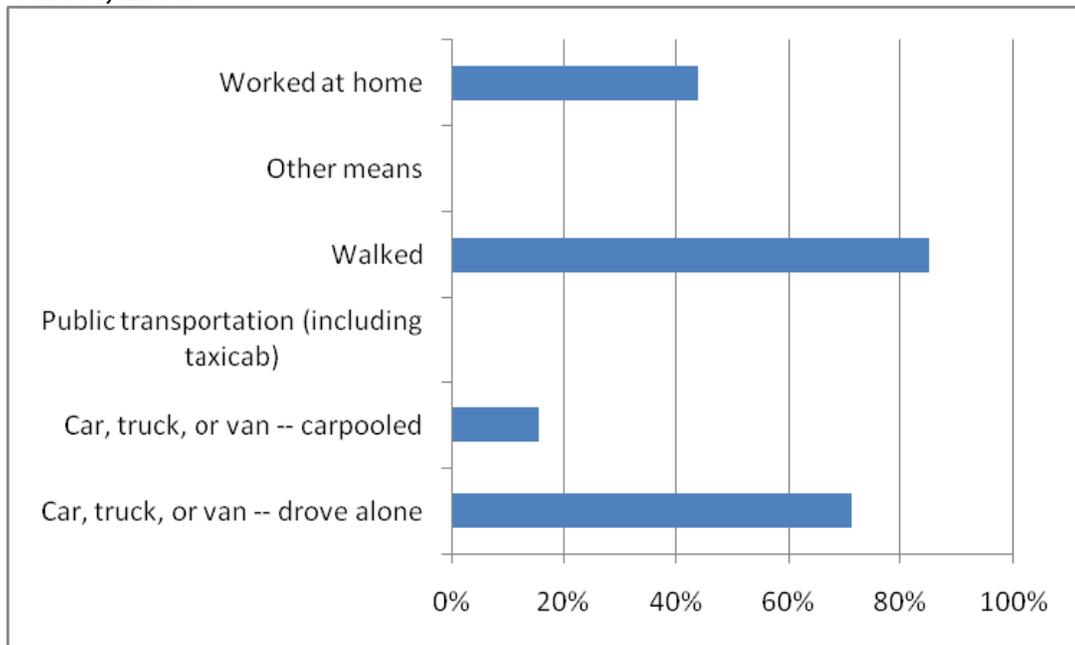
Land use & development

Development in Culver spans a total of 0.6 square miles, within its urban growth boundary. Culver is nestled in a fertile valley with Haystack Reservoir and the Crooked River National Grasslands to the east, Lake Billy Chinook and the Cove Palisades State Park to the west, Juniper Butte to the south and Round Butte to the north. Much of the land within Culver's urban growth boundary is undeveloped.

Transportation & commuting patterns

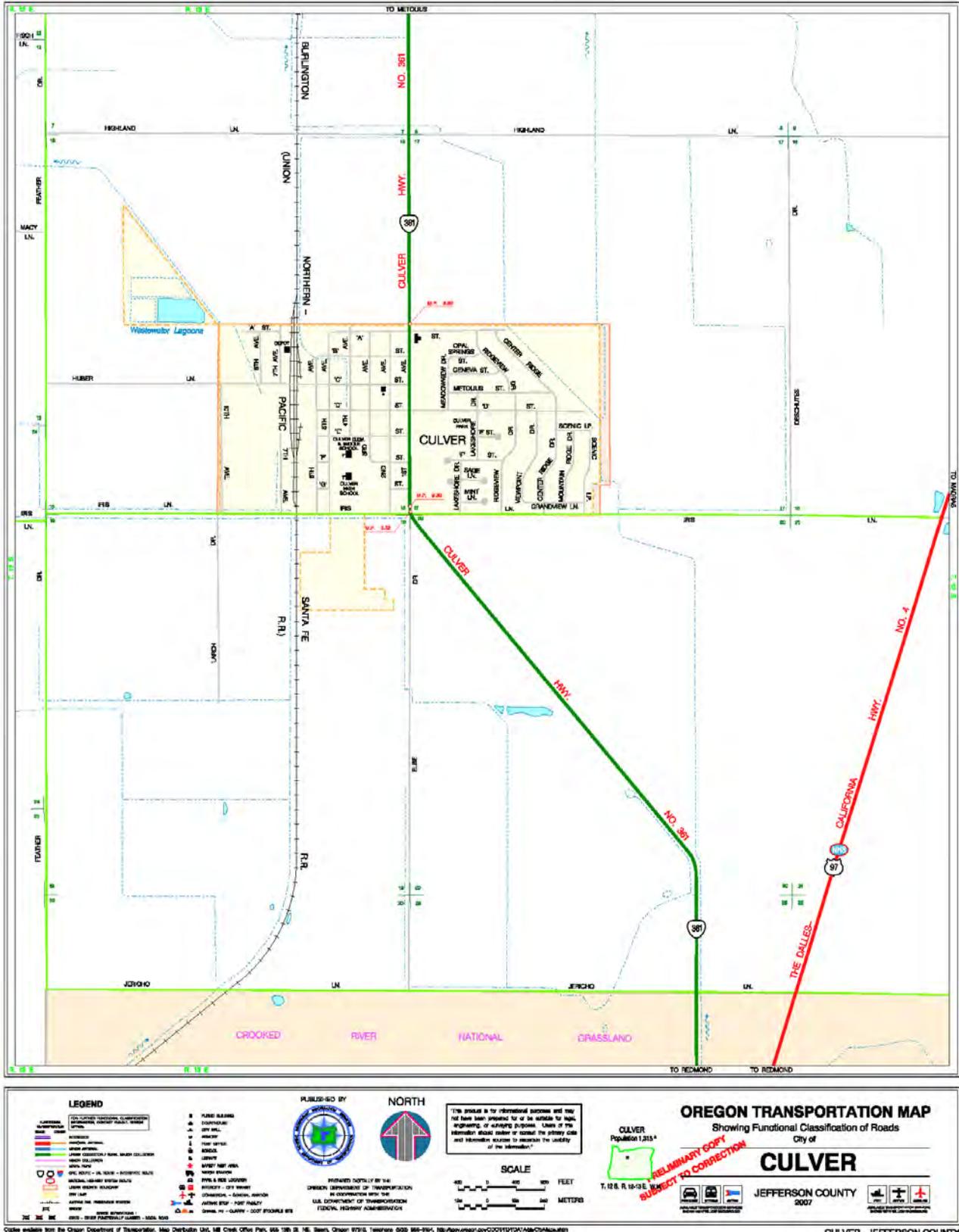
The City of Culver is located adjacent to Highway 97, which runs north and south across the State of Oregon. Transportation is an important consideration when planning for emergency service provisions. Growth within the City will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. How people travel to work is indicative of the prevalence of single occupancy vehicle travel, and can help predict the amount of traffic congestion and the potential for accidents. Figure 2.2 represents the different methods City residents use to travel to work. Additionally, Figure 2.3 shows the major transportation networks that run through Culver.

Figure 2.2 Transportation Type used to Commute to Work, Culver, 2000



Source: US Census, 2000

Figure 2.3 Culver Transportation Map, 2006



Source: Oregon Department of Transportation, 2007

Critical facilities & infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, and water and waste treatment facilities. Culver houses a police department, 1 elementary school, 1 middle school, and 1 high school.

Historic & cultural resources

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. Currently the National Register of Historic Places does not list any historic sites within the City of Culver.

Risk Assessment

The following hazards have been addressed in the Jefferson County Multi-Jurisdictional Natural Hazard Mitigation Plan. The City of Culver reviewed the County's plan on July 16, 2008 and assessed how Culver's risks vary from the risks facing the entire planning area.

Drought

The City of Culver is very unlikely to experience a drought. The Opal Springs aquifer serves as the City's water source, and supply is more than adequate. The spring is five miles southwest of Culver at the bottom of the 850 ft. deep Crooked River Canyon. Opal Springs flows approximately 108,000 gallons per minute at 53.8 degrees Fahrenheit. There is no seasonal variation in temperature, flow, or pH since the spring was first tested in 1925.^x

Opal Springs Bottled Water is sold nationwide, and it's the drinking water for 90% of Jefferson County. The water is not used for irrigation or agricultural uses, and so droughts that affect the County's agricultural base do not necessarily affect the cities. Culver has no history of drought, and has never been limited in drinking water supply. As such, the probability that Culver will experience a drought is very low. The County estimates a 'high' vulnerability to drought, meaning more than 10% of the population or regional assets are likely to be affected by an event. Due to its consistent water supply, Culver believes that the City has a 'low' vulnerability to regional drought events. If, of course, Opal Springs could no longer service the City, then the City's vulnerability would increase.

The impacts and community issues that result from droughts are adequately described within Jefferson County's Plan.

Earthquake

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes, characteristics, location, and extent of earthquake hazards for the region. The City of Culver has not experienced any major earthquake events in recent history. Most of the historic earthquake events occurred in the counties surrounding Jefferson County, the closest being in 1993 in Klamath Falls, 172 miles to the south.

Jefferson County estimates a 'moderate' probability that earthquakes will occur in the future, meaning one incident is likely within a 35-75 year period. The City of Culver agrees with the County's estimate, and expects that if the County experiences an earthquake, the City will as well.

Additionally, Jefferson County estimates a 'high' vulnerability to earthquake hazards. This vulnerability rating indicates that more than 10% of the population or regional assets are likely to be affected by a major emergency or event. The County's rating is accurate of the City's level of vulnerability as well. As described in Table 2.5 above on page 6, 57.9% of the City's housing was built before 1980. The older a home is, the greater its risk of damage from an earthquake. Structures built after the late 1970's in the Northwest used earthquake resistant designs and construction techniques.

Jefferson County's Plan identifies the types of community assets that may be vulnerable to earthquake hazards. Assets include infrastructure, critical facilities, homes, and businesses. Impacts include damages from ground shaking, amplification, surface faulting, and earthquake-induced landslides. Potential impacts described within the County's Plan are accurate of Culver as well.

The Department of Geology and Mineral Industries (DOGAMI) conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings. Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within the City of Culver, the following buildings were rated as 'high' or 'very high:'

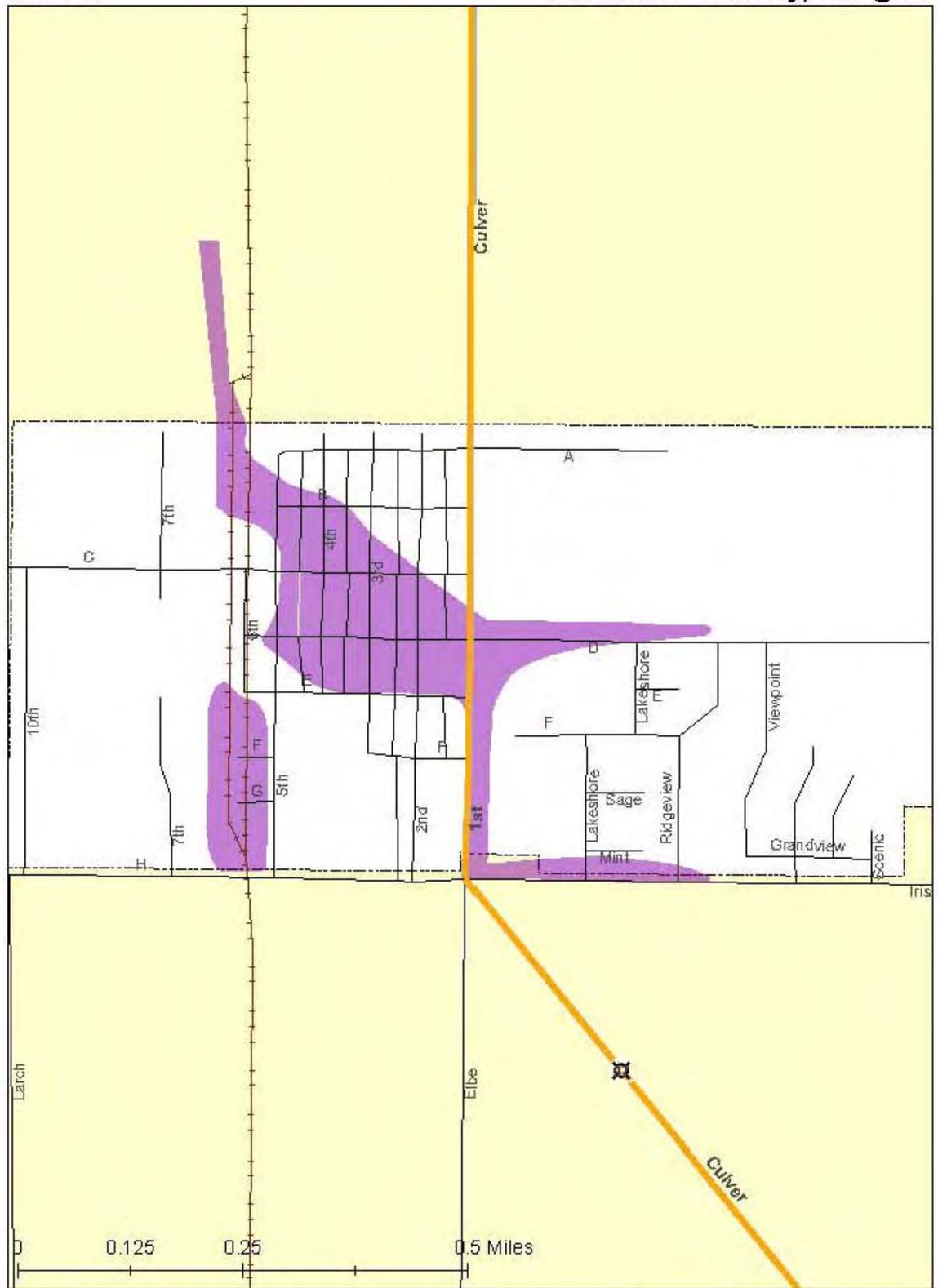
- Culver High School: *very high*
- Culver Police Department: *high*

Flood

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of a flood hazard. Several types of flooding are listed in the County's Plan, but flash flooding is the primary type of flooding that occurs in Culver. This type of flooding is common in the central and eastern areas of Oregon where there is little vegetation and intense, but short-duration rainfall. Portions of Culver are located in a floodplain (see figures below).

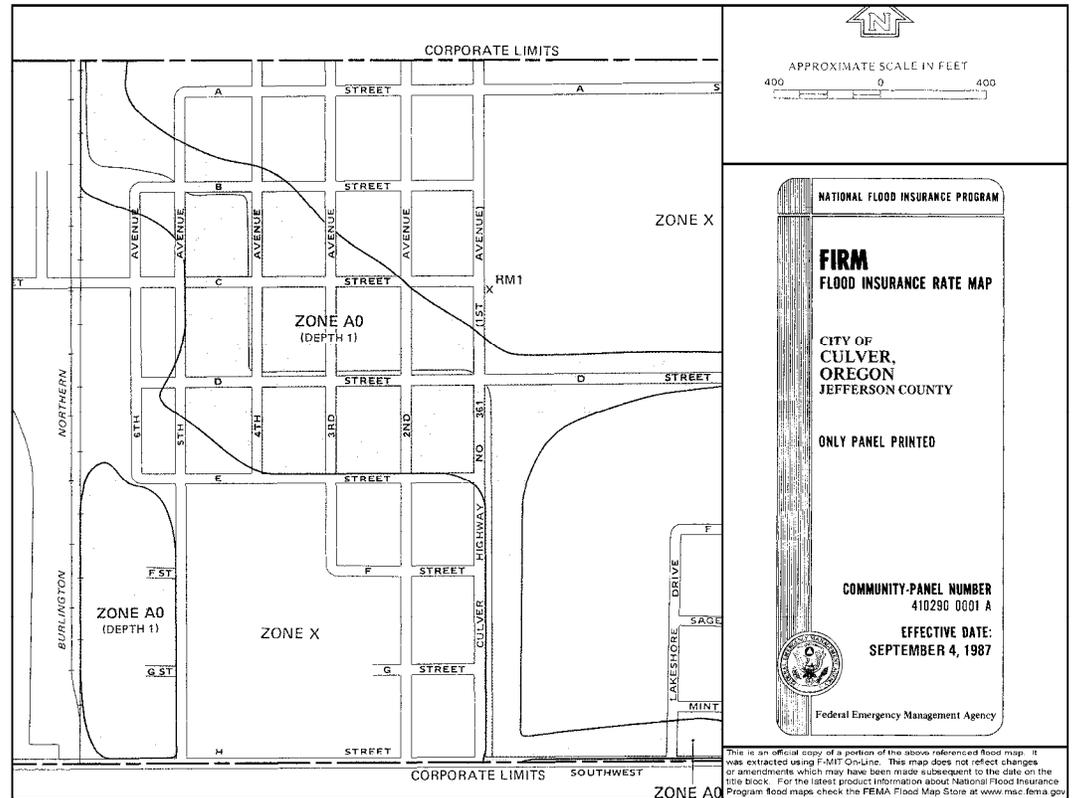
Culver

Jefferson County, Oregon



 100 and 500 year flood zone
 City Limits

Q3 Flood Data Provided by FEMA



Source: FEMA Map Service Center. Culver City/Jefferson County FIRM, 09/15/1987.

Culver is a participant in the National Flood Insurance Program, and the current effective map date of Culver’s Flood Insurance Rate Map is September 4, 1987. As shown in the Firmette above, much of the City is located in Zone AO. Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent shallow flooding where average depths are between 1 and 3 feet.^{xi} Properties located in this zone are required to purchase flood insurance. Information regarding the number and types of buildings, infrastructure, and critical facilities located in the flood zone is not available at this time.

Jefferson County estimates that its probability of experiencing a flood is “high.” Likewise, the County estimates a ‘high’ vulnerability to flood events. These ratings are accurate for Culver as well.

Community impacts have included flooding on streets and residential properties. The Post Office has flooded as well. Power outages occasionally accompany flooding events, and travel within the City can be restricted. As of 2008, zero NFIP insured structures in Culver have been repetitively damaged by floods. See Jefferson County’s Flood Hazard Annex for a comprehensive description of potential community impacts.

Landslide

Jefferson County’s Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of landslides, as well as

the location and extent of landslides within the County. Due to the City's flat topography, however, Culver has no history of landslides, and/or risk of experiencing landslides in the future. The City estimates a zero probability that future landslides will occur within Culver.

The City of Culver identified potential impacts from landslides outside City limits. Residents from the unincorporated community of Three Rivers work in Culver, Madras, and Metolius. The single route between Three Rivers and Culver (which is en route to Madras and Metolius) is susceptible to landslides, particularly on Jordan Road. If workers are unable to travel from Three Rivers to one of the three cities, businesses and employers may suffer short-term impacts. The extent of such an event, however, is unknown. Culver additionally expects to assist in recovery efforts, should a landslide occur outside City limits.

With the exception of the route between Three Rivers and Culver, landslides in other portions of the County are not expected to impact Culver. Alternative routes will prevent any economic impacts or transportation setbacks. As such, Culver estimates a 'low' vulnerability to [regional] landslide hazards, meaning less than 1% of the City's population will be affected by a major event.

Volcano

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of volcanic hazards, as well as previous occurrences, location and extent. In the City of Culver, Mt. Jefferson poses the greatest risk to residents. Volcano-related hazards from Mt. Jefferson would include tephra (volcanic ash), lahar, lava flow, debris flow / avalanche, and pyroclastic flow.^{xiii} The volcano is not extinct, and it's capable of large explosive eruptions. In addition to Mt. Jefferson, several prominent volcanoes surround the western side of Jefferson County.

Jefferson County has a low probability of experiencing volcanic hazards, meaning one incident is likely within a 75 - 100 year period. The County's vulnerability, however is 'moderate,' meaning 1-10% of the population or regional assets are likely to be affected by a major volcanic event. Both ratings are true for the City of Culver as well.

Community impacts are appropriately described within Jefferson County's Plan. In the event of a volcano large eruption clouds can extend for hundreds of miles downwind resulting in ash fall over enormous areas. Heavy ash fall, particularly when mixed with rain, can collapse buildings and even a minor ash fall can damage crops, electronics and machinery. See Jefferson County's Volcano Hazard Annex for a comprehensive description of potential community impacts.

Wildfire

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of wildfire hazards, as well as the location and extent of regional wildfire events. Jefferson County is divided (more or less) into three sections; the western part of the County is covered with coniferous forests; the central part of the County is flat and contains most of the County's population and agricultural activities; and the eastern part of the County is largely comprised of rolling hills with grass, juniper, and sagebrush.^{xiii} The City of Culver is located in the central region. The entire County is susceptible to wildfire, but areas most at-risk include the forestlands, and communities within the urban-wildland interface (i.e., the western part of the County). The County adequately identifies previous wildfire events, but none of the previous wildfires occurred within City limits.

Smoke is typically the only wildfire-related 'hazard' that Culver experiences. Forestland is not prevalent within or surrounding City-limits, and grass fires are rare. The County estimates a 'high' probability that wildfires will occur, meaning one incident is likely within a 10-35 year period. Culver, however, estimates a low probability that wildfire will occur within City limits, meaning one incident is likely within a 35-75 year period.

In Oregon, many communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards. The County's Community Wildfire Protection Plan identifies several wildland-urban interface communities within Jefferson County, but Culver is not one of them. Due to the increasing number of unincorporated communities that are building in harm's way, Jefferson County estimates a 'high' vulnerability to wildfire events. Because of the City's location, however, Culver estimates a 'moderate' vulnerability to regional wildfire events. See Jefferson County's Wildfire Hazard Annex for a comprehensive description of potential community impacts.

Windstorm

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of windstorm hazards, as well as the extent of potential events and previous occurrences within the region. Extreme winds occur throughout Jefferson County, including the City of Culver and surrounding areas.

Jefferson County estimates a high level of probability for wind storms, meaning one incident is likely within a 10 - 35 year period. The City of Culver's probability of experiencing a windstorm is the same as the County's. Jefferson County has a 'moderate' level of vulnerability for wind storms, meaning 1-10% of the population or region assets are likely be affected by a major emergency or disaster. The City of Culver's vulnerability to windstorms is the same as the County's.

Windstorms can affect the entire City; buildings, utilities, and transportation systems are particularly vulnerable to wind damage. Loss of power often occurs when winds reach 80mph or greater. Trees are especially hazardous in high wind events, and can damage electrical transmission lines, homes, and property. See Jefferson County's Windstorm Hazard Annex for a comprehensive description of potential community impacts.

Winter Storm

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of winter storm hazards, as well as the extent of potential events and previous occurrences within the region. Winter storms occur throughout Jefferson County, including the City of Culver and surrounding areas.

The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods. Jefferson County estimates a 'high' level of probability for winter storms, meaning one incident is likely within a 10-35 year period. The City of Culver's probability of experiencing a winter storm is the same as the County's. Likewise, Jefferson County has a 'high' level of vulnerability for winter storms, meaning more than 10% of the population or region assets would likely be affected by a major emergency or disaster. The City of Culver's vulnerability in the event of a windstorm is also high.

Winter storms can affect the entire City; buildings, utilities, and transportation systems in the City of Culver are particularly vulnerable to winter storm damage. Loss of power often occurs when ice builds up on power lines. Trees are especially hazardous in winter storm events, and can damage electrical transmission lines, homes, and property. See Jefferson County's Winter Storm Hazard Annex for a comprehensive description of potential community impacts.

Action Items

The following action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. City-specific action item worksheets are located at the end of the addendum.

- Develop a continuity of operations plan for the City of Culver to ensure continued operation in the event of a natural hazard emergency.
- Continue compliance with the National Flood Insurance Program (NFIP).
- Seek funding to seismically retrofit buildings at risk to earthquake damage.

Additionally, the City of Culver has chosen to partner with the County on the following actions. Please see Appendix A in Jefferson County's Natural Hazard Mitigation Plan for more detail regarding each of the actions listed below.

- Include volcanic ash fall in the Health Department's public outreach efforts to address respiration hazards, targeting specific vulnerable populations such as the elderly and youth.
- Coordinate mitigation planning activities with existing planning activities, such as emergency response tabletops, to discuss mitigation actions and avoid duplicating efforts.
- Develop an education and outreach program to educate residents about all the natural hazard events in Culver and to provide them with mitigation activities they can take to reduce the impact of natural hazards.
- Explore emergency response and preparedness measures to address response and preparedness needs for natural hazard events.
- Work with local businesses to develop business continuity plans.
- Develop strategies for collaborating and coordinating with other entities to improve mitigation and emergency management activities in Jefferson County.

The City of Culver will utilize the same prioritization process and plan maintenance schedule as outline in the County's Plan [See Section 4: Plan Implementation and Maintenance of the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan and Appendix C: Economic Analysis of Natural Hazard Mitigation Projects].

ⁱ Oregon Blue Book, City of Culver Community Profile.
<http://bluebook.state.or.us/local/cities/ad/culver.htm>

ⁱⁱ United States Census Bureau. 2000. Fact Sheet: Culver, Oregon. <www.census.gov>

ⁱⁱⁱ United States Census Bureau. 2000. Fact Sheet: Culver, Oregon. <www.census.gov>

^{iv} Oregon Blue Book, City of Culver Community Profile.
<http://bluebook.state.or.us/local/cities/ad/culver.htm>

^v US Census 2000, Culver, OR, "Profile of Selected Economic Characteristics: 2000"

^{vi} US Census, Small Area Income and Poverty Estimates, *Estimates for Oregon Counties, Household Median Income, 2000*,

vii US Census 2000, Culver City, OR, "Profile of General Demographic Characteristics: 2000"

viii US Census 2000, Culver City, OR, "Profile of General Demographic Characteristics: 2000"

ix US Census 2000, Culver City, OR, "Profile of Selected Housing Characteristics: 2000"

^x Deschutes Valley Water District. 2007 Water Quality Report.
http://dvwd.org/2007_water_quality_report.htm

^{xi} FEMA, Flood Hazards Mapping. Frequently Asked Questions: General Information.
http://www.fema.gov/plan/prevent/fhm/fq_gen13.shtm.

^{xii} USGS Open File Reports 99-24, 99-437, 97-513.

^{xiii} Jefferson County Community Wildfire Protection Plan, November 2005.

Natural Hazard Action Item Proposal Form

Proposed Action Item:		Alignment with Plan Goals:	
Develop a continuity of operations plan for the City of Culver to ensure continued operation in the event of a natural hazard emergency		3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City of Culver is vulnerable to a number of different natural hazards that could affect the administration and management of local government. Developing continuity of operations plans for the City will assist in maintaining a basic level of government to continue to provide needed services within the community. According to the Florida Division of Emergency Management, continuity of operations is accomplished through the development of plans, comprehensive procedures, and provisions for alternate facilities, personnel, resources, interoperable communications, and vital records/databases. The plan establishes policy and guidance to ensure the execution of the organization's most essential functions in any event which requires the relocation of selected personnel and functions to an alternate facility. Research conducted by Richard Wilson has shown that staff turnover is likely to occur after a disaster. Veteran staff is critical after a disaster. It is important to prevent turnover so that existing personnel do not have to take on extra responsibilities during an already stressful time. Continuity planning can also help lessen turnover by ensuring competitive salaries and benefits and by reducing the amount of stress staff will have to endure. The Disaster Mitigation Act of 2000 requires communities to develop actions that reduce the impact of a natural hazard [201.6(c)(3)(ii)]. Developing a continuity of operations plan will diminish the effects of a natural disaster by providing the City of Culver with a framework for continuing operations in a potentially chaotic situation. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Research and review completed continuity of operations plans to provide a foundation of expected content and issues to review. The COOP should ensure shelter housing for critical staff and family members such as city officials, public works employees, emergency response, and others. Assess and prioritize critical positions and resources vital to the continuance of important city functions. 			
Coordinating Organization:		City Manager	
Internal Partners:		External Partners:	
City Councilors; City Mayor			
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
Form Submitted by:		City of Culver Steering Committee	

Natural Hazard Action Item Proposal Form

Proposed Action Item:		Alignment with Plan Goals:	
Continue compliance with the National Flood Insurance Program (NFIP).		1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program (NFIP) provides communities with federally backed flood insurance, provided that communities develop and enforce adequate floodplain management measures. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance. The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will diminish flood damage to new and existing buildings in communities while providing homeowners, renters, and business owners additional flood insurance protection. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Actively participate with DLCD and FEMA during Community Assistance Visits. The Community Assisted Visit (CAV) is a scheduled visit to a community participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Conduct an assessment of Culver's floodplain ordinances to ensure they reflect current flood hazards. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
City Council		FEMA, Jefferson County Community Development Department, DLCD	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	City of Culver Steering Committee		

Natural Hazard Action Item Proposal Form

Proposed Action Item:		Alignment with Plan Goals:	
Seek funding to seismically retrofit buildings at risk to earthquake damage.		1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> In 2007 DOGAMI completed a Statewide Seismic Needs Assessment that used Rapid Visual Screening (RVS) to assess the seismic risk, also known as collapse potential, of schools, hospitals, and critical facilities such as police and fire stations in the state of Oregon. The RVS assessment is based on the maximum considered earthquake for the location being assessed, and rates buildings by a Very High, High, Moderate, or Low seismic risk. The RVS identified the following buildings as at risk: <ul style="list-style-type: none"> Culver High School: <i>very high</i> Culver Police Department: <i>high</i> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Identifying critical and essential facilities for seismic retrofit will help to identify major seismic issues and appropriate mitigation actions to protect critical and essential facilities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Further assess structures that were identified in DOGAMI's Seismic Needs Assessment as having a 'high' or 'very high' risk of collapse. Prioritize buildings for seismic retrofit and coordinate with OEM seismic grants coordinator to apply for funding. 			
Coordinating Organization:		City Council	
Internal Partners:		External Partners:	
509J School District, Police Department		Oregon Emergency Management; DOGAMI	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Culver Steering Committee	

Volume III: City Addenda

Madras

Overview

The City of Madras developed this addendum to the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Madras, Oregon, which include drought, earthquake, flood, landslide, volcano, wildfire, windstorm, and winter storm. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the City. 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.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use, flood mitigation, or economic development programs. The actions described in the addendum are intended to be implemented through existing plans and programs within the City.

The addendum is comprised of the following sections: 1) How was the Addendum Developed? 2) Community Profile; 3) Risk Assessment; 4) Action Items.

How was the Addendum Developed?

In the Fall of 2005, the Oregon Partnership for Disaster Resilience (Partnership / OPDR) at the University of Oregon's Community Service Center partnered with the Department of Geology and Mineral Industries (DOGAMI) and the Southeast Oregon Region (Harney and Malheur as well as Jefferson and Lake Counties) to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined the Partnership by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Southeast Oregon Region a grant to support the development of the natural hazard mitigation plans for the four counties in the region. OPDR, DOGAMI, and the participating communities were awarded the grant in the Fall of 2005 and Jefferson County began its local planning process in September, 2007.

In September 2007 the Partnership hired a Research Intern to manage the planning process for developing the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan. The Intern worked closely with the Jefferson County Community Development Director to develop a steering

committee. The City of Madras's City Administrator and Public Works Director served on the Countywide Steering Committee which helped guide the development the development of the County's Plan. A work session was held with City of Madras representatives on July 23, 2008 to develop this city-specific addendum. OPDR facilitated this work session to gather information for the City's risk assessment. The following representatives attended the work session:

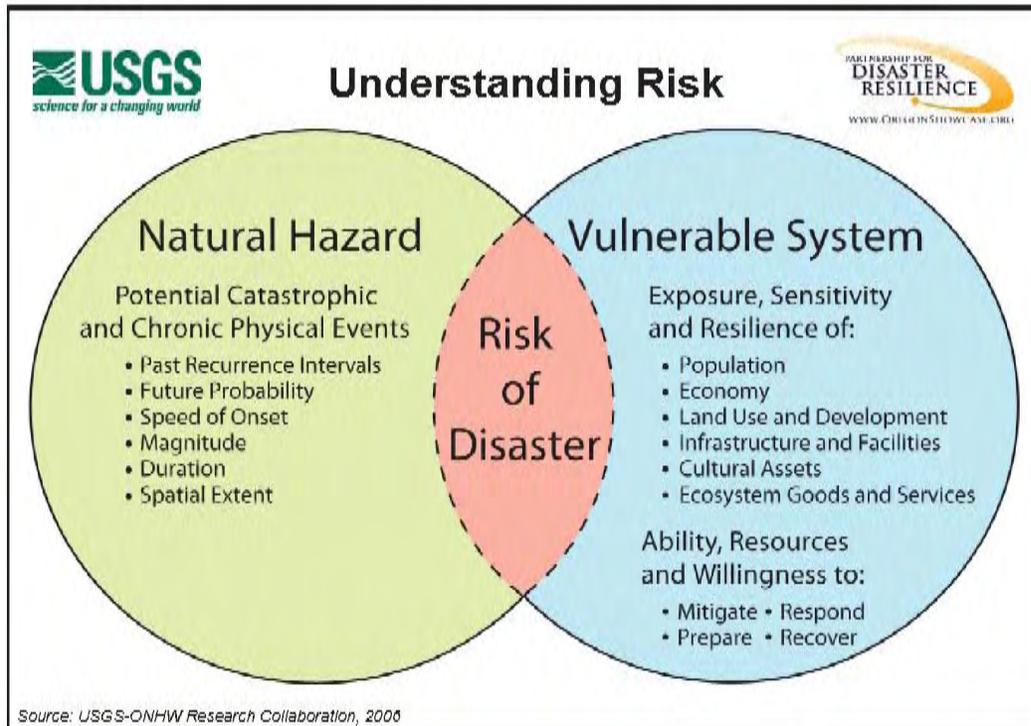
- Madras City Administrator
- Madras Public Works Director

The City of Madras adopted the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan via resolution on **Insert Date, Year**.

Community Profile

The following section describes the City of Madras from a number of perspectives in order to help define and understand the City's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Summary, should be used as the local level rationale for the City's risk reduction actions. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 2.1 below.

Figure 2.1 Understanding Risk



Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

Community Profile

This section provides information on the characteristics of the City of Madras, Oregon, in terms of geography, and demographics as well as economic base, development trends, housing, and transportation. Many of these community characteristics can affect how natural hazards impact communities, and how communities choose to plan for natural hazard mitigation. Considering these characteristics during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Geography and Climate

The City of Madras is located approximately 30 miles east of Mt. Jefferson in the Cascade Range and occupies a moderately sloping portion of a lava plateau in the Deschutes River drainage basin.¹ Madras is located in the center of Jefferson County and is the county seat. The central portion of Jefferson County is considered high desert, and is characterized by flat and broken terrain covered in sagebrush and grassland. The climate in the City of Madras is dry. Temperatures range from average highs around 87 degrees in July and August and average lows around 23 degrees in December and January. The City of Madras receives approximately 11 inches of rain annually. Willow Creek, a tributary of the lower Deschutes River, runs through the center of downtown Madras.

Population and Demographics

Since the City of Madras was incorporated in 1911 their population has been steadily growing. In 2007 the City of Madras's population was 6,585, an increase of 22.1% from 2000.

Table 2.1 City of Madras Population Change, 2000-2007

PSU estimates	Madras Population	% Change
2000	5130	X
2007	6585	22.1%

Source: Portland State Population Research Center

The impact in terms of loss and the ability to recover vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. Portions of the City of Madras's residents fall into these special needs populations. Over 20% of the City's population speaks English less than "very well." As shown in Table 2.2 below, 15.2% of families and 19.6% of all individuals in 2000 were living below the federal poverty level.ⁱⁱ Additionally, 10.5% of the City's residents are 65 years of age or older (see Table 2.3 below).

Table 2.2 City of Madras Poverty Status, 2000

Type	Total Persons	% of Population
Families	189	15.2%
Individuals	958	19.6%

Source: US Census 2000, Madras City, OR, "Profile of General Demographic Characteristics: 2000"

Table 2.3 City of Madras Population by Age, 2000

Age Range	Total Persons	%
Under 5	521	10.3%
5 to 9	515	10.1%
10 to 14	420	8.3%
15 to 19	370	7.3%
20 to 24	391	7.7%
25 to 34	856	16.9%
35 to 44	653	12.9%
45 to 54	497	9.8%
55 to 59	179	3.5%
60 to 64	142	2.8%
65 to 74	247	4.9%
75 to 84	189	3.7%
85 and over	98	1.9%
Total	5078	100%

Source: US Census 2000, Madras City, OR, "Profile of General Demographic Characteristics: 2000"

Employment and Economics

Historically, the economy of Madras has been largely based on the production of wood based products. Though the wood products industry is still the primary employer in Madras, the City's economy has been greatly influenced by the service, sales, and management industries.

Table 2.4 City of Madras Employment by Major Industry, 2000

Occupation	Total Persons	% of Population
Production, transportation, and material moving occupations	778	37.3%
Service occupations	375	18.0%
Management, professional, and related occupations	345	16.5%
Sales and office occupations	342	16.4%
Construction, extraction, and maintenance occupations	126	6.0%
Farming, fishing, and forestry occupations	122	5.8%

Source: US Census 2000, Madras City, OR, "Profile of Selected Economic Characteristics: 2000"

Median income can be used as an indicator of the strength of the region's economic stability. In 1999, the median household income in Madras was \$29,103.ⁱⁱⁱ This is almost \$13,000 below the 1999 national median household income of \$41,994, and around \$7,000 below the \$36,028 median household income for Jefferson County.^{iv} Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Housing

Housing type and year-built dates are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard stick-built homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

In 2000, Madras had 1,952 housing units. Of those, 92.3% were occupied (1,801), and 7.7% (151) were vacant.^v Of the occupied housing units, 51.2% (923) were owner occupied, and 48.8% (878) were renter occupied.^{vi} Nearly 55% of the City's housing stock was built prior to 1980, before stronger seismic building codes were put into place^{vii} (see Table 2.5 below).

Additionally, housing types (i.e., single units, mobile homes, etc.) are shown in Table 2.6 below.

Table 2.5 City of Madras Housing Structure Age, 2000

Year Built	Total Structures	% of Structures
1980-2000	872	45.3%
1960-1979	761	39.5%
Before 1960	294	15.7%

Source: US Census 2000, Madras City, OR, "Profile of Selected Housing Characteristics: 2000"

Table 2.6 City of Madras Housing Type, 2000

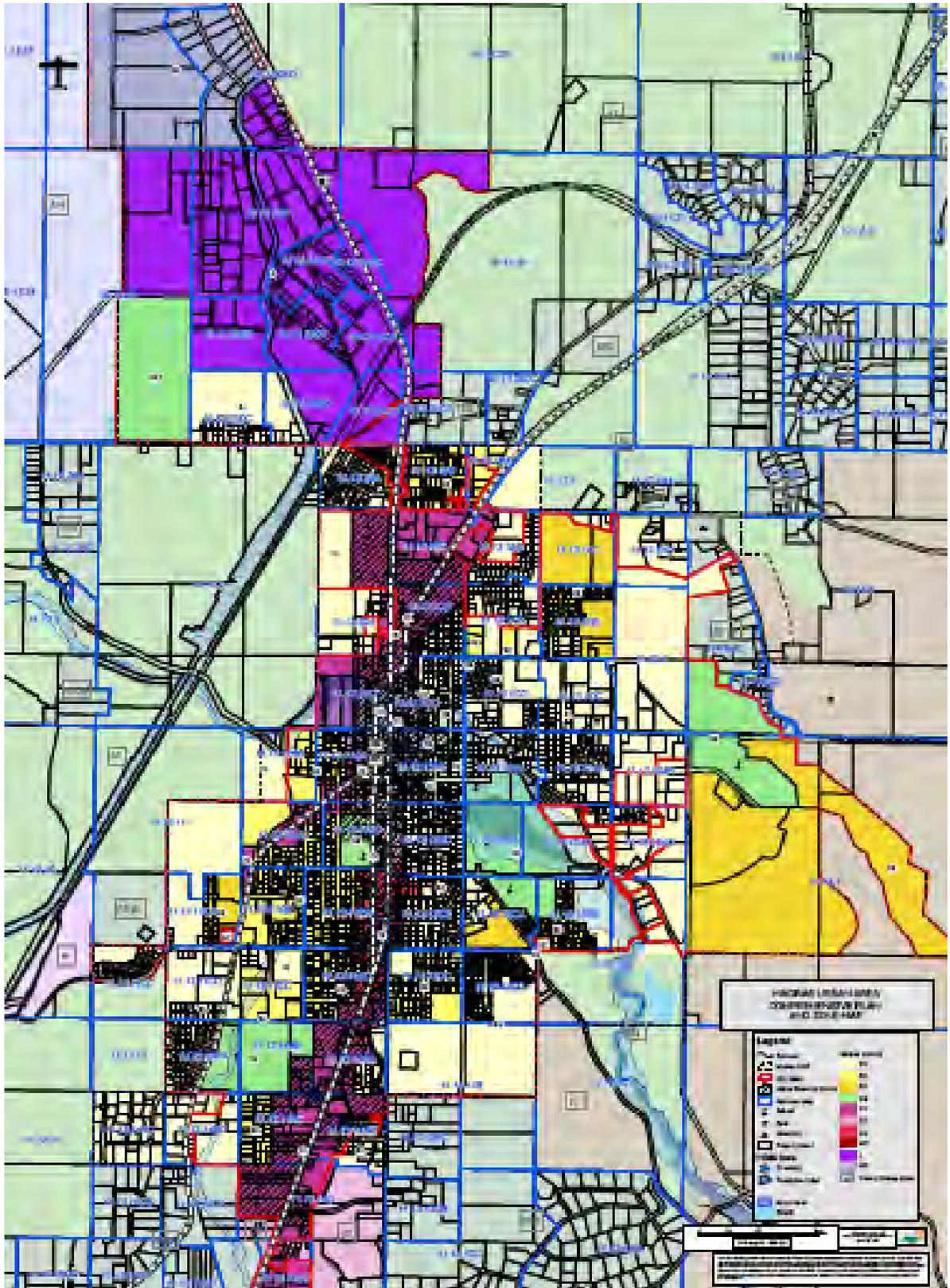
Housing Type	Total Structures	% of Structures
Single Unit	950	49.3%
Multi Unit	607	31.6%
Mobile Home	364	18.9%
Boat, RV, Van	6	0.3%

Source: US Census 2000, Madras City, OR, "Profile of Selected Housing Characteristics: 2000"

Land Use and Development

Development in Madras spans a total of 4.78 square miles, within its recently expanded urban growth boundary.^{viii} Madras partly sits in the floodplain of Willow Creek, a tributary of the lower Deschutes River. Much of the land with Madras's urban growth boundary is still undeveloped, or held in reserve for expansion of the industrial park at the newly-annexed Army Air Base north of the City.^{ix} Madras spreads mostly to the north and south along Highway 97. The downtown area has seen much revitalization and new construction in recent years. The downtown grid of streets in Madras is the basic footprint of the original town's extent.^x The downtown area is made up of mostly commercial businesses and government facilities. Most residential areas are focused east and south of Madras, since the Agency Plains (i.e., a plateau composed of arable land) to the north and west and the Industrial Park to the north hinder much growth in those directions.^{xi}

Figure 2.2 City of Madras Zoning Map (2007)

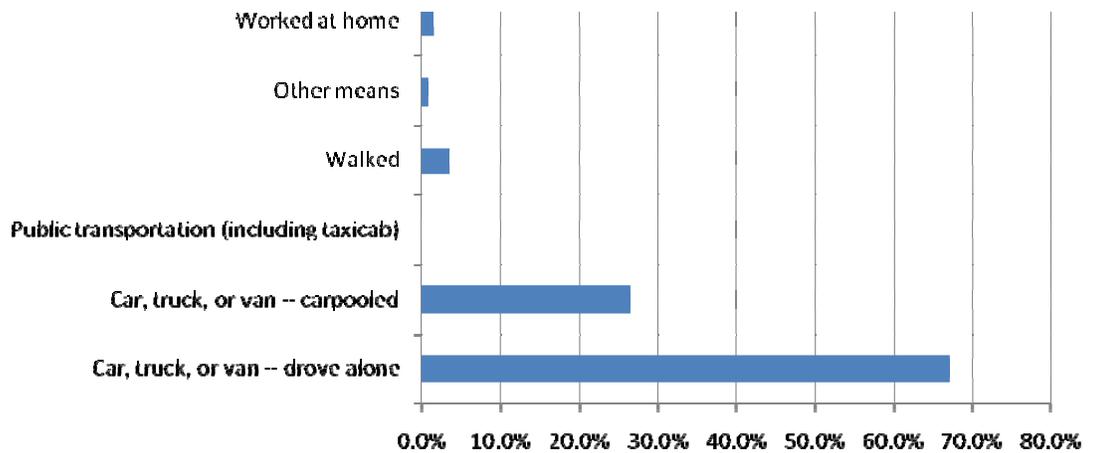


Source: City of Madras: <http://ci.madras.or.us/index.shtml>

Transportation and Commuting Patterns

Two major transportation routes run through Madras, Federal Highways 26 and 97. Highway 26 runs east to west and Highway 97 runs north and south. Transportation is an important consideration when planning for emergency service provisions. Growth within the City will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. How people travel to work is indicative of the prevalence of single occupancy vehicle travel, and can help predict the amount of traffic congestion and the potential for accidents. Figure 2.3 represents the different methods City residents use to travel to work, and Figure 2.4 shows the major transportation networks that run through Culver.

Figure 2.3 Transportation Type Used to Commute to Work, Madras, 2000



Source: US Census, 2000

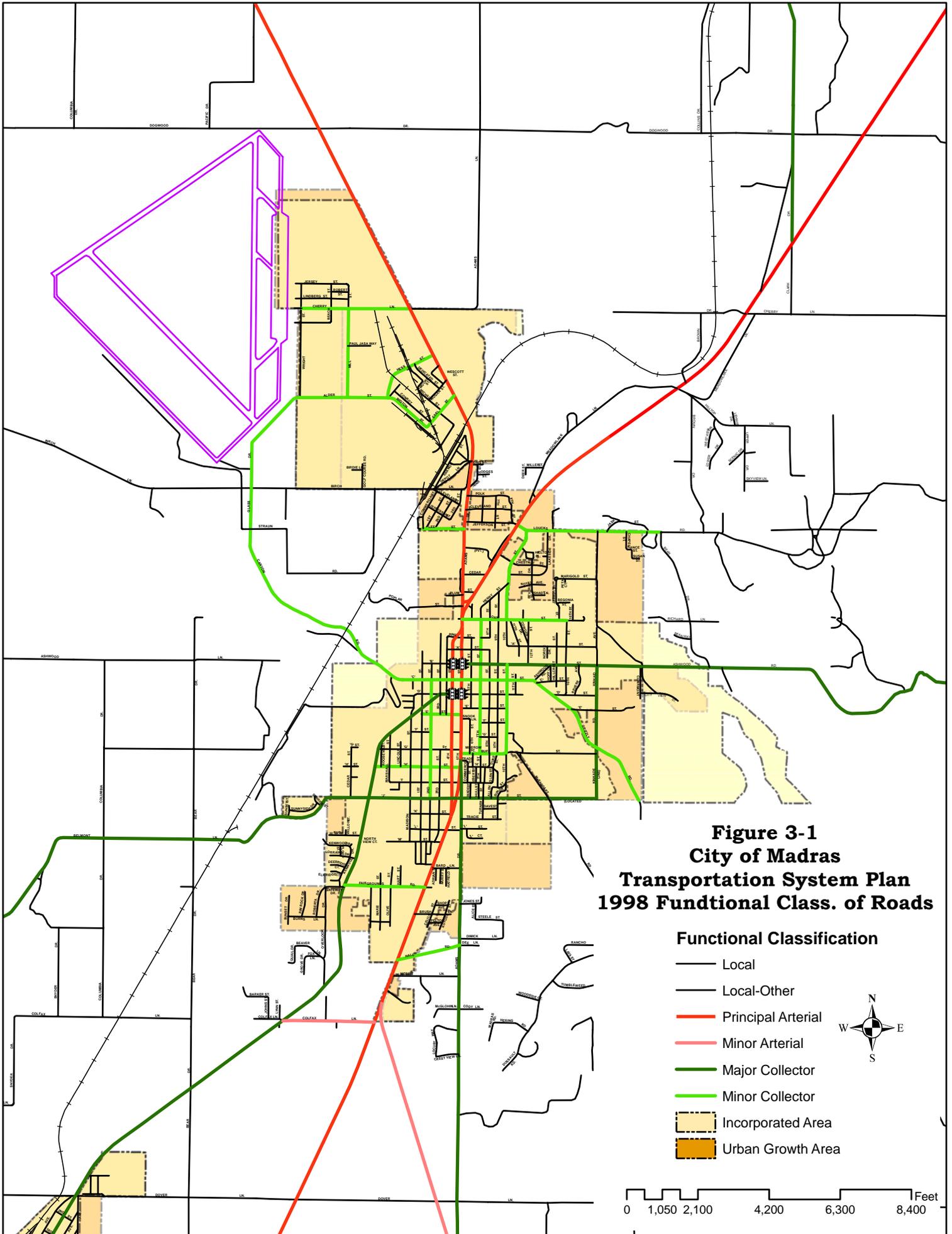
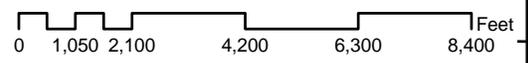


Figure 3-1
City of Madras
Transportation System Plan
1998 Functional Class. of Roads

Functional Classification

- Local
- Local-Other
- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Incorporated Area
- Urban Growth Area



Critical Facilities and Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, and water and waste treatment facilities. Madras houses the Jefferson County fire station, Madras City Hall and Police Department, 1 airport, 1 hospital, a water filtration plant and storage tank, 1 wastewater treatment plant, 2 clinics, 5 public elementary schools, 1 middle school, and 1 high school.

Historic and Cultural Resources

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 National Register of Historic Places lists 4 historic sites within the City of Madras. These historic resources include the Pioneer Homestead, Jefferson County Courthouse, Jefferson County Jail, and the Madras Conservative Baptist Church.

Risk Assessment

The following hazards have been addressed in the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan. The City of Madras reviewed the County's plan on July 22, 2008 and assessed how Madras's risks vary from the risks facing the entire planning area.

Drought

The City of Madras is unlikely to experience a drought. In the past, Madras has obtained its water supply from a number of sources. Wells alone have generally been unable to supply all of the City's water needs, and so the water supply has been supplemented by purchases from Deschutes Valley Irrigation District, originating from the Opal Springs aquifer. Since 1955, Madras has utilized water obtained from the North Unit Irrigation District canal to supplement its well sources during the high summer demand months. Two wells are currently utilized.^{xii} The City's Water System Master Plan sets a strategy for meeting current and future needs.

The City's water is not used for irrigation or agricultural uses, and so droughts that affect the County's agricultural base do not necessarily affect the cities. Madras has no history of drought, and has never been limited in drinking water supply. As such, the probability that Madras will experience a drought is very low. The County estimates a 'high' vulnerability to drought, meaning more than 10% of the population or regional assets are likely to be affected by an event. Due to its consistent water supply, however, Madras believes that the City has a 'low'

vulnerability to regional drought events. If, of course, the City's water supply could no longer service its needs, then the City's vulnerability would increase.

The impacts and community issues that result from droughts are adequately described within Jefferson County's Plan.

Earthquake

Jefferson County's Natural Hazards Mitigation Plan adequately describes the causes, characteristics, location, and extent of earthquake hazards for the region. The City of Madras has not experienced any major earthquake events in recent history. Most of the historic earthquake events occurred in the counties surrounding Jefferson County, the closest being in 1993 in Klamath Falls, 180 miles to the south.

Jefferson County estimates a 'moderate' probability that earthquakes will occur in the future, meaning one incident is likely within a 35-75 year period. The City of Madras agrees with the County's estimate, and expects that if the County experiences an earthquake, the City will as well.

Additionally, Jefferson County estimates a 'high' vulnerability to earthquake hazards. This vulnerability rating indicates that more than 10% of the population or regional assets are likely to be affected by a major emergency or event. The County's rating is accurate of the City's level of vulnerability as well. As described in Table 2.5 above on page 6, 57.9% of the City's housing was built before 1980. The older a home is, the greater its risk of damage from an earthquake. Structures built after the late 1970's in the Northwest used earthquake resistant designs and construction techniques.

Jefferson County's Plan identifies the types of community assets that may be vulnerable to earthquake hazards. Assets include infrastructure, critical facilities, homes, and businesses. Impacts include damages from ground shaking, amplification, surface faulting, and earthquake-induced landslides. Potential impacts described within the County's Plan are accurate of Madras as well.

The Department of Geology and Mineral Industries (DOGAMI) conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings.^{xiii} Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within the City of Madras, the following buildings were rated as 'high' or 'very high:'

- Metolius Elementary School: *high*
- Madras Elementary School: *very high*
- Westside Elementary School: *very high*

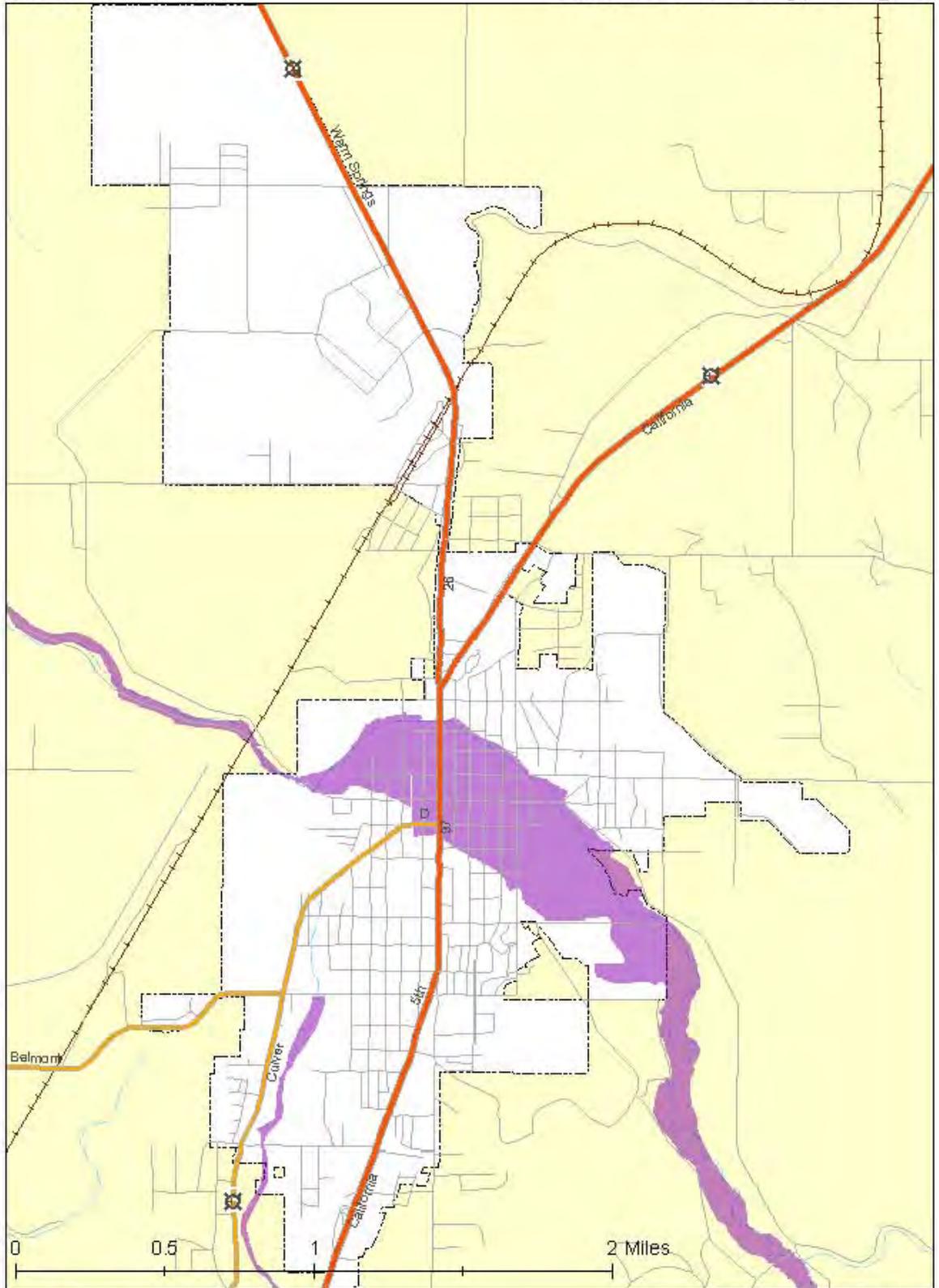
Additional community assets that may be vulnerable to earthquake include the City's airport, Madras City Hall & Police Department, and City bridges. The City Hall & Police Department (attached) are also in the floodway; retrofits should not be implemented until the flooding hazard is mitigated.

Flood

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of a flood hazard, as well as the history of flooding in the City of Madras. Much of downtown Madras is located in the Willow Creek floodplain and floodway (see figures below), and suffers from occasional flooding events. The City completed an update of their Flood Mitigation Plan (FMP) in 2005. The FMP valued the total private property in the floodway at \$4,784,000 (2004) and public property at \$3,002,000 (2004). The plan also identified the number and type of buildings in the floodway. There have been zero repetitive flood loss properties in the City of Madras.

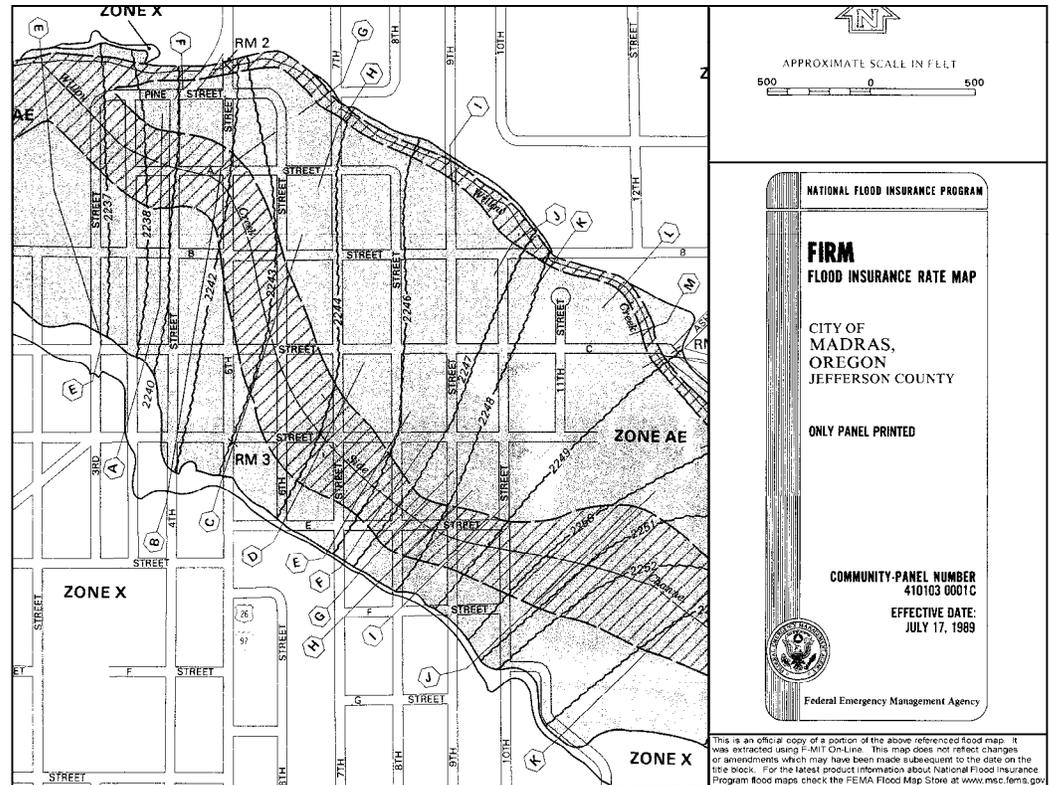
Madras

Jefferson County, Oregon



-  100 and 500 year flood zone
-  City Limits

Q3 Flood Data Provided by FEMA



Source: FEMA Map Service Center. Madras City/Jefferson County FIRM, 07/17/1989

As shown above, much of the City is located in Zone AE. Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual chance of flooding.^{xiv} Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Properties located in this zone are required to purchase flood insurance.

Jefferson County estimates a ‘high’ probability that flooding will occur. Likewise, the County estimates a ‘high’ vulnerability to flood events. Both ratings are accurate for the City of Madras as well.

Madras identified the C Street Bridge as in need of replacement, in addition to a number of foot bridges within the City. Facilities susceptible to flood damages include Madras City Hall, Madras Police Department, Madras Public works, and Madras schools, including the elementary, middle, and high schools. The City enacted a flood damage prevention ordinance (No. 469) on June 20, 1989 that requires developers to obtain permits for construction within any area of special flood hazard. Permits are contingent upon meeting design standards. Additional community impacts are adequately described within Jefferson County’s Flood Hazard Annex. Likewise, the City’s FMP is available for reference at City Hall, and is included as an appendix to Jefferson County’s Multi-Jurisdictional Natural Hazards Mitigation Plan.

Landslide

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of landslides, as well as the location and extent of landslides within the County. Due to the City's flat topography, however, Madras has no history of landslides, and/or risk of experiencing landslides in the future. The City estimates a zero probability that future landslides will occur within Madras.

The City of Madras identified potential impacts from landslides outside City limits. Residents from the unincorporated community of Three Rivers work in Culver, Madras, and Metolius. The single route between Three Rivers and Culver (which is en route to Madras and Metolius) is susceptible to landslides, particularly on Jordan Road. If workers are unable to travel from Three Rivers to one of the three cities, businesses and employers may suffer short-term impacts. The extent of such an event, however, is unknown. Madras additionally expects to assist in recovery efforts, should a landslide occur outside City limits.

With the exception of the route between Three Rivers and Culver, landslides in other portions of the County are not expected to impact Madras. Alternative routes will prevent any economic impacts or transportation setbacks. As such, Madras estimates a 'low' vulnerability to [regional] landslide hazards, meaning less than 1% of the City's population will be affected by a major event.

Volcano

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of volcanic hazards, as well as previous occurrences, location and extent. In the City of Madras, Mt. Jefferson poses the greatest risk to residents. Volcano-related hazards from Mt. Jefferson would include tephra (volcanic ash), lahar, lava flow, debris flow / avalanche, and pyroclastic flow.^{xv} The volcano is not extinct, and it's capable of large explosive eruptions. In addition to Mt. Jefferson, several prominent volcanoes surround the western side of Jefferson County.

Jefferson County has a low probability of experiencing volcanic hazards, meaning one incident is likely within a 75 - 100 year period. The County's vulnerability, however is 'moderate,' meaning 1-10% of the population or regional assets are likely to be affected by a major volcanic event. Both ratings are true for the City of Madras as well.

Community impacts are appropriately described within Jefferson County's Plan. In the event of a volcano large eruption clouds can extend for hundreds of miles downwind resulting in ash fall over enormous areas. Heavy ash fall, particularly when mixed with rain, can collapse buildings and even a minor ash fall can damage crops, electronics and machinery. See Jefferson County's Volcano Hazard Annex for a comprehensive description of potential community impacts.

Wildfire

Jefferson County's Multi-Jurisdictional Natural Hazard Mitigation Plan adequately describes the causes and characteristics of wildfire hazards, as well as the location and extent of regional wildfire events. Jefferson County is divided (more or less) into three sections; the western part of the County is covered with coniferous forests; the central part of the County is flat and contains most of the County's population and agricultural activities; and the eastern part of the County is largely comprised of rolling hills with grass, juniper, and sagebrush.^{xvi} The City of Madras is located in the central region. The entire County is susceptible to wildfire, but areas most at-risk include the forestlands, and communities within the urban-wildland interface (i.e., the western part of the County). The County adequately identifies previous wildfire events, but none of the previous wildfires occurred within City limits.

Smoke is typically the only wildfire-related impact or 'hazard' that Madras experiences. Forestland is not prevalent within or surrounding City-limits, and grass fires are rare. The County estimates a 'high' probability that wildfires will occur, meaning one incident is likely within a 10-35 year period. Madras, however, estimates a low probability that wildfire will occur within City limits, meaning one incident is likely within a 35-75 year period.

In Oregon, many communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards. The County's Community Wildfire Protection Plan identifies several wildland-urban interface communities within Jefferson County, but Madras is not one of them. Due to the increasing number of unincorporated communities that are building in harm's way, Jefferson County estimates a 'high' vulnerability to wildfire events. Because of the City's location, however, Madras estimates a 'moderate' vulnerability to regional wildfire events. See Jefferson County's Wildfire Hazard Annex for a comprehensive description of potential community impacts.

Windstorm

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of windstorm hazards, as well as the extent of potential events and previous occurrences within the region. Extreme winds occur throughout Jefferson County, including the City of Madras and surrounding areas.

Jefferson County estimates a high level of probability for wind storms, meaning one incident is likely within a 10 - 35 year period. The City of Madras's probability of experiencing a windstorm is the same as the County's. Jefferson County has a 'moderate' level of vulnerability for wind storms, meaning 1-10% of the population or region assets are likely be affected by a major emergency or disaster. The City of Madras's vulnerability to windstorms is the same as the County's.

Windstorms can affect the entire City; buildings, utilities, and transportation systems are particularly vulnerable to wind damage. Loss of power often occurs when winds reach 80mph or greater. Trees are especially hazardous in high wind events, and can damage electrical transmission lines, homes, and property. See Jefferson County's Windstorm Hazard Annex for a comprehensive description of potential community impacts.

Winter Storm

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of winter storm hazards, as well as the extent of potential events and previous occurrences within the region. Winter storms occur throughout Jefferson County, including the City of Madras and surrounding areas.

The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods. Jefferson County estimates a 'high' level of probability for winter storms, meaning one incident is likely within a 10-35 year period. The City of Madras's probability of experiencing a winter storm is the same as the County's. Likewise, Jefferson County has a 'high' level of vulnerability for winter storms, meaning more than 10% of the population or region assets would likely be affected by a major emergency or disaster. The City of Madras's vulnerability in the event of a windstorm is also high.

Winter storms can affect the entire City; buildings, utilities, and transportation systems in the City of Madras are particularly vulnerable to winter storm damage. Loss of power often occurs when ice builds up on power lines. Trees are especially hazardous in winter storm events, and can damage electrical transmission lines, homes, and property. See Jefferson County's Winter Storm Hazard Annex for a comprehensive description of potential community impacts.

Action Items

The following action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. Action item worksheets are located at the end of the addendum.

- Conduct education outreach to teach government staff, elected officials, and homeowners about no adverse impact (NAI) floodplain management practices.
- Obtain mechanized sand filling equipment.
- Remove City facilities from the floodway.
- Acquire properties located in the floodplain, and convert the land to open space.
- Elevate the C Street Bridge.

- Replace pedestrian footbridges.
- Trim large trees and brush along Willow Creek.
- Determine whether Madras’s Flood Insurance Rate Maps require updating.
- Continue compliance with the National Flood Insurance Program (NFIP).
- Seek funding to seismically retrofit buildings at risk to earthquake damage.
- Obtain reverse 911 for hazard warning purposes.
- Encourage private utility companies to underground existing power lines.

The City of Madras will utilize the same prioritization process and plan maintenance schedule as outline in the County’s Plan [See Section 4: Plan Implementation and Maintenance of the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan and Appendix C: Economic Analysis of Natural Hazard Mitigation Projects].

i City of Madras Water System Master Plan, 1980-2000.

ii United States Census Bureau. 2000. Fact Sheet: Madras, Oregon. <www.census.gov>.

iii US Census 2000, Madras City, OR, “Profile of Selected Economic Characteristics: 2000”

iv US Census, Small Area Income and Poverty Estimates, *Estimates for Oregon Counties, Household Median Income*, 2000.

v US Census 2000, Madras City, OR, “Profile of General Demographic Characteristics: 2000”

vi US Census 2000, Madras City, OR, “Profile of General Demographic Characteristics: 2000”

vii US Census 2000, Madras City, OR, “Profile of Selected Housing Characteristics: 2000”

viii Walker, Macy, Lealand Consulting Group. 2005 “City of Madras Urban Revitalization Action Plan”

ix Walker, Macy, Lealand Consulting Group. 2005 “City of Madras Urban Revitalization Action Plan”

x Walker, Macy, Lealand Consulting Group. 2005 “City of Madras Urban Revitalization Action Plan”

xi Walker, Macy, Lealand Consulting Group. 2005 "City of Madras Urban Revitalization Action Plan"

xii City of Madras Water System Master Plan, 1980-2000.

xiii McConnell, Vicki S. Department of Geology and Mineral Industries. "Statewide Seismic Needs Assessment: Implementation of Oregon 2005 Senate Bill 2 Relating to Public Safety, Earthquakes, and Seismic Rehabilitation of Public Buildings." 2007.
<http://www.oregongeology.com/sub/projects/rvs/OFR-O-07-02-SNAA-onscreen.pdf>.

xiv FEMA, Flood Hazards Mapping. Frequently Asked Questions: General Information.
http://www.fema.gov/plan/prevent/fhm/fq_gen13.shtm.

xv USGS Open File Reports 99-24, 99-437, 97-513.

xvi Jefferson County Community Wildfire Protection Plan, November 2005.

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Conduct education and outreach to teach government staff, elected officials, and homeowners about no adverse impact (NAI) floodplain management practices.		4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • "No Adverse Impact (NAI) can be called an attitude or a mindset-don't cause an adverse impact on others. It is important to convey this message to the general public, property owners, decision makers, design professionals, and developers. Your message should be: "know your community's hazards, know how to protect yourself, and understand how your actions could impact others."...Through various media, a community can reach out to residents and businesses and advise them of the flood hazard, what the community is doing about it, and what they can do to protect themselves." • No Adverse Impact floodplain management offers local governments a way to prevent the worsening of flooding and other negative impacts on the community. Most state and local governments have assume that the federal programs represent an acceptable standard of care. The minimum floodplain management standards of the National Flood Insurance Program have been accepted by many as the default standards for communities, even though they were designed for the purposes of an insurance program and not necessarily to control escalating flooding. • No Adverse Impact principles give communities a way to promote responsible floodplain development through community-based decision making. With the No Adverse Impact approach, communities will be able to put federal and state programs to better use—enhancing their local initiatives to their communities' advantage. No Adverse Impact floodplain management empowers the community (and its citizens) to build better-informed “wise development” stakeholders at the local level. It is a step towards individual accountability because it prevents increases in flood damage to other properties. No Adverse Impact floodplain management helps communities identify the potential impacts of development and implement action to mitigate them before the impacts occur. • No Adverse Impact floodplain management takes place when the actions of one property owner are not allowed to adversely affect the rights of other property owners. http://www.floods.org/NoAdverseImpact/NAI%20_Strategic_Plan_11-5-01.pdf 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Convey information during NHMP plan update meetings and/or Flood Mitigation Plan (FMP) plan update meetings. • Promote the development of a NAI community via the City's comprehensive planning process. • Disperse information at local gatherings, through local newspapers, or via water bills. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		DLCD, OEM, FEMA	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Obtain mechanized sand filling equipment		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • An easily transportable and mechanized bag filling machine is able to fill sandbags at a high rate of speed to meet the requirement for a large number of filled sandbags in areas where floods occur quickly and without warning. • Currently, the City of Madras stores empty sacks that can be individually filled (relatively slow process). Pre-filling sacks is not a practical solution (i.e., takes up space / sacks deteriorate when filled and/or not closed). • The 1964 flood caused an estimated \$1.5 million in property and inventory damages in Jefferson County. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Seek funding to obtain equipment. Potential funding sources are described within the State's Enhanced Natural Hazard Mitigation Plan, Appendix 5: http://www.oregonshowcase.org/downloads/pdf/stateplan/OR-SNHMP_appendix-05.pdf 			
Coordinating Organization:		City of Madras Public Works Department	
Internal Partners:		External Partners:	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Remove city facilities from the floodway.		2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Currently, the Police Department, City Hall, and the Public Works Department are located in the Willow Creek floodway. • Madras estimates a 'high' probability that flooding will occur. Likewise, Madras estimates a 'high' vulnerability to flood events. • Essential public services are provided from this Public Works Department. In the event of a flood emergency (or other emergency) this is where the personnel gather for work assignment and dispatch and where the various equipment comes from. • Jurisdictions can prohibit certain types of critical uses in floodplains (eg. Hospitals, fire stations, etc.) This is important to ensure that these vital services are not lost in the event of a flood. Careful planning should occur to ensure that these facilities are not sited in floodplains. If your critical facilities are already located in a floodplain, pre-disaster planning before a flood event is crucial to ensuring that these services are not incapacitated. It is also important to consider whether critical services or facilities will be able to access or will be accessible in the event of a natural disaster. [Source: Oregon Technical Resource Guide. July 2000. Community Planning Workshop. Eugene, OR: University of Oregon. p. 4-32.] • Oregon State Land Use Planning Goal 7 states that local governments shall avoid "development in hazard areas where the risk to people and property cannot be mitigated; and [prohibit] the siting of essential facilities, major structures, hazardous facilities and special occupancy structures, as defined in the state building code (ORS 455.447(1)(a)(b)(c) and (e)), in identified hazard areas, where the risk to public safety cannot be mitigated..." [Source: Statewide Land Use Planning Goal 7, Areas subject to Natural Hazards.] 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Convert properties to open space parking. • Acquire funding to relocate facilities out of the floodway 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Police Department, Public Works		FEMA, OEM	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Acquire properties located in the floodplain, and convert the land to open space.		1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Though this is usually the most expensive method of mitigation, it is also the most effective in terms of a flood mitigation strategy. Once the land in the floodplain is purchased outright by a local government entity, all development can be prohibited, and the land can be officially designated as open space. • The flood overflow channel flows through existing developed neighborhoods and a mobile home park. Less than 30 residential lots are affected but a significant number of commercial and government lots. Removing properties on a willing seller-willing buyer basis would result in removing barriers in the natural overflow (high risk) channel, and removing residences from this danger area. • In the City's mobile home park, trailers are built on top of the special flood hazard zone adjacent to Willow Creek. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • There are four types of buyouts: <ol style="list-style-type: none"> 1) Basic buyouts, which have no relocation element. 2) Buyout and infill programs which encourage the relocation of structures outside of the floodplain; 3) Buyout and reorganization plans which create new subdivisions where the moved structures are located; 4) Buyout and complete relocation, which involves the construction of an entire new town, using new or relocated old buildings. • Use fee simple acquisition of land and buyouts to acquire land in a floodplain and restrict development. • Funding sources include FEMA's Hazard Mitigation Grant Program administered in Oregon by the Oregon State Police (OSP)-Office of Emergency Management (OEM) 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
		OEM, FEMA	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Elevate the C Street Bridge		2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The C Street Bridge crosses Willow Creek. During flood events, the bridge has suffered damage. Elevating the bridge would prevent damage to the bridge, and continue to allow safe crossing of the creek. • In heavy floodwaters, the bridge has the potential to break off and dam the water. Additionally, the bridge may hit and damage additional bridges downstream. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Seek funding opportunities to raise bridge. • Determine safe height of bridge, and evaluate costs and benefits. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Community Development		FEMA, OEM	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Replace pedestrian footbridges.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • There are two remaining foot bridges on the west side of town that need replacing. Installation of a new pedestrian bridge on 3rd street is required as well. These bridges are important for pedestrian and bike use and even more so based on fuel prices and carbon footprint reduction as alternatives to driving. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Evaluate costs and benefits for a proposed project and alternatives to that project. Seek funding to replace pedestrian footbridges. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		OEM, FEMA	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Trim large trees and brush along Willow Creek		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 3. Protect natural and cultural resources 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Vegetation along Willow Creek serves an important role in flood mitigation, and water/habitat quality. Occasionally, tree limbs and brush will dam the water in a downstream location. To prevent the occurrence of flooding due to dammed vegetation, the City would like to implement a vegetation management program in which limbs and brush are occasionally trimmed and maintained. • There are several very large old trees in and/or overhanging the main channel of Willow Creek. If these trees were undercut by flood current or dropped major limbs they would block downstream bridge crossings and cause to increase significant and avoidable flooding. • One of the goals of the National Flood Insurance Program is to protect the natural and beneficial functions of floodplains. Natural and beneficial floodplain functions include both the natural infiltration capacities of floodplains, as well as minimizing the pollutants that can enter waters from floodplain development activities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Acquire funding to implement action. • Conduct public education and outreach (to solicit public opinion) prior to moving this project forward. Contact property owners with large trees and brush along the Creek. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Determine whether Madras's Flood Insurance Rate Maps require updating.		2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City's Flood Insurance Rate Map was developed on July 17, 1989. Homeowners have requested updates and/or verification that the map is still correct in its depiction of the City's flood hazard. In areas at high risk to flood, updated Flood Insurance Rate Maps can assist a community to accurately predict its risk to a future flooding event. Better predictions can assist a community to better identify mitigation strategies to reduce its flood risk. The Disaster Mitigation Act of 2000 requires communities to identify the geographic extent of hazards known to impact the community [201.6(c)(2)(i)]. Updated Flood Insurance Rate Maps can assist the City in better defining the flood hazard within the community given the development that has taken place since the current FIRMS were created. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> The Federal Emergency Management Agency's (FEMA) Mitigation Directorate maintains and updates the National Flood Insurance Program (NFIP) maps. Complete the MT-2 Forms Package (Application Forms for Conditional Letters of Map Revision and Letters of Map Revision) The forms and instructions included in this package were designed to assist requesters (community officials or individuals via community officials) in gathering the data that the FEMA needs to determine whether the effective NFIP map and Flood Insurance Study report for a community should be revised. These forms also should be used by community officials or individuals via community officials for requesting FEMA comments on a proposed project, which are issued in the form of a Conditional Letter of Map Revision. These forms will provide FEMA with assurance that all pertinent data relating to the revision are included in the submittal. They also will ensure that: (a) the data and methodology are based on current conditions; (b) qualified professionals have assembled the data and performed all necessary computations; and (c) all individuals and organizations affected by proposed changes are aware of the changes and will have an opportunity to comment on them. The MT-2 application forms and instructions can be downloaded from the FEMA Library. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Planning Commission		DLCD, FEMA, OEM	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Continue compliance with the National Flood Insurance Program (NFIP).		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The National Flood Insurance Program (NFIP) provides communities with federally backed flood insurance, provided that communities develop and enforce adequate floodplain management measures. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will diminish flood damage to new and existing buildings in communities while providing homeowners, renters, and business owners additional flood insurance protection. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Actively participate with DLCD and FEMA during Community Assistance Visits. The Community Assisted Visit (CAV) is a scheduled visit to a community participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. • Conduct an assessment of Madras's floodplain ordinances to ensure they reflect current flood hazards. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
City Council, Public Works		FEMA, Jefferson County Community Development Department, DLCD	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	City of Madras		

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Seek funding to seismically retrofit buildings at risk to earthquake damage.		1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> In 2007 DOGAMI conducted a Seismic Needs Assessment that identified the following buildings as at risk: Madras Police Department, Madras High School, Madras West Side Elementary School, Madras 10th Street Elementary School, and Culver High School. Some of these buildings, such as the police department and elementary school are over 60 years old. Besides high safety risk to very vulnerable populations (elementary schools), Madras could lose the functionality of the police department at the worst possible time, including records, communications and command and control. The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Identifying critical and essential facilities for seismic retrofit will help to identify major seismic issues and appropriate mitigation actions to protect critical and essential facilities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Further assess structures that were identified in DOGAMI's Seismic Needs Assessment as having a 'high' risk of collapse. Prioritize buildings for seismic retrofit and coordinate with OEM seismic grants coordinator to apply for funding. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works, City Council		Oregon Emergency Management; DOGAMI	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Obtain reverse 911 for hazard warning purposes.		1. Save lives and reduce injuries.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Reverse 911 plays a key role in effective communication – not only for general information, but also in times of crisis. Populations within chosen (at-risk) areas can be immediately notified of risk or imminent danger. Reverse 911 users can create lists of individuals with common characteristics (i.e., self-identified ‘at risk’ elderly populations could create a list, or citizen response teams) and contact them with helpful information as needed. 37% of Madras is Spanish-speaking. A call recipient on Reverse 911 can choose which language they prefer for future calls. In addition, a message can be recorded in multiple languages to serve multi-lingual needs. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Decide, as a community, when and how Reverse 911 should be used. Obtain funding for Reverse 911. Explore opportunities for reaching cell phones in addition to land lines. 			
Coordinating Organization:		Police Department	
Internal Partners:		External Partners:	
City Council		FEMA, Department of Homeland Security	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Action Item

Proposed Action Item:		Alignment with Plan Goals:	
Encourage private utility companies to underground existing power lines.		1. Save lives and reduce injuries. 3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Overhead electric and communication lines along US Hwy 97 are susceptible to vehicle and equipment damage. Hwy 97 is a main freight corridor with thousands of large trucks per day. The City of Madras has at least one significant wind event each year. Over 19,000 vehicles pass through the City's downtown each day. 18% of those vehicles are trucks, many carrying hazardous materials. From a public service delivery (electricity, cable, phone) and public safety perspective, it's good to bury these lines, especially in the more vulnerable areas. 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)]. Assessing and evaluating needed improvements for undergrounding utility extensions, can assist a community in determining what further actions are needed to help mitigate a community's risk to winter storms. <i>Goal 7 of Oregon's Land Use Planning Goals requires that local governments "adopt or amend, as necessary, based on the evaluation of risk, plan policies and implementing measures...[that prohibit] the siting of essential facilities, major structures, hazardous facilities and special occupancy structures, as defined in the state building code (ORS 455.447(1) (a)(b)(c) and (e)), in identified hazard areas..."</i> 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Determine undergrounding requirements for utility extension; assess and evaluate for any needed improvements. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Council, Community Development		Pacific Power, Central Electric Co-op.	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Madras	

Volume III: City Addenda

Metolius

Overview

The City of Metolius developed this addendum to the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Metolius, Oregon, which include drought, earthquake, flood, landslide, volcano, wildfire, windstorm, and winter storm. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the City. 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.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or transportation system programs. The actions described in the addendum are intended to be implemented through existing plans and programs within the City.

The addendum is comprised of the following sections: 1) How was the Addendum Developed? 2) Community Profile; 3) Risk Assessment; 4) Action Items.

How was the Addendum Developed?

In the Fall of 2005, the Oregon Partnership for Disaster Resilience (Partnership / OPDR) at the University of Oregon's Community Service Center partnered with the Department of Geology and Mineral Industries (DOGAMI) and the Southeast Oregon Region (Harney and Malheur as well as Jefferson and Lake Counties) to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined the Partnership by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Southeast Oregon Region a grant to support the development of the natural hazard mitigation plans for the four counties in the region. OPDR, DOGAMI, and the participating communities were awarded the grant in the Fall of 2005 and Jefferson County began its local planning process in September, 2007.

In September 2007 the Partnership hired a Research Intern to manage the planning process for developing the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan. The Intern worked closely with the Jefferson County Community Development Director to develop a steering

committee. The City of Metolius's Public Works Director served on the Countywide Steering Committee which helped guide the development the development of the County's Plan. A work session was held with the City of Metolius staff on July 16, 2008 to develop this city-specific addendum. OPDR facilitated this work session to gather information for the City's risk assessment. The following representatives attended the work session:

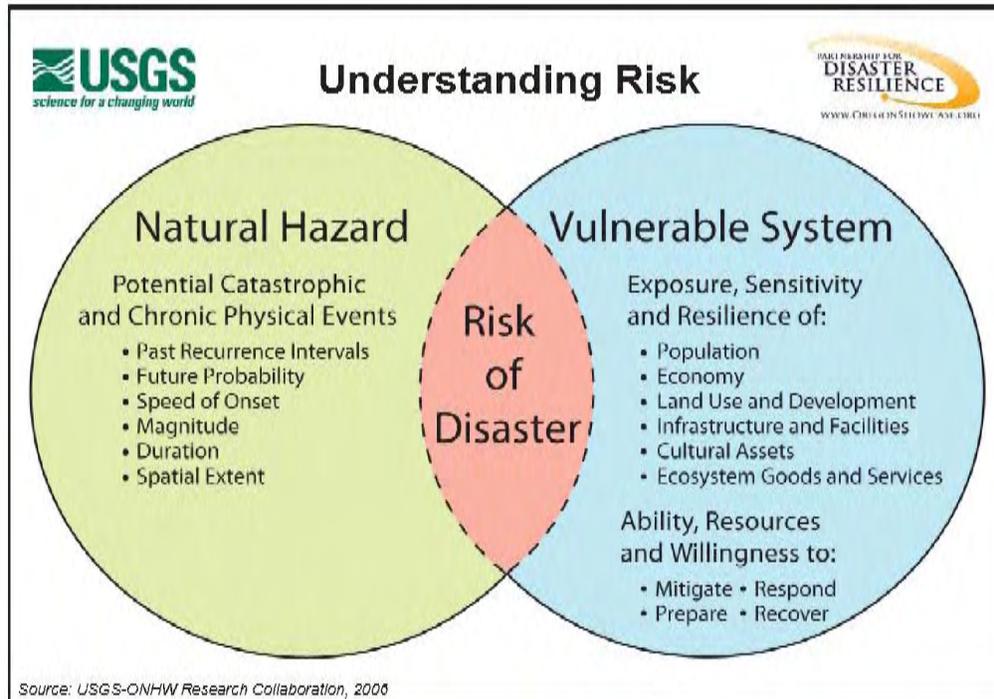
- Metolius Public Works Director
- Metolius City Councilor
- Metolius City Clerk
- Metolius City Recorder

The City of Metolius adopted the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan via resolution on **Insert Date, Year**.

Community Profile

The following section describes the City of Metolius from a number of perspectives in order to help define and understand the City's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Summary, should be used as the local level rationale for the City's risk reduction actions. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 2.1 below.

Figure 2.1 Understanding Risk



Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

Community Profile

This section provides information on the characteristics of the City of Metolius, Oregon, in terms of geography and demographics as well as economic base, development trends, housing, and transportation. Many of these community characteristics can affect how natural hazards impact communities, and how communities choose to plan for natural hazard mitigation. Considering these characteristics during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Geography and Climate

Metolius is located in the center of Jefferson County. The climate in the City of Metolius is dry. The central portion of Jefferson County is considered high desert, and is characterized by flat and broken terrain covered in sagebrush and grassland. Temperatures range from average highs around 84 degrees in July and August and average lows around 23 degrees in December and January. The City of Metolius receives approximately 10 inches of rain annually.ⁱ

Population and Demographics

Since the City of Metolius was incorporated in 1913 their population has been steadily growing. In 2006 the City of Metolius's population was 830, an increase of 30.7% from the 2000 census.ⁱⁱ Table 2.1 shows the City's population since 1990.

Table 2.1 City of Metolius Population Change, 1990-2006

Year	Metolius Population	% Change
1990	450	X
2000	635	41.1%
2006	830	30.7%

Source: US Census 2000, Metolius, OR, "Profile of General Demographic Characteristics: 2000"

Disaster impacts (in terms of loss and the ability to recover) vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. Portions of Metolius's residents fall into these special needs populations. Over 11% of the City's population speaks English less than "very well." In 2000, 14.0% of families and 16.6% of all individuals in the Metolius were living below the federal poverty level.ⁱⁱⁱ Additionally, 11.1% of the City's residents are 65 years of age or older (see Table 2.3 below).

Table 2.2 City of Metolius Poverty Status, 2000

Age Range	Total Persons	% of Population
Families	22	14.0%
Individuals	104	16.6%

Source: US Census 2000, Metolius, OR, "Profile of General Demographic Characteristics: 2000"

Table 2.3 City of Metolius Population by Age, 2000

Age Range	Total Persons	%
Under 5	66	10.4%
5 to 9	71	11.2%
10 to 14	62	9.8%
15 to 19	37	5.8%
20 to 24	30	4.7%
25 to 34	101	15.9%
35 to 44	99	15.6%
45 to 54	54	8.5%
55 to 59	18	2.8%
60 to 64	26	4.1%
65 to 74	39	6.1%
75 to 84	25	3.9%
85 and over	7	1.1%
Total	5078	100%

Source: US Census 2000, Metolius City, OR, "Profile of General Demographic Characteristics: 2000"

Employment and Economics

Historically, the economy of Metolius has been largely based on the production of wood based products. Though the wood products industry

is still the primary employer in Metolius the City's economy has been greatly influenced by the service, sales, and management industries.

Table 2.4 City of Metolius Employment by Major Industry, 2000

Age Range	Total Persons	% of Population
Production, transportation, and material moving occupations	95	36.8%
Service occupations	53	20.5%
Management, professional, and related occupations	43	16.7%
Sales and office occupations	38	14.7%
Construction, extraction, and maintenance occupations	24	9.3%
Farming, fishing, and forestry occupations	5	1.9%

Source: US Census 2000, Metolius City, OR, "Profile of Selected Economic Characteristics: 2000"

Median income can be used as an indicator of the strength of the region's economic stability. In 1999, the median household income in Metolius was \$32,375.^{iv} This is about \$10,000 below the 1999 national median household income of \$41,994, and about \$5,000 below the \$36,028 median household income for Jefferson County.^v Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Housing

Housing type and year-built dates are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard stick-built homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

In 2000, Metolius had 211 housing units. Of those, 97.3% were occupied (214), and 2.7% (6) were vacant.^{vi} Of the occupied housing units 66.8% (143) were owner occupied, 33.2% (71) were renter occupied.^{vii} Nearly 67% of the City's housing stock was built prior to 1980, before stronger seismic building codes were put into place^{viii} (see Table 2.5 below). Additionally,

housing types (i.e., single units, mobile homes, etc.) are shown in Table 2.6 below.

Table 2.5 City of Metolius Housing Structure Age, 2000

Year Built	Total Structures	% of Structures
1980-2000	70	33.2%
1960-1979	104	49.3%
Before 1960	37	17.5%

Source: US Census 2000, Metolius City, OR, "Profile of Selected Housing Characteristics: 2000"

Table 2.6 City of Metolius Housing Type, 2000

Housing Type	Total Structures	% of Structures
Single Unit	950	49.3%
Multi Unit	607	31.6%
Mobile Home	364	18.9%
Boat, RV, Van	6	0.3%

Source: US Census 2000, Metolius City, OR, "Profile of Selected Housing Characteristics: 2000"

Land Use and Development

Metolius is located 4 miles southwest of Madras on Highway 361. Development in Metolius spans a total of .41 square miles, within its urban growth boundary. The predominantly residential community is surrounded by agricultural ground. Metolius is very flat with an average elevation of 2,530 ft. above sea level. Metolius spreads mostly to the north and south along the Southwest Culver Highway, which parallels Highway 97. With the completion of a new state prison near Madras, new homes are sprouting up in Metolius to house people who will work there.

The City has two parks with picnic areas and playground equipment. The businesses located in/near Metolius include a restaurant, tavern, self-serve laundry, two markets, and one gas station. There is a kindergarten through fifth grade school located in Metolius.^{ix}

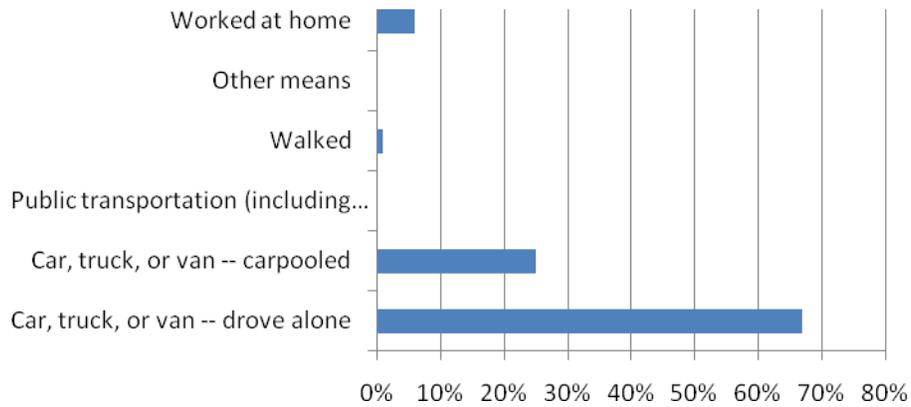
Transportation and Commuting Patterns

The Southwest Culver Highway is the one major transportation route that runs through Metolius. The Southwest Culver Highway serves as the major route between the City of Madras and the cities of Metolius and Culver. The Highway also provides access from Highway 97 to the Cove Palisades State Park-Lake Billy Chinook Recreation Area. The Southwest Culver Highway parallels Highway 97 until it intersects with Highway 97 in Madras.

Transportation is an important consideration when planning for emergency service provisions. Growth within the City will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. How people travel to work is indicative of the prevalence of single occupancy vehicle travel, and can help predict the

amount of traffic congestion and the potential for accidents. Figure 2.2 represents the different methods City residents use to travel to work, and Figure 2.3 shows the major transportation networks that run through Culver.

Figure 1.2 Transportation Type Used to Commute to Work, Metolius, 2000



Source: US Census, 2000

Critical Facilities and Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, and water and waste treatment facilities. Metolius has 1 public elementary school, a City Hall, and a wastewater treatment facility. The Deschutes Valley Water District provides domestic water to all residents, and fire and ambulance services are provided by the North Unit Fire Department, with stations located in Madras and Culver.

Historic and Cultural Resources

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. Currently the National Register of Historic Places does not list any historic sites within the City of Metolius, but Metolius's Depot building is considered to be an historic landmark.

Risk Assessment

The following hazards have been addressed in the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan. The City of Metolius reviewed the County's plan on July 16, 2008 and assessed how Metolius's risks vary from the risks facing the entire planning area.

Drought

The City of Metolius is very unlikely to experience a drought. The Opal Springs aquifer serves as the City's water source, and supply is more than adequate. The spring is five miles southwest of Culver at the bottom of the 850 ft. deep Crooked River Canyon. Opal Springs flows approximately 108,000 gallons per minute at 53.8 degrees Fahrenheit. There is no seasonal variation in temperature, flow, or pH since the spring was first tested in 1925.^x

Opal Springs Bottled Water is sold nationwide, and it's the drinking water for 90% of Jefferson County. The water is not used for irrigation or agricultural uses, and so droughts that affect the County's agricultural base do not necessarily affect the cities. Metolius has no history of drought, and has never been limited in drinking water supply. As such, the probability that Metolius will experience a drought is very low. The County estimates a 'high' vulnerability to drought, meaning more than 10% of the population or regional assets are likely to be affected by an event. Due to its consistent water supply, Culver believes that the City has a 'low' vulnerability to regional drought events. If, of course, Opal Springs could no longer service the City, then the City's vulnerability would increase.

The impacts and community issues that result from droughts are adequately described within Jefferson County's Plan.

Earthquake

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes, characteristics, location, and extent of earthquake hazards for the region. The City of Metolius has not experienced any major earthquake events in recent history. Most of the historic earthquake events occurred in the counties surrounding Jefferson County, the closest being in 1993 in Klamath Falls, 177 miles to the south.

Jefferson County estimates a 'moderate' probability that earthquakes will occur in the future, meaning one incident is likely within a 35-75 year period. The City of Metolius agrees with the County's estimate, and expects that if the County experiences an earthquake, the City will as well.

Additionally, Jefferson County estimates a 'high' vulnerability to earthquake hazards. This vulnerability rating indicates that more than 10% of the population or regional assets are likely to be affected by a major emergency or event. The County's rating is accurate of the City's level of vulnerability as well. As described in Table 2.5 above on page 6, 57.9% of the City's housing was built before 1980. The older a home is, the greater its risk of damage from an earthquake. Structures built after the late 1970's in the Northwest used earthquake resistant designs and construction techniques.

Jefferson County's Plan identifies the types of community assets that may be vulnerable to earthquake hazards. Assets include infrastructure, critical facilities, homes, and businesses. Impacts include damages from ground shaking, amplification, surface faulting, and earthquake-induced landslides. Potential impacts described within the County's Plan are accurate of Metolius as well.

The Department of Geology and Mineral Industries (DOGAMI) conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings.^{xi} Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within the City of Metolius, the following building was rated:

- Metolius Elementary School: *high*

Additional community assets that may be vulnerable to earthquake include City Hall and Metolius's historic Depot building.

Flood

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of a flood hazard, as well as the history of flooding events in the region. Metolius is not located within a floodplain (and is not a participant in the National Flood

Insurance Program), but heavy thunderstorms occasionally cause flash flooding events in the City. Metolius does not have any storm drains, and lower elevations along Highway 361 can fill up with water. Typically, however, no damages result.

Jefferson County estimates a 'high' probability that flooding will occur; due to the City's topography, however, Metolius estimate's a 'low' probability that flooding will occur within City limits. Jefferson County additionally estimates a 'high' vulnerability to flooding events. Metolius again, however, estimates a 'low' vulnerability.

Landslide

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of landslides, as well as the location and extent of landslides within the County. Due to the City's flat topography, however, Metolius has no history of landslides, and/or risk of experiencing landslides in the future. The City estimates a zero probability that future landslides will occur within Metolius.

The City of Metolius identified potential impacts from landslides outside City limits. Residents from the unincorporated community of Three Rivers work in Culver, Madras, and Metolius. The single route between Three Rivers and Culver (which is en route to Madras and Metolius) is susceptible to landslides, particularly on Jordan Road. If workers are unable to travel from Three Rivers to one of the three cities, businesses and employers may suffer short-term impacts. The extent of such an event, however, is unknown. Metolius additionally expects to assist in recovery efforts, should a landslide occur outside City limits.

With the exception of the route between Three Rivers and Culver, landslides in other portions of the County are not expected to impact Metolius. Alternative routes will prevent any economic impacts or transportation setbacks. As such, Metolius estimates a 'low' vulnerability to regional landslide hazards, meaning less than 1% of the City's population will be affected by a major event.

Volcano

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of volcanic hazards, as well as previous occurrences, location and extent. In the City of Metolius, Mt. Jefferson poses the greatest risk to residents. Volcano-related hazards from Mt. Jefferson would include tephra (volcanic ash), lahar, lava flow, debris flow/avalanche, and pyroclastic flow.^{xiii} The volcano is not extinct, and it's capable of large explosive eruptions. In addition to Mt. Jefferson, several prominent volcanoes surround the western side of Jefferson County.

Jefferson County has a low probability of experiencing volcanic hazards, meaning one incident is likely within a 75 - 100 year period. The County's

vulnerability, however is 'moderate,' meaning 1-10% of the population or regional assets are likely to be affected by a major volcanic event. Both ratings are true for the City of Metolius as well.

Community impacts are appropriately described within Jefferson County's Plan. In the event of a volcano large eruption clouds can extend for hundreds of miles downwind resulting in ash fall over enormous areas. Heavy ash fall, particularly when mixed with rain, can collapse buildings and even a minor ash fall can damage crops, electronics and machinery. See Jefferson County's Volcano Hazard Annex for a comprehensive description of potential community impacts.

Wildfire

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of wildfire hazards, as well as the location and extent of regional wildfire events. Jefferson County is divided (more or less) into three sections; the western part of the County is covered with coniferous forests; the central part of the County is flat and contains most of the County's population and agricultural activities; and the eastern part of the County is largely comprised of rolling hills with grass, juniper, and sagebrush.^{xiii} The City of Metolius is located in the central region. The entire County is susceptible to wildfire, but areas most at-risk include the forestlands, and communities within the urban-wildland interface (i.e., the western part of the County). The County adequately identifies previous wildfire events, but none of the previous wildfires occurred within City limits.

Smoke is typically the only wildfire-related 'hazard' that Metolius experiences. Forestland is not prevalent within or surrounding City-limits, and grass fires are rare. The County estimates a 'high' probability that wildfires will occur, meaning one incident is likely within a 10-35 year period. Metolius, however, estimates a low probability that wildfire will occur within City limits, meaning one incident is likely within a 35-75 year period.

In Oregon, many communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards. The County's Community Wildfire Protection Plan identifies several wildland-urban interface communities within Jefferson County, but Metolius is not one of them. Due to the increasing number of unincorporated communities that are building in harm's way, Jefferson County estimates a 'high' vulnerability to wildfire events. Because of the City's location, however, Metolius estimates a 'moderate' vulnerability to regional wildfire events. See Jefferson County's Wildfire Hazard Annex for a comprehensive description of potential community impacts.

Windstorm

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of windstorm hazards,

as well as the extent of potential events and previous occurrences within the region. Extreme winds occur throughout Jefferson County, including the City of Metolius and surrounding areas.

Jefferson County estimates a high probability for wind storms, meaning one incident is likely within a 10 - 35 year period. The City of Metolius's probability of experiencing a windstorm is the same as the County's. Jefferson County has a 'moderate' level of vulnerability for wind storms, meaning 1-10% of the population or region assets are likely be affected by a major emergency or disaster. The City of Metolius's vulnerability to windstorms is the same as the County's.

Windstorms can affect the entire City; buildings, utilities, and transportation systems are particularly vulnerable to wind damage. Loss of power often occurs when winds reach 80mph or greater. Trees are especially hazardous in high wind events, and can damage electrical transmission lines, homes, and property. See Jefferson County's Windstorm Hazard Annex for a comprehensive description of potential community impacts.

Winter Storm

Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics of winter storm hazards, as well as the extent of potential events and previous occurrences within the region. Winter storms occur throughout Jefferson County, including the City of Metolius and surrounding areas.

The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods. Jefferson County estimates a 'high' level of probability for winter storms, meaning one incident is likely within a 10-35 year period. The City of Metolius's probability of experiencing a winter storm is the same as the County's. Likewise, Jefferson County has a 'high' level of vulnerability for winter storms, meaning more than 10% of the population or region assets would likely be affected by a major emergency or disaster. The City of Metolius's vulnerability in the event of a windstorm is also high.

Winter storms can affect the entire City; buildings, utilities, and transportation systems in the City of Metolius are particularly vulnerable to winter storm damage. Loss of power often occurs when ice builds up on power lines. Trees are especially hazardous in winter storm events, and can damage electrical transmission lines, homes, and property. See Jefferson County's Winter Storm Hazard Annex for a comprehensive description of potential community impacts.

Action Items

The following action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk.

City-specific action item worksheets are located at the end of the addendum.

- Develop a continuity of operations plan for the City of Metolius to ensure continued operation in the event of a natural hazard emergency.
- Seek funding to seismically retrofit buildings at risk to earthquake damage.
- Identify an emergency shelter within the City of Metolius.

Additionally, the City of Metolius has chosen to partner with the County on the following actions. Please see Appendix A in Jefferson County's Multi-Jurisdictional Natural Hazards Mitigation Plan for more detail regarding each of the actions listed below.

- Upgrade culverts in unincorporated areas in Jefferson County to reduce flooding events on roads and bridges.
- Develop erosion prevention strategies for gravel roads in Jefferson County.
- Include volcanic ash in the Health Department's public outreach efforts to address respiration hazards, targeting specific vulnerable populations such as the elderly and youth.
- Develop an education and outreach program to educate residents about all the natural hazard events in Jefferson County and provide them with mitigation activities they can take to reduce the impact of natural hazards.
- Explore emergency response and preparedness measures to address response and preparedness needs for natural hazard events.
- Work with local businesses to develop business continuity plans.
- Coordinate mitigation planning activities with existing planning activities, such as emergency tabletops, to discuss mitigation actions and avoid duplicating efforts.

The City of Metolius will utilize the same prioritization process and plan maintenance schedule as outline in the County's Plan [See Section 4: Plan Implementation and Maintenance of the Jefferson County Multi-Jurisdictional Natural Hazards Mitigation Plan and Appendix C: Economic Analysis of Natural Hazard Mitigation Projects].

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- i Oregon Blue Book, City of Metolius Community Profile.
<http://bluebook.state.or.us/local/cities/lr/metolius.htm>
- ii United States Census Bureau. 2000. Fact Sheet: Metolius, Oregon. <www.census.gov>
- iii United States Census Bureau. 2000. Fact Sheet: Metolius, Oregon. <www.census.gov>
- iv US Census 2000, Metolius City, OR, "Profile of Selected Economic Characteristics: 2000"
- v US Census, Small Area Income and Poverty Estimates, *Estimates for Oregon Counties, Household Median Income, 2000*,
- vi US Census 2000, Metolius City, OR, "Profile of General Demographic Characteristics: 2000"
- vii US Census 2000, Metolius City, OR, "Profile of General Demographic Characteristics: 2000"
- viii US Census 2000, Metolius City, OR, "Profile of Selected Housing Characteristics: 2000"
- ix Madras-Jefferson Chamber of Commerce
- x Deschutes Valley Water District. 2007 Water Quality Report.
http://dvwd.org/2007_water_quality_report.htm
- xi McConnell, Vicki S. Department of Geology and Mineral Industries. "Statewide Seismic Needs Assessment: Implementation of Oregon 2005 Senate Bill 2 Relating to Public Safety, Earthquakes, and Seismic Rehabilitation of Public Buildings." 2007.
<http://www.oregongeology.com/sub/projects/rvs/OFR-O-07-02-SNAA-onscreen.pdf>.
- xii USGS Open File Reports 99-24, 99-437, 97-513.
- xiii Jefferson County Community Wildfire Protection Plan, November 2005.

Natural Hazard Action Item Proposal Form

Proposed Action Item:		Alignment with Plan Goals:	
Develop a continuity of operations plan for the City of Metolius to ensure continued operation in the event of a natural hazard emergency		3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City of Metolius is vulnerable to a number of different natural hazards that could affect the administration and management of local government. Developing continuity of operations plans for the City will assist in maintaining a basic level of government to continue to provide needed services within the community. According to the Florida Division of Emergency Management, continuity of operations is accomplished through the development of plans, comprehensive procedures, and provisions for alternate facilities, personnel, resources, interoperable communications, and vital records/databases. The plan establishes policy and guidance to ensure the execution of the organization's most essential functions in any event which requires the relocation of selected personnel and functions to an alternate facility. Research conducted by Richard Wilson has shown that staff turnover is likely to occur after a disaster. Veteran staff is critical after a disaster. It is important to prevent turnover so that existing personnel do not have to take on extra responsibilities during an already stressful time. Continuity planning can also help lessen turnover by ensuring competitive salaries and benefits and by reducing the amount of stress staff will have to endure. The Disaster Mitigation Act of 2000 requires communities to develop actions that reduce the impact of a natural hazard [201.6(c)(3)(ii)]. Developing a continuity of operations plan will diminish the effects of a natural disaster by providing the City of Culver with a framework for continuing operations in a potentially chaotic situation. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Research and review completed continuity of operations plans to provide a foundation of expected content and issues to review. The COOP should ensure shelter housing for critical staff and family members such as city officials, public works employees, emergency response, and others. Assess and prioritize critical positions and resources vital to the continuance of important city functions. 			
Coordinating Organization:		City Manager	
Internal Partners:		External Partners:	
City Councilors; City Mayor			
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
Form Submitted by:		City of Metolius Steering Committee	

Natural Hazard Action Item Proposal Form

Proposed Action Item:		Alignment with Plan Goals:	
Seek funding to seismically retrofit buildings at risk to earthquake damage.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • In 2007 DOGAMI completed a Statewide Seismic Needs Assessment that used Rapid Visual Screening (RVS) to assess the seismic risk, also known as collapse potential, of schools, hospitals, and critical facilities such as police and fire stations in the state of Oregon. The RVS assessment is based on the maximum considered earthquake for the location being assessed, and rates buildings by a Very High, High, Moderate, or Low seismic risk. The RVS identified the following building as at risk: <ul style="list-style-type: none"> ○ Metolius Elementary School: <i>high</i> • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Identifying critical and essential facilities for seismic retrofit will help to identify major seismic issues and appropriate mitigation actions to protect critical and essential facilities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Further assess structure(s) that were identified in DOGAMI's Seismic Needs Assessment. Coordinate with OEM seismic grants coordinator to apply for funding. 			
Coordinating Organization:		City Council	
Internal Partners:		External Partners:	
Police Department		Oregon Emergency Management; DOGAMI	
Timeline:		If available, estimated cost:	
Short Term (0-2 years)	Long Term (2-4 or more years)		
	LT		
Form Submitted by:		City of Metolius Steering Committee	

Natural Hazard Action Item Proposal Form

Proposed Action Item:		Alignment with Plan Goals:	
Identify an emergency shelter within the City of Metolius.		1. Save lives and reduce injuries.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Currently, the City of Metolius does not have a designated emergency shelter for the community. Based on the City's assessment of its vulnerabilities to natural hazards, the Metolius Steering Committee agreed that more attention to emergency protocols and post-disaster resources is required. The City recognizes the importance of this action, despite its deviation from the mitigation-emphasis of this Plan. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Obtain emergency shelter construction guidelines; determine the best community building to 'designate' as a shelter, and work toward building a new shelter, if needed. Evaluate building's design, and determine whether it's safe for probable hazards. Determine the 'type' of shelter most needed within the community. Utilize FEMA's publicized resources to do so. 			
Coordinating Organization:		City Council	
Internal Partners:		External Partners:	
Police Department		Oregon Emergency Management	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		City of Metolius Steering Committee	

Appendix A: Action Item Forms

Earthquake # 1

Proposed Action Item:		Alignment with Plan Goals:	
Identify critical and essential facilities for seismic retrofit.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Jefferson County contains a number of critical and essential facilities vulnerable to earthquake events. Identifying specific seismic issues related to each facility will help the County to prioritize retrofit needs, and to identify appropriate retrofitting measures. • In 2007 DOGAMI completed a Statewide Seismic Needs Assessment that used Rapid Visual Screening (RVS) to assess the seismic risk, also known as collapse potential, of schools, hospitals, and critical facilities such as police and fire stations in the state of Oregon. The RVS assessment is based on the maximum considered earthquake for the location being assessed, and rates buildings by a Very High, High, Moderate, or Low seismic risk. The Seismic Needs Assessment assessed a total of 35 buildings in Jefferson County. The results are summarized below, and the full data set can be found here: http://www.oregongeology.com/sub/projects/rvs/SSNA-abridged-data.pdf <ul style="list-style-type: none"> Schools Very High Seismic Risk-11 buildings High Seismic Risk-8 buildings Moderate Seismic Risk-1 building Low Seismic Risk-7 buildings Police Stations Very High Seismic Risk-1 building High Seismic Risk-1 building Low Seismic Risk-2 buildings Hospitals High Seismic Risk-3 buildings Fire Stations Low Seismic Risk-2 buildings • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Identifying critical and essential facilities for seismic retrofit will help to identify major seismic issues and appropriate mitigation actions to protect critical and essential facilities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Further assess structures that were identified in DOGAMI's Seismic Needs Assessment as having a 'high' risk of collapse. Prioritize buildings for seismic retrofit and coordinate with OEM seismic grants coordinator to apply for funding. 			
Lead Agency:		Community Development	
Internal Partners:		External Partners:	
Public Works, County Commissioners,		Oregon Emergency Management; DOGAMI	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		

Form Submitted by:	Jefferson County Steering Committee
Action Item Status: Pending	

Flood # 1

Proposed Action Item:		Alignment with Plan Goals:	
Develop flood mitigation strategies for critical facilities located in the floodplain.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Many critical facilities in Jefferson County, such as the County offices and the County Courthouse, are located in the floodplain or the floodway. Goal 7 of Oregon's Land Use Planning Goals requires that local governments "adopt or amend, as necessary, based on the evaluation of risk, plan policies and implementing measures...[that prohibit] the siting of essential facilities, major structures, hazardous facilities and special occupancy structures, as defined in the state building code (ORS 455.447(1) (a)(b)(c) and (e)), in identified hazard areas..." Relocating many of the critical facilities in Jefferson County will help fulfill Goal 7 and improve mitigation in Jefferson County. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Developing flood mitigation strategies for critical facilities will help to reduce the impact of flooding events when they occur in the County. . 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Move critical facilities, such as the County administrative offices and County courthouse, to areas outside the floodplain/floodway. • Identify all essential facilities, such as schools, that are located in the floodplain and determine appropriate mitigation measures to reduce the impact of flooding events. • Mitigation activities include raising buildings at or above the 100-year flood plain level, discouraging placement of critical facilities in the floodplain, flood-proofing structures that can't be moved, and limiting development in floodplain areas. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
Public Works		Federal Emergency Management Agency, Oregon Emergency Management	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Flood # 2

Proposed Action Item:		Alignment with Plan Goals:	
Explore coordination and support strategies to minimize the negative impact of upstream development on rivers and streams.		2. Minimize and prevent damage to public and private buildings and infrastructure. 5. Protect natural and cultural resources.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Steering Committee members identified upstream development on creeks in Jefferson County as having a negative impact on development downstream, especially with the increase in water runoff due to new developments. Implementing strategies to minimize development on rivers and streams reduces the chances of flooding on downstream developments. There is a direct link between upstream development and downstream flooding. As a community develops, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels and prevent groundwater recharge, increasing the probability of flooding. The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of natural hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Minimizing upstream development reduces the potential for flooding at new and existing buildings located downstream. Goal 7 of Oregon’s Statewide Planning Goals states that local governments shall “adopt or amend, as necessary...plan policies and implementing measures [to]...avoid development in hazard areas where the risk to people and property cannot be mitigated...” Incorporating flood mitigation regulations into the floodplain ordinance will regulate development in the floodplain to ensure it damage from floods is minimized. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Work with developers, community members and neighborhood groups to discuss the benefits of minimizing development on rivers and streams. Explore the potential for developer exactions, such as land dedication or off-site improvements in areas where development has a direct impact on rivers and streams. Reduce the allowed density in areas where development has a direct impact on rivers and streams. Conduct a public awareness campaign targeting residents in the floodplain to educate them about how to reduce the potential for flooding. Incorporate No Adverse Impacts (NAI) practices as outlined by the Association of State Floodplain Managers into local floodplain ordinances to maintain the natural flow of rainwater and reduce the impact of flooding on existing buildings. 			
Lead Agency:		Community Development	
Internal Partners:		External Partners:	
Public Works, GIS		FEMA, Department of Land Conservation and Development	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)			
<u>Long Term</u> (2-4 or more years)			
LT			
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Pending			

Flood # 3

Proposed Action Item:		Alignment with Plan Goals:	
Upgrade culverts in unincorporated areas in Jefferson County to reduce flooding events on roads and bridges.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Culverts in the Grizzly Road area, Rams Road area, and areas around the Railroad are easily clogged with debris during high flows. Backups cause flooding on roads and bridges in Jefferson County. • Wider culverts enhance the ability of the stormwater system to convey accumulated surface waters. • Maintaining open roads and bridges is essential during a flooding event that requires evacuation of Jefferson County residents. Additionally, continued operation of highways and roads facilitates a functioning economy. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of natural hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Upgrading culverts in unincorporated areas in Jefferson County will reduce flooding events on vital infrastructure such as roads and bridges. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Prioritize replacement of problem culverts, focusing first on those with repeat clogging and flooding. • Coordinate with Oregon Fish and Wildlife and local Watershed Council to ensure proper stream and fish habitat quality in areas surrounding culverts. • Review the County's Transportation System Plan to incorporate mitigation (i.e., culvert expansions) into planned upgrades, developments, or improvements. • Coordinate with Oregon Department of Transportation and Jefferson County Public Works to secure funding. • Seek state and/or federal funding. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
Buildings and Grounds		Oregon Department of Fish and Wildlife, Oregon Department of Transportation	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Flood # 4

Proposed Action Item:		Alignment with Plan Goals:	
Develop erosion prevention strategies for gravel roads in Jefferson County.		2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Crooked River Ranch and Three Rivers developments have gravel roads that suffer from erosion during heavy rain events. • Erosion from gravel roads accumulates in rivers and streams increasing the probability of flooding in surrounding areas. • Maintaining open roads is essential during a flooding event which requires evacuation of Jefferson County residents. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of natural hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Implementing erosion prevention strategies will reduce the chances of flooding downstream of an erosion site. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Prioritize erosion prevention projects, focusing first on areas most prone to erosion. • Coordinate with property owners to develop erosion prevention projects on private lands. • Coordinate with ODOT and Jefferson County Public Works to secure funding for erosion prevention projects. • Seek state and federal funding. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
Community Development, Buildings and Grounds		Oregon Department of Transportation, Oregon Department of Fish and Wildlife	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Flood # 5

Proposed Action Item:		Alignment with Plan Goals:	
Educate citizens in Jefferson County about flood issues and actions they can implement to mitigate the flood risk.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 4. Increase education, outreach, and awareness. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Residents are often unaware of how to reduce their risk of flood related damage, and could benefit from the availability of educational materials and workshops, especially residents in vulnerable areas. • The County could increase its resiliency towards flooding by organizing an effort to educate citizens about mitigation and preparedness activities that businesses and the public can implement to reduce the impact of flooding. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of natural hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Educating Jefferson County residents about actions they can implement to mitigate flood risk can greatly reduce the impact of a natural hazard event. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Coordinate public outreach campaigns with current events, such as Fire Prevention Week and EMS week. [National Emergency Medical Services Week brings together local communities and medical personnel to publicize safety and honor the dedication of those who provide the day-to-day lifesaving services of medicine's "front line."] • Include floodplain information in local newspapers and online so it is readily available to the public. • Conduct a public awareness campaign targeting residents in the floodplain to educate them about the mitigation strategies they can implement to further reduce their risk of sustaining flood damages (i.e., property elevations, landscaping techniques, flood-proofing strategies, etc.) • Make floodplain information available at the Jefferson County building permit counter and at the cities of Madras, Metolius, and Culver. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
Community Development		FEMA, OEM	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Flood # 6

Proposed Action Item:	Alignment with Plan Goals:	
Explore the possibility of updating the County's FEMA Flood Insurance Rate Map.	<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 4. Increase education, outreach, and awareness. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:		
<ul style="list-style-type: none"> • The Floodplain Insurance Rate Maps (FIRMs) for Jefferson County were created in the 1980's and <i>may</i> not reflect current floodplain patterns, especially around the population centers of Madras, Metolius and Culver. • In areas at high risk to flood, updated Flood Insurance Rate Maps can assist a community to accurately predict its risk to a future flooding event. Better predictions can assist a community to better identify mitigation strategies to reduce its flood risk. • The Disaster Mitigation Act of 2000 requires communities to identify the geographic extent of hazards known to impact the community [201.6(c)(2)(i)]. Updated Flood Insurance Rate Maps can assist the County in better defining the flood hazard within the community given the development that has taken place since the current FIRMS were created. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Updating the FIRM flood maps is the first step to understanding the flood hazard in Jefferson County and implementing appropriate mitigation actions to reduce the potential impact of a flood. 		
Ideas for Implementation:		
<ul style="list-style-type: none"> • Assess the validity of the current maps to determine whether updates are necessary. • The Federal Emergency Management Agency's (FEMA) Mitigation Directorate maintains and updates the National Flood Insurance Program (NFIP) maps. • Complete the MT-2 Forms Package (Application Forms for Conditional Letters of Map Revision and Letters of Map Revision) The forms and instructions included in this package were designed to assist requesters (community officials or individuals via community officials) in gathering the data that the FEMA needs to determine whether the effective NFIP map and Flood Insurance Study report for a community should be revised. These forms also should be used by community officials or individuals via community officials for requesting FEMA comments on a proposed project, which are issued in the form of a Conditional Letter of Map Revision. These forms will provide FEMA with assurance that all pertinent data relating to the revision are included in the submittal. They also will ensure that: (a) the data and methodology are based on current conditions; (b) qualified professionals have assembled the data and performed all necessary computations; and (c) all individuals and organizations affected by proposed changes are aware of the changes and will have an opportunity to comment on them. The MT-2 application forms and instructions can be downloaded from the FEMA Library. 		
Lead Agency:	Community Development	
Internal Partners:		External Partners:
GIS		FEMA
Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Jefferson County Steering Committee
Action Item Status: Pending	

Flood # 7

Proposed Action Item:		Alignment with Plan Goals:	
Encourage ODOT to develop an emergency bypass route through Madras.		1. Save lives and reduce injuries. 3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • A bypass would help in rerouting traffic on highway 97 especially during a flooding event. • Maintaining open roads is essential for evacuation of residents during a flooding event in Jefferson County. • Maintaining open roads is essential to emergency services. Additionally, continued operation of highways and roads facilitates a functioning economy. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. A bypass will allow emergency services to access new and existing buildings in the event of a flooding event, potentially reducing damages to vital infrastructure. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Work with Oregon Emergency Management and the Interagency Hazard Mitigation Team (IHMT) to forward this information to the Oregon Department of Transportation (ODOT). • Coordinate bypass project with regional Oregon Department of Transportation Area Commission on Transportation. • Coordinate and gather support for bypass project from City and County representatives. • Work with FEMA and ODOT to find funding sources. 			
Lead Agency:		County Commissioners	
Internal Partners:		External Partners:	
Public Works, Community Development, Emergency Services		Oregon Department of Transportation, Oregon Emergency Management, Oregon Partnership for Disaster Resilience, Interagency Hazard Mitigation Team	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Pending			

Flood # 8

Proposed Action Item:		Alignment with Plan Goals:	
Take steps to begin participating in the Community Rating System rating.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • 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, insurance premiums under the NFIP are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance. • Implementing mitigation activities through the NFIP's CRS program will diminish the impact of flooding events on these properties and reduce total property losses. • The Community Rating System rewards communities that undertake floodplain activities beyond the requirements of the National Flood Insurance Program. The CRS is a point system program that reduces flood insurance premiums for the citizens of participating communities. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Improving Jefferson County's CRS rating helps decrease vulnerability to floods. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Visit CRS website to find out specifics on what Jefferson County can do to improve their CRS rating. CRS website: http://training.fema.gov/EMIWeb/CRS/ • Work towards obtaining higher CRS class ratings (1 being the highest rating obtainable; 10 being a non-participating community). Activities that reduce flood insurance premiums fall under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
Public Works		FEMA	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Flood # 9

Proposed Action Item:		Alignment with Plan Goals:	
Continue compliance with the National Flood Insurance Program (NFIP).		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The National Flood Insurance Program (NFIP) provides communities with federally backed flood insurance, provided that communities develop and enforce adequate floodplain management measures. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance. • The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will diminish flood damage to new and existing buildings in communities while providing homeowners, renters, and business owners additional flood insurance protection. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Actively participate with DLCD and FEMA during Community Assistance Visits. The Community Assisted Visit (CAV) is a scheduled visit to a community participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. • Conduct an assessment of Jefferson County floodplain ordinances to ensure they reflect current flood hazards. 			
Lead Agency:		Community Development	
Internal Partners:		External Partners:	
County Commission, Public Works		FEMA	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Ongoing			

Landslide # 1

Proposed Action Item:		Alignment with Plan Goals:	
Identify areas vulnerable to landslides and develop mitigation strategies to reduce the likelihood of potentially hazardous events.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Additional suspected to be at risk to landslides include 1) Pelton Reservoir; 2) Northwest roads leading to Crooked River Ranch; 3) Camp Sherman’s southern access routes; 4) Jordan Road, near the bridge to Three Rivers; 5) Highway 26 as the road descends into the canyon and on the approach into Warm Springs. • Depending on the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. • Landslides can damage or temporarily disrupt utility services, roads, and other transportation / communication systems, including emergency response, fire, medical, police, etc. • Rock falls have occurred near Pelton Reservoir in the Warm Springs Reservation. • Camp Sherman wildfires in 2003 led to a series of landslides in the County. • Poor road conditions and wildfire events frequently lead to slides along potential evacuation routes. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying areas vulnerable to landslides can reduce the impacts of landslides on new and existing developments and infrastructure. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Improve knowledge of debris flow (rapid moving) landslide hazard areas. • Map steep slope areas. • Research existing community ordinances related to steep slope development. 			
Lead Agency:		GIS	
Internal Partners:		External Partners:	
Community Development, Public Works			
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Pending			

Landslide # 2

Proposed Action Item:		Alignment with Plan Goals:	
Adopt development standards that specify maximum cuts and fills and do not allow major alterations of drainage patterns.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item: Action item proposed by Margaret Boutell.			
<ul style="list-style-type: none"> • Additional suspected to be at risk to landslides include 1) Pelton Reservoir; 2) Northwest roads leading to Crooked River Ranch; 3) Camp Sherman's southern access routes; 4) Jordan Road, near the bridge to Three Rivers; 5) Highway 26 as the road descends into the canyon and on the approach into Warm Springs. • Depending on the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. • Landslides can damage or temporarily disrupt utility services, roads, and other transportation / communication systems, including emergency response, fire, medical, police, etc. • Rock falls have occurred near Pelton Reservoir in the Warm Springs Reservation. • Camp Sherman wildfires in 2003 led to a series of landslides in the County. • Poor road conditions and wildfire events frequently lead to slides along potential evacuation routes. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying areas vulnerable to landslides can reduce the impacts of landslides on new and existing developments and infrastructure. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Maintain plan submittal requirements and recommended measures to prevent erosion and control sediments on construction sites and other properties. • Support Jefferson County staff in the dissemination of information and updating of landslide prevention related code. • Restrict construction activity during rainy times of the year to control erosion on construction sites. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
County Commission		Department of Land Conservation and Development	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Wildfire # 1

Proposed Action Item:		Alignment with Plan Goals:	
Implement actions identified in the Jefferson County Community Wildfire Protection Plan (CWPP).		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 4. Increase education, outreach, and awareness. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Jefferson County completed a Community Wildfire Protection Plan (CWPP) in November, 2005. The CWPP is meant to serve as the wildfire chapter for the Jefferson County NHMP. Implementing actions identified in the CWPP can assist in reducing the impact of wildfire on Jefferson County. • The entire county is susceptible to wildfire. The Jefferson County Community Wildfire Protection Plan identifies the following communities as “at risk” to the effects of wildfire: Three Rivers, Crooked River Ranch, Ashwood, Gateway, Round Butte, North Madras Heights, Juniper Crest, Madras Ranchos / Canyon View, High Chaparral, Forest, Rim & Air Parks, Shamrock Estates, Juniper Butte, High Chaparral, See’s, Warm Springs, County Line. • “At-risk” infrastructure includes: Lake Simtustus RV Park, Lake Billy Chinook Campground, Haystack Reservoir, The Cove State Park, Pelton Park, Montgomery Shores / Robinson Headwaters / Monty Campground area, Cyrus Horse Camp, Skull Hollow Camp, Transmission lines from Pelton / Round Butte hydroelectric facilities, Madras Natural Gas compressor station, Grizzly Electric Substation, Opal Springs domestic water source • Goal 7 of Oregon’s Land Use Planning Goals requires that local governments “adopt or amend, as necessary, based on the evaluation of risk, plan policies and implementing measures...[that avoid] development in hazard areas where the risk to people and property cannot be mitigated.” Including mitigation measure in subdivision and partition ordinances can reduce the impact of wildfires on new development and help to prevent future wildfire losses. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Coordinate with responsible agencies listed in the Jefferson County CWPP to implement action items. • Seek funding to help pay for wildfire mitigation projects within the County. 			
Lead Agency:		Jefferson County Fire Chief and County Planner	
Internal Partners:		External Partners:	
Community Development, GIS		Oregon Department of Forestry, Three Rivers Volunteer Fire Department, the Confederated Tribes of Warm Springs, Crooked River Ranch RFD, State Fire Marshall	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Ongoing			

Wildfire # 2

Proposed Action Item:		Alignment with Plan Goals:	
Encourage communities to incorporate fire prevention materials and programs, such as Firewise, to help in fire prevention.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 4. Increase education, outreach, and awareness. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting wildfire prevention outreach helps reduce vulnerability of residents to wildfire events. • The “Firewise Clean-Up Week” is usually held in spring or October in association with the national Fire Prevention Week, and works to create a defensible space around residents’ homes. In addition, demonstration projects could be used to educate residents about longer-term investments to increase fire-safety. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Conducting wildfire prevention outreach measures will help to protect new and existing buildings from wildfire events. • The entire county is susceptible to wildfire. The Jefferson County Community Wildfire Protection Plan identifies the following communities as “at risk” to the effects of wildfire: Three Rivers, Crooked River Ranch, Ashwood, Gateway, Round Butte, North Madras Heights, Juniper Crest, Madras Ranchos / Canyon View, High Chaparral, Forest, Rim & Air Parks, Shamrock Estates, Juniper Butte, High Chaparral, See’s, Warm Springs, County Line. • “At-risk” infrastructure includes: Lake Simtustus RV Park, Lake Billy Chinook Campground, Haystack Reservoir, The Cove State Park, Pelton Park, Montgomery Shores / Robinson Headwaters / Monty Campground area, Cyrus Horse Camp, Skull Hollow Camp, Transmission lines from Pelton / Round Butte hydroelectric facilities, Madras Natural Gas compressor station, Grizzly Electric Substation, Opal Springs domestic water source 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Use Firewise and Institute for Business Home Services (IBHS) outreach materials to develop a wildfire outreach campaign to teach homeowners about creating a defensible space. • Distribute fire safety materials at public events and at city and county offices. • Coordinate with the BLM and the Forest Service to conduct home assessments. • Coordinate with responsible agencies listed in the Jefferson County CWPP to implement action items. 			
Lead Agency:	Jefferson County Fire Department		
Internal Partners:		External Partners:	
Jefferson County Search & Rescue		Chamber of Commerce, Boys & Girls Club, Central Oregon Intergovernmental Council, Extension Service	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Drought # 1

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate with fire district agencies to identify areas in need of additional water resources.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The average recurrence interval for severe droughts in Jefferson County is between 8-12 years. Drought incurs significant environmental and economic consequences – especially for Jefferson County’s agricultural and recreational employment sectors • The agriculture economy depends on well water and irrigated water from reservoirs and rivers for watering crops, and the lower water levels that result from drought means less water available for agriculture. Often, farmers have to choose between spending more money for water, or suffer from a reduced yield. • Availability of water is essential to effectively suppress wildfires in Jefferson County. • Forests in Jefferson County are more vulnerable to wildfires in drought conditions because trees become more stressed and their resistance to wildfires and disease is diminished. Dead fuel in forests is also higher than in the past, resulting in more available fuel that can lead to larger wildfire events. • The Disaster Mitigation Act of 2000 requires communities to create actions that will reduce the impact of natural hazards on the community [201.6(c)(3)(ii)]. Providing supplemental water supply tanks in key locations will enhance fire-fighting capabilities to reduce the impact of a wildfire on the community. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Prioritize water needs based on local fire vulnerability and current water capacity. • Seek funding opportunities for pay for supplemental water storage tanks. • Explore common valves with irrigation wells, as used in some areas in Nevada, to allow for quick water access in the event of a fire. 			
Lead Agency:		Jefferson County Fire Department	
Internal Partners:		External Partners:	
Public Works, Emergency Services		Oregon Department of Fish and Wildlife, Oregon Department of Forestry, BLM	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Pending			

Volcano # 1

Proposed Action Item:		Alignment with Plan Goals:	
Include volcanic ash fall in the Health Department’s public outreach efforts to address respiration hazards, targeting specific vulnerable populations such as the elderly and youth.		1. Save lives and reduce injuries. 4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Cascade volcanoes tend to erupt explosively, and have occurred at an average rate of 1 – 2 per century during the last 4,000 years. Future eruptions are certain. • Explosive eruptions blast solid and molten rock fragments (tephra) and volcanic gases into the air with tremendous force. Volcanic ash poses a serious hazard to aviation. Ash fall can extend hundreds of miles downwind. • Volcanic ash can lead to respiratory problems for vulnerable sectors of Jefferson County’s residents such as the elderly and youth. Increasing awareness through public outreach reduces the impact of a volcano on vulnerable groups residing in Jefferson County. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Evaluate current outreach efforts and modify as necessary. Determine methods for protecting respiratory health in the event of a volcanic eruption. • Support Health Department staff in the dissemination of information regarding respiration hazards in the event of a volcano. 			
Lead Agency:	Public/Mental Health		
Internal Partners:		External Partners:	
Emergency Services / Law Enforcement		United States Geological Survey (USGS) Cascades Volcano Observatory	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Windstorm # 1

Proposed Action Item:		Alignment with Plan Goals:	
Educate property owners on how to properly maintain trees to prevent power loss on power lines off the right of way.		2. Minimize and prevent damage to public and private buildings and infrastructure. 4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Educating property owners about how to prevent power outages on their private property can help reduce impacts of windstorm events on these homeowners. • Overhead electrical lines are subject to high winds and winter storm damage. The risk is higher on the lines going to a mountaintop or peak. • All of Jefferson County is at risk for winter storms. Due to the multitude of variables, such as wind speed, direction, and temperature, each storm is capable of causing extensive damage in any part of the County. • High winds can topple trees and break limbs which in turn can result in power outages and disrupt telephone, computer, and TV and radio service. • Wind storms affect Jefferson County on nearly a yearly basis, especially in the Crooked River Ranch area where winds can reach 65 mph. • During winter storm access to the line by the utility is difficult. This difficulty delays the time for restoration of power to Jefferson County residents. • The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards.[201.6(c)(3)(ii)] Educating property owners on how to properly maintain trees to prevent power loss on power lines off the right of way will reduce the impact of severe weather on Jefferson County. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Coordinate with the Jefferson County Public Works Department to gather information about the maintenance and removal of hazardous trees. • Work with the community and Jefferson County Public Works Department to identify areas that are prone to damage from nearby trees and perform the necessary maintenance or removal of those trees. • Create a hazardous tree inventory. • Work with the community and Jefferson County Public Works Department to identify high wind and icing areas from previous outages and apply for grants to underground utilities in those areas. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
		Central Oregon Electrical Cooperative	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Winter Storm # 1

Proposed Action Item:		Alignment with Plan Goals:	
Explore improvements for adequately heating schools and other critical facilities in extreme cold events by improving insulation and heating systems.		1. Save lives and reduce injuries. 5. Protect natural and cultural resources.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Jefferson County schools sometimes have trouble heating their buildings in the winter. • Destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds have a long history in Oregon. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March. • The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)]. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Determine whether insulation retrofits would be necessary and/or useful. • Seek funding sources for the purchase of power generators and plowing and pumping equipment. • Coordinate with local equipment rental businesses on possibility of utilizing power generators and heaters in the event of a winter storm. 			
Lead Agency:	509J School District		
Internal Partners:		External Partners:	
Public Works		Central Electric Cooperative	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Winter Storm # 2

Proposed Action Item:		Alignment with Plan Goals:	
Explore funding options to obtain equipment, such as power generators and plowing and pumping equipment, to help respond to winter storm events.		1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds have a long history in Oregon. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March. • Winter power outages are a problem for the County due to freezing of power lines (freezing fog). Obtaining backup power generators and plowing and pumping equipment will help the County improve their response in the event of a winter storm. • The County has vulnerable youth and elderly populations, many of whom are especially vulnerable to power outages and lack backup sources of heat and water. • The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards.[201.6(c)(3)(ii)] Acquiring additional generator power for Jefferson County will reduce its vulnerability to power outages in the event of a winter storm. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Seek funding sources for the purchase of power generators and plowing and pumping equipment. • Coordinate effort with the utility company, ODOT, and Jefferson County Public Works. • Coordinate with local equipment rental businesses on possibility of utilizing power generators and plowing and pumping equipment in the event of a winter storm. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
Buildings and Grounds			
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 1

Proposed Action Item:		Alignment with Plan Goals:	
Continue monitoring blue-green algae in reservoirs and other bodies of water in drought conditions to avoid harm to recreation and the environment.		1. Save lives and reduce injuries. 5. Protect natural and cultural resources.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Recreation is a vital sector of Jefferson County’s economy; ensuring blue-green algae does not accumulate in reservoirs is essential in maintaining this economy. • Certain species of blue-green algae are hazardous to people, pets and livestock. • Blue-green algae outbreaks alters the temperature of the water, which can have adverse effects on fish and other aquatic life, and can even result in fish kills. • Increases in biological oxygen demand result in decreases in oxygen concentration in the water, and this can adversely affect fish and other aquatic life, and can even result in fish kills. • The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)]. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Coordinate with the community to monitor blue-green algae reservoirs and other bodies of water. • Implement a public outreach campaign to educate Jefferson County citizens about the effects of blue-green algae. • Coordinate with the DEQ and Jefferson County Public Works on the eradication of blue-green algae. 			
Lead Agency:	Public Works		
Internal Partners:		External Partners:	
		Water district	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 2

Proposed Action Item:		Alignment with Plan Goals:	
Develop an education and outreach program to educate residents about all the natural hazard events in Jefferson County and provide them with mitigation activities they can take to reduce the impact of natural hazards.		1. Save lives and reduce injuries. 4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Several natural hazards, such as severe weather, earthquakes, and floods, have the potential for disrupting transportation services and isolating rural residents from basic services and needs. Jefferson County has a high number of rural residents, and they need to be educated about the dangers that natural hazards pose and what actions they can take to mitigate the impact hazards on the community. • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, therefore significantly reducing the impact of a natural disaster in Jefferson County. • The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)]. Educating Jefferson County residents about all the natural hazard events within the County can reduce the effects of natural hazards on the community. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Conduct public outreach campaigns, such as articles in the newspaper or through brochures instructing residents and businesses about the risks natural hazards pose and mitigation actions they can implement. • Coordinate with other groups conducting other emergency management activities to assist in conducting public outreach campaigns, developing emergency kits, and educating residents and businesses about other mitigation activities • Develop handouts that inform residents and businesses about natural hazard risk, appropriate mitigation actions that can be implemented, and where citizens can further obtain information. • Create an online informational website where residents and businesses can be educated about appropriate mitigation actions residents and businesses can implement to reduce the impact of natural hazards • Work with local real estate trade associations to prepare informational handouts advising property owners of natural hazard risks in their area and measures they can implement to reduce their risk of exposure. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
		Boy Scouts, Jefferson County Extension Office, Search & Rescue, MaCAT, Salvation Army	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT (ongoing)		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 3

Proposed Action Item:		Alignment with Plan Goals:	
Inventory historic and cultural resources, with an emphasis on unreinforced masonry buildings, and identify their vulnerabilities to natural hazards to develop mitigation actions for their protection.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 5. Protect natural and cultural resources. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Unreinforced masonry buildings are particularly vulnerable to seismic events. Many older commercial buildings in Jefferson County are unreinforced masonry and are vulnerable to damage in the event of an earthquake. This could have significant impacts on local economies in the event of an earthquake. Identifying mitigating measures for retrofitting masonry buildings will reduce the vulnerability of the buildings to an earthquake event and improve the resiliency of the local economy. • The National Register of Historic Places indicates that Jefferson County has 3 buildings listed on the National Register. These sites serve as important cultural and historic resources for Jefferson County and are worthy of additional protection. Identifying mitigation measures for resources listed on the National Register will help protect Jefferson County's historical heritage and ensure their long-term viability. • Tourism is a significant component of Jefferson County's economy and many tourists come to visit Jefferson County's historic and cultural resources. Identifying mitigating actions to help preserve these historic and cultural resources from damaging hazard events will preserve the cultural heritage of the County and maintain heritage tourism as a significant component in the County's economy. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Inventorying important historic and cultural resources and identifying their vulnerability to natural hazards will help to develop mitigation actions that reduce their overall vulnerability to natural hazards. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Work with the State Historic Preservation Office to determine vulnerabilities of community structures to natural hazards. • Identify appropriate mitigation measures to help preserve structures within the community that are at risk for each hazard type. • Create an online data base which illustrates an inventory of the number and type of structures within the community that are at risk for each hazard type. • Identify significant cultural and historic resources, whether on the national register or not, that are worthy of additional protection. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
Economic Development of Central Oregon		State Historic Preservation Officer	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 4

Proposed Action Item:		Alignment with Plan Goals:	
Explore emergency response and preparedness measures to address response and preparedness needs for natural hazard events.		1. Save lives and reduce injuries.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • There is a number of emergency response and preparedness measures available to Jefferson County, such as: reverse 9-11, educating hazardous materials teams, responders and community leaders in basic communication and response activities, and training on natural hazards and how to respond to them effectively. Exploring the effectiveness of these emergency response and preparedness measures will allow the County to most effectively respond to a natural disaster event. • The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)]. Developing emergency response and preparedness measures will reduce the effects of a hazard on Jefferson County. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Identify a shelter to receive displaced persons and create a way to provide food, water, bedding and personal hygiene supplies. • Identify how supplies could be shipped to our community in the event some roads are damaged. • Send a representative to ONHW workshops and trainings to explore emergency response and preparedness measures. • Research and review what adjacent counties are doing as per emergency response and preparedness measures. • Convene the Hazard Mitigation Coordinating Body on a regular basis to discuss emergency response and preparedness measures. • After natural hazard events occur, convene the Hazard Mitigation Coordinating Body to discuss adequacy of emergency response and preparedness measures and how they can be altered to better respond to natural hazards. 			
Lead Agency:	Emergency Services		
Internal Partners:		External Partners:	
		OEM, DHS	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 5

Proposed Action Item:		Alignment with Plan Goals:	
Work with local businesses to develop business continuity plans.		2. Minimize and prevent damage to public and private buildings and infrastructure. 4. Increase education, outreach, and awareness. 5. Protect natural and cultural resources.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • According to Daniel Alesch from the Public Entity Risk Institute, business continuity plans assist businesses in planning for future recovery efforts. In addition, research has shown that most small businesses are unable to recover after a disaster. Business continuity plans allow businesses and their employees to be better prepared for a disaster. Having plans in place may reduce the impact on the business, allowing employees to continue to work or get back to work faster. • Many small business owners and farmers in Jefferson County are located in areas that are susceptible to natural hazards. Preparing business continuity plans for these small enterprises can significantly reduce the impact of a natural hazard and help businesses to recover from a disaster. • Ranchers in Jefferson County can be particularly susceptible to severe weather events. A winter storm can make it difficult for cattle to find feed and can harm a rancher's livestock. Incorporating these hazards into a business continuity plan, and developing steps to continue business activities, will help a business recover faster from a natural disaster. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Coordinate with the local Chamber of Commerce to help develop business continuity plans. • Use the monthly Chamber of Commerce meetings as an informational forum to teach businesses the importance of developing business continuity plans. • Coordinate with ONHW to help conduct workshops with local businesses and farmers to help develop business continuity plans. • Create a website to disseminate information regarding business continuity plans. 			
Lead Agency:		Madras-Jefferson Chamber of Commerce	
Internal Partners:		External Partners:	
		Institute for Business and Home Safety	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
ST			
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Pending			

Multi-Hazard # 6

Proposed Action Item:		Alignment with Plan Goals:	
Develop continuity of operations plans for Jefferson County to ensure continued operation in the event of a natural hazard emergency.		<ol style="list-style-type: none"> 1. Save lives and reduce injuries. 2. Minimize and prevent damage to public and private buildings and infrastructure. 	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Jefferson County is vulnerable to a number of different natural hazards that could affect the administration and management of local government. Developing continuity of operations plans for the County will assist in maintaining a basic level of government to continue to provide needed services within the community. • According to the Florida Division of Emergency Management, continuity of operations is accomplished through the development of plans, comprehensive procedures, and provisions for alternate facilities, personnel, resources, interoperable communications, and vital records/databases. The plan establishes policy and guidance to ensure the execution of the organization's most essential functions in any event which requires the relocation of selected personnel and functions to an alternate facility. • Research conducted by Richard Wilson has shown that staff turnover is likely to occur after a disaster. Veteran staff is critical after a disaster. It is important to prevent turnover so that existing personnel do not have to take on extra responsibilities during an already stressful time. Continuity planning can also help lessen turnover by ensuring competitive salaries and benefits and by reducing the amount of stress staff will have to endure. • The Disaster Mitigation Act of 2000 requires communities to develop actions that reduce the impact of a natural hazard [201.6(c)(3)(ii)]. Developing a continuity of operations plan will diminish the effects of a natural disaster by providing Jefferson County with a framework for continuing operations in a potentially chaotic situation. 			
Ideas for Implementation:			
Ideas for implementation: Coordinate efforts with the Leadership Plan, talk to Jack Jones about this, he will have information.			
<ul style="list-style-type: none"> • Research and review completed continuity of operations plans to provide a foundation of expected content and issues to review. • The COOP should ensure shelter housing for critical staff and family members such as County officials, public works employees, emergency response, and others. • Assess and prioritize critical positions and resources vital to the continuance of important County functions. • Incorporate COOP into the existing Emergency Operations Plans where applicable. 			
Lead Agency:	County Commissioners		
Internal Partners:		External Partners:	
Assessor, Treasurer, Clerk			
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 7

Proposed Action Item:		Alignment with Plan Goals:	
The Jefferson County Natural Hazards Mitigation Steering Committee will be the coordinating body responsible for implementing the Jefferson County Natural Hazards Mitigation Plan.		3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Jefferson County Natural Hazards Mitigation Steering Committee identified itself, with the inclusion of other members, to be the main body to implement the Jefferson County Natural Hazards Mitigation Plan. The Disaster Mitigation Act of 2000 requires Mitigation Plans to include a maintenance section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle [201.6(c)(4)(i)]. A key component to effective maintenance is to have a coordinating body responsible for both the maintenance implementation of the plan to ensure that it remains relevant to Jefferson County's needs. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Convene the Hazard Mitigation coordinating body on a semi-annual basis to discuss Plan actions and methods for their implementation. After natural hazard events occur, convene the coordinating body to discuss action items for implementation or strategies for amending the plan to incorporate new action items. 			
Lead Agency:	Community Development		
Internal Partners:		External Partners:	
Jefferson County Natural Hazards Mitigation Steering Committee			
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT (ongoing)		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Multi-Hazard # 8

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate mitigation planning activities with existing planning activities, such as emergency response tabletops, to discuss mitigation actions and avoid duplicating efforts.		3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies. 4. Increase education, outreach, and awareness.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • There are a number of organizations in Jefferson County that conduct activities related to emergency management or public health and safety. These organizations include the Mountain View Hospital, the Jefferson County Department of Health, the US Forest Service, the Bureau of Land Management, the US Fish and Wildlife Service, the Jefferson County office of Emergency Management, and the Community Wildfire Protection Program (CWPP) Core Team, among others. Coordinating mitigation planning activities with other emergency management or public health and safety activities will avoid duplicating efforts and increase cooperation among different entities striving to improve disaster resilience in Jefferson County. • The Disaster Mitigation Act of 2000 requires communities to maintain the Hazard Mitigation Plan by having local governments incorporate the requirements of the mitigation plan into other planning mechanisms [201.6(c)(4)(ii)]. Coordinating mitigation activities with other emergency management or public health and safety planning activities will help local governments incorporate mitigation into other plans and policies currently being developed. Coordination will also reduce duplication of planning efforts, strengthening the overall mitigation planning process. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Include representatives from the Hazard Mitigation Coordinating Body in other emergency management and public health and safety planning efforts to ensure a link between mitigation and other planning activities. • Invite members of other committees to Hazard Mitigation Coordinating Body meetings. 			
Lead Agency:		Emergency Services	
Internal Partners:		External Partners:	
Community Development, Public Works		OEM, DLCD, DHS, OPDR, OPRD	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:		Jefferson County Steering Committee	
Action Item Status: Pending			

Multi-Hazard # 9

Proposed Action Item:		Alignment with Plan Goals:	
Develop strategies for collaborating and coordinating with other entities to improve mitigation and emergency management activities in Jefferson County.		3. Increase cooperation and coordination among private entities, local agencies, state agencies, and federal agencies.	
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • There are a number of organizations in Jefferson County that conduct activities related to emergency management or public health and safety. These organizations include the Mountain View Hospital, the Jefferson County Department of Health, the US Forest Service, the Bureau of Land Management, the US Fish and Wildlife Service, the Jefferson County office of Emergency Management, and the Community Wildfire Protection Program (CWPP) Core Team, among others. Coordinating mitigation planning activities with other emergency management or public health and safety activities will avoid duplicating efforts and increase cooperation among different entities striving to improve disaster resilience in Jefferson County. • The Disaster Mitigation Act of 2000 requires communities to maintain the Hazard Mitigation Plan by having local governments incorporate the requirements of the mitigation plan into other planning mechanisms [201.6(c)(4)(ii)]. Coordinating mitigation activities with other emergency management or public health and safety planning activities will help local governments incorporate mitigation into other plans and policies currently being developed. Coordination will also reduce duplication of planning efforts, strengthening the overall mitigation planning process. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Include representatives from the Hazard Mitigation Coordinating Body in other emergency management and public health and safety planning efforts to ensure a link between mitigation and other planning activities. • Invite members of other committees to Hazard Mitigation Coordinating Body meetings • Incorporate mitigation actions into other planning mechanisms, where appropriate. • Determine a method, schedule, and strategy for incorporating mitigation into existing plans & policies. Utilize the Partnership's 'matrix' document to do so at the five-year update. 			
Lead Agency:	Emergency Services		
Internal Partners:		External Partners:	
		Mountain View Hospital, Jefferson County Department of Health, USFS, BLM, USFWS, CWPP Core Team	
Timeline:		If available, estimated cost:	
<u>Short Term</u> (0-2 years)	<u>Long Term</u> (2-4 or more years)		
	LT		
Form Submitted by:	Jefferson County Steering Committee		
Action Item Status: Pending			

Appendix B: Planning and Public Process

October 16, 2007

Recipient's name

Title

Address

Dear _____:

Jefferson County and the Oregon Partnership for Disaster Resilience (the Partnership) invite you to join the Jefferson County Steering Committee to participate in developing a Natural Hazard Mitigation Plan. As a member of the steering committee, you will be able to provide valuable input in the process of developing actions that will help reduce the impact of natural hazards in Jefferson County.

A Natural Hazard Mitigation Plan is a non-regulatory plan that provides a community with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. The plan will identify natural hazards facing the county, where they are most likely to occur, and what populations and facilities will be adversely impacted. The plan will also identify a list of mitigation action items that aim to reduce the impact of natural hazards. Finally, an adopted mitigation plan will make Jefferson County, as well as the included cities, eligible for Pre-Disaster Mitigation grant funding and Hazard Mitigation Grant Program funding from the Federal Emergency Management Agency (FEMA). The federal grant funding will help the county pay for mitigation projects, such as flood and wildfire mitigation.

The development of the Jefferson County Mitigation Plan is part of a collaborative grant from FEMA—administered through the University of Oregon and the Partnership for Disaster Resilience—to assist 11 eastern Oregon counties in developing mitigation plans. The Partnership is an interdisciplinary organization based at the University of Oregon's Community Service Center that specializes in providing assistance to communities on the development of natural hazard plans. Jefferson County will serve as the primary point of contact and chair steering committee meetings, while the Partnership will take the lead on facilitating the planning process.

Our introductory steering committee meeting will take place at 9 am on November 16, 2007 at the Jefferson County Courthouse at 66 SE D Street in Madras. At this meeting we will be discussing the hazard mitigation planning process in more detail and what steering committee members can expect over the next few months as we develop the plan.

If you have any questions, please contact Margaret Boutell, the Jefferson County Community Development Director at (541) 475-2449, or by email at Margaret.Boutell@co.jefferson.or.us. In addition, please confirm your participation in the November steering committee meeting with Margaret as soon as possible.

Thank you for your time and we look forward to seeing you November 16th.

Sincerely,

Margaret Boutell
Jefferson County Community Development Director

Meeting: Jefferson County Natural Hazards Mitigation Plan Kickoff Meeting
Date: November 16, 2007
Time: 9 am-12 pm
Location: Jefferson County Board Room, 66 SE D Street, Madras, OR 97741

AGENDA

1. Introductions (10 min)
2. Partnership for Disaster Resilience Overview (20 min)
 - a. What is the Partnership for Disaster Resilience?
 - b. Partnership Activities
 - c. Mitigation Overview
3. Project Overview (45 min)
 - a. Project Goal
 - b. Natural Hazards Mitigation Plan Organization
 - c. City Addendums
4. Steering Committee and Partnership Expectations (10 min)
5. Project Timeline (10 min)
6. Region 6 Profile Reviews (10 min)
7. Wrap-up (10 min)

Jefferson County Introductory Steering Committee Meeting

Introducing Steering Committee members to the
 Jefferson County Natural Hazards Mitigation Planning Process
 November 16, 2007, 9 am
 Jefferson County Board Room
 66 SE D Street, Madras, Oregon

Name	Title	Organization Representing	Time In	Time Out	Location coming from (City)	Signature certifying this information is correct
Margaret Boutell	Community Development Director	Jefferson County	9:00 am			Margaret Boutell
MIKE FOLKES	JCSO	" "	9:00			
E.V. Smith	Public Works Culvert Natural Res.	City of Culver	0900			
Bob Flores	NRTL Team Ldr.	Sisters R.D./Deschutes N.R.	0900			
Slater Turner	District Ranger	Crooked River National Grassland	0900			Slater Turner
Bob McCounell	OPERATIONS SUG. MGR	CENTRAL REC COOP	09:00			
JACK JONES	Sheriff, JEFF. CO.	JCSO	0900			
Kay Baker	Supervisor/Assistant community	Jefferson 509 J & County ESD Crooked River Ranch	9:10			
Aaron Palmquist	Manager		9:01			

Meeting: Jefferson County Asset and Hazard Identification Workshop

Date: March 20, 2008

Time: 9 am to 12:30 pm

Location: Jefferson County Annex Building, 66 SE D Street, Madras, OR

AGENDA

- | | |
|---|----------------|
| 1. Introductions | 10 minutes |
| 2. Progress so far | 10 minutes |
| 3. Hazard Identification Workshop (Hazards and Impacts) | 1 hour 30 min. |
| a. Earthquake | |
| b. Flood | |
| c. Landslide | |
| d. Volcano | |
| e. Winter Storm | |
| f. Wind Storm | |
| g. Wildfire | |
| h. Drought | |
| <i>Break</i> | 10 minutes |
| 4. Asset Identification Workshop and Vulnerability Assessment | 1 hour |
| a. Human Population | |
| b. Economic Assets | |
| c. Cultural and Historic Resources | |
| d. Infrastructure and Critical Facilities | |
| e. Environmental Assets | |
| 5. Action Items | 20 minutes |
| a. Forms | |
| b. Developing Action Items for your community | |
| 6. Next Steps | 10 minutes |

Jefferson County Hazard and Asset ID Steering Committee Workshop

Conducting a Hazard Identification and Asset Identification

Workshop with Jefferson County Steering Committee members

March 20, 2008, 9 am to 1 pm

Jefferson County Board Room

66 SE D Street, Madras, Oregon

Name	Title	Organization Representing	Time In	Time Out	Location coming from (City)	Signature
Margaret Bartell	Community Dev. Director	Jefferson County	9:00am			Margaret Bartell
Thom Myers	Preparedness Coord.	JC Public Health	9:00am		Madras	Thom Myers
WAL Littlejohn	PUBLIC WORKS SUPERVISOR	METOLINS	9:00		METOLINS	WAL Littlejohn
Robert Flores	Asst. Dir. Risk Mgmt. Nat. Res. Team Ldr.	Sister R.D./Deschutes NF	9:00		Sisters/Metolins Basin	Robert Flores
Larry Langley	Chief Crooked River Ranch FD	CRR	0900		CRR	Larry Langley
Mark R. Carman	Asst. Chief/Fire Marshal	JCFD #2	0900		Madras	Mark R. Carman
Chris Fumk	Facilities Manager	Culver School Dist.	0900		Culver	Chris Fumk
Gus Burriel	Madras Public Works Dir.	City of Madras	0915		Madras	Gus Burriel

Meeting: Jefferson County Asset and Hazard Identification Workshop

Date: March 20, 2008

Time: 9 am to 12:30 pm

Location: Jefferson County Annex Building, 66 SE D Street, Madras, OR

MINUTES

1. Meeting attendees

- a. Margaret Boutell, Jefferson County Community Development Director
- b. Thom Myers, Preparedness Coordinator, Jefferson County Public Health
- c. Hal Littlejohn, Metolius Public Works Supervisor
- d. Robert Flores, District Ranger, Sisters Ranger District, Deschutes National Forest
- e. Larry Langley, Chief Crooked River Ranch
- f. Mark Carman, Assistant Chief/Fire Marshall, Jefferson County Fire Department # 1
- g. Chris Funk, Facilities Manager, Culver School District
- h. Gus Burrell, Madras Public Works
- i. A. Gregoor Passchier, Research Intern, Partnership for Disaster Resilience
- j. Krista Dillon, Assistant Director, Partnership for Disaster Resilience
- k. Bill Burns, Engineering Geologist, Department of Geologic and Mineral Industries

2. Introduction

The Oregon Partnership for Disaster Resilience (OPDR), together with Jefferson County, are developing a Natural Hazards Mitigation Plan for the County and the incorporated cities of Madras, Metolius, and Culver. The hazard and asset identification workshop is the second meeting with Jefferson County community members. The workshop identifies community assets and vulnerabilities, and how natural hazards impact those vulnerabilities. The ultimate goal is to understand the level of natural hazard risk in Jefferson County to assist in developing action items to mitigate that risk.

3. Progress so far

PDR has developed drafts of a community profile for Jefferson County that identifies major community characteristics relating to the economy, transportation, housing, infrastructure, and employment. The draft profile will be posted on the OPDR website for comments and review. OPDR is also researching hazard information for Jefferson County and the cities, and will incorporate information gathered at this meeting into the plan.

4. *Hazard and Asset Identification Workshop*

Identifying natural hazard history of a community provides background information on what events have occurred in the past so that the plan can address those hazards should they recur in the future. In addition, identifying major assets/issues in the community and how they are impacted by natural hazards will tailor the plan to those major issues. The workshop is as much a presentation to the steering committee as an information gathering session for the Partnership. Bill Burns from the Department of Geologic and Mineral Industries (DOGAMI) discussed the geologic side of natural hazards, and PDR presented hazard history information researched so far. Then the committee as a whole identified local natural hazard events and community assets to determine Jefferson County's overall level of risk. The committee also discussed the probability and vulnerability assessments for each of the natural hazards in Jefferson County.

Earthquake

Bill Burns' from DOGAMI noted the numerous faults located throughout Jefferson County, however, in recent history, Jefferson County has not experienced major earthquake events. The most recent event occurred in the Maupin area north of Madras where there were several swarms last year. Most of the historic earthquake events occurred in the counties surrounding Jefferson, the closest being in 1993 in Klamath Falls.

Vulnerable infrastructure in the County includes the following:

- The High Bridge over the Crooked River and the Deschutes River Bridge in north Jefferson County are vulnerable to earthquakes and could isolate the county if damaged. The bridges serve as the major links to surrounding communities, and beyond these bridges, there are only a few ways in and out of the county.
- The Round Butte regulation dam in addition to the electrical substation and gas lines are vulnerable to earthquakes. Damage to this infrastructure could cause dam leakages and power and gas outages.
- Other vulnerable dams include the Felton, Haystack, Round Butte dams. The dams provide irrigation water to the surrounding farms and Round Butte dam provides power to Portland and Northern California.
- Opal Springs water station provides water to Jefferson County and if damaged could restrict water distribution to the County.
- Bridges on the road to Prineville on Highway 20 are also vulnerable to earthquake damage
- Collection and treatment systems, such as sewer treatment plants and other necessary infrastructure are vulnerable to earthquake events

Vulnerable communities/populations in the County include the following:

- The City of Madras is one of the most isolated large communities in Central Oregon
- The Crooked River Ranch is also isolated from the rest of the county, and should the High Bridge be damaged after an earthquake, the residents of the Crooked River Ranch would not be able to get to work in Madras
- Many of the Crooked River Ranch residents have also built their homes near the rims of the canyon and are vulnerable to earthquake-induced landslides

- Crooked River Ranch has a population of 70% elderly people who are particularly vulnerable to many natural hazard events.
- Assisted living/nursing facilities may also be vulnerable because they are of ordinary construction and range from 5 to 18 years old.
- The International Building Code has amendments that deal specifically with earthquake issues in Oregon and provide structural improvements to new buildings, but older buildings are still vulnerable.

Economic Vulnerabilities

- If an earthquake were to occur and close Highway 97, the economic impacts could be significant, especially since all truck traffic would be closed. Highway 97 gets an average of 400 trucks a day, however when I-5 closed in December 2007, the number of trucks on 97 averaged 1000, and it is the primary alternative route for I-5.
- Damage to the rail line trestle over the Crooked River Gorge could impact rail traffic through Jefferson County.

Vulnerable Critical Facilities

- The Jefferson County Courthouse is an unreinforced masonry building
- The Crooked River Ranch Senior Center is an important community center for the Crooked River Ranch and could sustain damage in an earthquake.
- The Mountain View Hospital may be overwhelmed with mass casualties having only 24 to 44 beds. However the hospital is relatively new construction located on a hill and may not be as vulnerable to earthquakes as other buildings.
- The Deer Ridge Correctional Institution near Madras is built to today's standards and can house 2000 inmates.

Earthquake Probability: Moderate

Earthquake Vulnerability: High

Flood

Flood events occur in Jefferson County approximately every 10 years. The principle riverine flood sources for flooding in Jefferson County include Willow Creek, an unnamed stream north of Culver, and Muddy Creek. The most recent flooding event occurred in December 2005 when a warm spell of rain on snow caused extensive flooding in Culver and Madras, with some mudslide events occurring in the Crooked River Ranch area. The flood in 2005 caused approximately three to four feet of water on side streets in Madras and 18 inches of water flowing on Highway 97 leading to a five-hour delay along Highway 97. Homes had to be evacuated, County offices damaged, and total costs to infrastructure numbered in the hundreds of thousands. Much of downtown Madras is located in the Willow Creek floodway.

Communities in Jefferson County have taken steps to mitigate against floods. Madras has a Flood Mitigation Plan funded by Flood Mitigation Assistance money and has flood ordinances. Culver has their own planning department and has upgraded the culver on 9th Street, reducing the impact in on what had been a 10 year event. The County has a standard floodplain ordinance requiring a floodplain permit for new development. During the 2005 flooding event, Fire and Emergency Services were needed on North Willow Creek Road, and now they have staged at the Y on 97 to service the north side of town.

Vulnerable Critical Facilities

- Madras City Hall and Police are located in the floodplain
- County Courthouse and County offices are located in floodway
- The City of Madras road department, county, and city public works located in the floodplain as well.
- Madras Schools, including Elementary, Middle, and High Schools are located in the floodplain.
- The Crooked River Ranch Administrative Building was affected with runoff
- The Crooked River Ranch Fire Station could also be impacted by flooding events
- The City of Culver does not have any critical facilities located in the floodplain, mostly older residential buildings are located in the floodplain.

Vulnerable Infrastructure

- A number of culvert issues exist in unincorporated areas in Jefferson County, 24 inch culverts should be upgraded to 32 inch culverts.
- Flash flooding can occur in Canyons in the summer, usually one warning is issued per year, especially up the 26 corridor and on Highway 97.
- High flash flooding along the road ways could wash out roads
- At the Crooked River Ranch the roadways are gravel and dirt and are subject to erosion during flooding events.
- An important issue to consider is how to transport people if roads are flooded

Regulations that could impact mitigation are the salmon laws that regulate how culverts and floodways are constructed. Salmon are being introduced in Metolius and in the Warm Springs tribe making the area a salmon run, which puts additional regulations on widening culverts because of the effects they would have on salmon habitat.

Flood Probability: High

Flood Vulnerability: High

Landslide

Landslide events in Jefferson County have occurred as rockslides along the sides of cliffs and after major wildfire events. Rock falls have occurred near Pelton Reservoir in the Warm Springs Reservation, closing down Pelton Park. Parts of the park were sliding into the reservoir. In Camp Sherman wildfires in 2003 led to significant landslides in the area.

Vulnerable Communities include the following:

- The Crooked River Ranch is a one-way in, one-way out community. Their northwest roads are subject to landslides and they have not been reinforced. Over the past 25 years they have looked at areas as potential evacuation routes but the issue is not feasible.
- Crooked River Ranch has a rim setback for new residences
- Occasionally there are topples and falls along the canyon with cracks appearing near the golf course
- Camp Sherman is also vulnerable to landslide events, especially after the Eyerly wildfire in 2002. Combined with poor road conditions, the Camp Sherman area has problems along its south access routes, and alternate routes evacuation routes may also be affected by landslides.

Vulnerable Infrastructure includes the following:

- The bridge at Three Rivers is subject to landslide events along Jordan Road. This community is particularly vulnerable because it is currently growing.
- Landslides have occurred on Highway 26 as the road descends into the canyon and on the approach into Warm Springs.
- The County road department usually responds to rockfalls

The landslide ordinance requires completing a geotechnical report for foundations based on the geologic mapping. A potential action item would be to do education and outreach to homeowners for them to consider their options.

Landslide Probability: High

Landslide Vulnerability: High

Wildfire

Jefferson County currently has a Community Wildfire Protection Plan (CWPP) in place that documents areas vulnerable to wildfires, specific areas in the wildland-urban interface, and potential mitigation actions the county can implement. The County played a large role together with Chief Langley to create the CWPP and there was extensive community outreach on the plan.

Additional wildfire events include the Geneva I, II, III, and IV wildfires that occurred near Three Rivers, burning 400 acres less than a mile from the ranch. In 2007 a fire near the Crooked River Ranch burned 330 acres on BLM land, destroying 15 homes and threatening 80 others. The Black Crater Fire is another significant wildfire that affected Jefferson County. In 2007 the Baker Canyon Fire threatened homes, and residents in Camp Sherman had four days without resources. Central Oregon has fire management systems to monitor wildfire and these are located on the Bureau of Land Management (BLM) lands. One of the primary issues involved in fire fighting is that without quick access to respond, fire suppression is difficult. There are also evacuation issues associated with limited access communities. New developments in resort areas add additional issues near the Sisters/Camp Sherman area because of more development in the Wildland Urban Interface areas. An area of

particular concern is the potential destination resort being planned by the Metolius River headwaters and the potential increase of residents in the Wildland Urban Interface area.

Some potential action items address ingress/egress from the Crooked River Ranch and road upgrades. There is a new evacuation plan for the Ranch. In addition, subdivisions near Madras such as Three Rivers have the same issues being near a wildfire area.

Economic Vulnerabilities due to wildfire include:

- Less recreational camping in the Jefferson County area due to smoke and fire danger
- The Santiam Pass closed during the B & B Fire, significantly impacting transportation on Highway 20.
- Housing and other property lost value because of their vulnerability to wildfires

Vulnerable Communities include the following:

- Metolius has difficulty in evacuation
- In Sisters, near the Camp Sherman area, a destination resort at the head of the Metolius River is being considered, which can put people in harms way of wildfire
- Three Rivers and areas in Madras have problems with access/egress, especially in unincorporated communities.
- In Madras, the fire code is used to talk about ingress/egress from neighborhoods. If there are 100 units in a multi-family dwelling neighborhood, there must be two ways in and out of the neighborhood, but for single-family dwellings, access and egress is usually negotiated.
- New subdivisions in the county have standards, zoning laws require appropriate roofing, spark arresters, and access standards, but enforcement may be lacking.

A potential action item is that those areas vulnerable to wildfires will have standards for wildfire protection through fuels mitigation. The CWPP surveyed homes and found that there were more noncombustible homes than combustible. The Crooked River Ranch also has standards for wildfire in the CC & R's.

Wildfire Probability: High
Wildfire Vulnerability: High

Volcano

While volcanic activity is not a current threat in Jefferson County, the nearest active volcano, Mount St. Helens, can impact a community in terms of ash fall. The main issues related to ash fall are air intakes for automobile and other equipment. During the Mt. St. Helens eruption residents put nylons over intake areas to avoid ash from damaging equipment.

Vulnerable Populations

- Ash can affect breathing for all people, but can especially affect vulnerable populations such as the elderly and the young.

- A possible action item would be to provide resources to vulnerable populations about what to do when people encounter ash falls
- Currently the public health department does outreach for respiration, but this is mainly for atmospheric effects from wildfires rather than volcanic ash falls.
- The same atmospheric pollution occurred with the B & B fire where ash from the fire also affected vulnerable populations.

Environmental Vulnerabilities

- The environment can be negatively impacted by too much ash, especially concerning boating, tourism, fishing, and plant life

Economic Vulnerabilities

- Agriculture could be negatively impacted by having ash cover crops
- Should the roads close from ash fall, state resources would not be available
- Logging operations would be affected.

Infrastructure Vulnerabilities

- The total infrastructure system would require an assessment to test vulnerability to volcanic events and ash fall.

Although volcanoes produce a large amount of ash, ash from wildfires also negatively impact health and economies. The microclimates found in Jefferson County and the prevalent winds play a large role in depositing ash from wildfires around the county. Fire has a trigger list, so that when wildfires reach certain levels, communities are properly notified in terms of the health and safety concerns resulting from wildfires.

Volcano Probability: Low

Volcano Vulnerability: High

Winter Storm

Winter storm events coincided with the flooding events of 1976 and 2005. Some of the impacts of winter storm events are accessibility to emergency services, and the process for snow removal throughout the county.

Infrastructure Vulnerabilities

- The Central Oregon Electric Cooperative is frequently impacted from power outages in rural and isolated areas due to winter storms.
- The irrigation systems, such as the North Unit Irrigation District, are federally controlled, but used extensively by the cities and the rural farms. Extreme cold can cause water breaks when temperatures drop below 10 F.
- During heavy snow events, the snow plows cannot get to all the side streets, and warmer areas around manholes will melt the snow. The constant freezing and melting of snow around manholes often lead to potholes.

- In addition, roads are also significantly damaged during winterstorms

Vulnerable Critical Facilities

- In extreme cold events, some schools can't produce enough heat to heat the building
- If buses cannot run due to snow, then there is no school

Vulnerable Populations

- The cold and winter storms can affect the elderly and the poor that live in rural areas with poor access to services

Economic Vulnerabilities

- Agriculture can be impacted by winter storms by disrupting farming practices in extreme cold events and heavy snow

Winter storm probability: High

Winter storm vulnerability: High

Wind Storm

Wind storms affect Jefferson County almost on a yearly basis, especially in the Crooked River Ranch area where winds can reach 65 miles per hour. In addition, building codes are designed to withstand 80 mile per hour winds. The most recent wind storm occurred in December 2007, and in May 2006, sustained winds caused extensive tree damage.

Infrastructure Vulnerabilities

- New development requires more trees which can affect homes and power lines
- During wet seasons, blown over trees are more common.
- Power lines are impacted during windstorm events.
- If power loss occurs, some treatment plants cannot function. For example Culver does not have any backup power systems in place to deal with a power outage.

Economic Vulnerabilities

- Agriculture buildings can be affected, especially pole buildings
- Irrigation wheel lines can get tangled up in windstorms, affecting the agriculture economy.

Wind Storm Probability: High

Wind Storm Vulnerability: Moderate

Drought

Drought is a frequent problem in Jefferson County, especially since the county averages about 11” of rain each year. Jefferson County is likely still in a drought condition. This year the Crooked River Ranch received less snow, but when they did get snow, it came all at once. Overall, drought largely impacts agriculture and recreation in Jefferson County.

Infrastructure Vulnerabilities

- Dry canal beds due to evaporation. Although piping the canals will reduce overall evaporation, this does not help in terms of controlling flooding events and may affect groundwater supplies.

Economic Vulnerabilities

- Well water sources are impacted negatively as a result of drought
- There is a cap on extracting groundwater, especially in the Deschutes Aquifer, which can impact water use within the economy.
- Drought impacts agriculture by putting stress on farms that either have to spend money for more water, or suffer from reduced yield. More weeds are also present as a result of drought

Environmental Vulnerabilities

- Drought can impact agriculture development and the environment, especially concerning salmon restoration
- Drought can impact wildfire events. Drier forests are more combustible, and trees are also more stressed, decreasing resistance against wildfires and disease. With dead fuel higher now than in the past, forests are even more vulnerable.
- Drought lowers reservoirs, warms the water, and encourages the growth of bluegreen algae. This impacts fishing and recreation. To mitigate algae growths, reservoirs are monitored on a weekly basis.

Economic Vulnerabilities

- Economic impacts from drought are increased costs for agriculture and limited recreational opportunities in reservoirs and forests

Drought Probability: High

Drought Vulnerability: High

5. Action Items

Action items are the drivers of the mitigation plan, they are specific actions designed to reduce the impact of natural hazards on the community. Now that Jefferson County has identified the major natural hazards and how hazards affect primary assets in the community, the next step is to identify the actions the community should take to reduce their overall risk to natural hazards. However, actions are only useful for the community if they appropriately address local events and issues community members have identified.

Homework for the next meeting: Think about potential action items from your organization’s perspective and how they can benefit from mitigation. For example, if there is a culvert in Madras that floods every five years, a good action item would be to enlarge the culvert to reduce flooding events. Developing local, specific actions

will help when developing grants to fund the actions. Action item forms will be sent electronically to assist community members in developing them.

6. *Next Steps*

A new meeting time to discuss goals and action items will be announced in the coming weeks, but will likely fall on a Thursday.

Meeting: Goals and Action Items/Plan Implementation
Date: May 29, 2008
Time: 9 am to 12 pm
Location: Jefferson County Annex Building, 66 SE D Street, Madras, OR

AGENDA

Mission, Goals, and Action Items

- | | |
|--|------------------------------|
| 1. Introduction | (5 min) |
| 2. Mission and Goals Discussion | (20 min) |
| 3. Presentation of Action Items and Discussion | (3 min/action, 75 min total) |
| <i>Break</i> | (10 min) |

Plan Implementation

- | | |
|--|----------|
| 4. Plan Implementation Discussion | (30 min) |
| a. Identify Convener | |
| b. Identify Coordinating Body and members | |
| 5. Plan Maintenance/Implementation Discussion | (15 min) |
| a. Project Prioritization | |
| b. Continued Public Involvement | |
| c. Five Year Review of the Plan | |
| 6. Next Steps | (15 min) |
| a. Action item revisions and plan review process | |

Jefferson County Goals and Action Items Steering Committee Meeting

Discussing the goals and action items for the
 Jefferson County Natural Hazards Mitigation Plan

May 29, 2008, 9 am-12 pm

Jefferson County Board Room

66 SE D Street, Madras, Oregon

Name	Title	Organization Representing	Time In	Time Out	Location coming from (City)	Signature certifying this information is correct
Megan Findley	Oregon Partnership Assistant Resiliency	→	9:00	12:15 meal	Eugene	[Signature]
Mike Folkers	7cso-207	→	9:00	12:15	Madras	[Signature]
Don Culfels	BRIVE FD	→	9:00	12:15	3pm	[Signature]
Aaron Palmquist	community manager	crooked river Ranch	9:00	12:00	CRH	[Signature]
Jeff Sanders	509J - chair	509J School Dist	9:00	12:15	Warm Springs	[Signature]
Bob McConnell	OPERATION MANAGER	CENTRAL ELECTRIC COOP	9:00	12:15	MADRAS	[Signature]
Lynn Fluhr	Fire chief	Warm Springs Fire & Safety	9:00	12:15	Madras	[Signature]
Hal Littlejohn	Public Works Sup	METOLIVS	9:00	12:00	METOLIVS	[Signature]
E.V. Smith Jr	Public Works Sup	CULVER	9:00	12:15	Culver	[Signature]
Margaret Boutell	Community Dev. Director	Jefferson County	9:00	12:00	Madras	Margaret Boutell

To: City/Special District

From: Margaret Boutell Jefferson County Community Development Director

Date: October 15, 2007

Subject: Jefferson County Natural Hazard Mitigation Plan

Purpose

The purpose of this memo is to inform cities and/or special districts of their opportunity to become eligible for FEMA mitigation grant dollars. Currently Jefferson County is creating a comprehensive natural hazards mitigation plan. By identifying resources, information, and strategies for natural hazard-focused risk reduction, the county will become eligible for pre- and post-disaster mitigation funding assistance. This memo explains how cities and special districts within all of these counties may join in the planning process and become eligible for their own FEMA mitigation grants.

City / Special District Addendum Requirements

A natural hazards mitigation plan does three things: 1) It identifies a community's risk to natural hazards (flood, wildfire, etc.), 2) It outlines a range of actions that a community can take to reduce its risk of natural disasters, and 3) builds partnerships within the community to assist in implementing mitigation actions.

Once the mitigation plan is approved and adopted, the county will be eligible to receive funding for natural hazard mitigation activities from two programs: The Pre-Disaster Mitigation (PDM) Grant Program, for planning and implementing mitigation projects prior to a disaster event, and the Hazard Mitigation Grant Program (HMGP), for long-term mitigation measures to be implemented following a declared disaster.

Although cities and special districts may benefit from county-identified mitigation projects, future funding opportunities are reserved for communities that have completed FEMA-approved natural hazard mitigation plans. In order to be independently eligible for funding opportunities, cities and special districts must either 1) create an addendum to their county's FEMA-approved hazard mitigation plan, or 2) create their own FEMA - approved natural hazard mitigation plan. Creating an addendum to the county plan is the preferred option for small cities and involves four simple requirements:

- 1) Each jurisdiction must document its involvement in the county-wide planning process by attendance at meetings, workshops, etc. and by gathering relevant community-specific hazard information for the plan.
- 2) Each jurisdiction must review the county's natural hazard risk assessment and indicate where their risks may be greater than the county's assessment.
- 3) Each jurisdiction must develop community-specific action items (i.e., risk reduction strategies) for inclusion in the plan
- 4) Each jurisdiction must formally adopt, via resolution, their specific mitigation plan addendum and the final county hazard mitigation plan. (*Note: neither document is regulatory.*)

Participation is encouraged, but voluntary. Cities and special districts of all sizes that elect to participate in their county's mitigation plan can benefit not only from eligibility for mitigation grant dollars but also from the planning process itself, which helps communities assess their risks and better prepare for natural disasters.

Memo

Subject: Stakeholder Interview Summary: Diane Seyl, Director of Public Health at the Jefferson County Health Department

Author: Sara Schooley, Research Assistant, Oregon Partnership for Disaster Assistance

Date: May 23, 2008

Diane Seyl is the Director of Public Health at the Jefferson County Health Department which handles environmental health, water supplies, investigation of communicable disease concerns in Jefferson County. The Health Department also keeps a record of birth and death certificates.

In the past, the Health Department has not been involved in response or prevention of hazards. As time goes on, public health gets more involved, especially with vulnerable populations. Much of this push is coming from the state department of health, which is asking the counties to get involved.

Currently, the Jefferson County Health Department heads the Public Health Emergency Preparedness Team in the County; they are currently looking to hire a hazards coordinator. Their present mitigation planning concerns bio-hazards, terrorist activities and pandemic flu outbreaks. These plans include plans for communication and vaccination (tetanus for floods).

In Jefferson County, the Sheriff's department heads the disaster team. The public health department works with the Sheriff's office along with the school district, Best Care (drug and alcohol), Indian Health Services, and Mountain View Hospital, among others.

When the hazards plans were being worked on, there were regular meetings. Now that the plans are complete, the meetings have ceased. Also, resources restrict the amount of meetings that can occur. Diane believes that table top exercise meetings are the most beneficial.

Although growth of the population has not affected Jefferson County's mitigation strategies, the demographics and distribution of the community does. The population is aging and 52% children are living outside the urban core (Madras).

Diane suggested that this distribution makes communication and education more important because these vulnerable populations (elderly, families with children) might need to take care of themselves during and for a while after a natural hazard. In particular, communication needs to be synchronized between the police and fire stations. Currently, the various arms of law enforcement have satellite phones and are on the same bandwidth but more can be done and more practice on how to use the system is needed.

The Confederate Tribes of Warm Springs is also located in Jefferson County and has been difficult to work with for mitigation planning. Diane mentioned that the people work well together, but the bureaucratic structure and rules make it difficult for the organizations of the reservation and county to work together. For example, the reservation has its own public health agency, police department, fire, etc. and is not required to coordinate with the county. This difficulty is magnified because of a

historical lack of trust. An exercise with the reservation was attempted in the past, a tabletop of a “chemical spill,” and it was found that there are serious disconnects between the organizations. Diane concluded by stating that natural hazards are not well known in Jefferson County and that people think they only happen in Portland, so feel they do not have to be prepared. Also, due to the lack of resources (financial and human) in Jefferson County, it is difficult to develop and maintain a natural hazards program.

Appendix C:

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 State Police - 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 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, police, 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.

What are some Economic Analysis Approaches for Evaluating Mitigation Strategies?

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 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 county planning commission, 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.

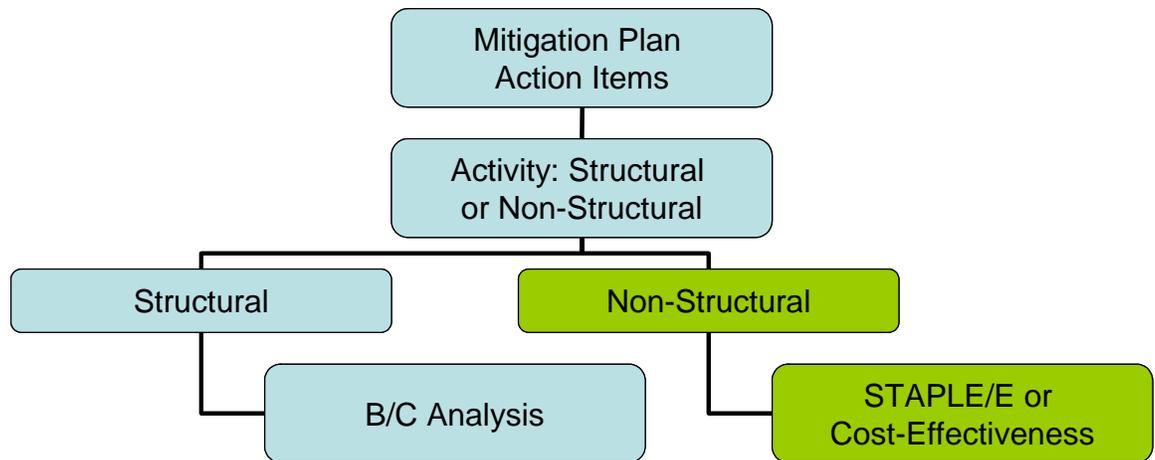
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 A.1: Economic Analysis Flowchart



Source: Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center, 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 State Police, 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.



Household Preparedness Survey

Jefferson, Harney, Lake and Malheur Counties



Household Natural Hazards Preparedness Survey

Survey Report for:

Jefferson County, Oregon
Harney County, Oregon
Lake County, Oregon
Malheur County, Oregon

Prepared by:

Oregon Natural Hazards Workgroup

Community Service Center
1209 University of Oregon
Eugene, OR 97403-1209
Phone: 541.346.3889
Fax: 541.346.2040
Email: onhw@uoregon.edu
<http://www.oregonshowcase.org>

January 2007



Special Thanks & Acknowledgements

The Community Service Center would like to thank the following individuals for their assistance on this project:

Rena Thompson, Jefferson County

Andy Seebert, Harney County

Phil McDonald, Lake County

Craig Smith, Malheur County

Project Manager:

Bethany Johnson, Oregon Natural Hazards Workgroup

Project Advisors:

Krista Mitchell, Project Coordinator, Oregon Natural Hazards Workgroup

André LeDuc, Director, Oregon Natural Hazards Workgroup

Robert Parker, Managing Director, Community Service Center

Natural Hazard Household Preparedness Survey

Background

The *Partners for Disaster Resistance and Resilience: Oregon Showcase State Program* was established in 2000 to provide a more coordinated approach to addressing risks from natural hazards in Oregon.

Establishing disaster safety as a public value is a shared objective among the partners involved with the Program. This Program strives to reduce deaths, injuries, property damage, economic losses and human suffering caused by natural disasters. The next flood, earthquake or wildfire cannot be avoided. However, we can make a comprehensive and concentrated effort to reduce the effects of these natural forces on our economic, social and environmental stability. The Program provides a comprehensive framework for government and the private sector to prepare for and minimize risk and impact of natural hazards.

The Federal Emergency Management Agency (FEMA) published Interim Rule 44 CFR Part 201 in February 2002, requiring all states and communities to develop natural hazard mitigation plans by November 2003. These planning and mitigation requirements for states and communities are being accomplished through the Pre-Disaster Mitigation Program (PDM). Oregon Natural Hazards Workgroup (ONHW) at the University of Oregon, as the coordinator of the *Partners for Disaster Resistance and Resilience: Oregon Showcase State Program*, is working with Oregon Emergency Management (OEM) and the PDM Program to assist local governments with their natural hazard mitigation planning efforts.

Citizen involvement is a key component in the natural hazard mitigation planning process. Citizens have the opportunity to voice their ideas, interests and concerns about the impact of natural disasters on their communities. To that end, the Disaster Mitigation Act of 2000¹ requires citizen involvement in the natural hazard mitigation planning process. It states:

An open public involvement process is essential to the development of an effective plan. In order to develop a more

¹ National Archives and Records Administration. 2002. Federal Emergency Management Agency 44 CFR Parts 201 and 206 Hazard Mitigation Planning and Hazard Mitigation Grant Program; Interim Final Rule in Federal Register.

comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.
2. An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process.

The benefits of citizen involvement, according to Bierle², include the following: (1) educate and inform public; (2) incorporate public values into decision making; (3) improve substantially the quality of decisions; (4) increase trust in institutions; (5) reduce conflict; and (6) ensure cost effectiveness.

The survey helps the counties of the Southeastern region, made up of Jefferson, Harney, Lake and Malheur Counties, realize Bierle's five benefits of citizen involvement in the natural hazard mitigation planning process. As part of the PDM Program, ONHW is assisting the Southeastern region of Oregon with the citizen involvement components of the natural hazard mitigation planning process.

Methodology

To conduct the household survey, ONHW modified the eight page survey administered statewide in 2002 to a five page survey. The purpose of the survey is to better understand the perceptions of risk to natural hazards held by citizens, as well as the level of preparedness and types of risk reduction activities in which citizens have engaged. (See Appendix A) The primary goal of the survey was to gauge the overall perception of natural disasters and determine a baseline level of loss reduction activity for residents in the community. ONHW adapted the statewide survey to include questions about citizens' support for different types of community planning actions. Planning actions mentioned included protecting critical facilities, disclosing natural hazard risks during real estate transactions, and the use of tax dollars to compensate land owners for not developing in hazardous areas.

The survey was sent to 1200 households in the Southeastern region, which includes: Jefferson, Harney, Lake and Malheur Counties. The households were randomly selected and population weighted based on registered voter lists provided to ONHW by each of the counties.

² Bierle, T. 1999. "Using social goals to evaluate public participation in environmental decisions." *Policy Studies Review*. 16(3/4), 75-103.

The mailing contained a cover letter, the survey instrument, an entry raffle form for a gift certificate to a local hardware store, and a postage-paid return envelope. Completed surveys were returned to ONHW. A second mailing was sent to households who did not respond to the first mailing, approximately three weeks later. ONHW received 277 valid responses, for a 23% response rate.

Limitations

The study identifies key issues about how members of the Southeastern Oregon communities perceive their risk to natural hazards, providing a snapshot of those perceptions at a single point in time. As such, survey responses may reflect external issues, such as heightened concern about terrorism or the current state of the economy. This study was not intended to be representative of the perceptions of all residents, and cannot be generalized to the public.

Organization of Report

The survey results are organized into the following sections:

Characteristics of Survey Respondents: This section reports information about respondent characteristics including: educational attainment, age, and length of time as an Oregon resident.

Perception of Risk: This section identifies the general level of concern over natural hazards risk.

Household Preparedness and Risk Reduction: This section describes the types of structural and nonstructural measures that are being implemented by survey respondents, and the types of resources or programs that might increase risk reduction activities.

Community Natural Hazard Preparedness: This section describes citizens' priorities for planning for natural hazards and the community-wide strategies respondents support.

Written Responses to Open-Ended Questions: This section includes summarizes the responses of the open-ended questions and comments.

Characteristics of Survey Respondents

Demographic survey questions provide a statistical overview of the characteristics of the respondents. This section of the survey asked respondents about their age and gender, their level of education, and how long they have lived in Oregon. The survey also included questions regarding respondents' present housing.

There were 277 people who responded to the survey, giving the survey a 23% response rate. Of the four counties the survey was mailed to, the majority of surveys returned came from residents of Jefferson and Malheur Counties (Table 1). This is not surprising as Jefferson and

Malheur have the greatest number of residents in the region with 50,339 of the 65,370 total residents (2000 U.S. Census). Zip codes provide a more specific location of the survey respondents than the county level data. Of the 30 different zip codes indicated, the most respondents live in the 97914 zip code (City of Ontario) followed by 97741 (City of Madras) (Table 2).

Table 1. Percent of Surveys Received Per County

County	Percent of Surveys Received
Harney	14%
Lake	15%
Jefferson	33%
Malheur	38%

Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006).

Table 2. Percent of Surveys Per Zipcode

Zip code	Percent of Surveys
97914	21%
97741	15%
97630	10%
97760	9%
97918	8%
97913	6%
97738	6%
97720	6%
97734	4%
Other	16%

Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006).

Gender and Age

Women accounted for 57% of survey respondents even though they represented just less than 50% of the population in the Southeastern region according to the 2000 Census. The mean age of survey respondents was 58 years. This is considerably higher than the average median age, 40 years, of residents in Southeastern Oregon according to the U.S. Census 2000. Table 3 compares the ages of survey respondents to the 2000 U.S. Census. This shows that younger people were underrepresented while older people were overrepresented.

Table 3. Percentage of Southeastern Oregon Population and Survey Respondents by Age Category (persons 20 and over)

Age Category	Mid & Southeastern Oregon³	Survey Respondents
20 - 24	6.0%	1.1%
25 - 34	12.3%	6.2%
35 - 44	14.4%	11.8%
45 - 54	13.3%	23.2%
55 - 59	5.2%	14.1%
60 - 64	4.6%	9.9%
65 - 74	7.5%	18.1%
75 - 84	4.7%	13.1%
85+	1.7%	1.1%

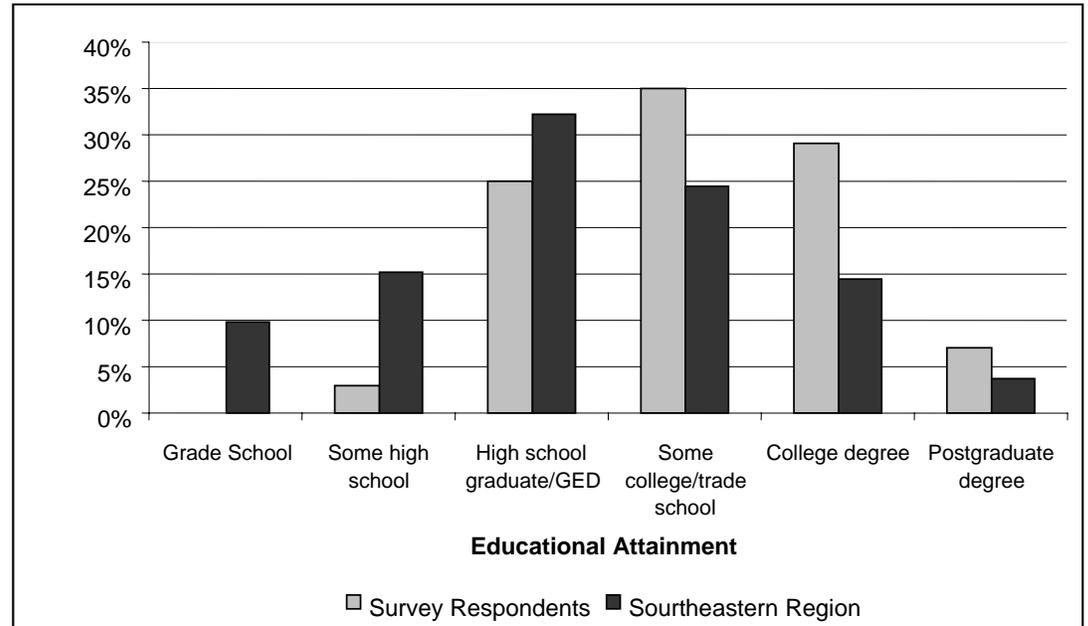
Source: U.S. Census Bureau: www.census.gov (2000) and Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006).

Level of Education

In general, survey respondents were relatively well educated. Figure 1 compares the level of education of survey respondents with the 2000 U.S. Census. About 71% of survey respondents have attended some college or gone to a trade school, obtained a college degree, or have a postgraduate degree. In contrast, figures from the Census show that an average of 43% of Southeastern residents have achieved this level of educational attainment. Survey respondents were much more likely to have completed a higher educational level than the overall population of the Southwestern region.

³ The age categories are percentages of the total number of people in each age group for all four counties as reported by the US Census 2000

Figure 1. Level of Education of Southeastern Oregon Population and Survey Respondents

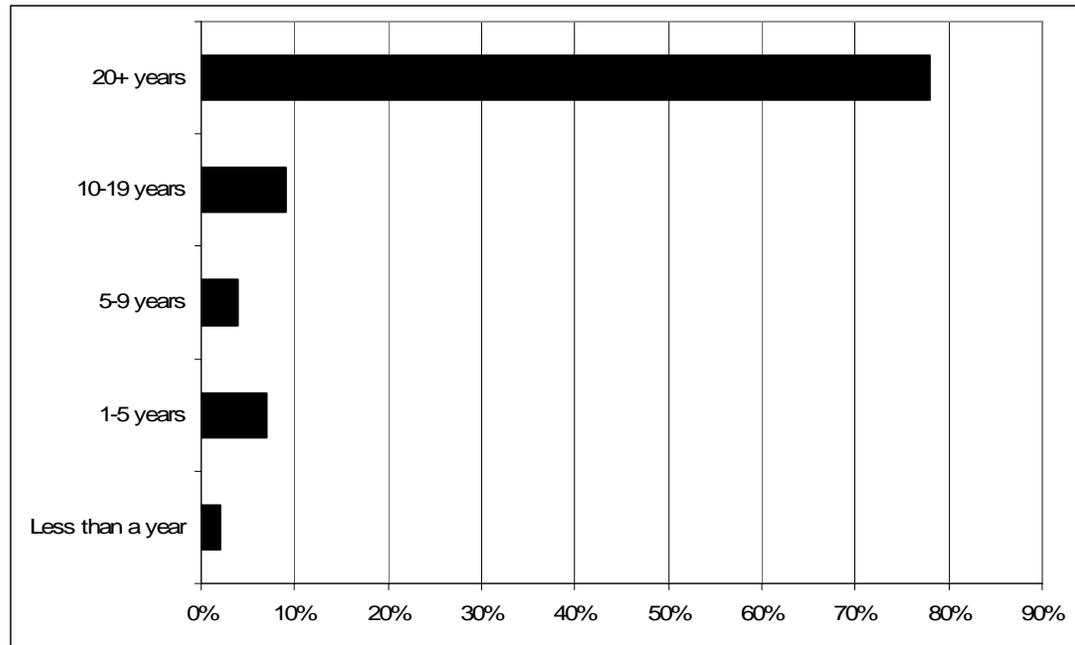


Source: U.S. Census Bureau: www.census.gov (2000) and Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

Oregon Residency

Approximately 78% percent of survey respondents have lived in Oregon for 20 years or more (see Figure 2). Respondents who have lived in Oregon for fewer than 20 years have most commonly moved from California (13%) and Idaho (13%).

Figure 2. Length of Time Survey Respondents Have Lived in Oregon



Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

Housing Characteristics

Housing characteristics are important variables in creating effective education and outreach programs. Knowledge of the percentage of homeowners in a community can help target the programs and homeowners might be more willing to invest time and money in making their homes more disaster resistance. Due to a data collection error, homeownership rates of survey respondents can not be reported. However, the US Census 2000 reports an average of 67% of Southeastern Oregon residents are homeowners.

Almost 66% of survey respondents live in single-family homes, 24% live in manufactured homes, 2% in apartments, and 3% live in duplexes. In addition, 76% said they have access to the internet.

Perception of Risk

It is helpful to understand community members' experiences and their perceptions of risk to natural hazards to make informed decisions about natural hazard risk reduction activities. The survey asked respondents about their level of concern for specific hazards in the Southeastern region. The primary objective of this question was to create a "natural hazard profile" of respondents to better understand how Southeastern residents perceive natural hazards.

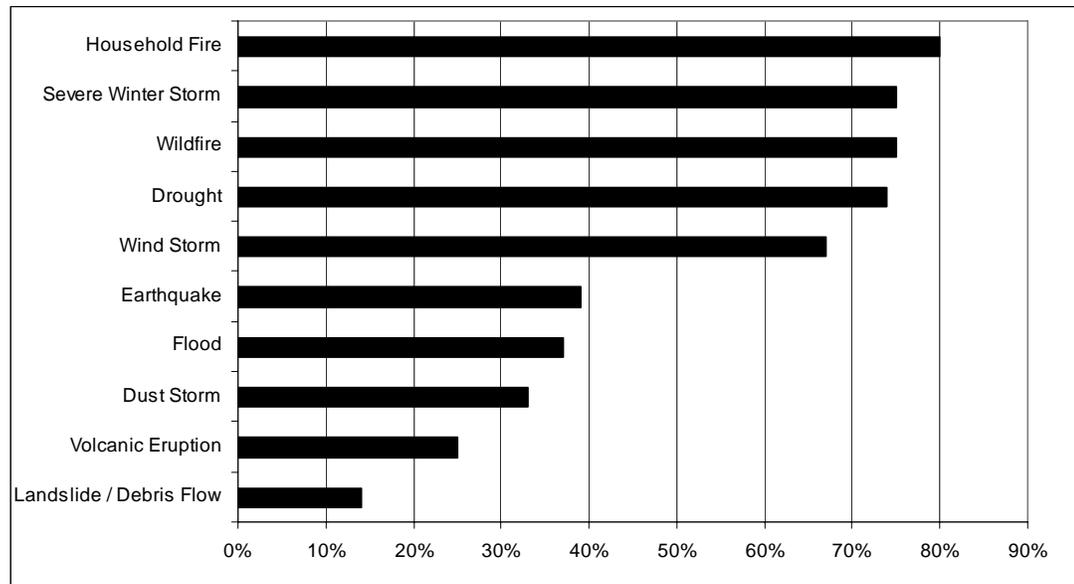
The survey asked respondents to rank their personal level of concern for specific natural disasters affecting their community. The results show that respondents were most concerned about household fire, wildfire, severe winter storm, drought and windstorm. The respondents are least concerned about landslide/debris flows. Figure 3 shows the percent of respondents that identified their level of concern as either "Very Concerned" or "Somewhat Concerned".

Table 4. Survey Respondents' Level of Concern Regarding Natural Hazards in the Southeastern Region

	Very Concerned	Somewhat Concerned	Neither Concerned nor Unconcerned	Not Very Concerned	Not Concerned
Drought	22%	52%	12%	9%	6%
Dust Storm	7%	26%	27%	22%	19%
Earthquake	11%	28%	21%	26%	14%
Flood	8%	29%	17%	23%	23%
Landslide / Debris Flow	4%	10%	23%	29%	34%
Wildfire	40%	35%	11%	8%	6%
Household Fire	31%	49%	11%	7%	2%
Volcanic Eruption	5%	20%	18%	20%	37%
Wind Storm	13%	54%	15%	11%	7%
Severe Winter Storm	23%	52%	14%	7%	4%

Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

Figure 3. Percentage of Survey Respondents' Who Are "Very Concerned" or "Somewhat Concerned" about Natural Hazards



Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

Household Preparedness and Risk Reduction

There are many steps people can take to prepare their households for a natural disaster or emergency. Preparing for a disaster can improve the safety and comfort of the members of a household immediately following a natural disaster or emergency. The survey asked respondents about what steps their households have taken or plan to take to increase their disaster preparedness.

Property Protection

Only 37% of the respondents considered the possible occurrence of a natural hazard when they bought or moved into their current homes. The need to have adequate provisions for financial and property recovery when natural disasters do occur is a necessary component of natural hazard preparedness. Fourteen percent of the respondents indicated they have flood insurance leaving 86% without it. However, 53% of those who don't have flood insurance indicated the reason is because their home is not located in the floodplain and 17% felt it was not necessary. Approximately the same amount of respondents (15%) indicated they have earthquake insurance. The top two reasons given by those who don't have earthquake insurance were that it is not necessary (37%) or that they never considered it (32%).

Table 5. Survey Respondents' Reasons For Not Having Flood and/or Earthquake Insurance

Flood Insurance		Earthquake Insurance	
Not located in the floodplain	53%	Not necessary	37%
Not necessary	17%	Not familiar with it/don't know	32%
Not familiar with it/don't know	9%	Not available	11%
Too Expensive	8%	Too Expensive	11%
Not available	6%	Deductible too high/not worth it	5%
Other	4%	Other	5%
Deductible too high/not worth it	3%		

Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

Sixty percent of respondents have used fire-resistant building or roofing materials and have secured their homes to its foundation. Fifty-six percent of respondents talked with members of their households about what to do in the case of a natural disaster or emergency. Table 6 summarizes the activities respondents indicated they have done, plan to do, have not done, or were unable to do to prepare for natural disasters.

Table 6. Survey Respondents' Household Disaster Preparedness Activities

	Have Done	Plan To Do	Not Done	Unable To Do	Does Not Apply
Attended meetings or received written information on natural disasters or emergency preparedness?	27%	7%	61%	5%	
Talked with members in your household about what to do in case of a natural disaster or emergency?	56%	14%	27%	2%	
Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	39%	19%	40%	2%	
Prepared a "Disaster Supply Kit" (Stored extra food, water, batteries, or other emergency supplies)?	41%	23%	36%	1%	
In the last year, has anyone in your household been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR)?	38%	6%	55%	1%	
Have you secured your water heaters, cabinets and bookcases to the wall?	26%	5%	62%	5%	4%
Have you fit your gas appliances with flexible connections?	24%	1%	14%	3%	58%
Used fire-resistant building or roofing materials?	60%	5%	22%	6%	7%
Secured your home to its foundation?	60%	3%	18%	9%	10%
Braced unreinforced masonry, concrete walls, and chimney?	22%	3%	27%	7%	41%
Elevated your home in preparation for floods?	19%	0%	20%	11%	50%

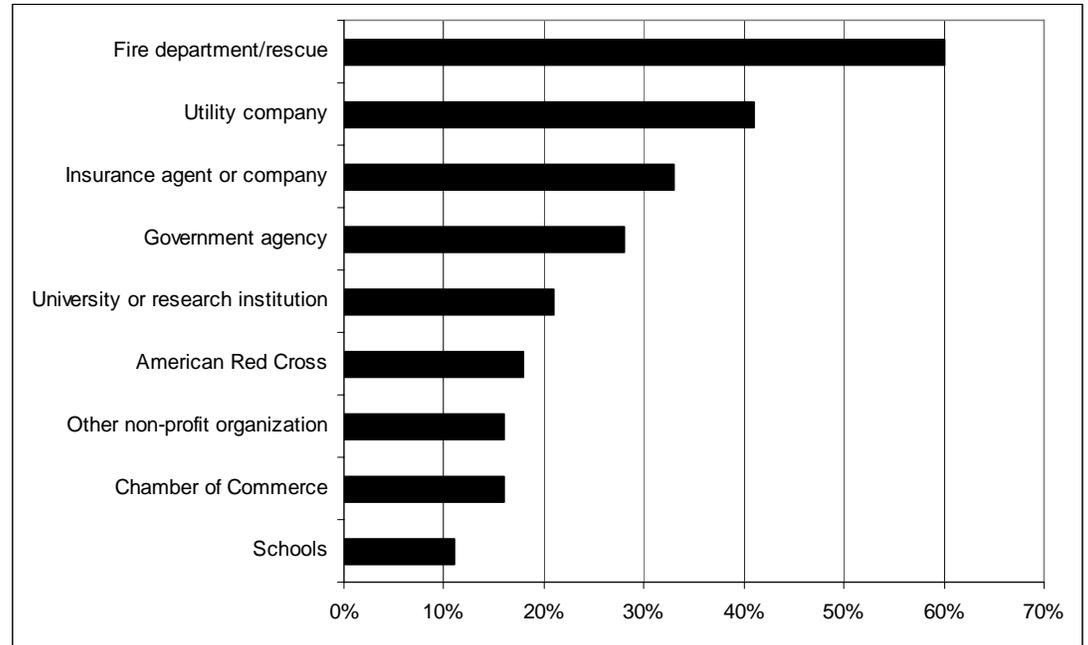
Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (June 2006)

Preferred Sources and Formats of Information

To develop and implement effective outreach and education activities, it is important to understand the mechanisms for information dissemination. Of the listed organizations that might provide information to households about household preparedness for natural disasters, respondents most frequently preferred the fire department or

rescue organization. Figure 4 shows that schools were the least preferred organization to be the primary information source.

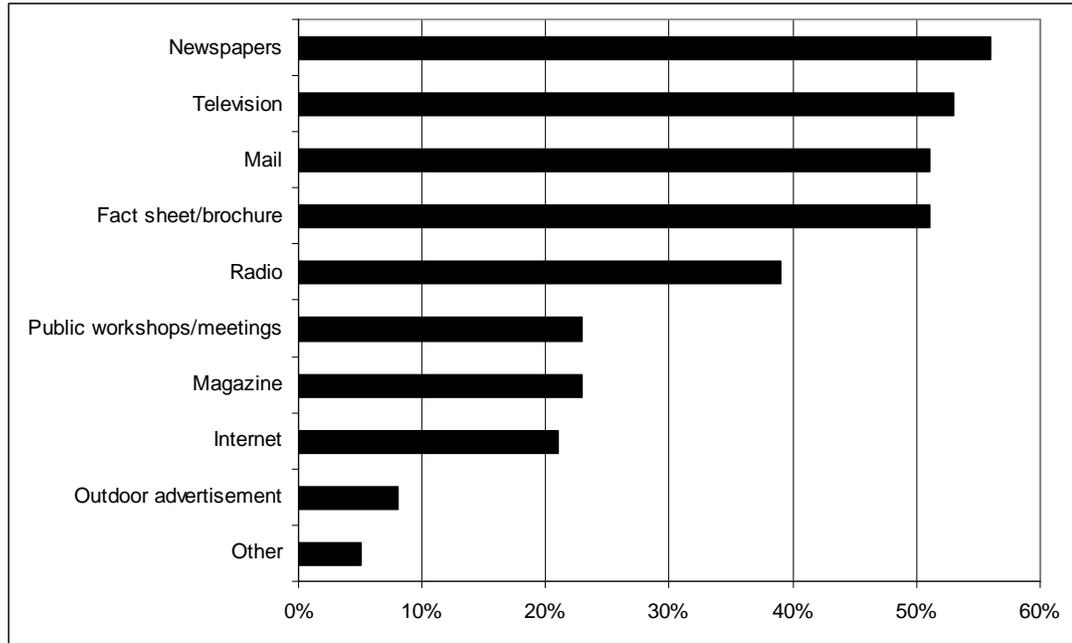
Figure 4. Survey Respondents' Preferred Sources of Information Regarding Household Preparedness



Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

When asked what the most effective way was to receive information, respondents indicated that the local newspaper (56%), television news (53%), fact sheet/brochure (51%), and mail (51%) were the most effective. Figure 5 shows how survey respondents rated the effectiveness of dissemination methods presented in the survey.

Figure 5. Survey Respondents' Ranking of Effectiveness of Selected Preparedness Outreach Methods



Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (September 2006)

Community Natural Hazard Preparedness

To assist those preparing the communities' natural hazard mitigation plans, it is essential to understand the importance community members place on specific community-level risk reduction actions. These questions could help Southeastern communities determine their citizens' priorities when planning for natural hazards. They also provide an idea of which types of strategies to reduce the communities' risk the citizens would be willing support. Table 7 illustrates the importance respondents placed on each potential natural hazard goal.

Over 95% of respondents indicated that it is very important or somewhat important to protect private property, protect critical facilities, protect and reduce damage to utilities, strengthen emergency services. The statement with the lowest priority (78%) is to protect historical and cultural landmarks.

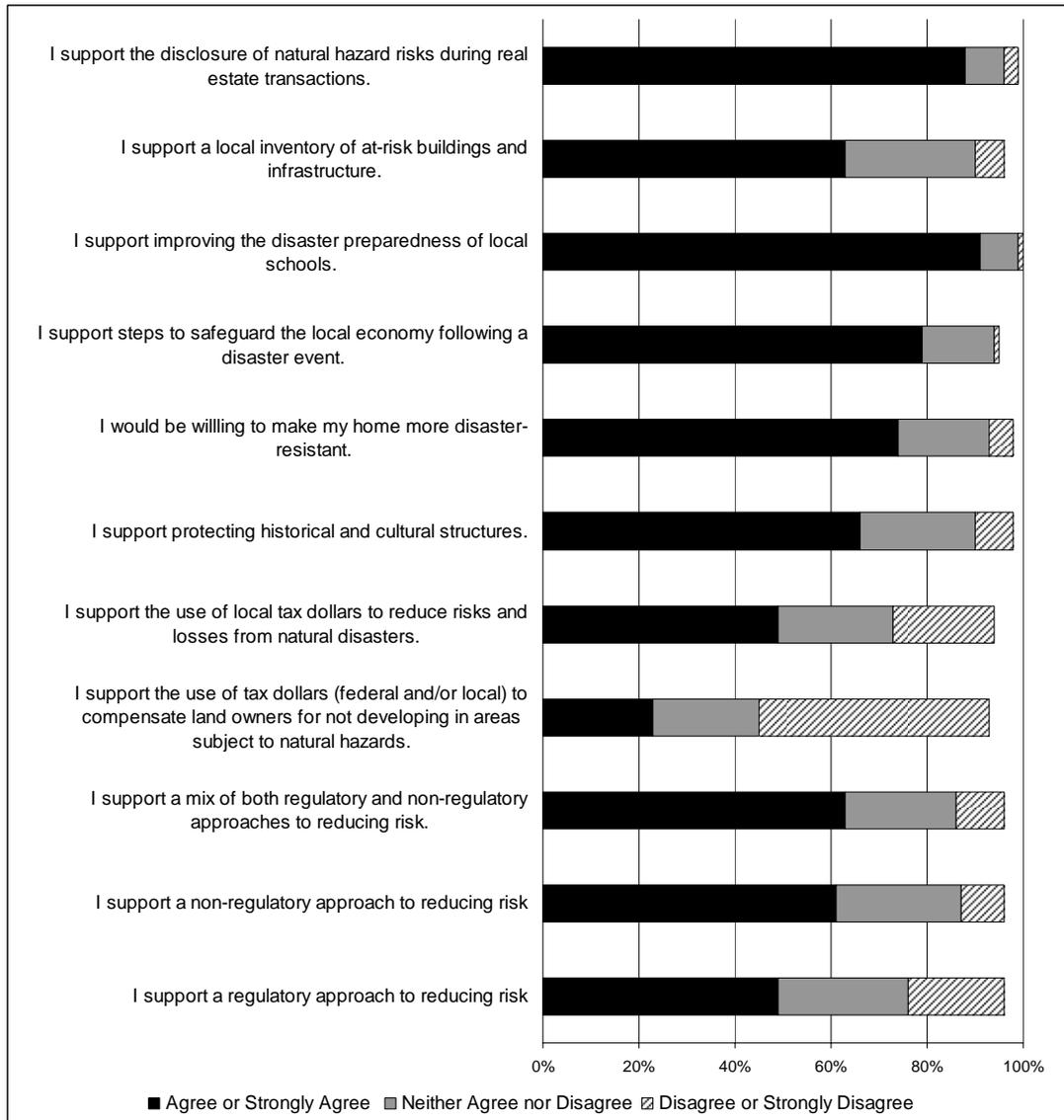
Table 7. Survey Respondents' Goal Prioritization

	Very Important	Somewhat Important	Neither Important nor Unimportant	Not Very Important	Not Important
Protecting private property	71%	24%	3%	1%	1%
Protecting critical facilities (e.g., transportation networks, hospitals, fire stations)	86%	12%	1%	0%	1%
Preventing development in hazard areas	46%	39%	10%	3%	2%
Enhancing the function of natural features (e.g., streams, wetlands)	37%	41%	14%	4%	4%
Protecting historical and cultural landmarks	31%	43%	19%	5%	2%
Protecting and reducing damage to utilities	70%	27%	3%	1%	0%
Strengthening emergency services (e.g., police, fire, ambulance)	68%	28%	3%	1%	1%
Disclosing natural hazard risks during real estate transactions	62%	29%	6%	2%	2%

Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

There are a number of activities a community can undertake to reduce the risk from natural hazards. These activities can be both regulatory and non-regulatory. Figure 6 and Table 8 shows respondents' general level of agreement regarding the community-wide strategies included in the survey.

Figure 6. Survey Respondents' General Level of Agreement Regarding Community-wide Strategies



Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

Table 8. Survey Respondents' General Level of Agreement by Percentage Regarding Community-wide Strategies

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not Sure
I support a regulatory approach to reducing risk	13%	36%	27%	16%	4%	4%
I support a non-regulatory approach to reducing risk	18%	43%	26%	8%	1%	5%
I support a mix of both regulatory and non-regulatory approaches to reducing risk.	23%	40%	23%	8%	2%	4%
I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards.	6%	17%	22%	32%	16%	6%
I support the use of local tax dollars to reduce risks and losses from natural disasters.	6%	43%	24%	16%	5%	6%
I support protecting historical and cultural structures.	13%	53%	24%	6%	2%	1%
I would be willing to make my home more disaster-resistant.	16%	58%	19%	4%	1%	3%
I support steps to safeguard the local economy following a disaster event.	17%	62%	15%	0%	1%	4%
I support improving the disaster preparedness of local schools.	34%	57%	8%	0%	1%	0%
I support a local inventory of at-risk buildings and infrastructure.	15%	48%	27%	4%	2%	4%
I support the disclosure of natural hazard risks during real estate transactions.	45%	43%	8%	2%	1%	1%

Source: Household Natural Hazards Preparedness Survey, Oregon Natural Hazards Workgroup, (Nov. 2006)

As shown in Figure 6 and Table 8, 91% of respondents indicated that it is very important or somewhat important for the community to improve the disaster preparedness of local schools. In addition, over 91% indicated that it is very important or somewhat important to disclosure natural hazard risks during real estate transactions.

Open-ended Survey Responses

Q3.1 If “NO” for flood, what is the main reason your household does not have insurance for flood events?

- Only through government agencies
- Haven't looked into it
- Not in flood zone
- We live on a hill (2)
- Refused by insurance company
- We rent
- House flood, not natural flood
- High desert
- No one will pay out even if you have flood insurance
- Told I didn't need it
- Wasn't suggested by agent

Q4.1 If “NO” for earthquake, what is the main reason your household does not have insurance for earthquake events?

Other

- Not offered in this area
- Didn't think there were earthquakes here
- Not sure, will find out. I think we do.
- Not in high risk area
- We rent
- Didn't think of it
- Probably not
- Looking into it/will consider
- Small chance of earthquake
- Not my home

Q6. Who is your preferred information source and what is the preferred way for you to receive information about how to make your household and home safer from natural disasters?

Other

- Want to talk to
- We called Andy Seebart and was told there was nothing available
- Our church has an excellent program to help w/preparedness
- Public service announcements over media: radio, TV
- Church
- Search & rescue meetings
- Church organization's meetings
- Landlord responsible
- Common sense
- Training in disaster
- Going to insurance agency & asking about coverage

Q 12. County

- Harney (37)
- Jefferson (84)
- Lake (38)
- Malheur (98)

Q16. Please indicate your level of education

- Lifetime of experience
- "5th" term college sr.
- Navy

Q17 Do you rent/own

- Mobile home 12' wide
- Acreage & shop
- Commercial bldg w/apartment
- Mobile home (2)
- Log home
- Apt. over store

Q18. If you have lived in Oregon for less than 20 years, in what state did you live before you moved to Oregon?

- Alaska (2)
- Arkansas
- Colorado (3)
- Illinois (2)
- Michigan
- Tennessee
- Wyoming (2)
- Arizona, Florida, Montana, Wyoming, Michigan, & Kansas
- North Carolina & Pennsylvania
- So. Dakota & Arizona

Please feel free to provide any additional comments.

- Some questions don't apply to me as I rent rather than own my residence!
- We always have extra food – in case of emergency. We have generator to keep refrigeration units & well operating, Lanterns & portable stove. The more information available will be good for everyone to get together to help in event of disaster.
- All is well – thank you.
- I think our rivers should be dredged so the high waters have a place to flow.
- Make the “Community Emergency Response Training” available to all residents in the state. It is an excellent program. It educates people in how to prepare themselves, family, & friends for disasters. It provides emergency response personnel with backup help.
- Of course because of global warming, the destruction of habitats, pollution, oil dependency, and people who either don't care or can't grasp what the consequences are of destroying all our resources, I am deeply concerned about eminent world-wide disasters.
- I am probably not a very good example to be completing this form – I'm a widow & live alone & was very unsure about how to answer most of these questions. I've only lived in this house about 2.5 years & it was new when I moved in, although it had a previous owner for a few months.

- Thank you for the time spent preparing, distributing, & utilizing citizens' input.
- 1) I would very much enjoy a final copy of survey results. 2) Civil servants are more & more forgetting who/whom. They work for why, they are on the personal list.
- I think we need less regulation.
- Home is located about 50 feet above 100 year flood plain and I am unaware of any history of earthquake history. It does concern me when I see construction (building) on steep slopes, or in areas prone to heavy runoffs.
- Tax dollars should not be used to restore homes/bldg built in known flood zones – flood zones should be clearly identified and public disclosure should be required. Give public information so they can make common sense discussion – regulations are too costly!
- We live on the rim of the Crooked River Gorge. The river is 100 feet out and 350 feet down.
- The more non-profit organizations (Red Cross) and churches are used the better. These have shown a great history of being closer to their communities, more compassionate, more sincere, and non-threatening. And they will be right there when a disaster occurs.
- Whatever approaches are used to assist us in making wiser choices regarding preparation for any emergencies, I believe they must be balanced – both regulatory & non-regulatory. One size does not fit all! For example, fire is a very real and present danger where we live, but flooding is not. So efforts need to be focused on what the most likely natural hazard(s) by area. Thank you for asking. Blessings on your work!
- My area is not subject to much by way of hazard – the Silvies River has flooded in the past, but I can't imagine it was more than 6-8 inches of water. Since this area is electric dependent, I have considered a small generator – not much else.
- In disaster preparedness I much prefer a non-regulated approach. But, to also have some regulations in place so that there is at least some disaster readiness in place should a disaster occur.
- Good luck. Most folks don't like being told what to do until there is an emergency & even then not! Compensating land owners to "not develop" seems an open unknown for a bottomless drain on the economy. Anyone can say "I want to build a huge [money-making] something" and you need to compensate them for their pipe dreams.
- It is hard for me to do these things, but family can do them. And I live with family. On Crooked River Ranch, over 4600 residents

reside. We have only one exit/access road. The BLM & State of Oregon have offered no solutions or help.

- Here in Summer Lake, we survived the winter fire, which became a firestorm due to inept state & federal performance. There was no common sense during the 1st 3 days of the fire, and the very agencies who should have been helping were exacerbating the situation. The best help came from local volunteers, friends, & neighbors. WE are now prepared & no longer count on state or federal help!!!
- People should depend on themselves and not expect the government to bail them out.
- Education is the main key to preparedness, not regulations. Some questions misleading, i.e. 8G, 7E. Historical & cultural protection is not necessarily the job of gov't, however, private & non-profit organizations can do this. *f – how would tax \$ be used?
- I am 89 years old and live in a rented duplex so some of my answers are left blank or I don't know correct answer! I believe this is a very important project. Good luck!
- I live alone, so not all apply directly.
- I believe it is each person's responsibility to determine what hazards are likely to happen in an area and then act accordingly.
- Everyone should have an emergency plan. My plan I keep my camp trailer ready and cleaned up to use for an emergency.
- I never vote for more taxes.
- I'm never in support of more taxes. And I'm reluctant for allowing government to interfere in our private lives. More rules always means less freedom.
- Encourage people to use common sense.



September 20, 2006

Dear Resident:

We need your help! The Counties of Jefferson, Harney, Lake, and Malheur are currently engaged in a cooperative planning process to reduce the risks and losses associated with natural disasters. As a part of this process, the *Partners for Disaster Resistance and Resilience* and the Oregon Natural Hazards Workgroup at the University of Oregon are conducting a household survey. This survey provides an opportunity for you to share your opinions about preparing for and reducing your household's and your community's risks from natural disasters. The information you provide about your household's needs for disaster preparedness could help the Mid and Southeast Region improve local disaster preparedness and risk reduction activities.

Your opinions are important to us! Please complete the enclosed survey and return it in the postage-paid envelope. The survey will take 15-20 minutes to complete. Please complete and return this survey by **Thursday, October 12, 2006**.

We will also enter your name in a drawing to win a gift certificate at Stunz Lumber Company, True Value Hardware, Big R Ranch Farm Home Supply, or Parr Lumber Company. Please fill out the enclosed form and return with your survey, or mail the gift certificate preference form in a separate envelope to be entered into the drawing.

Your returned survey indicates your willingness to take part in the study. Your participation in this study is voluntary. If you have questions regarding your rights as a research participant, please contact the Office of Human Subjects Compliance, Riverfront Research Park, Suite 106, University of Oregon, Eugene, OR 97403-5219, or call (541) 346-2510. All individual survey responses are strictly confidential and are for research purposes only.

If you have questions regarding the survey, please contact the Oregon Natural Hazards Workgroup at the University of Oregon at (541) 346-3588.

If you have questions about the regional planning process, please contact:

Jefferson County: Rena Thompson, 541-475-4462

Harney County: Andy Seebart, 541-573-5961

Lake County: Phil McDonald, 541-947-6027

Malheur County: Craig Smith, 541-473-5120

For information on *Partners for Disaster Resistance: Oregon Showcase State*, please visit <http://www.OregonShowcase.org>.

Thank you for your participation! We look forward to hearing your opinions!

Andre LeDuc, State Coordinator
Partners for Disaster Resistance & Resilience

Household Natural Hazards Preparedness Questionnaire

This questionnaire is designed to help gauge household preparedness for disasters, and knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. The questionnaire should be completed by an adult, preferably the homeowner or head of household. The information you provide about your needs for disaster preparedness could help improve public/private coordination of preparedness and risk reduction activities within your community. We ask that you please take a few minutes to complete this questionnaire.

Natural Hazard Household Risk Reduction

Households can do many things to prepare for a natural disaster or emergency. What you have on hand or are trained to do when a disaster strikes can make a big difference in your comfort and safety in the hours and days following a natural disaster or emergency. In addition, modifications to your home, including retrofits to strengthen your home's structure, can protect your home and its contents. The following questions focus on your household's preparedness for disaster events.

1. How concerned are you about the following natural disasters affecting your community?

(Check the corresponding box for each hazard)

Natural Disaster	Very Concerned	Somewhat Concerned	Neither Concerned nor Unconcerned	Not Very Concerned	Not Concerned
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dust Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide / Debris Flow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Household Fire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcanic Eruption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wind Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Did you consider the possible occurrence of a natural hazard when you bought/moved into your current home?

Yes No

3. Does your household have insurance coverage for flood events?

- Yes No

If you answered Yes, please skip to Question 4.

3.1 If “NO” for flood, what is the main reason your household does not have insurance for flood events?

(Please check one)

- Not available Deductibles too high/not worth it Not necessary
 Not located in the floodplain Not familiar with it/don’t know Too expensive
 Other: _____

4. Does your household have insurance coverage for earthquake events?

- Yes No

If you answered Yes, please skip to Question 5.

4.1 If “NO” for earthquake, what is the main reason your household does not have insurance for earthquake events? *(Please check one)*

- Not available Deductibles too high/not worth it Too expensive
 Not necessary Not familiar with it/don’t know Other: _____

5. In the following list, please check those activities that you have done in your household, plan to do in the near future, have not done, or are unable to do. For Questions F-K, there is also the option to check does not apply, if the preparation action does not apply to a feature of your home. *(Please check one answer for each preparedness activity)*

In your household, have you or someone in your household:	Have Done	Plan To Do	Not Done	Unable To Do	Does Not Apply
A. Attended meetings or received written information on natural disasters or emergency preparedness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
B. Talked with members in your household about what to do in case of a natural disaster or emergency?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
C. Developed a “Household/Family Emergency Plan” in order to decide what everyone would do in the event of a disaster?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
D. Prepared a “Disaster Supply Kit” (Stored extra food, water, batteries, or other emergency supplies)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
E. In the last year, has anyone in your household been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
F. Have you secured your water heater, cabinets and bookcases to the wall?	<input type="checkbox"/>				
G. Have you fit your gas appliances with flexible connections?	<input type="checkbox"/>				
H. Used fire-resistant building or roofing materials?	<input type="checkbox"/>				
I. Secured your home to its foundation?	<input type="checkbox"/>				
J. Braced unreinforced masonry, concrete walls, and chimney?	<input type="checkbox"/>				
K. Elevated your home in preparation for floods?	<input type="checkbox"/>				

Household Risk Reduction

6. Who is your preferred information source and what is the preferred way for you to receive information about how to make your household and home safer from natural disasters? (*Please check all that apply*)

Information Sources:

- Chamber of Commerce
- University or research institution
- Schools
- Fire Department/Rescue
- Utility company
- Insurance agent or company
- University or research institution
- Government agency
- American Red Cross
- Other non-profit organization

Methods:

- Fact Sheet/brochure
- Internet
- Mail
- Outdoor advertisements (signs, etc.)
- Radio
- Television
- Magazine
- Public workshops/meetings
- Newspapers
- Other (please explain):

Community Risk Reduction

7. Natural hazards can have a significant impact on a community, but planning for these events can help lessen the impacts. The following statements will help determine citizen priorities for planning for natural hazards. Please tell us how important each one is to you.

Statements	Very Important	Somewhat Important	Neither Important nor Unimportant	Not Very Important	Not Important
A. Protecting private property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Protecting critical facilities (e.g., transportation networks, hospitals, fire stations)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Preventing development in hazard areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Enhancing the function of natural features (e.g., streams, wetlands)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Protecting historical and cultural landmarks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Protecting and reducing damage to utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Strengthening emergency services (e.g.,- police, fire, ambulance)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Disclosing natural hazard risks during real estate transactions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

General Household Information

9. Please indicate your age: _____

10. Gender: Male Female

11. Zip Code: _____

12. County: _____

13. Do you have access to the internet?

- Yes
- No

14. Do you rent or own your home?

- Yes
- No

15. Please indicate your level of education:

- Grade School/No Schooling
- Some high school
- High school graduate/GED
- Some college/trade school

- College degree
- Postgraduate degree
- Other, please specify: _____

16. How long have you lived in Oregon?

- Less than a year
- 1-5 years
- 5-9 years
- 10-19 years
- 20 years or more

17. Do you rent/own

- Single-family home
- Duplex
- Apartment (3-4 units in structure)
- Apartment (5 or more unit structures)
- Condominium / townhouse
- Manufactured home
- Other: _____

18. If you have lived in Oregon for less than 20 years, in what state did you live before you moved to Oregon?

- Not Applicable
- Washington
- California
- Other _____
- Idaho

Please feel free to provide any additional comments in the space provided below:

THANK YOU VERY MUCH FOR PROVIDING THIS INFORMATION

The Oregon Natural Hazards Workgroup at the University of Oregon's Community Service Center prepared this survey. Implementation of this survey is made possible by funding from the Federal Emergency Management Agency, Oregon Emergency Management and the Public Entity Risk Institute.

*For more information, please contact Oregon Natural Hazards Workgroup
at 1209 University of Oregon, Eugene, OR 97403-1209,
call (541) 346-3889, or visit www.OregonShowcase.org*