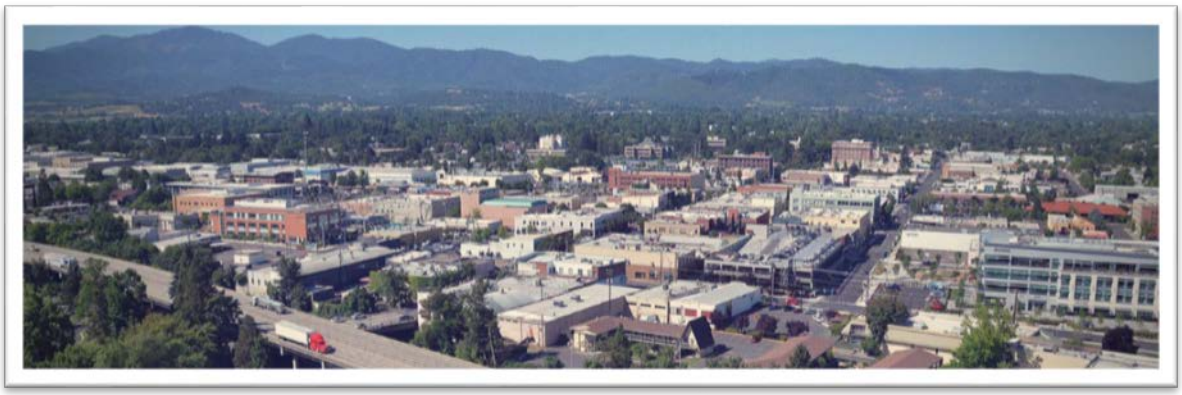
City of Medford Natural Hazards Mitigation Plan



Approved September 13, 2017

Effective through September 12, 2022

The *2017 Medford Natural Hazards Mitigation Plan* is a living document that will be reviewed and updated periodically.

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

For further information and to provide comments, contact:

Larry Masterman, Emergency Management Coordinator
City of Medford
200 South Ivy Street, Room 180
Medford, Oregon 97501
Telephone: 541-774-2322
Email: larry.masterman@cityofmedford.org

Brian Fish, Chief, Medford Fire-Rescue
City of Medford
200 South Ivy Street, Room 180
Medford, Oregon 97501
Telephone: 541-774-2300
Email: brian.fish@cityofmedford.org

The *2017 Medford Natural Hazards Mitigation Plan (NHMP)* has been prepared as a collaboration between the City of Medford and the State of Oregon Department of Land Conservation and Development (DLCD). In 2014, DLCD received a Pre-Disaster Mitigation grant (PDMC-PL-10-OR-2014-003) from the Federal Emergency Management Agency (FEMA) through the Oregon Emergency Management (OEM) to assist Medford with its NHMP.

Review and Approval Process Documentation

FEMA Approval Letter

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021-8627

FEMA

September 14, 2017

Honorable Gary Wheeler
Mayor, City of Medford
411 W 8th Street
Medford, Oregon 97501

Dear Mayor Wheeler:

On September 13, 2017, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, approved the ***Medford Natural Hazards Mitigation Plan*** as a local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the City of Medford eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants projects through September 12, 2022, through your state.

FEMA individually evaluates all application requests for funding according to the specific eligibility requirements of the applicable program. Though a specific mitigation activity or project identified in the plan may meet the eligibility requirements, it may not automatically receive approval for FEMA funding under any of the aforementioned programs.

Approved mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). For additional information regarding the CRS, please visit: www.fema.gov/national-flood-insurance-program-community-rating-system or contact your local floodplain manager.

Over the next five years, we encourage your community to follow the plan's schedule for monitoring and updating, and to develop further mitigation actions. To continue eligibility, the community must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, Planner with Oregon Office of Emergency Management, at (503) 378-2911, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

cc: Angie Lane, Oregon Office of Emergency Management

Enclosure

AS:vl

www.fema.gov

Medford Resolution No. 2017-105

RESOLUTION NO. 2017-105

A RESOLUTION adopting the 2017 Medford Natural Hazards Mitigation Plan.

WHEREAS, natural hazards threaten life, businesses, property, and environmental systems in the City of Medford; and

WHEREAS, an understanding of the nature, extent, and potential impacts of natural hazards is the foundation for developing strategies to reduce or eliminate those impacts; and

WHEREAS, natural hazards mitigation planning is the process through which such understanding and strategies are developed and a process for implementation is established in the City of Medford; and

WHEREAS, it is in the interest of the City of Medford to undertake natural hazards mitigation planning, integration, and implementation together as coordinated and multi-disciplinary planning strengthens communities and better serves us all; and

WHEREAS, the City of Medford previously prepared, implemented, and updated Natural Hazards Mitigation Plans in accordance with the Disaster Mitigation Act of 2000. These plans (approved in 2004 and 2010 respectively) were each approved by the Federal Emergency Management Agency (FEMA) for a period of five years; and

WHEREAS, the City of Medford 2010 Natural Hazards Mitigation Plan established and the 2017 Medford Natural Hazards Mitigation Plan retains "the overarching mission and purpose is to protect people, property, and the environment from the impact of natural disasters;" and

WHEREAS, the 2010 Medford Natural Hazards Mitigation Plan (formerly known as the City of Medford Pre-Disaster Mitigation Plan) is the most recent and expired on October 4, 2015; and

WHEREAS, having a natural hazards mitigation plan developed in accordance with the Disaster Mitigation Act of 2000 and approved by FEMA is a prerequisite for local government eligibility for certain federal pre- and post-disaster mitigations funds; and

WHEREAS, adoption of the updated 2017 Medford Natural Hazards Mitigation Plan is required for FEMA approval of the 2017 Medford Natural Hazards Mitigation Plan and maintained eligibility for certain federal pre- and post-disaster mitigations funds; and

WHEREAS, as a result of coordinated planning, the 2017 Medford Natural Hazards Mitigation Plan will be included in the Jackson County Multi-Jurisdictional Natural Hazards Mitigation Plan; and

WHEREAS, adoption of updated 2017 Medford Natural Hazards Mitigation Plan demonstrates the City of Medford's commitment to reducing or eliminating the potential impacts of

Resolution No. 2017-105 P:\Cassie\ORDS\1.Council Documents\090717\hazard

natural hazards and to achieving the Plan's goals; now, therefore,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MEDFORD, OREGON,

Section 1. That the 2017 Medford Natural Hazards Mitigation Plan is hereby adopted.

Section 2. The City Council hereby adopts the recitals above in support of this resolution.

PASSED by the Council and signed by me in authentication of its passage this 7 day of September, 2017.

ATTEST: _____ City Recorder

_____ Mayor

Resolution No. 2017-105 P:\Cassie\ORDS\1.Council Documents\090717\hazard

City of Medford Agenda Item Commentary for Item No. 80.5

CITY OF MEDFORD
AGENDA ITEM COMMENTARY
www.cityofmedford.org

Item No: 80.5

DEPARTMENT: Medford Fire-Rescue
PHONE: (541) 774-2301
STAFF CONTACT: Brian Fish, Fire Chief

AGENDA SECTION: Ordinances and Resolutions
MEETING DATE: September 7, 2017

COUNCIL BILL 2017-105
A RESOLUTION adopting the 2017 Medford Natural Hazards Mitigation Plan.

SUMMARY AND BACKGROUND
The Federal Emergency Management Agency (FEMA) requires an approved Natural Hazards Mitigation Plan (NHMP) in order for a jurisdiction to be eligible for a number of major grant programs and other pre- and post-disaster assistance. Medford's update to the 2010 plan was completed between June 2016 and August 2017. This was possible with significant technical support from the Oregon Department of Land Conservation and Development, along with local and regional input from a steering committee. The steering committee of 19 stakeholders included one Councilmember, community experts and City department leadership.

The 2017 draft was submitted to Oregon Emergency Management (OEM) on April 14, 2017, approved by OEM on May 23, 2017 and forwarded to FEMA Region 10. On June 27, 2017, FEMA requested additional detail in two of the 21 required elements; both dealing with past and future incorporation of mitigation actions into local government activities. On August 8, 2017 a revised draft was submitted to FEMA. The city received notification on August 15, 2017 of FEMA's approval pending the City of Medford's adoption.

City Council action to adopt the plan will result in final approval by FEMA. Any substantive changes to the draft will require resubmission to FEMA, and possibly to the State, delaying approval.

PREVIOUS COUNCIL ACTIONS
On September 16, 2010, Resolution 2010-211, Council adopted the updated City of Medford Pre-Disaster Mitigation Plan.

ANALYSIS
Approval maintains the City's eligibility for federal pre- and post-disaster funding, which could amount to several million dollars over the plan's five-year lifespan in the event of a disaster. A federal declaration of a local event may result in additional funding.

Significant highlights of the plan include an extensive community profile, community hazard identification and risk assessment, and a mitigation strategy and actions.

The final plan is expected to provide a better foundation for future updates. It contains updated hazard, risk, and vulnerability assessments that will be valuable in updating the City's Emergency Operations Plan, scheduled for completion during this fiscal year. The City's Comprehensive Plan, Continuity of Operations/Continuity of Government Plans, and other documents will also benefit from the NHMP.

FINANCIAL AND/OR RESOURCE CONSIDERATIONS
Eligibility for federal funding could amount to several million dollars; more in the event of a federally declared disaster impacting the City.

TIMING ISSUES
The City is currently working on a FEMA Pre-Disaster Mitigation Grant for seismic retrofitting of a downtown building. The deadline for that FEMA grant application is November 14, 2017. In order to be eligible to receive these grant funds, FEMA must approve the City Council adopted plan.

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CITY OF MEDFORD
AGENDA ITEM COMMENTARY
www.cityofmedford.org

Item No: 80.5

COUNCIL OPTIONS

- Adopt the NHMP in its current form, with prompt final approval from FEMA
- Propose edits (will delay final approval)
- Decline adoption of the NHMP (making our jurisdiction ineligible for certain federal funding)

STAFF RECOMMENDATION
Staff recommends adoption of the plan.

SUGGESTED MOTION
I move to adopt the draft 2017 update to Medford's Natural Hazards Mitigation Plan.

EXHIBITS
Resolution
Medford Natural Hazards Mitigation Plan, submitted to FEMA August 2017, on file in City Recorder's Office

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FEMA "Approval Pending Adoption" Letter

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

FEMA

August 15, 2017

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

Dear Ms. Lane:

As requested, on August 15, 2017, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, completed a pre-adoption review of the ***City of Medford Natural Hazards Mitigation Plan.*** This letter serves as Region 10's commitment to approve the plan upon receiving documentation of its adoption by the community. The plan successfully contains the required criteria, excluding the adoption, for hazard mitigation plans, as outlined in Code of Federal Regulation Title 44 Part 201.

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

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

Sincerely,

8/15/2017

X

Signed by: TAMRA D BIASCO

Tamra Biasco
Chief, Risk Analysis Branch
Mitigation Division

AS

FEMA Region 10 Local Mitigation Plan Review Tool dated August 15, 2017

FEMA REGION 10 LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to participating jurisdictions.

1. The Multi-Jurisdiction Summary Sheet is used to document how each jurisdiction met the requirements in the Plan.
2. The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
3. The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.

The FEMA Mitigation Planner must reference the *Local Mitigation Plan Review Guide* when completing this *Local Mitigation Plan Review Tool*.

Jurisdiction: Medford, Oregon	**Title of Plan:** City of Medford Natural Hazards Mitigation Plan	**Date of Plan:** May 22, 2017

Local Point of Contact: Larry Masterman	**Address:** City of Medford, 200 South Ivy Street, Room 180, Medford, Oregon 97501
Title: Emergency Management Coordinator	
Agency: City of Medford	
Phone Number: 541-774-2322 (office)	**E-Mail:** larry.masterman@cityofmedford.org

State Reviewer: Joseph Murray	**Title:** Planner	**Date:** May 23, 2017

FEMA Reviewer: Kate Skaggs Jason Farrell Amanda Siok	**Title:** Mitigation Champion Mitigation Champion Mitigation Planner	**Date:** June 9, 2017 June 22, 2017 September 3, 2017
Date Received in FEMA Region 10	June 9, 2017	
Plan Not Approved		
Plan Approvable Pending Adoption	August 15, 2017	
Plan Approved	September 13, 2017	

Local Mitigation Plan Review Tool A-1

SECTION 2: REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist is completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element is completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions are explained for each plan sub-element that is 'Not Met.' Sub-elements are referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable.

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Introduction to Summary of the NHMP, pp. 11-13; Acknowledgements of Participants, pp. 14-15; Chapter 3 Section, pp. 223-224; Chapter 4, pp. 262-264; Appendix E, pp. 314-321, .	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Introduction to Summary of the NHMP, pg, 13; Acknowledgements of Participants, pp. 14-15; Chapter 3 Section, pp. 223-224; Appendix E, pp. 324-330.	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Introduction to Summary of the NHMP, pp. 7, 13; Chapter 4, Section 2, pp. 265-266; Appendix E, pp. 322-356.	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Appendix A, pp. 270-285; Cited throughout plan.	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Pg. 2; Appendix E, pg. 336.	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Chapter 3 Section 4, pp. 264, 267-268.	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Chapter 2, Section 2, Severe Weather, pp. 86-88; Section 3, Floods, pp. 99-101; Section 4, Earthquakes, pp. 118-120; Section 5, WUI, pp. 134-139; Section 6, Landslides, pp. 148-152; Section 7, Volcanic Eruptions, pp. 163-170; Appendix B; Appendix D.	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Chapter 2, Section 2, Severe Weather, pp. 89-95; Section 3, Floods, pp. 101-107; Section 4, Earthquakes, pp. 121-125; Section 5, WUI, pp. 139-142; Section 6, Landslides, pp. 152-156; Section 7, Volcanic Eruptions, pp. 170-177.	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Chapter 2, Section 2, Severe Weather, pp. 95-98; Section 3, Floods, pp. 107-110; Section 4, Earthquakes, pp. 126-128; Section 5, WUI, pp. 142-143; Section 6, Landslides, pp. 156-157; Section 7, Volcanic Eruptions, pg. 177.	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Chapter 2, Section 3, pg. 108.	X	

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Chapter 3, Section 4, pp. 216-240.	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Chapter 2, Section 3, pg. 105; Appendix E, pp. 357 – 361.	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Executive Summary, pg. 7; Chapter 3, Section 2, pp. 210-211.	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Chapter 3, Section 4, pp. 243-258.	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Chapter 3, Section 3, pp. 214-215.	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Chapter 3, Section 4, pp. 216-217, 259.	X	
ELEMENT C: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Chapter 1, Section 4, pp. 32-34.	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))		X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Chapter 4, Section 1, pg. 264.	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	This NHMP has not yet been approved. Several places in the NHMP describe the approval process, including the Executive Summary on pages 7-10 and the Introduction to and Summary of the NHMP on page 11-13.	X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	NA		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
The State of Oregon imposes no additional requirements upon local NHMPs.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 3: PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths

- Information like the "lens of equity" in the community profile section help frame the narrative about the specific areas addressed in the plan.
- Including specific definitions for resiliency and vulnerability assist the reader in understanding those terms before their use later in the plan. .
- The planning process included strong public outreach activities.

Opportunities for Improvement

- Consider alternative formatting to make the document easier to read; for example, consolidating all planning process or public engagement information in one location.
- More clearly identify how the public can participate in the plan maintenance process.

Element B: Hazard Identification and Risk Assessment

Plan Strengths

- The plan integrates climate change into the discussion of hazards posing a threat to the City.
- The organization and layout of each hazard section helps the reader clearly follow the methodology.

Opportunities for Improvement

- At least one figure missing from report, including Figure 33.
- Consider providing graphic representations of the vulnerability information; for example, overlaying the location, or general location, of critical facilities in relation to hazard risk areas.

Element C: Mitigation Strategy

Plan Strengths

- The plan identifies a number of local planning mechanisms that will benefit from the data developed during the plan update process for this HMP.
- Focus on increasing public awareness and public engagement efforts.

Opportunities for Improvement

- Consider separating actions that focus more on recovery, response, and preparedness.

- Generally, actions that include words like continue, foster, and maintain are indicative of a current capability, and not necessarily a mitigation action.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths

- Re-evaluation of mitigation actions for the City and how they contribute to the vision for the City's resilience efforts.
- Including information on social equity and which populations may need additional support to address risks to natural hazards.

Opportunities for Improvement

- Consider more clearly illustrating how development trends have changed since the last plan update in relation to geographic location of natural hazard risk.

B. Resources for Implementing Your Approved Plan

The **Region 10 Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it in the FEMA Library at http://www.fema.gov/media-library/assets/documents/89725.

The Local Mitigation Plan Review Guide and Tool resource is available through FEMA's Library and should be referred to for the next plan update. http://www.fema.gov/library/viewRecord.do?id=4859

The Local Mitigation Planning Handbook is available. While the requirements under §201.6 have not changed, the Handbook provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements is available through the FEMA Library website. http://www.fema.gov/library/viewRecord.do?id=7209

The **Mitigation Ideas**: **A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. http://www.fema.gov/library/viewRecord.do?id=6938

FEMA Hazard Mitigation Assistance: Currently, FEMA administers three programs that provide funding for eligible mitigation projects that reduces disaster losses and protect life and property from future disaster damages. The three programs are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program.

- HMGP assists in implementing long-term hazard mitigation measures following a Presidential major disaster declaration
- PDM provides funds for hazard mitigation planning and projects on an annual basis
- FMA provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis

The mitigation strategy may include eligible projects to be funded through FEMA's hazard mitigation grant programs (Pre-Disaster Mitigation, Hazard Mitigation Grant Program, Flood Mitigation Assistance). Contact your State Hazard Mitigation Officer, Angie Lane at angie.lane@mil.state.or.us, for more information or visit: http://www.fema.gov/hazard-mitigation-assistance.

The FEMA Region X Risk Mapping, Analysis, and Planning program (Risk MAP) releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region. Past newsletters can be viewed at: http://www.starrteam.com/starr/RegionalWorkspaces/RegionX/Pages/default.aspx. If you would like to receive future newsletters, email rxnewsletter@starr-team.com

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Executive Summary

What is the 2017 Medford Natural Hazards Mitigation Plan?

The *2017 Medford Natural Hazards Mitigation Plan* (NHMP) identifies and examines the natural hazards facing the City of Medford and establishes a coordinated process (a plan) to implement actions to reduce impacts of natural disasters on the people and resources of the community.

A hazard is any situation that has the potential of causing damage to people, property, or the environment. Risk is the probability of an event or condition occurring. Vulnerability is the susceptibility of life, property, or the environment to damage if a hazard manifests to potential.

With the identified hazards, risks, and vulnerabilities, the *2017 Medford NHMP* identifies mitigation actions that may be taken proactively to reduce the impact of natural disasters on the people and resources of the community to reduce losses from those hazards.

With an approved NHMP in place, the City is eligible to receive competitive federal grants. These grants can provide significant assistance to local governments aiming to reduce their risk from natural hazards and the cost of recovery from disasters.

What is the mission and what are the goals?

During the process of crafting Medford's initial NHMP in 2004, the project team identified a mission and four goals whose achievement would fulfill this mission. For the *2017 Medford NHMP*, the Steering Committee chose to retain the mission and goals. The mission is to protect people, property and the environment from the impact of natural disasters. The goals are:

- Preventing personal injury, loss of life and damage to property and the environment from natural hazards.
- Enhancing the ability of emergency services to respond to the effects of hazards on people, property and the environment.
- Promoting public awareness and an understanding of natural hazards and the risk they present to quality of life and economic vitality.
- Forming partnerships with private and public sector agencies, businesses and organizations to further comprehensive planning and implementation of mitigation measures.

Was the Public Engaged for the 2017 Medford NHMP?

The City of Medford takes pride in its public outreach efforts and the level of civic participation. Outreach was performed using a variety of methods during the planning process including emails, website postings, distribution of printed flyers, word of mouth, community events, interviews, Steering Committee meetings, briefings to the Planning Commission and to the City Council, and an open house. Copies of the *2017 Medford NHMP* are on the City's website and catalogued at the downtown Jackson County Library District headquarters. The City of Medford Emergency Management Coordinator is the contact person for the *2017 Medford NHMP*.

What is the Community Profile?

People and places are not equally affected by natural hazards. The Community Profile increases our understanding of the vulnerability to hazards across the City of Medford by taking a closer look at the baseline information and trends that present the backdrop for Medford's natural hazards mitigation planning process, including:

- geology,
- topography,
- climate,
- historic and cultural resources of the City and its people,
- land use and development,
- population and demography,
- employment and economy,
- housing and community development,
- critical facilities and infrastructure,
- education and special districts,
- transportation,
- freight distribution, and
- communications.

What is the Hazard Analysis or Risk Assessment?

A Hazard Analysis (also called a risk assessment) describes the type, location, and extent of natural hazards that can affect the jurisdiction. Medford's natural hazards are ranked here from highest to lowest risk. Using measures to characterize risk - history, vulnerability, maximum threat, and probability – risk was assessed as to severity to derive a relative risk score for each hazard. Within the high to low range, the scores were bundled into risk levels.

Hazards and Risk Scores in Numerical Order (High to Low)

Hazard	Risk Score	Risk Level (H-M-L)
Severe Weather	240	High
Emerging Infectious Diseases	196	High
Air Quality	189	Medium-High
Wildland-Urban Interface Fires	183	Medium-High
Earthquakes	173	Medium
Volcanic Eruptions	159	Medium
Floods	152	Medium
Landslides	124	Low

Climate and climate change are included as part of the analysis of existing and future conditions. Hazards of drought (part of severe weather), wildfire, landslides, and flooding are projected to be impacted by climate change.

What is the Vulnerability Assessment?

The vulnerability assessment combines information on the natural hazard pathway and existing development exposed to that hazard. Examining location, social, economic, and development factors provides details on potential impacts to Medford's people, property and the environment. Since the year 2000, Medford has been the fastest growing municipality in the region, adding 10,000 new residents at an annual rate of 2.5%. This growth and development has increased the number of tax lots and structures located within hazard areas.

What are the Mitigation Actions?

Mitigation actions are specific projects and activities that help achieve the goals. Steering Committee planning sessions involved mitigation action evaluation and prioritization. Prioritization criteria were selected from several options. The selected criteria were: equity, environment, benefits, costs, risks, and capacity. Actions were scored and ranked into high, medium, and low priorities.

Due to the number of mitigation actions that were ranked high, an additional step was taken to select the top ten of the high ranked mitigation actions. The Steering Committee members voted to select ten mitigation actions by simply identifying their preferred ten actions (no ranking or scoring of them). All 19 of the Steering Committee members voted. These top ten mitigation actions are listed in the order of the number of votes received, in the Medford's Top Ranked Mitigation Actions table.

The action items are categorized as multi-hazard or hazard-specific, as well as short-term or long-term. Short-term mitigation actions are those that can be undertaken without extra personnel or other resources. Long-term mitigation actions are those requiring additional resources.

Medford's Top Ranked Mitigation Actions

Natural Hazard	Medford NHMP Mitigation Actions	Total Votes
Long-term Multi-hazard #5	Develop a long-term recovery plan for Medford from the effects of a disaster/ or catastrophe. Research plans for comparable cities in the West and deciding which elements are applicable to Medford and the risks it faces. Develop worst-case scenarios and long-term recovery needs for each prioritized hazard. Forecast the fiscal burden to be borne by the City, once likely state and federal assistance has been obtained. After adoption of the updated NHMP in 2017, revise the Environmental Element "Disasters and Hazards" section in the Comprehensive Plan to reference the current NHMP as having the most up to date hazards information.	16
Long-term Multi-hazard #6	Coordinate with American Red Cross to develop an inventory of facilities capable of offering shelter during disaster events. Determine the relative safety of each facility vis-à-vis prioritized hazards and what specifically must be done to address occupant safety during a hazard event.	15
Short-term Severe Weather #1	Continue opportunities and establish program that promote public awareness of severe weather hazards and the benefits of mitigation. Coordinate and collaborate with NWS. Use public and commercial television, radio, live presentations, utility bill inserts, newsletters, and City website.	14
Short-term Multi-hazard #5	Promote communitywide awareness to support family preparedness and self-sufficiency for a period of up to 14 days. Distribute information via sources such as the City's website, newsletters, and utility bills.	14
Short-term Multi-hazard #2	Maintain and develop public and private relationships to foster mitigation planning coordination and collaboration within the City of Medford.	12
Long-term Multi-hazard #10	Continue the assessment of City personnel emergency preparedness training, (including drills and exercises). Identify state and federal funding sources to provide for additional needs.	11
Short-term Multi-hazard #7	Develop a City Continuity of Operations (COOP) plan or annex to the Emergency Operations Plan.	10
Short-term Severe Weather #5	Maintain partnerships with the National Weather Service (NWS) to inform and warn the public about local weather hazards and protective actions, including: maintain the City's status as a Storm Ready/ Weather Ready community, and continue to support NWS efforts	10

	to disseminate, evaluate, and improve its warning products and public information.	
Short-term Multi-hazard #8	Develop an information and education strategy based on assessment of local hazards, risks, priorities, and other considerations. Continue developing whole community partnerships in education and outreach, e.g. preparedness academy and disaster movie nights with the library and the faith-based and civic leadership summit with local houses of worship. Pursue a partnership to reach the business community more effectively. Continue to deliver training and information products to the public, City employees, response partners, and other stakeholders, considering: relative threats of identified hazards; people with access and functional needs; social equity; a variety of delivery media and methods to reach a broad audience; collaboration with public private and partners in development and delivery; and maintain the NIMS compliance of staff.	9
Long-term Flood #1	Continue to update floodplain maps with current data. Update maps that use the floodplain data; such as floodplain maps with critical infrastructure data to identify at-risk facilities.	8
Short-term Earthquake #3	Support structural mitigation of infrastructure, schools and other public buildings.	8

What's new in the 2017 Medford NHMP?

For the *2017 Medford NHMP*, much of the existing information was revised or removed from the *2010 Medford NHMP* (then called the *Pre-Disaster Mitigation Plan*; City of Medford, 2010). A considerable amount of new information has been added, and the *2017 Medford NHMP* has been completely re-organized and reformatted. A new Hazards Analysis was performed so that current scientific information, recent hazard event data, and other current information was incorporated. Mitigation actions were revised or deleted from the 2010 Medford NHMP, and new ones were added. Existing maps were updated or removed. New maps were created. See Appendix C Map Methodology for details.

Who Reviews and Approves the NHMP?

The *2017 Medford NHMP* will be submitted to Oregon's Office of Emergency Management (OEM) and the Federal Emergency Management Agency (FEMA) Region X for review and approval. After the review, an "Approvable Pending Adoption" letter is issued from FEMA and OEM. With the letter, City of Medford staff will present the NHMP to City Council for adoption. After adoption, FEMA will send an "Approved" letter to OEM, who will then inform Medford of the approval. The NHMP is valid for five years. The result of the updated *2017 Medford NHMP* will be to keep Medford eligible for pre- and post-disaster funds from FEMA for mitigation planning and projects.

Medford is also participating in the *Jackson County Multi-Jurisdictional Natural Hazards Mitigation Plan* (MJNHMP) update. The *2017 Medford NHMP* will ultimately become an annex to the *Jackson County MJNHMP*.

Who Implements the Approved and Adopted NHMP?

Implementation of the *2017 Medford NHMP* will occur over the next five years as the City considers and adopts the mitigation actions into plans, policies, programs, and actions to reduce the community's risk from natural hazards. Monitoring, evaluation, and updating mitigation actions is the responsibility of the City's Emergency Management Coordinator, supported by the Steering Committee in ongoing meetings. The *2017 Medford NHMP* is intended to be part of a multifaceted approach to making the community safer and more resilient.

Introduction to and Summary of the Natural Hazards Mitigation Plan

> It is not the strongest of the species that survive, not the most intelligent, but the one most responsive to change. —attributed to Charles Darwin

> If we could first know where we are, and whither we are tending, we could better judge what to do, and how to do it. —Abraham Lincoln [Republican State Convention, Springfield, Illinois, June 16, 1858]

> The problem is not specific to earthquakes, of course. The Cascadia situation, a calamity in its own right, is also a parable for this age of ecological reckoning, and the questions it raises are ones that we all now face. How should a society respond to a looming crisis of uncertain timing but of catastrophic proportions? How can it begin to right itself when its entire infrastructure and culture developed in a way that leaves it profoundly vulnerable to natural disaster? —Kathryn Schulz (2015)

Planning is the process of making plans for something – it is an active and engaged endeavor. Natural Hazards Mitigation Plans are established and updated through the process of engaging the community. A hazard is any situation that has the potential of causing damage to people, property, or the environment (Oregon Department of Land Conservation and Development [DLCD], 2015). Hazard mitigation is any action taken to eliminate or reduce the vulnerability of people and property from hazards (FEMA, 2011b).

Medford's *2017 Natural Hazards Mitigation Plan* (NHMP) identifies and examines the hazards facing the City of Medford. The NHMP also evaluates and assesses the risks or the probability of the hazards (commonly called a hazard analysis or risk assessment), and the vulnerabilities of the community. Risk is the probability of an event or condition occurring (Mileti, 1999, as cited in Blanchard, 2008, p. 106). Vulnerability is the susceptibility of life, property, or the environment to damage if a hazard manifests to potential (Oregon DLCD, 2015).

With that information – the identified hazards, risks, and vulnerabilities - the NHMP identifies mitigation actions that may be taken proactively to reduce the impact of natural disasters on the people and resources of the community to reduce losses from those hazards. Furthermore, the NHMP establishes a coordinated process to implement the actions.

The mission, established by the project team for the *2004 Medford NHMP*, is to protect people, property, and the environment from the impact of natural disasters. The project team also identified four goals whose achievement would fulfill this mission. The Steering Committee for the *2017 Medford NHMP* chose to retain the mission and the goals. The goals are:

- Preventing personal injury, loss of life and damage to property and the environment from natural hazards.
- Enhancing the ability of emergency services to respond to the effects of hazards on people, property and the environment.
- Promoting public awareness and an understanding of natural hazards and the risk they present to quality of life and economic vitality.

- Forming partnerships with private and public sector agencies, businesses and organizations to further comprehensive planning and implementation of mitigation measures.

The City of Medford has not experienced serious natural disasters on a frequent or regular basis, but it has a history of severe, short-lived, winter storms (severe weather) and floods. With residential development spreading to the eastern hillsides, wildfire – referenced here as wildland-urban interface (WUI) fires – poses an increased threat to the urban fringes each summer. Much effort has been devoted to increasing awareness of and preparation for a Cascadia Subduction Zone (CSZ) earthquake that could have strong to devastating impacts in Oregon and Washington. It has the potential to be one of the most complex natural disasters in U.S. history, according to FEMA (n.d.-b). Medford's natural hazards also include landslides, volcanic eruptions, air quality, and emerging infectious diseases.

A Hazard Analysis performed by the Steering Committee as part of the *2017 Medford NHMP* resulted in ranking the risk levels of natural hazards from highest to lowest as follows:

- severe weather,
- emerging infectious diseases,
- air quality,
- wildland-urban interface (WUI) fires,
- earthquakes,
- volcanic eruptions,
- floods, and
- landslides.

The Hazard Analysis details are presented briefly in Chapter 2 Section 1 and fully in Appendix B.

The NHMP identifies existing mitigation efforts as well as mitigation actions that are intended to be implemented to minimize the impact of natural hazards on the community. This NHMP categorizes mitigation actions as either short-term or long-term actions. Short-term actions may be implemented with existing resources; long-term actions are those requiring new resources. The NHMP acknowledges but does not consider strictly human-caused hazards, such as hazardous materials or terrorism. The NHMP recognizes that hazards are not isolated, rather that multiple hazards may impact the community at once, in close succession, or as a cascading series of impacts. For example, severe weather may include heavy rain that leads to landslides and flooding.

Legislative Background. The City of Medford was required to have an approved Natural Hazards Mitigation Plan (NHMP) in place by November 1, 2004 as established by the Disaster Mitigation Act of 2000 (P.L. 1060-390) and implemented by the Federal Emergency Management Agency (FEMA), on February 26, 2002 (44 CFR Part 201). A stipulation of the law is that to receive pre- and post- disaster mitigation funds from FEMA, local governments must have a current, FEMA approved NHMP. In the NHMP, the City must identify a comprehensive set of mitigation actions related to the identified local natural hazards. NHMPs must be updated and re-approved every five years. Only those cities with an approved NHMP are eligible to apply for hazard mitigation grants.

NHMP Development. In 2014, the Department of Land Conservation and Development (DLCD) received a Pre-Disaster Mitigation grant (PDM 14) from FEMA through the Oregon Office of Emergency Management (OEM) to assist Medford with its NHMP. Due to several factors including the length of FEMA's grant process and Oregon's legislative process, DLCD requested an extension to the

grant funds performance period. This request was approved by FEMA on August 30, 2016 to provide the grant performance period from April 21, 2014 to September 30, 2017.

On May 23, 2016, DLCD and Medford staff held an organizational meeting. The first meeting of the Steering Committee (SC) was held on June 22, 2016. The Steering Committee determined that having one committee, which also served as the Community Partners Committee, would be more efficient than having separate committees. Steering Committee meetings were held in Medford and continued for the duration of the NHMP update process.

The SC was composed of City staff and outside organizations such as U.S. Army Corps of Engineers; American Red Cross; Jackson County Health & Human Services; 211 Emergency Info/Referral; Rogue Valley Community Organizations Active in Disasters (COAD); Jackson County Emergency Management; United Way; Rogue Valley Transit District, and the National Weather Service. A representative of the Cow Creek Band of Umpqua Tribe of Indians and a retired Southern Oregon University earth sciences professor also participated. The list of SC members and other contributors to the *2017 Medford NHMP* are listed in the Acknowledgements section.

To further involve the public, a Public Engagement Program was established. An informational flyer about the *2017 Medford NHMP* was prepared by DLCD with input from the SC; it was distributed electronically and in print throughout the NHMP process. SC meetings were open to the public. Meeting dates were posted on the City's website. For additional details on the range of public engagement activities, see Chapter 4, Section 2, Public Participation and Appendix E.

The entire 2010 Medford NHMP was reviewed and information was compared to current conditions to identify and prioritize the needed revisions. For the *2017 Medford NHMP*, the format has been re-organized, the text has been revised, photos and graphics have been added, and maps and tables have been revised and added. New data was gathered by DLCD staff, Medford staff, and other contributors. The NHMP contents and documents were reviewed as documents were made available to the SC, Planning Commission, City Council, and members of the public. For example, drafts of the NHMP were posted on the City's website at multiple points in the update process and an open house for the community was held on January 12, 2017. Again, see Chapter 4, Section 2, and Appendix E for details on the public participation during the *2017 Medford NHMP* process.

Benefits of a NHMP. The principal benefit of Medford developing a NHMP in 2004 and updating it in 2010 and 2017, is that it has established and updated a strategy for better withstanding natural hazards by identifying those hazards and actions to proactively protect people, property, and the environment. The NHMP provides an overall strategy and more current information about the community; details about hazards and vulnerability; resources; and has established partnerships.

With an approved NHMP in place, the City is eligible to apply to competitive federal grant programs, namely the Pre-Disaster Mitigation (PDM) Grant Program and the Hazard Mitigation Grant Program (HMGP). These programs offer significant assistance to local governments aiming to reduce their risk from natural hazards and the cost of recovery from disasters. The *2004 Medford NHMP* was reviewed by FEMA and OEM. Upon approval by City Council on November 4, 2004, the City of Medford was among a relatively small set of cities nationwide with a NHMP in place. The *2004 Medford NHMP* was updated in 2010. The *2017 Medford NHMP* also is reviewed by FEMA and OEM, and subsequently approved by those agencies and by the Medford City Council.

Acknowledgments of Participants

The City of Medford and the Oregon Department of Land Conservation and Development (DLCD) extend their sincere thanks to the many organizations and individuals who participated in the development of the *2017 Medford NHMP*, shared their expertise, and provided assistance. The variety of expertise, backgrounds, and perspectives provided an uncommonly rich resource for prioritizing the area's natural hazards, their potential impacts on the many segments of the Medford community, and practical actions to mitigate those hazards.

The commitment of the Steering Committee members, City staff, and others resulted in a NHMP with unprecedented detail and utility for Medford's future.

The project leadership for the *2017 Medford NHMP*: Co-chair Larry Masterman, Medford Emergency Management Coordinator; co-chair Jim Huber, Medford Planning Director (June – September 2016); co-chair Chris Olivier, Medford Planning Department GIS Coordinator (October 2016 onward); and Tricia Sears, Natural Hazards Planner, DLCD, project manager.

Special thanks are due to Chris Olivier and Medford GIS Manager David Pastizzo for their work to convert vast amounts of data into maps that will increase NHMP users' ability to comprehend, communicate, and act on that data.

The Steering Committee was crucial to the success of this planning effort, and exemplified the collaborative spirit of the Rogue Valley and Southern Oregon. The City of Medford is deeply grateful.

Steering Committee

Sam Barnum, Building Safety Director, City of Medford
Clay Bearnson, Medford City Council
Jim Buck, Operations Project Manager, Lost Creek Dam, US Army Corps of Engineers
Jenny Carver, Disaster Program Manager, American Red Cross (former)
Tracy DePew, Director of Emergency Management, Cow Creek Band of Umpqua Tribe of Indians
Eric Dittmer, Professor Emeritus, Southern Oregon University
Brian Fish, Chief of Fire and Rescue, City of Medford
Bill Hoke, Deputy City Manager, City of Medford (former)
Jim Huber, Planning Director, City of Medford (former)
Brett Johnson, Deputy Chief of Police, City of Medford
Laura Kimberly, Medford Branch Manager, Jackson County Library District
Abraham Loebs, Disaster Program Manager, American Red Cross
Larry Masterman, Emergency Management Coordinator, City of Medford
Chris Olivier, Planning Department GIS Coordinator, City of Medford
Tanya Phillips, Health Promotion Program Manager, Jackson County Health & Human Services
Carrie Prechtel, 211 Info Coordinator, Emergency Info/Referral
Paul Robinson, Rogue Valley Community Organizations Active in Disaster (COAD)
Sara Rubrecht, Emergency Manager, Jackson County
Jan Sanderson Taylor, Community Engagement Director, United Way of Jackson County
Ryan Sandler, Warning Meteorologist, National Weather Service
Jeff Simas, Traffic Supervisor, Public Works, City of Medford
Jon Sullivan, Associate Planner, Rogue Valley Transit District

Contributors

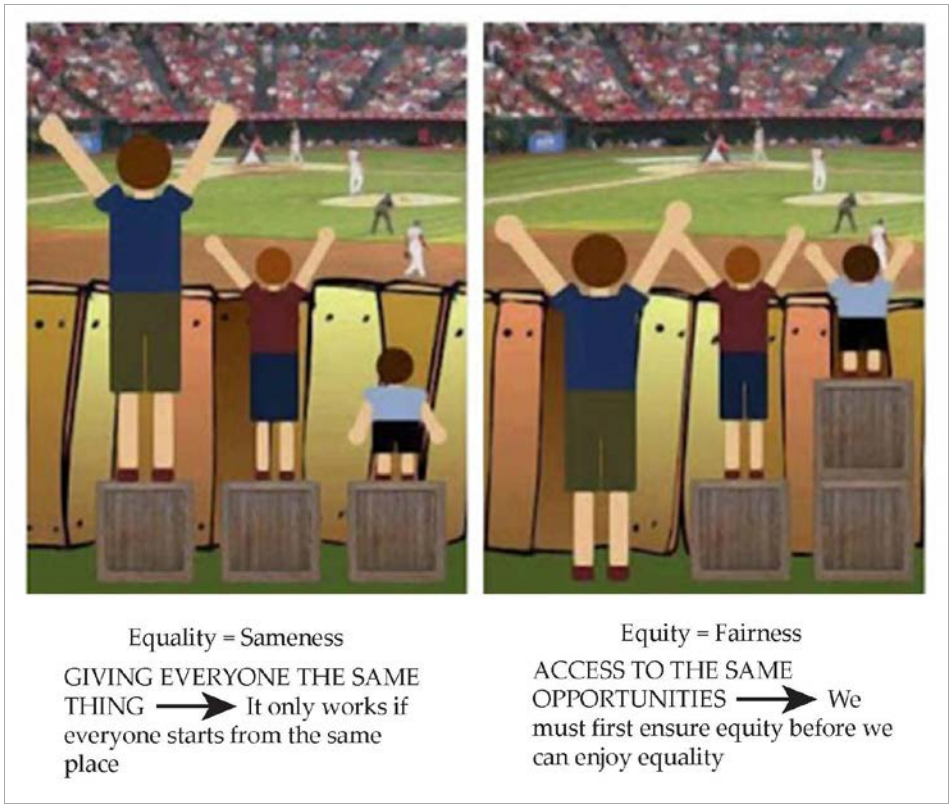
Adam Airoldi, City Arborist, City of Medford
Anthony Barnack, Ambient Air Monitoring Coordinator, Oregon Department of Environmental Quality (DEQ)
Sara Bristol, Public Information Officer, Medford Water Commission (former)
Bill Burns, Engineering Geologist, Oregon Department of Geology and Mineral Industries (DOGAMI)
Nancy Burns, Dam Safety, US Army Corps of Engineers
Bern Case, Airport Director, Rogue Valley International-Medford Airport, Jackson County
Kay Collins, Executive Management Coordinator, Coquille Indian Tribe
Matt Craig, Dam Safety Manager, US Army Corps of Engineers
Beth Depew, Healthcare Preparedness Liaison, Oregon Region 3 & 5, Oregon Health Authority
Lee Ann Easton, Attorney, Dorsay & Easton LLP
Megan Fagundes, Natural Resource Specialist, DEQ
Kevin Harris, Operations Manager, Emergency Communications of Southern Oregon (ECSO)
Peter Sugus Hatch, Historical Researcher/Cultural Resources Tech, Confederated Tribes of Siletz Indians
Jeff Jackson, Housing Rehabilitation Specialist, Housing Authority of Jackson County
Alan Journet, Ph.D, Co-Facilitator, Southern Oregon Climate Action Now (SOCAN)
Greg Kleinberg, Fire Marshal, City of Medford Fire-Rescue
Cindy Kolomechuk, National Fire Plan Coordinator, Oregon Department of Forestry (ODF)
Marni Koopman, Climate Change Scientist, Geos Institute
Matthew Krunglevich, District Fire Planner, Southwest Oregon District, ODF (former)
Dr. Charles Lane, Professor of Environmental Studies, Southern Oregon University
Richard Leman, Oregon Health Authority
Juventila Liko, Oregon Health Authority
Jason McClaughry, Eastern Oregon Regional Geologist, DOGAMI
Brenda Meade, Chairperson, Coquille Indian Tribe
Monte Mindenhall, Community Relations, PacifiCorps
John O'Connor, Cohesive Wildfire Strategy Coordinator, ODF Southwest Oregon District
Carla Paladino, Principal Planner – Long Range Divisions, City of Medford
David Pastizzo, GIS Manager, City of Medford
Brice Perkins, PE, Deputy Public Works Director, City of Medford
Curtis Peetz, District Services Support Manager, American Red Cross
Eddie Randles, Avista Utilities
Tarik Rawlings, Masters of Community and Regional Planning Candidate, University of Oregon
Jed Roberts, Flood Mapping Coordinator, DOGAMI
Rachel Sakata, Air Quality Planner, Oregon Department of Environmental Quality
Karl Sargent, Chief Engineer, KOBI
Deb Schueller, Publications Coordinator, DOGAMI
David Searcy, Conservation Coordinator, Medford Water Commission
Tricia Sears, Natural Hazards Planner, DLCD
Dr. Brian Shumate, Superintendent, Medford School District 549c
Brian Sjothun, City Manager, City of Medford
Tim Stevens, Park Maintenance Superintendent, City of Medford
Marc Stewart, Supervisory Hydrologist, USGS Oregon Water Science Center
Steve Vincent, Oregon Regional Business Manager, Avista Utilities
Yumei Wang, Geotechnical Engineer, DOGAMI
Tom Wiley, Geologist, Southwest Oregon Regional Geologist, DOGAMI (former)
Taylor Wilkerson, Wildland Fire Supervisor, ODF
Lee Winslow, District Fire Planner, Southwest Oregon District, ODF

Chapter 1 Community Profile

Places are unique. People are unique. People and places are not equally affected by natural hazards.

Looking at the community through the lens of equity—how people and places are differently situated—increases our understanding of the vulnerability to hazards across the City of Medford.

Figure 1. Equality Versus Equity



Source: City of Portland, Oregon, Office of Equity and Human Rights, adapted from the original graphic at http://indianfunnypicture.com/img/2013/01/Equality-Doesn't-Means-Justice-Facebook-Pics.jpg.

Section 1 Introduction

The Community Profile presents an overview of the City of Medford. It takes a closer look at the baseline information on and trends in:

- geology,
- topography,
- climate,
- historic and cultural resources of the City and its people,
- land use and development,
- population and demography,
- employment and economy,
- housing and community development,
- critical facilities and infrastructure,
- education and special districts,
- transportation,
- freight distribution, and
- communications.

The baseline information and trends present the backdrop for Medford's natural hazards mitigation planning process. People and places are not equally affected by natural hazards. People and places are unique. People with more economic, social, or political capital are likely to better withstand disaster events and to bounce back more quickly. Structures located outside of hazard areas and those constructed to higher building standards are more resilient to natural hazards. Looking at the community through the lens of equity—how people and places are differently situated—increases our understanding of the disproportionate vulnerability to hazards across the City of Medford.

The terms resilience and vulnerability are mentioned frequently in the *2017 Medford NHMP*. It is recognized that there are multiple definitions of these terms. To provide some framework for their use here, the following definitions are included. Additional definitions are provided in the Introduction in Chapter 2 Hazard Identification and Risk Assessment.

"Vulnerability is the degree to which people, property, resources, systems and cultural, economic, environmental and social activity is subject to harm, degradation or destruction" (Portland Bureau of Emergency Management [PBEM], 2012).

"Vulnerability is determined by a community's exposure, sensitivity, and resilience to natural hazards as well as by its ability to mitigate, prepare for, respond to, and recover from a disaster" (Oregon DLCD, 2015). Resilience is essentially the flip side of vulnerability. It is the ability to "survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it" (The Rockefeller Foundation, n.d.).

The Community Profile indicates that some people and places are more likely than others to experience greater impacts from natural hazards. These implications inform the Mitigation Strategy. See Chapter 3 Mitigation Strategy for more details on the mission, goals, and mitigation actions for the *2017 Medford NHMP*, as well as how the implementation of those will be achieved, along with the monitoring and evaluating of the NHMP, and the continued involvement of the public as the *2017 Medford NHMP* is integrated into plans, programs, and policies.

The NHMP focuses on natural hazards, but recognizes that other hazards such as human-caused and technological hazards occur. It is widely recognized that no hazard exists in isolation; therefore, consideration of the relationships of multiple hazards is important. Relationships of natural, human-caused, and technological hazards are linked. Cascading impacts may occur.

The *2015 Oregon Natural Hazards Mitigation Plan* (NHMP) (Oregon Department of Land Conservation & Development [DLCD], 2015) provides extensive natural hazard information for the entirety of Oregon, as well as at the regional level. Medford is part of Natural Hazards Region 4 as established by the State. The *2015 Oregon NHMP* will be referenced throughout the *2017 Medford NHMP*. Of particular note, FEMA's requirement regarding the recognition of possible future conditions includes climate change. Climate change is mentioned in the Community Profile and again, in more detail, in Chapter 2 Hazard Identification and Risk Assessment. Appendix D also provides climate trends and projections. State level information is described, along with the local information, to the extent available.

Figure 2. Oregon NHMP Natural Hazards Regions

Source: DLCD, 2015

According to the *2015 Oregon NHMP*, "The region's demographic, economic, infrastructure and development patterns indicate that some populations, structures and places may be more vulnerable to certain natural hazards than others. Mitigation efforts directed at these vulnerabilities may help boost the area's ability to bounce back after a natural disaster" (Oregon DLCD, 2015). In addition, the *2015 Oregon NHMP* states that in Region 4,

> Social vulnerability across the region is driven by low median household incomes and a high proportion of senior citizens. There are several indicators of vulnerability at the county level, including: high numbers of tourists in Jackson County; ... homelessness on the rise in Jackson and Josephine Counties; …and increases in poverty in Douglas and Jackson Counties (Oregon DLCD, 2015).

Section 2 Geology, Topography, and Climate

The City of Medford lies within the upper Rogue Valley, on the western edge of the Siskiyou Mountains, which are part of the Klamath Mountain Range that extends to the Pacific Ocean and divides southern Oregon from northern California. The Cascade Mountains are to the east and the Coast Range is to the west. The Klamath Mountains are composed primarily of volcanic and sedimentary materials that have been folded and faulted and contain intrusive and metamorphic rock. Subsequent erosion and other mountain-building forces occurred to produce prominent geological features near Medford, such as the Table Rocks and Roxy Ann Peak. Roxy Ann Peak is 3,573 feet high (SummitPost, n.d.) and is a dormant volcano. Medford is situated on stream deposits and sedimentary rock deposited 50 million years ago; the City has an elevation ranging from 1,300 to 3,010 feet (the top of Roxy Ann Peak is outside the city limits).

As described in the City of Medford's *Comprehensive Plan Environmental Element* (City of Medford Planning Department, 2011),

> Southwest Oregon's western interior valleys, which lie in the rain shadow of the Klamath/Siskiyou Mountains, tend to contain the urban areas, communities such as Medford, Ashland, Jacksonville, Gold Hill, Eagle Point, and Shady Cove. The valleys consist of floodplains, stream terraces, and flat to gentle slopes. Most development has occurred on quaternary alluvial and fluvial deposits, which eroded from the surrounding mountains and were subsequently deposited on the valley floor. A variety of soils developed on these deposits, ranging from deep, dark-colored prairie soils on well-drained terrace locations, to rocky, drought-prone soils to the northeast of Medford.

Jackson County's *Comprehensive Plan* identifies Roxy Ann Peak as an outstanding resource. Roxy Ann Peak is located in the 1,700-acre Prescott Park, which is owned and operated by the City of Medford. Prescott Park is outside the Medford Urban Growth Boundary. Residential hillside development, both inside and outside the UGB, continues to encroach upon Roxy Ann Peak (City of Medford Planning Department, 2011).

Figure 3. Roxy Ann Peak

Source: City of Medford (n.d.-i)

Figure 4. Medford, looking to the west from Roxy Ann Peak. Grayback Mountain is under the clouds and snow in the distance, taken January 15, 2006

Source: SummitPost.org, n.d., Roxy Ann Peak, http://www.summitpost.org/roxy-ann-peak/258689

Bear Creek—which traverses through Medford from south to north—and its riparian areas provide a particularly valuable habitat for riparian mammals, reptiles, and amphibians, and a wide variety of migratory and resident bird species. Both anadromous and resident fish species are present in Bear Creek (City of Medford Planning Department, 2011). Bear Creek is located entirely within Jackson County (Oregon DEQ, 2007). It is one of the Rogue River's primary tributaries, ending there after starting at Emigrant Lake.

The Bear Creek Watershed is approximately 361 square miles (Oregon DEQ, 2007). It is comprised of 83 tributary streams in 21 sub-watersheds; of those, 13 are fish-bearing streams (Oregon DEQ, 2007). Bear Creek has been one of the major salmon spawning tributaries to the Rogue River, and is the major discharge source for floodwaters in Medford. Several tributaries, such as Larson Creek and Lone Pine

Creek, also flow through the City of Medford. These waters drain into the Rogue River west of the White City industrial area, north of Medford.

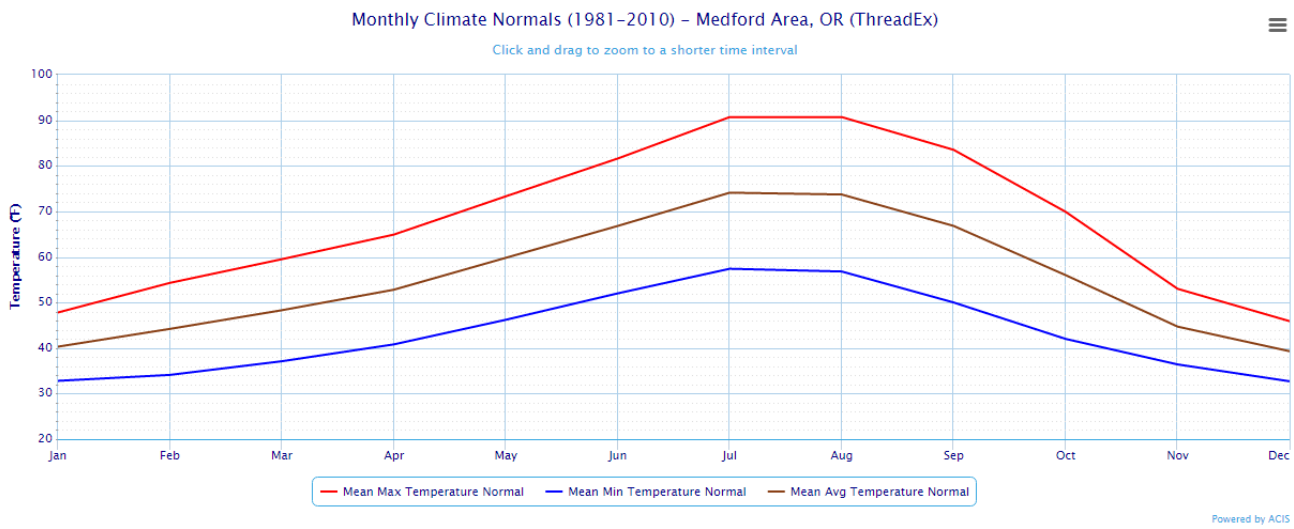
In addition to natural waterways, a complex irrigation canal system surrounds the City of Medford to the east and west, transporting irrigation water in the summer and stormwater at all times of the year. “In Bear Creek the primary determinant of flow in the creeks is irrigation water delivery, operational spill and return flows, especially during the summer months. Some of the highest creek flows occur during the summer dry period when irrigation demands are the highest” (Oregon DEQ, 2007).

Figure 5. Rogue Basin and Bear Creek Watershed

Source: Oregon DEQ, 2007

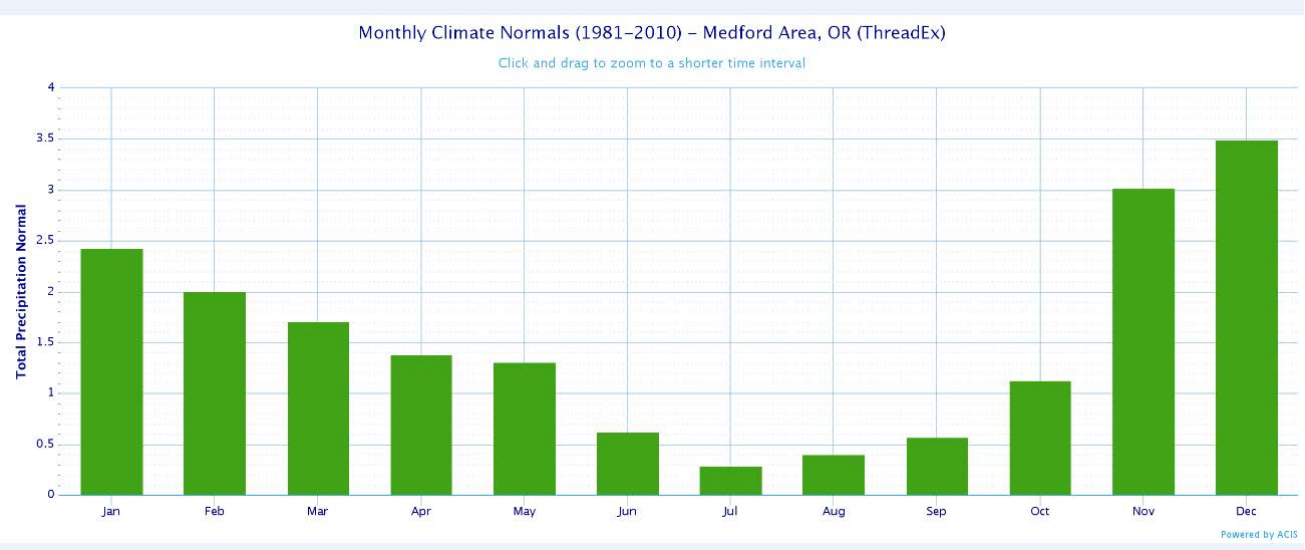
Medford has a moderate, seasonal climate. The average daily high temperature in the City is between 80 and 95 degrees Fahrenheit (F) in the summer and between 45 and 55 degrees F in the winter. The Rogue Valley has the lowest precipitation among Oregon’s western interior valleys, with Medford averaging about 18.35 inches of rain per year. This average, however, actually hides a range of rainfall values that have been as low as 8.99 inches in 2013 and as high as 31.41 inches in 1996 (Ryan Sandler, personal communication, July 28, 2016).

Figure 6. Monthly Climate Temperature Normals from 1981-2010 for Medford



Source: Ryan Sandler, personal communication, July 28, 2016

Figure 7. Monthly Climate Precipitation Norms from 1981-2010 for Medford



Source: Ryan Sandler, personal communication, July 28, 2016

Rainfall occurs primarily in the winter months. The phenomenon known as “rain on snow”, a combination of higher temperatures and heavy rains in the winter and early spring, can result in high runoff and flooding in the winter and early spring. Summers are dry and warm, requiring irrigation to support the region’s agricultural sector. Snow falls occasionally with an annual average of 4 inches in the City (Ryan Sandler, personal communication, July 28, 2016).

Normally, winds average less than five miles per hour (mph), prevailing from the south in the winter and from the northwest during the remainder of the year. Summer thunderstorms may bring gusty winds of 40 or 50 mph from any direction (City of Medford Planning Department, 2011), but these are uncommon with only eight thunderstorm days annually (Ryan Sandler. personal communication, July 28, 2016). While most climatic factors are beyond control, urbanization can cause changes in

atmospheric conditions. Generally, the urban climate, especially in larger cities, tends to be warmer, especially at night (Ryan Sandler, personal communication, July 28, 2016). According to the National Weather Service staff, Medford does exhibit an urban heat island effect, but it is relatively minor compared with big cities. The most noticeable change is for nighttime low temperatures at the airport being warmer. Annual rainfall has decreased slightly in recent decades (Ryan Sandler, personal communication, July 28, 2016).

Medford's climate includes higher summer temperatures and lower average rainfall than the remainder of the region due to a "rain shadow" effect caused by the surrounding Siskiyou and Coast Mountain Ranges (City of Medford Planning Department, 2011).

Table 1. Medford's Climate Data

Data	Date, Temperature, or Amount
Mean Annual Temperature	55.6 F (13.1 C)
Mean Annual Precipitation	18.4 in (46.6 cm)
Record Low	-10 F (-23.3 C) December 1919
Record High	115 F (46.1 C) July 1946
Average Growing Season	180 Days
Latest Recorded Frost	June 12
Earliest Recorded Frost	September 13
Average Annual Snowfall	4.1 in (10.4 cm)

Source: City of Medford (n.d.-h) and Ryan Sandler, personal communication, July 28, 2016

Local topography, in combination with climatic features, contributes to periodic flooding in the Bear Creek and Rogue River Valleys. Population growth and its attendant urbanization have heightened the impact of flooding in the valleys. Additionally, the valley's bowl-like shape, formed by bordering mountain ranges, promotes periods of atmospheric inversion, having deleterious effects on air quality, primarily during the winter months. Air quality will be further discussed in Section 8 of Chapter 2 Hazard Identification and Risk Assessment, and floods will be further discussed in Section 3 of that chapter. Local conditions are impacted by climate change.

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> The most reliable information on climate change to date is at the state level. The state information indicates that hazards projected to be impacted by climate change in Region 4 include drought, wildfire, flooding, and landslides. Climate models project warmer drier summers and a decline in mean summer precipitation for Oregon. Coupled with projected decreases in mountain snowpack due to warmer winter temperatures, all eight regions are expected to be affected by increased incidences of drought and wildfire. In addition, flooding and landslides are projected to occur more frequently throughout western Oregon. An increase in extreme precipitation is projected for some areas in Region 4 and could result in a greater risk of flooding characterized by increased magnitude and shorter return intervals in certain basins. Landslides in Oregon are strongly correlated with rainfall, so increased rainfall — particularly extreme events — will likely trigger more landslides. While winter storms and windstorms affect Region 4, there is little research on how climate change influences these hazards in the Pacific Northwest (Oregon DLCD, 2015).

The FEMA *Local Mitigation Plan Review Guide* identifies the requirement that the NHMP address changes to development that include looking at "risk and vulnerabilities to existing and potential

development, and takes into consideration possible future conditions that may impact the vulnerability of the community" (FEMA, 2011b). Climate change is a possible future condition that is considered as part of the *2017 Medford NHMP*. Additional details on climate change are provided in Chapter 2 Hazard Identification and Risk Assessment and in Appendix D Hazard Summary of Climate Trends and Projections.

Section 3 History, with Emphasis on Historic and Cultural Resources

Prior to the development of the City of Medford, Native Americans inhabited the area for generations. As part of the *2017 Medford NHMP* planning process that embraces community engagement, tribes were invited to participate. Upon the recommendation of the Executive Director of the Legislative Commission on Indian Services, invitations were specifically extended to the representatives of the Siletz, Coquille, Cow, and Grand Ronde tribes. The Emergency Manager of the Cow Creek Band of Umpqua Tribe of Indians attended the first Steering Committee and continued as a member. A representative from the Coquille Indian Tribe responded with a desire to be kept informed as the NHMP progressed. Each of the tribes has a unique history and experience that shapes them. This NHMP provides a very brief history.

History is the study of the past. Historic is significant, notable, and newsworthy. Cultural relates to the ideas, customs, and social behaviors of a society. Historic and cultural resources are important to our community because they provide unique information and insight about our past societies and environments. Historic and cultural resources include structures, objects, sites, and districts. Examples include unique architecture on buildings, prehistoric artifacts, burial sites, roads and bridges, earthworks, artwork, landforms, and battlefield sites. These may be designated as historic and cultural resources by local, state, and federal jurisdictions.

In the City of Medford's *Comprehensive Plan Environmental Element* (City of Medford Planning Department, 2011), natural resources are identified along with archaeological and historic resources as required to be addressed and inventoried in comprehensive plans by Goal 5 of the Statewide Planning Goals. As described in the *Comprehensive Plan*, "State law defines archaeological areas as those 'characterized with evidence of an ethnic, religious, or social group with distinctive traits, beliefs, and social forms'; and defines historic areas as 'lands with sites, structures, and objects that have local, regional, statewide, or national historical significance.'"

The National Register of Historic Places (https://npgallery.nps.gov/NRHP/) is an official registry for the preservation of historic and cultural resources. To be listed on the National Register of Historic Places, a district, site, building, structure or object must be 50 years or older in general. The Oregon State Historic Preservation Office (http://www.oregon.gov/oprd/HCD/SHPO/Pages/index.aspx) manages and administers programs to protect Oregon's historic and cultural resources.

Medford's historic districts are listed on the National Register of Historic Places and include: the Downtown Historic District; the South Oakdale Historic District; the Corning Court Ensemble; and the Geneva-Minnesota District. If historic structures are outside of these identified districts, then they are within their own Historic Preservation Overlay (City of Medford, n.d.-f) (Carla Paladino, personal communication, March 24, 2017).

The Cow Creek Band of Umpqua Tribe of Indians Emergency Manager (Tracy DePew, personal communication, June 29, 2016) provided a map of the ancestral territory, **Figure 9**, and included a description of their history as published on their website (http://www.cowcreek.com/tribal-government/pre-contact/). A portion of the history is excerpted here.

> For generations, our people, the Cow Creek Band of Umpqua, lived between the Cascade and the Coast ranges in the Umpqua and Rogue River watersheds in southwestern Oregon. Our homeland was one of high mountains, forested uplands and valley floors that provided abundant

> resources to sustain our tribal way of life. The heart of our country was concentrated on the South Umpqua River and its primary tributary, Cow Creek.
>
> Along the glistening rivers and streams, salmon was harvested using various methods of capture including spearing, netting, and trapping. Stick dams were constructed across creeks and funnel shaped baskets made of hazel shoots were placed in narrow channels to catch salmon as they surged upstream. Men also plunged into the water to tear large numbers of lamprey from the rocks. Both salmon and lamprey were smoked and dried, serving as stored food used during the winter months. Creeks and rivers provided additional nourishment in the form of trout, crawfish and freshwater mussels…
>
> When nights began to chill and the prospect of winter rain set in, our people dropped down from the mountains, abandoned the temporary huts of limbs and reed matting and took up residence in the permanent winter villages in the lowlands. The villages consisted of several plank-houses: semi-subterranean lodges constructed of split wood planks set on four upright posts. Four cross-beams supported the roof and were lashed to the corner posts and ridgepoles by hazel bark cordage. A notched log served as a ladder that provided steps down to a main activity area around a central fire pit. These dwellings also housed the gathered foods such as acorns, hazelnuts, cakes of camas, tarweed seeds, smoked salmon, lamprey, and dried meat.
>
> Life continued on in this way for our Tribe until contact with Euro-American newcomers in the early 1800s.

The Coquille Indian Tribe Chairperson provided a letter of comment and map of their service area. See **Figure 10**. An ancestral territory map is not available (Kay Collins, personal communication, May 10, 2017). As excerpted from the letter,

> On June 28, 1989, Congress pass public law 101-42, which restored federal recognition of my tribe as a sovereign government, and made us eligible to participate in federal Indian programs and to receive funding to provide health, education, housing assistance and pursue economic development for my Tribe's members. The Coquille Restoration Act also validated my Tribe's authority to manage and administer political and legal jurisdiction over our lands and resources, our businesses and our Tribal community members. Today we provide services to Tribal members throughout the world, and especially concentrated within our five-county service area of Coos, Curry, Douglas, Lane and Jackson Counties in Oregon (Brenda Meade, personal communication, October 28, 2016).

An attorney representing the Siletz Tribe provided a letter of comment. As excerpted from the letter,

> The Siletz Tribe is the legal and political successor to a number of Indian bands who were removed by the federal government and confederated on the Coast or Siletz Reservation which was established by Executive Order in 1855 including all the bands and tribes residing in the Rogue Valley, including the Takelma, Chetco, Galice/Applegate and Shasta peoples… Siletz ancestors fought in the Rogue Indian Wars and, negotiated the Treaty with the Rogue River at Table Rock in 1853. Ancestors of the Siletz Tribe ceded the lands of the Rogue Valley to the U.S. government and were removed to the Siletz Reservation. The Siletz Tribe is the legal historical successor to those tribes and bands, and these lands are the traditional territory of the Siletz Tribe (Lee Ann Easton, personal communication, October 28, 2106).

Figure 11 is the Siletz Ancestral Tribes and Homelands map.

In 1985, the Mail Tribune presented the City's 100-year history in a special edition entitled "Medford's First Century," from which much of the following description of the City's development is drawn ("Medford's First Century," 1985) unless otherwise noted.

The City of Medford grew up around the depot and right-of-way of the Oregon and California Railroad. The tracks reached Medford in January 1884. The City was incorporated as a town in February 1885. By 1890, the City had a population of 897. Money from the East Coast of the U.S. was invested in the pear and fruit orchards, bringing a boom to agriculture. Medford pears were shipped to the markets of the East Coast and Europe. By 1910, a 20-mile pipeline brought water from Little Butte Creek to the City.

The postcard image below was taken in 1907 or 1908. It shows the Nash Hotel and Medford's second railroad depot on the right. The Palm Building (currently known as the Goldy Building) and the Commercial Club's Exhibit Building next to the railroad tracks are on the left. Paving of Main Street (still known as Seventh Street at the time) was begun at the end of 1908.

Figure 8. Postcard of the Nash Hotel in Medford, Circa 1907-08

Source: Vicki Bryden, City of Medford, http://www.ci.medford.or.us/Page.asp?NavID=2960

By 1920, the City's population had grown to 5,756. Population and financial growth spurred by real estate speculation known as the "Orchard Boom" established Medford as a regional urban center. By the mid-1920s, the city had also become an aviation leader, claiming the first public airport and only airmail stop in Oregon (City of Medford, n.d.-e). The first large sawmill, Tomlin Box Co. (predecessor of Timber Products Co.), was built. Becoming the Jackson County seat in 1927 (City of Medford, n.d.-e), Medford's population almost doubled between 1920 and 1930 to 11,007 people. The City tapped the Big Butte Springs for its water supply.

By 1940, the effects of war on the international marketplace resulted in the pear industry expanding its domestic market. Harry and David Holmes of Bear Creek Orchards started a gift fruit business that still bears their name today. The population reached 11,281 in 1940.

During the period from 1941 to 1950, logging and sawmill industries expanded significantly, at first to support the war effort, and then to support the housing boom that followed the war. During World War II, the construction of the Camp White military training installation brought significant business and

population to the Medford area. After the war, the Veterans Administration transformed Camp White's hospital into a domiciliary and the City acquired the military's sewage treatment plant, facilitating Medford's continued growth. By 1950, the population was 17,305.

In the 1950s, wood products industries continued to grow. A second pipeline from Big Butte Springs to the City was constructed. The Medford Shopping Center opened. Rogue Valley Memorial Hospital, formerly known as Community Hospital, re-established itself on Barnett Road. The City population was 24,425 by 1960.

During the 1960s, the wood products industry overtook the pear industry as the City's most important. The Interstate 5 viaduct through the City was completed. Plans for a three dam system to control flooding on the Rogue River were supported and would include one on Lost Creek, the Applegate River, and Elk Creek. The medical community re-established Sacred Heart Hospital as Providence Hospital on Crater Lake Ave. Medford's reputation as a regional medical center for southern Oregon and northern California grew. The Robert A. Duff Water Treatment Plant Facility was built to draw water from the Rogue River during summer months. Medford sewage treatment began serving the region. The population reached 28,973.

During the 1970s, there was a slump in the lumber market. The public began to see the air quality problems created by burning of lumber by-products, orchard smudge pots, and wood stoves as a problem. A number of shopping centers opened, including Bear Creek Plaza and Black Oak Village. The City's population reached 39,603 by 1980.

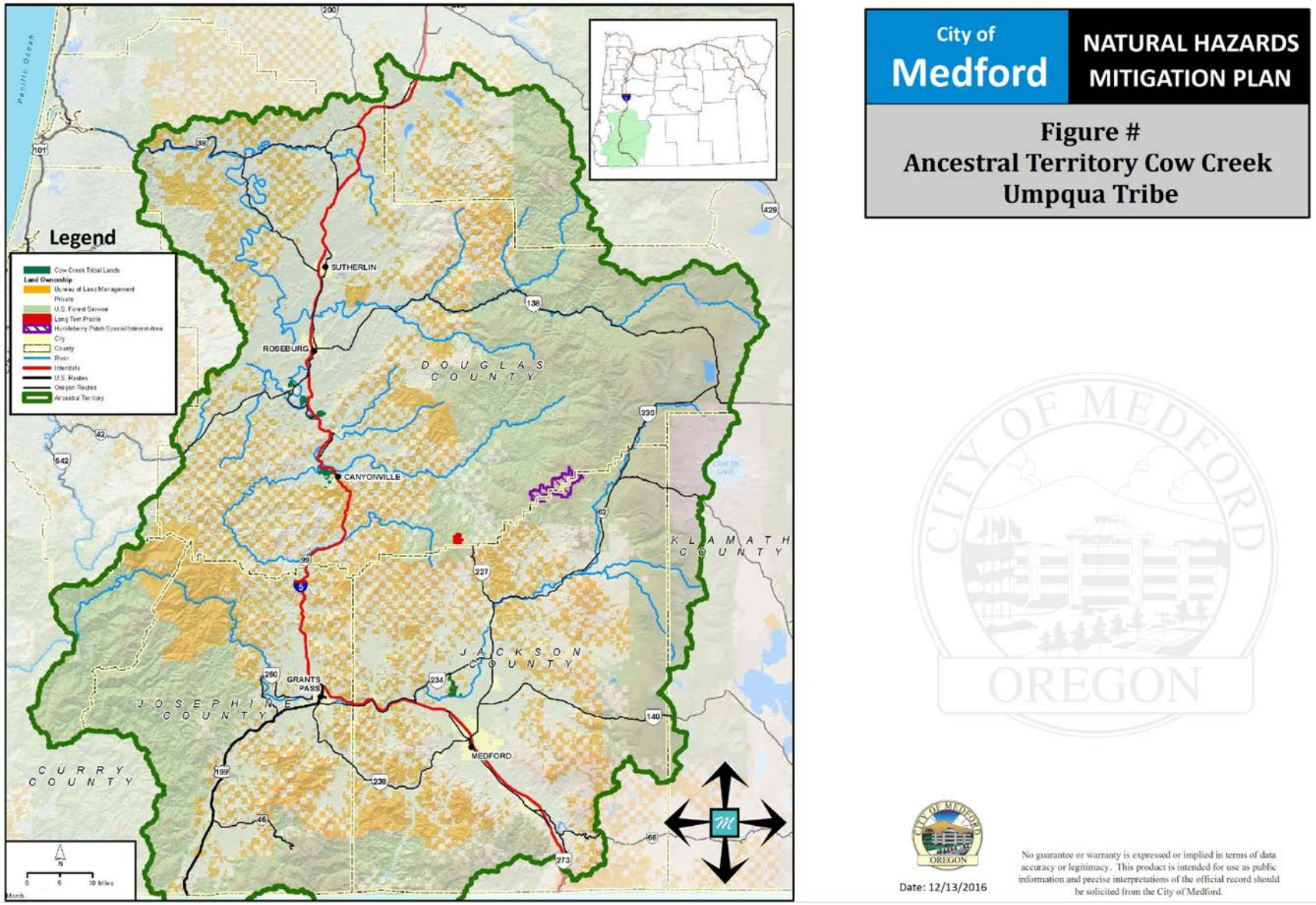
In the 1980s, the economic recession and high interest rates hurt the homebuilding industry, creating unemployment in the area due to its impact on the timber industry. Out of concerns for regional air quality, the State legislature passed an auto emission inspection and maintenance program. The population grew to 47,021 by 1990.

The 1990s saw continued expansion of the City's role as a regional medical center and a regional shopping and service center. The City grew by net in-migration as retirees were attracted to Medford by its mild climate, affordability (in contrast to California), quality medical community, and natural surroundings. The population reached 59,990 by 1999.

Since the year 2000 the City of Medford has continued to grow and has remained the region's fastest growing municipality, adding over 10,000 new residents at an annual rate of 2.5% (Carla Paladino, personal communication, March 30, 2017). The City's role as the region's service and trade center continued to grow and labor force participation rates increased (Carla Paladino, personal communication, March 30, 2017). Notably, Medford continues to be a center for medical and shopping services in the region (Carla Paladino, personal communication, March 10, 2017). In 2010, the City of Medford celebrated their 125th anniversary. Related to the celebration, a book by Kevin Keating, *Medford*, in the Images in America series, was published in 2011. "After convincing the railroad to build its depot on their prairie land near Bear Creek, they began building what became the second-fastest growing city in America, with over 100 new buildings in its first year" (Keating, 2011). The next several sections of the Community Profile provide additional details about Medford since the year 2000.

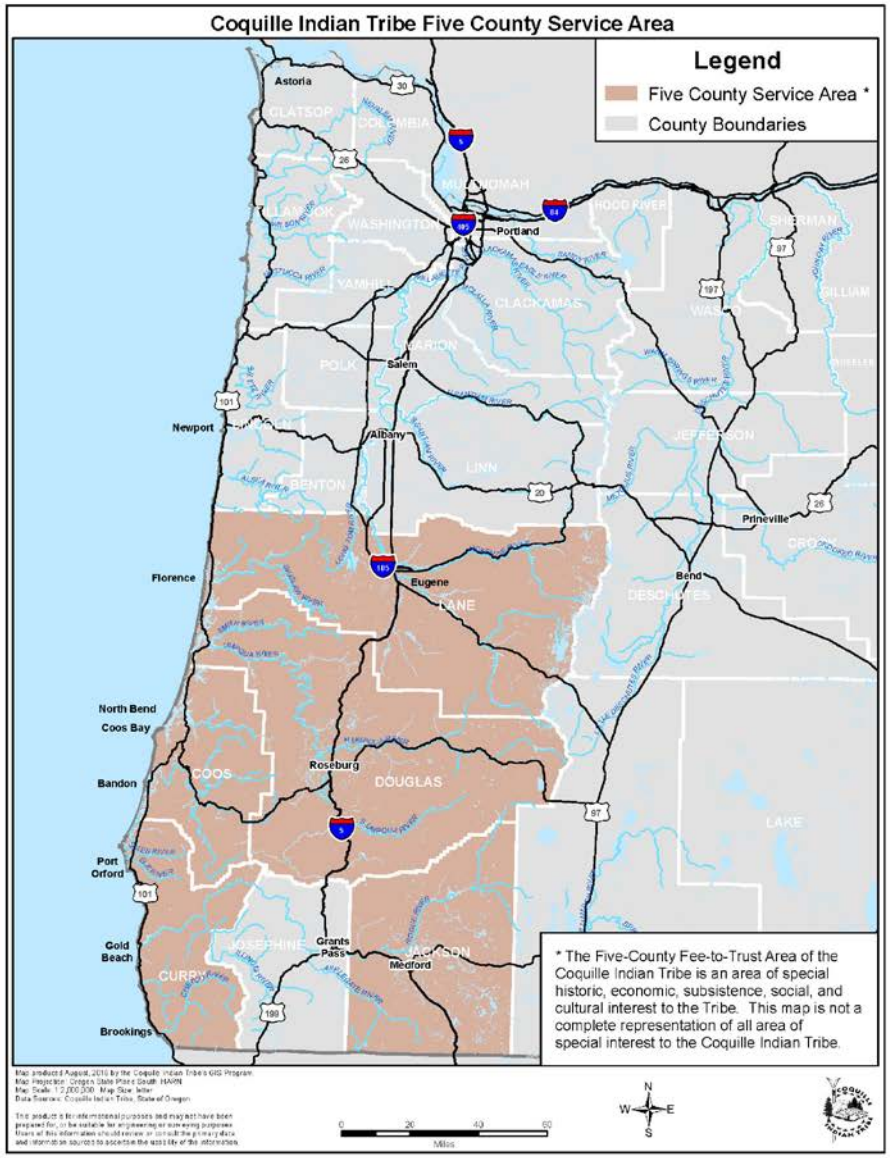
U.S. Census data shows the population of Medford as of April 1, 2010 was 74,907 and as of July 1, 2015 the population was 79,805; a 6.5% increase in that five-year period (U.S. Census Bureau, n.d.-b). Additional information about the City's population is provided in the following sections.

Figure 9. Ancestral Territory Cow Creek Umpqua Tribe



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, December 11, 2016 and Tracy DePew, personal communication, June 29, 2016

Figure 10. Coquille Indian Tribe Five County Service Area



City of Medford
NATURAL HAZARDS MITIGATION PLAN

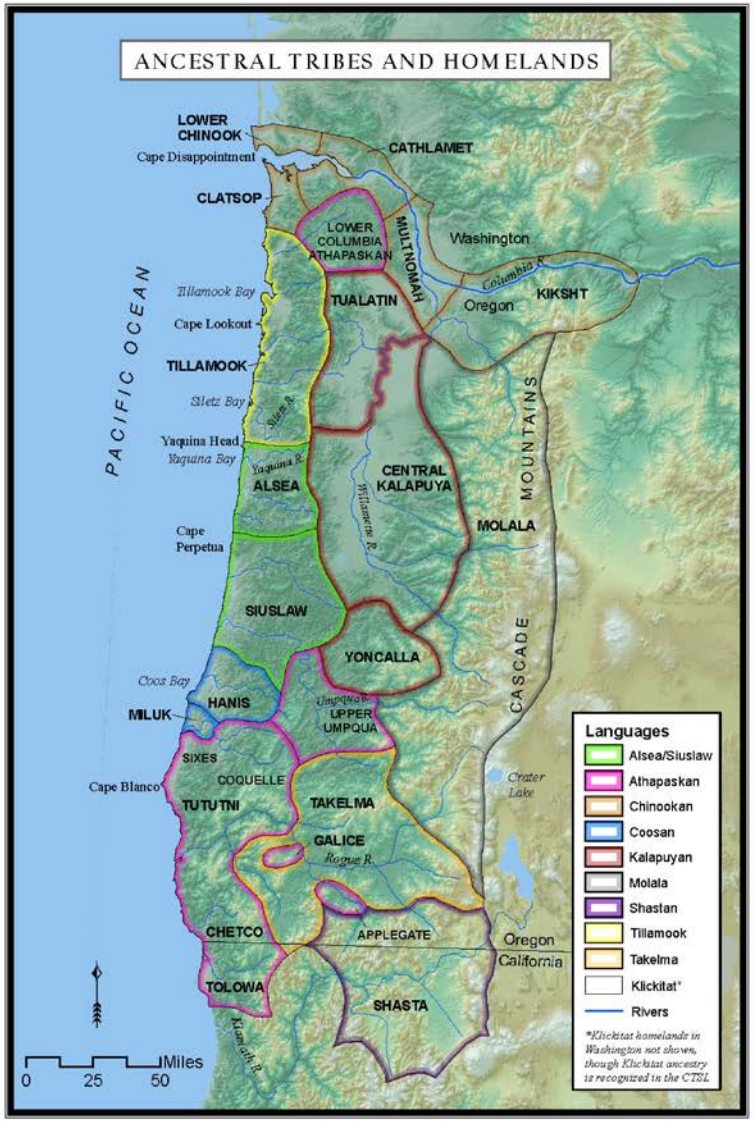
Figure #
Coquille Indian Tribe Five County Service Area

Date: 1/10/2017

No guarantee or warranty is expressed or implied in terms of data accuracy or legitimacy. This product is intended for use as public information and precise interpretations of the official record should be solicited from the City of Medford.

Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, January 10, 2017 and Kay Collins, personal communication, January 10, 2017

Figure 11. Siletz Ancestral Tribes and Homelands



City of Medford
NATURAL HAZARDS MITIGATION PLAN

Figure #
Siletz Ancestral Tribes and Homelands

Date: 4/6/2017

No guarantee or warranty is expressed or implied in terms of data accuracy or legitimacy. This product is intended for use as public information and precise interpretations of the official record should be solicited from the City of Medford.

Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, April 6, 2017 and Peter Hatch, personal communication, April 5, 2017

Section 4 Land Use and Development Trends

Within the city limits, Medford is 16,483 acres and within the Urban Growth Boundary (UGB) it is 18,076 acres (Chris Olivier, personal communication, October 10, 2016). Every city in Oregon has a boundary line enclosing lands that are eligible for urban development. These urban growth boundaries (UGBs) separate urbanizable land from rural land and are intended to provide a 20-year supply of buildable land to accommodate growth. This leaves lands outside the UGB as less developed, more rural areas. As of September 2016, Medford is working on an amendment to its UGB to comply with the land supply requirement of the State (City of Medford, n.d.-n).

Medford abuts the City of Central Point on the Northeast and a developed area within Jackson County, but associated with the City of Phoenix, on the south. The nearest other urban area is White City, an unincorporated community several miles to the north. Interstate 5 and State Highway Nos. 99, 238, 140 and 62 provide access to Medford from all directions.

Medford is divided by Bear Creek, as well as by the Interstate 5 freeway, which parallels Bear Creek. Twelve vehicular bridges cross Bear Creek in Medford. If these bridges were to fail in an earthquake event, West Medford and East Medford would be effectively separated. This is of special concern since both of the hospitals are located in East Medford. Municipal, county, state, and federal offices are located in West Medford. The larger land area of Medford is located east of Bear Creek. See Chapter 2 Section 3 Floods and Section 4 Earthquakes for a more detailed description of the resources located in West and East Medford that could be impacted by hazards and limit the access between the two sides of town. Maps within this NHMP illustrate Medford's geography.

East Medford slopes eastward and upward into the foothills, and contains much of the City's current and future low-density residential areas, as well as numerous high-density retirement facilities. SFR-2, the City's lowest density residential zoning, which allows two dwellings per acre, is utilized in the steepest areas. The street system in the older East Medford residential areas is somewhat unconnected with numerous cul-de-sacs.

The larger tracts of undeveloped land in East Medford often contain Oregon White Oak woodlands and associated underbrush; fire is an issue in this area. The areas where development meets vegetative fuels, such as forestland, are commonly referred to as the wildland-urban interface (WUI). WUI fire fuel includes both structures and vegetation. The defining characteristic of the WUI is a structure built in or immediately adjacent to essentially continuous vegetation (fuel). Each year a significant number of people build homes within or on the edge of the forest, thereby increasing the risk to this type of wildfire hazard. See Chapter 2, Section Wildland-Urban Interface Fires.

Just outside the UGB, the City owns and operates two relatively undeveloped parks, Prescott Park (1,740 acres) and Chrissy Park (160 acres) (City of Medford, n.d.-j, n.d.-a). These parks are currently included within Medford's proposed expansion of the UGB; the UGB is proposed to expand in nearly all directions around the current city boundaries (Carla Paladino, personal communication, March 10, 2017). In the past, a concern with development in the Roxy Ann Peak area has been the lack of routes into and out of the area, a situation that has caused problems for fire responders and residents in this WUI, particularly in terms of evacuating the area. Since the 2010 Medford NHMP, additional streets have been constructed to alleviate some of these access concerns.

A portion of the City's future growth will occur in the 1,000-acre Southeast Medford Plan Area. This specifically planned area will contain a dense 53 acre commercial area located inside a 178 acre

Southeast Village Center Transit Oriented District (TOD) (Carla Paladino, personal communication, March 10, 2017). Another growth area is located on the flank of Roxy Ann Peak near the UGB and Prescott Park, which contains areas of unstable soils and some potential landslide areas. According to the City of Medford Hillside Ordinance, a Geology and Soils Report from an Oregon licensed geologist or an engineering geologist, a Hydrology and Grading Report prepared by an Oregon registered civil engineer, and appropriate design, are required for new development in this area (City of Medford, 2009).

North Medford contains the regional Rogue Valley International–Medford Airport and much of the City's industrial and "big box" commercial areas, including most of the vacant industrial land. Residential and commercial areas are located to the north and south of the airport, including new residential development northwest of the airport in the City of Central Point. Within the City of Medford, the Airport Approach (A-A) and Airport Radar (A-R) Overlay Zones restrict creation of new conflicting uses within the airport area.

West Medford contains the older sections of the community, including the downtown and the expanding Civic Center. Much of west Medford is developed at a higher residential and commercial density, with a tightly gridded street system. This area contains the City's stock of affordable single-family housing, often 60 to 100 years old, interspersed with newer attached housing. Older rural-residential areas to the west and southwest are seeing higher density single-family development infill. The UGB will not expand significantly to the west due to high value agricultural soils.

Medford's most highly developed high-density residential and commercial corridor generally follows Bear Creek, including development within the 100-year floodplain. Tributaries to Bear Creek, such as Larson Creek, Lone Pine Creek, Lazy Creek, and Crooked Creek, bisect much of Medford. Development is also contained within the 100-year floodplains of these tributaries. More recently, greenways are being set aside along creeks and waterways, including the Bear Creek Greenway, which contains considerable land in public ownership. The City has acquired and completed the development of an additional 125 acres along Bear Creek south of the central city. This park is known as US Cellular Community Park and it experienced flooding in 1997 (Carla Paladino, personal communication March 10, 2017).

Future greenways are designated along the forks of Larson Creek in the Southeast Plan Area. The City's Riparian Corridor regulations limit development within 50 feet of the top of the banks of some of the creeks, including Bear Creek and Larson Creek. Other smaller creeks, such as Crooked Creek, are not regulated by the Riparian Corridor provisions.

Development in the "basins" of the creek tributaries results in an increase in flooding potential at lower elevations. The development of more impervious surfaces increases stormwater runoff from precipitation events; it reduces infiltration as it precludes infiltration of water to the subsurface.

Medford's considerable residential and non-residential growth during the 1990s, a disconnected east side street system, and a lack of alternatives to motor vehicle use have resulted in transportation system impacts and congestion. Now one of the primary goals is to increase the number of trips taken by transportation modes other than single-occupancy vehicles, by improving conditions for walking, biking, and using transit, as well as by placing housing and services/employment closer to one another. See Section 10 Transportation, Freight Distribution, and Communications.

Over the past 11 fiscal years (2005-2016), the City has averaged 217 single-family dwelling permits per year. The peak number during this time was 454 permits in 2005-2006 (Carla Paladino, personal

communication, March 10, 2017). Multi-family dwelling construction has averaged 121 permits over a three year period (2013-2016) (Carla Paladino, personal communication March 10, 2017). More details about the number of residential construction and land use permits in Medford are provided in Section 7 Housing and Community Development.

Due to its position as a regional service center for southwest Oregon and northern California, Medford has had increased commercial and light industrial development, particularly along the State highways. People from outlying communities travel daily to Medford for employment, services, education, and recreation. Medford tends to attract small businesses, as well as large retail establishments, franchise restaurants, medical facilities, and trucking terminals. Leading types of products include wine, recreational, fruit packing, grain crops, bearings and cylinders, lumber and wood, and artisanal food (Medford Chamber of Commerce, 2016). Large industrial uses have tended to locate in the White City area.

With the amount of development over the past decade, Medford's vacant commercial land supply is lower than in the past; however, this is expected to help promote redevelopment opportunities, particularly in the downtown and in other existing commercial districts. Four planned TODs, including the Southeast TOD and the downtown, are likely to increase commercial and other employment opportunities in existing areas. Considerable vacant industrial land remains available (Carla Paladino, personal communication, March 10, 2017). Additional details about development in Medford are provided in Section 6 Employment and Economic Development and in Section 10 Transportation, Freight Distribution, and Communications.

Regarding land use,

> Land use regulations and policies can assist in improving the quality of an urban environment. The use of preventive land use planning measures, such as minimizing paved surfaces, reducing the number of motor vehicle trips, adding vegetation and shade trees to streets and parking lots, preserving open waterways, and land use regulations that move to reduce auto use and that promote "pedestrian-friendly" neighborhoods and commercial centers assist in mitigating some of the adverse climatic conditions inherent to cities. Landscaping and waterways are assets to the community, and offset the effects of substantial concrete and asphalt, contributing to livability (City of Medford Planning Department, 2011).

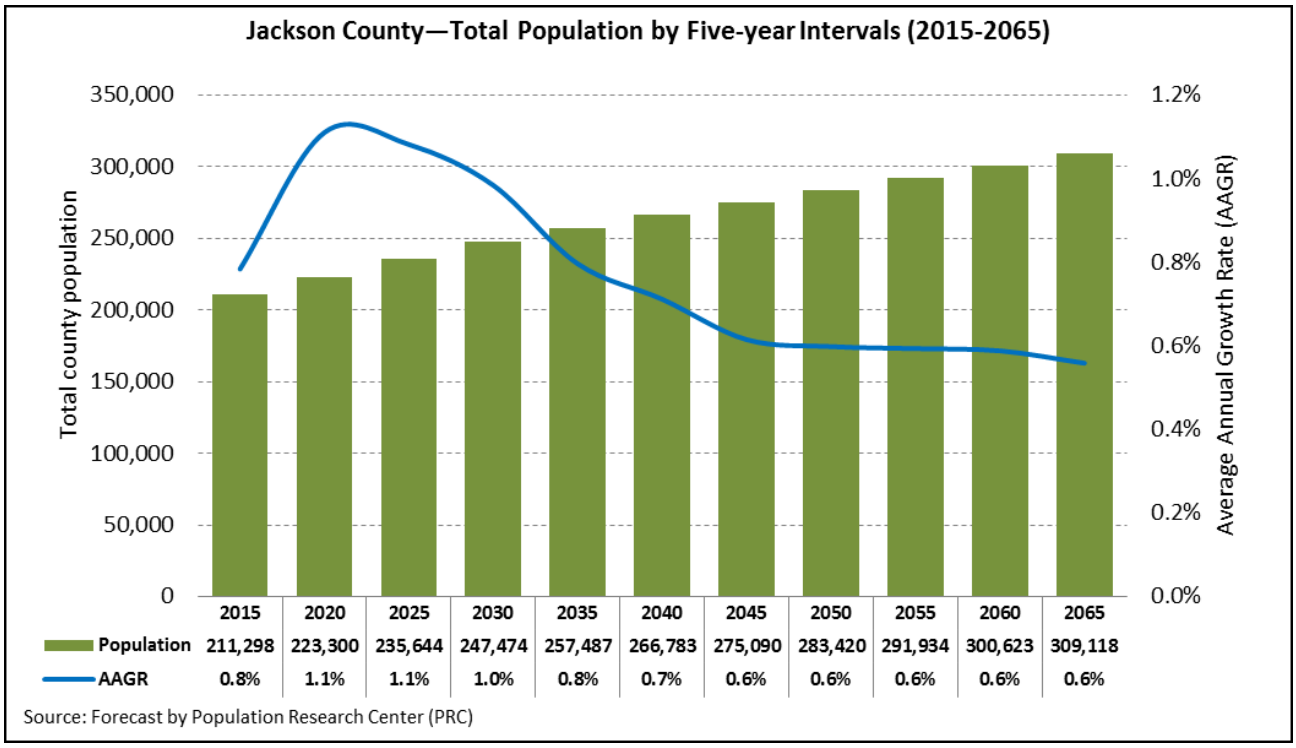
The Oregon Revised Statute (ORS) Chapter 197 (Oregon Land Use Planning Act) requires cities and counties to adopt comprehensive land use plans. Statewide Planning Goal 7 requires communities to inventory known natural hazards and implement appropriate safeguards for development in hazardous areas. Of note, Goal 7 and Oregon Senate Bill 12 are seen as serving as the foundation for local ordinances that regulate development in areas subject to landslides and other hazards (Oregon DLCD, n.d.-b). Goal 7 does not provide specific direction on how communities should address development in hazard areas.

Section 5 Population and Demographics

Medford is the county seat of Jackson County. Medford is the largest city in southern Oregon and the eighth largest in the State. As of July 1, 2015 the population was 79,805 (U.S. Census Bureau, n.d.). The City's land area totals 25.7 square miles (City of Medford, n.d.-h). The City is the center of commerce, industry, transportation, finance, retail and health services for an immediate metropolitan area extending within Jackson and Josephine counties, as well as for three other southwestern Oregon and northern California counties.

The compounded annual rate of population growth for the City of Medford from 1980 to 2006 was 2.42% compared to the similarly calculated growth rate for the State of Oregon as a whole of 1.31%, while Jackson County grew at a 1.57% annual rate (City of Medford, 2010). More recent data from the Population Research Center at Portland State University shows a projected growth rate for each 5 year period, from 2015 to 2065, varying from a low of 0.6% to a high of 1.1% (Portland State University, Population Research Center, 2015). It is important to recognize the population growth and the nature of the growth, in the role of natural hazards mitigation planning.

Figure 12. Jackson County Total Population by Five Year Intervals (2015-2065)



Source: Portland State University, Population Research Center, 2015

Looking at the growth by jurisdictions in Jackson County, as shown in **Table 2**, Medford's share of the population is 37.9% of the Jackson County population in 2015, and in 2035 it will be 38.8% (Portland State University, Population Research Center, 2015). Medford has the third highest average annual growth rate of the population areas listed in the table for Jackson County.

Table 2. County and Larger Sub-Areas Population and Average Annual Growth Rate

County and Larger Sub-Areas—Population and Average Annual Growth Rate (AAGR) (2015, 2035, and 2065)

	2015	2035	2065	AAGR (2015-2035)	AAGR (2035-2065)	Share of County 2015	Share of County 2035	Share of County 2065
Jackson County	*211,298*	*257,487*	*309,118*	*1.0%*	*0.6%*	*100.0%*	*100.0%*	*100.0%*
Ashland[1]	20,905	23,183	24,138	0.5%	0.1%	9.9%	9.0%	7.8%
Central Point	18,329	22,680	27,485	1.1%	0.6%	8.7%	8.8%	8.9%
Eagle Point	9,657	14,839	18,669	2.2%	0.8%	4.6%	5.8%	6.0%
Medford	80,024	99,835	124,582	1.1%	0.7%	37.9%	38.8%	40.3%
Smaller UGBs[2]	22,010	31,846	47,125	1.9%	1.3%	10.4%	12.4%	15.2%
Outside UGBs	60,373	65,104	67,119	0.4%	0.1%	28.6%	25.3%	21.7%

Source: Forecast by Population Research Center (PRC)

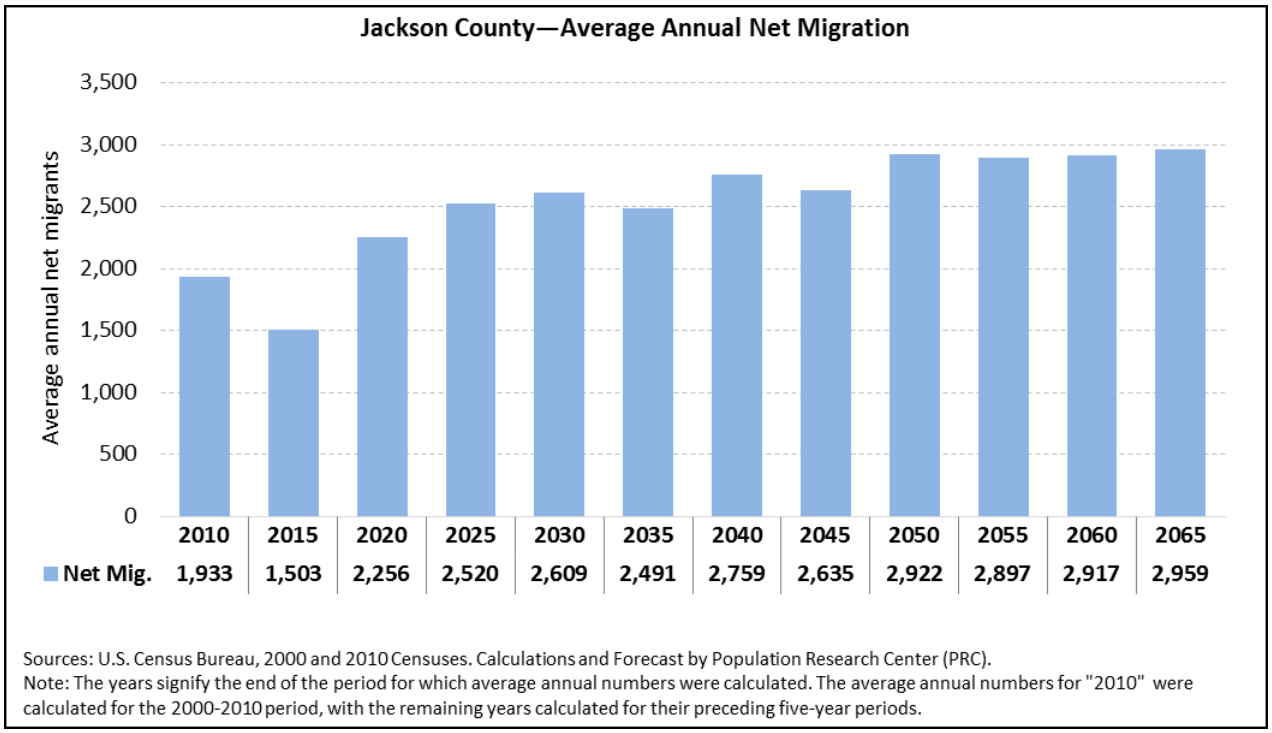
[1] For simplicity each UGB is referred to by its primary city's name.

[2] Smaller UGBs are those with populations less than 8,000 in forecast launch year.

Source: Portland State University, Population Research Center, 2015

The forces that drove Jackson County's population growth during the 1990s are still in place today. The vast majority is attributable to continued net in-migration as opposed to new natural increases. The average annual net migration for Jackson County is shown in **Figure 13**. Based on past trends, Medford will continue to capture a significant share of this population increase.

Figure 13. Jackson County – Average Annual Net Migration



Source: Oregon Population Forecast Program, 2015

According to the *Strategic Assessment of Transportation and Land Use Plan*,

> In the last 20 years, the area's population has grown by over 20 percent. With a 2010 household population of 168,000 the RVMPO region encompasses the urbanized areas of Jackson County and includes the cities of Ashland, Central Point, Eagle Point, Jacksonville, Medford, Phoenix, and Talent, along with the unincorporated area of White City and surrounding areas of Jackson

> County. Under current adopted plans, the RVMPO region's household population is expected to grow 47% to 247,000 by 2038 (Rogue Valley Metropolitan Planning Organization (RVMPO), 2016).

Much of the driving force behind the population boom is the draw of retirees from out-of-the-area, attracted by the mild climate that still has four distinct seasons. A portion of this in-migration is likely attributable to the national notoriety of the region as a desirable place to live. The Milken Institute ranks cities each year in their *Best Performing Cities: Where America's Jobs are Created and Sustained* report (Devol, Ratanatunga, & Bedroissian, 2015). In 2015, Medford ranked 28 out of 201 cities in the study. **Table 3**, excerpted from the Milken Institute website (http://www.best-cities.org/bestcities.taf?rankyear=2015&type=small-cities&metro=MMED), shows the components used to calculate the Best-Performing Cities rankings.

Table 3. Medford's Performance in Each Index Component

Component	2010	2011	2012	2013	2014	2015	Score/ Value
5-yr Job Growth	137	160	162	166	140	85	98.66
1-yr Job Growth	163	146	117	81	34	53	100.39
5-yr Wages & Salaries Growth	93	135	148	160	163	134	96.53
1-yr Wages & Salaries Growth	165	141	121	133	71	24	102.30
Short-Term Job Growth	85	64	71	121	147	13	101.43%
5-yr Relative HT GDP Growth	43	26	31	12	15	66	98.74
1-yr Relative HT GDP Growth	122	78	58	45	72	151	96.17
High-Tech GDP LQ	27	32	18	11	17	23	0.87
# of HT GDP LQs Over 1	8	6	7	1	11	9	5.0

Source: Milken Institute, n.d.

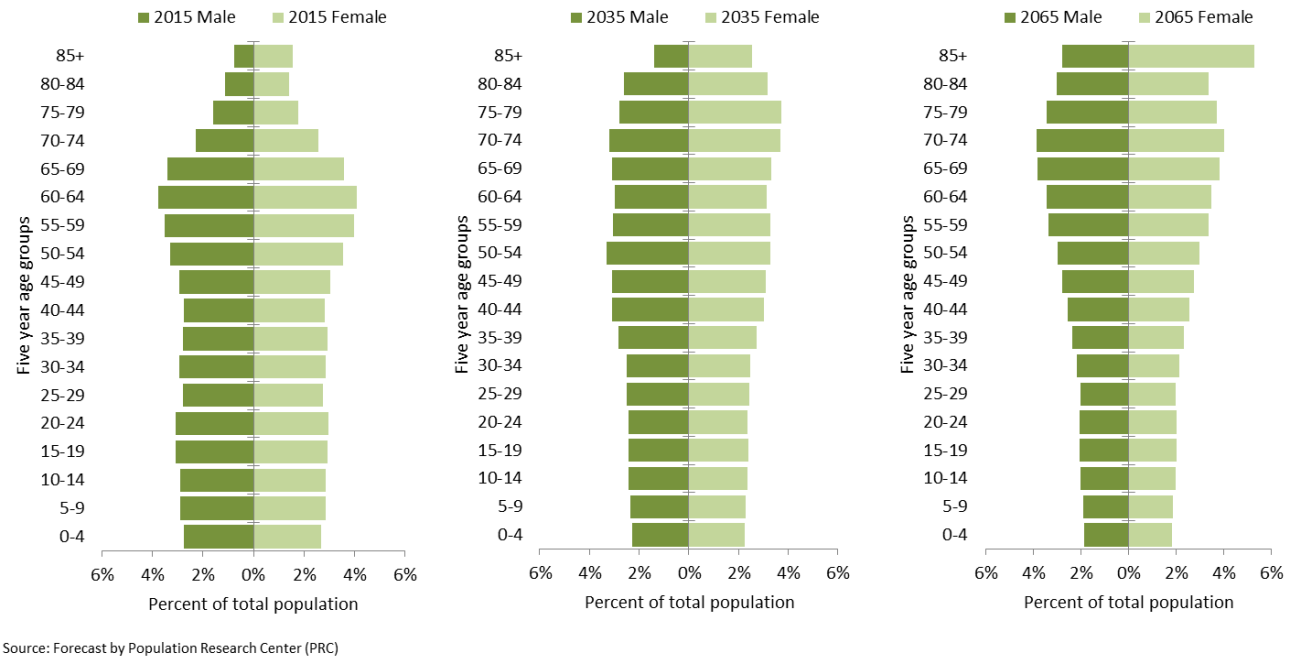
As described in the *2015 Best Performing Cities: Where America's Jobs are Created and Sustained*,

> The index measures growth in jobs, wages, salaries, and technology output over five years (2009-2014 for jobs and technology output, and 2008-2013 for wages and salaries) to adjust for extreme variations in business cycles. It also incorporates the latest available year's performance in these areas (2013-2014 for jobs and technology output, and 2012-2013 for wages and salaries). In addition, it includes a measure of 12-month job growth (August 2014-August 2015) to capture recent momentum among metropolitan economies.
>
> Employment growth is weighted more heavily because of its critical importance to community vitality, as is growth in wages and salaries because it signals the quality of the jobs being created and retained. Other measures reflect the concentration and diversity of technology industries within the MSAs and MDs. High-tech location quotients (LQs), which measure the industry's concentration in a particular metro relative to the national average, are included to gauge an area's participation in the knowledge-based economy. We also measure the number of specific high-tech fields (out of a possible 19) whose concentrations in an MSA or MD are higher than the national average (Devol et al., 2015).

In addition to population and job growth, the City's demographics include changes in the age structure over time, the percent of persons living below poverty, and the racial and ethnic make-up.

Regarding the City's age structure, there has been a trend toward an older population. In 1970, the median age in Medford was 30 years. By 2000, the median age had risen to 37 years. During that thirty-year period, the largest increase in any age group was in the group 65+ years. This group saw a 4% increase to 16.5% of the total population. By contrast, the largest decrease was in the 5-19 years group, which lost 5.9 percentage points (City of Medford, 2010) More current data from the Population Research Center shows the age group of 60-64 years as the largest percent of the population in Jackson County (Portland State University, Population Research Center, 2015).

Figure 14. Jackson County – Age Structure of the Population



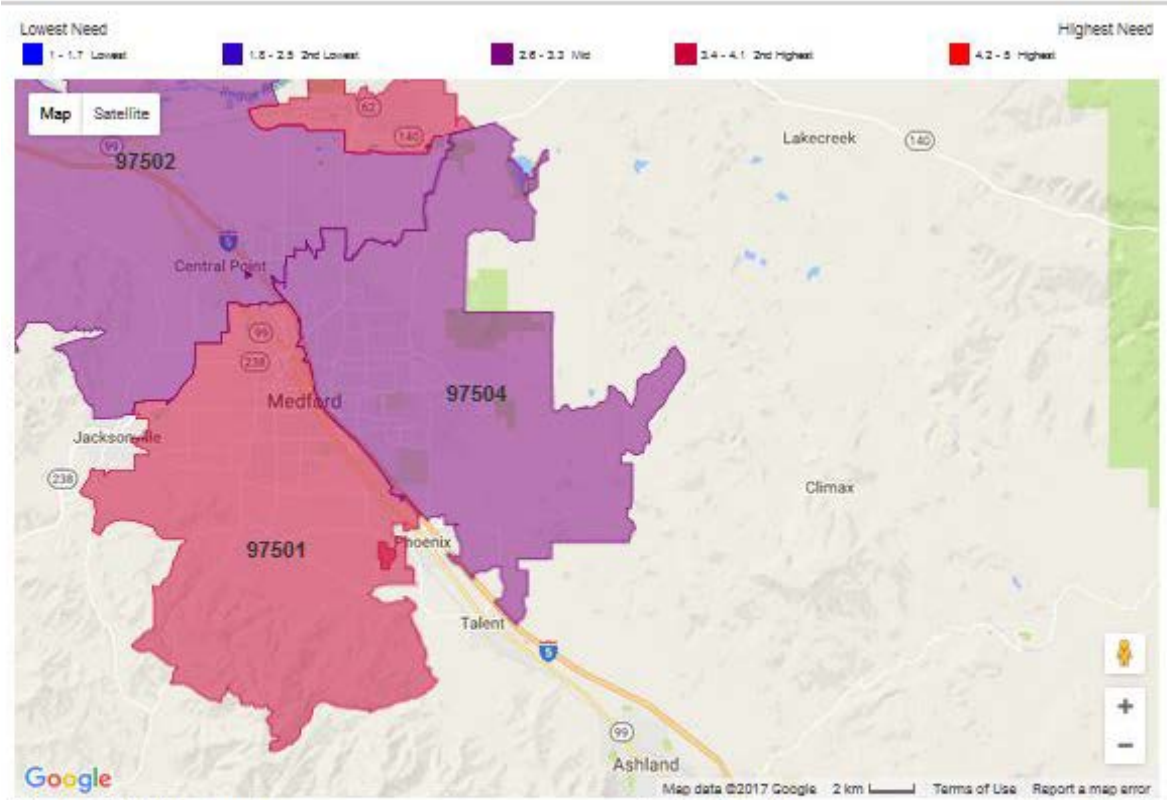
Source: Portland State University, Population Research Center, 2015

This increase in an older population is partially reflected in Medford's growth in residential care centers. These are variously termed as retirement, assisted living, attended living, and nursing home facilities. Many of these are located close to the two hospitals, Asante Rogue Regional Medical Center and Providence Medford Medical Center. Assisted living facilities also house technology-dependent adults and children. Many live very independently under normal circumstances, however disruptions in utilities, transportation, or delivery of supplies may make them particularly vulnerable in a disaster. In Jackson County, Medford is listed with a population of 76,779 people, which includes 12,943 people or 16.9% with a disability, according to the American Community Survey 5-Year Estimates (2010-2015) (Rubrecht, Howard, & Rawlings, 2017).

Another population that is vulnerable to natural hazards is persons and families living below established federal poverty levels. It is a commonly held assumption that the poor may have a more difficult time preparing for disasters and recovering from disasters, due to their relative lack of resources. According to the American Community Survey 5-Year Estimates (2010-2015), Medford has 17,596 people or 23.0% of the population in poverty. Of those, 5,759 people or 32.1% are identified as children under 18 (Rubrecht, Howard, & Rawlings, 2017).

Many factors combine to create vulnerable communities, also referred to as people with access and functional needs (PAFN). The Dignity Health Community Need Index (CNI) Map (http://cni.chw-interactive.org/) is used by the healthcare industry to rank the level of community need according to factors like income, cultural, education, insurance, and housing barriers. The tool was used to produce the map shown in **Figure 15**, which shows the Medford zip codes on a scale of least amount to greatest need. It was prepared and provided by Jan Sanderson Taylor of the United Way of Jackson County.

Figure 15. Community Need Index for Medford



Mean(zipcode): 3.4 / Mean(person): 3.4 CNI Score Median: 3.3 CNI Score Mode: 3.2

Zip Code	CNI Score	Population	City	County	State
97501	3.8	43128	Medford	Jackson	Oregon
97502	3.2	29151	Medford	Jackson	Oregon
97503	3.4	11140	Medford	Jackson	Oregon
97504	3.2	46670	Medford	Jackson	Oregon

Source: Jan Sanderson Taylor, personal communication, February 13, 2017

Community Need Index

1.0 – Least amount of need
2.0 – Some need
3.0 – Moderate need
4.0 – More significant need
5.0 – Greatest need

Zip Code Rankings

97501 – Medford 3.8
97502 – Medford/Central Point 3.2
97504 – Medford 3.2

American Community Survey and American Fact Finder reported that 12% of people under 65 in Medford are disabled, which is an estimated 7,773 people. They also identified that 45.4% of children are living in households receiving public assistance. Healthcare and social assistance receipts totaled $1.23 Million in Medford in 2012. 49.7% of housing is rental, with 60.5% of renters paying 30% or more of their income toward rent. Of 32,209 housing structures, 26,384 or 81.9% were built prior to 2000. This data was provided by Jan Sanderson Taylor based on American Fact Finder data (https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtm) and American Community Survey data (https://www.census.gov/quickfacts/table/IPE120215/4147000#flag-js-X).

Additional data from Ms. Taylor and these two websites includes the following:

High School graduates are 61.1% of the population of those 25 or older while 38.9% do not have a high school diploma.

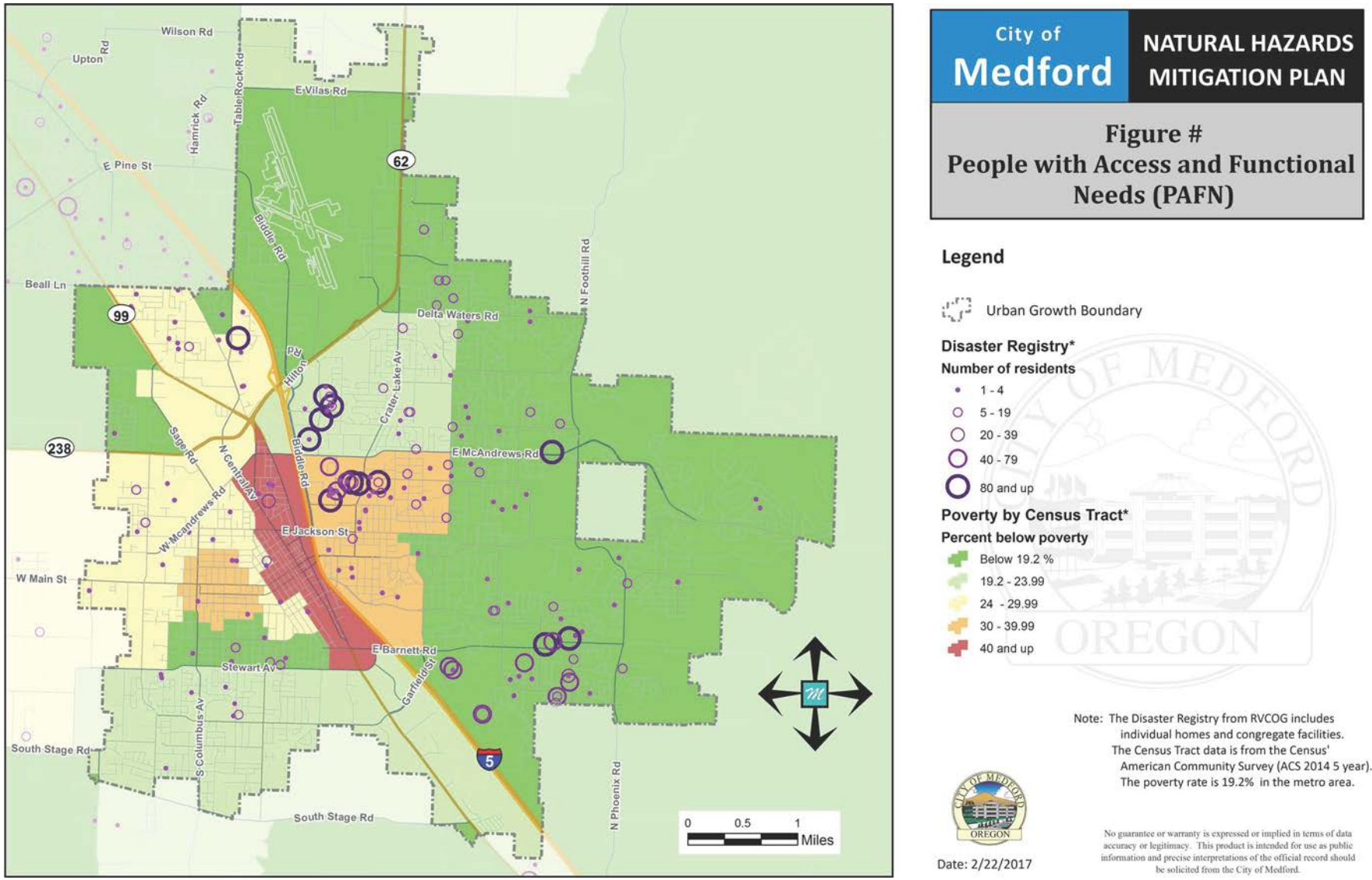
Racial and ethnic make-up is 79.7% White, 13.7% Hispanic/Latino, 0.8% Black, 1.3% Asian, 3.2% Mixed and 1.2% Other (Census Bureau). The American Community Survey reports 11.9% of people age 5 and up in Medford live in households where a language other than English is spoken at home.

The median age in Medford is 37.4 years. With 19.9% age 62 and older (approximately 15,438 people), 26.3% 19 or younger (approximately 20,386 people) and 53.8% in between (approximately 41,748 people), Medford falls around 46% in age-related potentially vulnerable populations.

Figure 16 locates the areas of residents with persons potentially likely to need more assistance or to access assistance during and after a disaster. The sources of the data are identified on the map; these are the Disaster Registry and American Community Survey census data related to the poverty level. The map is not intended to be comprehensive, but to provide a sense of distribution of those residents within the Medford UGB.

The Jackson County Disaster Registry (http://jacksoncountyor.org/emergency/Resources/Disaster-Registry) is a database of names, locations, and needs of people who necessitate special assistance during an emergency. This database is available to fire, police and rescue workers. Being on the Disaster Registry does not guarantee that a person will get help first in a disaster, only that their needs and residence locations are on record. The Rogue Valley Council of Governments website includes the application for the Disaster Registry for Jackson and Josephine Counties; both the City of Medford and Jackson County websites provide a description of the Disaster Registry.

Figure 16. People with Access and Functional Needs (PAFN)



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, February 22, 2017

Section 6 Employment and Economic Development

"Region 4 was hit particularly hard by the financial crisis that began in 2007 and continues to suffer from significantly low job recovery rates and below average wages. There are few key industries and employment sectors in Southwest Oregon. The area is particularly vulnerable during winter months when there are fewer employment opportunities" (Oregon DLCD, 2015). Furthermore,

> Region 4 is developing at about half the rate of the state. The majority of growth is occurring in cities along I-5, particularly within Jackson County. Mobile homes comprise significant share of housing units and are inherently vulnerable to natural hazards. Roughly two thirds of homes in this region were built prior to current seismic building standards, making them especially vulnerable (Oregon DLCD, 2015).

In the twentieth century, Jackson County's economy was dependent on timber, and to a lesser extent agriculture. Today, the regional economy is more diverse. Important economic sectors include tourism, financial services, higher education, retirement, healthcare, manufacturing, retail, electronic related sales and assembly, leisure, and hospitality (Medford Chamber of Commerce, 2016).

Home to well-known businesses like Harry and David (pears) and Jackson and Perkins (roses), the area is still one of the world's largest shippers of fruit, food gifts and roses. Increasingly, small businesses are locating in the Rogue Valley. Reasons cited for locating in the Rogue Valley include competitive utility costs, worker compensation rates, and costs of land (Medford Chamber of Commerce, 2016).

The City of Medford's *Comprehensive Plan Economic Element* (City of Medford Planning Department, 2008) states its purpose "is to determine the City's economic goals, policies and land needs concerning commercial and industrial development within the City limits and the Urban Growth Boundary."

Regarding current employment within the Medford UGB, it is concentrated in the Retail Trade (21.0%), Education & Health Services (18.0%), Professional and Business Services (11.8%) and Public Administration (11.0%) sectors. The employment distribution is consistent with the City's position as the services hub for much of Southern Oregon and Northern California. Medford accounts for 60.7% of all employment in Jackson County, with dominant shares in the service and trade sectors (City of Medford Planning Department, 2008).

Within the Medford UGB, between 2008 and 2028, the baseline employment forecast anticipates an increase of 29,912 jobs, reflecting an average annual growth rate of 1.7%. The high growth scenario projects an increase of 35,404 jobs (2.0% AAGR), while the low growth scenario projects 23,871 new jobs (1.4% AAGR). Education and Health Services, Professional Services, and Retail Trade are expected to account for over 61.7% of net new growth over the forecast period. Leisure and Hospitality, and Financial Activities are expected to account for an additional 18.6% (City of Medford Planning Department, 2008).

The *Comprehensive Plan Economic Element* identifies three tiers of economic opportunities potential and places the economic sectors within them. Tier 1 industries represent the best opportunities for economic growth and diversification. Tier 2 and 3 sectors also are also important components of Medford's economic opportunities, but these sectors may require more local initiative to market the opportunities available. Both Tier 2 and 3 industries will be particularly affected by policies and strategies Medford employs to maintain a competitive industrial and commercial land base.

Table 4. Medford's Tiers of Economic Opportunities Potential

Tier 1 Best Position	Tier 2 Strong but Challenging	Tier 3 Locally Competitive
Instruments	Mining	Food Products
Transit	Construction	Transportation Equipment
Transportation Services	Lumber and Wood	Air Transportation
Communications	Printing and Publishing	Wholesale Trade
Retail Trade	Stone, Glass, and Concrete	Insurance Carriers
Banking	Electronic Equipment	Insurance Agents and Brokers
	Trucking and Warehousing	Business Services
	Electric, Gas, and Sanitation	Legal Services
	Security and Commodity	Leisure and Hospitality Services
	Real Estate	
	Health Care	

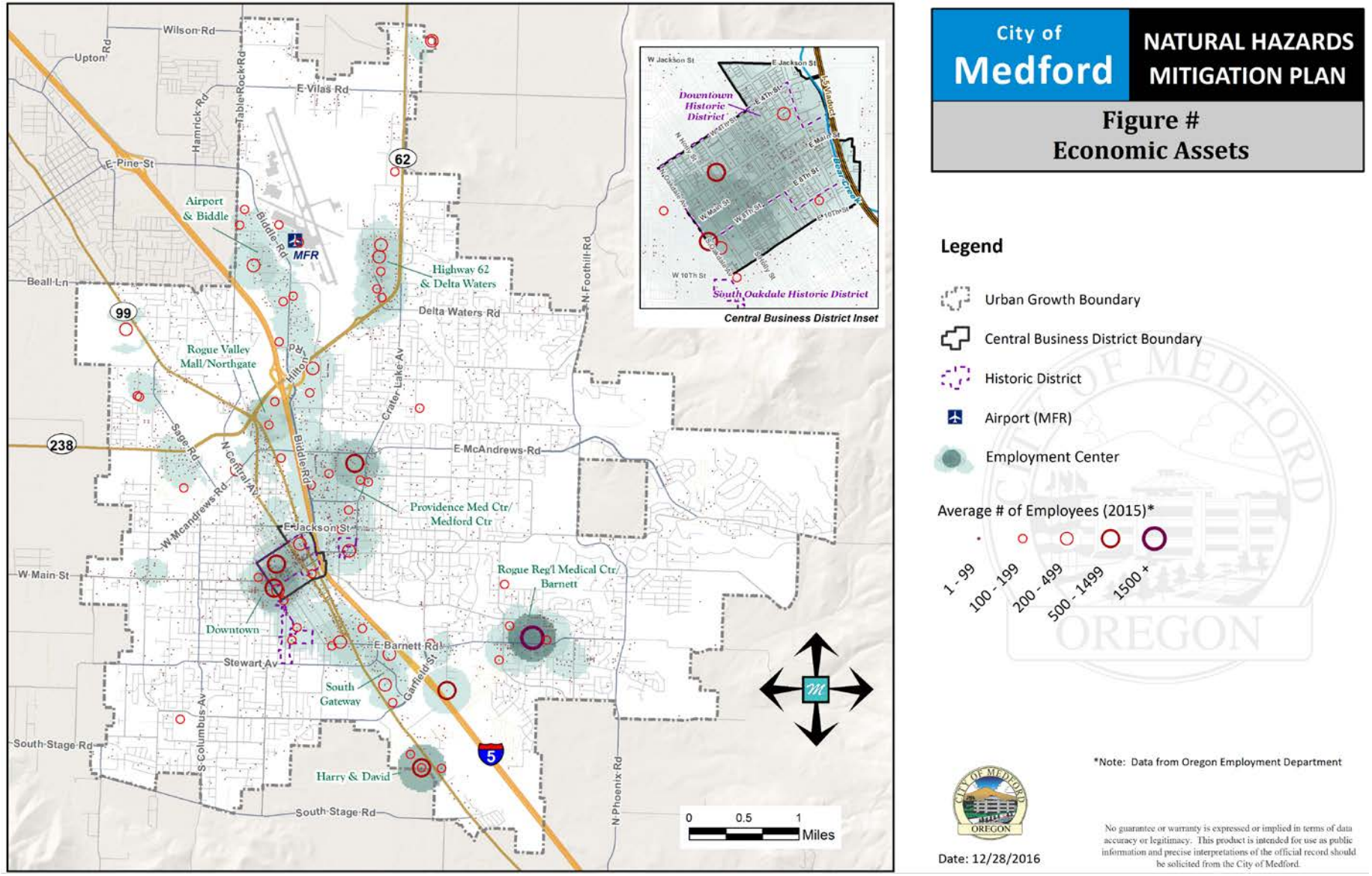
Source: City of Medford Planning Department, 2008

The *Comprehensive Plan Economic Element* also includes a Land Supply and Suitability Analysis that investigates the supply and suitability of employment lands in the City of Medford's UGB to serve employment land demands over the planning period. The conclusions of the *Comprehensive Plan Economic Element* provide a summary in these categories: the economic opportunities, employment land demand and supply, and economic opportunities goals and policies.

The City has focused development efforts in the City's downtown core. The Medford Urban Renewal Agency (MURA) was created in 1988 by the City Council and charged with the preparation of an urban revitalization proposal for the City. The urban renewal area encompasses approximately 577 acres (City of Medford Planning Department, 2008). In October 1988, Council approved the *City Center Revitalization Plan*, a plan that has been supplemented by special plans for specific downtown projects and ultimately succeeded by the *City Center 2050 Plan*. The MURA is still in existence and over the next several years the City Council will need to decide whether to extend it (Carla Paladino, personal communication, March 30, 2017).

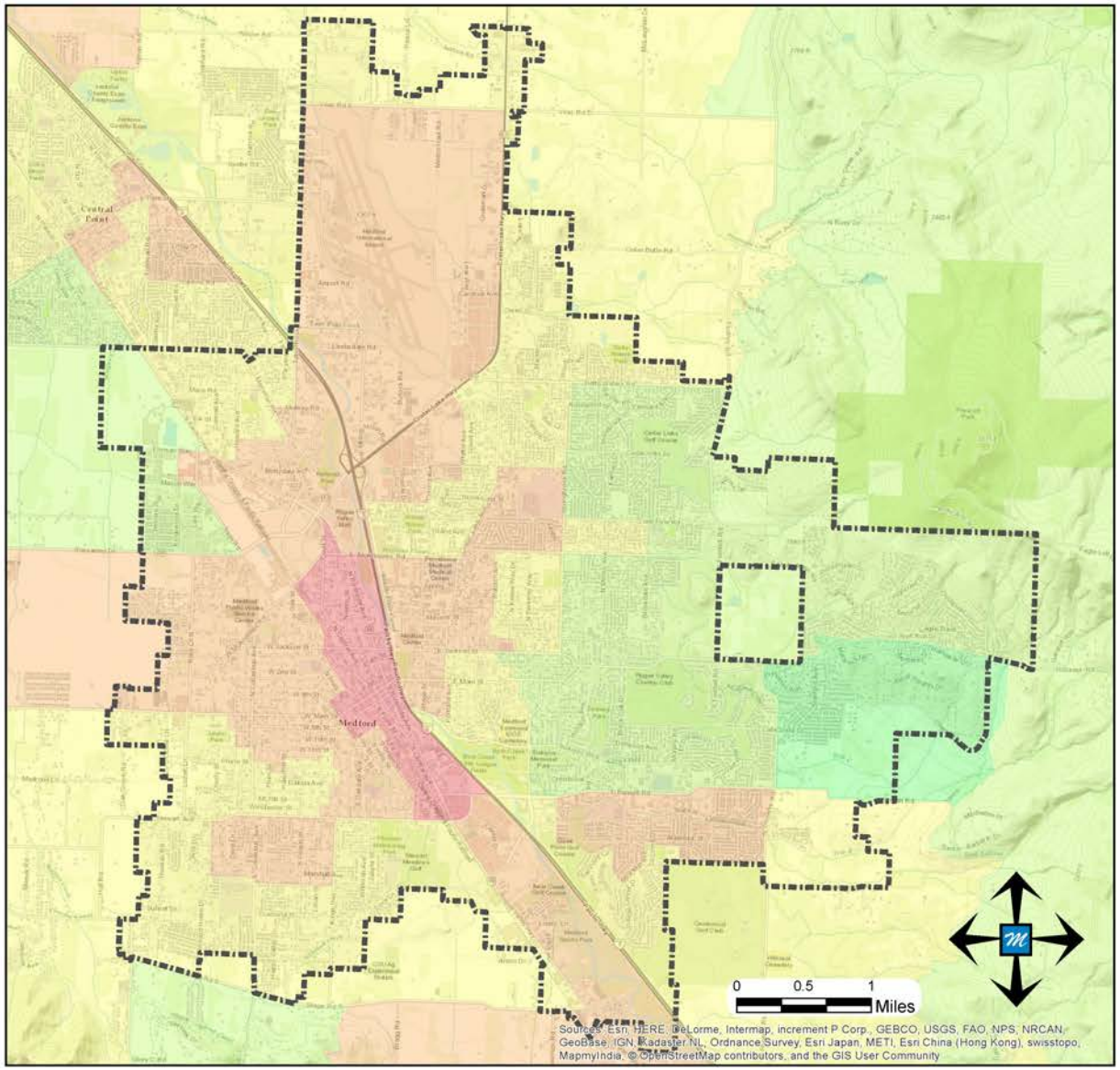
Figure 17 shows the locations of major employers in Medford, with five ranges of the number of employees. It also shows the Central Business District and the Historic District, the airport, hospitals, and highways. The majority of these assets are located along State Highway 99, near I-5 interchanges, and along the City's arterials. **Figure 18** shows the annual income of people within the UGB, in five income ranges, as based on U.S. Census data.

Figure 17. Economic Assets



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, December 28, 2016

Figure 18. Annual Median Household Income



City of Medford

NATURAL HAZARDS MITIGATION PLAN

Figure #
Annual Median Household Income

Legend

Urban Growth Boundary

Median Household Income

- $14,500 - $19,999
- $20,000 - $39,999
- $40,000 - $59,999
- $60,000 - $79,999
- $80,000 - $120,000

Note: Source data is from 2014 Census Block Group level data (field B19013e1) It represents an estimate of the Median Household Income in the past 12 months of all households (in 2014 inflation-adjusted dollars).

Date: 3/3/2017

No guarantee or warranty is expressed or implied in terms of data accuracy or legitimacy. This product is intended for use as public information and precise interpretations of the official record should be solicited from the City of Medford.

Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, March 3, 2017

Section 7 Housing and Community Development

In 2001, the Medford City Council created a Neighborhood Resources program. Using general City resources and Federal Community Development Block grant funds, the program is charged with maintaining stable, healthy neighborhoods and revitalizing challenged neighborhoods. A key component of flourishing neighborhoods and a critical aspect of quality of life is the availability of adequate, affordable living accommodations for residents. There are efforts to increase the number and availability of affordable housing units in Medford.

Prior to issuance of building permits, some developments require land use applications. **Table 5** shows the land use application data for Medford for 2014-2015. The City issued building permits for 2,294 multiple-family dwellings from 1996 to 2006 (City of Medford, 2010). **Table 6** shows the timeframe of 2005 to 2015 with each year listed with the number of single-family and multi-family building permits issued; the ten-year total is 3,960 permits.

Table 5. Land Use Applications in Medford 2014-2015

Class "C" Applications	Applications Submitted in 2014	Applications Submitted in 2015
Zone Changes	5	13
Preliminary Planned Unit Developments	3	2 (revisions)
Conditional Use Permits	5	9
Exceptions	8	15
Site Plan and Architectural Review	19	26
Land Divisions, Tentative Plats Partitions Subdivisions	 11 13	 5 14
Historic Review	17	23
Total	81	105

Source: Donna Holtz, City of Medford, personal communication, July 20, 2016

Table 6. City of Medford Building Permits Issued (Units) 2005-2015

Year	Single-Family Houses	Multi-Family Units	Total
2005	569	250	819
2006	394	196	590
2007	282	166	448
2008	115	82	197
2009	125	0	125
2010	102	79	181
2011	93	140	233
2012	141	119	260
2013	262	116	378
2014	239	111	350
2015	241	138	379
10-Year Total	2,563	1,397	3,,960

Source: Donna Holtz, City of Medford, personal communication, July 20, 2016

Table 7. Medford Housing by Structure Type as of 2015

Structure Type	Number of Units	Percentage of Total Units
1 unit detached	19,759	61.2
1 unit attached	2,030	6.3
2 units	1,163	3.6
3 or 4 units	2,567	8.0
5 to 9 units	1,532	4.7
10 to 19 units	833	2.6
20 or more units	2,887	8.9
Mobile home	1,476	4.6
Boat, RV, van, etc	32	0.1
Total	32,279	

Source: U.S. Census Bureau. American FactFinder,
http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_DP04&prodType=table

Table 8. Medford Housing by Year Built as of 2015

Year Built	Number of Units	Percentage of Total Units
Built 2010 or later	453	1.4
Built 2000-2009	5,729	17.7
Built 1990-1999	6,394	19.8
Built 1980-1989	3,854	11.9
Built 1970-1979	5,461	16.9
Built 1960-1969	3,089	9.6
Built 1950-1959	3,041	9.4
Built 1940-1949	1,808	5.6
Built 1939 or earlier	2,450	7.6
Total	32,279	

Source: U.S. Census Bureau. American FactFinder,
http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_DP04&prodType=table

It is forecasted that 15,050 new housing units are needed during 2009–2029. The estimated distribution of this new residential construction in Medford will be 9,813 single-family units and 5,237 multi-family units (City of Medford Planning Department, 2010).

The West Medford housing market area is substantially built-out, leaving mostly scattered vacant lots available for new infill development. A Transit Oriented District (TOD) is planned in West Medford near the intersection of Jacksonville Highway and North Ross Lane. The TOD is expected to contain a mixture of high-density residential and commercial employment uses designed to attract transit users and pedestrians. The close-in portions of East Medford are also substantially at capacity though active residential development is continuing in the suburban outer northeast, east and southeast areas. The bulk of recent single-family residential construction has been the rapidly urbanizing areas south of Stewart Avenue in Southwest Medford and in the outer east areas.

Home prices rose rapidly between late 2000 and early 2006 when the market peaked. During that time the average home sales price in Medford increased by approximately 115%. The five-year average between 2007 and 2012 saw a decrease in sales prices by approximately 39%. However, prices began to increase again between 2011 and 2016 by approximately 72% (Southern Oregon Multiple Listing Services) (provided by Carla Paladino, personal communication, March 30, 2017).

Section 8 Critical Facilities Critical Infrastructure, and Lifelines

Critical facilities, critical infrastructure, and lifelines may be defined in multiple ways, but however defined they are always integral to the functionality of the jurisdiction and community. The level of services in the City of Medford may attract people from a broad region who need assistance and supplies, especially when impacted by hazards and disasters. In particular, the quality and scale of medical facilities and personnel is a major draw, as well as the abundance of retail establishments, restaurants, and hotels. All of these are highly dependent on the integrity of ground transportation systems. Medford's critical facilities are shown on the Critical Facilities map in **Figure 23**.

The definition of critical infrastructure is "Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters" (U.S. Department of Homeland Security [U.S. DHS], n.d.). Critical infrastructure are impacted directly, through interdependencies, and/or through cascading effects.

There are 16 critical infrastructure sectors:

- chemical,
- commercial facilities,
- communication,
- critical manufacturing,
- dams,
- defense industrial base,
- emergency services,
- energy,
- financial services,
- food and agricultural,
- government facilities,
- healthcare and public health,
- information technology,
- nuclear reactors, materials, and waste,
- transportation systems, and
- waste and wastewater systems (U.S. DHS, n.d.).

A definition of lifelines: "Lifelines include utility systems (potable water, wastewater, oil, natural gas, electric power facilities and communication systems) and transportation systems (airways, bridges, roads, tunnels and waterways). Communication facilities are also important lifelines." (PBEM, 2012). Critical facilities are typically fire and police stations, hospitals, and utilities.

The *2015 Oregon NHMP* states, specific to Region 4 of the State's Natural Hazards Regions,

> Energy facilities and conveyance systems in the region help support the regional economy and are vulnerable to damage and service disruptions due to natural hazard events. The region has multiple dams, hydroelectric and biomass power-generation facilities that service the state. Of the state-owned dams in the region, 28 have High Threat Potential and 42 have Significant Threat Potential. (Oregon DLCD, 2015).

Furthermore, in this area, other systems are also vulnerable to damage,

> Older centralized water infrastructure is vulnerable to pollution and flooding, which can have implications for public health and water quality. During high-water events, the region's drinking water is vulnerable to high levels of pollutants entering waterways through combined sewer overflows (CSOs). Medford is the only city in the region that requires low impact development (LID) stormwater mitigation strategies in its development code (Oregon DLCD, 2015).

Figure 23 shows the location of critical facilities, critical infrastructure, and lifelines in Medford. The development of a comprehensive methodology for the identification, categorization, and prioritization of critical assets within a region is very important (CH2M Hill, 2007).

Utilities. Within the City of Medford, Pacific Power, provides electrical power. Avista Utilities supplies natural gas. Qwest provides landline telephone service. Each of these utilities operates under terms of a multi-year franchise agreement with the City for use of its right-of-way in supplying their services. There are also internet service providers (ISPs) that provide voice over internet protocol (VOIP) phone service; these are vulnerable to power failure and internet disruption.

According to the Oregon Regional Business Manager at Avista Utilities, using a four year average (2011-2015), the volume of natural gas being distributed throughout the greater Medford area is 9,052,121 dekatherms per year (Steve Vincent, personal communication, October 14, 2016). The Federal Energy Regulatory Commission, a division of the U.S. Department of Energy, regulates PacifiCorp's 10,894 megawatts of power generation, 72 generating plants, and the interstate transmission lines (Pacific Power, n.d.).

There is no national power grid. There are three power grids operating in the 48 contiguous states, operating independently of each other, although there are limited links between them (U.S. Energy Information Administration, n.d.). Oregon, Washington, and California operate within the Western Interconnection of the North American Power Grid, under the jurisdiction of the Western Systems Coordinating Council (WSCC). The WSCC sets the standards and rules for reliable operation of the transmission system. The federal government operates the regional grid systems (Monte Mendenhall, personal communication, August 4, 2016).

To protect against a negative domino effect across the entire interconnection, each control area must maintain an operating reserve as a margin of system emergencies. Plants are protected by relays to isolate themselves from the grid when necessary to reduce the likelihood of extended outages (Monte Mendenhall, personal communication, August 4, 2016).

PacifiCorp, which operates as Pacific Power in Oregon, has "a spinning reserve" which they are required to maintain, on a grid basis. They are permitting two transmission projects that will provide flexibility to feed from alternative energy sources in Jackson County. In the City of Medford they have the ability to switch to alternative sources, to minimize outage time, with the local distribution system (Monte Mendenhall, personal communication, August 4, 2016). A Regional Emergency Action Center in Portland coordinates materials, personnel, and equipment to respond to major outages in southern Oregon and northern California (Monte Mendenhall, personal communication, August, 2016).

Transportation. Transportation is a part of critical infrastructure and is thus included within Section 8 Critical Facilities, Critical Infrastructure, and Lifelines. A brief description is provided as transportation is related to bridges, the interstate highway system, the airport, and the railroad. The transportation

system integrity is essential for the delivery of emergency services. Special projects that have strengthened the transportation system in the Medford area are identified here.

Within this NHMP in Chapter 1 Community Profile, see Section 10 Transportation, Freight Distribution, and Communications for additional details regarding transportation.

The state highway system is overseen by the Oregon Department of Transportation (ODOT), and constitutes critical infrastructure in Medford. Interstate 5 (I-5) is a primary transportation corridor in the Medford area, linking Medford to areas north and south, and providing a constant influx of people, goods, and services. Disruption of this lifeline has the potential to interrupt multi-modal transportation options, the functionality of the economy, the safety of people, and other lifelines. In the event of a hazard or disaster affecting the I-5 corridor in Medford's vicinity, Highway 99 could potentially serve as alternative route for highway traffic because it also runs north and south through the city; however, segments of the highway are vulnerable to Bear Creek flooding.

Because of earthquake risk in Region 4, the seismic vulnerability of the region's bridges is an important issue. According to the Oregon Department of Transportation's (ODOT's) *Seismic Lifeline Repor*t, "the region has exposure to earthquakes, especially a Cascadia Subduction Zone event. Therefore, the seismic vulnerability of the region's lifelines, including roadways and bridges, is an important issue" (Oregon DLCD, 2015).

ODOT's *Seismic Vulnerability of Oregon State Highway Bridges Mitigation Strategies to Reduce Major Mobility Risks*, includes six scenario earthquakes as either crustal or subduction zone events. These are part of the statewide analyses of the transportation network. The scenarios are selected based on history of seismic activity, distance from potentially active faults, and proximity to critical highway routes. The six ODOT scenarios are: crustal earthquake in Portland; crustal earthquake in Scotts Mills; crustal earthquake in Klamath Falls; Cascadia Subduction Zone near Southern Oregon; Cascadia Subduction Zone near Northern Oregon; and a full length Cascadia Subduction Zone earthquake. ODOT categorizes the earthquake damage in "component damage states" as slight, moderate, extensive, and collapse levels (Nako, Shike, Six, Johnson, Dusicka & Meharary, 2009).

The most severe damage results from the full length Cascadia Subduction Zone earthquake at magnitude 9.0 with 6 complete collapses, 64 extensive, 106 moderate, and 164 slight damage states. The calculated losses were $1.08 billion for bridge repair and replacement and $177 million travel time related losses (Nako et al., 2009).

ODOT undertook a seismic retrofit of the Interstate 5 viaduct, known as the Medford Viaduct, through the City of Medford, in 2003. The 3,222 foot long bridge opened to traffic in 1962 and is one of more than 2,600 multi-span pre-cast/pre-stressed concrete beam or post-tensioned bridges managed by ODOT (City of Medford, n.d.-g).

> Work on the $8 million project accomplished several needed items. This included providing a phase one seismic retrofit tying the bridge deck to the vertical piers. In addition, the road deck and bridge rails were replaced and erosion protection was enhanced on several of the 48 bents or piers in or near Bear Creek. The phase one seismic retrofit included longitudinal cable restraints and the addition of concrete shear blocks for transverse force restraint. Phase one retrofit refers to external measures to support a bridge (City of Medford, n.d.-g).

Improvements for the Medford Viaduct are in the planning process and will include additional seismic evaluation. The I-5 Medford Viaduct Planning and Environmental Study began in 2016 and is projected to extend through 2019 (ODOT, 2015b, 2016). The study will examine the safety, operational, and structural needs of Interstate 5 in the City of Medford between the North (Exit 30) and South (Exit 27) Medford interchanges. The study will occur in two phases: Planning Process and NEPA Process (ODOT, 2015b, 2016). The Planning Process "will identify the specific near- and long-term problems with the Viaduct and the local street network and identify potential solutions." The National Environmental Policy Act (NEPA) Process "will evaluate the solution(s) from Phase 1 in more detail to determine the environmental impacts of potential solutions" (ODOT, 2015b, 2016). The Medford Viaduct crosses Bear Creek and several local streets.

As of February 2017, ODOT has a bridge deck overlay project on Barnett Road in Medford. According to Richard Randleman of ODOT, the bridge rates overall in satisfactory condition except for the bridge deck. Randleman, Project Leader, states the project is a concrete structural overlay on the bridge deck. Once the project is completed, the bridge should no longer be considered structurally deficient (Richard Randleman, personal communication, February 24, 2017). The ODOT (2015a) *Bridge Condition Report* provides more details.

ODOT's bridge conditions reports summarize bridge condition ratings on state highways and performance measures based on National Bridge Inventory and ODOT data. As a consistent reference point for evaluation, ODOT uses the bridge conditions snapshot provided annually to the Federal Highway Administration. Data from the April 2015 submittal is the basis of this current report. The report describes that structurally deficient is "as defined by the Federal Highway Administration, meaning the bridge has deteriorated deck, substructure or superstructure that requires repair" (ODOT, 2015a).

The Barnett Bridge has high average daily traffic and is an important part of the transportation infrastructure for Medford. According to Randleman, the bridge deck overlay project will be constructed in 2018.

The Rogue Valley Transportation District (RVTD) has served the Rogue Valley since 1975 (RVTD, n.d.). The RVTD serves Medford, Ashland, Talent, Phoenix, White City, Central Point, and Jacksonville with bus service. Medford contains the regional public transportation hub at Front Street Station (200 S. Front St.). RVTD operates a radial transit network with 9 routes, all beginning and ending at Front Street Station. Also serving Front Street Station are the inter-regional transit providers, including: Greyhound, SW point, and the Rogue Valley Commuter Line (RVCL) operated by Josephine County Transit (JCT). Front Street Station serves primarily as a transfer point between routes, resulting in over 1,000 boardings per day. In addition to the bus station, RVTD serves approximately 150 bus stops within Medford City limits (Jon Sullivan, personal communication, January 30, 2017).

RVTD has three facilities: Front Street Station (200 S. Front Street); Main Office, Bus Yard, Maintenance and Fueling Facility (3200 Crater Lake Avenue); and the Translink Office (non-emergency medical transportation) (239 E. Barnett) (Jon Sullivan, personal communication, February 3, 2017). **Figure 29** is the Transit Routes map.

Rogue Valley Transportation District's *Hazard and Security Plan* sets out the District's procedures for maintaining a safe and secure operations and service environment for passengers, employees and volunteers, and the surrounding community. RVTD plays an important role in emergencies.

> Rogue Valley Transportation District can increase its response capability during emergencies. However, during emergencies, Rogue Valley Transportation District may be limited by equipment damage, requests for aid from multiple sources, communication failures, and injuries. Rogue Valley Transportation District and Jackson County have entered into a Memorandum of Understanding whereas the County will, if necessary, provide emergency diesel fuel for District buses and a location for vehicular equipment maintenance during a declared emergency (RVTD, 2015).
>
> For many types of emergencies, Rogue Valley Transportation District generally is able to meet passenger emergency transportation needs using spare transit vehicles (along with privately owned vehicles, if needed). For larger-scale emergencies in which this is not possible, Rogue Valley Transportation District's Transportation Coordinator located at the Jackson County Emergency Operations Command Center will request supplemental transportation resources from the State ECC if capabilities are exceeded (RVTD, 2015).

Of note, the RVTD has been granted funds for the 2040 Transit Master Plan project, which will cover the RVTD service area. The 2016 award for Transportation and Growth Management (TGM) funds from DLCD will provide RVTD with money to improve public transportation (Bill Holmstrom, personal communication, August 16, 2016).

RVTD is a special district and is mentioned in Section 9 Educational Facilities and Special Districts; a description of RVTD's communications system is included in Section 10 Transportation, Freight Distribution, and Communications.

Wastewater systems. Water and wastewater utilities are vulnerable to a variety of hazards including natural disasters such as earthquakes, flooding, tornados, and wildfires. For utilities, the impacts from these hazard events include damaged equipment, loss of power, disruptions to service, and revenue losses (U.S. EPA, 2016b).

Built in the 1960s, the Regional Water Reclamation Facility operated by the City of Medford processes the City's sanitary sewer system effluent. Because this is a regional facility, transmission line financing and development is a shared expense with the Rogue Valley Sewer Service Authority and several small cities that utilize the water reclamation plant. The Medford Regional Water Reclamation Facility is located approximately eight miles north of the City of Medford on the south bank of the Rogue River at the intersection of Kirtland Road and Table Rock Road, as shown on the Critical Facilities Map, **Figure 23**, and provides continuous 24 hour per day wastewater treatment service for the Bear Creek Valley (with the exception of the City of Ashland) and Eagle Point. As a regional facility, flows are treated from the cities of Central Point, Jacksonville, Phoenix, Talent, Eagle Point, and unincorporated Jackson County areas. Over the years, the treatment facility has undergone a number of upgrades and expansions, keeping pace with advancing technologies, regulatory requirements, and the changing needs of the community (City of Medford, n.d.-p).

The lowest point of the facility is located at an elevation of 1,204 feet, approximately 16 feet above the elevation of the Rogue River. In the event of the failure of Lost Creek Dam, it is estimated that there might be as much as one foot of flooding on the facility site, which will not impact long-term plant operations, although temporary flooding of the disinfection tank could occur. The Lost Creek Dam and the Medford Regional Water Reclamation Facility are both on the Rogue River. The Medford Water Reclamation Facility is 27 miles downstream from Lost Creek Dam (Brice Perkins, personal communication, August 23, 2016).

All structures at the facility are constructed of concrete or earth and meet the current Zone 3 seismic requirements for Southern Oregon. In the event of a power outage, the facility has a stationary diesel powered one megawatt emergency generator that will automatically start to maintain plant operation (City of Medford, n.d.-p). The facility has switched from gaseous chloride to liquid sodium hypochlorite for disinfection, and has no chemicals that would pose a threat of atmospheric release off the facility site. In the event of a fire or hazardous spill on the plan site, the facility staff will either handle the event with its own trained staff or contact Jackson County Fire District for assistance (City of Medford, n.d.-p). Jackson County Fire District 3 is significantly closer to the Medford Regional Water Reclamation Facility and would have a faster response time than Medford Fire-Rescue (Brice Perkins, personal communication, August 23, 2016). Medford Fire-Rescue operates the Region 8 Hazardous Materials Response Team, with technician and specialist level services.

Figure 19. Medford Regional Water Reclamation Facility

Source: Brice Perkins, personal communication, August 30, 2016

Water Systems. The Medford Water Commission (MWC) is an autonomous agency of the City of Medford, established through a change in the City's Charter in 1922. Its sole responsibility is the operation and maintenance of the community's water system. The Medford Water Commission's principal source of water is Big Butte Springs, with the Rogue River used as a supplemental source during the summer months (City of Medford, n.d.-o). Domestic water service is supplied within all areas of the City, as well as some nearby communities and unincorporated areas.

Two different watersheds supply drinking water to around 136,000 Medford Water Commission customers (Sara Bristol, personal communication, August 22, 2016). They are the Big Butte Springs Watershed, a groundwater source, and the Rogue River Watershed, a surface water source. The Big Butte Springs Watershed is actually a smaller watershed within the Rogue River Watershed, as shown in **Figure 20** (Medford Water Commission, n.d.).

Water from Big Butte Springs is captured underground. The Big Butte Springs are enclosed, and thus, protected from contamination at the surface. The 56,000-acre Big Butte Springs watershed on the

westerly slopes of Mount McLoughlin is considered a “Drinking Water Protection Area” by the State of Oregon. The MWC has operated a watershed protection program for many years, implementing a variety of measures to lessen potential vulnerabilities to hazards and impacts. There is very little development in the region of Big Butte Springs. The MWC disinfects the water. Two separate pipelines, built for purposes of redundancy, feed water from the Big Butte Springs to the water distribution system and pipelines bring water to town by gravity. Power needs for chlorination can be accommodated by an on-site generator for 4 to 7 days in the event of a power outage (Sara Bristol, personal communication, August 22, 2016).

Figure 20. Watersheds Serving Medford Water Commission

Source: Medford Water Commission, n.d.

The actual capacity of the two Big Butte Springs pipelines is 26.4 million gallons per day (mgd). However, in the winter months the customer demand averages about 17 mgd. Due to hydraulics of the transmission lines, the MWC cannot incrementally adjust how much water is brought to town as needed. They are able to operate at pipe-and-a-half (often called “half pipe”), which delivers 19.8 mgd. During winter months when system demand is less than 19.8 mgd, the excess water is dechlorinated and released as “overflow” into Lone Pine Creek at Capital Reservoir (Sara Bristol, personal communication, August 23, 2016).

In the summer, Big Butte Springs is operating at two full pipes, which is capacity, as well as the river water from the Robert A. Duff Water Treatment Plant (Duff Plant). A flow of 26.4 mgd is the “typical” amount that Medford Water Commission receives from Big Butte Springs throughout the year. The consumption ranges from 17 mgd to 62 mgd (includes river water) throughout the year (Sara Bristol, personal communication, August 23, 2016).

If something should happen to the Big Butte Springs or to its distribution system, the Duff Plant next to the Rogue River in the White City area would act as the backup source. Every year, from May through

early October, the MWC draws water from the Rogue River at this plant. Bringing the Duff Plant online takes approximately 48 hours (Sara Bristol, personal communication, August 22, 2016).

Water from the Rogue River serves as a supplemental water supply during peak summer demand periods with a current plant capacity of 45 million gallons per day and an ultimate design capacity of 65 million gallons per day (Sara Bristol, personal communication, August 22, 2016). The system has almost 30,000 connections (Sara Bristol, personal communication, August 22, 2016). In Medford, there are 16 concrete reservoirs for a total storage of 36.2 million gallons. Other cities served have a cumulative total storage of 29.45 million gallons; however, this water is not available to Medford once it leaves the MWC system (Sara Bristol, personal communication, August 22, 2016).

The Duff Plant is located out of the floodplain. However, of note, the Duff Plant is within the Lost Creek Dam inundation zone. See **Figure 36**, Dam Inundation Zones map. Back-up power generation is sufficient to keep instrumentation running, but it would not fully power the treatment plant. The treatment plant has very high power demands; it would not operate during a power outage. The *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley* states that with climate change "Medford's water infrastructure could be at risk from more severe storms that create sedimentation in the Rogue River and require more water treatment at higher cost prior to delivery. Increased sedimentation of Emigrant Lake and other local reservoirs create turbid water conditions" (Geos Institute, 2016b).

According to the *Water Management and Conservation Plan* (*WMCP*),

"Curtailment planning is the development of proactive measures to reduce water demand if the water supply is reduced temporarily. Supply shortages could result from a number of situations, including those identified in this section" (CH2M, 2016). Initial curtailment procedures were adopted by MWC in 1992. As stated in the *WMCP* "Potential causes of water supply shortages include, but are not limited to the following:

- Long-term drought,
- Fire in the BBS or Rogue River watersheds that affects water quality,
- Contamination, such as from a chemical spill, that necessitates shutting down either water source,
- Flooding that forces shutdown of one or more facilities,
- Landslides or other natural disaster that damage water pipelines or facilities,
- Power outages, particularly those impacting the Duff WTP, and
- Facility or equipment failure, either from natural or human causes" (CH2M, 2016).

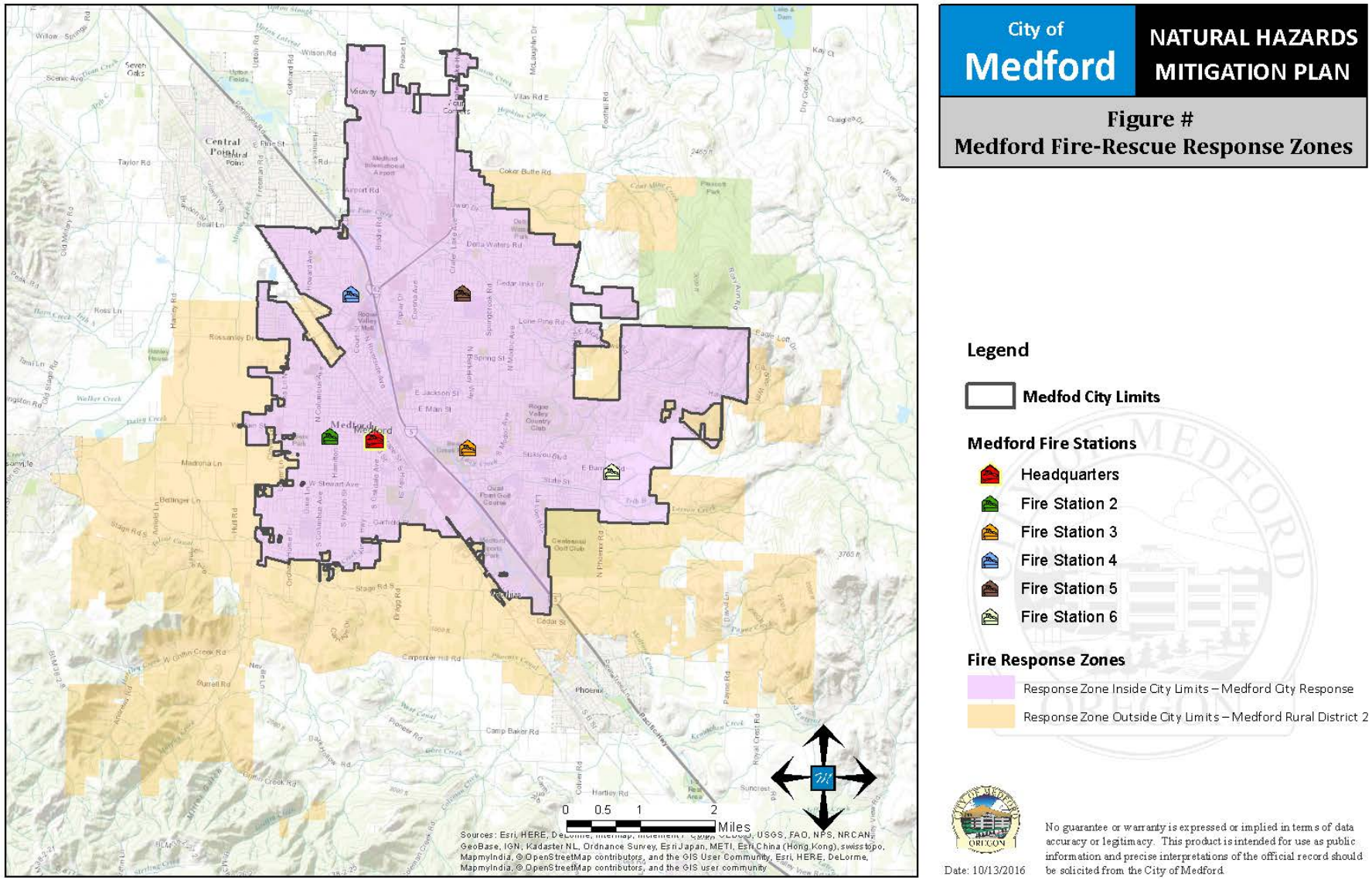
The *WMCP* states, "This curtailment plan recognizes the need to maintain essential public health and safety while applying measures in an equitable manner that minimizes impacts on economic activity and lifestyle. Actions may include more restriction on uses deemed less essential" (CH2M, 2016). MWC's history of curtailment actions is very limited. For additional details on the curtailment plan and other data related to the MWC, see the *WMCP*. The Medford Water Commission received approval from the Oregon Water Resources Board on July 5, 2017 for the updated *WMCP*. The *2017 WMCP* plan updates the *2009 WMCP*. The *2017 WMCP* will be reviewed again in five years and is effective through July 5, 2027 (David Searcy, personal communication, August 2, 2017).

Government offices. City government offices and centers are clustered in downtown Medford, in City Hall and the Lausmann Annex. The City's Emergency Operations Center is located in the Lausmann Annex. The Public Works Service Center is a main facility located in West Medford.

The City employs 103 sworn police officers and 33 civilian employees and 30 volunteers in the Medford Police Department (City of Medford, n.d.-k). The office was located at City Hall until a new headquarters building for the Medford Police opened in late 2016. Also in downtown Medford, Jackson County operates a criminal detention facility for use by law enforcement agencies in the County. There are other Jackson County facilities in Medford.

The City of Medford Fire-Rescue operates 5 fire stations plus a headquarters station, and employs 83 personnel (City of Medford, n.d.-c). Fire stations #2 and #4 have been constructed recently. **Figure 21** shows the location of the headquarters and other fire stations, and shows the fire response zones inside and outside of the city limits. Medford Fire-Rescue, under contract to the Medford Rural Fire Protection District, #2 is also responsible for responding to fires in specific rural areas outside the city limits. The firefighters, paramedics, EMTs, inspectors, administration and support staff of Medford Fire-Rescue provide professional, full-time fire-fighting, paramedic emergency medical response, hazardous materials response, heavy rescue, and life safety services. In addition, services are often provided through mutual aid agreements among neighboring communities. Medford Fire-Rescue has provided protection to the Medford Rural Fire Protection District #2, by agreements, since 1952.

Figure 21. Medford Fire-Rescue Response Zones



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, October 13, 2016

Emergency communications: Emergency Communications of Southern Oregon (ECSO 911) is located in Medford and serves the population of the Rogue Valley. ECSO is a combined emergency dispatch facility and Public Safety Answering Point (PSAP) for Jackson County 911 lines. The Center is also a regional "drop point" for emergency information to be share with Jackson and Josephine counties. ECSO answers 911 calls and dispatches law, fire, and EMS for 28 agencies serving a population of over 205,000 residents (Emergency Communications of Southern Oregon, n.d.).

The Operations Manager for ECSO 911 stated that the ECSO building was designed in 2008 and construction was completed in 2009. He also described that the primary backup center for both radio and phones is the Jackson County Sheriff's Office facility located at 5179 Crater Lake Highway. ECSO has plans in place to conduct 911 call taking operations at other pre-designated facilities within the county, depending on the type and extent of the 911 phone system outage (Kevin Harris, personal communication, April 10, 2017).

Medical facilities. There are fourteen medical clinics and groups in Medford (Jan Sanderson Taylor, personal communication, February 3, 2017). Local Medford hospitals include the Asante Rogue Regional Medical Center with 378 beds and Providence Medford Medical Center with 168 beds. Both hospitals provide emergency care services and both hospitals rotate trauma care as Level III trauma centers. Asante is located in southeast Medford on Barnett Road and Providence is located off Crater Lake Avenue in central Medford. See **Figure 23** Critical Facilities map for the location.

Asante Rogue Regional Medical Center provides "heart and stroke care, orthopedic services, cancer care, and diabetes care, as well as a comprehensive range of key services including neurology and neurosurgery, bariatric surgery, rehabilitation services, the regions only neonatal intensive care unit, hospice services, and the only hospital-based sleep center in Southern Oregon" (Asante, n.d.).

Providence Medford Medical Center provides "emergency services, stroke care, cardiac and vascular care, birth center, total joint replacement and spine health programs, robotic surgery, pain management services, and one of the most comprehensive rehabilitation programs in the region" (Providence Health & Services, n.d.).

La Clinica is not a hospital but it specializes in serving Latino and low-income residents; there are several locations providing medical, vision, and dental services in Medford and the surrounding area (La Clinica, n.d.).

Airport. The Rogue Valley International-Medford Airport is located in the northern part of Medford, within the Urban Growth Boundary. It serves the Southern Oregon and Northern California region, with the majority of the airport's users residing within Jackson County. In 2015, air transportation passengers totaled 757,091 and aircraft operations totaled over 40,000 (Jackson County Airport Authority, n.d.-a; Bern Case, personal communication, November 17, 2016).

The airport is owned by Jackson County. The airport has an Emergency Operations Plan. The airport is not a special district as defined by ORS (Marci Black, Rogue Valley International-Medford Airport, personal communication, August 1, 2016). Special districts are discussed in more detail in Section 9 of this chapter. Rogue Valley International – Medford Airport is the only commercial airport in the region and is the third busiest airport in Oregon (Travel Oregon, n.d.).

Related to safety of the airport, "[t]he Aircraft Rescue and Firefighting Department (ARFF) provides 24 hour, seven day a week protection of the airport with a total of four employees. These firefighters

provide medical services and fire protection for aircraft and structures on the airport" (Jackson County Airport Authority, n.d.-b).

According to the Airport Director, buildings at the airport that were constructed in the past 25 years have met or been upgraded to seismic standards. Private development during the same time period would have been permitted by the City and would also meet standards. Older buildings may be "questionable." The runways and taxiways meet FAA standards. However, based on the size, those are susceptible to earthquakes. The plan is to evaluate and mitigate as soon as possible should damage occur (Bern Case, personal communication, November 17, 2016).

Figure 22. Aerial photo of the Rogue Valley International – Medford Airport

Source: Rogue Valley International – Medford Airport, n.d.-a, http://jacksoncountyor.org/airport/General/About-Us/Overview

Energy supplies. An energy interruption can impact the transportation of goods, services, and the ability of government agencies and utilities to provide essential services. "An energy disruption can occur as a result of several factors including extreme weather conditions (wind storms that knock down utility poles/wires, heat waves that increase demand on the energy grid and sag power lines), other natural hazards (landslides, earthquakes, flooding) or adversarial threats including cyber security and sabotage/terrorism" (PBEM, 2012).

Petroleum provides a major source of energy use in Medford and in all of Oregon. Hazards may impact and disrupt access to petroleum and other energy supplies. Petroleum infrastructure interdependencies are recognized and are a critical part of hazard mitigation efforts. For example, the electricity, communications, and transportation (roads, bridges, and waterways) can be damaged by hazards and this in turn creates a need for back up supplies of energy and alternative methods of providing energy besides petroleum.

For Region 4, "The Bonneville Power Administration is the area's wholesale electricity distributor. The majority of the region is powered by PacifiCorp (Pacific Power and Light)" (Oregon DLCD, 2015).

"The region has a total of eight power-generating facilities: three are hydroelectric power facilities, and five are categorized as "other" (primarily biomass). In total the power-generating facilities have the ability to produce up to 391 megawatts of electricity" (Oregon DLCD, 2015).

According to the *2015 Oregon NHMP*, within Jackson County there are three power plants, two of which are powered by hydroelectricity and one of which is powered by other sources. Other sources include biomass, geothermal, solar, landfill gas, petroleum, and waste (Oregon DLCD, 2015).

> The majority of electrical power in Region 4 is generated through hydropower. Dams for hydropower generation are primarily situated on the Applegate, Rogue, and Umpqua Rivers. Dams operated by the Bonneville Power Administration (BPA) provide hydro-generated electricity to the state's consumer owned utilities. Major BPA dams in the region are located on the Applegate and Rogue Rivers (Oregon DLCD, 2015).

The Oregon Water Resources Department maintains an inventory of all large dams located in Oregon (using the National Inventory of Dams (NID) threat potential methodology). Within Jackson County, there are 78 dams; as evaluated for the threat potential of dams there are 14 high; 19 significant; and 42 low threats (Oregon DLCD, 2015).

"Although natural gas does not provide the most energy to the region, it does contribute a significant amount of energy to Pacific Power's portfolio" (Oregon DLCD, 2015). Natural gas (LNG) is transported via pipelines throughout the United States (Steve Vincent, personal communication, October 17, 2016).

"Southwestern Oregon primarily receives oil and gas from Alaska by way of the Puget Sound through pipelines and tankers. The region is at the southern end of this pipeline network. Oil and gas are supplied by Northern California through a separate network. The electric, oil, and gas lifelines … are both municipally and privately owned (Loy et al., 1976)" (Oregon DLCD, 2015). Of note, most of the petroleum used in Oregon is stored on liquefaction prone sediments in Portland.

> Oregon's critical energy infrastructure (CEI) Hub is located in an area with significant seismic hazard. Significant liquid fuel, natural gas and electrical infrastructure and facilities are situated in this relatively small area in Portland. The CEI Hub covers a six-mile stretch on the lower Willamette River located between the south tip of Sauvie Island and the Fremont Bridge on US Highway 30. The energy sector facilities in the CEI Hub include: all of Oregon's major liquid fuel port terminals; liquid fuel transmission pipelines and transfer stations; natural gas transmission pipelines; liquefied natural gas storage facility; high voltage electric substations and transmission lines; and electrical substations for local distribution. More than 90 percent of Oregon's refined petroleum products come from the Puget Sound area of Washington State. Oregon imports the product by pipeline and marine vessels to the CEI Hub before it is distributed throughout Oregon to the end user… In addition, much of NW Natural's natural gas passes through the CEI Hub. A high voltage electrical transmission corridor crosses the area as well as supplies distribution for this area (Wang, Bartlett, & Miles, 2012).

"The network of electrical transmission lines running through Region 4 is operated by Pacific Power and Light and primarily facilitates local energy production and distribution (Loy et al., 1976)" (Oregon DLCD, 2015). The natural gas delivered in southern Oregon comes from supply basins in British

Columbia, Alberta, and the Rockies (Steve Vincent, personal communication, October 17, 2016). Avista Utilities owns the local natural gas distribution pipelines (Steve Vincent, personal communication, October 17, 2016)

Oregon Revised Statutes (ORS) 176 and 469 authorize Oregon Department of Energy (ODOE) to prepare and respond to petroleum emergencies that impact the health and safety of Oregonians. ORS Chapter 176, Section 750 authorizes the ODOE to develop and maintain a statewide contingency plan in response to petroleum shortages or disruptions that impact the state. This includes the *Oregon Fuel Action Plan* (Deanna Henry, personal communication [September 2016 ODOE ESF 12 Fuel Strategy, 12 p. PDF], September 2, 2016, and ODOE, *Oregon Fuel Allocation Guidelines*, June 2016).

The *Oregon Fuel Action Plan* is "designed to bring bulk fuel supplies in from outside of the region to support the state's ongoing emergency response and recovery efforts until the regional infrastructure can be restored" (Oregon Department of Energy, 2016, ESF 12 Fuel Strategy section). The *Oregon Fuel Action Plan* includes the *Oregon Fuel Allocation Guidelines* (Deanna Henry, personal communication, September 2016). Emergency Support Function (ESF) 12 is Energy: "Assess fuel needs to assess and restore the petroleum, natural gas, and electricity supply and distribution systems and to perform other mission critical functions." ODOE is responsible for the petroleum sector and the Oregon Public Utilities Commission (OPUC) is responsible for the electricity and natural gas sectors (Oregon Department of Energy, 2016).

In an energy disruption, the criteria for allocating fuel include:

1) Governor's Emergency Declaration.
2) Emergency responders unable to obtain fuel at any price.
3) Market forces, voluntary fuel conservation, and/or mandatory fuel conservation measures fail to provide for adequate and equitable distribution of fuel (Oregon Department of Energy, 2016).

The fuel allocation structure to distribute fuel in an energy disruption:

1) ESF Primary State Agencies – There are 18 ESFs or critical lifeline services in Oregon.
2) County Emergency Management Agencies – There are 36 counties in Oregon.
3) Native American Tribes – There are nine federally recognized Native American Tribes in Oregon (Oregon Department of Energy, 2016).

According to the *Oregon Fuel Allocation Guidelines*,

> Time is needed to bring fuel from outside of the region to support Oregon's response and recovery activities. State, county, and tribal organizations should know the location and amount available within their jurisdictions to support initial life-saving functions and begin restoring critical lifeline services. Without roads to deliver supply, the fuel within each jurisdiction will be used to support the initial response until an alternate supply can be brought in from outside of the region to sustain response activities (Oregon Department of Energy, 2016).

The *Oregon State Energy Assurance Plan* identifies Oregon's consumption by energy source (from greatest to least) as petroleum, hydroelectric, natural gas, renewables, and coal (Oregon Department of Energy & the Oregon Public Utilities Commission, 2011). Oregon's renewable resources include hydropower, solar, geothermal, wave, biomass, and alternative fuels. Oregon's non-renewable energy sources are petroleum and natural gas (in compressed form referred to as liquefied natural gas or LNG). The combination of renewable and non-renewable energy sources provides some measure of assurance that energy will be available when it is needed (PBEM, 2012).

The City of Medford receives a fuel supply delivery each week that restores a six week supply of diesel and a four week supply of gasoline under normal consumption rates. Emergency response and recovery operations may increase demand depending on needs, or decrease demand because streets are impassable (Larry Masterman, personal communication, September 23, 2016).

These City facilities have permanently installed back-up generators:

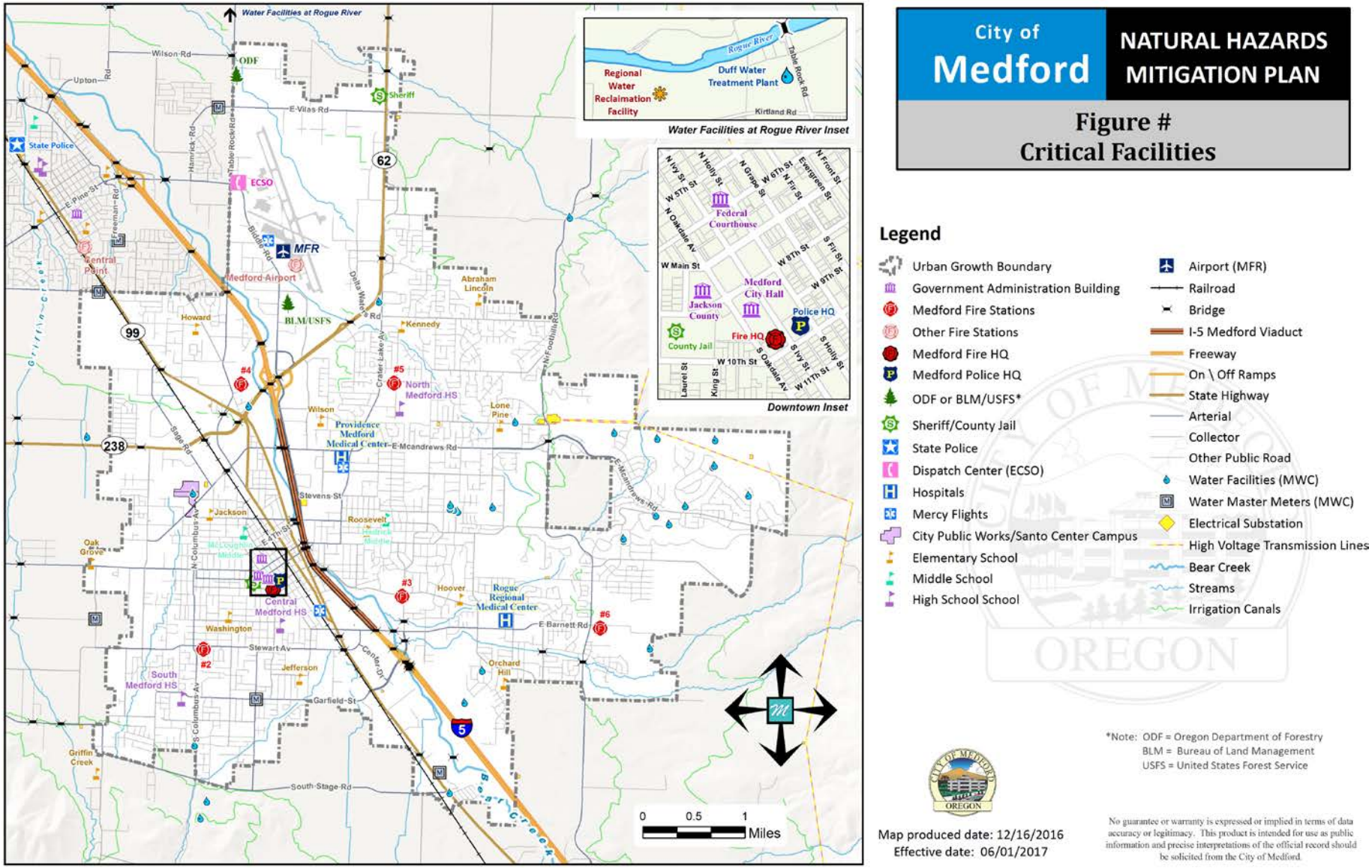
- City Hall,
- Lausmann Annex,
- Police Headquarters,
- All fire stations,
- The service center,
- Roxy Ann Peak communications facility (Larry Masterman, personal communication, September 23, 2016).

A small number of portable or mobile generators is available to augment the back-up generators (Larry Masterman, personal communication, December 16, 2016). To prepare for emergency situations, the City of Medford has an Emergency Operations Plan, a Business Continuity Plan, and a Natural Hazards Mitigation Plan (Larry Masterman, personal communication, October 12, 2016).

Disaster Shelters. The City of Medford's plan for providing temporary disaster sheltering is to collaborate with organizations like the American Red Cross to set up and manage shelters in support of the city when an emergency occurs. The American Red Cross maintains a list of potential shelter facilities that consists of public and privately owned facilities located throughout the city. These potential shelter sites are pre-surveyed for the following capabilities: accessibility, sleeping capacity, food preparation, and availability of showers. The list of potential shelter sites is not publicly posted because many factors go into determining the specific site that is used for a specific emergency. These factors include the location, type of disaster, and number of people displaced (Curtis Peetz, American Red Cross, personal communication, August 10, 2016).

As is well known, the American Red Cross opens shelters in emergency situations for all types of hazards. According to a report from the Red Cross National Shelter System and for the time period of 2010 through June 2016, there are no records that the American Red Cross opened a shelter in Jackson County for any hazard event (Jenny Carver, American Red Cross, personal communication, July 27, 2016).

Figure 23. Critical Facilities



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, December 16, 2016

Section 9 Educational Facilities and Special Districts

Southern Oregon Education Service District (ESD) serves 13 school districts, over 100 buildings, 3,500 teachers and 49,579 students in Jackson, Josephine and Klamath Counties — a 10,600 square-mile geographic area (Southern Oregon ESD, n.d.-a). It is a special district in accordance with ORS 174.116, Local government and local service district defined.

The Medford School District, 549c, is part of the Southern Oregon ESD. It includes three high schools, two middle schools, fourteen elementary schools, and one public charter school (Southern Oregon ESD, n.d.-b). The Medford School District serves a student population of 13,400 (Ben Davol, Southern Oregon ESD, personal communication, July 18, 2016).

Table 9. Schools in the Medford School District

School	Type
North Medford High	High
Central Medford High	High
South Medford High	High
Hedrick Middle School	Middle
McLoughlin Middle School	Middle
Abraham Lincoln Elementary School	Elementary
Griffin Creek Elementary School	Elementary
Hoover Elementary School	Elementary
Jackson Elementary School	Elementary
Jacksonville Elementary School	Elementary
Jefferson Elementary School	Elementary
Lone Pine Elementary School	Elementary
Kennedy Elementary School	Elementary
Oak Grove Elementary School	Elementary
Roosevelt Elementary School	Elementary
Ruch Elementary School	Elementary
Washington Elementary School	Elementary
Wilson Elementary School	Elementary
Logos Public Charter School	K-12

Source: Southern Oregon ESD, n.d.-b.

The Medford School District's boundaries extend beyond the Medford Urban Growth Boundary. Students from the district attend the schools located in the City of Medford. Schools are shown on **Figure 23**, the Critical Facilities map. A portion of the City, south of East Barnett Road, is located within the Phoenix-Talent School District, and one Phoenix-Talent elementary school is located within the City of Medford.

A community wide series of bonds, which totaled $193 million, were passed and provided funds for new construction and/ or rehabilitation of schools in the district. As a result, South High School was built. Two elementary schools, Jackson and Roosevelt, were almost entirely rebuilt due to multiple structural, age, and wear problems including seismic deficiency. The elementary schools opened in 2010. All three

schools were built under codes that include seismic requirements (Dr. Brian Shumate, personal communication, January 23, 2017).

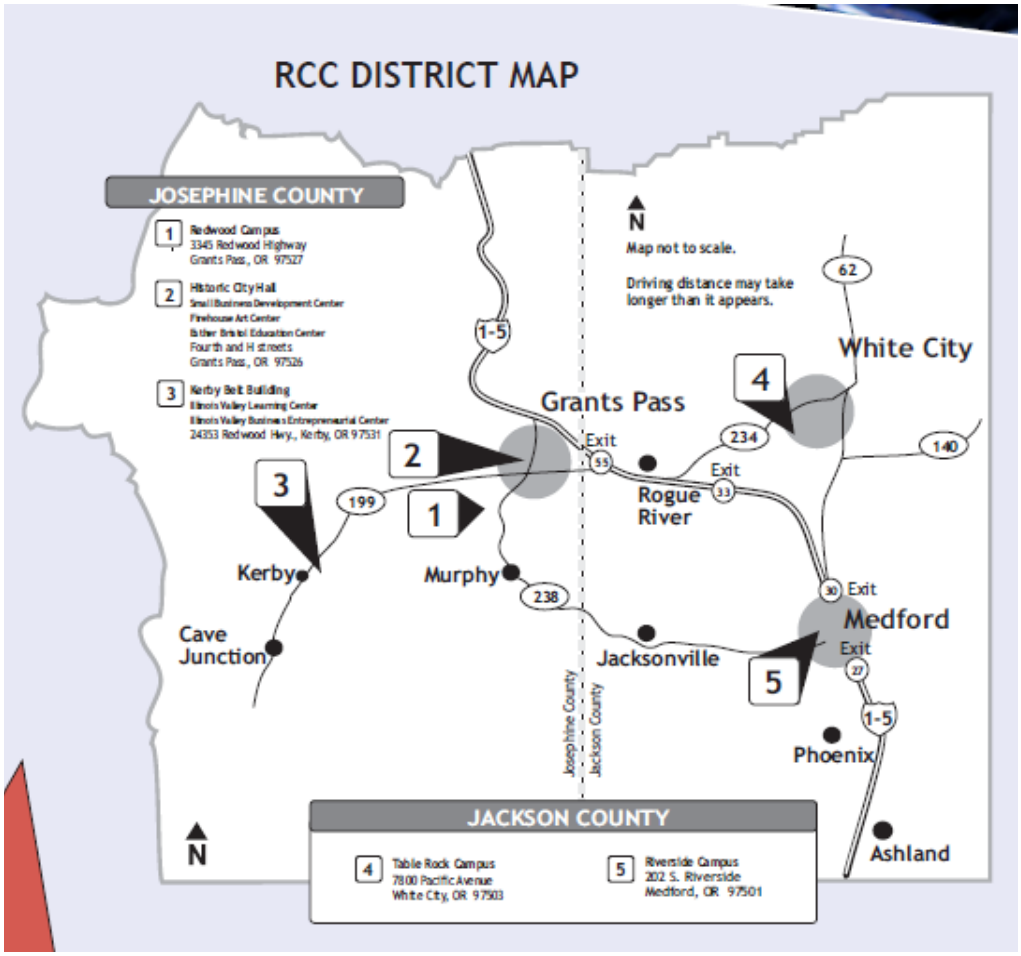
Rogue Community College (RCC) serves approximately 16,000-17,000 students including credit and non-credit students (RCC, n.d.). The college has campuses in both Jackson and Josephine counties; the main campus is located in Grants Pass. In Jackson County, RCC has developed the Riverside Center in downtown Medford. The multi-building complex houses classrooms, labs, student and community services areas and library and bookstore facilities. The Medford RCC campus has the highest enrollment numbers of any RCC campus. **Figure 24** is a map of the campus locations.

Table 10. 2014-2015 Annual Enrollment Data for RCC

Total Annual Enrollment 2014-2015 – Data as of 8/25/16		
Category	**# of People**	**% (If Applicable)**
Credit Students (headcount)	9,722	
Non-credit Students	6,862	
Total	16,584	
Attend at Riverside Campus	6,369	38.4
Attend at Table Rock Campus	3,187	19.2
Attend at Rockwood Campus	4,610	27.8
Distance ED/Other Sites	8,327	50.2
Total Attendance in Jackson County	11,230	67.7
Total Attendance in Josephine County	8,682	52.4
Attended more than one campus	1,575	9.5
Gender		
Men	7,177	43.51
Women	9,317	56.49
Students not reporting	90	0.54

Source: Rogue Community College (n.d.)

Figure 24. Map of Rogue Community College



Source: Rogue Community College, n.d.

Southern Oregon University (SOU) is primarily based in Ashland. In the fall of 2008, RCC and SOU opened a new 69,000 square foot classroom facility in downtown Medford. The Higher Education Center (HEC), is located at the corner of 8th and Riverside. Here, RCC and SOU work together to create a supportive environment for students pursuing two-year, four-year, and graduate degrees (Southern Oregon University, n.d.).

Figure 25. Higher Education Center in Medford

Source: [Photograph of Higher Education Center (HEC), Medford campus]. Southern Oregon University. Retrieved from https://inside.sou.edu/medford/index.html

In 2004, Jackson County opened a new 80,000 square foot library headquarters in Medford's downtown near the RCC campus, see **Figure 26**. The Jackson County Library system has existed for years, but by a public vote in 2014 it became the Jackson County Library District and is a special district (Jackson County Library District, n.d.). As such, it is an independent unit of local government dedicated to library operations in Jackson County. The Jackson County Library District leases 15 buildings from Jackson County (Maureen Swift, personal communication, November 22, 2016).

Figure 26. Jackson County Library, branch in downtown Medford

Source: David Pastizzo, GIS Manager, City of Medford, personal communication, May 25, 2017

Special districts were identified by FEMA and OEM, in the spring of 2016, as entities that need to have NHMPs to be eligible for Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Program (HMGP) funds. Natural hazards mitigation planning at the local jurisdictional level (counties, cites, special districts, PUDs, etc.) is not required by the State of Oregon or FEMA. However, if a local entity wants to participate in FEMA mitigation grant project funding (disaster and non-disaster grant programs), then having a FEMA-approved local Natural Hazards Mitigation Plan is required. For FEMA Public Assistance (PA), states must have a State Mitigation Plan for all permanent PA work; local jurisdictions do not have to have a local mitigation plan to meet PA program eligibility. As part of the *2017 Medford NHMP* planning process, which is a collaboration between Medford and DLCD, identification of and outreach to special districts has occurred to the extent practicable.

Medford Fire-Rescue has provided fire protection to the Medford Rural Fire Protection District 2 (MRFPD2) – a special district - under contractual agreement since 1952. The current agreement was renewed in 2016 and extends until 2017 (Larry Masterman, personal communication, December 16, 2016). This is a mutually beneficial relationship for both parties (City of Medford, n.d.-b). See Section 8 of Chapter 1 for additional information about fire protection in the Medford area.

The Rogue Valley Sewer Services (RVSS) District is a special district formed by the voters in 1966 to provide a regional solution to wastewater disposal problems (Rogue Valley Sewer Services, n.d.)

The Jackson County Vector Control District was formed by a vote of the public in 1968 for the purpose of providing mosquito and fly control to county residents. Actual control measures began in the summer of 1969. Because they are a special district acting under state authority as outlined in ORS 452, they have their own budget that is made up of property tax revenues (Jackson County Vector Control District, n.d.-a).

There are three irrigation districts in the Medford area; they are as special districts: Rogue River Valley Irrigation District (http://www.rrvid.org/); Medford Irrigation District (http://www.medfordid.org/); and the Talent Irrigation District (http://www.talentid.org/). **Figure 33** illustrates the boundaries of the irrigation districts as they relate to the Medford UGB. The Medford Irrigation District has 10,946 acres within the UGB while the Rogue River Valley Irrigation District has 4,531 acres and the Talent Irrigation District has 573 within the UGB.

The Rogue Valley Transportation District (RVTD) has served the Rogue Valley since 1975 and is a special district (RVTD, n.d.). See Chapter 1 Section 8 Critical Facilities for a more detailed description of RVTD.

The Jackson County Soil and Water Conservation District is a special district but there is no description of the date of inception on the website (Jackson County Soil and Water Conservation District, n.d.).

The Jacksonville Highway Water District was dissolved in 2016 by public vote ("Jacksonville Highway Water District to Dissolve," 2016). The Medford Water Commission has accepted these customers as "Outside Customers" (Sara Bristol, personal communication, August 22, 2016). See Section 8 of Chapter 1 for more information about the Medford Water Commission.

Section 10 Transportation, Freight Distribution, and Communications

"Region 4's growing population centers bring more workers, automobiles and trucks onto roads. A high percentage of workers driving alone to work coupled with interstate and international freight movement on the I-5 corridor create additional stresses on transportation systems. Some of these include added maintenance, congestion, oversized loads, and traffic accidents" (Oregon DLCD, 2015).

Because of earthquake risk in Region 4, the seismic vulnerability of the region's transportation system is an important issue. "According to the Oregon Department of Transportation's (ODOT's) Seismic Lifeline Report, the region has exposure to earthquakes, especially a Cascadia Subduction Zone event. Therefore, the seismic vulnerability of the region's lifelines, including roadways and bridges, is an important issue" (Oregon DLCD, 2015). Bridge conditions are monitored annually by ODOT,

> A distressed bridge (Di) is a condition rating used by the Oregon Department of Transportation (ODOT) indicating that a bridge has been identified as having a structural or other deficiency, while a deficient bridge (De) is a federal performance measure used for non-ODOT bridges. The ratings do not imply that a bridge is unsafe (ODOT, 2012, 2013). About 18% of the region's ODOT bridges are distressed, compared to 22% for the state (Oregon DLCD, 2015).

According to ODOT's *Seismic Vulnerability of Oregon State Highway Bridges: Mitigation Strategies to Reduce Major Mobility Risks*, the potential for structural collapse of bridges constructed during specific time periods, when subjected to earthquake forces, is relative. The bridge collapse potential reflects the design codes that were in effect during each given time period" (Nako et al., 2009).

Table 11. Structure Collapse Potential Relative to Year Constructed

Year Constructed	Structure Collapse Potential
Prior to 1975	Significant
1975 to 1994	Moderate
1995 to 2004	Low
2004 to present	Very Low

Source: Nako et al., 2009

Medford's geographic location and multi-modal transportation options create an urban hub of transportation, freight distribution, and communications. Medford lies on Interstate 5 as it runs north-south from Southern California to British Columbia. Medford is 27 miles north of the California border and is 75 miles east of the Pacific Ocean ("Medford, Oregon, Geography", n.d.). The City is in a geographically strategic position to serve the Willamette Valley and Portland (273 miles away) to the north as well as San Francisco and the Bay area to the south.

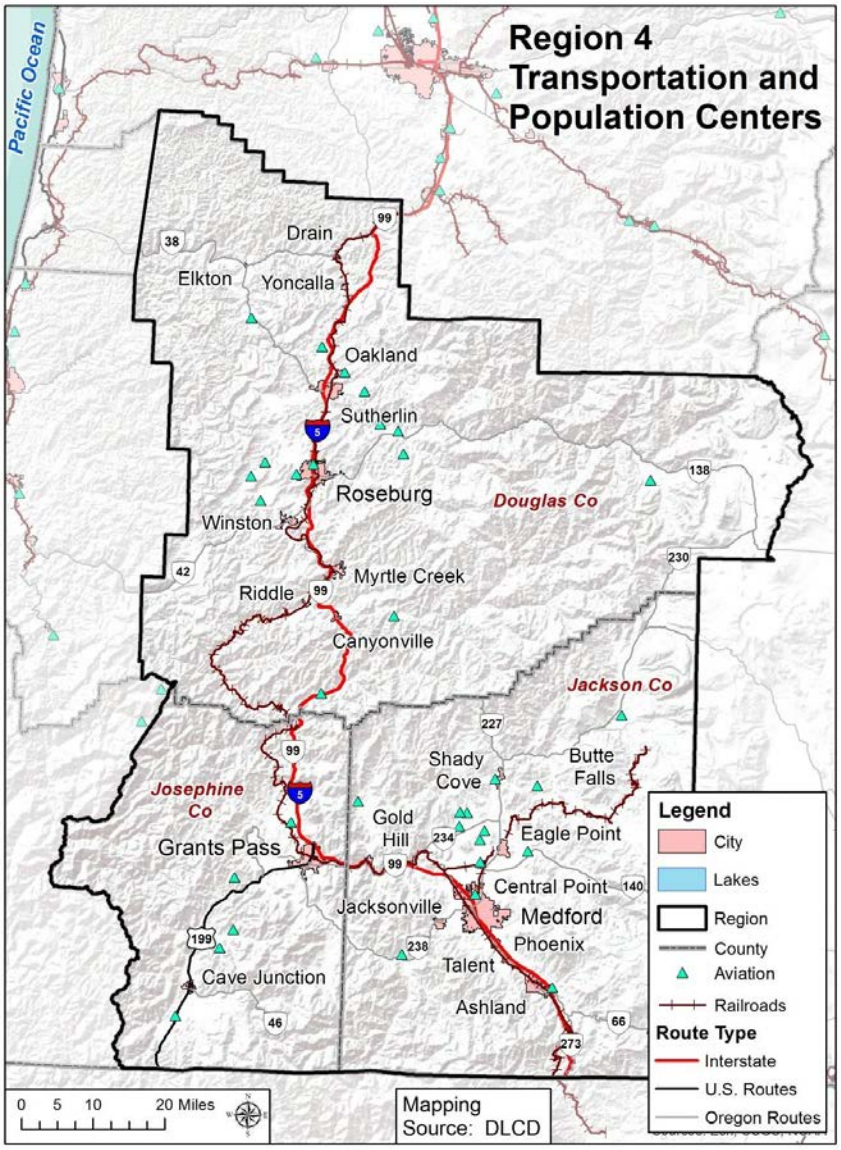
Medford is the leading freight distribution center for Southern Oregon and Northern California. At the center of a transportation, freight distribution, and communications network, Medford is dependent on the food, fuel and consumer goods that arrive by truck, principally via Interstate 5. Food, fuel, and consumer goods also arrive by air and by railroad. The City has excellent access to US 99 West and four major State highways. Trucking plays an important role in distributing fruit and other foodstuffs, as well as other products to markets throughout the Northwest and California.

The City imports so much of its food, fuel, and consumer goods that this may present vulnerability in the face of a hazard or disaster that substantially disrupts the interstate transportation and commerce

systems. People impacted by a hazard or disaster would likely come to Medford for assistance and supplies; this heightens the importance of maintaining and promptly restoring those resources and their distribution mechanisms.

Medford lies in a designated Enterprise Zone and Electronic Commerce Zone. These zones provide incentives to traded sector businesses. The incentives are tied to job creation and capital investment. Benefits within the Enterprise Zone are a three or five year property tax abatement on new capital investment. Benefits within the Electronic Commerce Zone, which applies to all Enterprise Zone properties, allow for property tax abatement on new capital investment plus an income tax credit. The Electronic Commerce Zone benefits can be spread over five years. More information is contained in the City of Medford's website under City Departments, Economic Development (Jim Huber and Bill Hoke, personal communication, August 30, 2016).

Figure 27. Region 4 Transportation and Population Centers



Source: Oregon DLCD, 2015

As described in the *2015 Oregon NHMP*,

> Railroads that run through Region 4 support cargo and trade flows. The region's rail providers are the Central Oregon & Pacific and the White City Terminal Railroad. There is no passenger rail line through the region. The Central Oregon & Pacific Line follows I-5 through the region, then runs west through Lane County and loops back into Region 4 through Reedsport. The White City Terminal Railroad is a short spur off the Central Oregon & Pacific Line in Jackson County (Loy et al., 1976). Oregon's rail system is critical to the state's economy, energy, and food systems. Rail systems export lumber and wood products, pulp and paper, and other goods produced in Oregon and carry products from other states to and through Oregon by rail (Cambridge Systematics, 2014) (Oregon DLCD, 2015).

The Central Oregon and Pacific Railroad (CORP) rail line that hauls freight to both northerly and southerly locales passes through and serves Medford. "The CORP has more than 300 miles of main line in this corridor. Forest products are the CORP's primary commodity group with the remaining traffic base consisting of farm products, metals and chemicals (Genesee & Wyoming Inc., n.d.).

Rogue Valley International–Medford Airport serves the City and surrounding areas in southern Oregon and northern California. Commercial air service is provided by Horizon Air/Alaska Airlines, United Airlines, Delta Air Lines and Allegiant. These carriers offer approximately 56 arriving and departing flights daily to and from San Francisco, Portland, Seattle, Los Angeles, Denver, Las Vegas, and Salt Lake City. Rogue Valley International – Medford Airport also serves general aviation traffic, including extensive corporate and business travel (Jackson County Airport Authority, n.d.-b). A more detailed description of the airport is included in Section 8 of Chapter 1.

Regional transportation systems play an important role as described in the *Rogue Valley Regional Transportation Plan*,

> Regional transportation systems have significant and long-term impacts on economic well-being and quality of life. Not only does the transportation system provide for the mobility of people and goods, it also influences patterns of growth and economic activity through accessibility to land. Furthermore, the performance of the transportation system affects such public policy concerns as air quality, environmental resource consumption, social equity, economic development, safety and security (RVMPO, 2013).

According to the *Strategic Assessment of Transportation and Land Use Planning*,

> By 2038, regional population growth, coupled with expected growth in household income will increase the demand for automotive travel in the Rogue Valley. By implementing the current adopted plans, the region is likely to see a significant increase in traffic delay resulting from this population growth, even though vehicle miles traveled per capita increases only slightly. Sensitivity tests show that a combination of enhanced transit, intelligent transportation systems, and pricing policies are effective solutions to limit the increase in travel delay. However, implementing some of these actions may be challenging. For example, current and projected levels of transit investment are likely to result in a decrease in transit service miles per capita, rather than allowing for enhanced transit service (RVMPO, 2016).

With regard to hazard mitigation planning, inadequate connectivity within the City's local street network and growing congestion may make timely emergency response increasingly more difficult.

The City of Medford is involved with both a local and a regional Transportation System Plan. A local Transportation System Plan (TSP) was adopted by the Medford City Council on November 20, 2003 and is currently being updated. The *Medford TSP* establishes the City's goals in developing its transportation system for both the short- and long-term. It identifies both existing and future needs, and includes improvements to meet those needs. The *TSP* is intended to serve as a blueprint to guide transportation decisions as development occurs; it outlines a twenty-year plan for transportation improvements and enhance general mobility throughout the City (City of Medford, n.d.-m).

> The *Medford TSP* addresses Oregon Statewide Planning Goal 12 and the Oregon Transportation Planning Rule (TPR). The TPR directs cities and counties to develop balanced transportation systems addressing all modes of travel including motor vehicles, transit, bicycles and pedestrians. The TPR envisions development of local plans that will promote changes in land use patterns and transportation systems that make it more convenient for people to walk, bicycle, use transit, and drive less to meet their daily needs. A fundamental issue in local and regional transportation system plans is a strategy to reduce reliance on the automobile (City of Medford, n.d.-m).

The *Medford TSP* has as its Goal 1 of the overall transportation system: "To provide a multi-modal transportation system for the Medford planning area that supports the safe, efficient, and accessible movement of all people and goods, and recognizes the area's role as the financial, medical, tourism, and business hub of Southern Oregon and Northern California" (Parametrix, 2003).

The Rogue Valley Regional Transportation Plan for 2013-2038 is dated March 26, 2013 and

> must cover at least a 20-year period, and it must address the principal modes of travel within the metropolitan area, including autos, public transit, bicycles, and walking. The plan contains projects and policies to guide development of all modes of transportation in the region... The Rogue Valley is a growing region, and population is expected to continue to increase. In addition, air quality problems continue to pose transportation planning challenges for the region. The long-range plan must consider these issues in order to be effective (City of Medford, n.d.-m).

Interstate 5, running in a northwest to southeast direction on the east side of downtown, bisects the City. A 3,229 foot portion of this freeway within the City is on an elevated viaduct and is susceptible to earthquake damage. Renovations to this viaduct are described above in Section 8 as part of the critical infrastructure discussion. The east and west sides of Medford are growing in population and development, and include important functions, services, and resources.

Two I-5 interchanges serve Medford and separate the City:

- The first interchange (Exit 30) at Highway 62 in the north end of town, serves the airport, the Rogue Valley Mall and other "big box" commercial areas, as well as the northwest industrial portion of the City.
- The second interchange (Exit 27) is at Highland Drive/Garfield Street in the south end of town. It serves much of the City's residential area, as well as the commercial node located near the interchange area and the Rogue Valley Medical Center to the east of the interchange area (Jim Huber and Karl MacNair, personal communication, August 22, 2016).

Interstate 5 serves as the north-south corridor through town for much local traffic. Some 40-50% of the traffic between the north and south interchanges is local, cross-town traffic (Jim Huber and Karl MacNair, personal communication, August 22, 2016).

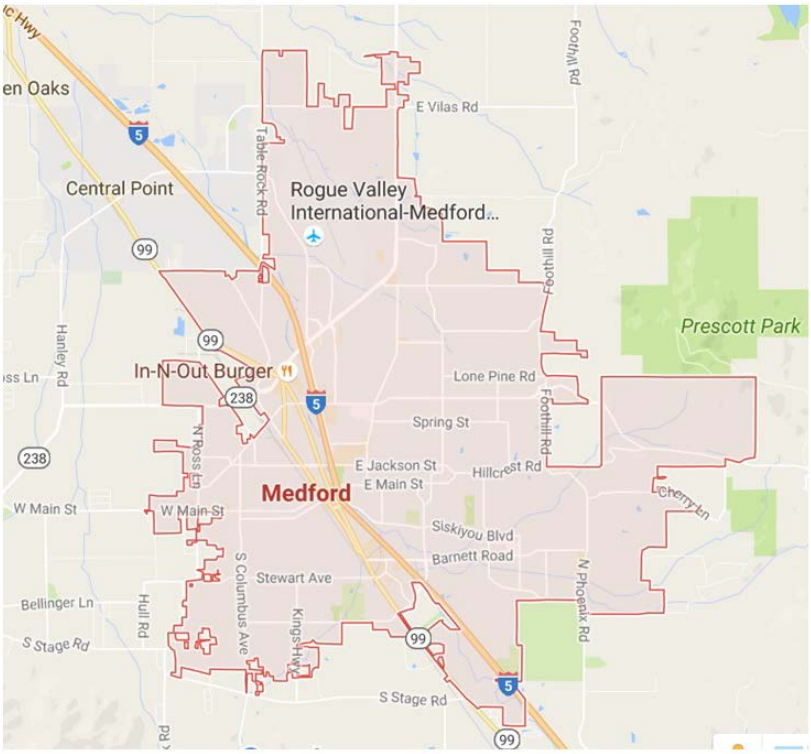
The *Medford TSP* identifies the arterial and collector streets; includes plans for short, medium, and long range improvements to streets and intersections; and identifies truck routes and freight facilities (Parametrix, 2003). The street system within the Medford UGB consists of a one- and two-way grid system in the downtown and in the older urban core area located largely to the west of downtown. Generally, I-5 is the boundary used as a reference to east and west Medford. The UGB is being amended, but the process is on-going during the update of this NHMP.

On the east side of I-5, the City's street system follows a grid pattern and is characterized by a lack of continuous higher order streets (arterial and collectors) that provide connections for longer distance, north-south through trips from one part of the City to another. Better arterial and collector connections are available for east-west traffic on the east side of the UGB. The eastern portions of the UGB are also characterized by rolling topography and the street system is influenced by this factor such that it is less grid shaped than other areas of Medford.

On the west side of I-5, the City's street system follows a grid pattern outside of the older urban core and is characterized by a lack of continuous higher order streets (arterial and collectors) that provide connections for longer distance, east-west through trips from one part of the City to another. Better arterial and collector connections are available for north-south traffic on the west side of the UGB (Jim Huber and Karl MacNair, personal communication, August 22, 2016).

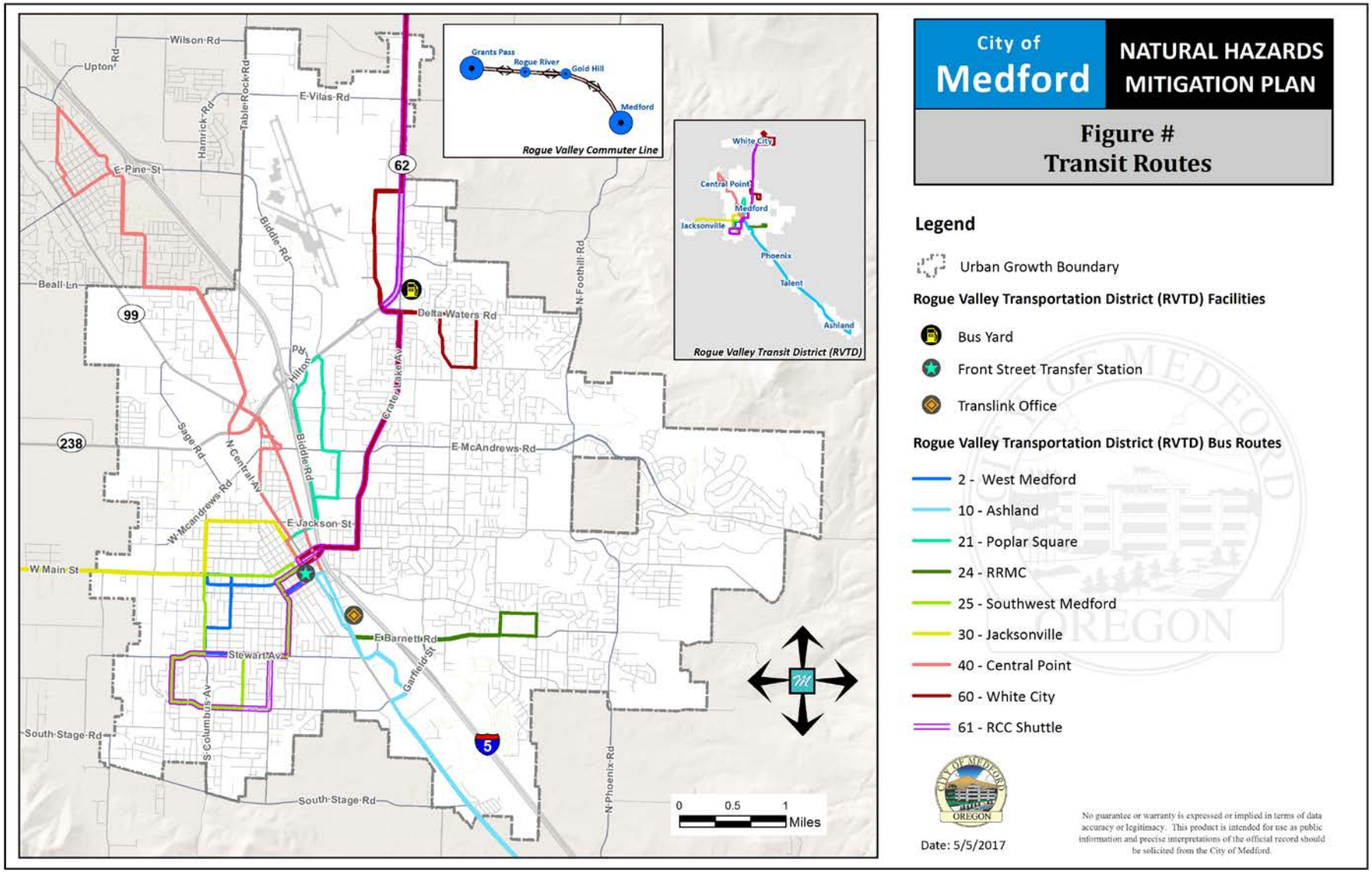
Existing travel patterns within the Medford area focus on the major activity centers within the City and on several major travel corridors. Major activity centers include, but are not limited to such areas as the downtown core area, the Rogue Valley Mall, the Northgate/ Alba Village, South Gateway Center, Crater Lake Plaza, the commercial strips along Biddle Road and Highway 99, and the airport area. Major travel corridors include Highway 99, Highway 62, McAndrews Road, Crater Lake Avenue, Barnett Road/Stewart Avenue, Garfield Street, Columbus Avenue/Sage Road, Foothill/North Phoenix Roads, Biddle Road, and Table Rock Road.

Figure 28. Map of Medford



Source: Google (n.d). Retreived August 2016 from https://www.google.com/maps/place/Medford,+OR/@42.3435662,-122.9141649. Map data: Google.

Figure 29. Transit Routes



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, May 5, 2017

Turning to communication systems, Medford has 12 radio stations and 7 local TV stations with satellite and cable TV service also available. The City is also home to 4 Internet service providers (ISPs) according to Data Center West (Larry Masterman, personal communication, January 11, 2017). According to the Oregon Association of Broadcasters *2015 Directory*, the following radio stations are listed for Medford, Ashland, and Phoenix: KAKT-FM; KBOY-FM; KCMX-AM; KCMX-FM; KDOV-FM; KIFS-FM; KLDZ-FM; KMED-AM; KRWQ-FM; KTMT-AM; KTMT-FM; and KZZE-FM. The 2015 Directory lists the following TV stations for Medford: KDOV-LP; KDRV-TV; KFBI-TV; KMCW-TV; KMVU-TV; KOBI-TV; and KTVL-TV.

This communications information is excerpted from the *2015 Oregon NHMP*:

> Telecommunications infrastructure includes television, telephone, broadband internet, radio, and amateur radio (ham radio). (Oregon DLCD, 2015).
>
> Television serves as a major provider for local, regional, and national news and weather information and can play a vital role in emergency communications. The local primary stations identified as emergency messengers by the Oregon State Emergency Alert System Plan are: KOBI-TV Channel 5, Medford; and Channel 49, Grants Pass. (Oregon DLCD, 2015).
>
> Landline telephone, mobile wireless telephone, and broadband service providers serve Region 4. Broadband technology including mobile wireless is provided in the region via five primary technologies: cable, digital subscriber line (DSL), fiber, fixed wireless, and mobile wireless. Internet service is becoming more readily available in the region with a greater number of providers and service types available within major communities and along major transportation corridors (I-5, US-199, etc.) (NTIA, n.d.). Landline telephones are common throughout the region; however, residents in rural areas rely more heavily upon the service since they may not have cellular reception outside of major transportation corridors (Oregon DLCD, 2015).
>
> Radio is readily available to those who live within Region 4 and can be accessed through car radios, emergency radios, and home sound systems. Radio is a major communication tool for weather and emergency messages. Radio transmitters for the Southern Oregon Operational Area are (Oregon Office of Emergency Management, 2013): WWF-97, 162.475 MHZ, Ashland; WXL-85, 162.400 MHZ, Medford; and WXL-98… (Oregon DLCD, 2015).
>
> Amateur radio, or ham radio, is a service provided by licensed amateur radio operators (hams) and is considered to be an alternate means of communicating when normal systems are down or at capacity. Emergency communication is a priority for the Amateur Radio Relay League (ARRL). (Oregon DLCD, 2015).

The Amateur Radio Emergency Service (ARES) and the Radio Amateur Civil Service (RACES) are public service organizations that provide licensed and trained amateur radio operators to serve the community in terms of crisis, natural disaster, or other emergencies. Operating as combined organizations at the county level, ARES/RACES groups support agencies of all types, such as local government, 911 centers, police, fire, hospitals, and other community service entities. ARES/RACES groups volunteer in the communities for non-emergency events and provide event communications or in times when 911 service or cell phone service is not available (Oregon ARES, n.d.).

Jackson County Amateur Radio Emergency Service (JCARES) is a group of licensed amateur radio operators that provide backup communications for Jackson County Emergency Management and other

agencies involved in disaster management needing emergency communications support. JCARES (n.d.) provides communication support for a variety of emergency services and organizations, including:

- County Emergency Management
- County Health Department
- Emergency Operations Centers
- Fire Departments
- Hospitals
- Mercy Flights
- National Weather Service.

The *Oregon State Emergency Alert System Plan*, dated September 15, 2014 outlines the organization and implementation of the State of Oregon Emergency Alert System (EAS). It is the guideline for Oregon State broadcasters and cable television operators, and state and local entities that are authorized to use EAS. The origin of the information that is broadcast on EAS is categorized as: national level system, state level system, weather emergencies, and local emergencies.

During an emergency, alert and warning officials need to provide the public with life-saving information quickly. According to the EAS, "the Integrated Public Alert and Warning System (THE IPAWS) is a modernization and integration of the nation's alert and warning infrastructure and will save time when time matters most, protecting life and property" (Oregon State Emergency Communications Committee, 2014).

The EAS further describes,

> Federal, State, territorial, tribal and local alerting authorities can use THE IPAWS and integrate local systems that use Common Alerting Protocol standards with THE IPAWS infrastructure. THE IPAWS provides public safety officials with an effective way to alert and warn the public about serious emergencies using the Emergency Alert System (EAS), Wireless Emergency Alerts (WEA), the National Oceanic and Atmospheric Administration (NOAA) Weather Radio, and other public alerting systems from a single interface. (Oregon State Emergency Communications Committee, 2014)

There are nine operational areas within Oregon. Each may prepare a local plan to facilitate the launch of local emergencies within the operational area. Medford is part of the Southern Oregon Operational Area; Jackson County is the originator and as such launches the messages (Oregon State Emergency Communications Committee, 2014).

Rogue Valley Transportation District (RVTD) has a radio communications partnership program; the following information was provided by Jon Sullivan of RVTD (personal communication, January 30, 2017). In 2013, RVTD was awarded Federal funding to update its radio communication system. RVTD required a system that provided clear communication throughout the coverage area, while still meeting the FCC's new narrow banding requirement. RVTD also required a system that was highly scalable, configurable, and reasonably future-proof. RVTD purchased the ASTRO 25 system from Motorola Solutions; it is a digital radio system operating in the 700 Mhz frequency range.

RVTD chose the ASTRO 25 system over other systems because of its value as a public safety resource. It is equipped to support Police, Fire, and emergency responders. The ASTRO 25 system is better equipped than many other systems because of its ability to manage multiple talk groups, and its ability to

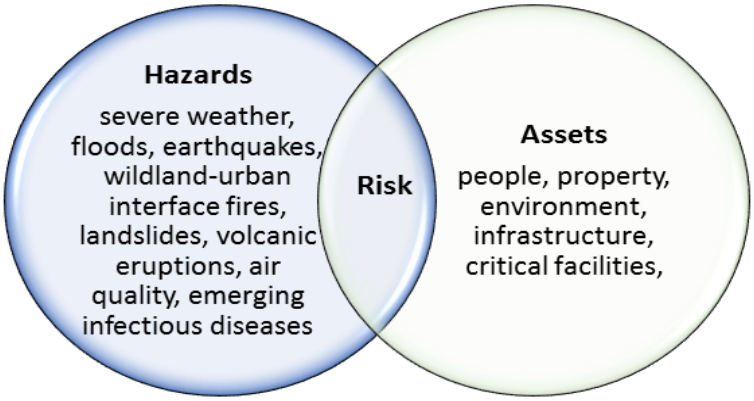
penetrate buildings and structures efficiently. The ASTRO 25 system is P25 compliant, meaning that it is interoperable with other P25 systems (like the Oregon Statewide radio system). Local responders using the ASTRO 25 system will someday have the ability to communicate directly with State and Federal agencies (using separate radio systems).

The ASTRO 25 system is a 'trunked' radio system, meaning that the system makes very efficient use of radio spectrum. The system uses a highly advanced 'switch' to manage up to 1000 unique radio units, and up to 100 unique 'talk groups'. With only 70 radios in RVTD's fleet, RVTD is using less than 1/10th of the system's capacity.

Public agencies who are considering replacement of existing radio equipment now have the option of partnering with RVTD to join this advanced, reliable radio network. RVTD's partnership program would enable any public agency to make use of the ASTRO 25 system on a subscription basis. The subscription would include the use of the ASTRO 25 L-Core (switch) and all associated components (including mountaintop equipment). For an agency with similar coverage requirements as RVTD, this could be a significant cost savings because it would eliminate the need to purchase and support the most expensive components of a radio system.

Chapter 2 Hazard Identification and Risk Assessment

Figure 30. Hazards, Assets, and Risk



Source: Tricia Sears, DLCD, December 2016

Figure 30 lists the Medford natural hazards in the order this chapter presents the information, rather than the rank of risk level of the hazards as determined in the Hazard Analysis. The Hazard Analysis results are described in this chapter in Section 1, and in more detail in Appendix B.

From the *Local Mitigation Plan Review Guide* (FEMA, 2011b):

44 CFR §201.6(c)(2)(i), The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

44 CFR §201.6(c)(2)(ii), The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)((2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe the vulnerability in terms of:

44 CFR §201.6(c)(2)(ii)(A), The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

44 CFR §201.6(c)(2)(ii)(B), An estimate of the potential dollar losses to vulnerable structures identified in this section and a description of the methodology used to prepare the estimate.

44 CFR §201.6(c)(2)(ii)(C), Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

44 CFR §201.6(c)(2)(ii), For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Section 1 Introduction

A brief recap of definitions is useful here to set the stage for this Hazard Identification and Risk Assessment. A hazard is "any situation that has the potential of causing property damage to people, property, or the environment" (Oregon DLCD, 2015). Risk is the probability of an event or condition occurring (Mileti, 1999, p. 106, as cited in Blanchard, 2008). Vulnerability is "the susceptibility of life, property, or the environment to damage if a hazard manifests to potential" according to the *2015 Oregon Natural Hazards Mitigation Plan* (Oregon DLCD, 2015).

A vulnerability assessment

> combines information from the hazard characterization 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 each hazard. Vulnerability is determined by a community's exposure, sensitivity, and resilience to natural hazards as well as by its ability to mitigate, prepare for, respond to, and recover from a disaster (Oregon DLCD, 2015).

The recognized natural hazards in the *2017 Medford NHMP* are: severe weather, floods, earthquakes, wildland-urban interface fires, landslides, volcanic eruptions, air quality, and emerging infectious diseases. The City of Medford's prior Hazard Analysis (Risk Assessment) was completed on March 3, 2004. It was used in both the *2004* and the *2010 Medford NHMPs*.

The updated Hazard Analysis work was performed at the September 23, 2016 Medford NHMP Steering Committee meeting. In this assessment, four measures characterizing risk – history, vulnerability, maximum threat, and probability – are assessed as to severity, weighted, and added together to derive a relative risk score for each hazard. The relative risk scores were then ranked from high to low. Within the high to low range, the scores were bundled into risk levels. The risk levels are shown in **Table 12**, coded with red as high risk, orange for medium risk, and yellow for low risk. Medford identified severe weather and emerging infectious diseases as the highest risk. The Steering Committee worked to come to consensus on the ratings for each of the four measures, as well as the total risk score, for each hazard. The Steering Committee recognized that subjectivity and judgement were involved in the assessment; some concerns were noted regarding the methodology used for the Hazard Analysis. The details of the Hazard Analysis are provided in Appendix B.

Table 12. Hazards and Risk Scores in Numerical Order (High to Low)

Hazard	Risk Score	Risk Level (H-M-L)
Severe Weather	**240**	**High**
Emerging Infectious Diseases	**196**	**High**
Air Quality	**189**	**Medium-High**
Wildland-Urban Interface Fires	**183**	**Medium-High**
Earthquakes	**173**	**Medium**
Volcanic Eruptions	**159**	**Medium**
Floods	**152**	**Medium**
Landslides	**124**	**Low**

The Hazard Analysis is constructed to:

- Establish priorities for planning, capability development, and hazard mitigation,
- Identify needs for hazard mitigation measures,
- Educate the public, public officials, and others about hazards and vulnerabilities, and
- Make informed judgments about potential risks.

As part of the Hazard Analysis work with the Steering Committee, a field trip was conducted to support the discussion. On September 23, 2016, members of the Steering Committee and several other interested parties, visited the Roxy Ann Peak area. Dr. Charles Lane and Professor Emeritus Eric Dittmer led the discussion about geology, landslides, and egress/ingress to the area. With the input of ODF staff, the group also discussed wildland-interface fires. Staff from NWS, Medford Fire-Rescue, Police, Emergency Management, United Way, DLCD, and Rogue Valley COAD also attended. Thought-provoking and lively discussion raised awareness of the hazards and impacts.

It is widely recognized that no hazard exists in isolation; therefore, consideration of the relationships of multiple hazards is important. Relationships of natural, human-caused, and technologic hazards are linked. Natural hazards are the focus of Natural Hazards Mitigation Plans.

"An effective risk assessment informs proposed actions by focusing attention and resources on the greatest risks. The four basic components of a risk assessment are: 1) hazard identification, 2) profiling of hazard events, 3) inventory of assets, and 4) estimation of potential human and economic losses based on the exposure and vulnerability of people, buildings, and infrastructure" (FEMA, n.d.-f). Medford's Hazard Analysis, or risk assessment, includes these components.

Each hazard section within this chapter includes the following subsections:

- introduction and hazard overview,
- types of hazard,
- location and extent of hazard,
- history,
- probability (which includes the relationship of climate change with the hazard), and
- vulnerability.

These subsections comprise and provide a risk analysis for the respective natural hazard that has been identified by the City of Medford.

Referring to the *2015 Oregon Natural Hazards Mitigation Plan* again,

> "A risk analysis involves estimating damages, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (a) the magnitude of the harm that may result, defined through vulnerability assessments; and (b) the likelihood or probability of the harm occurring, defined in the hazard characterization" (Oregon DLCD, 2015).

In other words, the two measurable components of risk involve how much harm may result, and what is the likelihood or chance it will happen. Risk has been defined in numerous ways as described in the *Guide to Emergency Management and Related Terms, Definitions, Concepts, Acronyms, Organizations,*

Programs, Guidance, Executive Orders & Legislation: A Tutorial on Emergency Management, Broadly Defined, Past and Present (Blanchard, 2008). The document includes these two definitions of risk:

"The probability of an event or condition occurring (Mileti, 1999, p. 106)."

"The probability of harmful consequences, or expected loss (of lives, people injured, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable/capable conditions. Conventionally risk is expressed by the equation Risk = Hazards x Vulnerability/Capacity (United Nations International Strategy for Disaster Reduction, 2002, p. 24)."

Resilience was a term used in the description of the vulnerability assessment. In the Community Profile, resilience was defined as essentially the flip side of vulnerability. It is the ability to "survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it" (The Rockefeller Foundation, n.d.). Another definition is "the ability to respond and to recover quickly from damage; it is the ability to 'bounce back.' A resilient system is not necessarily damage-resistant. Rather a resilient system is able to operate at some level when damage occurs" (PBEM, 2012). Resilience is a key part of hazard planning efforts and is often done through mitigation efforts, which are discussed in Chapter 3 Mitigation Strategy.

An additional definition is one for resilient communities. "Resilient communities proactively protect themselves against hazards, build self-sufficiency, and become more sustainable. Resilience…involves technical, organizational, social, and economic dimensions. It is fostered not only by government, but also by individual, organization, and business actions" (Godschalk, Rose, Mittler, Porter, & Taylor West, 2009). Resilience, it should be noted, relates risk with the hazards, the vulnerabilities, and the capacity. There are social, economic, environmental, and other capacities. A city, for example, may not return to its pre-disaster conditions, but it can recover and continue. The city may be different, perhaps in a "new normal" where it operates and functions differently than it did before the disaster.

Climate change is an important topic in hazard planning efforts as it relates to natural, human-caused, and technological hazards. Of note, FEMA's *Local Mitigation Plan Review Guide* (FEMA, 2011b) identifies as an overall intent in the Element B, Hazard Identification and Risk Assessment provisions that the the recognition of possible future conditions should be included; climate change is considered part of the assessment of current and future vulnerability to all hazards. In recognition of these factors, climate change is described in this introduction section and each hazard section includes descriptions of the relationship of the hazard and climate change.

The *2015 Oregon NHMP* provides a detailed overview of the relationship of climate change with the identified hazards in Oregon. Climate models project drought, wildfire, flooding, and landslides will to be impacted by climate change within Region 4 in the following ways:

- Warmer, drier summers.
- A decline in mean summer precipitation.
- Increased incidence of drought and wildfire due to projected warmer winter temperatures and consequent decreases in mountain snowpack.
- More frequent flooding and landslides.
    - An increase in extreme precipitation for some areas, which can result in a greater risk of flooding in certain basins, including an increased incidence of magnitude and return interval.

  - Because landslides in Oregon are strongly correlated with rainfall, increased rainfall – particularly extreme events – will likely trigger increased landslides.
- There is little research on how climate change will influence winter storms and windstorms in the Pacific Northwest (Oregon DLCD, 2015).

Local level information about climate change is found in documents such as these:

- Geos Institute, *Climate Science Overview for Ashland and the Rogue Valley, Oregon* (2016a),
- Geos Institute, *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley* (2016b),
- Oregon Climate Change Research Institute, *Climate Trends and Projections* (2016),
- Rogue Valley Metropolitan Planning Organization, *2013-2038 Regional Transportation Plan* (2013),
- Rogue Valley Metropolitan Planning Organization, *Strategic Assessment Final Report* (2016), and
- Jackson County, *Jackson County Integrated Fire Plan* (2006).

The *Jackson County Integrated Fire Plan* is in the process of being updated and is now called the *Rogue Valley Integrated Community Wildfire Protection Plan*. The Ashland *Climate and Energy Action Plan* was updated in March 2017 (City of Ashland, 2017). Dr. Alan Journet of Southern Oregon Climate Action Now (SOCAN) provided climate change information in Appendix D, Hazard Summary of Climate Trends and Projections.

As noted above and in Chapter 1 in Section 2, climate change is a possible future condition—related to changes in development—that must be considered as part of the *2017 Medford NHMP*. The changes may alter the characteristics of the hazards that currently affect Medford. Two definitions are provided here from the Intergovernmental Panel on Climate Change (IPCC) to provide additional framework for the discussion.

Climate change: "Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes" (Intergovernmental Panel on Climate Change, 2007).

[Climate change] adaptation: "Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc." (Intergovernmental Panel on Climate Change, 2007).

Medford's eight natural hazards include six of those identified by the State of Oregon, and two additional hazards that are not formally discussed in the *2015 Oregon NHMP*. As noted earlier, Medford

is part of Region 4 of the State's Natural Hazards Regions. “Region 4 is affected by eight of the state’s 11 natural hazards. Coastal hazards, dust storms, and tsunamis do not directly impact this region” (Oregon DLCD, 2015).

According to the *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley*,

> The climate change variables of greatest concern included the increase in severity and frequency of extreme heat and heat waves (89 more days per year of extreme temperatures, which could be 12 F hotter), the increased potential for large storms and flooding (large downpours 1.3” larger), loss of snowpack (-86%) and the associated loss of water storage in winter, declines in water quality due to warmer temperatures and lower flow, and overall change in climate conditions leading to disruptions in native vegetation and wildlife (Geos Institute, 2016b).

For the data identified in the *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley*, the change in number of days of severe heat and flooding were calculated for Ashland. However, because they calculated change rather than the actual number of days (which would vary from location to location), they are highly applicable to Medford and other cities in the Rogue Valley. Snowpack declines and changes in wildfire were not specific to Ashland and apply to the whole Rogue Valley (Marni Koopman, personal communication, October 7, 2016).

For clarification of the sub-categories within the hazard sections, the definitions of location, extent, probability, and impact are provided.

FEMA (2011b) describes the location as “the geographic areas in the planning area that are affected by the hazard.”

Extent, as described by FEMA (2011b), is “the strength or magnitude of the hazard.” Extent is frequently measured with a scale such as the Richter Scale or flood depth grids; other factors such as the duration and speed of onset are also included.

Probability is defined as “the likelihood of the hazard occurring and may be defined in terms of general descriptors (for example, unlikely, likely, highly unlikely), historical frequencies, statistical probabilities (for example: 1% chance of occurrence in any given year), and/or hazard probability maps” (FEMA, 2011b).
The definition of impact is “the consequences or effect of the hazard on the community and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have value to the community” (FEMA, 2011b).

This hazard identification and risk assessment focuses on natural hazards. A natural hazard is “a source of harm or difficulty created by a meteorological, environmental, or geological event” (FEMA, 2011b; U.S. DHS, 2010). Human-caused and technological hazards are not required to be addressed in this NHMP. Another definition of natural hazard is provided as those “which result from acts of nature, such as hurricanes, earthquakes, tornadoes, animal disease outbreak, pandemics, or epidemics” (U.S. DHS, 2013b). The *National Mitigation Framework* (Homeland Security, 2013a) graphic included as **Figure 31** illustrates the natural, human-caused, and technological hazards.

Climate change vulnerability is considered a function of three variables according to the *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley*: exposure, sensitivity, and adaptive capacity (Geos Institute, 2016b). Exposure is what changes the resource or population is expected to be

exposed to. Sensitivity is what the impacts are likely to be. Adaptive capacity is what actions or resources are available to reduce or avoid impacts (Geos Institute, 2016b). The "vulnerability is a function of exposure and sensitivity, which together define the impact, and adaptive capacity, which can act to lessen overall vulnerability" (Geos Institute, 2016b).

Figure 31. Examples of Threats and Hazards by Category

Source: U.S. DHA, 2013a

Section 2 Severe Weather

Introduction and Hazard Overview

In Chapter 1, the Community Profile, Section 2 Geology, Topography, and Climate included a description of the the local geology, topography, and climate of Medford. All of these factors relate to the weather in Medford. The definition of weather is "the state of the air and atmosphere at a particular time and place: the temperature and other outside conditions (such as rain, cloudiness, etc.) at a particular time and place" (Merriam-Webster, n.d.). Severe weather includes winter storm events such as heavy rain, wind, snow and ice; other severe weather events are thunderstorms, hail, lightning strikes, tornadoes, and drought/heat waves.

The definition of climate is "The composite or generally prevailing weather conditions of a region, throughout the year, averaged over a series of years" (National Weather Service, n.d.).

Severe weather is the most frequently occurring natural hazard in Medford. The Hazard Analysis revealed severe weather as the highest risk of the natural hazards in Medford. Typically, storms are short-term in nature, lasting one to two days, and can be managed with local emergency response resources. Particularly common are high winds and periods of extreme cold and heat. Less frequent incidents include, for example, snow and ice storms generated in the Siskiyou Mountains, which create very hazardous driving conditions and may lead to power outages.

Snowfalls of 6–12 inches in a 24-hour period over the Siskiyou Mountains typically causes delays of Interstate 5 at the Siskiyou Summit each winter (Ryan Sandler, personal communication, July 28, 2016), with this higher elevation snow disrupting the flow of interstate freight and traffic. Severe weather could cause traffic congestion or routes to be closed on I-5 and other roads due to events such as snow, ice, wind, and rain and other related hazards that also occur during the year. Low elevation snow accumulation, followed by durations of warmer rains, can lead to landslides and flood events, for example.

Most common from October through April, snowstorms and windstorms can disrupt the region's utilities, telecommunications and roadway systems. Damage from windstorms is typically related to the hazard of falling trees and limbs, and the consequent downing of utility infrastructure and power outages. Vegetation (trees getting into power lines) is the greatest cause of power outages in the Southern Oregon region, according to Pacific Power's 2016 annual report for 2011–2015 to the Oregon Public Utilities Commission. With overall electrical service reliability from 2011-2015 at 99.94%, including extreme weather events, vegetation causes caused 18.97% of the outage minutes in the Southern Oregon region. Communication systems that rely on electric service are challenged. Fallen limbs and uprooted trees can also block roadways, disrupting the transportation network (Monte Mendenhall, personal communication, August 4, 2016).

Significant storms have sustained winds of 40 mph with gusts of 55 mph. Usually winds this high in the valley are of very short duration, though there are times where winds can gust above 40 mph for a few hours (Ryan Sandler, personal communication, July 28, 2016). Particularly threatening are wintertime winds from the Siskiyou Mountain Range that can funnel through the Rogue Valley at 50 mph (Ryan Sandler, personal communication, July 28, 2016). The late summer and early fall wind storms, occurring during the dry season, often increase wildfire risks. Heavy rains, followed by strong winds, often result in the falling of entire, shallow-rooted trees.

Rain in southern Oregon results from a very specific weather process over the Pacific Ocean. Precipitation in the winter is due to clashing air masses forming low pressure areas, or storms, and their fronts. In addition, Medford experiences "atmospheric rivers" from the subtropics that reach southern Oregon and enhance the precipitation due to the terrain (Ryan Sandler, personal communication, July 28, 2016).

Jackson County has extended hot and dry weather conditions during the summer and early fall months. Sequential years of below normal rainfall over winter months can result in severe drought conditions, as were seen in 1939, 1976–1981, 1987–1994, 2001, and 2013–2015 (Ryan Sandler, personal communication, July 28, 2016).

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> Precipitation in Oregon follows a distinct spatial and temporal pattern; it tends to fall mostly in the cool season (October–March). The Cascade Mountains block rain-producing weather patterns, creating a very arid and dry environment east of these mountains. Moist air masses originating from the Pacific Ocean cool and condense when they encounter the mountain range, depositing precipitation primarily on the inland valleys and coastal areas (Oregon DLCD, 2015).

The *2015 Oregon Natural Hazards Mitigation Plan* describes El Nino and La Nina as follows:

> The variability of Oregon's climate often can be attributed to long-term oscillations in the equatorial Pacific Ocean: El Niño and La Niña. Simply stated, these systems involve the movement of abnormally warm or cool water into the eastern Pacific, dramatically affecting the weather in the Pacific Northwest. El Niño tends to bring warm and dry winters; the inverse is true with La Niña. However, there have been wet years during an El Niño event, dry years in a La Niña, and both types of water years in neutral conditions. In other words, El Niño and La Niña do not explain all of the variability in every given winter. Also, climate change is reducing the robustness of the low-elevation snowpack, which will likely influence the frequency of drought conditions and associated impacts on Oregon communities.
>
> An El Niño system moves heat, both in terms of water temperature and in atmospheric convection. The heat is transported toward North America, producing mild temperatures and dry conditions in Oregon. Its effects are most pronounced from December through March.
>
> La Niña conditions are more or less opposite of those created by El Niño. It involves the movement of abnormally cool water into the eastern Pacific. This event produces cooler than normal temperatures in Oregon and increased precipitation. It also is most pronounced from December to March" (Oregon DLCD, 2015).

Location and extent

The location of severe weather that may affect the City of Medford is described with numerous originating factors that are variable. The extent of the weather, or the strength or magnitude of the hazard, is also variable. The extent is further described in the Probability subsection. There are several figures that provide additional location and extent information.

Typically, winter storms that affect Medford are large cyclonic low pressure systems moving inland from the Pacific Ocean. These storms usually affect large areas of Oregon or even the whole Pacific

Northwest. Summer storms tend to be more localized. All of the infrastructure and population within Medford are exposed to severe weather. However, history shows that roads are more frequently impacted and thus are at higher risk of damage from severe weather events than buildings. The location and severity of events varies widely based on specific local conditions.

The topographic and hydrological conditions—such as steep or flat terrain or poor or well-drained soil—affect the magnitude and the duration and extent of heavy rainfall. The impact of heavy rainfall depends on both the total inches of rain and the intensity of rainfall (inches per hour or inches per day). Flash floods, which are produced by episodes of intense heavy rains (usually 6 hours or less) or dam failures, are rare in western Oregon but do present a potential hazard. Heavy rainfall can also trigger landslides in areas with saturated soil. In winter months, rainfall also includes the amount of rain plus snow melt, also known as a rain-on-snow event.

The data for rainfall, snowfall, and temperature discussed below are from Ryan Sandler, NWS Warning Coordination Meteorologist, of the National Weather Service (NWS).

The tables below provide data on precipitation, snowfall, and temperature for Medford. The precipitation is noted as the average annual precipitation, the lowest annual precipitation, and the highest annual precipitation. The snowfall is noted as the average annual snowfall, the lowest annual snowfall, and the highest annual snowfall. The temperature is noted in the lowest (mean minimum) and highest annual temperatures (mean maximum), and the average annual minimum and maximum temperatures.

Table 13. Precipitation in Medford

Location	Average Annual Precipitation (inches)	Period of Record	Lowest Annual Precipitation (inches)	Highest Annual Precipitation (inches)	Period of Record
Medford station	18.36	1912-2015	8.99	31.41	1912-2015

Source: Ryan Sandler, personal communication, July 28, 2016

Table 14. Snowfall in Medford

Location	Average Annual Snowfall (inches)	Period of Record	Lowest Annual Snowfall (inches)	Highest Annual Snowfall (inches)	Period of Record
Medford station	4.1	1912-2015	0.0	24.1	1912-2015

Source: Ryan Sandler, personal communication, July 28, 2016

Table 15. Temperature in Medford

Location	Average Annual Max Temperature (F)	Average Annual Min Temperature (F)	Period of Record	Lowest Annual Temperature (F)	Highest Annual Temperature (F)	Period of Record
Medford station	68.0°	43.2°	1912-2015	-10°	115°	1912-2015

Source: Ryan Sandler, personal communication, July 28, 2016

History

There are three types of declaration types that authorize the President of the United States to provide supplemental federal disaster assistance: Emergency Declarations (EM), Major Disaster Declarations (DR), and Fire Management Assistance Declarations (FM) (FEMA, n.d.-d). The events related to the different types of declaration and scope and amount of assistance differ. These declaration types are

noted when applicable in each of the history tables for events related to the natural hazards in the *2017 Medford NHMP*. The definitions below are excerpted from FEMA's Disaster Declarations Process website.

> Emergency Declarations: The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Emergency declarations supplement State and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. The total amount of assistance provided for in a single emergency may not exceed $5 million. The President shall report to Congress if this amount is exceeded.
>
> Major Disaster Declarations: The President can declare a major disaster for any natural event, including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, or, regardless of cause, fire, flood, or explosion, that the President determines has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work.
>
> Fire Management Declarations: Fire Management Assistance is available to States, local and tribal governments, for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands, which threaten such destruction as would constitute a major disaster. The Fire Management Assistance declaration process is initiated when a State submits a request for assistance to the Federal Emergency Management Agency (FEMA) Regional Director at the time a "threat of major disaster" exists. The entire process is accomplished on an expedited basis and a FEMA decision is rendered in a matter of hours.

As of January 2017, FEMA has issued 30 Federal disaster declarations (DR) and two emergency declarations (EM) for Oregon from 1955 through June 2016: the EMs were on April 29, 1977 for drought (EM-3039) and for the Oregon Hurricane Katrina Evacuation on September 7, 2005 (EM-3228). Most of the declarations are related to storm events causing flooding and landslides (FEMA, n.d.-e).

Originating in a Pacific Ocean typhoon, Oregon's outstanding historic windstorm, the October 1962 "Columbus Day" storm, had winds gusting to 116 miles per hour in Portland and was described by meteorologists as a cyclone. It killed 38 people and created $170 - $200 million in damages (in 1962 dollars, which would be approximately $1.5 billion in 2016) (Ryan Sandler, personal communication, July 28, 2016) in Oregon. Trees and power lines were toppled in Medford by gusts at 58 miles per hour.

In 1991, a winter storm front caused temperatures to drop to 6 degrees below zero at night and remain below 12 degrees during the day. This weather lasted approximately one week and caused significant damage to water pipes, heating systems and crops. It also affected natural gas distribution (City of Medford, 2010).

The summer months can also bring torrential rainstorms. On July 7, 2000, heavy afternoon rains, lightning and strong winds left thousands in the Rogue Valley without power for periods of time, sparked small rural fires, and led to serious traffic problems, as traffic signals went off with the power outages ("Wild Storm Batters Region," 2000). On that date, the Rogue Valley International – Medford Airport had wind gusts to 43 mph at 5:05 pm (Ryan Sandler, personal communication, January 23,

2017). The NWS notes that they do not issue severe thunderstorm warnings for frequent lightning because all thunderstorms by definition have lightning. However, they do issue severe thunderstorm warnings for high winds of 58+ mph (Ryan Sandler, personal communication, January 23, 2017).

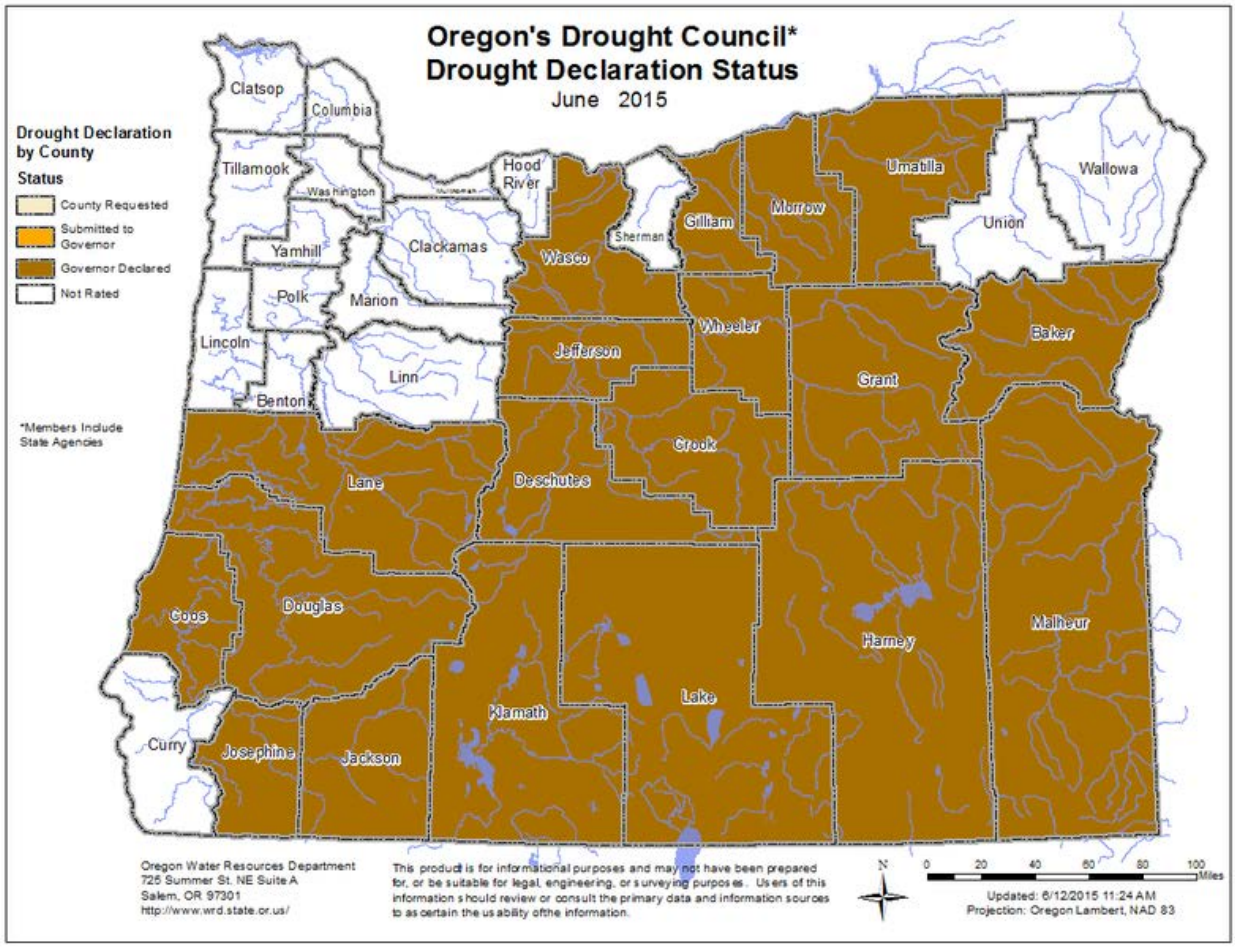
The Medford Water Commission draws its water supplies from the Big Butte Springs and Rogue River. Medford is not affected by drought in the same way as the region's communities that are dependent on snowpack or wells. The Medford Water Commission's system at Big Butte Springs can handle a capacity of 26.4 million gallons per day (mgd). Drought has never required the implementation of a water curtailment program in the City of Medford. A long drought cycle, however, has affected the volume of flows from the Big Butte Springs and required drawing water from the nearby Rancheria Springs. This has happened three to four times since the 1960s. During winter months, the water consumption averages 17 mgd day to customers from Big Butte Springs. From May through October each year, the Medford Water Commission uses water from both the Big Butte Springs and the Rogue River. Total water consumption averages 62 mgd during these summer months (Sara Bristol, personal communication, August 22, 2016). See Chapter 1 Section 8 for more information on Medford's water supply.

During the drought of 1977, Ashland instituted water rationing in February. Reeder Reservoir was then at 80 percent of capacity. Medford Water Commission officials discussed voluntary conservation measures, but imposed none. In April 1977, the Rogue and Umpqua mountain snowpack was 48 percent of the average for that date. Fortunately, record rains (200 percent of the average) in May 1977 eased the situation ("How Does it Compare to Other Droughts," 1992).

The 1992 drought was worse than the 1977 drought. It resulted from a run of 8 of the warmest and driest years on record. Normal annual precipitation in the City of Medford is 18.36 inches (Ryan Sandler, personal communication, July 28, 2016). From 1985 through 1992, annual precipitation was closer to 15 inches for all but one year. Even the flows at Big Butte Springs, Medford's water source, showed declines in the spring, rather than the usual increases from snow melt. The water flow in Big Butte Springs fell from 32 mgd to 28 mgd. The Medford Water Commission can compensate for the shortfall at Big Butte Springs by pulling water from the Rogue River at the Robert A. Duff Water Treatment Plant. The Medford Water Commission has not had to do that; the total flow at the Big Butte Springs is greater than the amount that is delivered to town (Sara Bristol, personal communication, August 22, 2016).

More recent drought information can be found in the Oregon Office of Emergency Management and Oregon Office of Water Resources *Drought Annex State of Oregon Emergency Operations Plan* from January 2016. "Record warm temperatures during 2015 contributed significantly to water supply shortages throughout the state. Warm temperatures led to a winter with record-low or near-record-low snowpack, contributing to dry soils and vegetation, as well as lower than normal streamflows and peak runoff occurring earlier in the year" (Oregon Office of Emergency Management and Oregon Water Resources Department, 2016).

Figure 32. Drought Declarations in Oregon in 2015



Source: Oregon Office of Emergency Management and Oregon Office of Water Resources, 2016

Table 16 provides descriptions of documented severe weather events in the Medford area. One of the most recent events in the table is a major winter storm.

On January 3, 2017 the City of Medford received an historic snowstorm ranging from 8 inches to around one foot. The 8.3 inches of snow that fell at the airport was the second largest calendar day snowfall in 106 years of record-keeping. This one daily snowfall was more than two times greater than the entire normal seasonal snowfall. The heavy wet snow caused numerous downed trees and branches leading to localized power outages. Due to cold temperatures, icy and snowy road conditions lingered, especially in the surrounding hills, causing the Medford school district to cancel classes for the entire week. The last storm to bring prolonged snowy and icy road conditions to the City of Medford occurred more than 3 years prior to this snowstorm (Ryan Sandler, personal communication, January 9, 2017).

Table 16. Significant Historic Weather Events

Date	Location	Type of Severe Weather	Description
Dec. 1861	Statewide	Snow	Snowfall 1-3 inches. Snow in Willamette Valley until late February 1862.
Jan. 1916	Statewide	Snow	Two snow storms, each dropped 5 inches or more.
Winter	Portland	Snow	Heavy snowfall.

Date	Location	Type of Severe Weather	Description
1927, 1936, 1937, 1943, 1949	area, W. Oregon		
Apr. 1931	W. Oregon	Winter storm	Unofficial wind speeds reported at 78 mph. Damaged fruit orchards and timber.
Jan. 1950	Statewide	Snow	Friday the 13th Storm. Heaviest snowfall since 1890. Freezing rain. Deep snowdrifts closed all highways west of the Cascades and through the Columbia Gorge. Roads and schools closed. Downed power lines. Severed communication. Hundreds of thousands of dollars in property damage.
Nov. 1951	W. Oregon	Winter storm	
Dec. 1951	W. Oregon	Winter storm	Statewide storm with wind speeds 60 mph in Willamette Valley. Widespread damage to transmission and utility lines. Damaged buildings.
Dec. 1955	W. Oregon	Winter storm	
Winter 1956 1960, 1962	W. Oregon	Snow, ice	Packed snow became ice. Many auto accidents.
Nov. 1958	Statewide	Winter storm	Every major highway blocked by fallen trees during windstorm. Gusts up to 71 mph.
Mar. 1960	Statewide	Snow	Snowfall amounts were 3-12 inches depending on location.
Oct. 1962	W. Oregon	Winter storm	1962 Columbus Day Storm. Most severe windstorm for Western Oregon due to sustained wind speeds and damage levels. Winds in the Willamette Valley up to 116 mph. 84 homes destroyed, 5,000 severely damaged. Killed 38 people and created $170-200 million in damages in the state. Trees and power lines toppled in Medford by 58 mph gusts.
Dec. 1964	Statewide	Heavy rains and flooding	DR-184. The statewide event occurred on December 24, 1964.
Mar. 1963	W. Oregon	Winter storm	
Oct. 1967	W. Oregon	Winter storm	
Jan. 1969	Statewide	Snow	Record-breaking snowfalls. $3 to $4 million in property damage.
Mar. 1971	W. Oregon	Winter storm	Great damage in the Willamette Valley; homes and power lines destroyed by falling trees.
Jan. 1972	W. Oregon	Storms and flooding	DR-319. Storm and flooding events on January 21, 1972.
Feb.–May 1977	Medford and Ashland	Drought	Ashland instituted water rationing in Feb. Reeder Reservoir was at 80% of capacity. Medford discussed voluntary conservation measures. Mountain snowpack was at 48% of average in April. May rains eased the situation.
Jan. 1980	Statewide	Winter storm	Series of storms bringing snow, ice, wind, and freezing rain. Six fatalities.
Nov. 1981	W. Oregon	Winter storm	
Feb. 1985	Statewide	Snow	Western valleys received 2-4 inches of snow. Massive power failures (tree limbs broke power lines).
1985-1992	Medford	Drought	Normal annual precipitation in the City of Medford is 18.36 inches. From 1985 through 1992, annual precipitation was closer to 15 inches for all but one year.
Mar. 1988	Statewide	Winter storm	Strong winds. Heavy snow.
Feb. 1989	Statewide	Winter storm	Heavy snowfall. Record low temperatures.
Jan. 1990	Statewide	Winter storm	Heavy rain with winds greater than 75 mph; significant damage; 1 death.
Feb. 1990	Statewide	Snow	Average snowfall from one storm was about 4 inches in the Willamette Valley.
1991	Medford	Winter storm	Storm caused temperatures to drop to 6 F below zero at night and remain below 12 F during the day. This weather lasted one week; caused damage to water pipes, heating systems, and crops and affected natural gas distribution.
1992	Medford	Drought	Resulted from a run of 8 years of the warmest and driest on record. Flows in the Big Butte Springs fell from 32 to 28 million gallons per day. Water was pulled from the Rogue River.
1992	Medford	Cold	An unusual cold spell created a draw on electrical power; Medford was on the edge of a brownout. US Army Corps diverted power from Lost Creek Power Plant to resolve the problem.

Date	Location	Type of Severe Weather	Description
Dec. 1992	W. Oregon	Snow	Heavy snow. Interstate 5 closed.
Feb. 1993	W. Oregon	Snow	Record snowfalls.
Dec. 1995	Statewide	Winter storm	Winds reached 62 mph in the Willamette Valley.
Dec. 1996	Statewide	Winter storm	DR-1160. Severe snow and ice. Up to 4 to 5 inches of ice in the Columbia Gorge. Interstate 84 closed for 4 days. Hundreds of downed trees and power lines.
Nov. 1997	W. Oregon	Wind storm	Uprooted trees. Considerable damage to small airports. Winds up to 52 mph.
Winter 1998-1999	Statewide	Snow	Series of storms. One of the snowiest winters in Oregon history.
July 2000	Rogue Valley	Rain and wind	Heavy afternoon rains, lightning, and strong winds resulted in power outages (e.g. traffic snarled as signals were off) and sparked small rural fires.
Feb. 2002	W. Oregon	Winter storm	Damages $6.14 million. Downed power lines and trees. Buildings damaged. Power outages caused some water supply problems.
Dec. 2003-Jan. 2004	Statewide	Snow and ice	DR-1510. Much of Portland area shut down. Twenty-six counties receive FEMA assistance.
Dec.2005 - Jan. 2006	Statewide	Storms, flooding, landslides, mudslides	DR-1632 declared in March 2006. Statewide impacts from storms, floods, landslides, and mudslides. Events occurred December 18, 2005 through January 21, 2006.
Jul. 2006	Statewide	Heatwave	Multiple days of temperatures over 100 degrees Farenheit.
Dec. 2006	W. Oregon	Winter storm	
Dec. 2007-Jan. 2008	W. Oregon	Winter storm	DR-1824. Severe winter storm, record and near record snow, landslides and mudslides.
Dec. 2009	Statewide	Winter storm	Snow and freezing rain in Salem, and Portland to Hood River. I-84 closed for 22 hours.
Nov. 2010	Statewide	Winter storm	Snow, freezing rain, and ice in Portland to Hood River.
Jan. 2011	Statewide	Winter storm	DR-1956. Severe winter storm, flooding, mudslides, landslides, and debris flows.
Aug. 2013	Jackson County	Rain and thunderstorms	On August 7, 2013 Monsoonal moisture combined with passing upper level disturbances and created thunderstorms over southern Oregon, some of which became severe.
2014	Regions 4, 6-8	Drought	Executive Order No. 14-04. May 6, 2014. Governor declared drought in 10 counties including Jackson and Josephine Counties. This was the third driest Nov.-Jan. period since 1895.
Dec. 2014	Jackson County	Wind and rain	On December 10 and 11, 2014 wind damage caused roofs to blow off, power lines and trees went down, One person died when a tree fell on a camper's tent.
Apr. 2015	Jackson County et al.	Drought	Executive Order No. 15-05. April 29, 2015. Determination of state of drought emergency in Deschutes, Grant, Jackson, Josephine, Lane, Morrow, Umatilla, and Wasco Counties due to drought, low snow pack levels, and low water conditions.
Dec. 2015	Western Oregon	Winter storm	DR-4258. Severe winter storms, straight-line winds, flooding, landslides, and mudslides. On December 12 and 13, 2015, a series of systems brought heavy precipitation – rain and snow. Power outages and downed trees occurred in Medford and other cities in Jackson County.
January 2017	Medford	Winter storm	Snowfall amounts ranged from 8 inches to 1 foot. The 8.3 inches of snow which fell at the airport was the 2nd largest calendar day snowfall in 106 years of record-keeping

Source: Taylor and Hatton, 1999; Oregon DLCD, 2015; NOAA NCEI Storm Events Database: https://www.ncdc.noaa.gov/stormevents/; FEMA Disaster Declarations website: https://www.fema.gov/disasters; Ryan Sandler, personal communication, July 28, 2016; https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=422599, Oregon Office of the Governor, 2014a, 2015; NOAA National Centers for Environmental Information, n.d.-a,-b,-c; and City of Medford, 2010.

Probability

The *2015 Oregon NHMP* states, "Natural hazards are often an expression of extreme conditions – windstorms, rain storms, floods, droughts, and so on. Extreme precipitation is perhaps the most common and widespread natural hazard in Oregon" (Oregon DLCD, 2015).

It is important to note that severe weather events are often the result of events that affect large geographic areas in Oregon and the Pacific Northwest. As such, it is difficult to make regional severe weather probability assessments. One approach to assess probability is to examine the pattern of historic severe weather events. See the History section for documented severe weather events in Medford and the surrounding area.

Because there has been more frequent severe weather in winter months, there is more data to support probability and vulnerability assessments for those types of events. There is a lack of sufficient data to assess the probability of events that occur less frequently and have a lesser impact on our communities. Based on climate change research, general probability statements about projected impacts of a changing climate on severe weather hazards are made.

A study by the Oregon Climate Change Research Institute, *Climate Change in the Northwest: Implications for our Landscapes, Waters, and Communities*, states that "Measures of temperature and precipitation extremes are projected to increase in the Northwest" (Dalton, Mote, & Snover, 2013).

According to the study,

> Climate models are unanimous that measures of heat extremes will increase and measures of cold extremes will decrease. Averaged over the Northwest, North American Regional Climate Change Assessment Program (NARCCAP) results project that in the period averaged over 2041 to 2070 there will be more days above maximum temperature thresholds and fewer days below minimum temperature thresholds compared with the 1971 - 2000 average. For example, the number of days greater than 32 °C (90 °F) increases by 8 days (± 7), and the number of days below freezing decreases by 35 days (± 6). Future changes in precipitation extremes are more certain than changes in total seasonal precipitation. The number of days with greater than 1 in (2.5 cm) of precipitation is projected to increase by 13% (± 7%) and the 20-year and 50-year return period extreme precipitation events are projected to increase 10% (-4 to +22%) and 13% (-5 to +28%), respectively, by mid-century (Dalton et al., 2013).

According to Ryan Sandler (personal communication, July 28, 2016) of NWS "Due to climate change, the probabilities are a moving target." He uses the 1981-2010 (most recent 30 year normal period) for recurrence intervals. He provided the following information for the City of Medford; data was recorded at the airport, except between 1911 and October 31, 1929, which were recorded downtown.

- About 2 inches of daily rainfall every 2 years, and 3 inches of daily rainfall every 10 years according to the *NOAA Atlas 2 Precipitation-Frequency Atlas of the Western United States 1973*. The all-time daily rainfall record is 3.30 inches in 1962.

- About every 2 years the temperature will reach 106+ deg. F. About every 3 years the temperature will reach 108+ F. About every 10 years the temperature will reach 110+ F. The all-time record is 115 F in 1946.

- About 2 out of 3 years sees a 1+ inch daily snowfall. About 1 out of 3 years sees a 2+ inch daily snowfall. About 1 out of 6 years sees a 3+ inch daily snowfall. About 1 in 15 years sees a 4+ inch daily snowfall. The all-time daily snowfall record is 11 inches in 1919.

- Low temperatures reach 10 F or lower about once every 10 years. The all-time coldest temperature is -10 F in 1919.

- The highest peak gust of wind was 75 mph in 1950. Wind is highly variable especially during thunderstorms. Nearly every year or two, there will be damaging winds in the city.

It's difficult to define drought for Medford. The city has ample water supplies with Big Butte Springs and the Rogue River, so there have never been city water shortages. The local irrigation district, which relies on reservoirs, has cut off water late in the summer, but usually it is late enough in the season that local supplies are adequate to sustain the major commercial growers. Drought conditions seem to occur in the region about every 10 years (Ryan Sandler, personal communication, July 28, 2016).

Vulnerability

Vulnerability assessment typically combines information on the hazard pathway with information on existing development exposed to that hazard. In the case of severe weather in Medford, there is no specific hazard pathway to map and thus, it is difficult to specify the exposed assets and persons to an individual hazard. History provides insight on the past patterns of windstorms, rain, snow, ice, heat, cold, and drought events. In reality, all persons and critical facilities are at risk from severe weather impacts, especially those that result in power outages. Critical facilities are identified and discussed in Chapter 1, Section 8 Critical Facilities, Critical Infrastructure, and Lifelines. **Figure 23** shows the location of critical facilities.

Windstorms: According to the *2015 Oregon NHMP*, windstorms in Region 4 "can occur when Pacific Ocean winds travel inland in a northeasterly direction. These storms generally impact the region's buildings, utilities, tree-lined roads, transmission lines, residential parcels, and transportation systems along open areas such as grasslands and farmland" (Oregon DLCD, 2015).

Winter storms: In addition, the *2015 Oregon NHMP* describes winter storms in Region 4 as follows, "Cold weather and high precipitation impact the region annually. Severe winter storms can shut down the I-5 corridor passage through the Siskiyou Mountains, which can adversely impact the economy regionally and statewide" (Oregon DLCD, 2015).

Droughts: The *2015 Oregon NHMP* states "Droughts can affect commerce, agriculture, fisheries, and overall quality of life in all three counties. Jackson and Josephine Counties were declared federal primary natural disaster areas by the U.S. Department of Agriculture in 2013" (Oregon DLCD, 2015).

Drought conditions also increase the risk of wildland fires, thus threatening the safety of the growing number of residents residing in wildland-urban interface (WUI) areas and rural communities. Wildfires are discussed in Chapter 2 in Section 5 Wildland-Urban Interface Fires. Medford's greatest risk from drought is the heightened risk of WUI fire in the eastern UGB area and around the city limits. Medford's drinking water supply is not highly vulnerable to drought.

During drought years, the southern Oregon economy is hurt as irrigators, local orchardists and farmers face diminishing water supplies. Fruit harvests that occur later in the growing season, such as Bosc and Comice pears, are especially vulnerable. Portions of three irrigation districts are within Medford's UGB. These are: the Medford Irrigation District; the Rogue River Valley Irrigation District; and the Talent Irrigation District; these are mapped on **Figure 33**. On farm lands, a variety of orchard fruits are grown, as well as alfalfa, grass hay, row crops, grass seed, pasture gardens and sugar beet seed. Following the principle of "first in time, first in use" during a drought, the Watermaster cuts back users with junior

water rights when the stream system cannot satisfy all users. At times, this has resulted in no users with rights dating after 1906 receiving their appropriation (City of Medford, 2010).

Each of the irrigation districts has diversions off Bear Creek that feed their systems. During times of drought, the needs of migrating fish can compete with irrigation needs. As more water is taken from Bear Creek, water temperatures rise. Silt is released into Bear Creek when canal gates are lifted, decreasing the amount of oxygen in the water and increasing water temperatures. Thus, conflicts can arise between the needs of the agricultural community and wildlife habitat.

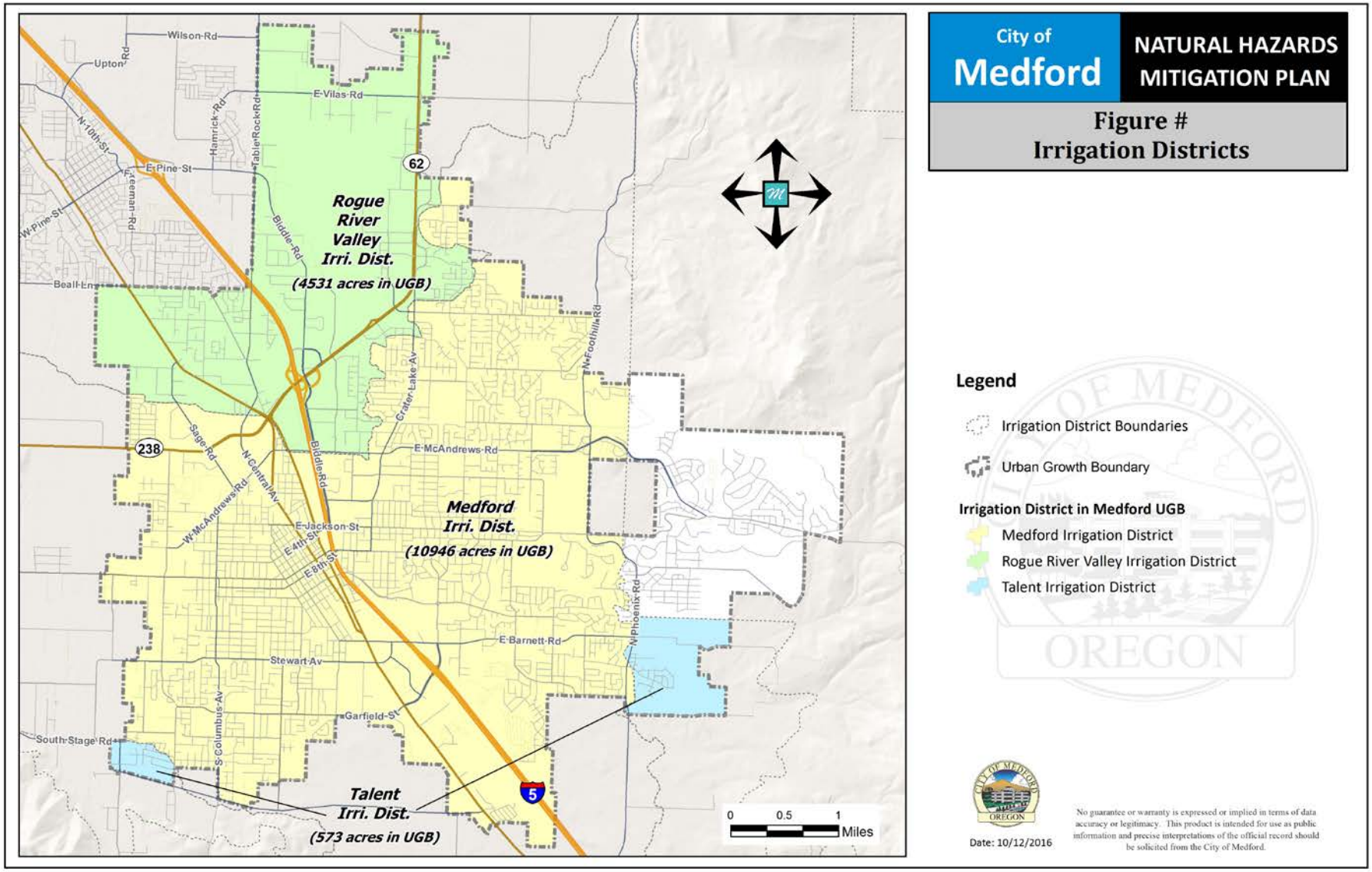
Severe weather events can affect buildings and infrastructure directly or indirectly. Direct effects include damages within Medford. Indirect effects involve damages occurring outside of the city that still affect Medford, such as disruption of transportation routes or utility services.

Table 17 provides a description of the generalized probable impacts to Medford in terms area, people, and structures. **Table 18** is the vulnerability assessment, which specifies: the location and extent of severe storms; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assets.

Table 17. Probable Impacts of Severe Weather in Medford

Inventory	Probable Impacts
Portion of Medford affected	Severe winter storms may affect all of Medford, although the severity of impacts typically varies significantly with location within Medford and Jackson County.
Buildings	Isolated damage from tree falls, wind, heavy snow loads, landslides, and localized flooding. Mobile homes are more vulnerable to high winds.
Streets and roads within Medford	Road closures due to snow or ice, tree falls, landslides or flooding, and related debris.
Highways to/from Medford	Road closures may also affect major highways to/from Medford.
Airports	Severe weather may result in temporary closures of Rogue Valley International – Medford Airport and smaller airports in the area.
Electric power	Loss of electric power may be localized or widespread due to effects of wind, snow, ice, and tree falls on local distribution lines or very widespread transmission line fail
Other utilities	Generally minor impacts on other utilities from winter storms, except for possible effects of loss of electric power. Telephone and other telecommunications systems with above ground lines may also experience outages.
Casualties	Potential for casualties (deaths and injuries) from tree falls or contact with downed power lines or from traffic accidents.

Figure 33. Irrigation Districts



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, October 12, 2016

Table 18. Vulnerability Assessment for Severe Weather

Location	Probability	Extent	Overview of Resources at Risk
All of Medford within the UGB and outside of the UGB.	Severe weather events are often the result of events that affect large geographic areas in Oregon and the Pacific Northwest. As such, it is difficult to make regional severe weather probability assessments. One approach to assess probability is to examine the pattern of historic severe weather events. Due to climate change, the probabilities are a moving target.	The strength or magnitude of the hazard is that severe weather may happen quickly, or slowly, and may last for minutes, hours, or days. It could vary in levels of severity.	High winds and heavy snows put structures at risk. Physical impacts to all types of structures and utilities may occur when trees fall and block roadways. Utilities outages such as power, phones, internet service, and broadcast media can impact operations of businesses and industries, and well-being of residents.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
20101 NHMP All areas of the City and all structures are potentially at risk. The effects of severe weather can be felt throughout the City or only in a particular area, depending on the event.	2017 NHMP All areas of the City and all structures are potentially at risk. The effects of severe weather can be felt throughout the City or only in a particular area, depending on the event.	Severe weather can have impacts particularly on young, elderly, and the medically fragile. Those who are dependent on electric-powered assistance devices and utilities.	Hospitals and the Regional Water Reclamation Facility (waste water treatment plant) are vulnerable if the length of the outage surpasses capacity of back-up systems. Fallen trees and debris can disrupt the transportation network. Medford Water Commission operations depend on electricity. High winds, snow, and ice can disrupt airport traffic by damaging airplanes on the ground, and limiting or preventing them from flying and landing.	Commercial and industrial enterprises may close due to outages. Even on a temporary short-term basis, this can have a significant impact. High winds can blow roofs off buildings or damage them. Snow loads can cause roofs to collapse. Sustained conditions may impact retail sales and the hospitality industry.	Windstorms can blow down large numbers of trees and/or limbs. Debris can jam Bear Creek and its tributaries.

Section 3 Floods

Introduction and Hazard Overview

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> Floods affect Southwest Oregon (Region 4) in the form of riverine flooding often preceded by rapid snow melt and heavy rain. All of the region's counties are considered moderately vulnerable to flooding. There are 18 repetitive flood loss properties in Region 4. There are 102 state-owned/leased facilities, valued at approximately $45.4 million, located in the region's flood hazard zone. Of these, four are considered critical/essential facilities. An additional 80 non-state-owned/leased critical/essential facilities are also located in this hazard zone (Oregon DLCD, 2015).

The Rogue Valley has a long history of destructive flood events. Over the past 60 years, major floods occurred in the Rogue Valley in 1955, 1962, 1964, 1974, and 1997. The region experiences the most severe flooding conditions when the effects of snowmelt and direct, heavy rainfall combine during periods of warmer temperatures in winter and early spring months. The peak months for flooding are November, December, and January. These floods can threaten public health, safety, and welfare by destroying or isolating structures, disrupting transportation systems, polluting water supplies, and destroying basic public facilities, such as sewer and electric services.

Types of Hazard

> A flood is any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. Floods occur for many reasons, such as long-lasting rainfall over a broad area, locally intense storm-generated rainfall, or rapid melting of a large snow pack with or without accompanying rainfall. Because floods result from many different circumstances, not all floods are equal in magnitude, duration, or effect (Holmes & Dinicola, 2010).

Medford is subject to these types of flooding: riverine, urban, and levee or dam failure.

Riverine Flooding: River flooding occurs when river or stream water levels rise and spill over the banks. This type of flooding often results from prolonged rainfall over a large geographic area and/or melting snowpack. River flooding is an important natural process that adds sediment and nutrients to fertile floodplain areas. Rivers can also change course over time, called channel migration, which can change where rivers crest in their banks.

Urban Flooding: As land is converted from natural-scape to hard-scape, the environment loses its ability to absorb rainfall. This transition from pervious to impervious surfaces results in more and faster runoff of water. During periods of urban flooding, streets can become swift moving rivers and storm drains may back up, causing additional nuisance flooding (Oregon DLCD, 2015). This falling and moving water will need a place to go, either absorbed or directed elsewhere.

For local rainfall events that exceed the collection and conveyance capacities of the stormwater drainage system, some level of flooding inevitably occurs. In many cases, local stormwater drainage systems are designed to allow minor street flooding to carry off stormwater that exceeds the capacity of the stormwater drainage system. In larger rainfall events, flooding may extend beyond streets and into yards. In major rainfall events, local stormwater drainage flooding can also flood buildings. In extreme

cases, local stormwater drainage flooding can result in several feet of water in buildings, with correspondingly high damage levels and loss of function.

According to a City of Medford engineer (Larry Beskow, City of Medford, personal communication, 2003) development in east Medford has changed both Lazy Creek and Lone Pine Creek. Much of the flow of these creeks, and others in Medford, has been piped. Development throughout Medford has increased the amount of runoff going into the stormwater system, which in turn, discharges into local creeks. Higher volumes of water are flowing at a faster rate into and through these creeks.

When this additional water flows into the streams during a heavy rain, it can cause flash flooding. A flash flood is a rapid flooding of low-lying areas in less than 6 hours (FEMA, 2015a). Over time, these heavy, sudden discharges have eroded and degraded the streambeds. Due to encroaching development, these streams are no longer able to meander through their floodplains, and the narrowed floodplains and filled wetlands no longer provide flood storage capacity. Development is also susceptible to damage during floods. Protection methods, such as the use of riprap, have tended to increase downstream impacts due to increased flow speeds.

Dam or Levee Failures: Levees are designed to protect against a certain level of flooding. However, levees can and do decay over time. Levees can also be overtopped or breached. Dams are an important resource in the U.S., providing many functions that include recreation, flood control, irrigation, water supply, and hydroelectric power. Dams can be overtopped or breached. Levee and dam breaches can result in flooding (FEMA, 2015a).

Location and Extent

The locations of floods that may affect the City of Medford are described within river related or dam inundation zones categories. The extent of the floods, or the strength or magnitude of the hazard, is variable. The extent of floods is further described in the Probability subsection. The Flood Hazard map, **Figure 35**, also provides location and extent information.

The Rogue River lies to the north of Medford and Bear Creek bisects the city. Emigrant Lake and Creek are south of Medford. In addition to flooding related to Bear Creek and the Rogue River, the City of Medford has been impacted by slow-rise flooding along Larson, Lazy, Elk Creek Terrain, and Lone Pine Creeks. Some flash flooding from heavy down pour may occur on Lone Pine Creek and Larson Creek. A portion of the City to the west borders the Elk Creek tributary, which can exhibit uncontrolled flooding. Localized flooding in the urban area may also result from debris blocking and plugging drainage systems.

Three dams in the Medford area could, if damaged, impact Medford with flood waters. These are the Lost Creek, the Emigrant, and the Hosler Dams. The extent of flooding would depend strongly on creek and river levels at the time of dam failure; the amount of available storage in dams downstream of a dam which failed; and whether or not progressive failure of downstream dams were to occur. Impacts of dam breaching could be exacerbated by heavy rainfall. Inundation area maps show the timing and extent of expected flooding from dam failure (National Dam Safety Review Board Emergency Action Plan Workgroup, 2009). Inundation maps are part of Emergency Action Plans and other operational plans prepared by dam owners. The maps are used for emergency and evacuation planning. An additional description of dams and their impacts, if breached by any method, is included in this section in Vulnerability. Section 4 Earthquakes notes the relationship of dams and earthquakes.

Medford's levees are limited to structures to contain irrigation canals, which may carry flood waters. Failures could result in inundation of residential yards (Roger Thorn, Medford Public Works, personal communication, December 15, 2016).

History

The flood of 1890. This flood began with the development of a solid snow pack resulting from heavy and continual snowfalls starting in October and extending through January. Snows blocked train travel over the Siskiyou Mountains and southbound passengers were stranded in Ashland for 33 days. In February, temperatures registered from 45 to 55 degrees Fahrenheit. In the first five days of February, 7 inches of rain fell. Nearly every bridge on every creek and river within the county was lost. The wooden Main Street Bridge over Bear Creek in Medford, only a year old, collapsed as locals posed on the bridge for photographers. Repair of the bridge was not completed until July (Miller, 2002).

The flood of 1962. This flood turned some Medford streets, including South Central and Riverside, into small streams. Buildings along Riverside and Central Avenues suffered damage from high waters. According to an article in the *Medford Mail Tribune*, a lake formed near 706 South Central Avenue.

> Several cars attempted to park in the lot at the Pacific Fruit and Produce company and found water well up the side of the vehicle. This water was reported coming from a creek in southwest Medford as was that running down Riverside ave. The small river on that avenue turned at Eighth St., crossing the bridge to cascade down the access road to Hawthorne park ("Week End Storm," 1962).

The flood of 1964. There were over $157 million of losses in the state, seven deaths and thousands evacuated. Before FEMA was created by Presidential executive order on April 1, 1979 (FEMA, n.d.-a), flood rating estimates were not always performed. Using current modeling efforts with historic records about river stages and discharges, FEMA's retrospective evaluation of this flood rated it approximately as a 100-year flood. It may have been the most damaging in Oregon's history. It was devastating to the Rogue Valley region; some 600 persons were evacuated. Bridges throughout the county were either washed out or rendered impassible, including Dodge Bridge, the Rogue River Bridge, the bridge over the Rogue River in Shady Cove, and the Gold Ray Bridge. State highways were closed in several directions. The flood's effects led, in part, to the construction of both Applegate and Lost Creek Dams by the Army Corps of Engineers ("Water – Its Flow," 1965).

Heavy snows followed by persistent rains triggered this flood that began in the last half of December and extended into January. At the time, Medford's normal December rainfall was 3.38 inches; December of 1964 brought 12.72 inches of rain. The communities of the Upper Rogue, Eagle Point, Gold Hill, Rogue River, and Shady Cove were hardest hit, but the effects were felt beyond their particular locales. A natural gas transmission line was washed out at the Gold Hill river crossing. Telephone and electric services were interrupted. Damage to the power system, including clean-up costs, was estimated at $3 million ("Water – Its Flow," 1965).

In Medford, the effects were less dramatic, but nonetheless troublesome:

> General flooding was reported by Medford Public Works Director Vernon Thorpe, on Mace Road in the Berrydale Area. Water was backing across Ellendale Drive behind St. Mary's High School…Closed to traffic today was Crater Lake Avenue north of Delta Waters Road, and Highland Drive from Greenwood Avenue to Barnett Road. Water was

> reported across the roads… Precautionary measures were being taken by the Medford Water Department to keep the 12-inch water main under the Main Street Bridge secure. …Large rocks were being dumped along the stream banks to keep soil from washing away ("Rogue Runs Wild," 1964).

The New Year's Flood of 1997. The second landmark flood, known as the New Year's flood, occurred in late December 1996 and early January 1997. This flood came on the heels of two months of very wet weather that had saturated local soils. The dramatic, short-lived flood events began on New Year's Eve. By January 2, however, it was reported that Bear Creek was flowing at one-eighth its New Year's Day flow ("Rogue Runs Wild," 1964). Officials estimated that Bear Creek flowed at 16,100 cubic feet per second, breaking a record set during the storm of December 14, 1962, when the creek flowed at more than 14,500 cubic feet per second ("Jan. 1: High Waters," 1997).

Residents of Crest Imperial Estates mobile home park off Barnett Road in Medford had to evacuate their homes. Some units were hauled to different locations before daybreak. One was swept away into the waters of Bear Creek. A total of eight mobile homes were destroyed. About 30 people took shelter in the National Guard Armory in Medford and the armory's parking lot was used for recreational vehicles (RVs), relocated from RV parks along Bear Creek ("Jan. 1: High Waters," 1997). The Barnett Townhomes, a fairly new low-income housing complex on Ellendale Drive, suffered damage from Larson Creek.

The telephone system was not fully operative on New Year's Day. A US West official reported that some 90% of all northbound long-distance telephone traffic from the Medford area was failing. This was traced to a broken fiber optic cable, exposed during a landslide on Tin Pan Peak near Rogue River ("Jan. 1: High Waters," 1997). This caused many problems for several days, such as ATM machines being inoperable in Grants Pass.

During this flood, there was severe damage to the historic plaza of Ashland, while damage in the Medford was less significant. According to National Flood Insurance Program (NFIP) records on this disaster (DR-1160), ten properties in Medford, valued at a total of $1,718,891, claimed damages with NFIP. These damages totaled $81,458. NFIP paid a total of $76,683 for insured damages. No NFIP payments were made for the contents of these buildings. From its Public Assistance Program that covers public facilities, FEMA provided the city with $47,234, representing 75% of the total damage of $62,979 to eight properties (City of Medford, 2010).

Jackson County's initial damage assessment report indicated that the New Year's Flood had caused $16 million in damages to housing; $12 million in damages to businesses; $9 million in damages to agriculture; and $13 million in damages to local government in costs and losses. Most of the housing damage occurred along Bear Creek. Nearly all business damage occurred along Ashland Creek, a tributary of Bear Creek. Agricultural damage was predominantly experienced in the Little Butte Creek and Applegate River watersheds. Infrastructure damage was sustained throughout the county (City of Medford, 2010).

Table 19. Significant Historic Floods

Date	Location	Type of Flood	Description
Feb. 1890	Medford	Rain on snow, flooding	Solid snowpack and heavy snowfall between Oct. 1889 and Jan. 1890. Feb. temperatures of 45-55 F with 7 inches of rain. Floods followed.
Dec. 1955	Statewide	Rain on snow	DR-49. Event occurred on December 29, 1955. Flooding and strong winds; 5 fatalities.
Jul. 1956	Statewide	Storms, flooding	DR-60. Event occurred on July 20, 1956. Storms and flooding.

Date	Location	Type of Flood	Description
Mar. 1957	Statewide	Flooding	DR-69. Event occurred on March 1, 1957.
Oct. 1962	Medford, Statewide	Storms	DR-136. Event occurred on October 16, 1962. Continued. Medford's rainfall in December was 12.72 in instead of normal of 3.38 in.
Feb. 1963	Statewide	Flooding	DR-144. Event occurred on February 25, 1963.
Dec. 1964	Medford, Statewide	Heavy rains, flooding, rain on snow	DR-184. Event occurred on December 24, 1964. Statewide damage totaled $157 million and 17 deaths.
1974	Western Oregon	Rain on snow, flooding	Flooding resulted from rain on snow events. Willamette River at Portland crested at 25.7 feet. Nine counties declared disasters.
Feb. 1986	Statewide	Snow melt, flooding	Intense rain, a melting snow, and flooding. Some homes evacuated.
1990	Western Oregon	Rain on snow, flooding	Ten rivers in eight counties were flooding in a rain-on-snow weather event. Many bridges were washed away.
Feb. 1996	Statewide	Storms, flooding, rain on snow	DR-1099 Winter storms with rain, snow, ice, floods, and landslides. Power outages, road closures and property damage. Warm temperatures, record breaking rains; extensive flooding in Multnomah County; widespread closures of major highways and secondary roads; 8 fatalities. 27 counties covered by the disaster declaration.
Nov. 1996	Statewide	Intense rain, rain on snow, flooding	DR-1149. Tropical air mass, intense rain, landslides, power outages.
Dec. 1996-Jan. 1997	Medford, Statewide	Winter storm, flooding	DR-1160. Severe snow and ice. Up to 4 to 5 inches of ice in the Columbia Gorge. Interstate 84 closed for 4 days. Hundreds of downed trees and power lines. Officials estimate that Bear Creek flowed at 16,100 cubic feet per second at one point.
Jan.-Feb. 1999	NW Oregon	Rain, flooding, landslides, mudslides	Widespread flooding on smaller rivers and streams; numerous landslides and mudslides.
Dec. 2007-Jan. 2008	NW Oregon	Winter storms, heavy rain, flooding	DR-1824. Severe winter storm, flooding, winds, record and near record snow, landslides and mudslides. Gresham received, 26" of snow. Many roads closed. Significant damages to public infrastructure, homes and businesses.
Jan. 2011	Statewide	Winter storm	DR-1956. Severe winter storm, flooding, mudslides, landslides, and debris flows.
Dec. 2015	Western Oregon	Winter storm, heavy rain	DR-4258. Severe winter storms, straight-line winds, flooding, landslides, and mudslides.

Source: NOAA NCEI Storm Events Database: https://www.ncdc.noaa.gov/stormevents/; FEMA, 2009b; Taylor and Hatton, 1999; FEMA, n.d.-d.

Probability

Flooding can happen anywhere, but certain areas are especially prone to serious flooding.

Scientists and engineers frequently use statistical probability (chance) to put a context to floods and their occurrence. This method of analysis is a tool and helps translate and implement the information. If the probability of a particular flood magnitude being equaled or exceeded is known, then risk can be assessed.

> The USGS and other agencies often refer to the percent chance of occurrence as an Annual Exceedance Probability or AEP. An AEP is always a fraction of one. So a 0.2 AEP flood has a 20% chance of occurring in any given year, and this corresponds to a 5-year recurrence-interval flood. Recurrence-interval terminology tends to be more understandable for flood intensity comparisons. (USGS, n.d.-d).

Another example would be that the 1-percent AEP flood has a 1 in 100 chance of being equaled or exceeded in any one year, and it has an average recurrence interval of 100 years. Therefore, it is often

referred to as the 100-year flood. Occurrence of a 100-year flood does not reduce the chances of another flood event of that level occurring within a short time period.

As described by the USGS, "Statistical techniques, through a process called frequency analysis, are used to estimate the probability of the occurrence of a given precipitation event. The recurrence interval is based on the probability that the given event will be equaled or exceeded in any given year" (USGS, n.d.-d).

A recurrence interval is defined as "The average number of years between floods of a certain size is the recurrence interval or return period. The actual number of years between floods of any given size varies a lot because of the naturally changing climate" (USGS, n.d.-d).

To help communities understand their risk, flood maps, also known as Flood Insurance Rate Maps (FIRMs), have been created by the FEMA to show locations with high-risk in Special Flood Hazard Areas (SFHA), moderate-to-low risk and undetermined-risk.

Special Flood Hazard Area: The term used by NFIP for "the floodplain identified on the flood insurance maps to represent the area that would be inundated by the base flood" (FEMA, 2009a). In these SFHA or high-risk areas, "there is at least a 1 in 4 chance of flooding during a 30-year mortgage. All home and business owners in these areas with mortgages from federally regulated or insured lenders are required to buy flood insurance. [High-risk areas] are shown on the flood maps as zones with letters A or V" (FloodPartners, n.d.).

According to FEMA,

> The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on NFIP maps. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V. (FEMA, n.d.-j).

The SFHA is shown in **Figure 35**.

Moderate to Low Risk Areas: "In moderate-to-low risk areas, the risk of being flooded is reduced but not completely removed." (FloodPartners, n.d). Moderate to low risk represents either 1% annual chance of flooding that is behind an accredited levee or a 0.2% annual chance of flooding that is behind an accredited levee or 0.2% annual chance of flooding. "These areas submit over 20% of NFIP claims and receive one-third of disaster assistance for flooding. Flood insurance isn't federally required in moderate-to-low areas, but it is recommended for all property owners and renters" (FloodPartners, n.d.). On flood maps, the moderate-to-low risk areas are shown as zones with letters B, C, X or shaded X (FloodPartners, n.d.).

Undetermined Risk Areas: "No flood-hazard analysis has been conducted in these areas, but a flood risk still exists. Flood insurance rates reflect the uncertainty of the flood risk. These areas are labeled with the letter D on the flood maps" (FloodPartners, n.d.).

Table 20 includes SFHA data for Jackson County, as collected from a FEMA map viewer. The data is at the county level, not at the city level. It still provides insight on SFHA.

Table 20. Special Flood Hazard Area Data for Jackson County

SFHA Data for Jackson County	
Percent of Population in SFHA	4.45%
Percentage of Housing Units in SFHA	4.65%
Riverine Area in SFHA	35.60 acres
Total Area in Jackson County	2801.64 acres
Riverine Housing Units in SFHA	4,226
Riverine Population in SFHA	9,031
Total Area in SFHA	35.60 acres
Total Housing Units in SFHA	4,226
Total Housing Units in Jackson County (2010)	90,937
Total Population in SFHA	9,031
Total Population in Jackson County (2010)	203,206

Source: English, 2015

NFIP and FIRM. In FEMA Region X's NFIP Guidebook: *A Local Administrator's Guide to Floodplain Management and the National Flood Insurance Program*, it states a study "showed that only 2% of the claims paid for flood damages are for post-FIRM structures (structures built after the date of a community's flood map and adoption of a local floodplain management ordinance), whereas 98% of the claims paid are for older or pre-FIRM structures. This is strong evidence that the NFIP is successful at protecting new development" (FEMA, 2009a).

Medford participants in the NFIP and conducts its land development in accordance with the guidelines established by that program. FIRMs, showing the anticipated levels of a hundred-year flood event (100-year floodplain), are maintained by the Planning Department. Medford's effective FIRM dates are: June 21, 1974 for the initial FIRM (FEMA, n.d.-c) and May 3, 2011 for the current FIRM (Oregon DLCD, 2011). Medford earned a Class 6 in the NFIP Community Rating Service (CRS) (Jim Huber, City of Medford, personal communication, July 26, 2016). The rating of 6 provides Medford with a 20% discounted rate on flood insurance to properties within the SFHA and a 10% discount for properties outside the SFHA (FEMA, 2015b).

Official FIRMs can be obtained online from the FEMA Flood Map Service Center (msc.fema.gov) or by contacting a jurisdiction. In Medford, contact the Planning Department.

The *Flood Insurance Study for Jackson County, OR and Incorporated Areas*, which became effective on May 2011, updated existing flood information (FEMA, 2011a). The original hydrologic and hydraulic analyses were performed by STRAAM Engineers, Inc. for FEMA and were completed in June 1978. The study covered "all significant flooding sources affecting the unincorporated areas of Jackson County" and the cities, including Medford (FEMA, 2011a).

The 2011 study provides the following information, with comments from DOGAMI staff:

- Larson Creek and portions of Bear Creek were re-delineated using contours derived from aerial photos. This is an improvement from the 1978 mapping, but re-delineation with lidar will provide better results.
- The section of Bear Creek just downstream of Crooked Creek confluence was not re-delineated and has not changed since the original 1978 study.
- Crooked Creek has not changed since the original 1978 study.

- Lone Pine and Lazy Creeks have not changed since the original 1978 study.
- Since the 2011 study does not mention it, it is assumed that all Zone A areas (lower Lone Pine Creek, Upton Slough, Ross Lane Drainage, and Swanson Creek) have not changed since the original 1978 study
- These locations are noted as unchanged since the 1978 study: the section of Bear Creek just downstream of Crooked Creek confluence, and Crooked, Lone Pine and Lazy Creeks (Jed Roberts, personal communication, August 18, 2016).

Medford does not have floodplain mapping based on lidar (Jed Roberts, personal communication, August 18, 2016). DOGAMI recommends the Digital Flood Insurance Rate Map (DFIRM) information from 2011 be updated with areas of potential mapping improvement in the following areas (see Appendix E for details):

- Approximate mapping (Zone A) for Upton Slough and Swanson Creek
- Approximate mapping (Zone A) for Ross Lane Drainage
- Ponding mapping (Zone AO) for Lone Pine Creek
- Possible expansion of flood mapping for Larson Creek and tributary
- Approximate mapping (Zone A) for Lone Pine Creek
- Approximate mapping (Zone A) for Lazy Creek (Jed Roberts, personal communication, August 18, 2016).

Conventional flood hazard maps examine only hazards posed by standing floodwaters on a given floodplain. However, damage from bank erosion as river channels naturally migrate may occur even in the absence of major flooding. Such channel migration can cause major damage. According to DOGAMI, channel migration doesn’t appear to be a major concern in the Medford area, but the susceptibility has not been studied. DOGAMI staff recommends that susceptibility be studied to help determine if detailed investigations and mapping are needed (Jed Roberts, personal communication, August 18, 2016).

Changing weather patterns, erosion, and development can affect floodplain boundaries. FEMA has been working to update and modernize flood maps by identifying watersheds where additional study may be needed. FEMA's 5-year Map Modernization Program put floodplain maps into digital format; the floodplain maps in Jackson County were updated as of May 3, 2011 (Oregon DLCD, 2011). These are the current floodplain maps and thus the current FIRM.

The update of the maps in Jackson County consisted of three major efforts:

> 1) New detailed studies of Daisy, Elk, Griffin, Horn, Jackson, and Mingus Creeks within the City of Central Point; 2) The digital conversion of effective floodplain mapping throughout the County. The digital conversion included the re-delineation of effective floodplain hazard areas using newly obtained topographic data within the Cities of Ashland, Central Point, Medford, Phoenix, Rogue River, and Shady Cove; and 3) The straight digital conversion, or capture, of flood hazards in areas without new topographic data. As part of the digitization process minor modifications were made to floodplain boundaries to improve mapping accuracy and alignment based on comparison to recent aerial photography (Oregon DLCD, 2011).

Oregon’s Risk Mapping, Assessment, and Planning (MAP) Program Coordinator states there have been six minor updates since May 3, 2011 (Steve Lucker, personal communication, August 17, 2016). Risk MAP is a program established and funded by FEMA and coordinated in Oregon by DLCD. Risk MAP

delivers quality data that increases public awareness and leads to action that reduces risk to life and property. Initially focused on flooding, Risk MAP now provides data, risk assessment and analysis for multiple hazards. Risk MAP's non-regulatory products enable communities to enhance their mitigation plans and actions (Oregon DLCD, 2011).

Climate change will certainly impact flooding. Climate change has already been discussed in both Section 1 Introduction and Section 2 Severe Weather. Reiterating that information briefly and building on that, related to flooding: there will be warmer and drier summers; an increase in extreme precipitation which includes an increased incidence of magnitude and return interval; and increased urbanized flooding from the more intense rain events in mid-winter (Oregon DLCD, 2015). Furthermore, the seasonal shifts in precipitation patterns means historical records may no longer provide a reliable guide to future flooding. See Appendix D for additional information.

Vulnerability

Geographic Information Systems (GIS) technology permits very detailed delineation and quantification of the City's vulnerability to flood hazard by attaching tabular data to geographic information. **Figure 35** is the Flood Hazard map. **Figure 23** is the Critical Facilities map, **Figure 16** is the People with Access and Functional Needs (PAFN) map, **Figure 17** is the Economic Assets map, **Figure 18** is the Annual Median Household Income map, and **Figure 36** is the Dam Inundation Zones map. These maps can be examined together to see where floods could impact Medford's assets such as population and economy.

Table 23 and **Table 24** are Medford's vulnerability assessments for the 100- and 500- year floods and include the summary of impact on exposed assets. **Table 25** provides that same data for the dam inundations zones. The tables specify: the extent of the 100- and 500- year floods in acreage; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); impacts to critical facilities; economic assets; and environmental assets. Impacts to human, natural and built systems that can be expected from flooding are summarized in a general description in **Table 21**.

For the 100-year flood, the number of structures within that area has decreased from 1,502 in the *2010 Medford NHMP* to 1,072 in the *2017 Medford NHMP*. The number of tax lots has increased from 953 in 2010 to 1,295 in 2017. The improvement value has nearly doubled, as it increased from $240,362,830 in 2010 to $444,845,390 in 2017. There are 855 acres in the 100-year floodplain. There are 82 employers with 1,627 employees within the 100-year floodplain.

For the 500-year flood, the number of structures within that area in 2010 was 3,694 while it is 3,782 in 2017. The number of tax lots was 2,248 in 2010 and is 3,124 in 2017. The improvement value in 2010 was $581,632,618 and in 2017 is $794,795,622.

For the dam inundation zones, the data in the *2010 Medford NHMP* was specific to Emigrant Dam. In the *2017 Medford NHMP*, the data includes Emigrant, Lost Creek, and Hosler Dams. Of note, inundation zones of the Lost Creek and Hosler Dams do not reach the Medford UGB. In 2010, there were 6,931 structures on 4,043 tax lots while in 2017 there are 7,155 structures on 4,630 tax lots. The improvement value in 2010 was $1,381,201,107 while it is $1,395,758,897 in 2017.

Growth and development in Medford has resulted in an increase in land divisions from 2010 to 2017, hence the increase in tax lots in the respective floodplain and inundation zones.

The data for the 100-year floodplain, 500-year floodplain, and the dam inundation zones is provided by the City of Medford (Chris Olivier, personal communication, March 24, 2017).

Table 21. Summary of Potential Flooding Impacts in General

Human systems	Increased risk of injuries, death, isolation, and displacement.	Release of toxic or hazardous materials from the inundation of industrial, commercial, or wastewater treatment facilities, or damage to storage tanks and pipelines.	Additional costs due to emergency response expenses, business closures, lost productivity and cleanup costs. Loss of displaced populations that choose not to return.
Natural systems	Loss of fish and wildlife washed into urbanized areas during flooding, called “stranding”.	Release of toxic or hazardous materials from increased street runoff and flooded businesses and homes, degrading water quality.	Loss of habitat through scour, erosion and vegetation removal that also increases water temperatures.
Infrastructure and the built environment	Water and structural damage to homes and businesses, as well as railroads, roads, bridges and culverts, and other infrastructure facilities located within, over or under floodplain locations.	Increased sediment in stormwater that can clog pipes and makes greenstreet facilities less effective.	Disruptions to utility (e.g., electricity, water, sewer) and transportation services.

Source: Multnomah County and City of Portland, 2014

Flooding poses challenges moving resources and providing services across Bear Creek. There are fire stations located on both sides of Bear Creek. Other resources such as the airport, both hospitals, the American Red Cross, the ODOT office/yard, the Jackson County Public Works, Transportation, Parks, Emergency Operations Center, and Sheriff’s offices (Oregon ARES, n.d.), and the Rogue Valley Regional Transit District bus yard and fueling facility are located on the east side. Resources such as the Rogue Valley Transit District paratransit dispatch center and vehicle yard, the Medford Service Center, the Oregon State Police, the National Guard armory, and the Jackson County administration offices are located on the west side of Medford. Floods could potentially impact much of Medford.

“In any disaster, buildings constructed to a higher standard not only reduce property damage but can also save lives. Homes constructed to National Flood Insurance Program (NFIP) standards incur 80 percent less damage from floods than structures not built to those standards” (FEMA, 2016). FEMA is particularly concerned about the elimination of repetitive losses. According to the Natural Hazards and Floodplain Specialist at the Oregon Department of Land Conservation and Development, the City of Medford has no NFIP repetitive loss and no severe repetitive properties loss properties on record as of August 22, 2016 (Christine Shirley, personal communication, August 22, 2016).

The NFIP defines a repetitive loss structure as an NFIP-insured structure that has had at least 2 paid flood losses of more than $1,000 each in any 10-year period. A severe repetitive loss structure is an NFIP-insured structure that has incurred flood damage for which:

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

FEMA provides guidance on floodplains and insurance in a variety of sources including *Saving on Flood Insurance, A Local Administrator's Guide to Floodplain Management and the National Flood Insurance Program*, and the Floodsmart.gov website.

Medford also participates in the NFIP's Community Rating System (CRS), as mentioned earlier. The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements (FEMA, n.d.-g). Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions (FEMA, 2007).

Table 22. NFIP Data for Medford, Oregon

Action	Date, Cost, or Amount
Effective FIRM and FIS	5/3/2011
Initial FIRM date	4/15/1981
Total policies	278
Pre-FIRM policies	116
Single family policies	214
2 to 4 family policies	8
Other residential	23
Non-residential	33
Minus rated A Zone	20
Minus rated V Zone	0
Insurance in force	$72,792,600.00
Total paid claims	13
Pre-FIRM claims paid	9
Substantial damage claims	1
Total paid amount	$88,145.13
Repetitive loss structures	0
Severe repetitive loss	0
CRS class rating	6
Last community assistance	9/29/2011

Source: Christine Shirley, DLCD, August 22, 2016

As noted in **Table 21**, flooding includes impacts to human, natural and built systems. Along the natural systems it should be recognized that development in floodplains disturbs habitat and species within and around that area. In July 2010, FEMA entered a settlement agreement with four organizations about the impact of NFIP related development on salmon. FEMA was required to then consult with the National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS). Subsequently, a scientific judgement called the Biological Opinion (BiOp) was published (Oregon DLCD, n.d.-a). It has the force of a decision document.

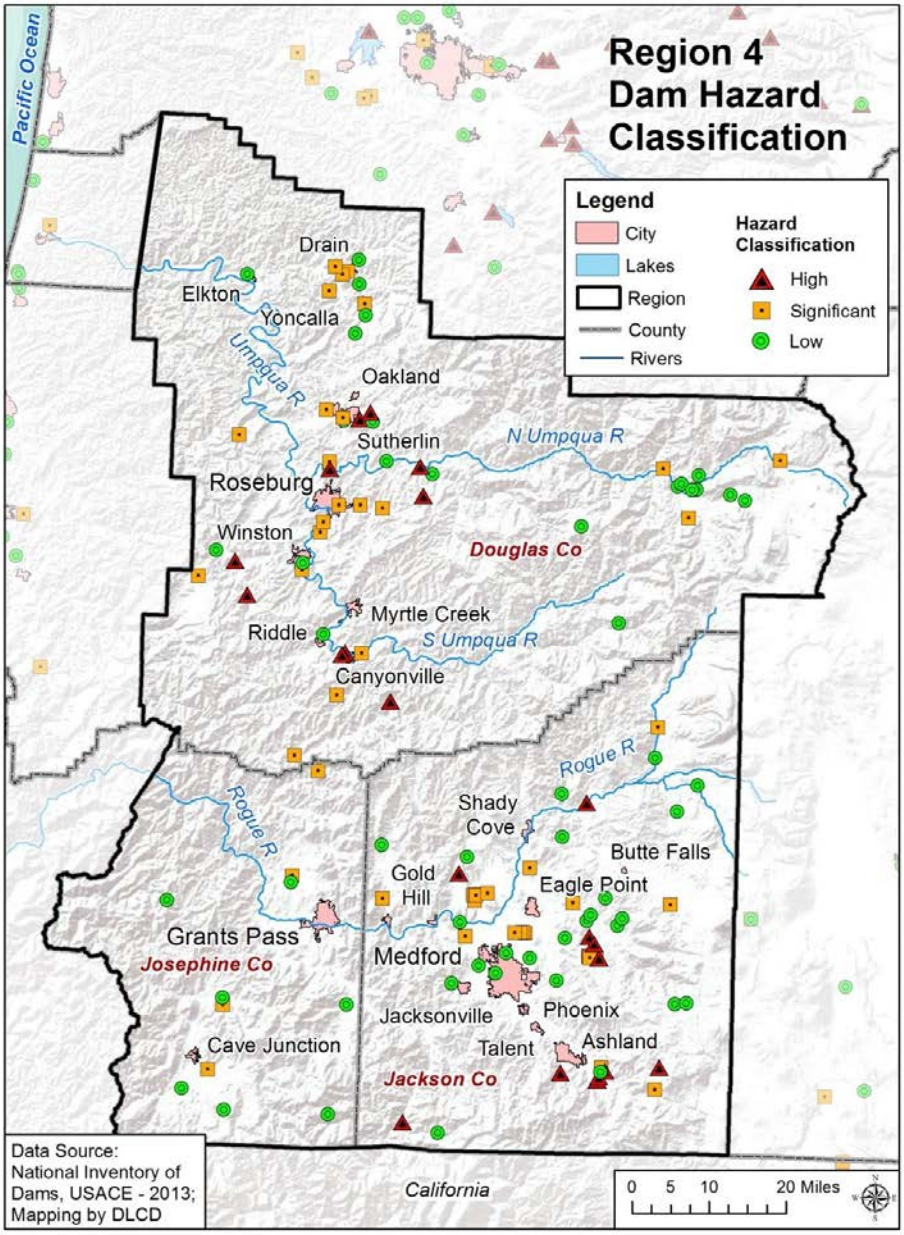
NMFS determined that "development in floodplains displaces important habitat, which salmon utilize during flood events, and contributes to instream water quality and hydrologic conditions that are unfavorable for fish" (Oregon DLCD, n.d.-a). FEMA is required to implement measures identified in the Reasonable and Prudent Alternatives (RPA) portion of the BiOp. The current interim phase is from the present through the next five years. NFIP communities in 31 counties with ESA listed salmonids will

need to increase habitat protections. FEMA will provide guidance, which is in the process of being drafted (Oregon DLCD, n.d.-a).

Dam Failure: Dams can pose risks to those living downstream who may be unaware that they are in a potential inundation zone. When dams age, deteriorate, or malfunction, they can release sudden, dangerous flood flows. Downstream development increases the potential consequences of a dam's failure. Many dams, should they fail, can also affect the delivery of essential utilities or flood control (FEMA, 2013a).

The Oregon Water Resources Department maintains an inventory of all large dams located in Oregon (using the National Inventory of Dams (NID) threat potential methodology. Within Jackson County, there are 75 dams; as evaluated for the threat potential of dams there are 14 high; 19 significant; and 42 low threats (Oregon DLCD, 2015). **Figure 34** shows the dam hazard classifications in Jackson, Josephine, and Douglas Counties. The map is based on data from the National Inventory of Dams, produced by the USACE in 2013.

Figure 34. Region 4 Dam Hazard Classification



Source: USACE as cited in Oregon DLCD, 2015

The downstream threat potential is defined by the Interagency Committee on Dam Safety as follows (U.S. Army Corps of Engineers, 2008):

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

- High Potential: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

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

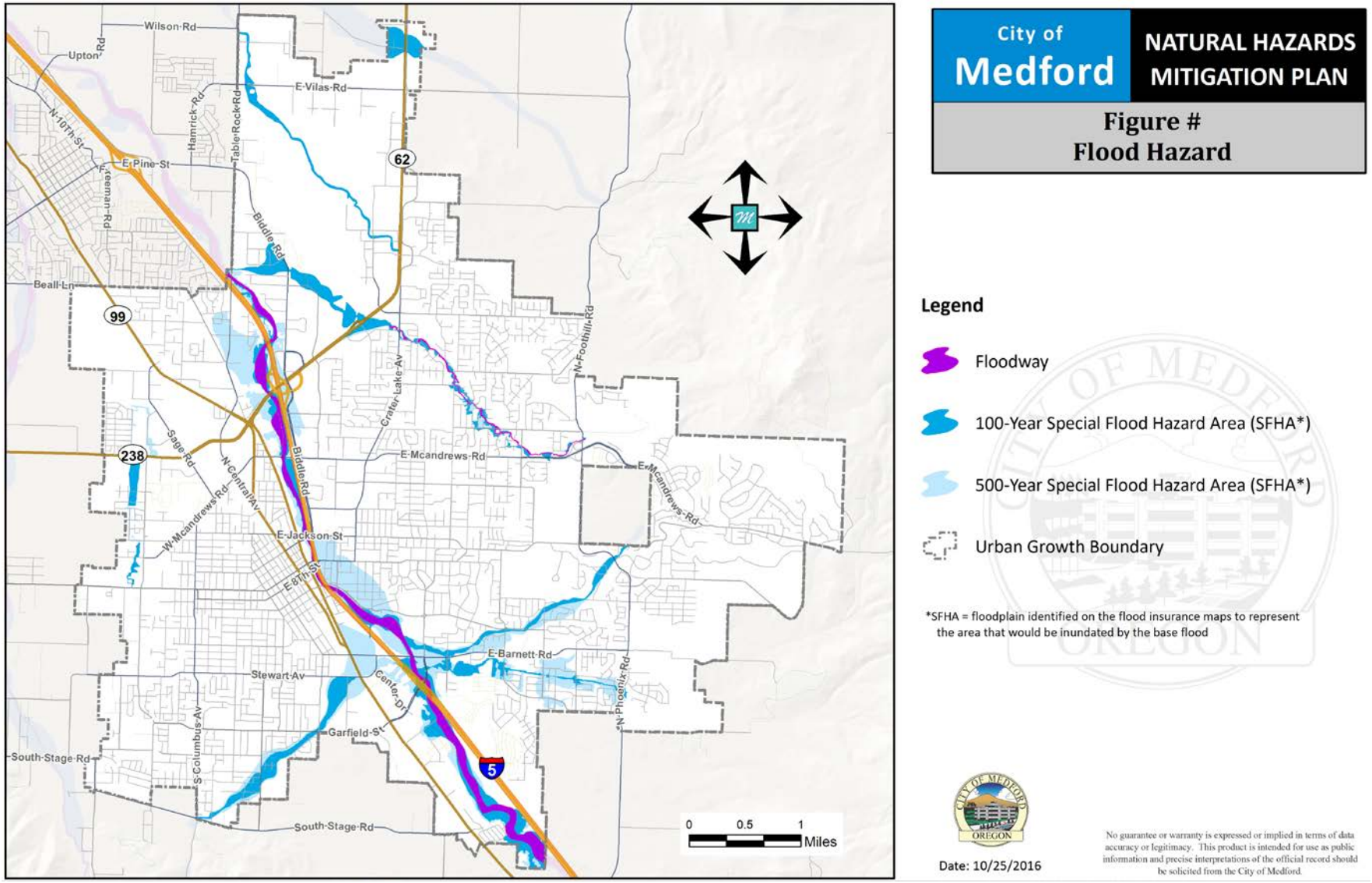
Dam or levee failures or partial failures are not usually caused by storm events. Both dams and levee systems are vulnerable to seismic activity. For more details on seismic activity, see Section 4 Earthquakes. Most failures fall into one or more of the following categories:

- Structural failures: Foundation defects, including settlement and slope instability, or damage caused by earthquakes, have caused about 30% of all dam failures in the United States.
- Mechanical failures: Malfunctioning gates, conduits, or valves can cause dam failure or flooding both upstream and downstream and account for about 36% of all dam failures in the United States.
- Hydraulic failures: Overtopping of a dam is often a precursor to dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest accounts for approximately 34% of all dam failures in the United States (FEMA, 2013a).

Because of the need to protect critical infrastructure information, inundation scenario maps cannot be released. However, they do inform the development of emergency and evacuation plans, and procedures to provide early warning to people within the inundation zone who could be affected by the sudden release of water caused by natural disaster, accident, or failure of any component of the system of dams. Dams in the Medford area that, if breached, could have impacts to people, property, and the environment include the Lost Creek Dam operated by the U.S. Army Corps of Engineers; the Hosler Dam operated by the City of Ashland; and the Emigrant Dam operated by the US Bureau of Reclamation. **Figure 36**, Dam Inundation Areas, has limited information about the Lost Creek Dam, Emigrant Dam, and Hosler Dam. Emigrant Dam's inundation zone would have more impact on Medford than those of Lost Creek and Hosler Dams. Emigrant Dam is 204 feet high and has a crest elevation of 750 feet. The reservoir's total capacity is 40,500 acre-feet (active 39,000 acre-feet) (U.S. Bureau of Reclamation, n.d.).

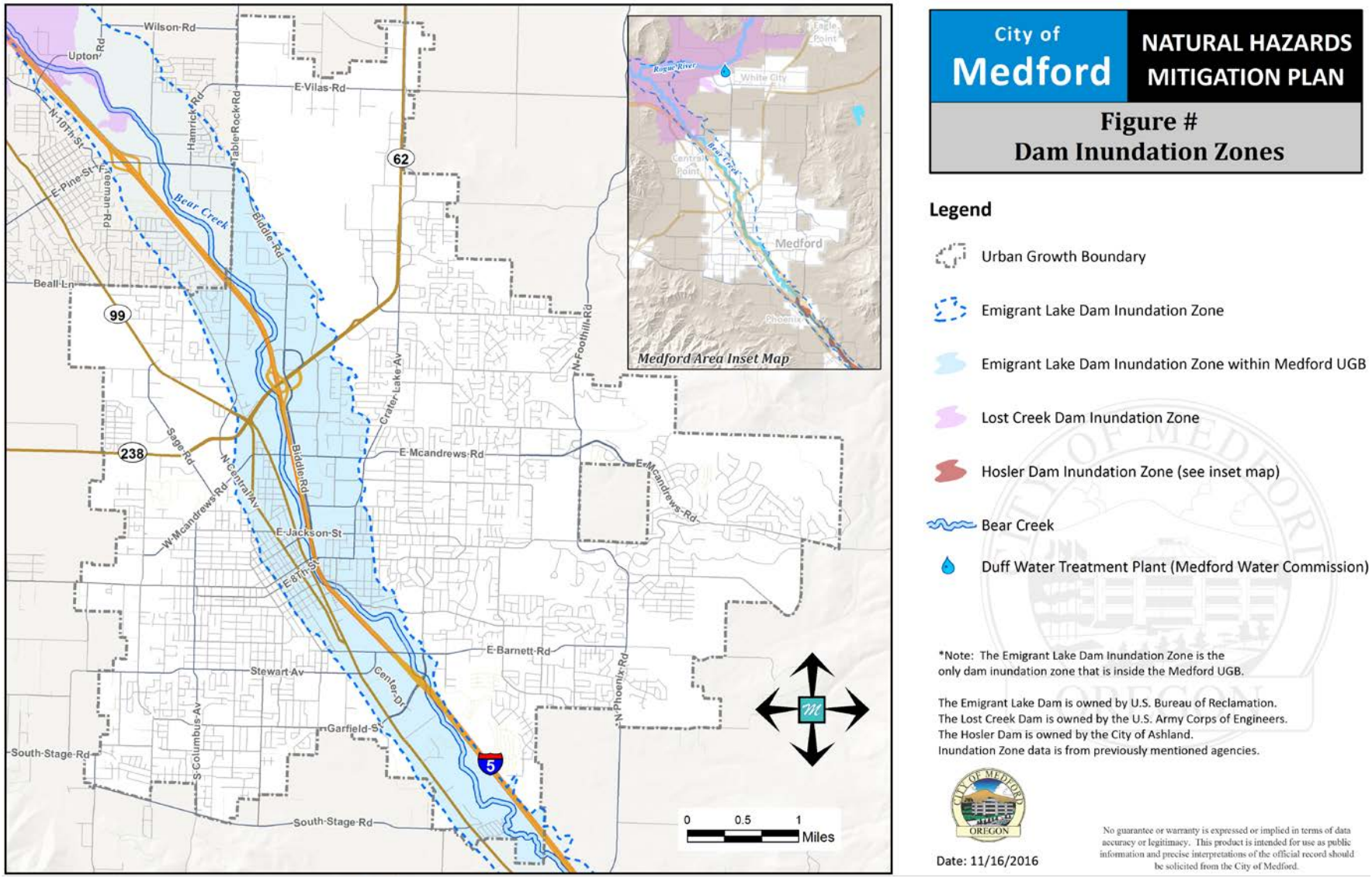
Other hazards that can impact flooding: Wildfires change the water conditions of a watershed, such as how fast water can move, and how vulnerable the land surface is to erosion. This can result in more severe flooding and debris flows. These secondary wildfire impacts can damage property and infrastructure. For instance, if a dam is in an area impacted by a wildfire, this could increase the risk of dam failure because of more water flow or sedimentation and debris obstructing spillways and reducing storage capacity in the reservoir. Surfaces of the dam and spillway, as well as related facilities, can also be damaged (Washington Department of Ecology, n.d.). See Section 5, Wildland-Urban Interface Fires, for more information about wildfire hazards in the Medford area.

Figure 35. Flood Hazard



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, October 25, 2016

Figure 36. Dam Inundation Zones



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, November 16, 2016

Table 23. Vulnerability Assessment for 100-Year Flood

Location	Probability	Extent	Overview of Resources at Risk
In the 100-year floodplain of Bear Creek and its tributaries. There are 855 acres within the 100-year floodplain (which includes the floodway). See the Flood Hazard map.	1% Annual Exceedance Probability (AEP) flood has a 1 in 100 chance of being equaled or exceeded in any one year, and it has an average recurrence interval of 100 years. Therefore, it is often referred to as the 100-year flood. A 100-year flood does not reduce the chances of another flood event of that level occurring within a short time period.	The strength or magnitude of the hazard is that water could rise slowly or quickly, and to multiple feet in depth. Evacuation may be necessary.	Damage to residences, businesses, industry, and critical facilities. Erosion of stream banks and loss of riparian habitat could occur. Ground and surface water contamination could occur. Transportation may be disrupted, including emergency response and recovery services.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
2010 NHMP There are 1,502 structures and 953 tax lots in this floodplain. The total improvement value of affected properties is $240,362,830. Of those structures, 739 are dwelling units.	2017 NHMP There are 1,072 structures and 1,295 tax lots in this floodplain. The total improvement value is $444,845,390.	There are manufactured home parks are located within this flood zone. There are a few low-income structures in this flood zone. There are assisted living facilities in this flood zone.	There is some flood risk to Asante Rogue Regional Medical Center. All Interstate-5 viaduct columns and the northbound exit at the South Medford Interchange are in this zone. Debris in water could create debris dams at the bridges. East Barnett Rd. and Siskiyou Boulevard will be flooded, making access to Asante Rogue Regional Medical Center more difficult to access. Police headquarters are on the west side, with several fire stations, and Public Works. There are fire stations on the east. Agency services will be impacted.	The Rogue Valley Mall is partly in and near this flood zone. Severe erosion (wasting) of stream banks and adjoining lands may destroy structures located in the flood zone. In the 2010 NHMP in this flood zone, there were 176 employers with a total of 2,258 employees. In the 2017 NHMP in this flood zone, there are 82 employers with a total of 1,627employees.	An overflow of sewage can occur, causing the pollution of ground water and surface water bodies. Severe erosion (wasting) of stream banks and adjoining lands will occur. There will be a loss of fish and general riparian habitat due to debris and infrastructure deposits in the streams.

Table 24. Vulnerability Assessment for 500-Year Flood

Location	Probability	Extent	Overview of Resources at Risk
In the 500-year floodplain of Bear Creek and its tributaries. There are 861 acres within the 500-year floodplain (which does not include the floodway). See the Flood Hazard map.	There is a 0.2% chance of the 500-year flood occurring each year.	The strength or magnitude of the hazard is that water could rise slowly or quickly, and to multiple feet in depth. Evacuation may be necessary.	This flood effectively separates the City on a northwest to southeast diagonal, following the path of Bear Creek and Interstate 5. The Interstate will be impassable in several places. Continuity in city services will be difficult. Government offices are on the west side, while hospitals are located on the east side. Health clinics are on both sides. Commercial malls and many employers are in this zone. Residences, businesses, industry, and critical facilities will be damaged. Transportation disruptions, including emergency response and recovery services. Erosion of stream banks and loss of riparian habitat. Ground and surface water contamination.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
2010 NHMP There are 3,694 structures on 2,248 tax lots in this floodplain. The total improvement value of affected properties is $581,632,618. Of those structures, 2,708 are dwelling units. In particular, the area known as “old East Medford,” the neighborhood of Portland and Willamette Streets, will be inundated.	2017 NHMP There are 3,782 structures on 3,124 tax lots in this floodplain, with an improvement value of $794,795,622. In particular, the area known as “old East Medford,” the neighborhood of Portland and Willamette Streets, will be inundated.	Residents in the Portland St. / Willamette St. neighborhoods will be impacted. Residents along Table Rock Road north of its juncture with Merriman Road will have to evacuate. Residents of mobile home parks will need to evacuate and find temporary shelter. It will be difficult for persons residing in West Medford to reach either of the two hospitals in East Medford, since the flood zone separates those two city sections.	The Asante Rogue Regional Medical Center will be in the center of a forked inundation area, making access difficult. Access to the airport from the south and west will be difficult; the airport itself is not in the flood zone. Police headquarters, several fire stations, and the Public Works office are on the west side. There are fire stations on the east side. Agency services will be impacted.	Small historic neighborhoods in the Geneva and Cottage St. area will be inundated. Large commercial establishments and malls north and south of Barnett and Stewart. The entire Rogue Valley Mall will be inundated. In the 2010 NHMP there were 436 employers in this flood zone with 6,048 employees. In the 2017 NHMP there are 263 employers and 3,470 employees. Extreme erosion (wasting) of streambanks will destroy parcels of land and the structures thereon.	Hawthorne and Bear Creek Parks, as well as the Bear Creek Greenway will be inundated and damaged. Surface water pollution will result from debris and infrastructure being deposited in streams. There will be extreme erosion (wasting) of streambanks and adjoining lands. There will be significant loss of fish and general riparian habitat.

Table 25. Vulnerability Assessment for Emigrant, Lost Creek, and Hosler Dams

Location	Probability	Extent	Overview of Resources at Risk
The inundation zone centers on Bear Creek and its tributaries, but extends much further. There are 3,337 acres in the dam inundation zones. The area covered is for Emigrant Dam. The dam inundation zones of Lost Creek and Hosler Dams do not extend to the Medford UGB. See the Dam Inundation Zones map.	According to agency officials, the chances of dam failure due to earthquake or other hazards are extremely low.	The strength or magnitude of the hazard is that water could rise slowly or quickly, and to multiple feet in depth.	The failure of Emigrant Dam would divide the community by a very broad inundation zone. A high proportion of commercial and employment centers would be inundated, causing a loss of jobs and revenue. Many residential areas would be inundated, creating a need to shelter high numbers of people. Interstate 5 would be impassable. High numbers of facilities housing vulnerable people would be affected and need special assistance. A failure of Lost Creek Dam would provide moderate to severe impacts. A failure of Hosler Dam would provide moderate impacts.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
2010 NHMP This data was specific to Emigrant Dam. A total of 6,931 structures on 4,043 tax lots are in this zone. The total improvement value of affected properties is $1,906,461,330. Some 5,581 dwelling units are included in the above number of structures.	2017 NHMP This data is specific to Emigrant Dam. A total of 7,155 structures on 4,630 tax lots with an improvement value of $1,395,758,897 are in this zone.	Many licensed care facilities lie within this inundation zone. The young, elderly, and medically fragile could be impacted. Residents of mobile home parks will have to evacuate. Persons in the area between Edwards and Court Streets will need to evacuate.	City offices in the downtown area will be impacted. Interstate 5 will be almost completely inundated on its path through the City. Access to the airport will be cut off, but the runway will be clear. Qwest's switching station at Central and Jackson will be inundated and telephone service may be disrupted. Providence Hospital is within the inundation area.	The downtown business district will be inundated, as well as malls and business centers along Biddle Road. In the 2010 NHMP, there were 1,516 places of business are in this zone and total employment numbers were 26,154. In the 2017 NHMP, there were 1,457 places of business in this zone with 22,758 employees. The loss of the reservoir and the valley's irrigation system could result in significant losses for the region's agricultural economy and uses in the City that rely on that system.	Waterways will likely be log-jammed. Sewer systems will overflow, polluting streams. Dam waters will wash a variety of debris, hazardous materials and infrastructure into streams, causing destruction of the natural habitat.

Section 4 Earthquakes

Introduction and Hazard Overview

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

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> Four types of earthquakes affect Region 4: (a) shallow crustal events, (b) deep intra-plate events within the subducting Juan de Fuca plate, (c) the offshore Cascadia Subduction Zone (CSZ) Fault, and (d) earthquakes associated with renewed volcanic activity. The CSZ is the chief earthquake hazard for Southwest Oregon. The region is particularly vulnerable due to the large area susceptible to earthquake-induced landslide, liquefaction, and ground shaking. In a 500-year model for a CSZ event or combined crustal events, all three of the region's counties rank among the top 15 counties with the highest expected earthquake damages and losses. The state's seismic lifelines along Interstate-5 and east-west routes that connect the region to the rest of the state are highly vulnerable to seismic events. There are 434 state-owned/leased facilities, valued at over $164.4 million, within this region's earthquake hazard zone. Of these, 34 are critical/essential facilities. An additional 1,069 non-state-owned/leased critical/essential facilities are also located within this hazard zone (Oregon DLCD, 2015).

Medford's risk from earthquakes is related to its location between two active fault areas as well as its regional importance as a transportation, freight distribution, communications, and service hub. To the east is the fault zone in the Klamath Falls area and to the west is the Cascadia Subduction Zone along the coast of Oregon.

Types of Hazard

Medford is susceptible to impacts from earthquakes from four sources noted above: (a) the off-shore Cascadia Subduction Zone (CSZ), (b) deep intraplate events within the subducting Juan de Fuca plate, (c) shallow crustal events within the North America Plate, and (d) earthquakes associated with renewed volcanic activity. All have some tie to the subducting or diving of the dense, oceanic Juan de Fuca Plate under the lighter, continental North America Plate. Stresses occur because of this movement and there appears to be a link between the subducting plate and the formation of volcanoes inland from the off-shore fault zone (Oregon DLCD, 2015). See the History and Probability sections for more information on the occurrence of these earthquake types.

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

Intraplate Earthquakes: Intraplate quakes occur within the subducting oceanic plate. These earthquakes occur quite deep in the earth. Ground shaking from such earthquakes would be very strong near the epicenter and strong ground shaking would be felt throughout Medford.

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

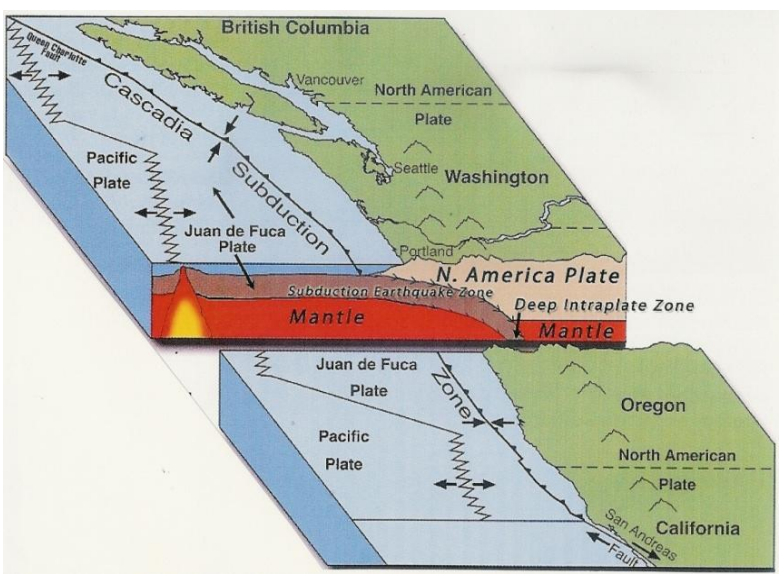
Earthquakes from Volcanic Activity: As stated above, there appears to be a link between the subducting plate and the formation of volcanoes some distance inland from the off-shore Cascadia Subduction Zone. Therefore, volcanic activity in the Cascades can trigger seismic activity that could impact Medford.

Location and Extent

The location of earthquakes that may affect the City of Medford are primarily based in the Pacific Ocean, and are described within the categories identified in the Types of Hazard subsection. The extent or the strength or magnitude is variable. See the Probability subsection.

Cascadia Subduction Zone Earthquakes. Great subduction earthquakes occur worldwide in subduction zones, where continent-sized pieces of the earth's crust are shoved deep into the earth. This long-term, slow "collision" between the plates requires adjustment from the rocks; after a point, no more adjustment is possible and the pressure is so great, the rocks break, sending a massive elastic rebound reaction through the earth that causes the earthquake. Subduction zone earthquakes are consistently the most powerful type of earthquake recorded, often registering magnitude 8.0 or 9.0 ("Getting Ready," 2002). **Figure 37** shows the geologic (plate tectonic) setting of the Cascadia Subduction Zone. These earthquakes occur about 20 to 60 kilometers (12 to 40 miles) offshore from the Pacific Ocean coastline.

Figure 37. Cascadia Subduction Zone: Cross Section, Magnitude 9.0 Earthquake Scenario



Source: Cascadia Region Earthquake Workgroup (2005), http://www.oregongeology.org/pubs/ofr/O-05-05.pdf

The City of Medford lies within the area bordering the Cascadia Subduction Zone. This zone is comprised of a 620 mile fault located off the West Coast, from British Columbia to Northern California. In this zone, the Pacific plate is being submerged beneath the North American plate; it is part of a larger area which includes the seismically active San Andreas Fault (a transform fault) and Alaskan earthquake zones. According to seismologists, should the entire Cascadia Subduction Zone rupture, a magnitude 9.0 earthquake would result (Oregon DLCD, 2015).

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

Crustal Earthquakes: Significant earthquakes occur in the Klamath Falls area, related to Cascade Mountain/Basin and Range contact zone range front faulting. Magnitudes have historically been in the Richter scale 3.0 to 5.0 range. "Although earthquakes from a variety of sources, such as the Cascadia Subduction Zone and volcanic eruptions in the Cascade Range, might affect Klamath County, the earthquakes from crustal faults in Klamath County will dominate the hazard due to their proximity" (Wang & Wang, 2002). There may also be unknown crustal faults along which earthquakes could occur. Two crustal earthquakes occurred in Klamath Falls in 1993, as noted in **Table 26** below.

Earthquakes from Volcanic Activity: According to the *2015 Oregon NHMP*,

> Earthquakes produced through volcanic activity could possibly reach magnitudes of 5.5. The 1980 Mount St. Helens eruption was preceded by a magnitude 5.1 earthquake. Despite the fact that Cascade volcanoes are some distance away from the major population centers in Region 2, earthquake shaking and secondary earthquake-related hazards such as lahars could cause major damage to these centers (Oregon DLCD, 2015).

Medford will potentially also be impacted by ashfall if prevailing winds direct ash into the city. Impacts from earthquakes are discussed in the Vulnerability section.

History

According to a staff engineer at DOGAMI, a series of small earthquakes were felt, about once every 20 years, over a period of 60 – 80 years, in the Medford area. The last one was in 1966. The faults where they occurred are not well-defined. Many of the faults in the Medford area have not been active in more than 2 million years; these ancient faults are not considered a significant risk (Tom Wiley, personal communication, June 2004).

According to the *2015 Oregon Natural Hazards Mitigation Plan*, in regards to Region 4,

> This part of Oregon has experienced no historic earthquakes of any significance that were centered in the region. However, the region has been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered outside the area. All considered, there is good reason to believe that the most devastating future earthquakes would probably originate along shallow crustal faults in the region and along the Cascadia Fault Zone. The magnitude 7.3 deep-seated intraplate event centered near Brookings in 1873 was probably

felt throughout Southwest Oregon. There have been no known intraplate events in the region's history or pre-history. The 1993 Klamath Falls earthquake was felt in the region (Oregon DLCD, 2015).

Table 26. Significant Historic Earthquakes

Date	Location	Size (M)	Description
Approximate years: 1400 BCE*, 1050 BCE, 600 BCE, 400. 750, 900	Offshore Cascadia Subduction Zone (CSZ)	Probably 8.0-9.0	Based on studies of earthquake and tsunami at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.
Jan. 1700	CSZ	About 9.0	Generated a tsunami that struck Oregon, Washington, and Japan. Destroyed Native American villages along the coast.
Nov. 1873	Brookings, OR	7.3	Impacts: chimneys fell in Port Orford, Grants Pass, and Jacksonville; no aftershocks; origin probably in the Gorda block of the Juan de Fuca plate; intraplate event.
Oct. 1897	Gresham, OR	6.7	Occurred on October 12, 1897.
Feb, 1892	Portland, OR	5.6	Occurred on February 4, 1892.
Mar. 1893	Umatilla, OR	5.7	Occurred on March 7, 1893.
May 1916	Richland, WA	5.7	Earthquake on May 13, 1916 centered on Richland, WA.
Apr. 1920	Fort Klamath, OR	5.0	Three shocks felt at Fort Klamath; the center was probably in the vicinity of Crater Lake.
Jul. 1936	Milton-Freewater, OR	6.1	The earthquake occurred on July 16, 1936.
Apr. 1949	Olympia, WA	7.1	Significant damage in Washington. Minor damage in NW Oregon.
Dec. 1953	Portland, OR	5.6	Occurred on December 16, 1953.
Nov. 1962	Vancouver, WA	5.5	Occurred on November 5, 1962. Centered in Vancouver and felt in the metro area, including Portland.
Oct. 1964	Portland, OR	5.3	Occurred on October 1, 1964. Earthquake on Sauvie Island in the Columbia River.
Apr. 1965	Seattle-Tacoma, WA	6.5	3 people killed. Only felt shaking in Multnomah County.
May 1968	Near Lakeview, OR	5.1	Occurred on May 30, 1968. Earthquake near the Adel-Warner Lakes in south central Oregon.
Feb. 1981	Mt. St. Helens, WA	5.5	Occurred on February 13, 1981. Centered near Mt. St. Helens and shook the Portland area.
Mar. 1993	Scotts Mills, OR	5.6	DR-985. On Mt. Angel-Gales Creek fault. $30 million damage (including Oregon Capitol Building in Salem). Magnitude 5.6 centered near Woodburn occurred on March 23, 1993.
Sep. 1993	Klamath Falls, OR	6.0	DR-1004. Two earthquakes in Klamath Falls, 2 people killed. Felt in Medford. Occurred on September 20, 1993. Magnitude 6.0 centered 10 mi NW of Klamath Falls and caused damaged to the courthouse and county offices. Magnitude 5.9 centered 15 mi NW of Klamath Falls closed highways and bridges.
Feb. 2001	Nisqually, WA	6.8	Felt in the region. No damage reported.

*BCE: Before the Common Era.

Sources: Wong and Bolt, 1995; Multnomah County Office of Emergency Management, 2012

In 1993, Oregon suffered three significant earthquakes. The first was near Salem in Scotts Mill (magnitude 5.6 on the Richter scale) and the other two were in Klamath Falls (magnitudes 5.9 and 6.0). The ones in the Klamath Falls area were felt in Medford. The 1993 Scotts Mill and Klamath Falls earthquakes were crustal earthquakes, which occur along short, shallow faults commonly visible at the earth's surface. Historically, these types of earthquakes have rarely exceeded magnitude 6.0, but the

historic record is too short to provide a true representation of the probable threats of crustal quakes. East of the Cascades, the majority of the earthquakes originate in crustal faults.

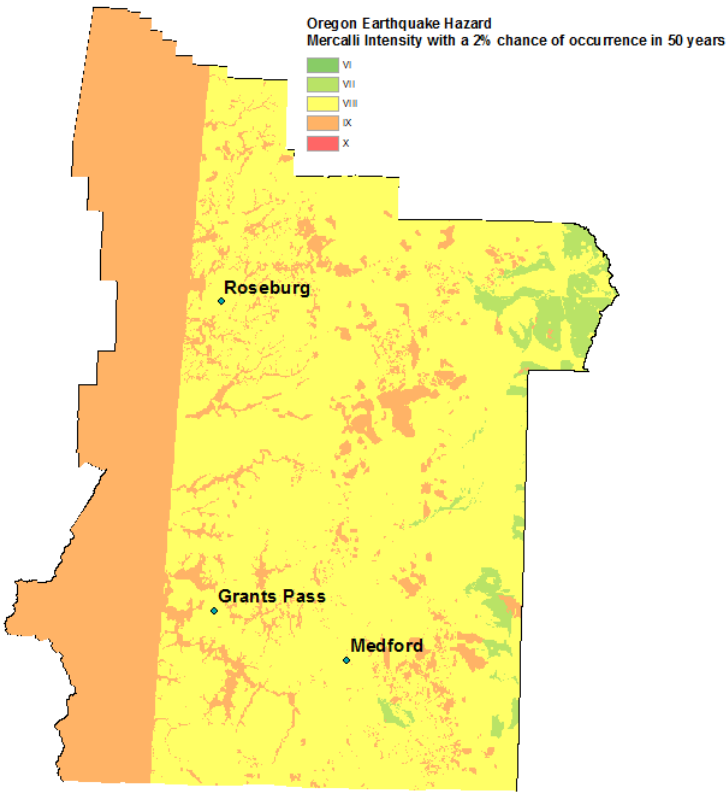
The three 1993 earthquakes caused damage in the Rogue Valley area. They were followed by aftershocks as large as magnitude 5.1 for a period of six months (Sherrod, Mastin, Scott, & Schilling, 1997). Epicenters for these earthquakes are near-north to northwest-trending faults about 19 miles northwest of Klamath Falls (Niewendorp & Neuhaus, 2003). In an unpublished manuscript dated 2000 by Thomas Ferrero of Ferraro Geologic, researchers estimated that a 7.0 magnitude earthquake is possible in the Klamath Falls area (City of Medford, 2010).

DOGAMI's *Map of Selected Earthquakes for Oregon 1841 through 2002* (DOGAMI, n.d.-a) shows the epicenters of over 14, 000 known earthquakes that occurred between 1841 and 2002 in Oregon. This map shows historic earthquakes in Oregon, off the coast, and along Oregon's border with southern Washington and northern California.

Probability

The map in **Figure 38** shows the expected level of earthquake damage along all known faults in Oregon that could impact Southern Oregon that has a 2% chance of occurring in the next 50 years (Oregon DLCD, 2015). Based on the Simplified Mercalli Levels defined by Madin and Burns (2013) and described in **Table 27**, Medford is subject to Level VIII effects of shaking, meaning significant to substantial damage in vulnerable buildings can be expected.

Figure 38. Probabilistic Earthquake Hazard in Region 4



Source: Madin and Burns, 2013 and Oregon DLCD, 2015

Table 27. Simplified Explanation of Mercalli Levels

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

Source: Madin and Burns, 2013

> This map shows the expected level of earthquake damage that has a 2% chance of occurring in the next 50 years. The map is based on the 2008 USGS National Seismic Hazard Map and has been adjusted to account for the effects of soils following the methods of Madin and Burns (2013). In this case, the strength of shaking calculated as peak ground acceleration and peak ground velocity is expressed as Mercalli intensity, which describes the effects of shaking on people and structures. This map incorporates all that is known about the probabilities of earthquake on all Oregon faults, including the Cascadia Subduction Zone (CSZ).
>
> For Oregon west of the crest of the Cascades, the CSZ is responsible for most of the hazard shown in Figure 2-150 (Mercalli figure above). The paleoseismic record includes 18 magnitude 8.8–9.1 megathrust earthquakes in the last 10,000 years that affected the entire subduction zone. The return period for the largest earthquakes is 530 years, and the probability of the next such event occurring in the next 50 years ranges from 7 to 12%. An additional 10–20 smaller, magnitude 8.3–8.5, earthquakes affected only the southern half of Oregon and northern California. The average return period for these is about 240 years, and the probability of a small or large subduction earthquake occurring in the next 50 years is 37-43% (Oregon DLCD, 2015).

In August 2016, new analysis about CSZ earthquakes, from Oregon State University, was published. The analysis suggests that CSZ earthquakes affecting more heavily populated areas are slightly more frequent than previously thought. These findings show the chances of an earthquake in the next 50 years have increased. “For central and northern Oregon, the chance of a seismic event during that period has been changed to 15-20 percent instead of 14-17 percent. In the zone area within Washington and British Columbia, the chance of an event has increased to 10-17 percent from 8-14 percent” (Meny, 2016).

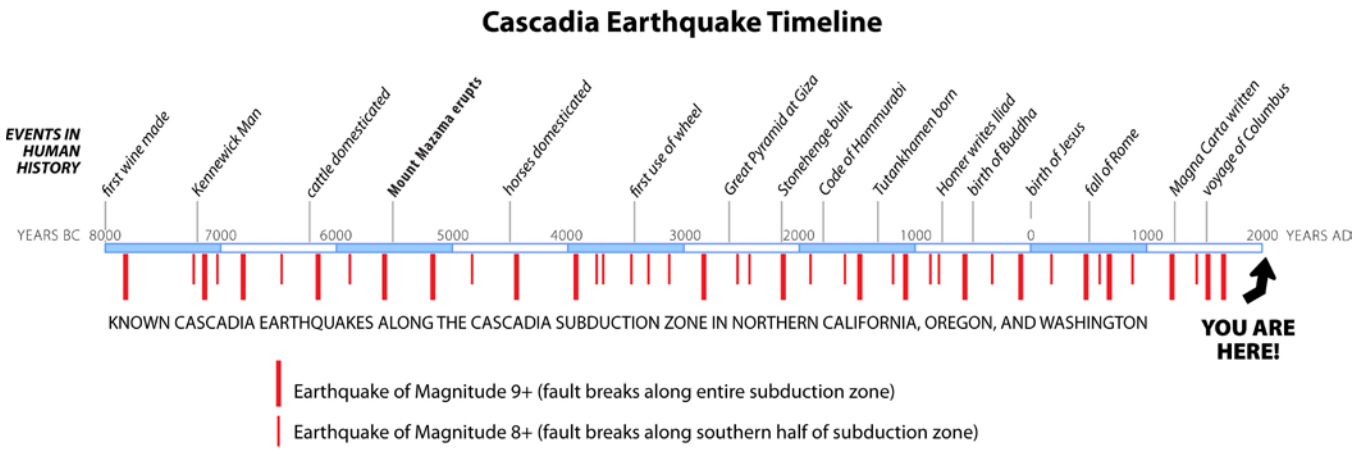
According to Chris Goldfinger of OSU,

> These new results are based on much better data than has been available before, and reinforce our confidence in findings regarding the potential for major earthquakes on the Cascadia Subduction Zone, especially the northern parts. The frequency, although not the intensity, of earthquakes there appears to be somewhat higher than we previously estimated (Meny, 2016).

Goldfinger also says, “Now we have a great deal more certainty that the general concern about earthquakes caused by the Cascadia Subduction Zone is scientifically valid, and we also have more precise information about the earthquake frequency and behavior of the subduction zone” (Danko, 2016).

The time interval is typically set to 50 years, and it can be any 50 years, not just the next 50 years. The time interval is used to determine the shaking hazard and includes all possible earthquakes that may occur (USGS, n.d.-c). **Figure 39** is a Cascadia earthquake time line widely used to illustrate history comparing human events and earthquake events along the Cascadia Subduction Zone.

Figure 39. Cascadia Earthquake Time Line



Source: OSSPAC, 2013 (data provided by Chris Goldfinger, Oregon State University; timeline by Ian P. Madin, DOGAMI).

In addition to the probabilistic map shown in **Figure 38** showing expected level of shaking, which is based on peak ground acceleration and peak ground velocity, the USGS has earthquake ground motion maps. These maps are periodically updated. Peak acceleration is only one type of peak ground motion (Yumei Wang, personal communication, August 18, 2016).

The 2014 U.S. Geological Survey (USGS) National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy (USGS, n.d.-c). Additional description of these maps is excerpted from the website and included here,

> The National Seismic Hazard Maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions. Maps for available periods (0.2 s, 1 s, PGA) and specified annual frequencies of exceedance can be calculated from the hazard curves. Figures depict probabilistic ground motions with a 2 percent probability of exceedance. Spectral accelerations are calculated for 5 percent damped linear elastic oscillators. All ground motions are calculated for site conditions with Vs30=760 m/s, corresponding to NEHRP B/C site class boundary.
>
> Probabilistic ground motion maps depict earthquake hazard by showing, by contour values, the earthquake ground motions (of a particular frequency) that have a common given probability of being exceeded in 50 years (and other time periods).The ground motions being considered at a given location are those from all future possible earthquake magnitudes at all possible distances from that location. The ground motion coming from a particular magnitude and distance is assigned an annual probability equal to the annual probability of occurrence of the causative magnitude and distance.

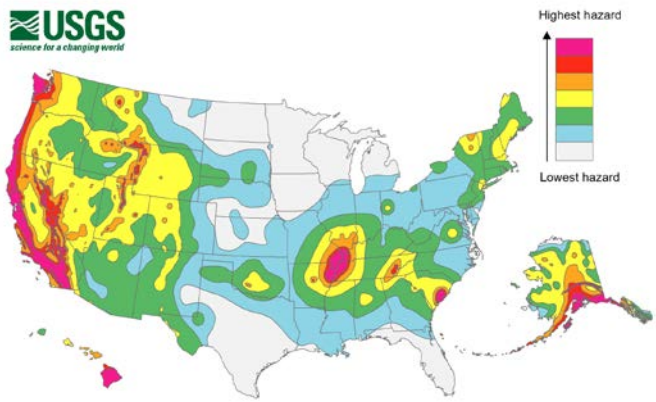
The goal of a hazard map is to depict the potential shaking hazard from future earthquakes.

> The ground motion values apply to ground motion expected for future individual earthquakes. The probabilistic ground motion calculation takes into account all possible future ground motions from all modeled earthquake magnitudes at all possible distances from the map site. The

spatial distribution of probabilistic ground motion values is shown with contours on the map, like a topo map shows different elevations, with each color representing a different range of levels of shaking (USGS, n.d.-c).

See **Figure 40**, which shows probabilistic ground acceleration. The ground motion around Medford will vary depending on the soil type. Medford is in a high seismicity zone (Yumei Wang, personal communication, August 18, 2016).

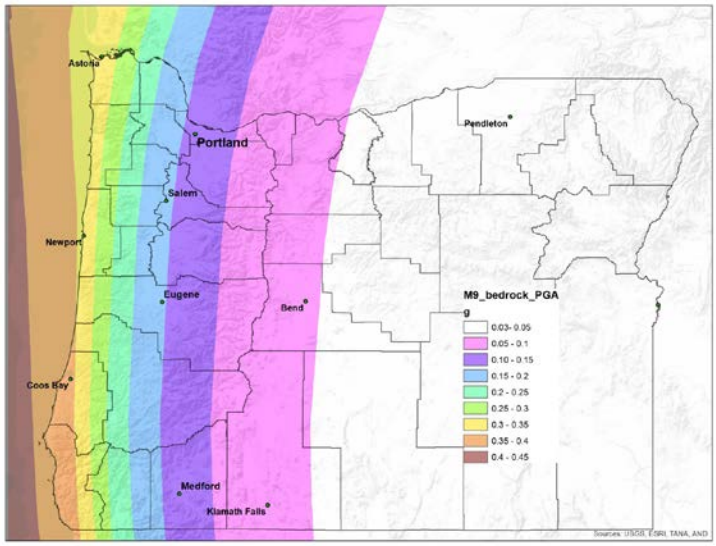
Figure 40. USGS Simplified 2014 Hazard Map (PGA, 2% in 50 Years)



Source: USGS (n.d.-c)

Figure 41 (Madin & Mabey, 1996, cited in Madin & Burns (2013) provides a view of peak ground acceleration related to the magnitude 9.0 earthquake. The map shows the decreasing acceleration from the western to the eastern parts of the state.

Figure 41. Bedrock (*V*s30 =760 m/sec) Peak Ground Acceleration (PGA) Map for the Scenario Magnitude 9.0 Earthquake



Source: Madin and Mabey, 1996, cited in Madin and Burns, 2013

Vulnerability

The additional scientific, media, and funding focus on earthquake hazards in the past 20 years has generated numerous important published papers on the probability of and the potential impacts of earthquakes in Oregon. For example, DOGAMI and Chris Goldfinger of OSU's work that was described above in Probability.

As identified in the *2010 Medford NHMP*, the DOGAMI paper *Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses* (Wang & Clark, 1999), describes that an M8.5 Cascadia Subduction Zone earthquake, is likely to occur off the Oregon Coast sometime in the next 100 years. The study details, such as the percentages of buildings that would be damaged and the valuation of economic losses, are outdated given changes in development and economy. However, the study is still cited as the reference source in more current publications.

Additional vulnerability data can be found in the *2015 Oregon Natural Hazards Mitigation Plan* and the *2013 Oregon Resilience Plan: Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami Report to the 77th Legislative Assembly*.

For the "Building Collapse Potential in Region 4, Jackson County," the *2015 Oregon NHMP* refers to a 2007 study. The study identifies 139 buildings as low (<1%); 13 buildings as moderate (>1%); 87 buildings as high (>10%); and 22 buildings as very high (100%) collapse potential. This information was completed by DOGAMI for a rapid visual screening (RVS) of educational and emergency facilities in Oregon communities as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events (Oregon DLCD, 2015).

The "Projected Dollar Losses in Region 4, Based on an M8.5 Subduction Event and a 500-Year Model" for Jackson County: the economic base loss in thousands (1999) is $7,829,000; the greatest absolute loss in thousands (1999) from an 8.5 CSZ event is $538,000; and the greatest absolute loss in thousands (1999) from a 500-year crustal event is $1,191,000 (Oregon DLCD, 2015). These numbers, as well as those in **Table 28**, are from the Wang and Clark (1999) study.

Table 28. Estimated Damages and Losses in Region 4 for Jackson County Associated with Two Earthquake Models

Damage/Loss	M8.5 CSZ	500-Year[1]
Injuries	428	930
Deaths	8	18
Displaced households	650	1,458
Economic losses for buildings[2]	$538 m	$1.2 b
Operational the "day after" the event[3]:		
Fire stations	75%	N/A
Police stations	62%	N/A
Schools	70%	N/A
Bridges	84%	N/A
Economic losses to:		
Highways	$10 m	$34 m
Airports	$2 m	$8 m
Communications	$2 m	$9 m
Debris generated (thousands of tons)	434	889

Notes:

[1]Every part of Oregon is subject to earthquakes. The 500-year model is an attempt to quantify the risk across the state. The estimate does not represent a single earthquake. Instead, the 500-year model includes many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. More and higher magnitude earthquakes than used in this model may occur (DOGAMI, 1999).

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

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

Source: Wang and Clark (1999) and DLCD (2015)

The 1999 study predicts that economic losses in Jackson County (related to damage to buildings, highways, airports, and communications systems) could run as high as $552 million. The study predicts slight to complete damage to 22% of Jackson County's homes, 32% of educational buildings, 42% of government buildings, 39% of commercial structures and 42% of industrial buildings. The day after the earthquake, it is predicted that 25% of fire stations would be non-operational, as would be 38% of police stations, 30% of schools and 16% of bridges. The study states that aspects of the computer model resulted in an underestimation of projected damages because the model did not include old-style brick buildings whose collapse during earthquakes can result in numerous casualties. While recognizing the 1999 study is eighteen years old and that many new buildings have been constructed and others retrofitted in Medford and Jackson County, it should be noted that the estimates remain useful for general planning purposes.

As stated in the 1999 study, a subduction earthquake would significantly damage residences, educational buildings, and government buildings, industrial and commercial buildings in Jackson County. In Medford, the unreinforced masonry buildings (URMs) in the downtown core and other areas would be especially vulnerable to a large earthquake. The mortar is old, and thus weakened, and the brick walls are typically not attached to the roofs, floors, or foundations.

Noting earthquake impacts to critical infrastructure and schools, there is an Oregon law that requires emergency facilities to be seismically safe by 2022, and public schools to be seismically safe by 2032. The full text of the law is found at: https://www.oregonlegislature.gov/bills_laws/ors/ors455.html (Yumei Wang, personal communication, July 29, 2016).

Table 30 Vulnerability Assessment of Earthquakes, quantifies the estimated damage to Medford. The table specifies: the location and extent of earthquakes; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assets. It is based on the assumption that homes and other structures are more vulnerable to earthquakes if built before the establishment of seismic construction standards in building codes, which are updated regularly. The table also identifies the number of tax lots the structures are on, and the improvement value.

In the *2010 Medford NHMP* there were 211 URMs identified; in the *2017 Medford NHMP* there are 192 URMs and/or buildings that require Building Department review. The buildings are on 290 tax lots and have an improved value of $112,513,320. There may be more URMs beyond this urban renewal district and within the Medford UGB; but **Figure 43** shows the location of the data as provided by the Building Safety Department.

Secondary disasters. Of major concern is the cascading effect of an earthquake. An earthquake may cause the disruption of a city's water system, the failure of a dam, the destruction of bridges and breaks

in the transportation network. Thus, the need arises to respond to several types of emergency situations at once, with few of the typical support systems in place and an inadequate infrastructure. In addition to structural damage to bridges, buildings, utilities, and communications systems, an earthquake of 6.0-8.0 on the Richter scale might result in:

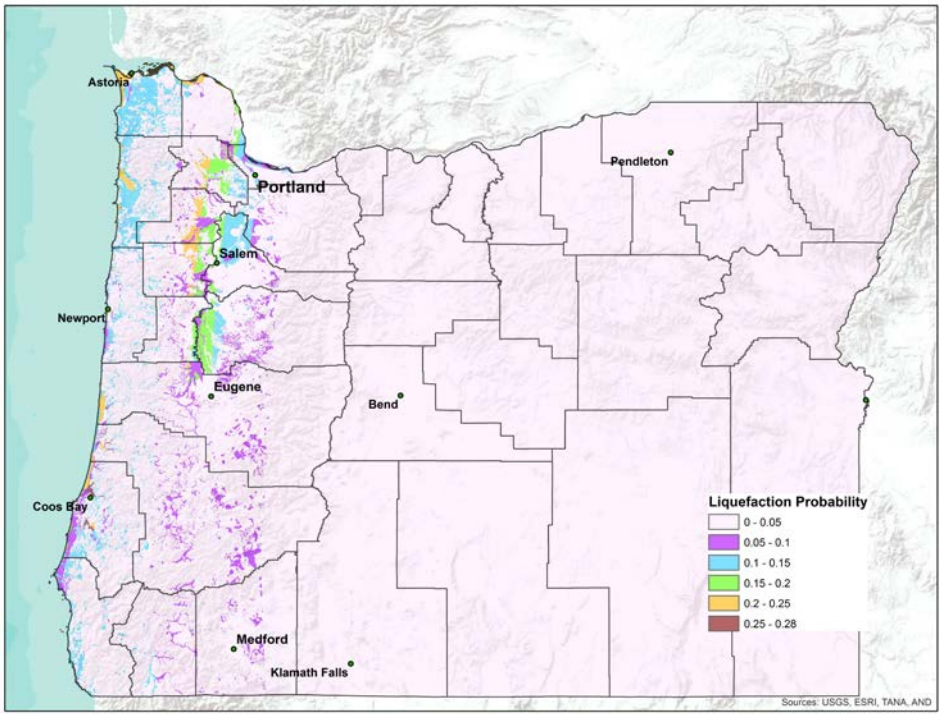
- Additional natural/environmental emergencies, such as floods and landslides.
- Industrial/technological emergencies, such as fires, explosions, and hazardous materials incidents.
- Disruption of vital services, such as water, sewer, power, gas, and transportation.
- Damage to and disruption of emergency response facilities, resources, and systems.
- Civil and political emergencies, such as looting.
- Damage to Emigrant, Lost Lake Creek, and Hosler Dams.

Earthquakes can also trigger liquefaction, settlement, lateral spreading, landslides, dam failures, levee failures and tsunamis, which can result in significant damage. A description of the location and extent of these additional seismic-related hazards is included.

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

> If an earthquake induces liquefaction, several things can happen: The liquefied layer and everything lying on top of it may move downslope. Alternatively, it may oscillate with displacements large enough to rupture pipelines, move bridge abutments, or rupture building foundations. Light objects, such as underground storage tanks, can float toward the surface, and heavy objects, such as buildings, can sink. Typical displacements can range from centimeters to meters. Thus, if the soil at a site liquefies, the damage resulting from an earthquake can be dramatically increased over what shaking alone might have caused (Wang & Wang, 2002).

Figure 42. Liquefaction Probability Map for M 9.0 Scenario Earthquake



Source: Madin and Burns (2013)

Earthquake ground motions may be significantly higher for certain soil types. Buildings and infrastructure in the higher amplification areas will generally suffer more damage in any given earthquake than similar buildings and infrastructure located in low amplification areas.

Earthquakes can trigger landslides, especially if one occurs during the rainy season when soils are saturated with water. The areas prone to earthquake-induced landslides are largely the same as those areas prone to landslides in general. Areas with steep slopes and loose rock or soils are most prone to landslides**.** For an estimate of the potential damage that earthquake-related landslides could have within Medford city limits and its UGB, refer to **Figure 52**. Recognizing the role that steep slopes play in landslides, **Table 36** identifies the number and value of homes built on slopes in ranges from zero to greater than 25%. See Section 6 Landslides for a more detailed discussion of landslides.

Earthquakes can cause dam failures. The most common mode of earthquake-induced dam failure is slumping or settlement of earthfill dams where the fill has not been properly compacted. If slumping occurs when a dam is full, then overtopping of the dam can lead to rapid erosion and dam failure is possible. Strong ground motions can also damage concrete dams. Furthermore, earthquakes can trigger landslides that flow into reservoirs and cause dam failures. Additional information about dams and levees, as related to floods, can be found in Section 3 Floods.

Significant dams in the Medford area include: the Lost Creek Dam, operated by the U.S. Army Corps of Engineers; the Hosler Dam, operated by the City of Ashland; and the Emigrant Dam, operated by the U.S. Bureau of Reclamation.

According a Bureau of Reclamation engineer, several studies of earthquake risk have been conducted on Emigrant Dam. The structure is actually comprised of two dams. The first was a cement arc dam built in

1924 by the Talent Irrigation District. The second was an earthen dam built around and over the existing arc dam for purposes of fortification in 1958 (Jeff Magers, personal communication, March 2004).

The likelihood of failure of Emigrant Dam is reported to be "extremely low, but not negligible", according to a Bureau of Land Reclamation engineer (Jeff Magers, personal communication, March 2004). In the unlikely event of catastrophic dam failure, the effects on Medford, in combination with other effects, could be severe. **Table 25** Vulnerability Assessment: Emigrant, Lost, and Hosler Dams, located in Section 3 Floods, quantifies the impact and indicates the effect on structures, people with access and functional needs (PAFN), critical facilities, economic assets, and environmental assets. See also **Figure 36,** Dam Inundation Zones.

Tsunamis result from earthquakes that cause a sudden rise or fall of the ocean floor. These ocean floor movements may produce tsunami waves. A similar earthquake phenomenon is seiches;

> Seiches are typically caused when strong winds and rapid changes in atmospheric pressure push water from one end of a body of water to the other. When the wind stops, the water rebounds to the other side of the enclosed area. The water then continues to oscillate back and forth for hours or even days. In a similar fashion, earthquakes, tsunamis, or severe storm fronts may also cause seiches along ocean shelves and ocean harbors (NOAA, n.d.).

Seiches may damage docks, other shorefront structures and dams. Seiches could cause localized damage to reservoirs or tanks. Medford is unlikely to be affected by tsunamis and seiches.

Recognizing the research on probability and impacts of earthquakes, Oregon's legislature took action. House Resolution 3, adopted in April 2011, directed the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) "to lead and coordinate preparation of an Oregon Resilience Plan that reviews policy options, summarizes relevant reports and studies by state agencies, and makes recommendations on policy direction to protect lives and keep commerce flowing during and after a Cascadia earthquake and tsunami" (OSSPAC, 2013).

OSSPAC offered the following definition of the seismic resilience goal: "Oregon citizens will not only be protected from life-threatening physical harm, but because of risk reduction measures and pre-disaster planning, communities will recover more quickly and with less continuing vulnerability following a Cascadia subduction zone earthquake and tsunami" (OSSPAC, 2013).

From the *2013 Oregon Resilience Plan: Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami Report to the 77th Legislative Assembly*, the timeframes for service recovery under present conditions are identified in **Table 29**.

Table 29. Timeframes for Service Recovery under Present Conditions in February 2013

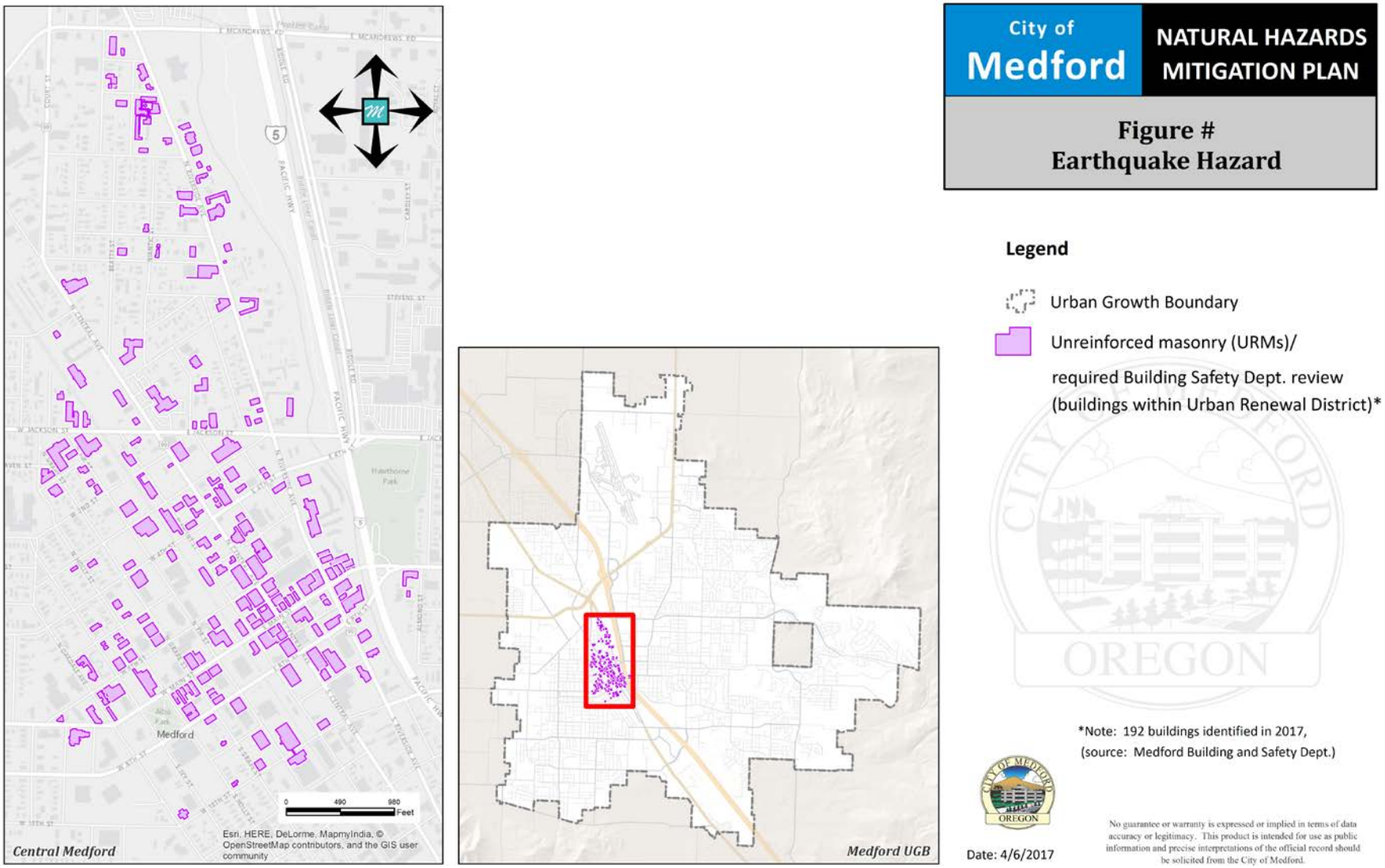
Critical Service	Zone	Estimated Time to Restore Service
Electricity	Valley	1 to 3 months
Electricity	Coast	3 to 6 months
Police and fire stations	Valley	2 to 4 months
Drinking water and sewer	Valley	1 month to 1 year
Drinking water and sewer	Coast	1 to 3 years
Top priority highways (partial restoration)	Valley	6 to 12 months
Health care facilities	Valley	18 months
Health care facilities	Coast	3 years

Source: OSSPAC, 2013

The vulnerability assessment for Medford reveals that 192 URMs and/or buildings that require Building Department review will be impacted by an earthquake. There may be other buildings within the Medford UGB in this same category; a full inventory of the buildings within the UGB was not available. Many additional buildings constructed of other materials will also be impacted. Building damage will greatly impact people as they lose their shelter, businesses, incomes, and people in the community. **Table 29** recovery timeframes show it will take up to three years to restore critical services; this highlights that the impacts from a Cascadia Subduction Zone earthquake are impressively severe. With restoration and recovery of critical services at such lengths of time, it is likely that many businesses will close and people will leave the area to start anew elsewhere.

The findings in **Table 29** are summarized with this striking observation, “Resilience gaps of this magnitude reveal a harsh truth: a policy of business as usual implies a post-earthquake future that could consist of decades of economic and population decline – in effect, a “lost generation” that will devastate our state and ripple beyond Oregon to affect the regional and national economy” (OSSPAC, 2013).

Figure 43. Earthquake Hazards



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, April 6, 2017

Table 30. Vulnerability Assessment for Earthquakes

Location	Probability	Extent	Overview of Resources at Risk
Subduction zone earthquake off the southern Oregon coast. All of Medford within the UGB.	The southern half of Oregon and northern California have an average return period about 240 years, and the probability of a small or large subduction earthquake occurring in the next 50 years is 37-43% (Oregon DLCD, 2015).	The strength or magnitude of the hazard is variable; the scale of damage depends on magnitude of the earthquake. Speed of the onset of an earthquake provides little warning time.	Severe damage to unreinforced masonry buildings. Slight to severe damage to government and educational facilities, residences, businesses, industrial sites, Interstate 5, the viaduct, other roads, and bridges in Medford. Electric, water, and gas utility infrastructure at risk.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
2010 NHMP There are 211 unreinforced masonry and/or buildings with required Building Department review. The number of tax lots and the improvement value was not determined in 2010. See also the Vulnerability Assessment for Landslides for additional impacts from earthquakes.	2017 NHMP There are 192 unreinforced masonry and/or buildings with required Building Department review. The buildings are on 290 tax lots with an improvement value of $112,513,320.	Individuals who are unable to support themselves independently for at least 14 days will be most vulnerable. Emergency services may be unable to reach persons in need. Low income persons living in older structures. Young, elderly, and medically fragile persons will be impacted.	Interstate 5 is vulnerable to structural damage. Roads, transit service, and the airport will be damaged. Fire stations, Police headquarters, Public Works, City Hall, and the Lausmann Annex will be damaged. Fire stations #2 and #4, and Police headquarters are new buildings. Services on east and west sides of the I-5 corridor will be disrupted and may be limited. Gas, electric, intranet, telephone service and other utilities and communications will be disrupted. ECSO 911 is located in a building constructed in 2009 and has backup facilities set at other pre-designated facilities.	The downtown historic district and business district will experience moderate to severe damage. All buildings may suffer damage. Critical facilities and infrastructure will be damaged. Limited or full closure of sectors of the economy such as business, industry, and government will greatly impact the overall economy and the ability of the city to recover.	There is the potential for spills and releases of hazardous materials into Bear Creek and other waterways, surface areas, and air. Debris and trash will enter the water systems and may jam the waterways. Open areas may suffer ground disruption. Many areas will receive evacuees and become spontaneous tent encampments and medical staging areas.

Section 5 Wildland-Urban Interface Fires

Introduction and Hazard Overview

According to the *2015 Oregon NHMP* for Region 4 in regards to wildfires:

> In Southwest Oregon the combination of proximity of communities to wildland areas; high summer temperatures; rugged terrain; and likelihood of summer thunderstorm activity contribute to the region's vulnerability to wildfire. Wildfires are most common during the late summer. Based on data from the *2013 West Wide Wildfire Risk Assessmen*t, in Region 4 Douglas and Jackson Counties have a high percentage of wildland acres in the Fire Risk, Wildland Development Areas, Fire Effects, or Fire Threat categories, making them especially vulnerable. Other areas of vulnerability are within wildland-urban interface communities (Oregon DLCD, 2015).

Nationally, more and more homes are being constructed in or adjacent to rural and wildland areas. A desire for a rural or suburban living environment, which provides easy access to urban areas, has increased the risk of fires in what is termed the wildland-urban interface. The areas where development meets vegetative fuels, such as forestland, are commonly referred to as the wildland-urban interface (WUI). WUI fire fuels include both structures and vegetation. The defining characteristic of the WUI is a structure built in or immediately adjacent to essentially continuous vegetation (fuel). Each year a significant number of people build homes within or on the edge of the forest, thereby increasing the risk to this type of wildfire hazard.

WUI risk has increased due to growth of residential developments on city peripheries and in rural areas, along with the suppression of smaller scale fires in forested areas that has resulted in vegetation and fuel conditions that support fires.

In Oregon, "there are about 240,000 homes worth around $6.5 billion within the WUI which has greatly complicated firefighting efforts and significantly increased the cost of fire suppression" (Oregon DLCD, 2015). Fires are caused by both human activities and natural events. According to the *2015 Oregon NHMP*, summers in the Region 4 area provide excellent weather conditions for extreme wildfires. Of note, lightning strikes are frequent during the summer months, and have the potential to ignite numerous and large fires (Oregon DLCD, 2015).

According to the *Balancing the Act of Living with Fire in the Applegate: Applegate Communities Collaborative Fire Protection Strategy* (Applegate Partnership, 2002), during 1970–1999, there were about 78 fires per year in the Applegate watershed. Some 56% of those fires were caused by human activity; lightning started the remaining 44%. That plan is now part of the *Jackson County Integrated Fire Plan* (Sara Rubrecht, personal communication, September 8, 2016).

The level of wildfire risk depends on the following factors (Multnomah County Emergency Management, 2016):

- Vegetative fuel load: The age of timber stands can be a factor in whether a non-threatening ground fire will spread to the canopy and become a dangerous crown fire. Clearings and fuel breaks will disrupt a slow moving wildfire enabling successful suppression. Large expanses of fallow fields or non-annual cash crops provide areas of continuous vegetation.
- Weather: High temperatures, low humidity, and high winds greatly accelerate the spread of a

wildland fire and make containment difficult or impossible.

- Topography: Steeper slopes exacerbate fire spreading and impede fire suppression efforts.
- Fire suppression resources: Water resources for fire suppression are typically lower in these areas that are served by pumped pressure zones. Fire department response times may be longer in these areas because of distance or narrow streets and driveways.
- Construction and defensible space: Fire-safe construction practices and defensible space practices such as weed abatement can reduce an area's risk to wildfire.

Forestland management practices such as fire exclusion, livestock grazing, and timber harvesting have altered the natural fire frequency, duration, extent and severity. As a result, risk to wildfire hazards is increasing in forested lands and in the WUI (USDA Forest Service, 2013).

Agricultural and ranching activities increase the risk of a human-caused wildfire spreading. Large expanses of fallow fields or non-annual cash crops provide areas of continuous vegetation (fuels) that have potential to threaten several homes and farmsteads. Under extreme weather conditions, escaped agricultural fires could threaten individual homes or a town (Multnomah County Emergency Management, 2011).

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

Types of Hazard

For the purposes of mitigation planning, three types of fires are defined: structure fires, wildland fires, and WUI fires. This chapter focuses on WUI fires that pose a threat to Medford.

Structure fires: Structure fires are fires where structures and contents are the primary fire fuel. Structure fires are most often confined to a single structure or location, in some cases they may spread to adjacent structures (Multnomah County Emergency Management, 2016).

Wildland fires: Wildland fires are fires where vegetation (grass, brush, trees) is the primary fire fuel - few or no structures are involved. The most common suppression strategy is to contain the fire at its boundaries, to stop the spread of the fire and then to let the fire burn itself out. Fire suppression responsibility is shared by local and state fire agencies (Multnomah County Emergency Management, 2016).

Wildland-urban interface (WUI) fires: The defining characteristics of a WUI are structures built in or immediately adjacent to areas with essentially continuous vegetative fuel loads. WUI fires often spread quickly and structures can become fuel sources. Fire suppression efforts focus on saving lives and on protecting structures to the extent possible (Multnomah County Emergency Management, 2016).

Location and Extent

The location of WUI fires that may affect the City of Medford are described with originating factors that are variable; and are primarily based on weather and fuel conditions. The extent of the WUI, or the

strength or magnitude, is also variable. The extent is further described in the Probability subsection. See also the Wildfire Hazard map, **Figure 44**.

As described in the *2015 Oregon NHMP*,

> Oregon has in excess of 41 million acres (more than 64,000 square miles) of forest and rangeland that is susceptible to damage from wildfire.
>
> Wildfires occur throughout the state and may start at any time of the year when weather and fuel conditions combine to allow ignition and spread.
>
> The majority of wildfires take place between June and October, and primarily occur in Oregon NHMP Natural Hazard Regions 4, 5, 6, and 7. However, even areas classified as low or moderate are susceptible to wildfires if the right combination of fuels, weather, and ignition conditions exist. Historically, Oregon's largest wildfires have burned in the Coast Range (Regions 1 and 2) where the average rainfall is high, but heavy fuel loads created low-frequency, high-intensity fire environment during the dry periods (Oregon DLCD, 2015).

Fire protection problems that can occur within WUI areas include use of combustible exterior construction materials, inadequate access for fire protection apparatus, inadequate fuel breaks around structures, driveways that are not clearly addressed, inadequate water supplies, and lack of knowledge by property owners regarding how to act when a fire threatens (USDA Forest Service, 2013).

According to the Cohesive Wildfire Strategy Coordinator for ODF Southwest Oregon District,

> Most metropolitan areas within the Rogue Valley are intermingled with wildland and green areas. Though many non-vegetative expanses do exist within metro areas (shopping malls, roads, parking lots, downtown sections, municipal and urban buildings, etc.) most areas are in close proximity to, or are adjacent to wildland areas with dense vegetation, and steep terrain. The combined hazards of intermingled wildland fuels and nearby heavily vegetated steep terrain, make it necessary to include most Rogue Valley metropolitan areas inside the current WUI boundaries.
>
> Other factors that influence combining Rogue Valley metropolitan areas into the WUI include the checker-boarded ownerships of the public and privately-owned wildland areas, close to the population centers. These wildland areas can be subject to heavy recreational and other human uses providing greater opportunities for human-caused wildfires. The vast majority of Rogue Valley metro areas and urban structures are located within ¼ mile or less of these high-use wildland areas. Wildfires create airborne burning embers that travel ½ mile or more from the fire. Structures, particularly those closely spaced as found in urban settings, are extremely vulnerable to ignitions from burning embers, and the spot fires created by burning embers.
>
> Most Rogue Valley metropolitan areas are surrounded by heavily vegetated, steep terrain with a high risk of wildfire. To provide sufficient fire protection for the population centers, it is essential for wildfire planning efforts to include metropolitan areas within the WUI boundaries, to ensure adequate suppression resources are available (John O'Connor, personal communication, March 27, 2017).

Areas within the Medford UGB that could be susceptible to WUI fires include the far eastern section of the community on the southern and western slopes of Roxy Ann Peak, and the area east of North Phoenix Road where steep slopes and thick natural vegetation exist. The City of Medford, the Medford Rural Fire Protection District 2, Jackson County, and the Oregon Department of Forestry respond according to the fire location and mutual aid agreements. **Figure 44** Wildfire Hazard, shows the location of wildfire hazards within and outside the Medford UGB.

From Oregon Department of Forestry's (ODF) perspective, the fuel load, type and arrangement found in the Roxy Ann Peak area is conducive to fast moving, high intensity wildfires, especially on the south and southwest facing slopes, which receive the greatest amount of solar exposure. Roxy Ann Peak also falls within the mid-elevation belt. In addition to the high flammability of the vegetation species, the ladder fuel arrangement of the vegetation poses the greatest challenge. When conditions are right, grasses provide the highest and fastest rate of fire spread; the buck brush and manzanita provide very high intensity fire, with unusually long flame lengths, and can produce firebrands (embers that produce spot fires ahead of the main fire). In the higher elevations, both the grasses and brush are situated beneath large conifers, which generates the highest number of British Thermal Units (BTUs) thus producing heat for the longest periods of time. Wildfires in these fuels and this arrangement commonly complicate control efforts, when coupled with limited vehicular access. During the summer of 2009, the Deer Ridge fire, located on Roxy Ann, burned rapidly from the bottom to the top of the peak, consuming all vegetation within control lines, at a high rate of spread. Since 2009, a large effort has been geared towards thinning projects to mitigate hazardous fuel loading areas in attempt to remove the ladder fuels. If a fire was to occur again, the fire intensity of treated areas would be reduced, giving fire crews a better, safer chance of catching a fire at a smaller size with less damage. (Taylor Wilkerson, ODF, Wildland Fire Supervisor, personal communication, January 19, 2017).

> Fire exclusion in Region 4 has created vegetation and fuel conditions for large and catastrophic fires that are more difficult to suppress than smaller fires. Throughout the watersheds, forests present a continuous fuel supply both vertically, in small, thin trees and dead branches (*ladder fuels*), and horizontally, in an abundance of dead and downed material. When a fire gets started in such a forest, the dead branches, sticks, twigs, and other material increase fire intensity and, with ladder fuels present, provide great opportunity for the fire to reach the forest canopy, resulting in a stand-killing crown fire. These conditions also affect the means in which prescribed fire and fuels treatment are applied to the landscape (Oregon DLCD, 2015).

The City of Medford is currently engaged in on-going fuel reduction projects in the Prescott Park area. The earliest work was performed in 2002. Projects also occurred in 2010, and 2013-2016; those totaled 142 acres treated. The fuel reduction focuses on reducing the density of understory and low woody vegetation like poison oak. Brush piles were scattered on eight acres treated in 2016. Prior to 2016, brush was either piled or cut and scattered to less than 12 inches depth. There have been at least two grants from ODF for this work; currently the work is supported by the City's Parks & Recreation operational budget. The fuel reduction work, according to City Arborist Adam Airoldi, will continue indefinitely to improve resiliency and reduce the risk of catastrophic fire (Adam Airoldi, personal communication, January 26, 2017).

The City of Medford is a participating member of the *Jackson County Integrated Fire Plan* (*JaCIFP*); it is dated 2006 (Jackson County Emergency Management, 2006). It is being updated and is now called the *Rogue Valley Integrated Community Wildfire Protection Plan* (Sara Rubrecht, personal communication, March 21, 2017).

> Although past efforts have been successful, it was recognized that there was a need for increased coordination among wildfire management agencies and a need for a greater understanding of and responsibility for wildfire safety among residents of Jackson County including the City of Medford. Since the creation of the National Fire Plan (NFP) in 2000 and passage of the Healthy Forests Restoration Act (HFRA) in 2003, communities have an increased opportunity to participate in federal agency wildfire fuels management planning, to receive funding for fuels management on private lands, and to be active participants in reducing wildfire risk (Jackson County Emergency Management, n.d.-b).
>
> The *Jackson County Integrated Fire Plan* seeks to reduce the risk of wildfire to life, property and natural resources in Jackson County by coordinating public agencies, community organizations, private landowners, and the public to increase their awareness of and responsibility for fire issues. The *Jackson County Integrated Fire Plan* is the wildfire chapter of the County's *Natural Hazards Mitigation Plan*; however, it also meets the national definition of a Community Wildfire Protection Plan (CWPP) (Jackson County Emergency Management, n.d.-a).

The CWPP process is designed to identify and prioritize areas for wildfire prevention and response efforts, referred to as Communities at Risk (CAR). According to Oregon's 2006 *Communities At Risk* Assessment (CARs Assessment), "a statewide task force was formed in February 2004 as part of the Oregon Department of Forestry's Fire Program Review to develop a statewide assessment of *Communities At Risk*" (Oregon Department of Forestry [ODF], 2006).

The CARs Assessment states "a *Community At Risk* is a geographic area within and surrounding permanent dwellings with basic infrastructure and services, under a common fire protection jurisdiction, government, or tribal trust or allotment, for which there is a significant threat due to wildfire" (ODF, 2006).The CARs Assessment identified Medford as a high risk CAR.

The Southern Oregon Forest Restoration Collaborative (SOFRC) was formed to address significant stressors stemming from fire regime disruption, extensive even-aged management and other land-use impacts, according to the *Rogue Basin Cohesive Forest Restoration Strategy: A Collaborative Vision for Resilient Landscapes and Fire Adapted Communities* (The Nature Conservancy, 2015).

The SOFRC developed the cohesive *Rogue Basin Forest Cohesive Forest Restoration Strategy (Strategy)* to "accelerate forest restoration planning, implementation, and monitoring tiered to regional assessments to match the scale of need." For the *Strategy*, The SOFRC established a 4.6 million acre analysis area that centered on the Rogue River Basin and encompassed the full extent of Federal lands managed by the Rogue River-Siskiyou National Forest, the Medford District Bureau of Land Management, and the National Park Service, along with the coastal watersheds south of the Rogue River (The Nature Conservancy, 2015).

The *Strategy* is

> designed to inform and support the federal land management agencies, the State of Oregon, and private landowners in planning integrative and cohesive active management to promote resilient landscapes, diverse habitats, fire-adapted human communities, and a predictable flow of ecosystem services and economic benefits. The Strategy will also be integral to updating the Jackson and Josephine County Fire Plans and regional Community Wildfire Protection Plans with risk assessment and potential priorities for treatment (The Nature Conservancy, 2015).

The *2014 Fire Plan Update* to the *Jackson County Integrated Fire Plan* (Jackson County Emergency Management, 2014) and the *Josephine County Integrated Fire Plan* (2004) identified that, in the past ten years, over 170 agencies, organizations, and companies in these two counties have embraced the national wildfire protection policies and invested many hours to reduce the risk of wildfire. The *2014 Fire Plan Update* also noted the partners are "aligning their counties Community Wildfire Protection Plans with the *National Wildfire Cohesive Strategy* and its *Western Regional Action Plan*. Current efforts focus on creating fire-adapted communities, fire response, and restoring and maintaining fire resilient forests" (Jackson County Emergency Management, 2014). The March 2017 draft of the *Rogue Valley Integrated Community Wildfire Protection Plan* provides updated information on these plans.

History

The *2015 Oregon NHMP* states "Historically, 70% of the wildfires suppressed on lands protected by the Oregon Department of Forestry (ODF) result from human activity. The remaining 30% result from lightning. Typically, large wildfires result primarily from lightning in remote, inaccessible areas" (Oregon DLCD, 2015). Wildfires in the Medford area have included WUI fires and wildland fires. These are listed in **Table 31**, Significant Historic Wildfires.

There have been several significant wildfires around Medford and in Jackson County. Given the geographic proximity and noting that the revised *Jackson County Integrated Fire Plan* includes Josephine County, as well as the more regional aspect of wildfire protection, the table below includes fires in the Medford area and the two counties. As described previously, WUI fires have increased in frequency and this is likely to continue as more residences are built and human activity increases in both WUI and wildland areas.

Of note, there are sets of electric transmission lines located on Roxy Ann Peak in Medford. Residents who move into the area in search of trees and rural views may be unaware of the need for the power company to control vegetation. According to a Pacific Power official, these lines "…are a critical coordinate providing energy to Southern Oregon and Northern California, from Medford to Mount Shasta - everything comes out of this hub…A tree on the line can have great ramifications" ("Shade Trees," 2001).

On September 21, 2009, a fire engulfed East Medford's Roxy Ann Peak, resulting in evacuations, road closures, and power outages. The Deer Ridge Fire reached a total area of 633 acres and more than 100 households required evacuation. Five air tankers and five helicopters battled the blaze (City of Medford, 2010) (City of Medford, n.d.-d). Pacific Power's facilities were threatened and were switched off, resulting in an 80 minute outage for approximately 25,000 customers in Jackson County (Monte Mendenhall, personal communication, August 4, 2016). This is one example of a wildfire impact on the community. **Table 31** is a list of significant wildfires in and near Medford.

Table 31. Significant Historic Wildfires

Date	Location	Description
1987		Silver Complex Fire burned 99,310 acres and cost $19 million to suppress.
1992	Jackson County	East Evans Creek Fire involved 10,135 acres burned and four structures lost.
Aug. 1994	Jackson County	FM-2112. The Hull Mountain Fire burned 8,000 acres, destroyed 44 structures, and killed one person. It was started by arson.
1994	Jackson County	The Sprignett Butte Fire burned 1,631 acres and was started by arson.

Date	Location	Description
1994	Roxy Ann Peak, Medford	Brushfire started by a vehicle off-roading illegally.
1999	Roxy Ann Peak, Medford	A blaze consumed two acres and was stopped 50 feet short of a residence. Cause was an overheated weed trimmer that caught fire. Same area as the 1994 Roxy Ann Peak brushfire.
2001	Jackson County	Antioch Road Fire burned 376 acres.
2001		Quartz Mountain Fire burned 6,300 acres.
2002	Josephine and Curry Counties	Biscuit Fire burned 499,945 acres and cost $150 million. Estimated to be one of Oregon's largest fires in recorded history. It encompassed most of the Kalmiopsis Wilderness.
July 2002	Near Jacksonville	FM-2445. 2002 Squires Peak fire burned 3,000 acres and threatened many homes.
Jul.- Aug. 2002	Butte Falls Resource Area near Medford	FM-2454. Timbered Rock Fire burned 27,111 acres on BLM and private forestlands. Cost $14 million of Oregon Land Protection Funds.
2003	Near Ashland, Jackson County	The Cover Road Fire burned 700 acres; occurred 3 miles east of Ashland.
2008	Jackson County	The Doubleday Fire burned 1,244 acres and threatened Butte Falls.
Sept. 2009	Roxy Ann Peak, Medford	Deer Ridge Fire on September 21, 2009. This WUI fire burned 633 acres and came within a few hundred feet of the city limits in the Roxy Ann Peak area. ODF provided an air tanker and helicopters to help extinguish the fire. Caused by a mower operating in dry grass.
2010	Ashland, Jackson County	The Oak Knoll Fire in Ashland destroyed 11 homes in 45 minutes. It burned 100 acres.
2013	Josephine County	Four fires sparked by lightning storm burned 47,000 acres in Josephine County. 1 firefighter died. Suppression costs for 3 of the fires on state lands was over $50 million. Caused damage to businesses relying on summer tourism and timber. Smoke created significant health risk to residents of both counties.
2013	Josephine, Douglas, Wasco, Grant	FM-5037. The Douglas Complex Fire combined with fires in Region 5, 6, and 7 and resulted in the most acres burned since 1951 on land protected by ODF. 48,324 acres burned.
2013	Josephine	FM-5039. The Brimstone Fire was part of the Southern Oregon fire storm that included the Douglas Complex. Burned 2,377 acres.
2013	Josephine	The Big Windy Fire was part of the Southern Oregon fire storm that included the Douglas Complex. Burned 26,725 acres. One firefighter died.
Jul 2014	Jackson County	The Launch Wildfire started on July 28 and extended through July 31. It was human caused. By August 2, the fire was held at 42 acres and was 100% contained. $325,000 was spent on firefighting efforts.
Jul 2014	Jackson County	The Beaver Complex was made up of the Salt Creek and Oregon Gulch fires, both were started by lightning on July 30.
Aug. 2014	Jackson County	Lightning initiated numerous fires in southern Oregon Cascades on August 1. By August 16, the fire covered 776 acres and containment estimates were not available. $5.3 million was spent on firefighting.
Aug. 2014	Jackson County	Executive Order No. 14-08. August 5, 2014. Invocation of Emergency Conflagration Act for the Beaver Complex Fire in Jackson County.
Aug. 2014	Jackson County	The Rogue River Drive Wildfire started by lightning on August 11. As of August 20, the fire covered 500 acres and was 95% contained. $1.9 million was spent on firefighting efforts.
Aug. 2014	Jackson County	Executive Order No. 14-10. August 14, 2014. Invocation of Emergency Conflagration Act for the Rogue River Drive Fire in Jackson County.
Sept 2014	Jackson County	The 790 Wildfire was started by lightning in the Sky Lakes Wilderness Area on July 31. As a wilderness area, it was allowed to burn until it reached the National Forest Land. On September 1, the fire covered 2,277 acres and was 11% contained. $2.7 million dollars were spent on firefighting efforts.
Jun 2015	Jackson County	The Bunker Hill Complex Fire was initiated by lightning on June 26. As of July 10 the fire was 388 acres and 100% contained. $5 million was spent on firefighting efforts.
Aug. 2015	Jackson County	The National Creek Complex wildfire consisted of the National Fire and the Crescent Fire, initiated by lightning on August 1. The fire covered 20,945 acres. $20.9 million was spent on firefighting

Date	Location	Description
		efforts.
Aug. 2015	Jackson County	The DL Potter Mountain Complex wildfire consisted of eight fires initiated by lightning on August 2. The fire covered 357 acres. $1.9 million was spent on firefighting efforts.
Jul 2016	Jackson County	The Bybee Creek Wildfire in Crater Lake National Park started on July 28. The likely cause is human activities. As of August 10, the fire was 1,072 acres and 100% contained. $4.7 million was spent on firefighting.
Aug. 2016	Jackson County	The Cleveland Ridge Wildfire started on August 22; it was caused by human activity. On August 30, the fire was 530 acres and 100% contained. $2.8 million dollars was spent on firefighting efforts.

Source: "Brush Fire Halted," 1999; Ballou, 2002; City of Medford, 2010; DLCD 2015; NOAA NCEI Storm Events database: https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=41%2COREGON#; City of Medford, n.d.-d; Oregon Office of the Governor, 2014b, 2014c; and Jackson County Emergency Management, 2014

Probability

According to the *2014 Interim Fire Plan Update*, there are about 350 fires sparked each year in Jackson and Josephine Counties. "At least once every 10 years several extraordinarily large wildfires (10,000 acres or greater) damage or destroy timber resources, threaten populated areas and blanket the region in dense smoke" (Jackson County Emergency Management, 2014).

As mentioned previously, the *Jackson County Integrated Fire Plan* (2006) and the *Josephine County Integrated Fire Plan* (2004) are in the process of being updated concurrently. According to ODF staff, "The current risk assessment is very robust and shows several different factors affecting our local communities. Some that are commonly used are fuels, topography, and values at risk" (Matt Krunglevich, personal communication, September 28, 2016). The update of the risk assessment includes these factors but uses different modeling and will result in newer data. The risk assessments, both current and the new update, are very similar for Jackson and Josephine Counties in terms of relative risk to large wildfires and loss. Both counties have extreme risk. On the edge areas of Medford, there is "extreme risk of wildfire until you get well into the city" (Matt Krunglevich, personal communication, September 28, 2016).

> Hot and dry summers combined with frequent lightning events, rugged terrain, and an abundance of fuels makes Region 4 a hotbed of fire activity. Historically, some of Region 4's largest fires have been caused by human activity. While lightning-caused fires accounted for nearly 70% of the fires in 2013, the 10-year average for lightning-caused fires is closer to 25% (Oregon DLCD, 2015). Climate is a recognized influence on fires.
>
> Current climate conditions, especially in drought years, influence the frequency, intensity, duration, and extent of fire. Summers are dry and lightning prone because a Pacific coast high-pressure system typically blocks precipitation for much of the season. In the upper elevations, where temperatures are low and rainfall is high, fires are less frequent than in the valleys. Larger climatic factors such as long-term global variations related to El Niño or to sunspot cycles also influence fire regimes, but this influence is confounded by local climatic variations, recent land management activities, and burns (Oregon DLCD, 2015).

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

example, based on a study conducted by the NRC, linked climate change to an increased exposure to wildfire smoke.

> As the world continues to warm with increasing greenhouse gases, a growing body of research suggests that wildfires will grow more frequent and intense. According to new findings published in *Climatic Change*, more wildfire activity will bring heavier smoke and more negative effects on human health. The Yale University-led study highlights the health consequences of having more smoke in the air (NASA Earth Observatory, n.d.-a).

According to the *2015 Oregon NHMP*, climate models project hotter, drier summers and a decline in mean summer precipitation for Oregon. Coupled with projected decreases in mountain snowpack due to warmer winter temperatures, Jackson County is expected to be affected by an increased incidence of drought and wildfire.

Of note, the *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley* states, "Today's forests developed under climatic conditions of the last millennium. The composition and structure of Southern Oregon's old growth forests may not occur again under modern climates and disturbance regimes (PNW Research Station, 2003). Restoration efforts may need to be adapted to restore forest diversity suitable to future climate" (Geos Institute, 2016b).

See the Vulnerability subsection for more information on the impacts of wildfires and Section 8 Air Quality for additional details on the health impacts of wildfires.

Vulnerability

The *2015 Oregon NHMP* states, "According to a University of Oregon study, The Economic Impacts of Large Wildfires, conducted between 2004 and 2008, the financial and social costs of wildfires impact lives and property, as well as the negative short and long-term economic and environmental consequences they cause" (Oregon DLCD, 2015).

As has been described previously, hazards impact people and property differently. The mission of the *2017 Medford NHMP* is "To protect people, property, and the environment." Wildfire, as with other hazards, impacts vulnerable populations more severely than other populations.

> Increasing construction in vulnerable areas increases risk for vulnerable populations. Oregon's Goal 4 and Goal 7 play critical roles in guiding development in these areas. Measures to enhance life safety enhancement and save costs include Community Wildfire Protection Plans (CWPPs), coordinated fire protection planning, and coordination by local, state, tribal, federal agencies, the private sector, and community organizations. Many local communities incorporate their CWPPs into their Local Natural Hazards Mitigation Plans (LNHMPs) (Oregon DLCD, 2015).

The *2015 Oregon NHMP* identifies Region 4 as one of the state's regions most susceptible to wildfire. "Based on data from the *2013 West Wide Wildfire Risk Assessment*, all counties in Region 4 have a high percentage of wildland acres subject to Fire Risk, Wildland Development Areas, Fire Effects, or Fire Threat, making them especially vulnerable" (Oregon DLCD, 2015).

This vulnerability is a result of several factors. The counties are made up of several smaller communities that lie within the wildland-urban interface and have a distinct vulnerability to wildfire given their proximity to forestland, high summer temperatures, rugged terrain, and likelihood of summer

thunderstorm activity. The human element is also a factor, with several populations intermixed in wildland areas. Other factors include arson and the high number of fires caused by debris burning and equipment use (Oregon DLCD, 2015).

"There are 198 state-owned/leased facilities located in this region's wildfire hazard zone, with a value of approximately $44 million. Of these, 11 are identified as critical/essential facilities. An additional 408 non-state-owned/leased critical/essential facilities are also located in this hazard zone" (Oregon DLCD, 2015).

Vulnerable populations, also referenced as people with access and functional needs (PAFN) are susceptible to additional hazard impacts. High levels of smoke from major fires pose health risks. Exposure to wildfire smoke can cause: coughing, stinging eyes, trouble breathing normally, scratchy throat, runny nose, irritated sinuses, wheezing and shortness of breath, chest pain, headaches, tiredness, an asthma attack, and fast heartbeat (CDC, n.d.-d).

> Wildfire smoke is a mixture of gases and fine particles that can irritate eyes and respiratory systems, and worsen chronic heart and respiratory diseases. The quantity and duration of smoke exposure, as well as a person's age and degree of susceptibility, play a role in determining whether or not someone will experience smoke-related health problems. Persons with pre-existing health conditions such as asthma or other chronic respiratory conditions and cardiovascular disease, people older than 65 years of age, infants and children, pregnant women, and smokers are particularly sensitive to smoke (Oregon DEQ et al., 2016).

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

According to the Forest Stewards Guild publication *Evaluating the Effectiveness of Wildfire Mitigation Activities in the Wildland-Urban Interface*,

> Disasters, including wildfire, often have a disproportionately negative impact on the most vulnerable such as the poor, the elderly, and people with disabilities (Buckland and Rahman 1999, Morrow 1999). An examination of the 2002 Rodeo-Chediski Fire showed that when fire hits, working class residents are more vulnerable than their richer neighbors (Collins and Bolin 2009). In addition, research from Oregon suggests that poor households are more likely situated in areas with minimal or non-existent fire response capabilities than less economically vulnerable households (Lynn and Gerlitz 2005). Even where wildfire mitigation programs exist, socially vulnerable communities are less likely to participate (Collins 2008, Ojerio et al. 2011). (Evans et al., 2015, p. 9)

One estimate placed a value of $84 on avoiding one wildfire-induced symptom day per exposed person per day (Richardson et al. 2012). "Firefighters themselves are exposed to greater risk when wildfires threaten homes and elicit an aggressive suppression response (Calkin et al. 2014). Wildfires in the WUI present unique, high-risk hazards for firefighters (Mangan 2000)" (Evans et al., 2015, p. 9). "Often, people whose homes are destroyed by wildfire do not rebuild after wildfire, causing long-term community change (Alexandre et al. 2015)" (Evans et al., 2015, p. 9).

In late July 2002, there were as many as 38 lightning fires in Jackson County. Smoke from the Timbered Rock fire blew in from the northeast and choked the valley. DEQ advised people with health problems to stay inside in air-conditioned environments and to avoid exercise outside ("Timbered Rock Blaze," 2002). Firefighters fought some of the fires for months and winds carried smoke into the Bear Creek Valley until Labor Day ("Tourism Choked," 2002).

Figure 44 is the Wildfire Hazard map. It includes wildfire hazards in two categories: Wildfire Hazard and Forestland Urban Interface (SB 360). Data sets are from Jackson County GIS. Hazards are shown inside and outside of the Medford UGB. The two categories of wildfire hazard are high-risk area and highest-risk area; these are subject to the Jackson County Planning & Development requirements because they are not within the city limits of Medford and thus the Medford codes are not applicable. The Forestland Urban Interface (SB 360) represents the 2010 State of Oregon Senate Bill 360 approved in 2011.

SB 360 was created by committee members that included State and County representatives. The law requires property owners in identified WUI areas to reduce excess vegetation, which may fuel a fire, around structures and along driveways. The code provision from Jackson County related to the Wildfire Hazard data is from Section 8.7 Wildfire Safety. It states,

> Applicability: This Section contains mandatory standards for all new and existing structures not exempted through Section 8.7.2 located in areas subject to wildfire hazards as identified on the "Hazardous Wildfire Area Map." The official version of the "Hazardous Wildfire Area Map" will be maintained by the Planning Divisions (OAR 660-006-0035, 40). Compliance with the standards of this section will be verified through a Fire Safety Inspection as coordinated through Jackson County Development Services and shall occur prior to issuance of building permits (Jackson County Development Services, 2005).

Table 32 specifies: the location and extent of WUI fires; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assets. Based on data provided by the City of Medford, there are 2,187 structures on 2,134 tax lots within the wildfire hazard inside the Medford UGB. The improvement value of those structures is $314,524,970. This is an increase in number of structures and in the number of tax lots within the wildfire hazard area from the *2010 Medford NHMP*. **Table 32** shows this comparison. Medford's population and development growth is a primary factor in the increase, as land is divided and developed.

Roxy Ann Peak has one full power FM radio station and four translators located on it (Karl Sargent, Chief Engineer, KOBI, personal communication, March 30, 2017).

The City of Medford Fire-Rescue, recognizing the challenges of development in wildfire hazard areas, has submitted a code amendment proposal application to the Oregon Department of Consumer & Business Services Building Codes Division (Kleinberg, 2016). The proposal is under review by the 2017 Oregon Residential Specialty Code Review Committee (https://www.oregon.gov/bcd/committees/Pages/17-residential-code-review.aspx), which serves and assists in technical review for the adoption of the *2017 Oregon Residential Specialty Code (ORSC).*

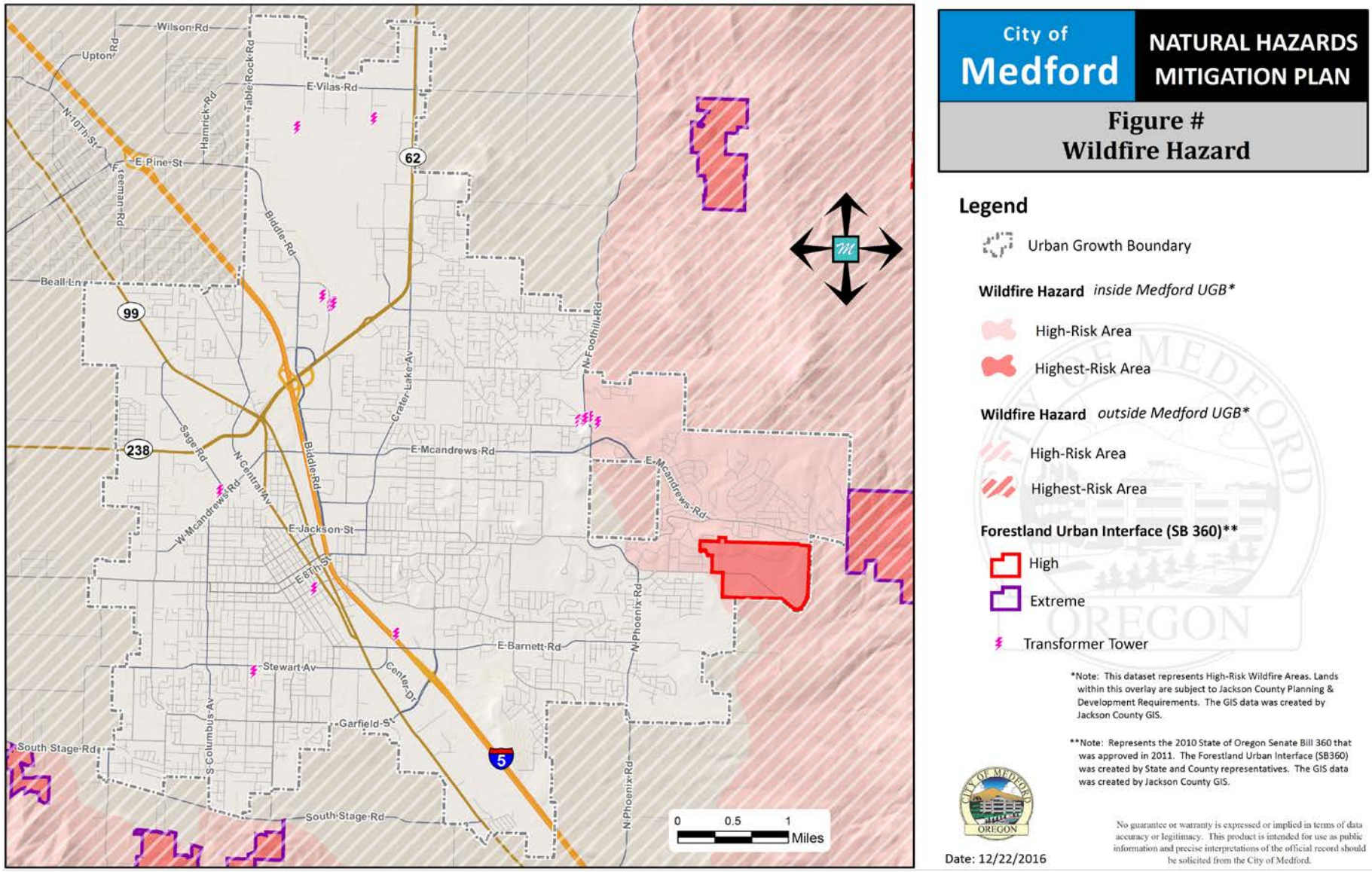
Medford's original proposal, submitted in September 2016, was to change provisions of R324 in the *ORSC*. As of March 2017, the proposal is to make it an appendix, rather than changing R324. Having wildfire hazard mitigation in the *ORSC* is supported by Medford because:

- "This would allow local jurisdictions that have a wildfire risk in their area to adopt mitigation measures that only apply to wildfire risk areas to help protect their community, first responders, and property" and

- "The draft appendix would allow materials that have not already been tested to be accepted if they go through the testing process. The testing requirements in the appendix follow the initial CA testing requirements and the ASTM requirements. Some of the CA standards later developed into ASTM standards. It is the intention to allow materials/ assemblies that have passed these testing standards to be acceptable for use" (Greg Kleinberg, personal communication, March 21, 2017).

On May 10, 2017, the Residential Structures Board voted unanimously to move the *2017 ORSC* forward with all the code change recommendations from the Code Change Committee, including the changes proposed by Medford, now referred to as Appendix W. If authorized by the Building Codes Director, Appendix W will be in the *2017 ORSC* when it is published in October, 2017. Appendix W then could be adopted by local jurisdictions (Greg Kleinberg, personal communication, May 11, 2017). Deputy Chief – Fire Marshal Greg Kleinberg of the City of Medford took the proposal through this process, and kept DLCD staff and others informed of this process.

Figure 44. Wildfire Hazard



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, December 22, 2016

Table 32. Vulnerability Assessment for Wildland-Urban Interface Fires

Location	Probability	Extent	Overview of Resources at Risk
Areas within the Medford UGB and outside the UGB. Highest-Risk Areas within the UGB are adjacent to the High-Risk and Highest-Risk Areas outside of the Medford UGB. East Medford hillside areas are most prone. See the Wildfire Hazard map.	"Hot and dry summers combined with frequent lightning events, rugged terrain, and an abundance of fuels makes Region 4 a hotbed of fire activity. Historically, some of Region 4's largest fires have been caused by human activity. While lightning-caused fires accounted for nearly 70% of the fires in 2013, the 10-year average for lightning-caused fires is closer to 25%" (Oregon DLCD, 2015). Climate is a recognized influence on fires.	The strength or magnitude of the hazard is variable. The intensity and strength of the fires is variable. They can occur suddenly or slowly, and spread.	Expensive, low density single-family homes on eastern hillsides, as well as residential neighborhoods in East Medford. Prescott Park and electric utility infrastructure are near Roxy Ann Peak. Roads may be closed due limited visibility, equipment staging, or fires encroaching. All forms of transportation and travel (airplanes, buses, cars) could be impacted.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
2010 NHMP There are 1,098 structures on 1,213 tax lots in the wildfire hazard area. The total improvement value of structures is $213,714,460.	2017 NHMP There are 2,187 structures on 2,134 tax lots in the wildfire hazard area. The total improvement value of the structures is $314,524,970.	All residents in the WUI area are at risk. People with access functional needs may be impacted by smoke, which can greatly impact young, elderly, and medically fragile persons. Some people may have difficulty evacuating the area.	Special communications equipment has been placed on Roxy Ann Peak for Oregon State Police and Oregon Department of Transportation. Two power transmission lines run north/south in the adjacent UGB. The transmission substation on Lone Pine services all of Jackson and Josephine Counties, and parts of Northern California. Hospitals and clinics may have an increase in patients due to fire related injuries and medical conditions exacerbated by the fires.	Commercial FM broadcast equipment is located on Roxy Ann Peak: one full power FM radio station and four translators. The homes in this zone, as well as the communications equipment on Roxy Ann Peak, are the main economic assets. There are no commercial areas in this zone. Retail and hospitality industry could be impacted.	Prescott Park, a City park, is on Roxy Ann Peak and within the WUI. Chrissy Park, an undeveloped City park, is also within the WUI. Wildfire will destroy natural habitat in the Roxy Ann Peak area. Air quality diminishes during wildfires and erosion can occur on burned lands.

Section 6 Landslides

Introduction and Hazard Overview

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

Landslides can result from a number of causes. Areas with steeper slopes, weaker geology, and higher annual precipitation tend to have more landslides. Most landslides in Medford happen during rainy months when soils are saturated. However, landslides may happen at any time of the year. Other contributing causes of landslides include: placing fill (weight) on steep slopes; vegetation removal; undercutting of a slope by erosion or excavation; and intense prolonged rainfall, or rapid snow melt that cause sharp changes in groundwater levels (DOGAMI, n.d.-b). As more areas susceptible to landslides are developed, greater losses and damages to people and property are likely to result from landslides. Projected increases in extreme precipitation caused by climate change will likely trigger increased landslides. The area's landslide risk is strongly correlated with rainfall, particularly in extreme rain events. Of note, areas denuded of vegetation by fire remain vulnerable to landslides for several years.

Earthquakes are likely to trigger landslides. Areas prone to seismically triggered landslides are the same as those prone to ordinary (i.e., non-seismic) landslides. As with ordinary landslides, seismically triggered landslides are more likely for earthquakes that occur when soils are saturated. See also Section 4, Earthquakes, for more information about earthquake hazards.

Types of Hazard

Four types of landslides – slides, flows, spreads, and topples/falls - are distinguished based on the types of materials involved, the mode of movement, and how they are triggered. The four types of landslides are characterized in **Figure 45**.

Landslides in the Medford area have most commonly consisted of debris flows along stream channels or slides along hillsides whose soils have become saturated during heavy rains.

> Debris flows, sometimes referred to as mudslides, mudflows, or debris avalanches, are common types of fast-moving landslides. These flows generally occur during periods of intense rainfall or rapid snowmelt. They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 mph but can exceed 35 mph. The consistency of debris flows ranges from watery mud to thick, rocky, mud that can carry large items such as boulders, trees and cars. Debris flows from different sources can combine in channels where their destructive power can be greatly increased. They continue flowing down hills and through channels, growing in volume with the addition of water, sand, mud, boulders, trees, and other materials. When the flows reach canyon mouths or flatter ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can wreak havoc in developed areas (Highland, Ellen, Christian, & Brown, 1997).

Figure 45. Types of Landslide Hazards

Source: DOGAMI (2008)

Location and Extent

The location of landslides that may affect the City of Medford are described with numerous originating factors that are variable. The extent of the landslides, or the strength or magnitude is variable. Extent is also described in the Probability subsection. The Landslide Hazard map, **Figure 52**, and the Medford Slope Map, Figure 53, provide more location and extent information.

The Oregon Department of Geology and Mineral Industries (DOGAMI) found that to more fully understand the landslide hazard in Oregon, lidar (light detection and ranging) topographic data must be collected and used during the mapping of existing landslides and modeling of future susceptibility (Oregon DLCD, 2015). Collaborative research in 2005 conducted by the DOGAMI and the U.S. Geological Survey Landslide Hazards Program resulted in two key findings. First, the use of the lidar data resulted in the identification of between 3 to 200 times the numbers of landslides identified using other data sets. Second, the ease and accuracy of mapping the spatial extent of landslides identified from lidar data were greatly improved compared to other mapping methods (Oregon DLCD, 2015). Thus, lidar is an excellent tool for hazard mitigation planning because it expands knowledge of the location and extent of landslides tremendously.

DOGAMI has updated its SLIDO database through December 29, 2014 (version 3.2 is the current). "SLIDO is a compilation of landslides in Oregon that have been identified on published maps. The original studies vary widely in scale, scope, and focus, which is reflected in a wide range in the accuracy, detail, and completeness with which the landslides are mapped" (DOGAMI, n.d.-b). This information is not lidar based but it does include all types of landslides. SLIDO data and an interactive web-based map can be found at the website http://www.oregongeology.org/sub/slido/index.htm.

The potential for landslides has increased as population growth and the desire for "view lots" has encouraged upscale residential growth into hillside areas that previously were uninhabited or lightly inhabited and often highly vegetated. The construction of access roads, utilities, and stormwater management systems into those areas are also development impacts. In wooded areas throughout the state, logging roads have been implicated as contributing to landslides.

While west Medford is relatively flat, with slopes of 0% to 5%. Slopes in east Medford increase to more than 15% and become steeper into the foothills, where slopes of 30% to 50% or greater exist. The maximum slope advisable for urban development is usually less than 25% (Marsh, 1991). **Figure 52** Landslide Hazards shows the landslide hazard as low, moderate, high, and very high while **Figure 53** Medford Slope Map shows the areas of slope in Medford ranging from 15% to 35% and greater than 35%.

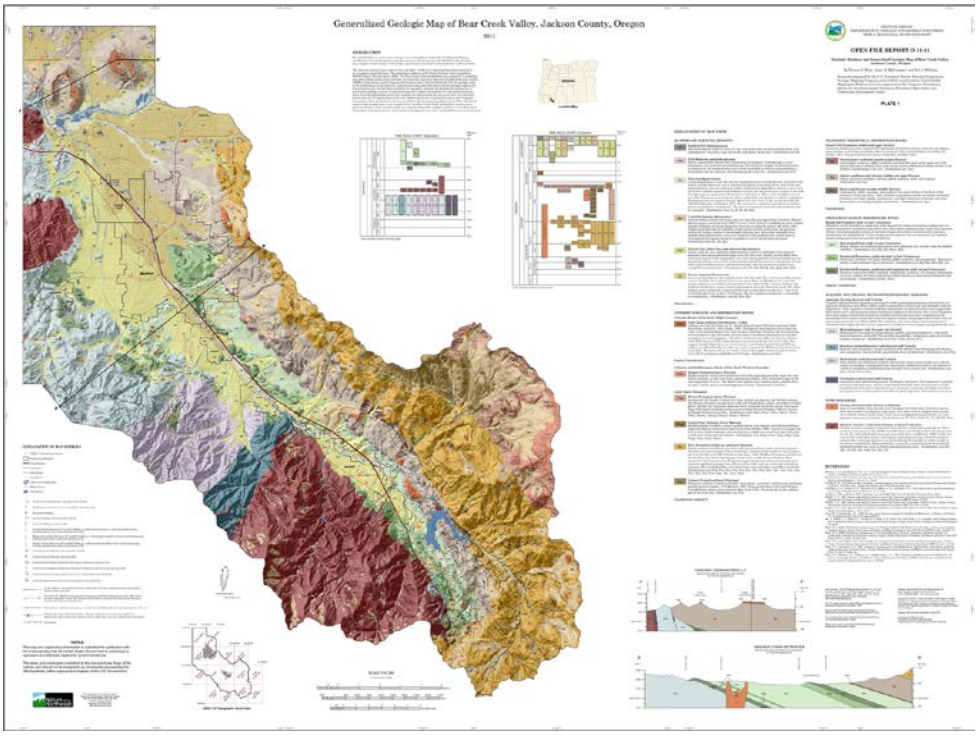
The *2015 Oregon NHMP* describes:

> Landslides occur throughout this region of the state, although areas with steeper slopes, weaker geology, and higher annual precipitation tend to have more landslides. In general, the Klamath Mountains have a high incidence of landslides. On occasion, major landslides sever major transportation routes such as U.S. or state highways and rail lines, causing temporary but significant economic damage. For example, new geologic mapping of the Medford area found 1,734 landslide, debris fan, and colluvium deposits indicating a high level of hazard in this small area (Oregon DLCD, 2015).

Figure 46 below shows a Generalized Geologic Map of Bear Creek Valley, Jackson County, Oregon. From the related DOGAMI *Open File Report 0-11-11*:

"Bear Creek Valley of southwest Oregon is a narrow alluvial basin flanked by the Klamath Mountains and Western Cascades physiographic provinces (Figure 1; Plate 1). The basin encompasses the agricultural, industrial, and population center of Medford and its surroundings. The project area for this study covers ~1,126 km2 (~435 mi2) of Bear Creek Valley and surrounding uplands. It extends along the Rogue River from the Gold Ray dam site upstream to the mouth of Little Butte Creek (east of Upper Table Rock) and covers all but the fringes of the Bear Creek drainage south of its mouth near the Gold Ray dam site. The cities of Ashland, Talent, Phoenix, Medford, Jacksonville, and Central Point are covered, along with the western part of White City" (Wiley, McClaughry, & D'Allura, 2011).

Figure 46. Generalized Geologic Map of Bear Creek Valley, Jackson County, Oregon



Source: Wiley et al. (2011)

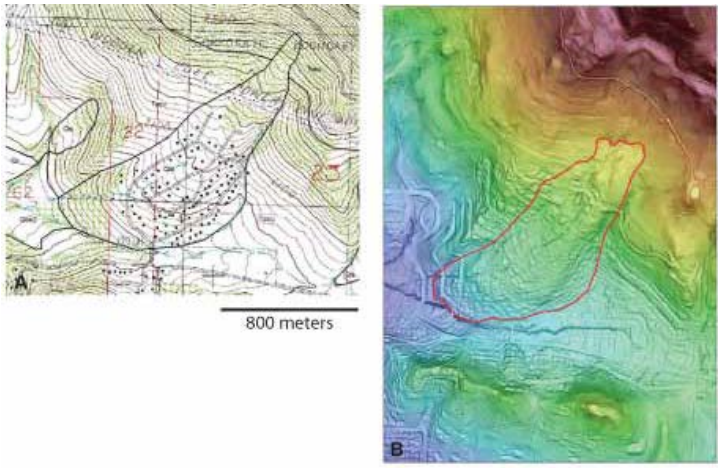
From the Geologic Hazards section of *Open File Report 0-11-11*:

> Landslides, rock falls, debris flows, and debris avalanches may present a significant geologic hazard in Bear Creek Valley. At least four general types of landslide deposits are present. They include 1) rock fall- and landslide-generated debris flows and debris avalanches represented by remnants of older slides, 2) complex landslides involving slow-moving unstable masses of rock and colluvium, 3) simple landslides involving terrace, cutbank, and cliff collapses, and 4) colluvium-derived landslides and slumps.
>
> Rock fall- and landslide-generated debris-flows may pose a significant geologic hazard where very steep slopes are present in Bear Creek Valley, especially along the flanks of the Table Rocks and cliffs in the eastern part of the valley.
>
> The main failure point for debris avalanches originating along the west flank of the Western Cascades appears to occur at the base of lava flows or thick welded tuff. Undercutting of these

contacts is capable of sending large boulders cascading down into adjacent valleys. Potential natural triggering mechanisms for these types of debris flows and large landslides include heavy rainfall, earthquakes, or extensive devegetation due to fire. Redirected drainage and poor construction practices are human activities that could initiate debris-avalanche-forming slope collapse. Many small alluvial fans and debris fans in Bear Creek Valley have been mapped on the basis of analysis of 1-m lidar DEMs. Rapidly moving landslides in the form of debris flows may be expected on both alluvial and debris fans that lie at the mouths of steep-sided, colluvium-filled canyons and upland drainages. Inundation of fan areas by rapidly moving debris flows is most likely during episodes of intense rainfall that occur after soils have been saturated by autumn and early winter rainfall. Some older landslides have produced deposits that because of their young age, lack of induration, and chaotic internal structure, experience problems with piping, settling, erosion, and local reactivation or internal sliding.

Landslide deposits (outlined polygons) east of the city of Medford as mapped using (a) existing topographic map and (b) new high-resolution lidar slope shade digital elevation model (DEM). Location in both A and B are the same location. Landslide deposits east of the city of Medford, some of which may be at least in part considered active, recently have been areas of intense development. Note the house pads and streets on the lidar DEM marking development on the landslide deposit (Wiley et al., 2011).

Figure 47. Mapped Landslide Deposits in Bear Valley



Source: Wiley et al. (2011)

History

Most landslides in Medford and in Jackson County have occurred during flood events. During the 1997 “New Year’s Day” flood, more than 70 landslides occurred in the county. The majority (70%) of the slope failures that occurred in the county were adjacent to road cuts on steep slopes. Of these, 77% were on south-facing slopes where vegetation has a more difficult time of re-establishing itself according to C.J. Atkinson’s unpublished paper entitled *Landslide Mapping Results*, June 5, 1998.

According to Medford’s Public Works staff, there were some small landslides on a slope in the Hillcrest area in 1997, associated with the heavy rains of that season. Flooding in the upper area resulted in topsoil sliding off the hillside. This was a drainage issue, rather than a structural one.

Significant landslides occurred before recorded history, in east Medford, on the slopes of Roxy Ann Peak. Roxy Ann Peak is a 30 million year old volcano. Its shoulders and head are gone, leaving what is called a volcanic neck. The landslides on Roxy Ann Peak were likely the effect of a subduction zone earthquake off the coast of Oregon ("Colossal Quake Will Come," 1998).

Growth continues to occur onto peripheral hillsides in Medford. The landslide deposit areas of Roxy Ann Peak have been developed with subdivisions of expensive homes. A concern is that these deposits could move during future severe earthquakes, thus resulting in damage to the people and homes in the subdivision. (Ferrero, 2000).

Ashland consulting geologist Thomas Ferrero has documented the instability of the ground in the Roxy Ann Peak area. In his *Geologic Hazards of the Roxy Anne Butte/East Medford Area*:

> …earthflow complexes in the vicinity are masses of unstable ground similar to the Skycrest mass before it slid. They are huge, slowly creeping unstable masses that are very unpredictable. Their movement tends to stop and go randomly, sometimes in sudden short bursts, or the whole mass may fail as at Skycrest…. Nearly every headwall on the slopes of Roxy Ann contains an earthflow complex. Houses are being constructed on one of the largest right now, in the area east of Eagle Trace. The large flat at Laurelcrest was long ago at the same elevation as the ridge above, hundreds of feet higher. The steep slope above the flat is a scarp, and the Laurelcrest flat is the top of a large earthflow mass (Ferrero, 2000).

An additional feature of interest in the Roxy Ann area is expansive clay soils. Hillside soils often consist of expansive clay and are characterized by instability. Landslides and soil erosion from development are particularly common in areas where the soils have low shear resistance, or the inability to withstand downward movement.

Ferrero (2000) describes that expansive clay soils, averaging four to five feet in depth, exist in the Roxy Ann area and extend toward the valley floor. In some areas where there has been earthflow or downslope "creep," the clay can be more than 20 feet in depth. The shrink-swell area, affected by fluctuations in moisture content, can extend up to eight feet beneath the surface. According to Ferrero (2000), many homes on the slopes of Roxy Ann are being built on foundations of imported granular fill on top of highly expansive clay. This will likely lead to foundation damage to homes, depending on localized conditions.

Heavy rains and strong winds from December 18, 2005 through January 21, 2006 caused damage to many public facilities in Oregon. A disaster declaration was made on March 20, 2006 (FEMA, n.d.-i). On December 30, 2006, a large section of the roadway fill on Roxy Ann Road slipped downhill due to the saturated soil. The damaged area measured 70 feet long x 20 feet wide x 2 feet deep, and prevented access to residences and public facilities including emergency services communication facilities atop Roxy Ann Peak (City of Medford Parks & Recreation Department, 2006). Approximately 75% of the road surface was lost during the slide, and material slid over 100 feet down the slope; Roxy Ann Road was closed about a week (Adam Airoldi, personal communication, April 7, 2017).

The City of Medford received funding from FEMA to repair the road and make additional repairs that would help mitigate future damage. Funds were expended on the design, construction management, and materials. As part of the mitigation, the contractor installed a 12" cross culvert and 140 linear feet of perforated fill drain. The improvements assist with water run-off during weather related events. The project scope included the following categories of repairs:

- Mobilization,
- Erosion Control,
- Traffic Control,
- Slide Repair,
- Slough Repairs,
- Drainage Improvements, and
- Pave Road Surface (City of Medford Parks & Recreation Department, 2006).

A March 2013 Medford Mail Tribune article ("New Heights for Bella Vista,") describes "a 50-yard gouge on a west-facing slope where the hillside slipped 6 to 10 feet after a water main broke a year ago, unleashing more than 150,000 gallons" of water at Bella Vista Heights. Bella Vista Heights is a subdivision in the east hills of Medford.

According to Medford staff, the slide was located southeast of the Foothill/McAndrews intersection, more specifically between La Strada Circle and Carino Lane. It happened in March 2012 after a newly constructed water main broke. The break occurred prior to construction of homes in the subdivision. The water main was fixed by eliminating the connection between La Strada Circle and Carino Lane (Jim Huber, personal communication, August 10, 2016).

Table 33. Significant Historic Landslides

Date	Location	Description
30 million years ago	Roxy Ann Peak, Medford	Landslides occur as a result of a subduction zone earthquake off the coast of Oregon.
Dec. 1964	Statewide	DR-184. Heavy rains and flooding, with landslides, on December 24, 1964.
Jan. 1974	Near Canyonville, OR	Nice employees working in a telephone building were killed when the building was pushed by a mudslide into Canyon Creek.
Feb. 1996	Statewide	Heavy rains and rapidly melting snow contributed to hundreds of landslides / debris flows across the state; many occurred on clear cuts that damaged logging roads.
Nov. 1996	Lane and Douglas Counties, also Statewide rain on snow, flooding	Heavy rain triggered mudslides in Lane and Douglas Counties; eight fatalities and several injuries in Douglas County. DR-1149. Tropical air mass, intense rain, landslides, power outages.
1997	Hillcrest area of Medford	Small landslides on a slope in the Hillcrest area of Medford, associated with rains. Flooding in the upper area resulted in topsoil sliding off the hillside.
Jan. 1997	Jackson County	During the 1997 New Year's Day flood, more than 70 landslides occurred in Jackson County.
Dec. 2003-Jan. 2004	Statewide	DR-1510. Winter storms with landslides.
Dec. 2005-Jan. 2006	Medford and Statewide	Heavy rain and storms occurred 12/18/05 through 1/21/06. On December 30, 2005 a large section of roadway fill on Roxy Ann Road slipped downhill. The damage area measured 70 ft. long x 20 ft. wide x 2 ft. deep. It prevented access to public facilities including the emergency communication tower atop Roxy Ann Peak. In March 2006, DR-1632 was issued. Statewide impacts from storms, floods, landslides, and mudslides.
Jan. 2011	Statewide	DR-1956. Severe winter storm, flooding, mudslides, landslides, and debris flows.
March 2012	Bella Vista Heights, Medford	50 yard gouge on a west-facing slope where the hillside slipped 6-10 feet after a water main broke.

Source: C.J. Atkinson, unpublished paper, *Landslide Mapping Results,* June 5, 1998; "Colossal Quake Will Come," 1998; City of Medford, 2010; Oregon DLCD, 2015; FEMA Disaster Declarations website: https://www.fema.gov/disasters; and Taylor and Hatton, 1999; Jim Huber, personal communication, August 2016; City of Medford Parks & Recreation, 2006.

Probability

Landslides tend to move repeatedly over time, so identifying the locations of existing landslides is critical for predicting the locations of future landslides. However, the locations of existing landslides alone is not enough to predict the future. The geology, slope, and triggering factors such as water, earthquakes, volcanic eruptions and humans must also be considered. When all of these factors are combined, it results in landslide susceptibility or the likely locations of future landslides. Inventory and susceptibility maps can be used to guide assessments for future developments, and can be used to assist in planning and mitigation of existing landslides (Oregon DLCD, 2015).

The best data to predict locations of future landslide events is the State of Oregon and Medford's current inventory of past landslides and the statewide Landslide Susceptibility Overview Map (Burns, Mickelson, & Madin, 2016) in **Figure 48**. Landslide inventory maps reveal areas that may require additional site evaluation prior to development. In areas where landslides are prone to happen, jurisdictions often require additional evaluation about factors such as the slope, and the soil and rock characteristics of the site prior to development. This site specific evaluation provides more information to identify and analyze the hazard and potential risk at the site. See Chapter 3 Mitigation Strategy for a description of Medford's in place mitigation efforts, including a hillside ordinance that was adopted in 2009.

In February 2016, DOGAMI published a landslide susceptibility overview map of Oregon and a related report called *Open File Report 0-16-02, Landslide Susceptibility Overview Map of Oregon*. The maps and report provide a general level of data for the entire state, with some specific data for the county and city level. The intended use of this overview map is to help identify regions (cities, counties, communities, portions of lifelines, watersheds, etc.) that may be at risk for future landslides. The map is designed to provide landslide hazard information for regional planning and specifically to identify areas where more detailed landslide mapping is needed (Burns et al., 2016).

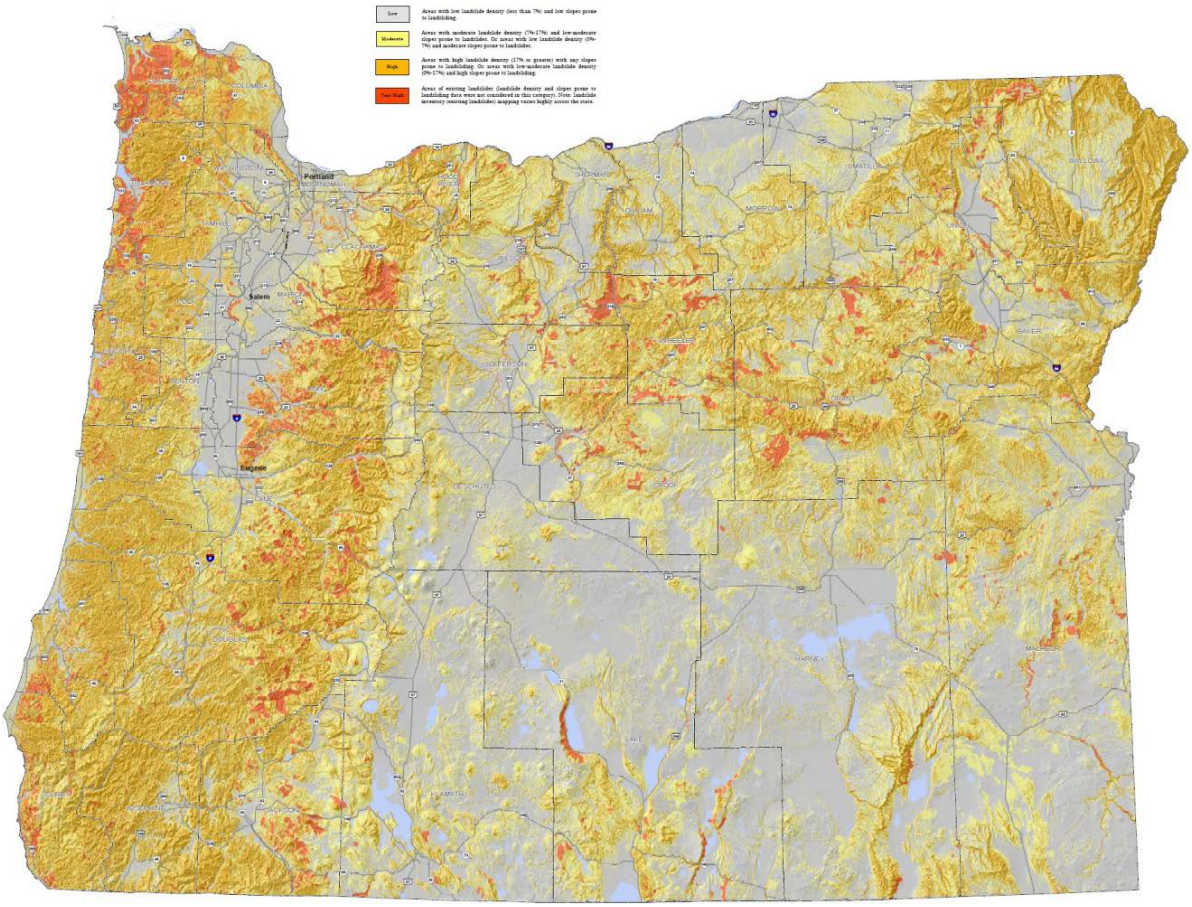
Table 34 uses data from the DOGAMI report to show the percentage of low to very high landslide susceptibility exposure of the area to landslides within Medford. For example, in Medford, of all the area identified as susceptible to landslides, 58.7% has a low susceptibility. Areas not identified as susceptible to landslides, are not included.

Table 34. Medford Landslide Susceptibility Exposure

Landslide Susceptibility Exposure in Sq. Ft.					Landslide Susceptibility Exposure in %			
Area sq. ft.	Low	Moderate	High	Very High	Low	Moderate	High	Very High
715,933,475	420,235,939	233,209,807	44,206,304	18,281,425	58.7%	32.6%	6.2%	2.6%

Source: Burns et al., 2016

Figure 48. Landslide Susceptibility Overview Map of Oregon



Source: Burns et al., 2016

"Landslides are found in every county in Oregon. There is a 100% probability of landslides occurring in this region in the future. Although we do not know exactly where and when they will occur, they are more likely to happen in the general areas where landslides have occurred in the past. Also, they will likely occur during heavy rainfall events or during a future earthquake" (Oregon DLCD, 2015).

According to the *2015 Oregon Natural Hazards Mitigation Plan*, climate models project an increased incidence of flooding and an increased magnitude of extreme flooding events to occur in western Oregon, including Medford. Increased rainfall, particularly extreme events, will likely trigger an increase in the number of landslides (Oregon DLCD, 2015).

Vulnerability

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> Landslides can occur throughout the region, though more tend to occur in areas with steeper slopes, weaker geology, and higher annual precipitation. Rain-induced landslides can occur during winter months. Earthquakes can trigger landslides in the region. Vulnerability is increased in populated areas such as in the Cities of Ashland and Medford and in the Klamath Mountains (Oregon DLCD, 2015).

Landslide impacts to state facilities are, "Of the 5,693 state facilities evaluated, 434 are located within landslide hazard areas in Region 4, totaling roughly $164.4 million. This includes 34 critical or essential facilities. An additional 1,069 critical or essential facilities not owned/leased by the state are located within a landslide hazard zone in Region 4" (Oregon DLCD, 2015).

Table 36 specifies: the location and extent of landslides; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assets. This NHMP assumes that structures built on slopes of more than 25% are at a greater potential risk of landslide than others. Within this category there are 420 structures on 1,032 tax lots with a total improved value of $419,223,530. Data from the 2010 NHMP are also included in **Table 36**, and it is evident that there has been an increase in the number of structures, and a substantial increase in the number of tax lots in the landslide hazard area. The population and development growth of Medford has resulted in many land divisions and development of those lands. As is described in Chapter 3 Mitigation Strategy, Medford has numerous existing provisions to mitigate impacts of landslide hazards through zoning, building, and fire code provisions. **Table 36** identifies the potential impact of landslide hazard on local assets in Medford.

Using the data from *Open File Report 0-16-02, Landslide Susceptibility Overview Map of Oregon* (Burns et al., 2016), the City of Medford determined the number of structures and tax lots within the low, moderate, high, and very high categories of hazard, within the Medford UGB. The table also includes the improvement value of the structures on the land within each hazard category. Total numbers cover the entire area of Medford within the UGB.

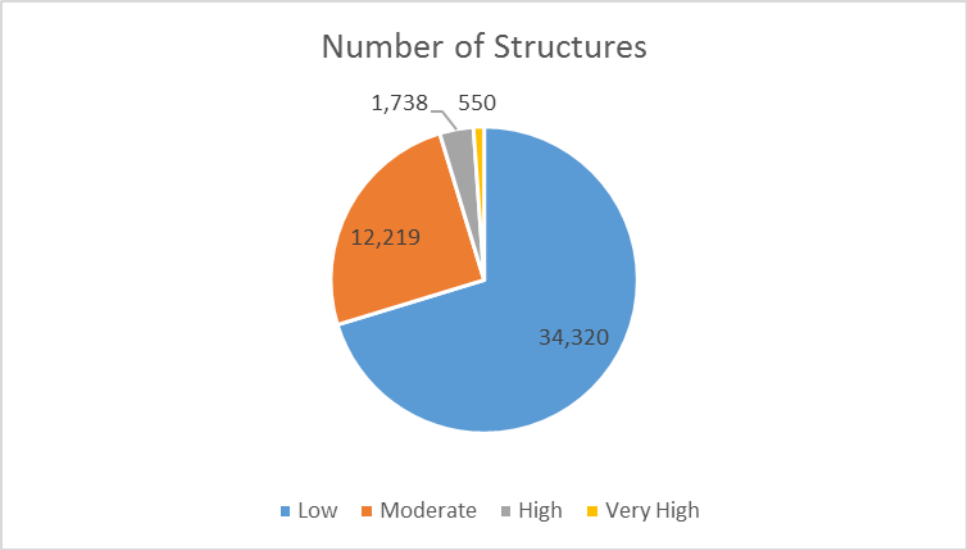
Table 35. Medford Vulnerability Assessment with Landslide Susceptibility Data

Landslide Hazard	# of Structures	# of Tax Lots	Improvement Value
Low	34,320	19,596	$3,421,925,403
Moderate	12,219	8,400	$1,555,122,300
High	1,738	1,430	$299,225,270
Very High	550	434	$73,196,740
Total	48,827	29,860	$5,349,469,713

Source: Burns et al., 2016 and Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, March 2017

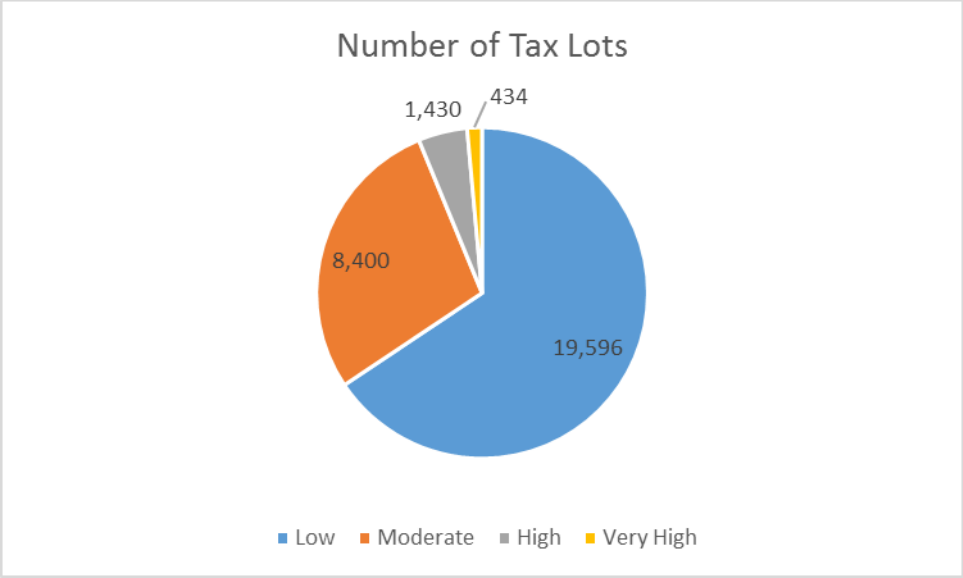
Based on the data in **Table 35**, the pie charts in **Figure 49** through **Figure 51** provide a visual illustration. The Landslide Hazard map in **Figure 52** shows the location of the low, moderate, high, and very high landslide areas within the Medford UGB.

Figure 49. Number of Structures within the Medford UGB Based on Landslide Susceptibility Data



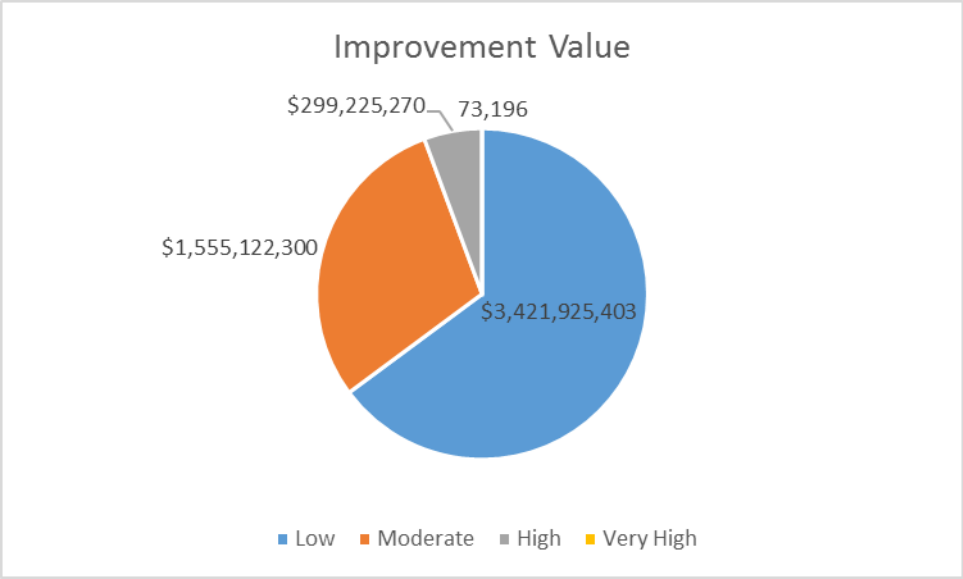
Source: Burns et al., 2016 and Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, March 2017

Figure 50. Number of Tax Lots within the Medford UGB Based on Landslide Susceptibility Data



Source: Burns et al., 2016 and Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, March 2017

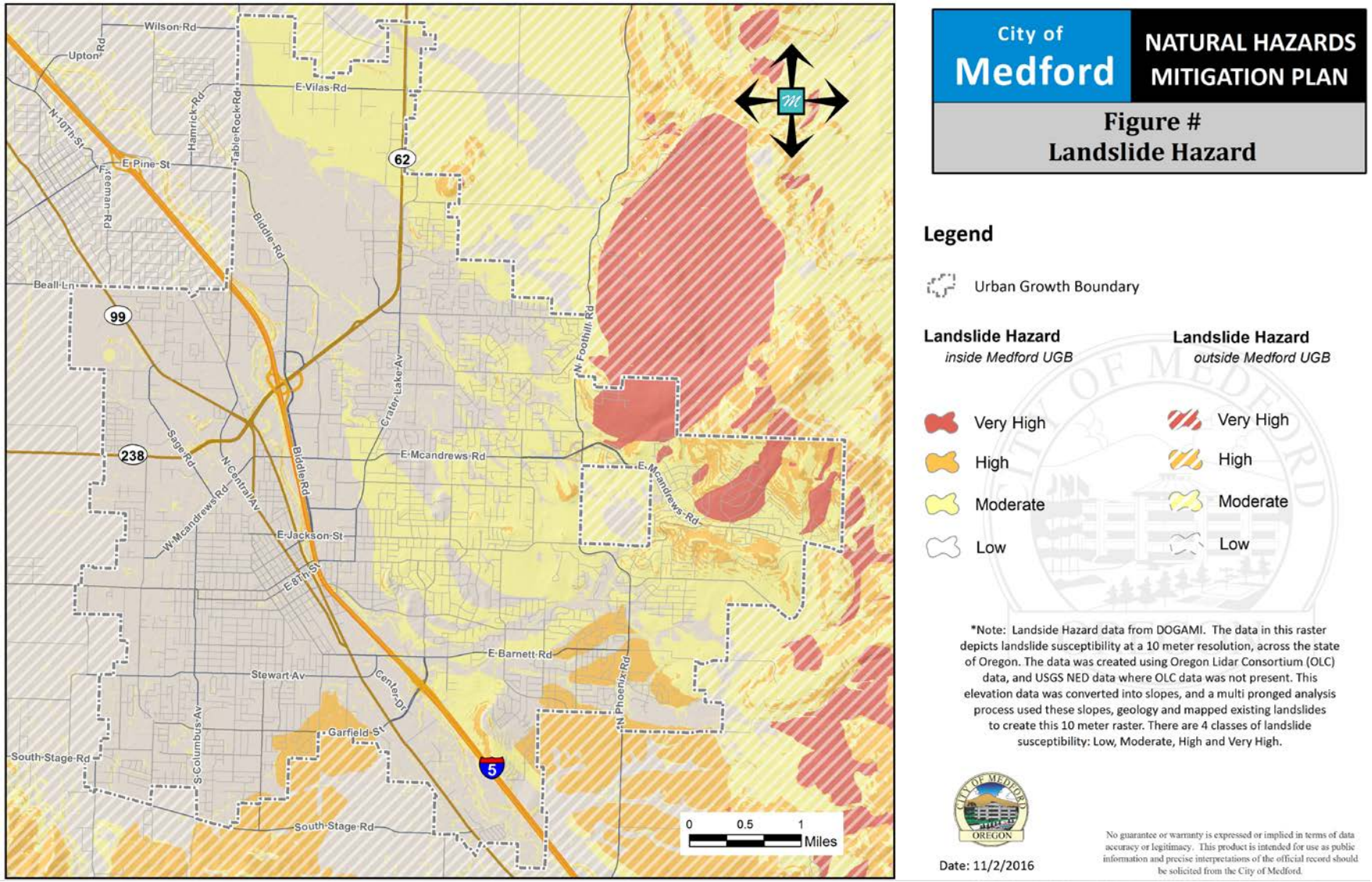
Figure 51. Improvement Value of Structures and Tax Lots within the Medford UGB Based on Landslide Susceptibility Data



Source: Burns et al., 2016 and Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, March 2017

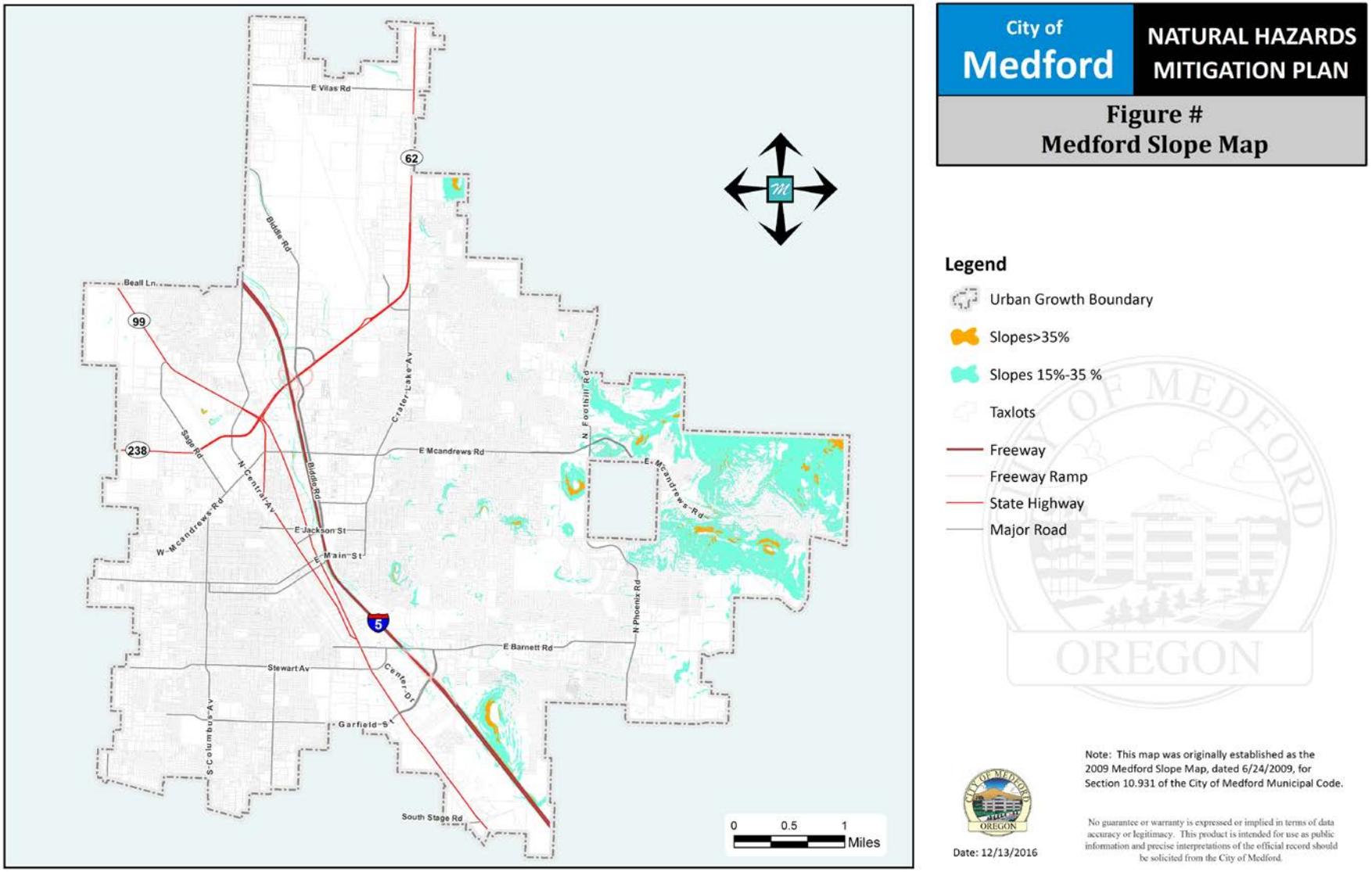
Landslides impact people and property in many ways. Landslides cause road blockages by dumping debris on road surfaces or cause road damages if the road surface itself slides downhill. Damages to roads and utilities are generally limited to small areas, often in residential areas, with low to moderate damages and economic losses. Of note, even very small ground displacements of a few inches often result in pipe failures, and building or road damages. The less common larger landslides can affect several buildings and homes or entire neighborhoods, major roads or highways, including bridges, overpasses and viaducts, or major utility lines. Large landslides can make significant economic impacts on a community, in the range of tens of millions dollars. Occupants of buildings or vehicles may be injured or killed by landslides of any size.

Figure 52. Landslide Hazard



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, November 2, 2016

Figure 53. Medford Slope Map



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, December 13, 2016

Table 36. Vulnerability Assessment of Landslides

Location	Probability	Extent	Overview of Resources at Risk
East Medford within the city limits and within the adjacent UGB in Roxy Ann Peak area are most prone, but any area within the Medford UGB could have a landslide. Landslides can also occur outside the UGB. See the Landslide Hazard map.	"There is a 100% probability of landslides occurring in this region in the future. Although we do not know exactly where and when they will occur, they are more likely to happen in the general areas where landslides have occurred in the past. Also, they will likely occur during heavy rainfall events or during a future earthquake" (Oregon DLCD, 2015).	The strength or magnitude of the hazard is variable, ranging from no practical impact to life and property threatening impacts.	Expensive, low density, single-family homes on the eastern hillsides are susceptible to landslides. Apart from residences, Prescott Park is on Roxy Ann Peak, and there is some electric utility infrastructure in the environs, some within and outside the City limits. Landslides could make the access road into this area impassable. There is concern that a subduction zone earthquake could dislodge ancient landslide areas that have been developed.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)		People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
2010 NHMP This plan assumes that structures built on slopes of more than 25% are at a greater potential risk of landslide than others. Within this category, there are 289 structures on 221 tax lots with a total improvement value of $186,408,330.	2017 NHMP This plan assumes that structures built on slopes of more than 25% are at a greater potential risk of landslide than others. Within this category there are 420 structures on 1,032 tax lots with a total improvement value of $419,223,530.	Residents residing on ancient debris flows, on or below potential debris flows are at risk. Residents may be at greater risk if their homes were constructed on slopes greater than 25%. Young, elderly, and medically fragile persons could be impacted.	At the junction of McAndrews and Hillcrest Roads, there is a utility corridor (water, electric, gas) that could be put at risk by a landslide. This could potentially cut off utilities to all persons living east of that location.	There is no commercial or industrial development in this area. Clean up activities related to landslides are very costly. Proactive structural upgrades and repairs are expensive. Stabilization of hillsides and the reconstruction of infrastructure (roads) is very costly.	Prescott Park on Roxy Ann Peak and Chrissy Park adjacent to the UGB. Landslides result in significant increases in stream erosion and the degradation of water quality.

Section 7 Volcanic Eruptions

Introduction and Hazard Overview

DOGAMI staff stated that since the eruption of Mount St. Helens in 1980, an "awakening" of research and technological advancements in the study of volcanoes has been made (Jason McClaughry, personal communication, September 29, 2016).

According to the *2015 Oregon Natural Hazards Mitigation Plan* for Region 4,

> Volcanic activity may occur within the eastern areas of the region's counties that coincide with the crest of the Cascade mountain range. Particular areas of vulnerability include Crater Lake, upper reaches of the Umpqua and Clearwater Rivers, and the OR-62 corridor. Most volcanic activity is considered local. However, lahars and ashfall can travel many miles and small mountain communities, dams, reservoirs, energy-generating facilities, and highways may be vulnerable. There are no state-owned/leased facilities and no critical/essential facilities located in a volcanic hazard zone within Region 4 (Oregon DLCD, 2015).

Cascadia Subduction Zone movement, the movement of continental plates against each other, generates volcanic activity in the Pacific Northwest. Eric Dittmer, Southern Oregon University Geology Professor Emeritus states:

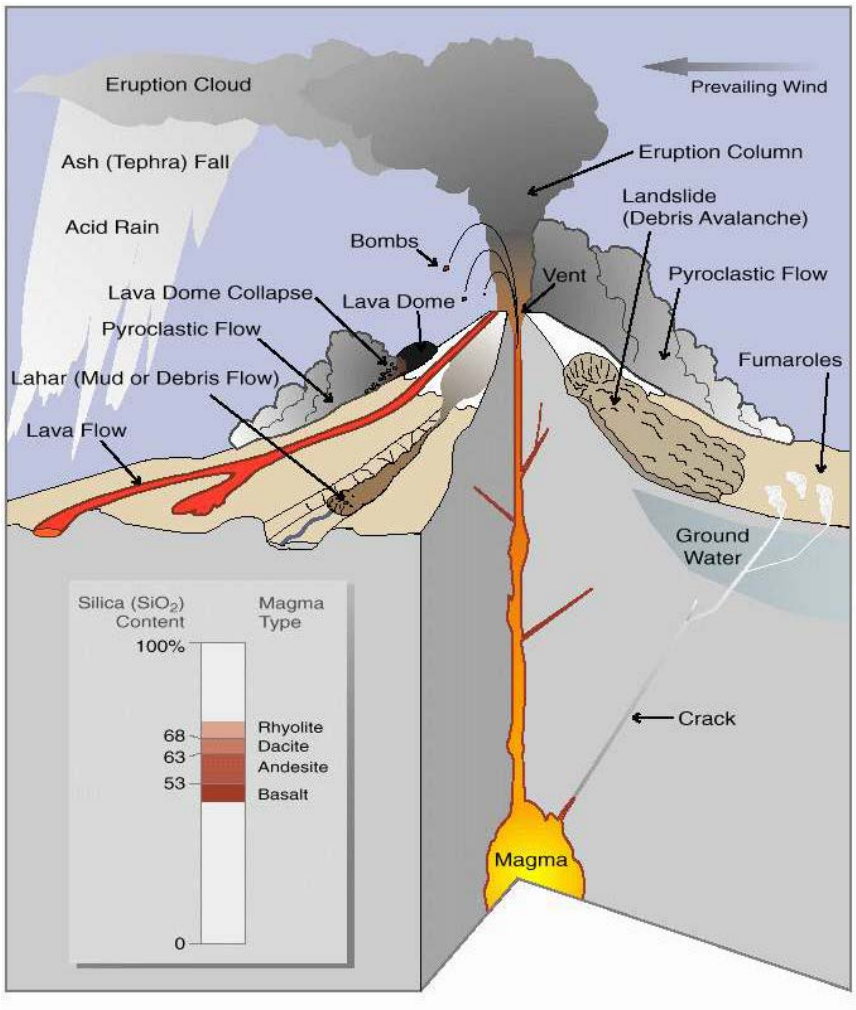
> When plates collide, the heavier oceanic crust dives under lighter continental crust. The diving (subducting) plate begins to melt in the heat under the crust (upper mantle) and the lighter minerals melt and rise through the crust in the form of magma that fuels volcanic eruptions. …That is why there are volcanoes such as Shasta, Pilot Rock, Roxy Ann, the Three Sisters, …and Hood just inland from the colliding plates off the Oregon and Washington Coast (Eric Dittmer, personal communication, 2010).

Types of Hazard

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

It should be noted that the Cascade Mountain Range (Cascades) can be the source of and location of multiple hazards such as volcanoes, landslides, floods, severe weather, wildfires, and earthquakes. Some hazards, such as lahars and landslides, can occur even when a volcano is not erupting (Mount Hood Facilitating Committee, 2013). **Figure 54** illustrates the types volcanic hazards commonly found in the Western United States and Alaska.

Figure 54. Volcanic Hazards



Source: Mount Hood Facilitating Committee, 2013

Ashfall: Ashfall occurs when explosive eruptions blast rock fragments into the air. Such blasts may include solid and molten rock fragments called tephra. The largest rock fragments -sometimes called "bombs" - generally fall within two miles of the eruption vent. Smaller ash fragments less than about 0.1" typically rise into the area forming a huge eruption column. In very large eruptions, ashfalls may total many feet in depth near the vent and extend for hundreds or even thousands of miles downwind. Modest production of ashfall would pose chiefly non-life-threatening hazards to nearby communities (USGS, 2016 as cited in Multnomah County Emergency Management, 2016). Even ashfall from a distant eruption may cause local health effects, reduce visibility, and damage to mechanical devices.

Blast effects: Blast effects may occur with violent eruptions, such as Mount St. Helens in 1980. Most volcanic blasts are largely upwards. However, the Mount St. Helens blast was lateral with impacts 17 miles from the volcano. Similar or larger blast zones are possible for any of the major Cascades volcanoes (USGS, 2016 as cited in Multnomah County Emergency Management, 2016).

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

populated areas are built on lahar flows from previous eruptions (USGS, 2016 as cited in Multnomah County Emergency Management, 2016).

Landslides: Landslides are the rapid downslope movement of rocky material, snow or ice. Volcano landslides can range from small movements of loose debris to massive collapses of the entire summit or sides of a volcano. Debris avalanches are a type of landslide. See Section 3 Landslides for additional details.

Lava flows: Lava flows are eruptions of molten rock. Lava flows for the major Cascades volcanoes tend to be thick and viscous, forming cones and thus typically affecting areas only very near the eruption vent. However, flows from the smaller mafic volcanoes may be less viscous flows that spread out over wider areas. Lava flows destroy everything in their path (USGS, 2016 as cited in Multnomah County Emergency Management, 2016).

Pyroclastic flows: Pyroclastic flows are high-speed avalanches of hot ash, rock fragments and gases. Pyroclastic flows can be as hot as 1,500 F and move downslope at 100 to 150 miles per hour. Pyroclastic flows are extremely deadly for anyone caught in their path (San Diego State University Department of Geological Sciences, n.d.). The French geologist Alfred Lacroix called the pyroclastic flow from Mt. Pelé that destroyed the city of St. Pierre in 1902 a *nuée ardente* (*glowing cloud*). The flow was generated from the explosive collapse of a growing lava dome at the summit of the volcano, which then swept down on the city. As a result, *nuée ardente* eruptions are often called *Peléen eruptions* (San Diego State University Department of Geological Sciences, n.d.).

Location and Extent

The location of volcanic hazards that may affect the City of Medford are described with numerous originating factors that are variable. The extent, or the strength or magnitude of the hazard, is also variable. The extent is further described in the Probability subsection. The Volcanic Hazards map, **Figure 54**, shows the types of volcanic hazards, while **Table 40**, Probability of Volcano Related Activity in Jackson County, provides extent information for those hazards.

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> The eastern boundaries of Douglas and Jackson Counties coincide with the crest of the Cascade Mountains, a volcanic range. The Cascade Mountains are still active as has been demonstrated by Mount St. Helens in Washington State. Volcanic activity in the Cascades will continue, but questions regarding how, to what extent, and when, remain. Both Douglas and Jackson Counties are at some risk from volcano-associated hazards however remote. Josephine County is west of the Cascade Mountains and is not subject to the same risks.
>
> Southwest Oregon communities are close to several prominent volcanic peaks, one of which is a national park (Crater Lake). The other peaks include Mount Bailey (elevation 8,363 ft.), Mount Thielsen (9,182 ft.), and Mount McLaughlin (9,495 ft.). Of the three, Crater Lake (6,178 ft.) may pose the greatest risk. It is a caldera and the remnant of a mountain (Mount Mazama) that probably had an elevation between 10,800 and 12,000 ft. The massive eruption, which produced the caldera, took place about 7,700 years ago. The long history at Mount Mazama strongly suggests that this volcanic center will be active in the future (Bacon, Mastin, Scott, & Nathenson, 1997). The presence of the lake means that any future eruption likely will be violent; there are

many examples of explosive activity brought about by magma coming into contact with water (Oregon DLCD, 2015).

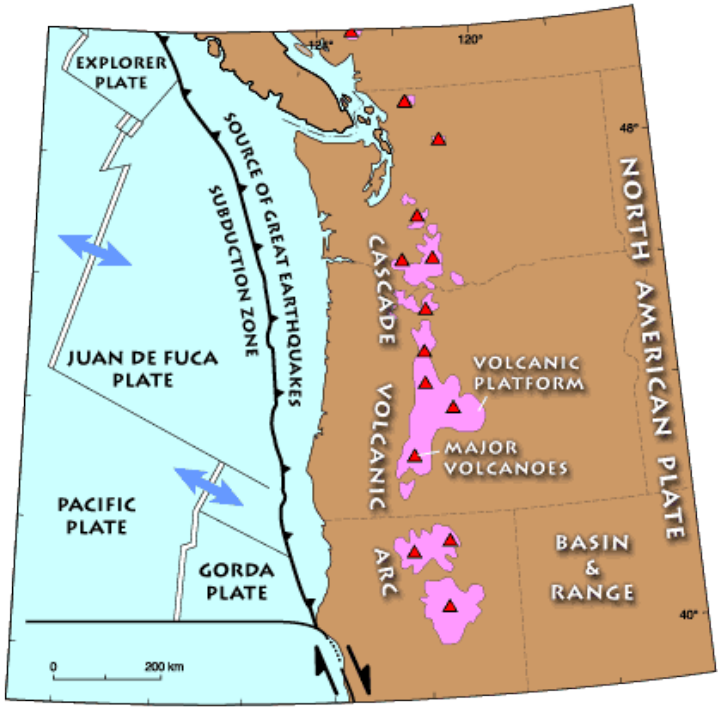
According to the USGS, the Cascades Province forms an arc-shaped band extending from British Columbia to Northern California, roughly parallel to the Pacific coastline. Within this region, 13 major volcanic centers lie in sequence (USGS, n.d.-e).

The Cascades Mountain Range is made up of a band of thousands of very small, short-lived volcanoes that have built a platform of lava and volcanic debris. Rising above this volcanic platform are a few strikingly large volcanoes that dominate the landscape (USGS, n.d.-e). The map in **Figure 55** shows the location of the Cascades volcanoes and the volcanic platform. Major volcanic centers are

- Mount Baker,
- Glacier Peak,
- Mount Rainier,
- Mount St. Helens,
- Mount Adams,
- Mount Hood,
- Mount Jefferson,
- Three Sisters,
- Newberry Caldera,
- Crater Lake (Mount Mazama),
- Medicine Lake,
- Mount Shasta, and
- Lassen Peak.

The map also shows the movement of the earth's tectonic plates (USGS, n.d.-e). Refer to **Figure 37** in the Section 4 Earthquakes, for the Cascadia Subduction Zone Cross Section showing the oceanic crust moving under the continental crust.

Figure 55. Location Map of Cascades Mountain Range Volcanoes and the Volcanic Platform



Source: USGS, n.d.-e

Table 39 lists the active volcanoes in Oregon, Washington, and California, the type of each volcano, and the date of the last eruption. There are shield and composite volcanoes in Jackson County.

According to DOGAMI staff, Crater Lake and Mount Shasta are the two biggest hazards known for Medford. They are both composite, active volcanoes near the city. One other volcanic vent in the Cascades south of Crater Lake does not have Mazama ash/pumice in its crater and therefore may post-date the approximately 8,000 year old catastrophic collapse of Mount Mazama. Mt. Shasta may have erupted in 1796, approximately, based on observations by a French sea captain. Mount McLaughlin is on the order of 100,000 years old. Roxy Ann Peak is about 30 million years old (Tom Wiley, personal communication, July 29, 2016).

Near to Medford is Mount McLoughlin, a shield volcano generally not considered active.

> Mount McLoughlin, at 9,495 feet, is the lowest in Oregon's chain of six major Cascade Range volcanic peaks (the others are Mount Hood, Mount Jefferson, and the Three Sisters, all above 10,000 feet). Except for its eastern base, which is in Klamath County, Mount McLoughlin lies within Jackson County on the watershed divide between the Rogue River and the upper Klamath River basin (“Mount McLoughlin,” n.d.).

Since 1926, the lower western slope of Mount McLoughlin has formed the municipal watershed for the City of Medford. The melting snows run down and through the lava layers to emerge at Big Butte Springs (“Mount McLoughlin,” n.d.).

“Geologically quite young, the mountain's mass was formed from alternating andesitic lava flows and pyroclastic eruptions during the late Pleistocene (Ice Age), most dating to 700,000–500,000 years ago but with some small flows only around 10,000 years old” (“Mount McLoughlin,” n.d.). The original

peak may have been over 10,000 ft., but glacial erosion over time has shaped the current peak ("Mount McLoughlin," n.d.). There is so little earthquake activity that seismic measurements are not taken; it is not considered an active volcano. However, if Mount McLoughlin were to erupt the results could be catastrophic. The volcano is approximately 30 miles northeast of Medford.

The three aligned stratovolcanoes called the Three Sisters — North, Middle, and South Sister — are "closely spaced, but they display very little family resemblance" (USGS, n.d.-p). The Three Sisters are located northeast of Medford. The most recent eruptions were near South Sister, about 2,000 years ago. In 2001, scientific and public interest in the Three Sisters was heightened when scientists recognized that a phase of uplift had started in 1997 within a broad area about 6 km west of South Sister. The Three Sisters reach of the Cascades arc contains at least 466 volcanoes that erupted within the past one million years, and most are small single-eruption volcanic vents; there are a few are low shields and stratocones such as Broken Top (USGS, n.d.-p).

Newberry Volcano is the largest volcano in the Cascades volcanic arc. It covers an area the size of Rhode Island (about 3,100 km^2 or 1,200 mi^2). Newberry has had an eruptive history. Unlike the familiar cone-shaped Cascades Mountain Range volcanoes, Newberry was built into the shape of a broad shield by repeated eruptions over the past 400,000 years. About 75,000 years ago a major explosive eruption and collapse event created a large volcanic depression at its summit that now hosts two caldera lakes. The last eruption of Newberry was about 1,300 years ago, and present-day hot springs and geologically young lava flows indicate that it is still an active volcano. It has a high threat potential (USGS, n.d.-o).

Crater Lake partly fills a caldera, an 8-by-10-km (5-by-6-mi) basin more than 1 km (0.6 mi) deep formed by collapse of the volcano known as Mount Mazama during a series of explosive eruptions about 7,700 years ago. With a maximum depth of 594 m (1,949 ft.), Crater Lake is the deepest lake in the United States (USGS, n.d.-b).

> Mount Mazama straddles the Cascade volcanic axis and is a cluster of overlapping stratovolcanoes that is the most voluminous Quaternary volcanic system in the Oregon Cascades. The volcano's compound edifice has been active relatively continuously since 420,000 years ago, and it is built mostly of andesite to dacite until it began erupting rhyodacite about 30,000 years ago, ramping up to the caldera-forming eruption (USGS, n.d.-b). The threat potential is high for Mount Mazama.

Mount Mazama, the Crater Lake caldera, and the deposits formed by the eruption are well preserved and have easy access, making them a natural laboratory for the study of volcanic and magmatic processes. According to the USGS,

> Research relating to the caldera-forming eruption has been of fundamental importance to volcanologists, helping them to understand large explosive eruptions, compositional zonation in magma chambers, and collapse caldera mechanisms. The climactic eruption is also the source of the widespread Mazama ash, a useful Holocene stratigraphic marker throughout the Pacific Northwest, adjacent Canada, and offshore (USGS, n.d.-b).

Mount Shasta, second in activity to Mount St. Helen's, lies 100 miles to the south of Medford. Mt. Shasta is a steep-sided stratovolcano located along the I-5 corridor in Northern California. It is 4,317 m (14,163 ft.) high (USGS, 2012). Mount Shasta began forming on the remnants of an older, similar volcano that collapsed 300,000 to 500,000 years ago. The collapse spawned one of the largest landslides known on Earth, covering more than 440 km^2 (170 mi^2) of Shasta Valley to the northeast (USGS, n.d.-l).

Activity over the last 300,000 years includes long intervals of quiet interrupted by shorter spans of frequent eruptions. Eruptions at about 11,000 years ago built Black Butte and Shastina on the western flanks of Mount Shasta. In the last few millennia, smaller eruptions have broken out at the volcano's summit and from vents on its upper east flank (USGS, n.d.-l).

USGS scientists are in the process of determining the age of the most recent eruption.

> Preliminary work indicates the volcano erupted in the past 200-300 years. Hot springs and volcanic gases seep from the summit indicating a relatively young and still-hot system. Non-volcanic shedding of young volcanic rock and ash from Mount Shasta's steep slopes occurs during heavy rainfall or glacial floods. In the last 1,000 years, more than 70 mudflows have inundated stream channels. The record of eruptions over the last 10,000 years suggests that, on average, at least one eruption occurs every 800 to 600 years at Mt Shasta (USGS, n.d.-l).

USGS and UNAVCO seismic and geodetic networks provide real-time volcano monitoring data. Earthquake activity has been low for the last few decades and ground deformation is negligible. USGS lists the threat potential from Mt. Shasta as high (USGS, n.d.-l).

Mt. Lassen and Lassen Volcanic Center lie in Lassen Volcanic National Park, which is south of Medford. Within the last 825,000 years, hundreds of explosive eruptions have come from vents scattered over 500 km^2 (approximately 200 mi^2). In the surrounding area there are over fifty effusive (non-explosive) eruptions that have occurred in the last 100,000 years. For the last 25,000 years the area has been quiet with three notable exception - the Chaos Crags eruption (1,100 years ago), the eruption of Cinder Cone (1666 A.D.), and the Lassen Peak eruption (A.D. 1914 to 1917) (USGS, n.d.-j).

> The Lassen Peak eruption consisted mostly of sporadic steam blasts. In May of 1915, however, partially molten rock oozing from the vent began building a precarious lava dome. The dome collapsed on May 19 sending an avalanche of hot rock down the north flank of the volcano. Three days later, a vertical column of ash exploded from the vent reaching altitudes of 30,000 feet. The ash column spawned a high-speed ground flow of hot gas and fragmented lava. Ash from the top of the column drifted downwind 200 miles to the east. On both days, melting snow fueled mudflows, flooding drainages 20-30 miles away. The older Chaos Crags eruption was similar in style, but considerably larger in magnitude (USGS, n.d.-j).

Lassen Volcanic Center has a geothermal system, numerous hot springs, steam vents, and boiling mud pots. Volcanic earthquakes are common, although most are too small to be felt. Non-volcanic earthquakes along regional faults also occur such as the earthquake swarms in 1936, 1945-1947, and 1950. These swarms included events above magnitude 4.0, with the two largest registering 5.0 and 5.5. Ground surveys show localized subsidence of the volcano, probably due to motion on regional faults. The USGS lists the potential threat as high (USGS, n.d.-j).

The USGS states, the "Volcanic threat is defined as the qualitative risk posed by a volcano to people and property. It combines volcanic hazards (the dangerous or destructive natural phenomena produced by a volcano) and exposure (the people and property at risk from the volcanic phenomena)" (USGS, n.d.-n). See Figure 56.

Figure 56. Volcano Threat: The Relationship of Volcano Hazards to Exposure

Source: USGS, n.d.-n

To determine the overall threat, ranking numerical values are assigned to the hazard and exposure factors at individual volcanoes. These factors are individually summed into a hazard score and an exposure score, which are then multiplied to generate the volcano's overall threat score. The resultant scores produce a relative ranking of U.S. volcanoes that can be grouped into five threat categories: Very High and High threat categories requiring the most robust monitoring coverage, a Moderate threat category requiring basic real-time monitoring coverage, and Low and Very Low threat categories requiring lesser degrees of monitoring" (USGS, n.d.-n).

Table 37. Excerpt from the USGS Regional Volcano Monitoring Priority Table

Region	Highest Priority	High Priority
Washington	Glacier Peak, Mount Baker, Mount Rainier, Mount St. Helens	Mount Adams
Oregon	Crater Lake, Mount Hood, Newberry, Three Sisters	
California	Lassen Volcanic Center, Mount Shasta	Clear Lake, Mono-Inyo Craters, Mono Lake Volcanic Field, Medicine Lake

Source: USGS, n.d.-n

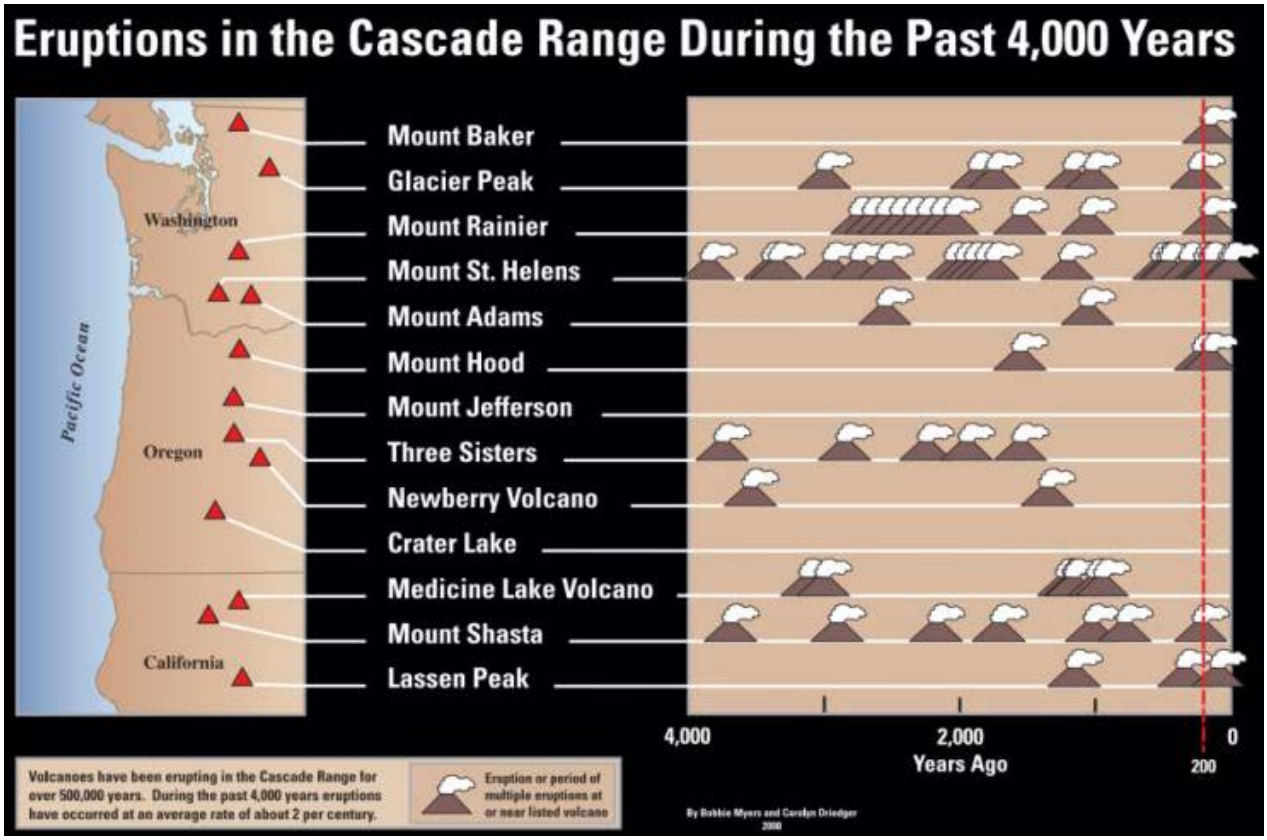
History

In Oregon, awareness of the potential for volcanic eruptions was greatly increased by the 1980 eruption of nearby Mount St. Helens in Washington which killed 57 people. In this eruption, lateral blast effects covered 230 square miles and reached 17 miles northwest of the crater, pyroclastic flows covered six square miles and reached 5 miles north of the crater, and landslides covered 23 square miles. Ash accumulations were about 10 inches at 10 miles downwind, 1 inch at 60 miles downwind, and ½ inch at 300 miles downwind. Lahars (mudflows) affected the North and South Forks of the Toutle River, the Green River, and ultimately the Columbia River as far as 70 miles from the volcano (USGS, n.d.-m).

Over the past 4,000 years in Oregon - a geologically short time period - there have been three eruptions of Mt. Hood, four eruptions in the Three Sisters area, two eruptions in the Newberry Volcano area and minor eruptions near Mt. Jefferson, at Blue Lake Crater, in the Sand Mountain Field, near Mt. Washington, and near Belknap Crater. During this time period, the most active volcano in the Cascades has been Mount St. Helens in Washington State with about 14 eruptions (Oregon DLCD, 2015). **Figure 57** below illustrates these eruptions on a timeline.

In a narrower timespan of the past 200 years, seven of the Cascade volcanoes have erupted. These include: Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens, Mount Hood, Mount Shasta, and Mount Lassen. The most recent series of events (1760–1907) consisted of small lahars, debris avalanches, steam explosions, and minor ash falls (Oregon DLCD, 2015).

Figure 57. Eruptions in the Cascade Range During the Past 4,000 Years



Source: Myers and Driedger, 2008

The northern reaches of volcanoes in the Cascade Range have been much more active than have those in southern Oregon. “Although there have been no recent volcanic events in the Jackson County area, it is important to note the area is active and susceptible to eruptive events since the region is a part of the volcanic Cascades Range” (University of Oregon’s Community Service Center, Oregon Partnership for Disaster Resilience, 2012). Usually a period of activity of months or years is likely to precede volcanic activity in the region.

Table 38. Significant Historic Volcanic Events

Date	Location	Description
About 18,000 to 7,7000 YBP	Mount Bachelor, central Cascades	Cinder cones and lava flows.
About 20,000 to 13,000 years before present (YBP)	Polallie eruptive episode, Mount Hood	Lava dome, pyroclastic flows, lahars, and tephra.
About 13, 000 YBP	Lava Mountain, south central Oregon	Lava Mountain field and lava flows.
About 13,000 YBP	Devils Garden, south central Oregon	Devils Garden field and lava flows.
About 13,000 YBP	Four Craters, south central Oregon	Four Craters field and lava flows.
About 7,780 to 15,000YBP	Cinnamon Butte, Southern Cascades	Basaltic scoria cone and lava flows.
About 7,700 YBP	Crater Lake Caldera	Formation of Crater Lake caldera, pyroclastic flows, and widespread ashfall.
About 7,7000 YBP	Parkdale, north central Oregon	Eruption of Parkdale lava flow.
About <7,700 YBP; 5,300 to 5,600 YBP	Davis Lake, southern Cascades	Lava flows and scoria cones in Davis Lake field.
About 10,000 to <7,7000 YBP	Cones south of Mount Jefferson; Forked Butte and South Cinder Peak	Lava flows.
About 4,000 to 3,000 YBP	Sand Mountain, central Cascades	Lava flows and cinder cones in Sand Mountain field.
About 3,000 to 1,5000 YBP	Belknap Volcano, central Cascades	Lava flows and tephra.
About 2,000 YBP	South Sister Volcano	Rhyolite lava flow.
About 1,500 YBP	Timberline eruptive period, Mount Hood	Lava dome, pyroclastic flows, lahars, and tephra.
About 1,300 YBP	Newberry Volcano, central Oregon	Eruption of Big Obsidian flow.
About 1,300 YBP	Blue Lake Crater	Spatter cones and tephra.
1760–1810	Crater Rock/Old Maid Flat on Mount Hood	Pyroclastic flows in upper White River; lahars in Old Maid Flat; dome building at Crater Rock.
1859/1865	Crater Rock on Mount Hood	Steam explosions and tephra falls.
1907 (?)	Crater Rock on Mount Hood	Steam explosions.
1980	Mount St. Helens (Washington)	Debris avalanche, ashfall, and flooding on Columbia River.
1981-1986	Mount St. Helens (Washington)	Lava dome growth, steam, and lahars.
1989-2001	Mount St. Helens (Washington)	Hydrothermal explosions.
2004-2008	Mount St. Helens (Washington)	Lava dome growth, steam, and ash.

Sources: USGS, n.d.-a; USGS, n.d.-m, n.d.-o; Wolfe and Pierson, 1995; Scott et al.,1997, 2001; Sherrod et al., 1997; Bacon et al., 1997; Walder et al., 1999; and Oregon DLCD, 2015.

Table 39. Active Volcanoes in Oregon, Washington, and California

Volcano	Type	Last Eruption
Mount Hood, OR	Stratovolcano	1866
Mount Jefferson, OR	Stratovolcano	950 main volcano inactive for >10,000 years
Blue Lake Crater, OR	Crater	1490 BC
Sand Mountain Field, OR	Cinder cones	1040 BC?
Mount Washington, OR	Shield volcano	620 main volcano inactive
Belknap Field, OR	Shield volcanoes	460?

North Sister Field, OR (USGS, n.d.-p)	Complex volcano	350
South Sister, OR (USGS, n.d.-p)	Complex volcano	50 BC?
Mount Bachelor, OR	Stratovolcano	5800 BC
Davis Lake, OR	Volcanic field	2790 BC?
Newberry Volcano, OR (USGS, n.d.-o)	Shield volcano	620 (1,300 years ago) Crater formation 300,000 to 500,000 years ago
Devil"s Garden, OR	Volcanic field	Unknown
Squaw Ridge Lava Field, OR	Volcanic field	Unknown
Four Crater's Lava Field, OR	Volcanic field	Unknown
Cinnamon Butte, OR	Cinder cones	Unknown
Crater Lake, OR	Caldera	2290 BC Crater formation about 7,700 years ago
Diamond Craters, OR	Volcanic field	Unknown
Saddle Butte, OR	Volcanic field	Unknown
Jordan Craters, OR	Volcanic field	1250 BC
Jackies Butte, OR	Volcanic field	Unknown
Mount Baker, WA (USGS, n.d.-i)	Stratovolcano	6,700 years ago
Glacier Peak, WA (USGS, n.d.-e)	Stratovolcano	1,100 years ago
Mount Rainier, WA (USGS, n.d.-k)	Stratovolcano	1,000 years ago
Mount Adams, WA (USGS, n.d.-h)	Stratovolcano	3,800 years ago
Mount St. Helens, WA (USGS, n.d.-m)	Stratovolcano	1980, 2004-2008
West Crater, WA (USGS, n.d.-q)	Volcanic field	8,000 years before present
Indian Heaven, WA (USGS, n.d.-g)	Shield volcano	9,000 years ago
Mount Shasta, CA	Stratovolcano	Within the past 200-300 years.
Mount Lassen, CA (USGS, n.d.-j)	Stratovolcano	Lassen Peak eruption (A.D. 1914 to 1917). The Lassen Peak eruption consisted mostly of sporadic steam blasts.

Probability

Inquiring about the probability of a volcanic eruption for a specific mountain is common.

> Geologists can make general forecasts of long-term volcanic activity from careful characterization of past activity, but they cannot supply a timeline. Several U.S. Geological Survey open-file reports provide the odds of certain events taking place at particular volcanoes. However, the U.S. Geological Survey stresses that government officials and the public must realize the limitations in forecasting eruptions and be prepared for such uncertainty (Oregon DLCD, 2015).

Geologists are often able to make short-range forecasts, on the order of months or weeks.

> There are usually several signs of impending volcanic activity that may lead up to eruptions. The upward movement of magma into a volcano prior to an eruption generally causes a significant increase in small, localized earthquakes and an increase in emission of carbon dioxide and compounds of sulfur and chlorine that can be measured in volcanic springs and the atmosphere above the volcano. Changes in the depth or location of magma beneath a volcano often cause changes in elevation. These changes can be detected through ground instrumentation or remote sensing (Oregon DLCD, 2015).

Volcanic activity in the Cascade Ranges is continually assessed and monitored by Cascades Volcanic Observatory scientists. If anomalous patterns are detected (for example, an increase in earthquakes), CVO staff coordinate the resources necessary to study the volcano (Oregon DLCD, 2015).

According to the *2015 Oregon NHMP*, there is basically no risk from volcanoes in Josephine County, with the exception of the possibility of ashfall. Comparing Josephine to nearby counties,

> Douglas and Jackson Counties are at greater risk of volcanic hazards. The probability of a 1 cm or greater ashfall varies from 1 in 5,000 to 1 in 10,000 (Sherrod et al., 1997). Based on the total number of eruptive episodes in the past 100,000 years, the average recurrence interval in the Crater Lake area is about 10,000 years. The annual probability of an eruption then, is about 1 in 10,000; the 30-year probability is about 1 in 330 (Bacon et al., 1997) (Oregon DLCD, 2015).

The probability of a volcano related activity or hazard is summarized in **Table 40** for Jackson County. Ashfall is the only hazard listed with a probability range out of the five hazards listed.

Table 40. Probability of Volcano Related Activity in Jackson County

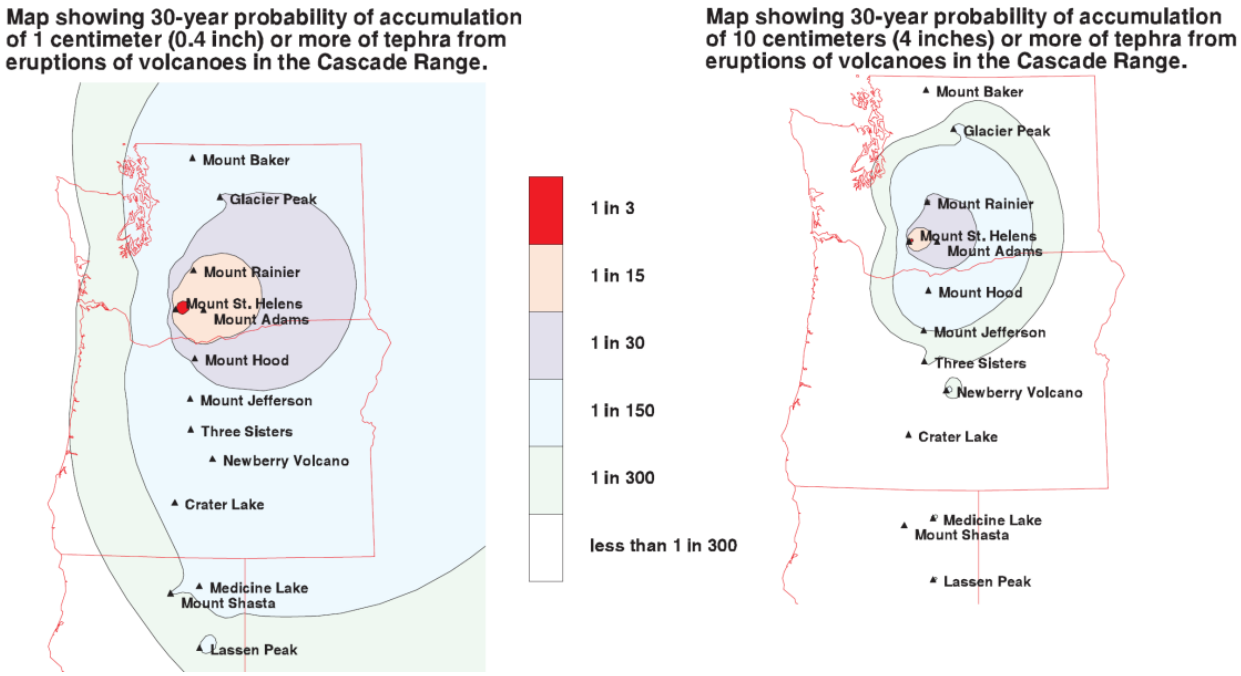
Volcano Related Hazard	Probability	Remarks
Volcanic ash (annual probability of 1 cm or more accumulation from eruptions throughout the Cascade Range)	1 in 5,000 to 1 in 10,000	Sherrod et al. (1997)
Lahar	Source: Crater Lake	Bacon et al. (1997)
Lava flow	No risk	Bacon et al. (1997)
Debris flow/avalanche	Source: Crater Lake	Bacon et al. (1997)
Pyroclastic flow	Source: Crater Lake	Bacon et al. (1997)

Source: Sherrod et al. (1997); Bacon et al. (1997)

As described in the *2015 Oregon NHMP*, return periods for ashfall from the Cascade Range are estimated by the USGS and shown in the map below, **Figure 58**. These maps predominantly reflect volcanic eruptions at Mount St. Helens, with 1 in 3 probability, because this volcano is much more active than the other volcanoes in the Cascades. Mount Rainier and Mount Hood are in the 1 in 15 probability range. These maps also show other mountains that are closer to Medford. The maps indicate the following return periods and probabilities:

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

Figure 58. Probable Ashfall from Volcanoes in Oregon and Washington



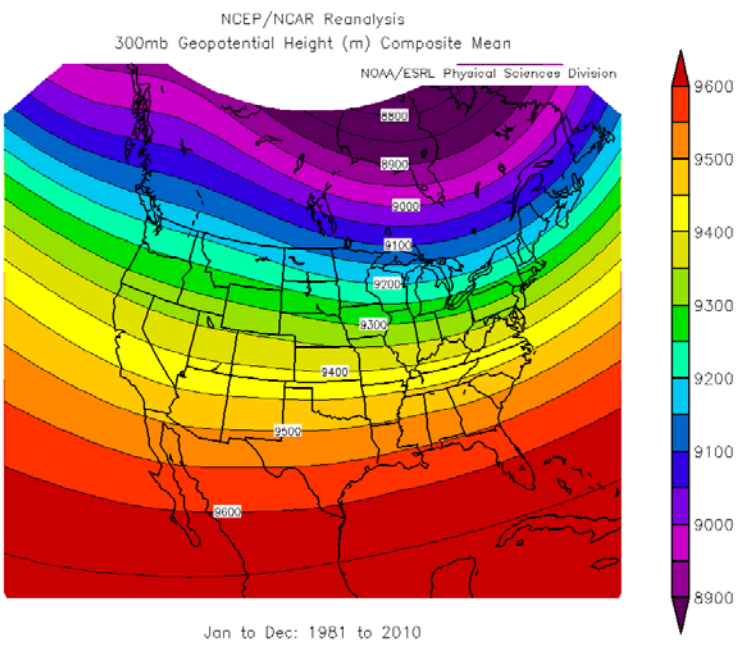
Source: Scott et al., 1997

The National Weather Service (NWS) Warning Meteorologist for Medford provided information showing prevailing winds aloft; assuming much of the ash from an eruption would reach the 18,000 to 30,000 foot levels. From fall through spring, the prevailing winds between these levels blow from west to east. In the summer, the prevailing winds aloft have more of a southwest to northeast component (Ryan Sandler, personal communication, August 16, 2016).

According to NWS, this means that in most scenarios Medford would not have a problem due to volcanic ashfall, based on the most common directions when averaging prevailing winds aloft over 30 years. However, Medford could be unlucky enough to have a weather scenario where an upper low is off the northern California coast when Mt. Shasta erupts. The circulation around the low pressure area could bring the ashfall into the Rogue Valley. The worst case scenario would be if this low was nearly stationary for days and the ashfall kept coming NWS estimates that at least 90% of the time Medford would see little to no ashfall from any possible eruptions in the Cascades. (Ryan Sandler, personal communication, August 16, 2016).

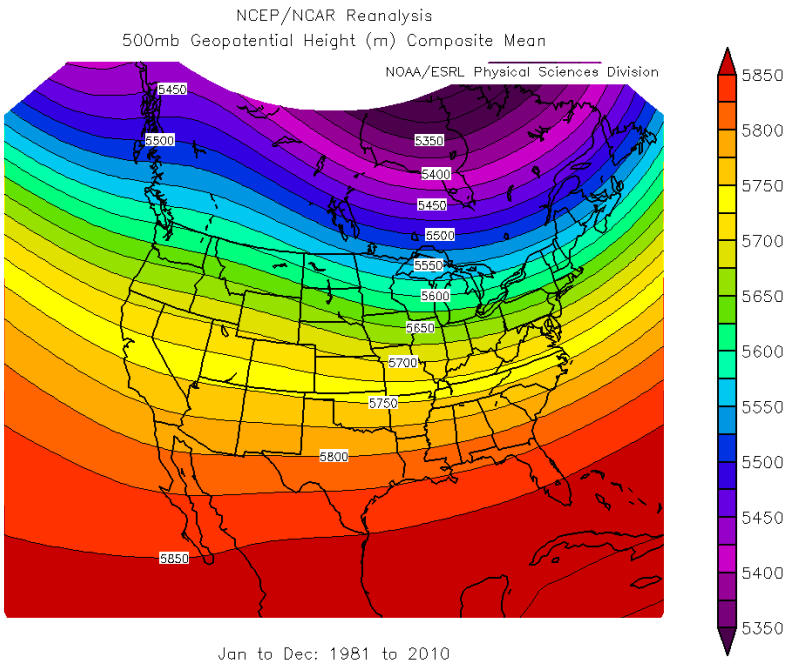
Figure 59 is around the 30,000 foot level and **Figure 60** is around the 18,000 foot level. These graphics show the annual average wind flow using the 30 year normals from 1981-2010 and are from the National Oceanic Atmospheric Administration (NOAA) in the Earth Systems Research Lab (ESRL). The wind direction follows (parallels) the lines from west to east.

Figure 59. Wind Direction around the 30,000 Foot Level



Source: Ryan Sandler, NWS, personal communication, August 16, 2016.

Figure 60. Prevailing Winds from the 18,000 Foot Level



Source: Ryan Sandler, NWS, personal communication, August 16, 2016.

According to the *2015 Oregon NHMP*, "Climate change is already affecting Oregon communities and resources, and needs to be recognized in various planning efforts as an important stressor that significantly influences the incidence — and in some cases the location — of natural hazards and hazard events. Climate change is anticipated to affect the frequency and/or magnitude of some kinds of natural

hazards in Oregon" (Oregon DLCD, 2015). It is unknown whether climate change will result in more frequent or intense volcanic eruption hazards.

Vulnerability

According to the *2015 Oregon Natural Hazards Mitigation Plan*,

> Douglas and Jackson Counties should consider the impact of volcano-related activity on small mountain communities, tourist attractions (e.g., Crater Lake) dams, reservoirs, and highways. These counties also should consider probable impacts on the local economy (e.g., wood products, tourism, and recreation) (Oregon DLCD, 2015).
>
> The U.S. Geological Survey has addressed volcanic hazards in the Crater Lake region (Bacon et al., 1997). This report includes maps depicting the areas at greatest risk. The park itself is in the greatest risk category. In Douglas County, the upper reaches of the Umpqua and Clearwater rivers are subject to volcano-associated hazards, as is the OR-62 corridor in Jackson County (Bacon et al., 1997) (Oregon DLCD, 2015).

Even minor amounts of ashfall can result in significant impacts, and 100% of the population, critical facilities, lifelines, public infrastructure, and private economy and business sector are vulnerable.

Possible impacts of ashfall include (Washington State Emergency Management Division & U.S. Geological Survey Cascades Volcano Observatory, 2011):

- Reduced sunlight and visibility;
- Respiratory problems for at-risk population such as elderly, young children or people with respiratory problems, and irritation to eyes;
- Impacts on public water supplies drawn from surface waters, including degradation of water quality (high turbidity) and increased maintenance requirements at water treatment plants;
- Electric power outages from ash-induced short circuits in distribution lines, transmission lines, and substations;
- Disruptions of air traffic;
- Clogging of filters, abrasion and corrosion, and other possible severe damage to vehicle engines, furnaces, heat pumps, air conditioners, commercial and public building combined HVAC systems (heating, ventilation and air conditioning) and other engines and mechanical equipment;
- Clean-up and ash removal from roofs, gutters, sidewalks, roads vehicles, HVAC systems and ductwork, engines and mechanical equipment; and
- Collapse of roofs and structures due to weight, and slippery conditions when wet. (A one-inch layer of ash weighs 5-10 pounds per square foot when dry, but 10-15 pounds per foot when wet).

Impacts from an eruption of Mount McLoughlin, which is generally considered inactive, would be dramatic given the proximity. Prevailing winds would normally carry the volcanic dust eastward. Residue from the eruption, due to the close proximity to the volcanic action, and a natural change of wind direction, either at low levels or in the winds aloft, would cause hot or cold ash to fall most anywhere. The City would have to remove accumulated ash and extinguish fires started by air borne hot embers. An eruption could render portions of the Medford water system sources inoperable. In addition, a pyroclastic flow or "nuee ardante," very hot gasses with ash and poisonous gases, can follow a valley down from the volcano. In this instance, it could move from Mount McLoughlin down Highway 140 to Medford.

If Mount Shasta were to explode, the strength of the eruption would be similar to that of Mount St. Helen's explosion in 1980. The winds would likely take most of the ash and flumes to the east. It could, however, deposit an inch of ash over Medford. Ash and solid debris could create utility outages, fires, health problems, and transportation problems. Damage to northern California would be much more significant and the Rogue Valley could expect to see an influx of victims seeking shelter, medical care and sustenance ("Getting Ready," 2002). As described in **Table 40**, Probability of Volcano Related Activity in Jackson County, the most likely impact to Medford from volcanic eruptions is ashfall. The other identified hazards: lahars, lava flows, debris flows/avalanches, and pyroclastic flows are unlikely to impact Medford.

Table 41 specifies: the location and extent of volcanic hazards; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assets. The description within the tables is a brief version of impacts described at length above. Potentially, all structures and people within the Medford UGB would be impacted by ashfall from one of these nearby volcanoes.

Table 41. Vulnerability Assessment for Volcanic Eruptions

Location	Probability	Extent	Overview of Resources at Risk
The nearest volcanoes that would impact Medford are Mt. McLouglin, Three Sisters, Newberry Volcano, Mt. Mazama, Mt. Shasta, and Mt. Lassen. Of these, Mount Shasta is most likely to erupt. Ashfall from any of these volcanoes could occur throughout Medford.	1 in 5,000 to 1 in 10,000 for ash fall (Oregon DLCD, 2015).	The strength or magnitude of the hazard is variable. Could range from short to long duration, and from nuisance to paralyzing and dangerous conditions.	Ashfall is the most probable impact. Persons with pre-existing respiratory ailments, the elderly and infants are the most vulnerable to the effects of ash. If a combination of ash and acidic gasses is present, infants and the very old or infirm may experience lung damage. For most people, ashfall will be an annoyance, rather than a serious health risk. Ash damages machinery of all types. It can make roads slippery. Home roofs can collapse from the weight of ash build-up. Ash can lead to the breakdown of public utilities, and home heating and cooling systems. Visibility can be reduced.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)	People with Access and Functional Needs	Critical Facilities	Economic Assets	Environmental Assets
The weight of ash can cause roofs to collapse, especially older homes with minimal pitch. This could occur anywhere in Medford, particularly to structures such as bungalows, which were built in the 1930s and 1940s. In general, HVAC (heating, ventilation, and air conditioning) systems in all structures are vulnerable, due to ash entering and damaging mechanical systems.	Travelers on I-5 may be stranded and need shelter. Young and elderly persons as well as the medically fragile and tthose with existing respiratory problems. People with outside occupations exposing them to ash for long periods of time.	Public utilities are vulnerable to ash and will need repair. Ash can clog sewers, sewage plants, and machinery of all kinds. Emergency services and public works personnel will need personal protective equipment to work in the ash. Emergency service vehicles may be damaged. The City, County, Rogue Valley Transit District, and ODOT will need to clean ash from the transportation network. Ashfall blots out light and creates high demands for electric light, causing possible brownouts or outages.	Depending on the nature and amount of the ash, livestock may be sickened and crops lost. Industrial sites may not function, due to the effects of ash on motors, HVAC systems, etc. Commerce will experience a downturn until the transportation network is functional and customers are mobile, no longer concerned about being exposed to ash.	If the event occurs in summer or early fall, the Medford Water Commission may have to stop drawing water from the Rogue River, due to contamination. Air quality may be affected for several days. Temporary ash removal and permanent disposal will be required; movement and storage of ash could impact the air, water, and land.

Section 8 Air Quality

Introduction and Hazard Overview

The hazard of air quality is not a common one for inclusion in Natural Hazards Mitigation Plans. In this updated NHMP, Medford continues to recognize the unique situations that factor into identification of air quality as a hazard for the area.

Given its bowl-like shape, the Rogue Valley experiences periods of air stagnation and atmospheric temperature inversions that trap pollution, particularly during the months of November, December, January, and February. During these months, the temperature near the ground decreases rapidly toward sunset. As the surface air cools, it flows down the mountain slopes, forming a pool of cold air on the valley floor with the warmer air above acting as a lid. The cooling within this layer typically produces fog, and, as air pollutants are discharged, they become trapped. During these stagnant conditions, the fog and trapped air can remain under this "lid" for several days, becoming increasingly polluted and unhealthy. Medford sits within this bowl and is thusly subject to inversions that occur within the Rogue Valley.

In the past, the largest sources of air pollution in the region included industry and residential wood stoves, which emit particulate matter and carbon monoxide. Substantial efforts have been made to reduce these emissions. More recently, concerns for air quality arise when smoke from regional wildfires either blows through the valley or becomes trapped during inversions. See Section 5 Wildland-Urban Interface Fires for more information about wildfire impacts.

Wood stove, industrial, and motor vehicle emissions continue to be a major source of air (and other types of) pollution. A definite contributing factor to traffic congestion is Medford's role as a regional retail, health, and service center. The number of commuters traveling to Medford for work, services, education, and recreation continues to increase, especially from the outlying communities of Ashland, Grants Pass, and Yreka, California.

Types of Hazard

The Clean Air Act of 1970 and the U.S. Environmental Protection Agency (EPA) established health-based National Ambient Air Quality Standards (NAAQS) for six air pollutants: carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and lead (Pb). The areas that fail to meet the standards are designated "non-attainment" and are required to develop plans to come into compliance with the standards. Once compliance with the standard is achieved, a maintenance plan is developed to ensure that air quality will not be compromised in the future. The Air Quality Maintenance Area (AQMA) for the Medford area is the Medford-Ashland AQMA (RVMPO, 2016).

The Oregon Department of Environmental Quality (DEQ) is a regulatory agency with the responsibility to protect and enhance the quality of Oregon's environment. DEQ is responsible for providing accurate scientific data concerning the State of Oregon's air quality "to ensure that the state meets the National Ambient Air Quality Standards (NAAQS) as required by the Federal Clean Air Act" (Oregon DEQ, n.d.).

Over time, the pollutants of significant concern for Medford have changed from ozone, carbon monoxide (CO) and particulate matter (PM_{10} and $PM_{2.5}$) which were problematic in the past, and were

identified as such in the 2010 NHMP. According to DEQ, the PM_{10} and CO levels have dropped so far below the standard that they are no longer pollutants of concern. Now, ozone, $PM_{2.5}$, and air toxics are the pollutants of concern. DEQ does not have any air toxics monitors in SW Oregon at this time (Anthony Barnack, personal communication, September 16, 2016).

Carbon monoxide is a colorless and odorless gas that interferes with the body's ability to use oxygen. It is emitted from combustion processes.

> Carbon monoxide in ambient air is formed primarily by the incomplete combustion of carbon-containing fuels and photochemical reactions in the atmosphere, with on-road mobile sources representing significant sources of CO to ambient air. Microenvironments influenced by on-road mobile sources are important contributors to ambient CO exposures, particularly in urban areas. Where present, other (non-ambient) CO sources can also be important influences on total CO exposure and on the impact of ambient CO exposure (U.S. EPA, 2010).

Typically the highest CO exposure concentrations are experienced while inside vehicles; therefore, time spent in motor vehicles and the elevated CO concentrations occurring on and near the roads play an important role in the levels of personal exposure to CO (U.S. EPA, 2010).

Ozone (O_3) is part of the ozone layer in the Earth's stratosphere. Ozone is harmful outside of the ozone layer in our lower atmosphere and at that point it is often referred to as smog, ground level ozone, or ozone pollution (U.S. EPA, n.d.-d). Ozone typically forms on days when the temperature is warm and stable.

Ground level ozone is not emitted directly into the air, it

> is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC. Breathing ozone can trigger a variety of health problems, particularly for children, the elderly, and people of all ages who have lung diseases such as asthma. Ground level ozone can also have harmful effects on sensitive vegetation and ecosystems (U.S. EPA, n.d.-d).

Particulate matter (PM_{10} and $PM_{2.5}$) comes mostly from smoke, dust, and vehicle exhaust.

> Particulate matter is the generic term for a broad class of chemically and physically diverse substances that exist as discrete liquid and/or solid particles over a wide range of sizes. Particles originate from a variety of anthropogenic stationary and mobile sources, as well as from natural sources. Particles may be emitted directly, or formed in the atmosphere by transformations of gaseous emissions such as sulfur oxides (SOX), oxides of nitrogen (NOX), and volatile organic compounds (VOC) (U.S. EPA, 2016a).

In 1987, standards for particulate matter, particles less than 10 microns in diameter (PM_{10}) were established for both 24 hour and annual levels. Subsequent to this, EPA conducted a comprehensive review of the human health effects of $PM_{10,}$ and determined that standards needed to be development for $PM_{2.5}$, to adequately protect human health. Health studies show harmful effects from breathing particles as small as 2.5 microns in diameter ($PM_{2.5}$). This smaller particle is inhaled deeper into the lungs and

potentially causes more damage than larger particles. “The health effects of particulate matter vary with the size, concentration, and chemical composition of the particles” (Oregon DEQ, n.d.).

Standards for $PM_{2.5}$ thus were established in 1997 for 24 hour and annual levels. Also in 1997, the PM_{10} levels for 24 hour and annual levels were changed. In 2006, the $PM_{2.5}$ levels were changed for the 24 hour exposure (U.S. EPA, 2010). See **Table 42**, Significant Historic Air Quality Events for additional information.

There are 188 air toxics, about 50 of concern, in Oregon. DEQ has monitored for air toxics in Medford in the past but this monitoring was only temporary and is moved around the state (Anthony Barnack, personal communication, September 16, 2016).

According to DEQ,

> Air toxics include diesel soot, benzene, polycyclic aromatic hydrocarbons (tar-like by-products from auto exhaust and other sources) metals including manganese, nickel and lead. Air toxics come from a variety of sources including cars and trucks, all types of burning (including fireplaces and woodstoves), businesses industries consumer products. Air toxics are air pollutants known or suspected to cause cancer or other serious health problems. National and state studies indicate that Oregonians are exposed to a number of air toxics at potentially harmful levels. (Oregon DEQ, n.d.).

Greenhouse gases are a key factor identified in the discussion of climate change and air quality pollutants. Gases that trap heat in the atmosphere are called greenhouse gases. These include carbon dioxide (CO_2), Ozone (O_3), Methane (CH_4), Nitrous Oxide (N_2O), and fluorinated gases. Each gas's effect on climate change depends on three main factors: How much of these gases are in the atmosphere? How long do they stay in the atmosphere? And how strongly do they impact global temperatures? (U.S. EPA, n.d.-c).

For Medford, DEQ provides monitoring and technical assistance in support of air quality monitoring projects and studies in these areas:

- Forest Health Network - areas in SW and NE Oregon impacted by smoke from federal lands. Operated in cooperation with the US Forest Service and the BLM.

- Local wood stove advisory and pollution prevention programs (Oregon DEQ, n.d.).

As part of DEQ’s responsibilities, it issues advisories on pollution. An Air Pollution Advisory is a call-to-action that DEQ issues to encourage individuals and businesses to reduce pollution-producing activities during summer hot spells and winter air stagnation times. Jackson County issues their own air advisories.

- During summer, DEQ issues Air Pollution Advisories for smog (ozone) in the Medford area when hot temperatures and low winds cause smog levels to rise (Oregon DEQ, n.d.).

- During winter, DEQ issues Air Pollution Advisories for particle pollution ($PM_{2.5}$) for any area of the state when cold temperatures and stagnant air cause particle pollution levels to rise (Oregon DEQ, n.d.).

Location and Extent

The location of air quality that may affect the City of Medford is described with numerous originating factors that are variable. The extent, or the strength or magnitude of the hazard, is also variable. The extent is further described in the Probability subsection. **Figure 67**, Map of Air Quality Monitoring in the Rogue Valley provides location information, while numerous tables and figures in this section include extent information for air quality.

The air quality pollutants of concern are for the entire Rogue Valley. A map showing the Medford-Ashland Air Quality Maintenance Area (AQMA) is shown in **Figure 67**.

History

Wildfire Smoke. According to DEQ's *Oregon Wildfire Response Protocol for Severe Smoke Episodes* (Version 4.4)

> Particulate matter in smoke poses the greatest risk to public health. The potential health effects vary depending on the size of the particles. Particles larger than 10 micrometers usually irritate only the eyes, nose and throat. Particles smaller than 2.5 micrometers ($PM_{2.5}$) can be inhaled deeply into the lungs, increasing the risk of cardiovascular and respiratory problems. When smoke levels are high, even healthy people may experience symptoms (Oregon DEQ et al., 2016).

A $PM_{2.5}$ dataset from DEQ, extending from January 2000 through December 2015 includes "forest fire flagged data" which is identified as FF. The data in that time period included these months with FF data: July, August, and September 2002: July and August 2003; August 2005; June, July, and August 2008; August and September 2009; August 2013; September 2014; and August 2015. "The data is flagged as FF or forest fire impact if part or all of the $PM_{2.5}$ was from forest fire smoke. The data remains in the data set for official use until EPA agrees to consider this data as an exceptional event and approves its removal from the data set. They do this when it has a regulatory impact on Medford's attainment status" (Anthony Barnack, personal communication, September 28, 2016).

See also Section 5 Wildland-Urban Interface Fires for a history of wildfires and impacts. Wildfire impacts from particulate matter are described in Vulnerability below.

CO and PM_{10} levels. The NAAQS for carbon monoxide (CO) was exceeded throughout most of the 1980s in Medford. However as of 2016, the PM_{10} and Co levels have decreased so much that they are no longer considered pollutants of concern (Anthony Barnack, personal communication, September 16, 2016).

The Medford UGB was established as the non-attainment boundary for CO in 1978, and, in 1987, the Medford-Ashland AQMA was designated as the non-attainment boundary for particulate matter (PM_{10}). As required by federal law, State Implementation Plans (SIPs) were prepared for these two pollutants because they exceeded the NAAQS in the Medford-Ashland AQMA. A SIP for CO was developed in 1982 by Jackson County, and later approved by the EPA. However, the SIP for PM_{10}, developed in 1991, was not approved, and was withdrawn.

In 1989, Jackson County began programs to improve PM_{10} levels, including regulating industry, outdoor burning, and wood stoves to reduce the regional smoke problem. The most heavily polluted areas had more than double the hazardous level of PM_{10} (Jackson County Environmental Health Division, *Jackson*

County Air Quality Aunnual Report 1995/96) (City of Medford, 2010). The more populated areas, such as Medford, were especially affected, although all portions of Jackson and Josephine Counties were affected to some degree. The measures taken have reduced the PM_{10} levels.

For carbon monoxide, the area encompassed by the Medford UGB was re-designated from non-attainment to attainment by the EPA in 2002, and the emissions budget for CO from transportation (mobile) sources was deemed adequate to maintain air quality (RVMPO, 2013).

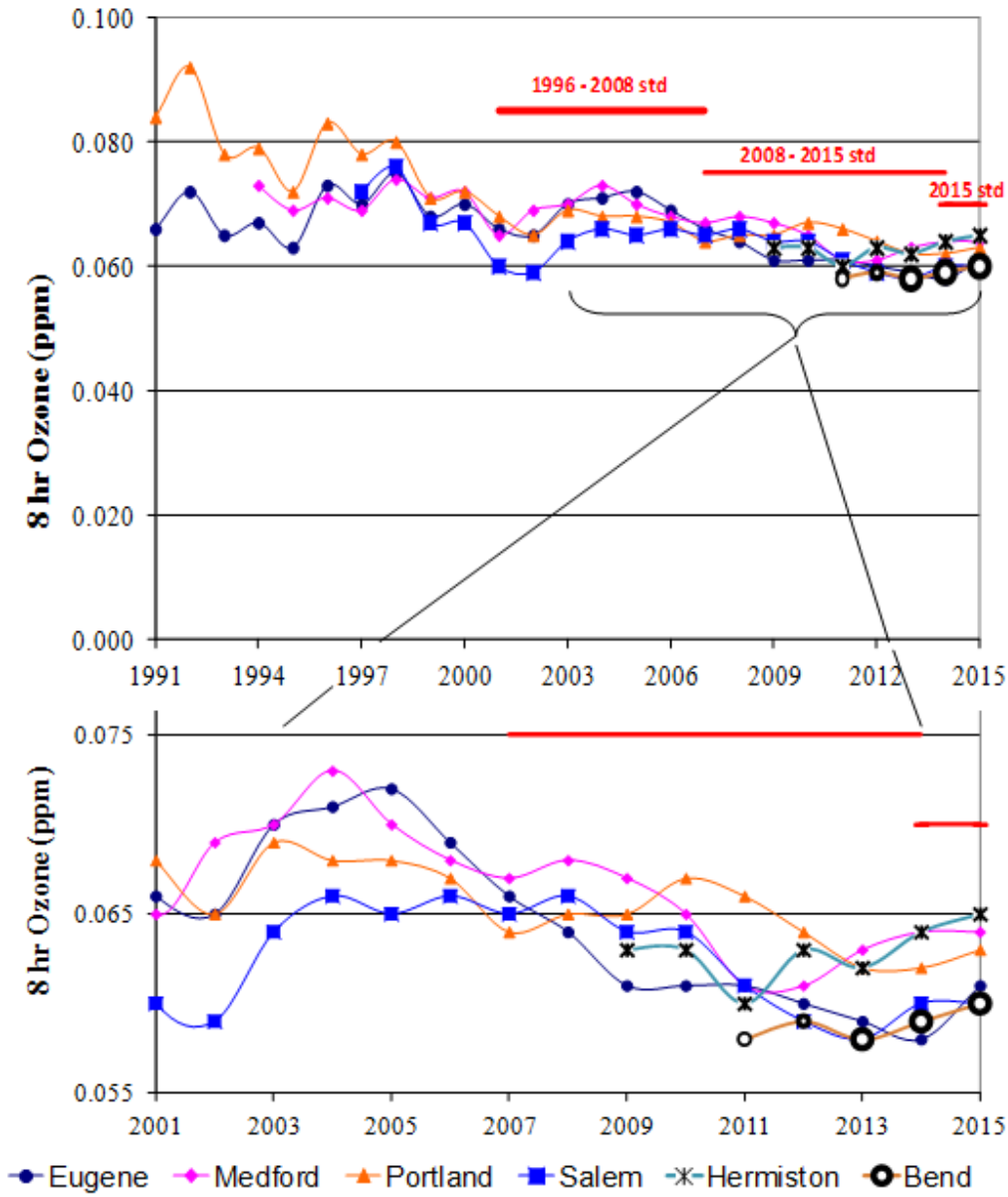
For PM_{10}, the Medford-Ashland AQMA, which is entirely within the RVMPO planning area, was re-designated from non-attainment to attainment by EPA in 2006, and the emissions budget for PM_{10} from transportation (mobile) sources was deemed adequate to maintain air quality (RVMPO, 2013).

The 2013-2038 Regional Transportation Plan describes that with the implementation of the current Regional Transportation Plan (RTP) and amended 2015 Metropolitan Transportation Improvement Program (MTIP), all current federal and state requirements for on-road transportation emissions within the planning area will be met.

> For the Medford UGB area, this means that on-road transportation-related emissions of CO will not exceed the budget for CO established by Oregon Department of Environmental Quality and approved by EPA in 2002. For the entire Medford-Ashland Air Quality Maintenance Area, an area within the RVMPO planning area, PM_{10} emissions from on-road transportation will not exceed the budget set by ODEQ and approved by EPA in 2006. This means that transportation projects will not impede the area in continuing to meet air quality requirements (RVMPO, 2013).

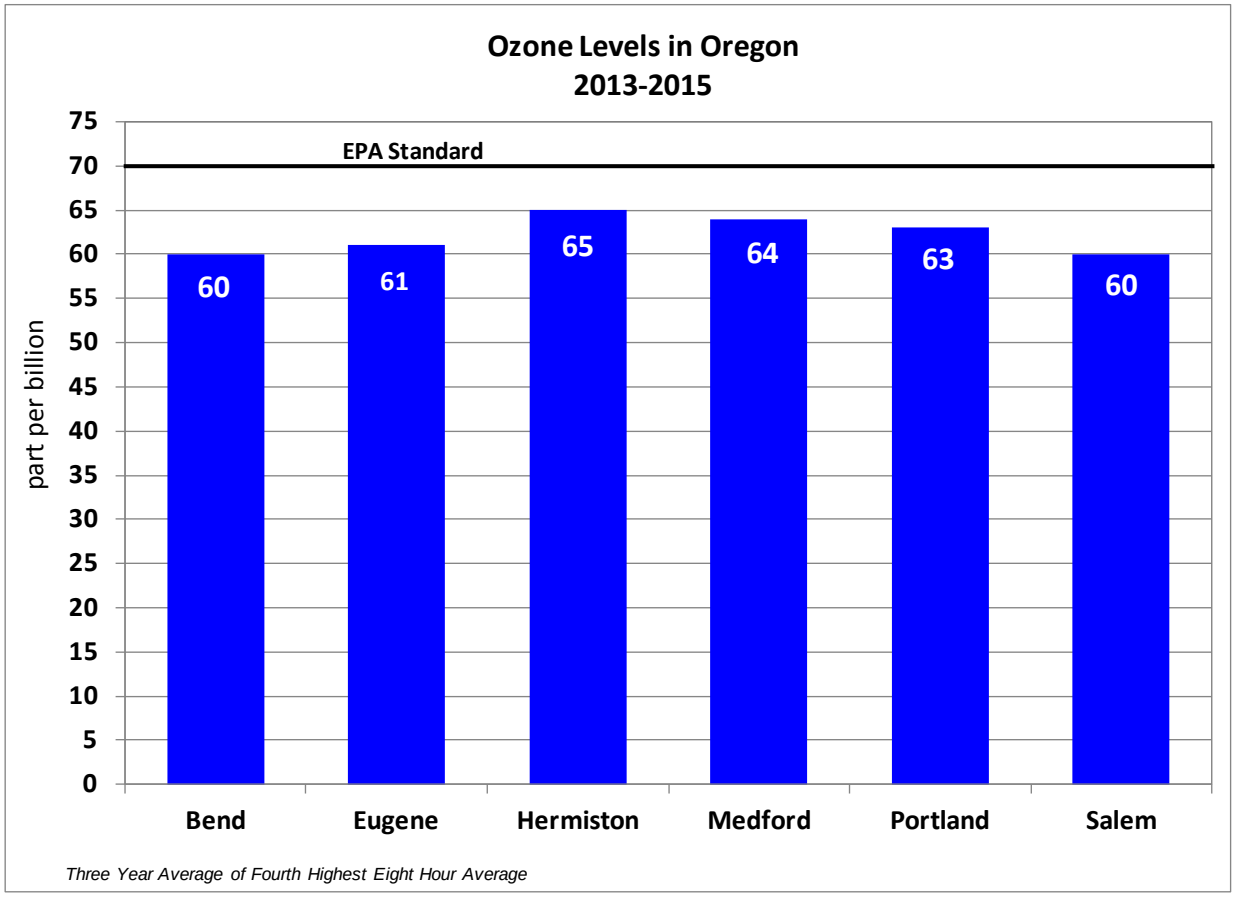
Ozone and $PM_{2.5}$ levels. There were several days in July and September of 1998 when ozone exceeded the standard of 0.12 ppm (*Jackson County Air Quality Annual Report 1995-1996*). From 1998 to 2007, the standard was not exceeded (DEQ, 2002 Oregon Air Quality Data Summaries) (City of Medford, 2010). Since 2007, as shown on the figure below, the ozone levels have declined in Medford, though a slight uptick in ozone levels is indicated in 2013-2015 timeframe.

Figure 61. Ozone Levels in Medford, Eugene, Portland, Salem, Hermiston, and Bend 1996-2015



Source: Anthony Barnack, personal communication, September 16, 2016

Figure 62. Ozone Levels in Oregon 2013-2015



Source: Anthony Barnack, personal communication, September 16, 2016

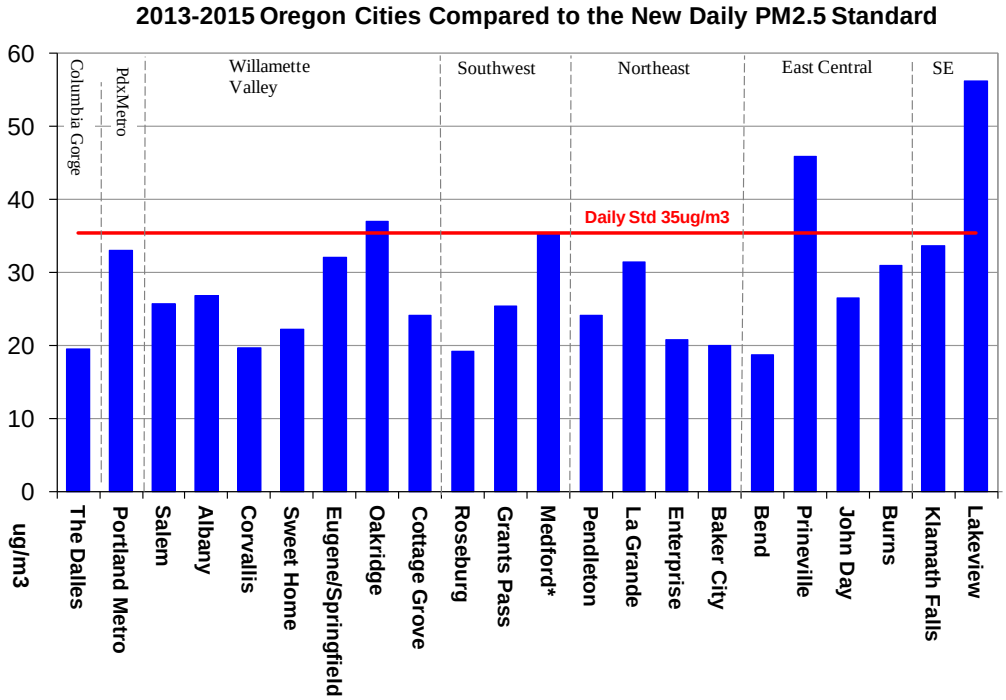
"The current criteria pollutants of concern are $PM_{2.5}$, ozone, and air toxics. The Medford-Ashland AQMA is under a maintenance plan for PM_{10} and CO but these pollutants are no longer near the standard" (Anthony Barnack, personal communication, September 28, 2016). $PM_{2.5}$ has replaced PM_{10} as a particulate of concern in Medford and around the country. In 2006, the $PM_{2.5}$ standard was lowered from 65ug/m^3 to 35ug/m^3. Medford trends close to the $PM_{2.5}$ standard in both daily and annual average levels.

Medford's 2015 $PM_{2.5}$ design value (without forest fire smoke data) is 35.4ug/m^3. The EPA standard is 35.5ug/m^3. The design value is based on the most recent three years of data. DEQ calculates the design value; compliance with the EPA standard is based on it. So the 2015 design value is based on the 3 year average of the 98th percentile of 2013, 2014, and 2015. (Rachel Sakata, personal communication March 1, 2017). The $PM_{2.5}$ non-forest fire smoke design value has been hovering just below the standard for several years, with the 2014 design value of 34.0 ug/m^3, and the 2013 design value of 34.2 ug/m^3 (Anthony Barnack, personal communication, September 22, 2016).

Other cities in Oregon, such as Eugene/Springfield, Portland, and Klamath Falls, also trend close to the daily PM2.5 standard, as shown in **Figure 63**. For the annual standards, Medford is close to the standard and in fact, has the highest levels of the cities shown in **Figure 64**. DEQ does not think Medford is in danger of violating this standard (Anthony Barnack, personal communication, September 28, 2016). In **Figure 65**, the Medford $PM_{2.5}$ trend comparison to the NAAQS, in both daily and annual levels, is

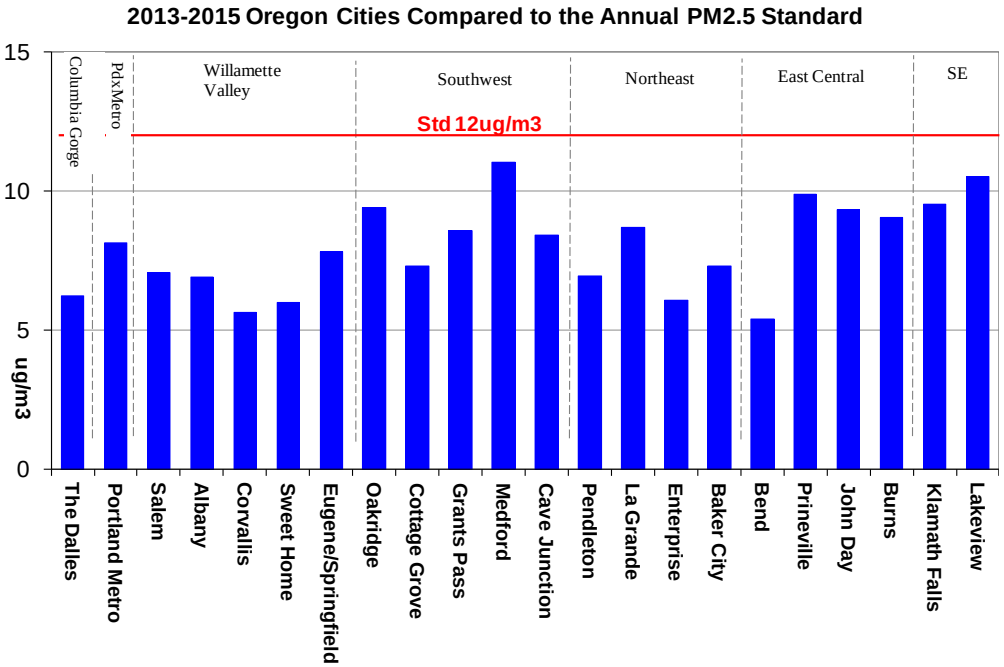
shown. Examples of cities that are violating the $PM_{2.5}$ standard include Prineville, Oakridge, and Lakeview.

Figure 63. 2013-2015 Oregon Cities Compared to the New Daily $PM_{2.5}$ Standard



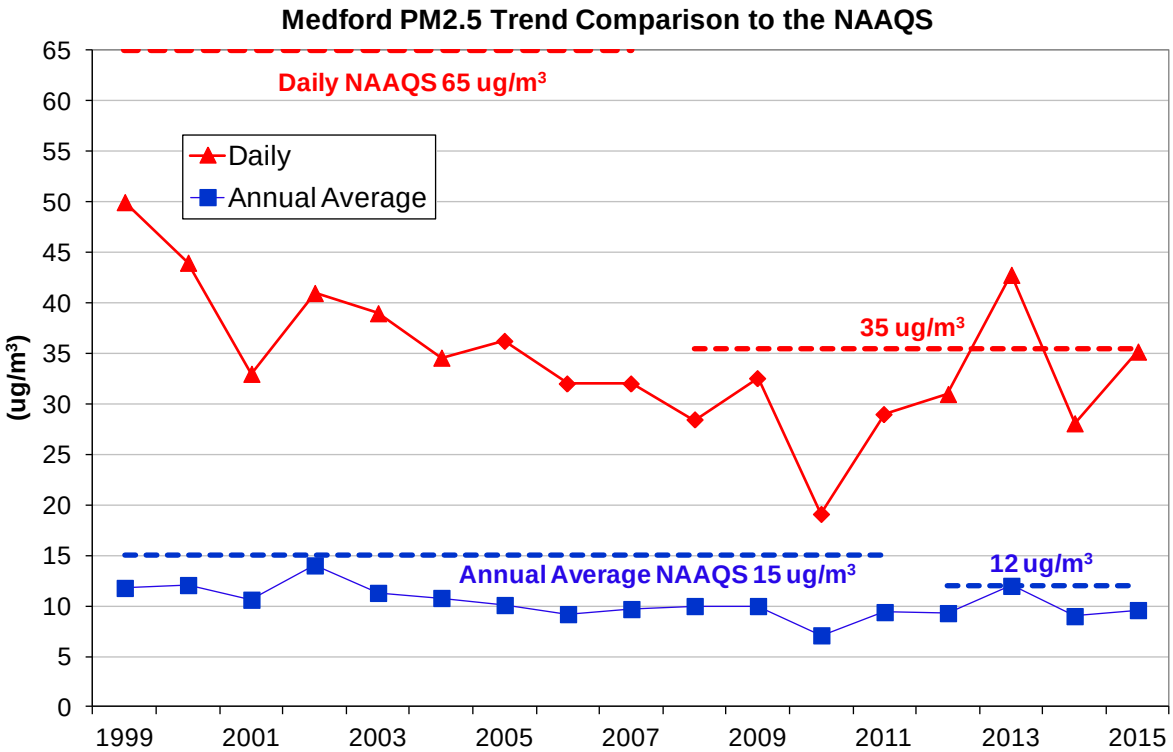
Source: Anthony Barnack, personal communication, September 16, 2016

Figure 64. 2013-2015 Oregon Cities Compared to the Annual $PM_{2.5}$ Standard



Source: Anthony Barnack, personal communication, September 16, 2016

Figure 65. Medford $PM_{2.5}$ Trend Comparison to the NAAQS

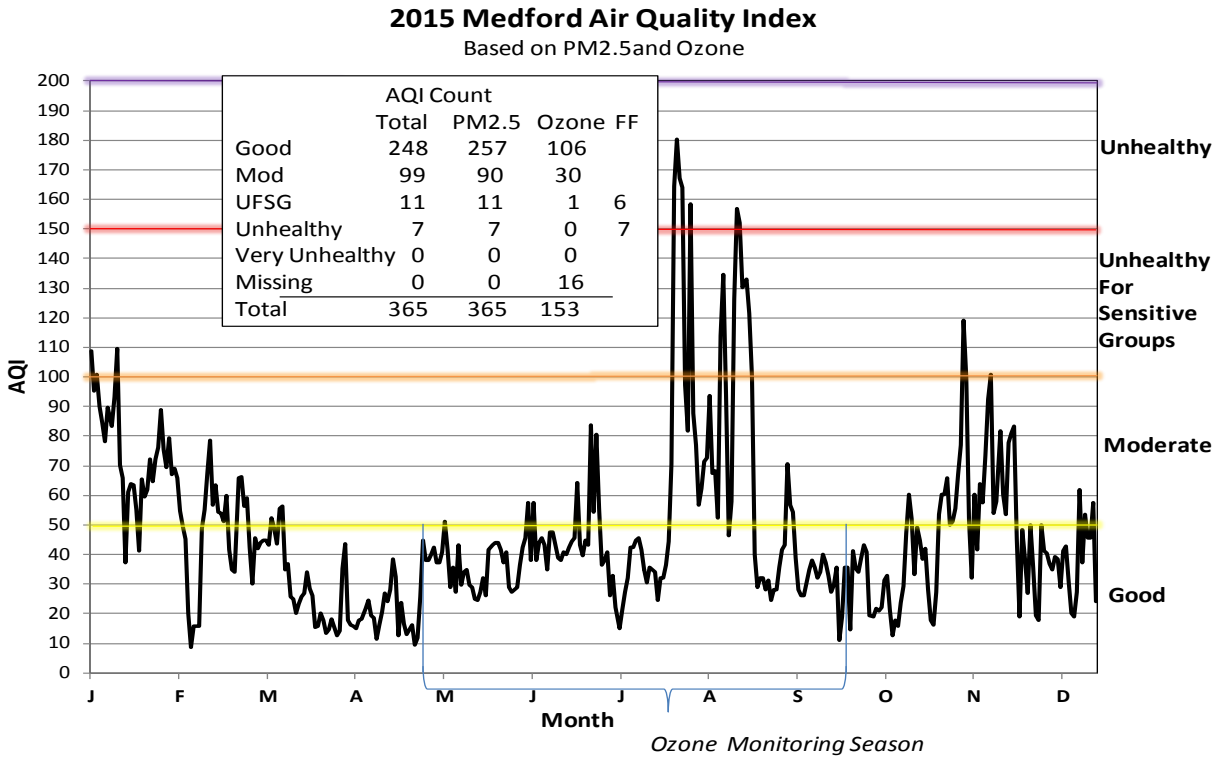


Source: Anthony Barnack, personal communication, September 16, 2016

The Air Quality Index (AQI) is a color-coded tool which shows air pollution levels. It is a scale used to report actual levels of ozone and other common pollutants in the air. The higher the AQI, the higher the health concern. The AQI is divided into categories that correspond to different levels of health concern (Oregon DEQ, 2015).

The Medford Air Quality Index (AQI) is shown in **Figure 66** and is based on both $PM_{2.5}$ and ozone, the two DEQ measured pollutants of concern. The AQI is shown monthly and also in health categories of good, moderate, unhealthy for sensitive groups, and unhealthy. A total number of days in the health categories for each of the pollutant categories is shown for both $PM_{2.5}$ and ozone respectively, along with an identification of FF for the forest fire flagged data.

Figure 66. 2015 Medford Air Quality Index



Source: Anthony Barnack, personal communication, September 16, 2016

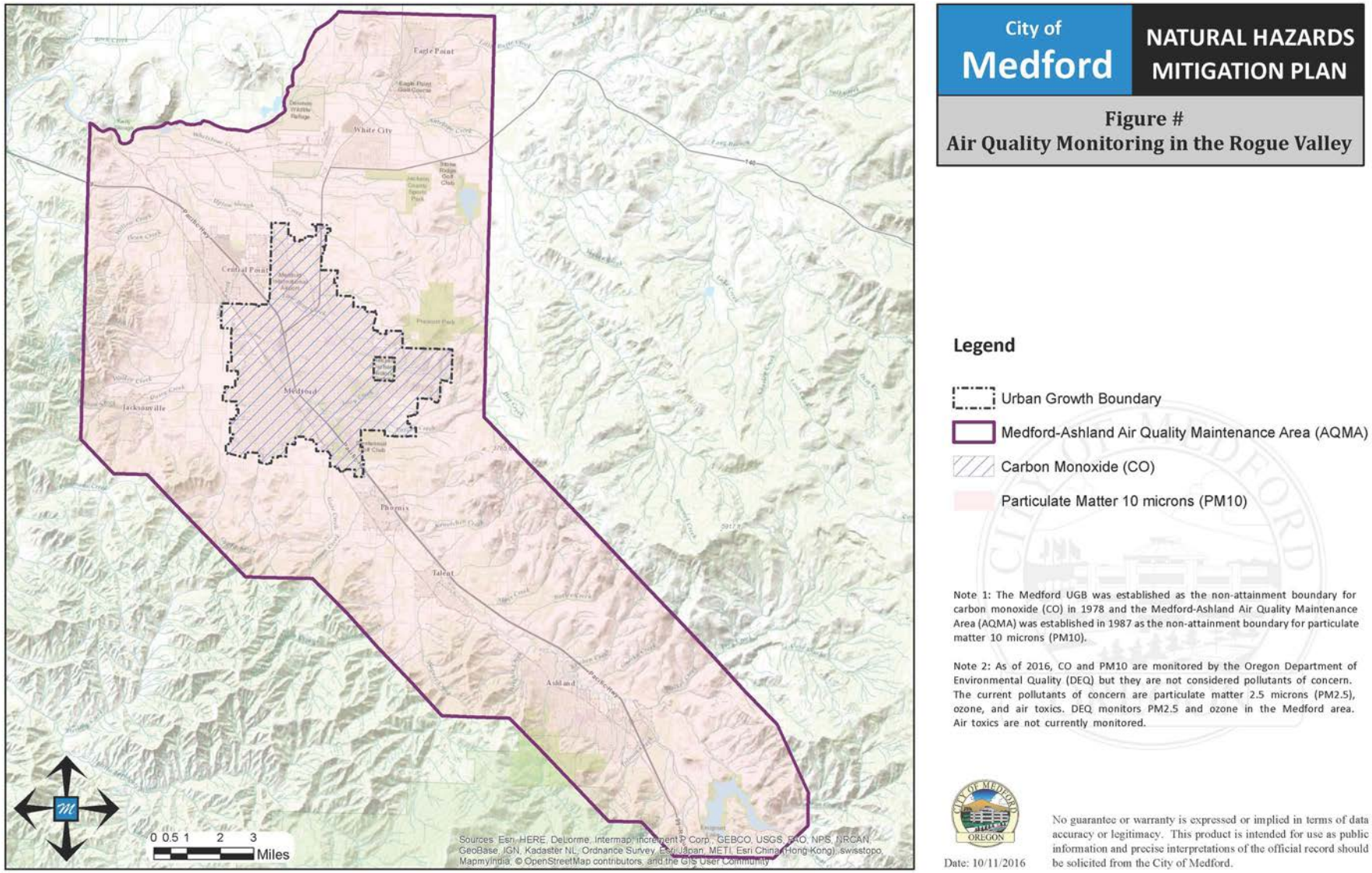
Significant historic events regarding air quality in the Medford area are identified in **Table 42**.

Table 42. Significant Historic Air Quality Events

Date	Location	Description
1978	Medford	The Medford UGB was established as the non-attainment boundary for CO.
1982	Jackson County	A State Improvement Plan (SIP) was developed for CO because it exceeded the NAAQS in the Medford-Ashland AQMA. It was approved by the EPA.
1987	Medford-Ashland	The Medford-Ashland AQMA was designated as the non-attainment boundary for particulate matter (PM_{10}).
1987	National	PM_{10} levels established at 24 hour (150ug/m^3) and annual (50 ug/m^3) exposure. 24 hour levels are not to be exceeded more than once per year on average over a 3-year period. Annual arithmetic mean, averaged over 3 years.
1989	Jackson County	Jackson County began programs to improve PM_{10} levels, including regulating industry, outdoor burning, and wood stoves, to reduce the regional smoke.
1980s	Medford	The NAAQS for CO was exceeded most of the 1980s in Medford.
1991	Jackson County	A SIP was developed for PM_{10}. It was not approved by EPA and was withdrawn.
1995-2007	Medford-Ashland	CO standards were twice exceeded in the Medford-Ashland Air Quality Maintenance Area (AQMA) (those dates were in 1999 and 2000).
1997	National	PM_{10} levels revised at 24 hour (150 ug/m^3) and annual (50 ug/m^3) exposure. $PM_{2.5}$ levels established at 24 hour (65 ug/m^3) and annual (15.0 ug/m^3) exposure. For the 24 hour that is the 98th percentile, averaged over 3 years. Annual arithmetic mean, averaged over 3 years.
2002	Jackson and Josephine Counties	Wildfires raged in these counties. Smoke from the Timbered Rock Fire blew in from the NE and choked the valley. DEQ advised people with health problems to stay in air-conditioned environments and avoid exercise outside. Smoke continued from summer to Labor Day.
2004	Oregon	Oregon DEQ announced that they would not move ahead with recommendations to relax emissions. Popular opposition was cited as the main reason.
2006	National	The standard for $PM_{2.5}$ was lowered from 65 ug/m^3 to 35 ug/m^3 at the 24 hour exposure. This means it is the 98th percentile, averaged over 3 years
2008	National	The standard for CO was lowered to 0.075 ug/m^3.
2013	Medford, Jackson County, and surrounding counties	Wildfires in 2013 brought the Medford AQI to a high of 238.5 ug/m^3 and the 24 hour average to 188.3 ug/m^3.
2015	Medford, Jackson County, and surrounding counties	Wildfires in 2015 resulted in the AQI of 183.6 ug/m^3 and the 24 hour average was 118.6 ug/m^3.
2016	Medford-Ashland	PM_{10} and CO levels are no longer pollutants of concern

Sources: “Timbered Rock Blaze," 2002; "Tourism Choked," 2002; Oregon DEQ, 2003; DEQ 2015 Oregon Air Quality Data from Anthony Barnack, personal communication, September 2016; Tanya Phillips, personal communication, March 2017; U.S. EPA 2010; U.S. EPA 2016a.

Figure 67. Map of Air Quality Monitoring in the Rogue Valley



Source: Chris Olivier, Planning Department GIS Coordinator, City of Medford, personal communication, October 13, 201**6**

Probability

As mentioned earlier, the Rogue Valley experience winter air stagnations. Depending upon climate conditions, these stagnations can be infrequent or numerous in any given year, which can have a potential impact to air quality levels for both PM2.5 and ozone in the area (Rachel Sakata, personal communication, March 1, 2017). Prevailing wind direction and strength can influence the location and extent of the air quality impacts. The probability of air quality at one level or another varies, as air quality is a range based on multiple factors such as those measured for CO, $PM_{2.5}$ and others described herein; no data was found with a distinct number specific to Medford.

Climate change and impacts from air quality are discussed in the Vulnerability subsection.

Vulnerability

Poor air quality puts the health of all persons at risk. The effects of poor air quality are long-term, chronic, and often difficult to trace. Those persons most at risk tend to be the elderly, very young children and people with pre-existing respiratory problems. As noted above, according to DEQ, particulate matter in smoke poses a serious air pollution threat to public health.

The increase in wildfires that produce smoke and impact air quality exacerbates people with underlying medical conditions such as, respiratory diseases (Beth DePew, personal communication, September 21, 2016).

Oregon Smoke Information (http://oregonsmoke.blogspot.com) is a website put together by city, county, tribal, state, and federal agencies to coordinate and aggregate information for Oregon communities that are affected by wildfire smoke. The information on the website is posted by the agencies, but the site was built and is maintained by volunteers.

Apart from the health effects, air quality is a constraining factor on transportation choices and commercial/industrial development in the Rogue Valley. Cars, trucks, industry and commerce and diverse activities discharge pollutants into the air. The growing residential population and the fact that Medford is a hub for transportation, freight, and distribution of goods keep pollutant emissions a constant concern.

Table 43 specifies: the location and extent of air quality; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assets. The information is in brief, as the more detailed descriptions are provided at length in the text.

A recently published study noted that "Researchers believe recent fire seasons give a taste of the more active wildfires of the future. Such fires are likely to increase air pollution, even as emissions from industry and motor vehicles have fallen in recent decades. (NASA Earth Observatory, n.d.-a). "The U.S. has really made great strides in reducing man-made particles," said study co-author Loretta Mickley of Harvard University. Now, she said, "wildfires dominate poor air quality in the West."

The study identifies that wildfires contribute roughly 18 percent of the total particulate emissions in the U.S. (NASA Earth Observatory, n.d.-a).

> Globally, fine particles have been linked to more than 3.3 million premature deaths... Particulate pollution, one of the results of burning matter, can cause a slew of health problems, including chronic obstructive pulmonary disease, acute lower respiratory illness, asthma, ischemic heart disease, and lung cancer.
>
> Using atmospheric and climate models, the research team found that more than 82 million people are likely to experience an increase in the frequency and duration of smoke waves. Northern California, western Oregon, and the Great Plains are among areas that researchers estimate will be hit hardest by particulate matter ($PM_{2.5}$) in the atmosphere.
>
> "Wildfires are difficult to predict because they're variable one day to the next and one year to the next," said Jason West, a professor of environmental science at the University of North Carolina. The new research is valuable, he said, because it places the fires into a health context. "What's interesting [about the study] is that it shows that climate change can have a direct impact on public health," said Mickley. "We're used to thinking of climate change as affecting temperatures and rising sea levels. This is something different that requires a lot of resources to control, affects millions of people, and it has been overlooked" (NASA Earth Observatory, n.d.-a).

CO and PM_{10} are no longer considered pollutants of concern for Medford as they have been in the past. Now, ozone and $PM_{2.5}$ are pollutants of concern. A short description of CO impacts to people and the environment is included to recognize Medford's past, before including a description of ozone and particulate matter impacts.

CO can cause harmful health effects by reducing oxygen delivery to the body's organs, especially the heart, brain, and tissues. At extremely high levels, CO can cause death.

> Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress. For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion (U.S. EPA, n.d.-a).

Shortness of breath, dry cough or pain when taking a deep breath, tightness of the chest, wheezing, and nausea are common responses to ozone.

> Ozone reacts with molecules in the lining of our airways. Chemical bonds break and reform in different ways with the addition of oxygen atoms (the process of oxidation) from ozone, and this

causes acute inflammation. The lining of our airways loses some of its ability to serve as a protective barrier to microbes, toxic chemicals, and allergens. Our airways respond by covering the affected areas with fluid and by contracting muscles. Breathing becomes more difficult.

Ozone also triggers asthma and may aggravate other respiratory illnesses such as pneumonia and bronchitis. Ozone concentrations can make the small bands of muscles that help control breathing more sensitive to dry air, cold or dust, so ozone exposure may increase allergic responses in susceptible people.

While the effects of acute, short-term episodes of ozone exposure are reversible, the human body's response to long-term exposure may not be reversible. Exposure to ozone at levels we commonly encounter in many of our own communities permanently scars the lungs of experimental animals, causing long-term impairment of lung capacity, or the volume of air that can be expelled from fully inflated lungs. Ozone may have similar effects on human lungs. Studies in animals also suggest that ozone may reduce the human immune system's ability to fight bacterial infections in the respiratory system.

Ozone damage to people can occur without any noticeable signs. Even when initial symptoms appear, they can disappear while ozone continues to cause harm. Otherwise healthy people can expect to experience acute but reversible effects if they exercise regularly outdoors when ozone levels are high. The NIEHS considers such people to be especially susceptible as a group (NASA Earth Observatory, n.d.-b).

Particulate matter is also known as particular pollution; it is a complex mixture of extremely small particles and liquid droplets that get into the air. Once inhaled, these particles can affect the heart and lungs, and cause serious health effects (U.S. EPA, n.d.-e).

The size of particles is directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into lungs and the bloodstream. Exposure to such particles can affect both the lungs and heart. People with heart or lung diseases, children, and older adults are the most likely to be affected by particle pollution exposure (U.S. EPA, n.d.-e).

Numerous scientific studies have linked particle pollution exposure to problems, including:

- premature death in people with heart or lung disease
- nonfatal heart attacks
- irregular heartbeat
- aggravated asthma
- decreased lung function
- increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing (U.S. EPA, n.d.-e).

Fine particles ($PM_{2.5}$) are the main cause of reduced visibility (haze) in parts of the United States, including many of our treasured national parks and wilderness areas. Particles can be carried over long distances by wind and then settle on ground or water. Depending on their chemical composition, the effects of this settling may include:

- making lakes and streams acidic

- changing the nutrient balance in coastal waters and large river basins
- depleting the nutrients in soil
- damaging sensitive forests and farm crops
- affecting the diversity of ecosystems
- contributing to acid rain effects (U.S. EPA, n.d.-e).

PM can stain and damage stone and other materials, including culturally important objects such as statues and monuments. Some of these effects are related to acid rain effects on materials (U.S. EPA, n.d.-e).

The DEQ *Oregon Wildfire Response Protocol for Severe Smoke Episodes (Version 4.4)* (Oregon DEQ et al., 2016) is specific to air quality; provides guidance and resources; and includes a table designed for use by affected jurisdictions in consultation with DEQ, the Oregon Health Authority and other agencies that are parties to the protocol.

> The table identifies recommended public health actions to be taken, based on the intensity and expected duration of smoke exposure. The Air Quality Index category and PM2.5 levels are derived from the federal PM2.5 health standard of 35µg/m3 (micrograms per cubic meter) for a 24-hour average (the Air Quality category "unhealthy for sensitive groups"). Decisions about which public health actions to recommend would be based on monitoring data and the projected smoke duration. The duration of smoke exposure noted in the table uses 24 hours as the basis for two sets of recommended health actions. This is because there is some evidence that sheltering-in-place (staying indoors with windows and doors closed) offers some protection in the first 24 hours, but there is minimal evidence for benefit beyond that. Recommendations in **Table 4** are cumulative. For each level and duration of exposure, unless the listed actions supersede previous ones, the recommendations above and to the left still apply (Oregon DEQ et al., 2016).

The Rogue Valley Metropolitan Planning Organization (RVMPO) worked with staff from the Oregon Department of Transportation (ODOT) and the Department of Land Conservation and Development (DLCD), in a voluntary planning effort known as a strategic assessment of adopted local and regional land use and transportation plans. As one of the key findings, the *Strategic Assessment of Transportation and Land Use* provides an optimistic statement about the future:

> Air quality in the Rogue Valley is expected to improve as a result of implementing adopted plans, as well as federal and state-led actions on vehicles and fuels; both greenhouse gases and criteria air pollutants, such as carbon monoxide, particulate matter, ozone, sulfur dioxide, nitrogen dioxide and lead, are expected to decline. By implementing adopted plans alone, greenhouse gas emissions are expected to decrease 0.6% by 2038, but when considered in combination with state and federal improvements to vehicles and fuels, the overall per capita GHG reduction in the region is expected to be 64% from 2005 levels. When combined with potential state-led actions implemented at the local level (e.g. ambitious policies addressing pay-as-you-drive insurance, eco-driving, low-roll-resistant tires, or a carbon tax), RVMPO can expect a 16% GHG reduction by 2038. However, much more work will be needed at the state and local level to reach the 19% GHG reduction target for the region. While no one policy on its own meets the target, sensitivity testing results include over 200 scenarios (beyond state-led vehicle and fuel related strategies) that can help the region achieve 19% GHG reduction. In addition, criteria air pollutants emitted from light duty vehicles are expected to drop over 50% from 2010 levels, primarily as a result of cleaner vehicles. The resulting air quality improvements provide

> key health benefits for all residents. The improved fuel efficiency of future vehicles also results in lower annual fuel consumption and energy use (RVMPO, 2016).

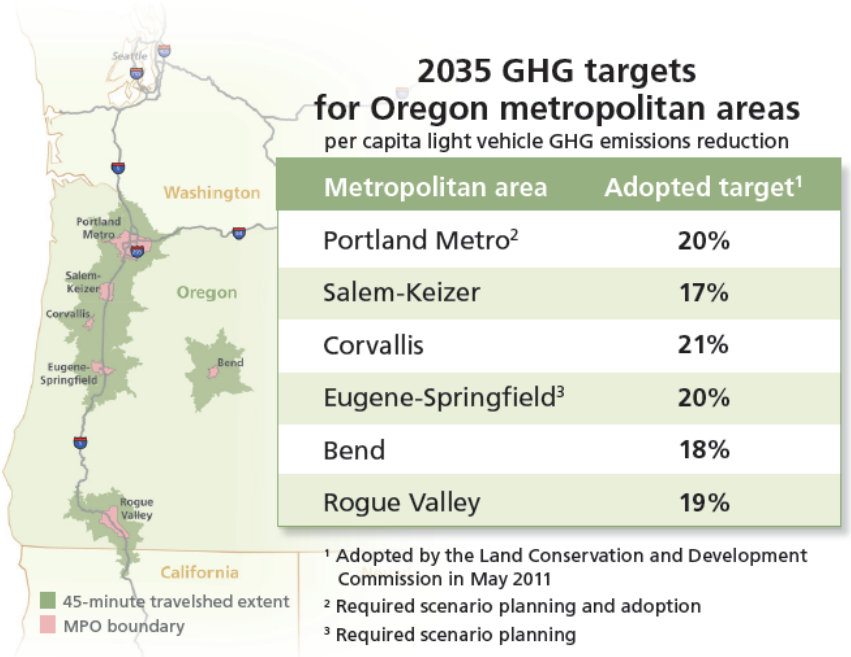
The *Strategic Assessment of Transportation and Land Use* also states,

> Considering GHG emissions reductions relative to the state target of 19% for the Rogue Valley, which measures reductions above and beyond improvements in fleet, fuels, and technology, the expected per capita reductions are about 16% when local plans are considered in combination with strategies and actions identified in the Statewide Transportation Strategy (i.e. ambitious pricing such as a carbon tax, and comprehensive system operations management techniques). However, it is important to note that the state target is for 2035 and no specific target exists for 2038, the future year analyzed in the state (RVMPO, 2016).

According to the *Strategic Assessment of Transportation and Land Use*, the Oregon Legislature passed House Bill 2001 (Jobs and Transportation Act) in 2009 and passed Senate Bill 1059 in 2010; these bills required the development of planning methods to reduce Greenhouse Gas (GHG) emissions from light motor vehicles within areas served by Metropolitan Planning Organizations (MPOs).

> In 2011, the Land Conservation and Development Commission (LCDC) adopted GHG emission reduction targets for six metropolitan areas. The targets are intended to guide scenario planning by metropolitan areas and identify the per capita percentage reduction in emissions that each area would need to achieve to enable the state to meet its overall emission reduction goals. Scenario planning to meet the targets is voluntary, except for the Portland metropolitan area – which is required to adopt a preferred land use and transportation scenario meeting its adopted target by the end of 2014 (RVMPO, 2016).

Figure 68. 2035 Greenhouse Gas Targets for Oregon Metropolitan Areas



Source: RVMPO, 2016

As the *Climate Change Vulnerability Assessment for Ashland and the Rogue Valley* stated,

> While greenhouse gases are measured globally, climate change impacts are locally specific. Each community feels climate change in a different way, depending on historic conditions and locally-specific climatic conditions and patterns of change. As these local impacts and changes worsen over time, we will need to prepare and protect our most vulnerable resources and populations from the impacts (Geos Institute, 2016b).

According to the *Climate Trends and Projections* report dated August 22, 2016 from the Oregon Climate Change Research Institute (OCCRI), "The global climate is warming primarily due to the accumulation of greenhouse gases in the atmosphere from human activities like burning fossil fuels. Future climate conditions will depend on the amount of future greenhouse gas emissions and how sensitive the climate is to those emissions (IPCC, 2013)." OCCRI's report was done to support the development of the City of Ashland's *Climate and Energy Action Plan*. The report "presents historical trends in Ashland's temperature and precipitation alongside future projections related to both average and extreme temperature and precipitation. Later sections analyze historical trends in Rogue Basin snowpack and future projections in snowpack and streamflow, as well as historical trends and future projections of wildfire in the western U.S." (Dalton, 2016).

Another local source of greenhouse gas information related to Jackson County is the March 2011 *Southern Oregon Regional Greenhouse Gas Inventory*, which was performed by Good Company (2011) and the Rogue Valley Council of Governments. According to the report, the GHG emissions inventory was to establish "a baseline carbon footprint of consumption in southern Oregon in order to discover the highest-leverage areas for change and to provide technical support for future project funding."

Appendix D, Summary of Climate Trends and Projections, written by Dr. Alan Journet of the Southern Oregon Climate Action Now (SOCAN), provides additional information about greenhouse gases and other air quality concerns, as part of the climate change description and analysis for Medford and Jackson County.

Table 43. Vulnerability Assessment for Air Quality

Location	Probability	Extent	Overview of Resources at Risk
Air quality varies throughout the area within the Medford UGB as well as outside of the UGB. Medford falls within the Medford-Ashland Air Quality Maintenance Area (AQMA) and has certain thresholds for $PM_{2.5}$, ozone, and air toxics to comply with DEQ and EPA requirements.	The probability of air quality at one level or another varies, as air quality is a range based on multiple factors such as those measured for CO, $PM_{2.5}$ and others described herein; no data was found with a distinct number specific to Medford.	The strength or magnitude of the hazard is variable with air quality. Factors such as direction and strength of prevailing winds, temperature, and emissions from wood stoves, industry, and motor vehicles. Wildfires also influence air quality.	Prevailing wind direction and strength can influence the location and extent of the air quality impacts to the Medford area within the UGB and outside of the UGB. All persons are subject to impacts; these will also vary depending on the health condition of the person. Residents without refrigeration based air conditioners can be impacted (evaporation coolers are ineffective against common contaminants).

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)	People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
PM can stain and damage stone and other materials, including culturally important objects such as statues and monuments.	CO can cause harmful health effects. Shortness of breath, dry cough or pain when taking a deep breath, tightness of the chest, wheezing, and even nausea are common responses to ozone. At extremely high levels, CO can cause death. Particle pollution exposure can lead to premature death in people with heart or lung disease; nonfatal heart attacks; irregular heartbeat; aggravated asthma; decreased lung function; and increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing.	Air quality can impact water sources such as reservoirs and drainage basins that provide drinking water. Air quality can impair visibility such that roads, airports, railroads, and other transportation systems become low or non-functioning. Use of emergency aircraft may be limited or curtailed.	Impacts to people's health, the environment, critical facilities, and structures have hard to quantify impacts in dollar amounts. Data includes but is not limited to links about air quality to premature death, increased health issues such as asthma, costs of increased health, and the costs of wildfire impacts. Residents may leave for the duration of the situation, and visitors may avoid travel through or to the area.	Fine particles ($PM_{2.5}$) are the main cause of reduced visibility (haze) in parts of the United States. Particles can be carried over long distances by wind and then settle on ground or water. The effects of this settling may include: making lakes and streams acidic; changing the nutrient balance in coastal waters and large river basins; depleting the nutrients in soil; damaging sensitive forests and farm crops; affecting the diversity of ecosystems; and contributing to acid rain effects.

Section 9 Emerging Infectious Diseases

Introduction and Hazard Overview

The hazard of disease outbreaks is not a common one for inclusion in Natural Hazard Mitigation Plans. Medford continues to recognize the unique situations that factor into identification of disease outbreaks as a hazard for the area.

Disease is a sickness, illness, or loss of health (CDC, n.d.-b).

Terms such as disease outbreaks, epidemics, and pandemics are often used to describe situations where multiple cases of infection are identified.

"The amount of a particular disease that is usually present in a community is referred to as the baseline or endemic level of the disease. This level is not necessarily the desired level, which may in fact be zero, but rather is the observed level" (CDC, n.d.-e).

The Centers for Disease Control and Prevention (CDC) states, "While some diseases are so rare in a given population that a single case warrants an epidemiologic investigation (e.g., rabies, plague, polio), other diseases occur more commonly so that only deviations from the norm warrant investigation" (CDC, n.d.-e). The following definitions are all from the CDC (n.d.-c):

- **Sporadic** refers to a disease that occurs infrequently and irregularly.
- **Endemic** refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area.
- **Hyperendemic** refers to persistent, high levels of disease occurrence.

Occasionally, the amount of disease in a community rises above the expected level.

- **Epidemic** refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.
- **Outbreak** carries the same definition of epidemic, but is often used for a more limited geographic area.
- **Cluster** refers to an aggregation of cases grouped in place and time that are suspected to be greater than the number expected, even though the expected number may not be known.
- **Pandemic** refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people.

Understanding how and why a particular disease spreads requires a multi-disciplinary study of biology, culture, society, economics, environment and technology. Diseases are caused by viruses, bacteria, or protozoa, which infect humans in a variety of ways. Some are water borne, air borne, or food borne; others are transmitted via interpersonal contact or contact with a vector, such as a mosquito. Norovirus and influenza are examples of familiar viruses. Examples of bacteria are E. coli and streptococcus. Cryptosporidium and giardia are caused by protozoa.

How many people die from a disease depends upon (WebMD, n.d.):

- The number of people who become infected
- The severity of disease caused by the virus (its virulence)

- The vulnerability of affected populations
- The effectiveness of preventive steps.

Medford is home to the largest, most concentrated population in Region 4 of Oregon's NHMP Natural Hazard Regions. As a regional employment, recreational, residential, retail and health care hub, Medford draws many non-residents on a daily basis into the area, multiplying the opportunities for further disease exposure and transmission among both visitors and residents. Recognizing this expanse of exposure is important; it is possible that a disease related issue could impact a large portion of the region's population.

For example, drinking water is provided by the Medford Water Commission. According to the Regional Engineer for the State Drinking Water Program, Medford faces no special vulnerabilities with respect to contamination of its surface water (Scott Curry, personal communication, December 2003). The water system is partially dependent upon river waters, thus it faces the same vulnerabilities as other cities that draw from rivers. Protection measures are in place to reduce and eliminate water contaminants, but it is not possible to fully control a multiple-use watershed like the Upper Rogue River and Big Butte Springs Watershed. These watersheds are home to urban and rural development, farming and ranching operations, recreation activities, and many other land uses that could potentially impact the water.

Types of Hazard

Over the years, many emerging and reemerging infectious disease outbreaks have occurred in the U.S. and around the world. To name a few: West Nile Virus; salmonella; E.coli; cryptosporidiosis; norovirus; Severe Acute Respiratory Syndrome (SARS); pertussis or whooping cough; Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS); H1N1, influenza, measles, Ebola, legionnaires, and Zika. The History subsection includes a description of notable infectious disease events in the Medford area.

Location and Extent

The diseases identified in Types of Hazard are not the only diseases that exist or could potentially impact Medford. The location and extent of diseases can vary greatly. An emerging infectious disease could occur anywhere in Medford, at any time. It could come suddenly or slowly, lightly or severely, and it could remain here briefly or for an extended amount of time.

Diseases are identified, researched, and managed as much as possible by public health agencies.

The Centers for Disease Control and Prevention (CDC) is the national leading public health agency in the U.S. The mission states, "Whether diseases start at home or abroad, are chronic or acute, curable or preventable, human error or deliberate attack, CDC fights disease and supports communities and citizens to do the same" (CDC, n.d.-c).

In Medford, the agency that provides surveillance, investigates reportable disease, infections or conditions, and carries out appropriate control measures is Jackson County Public Health. Oregon Health Authority may provide assistance in these investigations.

The mission of the Oregon Health Authority (OHA) is "Helping people and communities achieve optimum physical, mental and social well-being through partnerships, prevention and access to quality, affordable health care" (OHA, n.d.-a).

Jackson County Public Health is a division under Jackson County Health & Human Services (Jackson County Health and Human Services, n.d.-b). According to their website "The mission of Jackson County Health and Human Services is to plan, coordinate, and provide services that protect and promote the health and well-being of county residents" (Jackson County Health and Human Services, n.d.-a).

History

There were outbreaks of hepatitis in the 1970s related to sewage disposal and septic systems that failed in Jackson County's clay soils. There were outbreaks of bacterial infection in the 1980s related to food preparation in restaurants, and illnesses associated with E. coli.

In 1992, there were several incidences where people became ill with cryptosporidiosis, a waterborne parasite similar to giardia. In one incidence, all persons served by the Medford Water Commission system were on a boil water order from May 2 through 6. A week later, there was an incidence in White City. On May 22, there was a boil water order issued for the Talent area; it lasted until May 29. All told, it is estimated that as many as 15,000 people "may have had diarrheal illness lasting at least four days since the beginning of January" in 1992 (Oregon Health Division, 1992). Research ultimately substantiated that the source of the problem was not the fault of the Medford Water Commission system.

Between 1992 and 2002, there were periodic outbreaks of illnesses, such as norovirus and salmonella, in nursing homes and assisted living facilities (Gary Stevens, personal communication, July 2003). The congregate living facilities for the elderly are clustered in Medford near regional health facilities, which may mean Medford is more susceptible to outbreaks than other cities in the region. According to Jackson County Public Health staff, there were 23 norovirus outbreaks during 2010-2015 (Tanya Phillips, personal communication, October 4, 2016). Norovirus is the "leading cause of acute gastroenteritis in all age groups in the United States" (CDC, n.d.-a). "Norovirus can mutate and new strains appear, when this does happen there can be up to 50% more norovirus illness in years when there is a new strain of the virus going around. Each year on average in the US, norovirus causes 19-21 million cases of gastroenteritis. Outbreaks mostly occur in long-term care facilities, schools, and restaurants. Norovirus outbreaks are common and expected each year, just like the common cold" (Tanya Phillips, personal communication, October 4, 2016).

In 2003 and 2010, there were outbreaks of pertussis, known as "whooping cough", among children**.** This contagious disease, caused by bacteria, can engender serious health problems in very young children. In September 2003, Jackson County had the highest rate of infection of any county in Oregon, with 53.8 cases per 100,000 residents. The majority of cases were in Medford ("Pertussis Rate Persists," 2003). In 2003, the actual rate in Medford was 70.17 per 100,000 population compared with 12.36 for Oregon (Tanya Phillips, personal communication, September 21, 2016). For data year 2010, Jackson County's incidence rate for pertussis was lower than in 2003; between 8.0 and 19.1 cases per 100,000 people. This incidence rate was in the top third of counties in the state that year (Richard Leman, personal communication, September 20, 2016). The pertussis incidence rate in Jackson County for 2010 was 20.65 per 100,000 population, while the State of Oregon was 7.43 per 100,000 population (Tanya Phillips, personal communication, September 21, 2016).

West Nile Virus (WNV) is a mosquito-borne virus that produces mild symptoms in most infected persons. In a small number of cases, however, encephalitis (inflammation of the brain) may occur. In 2003 WNV was present in all the states west of the Rocky Mountains except Oregon. WNV arrived in Oregon in 2004. According to the Jackson County Vector Control District,

> In 2004 a dead crow in Vale, Oregon, tested positive for WNV. This was the state's first sign of WNV. West Nile virus has been detected in Jackson County during the 2005- 2008, and the 2012-2015 mosquito seasons. The Center for Disease Control and Prevention reports that there have been 177 human cases of West Nile virus in Oregon since 2004. The last known human case of West Nile virus in Jackson County was in 2005 (Jackson County Vector Control District, n.d.-b).

The Jackson County Vector Control District identifies two primary vector borne diseases that they deal with in the Rogue Valley in the human population. These are West Nile virus, described above, and Lyme disease, which is transmitted by ticks. Both of these diseases impact animal populations as well. Heartworm, which is transmitted by mosquitos, is also prevalent and impacts the dog population (Jim Lunders, personal communication, September 21, 2016).

In 2009, Medford had an unusually high number of H1N1 pandemic influenza cases compared to the rest of the state of Oregon (Beth DePew, personal communication, September 21, 2016).

During 2014 and 2015, there were 18 communicable disease outbreaks reported in Jackson County (Richard Leman, personal communication, September 15, 2016).

Table 44. Significant Historic Disease Events

Date	Location	Description
1970s	Medford	Outbreaks of hepatitis related to sewage disposal and septic systems that failed in the clay soils.
1980s	Medford	Outbreaks of bacterial infection and illnesses associated with E.coli related to food preparation in restaurants.
1992	Medford	People became ill with cryptosporidiosis, a waterborne parasite. Between January and June of 1992, approximately 15,000 people had diarreal illness lasting at least 4 days.
1992-present	Medford	Periodic outbreaks of norovirus and salmonella in nursing homes, assisted living facilities, and restaurants.
2003	Medford/Jackson County	Outbreak of pertussis aka whooping cough in children. Jackson County had the highest rate in Oregon with 53.8 cases per 100,000 residents.
2004	Oregon	West Nile Virus arrives in Oregon.
2009	Medford	HiN1 influenza outbreak.
2010	Jackson County	Outbreak of pertussis. Jackson County incidence rate was between 8.0 and 19.1 cases per 100,000 people.
2010-2015	Jackson County	There were 23 outbreaks of norovirus during this period.
2014-2015	Jackson County	There were 18 communicable disease outbreaks during this time period.

Sources: Gary Stevens, Jackson County, personal communication, 2003; "Pertussis Rate Persists," 2003; Beth DePew, personal communication, September 21, 2016; Tanya Phillips, personal communication, September 27, 2016; Richard Leman, personal communication, September 15, 2016; Oregon Health Division, 1992.

Probability

Emerging infectious diseases have been identified in the top five hazard vulnerabilities within our healthcare systems (Beth DePew, personal communication, September 21, 2016). There are many diseases, each with probability statistics attributed to them. Overall, it is probable a person will have one or more during their lifetime.

According to the EPA,

> The impacts of climate change threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience. Warmer temperatures and longer heat

> waves will lead to an increase in heat-related deaths reaching as much as thousands to tens of thousands of additional deaths each year by the end of the century during summer months. Exposure to extreme heat can lead to heat stroke and dehydration, as well as cardiovascular, respiratory, and cerebrovascular disease. Climate change can affect human health in two main ways, first by changing the severity or frequency of health problems. Every American is vulnerable to the health impacts associated with climate change, but some populations will be especially affected: These groups include the poor, some communities of color, limited English-proficiency and immigrant groups, indigenous peoples, children and pregnant women, older adults, vulnerable occupational groups, people with disabilities and people with medical conditions (U.S. EPA, n.d.-b).

There is a large population of migrant workers in Medford (Beth DePew, personal communication, September 21, 2016). It is difficult to estimate the number of migrant and seasonal farm workers in Medford and /or in Jackson County. The number of individuals employed in agricultural occupations changes each season. In addition, migrant and seasonal farm workers are often accompanied by family and others. It is recognized that migrant and seasonal farm workers may be especially vulnerable to disasters for reasons such as immigration status, limited English proficiency, low income, and poor quality of housing. Like tourists, migrant and seasonal farm workers may not be aware of the local hazards, emergency notification systems, and response practices, and my not have emergency supplies (Multnomah County Emergency Management, 2016).

In terms of changing future conditions, it is likely that climate change will influence the probabilities of emerging infectious diseases. For example, West Nile Virus, Lyme disease, and heartworm are identified by the Jackson County Vector Control District as vector borne diseases that occur in the Medford area. Staff states that,

> When talking about climate changes impacts on vector borne disease, two things come into play. First the diseases we currently have are more prevalent with warmer temperatures, second, vectors that previously couldn't live here now can, increasing both the types of diseases being transmitted and the number of individuals infected (Jim Lunders, personal communication, September 21, 2016).

Vulnerability

The vulnerabilities and impacts to people, property, and the environment from diseases vary widely. People with access and functional needs are more susceptible to impacts.

"The elderly, the very young, and people with existing medical conditions have less reserves in terms of their ability to deal with diseases and are therefore more impacted by the disease" (Beth DePew, personal communication, September 21, 2016).

"People who have weakened immune systems, children, pregnant women and people who are 65 and older are more susceptible to having complications related to disease infections such as the flu. People who are not immunized against preventable diseases are more susceptible to becoming infected' (Tanya Phillips, personal communication, September 27, 2016).

There are a myriad of health related statistics. One way to look at vulnerabilities and impacts is to look at statistics for both entire and specific populations. For example, for the 2015–2016 school year, Oregon's kindergarten students had a vaccine nonmedical exemption rate of 6.2% and Jackson County's

kindergarten student nonmedical exemption rate was 8.0% (Tanya Phillips, personal communication, September 27, 2016). Improving immunization rates is one of the seven priority areas from the *Oregon State Health Improvement Plan 2015-2019* (OHA, n.d.-b).

In Oregon, all health care providers shall report cases or suspected cases of specified diseases, infections, microorganisms, and conditions to local public health departments. Licensed laboratories shall also report all test results indicative of and specifics for the disease, infections, microorganisms, and conditions that are listed as reportable diseases, to the local public health department. Disease reporting enables appropriate public health follow-up for patients, helps identify outbreak, provides a better understanding of morbidity patterns, and may even save lives (Tanya Phillips, personal communication, March 1, 2017).

Disease information is reported and tracked but generally not mapped. However, in an effort to identify patterns in diseases, the Jackson County Health Department used GIS technology in 2004 to map all reported diseases. The result showed no particular geographic patterns to epidemics, with the exception that outbreaks of norovirus occur in large care facilities for the elderly and disabled. Subsequently, there have been no maps of that sort created by the Jackson County Health Department (Tanya Phillips, personal communication, September 20, 2016).

> The State of Oregon has developed a web based system called Oregon ESSENCE [Electronic Surveillance System for Early Notification of Community-Based Epidemics]. This system tracks all emergency department data in every hospital in the state. This tracks chief complaints of all patients entering our emergency departments and allows us to see, virtually in real time any spikes in disease activity in our state (Beth DePew, personal communication, September 21, 2016).

Similar symptoms are grouped together into syndrome categories. For example, difficulty breathing and wheezing comments are grouped in an asthma-like category. Using a statistical system, the counts of each syndrome are compared against what is expected at that time of year. Trends in emergency department visits can be identified (OHA, 2017).

The Oregon ESSENCE is a syndromic surveillance system that provides real-time data for Jackson County Public Health and Jackson County hospitals to monitor what is occurring in hospitals as it relates to infectious diseases and injuries, during and after a public health emergency. ESSENCE was used during the 2016-2017 influenza season to monitor the proportion of influenza like illness (ILI) and cases of ILI in Jackson County hospitals. The findings from ESSENCE showed that Jackson County was seeing twice the amount of patients for ILI in the hospitals for ILI than the rest of the state (Tanya Phillips, personal communication, March 1, 2017).

Populations of concern are noted by the EPA, in the *Climate Impacts on Human Health*:

> Some groups of people are more vulnerable than others to health risks from climate change. Three factors contribute to vulnerability: *sensitivity*, which refers to the degree to which people or groups are affected by a stressor such as higher temperatures; *exposure*, which refers to physical contact between a person and a stressor; and *adaptive capacity*, which refers to an ability to adjust to or avoid potential hazards. For example, while older adults are sensitive to extreme heat, an older person living in an air-conditioned apartment won't be exposed as long as she stays indoors, and as long as she can afford to pay for the electricity to run the air

conditioner. Her ability take these actions is a measure of her adaptive capacity (U.S. EPA, n.d.-b).

Some populations are especially vulnerable to climate health risks due to particular sensitivities, high likelihood of exposure, low adaptive capacity, or combinations of these factors.

- Communities of color (including Indigenous communities as well as specific racial and ethnic groups), low income, immigrants, and limited English proficiency face disproportionate vulnerabilities due to a wide variety of factors, such as higher risk of exposure, socioeconomic and educational factors that affect their adaptive capacity, and a higher prevalence of medical conditions that affect their sensitivity.
- Children are vulnerable to many health risks due to biological sensitivities and more opportunities for exposure (due to activities such as playing outdoors). Pregnant women are vulnerable to heat waves and other extreme events, like flooding.
- Older adults are vulnerable to many of the impacts of climate change. They may have greater sensitivity to heat and contaminants, a higher prevalence of disability or preexisting medical conditions, or limited financial resources that make it difficult to adapt to impacts.
- Occupational groups, such as outdoor workers, paramedics, firefighters, and transportation workers, as well as workers in hot indoor work environments, will be especially vulnerable to extreme heat and exposure to vector borne diseases.
- People with disabilities can be very vulnerable during extreme weather events, unless communities ensure that their emergency response plans specifically accommodate them.
- People with chronic medical conditions are typically vulnerable to extreme heat, especially if they are taking medications that make it difficult to regulate body temperature. Power outages can be particularly threatening for people reliant on certain medical equipment (U.S. EPA, n.d.-b).
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Table 45 specifies: the location and extent of emerging infectious diseases; potential damage to structures and their value; impacts to people with access and functional needs (PAFN); and the impacts to critical facilities; economic assets; and environmental assessment.

Table 45. Vulnerability Assessment for Emerging Infectious Diseases

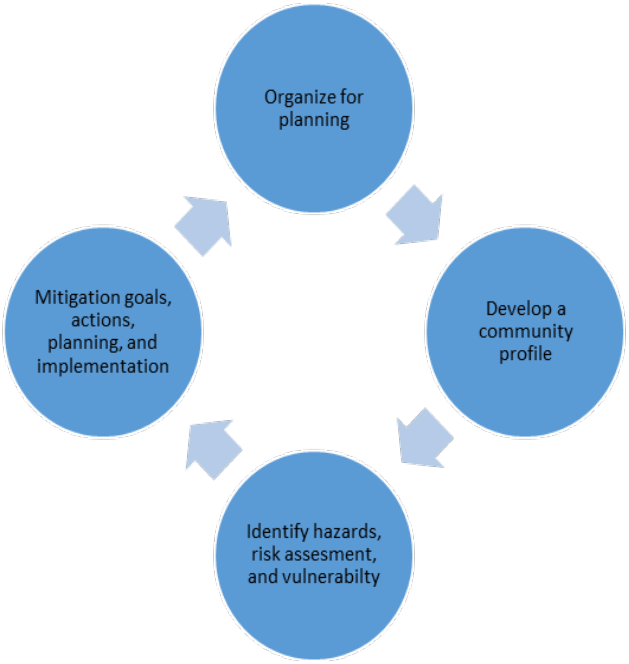
Location	Probability	Extent	Overview of Resources at Risk
An emerging infectious disease could occur anywhere in Medford, at any time.	Emerging infectious diseases have been identified in the top five hazard vulnerabilities within our healthcare systems. There are many diseases, each with probability statistics attributed to them. Overall, it is probable a person will have one or more during their lifetime.	The strength or magnitude of the hazard is variable. An emerging infectious disease could come suddenly or slowly, lightly or severely, and it could remain here briefly or for an extended amount of time. An outbreak may have a small impact on many, or a major impact on a few, or a small impact on impact on few, or a major impact on many. Situations can be localized or community wide.	The City of Medford is the largest, most concentrated population in Region 4 of Oregon's NHMP Natural Hazard Regions. As a regional employment, recreational, residential, retail and health care hub, Medford draws many non-residents on a daily basis into the area, multiplying the opportunities for further disease exposure to both visitors and residents.

Summary of Impacts on Exposed Assets

Structures (Residential, Commercial, Historic)	People with Access and Functional Needs (PAFN)	Critical Facilities	Economic Assets	Environmental Assets
Structures are generally not impacted by emerging infectious diseases. Structures generally house the populations that are impacted. Some facilities may be isolated or evacuated during an emerging infectious disease emergency.	The vulnerabilities and impacts to people, property, and the environment from diseases vary widely. People with access and functional needs are more susceptible to impacts. The elderly, the very young, and medically fragile persons have less reserves in terms of their ability to deal with diseases. People who have weakened immune systems, children, pregnant women and people who are 65 and older are more susceptible to having complications related to disease infections. People who are not immunized against preventable diseases are more susceptible to becoming infected. Those with poor personal hygiene skills or habits.	The critical facilities and services such as hospitals, airports, fire, police and so forth, are challenged to function when staff are impaired or unavailable due to illness.	Impacts to public health, the environment, critical facilities, and structures are difficult to quantify in dollar amounts. Clearly, however, widespread illness, disability, and death impact the economy. Critical facilities and services such as hospitals, airports, and public safety are challenged to function when their staffing is impacted; doubly so when an outbreak also increases demand for services. Industry, agriculture, retail, and other sectors of the economy are impacted. With diminished staff availability, production may be reduced or delayed; and retail and hospitality industry capacity and demand may drop sharply.	Water, air, and land can be contaminated by emerging infectious diseases. When this happens in localized or broad scale situations, many people can be greatly impacted. Plants and animals also suffer greatly from contaminated and degraded conditions.

Chapter 3 Mitigation Strategy

Figure 69. Medford Natural Hazards Mitigation Planning Process



Source: Tricia Sears, DLCD, October 2016

Figure 70. Goals, Actions, and Action Plan Diagram

Source: FEMA, 2013b

Section 1 Introduction

Disaster resilience is the ability of communities to "mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future disasters" (Bruneau et al., 2004). The Mitigation Strategy, with actions to mitigate hazards, is a key part of the *2017 Medford NHMP*. It consists of three main required components - mitigation goals, mitigation actions, and an action plan for implementation - as identified by the *Local Mitigation Planning Handbook* (FEMA, 2013b). These provide the framework to identify, prioritize, and implement Medford's actions to reduce risk to hazards.

Developing goals and prioritizing hazard mitigation actions are part of the Mitigation Strategy. Goals are general guidelines "that explain what the community wants to achieve with the plan" (FEMA, 2013b). "Goals are long-term policy statements and global visions that support the Mitigation Strategy. A critical step in the development of specific hazard mitigation actions and projects is assessing the community's existing authorities, policies, programs, and resources and its capability to use or modify local tools to reduce losses and vulnerability from profiled hazards" (FEMA, 2011b). Mitigation actions "are specific projects and activities that help achieve the goals" (FEMA, 2013b). How the mitigation actions will be implemented, including how those actions will be prioritized, administered, and incorporated into the community's existing planning mechanisms are the components that comprise the action plan (FEMA, 2013b).

According to the *Local Mitigation Plan Review Guide* (FEMA, 2011b), the overall intent of the Mitigation Strategy is to serve "as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs Local Mitigation Plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a Local Mitigation Plan lead to and support the mitigation strategy."

The *2017 Medford NHMP* goals were originally established as part of the *2004 Medford NHMP* planning process, and were retained for the *2010 Medford NHMP*. The mitigation actions, previously called measures, have been updated and are included below in the Mitigation Actions Tables. Medford has accomplished many mitigation actions over the years, and these are described in "Medford's Existing Efforts that Implement Mitigation Actions." The Mitigation Actions Tables establish the current actions and serve as the action plan for the *2017 Medford NHMP*. In addition to the mitigation actions, the Mitigation Actions Tables identify the lead departments and the partners for each action.

Medford's natural hazards: severe weather, floods, earthquakes, wildland-urban interface fires, landslides, volcanic eruptions, air quality, and emerging infectious diseases.

FEMA requirements for the Mitigation Strategy include:

44 CFR §201.6(c)(3), The plan shall include the following: A mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.

44 CFR §201.6(c)(3)(i), The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

44 CFR §201.6(c)(3)(ii), The hazard mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

44 CFR §201.6(c)(3)(iii), the hazard mitigation strategy shall include an action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization 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.

44 CFR §201.6(c)(3)(iv), For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

44 CFR §201.6(c)(4)(ii), The plan shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.

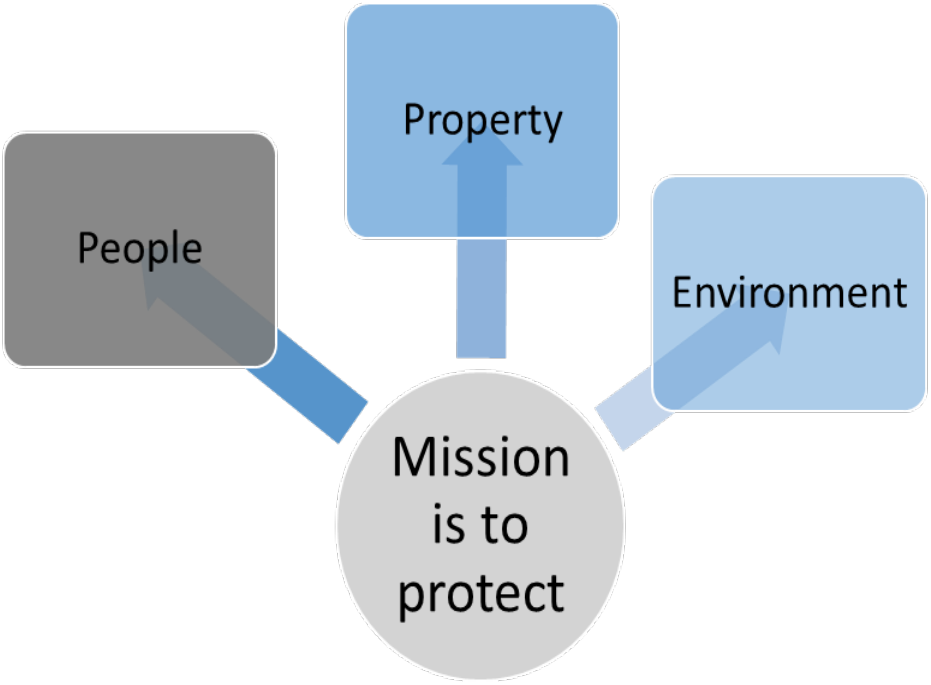
Section 2 Medford NHMP Mission and Goals

The Steering Committee developed goals for the *2004 Medford Natural Hazards Mitigation Plan (NHMP)* after assessing the natural hazards affecting the City and defining the scope of the City's vulnerabilities to those hazards. As they developed mitigation measures, now referred to as mitigation actions, the Steering Committee reviewed local mitigation plans as well as the Oregon NHMP. This was done to ensure coordination and to benefit from mitigation planning process experiences in other communities. This *2017 Medford NHMP* updates the *2010 Medford NHMP* and involves re-assessing the natural hazards and the mitigation actions. As described in Chapter 2 Hazard Identification and Risk Assessment, a Hazard Analysis was performed on September 23, 2016; the full details are included in Appendix B.

Medford's NHMP mission has been retained from the 2004 and 2010 NHMPs:

To Protect People, Property and the Environment from the Impacts of Natural Disasters

Figure 71. Medford's NHMP Mission



Source: Tricia Sears, DLCD, October 2016

This mission is served by four goals that reduce the vulnerability of the City's people, property and environment. The *2017 Medford NHMP* goals guide the overall direction of mitigation activities. They serve as touchstones for the City's overall mitigation program. Mitigation is integrated as part of City plans, programs, and policies. It is key to have an internal collaboration of City staff from departments such as Emergency Management, Planning, Building, Fire, Police, and Public Works so that mitigation is coordinated, supported, and comprehensively implemented. Thus, the NHMP makes the Medford community safer and more resilient.

The four goals of the NHMP are:

- **Preventing personal injury, loss of life and damage to property and the environment from natural hazards.**
- **Enhancing the ability of emergency services to respond to the effects of hazards on people, property and the environment.**
- **Promoting public awareness and an understanding of natural hazards and the risk they present to quality of life and economic vitality.**
- **Forming partnerships with private and public sector agencies, businesses and organizations to further comprehensive planning and implementation of mitigation measures.**

Figure 72. Medford's NHMP Goals

Source: Tricia Sears, DLCD, October 2016

The City has identified a comprehensive set of mitigation actions that identify strategies and actions serving these goals. The connection between mitigation actions and goals is displayed in the Mitigation Actions Tables in **Table 48** to Table 57. For each mitigation action, a dot is placed under each goal served by that measure. There are multi-hazard and hazard-specific mitigation actions.

The NHMP, as part of the Mitigation Strategy, must include analysis of actions and/or projects that are considered to reduce the impacts of hazards identified in the risk assessment, and identify the actions and /or projects that each jurisdiction intends to implement (FEMA, 2013b).

Section 3 Mitigation Action Items

Mitigation actions are taken to reduce the vulnerability of people, property, and the environment to the impact of natural hazards and disasters. They can take many forms, some target a specific issue of vulnerability while others have broad targets. There are multi-hazard and specific hazard mitigation actions. All the actions are intended to improve Medford's ability to protect itself and to recover from a disaster.

The multi-hazard mitigation actions respond to City needs that involve multiple hazards. They present broad strategies and actions that are useful regardless of what hazard impact or disaster occurs. Some actions relate to the maintenance and administration of the NHMP. Other actions focus on the need for further developing and sharing information on natural hazards. Actions also speak to unique qualities of the City's population, such as people with access and functional needs. The unique or specific hazard actions are more focused on mitigation needs related to that specific hazard. Of note, needs identified for one hazard may have similarities and differences to other hazards, and thus some actions for specific hazards may be similar other hazard actions.

Mitigation Actions can be discussed in these ways:

- Action Identification: Mitigation types,
- Action Priorities: What are the criteria used to establish priorities,
- Action Plan: The current actions.

The mitigation actions, previously called measures in the *2010 Medford NHMP*, and updated for the *2017 Medford NHMP*, are described in **Table 48** through **Table 57**.

Action Identification

A mitigation action is a specific action, project, activity, or process taken to reduce or eliminate long-term risk to people, property, and the environment from hazards and their impacts. It is not limited to, but can be, for example, a physical project such as elevating a structure above a floodplain or a process such as adopting changes to the building code (FEMA, 2011b). These mitigation actions are specific to the jurisdiction and are based on the community's risk, vulnerabilities, and priorities.

This process of evaluating mitigation actions can assist decision-makers in choosing the most effective strategy for their community to reduce risk and prevent loss from natural hazards. It can also save time and resources by determining the more feasible and appropriate actions.

By reducing risk, mitigation lessens the need for response resources and speeds recovery. Resilience of the community increases with accomplishment of the mitigation actions. FEMA categorizes types of mitigation actions as follows: 1) plans and regulations; 2) structural and infrastructure projects; 3) natural systems protection or restoration; 4) education and awareness programs; and 5) actions that improve the NHMP planning process and plan during implementation and future updates (FEMA, 2011b).

Table 46. Types of Mitigation Actions

Mitigation Type	Description	Examples
Local Plans	These actions include government authorities,	Comprehensive plans

and Regulations	policies, or codes that influence the way land and buildings are developed and built.	Land use ordinances Subdivision regulations Development review Building codes and enforcement National Flood Insurance Program (NFIP) Community Rating System Capital Improvement Programs (CIP) Open space preservation Stormwater management regulations and master plans
Structural and Infrastructure Projects	These actions involve modifying existing structures and infrastructure to protect them from hazards or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct man-made structures to reduce the impact of hazards. Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance Program.	Acquisitions and elevations of structures in flood-prone areas Utility undergrounding Structural retrofits Floodwalls and retaining walls Detention and retention structures Culverts
Natural Systems Protection	These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.	Sediment and erosion control Stream corridor restoration Forest management Conservation easement Wetlands restoration and preservation
Education and Awareness Programs	These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. A greater understanding and awareness of hazards and risk among local officials, stakeholders, and the public is more likely to result in risk-conscious decision-making.	Radio or television spots Websites with maps and information Real estate disclosure Presentations to school groups or neighborhood organizations Mailings to residents in hazard-prone areas StormReady Firewise Communities
Planning Process and Analysis	These are improvements to the hazard mitigation planning process and to the resulting plan document.	More detailed or advanced risk assessments Including additional stakeholders in planning and implementation processes Enhanced actions or improved format to plan or accessory documents

Source: FEMA, 2011b

At a work session on December 8, 2016, the Steering Committee updated the *2010 Medford NHMP* actions for the *2017 Medford NHMP*. Updating actions includes revising existing language, eliminating the action, and adding new actions. Actions were discussed in the context of the Hazard Analysis which was performed at the September 23, 2016 Steering Committee meeting. The Hazard Analysis provided a framework to determine which actions were important and to prioritize them so as to reduce risks to people, property, and the environment. Part of the analysis of developing specific hazard mitigation actions and projects is assessing the community's existing authorities, policies, programs, and resources, and the City's capability to use or modify local tools to reduce losses and vulnerability from profiled hazards (FEMA, 2011b).

Action Priorities

FEMA identifies that "The one requirement that must be part of the evaluation and prioritization process for mitigation actions is a benefit-cost review. That is, the planning team must consider the benefits that would result from a mitigation action versus the cost" (FEMA, 2013b). Cost estimates can be based on

experience and judgment. Criteria may vary, so long as the Steering Committee members discuss and agree upon the criteria to use to identify, analyze, and prioritize the mitigation actions. Costs and benefits were criteria in Medford's methodology for evaluating and prioritizing mitigation actions.

Evaluation and prioritization criteria for mitigation actions were borrowed from the Multnomah County *Multi-Jurisdictional Natural Hazards Mitigation Plan* (MC *MJNHMP*) Steering Committee (Multnomah County Emergency Management, 2016) and revised by the Medford NHMP Steering Committee (SC). In a vote by email selection process from February 24-27, 2017, the SC reviewed two options: a modified version of the prioritization criteria used in the MC *MJNHMP* and the STAPLEE Method. The Multnomah County *MJNHMP* criteria were selected by the SC by a vote of 14 yes and 1 abstention (4 members did not vote).

Mitigation action evaluation criteria include:

- Minimal equity impacts
- Technically feasible
- Legal authority exists
- Administrative capacity exists
- Political/public support exists
- Minimal adverse environmental impacts
- Addresses an identified risk
- Is consistent and meets goals.

As follow up to the December 8, 2016 SC meeting, the March 2, 2017 SC meeting involved additional mitigation action evaluation and prioritization. At that meeting, the SC crafted mitigation actions for air quality and emerging infectious diseases, which had no actions listed. The SC also prioritized many of the mitigation actions for each of the hazards. On March 8th, a subgroup of the SC met to finish prioritizing the mitigation actions. After the actions were prioritized, selection of the top ten of the high priority actions began as described below.

Medford's hazards are, in order of the highest to lowest rank determined in the hazard analysis:

- Severe Weather
- Emerging Infectious Diseases
- Air Quality
- Wildland-Urban Interface Fires
- Earthquakes
- Volcanic Eruptions
- Floods
- Landslides

In **Table 47**, Mitigation Action Prioritization Criteria, the screening criteria and point assignment are shown. Total points are assigned to each action. To obtain the total, each action will have scores based on the scoring system of low (1 point), medium (2 points), and high (3 points) for each criteria. The scores of the six criteria in the table: equity, environment, benefits, costs, risks, and capacity are then totaled for that action. Once all the actions have total points, the actions can be identified with their score and then into high, medium, and low categories.

The overall score provides a priority ranking for the action, with the highest scores equaling the highest ranked actions. There are 27 mitigation actions with a total score of 18 (out of 18 possible points). As

determined by DLCD staff and the co-chairs of the Medford NHMP SC, the priority scale is high (17-18 points), medium (13-16 points), and low (12 points or less).

To narrow down the mitigation actions to ten top-ranked mitigation actions, a vote was taken by the Steering Committee. Using a worksheet sent by email from DLCD staff, the SC then selected the top ten actions out of the 27 that scored 18 points. The task for each SC member was to simply select ten mitigation actions, with no priority or scoring of the ten selected. These selected actions, listed in **Table 57**, Medford's Top Ranked Mitigation Actions, are the top ten of the high priority mitigation actions for the *2017 Medford NHMP*. All 19 of the SC members voted. The "Total Votes" column is the number of times a SC member voted for that action.

Table 47. Mitigation Action Prioritization Criteria

Criteria	High (3 points)	Medium (2 points)	Low (1 point)
Equity	Social benefits are highly likely especially for people in areas with high hazard exposure, people who have been disproportionately impacted by natural disasters.	Social impacts are likely to be neutral to positive, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.	Social impacts are likely to be neutral, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.
Environment	Environmental benefits are highly likely, avoids negative consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources.	Environmental impacts are likely to be neutral to positive to environmental assets.	Environmental impacts are likely to be neutral to environmental assets.
Benefits	Supports compliance with a legal mandate or will have an immediate impact on the reduction of risk exposure to life and property.	Will have a long-term impact on the reduction of risk exposure to life and property.	Long-term benefits of the action are difficult to quantify in the short-term.
Costs	Possible to fund under existing budget. Project is or can be part of an existing on-going program or would not require substantial effort to initiate or appropriate funds.	Possible to budget for under existing work plan, but would require reapportionment of the budget or a budget amendment.	Existing work plan and funding levels are not adequate to cover the costs of the proposed project.
Risk	Addresses a high-risk issue as described in the risk assessment.	Addresses a moderate-risk issue as described in the risk assessment.	Addresses a low-risk issue or has not been assessed for the level of risk.
Capacity	Capacity is highly feasible within 1 to 3 years.	Capacity is feasible within 5 years, but may need to be further explored.	Capacity is uncertain to unlikely within 5 years.

Source: Multnomah County Emergency Management, 2016; revised by the Oregon Department of Land Conservation and Development, 2/24/17.

Action Plans

The Mitigation Actions Tables are the action plan of the Mitigation Strategy. **Table 48** through **Table 57** show the City of Medford's action items for multi-hazard and for specific hazards, within short-term and long-term categories. Short-term mitigation actions are those that can be undertaken without extra personnel or other resources. Long-term mitigation actions are those requiring additional resources.

In the *2010 Medford NHMP*, the mitigation actions were called mitigation measures. Appendix F includes the "Status of Medford's 2010 NHMP Mitigation Actions" table which provides a status update of each of the mitigation actions included in the *2010 Medford NHMP*.

Section 4 Implementation

The *2017 Medford NHMP* is required to include a process through which the planned mitigation actions are incorporated into other planning mechanisms available to the City. Below is a list of potential planning mechanism types that are often used at the local level. Among the local planning mechanisms available are those that address the Statewide Planning Goals and their legislative rules and requirements. These include Medford's *Comprehensive Plan* goals, policies, and implementation strategies; municipal code requirements; and the capital improvement program (CIP). The *City of Medford Strategic Plan 2015-2020* also includes actions related to natural hazard mitigation. The *2017 Medford NHMP* provides mitigation actions that will be implemented throughout the goals, policies, and strategies of the City of Medford. The multiple planning mechanisms that Medford uses to implement natural hazard mitigation are described in the "Medford's Existing Efforts that Implement Mitigation Actions" section below.

Implementation can be discussed in three ways:

- Coordinating Body: Responsible party for implementation of the NHMP,
- Mechanisms: Ways to integrate NHMP actions,
- Funding: Brief descriptions of potential funding sources.
-

Coordinating Body

Monitoring of mitigation actions will be continuous by the Emergency Management Coordinator. In addition, meetings of the Emergency Management Coordinator with the Planning Department representative, and meetings with the Steering Committee, will be convened during the timeframe covered by this NHMP. Meetings and potential changes to the NHMP will be documented by the Emergency Management Coordinator. These activities are part of the planning process. See Chapter 4 Planning Process for additional details.

Mitigation actions that have been implemented at the City of Medford are described in the "Medford's Existing Efforts that Implement Mitigation Actions" section, after the three ways of implementation are discussed. The Mitigation Actions Tables, **Table 48** through **Table 57** are also recognized as the action plan that implements the Mitigation Strategy. The Mitigation Actions Tables include the hazard with a priority ranking, as well as funding sources and partners for that action.

The Medford NHMP Steering Committee, led by the Emergency Management Coordinator and the Planning Department representative as co-chairs, are the responsible party for the coordination and implementation of the mitigation actions. They are also responsible for the NHMP monitoring, evaluating, and updating of the NHMP.

Mechanisms

Planning mechanisms "means governance structures that are used to manage local land use development and community decision-making, such as comprehensive plans, capital improvement plans, or other long-range plans" (FEMA, 2011b).

Integration is critical in moving the detailed hazard information from the non-regulatory NHMP into other plans, policies, and strategies for further implementation. This increases the likelihood of awareness, support, and implementation. While NHMPs are non-regulatory, the incentive to have them

is quite strong for a variety of reasons, including securing the City of Medford's eligibility for both pre- and post- disaster mitigation funding from FEMA.

The types of mechanisms often used to implement mitigation actions at the local level include:

- Comprehensive Plan,
- Development/Zoning Code,
- Annual Budget,
- Transportation System Plan,
- Capital Improvement Plan,
- Stormwater Management Plan,
- Parks and Recreation Master Plan,
- Emergency Operations Plan,
- Business Continuity of Operations Plan,
- Urban Renewal Plan,
- City Council and Planning Commission Work Plans,
- Community Wildfire Protection Plan,
- Climate Action Plan,
- Safety Programs,
- Facilities Maintenance Plan, and
- Water Management and Conservation Plan.

The benefits of integrating the NHMP into existing planning mechanisms:

- Reduce a community's vulnerability to disasters,
- Support effective pre- and post- disaster decision-making,
- Create effective planning tools,
- Speed the return of an impacted community to normalcy following a hazard event, and
- Provide a forum for analysis of potentially sensitive issues (FEMA, 2013b).

Funding

An important part of implementing the NHMP, in addition to identifying the coordinating body and the mechanisms, is having resources. The City of Medford budgets on a biennial basis in odd-numbered years, consistent with the State of Oregon's fiscal planning cycle (Larry Masterman, personal communication, January 3, 2017). The budget process is the best time for City departments to propose capital improvement projects. Public input is included in the process, which also specifically engages a Budget Committee. The Medford City Council is the final decision-maker for budget approval. The Budget Committee consists of the Mayor, eight Council members, and citizens appointed to four-year terms. This committee meets 5 – 6 times during budget-years and at least annually on off-cycle years, and is the chief policy-recommending body for the City Council. Any citizen is welcome to make comments at the "oral requests and communications" segment of each meeting's agenda (Brian Sjothun, personal communication, January 19, 2017).

In the Mitigation Actions Tables, the column "Potential Funding Resources" includes existing resources, such as those allocated by the City, and other specific resources such as Flood Mitigation Assistance or Pre-Disaster Mitigation grants. As noted above in the "Coordinating Body" section, the Steering Committee, led by the Emergency Management Coordinator and the Planning Department

representative, are the responsible party for the coordination and implementation of the Mitigation Strategy. It will be important for the Steering Committee to meet occasionally between NHMP updates to provide continuity for the Mitigation Strategy.

There are a few state and federal grant programs specifically focused on hazard mitigation. However, many state and federal grant programs that focus on other matters could be applied to hazard mitigation projects. The following information is from the Multnomah County Multi-Jurisdictional NHMP (Multnomah County Emergency Management, 2016) and updated by DLCD in this NHMP.

State Programs

Oregon Department of Land Conservation and Development Technical Assistance (TA) Grants

DLCD offers grants to local and tribal governments to complete projects that update comprehensive plans, land use ordinances, development codes and other planning regulations. TA grant awards are guided by the Grants Allocation Plan. Grant Allocation Plan priorities include economic development, streamlining planning processes, natural hazards planning, updating codes to comply with changes in state law, and infrastructure finance planning.
Website: https://ww.oregon.gov/LCD/Pages/grants.aspx

Oregon Military Department, Office of Emergency Management (OEM)

OEM provides grant guidance on hazard mitigation programs; see the section on Hazard Mitigation Grants.
Website: http://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Oregon Seismic Rehabilitation Grant Program (SRGP)

In 2009, Oregon established the SRGP to fund seismic retrofits for critical public buildings, particularly schools and emergency services facilities. SRGP has two advantages relative to federal grant programs: no match requirement, although there is a maximum limit; and statewide competition instead of federal competition. Eligible schools include buildings owned by public K-12 school districts, education service districts, community colleges, and the Oregon University system. Eligible emergency services facilities include hospital buildings with acute inpatient care, fire stations, police stations, sheriff's offices, and other facilities used by state, county, district, or municipal law enforcement agencies.
Website: http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/

Oregon Watershed Enhancement Board (OWEB)

While OWEB primarily supports projects that address coastal salmon restoration and improve water quality statewide, these projects also can reduce flood and landslide hazards. OWEB also coordinates watershed workshops for landowners, watershed councils, educators and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees and other sources. OWEB awards approximately $20 million in funding annually.
Website: http://www.oregon.gov/OWEB/Pages/Index.aspx

Federal Programs: Pre-Disaster

Flood Mitigation Assistance (FMA) Program

The FMA Program is administered through FEMA. The overall goal of FMA is to build cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other NFIP insurable structures.

Website: https://www.fema.gov/flood-mitigation-assistance-grant-program

Pre-Disaster Mitigation (PDM) Grant Program

PDM is a FEMA grant program that provides funds to states, territories, tribal governments, communities and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.
Website: http://www.fema.gov/pre-disaster-mitigation-grant-program

Federal Programs: Post Disaster

Community Development Block Grant (CDBG) Program

The CDBG Program is a U.S. Department of Housing and Urban Development (HUD) program that promotes viable communities by providing 1) decent housing, 2) quality living environments, and 3) economic opportunities, especially for low and moderate income persons. Eligible activities relevant to hazard mitigation include the acquisition of property for public purposes, the construction/ reconstruction of public infrastructure, and community planning activities. Under special circumstances, CDBG funds can be used to meet urgent community development needs arising in the last 18 months which pose threats to health and welfare.
Website: http://portal.hud.gov/hudportal/HUD?scr=/program_offices/comm_planning/communitydevelopment/programs

Community Development Block Grant – Disaster Recovery (CDBG-DR)

In response to presidentially declared disasters, Congress may appropriate additional funding for the CDBG Program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery progress. CDBG-DR funds a broad range of recovery activities and can help communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration and the U.S. Army Corps of Engineers.
Website: https://www.hudexchange.info/programs/cdbg-dr-eligibility-requirementshttp://portal.hud.gov/hudportal/HUD?scr=/program_offices/comm_planning/communitydevelopment/programs

Hazard Mitigation Grant Program (HMGP)

FEMA's HMGP grants provide funding to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of HGMP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
Website: http://www.fema.gov/hazard-mitigation-grant-program

Public Assistance (PA) – Section 406 Hazard Mitigation

Through the PA Program, FEMA provides supplemental federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private nonprofit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process. This is authorized under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
Website: http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit

Small Business Administration (SBA) Disaster Loan Program

The U.S. SBA provides low-interest disaster loans to businesses of all sizes, private nonprofit organizations, homeowners and renters. SBA disaster loans can be used to repair or replace items damaged or destroyed in a declared disaster such as: real estate, personal property, machinery and equipment, and inventory and business assets.
Website: https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster-loans

Federal Programs: Project Support

Agricultural Conservation Easement Program (ACEP)

The United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) ACEP Program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements Program, NCRCS helps American Indian tribes, state and local governments, and nongovernment organizations protect working agricultural lands and limit non-agricultural uses of the land.
Website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/

Assistance to Firefighters Grant Program (AFG)

FEMA's AFG grants are awarded to fire departments to enhance their ability to protect the public and fire service personal from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER).
Website: http://www.fema.gov/welcome-assistance-firefighters-grant-program

Community Development Block Grant Entitlement Communities Program

HUD's CDBG Entitlement Communities Program provides grants to eligible cities and urban counties to develop viable communities (e.g. decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate – income persons.
Website: https://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/community development/programs

Emergency Management Performance Grants (EMPG)

These FEMA grants help state and local governments sustain and enhance their all-hazards emergency management programs. Grant applications for EMPG are made to OEM.
Website: https://www.fema.gov/emergency-management-performance-grant-program
Website: http://www.oregon.gov/OEM/emresources/Grants/Pages/EMPG.aspx

Emergency Watershed Protection Program, USDA- NRCS

This USDA NRCS Program provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazards.
Website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/epp

Federal Lands to Parks Program

This program, operated through the U.S. Department of Interior's National Parks Service, identifies, assesses, and transfers available federal real property for acquisition for state and local parks and recreation areas, such as open space.
Website: http://www.nps.gov/ncrc/programs/flp/index.htm

HOME Investments Partnerships Program (HOME)

HUD's HOME Program provides grants to states and local governments for permanent and transitional housing, including support for property acquisition and rehabilitation, for low-income persons.
Website: http://www.hud.gov/offices/cpd/affordablehousing/programs/home/

National Flood Insurance Program (NFIP)

FEMA's NFIP makes flood insurance available to residents of communities that adopt and enforce minimum floodplain management requirements.
Website: http://www.fema.gov/national-flood-insurance-program

National Fire Plan (NFP)

Together, the USDA Forest Service and the U.S. Department of the Interior are working to provide technical, financial, and resource guidance and support for wildland fire management across the United States through the NFP. This plan addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.
Website: http://www.forestsandrangelands.gov

North American Wetland Conservancy (NAWC) Fund

The NAWC Fund is a program through the U.S. Fish and Wildlife Service (USFWS) that provides cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats.
Website: https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php

Partners for Fish and Wildlife (PFW) Program

Another USFWS Program, the PFW provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.
Website: http://www.fws.gov/partners

Public Assistance (PA) Grant Program

The objective of FEMA's PA Grant Program is to provide assistance to state, tribal, and local governments, and certain types of private nonprofit organizations, so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.
Website: http://www.fema.gov/public-assistance-lcoal-state-tribal-and-non-profit

Medford's Existing Efforts that Implement Mitigation Actions

"For a community to succeed in reducing risks in the long-term, the information and recommendations of the mitigation plan should be integrated throughout government operations" (FEMA, 2013b).

To illustrate the existing implementation of the City of Medford's goals, policies, and strategies through such documents as Medford's *Comprehensive Plan*, *Land Development Code*, *Building Code*, *Transportation System Plan*, Capital Improvement Program, *Emergency Operations Plan*, and so forth, the following information is provided. In narrative format, the existing work that the City of Medford is doing and as applicable, the processes used for the implementation, are described. The efforts relate to the integration of science and policy, as informed by the work on natural hazards mitigation planning, emergency operations, land use, transportation, building, and public works. The information is organized as multi-hazard and then as specific hazards in the order the hazards were presented in

Chapter 2 Hazard Identification and Risk Assessment. See the Mitigation Actions Tables, **Table 48** through **Table 57**, for the actions for continued and future work.

In the *2010 Medford NHMP*, the mitigation actions were called mitigation measures. **Appendix F** includes the "Status of Medford's 2010 NHMP Mitigation Actions" table which provides a status update of each of the mitigation actions included in the *2010 Medford NHMP*. In some cases, the 2010 mitigation action does not have a related mitigation action in the 2017. There are many new mitigation actions in the 2017 *Medford NHMP*.

Of note, the *2017 Medford NHMP* work is already raising awareness of natural hazards and mitigation planning throughout the Medford city government, according to the Emergency Management Coordinator, Larry Masterman (Larry Masterman, personal communication, August 3, 2017).

Multi-Hazard Mitigation Actions

Data and Maps. When the City considers new technology in data collection and mapping, the application to hazard assessment and mitigation will be taken into account. As part of the *2017 Medford NHMP*, the most current, relevant data was researched and provided to the extent practicable. For example, GIS layers for landslides, floods, earthquakes, wildfires, and volcanic eruptions have been provided from the State of Oregon to Medford. Data layers for air quality, epidemics, and severe weather have also been gathered from reference sources. Many maps in this *2017 Medford NHMP* were created where none existed before, or revised to reflect more current information and practices. A lot of new scientific information is included in this NHMP. It is worth noting that the Hazard Identification and Risk Assessment was completely re-developed for the *2017 Medford NHMP*.

Having up to date data and maps is a very important part of natural hazard mitigation planning, emergency preparedness, and community development. Recognizing, understanding, and sharing information creates a multi-disciplinary effort to integrate information and actions, identify priorities, and strategize for the future.

As was done with natural hazards planning work performed for the *2004* and *2010 Medford NHMPs*, some content of the *2017 Medford NHMP* will be adopted directly into other plans and processes that guide governance of the City. The data, maps, and other products will also be referenced in developing new and updated content for existing plans. Below, descriptions of existing plans and efforts that could use the maps, data, and other information are included specifically.

Land Use Code. There are certain "elements" or sections of the City of Medford's *Comprehensive Plan* that address natural hazards. These include the "Natural Resources" and "Disasters and Hazards" sections of the Environmental Element; the various primary utilities sections (water, sewer, storm drainage, and transportation) of the Public Facilities Element; the General Land Use Plan Element; and the Urbanization Element. The *Comprehensive Plan* is periodically reviewed and updated as required by State of Oregon. The mitigation actions in the *2017 Medford NHMP* will be considered and incorporated into revisions of the goals, policies, and implementation strategies of Medford's *Comprehensive Plan*. These are used to develop implementing regulations and to review new development. This process of revising the *Comprehensive Plan* includes consideration and action by the Planning Commission with the goal of ultimate adoption by the City Council.

Emergency Operations Plan*:* The *Emergency Operations Plan* is an all-hazard plan that describes how the City of Medford will organize and respond to emergencies and disasters.

The City of Medford's *Emergency Operations Plan* (EOP) states the scope of the EOP is,

> The City of Medford will respond to all man-made or natural disasters within the City Boundaries, to any land owned by the City of Medford or Medford Water Commission when the response will benefit the City and/or the City can benefit the outcome of the incident, and to any disaster within the Medford Rural Fire Protection District #2 that is normally covered by the Medford Fire-Rescue.
>
> The City EOP is intended to be invoked whenever the City must respond to an unforeseen incident or a planned event whose size or complexity is beyond that normally handled by routine operations. Such occurrences may include natural or human-caused disasters and may impact the City itself, neighboring cities, unincorporated areas of the County, or a combination thereof. Notwithstanding its reach, this plan is intended to guide only the City's emergency operations, complementing and supporting implementation of the emergency response plans of the various local governments, special districts, and other public- and private sector entities within and around the city but not supplanting or taking precedence over them (City of Medford, 2012).

An update to Medford's 2012 *Emergency Operations Plan* is under way for the current fiscal year. The Emergency Management Coordinator is the lead on the process. It is expected that *2017 Medford NHMP* will provide considerable input for threat, hazard, and risk assessment, resulting in improved strategies and response measures. Updating Medford's 2012 *EOP* was deliberately scheduled to follow the development of the *2017 Medford NHMP*. It is anticipated that the research and products of the *2017 Medford NHMP* will be referenced extensively in the *EOP* update.

Continuity of Operations. The City of Medford (2011) has a draft *Continuity of Operations Plan* dated July 19, 2011. It provides a framework to guide the efforts to mitigate, prepare for, respond to, and recover from major emergencies and disasters. The draft states "This *Continuity of Operations (COOP) Plan was developed according to Department of Homeland Security (DHS) Headquarters Continuity of Operations (COOP) Guidance Document, dated April 2004*, which provides a structure for formulating a COOP plan." The draft Medford *COOP* also states that it is based on the Presidential Decision Directive–67, "Ensuring Constitutional Government and Continuity of Government Operations, which requires all Federal departments and agencies to have a viable COOP capability; and local communities to prepare for emergencies and disasters."

As part of the *EOP* update, a decision will be made whether Continuity of Operations (COOP) and Continuity of Government (COG) will become annexes to the *EOP* or developed as a separate plan. In either case, the *2017 Medford NHMP* will factor heavily into determining related measures to prevent, protect, respond, and recover from all hazards, including natural.

City infrastructure in GIS. The street lights GIS module was completed in 2009. A street standards ordinance was adopted in September 2009. The stormwater detention ordinance was adopted in November 2009. Using the new aerial photos and planimetric data allows additional data and map updates to be performed (Chris Olivier, personal communication, December 23, 2016). Most of the maps in this NHMP, including the Critical Facilities map, have been updated or newly created using this information. See Appendix C Map Methodology for details.

The *2017 Medford NHMP*, including all of these products, will be made available to department heads and, for that matter, all staff. It is expected to be beneficial for development of strategic and tactical plans, project prioritization, budgeting, and other aspects of operations. The GIS team has expressed its commitment to continuing to support these efforts.

Recovery Plan. Currently, the City of Medford does not have specific recovery plan for the recovery of the City after a disaster. The City considers these three plans as constituting the infrastructure recovery plans: the *Transportation System Plan*; the *Stormwater Master Plan*; and the *Sewer Collection Master Plan*. The Public Facilities Element of the *Medford Comprehensive Plan* includes these three plans. The Environmental Element of the *Medford Comprehensive Plan* includes discussion of hazards and regulations. Plans for the update of the City's *Emergency Operations Plan* include a comprehensive recovery annex. Depending on its volume, it may become a separate document. This project is led by the Emergency Management Coordinator.

Training Efforts. The City maintains a robust training strategy related to emergency management and hazard mitigation, led by the Emergency Management Coordinator (Larry Masterman, personal Communication, December 8, 2016). The City has maintained a high level of National Incident Management System (NIMS) training compliance since the *2010 Medford NHMP*, and remains committed to a comprehensive program. From January 1, 2014 through June 30, 2017, a total of 6,745 student hours of community preparedness training were provided to 2,629 students. In that same time period, the 399 City of Medford employees and volunteers were trained, totaling 2,453 student hours; in other agencies there were 968 students trained, totaling 2,751 student hours (Larry Masterman, personal communication, July 26, 2017). Additional information can be found in the *City of Medford Emergency Management Program Summary* included in **Appendix E**.

City of Medford Strategic Plan. The *City of Medford Strategic Plan 2015-20* was approved in February 2015 and extends through 2020. The "goals, objectives, and action items contained in this document will be reflected and referenced in future budget proposals" (City of Medford, 2015). The actions related to natural hazard mitigation include:

1.2a. Update the seismic retrofit portion of the Municipal Code Chapter 9.

1.3a. Hold annual public outreach event related to floodplain hazards.

1.3b. Hold annual public outreach events related to fire and life safety.

1.3e. Increase public emergency preparedness outreach activities to promote all-hazard readiness and resilience.

1.11a. Continuously eliminate capacity deficiencies in the storm drain system to prevent flooding.

1.11b. Annually remove debris and overgrowth in flood channels.

1.11c. Promote increased community participation in the emergency alert system.

1.12a. Monitor incident statistics to identify incident trends.

1.12b. Continued development of regional partnerships to strengthen local emergency response.

1.12c. Conduct threat and risk assessment of high risk occupancies.

1.12f. Develop and maintain Natural Hazard Mitigation Plan.

1.12g. Update and maintain Emergency Operations Center on City Hall campus.

2.1c. Maintain and expand programs and activities to provide public education regarding emergency preparedness.

2.1d. Address transportation alternatives to respond to disaster impacts.

2.1e. Maintain a Citizen Emergency Response Team (CERT) program.

2.2a. Evaluate current Administrative Regulations regarding emergency preparedness and response for relevance and consider new or revised Administrative Regulations as necessary.

2.2b. Explore options to maintain the second Emergency Management position after AmeriCorps participation sunsets.

2.2c. Appoint and train a Crisis Management Team of key City Management to provide high level leadership during any major emergency response.

4.1b. Development and implement employee training program with focus on emergency preparedness.

6.9a. Establish a working group of business, non-governmental organizations, and others to explore options and promote resilience in the business community.

6.9b. Offer related presentations and resources to inform and motivate business resilience.

9.7a. Establish a disaster transportation working group that includes the City, RVTD, First Student, and other potential transporters of people and material.

9.7b. Develop necessary agreements to establish and maintain a robust land transportation capability.

11.3b. Maintain and/or improve the ISO rating for the floodplain Community Rating Service.

The *2017 Medford NHMP* content will provide context and detail for many of these activities throughout the life of the document. Items proposed for inclusion in the *City of Medford Strategic Plan 2015-20* or future plans would go to department heads for discussion and prioritization, then submitted to the City Council for approval.

Transportation Planning. Staff in the City of Medford Planning and Engineering Departments are working together to update the City's *Transportation System Plan (TSP)* (Carla Paladino, personal communication, August 1, 2017). Efforts to integrate information from the *2017 Medford NHMP* into the *TSP* are underway. The *2017 Medford NHMP* includes comprehensive information on the natural hazards that may impact transportation needs, capabilities, and safety. As recommended by the City of Medford Emergency Management Coordinator, the following items about the relationship of transportation with natural hazards are identified for consideration in the *TSP* update (Larry Masterman, personal communication, August 1, 2017).

- Plan for flexibility during and after emergencies and extreme events. For example, the winter storm of January 2017 and the Country Crossing festival in July 2017 challenged many aspects of the transportation system. Street conditions in January prevented local hospitals from discharging patients at the same time that demand for beds increased due to a flu outbreak. Response times for emergency services were prolonged because of street conditions and a related increase in motor vehicle collisions, falls, and other requests for service.

- Include emergency management, police, and fire services as appropriate in strategic transportation planning efforts. Consult as necessary throughout the planning process.

- In hazard prone areas, such as those vulnerable to landslide and wildland-urban interface fires, plan for adequate alternative routes for emergency evacuation and for emergency service access. For examples, cul-de-sacs can be challenging in terms of access in emergency situations.

- Consider traffic controls (warning lights or others) that could be automatically triggered by the earthquake warning system being implemented throughout Pacific coastal states. Consider how 30 seconds of warning could be used to protect those using the City's transportation resources, reduce damage to infrastructure, and expedite restoration of services and functionality.

- Note that in emergencies, when transportation routes are disrupted, fuel supplies can be inadequate or inaccessible.

- When selecting transportation projects that promote resiliency, consider the impacts on neighborhood and other streets in the event of a natural or manmade disaster. Consider designing parking and other facilities in ways that will make them more useful as gathering points and public information locations during and after emergencies.

- Coordinate with State and Federal agencies to increase Medford's resiliency to natural disasters related to the movement of freight, materials and resources. This effort should include local emergency management and public safety agencies, and include pedestrian traffic, gathering locations, rapid restoration for emergency vehicle traffic, and ultimately full use to support post-disaster recovery and resilience.

In the Air Quality subsection below, there is an additional description of transportation planning related specifically to air quality.

Medford collaboration with American Red Cross. The American Red Cross provides general disaster preparedness education to individuals of all ages and demographics as part of their routine programming (Curtis Peetz, personal communication, August 29, 2016). The American Red Cross identifies possible shelter facilities and enters into agreements with organizations and individuals that own or manage those facilities. They work with cities, counties, first responder agencies, and residents to open shelter when it is needed and fits within their response criteria (Jenny Carver, personal communication, August 22, 2016). One example of Medford's' collaboration with the American Red Cross is the Prepare Out Loud event that was held in Medford on October 6, 2016. Another example of Medford's collaboration with the American Red Cross is the Faith and Civic Leaders Disaster Summit that was held on October 8, 2016. Copies of the flyers for the events are included in Appendix E, Planning Documentation. The *2017 Medford NHMP* includes mitigation actions related to public education, public/private partnerships, and other collaborative efforts with the American Red Cross. Specifically, mitigation action, long-term multi-hazard #6 identifies the work regarding shelter facilities during disaster events.

Severe Weather

A strong collaboration between the City of Medford and the National Weather Service office in Medford provides an excellent basis for information sharing and active mitigation efforts. The *2017 Medford NHMP* includes mitigation actions specific to severe weather.

Medford as a StormReady City. In 2002, the National Weather Service (NWS) recognized the City of Medford the as a StormReady city. It was the first city in Oregon to achieve this designation (City of Medford, n.d.-l). The StormReady Program is about preparing for your community's "increasing vulnerability to extreme weather and water events" (NOAA Weather-Ready Nation, n.d.) and is designed to help cities and counties implement procedures to reduce the potential for disastrous, weather-related consequences. It is a voluntary program providing guidelines in a variety of areas.

To be officially StormReady (http://www.weather.gov/stormready/), a community must:

- Establish a 24-hour warning point and emergency operations center,
- Have more than one way to receive severe weather warnings and forecasts and to alert the public,
- Create a system that monitors weather conditions locally,
- Promote the importance of public readiness through community seminars, and
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
-

To comply with the guidelines, the Public Works Department, in cooperation with other City departments (City of Medford, 2010), established:

- A 24-hour warning point that can receive NWS information and provide local reports, as well as an Emergency Operations Center to staff hazardous weather event functions; multiple warning reception capabilities and locations;
- Sites and capabilities for monitoring weather and watercourse levels;
- Means for ensuring timely dissemination of local warning to citizens;
- Community educational activities for preparedness purposes; and
- An administrative arm producing hazardous weather action plans.

By being StormReady, the City of Medford promotes the goals of a Weather Ready Nation; Medford has a Weather Ready Nation Ambassador (Ryan Sandler, personal communication, March 20, 2017). The goals of the Weather Ready Nation program include building innovative partnerships with other weather information providers and with organizations across all segments of society for better community, business, and personal decision making (NOAA Weather-Ready Nation, n.d.). Medford plans to continue the partnership with NWS on these matters.

Severe Weather Watches and Warnings. The City benefits from the work of the National Weather Service (NWS), located adjacent to the Rogue Valley International – Medford Airport. The NWS, whose mission is to protect lives and property from severe weather, forecasts weather for a nine county area in Oregon and Northern California. NWS issues severe weather warnings and watches, assisted by approximately 1,021 trained volunteer weather "spotters" throughout their region (Ryan Sandler, personal communication, November 22, 2016). NWS also provides fire weather forecasts, warnings, and watches to fire agencies and the National Forests. The River Forecast Center in Portland provides modeling information on river flows to the local NWS office, which in turn issues flood watches and

warnings. As noted above, the City has 24-hour a day access to NWS information (http://www.weather.gov/).

The Power Grid. The private sector is also engaged in mitigation efforts. To protect against power outages, Pacific Power works to improve the redundancy in the electric power system. In new developments, Pacific Power often installs electric lines underground. See Chapter 1 Section 8 for additional information about the power grid.

Tree removal and Pruning. Tree pruning and removal are critical activities related to mitigation for potential power outages and storm damages. Annual tree pruning programs are contracted by Pacific Power. Program activities are communicated to and coordinated with the City Arborist at the City of Medford Parks & Recreation Department (Adam Airoldi, personal communication, December 29, 2016). The *2017 Medford NHMP* includes mitigation actions that will continue to emphasize tree care throughout Medford, as well as the relationship with Pacific Power (a division of PacifiCorp).

Trees in the public right-of-way are considered a public resource. A permitting process overseen by the Parks & Recreation Department is used to determine whether a tree should be removed, following standards developed in 2016 by the Tree Committee. Hazard trees designated by the City Arborist are automatic candidates for removal. Besides street trees along arterial and collector streets, which are maintained by the City, trees in the public right-of-way are inspected based on reports from the community and where a concern is noted. Pacific Power and their contractors inspect and notify residents about concerns on private property. Across all public property maintained by the City, an estimated 989 dead or hazard trees have been identified and removed between 2014 and 2016 (Adam Airoldi, personal communication, December 29, 2016).

The Medford City Arborist has provided comprehensive training to Parks & Recreation maintenance employees and Public Works staff to identify hazard trees. This will continue to occur on a regular and as needed basis. The City Arborist meets regularly with Pacific Power to coordinate tree related activities (Adam Airoldi, personal communication, December 29, 2016).

City of Medford Municipal Codes 6.700 to 6.750 contain provisions and prohibitions related to trees in the public right-of-way (Adam Airoldi, personal communication, December 29, 2016). Municipal Code provisions are approved by City Council. The *City of Medford Street Tree Removal Criteria* flyer states,

> Owners of property abutting streets are responsible for the care and maintenance of trees located in the public right-of-way (6.730). An application for street tree removal permit may be approved when the adjacent property owner has sufficiently demonstrated that the detriment from the continuing presence of a tree outweighs the public benefit provided by the tree (6.725). Trees that are determined to be dead, high risk, incurably or infectiously diseased, or are an "inappropriate species" as designated by the City are automatic candidates for removal. Any tree that is removed from the right-of-way must be replaced (6.725) (City of Medford Parks & Recreation Department, 2016a).

The City of Medford Parks & Recreation also has a vegetation fuel reduction project in the Prescott Park area. See Chapter 2 Section 5 Wildland-Urban Interface Fires for details.

Curtailment Plan. The Medford Water Commission has developed a curtailment plan that can be implemented during drought or other events, e.g., concerns regarding contamination, broken water lines, etc. The plan has a set of actions ranging from voluntary to restrictive, depending on the severity of the

problem. See Chapter 1 Section 8 for additional information about the Medford Water Commission and the *Water Management and Conservation Plan (WMCP)*. Of note, the Medford Water Commission received approval from the Oregon Water Resources Board on July 5, 2017 for the updated *WMCP*. The *2017 WMCP* plan updates the *2009 WMCP*. The *2017 WMCP* will be reviewed again in five years and is effective through July 5, 2027 (David Searcy, personal communication, August 2, 2017).

Conservation. The Medford Water Commission (MWC) has a conservation program to help people think about water usage. As part of that, MWC offers a free Sprinkler Checkup Program where staff visit properties to assess how people are watering their landscape and offer advice on how to do it more effectively. Additionally, the MWC participates with the City of Medford in requiring the use of drought-tolerant landscaping to reduce water use in new commercial, industrial, multi-family, and institutional projects. Other conservation programs include Water Sense toilet rebates and grants to non-profits for the renovation of existing water thirsty landscapes. More information is within the MWC's *Water Management and Conservation Plan*.

Dam Flows. The regional context of drought management and mitigation includes activities by the Bureau of Reclamation, irrigation districts, the U.S. Army Corps of Engineers (USACE), and neighboring cities. The USACE manages the Applegate Dam (USACE, http://www.nwd-wc.usace.army.mil/dd/common/projects/www/app.html) and the Lost Creek Lake Dam (USACE, http://www.nwd-wc.usace.army.mil/dd/common/projects/www/los.html), the two largest dams in the region. Using information and predictions regarding the snow pack and expected run off, USACE regulates the flow from the two dams. The Bureau of Reclamation oversees the smaller dams in the region, such as those at Fish, Emigrant, and Howard Prairie Lakes. The Irrigation District manages the flow of water from the dams, according to needs and available resources. Additional information is included in Chapter 2 in Section 3 Floods and Section 4 Earthquakes.

Irrigation Districts. During drought periods, irrigation districts will often move to lengthier rotation schedules to stretch the available water resources. This may entail changing the delivery schedule from 7 to 14 days or as many as 24 days, depending on circumstances. Irrigation districts are described in Chapter 1 Section 9 and shown on **Figure 33**, Irrigation Districts, map.

Irrigation districts work with irrigators and watershed councils to educate users about better irrigation practices that lead to more efficient use of water.

Irrigation districts use technology to better manage the available water. The Bureau of Reclamation has a Hydromet satellite system that takes readings of water temperatures and volume of water in ditches, streams, and reservoirs. Telemetry readings on the canal systems check water volumes, allowing ongoing management adjustments to the canal systems. The irrigation districts also pipe their irrigation systems to avoid evaporation and to decrease maintenance needs (Brian Hampson, personal communication, January 10, 2017).

The *2017 Medford NHMP* includes a mitigation action, long-term flood #8, to partner with irrigation districts to assess and mitigate flood hazards.

Parks & Recreation. The City of Medford Parks & Recreation Department (2016c) has a Standard Operating Procedure called "Severe Weather Policy" (PRD-16-01). It was issued on January 5, 2016. The policy was adopted to "define the steps to be followed in the event of severe weather that could pose a threat to participants, members of the public and staff during recreational activities and events" (PRD-16-01). The Standard Operating Procedures documents are signed by the Director of the Parks &

Recreation Department and the Superintendent. The City of Medford has a Parks and Recreation *Leisure Services Plan*, dated 2016-2025, to guide is work on natural and developed resources. This document updates the 2006 *Leisure Services Plan* (http://www.ci.medford.or.us/Page.asp?NavID=1203).

This department is recognized as a key partner in immediate response and short term recovery after a natural disaster. It operates many open spaces, fixed facilities, and other potential locations and services likely to be crucial to mass care and shelter, points of dispensing, and other emergency activities. The *2017 Medford NHMP* may be incorporated into relevant internal documents and efforts.

Land Use. The Medford Land Development Code, in Section 10.555, Underground Utilities, requires all utilities in new developments to be underground. Land Development Code provisions are approved by the Medford City Council.

Floods

The flood hazard detail provided in the *2017 Medford NHMP* update is unprecedented in City plans, and is expected to be beneficial to agencies with flood control and response roles in and around the jurisdiction. The *2017 Medford NHMP* includes mitigation actions specific to floods.

NFIP and FIRM. The City is a participant in the National Flood Insurance Program (NFIP) and conducts its land development in accordance with the guidelines established by that program. Flood Insurance Rate Maps (FIRM), showing the anticipated levels of a hundred-year flood event (100-year floodplain), are maintained by the Planning Department. FEMA has determined that Medford earned a Class 6 in the NFIP Community Rating Service (CRS) (Jim Huber, City of Medford, personal communication, July 26, 2016). Medford has no NFIP repetitive loss properties and no severe repetitive loss properties on record as of August 22, 2016 (Chris Shirley, personal communication, August 22, 2016). See also Chapter 2 Section 3 Floods. NFIP and FIRM are FEMA related requirements.

Stormwater Management. The purpose of the City of Medford's stormwater management program is to reduce the risk of negative impacts from stormwater to people, to residential, commercial, industrial, and institutional structures; to infrastructure, such as roads; and to the environment. The City has a program of stormwater management practices and improvements designed to systematically reduce the risk. The methods include improvements to stormwater conveyances, use of detention facilities, preservation of wetlands, and regulation of new construction in floodplains. The Public Works Department is responsible for the City's stormwater management program, including evaluating and mitigating the system-wide effects of proposed development. Historically, the primary focus of the program was to control the stormwater quantity, but current regulations also require a focus on quality.

The *City of Medford Stormwater Management Plan* addresses existing activities to maintain and enhance the quality of stormwater runoff and outlines required modifications to those activities (City of Medford, n.d.-l). The City maintains this plan for all basins within the UGB and implements it by upgrading existing facilities and providing new facilities through public and private development. During the winter, water in the open ditches, which are part of the City's stormwater system, flows into the City's piped storm drain system and to local irrigation ditches and canals.

The *Stormwater Management Plan* incorporates recommendations from the City's 1996 *Comprehensive Medford Area Drainage Master Plan* into a new capital improvement program (CIP), with estimated costs for maintenance, engineering and other stormwater activities (City of Medford, n.d.-l).

The current drainage plan within the Medford UGB is the *Comprehensive Medford Area Drainage Master Plan*, produced by Brown and Caldwell in 1996. There are two areas with newer and more detailed basin plans, Little Elk Creek and Larson Creek. In those areas, the new drainage basin plans take precedence over the 1996 one (Carla Paladino, personal communication, November 18, 2016). To minimize the hazards posed by floods, Medford implements the recommendations of the *Drainage Master Plan* through revisions to the *Comprehensive Plan* and the *Land Development Code*, in addition to implementing the related state and federal regulations. Provisions in these plans and codes are reviewed and approved by the Medford City Council.

In December 2008, the City included an information sheet about what people can do to help water quality with the water bill. The City has placed colorful markers on drainage inlets advising that water in this inlet "drains to stream." These are just two of the actions accomplished to meet permit requirements and increase water quality in the creeks (City of Medford, n.d.-l).

A demonstration project for stormwater runoff was completed in 2009 in cooperation with the Coyote Trails (formerly Jefferson Nature Center).

The Building Code. Sections 9.100, 9.101, and 9.110 of the *Medford Municipal Code* adopt the 2014 edition of the Oregon Structural Specialty Code *(OSSC*), based on the *International Building Code* (*IBC*), the 2014 edition of the *Oregon Residential Specialty Code* (*ORSC*), and the 2014 *Oregon Energy Efficiency Specialty Code* (*OEESC*) respectively (Sam Barnum, personal communication, November 21, 2016). Building code provisions are adopted by the Medford City Council.

The City prohibits development in the floodway, and severely limits development in the 100-year floodplain to use for open space, agricultural, recreational or similar uses. Appendix G, Flood-Resistant Construction, of the *OSSC* in Section G101.1 aims to minimize public and private losses due to flood conditions. This section states the purpose as "promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific flood hazard areas designed to:

- Prevent unnecessary disruption of commerce, access, and public service in times of flooding;
- Manage the alteration of natural floodplains, stream channels and shorelines;
- Manage filling, grading, dredging, and other development which may cause flood damage or erosion potential;
- Prevent or regulate the construction of flood barriers which will divert floodwaters or which can increase flood hazards; and
- Contribute to improved construction techniques in the floodplain.

The Building Safety Department initially screens all permits for an array of floodplain implications, bulleted above, and identifies concerns to the applicant. Thus, early in the land use and building process, the applicant is notified that the proposal must also be reviewed by one or more agencies external to the City of Medford, such as the Army Corps of Engineers, Division of State Lands, and Department of Environmental Quality. The City works in cooperation with these agencies to see that construction complies with all pertinent state and federal regulations.

OSSC Appendix G "provides minimal standards for development in flood areas" (International Code Council, Inc. and the State of Oregon, 2014). *ORSC* Section R322 Flood-Resistant Construction states "Buildings and structures constructed in whole or in part in flood hazard areas (including V or A Zones) as identified by the Floodplain Administrator shall be designed and constructed in accordance with the provisions in this section" (*ORSC*, Chapter 3, Section 322). According to G101.2 in the *OSSC*, "flood

hazard areas are established in Section 1612.3 of the *International Building Code* (*IBC*) and adopted by the applicable governing authority on [insert date]" (International Code Council, Inc. and the State of Oregon, 2014)..

Special Flood Hazard Areas refer to land within the community subject to a 1% or greater chance of flooding in any given year or the 100-year floodplain. Some of the many specific requirements in these sections include: the anchoring of all manufactured homes; use of construction materials that are resistant to flood damage; and ensuring that the lowest floor of new construction/substantial improvement, including the basement, is elevated one foot or more above base flood elevation. See Chapter 2 Section 3 Floods for additional details on flood hazard areas, Special Flood Hazard Areas (SFHA), and floodplain maps. See **Figure 35**, Flood Hazard.

Medford Land Development Code. This code has provisions relating to development, which require the identification and documentation of an array of site characteristics, including: proximity to wetlands; drainage characteristics; flood-prone areas; and designated floodplains. The Land Development Code provisions are adopted by the Medford City Council.

Post-development runoff control is a requirement of the National Pollutant Discharge Elimination System (NPDES), Phase II rules. The City developed ordinances in 2008 to require developers provide stormwater detention facilities in new developments, including land divisions and planned unit developments. The ordinances require those facilities be privately maintained.

In 2013 the City acquired 3.87 total acres of land for the Southeast Plan Area Greenway (City of Medford, Ordinance No. 2013-88 and Ordinance No. 2013-89).

Medford *Land Development Code* section 10.924-10.928, Permitted Activities within Riparian Corridors, identify the regulations pertaining to Riparian Corridors. The Planning Department proposes to amend the Riparian Corridor to include wetland regulations. An extension of the existing Riparian Corridors will be proposed in the Urban Reserve (Chris Olivier, personal communication, December 1, 2016) (Carla Paladino, personal communication, March 30, 2017).

USGS. The United State Geological Survey (USGS) Oregon Water Science Center, Central Point Field Office is responsible for operating 21 streamflow sites in the Southern Oregon area of Jackson and Josephine counties. These sites collect a continuous record of 15-minute gauge height data. From the gauge height data, a continuous record of stream discharge based on a stage-discharge relationship is produced. The relationship is defined and maintained at each streamflow site by making discharge measurements over a range of stages (Marc Stewart, Supervisory Hydrologist, personal communication, January 11, 2017).

In downtown Medford, there is a gauge located on Bear Creek (14357500 Bear Creek at Medford, Oregon) just downstream of the East 12th Street Bridge. The USGS works with USACE, US Bureau of Reclamation, the Oregon Water Resources Department (OWRD) and other state and local partners to manage and fund the network of gauges. The NWS uses the data for flood forecasting and streamflow predications. The USACE funds gauges in the counties and uses the information to help make informed decisions for managing the storage and release of water at the local projects (dams) (Marc Stewart, Supervisory Hydrologist, personal communication, January 11, 2017).

USGS Streamflow information is transmitted electronically and the streamflow information is available on the Web in real time (http://waterdata.usgs.gov). The OWRD gauges are part of the network of

gauges in Jackson and Josephine Counties and Bear Creek (http://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/). Note that discharge is in cubic feet per second (cfs) and gauge height is reported in feet (Marc Stewart, Supervisory Hydrologist, personal communication, January 11, 2017).

Earthquakes

Understanding of the region's risk of a catastrophic earthquake has expanded tremendously during the past decade. The *2017 Medford NHMP* update captures and communicates much of that for inclusion in all manner of response, recovery, and mitigation plans, training strategies, and other efforts in Medford. The *2017 Medford NHMP* includes mitigation actions specific to earthquakes.

Building and Development Codes. Since 1993, when the Seismic Zone rating of Oregon was revised from Zone 2 to Zone 3, new buildings in Oregon have been required to meet more stringent seismic construction standards. Local jurisdictions can designate seismic standards for existing structures. State and local government buildings and facilities are required to be inspected and to meet higher standards.

In 1995, the Oregon Legislature created a task force to examine and develop recommendations concerning the threat of earthquakes to structures. The task force recommendations address unreinforced masonry buildings (URMs), where the greatest amount of upgrading is required to meet current standards. Downtown Medford, like the downtowns of many Oregon cities, is especially prone to earthquake damage due to the large number of URM structures.

The City of Medford utilizes building and development standards to mitigate the potentially damaging effects of earthquakes. New construction is required to meet the standards of seismic design category D of the *International Building Code* (*IBC*). The City wants city-owned buildings to meet earthquake standards. It commissioned seismic evaluations and retrofitting of City Hall, the Regional Water Reclamation Facility, and the Carnegie Library building as described below in the Seismic Retrofits section.

The City's *Building Code*, Sections 9.600 through 9.655, addresses seismic design requirements for existing buildings. These requirements are triggered by application for a permit to change the occupancy classification, add square footage, or alter the building. Section 9.600 (2) states that pursuant to OAR 455.202(4), the provisions of this chapter, which prescribe seismic rehabilitation standards for existing buildings, can be used in lieu of meeting the requirements of the current edition of the *OSSC* (Sam Barnum, personal communication, November 21, 2016).

The City requires a FEMA 178/310 Evaluation to assess the potential earthquake-related risk to people posed by the building or building component. The evaluation is conducted according to the provisions of the *NEHRP Handbook for the Seismic Evaluation of Existing Buildings*, published by FEMA. The American Society of Civil Engineers (ASCE) contracted with the Federal Emergency Management Agency (FEMA) to convert FEMA 178, *NEHRP Handbook for the Seismic Evaluation of Existing Buildings* into a prestandard. The development of the prestandard was the first step in turning FEMA 178 into an American National Standards Institute (ANSI) approved national consensus standard. The document was completed in January 1998 and is published as FEMA 310, *Handbook for the Seismic Evaluation of Buildings--A Prestandard*. (FEMA, 1998).

The Medford City Council approved the use of the *2012 International Property Maintenance Code* (IPMC), which replaces the *1997 Uniform Code for the Abatement of Dangerous Buildings* and the *1997 Uniform Housing Code*, at a public hearing on December 2, 2016. The City of Medford Building Safety

Department's *Operating Plan* was updated on December 2, 2016 (Sam Barnum, personal communication, December 28, 2016).

> The division and every municipality that administers and enforces a building inspection program or desires to assume responsibilities to administer and enforce a building inspection program, shall prepare an operating plan describing the manner in which the municipality or the division will do so. The operating plan shall establish specific processes and goals, consistent with the program standards described in ORS 455.153 and OAR 918-020-0090. This *Operating Plan* is on file with the state of Oregon Building Codes Department and is available through the City of Medford's Building Department upon request. This *Operating Plan* has been prepared by staff of the City of Medford Building Safety Department to comply with ORS 455.153 and OAR 918-020-0090 (City of Medford, 2016).

Protecting the Downtown Core. The downtown core of Medford contains many historic and unreinforced masonry buildings. The Downtown Historic District is bounded on either side of Main Street by Fourth and Ninth Streets, approximately five city blocks in breadth. To the east and west, it is bounded by Riverside and Oakdale Avenues, respectively. The District covers an area of 97 acres and holds 169 historic buildings within its boundaries (Chris Olivier, personal communication, December 28, 2016). **Figure 43**, Earthquake Hazard, is a map that includes the buildings classified as unreinforced masonry and or require Building Safety Department review.

In Medford's *City Center 2050 Plan*, the downtown core plays a significant role in creating a high quality downtown central core that supports the city's neighborhood districts. The *City Center 2050 Plan* identifies major functions/districts of the downtown area as cultural and entertainment, governmental, educational, office, and residential. Previous downtown redevelopment activities have led to the construction of new structures and the renovation of existing ones, such as the Ginger Rogers Craterian Theater, parking structures, and a new main building for the Jackson County Library System. These investments highlight the need to protect the historic backbone of the downtown area from earthquakes.

Seismic Retrofits. Notable seismic retrofit projects have been undertaken on public facilities in Medford. In 2001, the City invested $180,000 in retrofitting the Public Works Service Center. Wall and roof structures were joined and reinforced to prevent shifting. In 2000, as the City was undergoing a comprehensive long-range facilities adequacy analysis, it became apparent that the 36-year old City Hall fell into the non-compliant seismic category. Structural engineers hired to evaluate the building's earthquake resistance concluded that future anticipated events were likely to be much more severe than the building could withstand. A further complication was that at the time, the City housed its critical public safety operations (Police and 911- Emergency Dispatch) in City Hall (City of Medford, 2010).

The engineers recommended upgrading the strength of the City Hall building to a significantly higher level of safety, it was not economically or practically feasible to achieve current seismic code. The plan increased the length of support columns around the building and to turn them into shear-walls, adding redundancy to the structure. The design better distributes the weight of the building and beams stabilize the movement of the structure during a seismic event, enabling the safe evacuation of building inhabitants and preventing loss of life. The reinforced building will be able to withstand ground swells, and motions back and forth and up and down.

The $700,000 project has significantly improved the performance of the City Hall. According to the engineering firm, the project was designed "for an unusually large earthquake that statistically occurs on

average every 500 years, and within a 50-year interval, there is a 10% chance that a larger one could take place." The end result is that the building can be expected to successfully endure anticipated moderate seismic events and enable a safe evacuation in the event of large earthquake. The City Hall seismic retrofit was completed in 2003 (City of Medford, 2010).

In 2002, the City invested in retrofitting the Regional Water Reclamation Facility to better withstand earthquake events. As noted previously, this facility treats sewage from homes and businesses in Medford, Central Point, Jacksonville, Talent, Phoenix and Eagle Point. If the plant were inoperable after an earthquake, serious health problems could ensue. The upgrades prepared the plant for an earthquake with a 2% probability of occurring in 50 years. The upgrades mainly consisted of reinforcing and bracing concrete walls and other facility components ("Medford Wants," 2002).

In 2003, Oregon Department of Transportation completed an $8 million Phase One seismic retrofit of the Interstate 5 viaduct that crosses downtown Medford. At that time the viaduct handled more than 46,000 vehicles per day; it continues to be a vital link for both Medford residents and interstate travelers. Phase One retrofits consisted of external measures to support a bridge. As part of the project, the bridge deck was tied to the vertical piers. ODOT replaced the road deck and bridge rails and enhanced the erosion protection on several of the 48 bents or piers in or near Bear Creek. The retrofit also included longitudinal cable restraints and the addition of concrete shear blocks for transverse force restraint. See Chapter 1 Section 8 Critical Facilities, Critical Infrastructure, and Lifelines for more details.

Council also approved a contract with a local engineering firm to identify and recommend corrective seismic upgrades for the historic Carnegie Library originally built in 1911, with an addition completed in 1950. The library, located in downtown Medford near City Hall, is used for large and small group gatherings, and office space for selected not-for-profits.

Another example of the commitment to retrofitting public facilities is the relocation in May 2004 of Rogue Valley Consolidated Communications (911-Dispatch), an essential public safety service under FEMA guidelines. The dispatch center was relocated in 2004 to a remodeled site in the Lausmann Annex, a building constructed in 1998 to the highest seismic standards. Dispatch services were located previously on the basement level of City Hall. The seismic retrofit of that building could not guarantee dispatch personnel safety and continuity in services after an earthquake. This relocation was a costly, but it was a prudent, pre-disaster mitigation action.

In July 2005, the City of Medford was selected by FEMA for a grant award to be utilized for structural and non-structural upgrades at Fire Stations #3, 4, and 5. These upgrades included construction of shear walls, improved connections to roof decking, overhead door support, bracing of heaters, anchoring of cabinets and shelving, installation of steel tubes, strapping of water heaters, anchoring of propane tanks, securing of light fixtures, removal of chimney, bracing of another chimney, replacement of some windows and doors, anchoring of air compressor, installing foundation bolts, and installing a steel moment resisting frame. The final project cost was $210,666.70 (City of Medford, 2010).

The City Council, at its April 2008 goal setting meeting, reaffirmed its goal to provide adequate public safety facilities and staffing by providing new public safety facilities.

Dam Failure Exercises and Plans. As discussed in Chapter 2 in Section 3 Floods and in Section 4 Earthquakes, one impact from an earthquake could be the failure of one or more dams in the region. The failure of Emigrant Dam, owned by the Bureau of Reclamation; Lost Creek Dam, owned by the USACE; and Hosler Dam, owned by the City of Ashland; would affect the City of Medford. The

agencies that own the dams have Emergency Action Plans to guide its personnel in identifying and handling dam failure. The plans were prepared to ensure that the agencies can provide timely advance notifications to local authorities of the development of hazardous situations. With that information, the City has prepared a map, **Figure 36** Dam Inundation Zones, identifying dam failure impact areas.

The City periodically participates in tabletop exercises simulating dam failure with the emergency management/response community and continuously coordinates information and actions with them.

Wildland-Urban Interface Fires

Since the *2010 Medford NHMP* was adopted, Medford has continued to be threatened by these fires. Recent experience has included fires that didn't directly threaten the City or its population, but created poor air quality, poor visibility, and other hazards. These are included in the City's considerations for use in plans and operations throughout the City. The *2017 Medford NHMP* includes mitigation actions specific to WUI fires.

Special Equipment. Wildland fires require special equipment to reach the inaccessible areas typical of wildland areas. The City of Medford has invested in specialized equipment designed specifically for wildland terrain in addition to standard fire-fighting equipment with the forces of fire fighters to fight wildland fires effectively. Medford Fire-Rescue is described in Chapter 1 Section 8. The area of coverage is shown on **Figure 21**, Medford Fire-Rescue Response Zones, map. The Wildfire Hazard map is **Figure 44**. The Oregon Department of Forestry is one of the City's primary partners.

Senate Bill 360. The most significant effort to increase protection and reduce risk from WUI fires relates to Senate Bill 360, the Oregon Forestland-Urban Interface Fire Protection Act of 1997 and its administrative rules. This act resulted in the establishment of county committees whose goal was to define and classify interface lands according to natural vegetative fuel hazard value and topography hazard value. Once all lands are classified, property owners are notified of the status of their land within that classificatory system and of modifications they must make to their homes and property for purposes of compliance. Modifications vary and include creating fuel breaks, relocating flammable materials on the property, eliminating vegetative materials impinging on the driveway and home, and other activities. Owners have 2 years to certify that their property is in compliance. See **Figure 44**, Wildfire Hazard, for the location of wildfire areas. See also Chapter 2 Section 5 Wildland-Urban Interface Fires.

Jackson County Integrated Fire Plan. The City of Medford is a member of the *Jackson County Integrated Fire Plan*; the existing plan is in the process of being updated and is now called the *Rogue Valley Integrated Community Wildfire Protection Plan*. See Chapter 2 Section 5 Wildland-Urban Interface Fires for more details. The *Jackson County Integrated Fire Plan* and documents can be found at http://jacksoncountyor.org/emergency/County-Plans/Fire-Plan.

Air Response. The City of Medford strives to minimize the loss of life and property resulting from wildland fires within the UGB. It has a contract with the Oregon Department of Forestry for air response to wildland-urban interface fires.

Education. Medford Fire-Rescue works to educate the public in wildland fire safety. It has placed pertinent educational materials in the Jackson County library system, as well as on its website. Medford Fire-Rescue promotes public awareness through seasonal press releases and a WUI home assessment program and public service announcements. Medford is a Firewise Community; the Firewise Communities Program encourages local solutions for safety by involving homeowners in taking

individual responsibility for preparing their homes from the risk of wildfire (National Fire Protection Association (NFPA) Firewise Communities Program, n.d.-a). The program is co-sponsored by the USDA Forest Service, the US Department of the Interior, and the National Association of State Foresters. Medford is part of the Rogue Valley Fire Prevention Cooperative, which has been providing fire prevention education in the Rogue Valley since 1976.

Figure 73. Medford's Firewise Communities Sign and Prepare Yourself Sign

Source: Larry Masterman, personal communication, August 2016 and Medford Fire-Rescue Facebook page, https://www.facebook.com/MedfordFireDepartment/, August 2016

Land Use Planning. The Planning Department routes Public Committee - City Council, Planning Commission, and Site Plan and Architectural Commission (SPAC) - projects to Medford Fire-Rescue. Comments received are included in staff reports as discretionary conditions when appropriate (Chris Olivier, personal communication, December 28, 2016).

The Planning Commission considers ingress and egress for new developments when reviewing new subdivisions (Chris Olivier, personal communication, December 23, 2016).

Medford Fire-Rescue is involved in the beginning of every land development project and provides a report that explains water supply and access requirements (Chris Olivier, personal communication, December 28, 2016).

Regulation of Grass. The City requires property owners to remove weeds over a certain height from their properties by a designated date each year. This is a regulation in the Municipal Code. The Code Enforcement Division sends out letters to property owners who are not in compliance.

ODF Grants to Property Owners. The Oregon Department of Forestry provides small grants from the National Fire Plan program to homeowners who develop defensible space around their homes and driveways. Residents can apply for cost-share incentives up to $400 to modify an acre of vegetation around their homes. Modifications include removing dead vegetation, thinning flammable brush and small trees, and creating vertical spaces between flammable brush and the lower limbs of larger trees.

The *2014 Interim Fire Plan Update* for the *2014 Interim Josephine-Jackson County Fire Plan* describes,

> The proven overall strategy is to identify at risk landscapes where groups of landowners, neighborhoods, or communities have interest in becoming more fire adaptive and where grant funding can serve to create specific strategic fuels treatments and/or provide seed money to help these neighborhoods get started and generate additional interest. This plan also supports alignment of BLM/USFS hazardous fuels work with fire plan strategies and areas collaboratively identified with NRCS (Jackson County Emergency Management, 2014).

The *2014 Interim Fire Plan Update* (Jackson County Emergency Management, 2014) identifies Jackson County Priority Landscapes/ Communities. Within that category, the Firewise/Local CWPP section includes "East Medford neighborhood (developing FW)."

According to the *2015 Oregon NHMP*,

> While Oregon's Emergency Conflagration Act helps protect WUI communities that have depleted their local resources when threatened by an advancing wildfire, the escalating number of fires has led to the recognition that citizens in high fire risk communities need to provide mitigation and an appropriate level of local fire protection. Oregon's seller disclosure law requires a statement of whether or not property is classified as forestland-urban interface. Collaboration and coordination is ongoing among several agencies to promote educational efforts through programs like Firewise, the Oregon Forestland-Urban Interface Fire Protection Act, and Fire Adapted Communities from the National Cohesive Wildfire Strategy (Oregon DLCD, 2015).

Landslides

The *2017 Medford NHMP* process included review of current data and a field study by the Steering Committee led by a pair of local geologists. The resulting understanding of landslide issues is incorporated in the document, and is expected to be considered in the development of plans, procedures, and other activities throughout its life. There are mitigation actions in the *2017 Medford NHMP* specifically related to landslides.

See **Table 53** for the landslide mitigation actions. In the *2010 Medford NHMP*, there were two distinct desires: to better define the degree of landslide risk suggested by the DOGAMI model of debris flows identified in the IMS-22 map published in 2002, and to establish a hillside development ordinance that protects existing and future residents and property. A considerable amount of landslide hazard information has been studied and prepared since 2002, as described in Chapter 2 Section 6 Landslides. With the *2017 Medford NHMP*, the most current GIS layers of data for landslides and other hazards have been provided to Medford by the State of Oregon and from other sources as well. See **Figure 52** for the Landslide Hazard Map and **Figure 53** for the Medford Slope Map from 2009. The Medford Hillside Ordinance was adopted in 2009.

In addition, landslide information from DOGAMI that is included in this *2017 Medford NHMP*: the 2011 Generalized Geologic Map of Bear Creek Valley, Jackson County, Oregon and the related DOGAMI *Open File Report 0-11-11*; and the published in February 2016 landslide susceptibility overview map of Oregon and a related report called *Open File Report 0-16-02, Landslide Susceptibility Overview Map of Oregon*.

Engineering Requirements. As noted in Chapter 2 Section 6 Landslides, expansive soil can cause structural damage to foundations. The City of Medford requires a foundation analysis for construction in areas exhibiting such soil. In areas potentially subject to landslides or on steep slopes, the Building Safety Department requires all foundations to be engineered. The Building Safety and Public Works Departments then review them.

Securing Infrastructure. On steep slopes, water and sewer lines must be "keyed into" hillsides. This entails the burying of a concrete anchor into the subsurface rock, a structural technique that holds the lines in place.

Land Use Planning. The Medford City Council adopted a Hillside Ordinance in 2009 as an amendment to the *Land Development Code* (Chapter 10 of the Municipal Code). In general, development on slopes in excess of fifteen percent (15%) is subject to its requirements. Requirements include submittal of a Constraints Analysis to the City Engineer of the Public Works Department, consisting of a Geology and Soils Report and a Hydrology and Grading Report. The purpose of the analysis is to identify physical constraints of the property and to propose mitigation measures (Jim Huber, personal communication, August 3, 2016).

Medford's zoning provision for slopes that are 15% or greater limits residential development to two units per acre (SFR-2) (Jim Huber, personal communication, August 8, 2016).

Since 2010, road access to developments in the Roxy Ann Peak area has improved. Cherry Lane and Hillcrest Road/McAndrews Road provide ingress and egress to the area. Continuing to evaluate access routes, especially in steep slope areas, is a focus for Medford Fire-Rescue and the Planning staff.

Building Codes. The Building and Safety Department is involved during construction on steep slopes. Prior to construction, development on slopes in excess of thirty-three percent (33%) or on any expansive soils, regardless of the slope, requires a geotechnical report. Construction is regulated by provisions of the 2014 Oregon Residential Specialty Code (and as may be amended in the future) (Jim Huber, personal communication, August 3, 2016).

Volcanic Eruptions

Although the hazards, threats, and risks of volcanic activity have not changed since the *2010 Medford NHMP*, the *2017 Medford NHMP* added detail regarding ash fallout from more distant volcanoes. More detailed geologic information is also included for easy access to those engaged in plans for the City's future. The *2017 Medford NHMP* contains mitigation actions specific to volcanic eruptions.

USGS. After the dramatic and destructive eruption of Mount St. Helens in 1980, the U. S. Congress provided funding to the USGS for a volcano observatory for the Cascade Range, to better protect life and property in the Pacific Northwest. This observatory, the David A. Johnston Cascades Volcano Observatory (CVO), monitors several potentially active volcanoes in the Pacific Northwest. It works in cooperation with the Pacific Northwest Seismograph Network (PNSN), taking portable equipment to evaluate hazards at sites of seismic activity. The CVO also uses remote sensing aided by radar images from satellites to detect ground surface movements. The CVO shares information with emergency management and planning officials throughout the region. It studies and assesses potential hazards from volcanoes and educates officials and citizens about the potential effects of volcanic activity and earthquakes (USGS, n.d.-a). See Chapter 2 Section 4 Earthquakes for additional information about earthquakes.

Air Quality

In 2017, the greatest threat to Medford's air quality are from natural hazards. The specific issues related to Wildland-Urban Interface fires and volcanic activities have been added. The *2017 Medford NHMP* includes mitigation actions specific to air quality.

Emission Reduction Programs. As noted, air quality in the Medford-Ashland AQMA has improved dramatically in recent years, due, in part, to programs implemented in Medford and the other jurisdictions in the area to reduce emissions and bring the area into attainment with the NAAQS. The Oregon Department of Environmental Quality (DEQ) is the main regulatory authority for air quality in Oregon. See Chapter 2 Section 8 for details on air quality in Medford.

Although air quality has improved, there is a continuing need for these programs. A brief description of each program follows (Oregon DEQ, n.d.).

- The Vehicle Inspection and Maintenance (I & M) Program requires that all motor vehicles belonging to residents of the Medford-Ashland AQMA be tested for excessive emissions.

- To reduce CO emissions, the Clean Air Act required the sale of oxygenated fuel during the winter in Jackson County and other Oregon counties and cities as of 1992. As of September 28, 2002, the oxygenated fuel requirement was lifted in Jackson County, due to improved air quality indices.

- The Small Business Assistance Program, administered by Oregon Department of Environmental Quality, provides information and technical assistance to small businesses that produce air emissions, such as dry cleaners, auto-body shops, printers, and small manufacturers.

- In 1983, Oregon began a long-term process of regulating the use of wood stoves. The focus was on promoting non-polluting wood stoves. By 1986, only wood stoves certified as meeting new emission standards were permitted to be sold in Oregon. Later, the EPA adopted nationwide standards for wood stove emissions. In 1991, the sale or installation of uncertified stoves by private parties was banned in Oregon, and uncertified stoves were required to be removed upon sale of a home in a PM_{10} non-attainment area. Few installation permits are now issued in the City of Medford for new wood stoves, and weatherization of the home is required when a new wood stove is installed.

- The Housing Authority of Jackson County administers programs for lower income households. Between 1990 and 1994, the Housing Authority ran a "Woodsmoke" program that replaced wood stoves and installed new heating systems in homes that were within the AQMA in Jackson County, including Medford and Central Point. With that program, 574 wood stoves were removed. The current program is a comprehensive home repair program; removing wood stoves is one goal; 38 wood stoves have been removed from 1995-2017. The total number of wood stoves removed through these two programs from 1990 to 2017 is 612 (Jeff Jackson, personal communication, March 17, 2017).

- Medford was part of the Interagency Air Quality Team, consisting of representatives from Ashland, Central Point, Jackson County, ACCESS, Inc., the Housing Authority of Jackson

County, Pacific Power, Avista Natural Gas, and Oregon DEQ. The team is no longer in existence (Tanya Phillips, personal communication, December 28, 2016).

- Smoke from woodstoves and fireplaces can contribute significantly to air pollution in the fall and winter, especially during periods of air stagnation. The Wood Burning Advisory was developed to restrict burning in solid fuel devices (woodstoves, fireplaces, etc.) during high pollution episodes in the Air Quality Maintenance Area (AQMA). The Wood Burning Advisory designates days as green, yellow, or red depending on the amount of particulate matter in the air. The Jackson County Environmental Public Health Division staff establishes the daily advisory by 7:00 a.m. each day from November 1 through February 28 (Tanya Phillips, personal communication, December 28, 2016).

- Outdoor burning is not permitted within the City of Medford, and, in Jackson County, is permitted only when the predicted afternoon ventilation index is 400 or greater. From November 1 through February 28, all outdoor burning within the Medford-Ashland AQMA is prohibited (Tanya Phillips, personal communication, December 28, 2016).

- Educating the public about ways that individuals can help improve and maintain air quality in the Rogue Valley has been one of the most effective means of improving air quality. The goal of these educational programs is to teach residents that continued compliance with air quality improvement programs is necessary, and that air quality continues to improve because of public cooperation.

- The federal Congestion Mitigation and Air Quality Improvement (CMAQ) Program has provided considerable funding to jurisdictions within the Medford-Ashland AQMA for dust and motor vehicle emission reduction programs. The City of Medford was allocated funds to pave alleys, install curbs, gutters, sidewalks, and bicycle lanes, and enhance street sweeping. Additional funds have extended the Bear Creek Greenway multi-use path; aided in the construction of a park-and-ride lot and transit transfer station at the South Gateway Shopping Center for the Rogue Valley Transportation District (RVTD); and helped fund a compressed natural gas fueling station in Medford.

- The City of Medford has implemented a computerized traffic signal control system designed to minimize overall delay for motorists, thus decreasing CO emissions from idling automobiles.

- The City's Public Works Department has a year-round Street Sweeping Program that cleans dirt from streets, thus keeping contaminants from the stormwater system, creeks and streams, and decreasing the amount of dust in the air.

Land Use Strategies. Implemented through the *Land Development Code* and the *Comprehensive Plan*, land use strategies, such as those that reduce vehicle miles traveled (VMT) and retain vegetation, can assist in achieving and maintaining compliance with air quality standards. Provisions in the *Land Development Code* and the *Comprehensive Plan* are approved by the Medford City Council. The *2003 Medford Transportation System Plan* required the development of Transit Oriented Districts (TODs) in four locations in Medford to reduce the growth of vehicle miles traveled (VMTs). Medford's TODs are: City Center, Southeast, West, and North. These areas contain mixed residential and commercial development, which lessens the number and length of auto trips for work or shopping due to the convenient access to both activities.

RVTD. The Rogue Valley Transportation District (RVTD) is one of the agencies active in air quality issues through their efforts to reduce single-occupancy vehicle trips and their use of non-polluting, compressed natural gas-fueled buses. See also Chapter 1 Section 8 Critical Facilities and Section 9 Education Facilities and Special Districts. The Transit Routes map is **Figure 29**.

City Cooperation and Participation. The City of Medford aims to maintain compliance with National Ambient Air Quality Standards (NAAQS). The City has participated, along with state and local agencies involved in air quality attainment, in the preparation and implementation of the applicable Air Quality Management Plans (AQMPs) and State Implementation Plans (SIPs) for the Medford-Ashland Air Quality Maintenance Area (AQMA). The City plans to continue participating, along with Jackson County and other affected agencies, in administering air quality public education and smoke reduction programs. Oregon DEQ is the main regulatory agency for these provisions.

Transportation Planning. The *Medford Transportation System Plan* (TSP), the *State Implementation Plan* (SIP) and the Oregon Transportation Planning Rule (TPR) present strategies for reducing emissions and improving air quality, such as increasing the use of alternative transportation modes, and the use of alternative motor vehicle fuels, such as compressed natural gas and electricity. The City works to develop a well-connected circulation system and promote other techniques that foster alternative modes of transportation, such as pedestrian-oriented mixed-use development and a well-connected bicycle transportation system. Through the Rogue Valley Metropolitan Organization (RVMPO), the City encourages the use of incentives by Medford's larger employers to induce employees to use alternative modes of transportation or work at home to reduce motor vehicle emissions.

City Focus on Fuel Efficiency. In 2002, the City Manager of Medford directed department heads to review their fuel usage and fleet management to reduce costs, ameliorate air quality, and increase efficiency. Since then, fuel efficiency has been a priority and that will continue.

- The **Police Department** has no hybrid or electric vehicles (Brett Johnson, personal communication, December 30, 2016).
- The **Building Safety Department** has five hybrid Ford Escapes that are used for inspections (Sam Barnum, personal communication, December 28, 2016).
- The **Public Works Department** has one hybrid compact sedan (Jeff Simas, personal communication, January 5, 2017).
- The **Parks & Recreation Department** has accomplished the following regarding fuel efficiency:
    - Parks & Recreation has developed and implemented a park zone team maintenance program that consolidates staff into teams that perform maintenance within a defined sector of Medford. This program has significantly reduced fuel consumption as multiple staff members are traveling to work sites together and completing work without taking separate vehicles. A reduction in fuel consumption of 38% has resulted.
    - Parks & Recreation has also implemented a vehicle replacement plan for retiring vehicles that are less fuel efficient with vehicles that are smaller and more fuel efficient. The department recently acquired three new vehicles and retired four.
    - Parks & Recreation currently has three electric golf carts and three electric maintenance vehicles. The three electric maintenance vehicles are no longer in service due to excessive maintenance needs but are still in the fleet. No hybrids are in the fleet (Tim Stevens, personal communication, January 3, 2017).
- The **Emergency Management** office evaluates vehicles to purchase based on fuel economy, relative life cycle, and related factors. The fleet includes a gasoline Ford Explorer, a used diesel

ambulance, and a diesel command vehicle (Larry Masterman, personal communication, December 28, 2016).

- The **Planning Department** has one gasoline vehicle and no hybrid vehicles (Chris Olivier, personal communication, December 28, 2016).
- The **Medford Water Commission** has one Ford Escape hybrid for visiting the sampling stations (David Searcy, personal communication, December 28, 2016).

Community Health. The City of Medford Parks & Recreation Department (2016b) has a Standard Operating Procedure called "Air Quality Standards for Recreation Programs/ Events" (PRD-13-01R). It was issued on November 5, 2013 and revised on January 5, 2016. The purpose of the policy is to 1) identify action levels based on AQI readings posted at www.airnow.gov, 2) outline procedures aimed at reducing program participants' exposures to unhealthy outdoor air and 3) establish a protocol to cancel or reschedule department programs / events when appropriate (City of Medford Parks & Recreation Department, 2016b). The Standard Operating Procedures documents are signed by the Director of the Parks & Recreation Department and the Superintendent.

Emerging Infectious Diseases

Since the *2010 Medford NHMP*, the Medford community has had to respond to new risks, including Ebola, ZIKA, and others. This trend is expected to continue through the life of the *2017 Medford NHMP*. The *2017 Medford NHMP* includes mitigation actions specific to emerging infectious diseases.

Although the City does not operate a public health department, the *2017 Medford NHMP* includes information to help City response organizations anticipate needs and implement measures directed or recommended by Jackson County Public Health, the Oregon Health Authority, and/or the U.S. Centers for Disease Control and Prevention.

Health and Human Services. Jackson County's Health and Human Services Division is responsible for enforcing laws that protect community health, clean air, water purity, and food service throughout Jackson County, including the cities. If Jackson County requires security and/or assistance for health these services within Medford, it works with Medford's Police, Fire-Rescue, Building, Planning, and Public Works Departments.

The Health and Human Services Division licenses and inspects restaurants, mobile units such as coffee, hot dog and taco stands, and temporary restaurants, such as food booths at local events. The Division regulates food handlers by offering food handler classes, administering food handler tests, and issuing certificates.

The Division reduces and/or prevents the contamination of public drinking water supplies throughout the county in smaller water systems. It does not have a regulatory relationship with the Medford Water Commission. However, it is legally responsible for conducting disease investigation in the City of Medford. If there is an outbreak of a disease, the Division works to find the source of that problem, how it is spreading, and monitors its progression.

State Drinking Water Program. The Regional Engineer for the Oregon Department of Human Services' Drinking Water Program oversees all municipal water systems in the region, ensuring that they periodically test and perform all necessary treatment of drinking water. The State of Oregon implements the federal drinking water requirements. Contamination testing consists of two types: microbiological and chemical. The Medford Water Commission (MWC) conducts 90–100

microbiological tests per month. The number of tests is based on population. Microbiological testing begins with testing for coliform bacteria, the indicator organism. If tests are positive, then further testing is conducted for e. coli and fecal coliform. A field investigation is also made (David Searcy, personal communication, November 21, 2016). The State of Oregon and MWC work together to investigate water contamination incidents.

Chemical testing is done for inorganic and organic chemicals. Inorganic chemicals are heavy metals, such as arsenic. Inorganic testing for arsenic occurs once per year for surface water and once every 3 years for groundwater. Nitrate is once per year for all water systems. Organic chemicals are categorized as either volatile or synthetic; they are considered possible carcinogens. Volatile organic chemicals include cleaners and degreasers. Testing for volatile organic chemicals occurs yearly for surface water and once every 3 years for ground water. Synthetic chemicals include herbicides and pesticides. Testing for these is done once every 3 years. Apart from monitoring testing results, the Regional Engineer is responsible for inspecting the entire water system, including all reservoirs in the Medford Water Commission system (Scott Curry, Regional Engineer, Drinking Water Program, Oregon Department of Human Services, personal communication, December 2003).

Jackson County Vector Control District. See also Chapter 1 Section 8 Education Facilities and Special Districts. This special district was formed in 1968 to provide mosquito and fly control to residents. The goal is to prevent new vector sources from developing and to abate existing vector populations and their sources, all in an effort to protect public health and comfort. Vectors are insects, rodents or other animals that can host and/or transmit diseases to human or their domesticated animals. The District's surveillance program collects dead crows for laboratory research related to identifying and tracking West Nile Virus. During the summer, the District's operators use all-terrain vehicles to spray mosquito breeding sites with larvicides. Regulations protecting riparian areas have resulted in the protection of vector breeding grounds, especially those of mosquitos. It is assumed that functioning wetlands harbor enough natural predators to control the vector populations (Jackson County Vector Control District, n.d.-a).

Mitigation Actions and the Action Plan

"The action plan lays the groundwork for implementation by describing how the mitigation plan will be incorporated into existing planning mechanisms and how the mitigation actions will be prioritized, implemented, and administered by each jurisdiction" (FEMA, 2013b).

The City of Medford's mitigation actions are in the multi-hazard and specific hazard Mitigation Actions Tables below. The short-term mitigation actions are those that can be undertaken without extra personnel or other resources. Long-term mitigation actions are those requiring additional resources for execution. When prioritizing potential long-term projects for implementation, the City typically conducts cost-benefit analysis to inform the decision-making. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. While a cost-benefit analysis of projects is essential, sometimes it is a matter of City principles to move ahead with the projects regardless. Examples include the seismic upgrade of City Hall and the transfer of the dispatch center to a seismically sound building.

During the preparation of this NHMP, subject matter experts made recommendations and these have been included as mitigation actions.

Mitigation actions related to floods are presented in **Table 50**. They reflect the importance of stormwater management and avoiding development in the floodplain. As previously described in Chapter 2 Section 3 Floods, DOGAMI recommends the Digital Flood Insurance Rate Map (DFIRM) information from 2011 be updated with potential mapping improvement in the following areas which are identified on aerial photo maps (see Appendix E):

- Approximate mapping (Zone A) for Upton Slough and Swanson Creek,
- Approximate mapping (Zone A) for Ross Lane Drainage,
- Ponding mapping (Zone AO) for Lone Pine Creek,
- Possible expansion of flood mapping for Larson Creek and tributary,
- Approximate mapping (Zone A) for Lone Pine Creek, and
- Approximate mapping (Zone A) for Lazy Creek (Jed Roberts, personal communication, August 18, 2016)

According to DOGAMI, channel migration doesn't appear to be a major concern in the Medford area, but the susceptibility has not been studied. DOGAMI staff recommends that susceptibility be studied to help determine if detailed investigations and mapping are needed (Jed Roberts, personal communication, August 18, 2016).

Mitigation actions related to earthquake hazards are presented in **Table 51**. Public awareness and preparedness, and the execution of seismic retrofit projects on public structures are emphasized.

DOGAMI recommendations related to earthquakes usually involve:

- Conducting seismic vulnerability assessments of infrastructure,
- Having mitigation plans that address those findings,
- Getting seismic planning institutionalized into programs so the improvements are integrated into operations (e.g., Medford's schools, hospitals, transportation department, water districts, wastewater districts, levees and dams, electricity providers, etc.) and tracking the progress (Yumei Wang, personal communication, August 18, 2016).

Table 48. Multi-Hazard Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Multi-Hazard Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
High (18)	Short-term Multi-hazard #1	Identify and pursue new state and federal funding opportunities to develop and implement Medford's mitigation activities.	Existing resources	Emergency Management Coordinator, Planning	•	•	•	•
High (18)	Short-term Multi-hazard #2	Maintain and develop public and private relationships to foster mitigation planning coordination and collaboration within the City of Medford.	Existing resources	Emergency Management Coordinator, Fire, Police, Public Works	•	•	•	•
High (17)	Short-term Multi-hazard #3	Continue to update the City Emergency Operations Plan, linking emergency services with natural hazard mitigation implementation, enhancing public education, and reviewing evacuation routes and alerting systems.	Existing resources	Emergency Management Coordinator, Fire	•	•	•	•
High (18)	Short-term Multi-hazard #4	Keep the most current City of Medford's Natural Hazards Mitigation Plan available to the public in the following locations at a minimum: City's website; Emergency Management Coordinator's office; Rogue Community College; Jackson County Library District; and other public access points.	Existing resources	Emergency Management Coordinator	•		•	•
High (18)	Short-term Multi-hazard #5	Promote communitywide awareness to support family preparedness and self-sufficiency for a period of up to 14 days. Distribute the information via sources such as the City's website, newsletters, and utility bills.	Existing resources	Emergency Management Coordinator, American Red Cross (ARC), Jackson County	•	•	•	•
High (18)	Short-term Multi-hazard #6	Maintain the Natural Hazards Mitigation Plan Steering Committee to facilitate implementation, monitoring, and evaluation of citywide mitigation activities. Meet at least once a year.	Existing resources	Emergency Management Coordinator	•	•	•	•
High (18)	Short-term Multi-	Develop a Continuity of Operations	Existing	Emergency	•	•	•	•

Priority (High, Medium, Low)	Natural Hazard	Multi-Hazard Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
	hazard #7	(COOP) plan or annex to the Emergency Operations Plan.	resources, grants	Management Coordinator				
(High (18)	Short-term Multi-hazard #8	Develop an information and education strategy based on assessment of local hazards, risks, priorities, and other considerations. Continue developing whole community partnerships in education and outreach, e.g. preparedness academy and disaster movie nights with the library and the faith-based and civic leadership summit with local houses of worship. Pursue a partnership to reach the business community more effectively. Continue to deliver training and information products to the public, City employees, response partners, and other stakeholders, considering: relative threats of identified hazards; people with access and functional needs; social equity; a variety of delivery media and methods to reach a broad audience; collaboration with public and private partners in development and delivery; and maintain the NIMS compliance of staff.	Existing resources	Emergency Management Coordinator, Planning, Fire, Public Works, Technology Services, GIS	•	•	•	•
High (18)	Long-term Multi-hazard #1	Continue to adjust policies and programs based on the Medford NHMP.	Pre-Disaster Mitigation (PDM) Program; existing resources	Emergency Management Coordinator, Planning, Fire, Public Works, Technology Services, GIS	•	•	•	•
High (18)	Long-term Multi-hazard #2	Continue to refine hazard map data and keep it updated. Share information with City departments, the public, and external partners.	Pre-Disaster Mitigation (PDM) Program; existing resources	Planning, Building, Technology Services, GIS, State of Oregon agencies such as DOGAMI and DLCD	•	•	•	•
High (17)	Long-term Multi-hazard #3	Support measures to serve People with Access and Functional Needs (PAFN) including hazard communication, evacuation and sheltering. Coordinate with	Pre-Disaster Mitigation (PDM) Program; existing resources; Department of	Emergency Management Coordinator, Police, Fire, Community Resources, Jackson	•	•	•	•

Priority (High, Medium, Low)	Natural Hazard	Multi-Hazard Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
		advocates, social services, care facilities, and others to meet with City staff to discuss local risks, hazards, and learn how other communities have organized to provide and facilitate similar support. Include the RVCOG's Disaster Registry and other sources to help identify and assess PAFN needs.	Homeland Security	County Health and Human Services, Jackson County Emergency Management ARC, Care Facilities, ECSO, RVTD, RVCOG's Vulnerable Populations Committee				
High (18)	Long-term Multi-hazard #4	Develop a reporting system for tracking information continuously about non-declared natural hazard events. The information will be compiled on an annual basis.	Pre-Disaster Mitigation (PDM) Program; existing resources	Emergency Management Coordinator, Fire, Planning, GIS	•	•	•	•
High (18)	Long-term Multi-hazard #5	Develop a long-term recovery plan for Medford from the effects of a disaster/ or catastrophe. Research plans for comparable cities in the West and deciding which elements are applicable to Medford and the risks it faces. Develop worst-case scenarios and long-term recovery needs for each prioritized hazard. Forecast the fiscal burden to be borne by the City, once likely state and federal assistance has been obtained. After adoption of the updated NHMP in 2017, revise the Environmental Element "Disasters and Hazards" section in the Comprehensive Plan to reference the current NHMP as having the most up to date hazards information.	Pre-Disaster Mitigation (PDM) Program; existing staff resources	Emergency Management Coordinator, Public Works, Fire, Technology Services, GIS	•	•	•	•
High (18)	Long-term Multi-hazard #6	Coordinate with American Red Cross to develop an inventory of facilities capable of offering shelter during disaster events. Determine the relative safety of each facility vis-à-vis prioritized hazards and what specifically must be done to address	Pre-Disaster Mitigation (PDM) Program	Emergency Management Coordinator, Planning, Fire, Public Works, GIS		•		•

Priority (High, Medium, Low)	Natural Hazard	Multi-Hazard Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
		occupant safety during a hazard event.						
Medium (16)	Long-term Multi-hazard #7	Continue to assess the adequacy of shelter and mass care service delivery in all areas of the City. Compare populations to be served with the capacities and accommodations of local facilities and services. Develop a prioritized list of needs for each area. Identify funding and resources such as materials and volunteers to serve those needs.	Existing resources	Emergency Management Coordinator, Fire, American Red Cross, Planning, GIS	•		•	•
High (17)	Long-term Multi-hazard #8	Enhance the existing alert system (Jackson County "Citizen Alert") for notifying people about general hazard information and impending or in process hazard events, e.g. pre-designated flood vulnerable areas.	FEMA hazard mitigation grants and others	Emergency Management Coordinator, Fire, Planning, American Red Cross, Technology Services, GIS	•		•	•
High (18)	Long-term Multi-hazard #9	Continue to identify specific mitigation-related criteria that can be incorporated into the land use planning process, e.g. use of temporary gravel roads for fire access during development, and providing pedestrian pathways with universal access.	Dept. of Homeland Security	Emergency Management Coordinator, Planning, Police, Fire,	•	•	•	•
High (18)	Long-term Multi-hazard #10	Continue the assessment of City personnel emergency preparedness training, (including drills and exercises). Identify state and federal funding sources to provide for additional needs.	Existing resources	Emergency Management Coordinator, Fire, Police	•		•	
High (18)	Long-term Multi-hazard #11	Continue the updates every 3 years to maintain aerial photos and planimetric data.	Existing resources	Emergency Management Coordinator, Planning, GIS	•	•		•

Table 49. Severe Weather Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Severe Weather Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
High (18)	Short-term Severe Weather #1	Continue opportunities and establish program that promote public awareness of severe weather hazards and the benefits of mitigation. Coordinate and collaborate with National Weather Service (NWS).Use Public and commercial television, radio, live presentations, utility bill inserts, newsletters, and City website.	Existing resources	Emergency Management Coordinator,	•	•	•	•
Low (7)	Short-term Severe Weather #2	Continue support of Pacific Power removal/replacement program for trees that threaten utilities in the public right-of-way.	Existing resources	Parks & Recreation, Emergency Management Coordinator,	•			•
Medium (14)	Short-term Severe Weather #3	Continue support of the identification of trees that pose a risk to utilities and structures. Continue to have the City Arborist maintain the citywide inventory of trees. This inventory consists of hazardous trees in the public right-of-way, City owned property and private property that could possibly affect utility services if the tree was to fall. Continue the permit process overseen by Parks & Recreation that is used to determine whether a tree should be removed.	Existing resources	Emergency Management Coordinator, Public Works, Parks and Recreation	•		•	•
Medium (16)	Short-term Severe Weather #4	Through public incentives, partnerships, and regulations continue to support the construction of underground utilities. Reference Medford Land Development Code section 10.555 which requires all utilities in new developments to be underground.	Existing resources	Emergency Management Coordinator, Planning, Public Works, Building	•			•
High (18)	Short-term Severe Weather #5	Maintain partnerships with the National Weather Service (NWS) to inform and warn the public about local weather hazards and protective actions, including: maintain the City's status as a Storm Ready/ Weather Ready community, and continue to support	Existing resources	Emergency Management Coordinator, National Weather Service	•		•	•

Priority (High, Medium, Low)	Natural Hazard	Severe Weather Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
		NWS efforts to disseminate, evaluate, and improve its warning products and public information.						

Table 50. Flood Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Floods Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
High (18)	Short-term Flood #1	Update the "Summary of Impact on Exposed Assets" information each year (# structures, # tax lots, total improved value). The data is based on properties within the 100-year and 500-year floodplains.	Existing resources	Emergency Management Coordinator, Planning, Building, GIS		•	•	•
Medium (16)	Short-term Flood #2	Continue to maintain sandbag and sand supplies for City residents and businesses. Improve this service by: Identifying a second location east of Bear Creek and establishing supplies there as resources permit Improving sandbagging station(s) by posting signage with filling and placement instructions, using images and/or multiple languages Consider how to improve pre-flood public awareness of these locations without inviting abuse.	Existing resources	Emergency Management Coordinator, Fire, Police	•	•	•	•
High (18)	Long-term Flood #1	Continue to update floodplain maps with current data. Update maps that use the floodplain data; such as floodplain maps with critical infrastructure data to identify at-risk facilities.	Flood Mitigation Assistance Program (FMA); PDM	Emergency Management Coordinator, GIS, Planning, Fire, Police, Public Works		•	•	•
Low (11)	Long-term Flood #2	Pursue further land acquisition to preserve open space in the floodplain. Include policies supporting the City's acquisition of Greenway parcels in the Parks Master Plan. Establish parameters to identify properties to acquire. Identify properties to acquire.	Voluntary service organizations, such as Rotary; FMA	~~CMO,~~ Emergency Management Coordinator, Parks & Recreation	•		•	•
High (18)	Long-term Flood #3	Continue to implement stormwater and urban design best management practices using the Stormwater Management Plan. Include Rogue Valley Sewer District as partner.	Existing resources	Emergency Management Coordinator, Public Works, Rogue Valley Sewer District	•			
Medium (15)	Long-term Flood #4	Update applicable City codes to improve risk reduction and prevention of flood impacts.	Existing resources	Planning, Building, Emergency Management	•	•		

Priority (High, Medium, Low)	Natural Hazard	Floods Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
				Coordinator				
High (18)	Long-term Flood #5	Continue to participate in regional partnerships to reduce flood losses. Partner with the Rogue River Watershed Council on projects that improve flood mitigation. Identify other partners or projects.	Oregon Watershed Enhancement Board (OWEB).	Public Works, Emergency Management Coordinator,	•	•	•	•
Medium (16)	Long-term Flood #6	Continue to increase the City's Community Rating System rating over time.	Existing resources	Planning, Building	•			•
Medium (16)	Long-term Flood #7	Strengthen floodplain development regulations. Continue to add setbacks along creeks.	Existing resources	Planning, Building, Emergency Management Coordinator, GIS	•			
Medium (14)	Long-term Flood #8	Partner with irrigation districts to assess and mitigate flood hazards.	PDM; Flood Mitigation Assistance (FMA)	Building, Planning, GIS, Emergency Management Coordinator	•		•	
Low (10)	Long-term Flood #9	Identify structures that may impede the flow of water or raise floodplain elevation.	PDM; FMA	Planning; Building, Public Works, GIS, Emergency Management Coordinator	•	•		
Low (13)	Long-term Flood #10	Collaborate with DOGAMI on potential mapping improvements to the 2011 DFIRM information as recommended in the *2017 Medford NHMP*.	PDM; FMA	Emergency Management Coordinator, GIS, Planning, DOGAMI	•		•	•
Low (13)	Long-term Flood #11	Collaborate with DOGAMI and local subject matter experts to study the susceptibility of channel migration in the Medford area to help determine if detailed investigations and mapping are needed.	PDM, FMA	Emergency Management Coordinator, GIS, Planning, DOGAMI	•		•	•

Table 51. Earthquake Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Earthquake Mitigation Actions	Potential Funding Resources	Lead Department (s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
Medium (14)	Short-term Earthquake #1	Continue to identify the City-owned facilities that need earthquake mitigation; prioritize the work for those buildings and identify funding sources.	Existing Resources, other grants	Emergency Management Coordinator, Planning, Building, GIS		•		
High (17)	Short-term Earthquake #2	Include seismic analysis as part of the space use study for City-owned facilities.	Existing Resources & Pre-Disaster Mitigation (PDM) funds.	Emergency Management Coordinator, Building, Planning, GIS	•		•	•
High (18)	Short-term Earthquake #3	Support structural mitigation of infrastructure, schools and other public buildings.	PDM	Emergency Management Coordinator, GIS, Planning	•		•	•
High (18)	Short-term Earthquake #4	Ask DOGAMI to conduct a study of local earthquake hazards in Medford.	Existing resources	Emergency Management Coordinator, DOGAMI	•		•	
High (17)	Short-term Earthquake #5	Update "Summary of Impact on Exposed Assets information (# structures, # tax lots, total improved value) each year for earthquakes.	Existing resources	Emergency Management Coordinator	•		•	•
High (18)	Short-term Earthquake #6	Host the Southern Cascadia Earthquake Summit on September 26 and 27, 2017 in Medford.	Existing resources, donations	Emergency Management, Planning, Eric Dittmer of Southern Oregon University	•		•	•
Medium (16)	Short-term Earthquake #7	Create a new educational video about earthquake awareness and preparation specific to the Medford area.	Existing resources, grants	Emergency Management, Planning, Eric Dittmer of Southern Oregon University, DOGAMI	•	•	•	•
Medium (16)	Long-term Earthquake #1	Explore public/private partnerships for retrofitting projects.	Existing resources	Emergency Management Coordinator, American Red Cross; Hispanic Interagency Committee	•	•	•	•

Priority (High, Medium, Low)	Natural Hazard	Earthquake Mitigation Actions	Potential Funding Resources	Lead Department (s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
				Vulnerable Populations Committee, United Way, Jackson County				
Medium (16)	Long-term Earthquake #2	Review other cities' programs of loan options, grants, and best practices for seismic upgrades. Consider their potential for a program in Medford.	Pre-Disaster Mitigation.	Emergency Management Coordinator	•	•	•	•

Table 52. Wildland-Urban Interface Fires Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Wildland-Urban Interface (WUI) Fires Mitigation Actions	Potential Funding Resources	Lead Department (s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
High (17)	Short-term WUI Fires #1	Work with Jackson County to support the maintenance and update of WUI fire maps and the development of requirements that assist WUI fire mitigation within the Urban Growth Boundary. Propose the adoption of a parallel set of requirements within City limits near interface areas.	Existing Resources US Fire Administration (USFA): Assistance to Firefighters Grant Program; Fire Prevention and Safety Grants	Emergency Management Coordinator, Fire, GIS, Planning, Jackson County Emergency Management, Rogue Valley Fire Prevention Cooperative, ODF	•		•	•
High (18)	Short-term WUI Fires #2	Update the "Summary of Impact on Exposed Assets" information each year (# structures, # tax lots, total improved value). The data is based on properties within the high risk fire zone.	Existing resources	Emergency Management Coordinator, Fire, GIS, Planning, Building	•		•	•
Medium (15)	Long-term WUI Fires #1	Increase the communication and collaboration among WUI property owners and public agencies to identify the risks in WUI areas; increase local knowledge of protective measures and available federal assistance programs.	US Fire Administration (USFA): Assistance to Firefighters Grant Program; Fire Prevention and Safety Grants.	Emergency Management Coordinator, Fire, GIS, Planning, Jackson County, ODF	•		•	•
Medium (14)	Long-term WUI Fires #2	Reduce wildfire fuels in high-risk WUI hazard areas. Undertake neighborhood meetings in these areas to educate property owners about what they can do to decrease fire hazard to their homes.	US Fire Administration (USFA): Assistance to Firefighters Grant Program; Fire Prevention and Safety Grants.	Emergency Management Coordinator, Fire, GIS, Planning, Jackson County, ODF	•	•	•	•
Low (12)	Long-term WUI Fires #3	Explore the City's ability to prohibit particular building materials and practices in high hazard areas, e.g., CC&R requirements and building codes.	Existing resources	Emergency Management Coordinator, Planning, Fire, Building, City Attorney	•	•	•	
Medium (13)	Long-term WUI Fires #4	Continue to consider the need for adequate ingress and egress for	Existing resources	Planning, Fire, Public Works	•			•

Priority (High, Medium, Low)	Natural Hazard	Wildland-Urban Interface (WUI) Fires Mitigation Actions	Potential Funding Resources	Lead Department (s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
		evacuation purposes during the land use planning process.						

Table 53. Landslide Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Landslides Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
High (18)	Short-term Landslide #1	Update the "Summary of Impact on Exposed Assets" information each year (# structures, # tax lots, total improved value). The data is based on properties with slopes 25% or more.	Existing resources	Emergency Management Coordinator, Planning, Building Department, GIS,	•			•
Medium (14)	Long-term Landslide #1	Explore options for alternative access to existing hillside developments in steep slope areas. Focus on developments on the steep slopes of Roxy Ann Peak.	Existing resources	Emergency Management Coordinator, Planning, Fire	•	•		

Table 54. Volcanic Eruptions Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Volcanic Eruptions Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
Medium (14)	Short-term Volcanic #1	Use the research about plume models and prevailing winds from National Weather Service (NWS) to better determine the City's vulnerability to volcanic ash fallout.	Existing resources	Emergency Management Coordinator, Technology Services, GIS, National Weather Service, USGS, DOGAMI	•	•		•
Medium (16)	Long-term Volcanic #1	Explore options for a regional ash management plan. Discuss with the Rogue Valley Council of Governments and the Jackson County Emergency Management Advisory Group.	Existing resources	Emergency Management Coordinator, Public Works	•	•		•
Medium (14)	Long-term Volcanic #2	Coordinate with agencies to protect people from the health and other effects of ash. Provide information regarding shelter in place, respiratory and skin protection, and avoiding use of vehicles and machinery vulnerable to damage.	Existing resources	Emergency Management Coordinator, Jackson County,	•	•		•

Table 55. Air Quality Mitigation Actions

Priority (High, Medium, Low)	Natural Hazard	Air Quality Mitigation Actions	Potential Funding Resources	Lead Department(s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
High (17)	Short-term Air Quality #1	Examine the need and potential of establishing clean air respite/shelters in Medford (locations such as the library).	Existing resources.	Emergency Management Coordinator,	•		•	•
High (18)	Long-term Air Quality #1	Encourage a robust pedestrian and bicycle network (e.g. paint streets with bike information).	Existing resources, Pre-Disaster Mitigation	Emergency Management Coordinator, Planning	•		•	•
Medium (14)	Long-term Air Quality #2	Encourage use and accessibility of alternative fuels for all vehicles.	Pre-Disaster Mitigation	Emergency Management Coordinator,	•		•	•

Table 56. Emerging Infectious Diseases Mitigation Actions

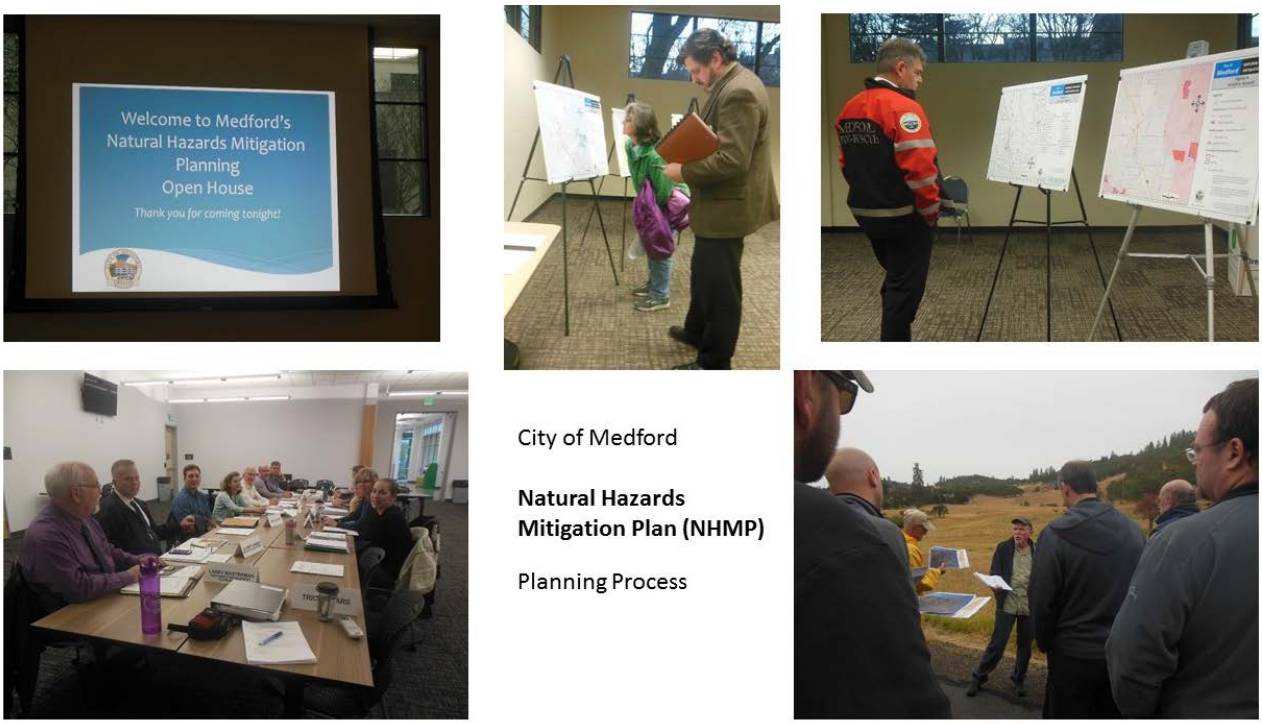
Priority (High, Medium, Low)	Natural Hazard	Emerging Infectious Diseases Mitigation Actions	Potential Funding Resources	Lead Department (s)	Goal: Preventing Injury and Damage	Goal: Enhancing Emergency Services	Goal: Promoting Public Awareness	Goal: Forming Partnerships
Medium (14)	Long-term Disease Outbreaks #1	Encourage employees to be healthy (e.g. go or stay home if sick, use hand sanitizer, wear mask).	Pre-Disaster Mitigation	Emergency Management Coordinator	•		•	•
Low (13)	Long-term Disease Outbreaks #2	Set up/make sure alternative work options are available to employees, e.g. remote work program.	Pre-Disaster Mitigation	Emergency Management Coordinator	•		•	•

Table 57. Medford's Top Ranked Mitigation Actions

Natural Hazard	Medford NHMP Mitigation Actions	Total Votes
Long-term Multi-hazard #5	Develop a long-term recovery plan for Medford from the effects of a disaster/ or catastrophe. Research plans for comparable cities in the West and deciding which elements are applicable to Medford and the risks it faces. Develop worst-case scenarios and long-term recovery needs for each prioritized hazard. Forecast the fiscal burden to be borne by the City, once likely state and federal assistance has been obtained. After adoption of the updated NHMP in 2017, revise the Environmental Element "Disasters and Hazards" section in the Comprehensive Plan to reference the current NHMP as having the most up to date hazards information.	16
Long-term Multi-hazard #6	Coordinate with American Red Cross to develop an inventory of facilities capable of offering shelter during disaster events. Determine the relative safety of each facility vis-à-vis prioritized hazards and what specifically must be done to address occupant safety during a hazard event.	15
Short-term Severe Weather #1	Continue opportunities and establish program that promote public awareness of severe weather hazards and the benefits of mitigation. Coordinate and collaborate with NWS. Use public and commercial television, radio, live presentations, utility bill inserts, newsletters, and City website.	14
Short-term Multi-hazard #5	Promote communitywide awareness to support family preparedness and self-sufficiency for a period of up to 14 days. Distribute information via sources such as the City's website, newsletters, and utility bills.	14
Short-term Multi-hazard #2	Maintain and develop public and private relationships to foster mitigation planning coordination and collaboration within the City of Medford.	12
Long-term Multi-hazard #10	Continue the assessment of City personnel emergency preparedness training, (including drills and exercises). Identify state and federal funding sources to provide for additional needs.	11
Short-term Multi-hazard #7	Develop a City Continuity of Operations (COOP) plan or annex to the Emergency Operations Plan.	10
Short-term Severe Weather #5	Maintain partnerships with the National Weather Service (NWS) to inform and warn the public about local weather hazards and protective actions, including: maintain the City's status as a Storm Ready/ Weather Ready community, and continue to support NWS efforts to disseminate, evaluate, and improve its warning products and public information.	10
Short-term Multi-hazard #8	Develop an information and education strategy based on assessment of local hazards, risks, priorities, and other considerations. Continue developing whole community partnerships in education and outreach, e.g. preparedness academy and disaster movie nights with the library and the faith-based and civic leadership summit with local houses of worship. Pursue a partnership to reach the business community more effectively. Continue to deliver training and information products to the public, City employees, response partners, and other stakeholders, considering: relative threats of identified hazards; people with access and functional needs; social equity; a variety of delivery media and methods to reach a broad audience; collaboration with public private and partners in development and delivery; and maintain the NIMS compliance of staff.	9
Long-term Flood #1	Continue to update floodplain maps with current data. Update maps that use the floodplain data; such as floodplain maps with critical infrastructure data to identify at-risk facilities.	8
Short-term Earthquake #3	Support structural mitigation of infrastructure, schools and other public buildings.	8

Chapter 4 Planning Process

Figure 74. Scenes from Medford's NHMP Planning Process



Source: Tricia Sears, DLCD, January 2017

Section 1 Introduction

"An effective and open planning process helps ensure that citizens understand the risks and vulnerability, and they can work with the jurisdiction to support policies, actions, and tools that over the long-term will lead to a reduction in future losses" (FEMA, 2011b).

In CFR 44, as part of the Natural Hazards Mitigation Plan, FEMA identifies several requirements for the planning process such as 201.6(b); 201.6 (b)(1); 201.6(b)(2); 201.6(b)(3); 201.6(c)(1); 206(c)(4)(i); and 201.6(c)(4)(iii). According to the *Local Mitigation Plan Review Guide*,

> FEMA will accept the planning process as defined by the community, as long as the mitigation plan includes a narrative description of the process used to develop the mitigation plan – a systematic account about how the mitigation plan evolved from the formation of a planning team, to how the public participated, to how each section of the plan was developed, to what plans or studies were incorporated in the plan, to how it will be implemented. Documentation of a current planning process is required for both new and updated plans (FEMA, 2011b).

44 CFR §201.6(b), An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

44 CFR §201.6(b)(1), An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

44 CFR§201.6(b)(2), An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation, 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; and

44 CFR §201.6(b)(3), Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

44 CFR §201.6(c)(1), The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

44 CFR §201.6(c)(4)(i), The plan maintenance process shall include a method and schedule for monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

44 CFR §201.6(c)(4)(iii), The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Organizing and Planning for the Medford NHMP

The City of Medford worked with DLCD to determine the most effective way to update the *2010 Medford NHMP*. Medford was included, along with several other jurisdictions, in a Pre-Disaster Mitigation (PDM) grant that DLCD made to FEMA in 2014. DLCD received grant approval and funding for PDM 14 from FEMA through OEM to assist Medford with its NHMP update. The grant's original performance period was from April 21, 2014 through September 30, 2016. Because FEMA's grant award process and then Oregon's subsequent legislative fiscal process took an extensive amount of time, a 12-month no-cost period of performance extension from FEMA to complete the update was requested by DLCD in July 2016. FEMA granted the extension on August 30, 2016; this provided a grant performance period that extended through September 30, 2017 for PDMC-PL-OR-2014-003.

FEMA does not allow DLCD to disburse the PDM 14 grant funds to local governments to complete updates on their own. Therefore, DLCD used the grant funds to provide consulting and technical assistance to Medford to complete the update, and Medford provided cost-share through in-kind services. Medford documented its cost-share expenditures.

During the *2017 Medford NHMP* planning process, Medford entered the Jackson County *Multi-Jurisdictional NHMP* update process. Once the *2017 Medford NHMP* is approved, Medford will re-adopt the NHMP as an addendum to the Jackson County *MJNHMP*. DLCD will provide technical assistance to Medford during this process and on the integration of its NHMP into Medford's existing planning mechanisms.

Invitations to the Medford NHMP Steering Committee members were extended by the Emergency Management Coordinator and DLCD staff at the beginning and throughout the planning process. Medford's NHMP kickoff meeting occurred on June 22, 2016, beginning a planning process for the City of Medford's *Natural Hazards Mitigation Plan* that continued through June 2017. The most current version of the Project Schedule is included in Appendix E. Additional documentation, such as but not limited to the Public Engagement Program, the Memorandum/Scope of Work, timeline of project activities, agendas, website screen shots, informational flyers, and floodplain information, is also in Appendix E.

At the June 22, 2016 Steering Committee (SC) meeting, the members of the SC determined that having one committee rather than two separate committees (the Steering Committee and the Community Partners Committee) would be most efficient. Larry Masterman, the Emergency Management Coordinator, and Jim Huber, the Planning Director at that time, agreed to co-chair the Steering Committee. After Jim Huber's retirement, Chris Olivier stepped in as co-chair and continued the Planning Department representation.

The Steering Committee was comprised of City staff, agencies, and community groups and was intended to bring a range of community perspectives, interests, and expertise to the planning process. The role of this Steering Committee was to: generate ideas for plan content; provide required information; develop or assist in the development of plan components; react to and critique draft plan components; and participate in the generation of mitigation actions. A list of the Steering Committee members, as well as other participants and contributors is provided in the Acknowledgements section at the beginning of the *2017 Medford NHMP*.

Review of Plan Format and Content, and Changes Made

"To continue to be an effective representation of the jurisdictions overall strategy for reducing risk to natural hazards, the updated local mitigation plan must reflect current conditions and progress in mitigation efforts. The 5-year plan update is an opportunity for each jurisdiction to assess its previous goals and actions, evaluate progress in implementing the action plan, and adjust its actions to address current realities" (FEMA, 2013b).

The original Medford NHMP was approved by FEMA in 2004. In August 2010, an updated NHMP with the title of *Pre-Disaster Mitigation Plan* and relying primarily on the 2004 NHMP information, was approved by FEMA.

For the *2017 Medford NHMP*, much of the existing NHMP information was either revised or removed. A considerable amount of information was added, and the NHMP was completely re-organized and reformatted. A new Hazards Analysis was performed so that current scientific information, recent hazard event data, and other current information was used. Mitigation actions, formerly called measures, were revised or deleted. New mitigation actions were added. Existing maps were revised or deleted. New maps were added. Map methodologies are described in Appendix C Map Methodology.

Data was gathered by DLCD and Medford staff using extensive research and collaboration with other agencies and organizations. In particular, the Medford Planning, GIS, and Emergency Management staff provided considerable information during the NHMP planning process.

Review of the existing material and transformation of the NHMP into this current version included review of technical analyses, datasets, local information, regional and state information, academic materials, and other resources; all references are identified briefly within the NHMP text and fully in Appendix A References.

A brief description of the focus and formation of the chapter content in the *2017 Medford NHMP* is included below.

Develop a Community Profile: Chapter 1

The Community Profile increases our understanding of the vulnerability to hazards across the City of Medford by taking a closer look at the baseline information and trends that present the backdrop for Medford's natural hazards mitigation planning process. The Community Profile also suggests how the baseline information and trends affect the City's ability to prepare for, mitigate, respond to or recover from a disaster. The Community Profile was developed in a collaborative fashion by DLCD staff and the Steering Committee, using available documents and conducting additional research.

Hazard Identification and Risk Assessment: Chapter 2

The identified natural hazards faced by Medford were reviewed and described with respect to the type of hazard, the location and extent of the hazard, the history of hazard events, the probability of future events (the likelihood of occurrence in terms of intensity and frequency), and the impacts and vulnerabilities on the City of Medford. The City's vulnerability to each hazard was defined. One of the tools used was an inventory of the built and natural environment lying within the area affected by each hazard. This was done using GIS mapping and database capabilities. Estimates were made of the number of impacted structures and the potential dollar losses from the hazards. A Hazard Analysis was performed at the September 23, 2016 Steering Committee meeting. As completed, it provides a relative

ranking of natural hazards faced by the City. Severe weather is the highest rank hazard in the Hazard Analysis. See Appendix B for the Hazard Analysis, and an explanation of the methodology used. Steering Committee members expressed the most concern for the risk represented by severe weather, floods, earthquakes, and wildland-urban interface fires.

Mitigation Strategy and Planning Process: Chapters 3 and 4

In 2004, having assessed the hazards faced by the City and ongoing mitigation actions, the Steering Committee developed an overarching mission and four goals serving that mission. The mission and goals were retained in the *2010 Medford NHMP* and again in the *2017 Medford NHMP*. The current Steering Committee also reviewed the action items from the *2010 Medford NHMP*. Those action items were categorized as multi-hazard or hazard-specific, as well as short-term or long-term, and reviewed and assessed. The Steering Committee identified what the City has accomplished; those are included in the "Medford's Existing Efforts that Implement Mitigation Actions" portion of Chapter 3. Accomplished actions are mitigation because they are actions that were taken to reduce or eliminate risk to people, property, and the environment from hazards. The Steering Committee also determined if the actions were to be retained, revised, or deleted, as well as adding new actions.

As described in Chapter 3, monitoring of mitigation actions will be continuous by the Emergency Management Coordinator, who is the primary responsible party for monitoring, evaluating, and updating the *2017 Medford NHMP*. Meetings of the Emergency Management Coordinator with the Planning Department representative, and meetings with the Steering Committee, will be convened during the timeframe covered by the *2017 Medford NHMP*. Meetings, public outreach, hazard events, and potential changes needed to the NHMP will be documented by the Emergency Management Coordinator.

Chapter 4 describes the planning process for the *2017 Medford NHMP*. Topics include: CFRs, organizing and planning, review of plan for materials and content, public participation, and maintaining the plan.

Appendices: Chapter 5

The Appendices include the References, the Hazard Analysis, the Map Methodology, Hazard Summary of Climate Trends and Projections, and the Planning Documentation. Outreach efforts for the *2017 Medford NHMP* are included in Planning Documentation.

Section 2 Public Participation

The City of Medford takes pride in its public outreach efforts and the level of civic participation. Outreach was performed in a variety of methods during the *2017 Medford NHMP* process including emails, website postings, distribution of printed flyers, word of mouth, community events, interviews, open Steering Committee meetings, briefings to the Planning Commission and to the City Council, and an open house. Copies of the *2017 Medford NHMP* are on the City's website and catalogued and maintained at the downtown Jackson County Library District headquarters. The contact person on the NHMP is the City of Medford Emergency Management Coordinator. Documentation of the NHMP planning process, including public participation, is included in Chapter 5.

Medford's past NHMP work relates to the present. With that in mind, the NHMP goals and preferred implementation strategies identified in 2004 continue to have a role. Note that the source of the following information is the City of Medford (2010).

In May 2004, after the NHMP goals were developed by the Steering Committee, NHMP project staff convened a special focus group to represent a broad range of perspectives and stakeholders in the community. Invited were Neighborhood Watch Captains from each City ward, a developer, downtown businesspeople, the owner two assisted living facilities, a nurse who specializes in disaster preparedness from the local health care industry, a senior, and the Neighborhood Resource Coordinator for the City of Medford.

The Oregon Natural Hazards Workshop of the University of Oregon led the focus group. Participants were asked to prioritize the NHMP goals. From this process, the City learned that stakeholders strongly favored an emphasis on the goals of Promoting Public Awareness and Enhancing Emergency Services. According to the participants, residents have primary responsibility for disaster preparedness and the well-being of their families. Educating the public about that responsibility and the importance of preparedness were seen as the key to mitigation. Prevention was seen as less effective and regulation as onerous and less productive.

The focus group was then asked to imagine that they were City Councilors with funds to budget among four strategies for achieving each of the four mitigation goals. The strategies were education, providing incentives, regulation, or acquisition of property or resources. **Table 58** below displays the choices they made.

Table 58. Preferred Implementation Strategies

Goal	Education	Regulation	Acquisition	Incentives
Prevention	$44,000	$23,000	$4,000	*
Emergency Services	$35,000	$7,000	$14,000	*
Public Awareness	$28,000	*	*	$12,000
Partnerships	$16,000	*	*	$24,000
*Not Applicable				

Source: Oregon Natural Hazards Workgroup, May 2004 as cited by City of Medford, 2010

The total of the amounts allocated to each of the four strategies revealed a clear emphasis on education. Of the entire $207,000, some 59% was dedicated to the education strategy. Education was followed by incentives (17%), regulation (14%), and acquisition (9%).

These results are consistent with the 2004 ranking of mitigation goals, whereby participants deemed promoting public awareness most important. The results reflect commonly expressed local values that stress the importance of personal responsibility.

With this direction from citizens, the City placed top priority on implementing short-term and long-term actions that preserve the life, health and safety of its citizens. The City implemented public awareness and mitigation strategies whenever possible and continues to do so.

Section 3 Maintaining the Plan

Plan maintenance is a critical component of the NHMP. It ensures that the *2017 Medford NHMP* will continue to be current and guide mitigation actions into the future. It is possible that the mission and goals will change over time, if determined as an appropriate step by the Steering Committee. NHMP strategies and actions will require periodic review and refinement, in addition to the required NHMP update timelines. Also, new scientific information that can change the understanding of hazard risk occasionally becomes available. This new information should be reflected in the NHMP and, if necessary, acted upon.

Monitoring and Evaluation

As discussed in Chapter 3 Mitigation Strategy, the Steering Committee will be responsible for monitoring and evaluating the NHMP, led by the Emergency Management Coordinator, between updates. During the monitoring and evaluation phase, the committee will discuss the following:

- Funding opportunities,
- New data,
- Mitigation action progress,
- Public comments,
- Elected official comments,
- New mitigation actions,
- Mitigation action screening and prioritization criteria,
- Lessons learned,
- Mitigation success,
- Priorities for the next plan update.

The committee may choose to meet additional times than the usual schedule – such as after a disaster event or if new funding opportunities arise – to review the mitigation actions of the NHMP and reconsider priorities for implementation of those actions.

NHMP Updates

The *2017 Medford NHMP* will be updated every five years, as required by the Disaster Mitigation Act of 2000. The questions below are borrowed from the Multnomah County Multi-Jurisdictional NHMP (Multnomah County Emergency Management, 2016). Questions to be considered include but are not limited to:

- Are the plan goals still applicable? If no, what are the modifications that should be made?
- Do the plan's priorities align with state priorities? If no, what steps do we take to align priorities?
- What new partners should be brought to the table?
- What new local, regional, state, or federal policies influencing natural hazard should be addressed?
- What mitigation activities has the community successfully implemented since the last plan was updated?
- What new issues or problems related to hazards have been identified in the community?

- What existing actions need to be reprioritized for implementation?
- Are the actions still appropriate given current resources?
- What changes in development patterns could influence the effects of hazards?
- What significant changes in the community's demographics could influence the effects of hazards?
- What new studies or data would enhance the risk assessment?
- Has the community been affected by any disasters? How did the plan accurately or inaccurately address the impacts of those events?

Discussing these questions as well others, will help the communities determine what components of the NHMP need to be updated.

Chapter 5 Appendices

Source: Tricia Sears, DLCD, April 2017. Medford urban growth boundary (UGB) outline from Oregon Department of Land Conservation and Development (DLCD. (2015, March 4). Oregon Urban Growth Boundaries – 2014 [GIS shapefile]. Retrieved from http://spatialdata.oregonexplorer.info/geoportal/details;id=dfa4ff218b044c749e0463294d9e325e

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Glossary – Limited Key Terms

Climate: The definition of climate is "The composite or generally prevailing weather conditions of a region, throughout the year, averaged over a series of years" (National Weather Service, n.d.).

Climate change: "Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes." (Intergovernmental Panel on Climate Change, 2007).

[Climate change] adaptation: "Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc." (Intergovernmental Panel on Climate Change, 2007).

Extent is "the strength or magnitude of the hazard" (FEMA, 2011b). Extent is frequently measured with a scale such as the Richter Scale or flood depth grids; other factors such as the duration and speed of onset are also included.

A **hazard** is "any situation that has the potential of causing property damage to people, property, or the environment" (Oregon DLCD, 2015). Risk is the probability of an event or condition occurring (Mileti, 1999, p. 106, as cited in Blanchard, 2008).

Impact is "the consequences or effect of the hazard on the community and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have value to the community" (FEMA, 2011b).

Location: FEMA describes the location as "the geographic areas in the planning area that are affected by the hazard" (FEMA, 2011b).

A **natural hazard** is "a source of harm or difficulty created by a meteorological, environmental, or geological event" (FEMA, 2011b; U.S. DHS, 2010). Human-caused and technological hazards are not required to be addressed in this NHMP. Another definition of natural hazard is provided as those "which result from acts of nature, such as hurricanes, earthquakes, tornadoes, animal disease outbreak, pandemics, or epidemics" (U.S. DHS, 2013b).

Probability is defined as "the likelihood of the hazard occurring and may be defined in terms of general descriptors (for example, unlikely, likely, highly unlikely), historical frequencies, statistical probabilities (for example: 1% chance of occurrence in any given year), and/or hazard probability maps" (FEMA, 2011b).

Repetitive loss properties: "Those for which two or more losses of at least $1,000 each have been paid under the national Flood Insurance Program (NFIP) within any 10-year period since 1978" (FEMA, 2011b).

Resilience is essentially the flip side of vulnerability. It is the ability to "survive,

adapt, and grow in the face of stress and shocks, and even transform when conditions require it" (The Rockefeller Foundation, n.d.). Another definition is "the ability to respond and to recover quickly from damage; it is the ability to 'bounce back.' A resilient system is not necessarily damage-resistant. Rather a resilient system is able to operate at some level when damage occurs" (PBEM, 2012).

Resilient communities. "Resilient communities proactively protect themselves against hazards, build self-sufficiency, and become more sustainable. Resilience…involves technical, organizational, social, and economic dimensions. It is fostered not only by government, but also by individual, organization, and business actions" (Godschalk, Rose, Mittler, Porter, & Taylor West, 2009).

Risk "The probability of an event or condition occurring (Mileti, 1999, p. 106)." "The probability of harmful consequences, or expected loss (of lives, people injured, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable/capable conditions. Conventionally risk is expressed by the equation Risk = Hazards x Vulnerability/Capacity (United Nations International Strategy for Disaster Reduction, 2002, p. 24)." *Guide to Emergency Management and Related Terms, Definitions, Concepts, Acronyms, Organizations, Programs, Guidance, Executive Orders & Legislation: A Tutorial on Emergency Management, Broadly Defined, Past and Present* (Blanchard, 2008).

Risk analysis "A risk analysis involves estimating damages, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (a) the magnitude of the harm that may result, defined through vulnerability assessments; and (b) the likelihood or probability of the harm occurring, defined in the hazard characterization" (Oregon DLCD, 2015).

Risk assessment "An effective risk assessment informs proposed actions by focusing attention and resources on the greatest risks. The four basic components of a risk assessment are: 1) hazard identification, 2) profiling of hazard events, 3) inventory of assets, and 4) estimation of potential human and economic losses based on the exposure and vulnerability of people, buildings, and infrastructure" (FEMA, n.d.-f).

Severe repetitive loss properties: "Those residential properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building" (FEMA, 2011b).

Vulnerability is "the susceptibility of life, property, or the environment to damage if a hazard manifests to potential" according to the *2015 Oregon Natural Hazards Mitigation Plan* (Oregon DLCD, 2015).

Vulnerability assessment "combines information from the hazard characterization 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 each hazard. Vulnerability is determined by a community's exposure, sensitivity, and resilience to natural hazards as well as by its ability to mitigate, prepare for, respond to, and recover from a disaster" (Oregon DLCD, 2015).

Weather: The definition of weather is "the state of the air and atmosphere at a particular time and place: the temperature and other outside conditions (such as rain, cloudiness, etc.) at a particular time and place" (Merriam-Webster, n.d.). Severe weather includes winter storm events such as heavy rain, wind, snow and ice; other severe weather events are thunderstorms, hail, lightning strikes, tornadoes, and drought/heat waves.

Appendix B Hazard Analysis Summary

The methodology for this **Hazard Analysis** was first developed by FEMA in 1983. It was gradually refined by Oregon Emergency Management (OEM) and shared with local jurisdictions across Oregon. Although nearly every jurisdiction in Oregon uses this process, the range of scored values is relative only within the individual jurisdiction; it is not meant to compare one jurisdiction to another.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible), one order of magnitude from lowest to highest**. Vulnerability** and **probability** are the two key components of the methodology.

- **Vulnerability** examines both typical and maximum credible events in terms of the amount of population and property likely to be affected.
- **Probability** is a measure of the likelihood of a future event occurring within a specific period of time. It uses the frequency of the occurrence of hazard events.

Vulnerability accounts for approximately 60% of the total risk score, and probability accounts for approximately 40%.

This particular Hazard Analysis is an early step in determining the risk – the potential for harm – facing a community. When complete, it provides a table of relative risks to focus planning priorities on those hazards most likely to occur and cause the most damage. This Hazard Analysis, therefore, is constructed to:

- Establish priorities for planning, capability development, and hazard mitigation,
- Identify needs for hazard mitigation measures,
- Educate the public as well as public officials about hazards and vulnerabilities, and
- Make informed judgments about potential risks.

The City of Medford's prior Hazard Analysis was completed on March 3, 2004 and used in both the 2004 and 2010 Natural Hazards Mitigation Plans (NHMP). This Hazard Analysis was performed on September 23, 2016 as part of the 2017 NHMP update. It provided an opportunity to revisit the hazards, update the analysis, and reorder the priorities if necessary.

Medford's hazards in 2016 are (2004 names are in parentheses):
Severe Weather: includes drought, winter storms, snow, ice, cold, heat, wind, and rain (formerly called Severe Storms)
Floods
Earthquakes
Air Quality (formerly called Poor Air Quality)
Emerging Infectious Diseases (formerly called Epidemics)
Volcanic Eruptions
Wildland-Urban Interface Fires
Landslides

COMPLETING THE HAZARD ANALYSIS WORKSHEET

Values assigned as scores are very subjective.

DESIGNATION	RATING
LOW	0 to 3
MEDIUM	4 to 7
HIGH	8 to 10

By multiplying the *weight factors* associated with the categories by the *severity ratings*, we can arrive at a sub-score for history, vulnerability, maximum threat, and probability for each hazard. Adding the sub-scores will produce a **total risk score** for each hazard.

History is the record of previous occurrences requiring a response.

Low: 0-1 event in the past 10 years
Medium: 2-3 events in the past 10 years
High: 4+ events in the past 10 years

The weight factor for the history category is 2.

Vulnerability is a measure of the percentage of the population and property likely to be affected during an occurrence of an incident.

Low: <1% affected
Medium: 1 – 10% affected
High: >10% affected

The weight factor for the vulnerability category is 5.

Maximum Threat is a measure of the highest percentage of the population or property which could be impacted under a worst-case scenario.

Low: <5% affected
Medium: 5 – 25% affected
High: >25% affected

The weight factor for the maximum threat category is 10.

Probability is a measure of the likelihood of a future event occurring within a specified period of time.

Low: more than 10 years between events
Medium: from 5 to 10 years between events
High: likely within the next 5 years

The weight factor for the probability category is 7.

HAZARD ANALYSIS WORKSHEET

STEP 1: View Prior Scores and Calculate New Scores

Prior: 2004 Scores

HAZARD	HISTORY WF = 2		VULNERABILITY WF = 5		MAX THREAT WF = 10		PROBABILITY WF = 7		RISK SCORE
Severe Storms	2 x	**10**	5 x	**10**	10 x	**10**	7 x	**9**	**233**
Floods	2 x	**10**	5 x	**9**	10 x	**9**	7 x	**10**	**225**
Earthquakes	2 x	**1**	5 x	**10**	10 x	**10**	7 x	**7**	**201**
Poor Air Quality	2 x	**8**	5 x	**4**	10 x	**8**	7 x	**9**	**179**
Epidemics	2 x	**10**	5 x	**1**	10 x	**9**	7 x	**9**	**178**
Drought	2 x	**10**	5 x	**2**	10 x	**6**	7 x	**10**	**160**
Volcanic Eruptions	2 x	**1**	5 x	**10**	10 x	**10**	7 x	**1**	**159**
Wildland-Urban Interface Fires	2 x	**5**	5 x	**5**	10 x	**5**	7 x	**9**	**148**
Landslides	2 x	**1**	5 x	**10**	10 x	**5**	7 x	**1**	**109**

New: 2016 Scores

HAZARD	HISTORY WF = 2		VULNERABILITY WF = 5		MAX THREAT WF = 10		PROBABILITY WF = 7		RISK SCORE
Severe Weather: Includes drought, winter storms, snow, ice, cold, heat, wind, rain (Severe Storms)	2 x	**10**	5 x	**10**	10 x	**10**	7 x	**10**	**240**
Floods	2 x	**6**	5 x	**5**	10 x	**8**	7 x	**5**	**152**
Earthquakes	2 x	**1**	5 x	**10**	10 x	**10**	7 x	**3**	**173**
Air Quality (Poor Air Quality)	2 x	**8**	5 x	**8**	10 x	**7**	7 x	**9**	**189**
Emerging Infectious Diseases (Epidemics)	2 x	**6**	5 x	**7**	10 x	**10**	7 x	**7**	**196**
Volcanic Eruptions	2 x	**1**	5 x	**10**	10 x	**10**	7 x	**1**	**159**
Wildland-Urban Interface Fires	2 x	**9**	5 x	**5**	10 x	**7**	7 x	**10**	**183**
Landslides	2 x	**8**	5 x	**3**	10 x	**3**	7 x	**9**	**124**

HAZARD ANALYSIS SUMMARY

STEP 2: Hazards and Risk Scores in Numerical Order (High to Low)

STEP 3: Decide Risk Levels (High-Medium-Low)

HAZARD	RISK SCORE	RISK LEVEL (H-M-L)
Severe Weather	**240**	**High**
Emerging Infectious Diseases	**196**	**High**
Air Quality	**189**	**Medium-High**
Wildland-Urban Interface Fires	**183**	**Medium-High**
Earthquakes	**173**	**Medium**
Volcanic Eruptions	**159**	**Medium**
Floods	**152**	**Medium**
Landslides	**124**	**Low**

HAZARD ANALYSIS RECAP

The Hazard Analysis work was performed at the September 23, 2016 Medford NHMP Steering Committee meeting. This Hazard Analysis Summary was prepared on October 13, 2016.

Issues Identified During the Discussion

In this assessment, four measures characterizing risk – history, vulnerability, maximum threat, and probability – are assessed as to severity, weighted, and added together to derive a relative risk score for each hazard. The weights for each measure are noted within the matrix above in “2016 Scores” as well as in the description of the “Completing the Hazard Analysis Worksheet.”

Much discussion occurred regarding the definitions of the weighted measures. For example, when defining vulnerability and maximum threat, the percentages are based on those “affected.” Questions arose as to how much impact or influence is considered “affected” to the population and property. Estimating the appropriate percentage for vulnerability and maximum threat provided some challenge.

The group continued to come to consensus on the ratings for each of the four measures, as well as the total score, for each hazard. Several hazards - floods, air quality, and wildland-urban interface fires (WUI) - were discussed more than once, and revised ratings were made as a result of the discussions. Wildland-urban interface fires were further discussed with Chief Fish of Medford Fire-Rescue after the meeting. Medford Fire-Rescue provides response in the City and has provided response since 1952 to the Medford Rural Fire Protection District. With this in mind, the risk ratings for WUI were adjusted to reflect the events that occur in both areas.

Earthquakes generated discussion regarding the idea that the methodology really does not fit. Earthquakes are very much a focus of preparedness by agencies, non-profits, and the entire community.

However, earthquakes do not happen frequently at a large scale in this area. Within the ratings, earthquakes rank fifth out of the eight Medford hazards. It is well documented that the Cascadia Subduction Zone earthquake is “due” to happen. With the anticipated large scale of the event and the fact that the event will occur suddenly with little warning, a great deal of resources must be gathered and prepared in advance to the extent practicable.

Floods most commonly occur naturally. It should be noted that levees and dams can be breached (by natural or other hazards) and have flood impacts. Medford could be impacted by breaches of Lost Creek Dam, Emigrant Dam, and Hosler Dam. With floods, there could be a problem getting to services provided on the east and west sides of Medford, which would be either side of I-5 and Bear Creek. There are fire stations located on both sides of Medford. Other resources such as the airport, both hospitals, the American Red Cross, the ODOT office/yard, the Jackson County Public Works and Sheriff’s offices, and the Rogue Valley Regional Transit District bus yard and fueling facility are located on the east side. Resources such as the Rogue Valley Transit District paratransit dispatch center and vehicle yard, the Medford Service Center, the Oregon State Police, the National Guard armory, and the Jackson County administration offices are located on the west side of Medford. Floods could potentially impact much of Medford.

Severe storms scored all the points possible due to the breadth of hazard types within this category, the frequency, and number of people impacted in both an incident and in the worst case scenario.

As part of the Hazard Analysis work with the Steering Committee, a fieldtrip was conducted to support the discussion. On September 23, 2016, members of the Steering Committee and several other interested parties, visited the Roxy Ann Peak area. Dr. Charles Land and Professor Emeritus Eric Dittmer led the discussion about geology, landslides, and egress/ingress to the area. With the input of ODF staff, the group also discussed wildland-interface fires. Staff from NWS, Medford Fire-Rescue, Police, Emergency Management, United Way, DLCD, and Rogue Valley COAD also attended. Thought-provoking and lively discussion raised awareness of the hazards and impacts that have happened and could happen.

Within the severity designations of low, medium, and high, there is room for subjectivity in selecting the severity rating. The designations of low, medium, and high shown in the table above were designated by Tricia Sears, DLCD Staff, and Larry Masterman, Medford’s Emergency Management Coordinator, after the Steering Committee meeting. These designations are based on scores that are relatively close together, with score gaps being identified as the changes for risk levels.

Medford’s Hazards in Summary

See also the Medford *Natural Hazards Mitigation Plan* (NHMP) for details. A draft of the 2017 Medford NHMP will be published in October 2016; it is an update of the 2010 NHMP.

Severe Weather: Severe weather includes drought, winter storms, snow, ice, cold, heat, wind, and rain. In Medford, rain, wind, snow, and ice events most commonly occur in October through March or April. In the 2004 Medford Hazard Analysis, this hazard was called Severe Storms.

Floods: Medford experiences the most severe flooding conditions when the effects of snowmelt and direct, heavy rainfall combine during periods of warmer temperatures in winter and early spring months. Most commonly, floods occur from natural events (impacts from which can be greatly influenced by

rural and urban development). It is also possible that levees and dams (Lost Creek Dam, Emigrant Dam, and Hosler Dam) could be breached and would potentially impact Medford.

Earthquakes: Medford is susceptible to impacts from earthquakes from four sources: (a) the off-shore Cascadia Subduction Zone (CSZ), (b) deep intraplate events within the subducting Juan de Fuca plate, (c) shallow crustal events within the North America Plate, and (d) earthquakes associated with renewed volcanic activity. The Cascadia Subduction Zone and the subduction process is responsible for most of the earthquakes in the Pacific Northwest as well as for creating the volcanoes in the Cascades.

> The paleoseismic record includes 18 magnitude 8.8–9.1 megathrust earthquakes in the last 10,000 years that affected the entire subduction zone. The return period for the largest earthquakes is 530 years, and the probability of the next such event occurring in the next 50 years ranges from 7 to 12%. An additional 10–20 smaller, magnitude 8.3–8.5, earthquakes affected only the southern half of Oregon and northern California. The average return period for these is about 240 years, and the probability of a small or large subduction earthquake occurring in the next 50 years is 37-43% (Oregon DLCD, 2015).

In August 2016 new analysis about CSZ earthquakes, from Oregon State University, was published. The analysis suggests that CSZ earthquakes affecting more heavily populated areas are slightly more frequent than previously thought. These findings show the chances of an earthquake in the next 50 years have increased. “For central and northern Oregon, the chance of a seismic event during that period has been changed to 15-20 percent instead of 14-17 percent. In the zone area within Washington and British Columbia, the chance of an event has increased to 10-17 percent from 8-14 percent” (Meny, 2016). According to Chris Goldfinger of OSU, “These new results are based on much better data than has been available before, and reinforce our confidence in findings regarding the potential for major earthquakes on the Cascadia Subduction Zone, especially the northern parts. The frequency, although not the intensity, of earthquakes there appears to be somewhat higher than we previously estimated.”

Air Quality: Given its bowl-like shape, the Rogue Valley experiences periods of air stagnation and atmospheric temperature inversions that trap pollution, particularly during the months of December, January, and February. Over time, the pollutants of significant concern for Medford have changed from ozone, carbon monoxide and particulate matter (PM_{10} and $PM_{2.5}$) which were problematic in the past, to the current pollutants of concern, which are ozone, particulate matter ($PM_{2.5}$) and air toxics. Concerns for air quality arise when smoke from regional wildfires either blows through the valley or becomes trapped during inversions. In the 2004 Medford Hazard Analysis, this hazard was called Poor Air Quality.

Emerging Infectious Diseases: According to the Centers for Disease Control, disease is a sickness, illness or loss of health. Disease outbreaks can turn into epidemics and pandemics if they spread through a localized community to a broader and more extensive population. In the 2004 Medford Hazard Analysis, this hazard was called Epidemics.

Volcanic Eruptions: Volcanic eruption hazards include: blast effects, ashfall, lahars, landslides, lava flows, and pyroclastic flows. The Cascade Mountain Range, with mountains in Washington, Oregon, and northern California, provides the major source of volcanic activity in the Medford area.

> Volcanic activity may occur within the eastern areas of the region’s counties that coincide with the crest of the Cascade mountain range. Particular areas of vulnerability include Crater Lake, upper reaches of the Umpqua and Clearwater Rivers, and the OR-62 corridor. Most volcanic

activity is considered local. However, lahars and ashfall can travel many miles and small mountain communities, dams, reservoirs, energy-generating facilities, and highways may be vulnerable (Oregon DLCD, 2015).

Wildland-Urban Interface Fires: The areas where development meets vegetative fuels, such as forestland, are commonly referred to as the wildland-urban interface (WUI). WUI fire fuels include both structures and vegetation. The defining characteristic of the WUI is a structure built in or immediately adjacent to essentially continuous vegetation (fuel). Each year a significant number of people build homes within or on the edge of the forest, thereby increasing the risk to this type of wildfire hazard. Medford Fire-Rescue and Oregon Department of Forestry are two of the main responders to WUI fires in the Medford area.

Landslides: The term “landslide” refers to a variety of slope instabilities that result in the downward and outward movement of slope-forming materials, including rocks, soils, and artificial fill. There are three main factors or triggers that determine potential for landslides: slope, soil and rock characteristics, and water content. Four types of landslides – slides, flows, spreads, and topples/falls - are distinguished based on the types of materials involved, the mode of movement, and how they are triggered. Landslides in the Medford area have most commonly consisted of debris flows along stream channels or slides along hillsides whose soils have become saturated during heavy rains.

Appendix C Map Methodology

Chris Olivier, City of Medford Planning Department, served as the Co-Chair of the Steering Committee and as cartographer on the *2017 Medford NHMP*. The following table is his explanation of the methodology used to prepare the maps in this NHMP.

City of Medford			NATURAL HAZARDS MITIGATION PLAN	
Mapping Metadata				
Figure #	**Map Title**	**Layer (if applicable)**	**Description**	**Source**
	Ancestral Territory Cow Creek Tribe	Ancestral Territory	Extent of ancestral territory of Cow Creek Umpqua Tribe	Cow Creek Umpqua Tribe
	Air Quality	Medford-Ashland Air Quality Maintenance Area (AQMA)	With its common airshed, the Rogue Valley boundary was established under the 1990 Clean Air Act Amendments	Rogue Valley Metropolitan Planning Organization (RVMPO) / Rogue Valley Council of Governments (RVCOG)
		Carbon Monoxide (CO)	Medford UGB was established as the non-attainment boundary for CO in 1978	
		Particulate Matter 10 microns (PM10)	AQMA was established as the non-attainment boundary for PM10 in 1987	
	Coquille Tribe	Coquille Five County Service Area	This is an area of special historic, economic, subsistence, social and cultural interest to the Tribe	Coquille Indian Tribe
	Critical Facilities	Critical Facilities Locations	Point data locations of Fire, Police, Federal, State, Hospitals and other facilities	City of Medford
		Schools	Public school locations (Elementary, Middle and High)	
		Bridge	2014 Bridge data includes location and identification	Oregon Department of Transportation (ODOT)
		Water Facilities	Includes control and pump stations, reservoirs, offices and treatment facilities	Medford Water Commission (MWC)
		Water Master Meters	Location of master meters	
		Electrical Substation	Location of PacificCorp's electrical substations	Jackson County
		High Voltage Transmission Lines	Location of PacifiCorp's high voltage transmission lines	
	Dam Inundation Zone	Emigrant Lake Dam Inundation Zone	Dam Inundation Zone affects central Medford along Bear Creek	United States Bureau of Reclamation
		Lost Creek Dam Inundation Zone	Affects area along Rogue River and lower Bear Creek, not in Medford UGB	United States Army Corps of Engineers

City of Medford			NATURAL HAZARDS MITIGATION PLAN	
Mapping Metadata				
Figure #	**Map Title**	**Layer (if applicable)**	**Description**	**Source**
		Hosler Dam Inundation Zone	Dam above Ashland affects Bear Creek, extent does not reach Medford UGB	City of Ashland
		Duff Water Treatment Plant	MWC water intake facility at Rogue River adjacent to Table Rock Bridge	Medford Water Commission
	Earthquake	Unreinforced masonry (URMs) /required Building Safety Dept. review	192 buildings identified in 2017 within Urban Renewal District	City of Medford Building Safety Department
	Economic Assets	Central Business District Boundary	Category from Medford Zoning Overlay	City of Medford Planning Department
		Historic District	Category from Medford Zoning Overlay	
		Employment Center	"Hot spot" layer created using Employment data from OED	
		Average # of Employees (2015)	Symbolized point data featuring # of employees in 5 categories	State of Oregon Employment Department (OED)
	Flood Hazard	Floodway	A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.	Federal Emergency Management Agency (FEMA)
		100-Year Special Flood Hazard Area (SFHA)	The 100-year flood area has a 1% chance of a flood event occurring in any given year.	
		500-Year Special Flood Hazard Area (SFHA)	The 500-year flood area has a 0.2% chance of a flood event occurring in any given year.	
	Household Income	Median Household Income	Source data is from 2014 Census Block Group level data (field B19013e1). It represents an estimate of the Median Household Income in the past 12 months of all households (in 2014 inflation-adjusted dollars)	United States Census Bureau
	Irrigation Districts	Irrigation District Boundaries	Three irrigation districts that serve the Medford UGB are Rogue River Valley, Medford, and Talent Irrigation Districts	Jackson County

City of Medford			NATURAL HAZARDS MITIGATION PLAN	
Mapping Metadata				
Figure #	**Map Title**	**Layer (if applicable)**	**Description**	**Source**
	Landslide Hazard	Landslide Hazard (all)	Raster data depicting landslide susceptibility at a 10 meter resolution. Data was created using Lidar and placed into 4 classes of susceptibility	Oregon Department of Geology and Mineral Industries (DOGAMI)
	Medford Fire-Rescue Response Zones	Medford City Limits	Medford City Limits Boundary	City of Medford
		Medford Fire Stations	Locations of City of Medford Fire Stations and Headquarters	
		Fire Response Zones	Extent of Medford Fire-Rescue Response Zones for inside City Limits (Medford City Response) and outside City Limits (Rural District 2)	
	Medford Slope	Slopes > 35%	The map and data originate from the 2009 Medford Slope Map, dated 6/24/2009, for Section 10.931 of the City of Medford Municipal Code	City of Medford Planning Department
		Slopes 15% - 35%		
	People with Access and Functional Needs (PAFN)	Disaster Registry	Location and amount of residents of individual homes and congregate facilities which self-register	Rogue Valley Council of Governments (RVCOG)
		Poverty by Census Tract	Data is from the American Community Survey (ACS 2014 5 year). The poverty rate is 19.2% in the local metro area.	United States Census Bureau
	Siletz Ancestral Tribes and Homelands	Ancestral Territory	Extent of ancestral territory of Siletz Tribes	Confederated Tribes of Siletz Indians
	Transit Routes	Rogue Valley Transportation District (RVTD) Facilities	Location of Bus Yard (Fuel Station & Headquarters), Front Street Transfer Station and Translink Office	Rogue Valley Transportation District (RVTD)
		Rogue Valley Transportation District t (RVTD) Bus Routes	Individual routes shown in different colors	
		Rogue Valley Commuter Line	Inset map depicts Medford to Grants Pass Commuter Line with stops	Josephine County Transit (JCT)

City of Medford			NATURAL HAZARDS MITIGATION PLAN	
Mapping Metadata				
Figure #	**Map Title**	**Layer (if applicable)**	**Description**	**Source**
	Wildfire	Wildfire Hazard	Represents High-Risk Wildfire Areas. Lands within this overlay are subject to Jackson County Planning & Development Requirements.	Jackson County
		Forestland Urban Interface (SB 360)	Represents 2010 State of Oregon Senate Bill created by State and County	
		Transformer Tower	Location of transformer tower	
	Multiple Maps	Urban Growth Boundary	Extent of Medford UGB	City of Medford
		Streets	Streets symbolized by class: Freeway, State Highway, Arterial, Collector and Other Public Road	Emergency Communications of Southern Oregon

Appendix D Hazard Summary of Climate Trends and Projections

Southern Oregon Climate Action Now

SOCAN

Confronting Climate Change

http://socan.info

Summary of Climate Trends and Projections for Jackson County
for: Medford Natural Hazards Mitigation Plan

Alan Journet Ph.D.

Co-facilitator, Southern Oregon Climate Action Now

This discussion of climate trends and projections focuses on Jackson County, but includes data on recent historic trends for Medford where these are available. Although specific projections for Medford are not available, there is no reason to suspect the pattern would be different from that suggested here for Jackson County as a whole.

As will be seen, in general, the climate projections for Jackson County are largely simple continuations of the trends we are currently experiencing. The following county-wide discussion is based largely on United States Geological Survey (USGS) data on trends and projections formulated from National Oceanic and Atmospheric Administration (NOAA) data and 28 climate models. Medford data come from the local NOAA Weather Service office and NOAA websites.

Graphs from the USGS website depict both recent historic trends and projections through the end of the century. The projections illustrate two scenarios. The red lines (Representative Concentration Pathway - RCP - 8.5), represent a scenario that assumes we continue to consuming fossil fuels at the accelerating rate we have exhibited to date, resulting in an accelerating pattern of greenhouse gas emissions. This is often called the Business As Usual (BAU) scenario. Meanwhile, the blue lines (RCP 4.5) assume we change that trajectory, and slow the rate of accelerating fossil fuel use and GHG emissions by about 50%.

Temperature

The average temperature in Jackson County rose about 1.5 □F during the second half of last century (Figure 1) compared to the mean for that period. Meanwhile, the anticipated BAU average temperature increase by the end of the century will likely be about 9.4 □F. Projected seasonal temperatures indicate summer and fall will be substantially hotter, with notable increases to 2050 – 2074 and 2090-2099 while

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winter and spring temperatures will increase, but to a lesser extent (Table 1). By 2100, July will likely experience a month long high close to 95 □F.

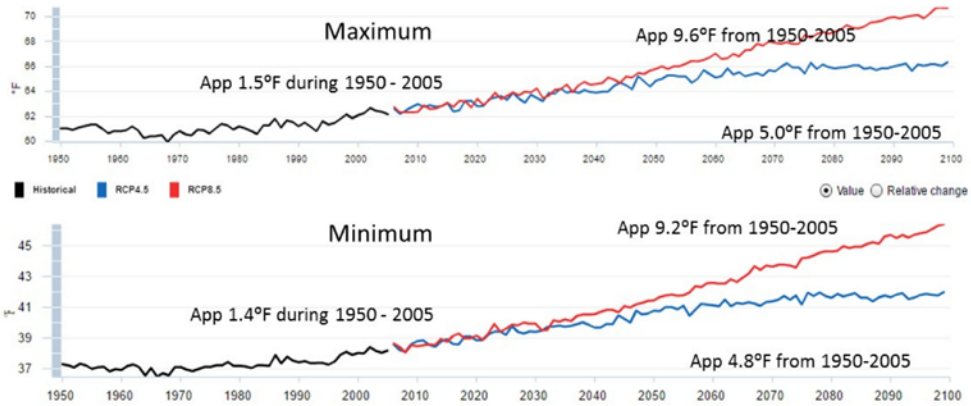

Figure 1. USGS Trends and Projections for Jackson County maximum and minimum temperatures. The Business as Usual projection (red line) suggests an increase across the county of 9.4°F compared to late the 20th Century average. App = approximately.

	1950 – 2005 Ave	2050 – 2074 Ave	Increase	2090 – 2099 Ave	Increase
Winter	36.48	41.28	4.83	44.05	7.73
Spring	45.90	50.45	4.55	53.19	7.95
Summer	63.63	70.47	6.83	74.75	11.77
Fall	50.73	56.72	6.00	60.29	9.73

Table 1. Projected Temperature and increases for the periods 2050-2070 and 2090- 2099 and increases from the late 20th Century (1950 – 2005) average. Data from USGS.

The historic trend for Medford (Figure 2) exhibits a parallel pattern to the county as a whole discussed above. Including temperature data from the recent years of 2014 and 2015 the trend exhibits a century increase of over 2 □F, slightly above the county trend.

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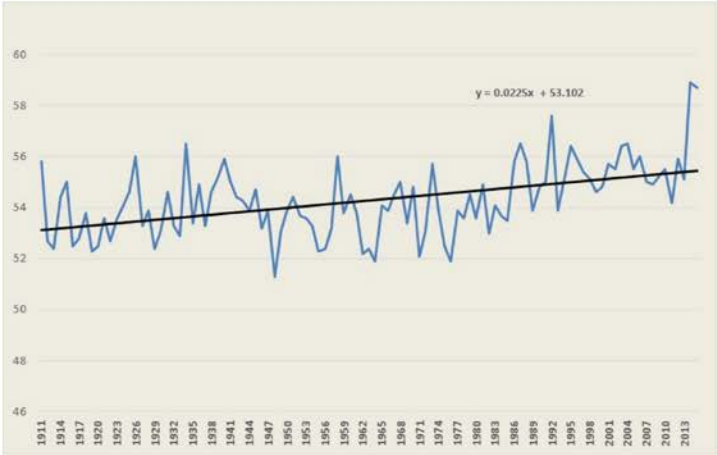

Figure 2 NOAA Historic Temperature trend for Medford through 2015 shows a rise of 2.25°F per century.

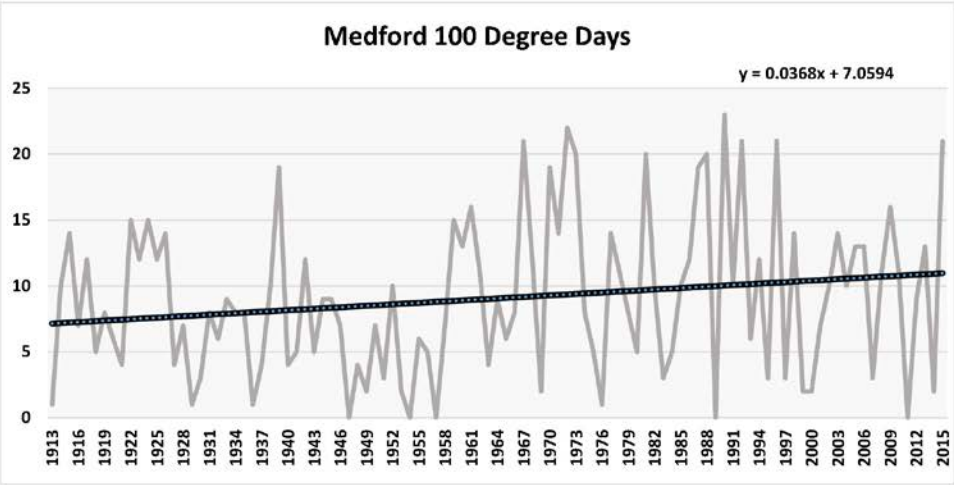

Figure 3. Number of days over 100°F during the last century

3

The trend in days over 100°F in Medford is presented in Figure 3. This shows much variability but an increase from 7 to 11 days. By the end of the century, this value is likely to increase to some 45 days although these are not necessarily expected to be consecutive days (Melillo *et al.* 2014).

Precipitation (including Snowfall)

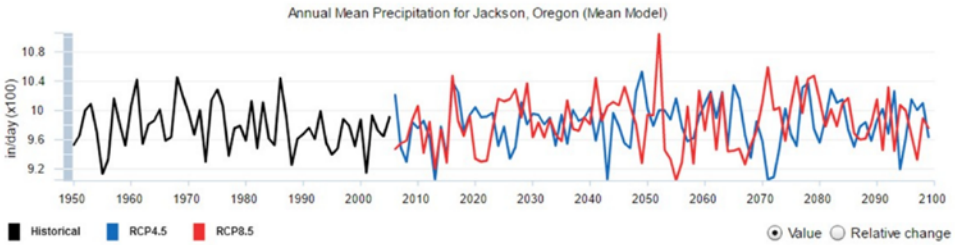

Figure 4. The Jackson County precipitation trend and projections from the USGS.

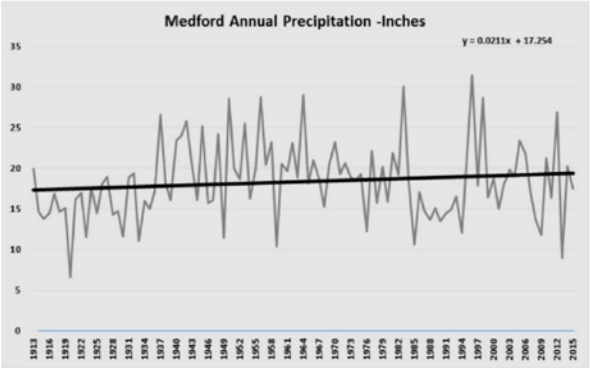

Figure 5. Precipitation trend for Medford.

The historic precipitation pattern for Jackson County has been variable though this pattern is imposed on an overall trend that remains flat (Figure 4). The projection, meanwhile, indicates the annual variability will increase (with wet years likely wetter and dry years likely dryer) but again no overall increase or decrease (Melillo *et al.* 2014).

The precipitation trend for Medford is presented in Figure 5. This shows a historically slight but probably insignificant increase.

Two additional features of the regional (Pacific Northwest) precipitation trend are relevant: seasonal and intensity patterns. In the future, winters are likely to be somewhat wetter, and summers dryer, with spring and fall remaining unchanged (Melillo *et al.* 2014). Additionally, the current trend wherein precipitation falls increasingly as heavy downpours rather than light drizzle will likely continue and become more severe – inducing more frequent flooding, soil erosion, and landslides without replenishing soil moisture as effectively (Melillo *et al.* 2014).

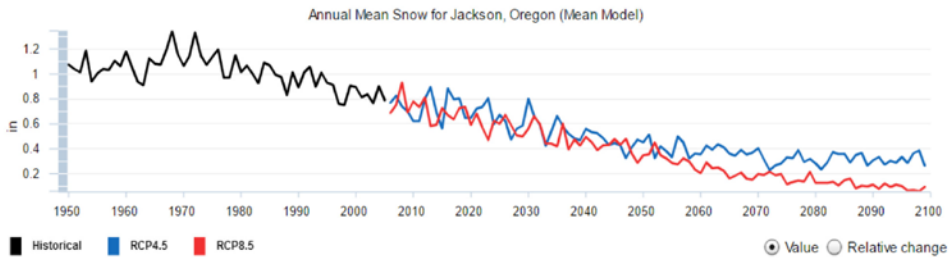

Figure 6. Snowpack, as snow water equivalent, trend and projections for Jackson County

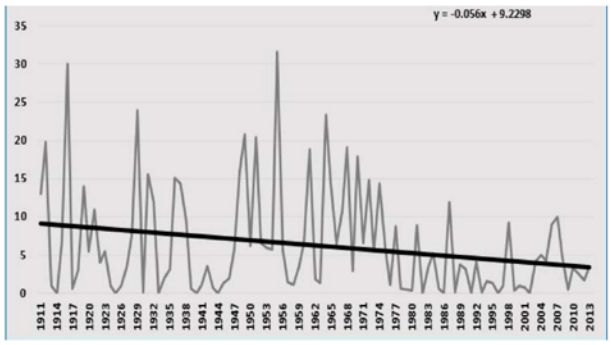

Figure 7. The snowfall trend (inches) in Medford through the last century.

Meanwhile, the trend in snowfall alone (measured and projected in terms of Snow Water Equivalent, SWE) will likely continue declining as it has done since the 1970s (Figure 6). This means declining snowpack, particularly relevant at high elevations since precipitation falls lower as rain rather than higher as snow. By the end of the century, the BAU scenario indicates SWE will be 10-20% of the late 20th century average with many years experiencing no snowfall.

The historic trend for Medford (Figure 7) shows a parallel drop from the 1970s. Meanwhile, snowfall has been declining at Crater Lake since the 1930s (Figure 8). If this trend continues as expected, it is likely to impact Lost Creek Lake storage and Rogue River flow.

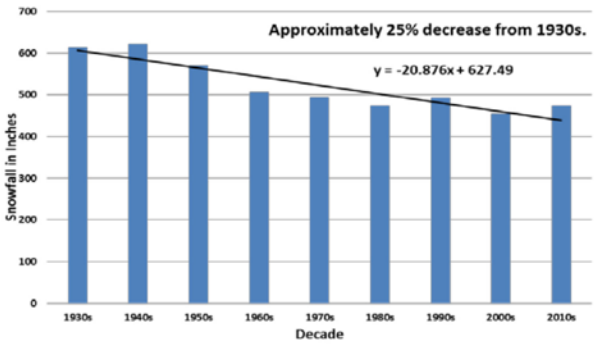

Figure 8. Crater Lake snowfall trends from the 1930s

These trends, combined with that of spring arriving earlier, are likely to have several critically important impacts discussed below.

Temperature and Precipitation Trend Consequences

Evaporative deficit measures the actual evaporation (of available moisture) compared to the potential evaporation (assuming unlimited moisture). When this value is negative, soils dry out. In Jackson County, this value has been rising since the 1970s, and is expected to continue to rise by an estimated 133% by the end of the century (Figure 9).

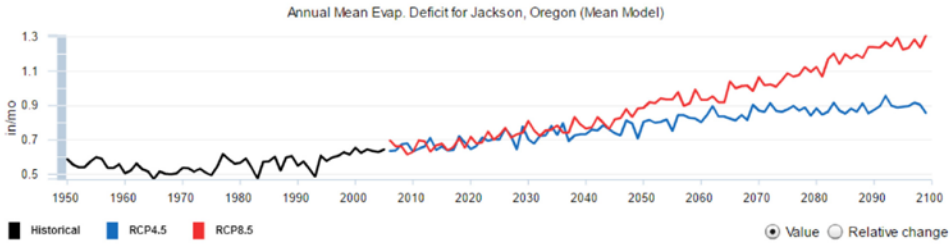

Figure 9. Evaporative Deficit trend and projections for Jackson County

Not surprisingly, the result is reducing soil moisture in Jackson County (Figure 10). Already declining, soil moisture is expected to decline some 20% through the century.

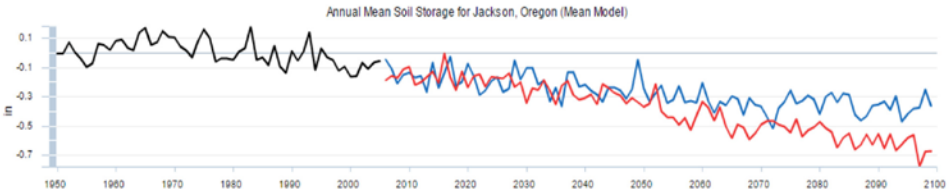

Figure 10. Soil moisture storage trend and projections for Jackson County

Potential Impacts

A reasonable consequence of this set of temperature, precipitation, snowpack, and evaporative deficit trends is drought. An analysis of drought potential for the Western states (Ault *et al.* 2014) suggested that this region has a 40% – 50% chance of experiencing an 11-year drought, with a 20% – 50% chance of experiencing a 35-year mega-drought.

As growing season temperature rises, snowpack dwindles, and spring snowmelt arrives earlier, soils will likely dry out more extensively during summer, with the region anticipating substantially higher wildfire risk. Indeed, these are exactly the factors that correlate with higher fire risk (Westerling *et al.* 2006). Marlon *et al.* (2012), among others, suggest that the region is experiencing a substantial fire deficit as a result of regional warming and changing. Meanwhile, Melillo *et al.* (2014) argue that only a 2.2^{o}F

temperature increase will result in a 300% increase in area burned. In addition to the recreational and economic losses, increased wildfire risk brings greater health risks from smoke and micro-particulates.

The impact of the array of climate trends anticipated for the region are troubling. The combination suggests serious problems for agriculture, forestry, and natural systems because these are all profoundly influenced by the combination of temperature and precipitation patterns that the global warming trend influence globally and regionally.

Should the variables discussed above shift to the extent suggested by the projections, the region will experience considerable changes. It is recommended that we understand the potential impacts, do whatever we can to avert them, and simultaneously manage our biological systems in such a way as to help them adapt to the changes that are a consequence of the emissions already released.

Heat Balance

One reality that is important to appreciate when considering biological effects is the heat balance of organisms. While humans, other mammals, and birds are endothermic – generating their own body heat and regulating body temperature physiologically, ectotherms (insects, fish, amphibians, reptiles, plants) are dependent on external ambient temperature. Up to a critical temperature, which causes overheating and death, warming leads to increased metabolic rate, more rapid growth and development and thus larger populations. Most pathogens and infectious disease organisms fall into this category, as do their vectors. A warming climate thus leads their populations to increase more rapidly and their range to expand towards the North and South Poles and up in elevation.

Natural, Agricultural and Forestry Systems

Several decades ago, R.H. Whittaker (1970) developed a chart (Figure 11) depicting the distribution of the world's natural systems (biomes) in relation to average annual temperature and precipitation. The distribution of biomes around the world is determined largely by these two variables, acting in combination with soil characteristics. The message is that if these variable are modified, even minimally for biomes on the edge of current

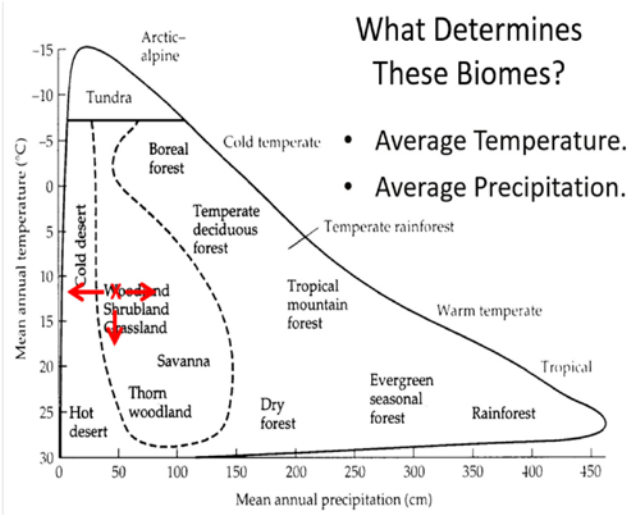

Figure 11. Whittaker 1970 chart depicting biome distribution in relation to temperature and precipitation

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conditions, the survival of current biomes and the species of which they are composed will likely be severely undermined to the point of their being eliminated at least regionally and maybe globally.

The relevance of threat to these natural systems posed by a changing climate is not limited to the loss of biodiversity (native flora and fauna / wildlife), our outdoor recreation areas, critical watersheds, and valuable resources such as forests; it also has direct relevance to us. This is because human agriculture is dependent on exactly the same two variables that control the success of biomes. The best illustration of this is the fact that the American grain belt down the central bank of states of the U.S. exists where the natural biome of grassland / prairie historically existed. Thus, if we compromise natural biomes, we also compromise our agriculture, and our commercial forestry.

By modeling future conditions globally under different atmospheric greenhouse gas concentration scenarios, Williams and Jackson (2007) illustrated the problem clearly (Figure 12). They explored future carbon dioxide concentrations of 850 and 550 ppm (parts per million) compared to the historical (pre-industrial revolution) concentration of about 280 ppm and the current concentration of about 400 ppm. The concentrations they chose represent where we might reach during this century according to the

500-km limit

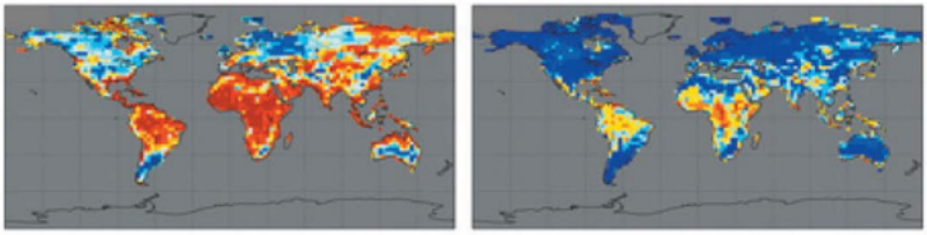

Figure 12. Williams and Jackson (2007) depictions of future biome survival probability under two atmospheric carbon dioxide concentration scenarios (L 850 ppm; R 550 ppm)

BAU scenario (850 ppm), as compared to the scenario comprising a reduced emissions trajectory (550 ppm). Areas that are red indicate there is no possibility that biomes will find a suitable location within the designated distance, while blue areas indicate a probability of 100%. Among the questions they posed was: is there anywhere, within 500 kilometers (about 300 miles) of their current location, that current biomes might find conditions appropriate? This value is a reasonable generalization for biomes since native flora and fauna have a limited capacity for dispersal to locations at great distance from that currently occupied. This distance is controlled by the dispersal capacity of propagules (seeds and juveniles). Additionally, human activities and infrastructure (agriculture, cities, roads etc.) now present barriers to the natural dispersal potential of species.

It is critical to appreciate that the carbon dioxide concentrations are not themselves the cause of the pattern. Rather it is the global warming and climate change consequences of those concentrations that drive the projections. What these authors suggest is that under the 850 ppm scenario most of northern (tropical / sub-tropical) South America and Africa will be devastated. Biomes of the coastal Southwestern and Southeastern United States and northern and southern Australia are similarly threatened as are the biomes of much of Asia. Additionally, note the threat to the grassland biomes and the grain belt of the Central United States. See below for a discussion of potential impacts on Southern Oregon forest species and agriculture.

The impact of future conditions on forests is of particular concern in SW Oregon. Westerling *et al.* (2006) identified warming during the growing season and timing of spring snowmelt as two variables that correlate with increased wildfire activity. As would be expected, warmer summers and earlier spring snowmelt correlate with high fire years since these lead to dryer conditions during late summer and fall.

Rehfeldt *et al.* (2006 and http://charcoal.cnre.vt.edu/climate/species/) evaluated the impact of future conditions on the viability of western tree species. As an example, the current and future viability and range for Douglas fir and Ponderosa pine in Oregon are presented in Figures 13 and 14. The color represents viability from 0.5 (yellow) through 0.75 (green) to 1 (red). Both species are projected to exhibit range contraction in this region. The maps show the current distribution on the left and the future scenario, 90 years from now, on the right.

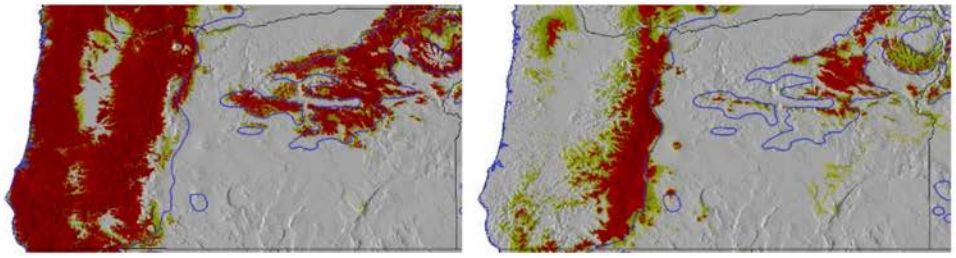

Figure 13. Douglas fir distribution and viability through 21st century.

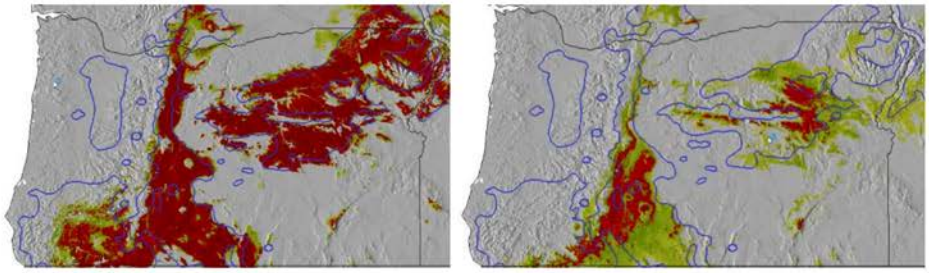

Figure 14. Ponderosa pine distribution and viability through the 21st Century:
In addition, according to Rehfeldt's models, by late century Oregon will be outside the range of the Lodgepole pine.

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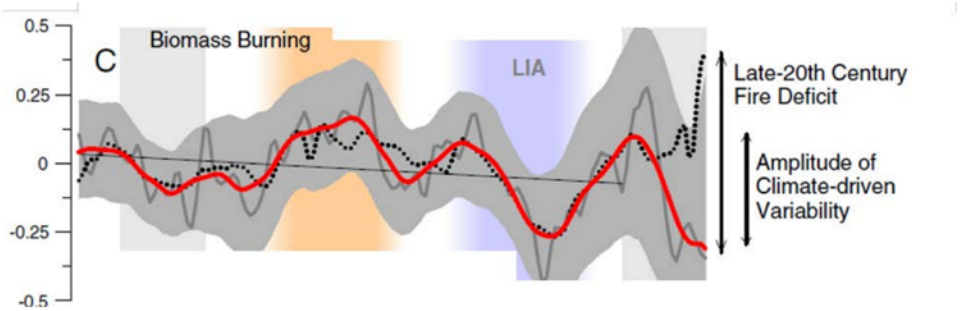
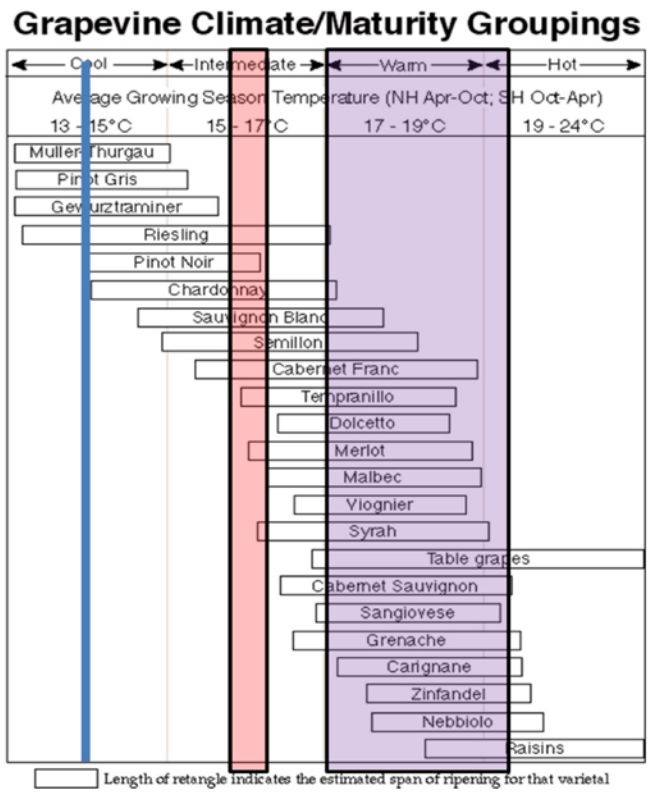


Figure 15. Relative changes in biomass burning in the Western United States for the past 3,000 years indicating the current fire deficit.

Given that many of the climate trends reported above can be traced back to the 1970s, it should be no surprise that the wildfire season in the Western states has expanded some two and a half months since that time. Data from the Interagency Fire Center indicate that the number of wildland acres burned has increased over this period. Climate Central http://www.climatecentral.org/western-wildfire-trends), meanwhile, reports that both the number of western acres burning and the size of western fires has been increasing since that period. However, analyses that include earlier decades and centuries yield a slightly different perspective. Marlon *et al.* 2012, for example, report (Figure 15) that we are currently experiencing an unusually low level of biomass burning. In fact, given the temperature and drought conditions present in the western forests, these authors conclude, that we are experiencing a profound fire deficit. Meanwhile, studies of burn scars in tree trunks reveal that the historical natural fire return interval (average period between natural fire events in a location) through much of the Rogue Basin was less than a decade (Metlen *et*

Figure 16. Optimal growing season temperatures for grape varietals typical of the Rogue Basin. Blue: 1960 – 1999 actual average temperature, Pink - 2035-2045 projected temperature; Purple 2075 – 2085 projected temperatures. Modified from Jones (2006).



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al. 2016). This represents a marked difference from current trends since the imposition of fire suppression, when the fire return interval has lengthened to between 40 and 10,000 years (Metlen *et al.* 2015). With climate change, the tendency will be to return in the direction of the earlier fire return intervals as wildfires occur much more frequently.

Regional Agriculture

Two examples will illustrate the potential impact of these climate trends on our local agriculture: grapes and pears.

Figure 16 depicts the growing season optimum temperatures for wine varietals grown in Southern Oregon (Jones 2006). On this, the late 20th Century growing season actual temperature average are superimposed for the growing season (blue), the 2035-2045 projected average (pink) and the 2075-2085 projected average (purple). The chart suggests the wisdom displayed by vintners who have adjusted to warming through the century by adopting warmer growing season varietals. Unless extreme temperatures are achieved, warmer grape varietals can protect the wine industry. The pattern among grape varietals where colder season varietals are being and will be further compromised can be generalized to other local agricultural crops.

While the warmer conditions during the growing season are one potential problem facing crop production, another is the absence of a sufficient number of chilling hours during winter when the temperature is between 32 and 45 degrees F (about 800 hours for Bartlett pears). This is particularly a threat for perennial crops. While warming winters are not yet sufficient to pose problems for the spring development of pears, with continued warming, this could become a concern in the future.

Freshwater Resources

The impact of the changing climate on our freshwater systems should also be considered. As Myer (2013) reported, the water quality in many of our streams is already compromised. Depleted flow and warming water can only make matters worse – threatening our iconic fish species and the health of our waters for irrigation and consumption. Warmer waters result in reduced oxygen concentration

Figure 17. Outline image of S. Oregon and California indicating future Medford climate possibilities. Map: http://www.netstate.com/states/maps/images/ca_outlinebord.gif

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compromising iconic fish species and causing massive fish kills while also stimulating more rapid development conditions for water and vector borne disease organisms.

Severe Weather

Studies (e.g. Francis and Vavrus 2012, Screen and Simmonds 2014,) have suggested that a primary factor inducing severe weather is the loop in the polar jet stream. The argument (somewhat controversial) is that the passage of the jet stream is influenced by the difference in temperature between the Arctic and Temperate regions. When this difference is large, the Jetstream tends to flow fast and direct. But when the difference is reduced, as is happening because the Arctic is warming faster than the temperate zone, the jet stream is slowed and the wave is increased. As a result, more bouts of extreme weather (storms, floods, heat waves droughts etc.) are experienced in temperate North America. Since the warming Arctic is likely to reduce this temperature difference even further, Oregon should anticipate an increase in the frequency of extreme weather event

Health

It is possible that the direct effects of global warming and climate change on human health are among the most serious that we face; they are, reasonably, certainly among the potential effects that generate most interest and concern among residents.

The following notes have been modified slightly from Oregon Heath Authority and the U.S. Global Change reports.

From Haggerty *et al.* (2014) dealing with Oregon concerns:

Some communities will be affected more than others.
Climate change is likely to make health disparities worse.

- Some populations, like communities of color and low-income households, already bear a disproportionate burden of disease.
- These groups face more exposures to hazards and have fewer resources to recover from climate change related impacts.

Risk is higher among certain groups

- American Indians risk further loss of cultural traditions, sustenance and way of life.
- Older adults are more at risk of heat-related illness and death.
- People in low-income urban neighborhoods are at greater risk of heat-related illness due to the urban heat island effect.
- People living on steep slopes are at risk of landslides and those living at the interface of wildlands are more at risk of wildfire.
- Residents on the coast are more at risk from extreme storms.
- Private well users may be at greater risk of water insecurity.
- People working outside, such as farmworkers and construction workers, are more at risk of negative health effects.
- People working on the front lines of emergencies, including firefighters and first responders, are more at risk of injury and death.
- Children face cumulative impacts over their lifetime, which will be greater than those of earlier generations.

We can work together to protect our families and communities.
Oregon's Public Health Division is taking action to reduce risks.

- Oregon's Public Health Division recognizes that climate affects health in many ways. We are working to further understand our risks and what we can do to prepare for the changes ahead.
- Addressing health disparities and prioritizing the needs of our most vulnerable communities will build Oregon's overall resilience.

Collaboration is essential to building our resilience.

- Taking action requires collaboration across agencies, sectors and cultures.
- Innovative solutions come from our many diverse communities.
- Adapting to climate change includes building local capacity and leadership in traditionally underrepresented communities.

Everyone has a role to play.

- Everyone has a role to play in protecting and improving our quality of life in Oregon. Learn more at: **www.healthoregon.org/climatechange.**

Meanwhile, Crimmins *et al.* 2016, addressing national concerns, pointed out that: "Every American is vulnerable to the health impacts associated with climate change" (p. 3). They listed the major concerns nationally as follows:

- *Extreme Heat:* More frequent severe prolonged heat events cause elevated temperatures which lead to increases in heat related deaths and illness.
- *Outdoor Air Quality:* Increasing temperatures and changing precipitations patterns cause decreasing air quality (ozone, particulate matter, higher pollen counts) which lead to premature death, acute and chronic cardiovascular and respiratory illnesses.
- *Flooding:* Rising sea level and more frequent or intense extreme precipitation, severe storms, and storm surge events cause contaminated water, debris and disruptions to essential infrastructure which lead to drowning, injuries, mental health consequences and other illnesses.
- *Vector-Borne Infection:* Changes in temperature extremes and seasonal weather patterns cause earlier and geographically and temporally expanded tick and mosquito range, leading to increased tick-borne diseases such as Lyme disease and mosquito borne diseases such as malaria.
- *Water-Related Infection:* Rising sea surface, stream, river, and lake temperature, changes in precipitation and runoff affecting coastal salinity cause contamination of recreational waters and marine and freshwater aquatic food which lead to diarrhea, intestinal illnesses, circulatory system infections, and death.
- *Food–Related Infection:* Increased temperature, humidity combined with and extended growing season lead to increased growth rate in pathogens accompanied by seasonal shifts in exposure to such disease agents as *Salmonella* lead to increased risk of gastro-intestinal disease outbreaks – such as *Salmonella* poisoning.
- *Mental Health and Well-being:* Climate change induces increased temperatures and extreme weather events, which results in increased exposure to heat waves and traumatic events such as

disasters. In turn, these result in distress, grief, behavioral health disorders (aggression) and impacts to social resilience.

Chapter 2 of the Medford Natural Hazards Mitigation Plan discusses some of these issues.

More recently, the Oregon Health Authority's Oregon Climate and Health Profile Report (OHAPHD 2017) considers the following:

It starts with building our workforce capacity to promote long-term changes in:

- The plan includes case studies and videos that highlight how our public health workforce is already taking action to build community resilience.
- Our Climate and Health Program is leading a collaborative of local health departments across the state who are implementing resilience strategies.
- Climate and health strategies in the new Resilience Plan include:

policies,

- Actively engaging with our diverse community partners and elevating the voices of our most vulnerable populations to inform policy priorities.
- Informing policies that affect air quality and reduce air pollution.
- Promoting policies that strengthen our local food systems.

systems,

- Conducting regular monitoring of climate and health indicators, and monitoring the progress made on our resilience strategies.
- Equipping our health care partners with the information they need to protect patients from climate-related health risks.
- Supporting community-driven climate adaptations that contribute to building an evidence base for effective climate and health interventions.

and environments,

- Promoting community improvements that encourage walking, biking and the use of public transit.
- Helping to ensure access to safe places for communities to gather, build community and take refuge.
- Prioritizing public health interventions that address the root causes of health inequities and preventable diseases in Oregon.

A Living Reference Point

By mid-century, it is suggested the Medford climate (Figure 17) will resemble that currently experienced by Redding, CA (Mote 2015) with a July average high of 96.8°F and an average January low of 38°F (http://www.bestplaces.net/climate/city/california/redding). Meanwhile, by 2100 Medford summer is likely to experience the current climatic conditions in Delano, CA (near Bakersfield) (http://www.climatecentral.org/news/summer-temperatures-co2-emissions-1001-cities-16583 with 10

inches of annual rainfall, 0.1 inches of annual snowfall, an average July high of 99.9°F, and an average January low of 36°F (http://www.bestplaces.net/climate/city/california/delano).

Conclusion:

Since the FEMA definition of natural hazards as: "A natural hazard is a source of harm or difficulty created by a meteorological, environmental, or geological event" and the Homeland Security (2013) definition as an event "which result from acts of nature, such as hurricanes, earthquakes, tornadoes, animal disease outbreak, pandemics, or epidemics" it seems that events resulting from global warming and the changing disruption that follows should be included in a Natural Hazards Mitigation Plan. The consensus among climate scientists is that the major driver of the global warming that causes the climate disruptions discussed here is human-induced emissions of greenhouse gases.

Global warming and climate disruptions are currently causing, and will undoubtedly cause an increasing frequency of, hazardous events. It is worth noting that the main impact will probably be from the basic advancing and destructive trends as much as from extreme events. Efforts should be directed to preparing for these trends as much as preparing for the extreme events.

One of the clearest messages to be gleaned from the climate trends and projections is that planning – especially natural hazard mitigation planning - should take into consideration what these trends and projections suggest about our future. While we are generally accustomed to relying on recent historic average as the norm which suggest what the next few years will reveal, we should also consider trends. Unless some serious international effort is launched that diverts us from the Business As Usual trajectory, the BAU trajectory is what we will probably follow – at least over the short term.

Evidence suggests the following should be embodied in natural hazard mitigation planning:

1. Increasing temperatures and heat waves that will pose direct and short term health risks especially to vulnerable communities suggesting consideration be given to preparing such communities for the threats and medical centers for the consequences.
2. Decreasing snowpack and increasing drought that pose threats to water supplies, agriculture and forestry – including wildfires with direct recreational economy and human health effects – suggesting a need for systems managers and extension advisers to be preparing for such eventualities.
3. Similar temperature trends increasing the risk of vector and water-borne disease epidemics suggests medical centers should be preparing for such events.
4. Increasing flood risk compromising infrastructure (roads, bridges, water /waste treatment facilities) suggests maintenance, repair and construction plans should account for these threats.
5. That temperature trends will cause problems for inhabitants of insufficiently well-constructed residences suggests consideration should be given to developing building codes that assure preparation for the forthcoming climatic conditions.
6. Since temperature and extreme events cause mental health stress community mental health agencies should be prepared to deal with this.

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Appendix E Planning Documentation

Timeline of Project Activities

July 2014

- DLCD applied for Pre-Disaster Mitigation (PDM) funds from FEMA.

October 2014

- Jackson County Multi-Jurisdictional Natural Hazards Mitigation Plan (MJNHMP) Steering Committee meeting held on October 21, 2014.

March 2015

- Jackson County MJNHMP Steering Committee meeting held on March 11, 2015.

August 2015

- FEMA obligated the PDM 14 grant funding

November 2015

- DLCD and OEM signed the sub-grant agreement for PDM 14.

March 2016

- DLCD received legislative authority to accept and use the PDM 14 grant.

April 2016

- DLCD hired two natural hazard planners.

May 2016

- The new DLCD natural hazard planners begin work, joining the natural hazards team.

- Initial organization meeting for the *2017 Medford NHMP* with DLCD natural hazard planners and City of Medford Emergency Manager et al on May 23, 2016.

June 2016

- Email from Tricia Sears of DLCD to Karen Quigley, Executive Director of the Legislative Commission on Indian Services on June 16, 2016. Email from Tricia Sears to Ben Souede, General Counsel in the Governor's office on June 16, 2016. Email from Tricia Sears to tribal government representatives, as provided by Karen Quigley, on June 20, 2016.

- Initial Medford Natural Hazards Mitigation Plan (NHMP) Steering Committee meeting on June 22, 2016.

- Steering Committee roster and contacts revised as most current list on June 29, 2016.

July 2016

- Phone call and email on July 5, 2016 from Tricia Sears of DLCD to Stephanie Holtey, Community Planner II, City of Central Point, regarding Central Point and Medford NHMPs.

- On July 14, 2016 OEM staff, Dennis Sigrist, submitted a request to FEMA for extension of the grant performance period from September 30, 2016 to September 30, 2017.

- Emergency Management Advisory Group, hosted by Jackson County, meeting on July 19, 2016. Larry Masterman of Medford attended. Agenda included discussion of NHMPs (Medford, Central Point, and Jackson County).

- The initial launch and posting of information about the *2017 Medford NHMP* information is made on the City of Medford website on July 20, 2016.

- Memorandum of Agreement between the City of Medford and the Oregon Department of Land Conservation and Development (DLCD) finalized with signatures by Gary Wheeler, Mayor of the City of Medford on July 27, 2016 and Jim Rue, Director of DLCD, on August 10, 2016.

- Work on data gathering and analysis; Community Profile; Hazard characterization and analysis; probability and vulnerability assessment (OEM methodology); severe and repetitive loss properties; potential dollar loss, conclusions; and mitigation action suggestions.

August 2016

- Work on data gathering and analysis; Community Profile; Hazard characterization and analysis; probability and vulnerability assessment (OEM methodology); severe and repetitive loss properties; potential dollar loss, conclusions; and mitigation action suggestions.

- NHMP GIS Group meeting on August 9, 2016 with Tricia Sears, Larry Masterman, Jim Huber, Chris Olivier, and David Pastizzo.

- Draft *2017 Medford NHMP* informational flyer provided to SC co-chairs Larry Masterman and Jim Huber of the City of Medford on August 2, 2016. The final version of the flyer was provided on August 16, 2016.

- Planning Commission briefing on August 22, 2016. Larry Masterman, Jim Huber, and Tricia Sears presented.

- Phone conversation and follow up with Stephanie Holtey, Central Point, OR regarding NHMPs.

- City Council briefing on August 25, 2016. Larry Masterman, Jim Huber, and Tricia Sears presented.

September 2016

- Preparedness Academy hosted by City of Medford Emergency Management, Medford Chapter of the American Red Cross, Jackson County Library Services, and the Friends of the Medford Library. Classes on September 7, 14, 21, and 28. The *2017 Medford NHMP* flyers were distributed.

- NHMP GIS Group meeting on September 6, 2016 with Tricia Sears, Larry Masterman, Jim Huber, Chris Olivier, and David Pastizzo.

- Larry Masterman interviews: tv on September 6, 2016; radio on September 12, 2016 (KMED); and tv on September 16, 2016 (KOBI).

- On September 14, 2016 we received notification that FEMA approved the July 14, 2016 request from OEM for extension of the grant performance period from September 30, 2016 to September 30, 2017. The request was granted by FEMA on August 30, 2016.

- Central Point NHMP Steering Committee meeting on September 15, 2016. Larry Masterman from City of Medford attended.

- Medford Safety and Emergency Preparedness Fair at the Rogue Valley Mall in Medford on September 17, 2016 with Larry Masterman representing City of Medford Emergency Management. Distributed Medford NHMP flyers.

- The Medford NHMP Steering Committee meeting was held on September 23, 2016. Hazard Analysis work performed.

- Site visit to Roxy Ann Peak in Medford on September 23, 2016. DLCD staff and Medford NHMP Steering Committee members attended.

- On September 26, 2016 a link to the Medford website for the NHMP from the State of Oregon website, was created.

- Continue work on data gathering and analysis; Community Profile; Hazard characterization and analysis; probability and vulnerability assessment (OEM methodology); severe and repetitive loss properties; potential dollar loss, conclusions; and mitigation action suggestions

October 2016

- Medford NHMP GIS Group meeting on October 3, 2016 with Tricia Sears, Chris Olivier, and David Pastizzo.

- Faith-based and Civic Leadership Preparedness Summit on October 8, 2016. City of Medford Emergency Management represented by Larry Masterman. Medford NHMP flyers distributed.

- Draft Medford NHMP (Community Profile and Risk Assessment) available for review on October 14, 2016. Comments were accepted after the comment period closing date of October 28, 2016.

- On October 24, 2016 the City of Medford posted the draft Medford NHMP on their website. Updated versions of the Medford NHMP Table of Contents and Project Schedule were also posted on the City's website.

- On October 28, 2016 the 20 hour CERT training for the Rogue Valley Manor, a senior development, in Medford is completed. It was led by Larry Masterman of the City of Medford.

- Community Profile and Risk Assessment revisions, resulting from comments received during the draft Medford NHMP comment period, are in process.

November 2016

- Review and revise NHMP goals; review and update mitigation actions; prioritize mitigation actions; development Mitigation Action Implementation Plan.

- Medford NHMP GIS Group meeting on November 2, 2016 with Tricia Sears, Chris Olivier, David Pastizzo, and Larry Masterman.

- Larry Masterman was interviewed by KOBI Channel 5 tv, with a focus on earthquakes, in Medford on November 3, 2016.

December 2016

- Steering Committee meeting on December 8, 2016. Mitigation Actions work performed and planning for the Medford NHMP open house.

- Medford NHMP GIS Group meeting on December 8, 2016 with Tricia Sears, Chris Olivier, David Pastizzo, and Larry Masterman.

- Reach out to Medford City Council after November election to orient new council members about the NHMP. Invite City Council and Planning Commission to the open house.

- Leland O'Driscoll, with the ShakeAlert Program at the University of Oregon and the Pacific Northwest Seismic Network, presented on the ShakeAlert Program for the City of Medford senior staff on December 19, 2016.

- Review and update Capability Assessment; revise Mitigation Action Implementation Plan; develop Mitigation Strategy; and develop Plan Maintenance Process. Draft Mitigation Strategy and Plan Maintenance available for review by December 31, 2016.

January 2017

- Larry Masterman interview with the Five on 5, KOBI Channel 5 tv, on January 3, 2017. He discussed emergency preparedness and the NHMP update, with emphasis on the open house on January 12th.

- Medford NHMP GIS Group meeting on January 4, 2017 with Tricia Sears, Chris Olivier, David Pastizzo, and Larry Masterman.

- Larry Masterman is interviewed by the Medford Mail Tribune on January 11, 2017.

- As of the morning of January 11, 2017, the Medford Police Department Facebook page had 7,000 hits. Information about the January 12, 2017 NHMP open house was posted there on January 9, 2017.

- Medford Mail Tribune publishes "Open House on City Disaster Plan Set for Thursday" article on January 12, 2017.

- Medford hosted the NHMP open house on January 12, 2017. Attended by the public, most of the Medford NHMP Steering Committee, and Tricia Sears of DLCD .This event was a collaboration with Jackson County and the Oregon Partnership for Disaster Resilience (OPDR); the open

house also provided a forum for the kickoff for the Jackson County NHMP. Mike Howard and Tarik Rawlings from OPDR attended.

- On January 13, 2017, Jackson County and OPDR hosted the Steering Committee for the Jackson County NHMP. Larry Masterman is on the Steering Committee for the Jackson County NHMP and attended the meeting. Tricia Sears for DLCD also attended.

- Draft Medford NHMP published for review on January 27, 2017. Includes Chapters 1 Community Profile, 2 Hazard Identification and Risk Assessments, 3 Mitigation Strategy, and 4 Planning Process.

February 2017

- Medford NHMP GIS Group meeting on February 2, 2017 with Tricia Sears, Chris Olivier, David Pastizzo, and Larry Masterman.

- On February 8 and 9, 2017 the FEMA G-318 class, Mitigation Planning for Local Governments, was held in Medford, OR. Hosted by FEMA, OEM, DLCD, Medford, and OPDR.

- From February 24-27, 2017 DLCD staff conducted a vote by email for the selection of the mitigation prioritization criteria by the Steering Committee.

- On February 27, 2016, Chris Olivier, Carla Paladino, Larry Masterman, and Tricia Sears briefed the Planning Commission.

- Continue to receive comments on draft NHMP, revise, and add final sections.

- On February 28, 2017 Larry Masterman attended the Steering Committee meeting for the Jackson County NHMP.

March 2017

- On March 1, 2017, Larry Masterman had an interview on Five on 5, KOBI Channel 5, to discuss the Medford NHMP.

- Steering Committee meeting on March 2, 2017. Includes the second work session on the mitigation actions.

- On March 2, 2017, Larry Masterman, Chris Olivier, and Tricia Sears briefed the City Council.

- Medford NHMP GIS Group meeting on March 2, 2017 with Tricia Sears, Chris Olivier, David Pastizzo, and Larry Masterman.

- The Medford NHMP Steering Committee subgroup met on March 8, 2017 to focus on mitigation action prioritization.

- Parts of the draft Medford NHMP published on March 14, 2017 included: Mitigation Actions Tables Only; Hazard Summary of Climate Trends and Projections; Transit map, Household Income map, Earthquake Hazard map; and People with Access and Functional Needs map.

- From March 13-29, 2017 DLCD staff conducted a vote by email for the selection of the top ten mitigation actions by the Steering Committee.

April 2017

- Draft Medford NHMP comments due to DLCD by April 3, 2017.

- On April 14, 2017, DLCD Natural Hazards Planner, Tricia Sears, submitted the Draft Medford NHMP to the Oregon Office of Emergency Management and to FEMA for review.
- Jackson County NHMP Steering Committee meetings April 19-21, 2017.

- Complete FEMA local NHMP review tool.

- Make any changes required by OEM or FEMA.

May 2017

- Submit revised NHMP to OEM and FEMA on May 26, 2017. On May 23, 2017, OEM Planner, Joseph Murray, contacted Tricia Sears, and Larry Masterman, Emergency Management Coordinator at the City of Medford, that he had submitted the Draft Medford NHMP to FEMA. He requested no revisions.

- On May 26, 2017, Tricia Sears provided a revised Draft Medford NHMP to OEM and FEMA. This version incorporated some changes to references and other parts, which DLCD and the City of Medford wished to refine.

June 2017

- On June 27, 2017, Amanda Siok, Mitigation Planner, FEMA, contacted Tricia Sears, Joseph Murray, and Angie Lane, OEM, to inform them that revisions were needed to the Draft Medford NHMP.
- June 28, 2017, Tricia Sears and Joseph Murray discussed the FEMA response in the Local Mitigation Plan Review Tool. Tricia emailed Larry and Joseph with comments. The dialogue continued on June 29 and 30, 2017.
- On June 30, 2017, Joseph emailed Amanda stating that we believe the Draft Medford NHMP meets the requirements, with an explanation of how and why.
- On June 30, 2017 Amanda responded to say that she would review the information further and respond to us on July 5, 2017.

July 2017

- On July 6, 2017, Tricia Sears, Joseph Murray, Larry Masterman, and Amanda Siok had a conference call to discuss the requested revisions to the Draft Medford NHMP.

- On July 26, 2017, Tricia Sears informally submitted the revised Draft Medford NHMP to Amanda Siok for comments. Joseph Murray, Larry Masterman, and Brett Holt were cc’d on the email.

August 2017

- August 8, 2017, Tricia Sears submitted the revised Draft Medford NHMP to Amanda Siok at FEMA and to Joseph Murry at OEM. Larry Masterman, and Brett Holt were cc'd on the email.

- On August 15, 2017 Medford received the "Approvable Pending Adoption" letter and the Local Mitigation Plan Review Tool with comments from FEMA.

September 2017

- A Medford City Council session was held on September 7, 2017 to discuss the *2017 Medford NHMP*. Fire Chief Brian Fish presented the *2017 Medford NHMP*. City Council voted to approve the *2017 Medford NHMP* and signed the corresponding resolution adopting it.

- The FEMA final approval letter was issued on September 14, 2017 stating that the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, approved the *2017 Medford NHMP* on September 13, 2017. The approval is valid through September 12, 2022.

- A final PDF of the *2017 Medford NHMP* was prepared and provided to relevant parties.

Project Schedule

Medford Natural Hazards Mitigation Plan (NHMP) Update PROJECT SCHEDULE June 22, 2016 Updated January 30, 2017	
MONTH	**STEERING COMMITTEE (SC) TOPIC**
June 2016	**Project Initiation**
SC: Wednesday, 6/22, 1-3 pm (milestone date 6/15/16)	• Memorandum of Agreement/ Statement of Work (MOA/SOW) • Cost Share Documentation Form • Project Schedule • Ground Rules • Community Partners Committee membership (draft) • Public Engagement Program • Draft Table of Contents • Finalize SC membership (milestone date 6/30/16)
July 2016	**Community Profile (CP) & Risk Assessment (RA)**
SC: NA	• Data gathering and analysis • Work on and draft: ○ Community Profile ○ Hazard Characterization & Analysis ○ Probability & Vulnerability Assessment (OEM methodology) • Continue to work on and discuss draft: ○ Vulnerability Assessment ○ Severe/Repetitive Loss Properties ○ Potential Dollar Loss ○ Conclusions ○ Mitigation action suggestions
August 2016	**Community Profile & Risk Assessment**
SC: NA Planning Commission: Monday, 8/22, noon-1 pm City Council: Thursday, 8/25, noon-2pm	• Continue data gathering and analysis • Continue to work on and discuss draft: ○ Community Profile ○ Hazard Characterization & Analysis ○ Probability & Vulnerability Assessment (OEM methodology) • Continue to work on and discuss draft: ○ Vulnerability Assessment ○ Severe/Repetitive Loss Properties ○ Potential Dollar Loss ○ Conclusions ○ Mitigation action suggestions
September 2016	**Community Profile & Risk Assessment**
SC: Friday, 9/23, 1-3 pm Optional fieldtrip 10 am-noon 9/23/16	• Planning Commission and City Council meetings for work sessions before SC meeting • Steering Committee meeting, targeted the week of September 19th
October 2016	**Community Profile & Risk Assessment**
SC: NA (milestone date 10/31/16)	• Draft CP & RA available for review (first two weeks of October) • Revise CP & RA (integrate comments received) (milestone date 10/31/16)

Medford Natural Hazards Mitigation Plan (NHMP) Update PROJECT SCHEDULE June 22, 2016 Updated January 30, 2017	
MONTH	**STEERING COMMITTEE (SC) TOPIC**
November 2016	**Mitigation Strategy (MS) & Plan Maintenance (PM)**
SC: NA (milestone date 12/31/16)	• Review and revise NHMP Goals • Review and update mitigation actions • Prioritize mitigation actions • Develop Mitigation Action Implementation Plan
December 2016	**Mitigation Strategy & Plan Maintenance**
SC: Thursday, 12/8, 9 to 11 am (milestone date 12/31/16)	• Review and update Capability Assessment • Revise Mitigation Action Implementation Plan • Develop Plan Maintenance Process • Draft MS and PM available for review (milestone date 12/31/16)
January 2017	**Risk Assessment & Mitigation Strategy & Plan Maintenance**
SC: NA Open house: Thursday, 1/12/17, 4:30-7:30 pm	• Host open house (milestone date 1/15/17) • Draft NHMP available (includes CP, RA, MS, PM, Documentation of Planning Process) (milestone date 1/31/17)
February 2017*	**Risk Assessment & Mitigation Strategy & Plan Maintenance**
SC: Planning Commission: 2/27/17 noon	• Receive comments on draft NHMP, revise, add final sections • Planning Commission briefing during session, noon to 1:30 pm • Draft full NHMP available (includes Exec Sum, Intro, Acronyms) (milestone date 2/28/17)
March 2017	**Finalize NHMP**
SC: Thursday, 3/2/17, 9 to 11 am City Council: 3/2/17 noon	• Draft full NHMP available (includes Exec Sum, Intro, Acronyms) (milestone date 2/28/17) • City Council briefing during session, noon to 2 pm • Finalize draft full NHMP (milestone date 3/30/17)
April 2017	**OEM & FEMA Review**
SC: NA	• Submit to OEM and FEMA (milestone date 4/1/17) • Complete FEMA local NHMP review tool • Make any changes required by OEM or FEMA
May 2017	**OEM & FEMA Review**
SC: NA	• Make any changes required by OEM or FEMA • Receive "Approvable Pending Adoption" from FEMA • Schedule NHMP for adoption at City Council
June 2017	**Adoption**
SC: NA	• City Council adopts NHMP (milestone date 6/30/17) • FEMA Final Approval (milestone date 6/30/17)
Note *	*February SC meeting scheduled for March due to FEMA G-318 class in Medford February 8 & 9, 2017 and the FEMA Mitigation Summit in Lynnwood, WA February 13-16, 2017
Note 1	Phone and email contact of committee members will occur throughout the NHMP process.
Note 2	The Steering Committee chose to have one committee.

TIMELINE VIEW 6/29/16

Steering Committee

Initiation	Community Profile & Risk Assessment				Mitigation Strategy & Plan Maintenance		CP & RA & MS & PM		Finalize & OEM/FEMA Review		Revise & Schedule	Adopt
Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17

Public Engagement Program

Medford NHMP Update
DRAFT Public Engagement Program
June 22, 2016

Public Engagement Program (PEP) Goals:

A. Raise awareness of data on hazards, vulnerabilities, risks, and what has been and is being done to mitigate them.
B. Receive thoughtful and actionable comments on Risk Assessment and Mitigation Strategy drafts.
C. Generate ideas for NHMP goals and mitigation actions.
D. Generate support for adopting the updated NHMP.
E. Generate support for integrating the NHMP into the comprehensive plan and other plans, policies, and programs.

Public Engagement Program Policies:

A. The PEP will establish an open and transparent planning process.
B. All meetings will be duly advertised and open to the public.
C. The CITY OF MEDFORD will participate to the full extent of its ability in executing a robust local outreach strategy to generate public awareness, interest, and participation.
D. At least two opportunities for public comment will be included, one during drafting and one prior to plan approval.
E. "The public" that MEDFORD will identify and to whom it will reach out includes but is not limited to:
    a. Neighboring communities;
    b. Local and regional agencies involved in hazard mitigation activities;
    c. Agencies that have the authority to regulate development;
    d. Businesses;
    e. Academia;
    f. Other private and non-profit interests; and
    g. Underrepresented populations.
F. MEDFORD will identify and recruit for service as the Community Partners Committee, community members and local, state, and federal agency staff who represent each of the "whole community" sectors as set forth in current FEMA documents:
    a. Emergency management;
    b. Economic development;
    c. Land use and development;
    d. Housing;
    e. Health and social services;
    f. Infrastructure; and
    g. Natural and cultural resources.

Medford Public Engagement Program Strategies:

#	Strategy	Yes will do	Under consideration	No	Comments
1.	Establish an interactive website where people can review and comment on drafts.				
2.	Post meeting announcements and meeting materials to a website.				
3.	Post materials for comment to website.				
4.	Drive web traffic to the interactive website to afford all people an opportunity to comment online.				
5.	Establish a listserve to which people can subscribe to for project information.				
6.	Email notice of meetings and comment opportunities to a listserv.				
7.	Email notice of meetings and comment opportunities to other email lists.				
8.	Establish a dedicated email box for receiving comments from website and other sources.				
9.	Issue media releases to: • Radio stations • Television stations • Newspapers				
10.	Advertise using closed circuit local public television: • Advertisements • Interviews				
11.	Stream meetings live online.				
12.	Archive meetings online for later scheduled or on-demand public viewing.				
13.	Publish meeting notices in newspaper event listings.				
14.	Insert flyers about upcoming meetings and events into newspapers.				

#	Strategy	Yes will do	Under consideration	No	Comments
15.	Insert information about upcoming meetings and events into utility bills.				
16.	Distribute flyers to: • Schools • Community Centers • Libraries • Fire Stations • Police Stations • City Hall				
17.	Hold at least one public meeting to obtain comments on the draft Risk Assessment and Mitigation Strategy sections.				
18.	Provide information at booths or tables during public events.				
19.	Steering Committee Meetings: • Provide notice of meetings. • Provide time for public input.				
20.	Community Partners Committee: • Provide notice of meetings. • Provide time for public input.				
21.	Planning Commission Work Sessions: • Follow regular notice procedures. • Provide time for public input (if applicable).				
22.	Board/Council Work Sessions: • Follow regular notice procedures. • Provide time for public input (if applicable).				
23.	Adoption Proceedings: • Follow regular notice procedures. • Provide time for public input.				

Steering Committee Agendas

City of Medford NHMP Update
Steering Committee Meeting

Wednesday, June 22, 2016
1:00 – 3:00 PM

City of Medford Emergency Management
411 W. 8th Street, Room 330, Medford Room
Medford, OR 97501

AGENDA

I. Welcome & Introductions — Larry Masterman

II. NHMP Update Project — Tricia Sears
- What is the NHMP? Why is it important?
- NHMP Grant, including Cost Share
- DLCD Roles and Responsibilities, Memorandum of Agreement/ Scope of Work
- Planning Process and Schedule
- Post-NHMP Implementation

III. Steering Committee — Larry and Tricia
- Technical Advice and Policy Direction (Decisions, Recommendations)
- Participation in Public Meetings (Open House, Planning Commission and City Council work sessions)
- Project Schedule (Review and Establish Meeting Dates)
- Elect a Chair
- Ground Rules
- Existing Codes, Policies, and Programs
- Data (Updates to Calculations and Maps, Deadline for References)

IV. Community Partners Committee — Larry and Tricia
- Additional Partners
- Special Districts

V. Public Engagement Program — Larry and Tricia
- Review and refine draft

VI. Proposed Reorganization of NHMP — Larry and Tricia
- Review proposed Table of Contents

VII. Next Steps — Tricia

Materials
From Medford: Draft roster of Steering Committee and printed copies of 2010 NHMP
From DLCD: Memorandum of Agreement/ Scope of Work; Meeting Agenda; Project Presentation; Cost Share Documentation Form; Draft Project Schedule; Draft Steering Committee Ground Rules; Draft Public Engagement Program; Draft Table of Contents

City of Medford NHMP Update
Steering Committee Meeting

Friday, September 23, 2016
1:00 – 3:00 PM

City of Medford Emergency Management
411 W. 8th Street, Room 330, Medford Room
Medford, OR 97501

AGENDA

I. Welcome & Introductions (5 min) — Larry Masterman

II. Medford NHMP Update (15 min) — Tricia Sears et al
- What has happened since the June 22, 2016 SC meeting
  - Field trip this morning to Roxy Ann Peak
  - MOU/SOW signed
  - City of Medford website about NHMP
  - Medford NHMP Flyer (see handout)
  - August 22 at Planning Commission and August 25 at City Council
  - Draft NHMP text and maps in process
  - Updated Project Schedule and Table of Contents (see handouts)
  - New Irrigation Districts map (see handout)
- Committee member updates and news

III. Hazard Analysis (HA) Work Session (90 min) — Larry and Tricia
- Introduction, Explanation, Warm Up Exercise
- HA Worksheet and Significant Historic Hazard Events Tables (see handouts)

V. Next Steps and Actions (10 min) — Tricia
- Next SC meeting date, target December 2016
- Open House date, target January 2017
- Doodle polls will be sent to select specific dates for the SC and open house meeting dates
- Draft Medford NHMP Chapters Community Profile and Risk Assessment go out for SC and public review, publish it the week of October 3-7 and provide two weeks for comment
- Next Planning Commission and City Council meetings, January 2017

Materials
Updated Steering Committee Roster Contacts
Meeting Agenda
Medford NHMP Flyer
Updated Project Schedule
Revised Table of Contents
HA Worksheet
Significant Historic Hazard Events Tables
Irrigation Districts Map
Meeting Sign In sheet
Printed copies of 2010 NHMP (as needed)

City of Medford NHMP Update
Steering Committee Meeting

Thursday, December 8, 2016
9:00 – 11:00 AM

City of Medford Police Department Building
219 S. Ivy St., Community Room
Medford, OR 97501

AGENDA

I. Welcome & Introductions (5 min) — Larry Masterman

II. Medford NHMP Update (15 min) — Tricia Sears et al
- Draft Medford NHMP (10/14/16 version) Responses and Revisions
- Updated Project Schedule and Table of Contents (with notes) (see handouts)
- Discussion and Vote on the Title of Section 9 in Chapter 2
  - Epidemics, Disease, Disease Outbreaks, or Emerging Infectious Disease
- Medford NHMP Open House Planning
  - January 12th from 3:30 to 7:30 pm at the Carnegie Building, Community Room
  - Collaboration with OPDR and Jackson County to also kickoff their NHMP
  - Medford NHMP Open House Flyer (see handout)
  - Attendance and schedule of panel of speakers
- FEMA G-318 class in Medford on February 8 and 9, 2017 (see handout)
- Committee member updates and news

III. Mitigation Actions Work Session (90 min) — Larry and Tricia
- Introduction and Explanation
- Mitigation Actions Tables: Existing and Proposed Changes (see handout)

V. Next Steps and Actions (10 min) — Tricia
- Next SC meeting, preferences of dates and times in February or March 2017
- Doodle poll will be sent to select a specific date and time for the next SC meeting
- Draft Medford NHMP out for review to the Steering Committee and public the week of January 2nd; comments due the week of January 23rd
- Next Planning Commission and City Council meetings, January or February 2017

Materials
Updated Steering Committee Roster Contacts
Meeting Agenda
Updated Project Schedule
Revised Table of Contents
Medford Open House Flyer
FEMA G-318 Class Flyer
Mitigation Actions Tables
Meeting Sign-In Sheet
Printed copies of 2010 NHMP (as needed)

City of Medford NHMP Update
Steering Committee Meeting

Thursday, March 2, 2017
9:00 – 11:00 AM

City of Medford Police Department Building
219 S. Ivy St., Prescott Room
Medford, OR 97501

AGENDA

I. Welcome & Introductions (5 min) — Larry Masterman

II. Medford NHMP Update (20 min) — Tricia Sears et al
- Draft Medford NHMP dated 1/27/17, Responses and Revisions
- Draft Climate Appendix dated 2/26/17
- Updated Project Schedule and SC Roster (see handouts)
- Debrief on the Medford NHMP Open House on January 12, 2017
- Debrief on the FEMA G-318 class in Medford on February 8 and 9, 2017
- Debrief on the Planning Commission meeting on February 27, 2017
- Upcoming City Council meeting on March 2, 2017
- Committee member updates and news

III. Mitigation Actions Work Session (75 min) — Larry and Tricia
- Introduction and Explanation
- Mitigation Actions Tables (see handouts)
- Additional Work

IV. Next Steps and Actions (20 min) — Tricia
- Next SC meeting? If needed, preferences of dates and times?
- Doodle poll will be sent to select a specific date and time for the next SC meeting
- Medford NHMP out for review to SC and public the week of March 13-17, 2017
- Medford NHMP out for review to FEMA and OEM the week of April 3, 2017
- Next Planning Commission and City Council meetings, June 2017

Materials
Meeting Agenda
Project Schedule (dated 1/30/17)
Steering Committee Roster Contacts (dated 2/17/17)
Mitigation Actions Tables (dated 2/28/17)
Mitigation Actions Considerations from the STAPLEE Method (dated 2/28/17)
Meeting Sign-In Sheet

Planning Commission Agendas

Planning Commission

Agenda

Study Session

August 22, 2016
Noon

City Hall, Medford Room 330
411 West Eighth Street, Medford, Oregon

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10. Introductions

20. Discussion item

20.1 National Hazards Mitigation Plan

20.2 Wetland Regulations

30. Adjournment

Planning Commission Agenda

Planning Commission

Agenda

Study Session

February 27, 2017
Noon

City Hall, Medford Room 330
411 West Eighth Street, Medford, Oregon

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10. Introductions

20. Discussion items

20.1 National Hazards Mitigation Plan

20.2 Greenway Trails Amendment Initiation

20.3 TSP amendment regarding Foothills Rd.

30. Adjournment

City Council Agendas

City Council Study Session

Revised Agenda

August 25, 2016
12:00 PM
City Hall, Medford Room
411 West 8th Street, Medford, Oregon

1. Water Commission Update on Lead Issues
2. Natural Hazard Mitigation Plan

NHMP Informational Flyer

Medford Natural Hazards Mitigation Plan Update

August 2016

Windstorms, Heat, Floods, Earthquakes, Wildfires…
What Concerns You?

Communities are stronger when they recognize the risks from natural hazards and make efforts to prepare for them and to reduce potential damage.

The City of Medford's first ***Natural Hazards Mitigation Plan*** (NHMP) was completed in November 2004 and updated in August 2010.

Now, the City of Medford is collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update the NHMP again. The updated NHMP will continue the City's eligibility for disaster related funding.

> ***"The overarching mission and purpose is to protect people, property, and the environment from the impact of natural disasters."***
>
> City of Medford 2010 Natural Hazards Mitigation Plan

A Steering Committee, co-chaired by the Emergency Management Coordinator and the Planning Director, is working with the DLCD staff to update the NHMP. The NHMP is targeted for completion by June 30, 2017.

Oregon Department of Land Conservation and Development

For more information and to provide comments:

Larry Masterman, Emergency Management Coordinator | City of Medford | #541-774-2091
Website: http://readymedford.org
Email: Naturalhazards@cityofmedford.org

CITY OF MEDFORD OREGON

Emergency preparedness and hazard mitigation planning involve preparing the individual and the community for hazards that may impact them.

Why engage in natural hazard mitigation planning?

- ***To avoid disasters*** by reducing or eliminating long-term risk to people, property, and the environment from natural hazards.
- ***To maintain eligibility*** for disaster related funding.
- ***To increase safety and resiliency*** by integrating hazard mitigation into the City of Medford's plans, programs, and policies.

What are the basic NHMP requirements?

- ***Review and revise*** the Natural Hazards Mitigation Plan to:
  - Incorporate ***new information***,
  - Show ***progress in mitigation***, and
  - Document ***changes in priorities***.
- Submit to state and federal agencies for ***re-approval every five years***.

Medford's Natural Hazards

severe weather
floods
earthquakes
wildfires
air quality
landslides
volcanic eruptions
disease outbreaks

Integration

of the NHMP with Medford's plans, programs, and policies helps ensure that hazard mitigation will be considered in emergency management and land use planning decisions - making the community ***safer and more resilient.***

Medford flyer 8-16-16

R U Ready Flyer

Local emergency agencies and nonprofit organizations will display vehicles and equipment, give away preparedness and safety items along with giving valuable information to help you before, during and after a disaster.

Prepare Out Loud Flyer

American Red Cross
Cascades Region

Prepare Out Loud

Learn the facts. Take action. Talk about it.

Together we can rise to the challenge of a Cascadia Earthquake.

The American Red Cross Prepare Out Loud presentation will empower you to be ready for disasters of all kinds (including a Cascadia earthquake) by taking practical steps to start preparing, being vocal about your preparedness and encouraging others to start preparing.

Learn more about:

- The science and history of the Cascadia Subduction Zone
- Human behavior during disasters
- What to expect during and after a Cascadia earthquake
- How to prepare to quickly locate your loved ones following a disaster
- How much food, water, and supplies you will need to take care of yourself and others

Free to attend

WHEN: THURSDAY
OCTOBER 6, 2016
5:30 – 7:00 PM

WHERE: Asante's Smullin Health Education Center
2825 E BARNETT RD
MEDFORD, OR 97504

Register at:
redcross.org
PrepareOutLoudMedford

in partnership with — *community partners*

ASANTE® · RV COAD · LIVE UNITED United Way of Jackson County · THE CHAMBER · JACKSON COUNTY oregon

What others are saying about Prepare Out Loud

usbank.

"Prepare Out Loud offers informative, practical and easy-to-implement steps to help people take immediate action. Those who attend will feel inspired and empowered to prepare."

– Karen Kervin
U.S. Bank Vice President and Community Relations Manager

FredMeyer.

"The Prepare Out Loud presentation is an absolute eye opener! You will learn about different types of earthquakes and understand their potential impact. You will learn the steps you must take to plan ahead and what to do when an earthquake occurs. It motivated me to complete my own personal planning and preparation. Be 'prepared' for an engaging and informative session. Don't miss it!"

– Louisa Awbery
Fred Meyer General Merchandise Manager

NW Natural

"We know we need to prepare for a disaster and Prepare Out Loud helps people and organizations know where to start. I came to the presentation knowing I would learn more about the hazards we face in the Pacific Northwest, such as the Cascadia Subduction Zone. What I didn't realize is how motivating the topic could be. Prepare Out Loud is inspiring thought-provoking conversations and stimulating preparedness."

– Von Summers
NW Natural Community Affairs Manager

BOMA Oregon

"My family is prepared, but before Prepare Out Loud, I had not given a lot of thought to my employees, friends and neighbors personal preparedness. It should be all of our jobs to make sure our employees (and friends, and neighbors) are prepared. Prepare Out Loud was an informative and engaging presentation. I encourage everyone to attend."

– Susan Steward
BOMA Oregon Executive Director

American Red Cross
Cascades Region

redcross.org/PrepareOutLoud

Faith and Civic Leaders Disaster Summit Flyer

FAITH AND CIVIC LEADERS
DISASTER SUMMIT

Date: Saturday, October 8, 2016
Time: 10 a.m. - 3 p.m.

Location: Sacred Heart Catholic Church
517 W. 10th Street
Medford, OR 97501

Join Us!

Learn How To:

- Better prepare your congregation and community for disasters
- Understand the roles of emergency response agencies
- Involve your faith community in preparedness and disaster relief efforts
- Enroll in FREE Red Cross preparedness and response training
- Be part of a readiness network for faith-based leaders

Summit Presentations Include:

- Understanding Local Hazards
- Red Cross Disaster Response & Programs
- A Presentation on the Cascadia Subduction Zone
- Preparedness Measures Against Active Threats
- Panel of Responders from the Umpqua Community College tragedy
- Testimony from a Fire Department Leader who Lost Their Home to a Wildfire.

American Red Cross

Register at **redcross.org/MedfordDisasterSummit**

This summit is made possible by the efforts of a local planning committee comprised of faith, civic and government leaders in partnership with the American Red Cross.

Preparedness Academy Flyer

Jackson County Library Services

Medford Branch Library
205 South Central Ave
541-774-8679
jcls.org

Wednesdays in September, 6 – 8 p.m.

Preparedness Academy

Severe weather, floods and large earthquakes are in our future. Our communities are stronger when we are prepared for those emergencies. As part of National Preparedness Month, join the Preparedness Academy. The four sessions will help you to prepare for the worst, including assembling an emergency kit on a shoestring budget.

Enrollment is limited, please call 541-774-8679 or email *medref@jcls.org* to reserve your spot.

September 7: Local Hazards and Threats
September 14: Family and Individual Emergency Planning
September 21: Preparing your Personal Emergency Kit
September 28: Getting Involved for a More Resilient Community

Preparedness Academy is proudly sponsored by Jackson County Library Services, the Friends of the Medford Library, the Medford Chapter of the American Red Cross, and City of Medford Emergency Management

NHMP Open House Flyer

City of Medford
Natural Hazards Mitigation Plan

Severe Weather, Floods, Earthquakes, Wildfires, Landslides, Volcanic Eruptions, Emerging Infectious Disease … What Concerns You?

COMMUNITY OPEN HOUSE

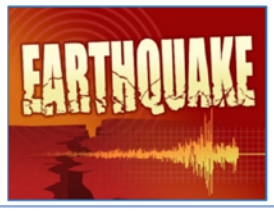
Carnegie Library
413 W. Main St. Medford, OR 97501

Drop by any time!

January 12, 2017 4:30 pm to 7:30 pm

Focused panel presentations and discussion are included:

5:15 pm: Youth and social services
6:00 pm: Business
6:45 pm: Community and hazards



Copies of the draft **Natural Hazards Mitigation Plan (NHMP)** and maps will be available for review. Representatives from the following groups will be present.

- City and County departments
- State of Oregon
- Oregon Partnership for Disaster Resilience
- Non-governmental organizations
- Special districts
- Business
- Tribes

Oregon Department of Land Conservation and Development

For more information or to provide comments:

Larry Masterman, Emergency Mgt. Coordinator
City of Medford | #541-774-2091
Website: http:/readymedford.org
Email: Naturalhazards@cityofmedford.org

CITY OF MEDFORD OREGON

The City of Medford is updating its Natural Hazards Mitigation Plan (NHMP) in collaboration with the Oregon Department of Land Conservation and Development (DLCD). The updated NHMP will continue the City's eligibility for disaster related funding. The NHMP is targeted for completion by June 30, 2017.

Integration of the NHMP with Medford's other plans, programs, and policies helps ensure that hazard mitigation will be considered in emergency management and land use planning decisions - making the community safer and more resilient.

HOW DOES THE CITY OF MEDFORD NHMP FIT INTO THE JACKSON COUNTY NHMP?

Jackson County is also in the process of a NHMP update and is collaborating with the Oregon Partnership for Disaster Resilience (OPDR). This update is targeted for completion in late 2017. The Jackson County Emergency Manager is a member of the Medford NHMP Steering Committee, and the City of Medford is a member of the Jackson County NHMP Steering Committee. The Medford NHMP will become an addendum to the County NHMP when the County NHMP update is completed.

For more information about the Jackson County NHMP:

Sara Rubrecht, Emergency Manager | Jackson County| #541-774-6790
Website: http://jacksoncountyor.org/emergency/County-Plans/NHMP
Email: jacksonem@jacksoncounty.org

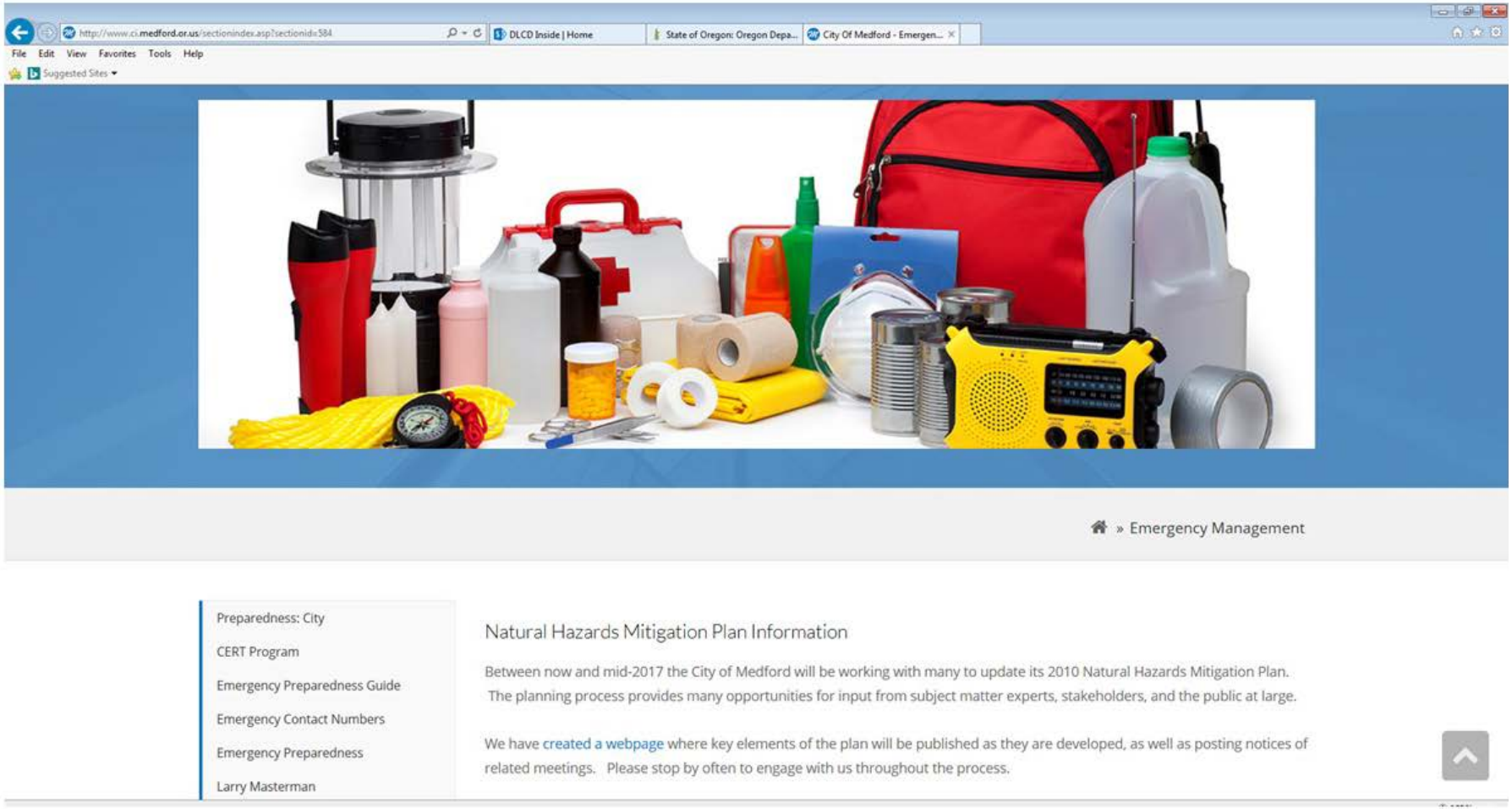
Mike Howard, Asst. Program Dir. | Oregon Partnership for Disaster Resilience
#541-346-8413 | mrhoward@uoregon.edu

Medford open house flyer 12-20-16

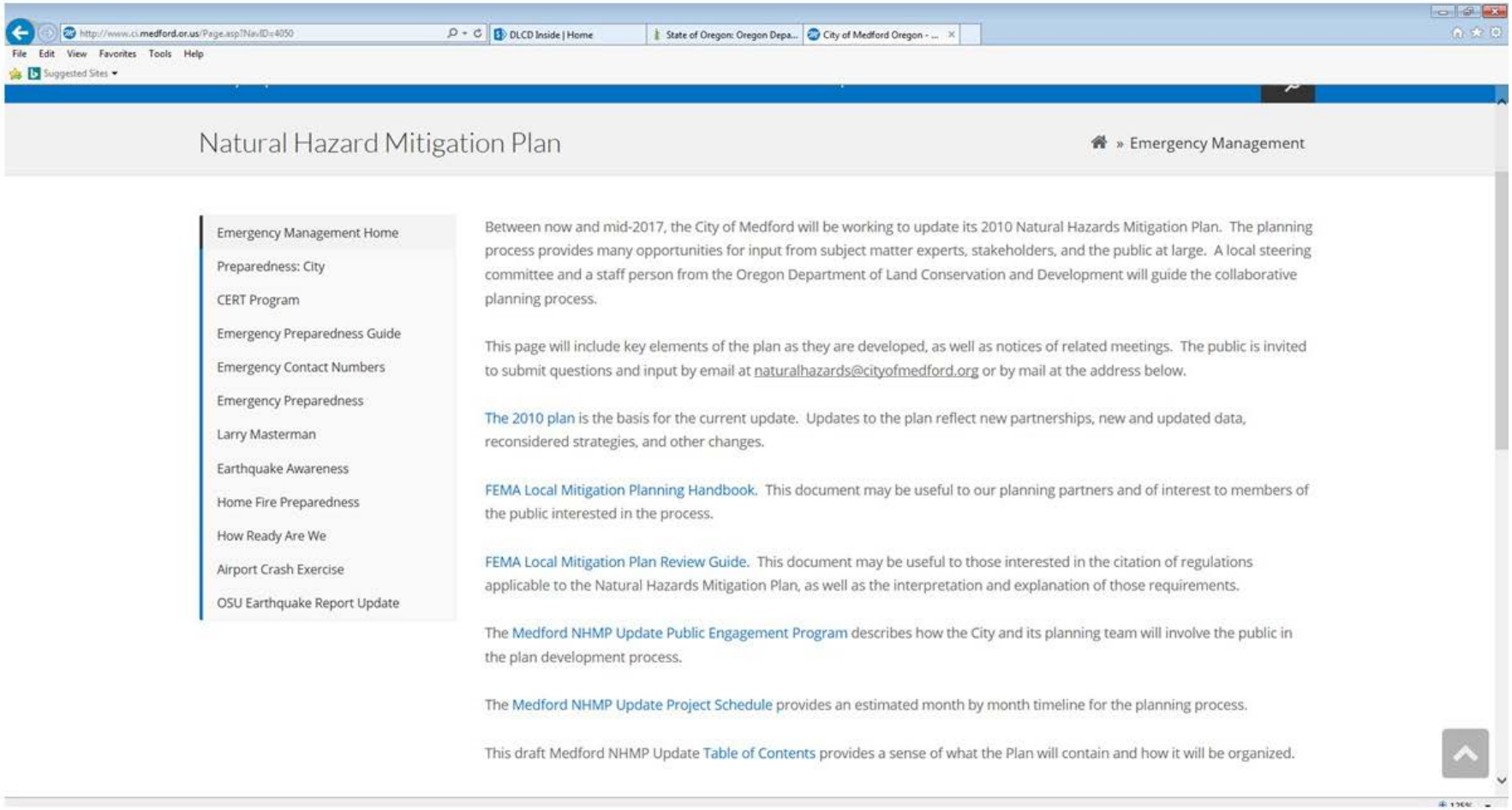
City of Medford Website Screen Shots

The website screen shots are “print screen” shots taken of the City of Medford Emergency Management website at points in time throughout the *2017 Medford NHMP* planning process.

City of Medford Emergency Management Website (home page) on 8/18/16
http://www.ci.medford.or.us/sectionindex.asp?sectionid=584



City of Medford Emergency Management Website on 8/18/16
http://www.ci.medford.or.us/Page.asp?NavID=4050



Natural Hazard Mitigation Plan

» Emergency Management

- Emergency Management Home
- Preparedness: City
- CERT Program
- Emergency Preparedness Guide
- Emergency Contact Numbers
- Emergency Preparedness
- Larry Masterman
- Earthquake Awareness
- Home Fire Preparedness
- How Ready Are We
- Airport Crash Exercise
- OSU Earthquake Report Update

Between now and mid-2017, the City of Medford will be working to update its 2010 Natural Hazards Mitigation Plan. The planning process provides many opportunities for input from subject matter experts, stakeholders, and the public at large. A local steering committee and a staff person from the Oregon Department of Land Conservation and Development will guide the collaborative planning process.

This page will include key elements of the plan as they are developed, as well as notices of related meetings. The public is invited to submit questions and input by email at naturalhazards@cityofmedford.org or by mail at the address below.

The 2010 plan is the basis for the current update. Updates to the plan reflect new partnerships, new and updated data, reconsidered strategies, and other changes.

FEMA Local Mitigation Planning Handbook. This document may be useful to our planning partners and of interest to members of the public interested in the process.

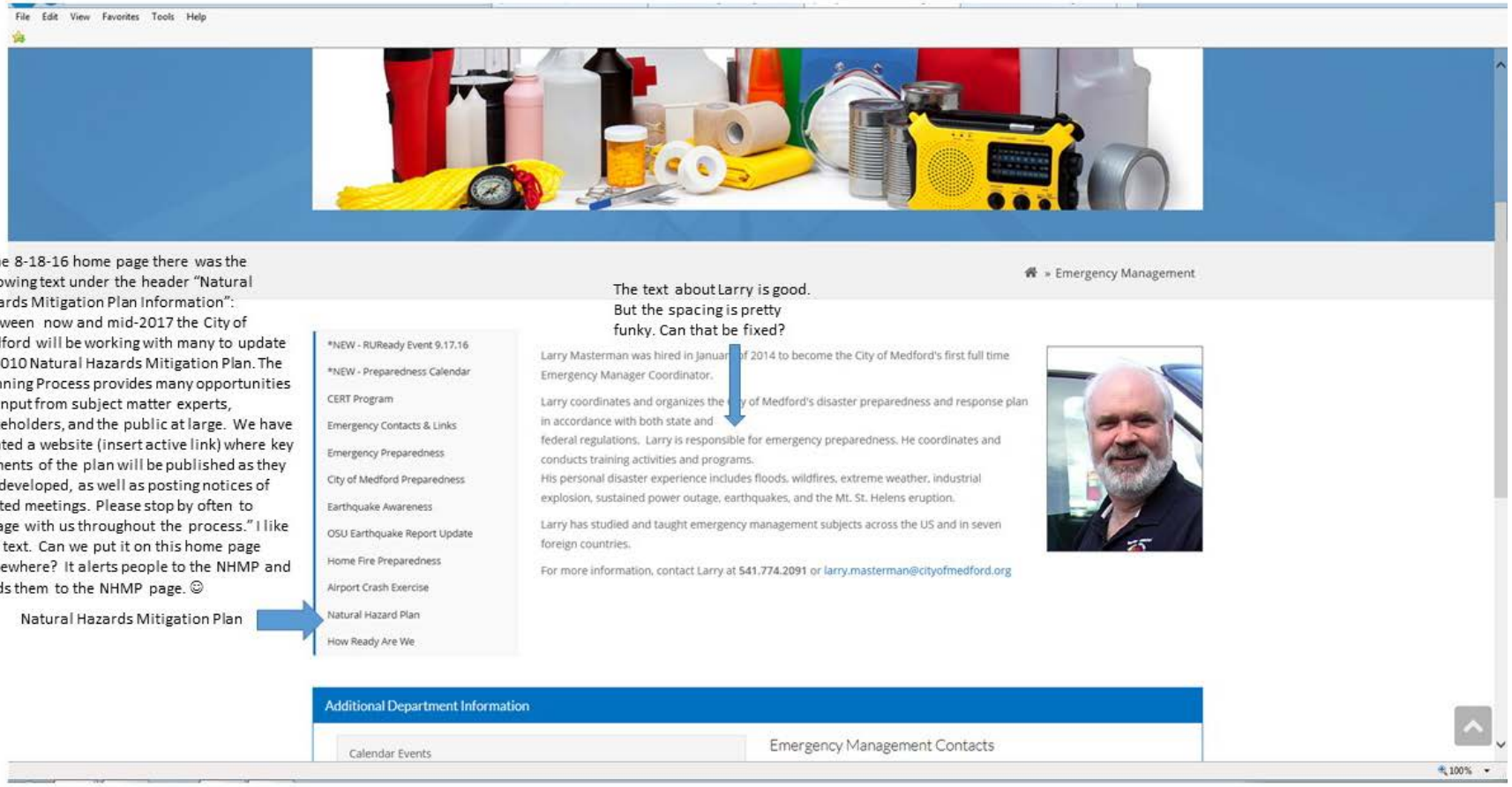
FEMA Local Mitigation Plan Review Guide. This document may be useful to those interested in the citation of regulations applicable to the Natural Hazards Mitigation Plan, as well as the interpretation and explanation of those requirements.

The Medford NHMP Update Public Engagement Program describes how the City and its planning team will involve the public in the plan development process.

The Medford NHMP Update Project Schedule provides an estimated month by month timeline for the planning process.

This draft Medford NHMP Update Table of Contents provides a sense of what the Plan will contain and how it will be organized.

City of Medford Emergency Management Website (home page) on 8/25/16
http://www.ci.medford.or.us/sectionindex.asp?sectionid=584

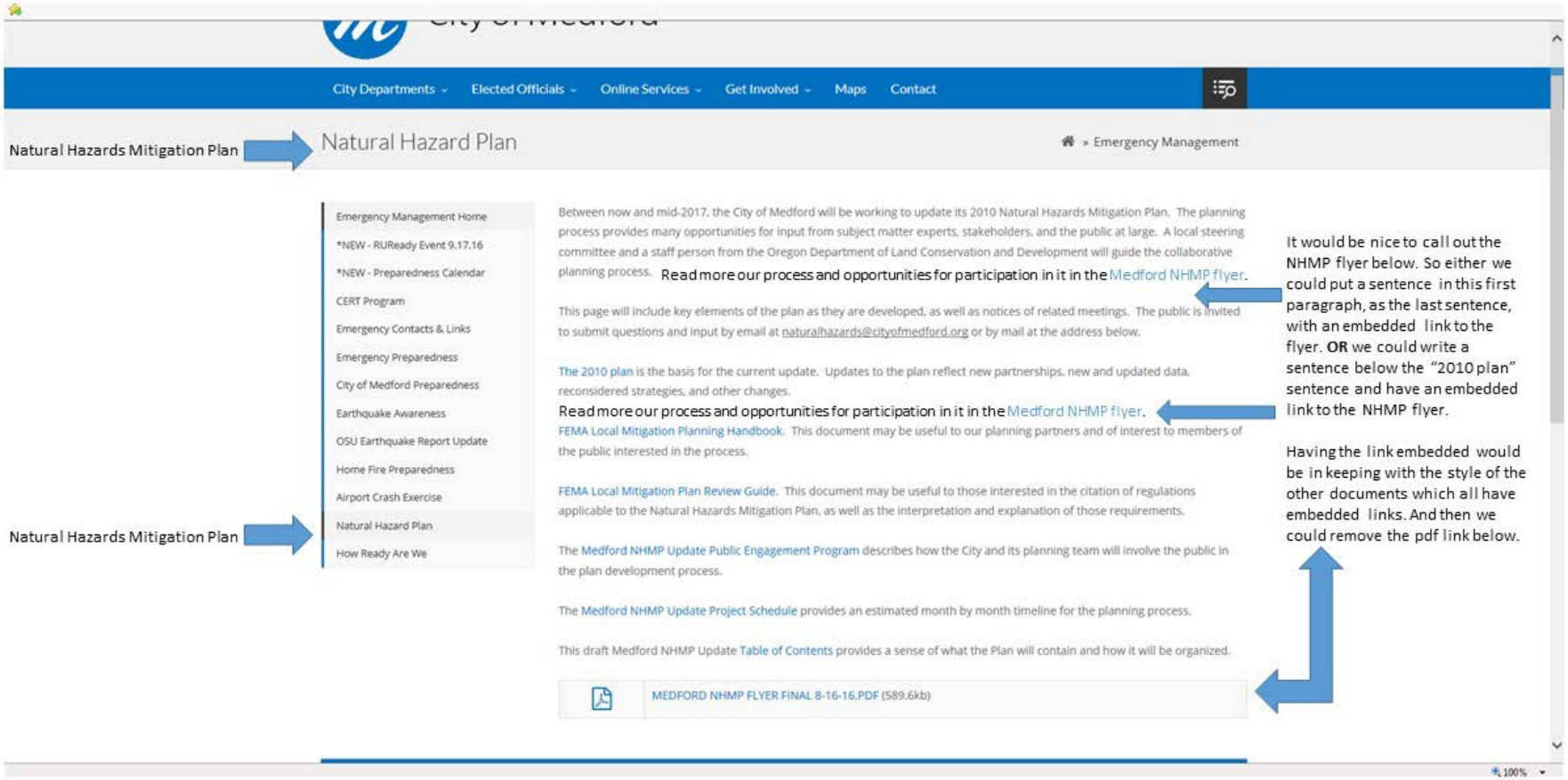


In the 8-18-16 home page there was the following text under the header "Natural Hazards Mitigation Plan Information": "Between now and mid-2017 the City of Medford will be working with many to update its 2010 Natural Hazards Mitigation Plan. The Planning Process provides many opportunities for input from subject matter experts, stakeholders, and the public at large. We have created a website (insert active link) where key elements of the plan will be published as they are developed, as well as posting notices of related meetings. Please stop by often to engage with us throughout the process." I like that text. Can we put it on this home page somewhere? It alerts people to the NHMP and sends them to the NHMP page. ☺

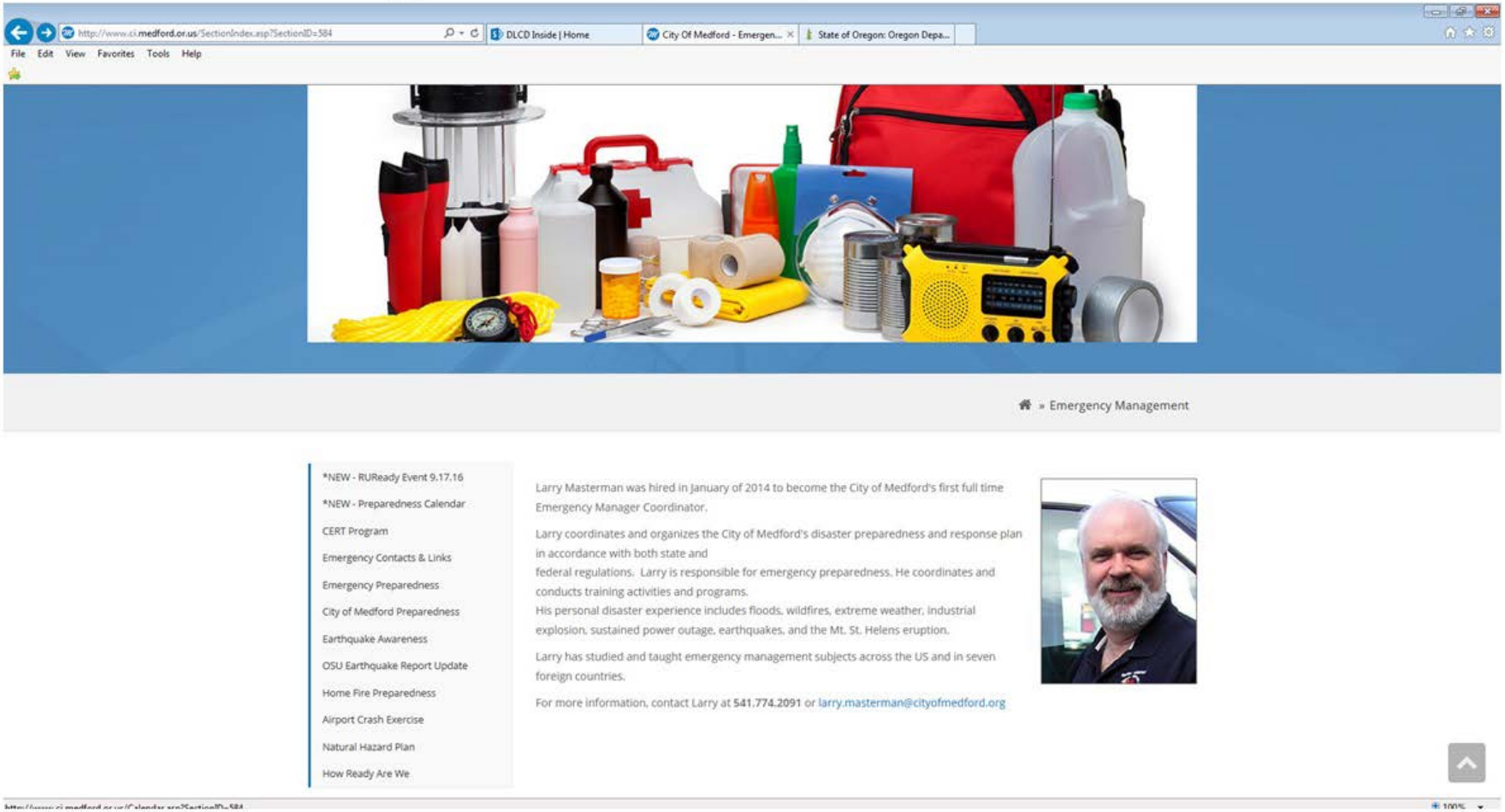
Natural Hazards Mitigation Plan

The text about Larry is good. But the spacing is pretty funky. Can that be fixed?

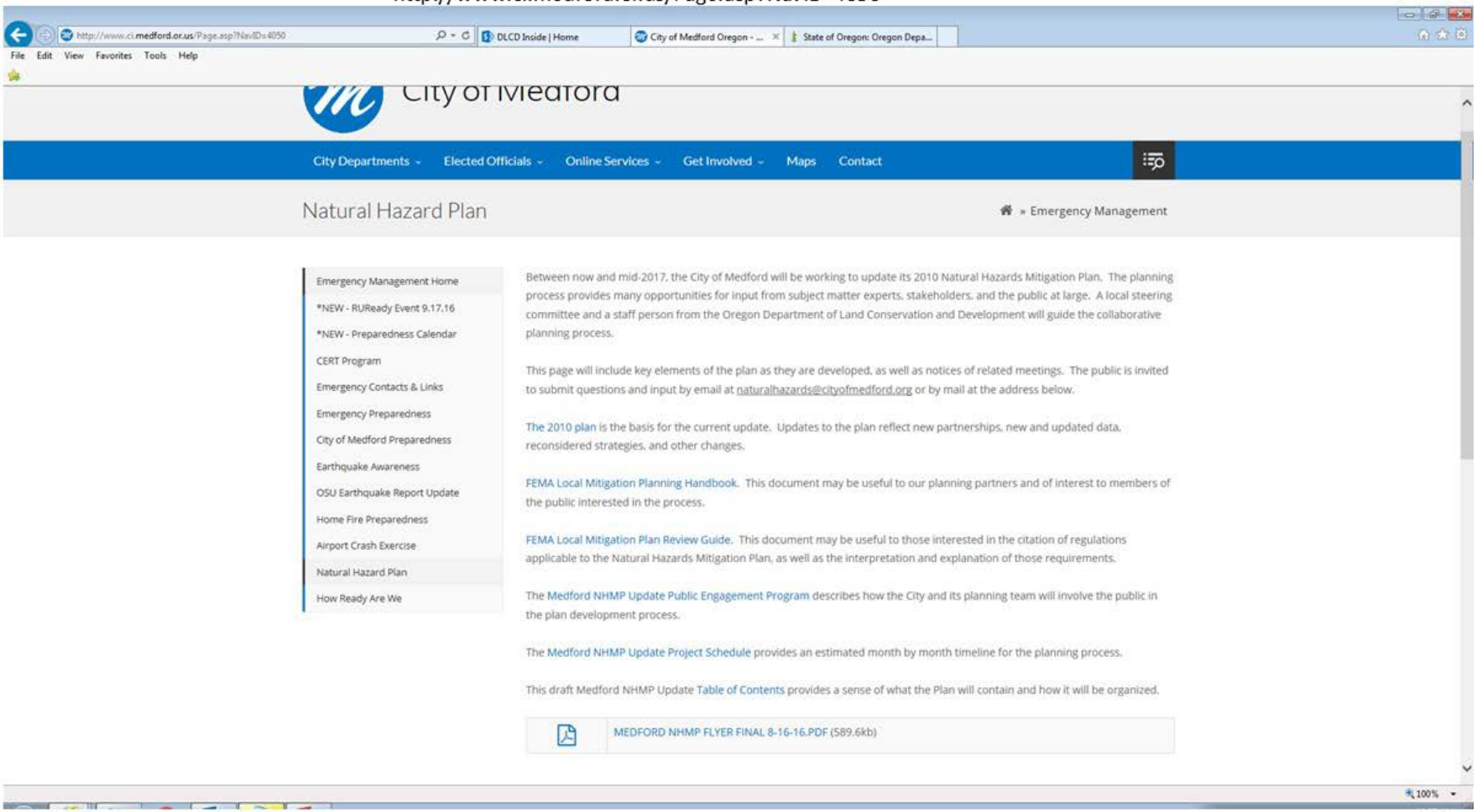
City of Medford Emergency Management Website on 8/25/16
http://www.ci.medford.or.us/Page.asp?NavID=4050



City of Medford Emergency Management Website (home page) on 9/14/16
http://www.ci.medford.or.us/sectionindex.asp?sectionid=584



City of Medford Emergency Management Website on 9/14/16
http://www.ci.medford.or.us/Page.asp?NavID=4050



http://www.ci.medford.or.us/Page.asp?NavID=4050

File Edit View Favorites Tools Help

City of Medford

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Natural Hazard Plan

» Emergency Management

- Emergency Management Home
- *NEW - RUReady Event 9.17.16
- *NEW - Preparedness Calendar
- CERT Program
- Emergency Contacts & Links
- Emergency Preparedness
- City of Medford Preparedness
- Earthquake Awareness
- OSU Earthquake Report Update
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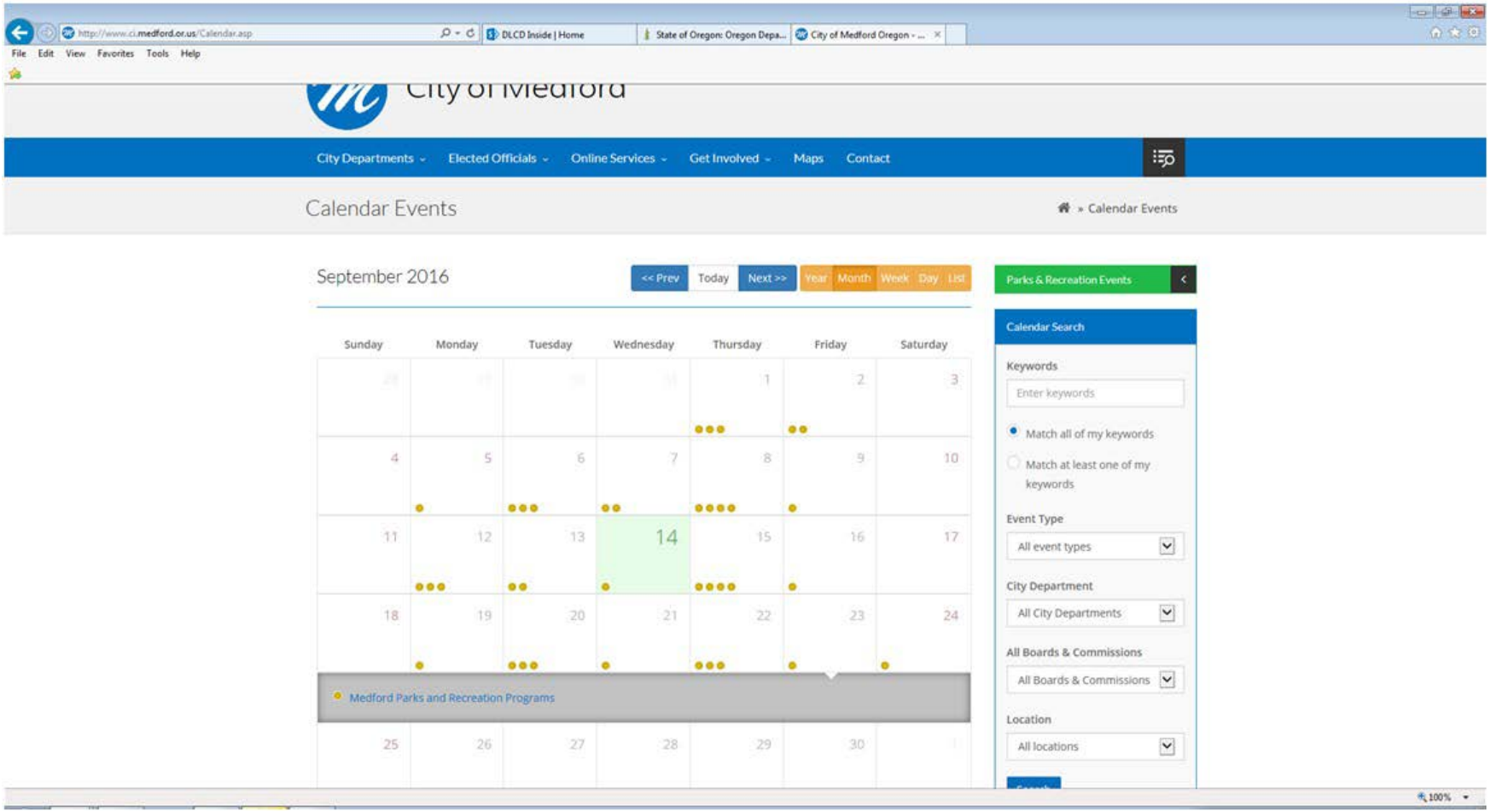
MEDFORD NHMP FLYER FINAL 8-16-16.PDF (589.6kb)

City of Medford Emergency Management Website on 9/14/16
http://www.ci.medford.or.us/Calendar.asp



City of Medford website 9/22/16
http://www.ci.medford.or.us/Page.asp?NavID=4072

http://www.ci.medford.or.us/Page.asp?NavID=4072 | DLCD Inside | Home | DLCD Streaming Video | Climate Impacts on Human H... | City of Medford Oregon - *...

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*NEW - Preparedness Calendar

» Emergency Management

- Emergency Management Home
- *NEW - Preparedness Calendar
- *NEW - Prepare Out Loud 10.6. . .
- *NEW - Red Cross 10.8.16
- CERT Program
- Emergency Contacts & Links
- Emergency Preparedness
- City of Medford Preparedness
- Earthquake Awareness
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National Preparedness Month

Rogue Valley Events 2016

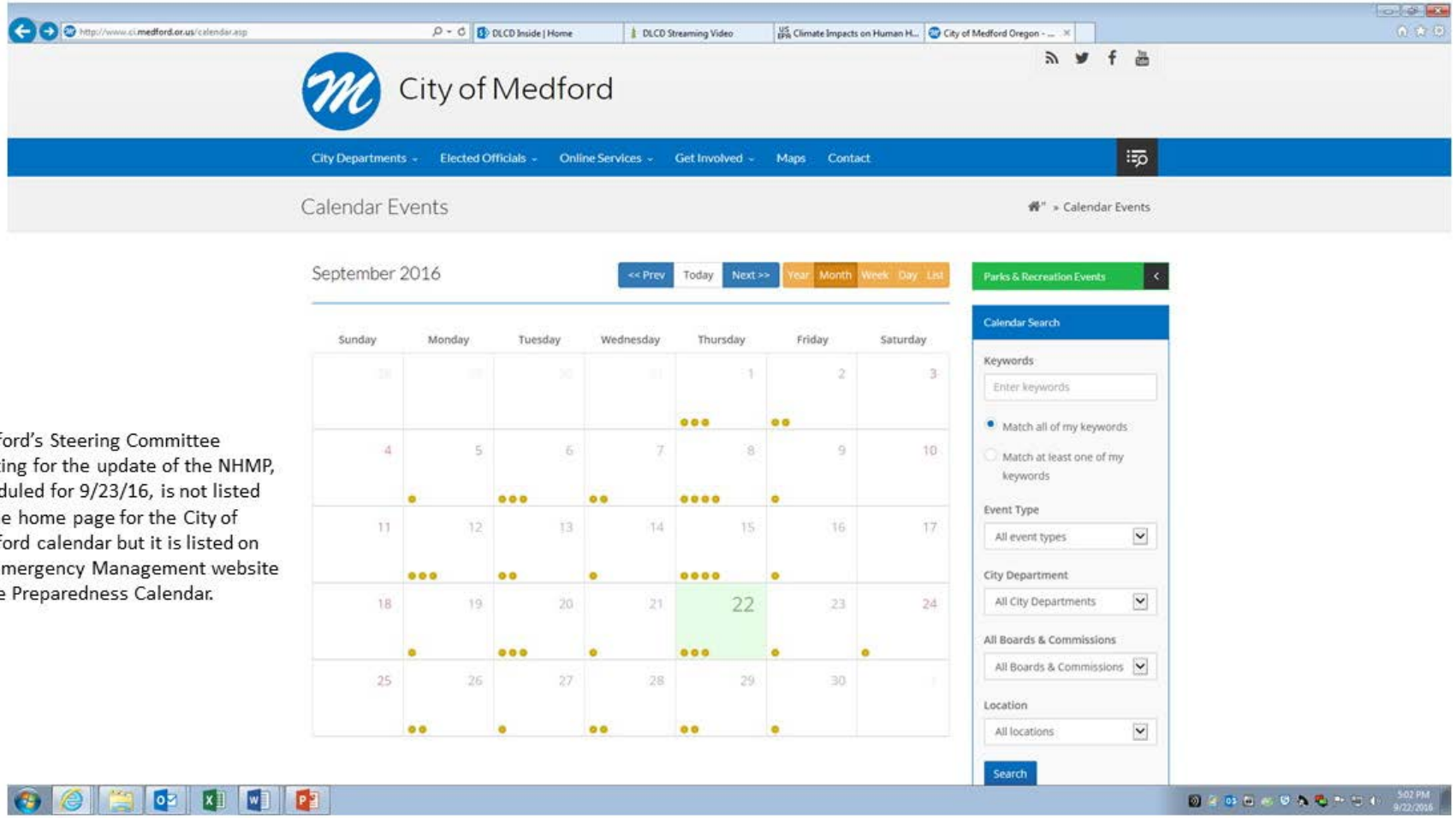
Date/Time	Event	Location	Web/Email	Phone
Sept. 7, 14, 21, 28 6:00 to 8:00 PM (attendance at all four sessions is recommended)	Medford Library Preparedness Academy (Attendees will receive free supplies for their personal emergency kit)	Medford Main Library 205 S. Central Avenue, Medford	medref@jcls.org	541-774-8679
Sept. 10	Ashland is Ready Preparedness event $10 advance ticket	SOU	http://www.ashland.or.us/Page.asp?NavID=15722	541-482-2770
Sept. 12 7:30 AM	Bill Meyer Show: Emergency Preparedness	KMED Radio AM 1440 FM 106.7	billmeyershow.com (also available as a podcast here after the air date)	
Sept. 17 10:00 to 2:00	Rogue Ready Preparedness & Safety Fair	Rogue Valley Mall Inside & outside	ReadyMedford.org	541-774-2091
Sept. 17, 24 & 25 (attendance at all three sessions is required for completion)	Community Emergency Response Team Basic Training *Prior enrollment is required*	Applegate Fire District 9 and Jacksonville Public Works yard, Jacksonville	http://www.centralpointoregon.gov/cert/page/cert-trainings	541-423-1051
Sept. 23 1:00	Natural Hazards Mitigation Plan update (public meeting)	Medford City Hall Medford Room (340)	ReadyMedford.org	541-774-2091
Oct. 8 10:00 to 3:00	Faith-Based and Civic Leadership Preparedness Summit	Sacred Heart Catholic Church Parish Hall 517 W. 10th Street Medford	ReadyMedford.org	541-774-2091

Updated 8/23/16

Calendar Doc

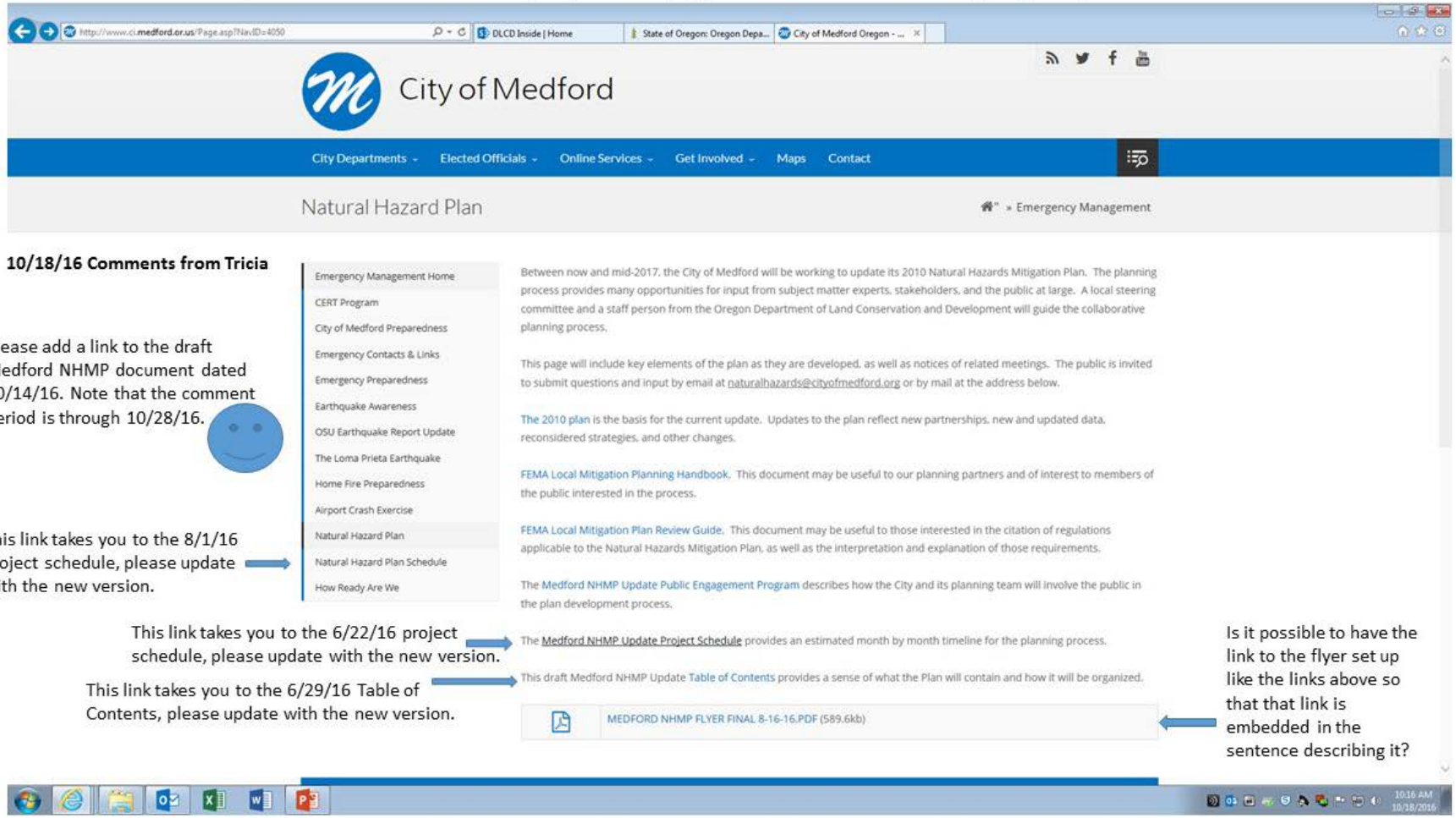
PREPAREDNESS MONTH 2016 CALENDAR.PDF (275kb)

City of Medford website 9/22/16
http://www.ci.medford.or.us/calendar.asp



Medford's Steering Committee meeting for the update of the NHMP, scheduled for 9/23/16, is not listed on the home page for the City of Medford calendar but it is listed on the Emergency Management website in the Preparedness Calendar.

City of Medford website 10/18/16 http://www.ci.medford.or.us/Page.asp?NavID=4050



10/18/16 Comments from Tricia

Please add a link to the draft Medford NHMP document dated 10/14/16. Note that the comment period is through 10/28/16.

This link takes you to the 8/1/16 project schedule, please update with the new version.

This link takes you to the 6/22/16 project schedule, please update with the new version.

This link takes you to the 6/29/16 Table of Contents, please update with the new version.

Is it possible to have the link to the flyer set up like the links above so that that link is embedded in the sentence describing it?

City of Medford website 10/20/16 (1:26 pm) http://www.ci.medford.or.us/Page.asp?NavID=4050

http://www.ci.medford.or.us/Page.asp?NavID=4050 | DLCD Inside | Home | State of Oregon: Oregon Depa... | City of Medford Oregon - ...

- Emergency Contacts & Links
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Hazard Photo

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10/20/16 Tricia has the same comments on the web page here as on 10/18/16 (see that screen shot ppt with comments).

City of Medford website 10/25/16
http://www.ci.medford.or.us/Page.asp?NavID=4050

http://www.ci.medford.or.us/Page.asp?NavID=4050 | DLCD Inside | Home | City of Medford Oregon - ...

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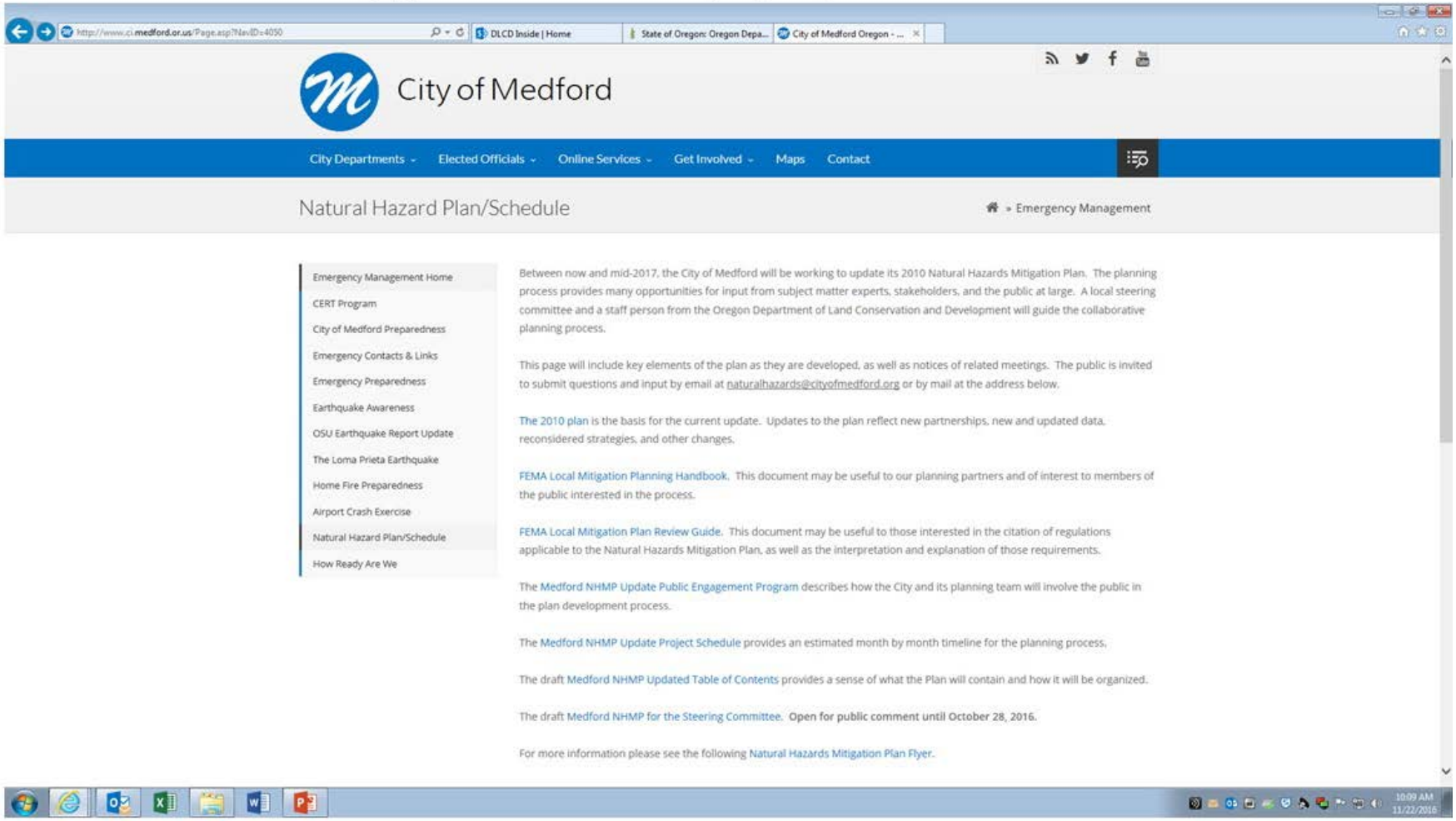
City of Medford website 11/22/16
http://www.ci.medford.or.us/Page.asp?NavID=4050



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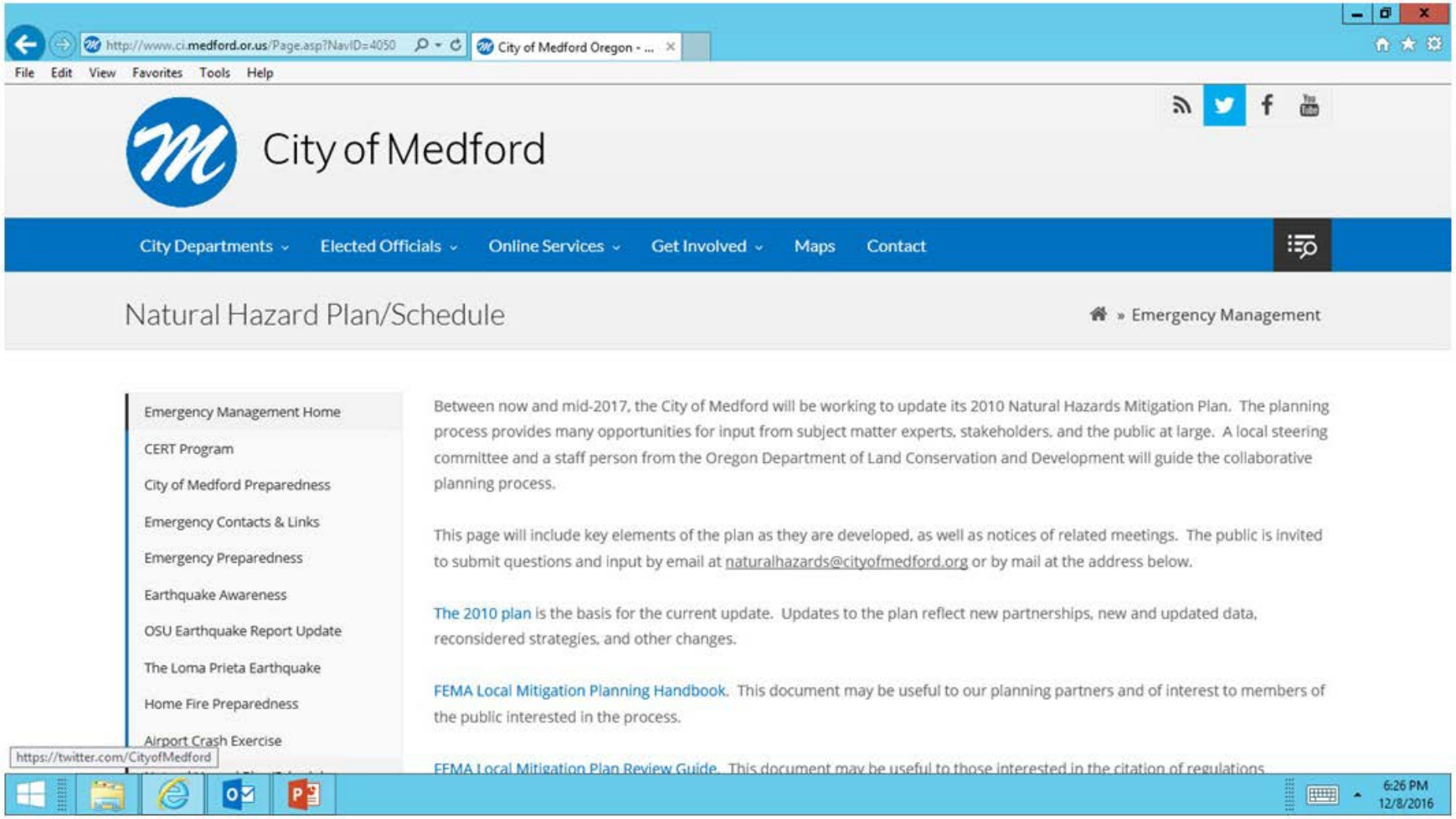
City of Medford website 12/2/16
http://www.ci.medford.or.us/SectionIndex.asp?SectionID=584



City of Medford website 12/2/16
http://www.ci.medford.or.us/SectionIndex.asp?SectionID=584

http://www.ci.medford.or.us/Page.asp?NavID=4050 City of Medford Oregon - ...

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Additional Department Information

6:25 PM
12/8/2016

City of Medford website 12/28/16
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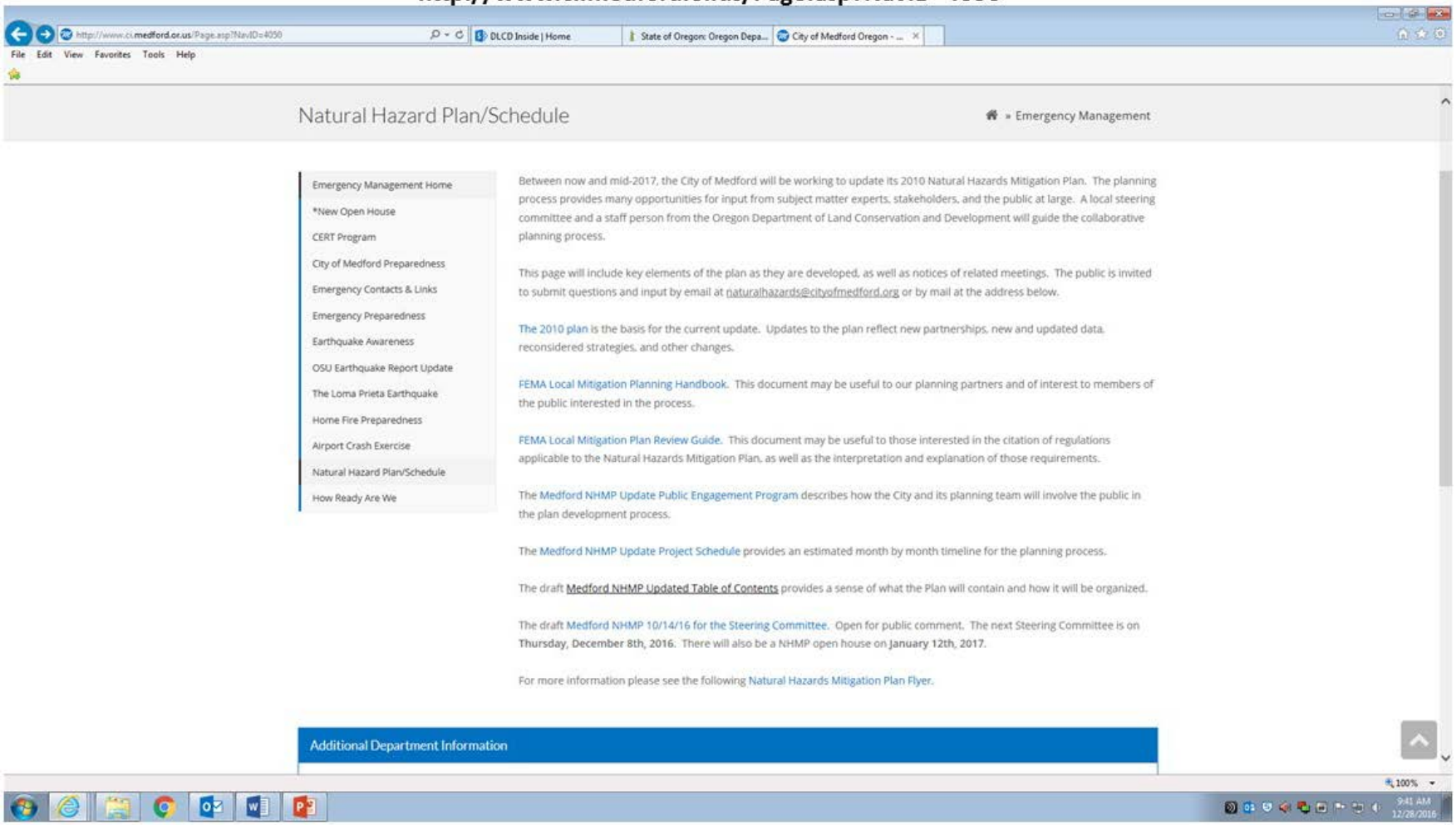

http://www.ci.medford.or.us/Page.asp?NavID=4050

DLCD Inside | Home | State of Oregon: Oregon Depa... | City of Medford Oregon - ...

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100%

9:41 AM 12/28/2016

Medford NHMP 2/3/17

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Medford NHMP 3/23/17

http://www.ci.medford.or.us/Page.asp?NavID=4050

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Please find the related documents as part of this plan:
The Medford NHMP Mitigation Action Table (3/14/17).
Climate Appendix - Hazard Summary of Climate Trends and Projections.
People with Access and Functional Needs (PAFN) map (2/22/17).
Transit Map (2/23/17).
Median Household Income Map (3/3/17).
Earthquake Hazards map (3/14/17).

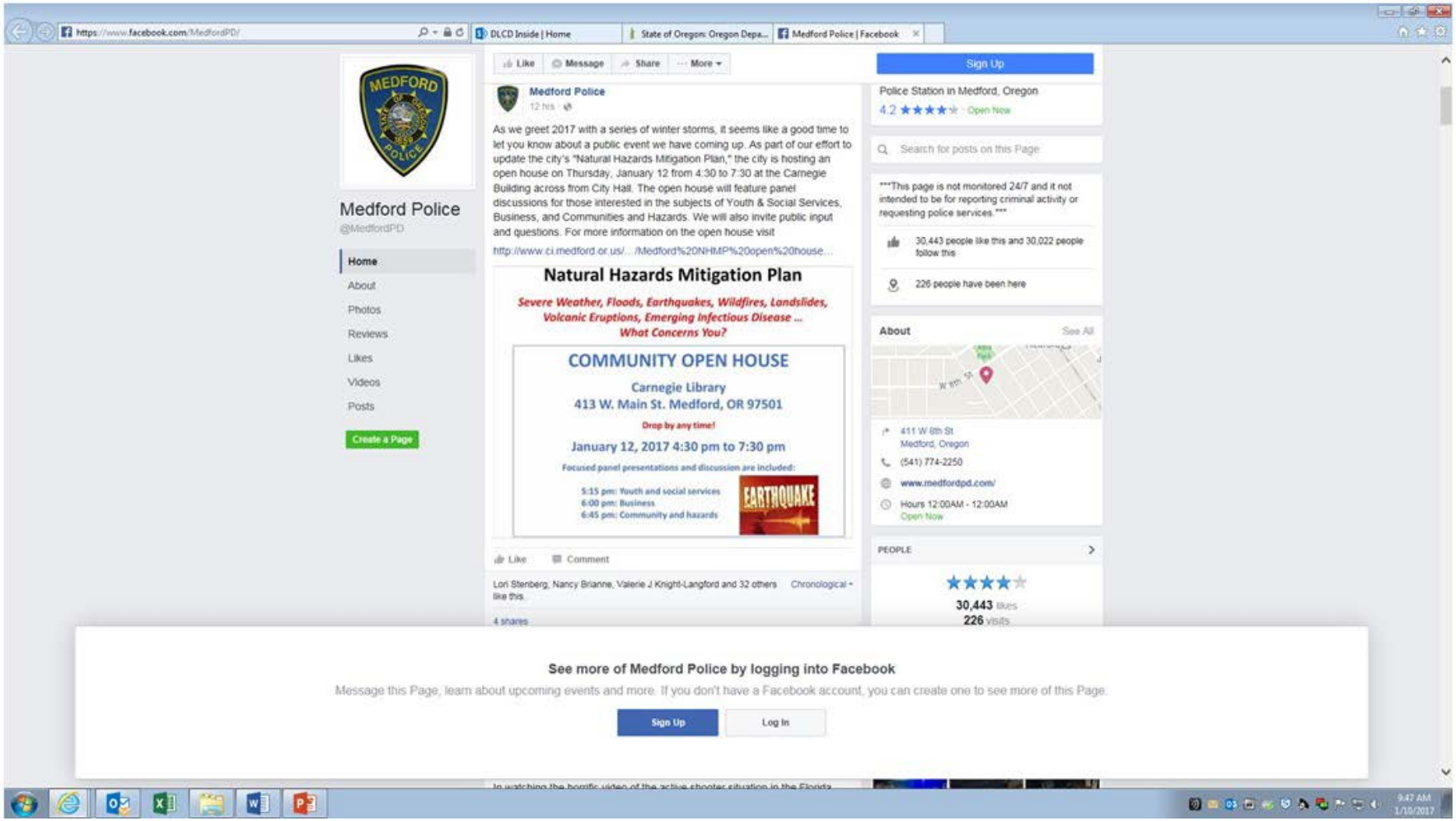
For more information please see the following Natural Hazards Mitigation Plan Flyer.

100%

Medford Police Facebook Screen Shot

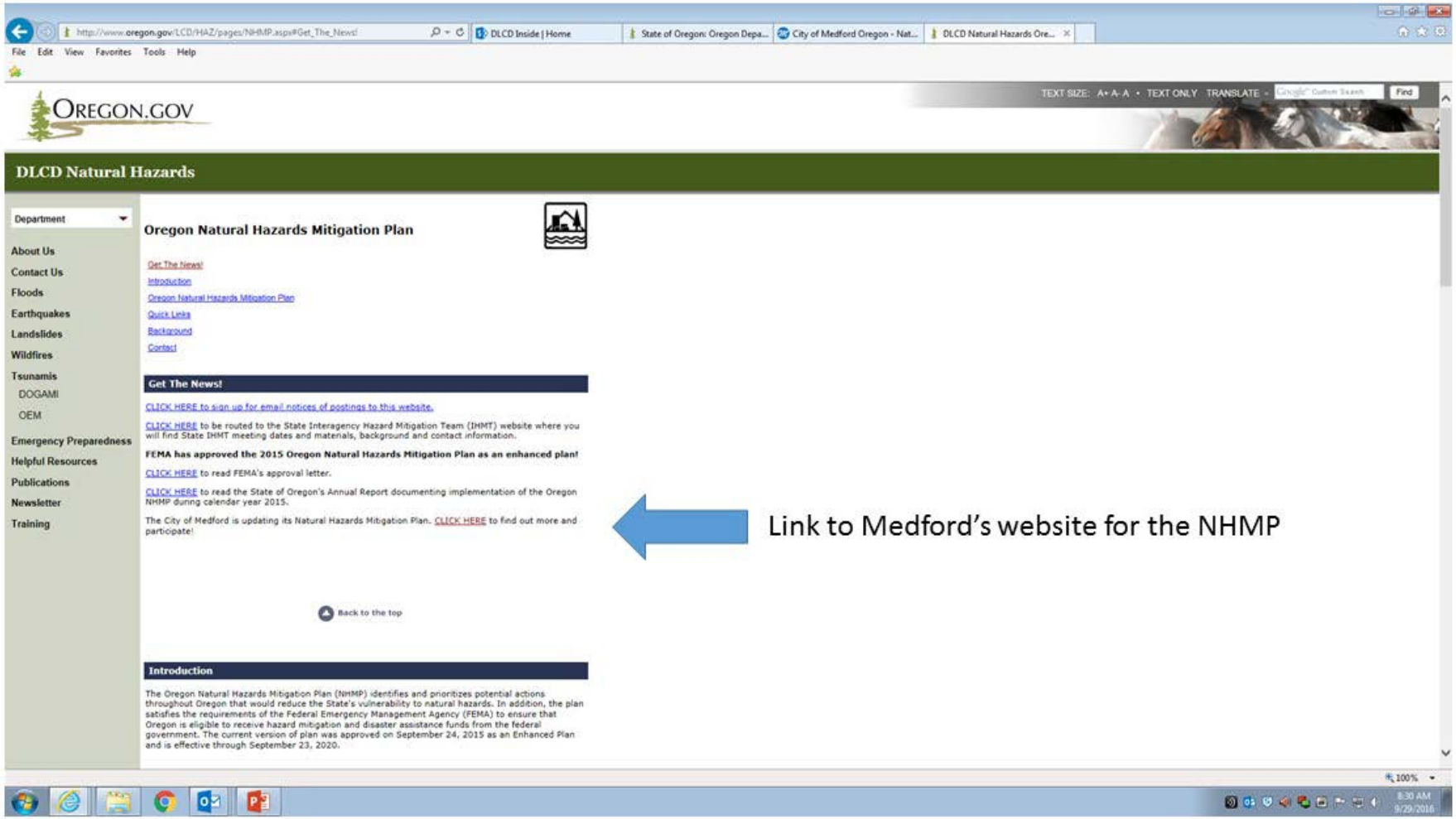
https://www.facebook.com/MedfordPD/

January 10, 2017

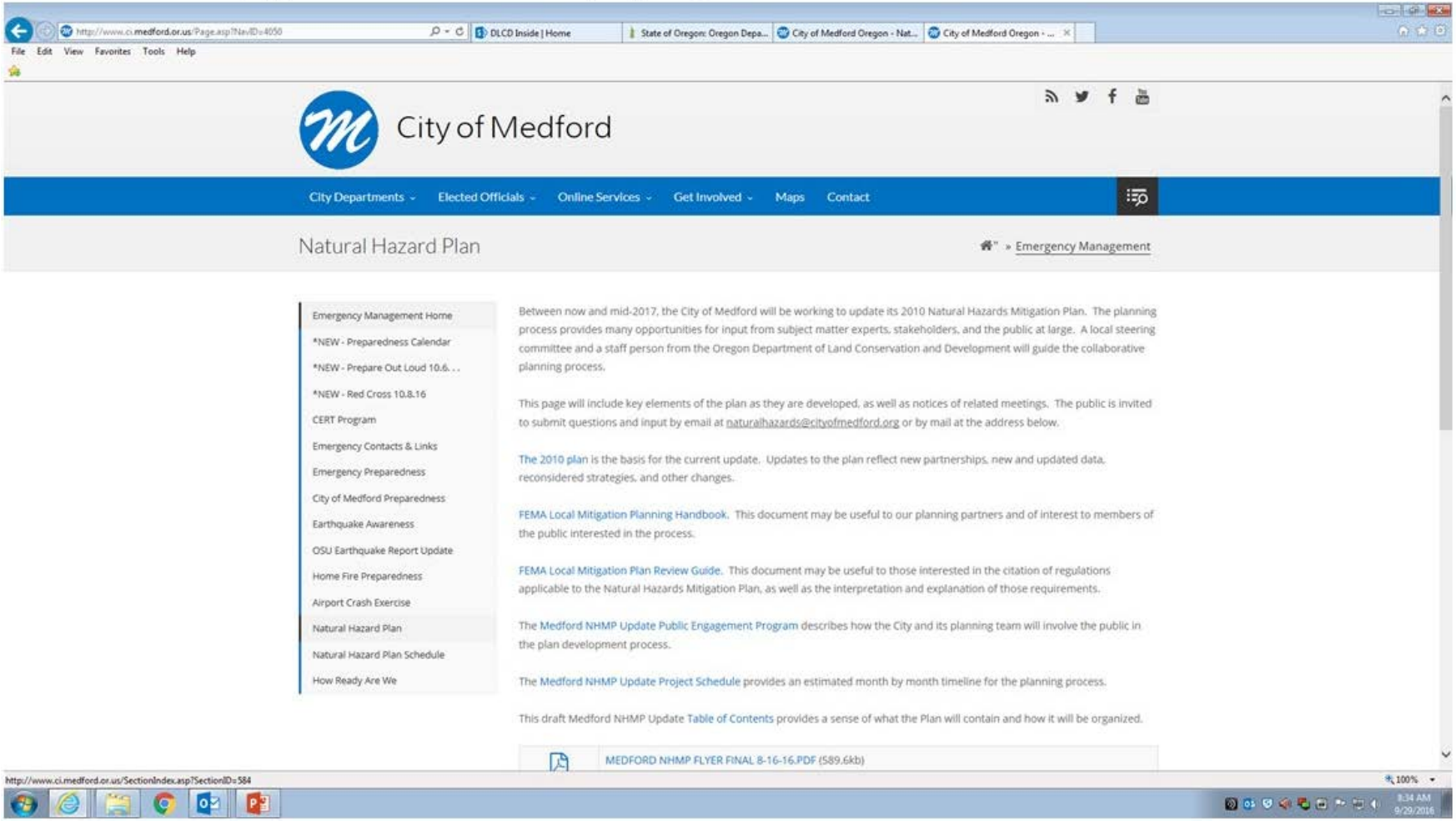


DLCD Website Screen Shots

State of Oregon website 9/29/16
http://www.oregon.gov/LCD/HAZ/pages/NHMP.aspx#Get_The_News!



City of Medford website on 9/29/16 (using link from State of Oregon website)
http://www.ci.medford.or.us/Page.asp?NavID=4050



Emergency Management Program Summary

City of Medford

Emergency Management Program Summary

January 2014-October 2016

Staff Report by Larry Masterman, Emergency Management Coordinator

Overview:

As the manager of Medford's emergency management (EM) program since it was initiated in 2014 I have approached it from the perspective that the most successful community EM programs have three key ingredients in common: The training and skills of their people; the quality of their relationships with other organizations, and; the preparedness of their communities at large. Another factor is economy… it has been calculated that every dollar spent on preparedness saves twelve times that in response and recovery costs.

Training:

To begin with those strategic goals, I instituted an ambitious training program, bringing in many courses that had not been conducted in the area in recent memory, and still others that had never been offered here. An early priority was advanced and specialized incident command training for public safety leadership and others. In the past two years, those courses have included:

- Intermediate Incident Command
- Advanced Incident Command
- Flood Fight Strategies and Tactics
- Continuity of Operations Planning
- Incident Command Overview for Executives and Senior Officials
- Senior Officials Workshop for All Hazards Preparedness

Instructors were brought in from FEMA headquarters, Texas A&M, the Army Corps of Engineers, and other lead agencies at no cost to the City. In longer courses we provided light snacks and beverages.

Image: Instructors from Texas A&M's National Emergency Response and Rescue Training Center deliver the course Intermediate Incident Command for Complex and Expanding Incidents at Medford's Carnegie Library in 2014

In all cases, cooperating agencies and neighboring jurisdictions were invited to participate, and many did. Joint training with our potential response partners is essential to effective response and recovery operations during and after a major emergency. Response partners from neighboring cities, Jackson and

Medford Emergency Management Program Summary 2014-2016 1

Josephine Counties, State and federal agencies, and nongovernmental organizations have trained with us. Others have traveled from as far away as Klamath Falls, Brookings, Salem, and FEMA Region X.

Training has also been provided to community members at large, ranging from 1-hour awareness-level presentations to multi-day courses. Audiences have included such diverse groups as Living Opportunities staff, homeowners associations, professional organizations, and others.

All told, training through October 2016 has included:

Total courses/presentations:	71
City of Medford employees and volunteers:	381
Other agencies and organizations:	730
Members of the public:	2,333
Total students:	3,444
Student hours delivered:	9,578

Image: Presenting a lecture on mass casualty response for a 2015 EMS Conference at Asante's Smullin Center.

Relationship building:

Although joint training has had a significant benefit to maintaining interagency relationships, other efforts have cultivated that network further.

It is widely acknowledged that no jurisdiction, agency, or group can manage a disaster on its own. The ability to plan, operate, and communicate effectively under the worst of conditions relies on levels of teamwork, common understanding and trust that can only be gained through working together before an emergency occurs. A few examples from the past 34 months include:

- Inviting partner organizations to co-present in courses, live public events, television and radio programs. Jackson County EM, Oregon Emergency Management, ODOT, the National Weather Service, Jackson County Libraries, SO Humane, and academia have joined EM so far.
- Training and awareness programs have been provided to the Oregon National Guard, Oregon Department of Justice, ODOT, the Rogue Valley Council of Governments, Rogue Valley Community Organizations Active in Disaster, Amateur Radio Emergency Service, 549c leadership, and many others.
- EM has participated in emergency exercises conducted by neighboring jurisdictions in roles of co-responder, evaluator and subject matter expert.
- EM has distributed training opportunities, grant programs, collaboration opportunities and other information to neighboring agencies and organizations.
- EM promoted monthly meetings of the region's five CERT team leaders, resulting in greater common training and interoperability.
- Medford's CERT members assist neighboring teams during large civic events such as Red White and Boom and Boatnicks.

- EM routinely acts as a resource and subject matter expert for neighboring organizations lacking their own emergency management staff. This typically involves answering questions, providing materials, and making referrals.

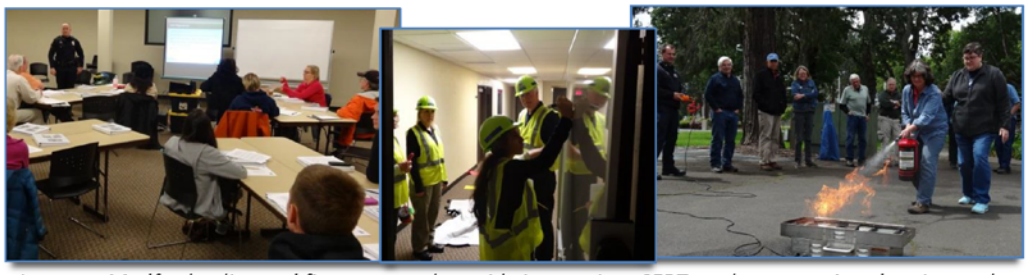
Images: Medford EM participated in a weapon of mass destruction exercise with the Oregon National Guard and Region 8 hazardous materials team, co-presented a public earthquake preparedness presentation with state and local geologists, and evaluated medical operations during a plane crash exercise at Medford-Rogue Valley Airport

Community preparedness:

A cornerstone of community outreach and training has been the 24-hour Community Emergency Response Team (CERT) courses. This month saw the completion of our sixth course offering in just over two years, this one being filled to capacity with residents and staff of Rogue Valley Manor. Students learn a variety of emergency skills, including hazard assessment, casualty care, disaster psychology, light rescue, and working with professional responders. Graduates are invited, but not obligated, to join Medford's team.

The October course brings the number of trained CERT students near 100. The Medford team currently numbers 14 active members.

By using subject matter experts from local agencies as faculty, students have been exposed to Medford Police, Fire-Rescue, CERT members, EM staff, and the local chaplaincy.



Images: Medford police and fire personnel provide instruction; CERT students practice planning and briefing an interior search operation; students practice extinguishing live fire under the watchful eye of Medford Fire and Rescue

Medford EM has partnered with dozens of local agencies and organizations for additional community events:

- In 2015 and 2016, we led the planning and execution of large preparedness and safety fairs during National Preparedness Month. For this year's event nearly 40 emergency and social services agencies participated, reaching more than 500 families

- During four September evenings, EM teamed with Medford's Main Library, the Red Cross, and 211 Info to deliver a series of public preparedness workshops. Each session provided different lessons on preparedness, and each student received items to start or augment their own emergency kit. All items were donated by local retailers. A similar series, without the supplies, was conducted earlier this year at the Santo Center in partnership with Parks & Recreation.
- On October 8 the City partnered with the American Red Cross, local churches and others to host the area's first preparedness summit for faith-based and civic leaders. Some 75 attended from throughout the region.
- Many presentations have been customized for delivery to specific community groups. To date these have included seniors, developmentally delayed, professional engineers, National Guard, college students, and social services agencies.

Facilities:

In January of 2014, Medford's Emergency Operations Center (EOC) at the Lausmann Annex had a single telephone, power and network jacks that required all cords and cables to cross walkways to reach workstations, and a cabinet full of out of date plans. EM initiated an activation drill using current EOC staff, and learned that the facility could not be activated promptly or effectively. Keys to locked cabinets were not immediately available, phones were expected to be scrounged from wherever they could be found, and other challenges surfaced.

Although major work was not budgeted, eight dedicated telephone sets were installed, and power and network jacks were added to the floor, where they would not constitute a safety hazard. Updated plans and other documents were placed, and procedures refined.

Work remains to be done, however the facility is more ready now than in the past.

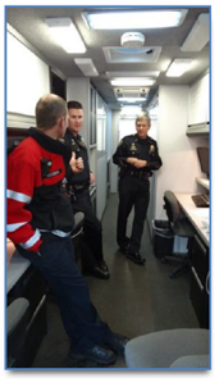
EM participated in early design meetings for the community room/EOC at the new Medford Police headquarters, however budget constraints eliminated most proposed features.

City Hall and the Lausmann Annex were made more disaster resilient by installing battery powered lighting in stairwells, hallways, and other evacuation routes. Although the buildings are served by a backup generator, interruptions in lighting were a known problem.

For protection against an active shooter or other assailant, EM proposed securing spaces such as break rooms as safe refuge areas, and installing peepholes in doors opening into common areas. Those measures have been taken, and all staff have received active assailant training.

No EOC is impervious to damage or disruptions of essential services, and EM identified a desire for a backup. In 2015 EM identified an underutilized mobile command post purchased by Jackson County in 2005 at a cost of $250,000. Discussions with the County ensued, and in early 2016 the City bought the vehicle for $1. A small amount of additional money was necessary for new batteries, safety inspection, and maintenance, and additional funding will be necessary to update communications and video equipment. A $4,000 grant was obtained to purchase and install satellite voice and data equipment.

Additional updates are planned, however not yet budgeted, for radio communications, television receivers, the mast-mounted video camera, lighting and terrestrial Internet access, and a small committee has been proposed by EM to guide outfitting and use of the vehicle.



Images: Exterior and interior views of the command vehicle

Emergency planning:

I agree to a limited extent with General Eisenhower's contention that "...plans are worthless, but the planning process is indispensable". Just the same, certain plans are required for NIMS compliance, eligibility for some grant programs, and maximum FEMA reimbursement of response and recovery costs.

For the past two years I have worked with the Oregon Department of Land Conservation and Development to obtain a FEMA grant for an update to our 2010 Pre-Disaster Mitigation Plan. The grant was awarded earlier this year, and work has been underway since spring. Thanks to a steering committee of 20 highly qualified local, federal, state and regional partners, the 2017 plan promises to provide an unprecedented level of detail and currency that will serve City strategic planning needs well into the future.

Review of Medford's Emergency Operations Plan (EOP) has been ongoing, and many improvements are contemplated. Major revision work is planned after completion of the mitigation plan addressed above.

At the request of Jackson County's Emergency Medical Services medical director, EM led the revision of the county Mass Casualty Response Plan in late 2015 and early 2016.

Grants and donations:

EM has been successful in obtaining a number of competitive public and private grants to augment funding for the program.

- Three annual State Homeland Security Grant Program awards have been won, providing equipment and supplies for the CERT program, and printing family emergency preparedness guides for distribution to the public. Those guides also promote local CERT programs. Total awards to date: $32,193
- The Chaney Family Foundation awarded $4,000 for satellite communications equipment in the command vehicle.
- An ambulance was donated by Mercy Flights for CERT equipment and personnel transportation.

EM has initiated discussions with Oregon Emergency Management regarding FEMA's Emergency Management Performance Grant program. This federally funded program is currently allocated to the state, each county, each recognized tribe, and those cities with populations over 85,000 that operate emergency management programs. Although Medford falls short of the population threshold, we hope to influence a reduction that would allow our participation in the near future. At current funding levels, Medford's allocation would be approximately $70.000 per year, with minimal impact on historical recipients.

Responses:

During this period I responded directly to a hazardous materials incident with Medford Fire-Rescue, and a late-night warehouse fire, also with MFR. Although EM's function is rarely an on-scene role, I responded as an opportunity to observe how our responders operate and to offer any support.

During several severe storms I have monitored public safety radio traffic, media, and other information sources, and provided support to community members seeking information and instructions.

In September of this year, I coordinated our CERT's support of the Jacksonville search for a missing runner.

Local events:

Within my first few months in the position, I began working with City departments and others to use large planned events as practice and exercise opportunities for major emergency operations. For the past three years, the Pear Blossom activities have included preparation of Incident Action Plans, Communications Plans, and other documents. This year we used our own command vehicle to coordinate police, fire, EMS, and CERT operations.

EM and CERT have also been involved in the Medford Cruise, and are available for other large events on request.

Professional development:

Continuing education is essential in many fields, especially those like emergency management that evolve rapidly and are critical to a community's security, safety, and resilience.

Last year I obtained FEMA certification to teach its Incident Command System and National Incident Management System courses, FEMA's certification as a Master Continuity Practitioner, and Oregon Emergency Management's state EM specialist certification. All required completion of a number of courses, examinations, and practical work.

This year I became Oregon's first graduate of FEMA's Emergency Management Advanced Academy. This required attending four one-week sessions at the National Emergency Training Center in Maryland over the course of 18 months, with FEMA paying all costs except meals.

My Certified Emergency Manager credential from the International Association of Emergency Managers requires renewal every five years, with substantial educational, service, and other requirements. I currently meet all requirements, and expect to receive my renewal in 2017.

Other activities:

This short report isn't intended to provide a complete account of activities, priorities, and accomplishments over the past 34 months, only to provide a broad sense of this unique program.

Other activities have been abundant, productive, and, in many cases, innovative.

I am available to provide any additional information or assistance City leadership might desire.

Submitted October 19, 2016

Larry Masterman, CEM
Emergency Management Coordinator

FEMA CRS Letter

U.S. Department of Homeland Security
500 C Street, SW
Washington, DC 20472

NOV 2 0 2014

FEMA

The Honorable Gary Wheeler
Mayor, City of Medford
411 West 8th Street
Medford, OR 97501

Dear Mayor Wheeler:

Congratulations! The Department of Homeland Security, Federal Emergency Management Agency (FEMA), has determined that your community will increase to a Class 6 in the National Flood Insurance Program (NFIP) Community Rating System (CRS).

The floodplain management activities implemented by your community qualifies it for a 20 percent discount of the premium cost of flood insurance for NFIP policies issued or renewed in Special Flood Hazard Areas on or after October 1, 2014. This increase in CRS class is based on a field verification of your 5-year cycle CRS application. I am enclosing the field verification report showing the results of your application review for your records.

Please note that Preferred Risk Policies, applicable in Zones B, C, and X on your community's NFIP Flood Insurance Rate Map, are not eligible for the CRS discount. Standard rated flood insurance policies in Zones B, C, X, D, AR, and A99 are limited to a CRS discount of 10 percent in CRS Class 1–6 communities and 5 percent in CRS Class 7–9 communities. The rates for these zones already reflect significant premium reductions.

If your community does not change its floodplain management practices, the CRS rating for your community will automatically be renewed annually and a notification letter will not be sent to your community. This renewal will occur as long as your community continues to implement the CRS activities you certify each October. If no additional modifications or new CRS activities are added, the next verification visit for your community will be in accordance with its established 5-year cycle. FEMA will periodically send the *NFIP/CRS Update* newsletter and other notices to your CRS Coordinator.

I commend you on your community's actions and your determination to lead your community to be more disaster resistant. This commitment enhances public safety, protects property, preserves the natural functions of floodplains, and reduces flood insurance premiums.

If you have any questions or need additional information, please contact the FEMA Region X Office, CRS Coordinator, John Graves, CFM, by telephone at (425) 487 – 4737.

Sincerely,

David L. Miller
Associate Administrator
Federal Insurance and Mitigation Administration

Enclosure

cc: Christy Taylor, Development Services Manager

NFIP/CRS

COMMUNITY RATING SYSTEM

VERIFICATION REPORT

City of Medford, OR

NFIP Number: 410096

Date of Verification Visit: August 22, 2013

Verified Class 6

Cycle

This Verification Report is provided to explain the recommendations of Insurance Services Office, Inc. (ISO) to DHS/FEMA concerning credits under the Community Rating System (CRS) for the above named community.

A total of 2131 credit points are verified which results in a recommendation that the community improve from a CRS Class 8 to a CRS Class 6. The community has met the Class 6 prerequisite with a Building Code Effectiveness Grading Schedule (BCEGS) Classification of 2/2. The following is a summary of our findings with the total CRS credit points for each activity listed in parenthesis:

Activity 310 – Elevation Certificates: The Building Safety Department maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation Certificates are also kept for post-FIRM buildings. (39 points)

Activity 320 – Map Information Service: Credit is provided for furnishing inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM). Credit is also provided for the community furnishing additional FIRM information, information about problems not shown on the FIRM, flood depth data, special flood related hazards, historical flood information, and natural floodplain functions. The service is publicized annually and records are maintained. (90 points)

Activity 330 – Outreach Projects: Credit is provided for general outreach projects that include miscellaneous flood related flyers, and a targeted outreach project that includes a floodplain residents Letter. (60 points)

Activity 340 – Hazard Disclosure: Credit is provided for state regulations requiring disclosure of flood hazards. Real estate agents provide a brochure advising prospective buyers about insurance and checking property flood hazards. (23 points)

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Jackson County Library – Medford Branch. Credit is also provided for floodplain information displayed on the community's website. (89 points)

Activity 360 – Flood Protection Assistance: Credit is provided for offering one-on-one advice regarding property protection. (25 points)

Activity 410 – Floodplain Mapping: Credit is provided for conducting and adopting flood studies for areas not included on the FIRMs and that exceed minimum mapping standards. (19 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 66 percent of the Special Flood Hazard Area (SFHA) as open space, protecting open space land with deed restrictions, and preserving open space land in a natural state. (812 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require enclosure limits and local drainage protection. Credit is also provided for the enforcement of building codes, a BCEGS Classification of 2/2, state mandated regulatory standards and regulations administration. (166 points)

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using digitized maps in the day to day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study Reports. (165 points)

Activity 450 – Stormwater Management: The community enforces regulations for stormwater management, soil and erosion control and water quality. (166 points)

Section 502 - Repetitive Loss Category: The City of Medford, OR is a Category A community for CRS purposes and no action is required. (No credit points are applicable to this section)

Activity 540 – Drainage System Maintenance: All of the community's drainage system is inspected regularly throughout the year and maintenance is performed as needed. Credit is also provided for listing problem sites that are inspected more frequently, and for implementing an ongoing Capital Improvements Program. The community enforces a regulation prohibiting dumping in the drainage system, and annually publicizes the regulation or has appropriate signs posted. (443 points)

Activity 630 – Dams: Credit is provided for a State Dam Safety Program. (34 points)

Activity 710 – County Growth Adjustment: All credit in the 400 series is multiplied by the growth rate of the county to account for growth pressures. The growth rate for the City of Medford, OR is 1.08.

Attached is the Community Calculations Worksheet that lists the verified credit points for the Community Rating System.

CEO Name / Address:

The Honorable Gary Wheeler
Mayor of Medford
411 West Eighth Avenue
Medford, Oregon 97501

CRS Coordinator Name / Address:

Christy Taylor
Development Services Manager
200 South Ivy Street
Medford, Oregon 97501
(541) 774-2367

Date Report Prepared: May 12, 2014

Community : City of Medford, OR **NFIP Number :** 410096

720 COMMUNITY CREDIT CALCULATIONS (Cycle):

CALCULATION SECTION :

Verified Activity Calculations:

					Credit
c310	39				39
c320	90				90
c330	60				60
c340	23				23
c350	89				89
c360	25				25
C370					
c410	18	x CGA	1.08	=	19
c420	752	x CGA	1.08	=	812
c430	154	x CGA	1.08	=	166
c440	153	x CGA	1.08	=	165
c450	154	x CGA	1.08	=	166
c510					
c520					
c530					
c540	443				443
c610					
c620					
c630	34				34

Community Classification Calculation:

cT = total of above cT = 2131

Community Classification (from Table 110-1): Class = 6

CEO Name/Address:

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Mayor of Medford
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Medford, Oregon 97501

CRS Coordinator Name/Address:

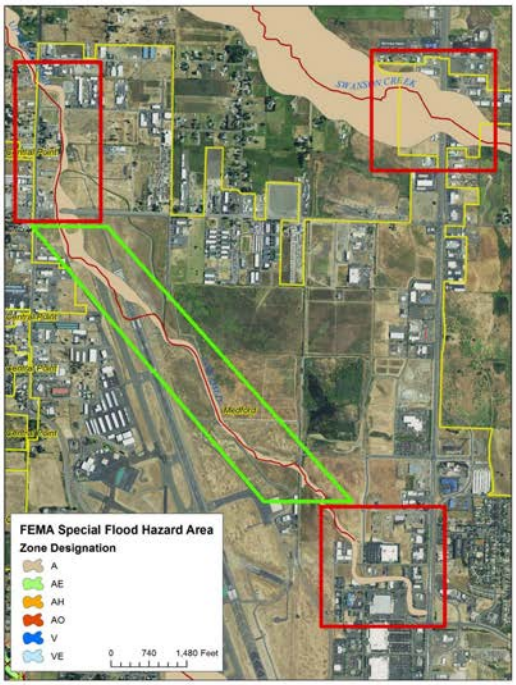
Christy Taylor
Development Services Manager
200 South Ivy Street
Medford, Oregon 97501
(541) 774-2367

Date Report Prepared: May 12, 2014

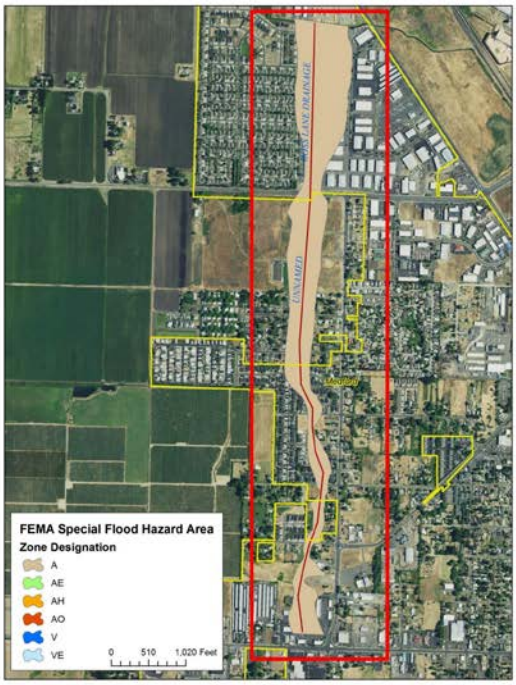
AW-720

DOGAMI Flood Information for Medford (November 17, 2016)

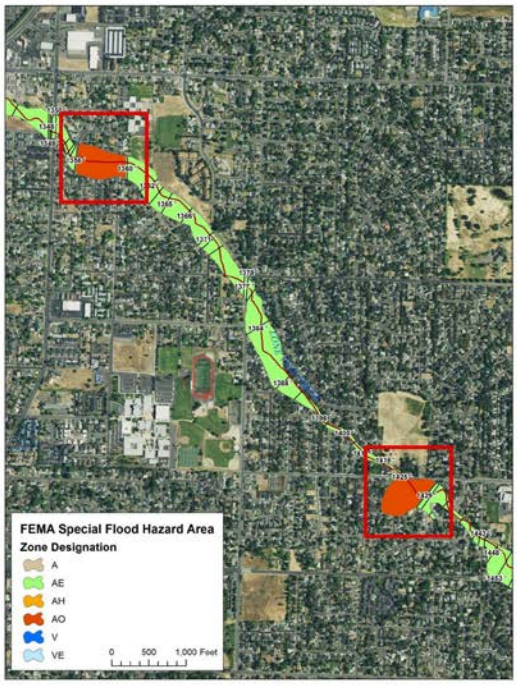
1. Approximate mapping (Zone A) for Upton Slough and Swanson Creek: Upton Slough and Swanson Creek have been mapped with approximate methods (Zone A) within the Medford city limits. These areas do not have base flood elevations available which presents a challenge for floodplain management. Note that three areas already have significant development in or near the mapped floodplains (outlined in red). An area of Upton Slough may be considered for future development and currently runs through the airport (outlined in green). These areas should be considered for upgrade to a detailed study (Zone AE) with base flood elevations.



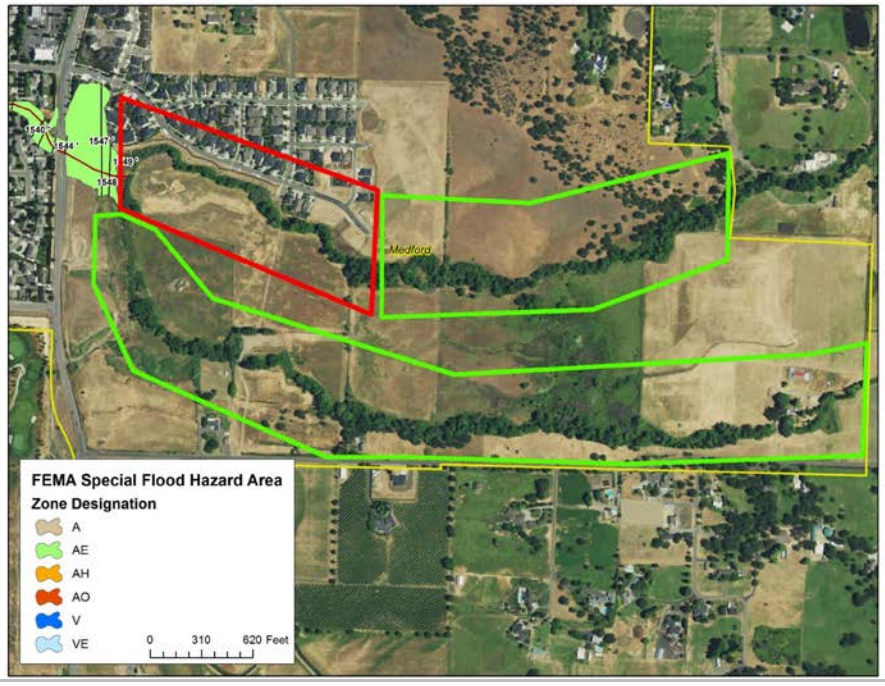
2. Approximate mapping (Zone A) for Ross Lane Drainage: Ross Lane Drainage has been mapped with approximate methods (Zone A) within the Medford city limits. These areas do not have base flood elevations available which presents a challenge for floodplain management. Note that the area already has significant development in or near the mapped floodplains (outlined in red). This area should be considered for upgrade to a detailed study (Zone AE) with base flood elevations.



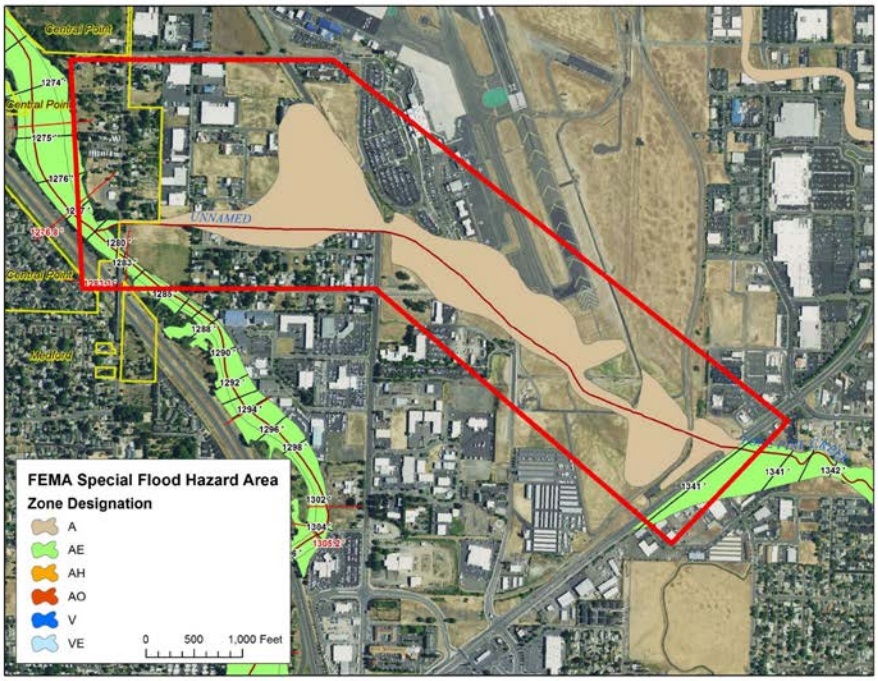
3. Ponding mapping (Zone AO) for Lone Pine Creek: Portions of Lone Pine Creek has been mapped to show areas of ponding (Zone AO, outlined in red). Flooding is characterized in terms of depth rather than elevation in these areas, which presents a challenge for floodplain management. These area should be considered for re-study and designated as a flood zone with elevations, such as Zone AE or Zone AH.



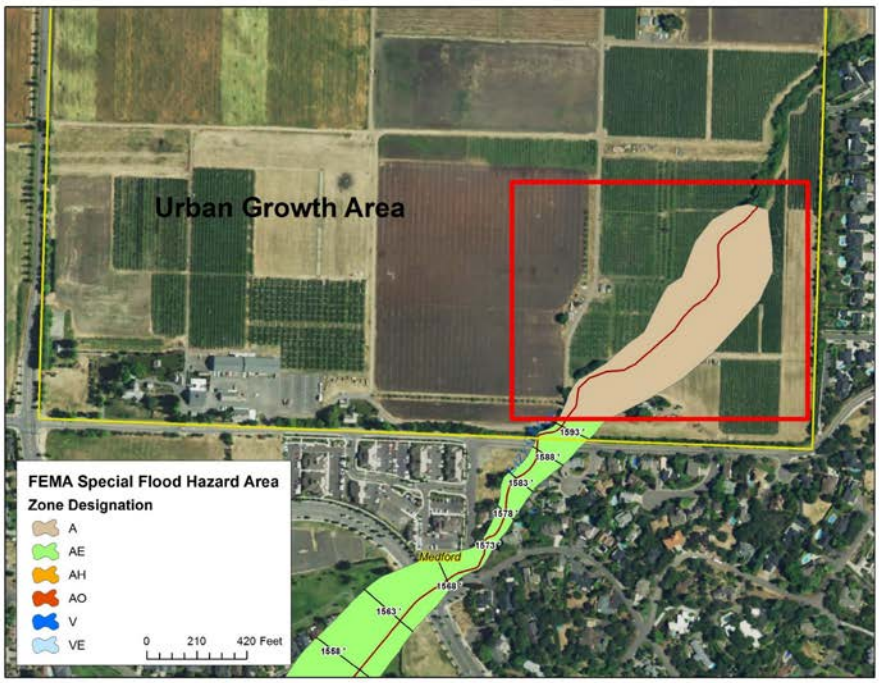
4. Possible expansion of flood mapping for Larson Creek and tributary: New development along Larson Creek has occurred (outlined in red), apparently since the existing flood mapping effort was completed. This area should be prioritized for flood mapping, preferably a detailed study (Zone AE), given the development density. There should also be consideration of future development within the city limits along Larson Creek and its tributary to the south (outlined in green). If these areas are likely to be developed, new flood mapping should be prioritized.



5. Approximate mapping (Zone A) for Lone Pine Creek: The lower portion of Lone Pine Creek has been mapped with approximate methods (Zone A) within the Medford city limits (outlined in red). This area does not have base flood elevations available which presents a challenge for floodplain management, considering it has already been developed and has potential for future development. This area should be considered for upgrade to a detailed study (Zone AE) with base flood elevations.



6. Approximate mapping (Zone A) for Lazy Creek: The upper portion of Lazy Creek falls outside Medford city limits, but within the city's urban growth area. This portion of Lazy Creek has been mapped with approximate methods (Zone A, outlined in red). This area does not have base flood elevations available which presents a challenge for floodplain management. If future development is targeted for this area it should be prioritized for upgrade to a detailed study (Zone AE) with base flood elevations.



Memorandum of Agreement/Scope of Work

MEMORANDUM OF AGREEMENT

City of Medford, Oregon
and
Oregon Department of Land Conservation and Development

Project Summary

This Memorandum of Agreement (MOA) is to formalize a working relationship between the Oregon Department of Land Conservation and Development (DLCD) and the City of Medford (MEDFORD) that is to result in an updated City of Medford Natural Hazards Mitigation Plan (NHMP). The project is funded by the Federal Emergency Management Agency (FEMA). DLCD will act as consultant. This is a no-cost agreement inasmuch as no funds are to be exchanged between MEDFORD and DLCD. MEDFORD will provide and document in-kind services as cost-share.

Background

To be eligible to receive certain pre- and post-disaster natural hazard mitigation funds from FEMA, local governments must have a current, FEMA-approved NHMP. NHMPs must be updated and re-approved every five years. Medford's NHMP expired October 4, 2015; therefore it is important for MEDFORD to update its NHMP as soon as possible. DLCD has received a Pre-Disaster Mitigation grant (PDM 14) from FEMA through OEM to assist MEDFORD with its NHMP update.

The grant's performance period is from April 21, 2014 through September 30, 2016. Because FEMA's grant award process and then Oregon's subsequent legislative fiscal process have together taken an inordinately long time in this case, we anticipate requesting at least one 12-month no-cost period of performance extension from FEMA to complete the update. The term of this agreement assumes one such extension will be granted.

FEMA does not allow DLCD to disburse the PDM 14 grant funds to local governments to complete updates on their own. Therefore, DLCD will use the grant funds to provide consulting and technical assistance to MEDFORD to complete the update, and MEDFORD will provide cost-share through in-kind services. Medford will document its cost-share expenditures. Neither party will invoice the other.

In addition, after the NHMP is adopted, MEDFORD will enter the Jackson County Multi-Jurisdictional NHMP update process with the intent of readopting its updated NHMP as an addendum to that plan. DLCD will provide technical assistance to MEDFORD during this process. DLCD will also provide technical assistance to MEDFORD on the integration of its updated NHMP into MEDFORD's existing planning mechanisms.

1

Tasks

See Attachment A, Statement of Work.

PDM grants must culminate in a locally-adopted and FEMA-approved NHMP. Because this project is funded through a PDM grant, MEDFORD must not only consider but also adopt a FEMA-approvable NHMP.

Term, Termination and Amendment

This agreement shall remain in effect from the date it is fully executed through September 30, 2017, unless the 12-month no-cost extension to be requested from FEMA is not granted. Either Party may unilaterally terminate the agreement with sixty days' written notice to the other Party. The terms of this agreement may not be altered, modified, supplemented or otherwise amended, except by written agreement signed by both of the Parties.

Limitation of Liability

EXCEPT FOR LIABILITY ARISING UNDER OR RELATED TO SECTION 10, NEITHER PARTY WILL BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL , OR OTHER INDIRECT DAMAGES ARISING OUT OF OR RELATED TO THIS AGREEMENT, REGARDLESS OF WHETHER THE LIABILITY CLAIM IS BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, PRODUCT LIABILITY OR OTHERWISE. NEITHER PARTY WILL BE LIABLE FOR ANY DAMAGES OF ANY SORT ARISING SOLELY FROM THE TERMINATION OF THIS AGREEMENT IN ACCORDANCE WITH ITS TERMS.

Force Majeure

Neither Party is responsible for any failure to perform nor any delay in performance of any obligations under this agreement caused by fire, civil unrest, labor unrest, natural causes, or war, which is beyond that Party's reasonable control. Each Party shall, however, make all reasonable efforts to remove or eliminate such cause of failure to perform or delay in performance and shall, upon the cessation of the cause, diligently pursue performance of its obligations under this agreement.

Intended Beneficiaries

DLCD and MEDFORD are the only parties to this Agreement and are the only parties entitled to enforce its terms. Nothing in this agreement provides, is intended to provide, or may be construed to provide any direct or indirect benefit or right to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of this agreement.

Notice/Contacts

DLCD:

Name	Tricia Sears (Primary Point of Contact)
Address	635 Capitol Street, NE Salem, OR 97301-2540
Email	tricia.sears@state.or.us
Phone	(503) 934-0031

Name	Marian Lahav (Secondary Point of Contact and Grant Manager)
Address	635 Capitol Street, NE Salem, OR 97301-2540
Email	marian.lahav@state.or.us
Phone	(503) 934-0024

MEDFORD:

Name	Larry Masterman
Address	411 W 8th Street, Room 310 Medford, OR 97501-3105
Email	Larry.Masterman@cityofmedford.org
Phone	(541) 774-2091

(BALANCE OF PAGE INTENTIONALLY LEFT BLANK)

Nothing in this Memorandum of Agreement shall be construed as obligating the other party to expend funds or obligate future payment of money authorized by law and administratively available for this work.

DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT, STATE OF OREGON

By_____ Date 08.10.16
Jim Rue, Director

CITY OF MEDFORD, OREGON

By_____ Date 7-27-2016
Gary Wheeler, Mayor

4

ATTACHMENT A:

STATEMENT OF WORK

STATEMENT OF WORK

City of MEDFORD Natural Hazards Mitigation Plan (NHMP) Update

PROJECT DESCRIPTION

The purposes of this statement of work are to:

1. Review and update MEDFORD's NHMP such that it is ultimately adopted by MEDFORD and approved by FEMA;
2. Develop a plan for integrating the approved NHMP with MEDFORD's existing planning mechanisms by preparing a crosswalk identifying where NHMP elements could be integrated with such documents and an action plan for achieving integration; and
3. Assist Medford with integrating its updated NHMP into Jackson County's multi-jurisdictional NHMP.

STATEMENT OF WORK

In addition to the work and deliverables specified below by task, MEDFORD agrees to:

1. Handle meeting and public outreach logistics;
2. Lead public outreach;
3. Perform administrative functions including tracking and timely reporting its cost share on a quarterly basis; and
4. Execute regular staff responsibilities throughout the public process to review and adopt the updated NHMP.
5. Provide GIS services.

In addition to and for clarification of the work and deliverables specified below by task, the CITY agrees to:

1. Provide adequate public notice of meetings and events through a variety of means (examples include handouts, newspaper inserts, distribution of flyers to public sites, news releases to radio and television stations, newspaper event listings, utility bill inserts; etc.).
2. Provide information about the project on its website and drive web traffic to the interactive website for the project hosted by the CITY;
3. Provide a subscription listserv (not interactive – information out only) or email service to advise interested parties of opportunities to participate in meetings and events and to comment on draft materials;
4. Assist CONSULTANT in working with the Steering Committee and Community Partners Committee members to gather data, information, and materials needed for NHMP development.

5. Perform administrative functions including tracking and timely reporting its cost share on a quarterly basis; and
6. Execute regular staff responsibilities throughout the public process to review and adopt the updated NHMP.

In addition to and for clarification of the work and deliverables specified below by task, DLCD agrees to:

1. Prepare meeting materials and provide them to the CITY at least seven days in advance of meetings;
2. Lead and facilitate meetings and public outreach events;
3. Gather and analyze data for the NHMP;
4. Write, edit, and after FEMA approval, finalize the NHMP;
5. Assist the CITY with preparation for and execution of (a) City Council workshop(s) and NHMP adoption proceeding as necessary.

DLCD and MEDFORD agree to take a strategic approach to the NHMP update and perform the following tasks:

TASK 1: ORGANIZE

Purpose
The purpose of Task 1 is to organize for project initiation.

Task 1.1: Hold Organizational Meeting
MEDFORD and DLCD staff involved in the project will meet to clarify roles and responsibilities; develop a protocol to ensure clear and effective communication; resolve any questions about content, process, or scope of work; and develop a draft Public Engagement Program (PEP) for Steering Committee (SC) review.

The PEP will establish an open and transparent planning process. It will incorporate one or two public meeting(s), format and timing to be determined. At least two opportunities for the public to comment will be included, one during drafting and one prior to plan approval. "The public" is understood to include but not be limited to neighboring communities, local and regional agencies involved in hazard mitigation activities; agencies that have the authority to regulate development, businesses, academia, and other private and non-profit interests.

MEDFORD will identify and recruit stakeholders and interested parties who, at a minimum, represent each of the "whole community" sectors as set forth in current FEMA documents: a. Emergency Management; b. Economic Development; c. Land Use and Development; d. Housing; e. Health and Social Services; f. Infrastructure; and g. Natural and Cultural Resources to serve on the Community Partners Committee (CPC).

MEDFORD will establish and maintain a webpage and listserv for the project.

FEMA Requirements: 44 CFR §201.6(b) and (c)(1)

Deliverables

MEDFORD:

1. Coordinate Organizational Meeting (#1).
2. Establish project web page.
3. Establish project listserv.
4. Provide rosters of SC and CPC members, stakeholders and interested parties.

DLCD:

5. Provide meeting agenda.
6. Provide meeting notes containing:
   a. Roles and Responsibilities
   b. Communication Protocol
   c. Clarification of content, process, or scope of work questions
   d. Draft Public Engagement Program including MEDFORD's rosters of SC members, CPC members, stakeholders and interested parties.

Milestone: May 31, 2016

TASK 2: INITIATE

Purpose

The purpose of Task 2 is to initiate the project by activating the Steering Committee (SC); reviewing and revising the Statement of Work; establishing a project schedule; developing a protocol to ensure clear and effective communication; discussing the draft Community Partners Committee (CPC) roster; reviewing the draft Table of Contents; and refining the Public Engagement Program (PEP).

The PEP will be establish an open and transparent planning process. It will incorporate at least one public meeting, format and timing to be determined. At least two opportunities for the public to comment will be included, one during drafting and one prior to plan approval. "The public" is understood to include but not be limited to neighboring communities, local and regional agencies involved in hazard mitigation activities; agencies that have the authority to regulate development, businesses, academia, and other private and non-profit interests.

DLCD and the SC will identify and recruit stakeholders and interested parties who, at a minimum, represent each of the "whole community" sectors as set forth in current FEMA documents: a. Emergency Management; b. Economic Development; c. Land Use

and Development; d. Housing; e. Health and Social services; f. Infrastructure; and g. Natural and Cultural Resources to serve on the CPC.

All meetings will be duly advertised and open to the public.

Task 2.1: Hold Steering Committee Meeting

The purpose of this meeting will be to introduce the project, project schedule, and PEP to the SC; solicit the SC's input on the PEP and Table of Contents; and solicit information on the status of MEDFORD's 2010 NHMP as well as advice on changes for the updated NHMP. MEDFORD will furnish materials to participants at least one week ahead of the meeting.

FEMA Requirements: 44 CFR 201.6(b) and (c)(1)

Deliverables

MEDFORD
DLCD

1. Coordinate Initial SC Meeting (#2).
2. Provide meeting agenda.
3. Provide meeting notes containing:
   a. Revised PEP including potential participants
   b. 2010 NHMP status updates
   c. Potential changes for the updated NHMP

Milestone: June 15, 2016

Task 2.2: Confirm Community Partners Committee

MEDFORD will contact and confirm CPC members in accordance with the SC's input on the PEP.

FEMA Requirements: 44 CFR 201.6(b) and (c)(1)

Deliverables

MEDFORD

1. Committee rosters with complete contact information for SC and CPC members.

Milestone: June 30, 2016

TASK 3: Update the 2010 NHMP

Purpose

The purpose of Task 3 is to review and update MEDFORD's 2010 NHMP such that it meets the requirements of 44 CFR 201.6 as indicated by the September 30, 2011 version of FEMA's Local Mitigation Plan Review Guide and is therefore approvable by FEMA.

Task 3.1: Review and Update the Risk Assessment

The risk assessment contains:

1. A characterization and analysis of each of the hazards to which MEDFORD is subject (severe weather, floods, earthquakes, wildfires, landslides, volcanic eruptions, drought) including how climate change may affect them individually and collectively to the extent data is available. MEDFORD's 2010 NHMP also addresses air quality and epidemics. If MEDFORD chooses to include them in this update, MEDFORD will be primarily responsible for those sections.
2. An assessment of probability of hazard occurrence.
3. A profile of community characteristics including geography, population demographics, land use and development trends (changes in development), housing and employment, transportation, critical facilities and infrastructure, historic and cultural resources, and identification of NFIP-insured structures that have sustained repetitive flood damages.
4. An assessment of vulnerability to each hazard.
5. An assessment of potential dollar losses to buildings, repetitive flood loss structures, infrastructure, and critical facilities from each hazard (to the extent data is available).
6. Conclusions (to the extent reasonable based on the data and analysis) as to the priorities for mitigation actions.

FEMA Requirements: 44 CFR 201.6(b), (c)(1), (c)(2) and (d)(3)

<u>Deliverables</u>

MEDFORD

1. Coordinate up to 4 CPC and 2 SC meetings. Meetings may be consolidated as agreed by DLCD and MEDFORD.
2. Produce necessary GIS maps.
3. Provide relevant existing plans, studies, reports, and technical information for review and potential incorporation.
4. Provide supplemental and updated information for hazard characterization and analysis.
5. Provide information, statistics, and maps for community profile including changes in development.
6. Provide information, statistics, and maps for vulnerability assessment.
7. Provide information, statistics, and maps for potential loss assessment.

DLCD

9. Facilitate up to 4 CPC and 2 SC meetings. Provide agendas and notes.
10. Provide most current GIS hazard layers (flood, earthquake, wildfire, landslide, volcanic eruptions).
11. Incorporate relevant existing plans, studies, reports, and technical information subsequent to CPC review.

12. Conduct probability and vulnerability assessment using the OEM methodology.
13. Provide two drafts of the risk assessment chapter, one initial and one revised subsequent to CPC and SC review.

Milestone: October 31, 2016

Task 3.2: Review and Update the Mitigation Strategy

The mitigation strategy contains:

1. Goals and mitigation actions based on the conclusions of the risk assessment, emphasizing buildings and infrastructure.
2. Identification of changes in mitigation efforts and priorities.
3. An action plan describing how mitigation actions will be prioritized, implemented, and administered.
4. A description of MEDFORD's participation in the National Flood Insurance Program (NFIP) and continued compliance with its requirements.
5. Documentation of MEDFORD's existing authorities, policies, programs, and resources for implementing the mitigation actions and its ability to expand on and improve them (capability assessment).

FEMA Requirements: 44 CFR 201.6(b), (c)(1), (c)(3) and (d)(3)

Deliverables

MEDFORD

1. Coordinate 2 CPC meetings and 1 SC meeting. Meetings may be consolidated as agreed by DLCD and MEDFORD.
2. Provide status of existing mitigation actions.
3. Identify changes in mitigation priorities.
4. Provide description of MEDFORD's participation in the NFIP and continued compliance with its requirements.
5. Provide documentation of MEDFORD's existing authorities, policies, programs, and resources for implementing the mitigation actions and its ability to expand on and improve them (capability assessment).

DLCD

6. Facilitate up to 2 CPC meetings and 1 SC meeting. Provide agenda and notes.
7. Conduct review and update of goals.
8. Conduct review, update, and prioritization of mitigation actions.
9. Produce draft mitigation action plan.
10. Provide two drafts of the mitigation strategy chapter, one initial and one revised subsequent to CPC and SC review.

Milestone: December 31, 2016

Task 3.3: Review and Update the Plan Maintenance Process

The plan maintenance process contains:

1. A description of the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
2. A discussion of how MEDFORD will continue public participation during the plan maintenance process.
3. A crosswalk identifying where NHMP elements could be appropriately integrated with existing planning mechanisms.
4. A process by which MEDFORD will achieve integration.

FEMA Requirements: 44 CFR 201.6(b), (c)(1), and (c)(4)

Deliverables

MEDFORD	1. Coordinate 1 SC meeting OR incorporate into a Task 3.2 meeting. Meetings may be consolidated as agreed by DLCD and MEDFORD.
DLCD	2. Facilitate 1 SC meeting OR incorporate into a Task 3.2 meeting. If separate meeting, provide meeting agenda and notes.
	3. Provide two drafts of the plan maintenance process and integration crosswalk and process, one initial and one revised subsequent to SC review. May be accomplished with Task 3.2.

Milestone: December 31, 2016

Task 3.4: Hold Public Meeting(s) to Review Draft NHMP

The purpose of this meeting is to provide an opportunity for staff to present and discuss the primary content of the NHMP and obtain public comment.

FEMA Requirements: 44 CFR 201.6(b)

Deliverables

MEDFORD	1. Coordinate 1 or 2 public review meeting(s).
DLCD and MEDFORD	2. Develop materials including joint presentation for the public review meeting.
DLCD	3. Facilitate 1 or 2 public review meeting(s). Provide agenda(s) and notes.

Milestone: January 15, 2017

Task 3.5: Document the Planning Process

The updated NHMP contains a section documenting the planning process by:

1. Describing how the plan was prepared, who was included, how the public was involved, and the opportunities for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, and other interested parties to be involved;
2. Describing the opportunities for the public to comment during drafting and prior to plan approval;
3. Describing how existing plans, studies, reports, and technical information were incorporated; and
4. Including documentation of meetings and other public input.

Review of this section may be accomplished by means other than a meeting (such as online commenting), unless it can be incorporated into a Task 3.2 or Task 3.3 SC meeting.

FEMA Requirements: 44 CFR 201.6(b), (c)(1)

Deliverables

DLCD

1. Provide two drafts of the planning process documentation, one initial and one revised subsequent to public review.

Milestone: January 31, 2017

Task 3.6: Review and Update Remaining Plan Chapters

Other Plan chapters that need to be reviewed and updated include the Executive Summary, Introduction, and List of Acronyms. Developing and including a glossary will be done at MEDFORD's discretion. Review of this section may be accomplished by means other than a meeting (such as online commenting).

FEMA Requirements: 44 CFR 201.6(b), (c)(1)

Deliverables

DLCD

1. Provide two drafts of the remaining Plan chapters, one initial and one revised subsequent to staff review.

Milestone: February 28, 2017

Task 3.7: Finalize Draft NHMP for State and Federal Review

At this point, all sections of the draft NHMP will have been written and reviewed by interested parties. This step entails combining them all into a single document, editing the entire document, adding a cover, title page, acknowledgements, page numbers, etc. to finalize the Draft NHMP for the review and approval process.

FEMA Requirements: 44 CFR 201.6(b)

Deliverables

DLCD	1. Finalized Draft NHMP

Milestone: March 30, 2017

TASK 4: Review and Approval Process

Purpose

The purpose of Task 4 is to ensure that all the necessary steps toward final FEMA approval are taken; MEDFORD adopts the updated NHMP without substantive changes; and FEMA approves the adopted NHMP.

There are two levels of review prior to approval: state and federal. Revisions to the draft NHMP may be required at one or both levels. The State of Oregon will perform the first review and when it deems the draft NHMP approvable, the State will submit it to FEMA. When FEMA establishes that the draft is approvable, FEMA will issue an "Approvable Pending Adoption (APA)" letter to MEDFORD.

Upon receipt of FEMA's APA letter, MEDFORD will schedule and advertise a public meeting to adopt the draft NHMP (generally done by resolution). Following adoption, MEDFORD will submit the adopted NHMP with evidence of adoption to the State, which who will forward the package to FEMA. Upon receipt, FEMA will issue its letter of approval. Should MEDFORD make substantive changes to the draft NHMP with adoption, the review process would begin again.

PDM grants must culminate in a locally-adopted and FEMA-approved NHMP. Because this project is funded through a PDM grant, MEDFORD must not only consider but also adopt a FEMA-approvable NHMP.

Task 4.1: Submit Draft NHMP for State and Federal Review

The State will review the draft NHMP and when it is FEMA-approvable, the State will submit it to FEMA for formal review. DLCD and MEDFORD will make any necessary revisions with review by the SC and public as appropriate until FEMA issues the APA letter.

FEMA Requirements: 44 CFR 201.6(d)(1) and (d)(2)

Deliverables

MEDFORD	1. Submit draft NHMP to the State for review.
DLCD and MEDFORD	2. Make any required changes and resubmit until the State and FEMA are satisfied that the draft NHMP is approvable as evidenced by receipt of FEMA's APA letter.
DLCD	3. Completed FEMA local NHMP review tool.

Milestone:	Submittal:	April 1, 2017
	Completed State and FEMA reviews:	April 30, 2017

Task 4.2: Adopt and Submit NHMP to FEMA

MEDFORD will submit the Draft NHMP to City Council for adoption at a regular City Council meeting and submit the adopted NHMP with evidence of adoption to FEMA. Should MEDFORD make substantive revisions to the draft NHMP, the review and approval process will begin again.

FEMA Requirements: 44 CFR 201.6(c)(5)

Deliverables

MEDFORD

1. Schedule draft NHMP for adoption at regular City Council meeting
2. Draft staff report.
3. Resubmit adopted NHMP with evidence of adoption to the State.

DLCD

4. At MEDFORD's request, attend City Council meeting for adoption.
5. Insert evidence of adoption and FEMA approval letter into the NHMP.

Milestone: June 30, 2017

PROJECT BUDGET and PAYMENT SCHEDULE

No funds will be exchanged. DLCD will use PDM 14 federal cost share grant funds to execute its tasks. MEDFORD will provide its cost share of $8,250.00 minimum by using its own, **non-federal funds** to execute its tasks and will report expenditures to DLCD on a quarterly basis.

POST-PDM GRANT ACTIVITIES: COLLABORATION AND INTEGRATION

COLLABORATION

MEDFORD will enter the Jackson County Multi-Jurisdictional NHMP update process with the intent of readopting its updated NHMP as an addendum to that plan. DLCD will provide technical assistance to MEDFORD during this second update process.

INTEGRATION

DLCD is committed to providing technical support to MEDFORD for the integration of its updated NHMP into MEDFORD's existing planning mechanisms as described in Task 3.3 #3 and #4 and DLCD deliverable #3.

Appendix F Status of Medford's 2010 NHMP Mitigation Actions

The content of the tables below is excerpted exactly as presented in the *2010 Medford Pre-Disaster Mitigation Plan*; which is referenced as the *2010 Medford NHMP* in the *2017 Medford NHMP*. In the 2010 Medford NHMP, the mitigation actions were called mitigation measures. To demonstrate compliance with the FEMA Local Plan Review Tool requirement D.2 "Was the plan revised to reflect progress in local mitigation efforts?" the tables have been revised to include a notation in the "status" column and a notation in the "mitigation measures" column. The new text in both of these columns is identified in blue color.

The notation in the "status" column shows the status of the mitigation action in 2010 and in 2017. The 2017 notation identifies the most closely related mitigation actions included in the *2017 Medford NHMP* Mitigation Action Tables. In some cases, the 2010 mitigation action does not have a related mitigation action in the 2017. There are many new mitigation actions in the 2017 *Medford NHMP*. The *2010 Medford NHMP* did not include tables of mitigation actions for the air quality, epidemics (now called emerging infectious diseases), and drought hazards. In the "mitigation measures" column, there is a short description of what Medford has done since 2010 related to that mitigation action. For additional information about the work that Medford has done and is currently doing related to natural hazards, see the subsection "Medford's Existing Efforts that Implement Mitigation Actions" in Chapter 3.

The *2017 Medford NHMP* Mitigation Actions Tables include actions for all eight of the identified natural hazards for Medford. The natural hazards are: severe weather, floods, earthquakes, Wildland-Urban Interface fires, landslides, volcanic eruptions, air quality, and emerging infectious diseases. The Mitigation Actions Tables are **Table 48** through **Table 57**; they show the City of Medford's mitigation action items for multi-hazard and for specific hazards, within short-term and long-term categories. Short-term mitigation actions are those that can be undertaken without extra personnel or other resources. Long-term mitigation actions are those requiring additional resources.

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #1	Short-term Multi-hazard #1	Identify and pursue new state and federal funding opportunities to develop and implement local mitigation activities. Grant opportunities are reviewed regularly and appropriate opportunities are investigated and pursued. Since the 2010 update, the City has established a full-time dedicated Emergency Management Coordinator position. This measure is a key performance criterion.	Existing Resources	City Manager's Office (CMO)	●	●	●	●
2010: Ongoing 2017: STMH #2	Short-term Multi-hazard #2	Maintain public and private partnerships to foster natural hazard program coordination and collaboration within the City of Medford. Ongoing IGA with other local government agencies. This has been expanded greatly, including new partnerships with entities as diverse as libraries, schools, public safety agencies, public health, hospitals, and volunteer organizations.	Existing Resources	Fire, Police & Public Works	●	●	●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #3	Short-term Multi-hazard #3	Continue to periodically update the City Emergency Operations Plan, linking emergency services with natural hazard mitigation programs and enhancing public education. Updates to the evacuation routes and alerting systems are done annually. A comprehensive update to the EOP is under way in the current fiscal year. The *2017 Medford NHMP* will provide a great deal of new material for the EOP update, targeted for approval in June 2018.	Existing Resources	Fire	●	●	●	●
2010: Completed 2017: STMH #4	Short-term Multi-hazard #4	Make the Medford Pre-Disaster Mitigation Plan available to the public by placing it on the City's web site and in the Medford reference library. Completed. The City has had a website since before the *2010 Medford NHMP*; new features include easier access and much more content. The approved NHMP will be included there and widely available through libraries and other public sources.	Existing Resources	CMO	●		●	●
2010: Ongoing 2017:	Short-term Multi-hazard #5	As a matter of family disaster preparedness, encourage all families to have provisions on hand that allow them to be self-sufficient for a period of up to five	Existing Resources	Emergency Mgt. Team, American Red Cross	●	●	●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters			
					Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
SHMH #5 SHMH #8		days. • Use the City's Newsletter, website, and Neighborhood Watch Program to broadcast and/or distribute Red Cross Pamphlets about Family Emergency Kits. • Distribute the Jackson County Emergency Preparedness Guide for Families via Neighborhood Walk Since 2014 these measures have been a priority activity for the City's emergency management program. From 1/1/14 through 6/30/17, a total of 6,745 student hours of community preparedness training were provided to 2,629 students. City of Medford employees and volunteers: 399 students, 2,453 student hours. Other agencies: 968 students, 2,751 student hours. Web, social media, City-published activity guides, utility bill inserts, and mass media efforts have been used to promote individual, family, and community preparedness. The self-sufficiency period has been updated to 14 days.		(ARC)				

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters			
					Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #6	Short-term Multi-hazard #6	Maintain the Pre-Disaster Mitigation Plan Steering Committee to facilitate implementation, monitoring and evaluation of citywide mitigation activities. Committee meets annually to review plan. This measure was not carried out until 2015, when the group was reconstituted and re-energized to lead the update. Its continued work is now a feature of the City's planning strategy.	Existing Resources	CMO	●	●	●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #8, LTMH #1 LTMH #2	Long-term Multi-hazard #1	Increase technical knowledge of natural hazards and mitigation strategies in Medford and adjust policies and programs based on that knowledge. • Increase the accuracy and comprehensiveness of the GIS inventory of all critical facilities, large employers & public assembly areas and lifelines. • All departments continue to receive emergency response training via NIMS program and desktop trainings. • Continued updates and expansion of city infrastructure in GIS. Street lights GIS module was completed in 2009. • The map of critical facilities was updated in August 2008. • Fire Dept. maintains hazardous materials inventory and works with GIS to identify critical infrastructure. Increasing technical knowledge of natural hazards is a multi-disciplinary effort that continues. The mitigation actions identified in the status column provide specifics.	Pre-disaster Mitigation (PDM) Program; existing resources.	Planning, Fire, -Public Works, Technology Services, GIS	●	●	●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Completed 2017: LTMH #2	Long-term Multi-hazard #2	Refine hazard map overlays, paying special attention to what has still not been mapped by FEMA in southeast Medford, and distribute to City departments for use in reviewing development applications • The landslide, wildfire, flood, and earthquake hazard maps were all updated in August 2008. The update includes comprehensive updates and new map overlays, related to all identified hazards, far beyond what had been previously mapped.	Pre-disaster Mitigation (PDM) Program; existing resources	Planning, Building, Technology Services, GIS	●		●	
2010: Completed by Jackson County DHS and RVCOG 2017: LTMH #3 LTMH #11	Long-term Multi-hazard #3	Create and maintain a system to support populations with special needs within Medford city limits, including evacuation and shelter. • Begin by inviting self-advocates, advocacy organizations, social service and care facilities to meet with City staff to discuss local risks from hazards and learn how other communities have organized to provide and facilitate this support. • City continues working relationship with Jackson County Health and Human Services and Emergency	Pre-disaster Mitigation (PDM) Program; existing resources; Dept. of Homeland Security	Police, Fire, Community Resources, Jackson County Health Dept., ARC, Care Facilities	●	●	●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters			
					Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
		Management to maintain systems of support for populations with special needs. Since the 2010 update, the City has been a key participant in the Rogue Valley Council of Governments' Vulnerable Populations Committee and its efforts, hosted an access survey for deaf/hearing impaired residents, and has been an active proponent for access and services.						

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #8	Long-term Multi-hazard #4	Improve public awareness and provide people with steps to reduce their risk to natural hazards. • Obtain publications on earthquakes, wildfires, and floods from the Institute for Business and Home Safety or similar publications and make them available at popular public events at booths staffed by Community Service Officers, students in the Explorer program, or Neighborhood Watch volunteers. • Include prevention and preparedness brochures during Neighborhood Walk visits and at City Hall. • Fire Dept. continues to provide and distribute a variety of brochures on natural hazard reduction at various community events and have them posted on the City website. Comprehensive efforts were instituted for earthquake, flood, severe weather, air quality, and all-hazards awareness.	Pre-disaster Mitigation (PDM) Program; existing resources	Fire,	●		●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LTMH #4	Long-term Multi-hazard #5	Develop a system for data collection for non-declared natural hazard events. • Fire Dept. continues to improve its incident records management system and use of proactive data analysis for pre-incident planning purposes. The Emergency Management Coordinator will be the lead and will compile the information on an annual basis.	Pre-disaster Mitigation (PDM) Program; existing staff resources	Public Works, Fire, Technology Services, GIS	●	●	●	
2010: Ongoing 2017: LTMH#5	Long-term Multi-hazard #6	Development of a long-term recovery plan for Medford from the effects of catastrophic hazards. • Begin by researching such plans for similarly sized cities in the West and deciding which elements are applicable to Medford and the risks it faces. • Develop worst-case scenarios and long-term recovery needs for each prioritized hazard. Forecast the fiscal burden to be borne by the City alone, once all state and federal assistance has been obtained. • Since specific impact locations are	Pre-disaster Mitigation (PDM) Program	Planning, Fire, ~~Police,~~ Public Works		●		●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters			
					Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
		unknown, the following three plans constitute infrastructure recovery plans at this time: Transportation System Plan, Storm Water Master Plan, and Sewer Collection Master Plan. • City Manager, Public Works Director & Assistant to the City Manager have received training from the Emmitsburg FEMA facility in 2008/09. • The Public Facilities and Environmental Elements which are adopted in the City's Comprehensive Plan provides guidance for recovery. • The Public Facilities Element includes the Transportation System Plan, and the Storm Water and Sewer Collection Master Plans. The Environmental Element includes a discussion of hazards and the regulations and steps the city has taken to mitigate these potential events. • Fire Dept. annex to the COOP						

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters			
					Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
		provides for a recovery from the effects of catastrophic hazards in the relatively short term. The EOP update is expected to include all of this.						
2010: Ongoing 2017: LTMH #7	Long-term Multi-hazard #7	Develop an inventory of publicly owned facilities capable of offering safe haven to citizens during disaster events. • Determine the relative safety of each facility vis-à-vis prioritized hazards and what specifically must be done to ensure the safety of persons in this facility during a hazard event. • This is being incorporated into the development of the City's COOP • Fire Dept. continuously reviews and coordinates with City GIS and Public Works to identify suitable facilities for safe haven. Since 2010 the City has begun partnering with the Red Cross to identify and assess potential shelter locations.	Existing resources.	CMO, Fire, ARC	●			●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LTMH #6	Long-term Multi-hazard #8	Cooperate with the American Red Cross to assess the adequacy of service delivery in all areas of the City. • Using GIS capabilities, compare the populations to be served with the capacities and accommodations of local facilities and services. Develop a prioritized list of needs for each area. Identify funding to serve those needs. • This is being reviewed in conjunction with development of the city's COOP • The critical facilities, Vulnerable Special Populations, and Special Populations maps were updated in August 2008. • Fire Dept. in partnership with American Red Cross to review and assess adequacy of service delivery. Shelters have been identified by Jackson County GIS.	Anna Mae Foundation may grant funds to the ARC; existing resources.	Fire, Planning, ARC, Technology Services, GIS	●		●	●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LTMH #8	Long-term Multi-hazard #9	Assess the feasibility of implementing new, effective measures for notifying citizens about impending disasters and the need to evacuate, e.g., Reverse 9-1-1, EAS. • City dispatch currently provides a reverse 911 system and we are evaluating the use of social networks and non-conventional media for public notification. Work continues to improve the efficacy of the Jackson County Citizen Alert system for those in the City of Medford. Developments of the Emergency Alert System (EAS) and Integrated Public Alert and Warning System (IPAWS) are monitored for local application.	Dept. of Homeland Security	Police, Fire	●	●	●	

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LTMH #9	Long-term Multi-hazard #10	Identify specific mitigation-related criteria that can be incorporated into the land use planning process, e.g. use of temporary gravel roads for fire access during development, providing pedestrian pathways with universal access. • All mitigation-related criteria is incorporated as land use standards are updated. • Street standards ordinance adopted in September 2009. • Stormwater detention ordinance was adopted in November 2009. • Adoption of Hillside Ordinance in 2009 regulating hillside development on slopes. • Fire Dept. is currently evaluating the feasibility of adding wildland access points to our mobile data computer maps used for response. Fire also coordinates with developers to assure adequate fire apparatus access. This work continues as a priority for the City; it builds on past efforts that are now in place and looks for additional areas.	Existing resources	Planning, Fire, Public Works	●		●	

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #2	Long-term Multi-hazard #11	Determine ways to better integrate the resources of utility companies (personnel, equipment and information) with those of the City during events. • Assess the effectiveness of liaison positions in the City ECC and in the Unified Command Structure. • Fire dept. is continuing to evaluate and establish lists that identify critical personnel and resources from both governmental and non-governmental partners. The Emergency Management Program has actively developed relationships with commercial power, natural gas, telecommunications, and other utility providers. These feature prominently in the Earthquake Summit planned for September 2017 in Medford.	Existing Resources	CMO, Fire, Public Works, PacifiCorp, Qwest, Avista	●	●		●

Status	Natural Hazard	Table 1-2 Multi-Hazard Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LTMH #10	Long-term Multi-hazard #12	Assess the adequacy of training, personnel and equipment available to City Emergency Services for responding to widespread and/or multiple concurrent events. • Determine the City's level of acceptable risk and ensure that Emergency Services can protect the community at that desired level. Use tabletop exercises to gain perspective on the allocation of existing resources. Identify state and federal funding to provide for additional needs. 85% of city staff identified as necessary for response to emergencies have been trained utilizing the NIMS online training. Additional training is continuously sought, delivered, facilitated, and evaluated. Updated training statistics are noted in STMH #5 above.	Existing Resources; Dept. of Homeland Security.	CMO, Emergency Mgt. Team	●	●		

Status	Natural Hazard	Table 2-2 Severe Storms Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: ST Severe Weather #1 ST Severe Weather #5	Short-term Storms #1	Explore opportunities on public access television and through local schools for promoting public awareness of storm hazards and the benefits of mitigation. • Information on emergency preparedness is published in the city's newsletter on annual basis. • City of Medford is a National Weather Service Certified Storm Ready Community which was the topic of a public access television show. Similar efforts have continued and increased since the 2010 update, in close partnership with the Medford National Weather Service office and media partners.	Existing Resources	CMO, Emergency Mgt. Team	●	●	●	●
2010: Ongoing 2017: ST Severe Weather #2	Short-term Storms #2	Support PacifiCorp's concept of a removal/replacement program for trees that threaten utilities. • Present it to the City's Tree Committee for their review and recommendation to City Council for adoption. Continue to support the partnership with PacifiCorp regarding trees.	Existing Resources	Parks & Recreation, CMO	●			●

Status	Natural Hazard	Table 2-2 Severe Storms Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: ST Severe Weather #3	Short-term Storms #3	Support the concept of identifying trees that pose a risk to utilities and structures. • The Parks & Recreation Dept. through the work of the City Arborist, has completed a city-wide inventory of trees. This inventory consists of identifying and removing hazardous trees in the public right-of-way, city owned property and private property that could possibly affect utility services if the tree was to fall. Over the past three years, the City of Medford has removed or provided permits to private land owners for the removal of over 300 identified problem trees. • The City Arborist has provided comprehensive training to other park maintenance employees along with Public Works staff in identifying problem trees. Finally the city arborist meets regularly with PacifiCorp to coordinate the trimming and removal of trees that are under transmission lines. Continue the City Arborist work. Details are provided in the *2017 Medford NHMP*.	Existing Resources	Public Works, Parks and Recreation	●			

Status	Natural Hazard	Table 2-2 Severe Storms Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Completed 2017: ST Severe Weather #4	Short-term Storms #4	Through public incentives, partnerships, and regulations continue to support the construction of underground utilities. • Medford Land Development code section 10.555 requires all utilities in new developments to be underground. Continue the implementation of the code provisions and to support the construction of underground utilities.	Existing Resources	CMO, Planning, Public Works, Building	●			●

Status	Natural Hazard	Table 2-5 Flood Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Completed 2017: ST Flood #1 LT Flood #1	Long-term Flood #1	Completed – Mitigation needs identified in applicable facility master plans. • City GIS maintains FEMA floodplain maps which can be coupled with critical infrastructure layers to identify at-risk facilities. Each year update the "Summary of Impact on Exposed Assets Data" collected during this NHMP update and continue to update floodplain maps as information is available. Review this information and the relationship with critical infrastructure.	Flood Mitigation Assistance Program (FMA); PDM.	Fire, Police, Public Works	●	●	●	●

Status	Natural Hazard	Table 2-5 Flood Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LT Flood #2	Long-term Flood #2	Pursue further public acquisition to preserve open space in the floodplain. • Include policies supporting the City's acquisition of Greenway parcels in the Parks Master Plan. • The City has acquired additional properties in the US Cellular Sports Park facility. • A demonstration project for storm water runoff was completed in 2009 in cooperation with the Jefferson Nature center. • The City has acquired 1.85 acres through private donations along Larson Creek. An additional 3 acres is anticipated as part of the SE Area Plan development for greenway space. As part of the pursuit of further land acquisition, the City will establish parameters to identify properties to acquire, and identify properties to acquire.	Voluntary service organizations, such as Rotary; FMA.	CMO, Parks and Recreation	●			

Status	Natural Hazard	Table 2-5 Flood Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #8	Long-term Flood #3	Provide education related to flood hazards to households and businesses. • Share FEMA Emergency Preparedness for Business guides with Chamber of Commerce representatives to determine member interest and the Chamber's interest in distributing them throughout their organization. In 2015 the City Emergency Management Program hosted three iterations of Flood Fight Strategies and Tactics course by US Army Corps of Engineers.	Existing resources.	Emergency Mgt. Team, Economic Development; Building	●	●	●	
2010: Ongoing 2017: LT Flood #3	Long-term Flood #4	Implement storm water and urban design best management practices, using the newly completed Storm Water Management Plan as a guide. • Storm detention ordinance was adopted in November 2009. It has been used in the design and construction of new public safety facilities.	Existing resources.	Public Works	●			

Status	Natural Hazard	Table 2-5 Flood Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LT Flood #4	Long-term Flood #5	Update applicable City codes to improve risk reduction and prevention of flood impacts. • Medford Land Development Code sections 10.924-10.928 identify the regulations pertaining to Riparian Corridors. Within the next year, the Planning Dept. will present a proposal to the City Council for the designation of additional riparian corridors within the City.	Existing resources.	Planning, Building	●	●		
2010: Ongoing 2017: LT Flood #5 LT Flood #8	Long-term Flood #6	Participate in regional partnerships to reduce flood losses in the region. • Partner with the Bear Creek Watershed Council on projects that improve flood mitigation. Bear Creek Watershed Council is now part of the Rogue River Watershed Council. That partnership continues. The City will partner with the irrigation districts to assess and mitigate flood hazards.	Oregon Watershed Enhancement Board (OWEB).	Public Works, CMO	●	●	●	●
2010: Ongoing 2017: LT Flood #6	Long-term Flood #7	Continue to increase the City's Community Rating System rating over time. In 2016 the City was awarded an increased CRS rating. Efforts will continue to maintain and increase the CRS rating.	Existing Resources.	Planning, Building	●			●

Status	Natural Hazard	Table 2-5 Flood Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LT Flood #7	Long-term Flood #8	Strengthen floodplain development regulations. • Add Lazy Creek to the creeks protected by the Riparian Corridor regulations preventing development with a setback from the bank tops. • Continue to add setbacks along other creeks. • Medford Land Development Code sections 10.924-10.928 identify the regulations pertaining to Riparian Corridors. Within the next year, the Planning Dept. will present a proposal to the City Council for the designation of additional riparian corridors within the City. The City will continue to strengthen floodplain development regulations and will continue to add setbacks along creeks.	Existing Resources.	Planning, Building	●			

Status	Natural Hazard	Table 2-5 Flood Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #8 LT Flood #9	Long-term Flood #9	Using the maps developed for this PDM Plan, conduct site visits at structures in the 100-year flood plain and determine whether they are vulnerable to floods or were specially constructed with the potential for flooding in mind. For vulnerable structures, provide the property owner with information on mitigation. Education about all hazards is a priority action for the City. The City will identify structures that may impede the flow of water or raise floodplain elevation.	PDM; Flood Mitigation Assistance (FMA).	Building	●			
2010: Completed 2017: LT Flood #9	Long-term Flood #10	Request that FEMA, during its update of flood plain maps, identify structures in the flood plain, such as bridges, culverts and buildings that impede the flow of water or raise the elevation of the floodplain. The City will identify structures that may impede the flow of water or raise floodplain elevation.	NA	Building, Public Works	●	●		

Status	Natural Hazard	Table 2-9 Earthquake Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Partially Completed 2017: STEQ #1 STEQ #2 STEQ #3 LTEQ #2	Short-term Earthquake #1	Identify funding sources for undertaking earthquake mitigation in City-owned facilities. • Target the structural retrofit of the Carnegie Library Building and four City fire stations, and additional "safe havens", such as the Santo Community Center, as funds become available. • Fire Stations were upgraded in July 2005 with funding provided by FEMA grant. • The Carnegie Library Building renovation project is still being evaluated due to limited funding opportunities. Medford Police headquarters were relocated to a new facility in 2016, from the 1960s-era City Hall. Two new fire stations are in service, replacing older facilities. A third is scheduled to open in 2018. A multi-million dollar upgrade to the City's main water treatment plan is planned.	Existing Resources	CMO	●	●		

Status	Natural Hazard	Table 2-9 Earthquake Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STEQ #3	Short-term Earthquake #2	Support structural mitigation of infrastructure, schools and other public buildings. • The City will model an active retrofit program for other public entities, share information with school districts on federal funding mechanisms, and facilitate the consideration of their applications. • City Hall seismic retrofit was completed in 2003 and serves as an example project. Details about the City Hall retrofit and other efforts are described in the text of this *2017 Medford NHMP*. The City continues to focus support on structural mitigation of infrastructure, schools, and public buildings.	Existing Resources & Pre-Disaster Mitigation (PDM) funds.	CMO, Building	●		●	●
2010: Ongoing 2017: STEQ #4	Short-term Earthquake #3	Ask DOGAMI to conduct a study of local earthquake hazards in Medford. Present the findings of that study to insurance companies and request that they use them to inform homebuyers of their potential risk. • DOGAMI is slated to begin a detailed geologic mapping project of the entire Ashland-Medford urban area in June 2010, There is a 2011 Generalized Geologic Map of Bear Creek Valley, Jackson County, Oregon and related DOGAMI *Open File Report O-11-11*:	Existing Resources	CMO	●		●	●

Status	Natural Hazard	Table 2-9 Earthquake Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Delete 2017: LTEQ #1 LTEQ #2	Short-term Earthquake #4	Publicize the Medford Urban Renewal Agency's low-interest loans for earthquake mitigation on the City web site and in the City Newsletter. • This program no longer funded by the Urban Renewal Agency. The City is exploring partnerships for retrofitting projects, and will review other cities' programs regarding seismic upgrades and consider the potential for use in Medford.	Existing Resources	CMO, MURA	●			
2010: Delete 2017: STMH #8	Short-term Earthquake #5	Find ways to educate the insurance and real estate industries about Medford's earthquake hazards, such that they advise citizenry of the availability of earthquake insurance. • This information is already provided by insurance and real estate industries. In addition, public awareness has been addressed using print, television, radio, Web, and other media. A multi-hazard education program will continue.	Existing Resources	CMO	●		●	●

Status	Natural Hazard	Table 2-9 Earthquake Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission: To Protect People, Property and the Environment from the Impact of Natural Disasters — Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Complete 2017: STMH #8	Long-term Earthquake #1	Ensure that all Medford residents, whatever their income, disability or ethnicity, have information on earthquake hazards and preparedness. • Contact local advocacy groups, senior centers, social service agencies and care facilities serving these populations and provide them with pertinent Red Cross pamphlets and information about video resources in the public library system. • Red Cross in partnership with Jackson County emergency management, Department of Health & Human Services and United Way of Jackson County provide information to all agencies serving citizens of low-moderate income and the homeless. A multi-hazard education program will continue.	Existing resources.	Emergency Mgt. Team' American Red Cross; Hispanic Interagency Committee.	●	●	●	
2010: Delete 2017: LTEQ #1	Long-term Earthquake #2	Develop public/private partnerships for retrofitting projects. • No funding available for this item. The City will keep this as a focus.	Pre-Disaster Mitigation.	CMO	●	●		●

Status	Natural Hazard	Table 2-11 Wildland-Urban Interface (WUI) Fires Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: ST WUI #1	Short-term WUI Fires #1	Work with Jackson County to support the adoption of WUI fire maps and the development of requirements that assist WUI fire mitigation in the Urban Growth Boundary. • Propose the adoption of a parallel set of requirements within City limits near interface areas. • Fire Dept. is currently working with Jackson County Integrated Fire Plan and Jackson County has developed Wildland-Urban Interface fire maps to help assess hazards to assist in fire mitigation. In addition, a new WUI home assessment program is being developed and delivered. Medford Fire-Rescue continues to focus on WUI efforts. The City now has an Emergency Management Coordinator. Additional partners have been added since 2010 to implement mitigation. The *Jackson County Integrated Fire Plan* is being updated and is available in draft as of Spring 2017; it is now called the *Rogue Valley Integrated Community Wildfire Protection Plan*. Figure 21 is the Medford Fire-Rescue Response Zones. Figure 44 is the Wildfire Hazard Map.	Existing Resources	Fire	●		●	●

Status	Natural Hazard	Table 2-11 Wildland-Urban Interface (WUI) Fires Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #8 LT WUI #1 LT WUI #2	Short-term WUI Fires #2	Continue to promote public awareness campaigns for property owners living in interface areas. • Use public service announcements to reach the broader public and direct mailings to property owners in hazardous areas. • Fire Dept. promotes public awareness through seasonal press releases and WUI home assessment program. Fire Dept. also works with other agencies/committees including Rogue Valley Fire Prevention Cooperative and Jackson County Integrated Fire Plan which develop and deliver public service announcements in this area. Medford is focusing on an all hazards education program; WUI fires are included. Again, partnerships are important and have been expanded since 2010. Communication of available information remains important.	US Fire Administration (USFA): Assistance to Firefighters Grant Program; Fire Prevention and Safety Grants.	Fire	●		●	

Status	Natural Hazard	Table 2-11 Wildland-Urban Interface (WUI) Fires Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: STMH #8 LT WUI #1	Long-term WUI Fires #1	Increase the communication and collaboration among WUI property owners and public agencies to identify the risks in WUI areas, increase local knowledge of protective measures and available federal assistance programs. • Fire Dept. is starting WUI Home Assessment Program which will give WUI property owners advice, education and information on potential assistance programs to aid them in WUI fuel reduction measures. See comments above in ST WUI Fires ST #1 and #2.	US Fire Administration (USFA): Assistance to Firefighters Grant Program; Fire Prevention and Safety Grants.	Fire	●		●	●
2010: Ongoing 2017: STMH #8 LT WUI #2	Long-term WUI Fires #2	Reduce wildfire fuels in high-risk WUI fire hazard areas. • Undertake neighborhood meetings in these areas to educate property owners about what they can do to decrease fire hazard to their homes. • Fire Dept. is beginning WUI home assessment program which will involve a door to door educational campaign for WUI fuel reduction. See comments above in ST WUI Fires ST #1 and #2.	US Fire Administration (USFA): Assistance to Firefighters Grant Program; Fire Prevention and Safety Grants.	Fire	●	●	●	●

Status	Natural Hazard	Table 2-11 Wildland-Urban Interface (WUI) Fires Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LT WUI #3	Long-term WUI Fires #3	Explore the City's ability to prohibit particular building materials and practices in high hazard areas, e.g., CC&R requirements. • If it is determined to be legal, consider including such restrictions in city ordinances. • The Planning Dept. solicits recommendations from the Fire Dept. and includes them in staff reports as discretionary conditions for the Site Plan & Architectural Commission, Planning Commission and City Council consideration when appropriate. The City of Medford Fire-Rescue, recognizing the challenges of development in wildfire hazard areas, submitted a code amendment proposal application to the Oregon Department of Consumer & Business Services Building Codes Division. Medford's original proposal, submitted in September 2016, was to change provisions of R324 in the *ORSC*. As of March 2017, the proposal is to make it an appendix, rather than changing R324. See the *2017 Medford NHMP* text for details.	Existing resources.	Planning, Fire, Building	●	●	●	

Status	Natural Hazard	Table 2-11 Wildland-Urban Interface (WUI) Fires Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LT WUI #4	Long-term WUI Fires #4	Consider the need for adequate ingress and egress for evacuation purposes during the land use planning process. • This is particularly important in the eastern hillside developments. • Ingress and egress for new developments are considered by the Planning Commission when reviewing new subdivisions. • Fire Dept. is involved in the beginning of every land development project and provides a report which explains water supply and access requirements. Since 2010, the Medford Fire-Rescue has continued to work with the land use staff during land use reviews to evaluate ingress and egress.	Existing resources.	Planning, Fire, Public Works	●			●

Status	Natural Hazard	Table 2-13 Landslide Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Completed 2017: NA	Short-term Landslide #1	Explore the potential for testing the validity of the DOGAMI Debris-Flow Risk Area mapping in the Roxy Ann Peak area. • Contact the Regional Geologist to see if he would like to partner on this idea. Explore federal funding opportunities. Debris flow mapping is part of overall landslide mapping efforts that DOGAMI does. There is a 2011 Generalized Geologic Map of Bear Creek Valley, Jackson County, Oregon and related DOGAMI *Open File Report O-11-11*. In February 2016, DOGAMI published a landslide susceptibility overview map of Oregon and a related report called *Open File Report O-16-02, Landslide Susceptibility Overview Map of Oregon*. This DOGAMI information is being integrated into Medford's plans, policies, and programs.	Pre-Disaster Mitigation.					●

Status	Natural Hazard	Table 2-13 Landslide Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Completed 2017: ST Landslide #1	Long-term Landslide #1	Establish a hillside development ordinance that protects existing development in landslide-prone areas; includes public education about the risks to life and property in steep slope areas; implements construction and subdivision design that reduces potential adverse impacts on steep slopes; and treats issues related to proper drainage systems. • Hillside ordinance was completed and adopted by City Council in 2009 The Hillside ordinance remains in effect. A new mitigation action, ST Landslide #1 will have the City update the "Summary of Impact on Exposed Assets" information each year.	Existing resources.	Public Works, Planning	●	●	●	
2010: Completed 2017: LT Landslide #1	Long-term Landslide #2	Explore options for alternative access to existing hillside developments in steep slope areas. • Focus on developments on the steep slopes of Roxy Ann. Completed – included in Hillside ordinance. The City has determined it is important to continue to review access to developments in steep slope areas.	Existing resources.	Public Works	●	●		

Status	Natural Hazard	Table 2-15 Volcanic Activity Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Completed 2017: ST Volcanic #1	Short-term Volcanic #1	Research the availability of plume models to better determine the City's vulnerability to volcanic ash. • Use the model to assess the risk posed by Mount Shasta. • City of Medford GIS systems have developed a plume modeling program. The City will use research about plume models and prevailing winds from NWS.	Existing resources.	Technology Services GIS	●	●		
2010: Completed 2017: SSTMH #8 LT Volcanic #2	Short-term Volcanic #2	Increase the public's awareness of the potential for volcanic eruptions. • Information included in Emergency Preparedness brochure distributed during Neighborhood Walk visits with residents. The City keeps an all hazards focus on educational efforts.	Existing resources.	Emergency Mgt. Team	●	●	●	
2010: Deleted 2017: LT Volcanic #1	Long-term Volcanic #1	Explore options for a regional ash disposal plan. • Begin pertinent discussions at a Board Meeting of the Rogue Valley Council of Governments or at the regional City Managers' Meeting. • Low priority issue for members of the Rogue Valley Council of Governments – will not be pursued at this time. The City will renew efforts and discuss this with the RV COG and the Jackson County Emergency Management Advisory Group.	Existing resources.	Public Works	●	●		●

Status	Natural Hazard	Table 2-15 Volcanic Activity Mitigation Measures	Potential Funding Resources	Lead Department(s) & Partners	Mission To Protect People, Property and the Environment from the Impact of Natural Disasters Goals			
					Preventing Injury and Damage	Enhancing Emergency Services	Promoting Public Awareness	Forming Partnerships
2010: Ongoing 2017: LT Volcanic #2	Long-term Volcanic #2	Coordinate with other agencies to protect citizens from the health effects of ash. • Hold tabletop exercises among emergency response and health care facility personnel to simulate conditions and responses and to assess human and technical capacities. • Has not been topic of table top exercise at this time as trainings have been focused on events with a higher occurrence rate. The City will continue this effort to coordinate with partners and to provide information.	Existing resources.	Emergency Mgt. Team	●	●		●