

**NATURAL HAZARDS MITIGATION PLAN
(NHMP)**



Community Development Department

Prepared by:



4445 SW Barbur Blvd., Ste. 101
Portland, Oregon 97201
503/241-9404



And

Robert Olson Associates Inc.

With Support From

OTAK Inc.

June 2002
Revised December 2002

Golder Associates Incorporated and Robert Olson Associates, with support from Otak Inc., are proud to present this Natural Hazard Mitigation Plan. This plan is a compilation of results presented in the Hazard Issue Papers 1, 2, and 3, with a focus on defining natural hazards affecting the City of Salem area, assessing on-going and planned hazard mitigation activities, evaluating additional mitigation measures that could be taken, defining a strategy for implementation of such measures, and to serve as a qualifying document for various hazard mitigation programs. Consider it a living document subject to revision as the needs of the City of Salem area change.

We appreciate OTAK Inc., namely Todd Chase and Julie Jacobs, for their presentation of the City's natural hazards and other maps, as well as the incorporation of State and Federal maps into the City's GIS files.

Many thanks to Curt Schneider (City Community Planning & Development) and other dedicated members of the Technical Advisory Committee, namely:

- City of Salem Community Development – Cecilia DeSantis Urbani, Jeanne Fromm, Nate Brown, Peter Gutowsky, Tina Schweickert, Alan Kessler, Bruce Fichtman, Burnie Pearson, Cathy Hoffman, Les Sasaki, Julie Warncke, Suzanne Dufner, Vickie Hardin Woods and William Healy
- City of Salem Community Services (CSD) – Ed Jochums
- City of Salem Fire Department & Emergency Preparedness – Roger Stevenson
- City of Salem Legal Department – Paul Lee
- City of Salem Manager's Office – Bob Wells
- City of Salem Personnel Department, Risk Management – Sharee Emmons
- City of Salem Police Department – Lyle Gembala
- City of Salem Public Works Department – Howard Biskie, Rollie Baxter, and Steve Downs
- City of Keizer – Kelly Walther, Petersen Engineering
- Federal Emergency Management Agency – Debbie Key
- Marion County Fire District No. 1 – Ron Smith
- Marion County Community Development – Les Sasaki, Brandon Reich and Sterling Anderson
- Marion County Public Works and Emergency Management – Bruce Visser
- Mid Willamette Valley Council of Governments – David Galati
- Polk County Planning Community Development – Gene Clemens and Jim Allen
- Polk County Sheriff's Department, Emergency Management – Bob Wolfe
- Salem / Keizer School District – Henry Behrendt, Oscar Vega, and Richard Goward
- State of Oregon, Administrative Services – John Hamilton
- State of Oregon, Geology and Mineral Industries – Dennis Olmstead
- State of Oregon, Land Conservation and Development – Jim Kennedy and Ann Beier
- State of Oregon, State Police, Office of Emergency Management – Dennis Sigrist and Joseph Murray

We appreciate their valued input during meetings and their review of draft documents.
Sincerely, Natural Hazard Mitigation Plan (NHMP) planning team

David K. Rankin, R.P.G., C.E.G.
Golder Associates Inc.
4445 SW Barbur Blvd., Suite 101
Portland, Oregon 97201
503/241-9404

Robert A. Olson, President
Robert Olson Associates
100 Egloff Circle
Folsom, California 95630
916/989-6201

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 INTRODUCTION	1
1.1 Purposes of This Plan	1
1.2 The Planning Context	1
1.3 Hazard Mitigation	2
1.4 Planning Process Summarized	3
1.4.1 Development of the Salem Natural Hazards Mitigation Plan	3
1.4.2 Technical Advisory Committee	4
1.4.3 Citizen Involvement	4
1.5 City of Salem	5
1.6 Natural Hazard Mitigation Plan Components	7
2.0 NATURAL HAZARDS	8
2.1 Oregon’s Principal Natural Hazards	8
2.1.1 Flood Hazard	8
2.1.2 Earthquake Hazard	8
2.1.3 Landslide Hazard	9
2.1.4 Severe Weather Hazards	9
2.1.5 Urban-Wildland Interface Fire Hazard	9
2.1.6 Volcano Eruption Hazard	10
2.1.7 Tsunamis Hazard	10
2.1.8 Hazardous Materials Release Hazard	10
2.2 The City of Salem’s Natural Hazards	11
2.2.1 Hazard Rankings	11
2.2.2 Mapped Hazards	11
2.2.3 “All-Hazard” (Composite-Hazard) Map	11
3.0 GOALS AND OBJECTIVES	13
4.0 MITIGATION MEASURES	15
4.1 General Measures Available to Reduce Future Losses	15
4.1.1 Prevention	15
4.1.2 Land Use Planning	15
4.1.3 Zoning	16
4.1.4 Subdivision Regulations	16
4.1.5 Capital Improvements Planning	16
4.1.6 Open Space Preservation	16
4.1.7 Property Protection	16
4.1.8 Acquisition and Relocation	16
4.1.9 Building Codes	17
4.1.10 Manufactured Dwelling Installation Regulations	17
4.1.11 Retrofitting or Rehabilitation	17
4.1.12 Property Maintenance and Incremental Retrofitting	17
4.1.13 Protecting Critical Facilities	17
4.1.14 Dam and Levee Safety	18
4.1.15 Special Design / Construction Standards and Review / Inspection Procedures	18
4.1.16 Structural Projects	18
4.1.17 Insurance	19
4.1.18 Emergency Services	19
4.1.19 Warning	19
4.1.20 Disaster Mitigation Activities	19
4.1.21 Public Education	20

City of Salem

4.2	Other Considerations	20
4.2.1	Benefit/Cost Analysis for Natural Hazard Mitigation	20
4.2.2	Concurrent Hazards and Compound Disasters	21
4.2.3	Multiple Objective Management	21
4.3	The City of Salem’s Current and Prospective Mitigation Measures	21
5.0	MITIGATION ACTION PLAN	22
5.1	City Policy Actions	22
5.2	Mitigation Plan Implementation Actions	22
6.0	REFERENCES – PARTIAL LIST	31
7.0	APPENDIX - INFORMATION AND RESOURCE COMPENDIUM	36
7.1	Additional Federal and State Government Mitigation Information	36
7.2	“All-Hazards Assessment” Table	44
7.3	Essential Facility, Major Structure, Hazardous Facility, and Special Occupancy Structures per ORS 455.477 (excerpt)	47
7.4	Benefit-Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures	48
7.5	Public Outreach Announcement	52
MAPS		
Map 1	Important Facilities and Locations of Hazardous Materials	Between pages 10 and 11
Map 2	Flood Information	Between pages 12 and 13
Map 3	Relative Earthquake Hazards - 1996	Between pages 12 and 13
Map 4	Landslide Susceptibility Study Information	Between pages 12 and 13
Map 5	Total Number of Natural Hazards Present	Between pages 12 and 13

1.0 INTRODUCTION

“We have the opportunity here in Salem, at this time in our history, to assure that Salem becomes an outstanding example of what a community can achieve in livability. However, whether we achieve that potential will depend on the way that we approach the issue of growth.”

- Mike Swaim, Mayor, January 2000

Salem has experienced and is vulnerable to losses caused by natural hazard events. For purposes of this plan, these hazards include floods, landslides, earthquakes, severe wind and ice storms, urban-wildland interface fires, volcanic eruptions, and hazardous materials incidents. All hazards are potential threats capable of causing significant future life and property losses. Some events may lead to “compound disasters,” such as earthquakes that trigger landslides and hazardous materials releases.

The City of Salem has benefitted from its natural setting, situated in the heart of the valley with the Willamette River flowing through the center of the City and flanked by the Salem Hills and Eola Hills to the south and west.

It is a well-accepted tenet that natural activities, such as rain, cold and heat are by themselves beneficial or, at worst, benign. They are part of the natural order. Floods replenish floodplains with nutrients and recharge aquifers, and wildfires help preserve and restore appropriate plant life. These “hazards” do not cause problems except where humans are affected.

Disasters occur when natural hazards affect human development, especially in urban areas. We are recognizing the adverse consequences of occupying hazardous areas (such as floodplains and steep hillsides) and following construction practices that do not account for natural activities (such as earthquakes, erosion, wind, and wildfire). This lesson was most recently brought home to Salem’s residents in February and November 1996 when floods and landslides caused extensive damage to homes, businesses, and public utilities and other infrastructure.

1.1 Purposes of This Plan

The general purposes of the Natural Hazard Mitigation Plan (NHMP) are to:

- P Define the scope of and experience with natural hazards affecting the community,
- P Assess the ongoing hazard mitigation activities in the community, including approaches that the City is currently utilizing,
- P Evaluate additional mitigation measures that should be undertaken,
- P Define a strategy for implementation of mitigation projects and activities by all stakeholders (including cities, counties, citizens, businesses, others),
- P Serve as a qualifying document for various hazard mitigation programs which are coordinated through the Oregon State Police, Office of Emergency Management (OEM), and
- P Act as a resource document, subject to change, as the community refines hazard mitigation goals, strategy, and implementation.

1.2 The Planning Context

This hazard mitigation plan was developed within a larger context and process managed by the City of Salem Community Development Department.

One component of the planning process involves what is known as *The Salem Futures Project*. This project, guided by a 35-member Citizens Advisory Committee (CAC), involves a comprehensive review of how to

manage future growth and maintain the quality of life through 2050. The project is primarily an effort to integrate land use and transportation planning. Salem Futures is an opportunity to update land use policies and make all City policies consistent with the citizen's vision for future growth.

The primary goals of the Salem Futures project are to explain the implications of extending current development trends, identify a longer term vision for community development and growth management, develop criteria to judge the efficacy of alternative land use scenarios, develop alternative land use scenarios, and conduct a preliminary qualitative analysis as part of describing the alternatives.

The Salem Futures Project consists of three major phases. Phase 1 work included completion of a vision statement for the year 2050, development of evaluation criteria for the plan, and conceptual alternative land use scenarios. The vision statement addresses community, neighborhoods, the economy, the environment, and transportation.

Phase 2 was an in-depth analysis of the alternative land use scenarios that provided the information needed to craft a preferred alternative. Issues addressed in Phase 2 included identifying impacts resulting from implementation of the current comprehensive plan (base case). Phase 2 concluded with selection of a preferred alternative, approved by City Council in Spring 2002. The preferred alternative concentrates future development in growth centers and corridors throughout the Urban Growth Boundary (UGB).

Phase 3 will lead to formal adoption of changes to the comprehensive plan and zoning ordinances to implement the preferred alternative. This is expected to happen in 2002-2004.

It is expected that the hazards and resultant planning needs identified in the Natural Hazard Mitigation Plan will be incorporated into the Salem Futures Project.

1.3 Hazard Mitigation

The Federal Emergency Management Agency (FEMA) defines mitigation as "sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects."

There are two approaches to dealing with natural hazards: manage the hazard or manage the development. In some cases, especially when it affects existing development, managing the hazard may be more appropriate and/or more efficient. For example, drainage improvements can mitigate small scale flooding and keep developed areas dry. Also, wildfires that threaten existing homes can be mitigated by brush-free clear zones and fire-resistant roofing materials.

In other cases, it makes more sense to manage development. It is easier, less disruptive of the environment, and often cheaper to avoid high velocity floodplains and slide-prone hillsides than to build structures to control flooding or landslides. It is safer to construct earthquake-resistant buildings than to ignore the threat. Together, these two approaches comprise the range of hazard mitigation options.

There are a variety of specific loss prevention strategies and measures to help manage the hazards and manage the development. Some will work in Salem while others may not, depending on the hazards and the resources available to the City to implement the measures. These are addressed in greater detail in Chapter 2.

Preparation of Salem's NHMP must coordinate with, or meet guidelines of FEMA's National Mitigation Strategy (published 1996), State of Oregon Interagency Hazard Mitigation Team Report (IHMT) for the February 1996 Flooding, Landslides and Stream Erosion (1996), National Earthquake Hazards Reduction Program (NEHRP), the Federal Interagency Floodplain Management Task Force's Unified National Program for Floodplain Management (1994), floodplain management planning credit criteria for FEMA's Community Rating System (CRS), planning requirements of FEMA's Hazard Mitigation Grant (HMGP) and Flood Mitigation Assistance (FMA) programs, State of Oregon Natural Hazards Mitigation Plan (June 2000), the Department of Land Conservation and Development's (DLCDD) Statewide Planning Goal 7, and Oregon's Action Plan for Protecting Rural/Forest Lands from Wildfire (November, 1988).

1.4 Planning Process Summarized

Determining what mitigation strategies and measures are best for an area is done through a planning process. During this process, the various hazards are inventoried, the risks from each are judged, the full range of possible loss prevention measures are reviewed, current mitigation measures are identified, and the most appropriate and affordable new ones are recommended for implementation.

All levels of government conduct mitigation planning. At the Federal level, the Federal Emergency Management Agency has produced a *National Mitigation Strategy* that provides broad guidelines for national activities. At the State level, Oregon State Police (Office of Emergency Management) is preparing a comprehensive state hazard mitigation plan pursuant to Section 409 of the Federal Stafford Act, amended in the Fall of 2000 and renamed to Section 322 of the amended Stafford Act. Refer to Appendix 7.1 for updates on the Stafford Act and more information about federal and state mitigation activities, laws, and programs.

Other Oregon cities, counties, and regional agencies have prepared mitigation plans after disasters and, like Salem's plan, as parts of continuing planning processes.

1.4.1 Development of the Salem Natural Hazards Mitigation Plan

The Salem City Council approved the scope of work for the Natural Hazards Mitigation Plan (NHMP) in February of 1998. The planning process included the following four phases.

1-Hazard Identification and Assessment. During the first phase, information was gathered to identify existing and potential hazard areas found within the Salem UGB.

2- Identification of Goals and Objectives. During phase two hazard mitigation goals and objectives were created to guide the development of the mitigation action plan. To help accomplish this, the Salem Area Comprehensive Plan (SACP) was analyzed to determine

how the goals and policies applied to hazards. The SACP was also reviewed to determine how to increase its effectiveness towards natural hazards mitigation.

3-Identification of Mitigation Measures. Phase three involved identifying current mitigation efforts in the City of Salem, examining additional measures to reduce the City's vulnerability to natural hazards, and determining new mitigation measures applicable to Salem and actions necessary for implementation.

4- Development of a Mitigation Action Plan. In phase four, implementation priorities were discussed, including projects, funding alternatives, phasing and time lines, in order to develop the mitigation action plan.

1.4.2 Technical Advisory Committee

In March of 1998, the City of Salem formed a Technical Advisory Committee led by the Community Development Department to guide development of the NHMP. Participants in the NHMP Technical Advisory Committee included the City of Salem Fire, Public Works, Personnel, Police, Emergency Preparedness, City Managers Office, and Legal bureaus/departments, as well as Marion County, Polk County, Mid-Willamette Valley Council of Governments, City of Keizer, Salem/Keizer School District, State of Oregon Department of Geology and Mineral Industries, State of Oregon Department of Land Conservation and Development, Oregon State Police Office of Emergency Management (OEM), State of Oregon Administrative Services, and the Federal Emergency Management Agency. The Technical Advisory Committee held thirteen work sessions beginning in 1998 and ending in 2001. The Technical Advisory Committee provided technical assistance by reviewing and commenting on each section of the Plan as it was developed. Another important function of the Technical Advisory Committee included better coordination on hazard mitigation efforts found in existing plans and programs.

1.4.3 Citizen Involvement

There were several opportunities for public involvement throughout the planning process. A total of three open houses were held at various phases in the planning process to obtain citizen feedback and provide the public with an update on the development of the Plan. The first open house, held on December 15, 1999, provided the public with an opportunity to comment on the natural hazards inventory and to provide comments regarding the goals, objectives and direction the Plan should follow. The second open house, held on March 15, 2001, provided another opportunity to obtain citizen feedback and educate interested citizens on the Plan's progress. Comments and ideas regarding possible mitigation measures were also sought at this meeting. The final open house, held on May 2, 2001, provided the public an opportunity to review and provide comments on a completed draft of the Natural Hazards Mitigation Plan. Handouts, maps/graphics and staff presentations were made available at these meetings. Surveys were also used to obtain additional public comments. An example of a public outreach announcement can be seen in Section 7.5 of the Appendix.

Other opportunities for public involvement included public meetings held before the City of Salem's Planning Commission and City Council. Public meetings and planning activities were announced through

press releases to local radio stations, the Salem Statesman Journal newspaper, City newsletter (*Current Issues*), the City's web site, and staff reports to City Council and Planning Commission members.

1.5 City of Salem

Local authority for hazard mitigation is principally derived from state law and local ordinances that are within the delegated powers of local government. Specific hazard mitigation plans and IHMT reports often recommend local administrative and legislative actions, and other recommendations focusing on needed state legislative, regulatory, or administrative actions.

Within the City of Salem, the Salem Area Comprehensive Plan (SACP) and Map, Salem Revised Code (SRC), Oregon Model Flood Damage Prevention Ordinance (adopted by the City), and the City Public Works Department Design Standards and Standard Construction Specifications appear to apply to planning and implementation of hazard mitigation. In addition, a series of master plans and issue specific plans/studies have been developed and also apply to hazard mitigation.

P Comprehensive Plan & Map. The SACP is a long-range plan for guiding development in the Salem urban area and its relationship with Salem/Keizer urban area. The plan was first adopted by Salem, Marion, and Polk Counties in 1973 through a process that involved broad-based participation by area citizens. The plan was revised in 1982 to conform with State Land Use Goals. A 1986 plan amendment reduced the urbanizable area of by 2,400 acres. The plan has been periodically reviewed and updated since 1988. The current SACP was adopted in 1992 and revised in March 1997.

SACP Map designations include single family residential, multifamily residential, developing residential, commercial, Central Business District, industrial, industrial/commercial, parks open space and outdoor recreation, community services, river-oriented mixed uses, and farming and resource management (applied to areas zoned "Exclusive Farm Use"). In the Comprehensive Plan, recognized "special conditions" that affect development are floodplains, geologic conditions, soils, aggregate resources, fish and wildlife, the Willamette Greenway Boundary, historic landmarks, and airspace obstructions (around McNary Field).

The Floodplain Boundary Map Series (1986) and the 1984 Flood Insurance Rate Maps (FIRM) are referenced in the Plan. A 1977 report by the State of Oregon and site specific reports are referenced in the plan pertinent to geologic conditions. The State report addresses steep slopes, landslide topography, and high groundwater. Soil Conservation Service maps and a 1974 report by the State Soil Conservationist are referenced. A 1961 State report is referenced pertinent to aggregate resources. State jurisdiction over fish spawning streams (including Mill and Pringle Creeks, and Shelton Ditch), State Fish & Wildlife Commission establishment of the Brown Island and Minto Island Wildlife Refuge, and Audubon Society's maintenance of a 22-acre heron rookery on the north end of Minto Island are referenced as significant fish and wildlife habitat. The Willamette Greenway boundary was adopted in 1976 and delineated by the Oregon Department of Transportation (ODOT) on 1"=400 foot maps. The Salem Revised Code (Chapter 56) designates

historic landmarks, including those on the National Historic Register, that the City may wish to protect from hazard impacts. The Salem Revised Code (Chapter 125) addresses airspace concerns.

- P Salem Revised Code. Title I of the Code (Chapters 6 and 20) apply to the organization and implementation of the Salem Planning Commission and Design Review Board, respectively.

Title V (Community Development Standards) includes a long list of codes, of which Building Codes (Chapter 56), dangerous buildings (Chapter 56), comprehensive planning (Chapter 64) and urban growth management (Chapter 66) are a part. Chapter 64 details procedures for amending or otherwise changing the comprehensive plan and neighborhood plans, as well as lists “detailed” plans adopted by the City. Such detailed plans pertain to master planning related to parks, stormwater, the Willamette Greenway, transportation corridors, neighborhoods, and public facilities. Chapter 69 includes the recently adopted Landslide Hazard Ordinance intended to guide the review of development in landslide hazard areas. Chapters within Title V also include sections on subdivisions, excavation and filling (including areas near or within designated waterways or a floodplain overlay zone), maintenance of brush that is a fire hazard, trees and vegetation.

Chapters within Title X pertain to zoning, including the effect of other regulations (Chapter 110), setbacks and hillside lots (Chapter 130), all the various zoning designations, and special “overlay” zones for floodplains (Chapter 140), the Willamette Greenway (Chapter 141), and several areas/neighborhoods. The City recently adopted a new Erosion Prevention and Sediment Control Program (Chapter 75), effective September 2001.

- P Oregon Model Flood Damage Prevention Ordinance. All Oregon cities utilized and adopted this model ordinance to comply with standards for participation in the National Flood Insurance Program (NFIP). This model includes standards and provisions that “encourage sound floodplain management and, if implemented, allows property owners to obtain flood insurance at a more affordable rate”. The model includes a minimum requirement for non-residential construction that the lowest floor is elevated one foot above the base flood or that the lowest floor is flood proofed.

The Salem Public Works Department published a report on the 1996 February floods that identified areas of inundation during the flood and compared the City data to FEMA data. There were significant differences between the City’s 1996 data and FIRM data. Compared with the plotted 100-year flood level on the FIRMs, 1996 flood levels documented by the City ranged from an equivalent 42- to 143-year flood recurrence interval. Revised FIRM data for Mill Creek has been received and is scheduled for completion in the Fall of 2002.

The most significant flooding occurred along Mill Creek. A 1990 draft US Army Corps of Engineers (COE) flood damage reduction study for Mill and Pringle creeks and Shelton Ditch was inconclusive on the best option for mitigation. However, upstream storage and increasing conveyance capacity were the general solutions evaluated.

Several projects spun off of this study including draft revisions of the FIRMs in 1998 and 2000, and the COE’s *Section 205 Hydrologic and Hydraulic Analysis*. The latter effort focused on developing

an updated computer hydraulic model (UNET) of Mill Creek and its tributaries as part of the comprehensive Section 205 Flood Damage Reduction Study, completed in February 2002. A version of the model included some significant modifications of the floodway and floodplain.

- P Public Works Department *Design Standards and Standard Construction Specifications*. A review of the Design Standards and Standard Construction specifications (two documents) suggests that, as intended, the documents are a guide for City permit/design review staff and design consultants during the permit/design review process.

- P Master Plans. Several master plans exist and portions of these plans directly or indirectly apply to hazard mitigation. Master plans have been developed for the stormwater, water, wastewater, transportation, and parks systems within the City.

- P Other Plans/Reports. Other plans and reports have been prepared including the *Seismic Vulnerability Evaluation of Existing Water and Wastewater Facilities, City of Salem, Oregon*. This 1996 report for Public Works identified areas of relative seismic hazard. In this report, thirteen known faults in the Willamette Valley were identified that could affect the City of Salem study area. The significant local faults in the study area included the Turner Fault, the Mill Creek Fault, and the Waldo Hills Frontal Range Fault. Earthquakes of magnitude greater than 6.5 are not expected from these features. Significant ground shaking could occur within the project area due to proximity of the faults. Also, the February 28, 2001 deep-seated “subduction zone” event near Olympia is a recent reminder of the potential for larger earthquakes.

1.6 Natural Hazard Mitigation Plan Components

This mitigation plan consists of four more chapters and supporting appendices. Chapter 2 provides further information about natural hazards of concern to the City of Salem. Chapter 3 defines mitigation goals and objectives. Chapter 4 contains information about general mitigation measures and those measures applicable to specific hazards, including how the City addresses each measure now and what should be done in the short- and long-terms to help prevent future losses. Chapter 5 focuses on which actions should be taken, by whom, and by when.

2.0 NATURAL HAZARDS

2.1 Oregon's Principal Natural Hazards

This plan addresses multiple natural hazards that have or could affect portions of the State of Oregon and the City of Salem. We share multiple hazards with our neighboring states, and have experienced several Presidentially declared disasters in recent years. While some hazards present different risks in terms of their frequency and potential impacts, the full range of hazards includes floods, landslides, severe Pacific storms, earthquakes, tsunamis, volcanic eruptions, urban-wildland interface fires, and freezes/ice storms.

Lives lost, injuries occurred, property damaged, services interrupted, and extraordinary costs paid have been the hallmarks of several recent Oregon disasters. Most of these have resulted in the Presidential declaration of a major disaster, but other more frequent smaller scale losses occur which might result in local or state declarations of emergencies. While difficult to estimate, total aggregate losses due to the occurrence of natural hazards have amounted to hundreds of millions of dollars during the last decade. For example, nearly \$222 million was provided to Oregon by several federal programs for three recent flood disasters in the last decade (1996/7). This plan is designed to help reduce such losses and their costs to the public and private sectors.

2.1.1 Flood Hazard

Flooding results when rain or snowmelt create water flows that exceed the carrying capacity of rivers, streams, channels, ditches, and other watercourses. In Oregon, flooding is most common from October through April when storms from the Pacific Ocean bring intense rainfall. Flooding can be aggravated when rain is accompanied by snowmelt and frozen ground. In general, Oregon is subject to two principal types of flooding: riverine and local drainage. Riverine flooding on the larger rivers and streams usually results from large storms or prolonged wet periods. Local drainage flooding occurs along the smaller streams, creeks, and drainage ways, and is more likely to result from heavy local storms and debris-clogged storm drainage systems. The areas subject to riverine flooding have been mapped by the Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program (NFIP). The national and state flood mapping standard is the 100-year or base floodplain. The City of Salem also mapped flood inundation during the 1996 flood.

2.1.2 Earthquake Hazard

Oregon sits on the Cascadia subduction zone where the Pacific Plate is sliding under the North American Plate. While earthquakes along this zone occur infrequently, plate movement can produce major earthquakes. In addition, the western part of Oregon is underlain by a large and complex system of faults (e.g., Portland Hills) that can produce damaging earthquakes. There is a direct relationship between a fault's length and its ability to generate damaging ground motions: smaller nearby faults produce lower magnitude events, but their ground shaking can be strong and damage can be high because of the fault's proximity. In contrast, offshore subduction zone events can generate earthquakes with great magnitudes, but because of their distance and depth may result in only moderate shaking in western Oregon. Earthquakes can trigger other geologic and soils failures that contribute to damage.

The State of Oregon has mapped earthquake hazards in much of the Salem area. The maps show liquefaction, ground motion amplification, landslide susceptibility, and relative earthquake hazards.

2.1.3 Landslide Hazard

Many hillsides, especially in Western Oregon, are unstable and vulnerable to landslides, debris, and mudflows. These can result from ground saturation, runoff, improper or poorly designed drainage systems or earthquakes. Landsliding is a natural process that tends to reduce the height and slope of mountains and ridges and is part of the normal ongoing process of smoothing topographical high points. Slides occur in natural materials and in placed fill materials. The process is simple: a mass of earth slides when the forces from the weight of the slide mass exceeds the strength of the material holding it in place. Determining specifically when and where sliding will occur is difficult. Landslides and mudflows occur especially when prolonged heavy rainfall saturates the soil and rock, and when human activities steepen the slopes, remove the toes, or add weight or water to the slopes.

Landslides and mudslides in the City of Salem watershed negatively impact the surface water quality of the North Santiam River, which prevents the use of the City's slow sand filters for drinking water treatment. The City installed a new pre-treatment facility in 1998 to reduce the potential impact of surface water quality.

Landslide hazard mapping was conducted by the Oregon Department of Geology and Mineral Industries (DOGAMI) in cooperation with the City of Salem and Marion County. Areas mapped include the Eastern Portion of the Eola Hills and Western Portion of the Salem Hills.

2.1.4 Severe Weather Hazards

This broadly defined hazard category includes windstorms, severe winter hazards (e.g., snow, ice, prolonged cold), thunderstorms, and tornadoes that disrupt vital systems and threaten lives and property. Wind and ice storms are caused by severe weather conditions. Windstorms can occur at any time of the year while ice storms are confined to the winter months. Wind storms, occasionally associated with Pacific Coast hurricanes migrating north, usually do not exceed 90 miles per hour, but wind speeds of 119 miles per hour were recorded in Portland during the October 1962 Columbus Day storm. Ice storms can be accompanied by high winds, and they have similar impacts, especially to trees, power lines, and residential utility services. These events can affect many areas. Severe ice storms occur more frequently in areas exposed to east wind patterns through the Columbia River Gorge, particularly eastern Multnomah and Clackamas Counties.

2.1.5 Urban-Wildland Interface Fire Hazard

While more common to the arid areas of eastern Oregon, the potential for losses due to urban-wildland interface fires in the urbanized region should not be ignored. The heavily treed hillsides around Salem have long been occupied by residences, and the trend of people locating in or near forested lands continues. Fires in such heavily wooded areas are natural occurrences, and the threat increases when subject to more human activity. The State of Oregon has noted that such interfaces really are an intermingling of homes and other structures at various densities and complexity within areas of heavy natural cover or forestlands. When buildings burn in or close to areas of heavy vegetation, especially during the dry months, the risk increases.

Areas where structures are built in proximity to dense vegetation may be vulnerable to urban-wildland interface fire. Of particular concern are areas with narrow roadways and few routes of egress and ingress.

2.1.6 Volcano Eruption Hazard

Evaluation of the volcano eruption hazard is primarily that of predicting lahar (mud flow) paths based on topography and ashfall patterns based on prevailing wind patterns. Prediction of eruptions has only recently become a reality in some cases where a volcano is instrumented and magma movement can be detected by seismic activity. In general, this instrumentation is not in place on Oregon volcanoes.

Salem's North Santiam watershed consists primarily of forest land on the west side of the Cascade Mountains. This watershed could be severely impacted by mudflows and volcanic ash falls derived from regional volcanic activity.

2.1.7 Tsunamis Hazard

Tsunamis are caused by any large-scale disturbance of the sea floor. Evaluation of the hazard involves frequency and severity of the causes, including faulting, landslides, and volcanic eruptions. For Oregon, the coast is at risk from distant tsunamis from Alaska, for example, and from near-source tsunamis caused by subduction zone earthquakes offshore. DOGAMI has mapped the coast on a reconnaissance level for tsunami inundation and selected communities have been mapped in detail. The relatively short duration of a tsunami event on the Oregon coast is not expected to affect Willamette River basin surface water levels, to the degree that flooding would be a concern. However, the Salem area may be affected indirectly by a tsunami event. For example, local Fire Department assistance may be needed or displaced persons from the Oregon Coast may require temporary food and housing in Salem.

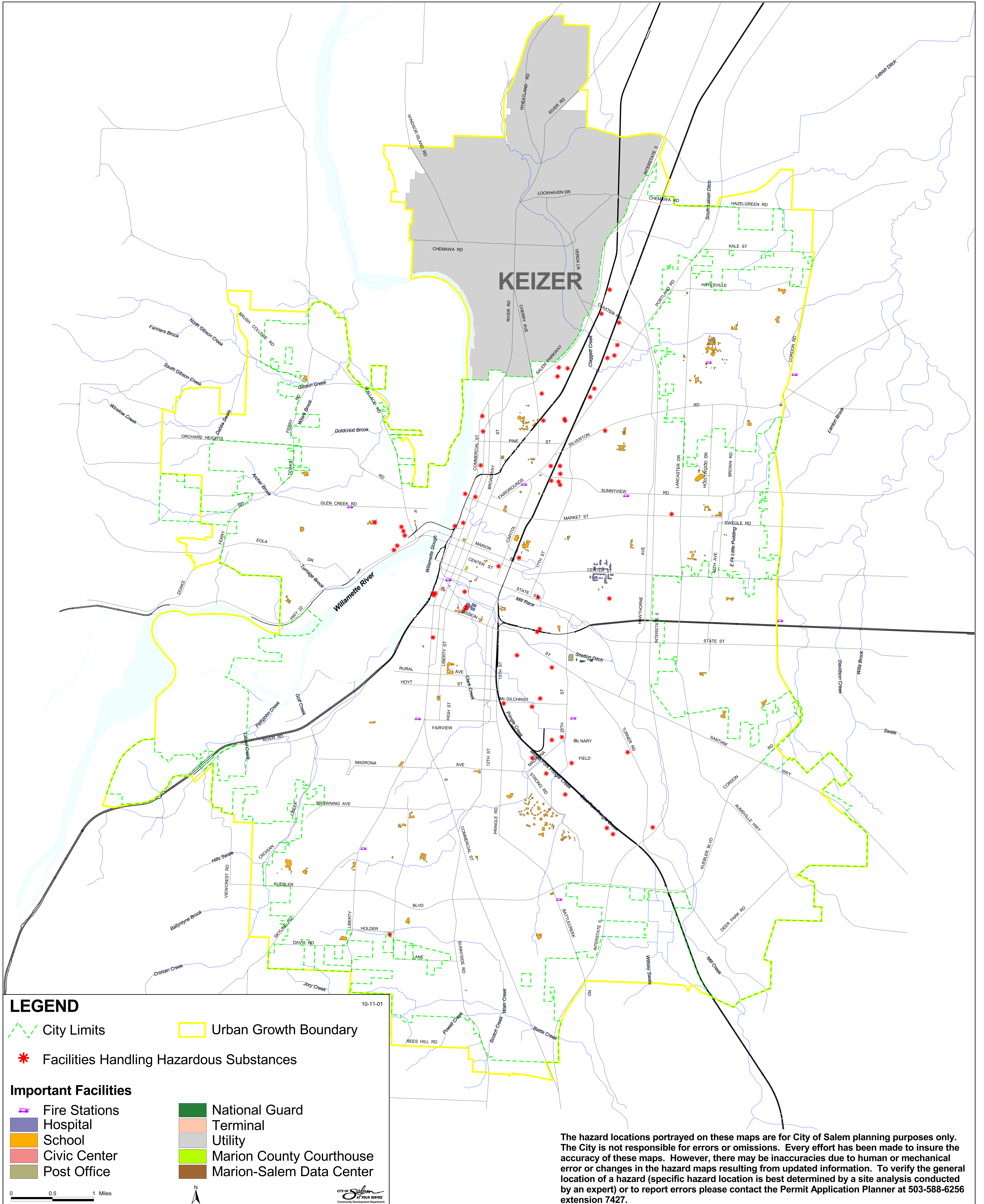
2.1.8 Hazardous Materials Release Hazard

Few communities appear to address hazardous materials (HAZMAT) as a stand-alone issue and certainly not within the realm of natural hazards. Chemical and other man-made disaster/hazard issues are generally handled through the local Fire Department and the City of Salem is no exception. For the purposes of the HMP, hazardous materials releases are considered a secondary hazard derived from the impact of a natural hazard event (e.g., flooding in a chemical storage area results in toxic levels of chemicals in water or air).

The City of Salem Fire Department has a copy of a hazardous materials database maintained by the State Fire Marshall. This database includes information on chemicals stored by address with name/phone of a contact person. These sites are shown on Map 1 on the following page. The Oregon Department of Environmental Quality (DEQ) has a vast database (e.g., underground fuel tanks, waste generators, contaminated properties, etc.). These and other databases are linked to addresses of sites that use/generate hazardous materials/waste.

SALEM UGB NATURAL HAZARD MITIGATION PLAN

MAP 1: IMPORTANT FACILITIES & LOCATIONS OF HAZARDOUS SUBSTANCES



LEGEND

City Limits Urban Growth Boundary

Facilities Handling Hazardous Substances

Important Facilities

Fire Stations	National Guard
Hospital	Terminal
School	Utility
Civic Center	Marion County Courthouse
Post Office	Marion-Salem Data Center

0 0.5 1 Miles



CITY OF Salem
AT YOUR SERVICE
Community Development Department

The hazard locations portrayed on these maps are for City of Salem planning purposes only. The City is not responsible for errors or omissions. Every effort has been made to insure the accuracy of these maps. However, there may be inaccuracies due to human or mechanical error or changes in the hazard maps resulting from updated information. To verify the general location of a hazard (specific hazard location is best determined by a site analysis conducted by an expert) or to report errors please contact the Permit Application Planner at 503-588-6256 extension 7427.

2.2 The City of Salem’s Natural Hazards

2.2.1 Hazard Rankings

Certainly all of the above-described hazards are of concern to the City of Salem. Based on the NHMP planning team’s experience and review of hazard data for Oregon and the City of Salem region, some hazards are of a significantly lower concern than others. In order to rank these hazards within the context of the Salem area, the NHMP planning team asked the Technical Advisory Committee (NHMP) for their assessment of the primary hazards. The TAC was asked to rank all seven primary hazards in terms of overall vulnerability and then assign a weighted vulnerability (low, medium, or high) to each of the hazards. A print of the current tabulation of relative vulnerability to each of the hazards is presented on the “All-Hazard Assessment” sheet (see Appendix 7.2).

Additional input from others beyond the Technical Advisory Committee is recommended. However, it appears that flooding is of primary concern. Landslides are second on the list, perhaps due to the recent adoption of the landslide ordinance into the SRC. Earthquakes and severe wind/ice storms are a lesser concern. Hazardous materials incidents/releases and urban-wildland interface fires are also a concern. Volcanic eruptions are of little concern.

2.2.2 Mapped Hazards

The City of Salem utilizes computer mapping software for planning and other purposes. The maps show features such as zoning, land use, school locations, aerial photos, ground surface slopes, ground surface elevation contours, parks, drainageways/creeks, and wetlands. Natural hazards concerns have been mapped by the City and these include floodways, floodplains, areas inundated during the 1996 floods, and areas of high landslide hazard. While preparing the HMP, several other map “overlays” of information from State sources were added to the City’s map base. Such information includes mapped areas of relative vulnerability to an earthquake (e.g., soil liquefaction, relative earthquake hazard, and earthquake amplification hazard).

2.2.3 “All-Hazard” (Total Natural Hazards Present) Map

As discussed in later sections of this NHMP, additional work is needed to assess the relative hazard and the impact of combined hazards during a single event. However, an initial assessment of combined hazards can be achieved through (1) combining relative hazard “rankings” (see Appendix, Section 7.2) or (2) creation of a map illustrating the number of hazards in any one location (see Maps 2-5 on following pages).

(1) Hazard Ranking. In the “all-hazards assessment” ranking table (Section 7.2, Appendix) developed by the TAC, all three of these hazards were given a numeric score shown in parentheses.

P Relative earthquake hazard – This map possesses four subdivisions of hazard. These categories are lowest, low to moderate, intermediate to high, and highest. (Score = 8 points).

- P Flooding – Three areas mapped are the floodway, floodplain (i.e., “100-year” flood zone), and the areas inundated during the 1996 floods. (Score = 21).
- P Landslides - This map presents several ranges of ground surface slope gradients and areas of “high” slope that are also in areas where landslides have been identified. (Score = 14).

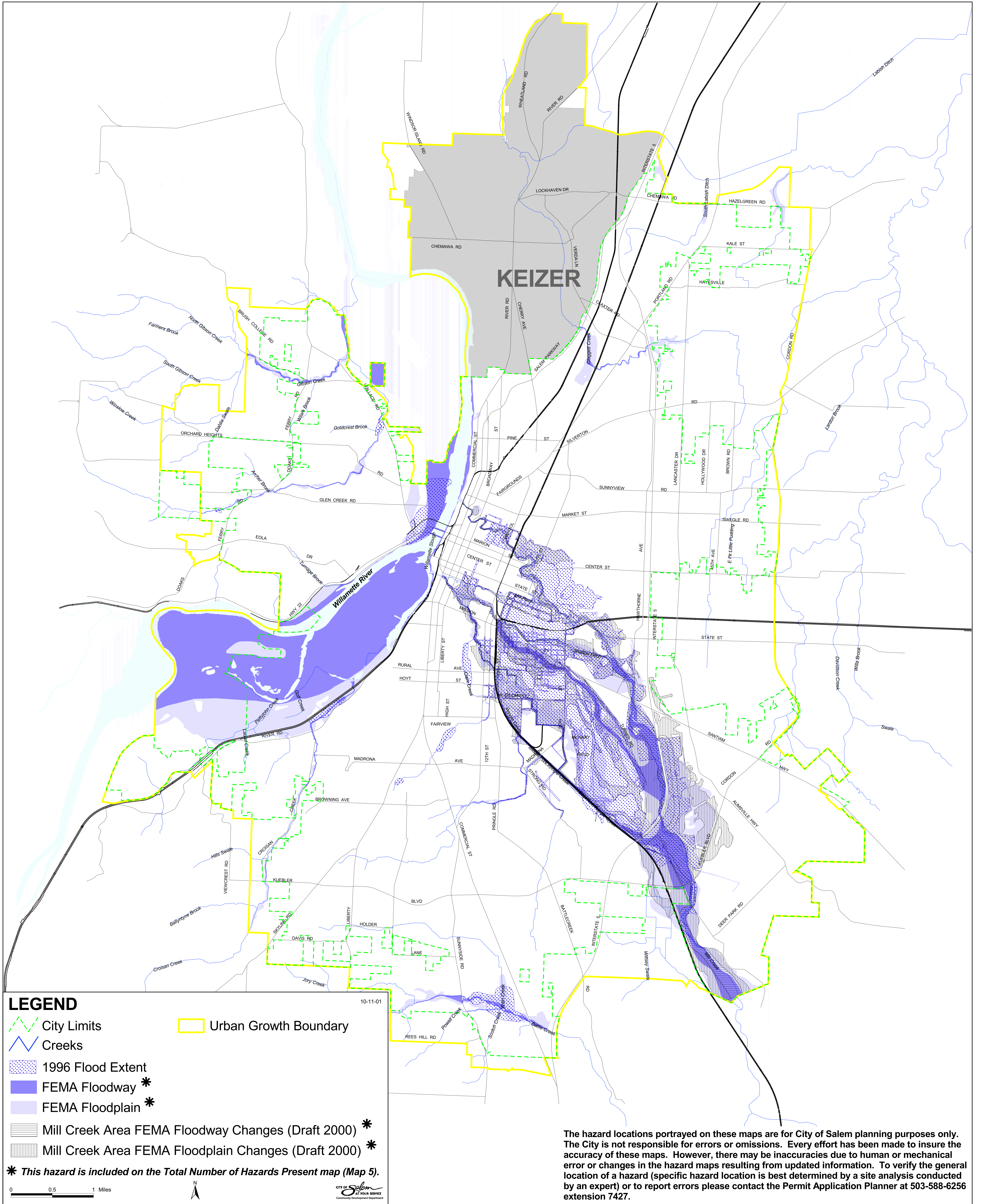
Initially, each of the three hazards and subdivision of each hazard were weighted with the scores (presented above). All three weighted hazard map layers were combined to develop the composite-hazard map. A preliminary review of the initial draft of the composite-hazard map revealed that the areas shown with a low or low to medium composite-hazard are influenced by ground slope information presented on the landslide map with some influence from the earthquake data. Those areas shown with a medium composite-hazard appeared to be more influenced by the flood data. Medium to high composite-hazard areas appeared to be influenced by a combination of landslide and flooding.

- (2) Total Natural Hazards Present (Overlay) Map. The three natural hazard maps were used in the development of the Total Natural Hazards Present (composite-hazard) map. The “flood information” (Map 2) includes FEMA mapped floodplain and floodway, the Mill Creek Area FEMA Floodplain and Floodway Changes (Draft 2000) document and the mapped extent of the 1996 flood. All of the flood information, except the 1996 flood extent information, is reflected in the Total Natural Hazards Present map. The “relative earthquake hazard” (Map 3) that was developed rated hazard risks into four (4) categories—from low to high. The medium/high to high categories are reflected in the Total Natural Hazards Present map. The “landslide hazard”(Map 4) illustrates the low and moderate to high categories of the study. The moderate to high hazard assessment categories are included in the Total Natural Hazards Present map as the City has determined through the adoption of an ordinance that these are of greatest concern and development in these areas should be regulated. Each of the hazard maps noted above were placed ‘over’ one another and then where one or more of the hazards overlay one another in any one location the number of hazards were added up to compile the Total Natural Hazards Present map. The result is the Total Natural Hazards Present map (Map 5) which is a ‘composite’ map of the primary hazards of concern. The maps in this plan are reduced in size and are included here for illustrative purposes. Larger sized maps are produced separately from the text of this HMP and are on file in the Community Development Department.

The TAC reviewed the two methods noted above. Upon further review of the composite-map by the TAC, it was agreed that additional work is needed to assess the relative hazard and the impact of combined hazards during a single event. This combined-hazard assessment potentially could be the first item reviewed by City staff and the public during the process of assessing natural hazard impacts on land use and development.

SALEM UGB NATURAL HAZARD MITIGATION PLAN

MAP 2: FLOOD INFORMATION



LEGEND

- City Limits
- Creeks
- 1996 Flood Extent
- FEMA Floodway *
- FEMA Floodplain *
- Mill Creek Area FEMA Floodway Changes (Draft 2000) *
- Mill Creek Area FEMA Floodplain Changes (Draft 2000) *

* This hazard is included on the Total Number of Hazards Present map (Map 5).

0 0.5 1 Miles

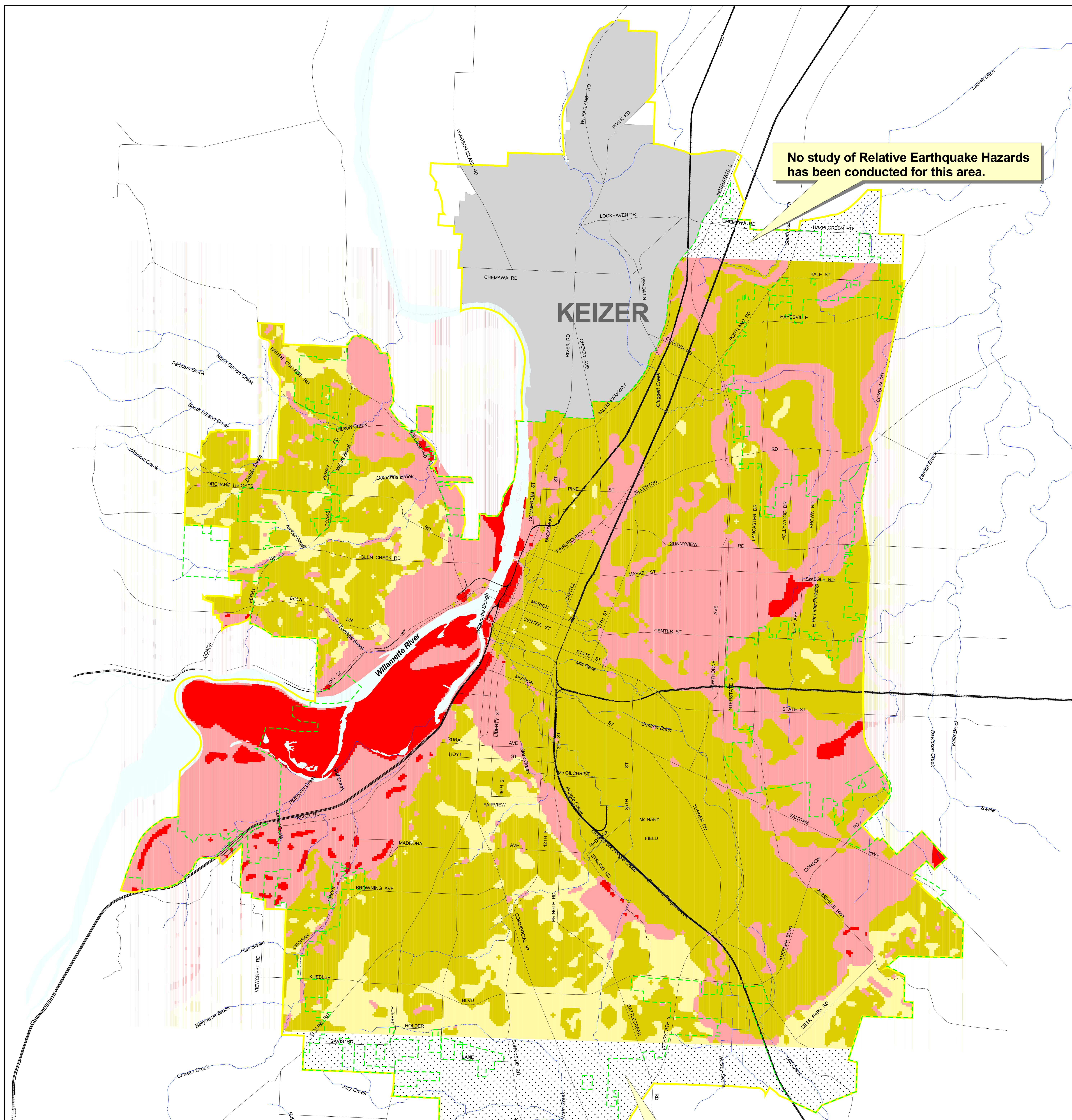


CITY OF SALEM
AT YOUR SERVICE
Community Development Department

The hazard locations portrayed on these maps are for City of Salem planning purposes only. The City is not responsible for errors or omissions. Every effort has been made to insure the accuracy of these maps. However, there may be inaccuracies due to human or mechanical error or changes in the hazard maps resulting from updated information. To verify the general location of a hazard (specific hazard location is best determined by a site analysis conducted by an expert) or to report errors please contact the Permit Application Planner at 503-588-6256 extension 7427.

SALEM UGB NATURAL HAZARD MITIGATION PLAN

MAP 3: RELATIVE EARTHQUAKE HAZARDS - 1996



LEGEND

--- City Limits Urban Growth Boundary

Relative Earthquake Hazard Risk Level

- Zone A-High*
- Zone B-Med/High*
- Zone C-Low/Med
- Zone D-Low

* This hazard is included on the Total Number of Hazards Present map (Map 5).

0 0.5 1 Miles

N

CITY OF Salem
AT YOUR SERVICE
Community Development Department

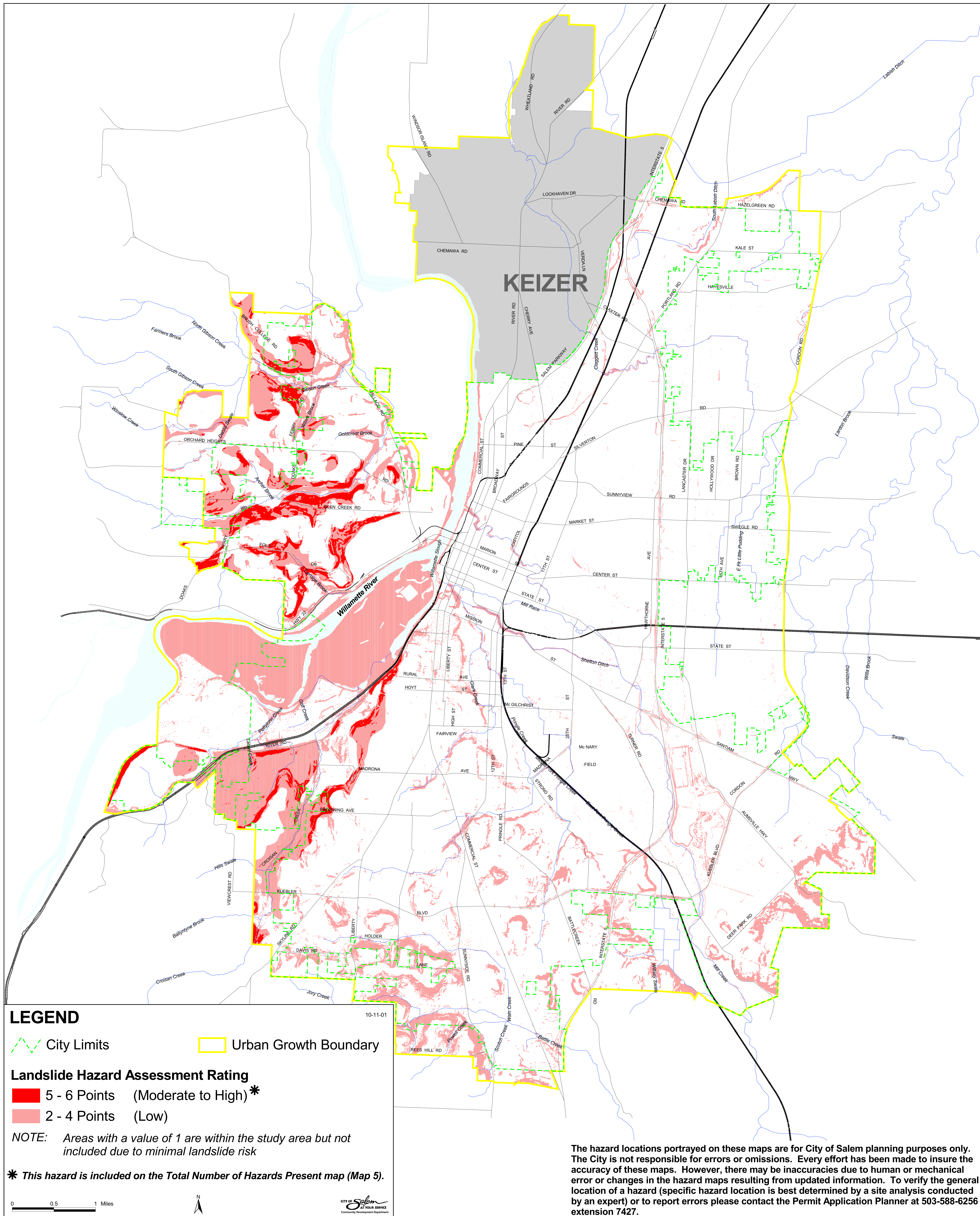
No study of Relative Earthquake Hazards has been conducted for this area.

No study of Relative Earthquake Hazards has been conducted for this area.

The hazard locations portrayed on these maps are for City of Salem planning purposes only. The City is not responsible for errors or omissions. Every effort has been made to insure the accuracy of these maps. However, there may be inaccuracies due to human or mechanical error or changes in the hazard maps resulting from updated information. To verify the general location of a hazard (specific hazard location is best determined by a site analysis conducted by an expert) or to report errors please contact the Permit Application Planner at 503-588-6256 extension 7427.

SALEM UGB NATURAL HAZARD MITIGATION PLAN

MAP 4: LANDSLIDE SUSCEPTIBILITY STUDY INFORMATION



LEGEND

- - - City Limits
 Urban Growth Boundary

Landslide Hazard Assessment Rating

5 - 6 Points (Moderate to High)*

2 - 4 Points (Low)

NOTE: Areas with a value of 1 are within the study area but not included due to minimal landslide risk

* This hazard is included on the Total Number of Hazards Present map (Map 5).

0 0.5 1 Miles

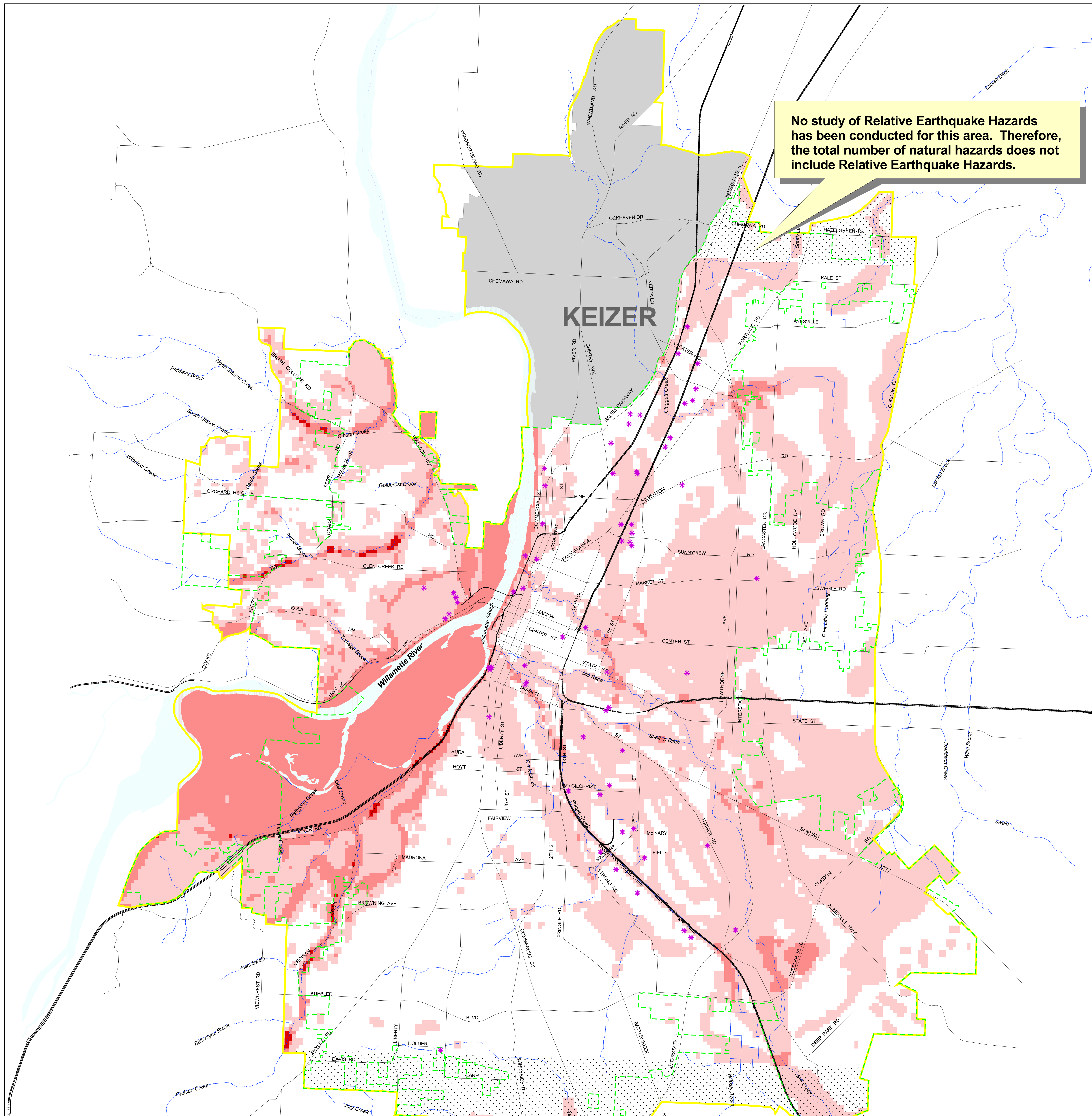


CITY OF Salem
 AT YOUR SERVICE
 Community Development Department

The hazard locations portrayed on these maps are for City of Salem planning purposes only. The City is not responsible for errors or omissions. Every effort has been made to insure the accuracy of these maps. However, there may be inaccuracies due to human or mechanical error or changes in the hazard maps resulting from updated information. To verify the general location of a hazard (specific hazard location is best determined by a site analysis conducted by an expert) or to report errors please contact the Permit Application Planner at 503-588-6256 extension 7427.

SALEM UGB NATURAL HAZARD MITIGATION PLAN

MAP 5: TOTAL NUMBER OF NATURAL HAZARDS PRESENT



No study of Relative Earthquake Hazards has been conducted for this area. Therefore, the total number of natural hazards does not include Relative Earthquake Hazards.

No study of Relative Earthquake Hazards has been conducted for this area. Therefore, the total number of natural hazards does not include Relative Earthquake Hazards.

LEGEND

- - - City Limits
- Urban Growth Boundary
- * Facilities Handling Hazardous Substances

Number of Hazards Present

- 3 Hazards
- 2 Hazards
- 1 Hazard

Mapped natural hazards include:
 Floodway & Floodplain
 Relative Earthquake Hazards
 Landslide Susceptibility

0 0.5 1 Miles



The hazard locations portrayed on these maps are for City of Salem planning purposes only. The City is not responsible for errors or omissions. Every effort has been made to insure the accuracy of these maps. However, there may be inaccuracies due to human or mechanical error or changes in the hazard maps resulting from updated information. To verify the general location of a hazard (specific hazard location is best determined by a site analysis conducted by an expert) or to report errors please contact the Permit Application Planner at 503-588-6256 extension 7427.

3.0 GOALS AND OBJECTIVES

The lives and properties of the residents of City of Salem are threatened by a variety of hazards, many of which are addressed in this plan. This chapter sets goals and objectives for subsequent activities to mitigate the threats from those hazards.

This plan focuses on three principal goals: (1) protect lives; (2) protect existing development; and (3) guide future development that reduces the hazard impact.

Goal 1. Lives should be protected.

Objective 1.1. The emergency management system should continue to provide early warning of and response to all life-threatening hazards that can be predicted, such as floods, dam failures, landslides, severe storms, wildfires, and hazardous materials incidents.

Objective 1.2. Residents, businesses, and public employees should be given information on safety and health precautions to take in advance of and during a disaster.

Objective 1.3. Emergency response plans should continue to give top priority to measures that protect people. Examples include proper training, public outreach, evacuation routing, sealing off roads threatened by landslides and flooding, and search and rescue in damaged buildings.

Objective 1.4. Special attention should be paid to responding to hazardous materials incidents because they can happen at any time without warning and there can be secondary effects.

Goal 2. Existing properties should be protected.

Objective 2.1. Specific area mitigation plans should be prepared where there is a concentration of properties subject to a high risk from one or more hazards. Such plans should consider the full range of alternatives, including prevention through avoidance of the hazard, acquisition of undeveloped property, and acquisition/relocation of buildings and structures.

Objective 2.2. Site-specific measures should be taken at known high hazard sites, such as landslide-prone hillsides above important roads and hazardous materials storage facilities, and repetitive flood loss properties that sustain multiple insured losses (this needs to be further and substantially developed).

Objective 2.3. Maintenance programs, such as drainage system inspection and trash/debris removal, should be continued to reduce the potential for flooding and other problems.

Objective 2.4. Residents and businesses should be advised and assisted, to the extent possible, in taking appropriate mitigation steps to protect their properties.

Objective 2.5. A hazard analysis and risk assessment should be conducted for each critical facility and each major publicly owned facility, followed by a determination of appropriate and cost effective mitigation measures.

Goal 3. Future development should be protected.

Objective 3.1. Land use plans and regulations (including Urban Growth Boundary and Urban Reserve Area delineations, if adopted) should direct development away from site-specific natural hazards (including flooding and landslides, the primary hazards of concern).

Objective 3.2. Where areas are not set aside from development, appropriate investigations and protective measures should be required before development plans are approved.

Objective 3.3. New buildings and substantial improvements to existing buildings should be governed by and incorporate all appropriate building code and construction measures to protect them against failure or damage.

Objective 3.4. Proposals for new subdivisions and other major developments should continue to be reviewed to ensure that they do not cause problems to other properties due to stormwater runoff, inappropriate vegetation, inadequately stored hazardous materials, improper excavating and filling, or other such conditions. Clustering of uses in non-hazard (or less hazardous) areas and transfer of development rights are other forms of hazard mitigation.

4.0 MITIGATION MEASURES

There are several values to be achieved by developing and implementing effective hazard mitigation programs. Actions taken by state, regional, and local governments, the private sector, public utilities, and others who invest in hazard mitigation help ensure the continuity and survivability (i.e., disaster resistance) of their respective physical assets and services. Some of the most apparent benefits of mitigation are reduced human and physical losses, less need to allocate funds and other resources--which can be used for other purposes--to support the immediate and long-term recovery and restoration of damaged assets, lower response costs and demands on emergency services providers, and reduced direct and indirect impacts on the economy. Further benefits of mitigation include enhancing the quality of neighborhoods and public places, and maintaining or improving natural, recreational, and environmental assets, such as habitats, water quality, and agricultural and forest productivity.

4.1 General Measures Available to Reduce Future Losses

Measures that can be taken to reduce vulnerability to natural hazards generally fall into six principal categories: (1) prevention, (2) property protection, (3) emergency services, (4) critical facilities protection, (5) structural projects, and (6) public education. Each is discussed below and is illustrated by mitigation activities that could apply to all natural hazards (i.e., they represent major policy direction).

4.1.1 Prevention

Preventive measures are designed to keep the problem from occurring or getting worse. They attempt to ensure that future development is not exposed to damage by one or more hazards. Preventive measures are usually administered by planning, building code enforcement, and/or zoning agencies, or they can be taken voluntarily (providing citizens have adequate information).

4.1.2 Land Use Planning

While it must be addressed far in advance of actual new development or redevelopment, effective land use planning can lead to an understanding of the existence of natural hazards, the risks associated with them and the determination of methods to minimize future losses through various techniques such as clustering development to avoid hazard areas. Moreover, "land re-use" projects (i.e., redevelopment) can also provide opportunities to improve mitigation by adjusting current land uses and requiring building codes and standards for new buildings or the rehabilitation of existing ones.

Oregon state law requires every city and county to adopt a comprehensive plan and land use regulations. Once the state (i.e., DLCD) "acknowledges" (i.e., approves) a plan's consistency with statewide goals, Oregon law then deems many land development decisions "ministerial" and, therefore, not subject to procedural requirements. Local plans are reviewed periodically by DLCD.

4.1.3 Zoning

Zoning laws and ordinances regulate development by dividing the community into zones or districts and by setting development criteria for each district. Zoning decisions may dedicate areas for public use, conservation, agriculture, commercial use, and cluster development or planned unit development to control construction. Density of development can also be regulated by hillside control formulae, clustering development away from hazard areas, and transferring development rights from hazardous areas to safer areas.

4.1.4 Subdivision Regulations

Subdivision regulations govern how land will be subdivided into lots. These regulations set construction and location standards for the infrastructure. A variety of measures can be used to mitigate hazards on subdivided areas.

4.1.5 Capital Improvements Planning

Capital improvement programs identify where major public expenditures will be made over the next five to twenty years. Capital improvement plans can contribute to hazard mitigation by securing hazardous areas for low risk uses, realigning or replacing roads and utilities, strengthening or replacing unsafe structures, and prescribing standards for the design and construction of new facilities in high hazard areas.

4.1.6 Open Space Preservation

Keeping a hazardous area free from development reduces risk. Land use and capital improvement plans identify areas to be preserved by acquisition and other means, such as purchasing easements.

4.1.7 Property Protection

Property protection measures are used to modify buildings to protect them from hazards. These can be inexpensive or highly expensive measures depending on the complexity of the work involved. Some measures do not affect the building's appearance or use, making them appropriate for historical sites or landmarks.

4.1.8 Acquisition and Relocation

Where a natural hazard is localized, such as with flooding, landslides, or other comparable situations, getting vulnerable development out of the way is the surest way to protect them. The major difference between acquisition and relocation is that the former involves the demolition of the improvements while both require the land remain as open space in perpetuity.

4.1.9 Building Codes

The adoption and effective enforcement of building codes are among the most important hazard mitigation measures related to the design and construction of structures for human occupancy. There are multiple codes that, when combined, deal with mitigating losses from specific hazards.

In Oregon, the state building code is composed of several specialty codes (e.g., plumbing, structural, mechanical, elevator, electrical, boiler and pressure vessel). All buildings in Oregon must conform to the state's codes. Cities choose to enforce all or part of the code within their jurisdictions. Counties or state staff may assume this responsibility if the local jurisdiction chooses not to enforce building codes.

In Oregon, all communities exposed to flood risk participate in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for new buildings or substantially improved ones in the community's floodplains. National floodplain management standards are minimums, and do not always protect properties. Oregon, however, requires elevations to be an additional foot above the national Base Flood Elevation (BFE) unless there is a higher local standard.

4.1.10 Manufactured Dwelling Installation Regulations

Manufactured or modular homes are particularly susceptible to damage because they are lighter and less resistant to natural forces. Their lower costs also mean that it takes less damage to make a mobile home a total economic loss.

In Oregon, mobile homes must be tied down in all designated flood areas and braced for wind in two high-risk areas, but there are no tie-down or bracing requirements for earthquakes. Nevertheless, there are standards for commercial bracing systems for seismic reinforcing that are sold for voluntary installation.

4.1.11 Retrofitting or Rehabilitation

Depending on the nature of the risk and the expected performance of the buildings and systems under defined hazard conditions, and especially where the risk may not be severe, it may be cost effective to modify ("retrofit" or "rehabilitate") buildings or infrastructure elements.

4.1.12 Property Maintenance and Incremental Retrofitting

The incremental approach to mitigation can be effective over the long term by using maintenance and capital funds to address vulnerabilities while other work is done to maintain structures. Such measures may be done voluntarily, or they may be contained in codes or regulations governing remodeling or sales of properties.

4.1.13 Protecting Critical Facilities

Mitigating the exposure of, responding quickly to, and restoring the services and functioning of critical facilities is central to disaster recovery. Therefore, critical facilities are often highlighted as a focus for

mitigation measures. Many critical facilities are privately owned. There are several facilities considered critical to the life, health, and safety of the citizens. Such facilities include:

- P** Buildings or locations vital to the emergency response effort (e.g., emergency operations centers, 911 Center, Salem police and fire stations, municipal water distribution/storage systems, hospitals, highway/road departments and select roads/bridges, some suppliers, radio/TV stations and towers), and
- P** Buildings or locations that, if damaged, would create secondary disasters (e.g., hazardous materials facilities, water and wastewater distribution/treatment facilities, schools, nursing homes, natural gas/petroleum pipelines, and prison/jail facilities).

There are also “essential facilities, hazardous facilities, major structures, and special occupancy structures” susceptible to earthquakes and tsunami inundation, as defined by Oregon Revised Statute (ORS) 455.477. The full definition is presented in Section 7.3 of the HMP.

4.1.14 Dam and Levee Safety

These are often large structures, and if they fail can become major hazards themselves. Sometimes failures are gradual, allowing time for warning, evacuation, and protective measures, but failures may occur with little or no notice. Regular inspections by qualified personnel as part of dam safety programs are important to preventing future losses.

In Oregon, the Safety of Dams Program within the Oregon Water Resources Department provides a state-level monitoring and inspection system for dams within the state’s jurisdiction. However, the program does not meet Federal dam safety inspection standards, nor does it encompass all special public and private structures throughout the state.

4.1.15 Special Design / Construction Standards and Review / Inspection Procedures

The siting, design, construction, and inspection procedures for critical facilities can be governed by special requirements, laws, codes, ordinances or other measures. Special precautions may be taken voluntarily by the owners and operators of such facilities.

4.1.16 Structural Projects

Structural projects are used to control the hazard from reaching or damaging developed areas. These measures are “structural” because they involve the construction of facilities. However, most structural projects can be very expensive to construct and maintain, and they may have other shortcomings (e.g., environmental impacts, diversion of impact to another area, and high maintenance costs).

In Oregon, there are numerous structural projects that have been constructed over several decades. Some are for flood control (e.g., dams and levees) and others are multi-purpose, such as Bonneville dam on the

Columbia River, and much closer to Salem, the Detroit Dam. In Salem, the Weir Dam (which diverts a portion of Mill Creek into the Shelton Ditch) would be considered such a structural project.

4.1.17 Insurance

Insurance has the advantage that the property is financially protected. Damage is not prevented or mitigated, however, the financial impact is reduced. Claim payments are sometimes sufficient to help property owners to retrofit or otherwise mitigate against a re-occurrence. In addition, property insurance companies and lending institutions are showing increasing interest in encouraging, through reduced premiums (for example), owner actions to reduce the threat before a hazardous event.

4.1.18 Emergency Services

Emergency services protect and serve people before, during and after disasters. OEM exists at the state level, and counties and most cities have emergency management programs to coordinate preparedness, warning, response, and recovery activities. While these programs are commonly seen as response oriented, many have roles in hazard mitigation. Two programs of importance relate to warning and post-disaster mitigation activities.

4.1.19 Warning

Response to disaster begins with understanding that a damaging event might occur. Early and accurate warnings increases the number of people that can take mitigative or protective actions.

In Oregon, the “State Warning Point” (administered through the Oregon State Police, Office of Emergency Management) is charged with issuing official warnings of impending situations (e.g., severe weather, floods, tsunamis, landslides and debris flows), but the populace may receive the same information and unofficial messages from other local officials and the media. Warnings are issued through the Emergency Alert System (EAS).

4.1.20 Disaster Mitigation Activities

Before a disaster strikes, state and federal agencies are providing technical assistance to local governments regarding hazard mitigation planning and implementation. Detailed discussion of such activities are woven throughout this NHMP.

Mitigation activities can be taken after a disaster to help people prepare for the next one. There are a wide range of measures that constitute mitigation, many of which constitute application of these general measures to specific projects. Many mitigation projects are initiated before the community returns to “normal.” There are FEMA programs under the Stafford Act that contribute to mitigation, especially the Public Assistance and Hazard Mitigation Grant Program. In Oregon, these programs have been used extensively to reduce future losses from flooding and other hazards.

4.1.21 Public Education

Mitigation-oriented public education activities advise the general community and specified sub-groups in the community about hazards, and such activities describe protective actions to reduce exposure to loss. Activities generally fall into three types: outreach, technical assistance, and disclosure requirements. In Oregon, several state agencies (including Oregon State Police, Office of Emergency Management) have ongoing educational programs that include mitigation or that could include mitigation information for their intended audiences.

The application and need to strengthen many of these mitigation measures in the State of Oregon is reflected in Chapter 5 that contains the long- and short-term action plan.

4.2 Other Considerations

4.2.1 Benefit/Cost Analysis for Natural Hazard Mitigation

Much of the loss from natural disasters comes in the forms of property and contents damage, additional living and business interruption costs, and other costs directly related to the impacts of such events. The challenge is to determine the economic feasibility of preventive actions that may lessen future losses. Thus, the basic issue in mitigation policy-making centers on the government, in conjunction with its citizens, deciding whether the benefits of mitigation exceed the costs, especially if no regulation or standard is required. Such regulations or standards may prescribe minimum levels of protection, and in some cases benefit-cost analyses could demonstrate that exceeding such minimums would still be economically defensible.

If federal funding is involved in hazard mitigation projects, Congress has required the Corps of Engineers, the Federal Emergency Management Agency, and other agencies to determine if the benefits exceed the costs of such projects. During the last decade benefit/cost analysis methods have been developed and widely applied to judge the economic effectiveness of proposed hazard mitigation projects. A universally applicable summary of the methods, their requirements, and other attributes is presented in Appendix 7.4.

Conducting such analyses, especially in the natural hazards field, is particularly uncertain. The reasons for this include the recognition that risk is often poorly understood and largely subjective, the immediate and longer term economic impacts are difficult to assess, and a variety of mitigation alternatives may be available. Nevertheless, such analyses will likely be required in the future, and such analyses can help state and federal officials judge which proposed projects are relatively more beneficial than others (i.e., help set priorities among several competing proposals).

Benefit/cost analysis by itself, however, does not address the full range of considerations, especially non-economic ones, attributable to specific projects. Some of these might include, for example, community values, historic properties, habitat and environmental issues, especially important or critical facilities, and others. This analysis is particularly important for capital improvement projects.

4.2.2 Concurrent Hazards and Compound Disasters

When considering the impacts of natural hazards on current and future development, it is important to understand that, depending on the triggering event (e.g., earthquake), many other problems may result from the event. Therefore, in developing and implementing mitigation programs and measures it is necessary to consider all relevant hazards, including the potential for their interactions to have combined effects on the area. For example, landslides and floods are associated with heavy rainfall. Earthquake shaking could trigger the collapse of a volcanic dome, which might be followed by an eruption that ignites wildfires. A major landslide could destroy a road, damage utility systems, isolate an area, and block a stream or river resulting in flooding.

4.2.3 Multiple Objective Management

Multi-Objective Management (MOM) has emerged as an effective way to include many interests, rather than just a few, that are or should be involved in hazard mitigation. The underlying principles of MOM are easily transferable to mitigate additional hazards and address other community concerns that emerge during such planning processes. The principles are: (1) getting together everyone with a concern or problem that has the potential to affect or be affected by the particular hazard; (2) building alliances with other stakeholder groups (including cities, counties, citizens, businesses, and others) in the search for solutions; and (3) using other resources that already exist.

Guidebooks on the use of MOM are available, such as *Using Multi-Objective Management to Reduce Flood Losses in Your Watershed* (1996), published by the Association of State Floodplain Managers, Inc. The overall process focuses on “what is best for your community” and building consensus on what should be done. The basic steps for multi-objective planning are:

- (1) Get organized,
- (2) Involve other local people or groups,
- (3) Contact agencies and organizations that have an interest or can provide advice or assistance,
- (4) Define the community’s hazards problems,
- (5) Agree on goals and objectives for community planning and action,
- (6) Review alternatives to reducing potential losses,
- (7) Prepare a written document,
- (8) Get public and official acceptance of the plan, and
- (9) Implement and follow through on the steps specified in the plan.

4.3 The City of Salem’s Current and Prospective Mitigation Measures

For each of the hazards included in this plan, the “All-Hazards Assessment” sheet (see Section 7.2, Appendix) combines information about the City of Salem’s current mitigation measures and prospective short- and long-term measures the City will take to further reduce potential future losses. This program ties closely to Chapter 5 (Mitigation Action Plan) which addresses other tasks, responsibilities, and schedules.

5.0 MITIGATION ACTION PLAN

The approach recommended in this plan is for the City of Salem to pursue implementation of the goals and objectives listed in Chapter 3 through a Mitigation Action Plan. It includes tasks, lead agency responsibilities, and a schedule to prevent or reduce potential future losses. Additional details on these recommendations are presented in the Hazard Issue Paper #3, many elements of which have been incorporated into the Natural Hazard Mitigation Plan (NHMP).

5.1 City Policy Actions

Action 1: Accept this Natural Hazards Mitigation Plan.

Lead agency: City Council

Deadline: Summer of 2002

Action 2: Mitigation Coordinating Committee - Designate a standing Mitigation Coordinating Committee (MCC) which will be a technical committee made up of staff from city departments, other agencies and private sector experts (such as businesses, academia, and other private and non-profit interests).

The Committee should be charged with:

- P Coordinating the implementation of this Natural Hazard Mitigation Plan,
- P Monitoring progress in implementing the Plan,
- P Setting priorities among competing action items,
- P Working with each department in the development of a work plan and budgeting of each of the action items as prioritized by the Committee,
- P Coordinating the Plan and its implementation with relevant city, county and state plans and city, state and federal regulations.
- P Submitting an annual progress report to the Environmental Commission, Planning Commission and City Council,
- P Recommending changes needed to this Plan as community needs evolve, and
- P Incorporating hazard assessment/mitigation goals into all City activities.

Lead agency: Community Development Department in partnership with other stakeholders represented on the Technical Advisory Committee.

Deadline: Winter of 2003

5.2 Mitigation Plan Implementation Actions

Action 3: Capitol Planning Commission - Meet with the Capitol Planning Commission to determine what roles it plays in mitigating natural hazards, especially for State of Oregon properties or others in Salem for which it has jurisdiction.

Lead agency: Community Development Department

Deadline: Within 6 months after accepting this plan.

Action 4: Update “All-Hazards” Ranking - Obtain additional input from stakeholders (cities, counties, citizens, businesses, and others) on the “All-Hazards” ranking (see Appendix 7.2 and Section 2.2.3) to better identify the primary hazards of concern to the citizens of the Salem area. Input can be solicited through on-going meetings of the Natural Hazards Mitigation Coordinating Committee, the Salem Futures process, and other venues. For comparison purposes, consider conducting a hazard ranking issue using the “Hazard Analysis” system used by the Office of Emergency Management (Oregon State Police) in conjunction with Oregon counties (see Section 6.0 of the NHMP for a reference).

Lead agency: Community Development Department and Fire Department

Deadline: to be determined (tbd)

Action 5: Refine Existing Hazards Mapping - Consider additional research and mapping to better define hazards and property at risk. Include mapping that addresses pathways for volcanic mudflows, areas impacted by a catastrophic failure of the Detroit Dam and other dams or large above-ground reservoirs, areas of landslide risk adjacent to the North Santiam River (upstream of the Geren Island water intake structures), and urban-wildland interface high fire risk areas.

Pertinent to hazardous materials concerns, develop a City-wide map of facilities manufacturing, storing, using, transporting, or otherwise handling significant amounts of hazardous materials as a basis for requiring or encouraging owners to prevent spills and other releases. Rank the facilities in terms of the risk of impact following a natural disaster and develop several disaster response scenarios. Incorporate this inventory and ranking into a database for plotting on City of Salem computer generated maps. Incorporate the response scenarios into the current Fire Department training program.

OEM’s checklist for local mitigation plans includes the need to estimate the type and number of structures within the community at risk for each hazard type, including residences, businesses, critical facilities (hospitals, fire stations, and storage sites for hazardous materials), and infrastructure (e.g., roads and utilities). Perhaps this information can be easily mapped. There also needs to be a map of repetitive flood loss properties (extent of flooding, no evaluation of cost of property damage) and discussion of potential mitigation activities for these properties.

Any mapping of critical facilities and infrastructure should give due consideration to potential security ramifications. Consider aggregating data as appropriate to protect critical facilities and/or site-specific property data.

Lead Agency: Community Development Department and Fire Department

Deadline: tbd

Action 6: Facilities at Risk & Emergency Preparedness/Response - The City should continue to contact each of the identified facilities to:

- P Develop a list of contacts and telephone numbers,
- P Determine if they have their own emergency response plans,

- P Determine any special coordination that will be needed during a disaster, and
- P Reminder contacts should be made and the list should be updated at least annually

The City Fire Department has performed this work pertinent to hazardous materials facilities. Also, Marion County has developed and continues to update a Resource Directory for emergency management personnel - based on a review of the index, the Directory appears to be very comprehensive.

The City should develop an electronic map-database containing the Fire Department's list of critical and other facilities at risk so the data is readily accessible to all City and other personnel responding to a disaster. This information should be combined with mapped hazards. Each of these facilities should be evaluated for its' survivability following a single and compound disaster.

In addition to hazardous facilities, there are also a larger number of essential facilities, major structures, and special occupancy structures, as defined in ORS 455.447(1)(a)(b)(c) and (e), at risk of an earthquake. Some of the facilities that fall under this definition also are listed by the City as critical or otherwise at risk. Many of these facilities are also at risk of flooding and other natural hazards. The City should consolidate and refine existing lists of facilities subject to a single or compound natural hazard event into a single electronic map-database so that the data is readily accessible to all City and other personnel responding to a disaster. This information should be combined with mapped hazards. Each critical facility should be evaluated for its' survivability following a single and compound disaster. Public Works department notes that completing this action would be a multi-year work item subject to funding in the annual budget.

Lead Agency: Fire Department and Public Works Department
Deadline: tbd

Action 7: Public Outreach - Inform the public about the benefits of hazard mitigation. Possible actions include:

- P Use city programs providing loans for housing rehabilitation (e.g., Homeowner Rehabilitation Loan Program) as a means to provide public outreach on appropriate hazard protection and retrofitting measures. The City could support this by, for example, holding seminars and providing simple example mitigation diagrams and instructions.
- P Present the Natural Hazard Mitigation Plan at neighborhood association meetings.
- P Develop an updateable database of names, phone numbers, etc. of all stakeholders (cities, counties, citizens, businesses, and others) involved in planning for and responding to natural disasters.
- P Expand publicity on the availability of hazard data for any address. Develop generic handouts that explain the data, its shortcomings, and how to obtain more accurate data on any particular site. The handouts should also describe appropriate protection and retrofitting measures and where more information on them can be obtained.
- P Inventory properties located within high hazard areas and inform property owners of the limited ability to obtain natural disaster insurance.

- P The City should work with and encourage local real estate trade associations to prepare a handout advising property buyers about the variety of possible hazards and where to get locally available information about a property's exposure to these hazards.
- P Consider revising the Salem Revised Code (SRC) to include the need for owner disclosure and recording of known natural hazards in a fashion similar to that required in the landslide ordinance.
- P Include a copy of the NHMP and any future updates as an additional Annex to the City's Emergency Management Plan (EMP).

Lead agency: Community Development Department and Fire Department
Deadline: tbd

Action 8: Disaster Awareness/Warning - The City should research and review the feasibility of the following in consultation with the National Weather Service and/or other agencies involved in warnings. Consider:

- P Installing other stream gauges on the Willamette River, North Santiam River, and Pringle/Mill Creeks, building on the expanded urban stream monitoring system already being implemented by the City pursuant to the *Stormwater Master Plan*.
- P Performing a benefit/cost analysis of a local flood warning system on local creeks - an analysis that is consistent with the recently adopted Stormwater Master Plan and the Corps of Engineers (COE) Section 205 Flood Damage Reduction Study for Mill Creek, and
- P Developing a general landslide awareness program based on monitoring soil saturation and rain forecasts (e.g. press release associated with extended period of rain).

Lead Agency: Fire Department, Community Development Department, & Public Works Department
Deadline: tbd

Action 9: Disaster Response - The City should continue to update its emergency operations plan. The revised plan should include current resource lists and Emergency Management Plan (EMP) annexes for each of the hazards discussed in this report. It should utilize the latest GIS mapping available and include a flood stage forecast map that relates the potential inundation areas and damage to specific flood forecasts. A list of appropriate response steps should be included for each flood stage level. Perhaps the EMP should also include the potential for hazardous materials spills. Additional guidelines can be found in FEMA's Community Rating System publications.

The updated emergency operations plan should include a post-disaster recovery and mitigation annex/appendix with procedures that encourage property owners to incorporate retrofitting and mitigation measures and identifies where outside financial assistance would help. Guidance for this effort is available through FEMA and the Oregon State Police, Office of Emergency Management.

The City should maintain liaison with the Oregon State Police, Office of Emergency Management with the intent of keeping informed about federal and state laws and regulations governing all aspects of post-disaster recovery and mitigation.

Lead agency: Fire Department, Community Development Department, Public Works Department and Police Department

Deadline: tbd

Action 10: Development Planning/Design/Permitting/Maintenance - Review the subdivision, zoning and other ordinances, and permit review procedures to determine what changes, if any, are needed to reduce or prevent losses from future natural hazards events. These changes could include provisions for:

- P Future development should be moved away from identified/mapped high hazard areas and/or transferring development rights from high hazard areas to safer areas, especially in those areas where the risk to people and property cannot be mitigated. This includes prohibition of siting essential facilities, major structures, hazardous facilities, and special occupancy structures (per ORS definition, see Section 7.3 in this HMP) in identified hazardous areas unless the siting of such a facility/structure is needed to provide essential emergency response in a timely manner. If the Salem Futures Project culminates in a plan that recommends the inclusion of urban reserves and, through the implementation of the NHMP, the City restricts future development, in general, the City should, as one possible option, request from the Oregon DLCDC the ability to develop the urban reserves and potentially expand the Urban Growth Boundary (UGB) rather than allow development in hazardous areas.
- P Encourage landowners in the UGB to provide set-asides for open space or less intensive public-private partnership development. This concept could include a provision that requires new buyers of property to set aside space or sell it to the City or other organization devoted to protecting land. Procedures to review subdivision and other large development proposals could ensure a review to identify hazardous areas. Such areas could be set aside, either as prime spots for acquisition, or protection via environmental or other easements. Regardless, preparation of policy for set-asides must maintain a balance of public safety and costs to acquire property subject to natural disasters.
- P Voluntary (with incentives) seismic upgrades of critical or otherwise essential facilities located in high seismic risk areas.
- P Evaluate a range of mitigation measures (e.g., less flammable building materials, fuel breaks, etc.) to reduce urban-wildland interface fire risk. Consider requiring that development plans describe procedures for ongoing vegetation maintenance required to minimize the risk of fire in the urban-wildland interface.
- P Broader use of all natural hazard overlays (including a composite-hazard map) to better guide the planning and permit review process. Put all hazard overlay maps in zoning books used at the permits center counter.
- P Enhanced use of a watershed approach for new development that includes contributions from upstream development and impact on, for example, Mill Creek as it passes through Salem.

Lead Agency: Community Development Department (Planning and Building & Safety Divisions), Fire Department, and Public Works Department

Deadline: tbd

Action 11: Capital Improvement Plans (CIPs) – Build on existing hazard mitigation efforts with the goal of improving the planning/budgeting process such that CIPs continue to contribute to hazard mitigation. Possible measures to evaluate include securing hazardous areas for low risk uses; realigning or replacing roads and utilities when feasible in the course of regularly scheduled replacement; strengthening or replacing unsafe public structures (especially facilities critical to disaster and post-disaster planning/response), and prescribing standards for the design and construction of new public facilities in high hazard areas. Suggested projects include those related to flood damage reduction, seismic upgrades of “critical” (per UBC) and “non-critical” but essential facilities, and retrofitting/relocation of structures in landslide prone areas.

Lead agency: Public Works Department, Fire Department, Police Department, and Community Development Department

Deadline: tbd

Action 12: SWMP Recommendations – Implement recommendations presented in the Stormwater Master Program Plan (SWMP). These recommendations relate to review of policy and over 200 project-specific measures to better manage stormwater quantity/quality and flooding.

Lead agency: Public Works Department

Deadline: tbd

Action 13: Farming and Forestry Practices - Contact the Marion and Polk Soil and Water Conservation Districts to determine the potential for increased flooding due to farming and forestry practices in the various smaller watersheds. If there is a concern, encourage appropriate federal, state and regional agencies to help initiate safer agricultural and forestry practices.

Lead agency: Public Works Department

Deadline: tbd

Action 14: Increase Flood “Freeboard” - If the current regulated flood elevations are too low, as determined by the City of Salem, consider requiring a higher protection level, rather than waiting for a possible new flood study. Consider a freeboard higher than one foot above the 100-year elevation in areas where past floods (including the 1996 floods) have been higher than the 100-year elevation. Marion County increased the freeboard to 2 feet. Check with the State of Oregon (Department of Land Conservation & Development) on this standard.

Lead agency: Public Works Department

Deadline: tbd

Action 15: Inventory Flood Damage - City staff should first check with potential funding sources, including FEMA’s Hazard Mitigation and Flood Mitigation Assistance Grant Programs, to determine the possibility of receiving funds for such an inventory. OEM has a general inventory. If funding is available, consider contacting property owners in order to develop an inventory with a focus on those areas subject to repetitive losses (i.e., two or more losses). If there are no funding sources immediately available, the City should

consider maintaining contact with the owners of these properties and contacting them after the next flood or other disaster affects the same area. It is likely that new sources of funding would be available then.

Lead agency: Public Works Department
Deadline: tbd

Action 16: Risk Assessment - Although many features of a risk assessment have been addressed in preparation of this plan or are included in other Action items presented in this section of the NHMP, new (as of February 2001) draft OEM criteria for the risk assessment component of local plans are presented below (these draft criteria should be reviewed against OEM's Evaluation Criteria Checklist for Local Natural Hazards Mitigation Plan Review, January 2002). Many of these issues have been fully addressed in preparation of this NHMP. Other issues require additional work and should be evaluated and prioritized for implementation by the standing Mitigation Coordinating Committee, taking into consideration competing action items and budgetary considerations.

- P A discussion of past hazard events. *Action needed* - none, addressed in this HMP (see table in Appendix 7.2).
- P A description of the various hazard types threatening the community. *Action needed* - none, addressed in this HMP.
- P Maps outlining all natural hazard areas within the community. *Action needed* - none, addressed in this HMP.
- P An estimate of the type and number of structures within the community at risk for each hazard type, including residences, businesses, critical facilities (hospitals, fire stations, and storage sites for hazardous materials), and infrastructure (e.g., roads and utilities). Marion County and the City of Salem are jointly participating in a grant to generate an inventory of unreinforced masonry buildings in Salem. City and County divisions have listings of critical and other essential facilities and infrastructure. *Action needed* - expand the inventory, add facilities that meet the definitions presented in ORS 455 (see Section 7.3 of this NHMP) and add information to the existing mapping developed.
- P A map and discussion of repetitive flood loss properties and potential mitigation activities for these properties. *Action needed* - Create map, conduct assessment of mitigation activities, and, describe potential activities to be conducted to ensure compliance with the NFIP including activities designed to reduce the number of NFIP targeted repetitive loss properties.
- P A summary of potential impacts on residents and the economy and an estimation of potential losses for each hazard type. *Action needed* - Consider preparing an estimate of losses under various hazard or combined hazard scenarios. The COE Section 205 Flood Control Feasibility Study considered this from the Mill Creek flooding perspective and information used in that study can be found in the final February 2002 report. Public Works Department notes that completing this action would be a multi-year work item subject to funding in the annual budget.
- P If not already implemented, audit the effectiveness of existing code as they relate to hazard mitigation. One method referenced in FEMA documents is the Building Code Effectiveness Grading Report (BCEGR).

Lead agency: Public Works Department (for flooding) and Community Development Department (Building & Safety Division).

Deadline: tbd

Action 17: Plan Maintenance and Implementation - Reducing future losses from natural hazards is a long-term and complex process. Mitigation begins as early as possible so hazards are avoided, future vulnerability is not increased beyond acceptable risk levels, and feasible corrective actions are taken to reduce existing community vulnerability.

In January 2002, OEM released a document, *State of Oregon, Local Natural Hazard Mitigation Plans: An Evaluation Process*. This document includes OEM's Evaluation Criteria Checklist for Local Natural Hazards Mitigation Plan Review. On February 26, 2002, FEMA released new rules on local hazard mitigation planning (44 CFR Part 201.6). The City of Salem draft NHMP was completed in September 2001. Staff coordinated development of the NHMP with draft OEM guidelines (February 2001). As part of implementation, the Plan and its Action Items were reviewed in December 2002 for consistency with the new rules and guidelines and modifications were made to bring this plan into compliance. The Plan has been revised to include the following plan criteria as required by FEMA:

- P A more detailed description of the Plan's development process,
- P A description of how the public was involved,
- P A profile of previous hazard events,
- P A description of how implementation action items will be prioritized and,
- P A schedule for monitoring, evaluating and updating the Plan.

Note that per the new FEMA requirements, local jurisdictions must have plans approved by FEMA by November 1, 2004, to be eligible for Hazard Mitigation Grant Program project grants for Presidentially-declared disasters after this date.

This *City of Salem Natural Hazards Mitigation Plan*, like all plans, requires periodic reviews and revisions so it remains current, reflects recent information, and provides a platform for sustained policy development and action. Specifically, the Mitigation Coordinating Committee (MCC) members will review the plan annually to ensure that it continues to serve the needs of the City of Salem. The committee also will prepare hazard mitigation reports for specific disaster events when they affect Salem. To ensure these tasks are completed, the Mitigation Coordinating Committee will hold regularly scheduled meetings at least twice a year, in addition to specially arranged meetings in the event a natural hazard occurs.

Prioritization of mitigation actions, as outlined in this section, is an important first step towards implementing the Natural Hazards Mitigation Plan. The Mitigation Coordinating Committee will prioritize action items based on relative costs and benefits. Prioritization of action items will also address other considerations, especially non-economic ones, attributable to specific projects. Some of these may include, for example, community values, historic properties, habitat and environmental issues. Action items will be implemented subject to available funds.

The City of Salem should refine all interagency agreements (if any exist), and develop new ones as appropriate, pertinent to those action items presented in this NHMP and/or new action items derived from future refinements of the HMP. The agreements should identify individual positions and agencies/departments with specific responsibilities in this regard, and identification of potential funding sources. The agreements should also detail how coordination with the State will occur during plan implementation.

The MCC should outline a Plan Maintenance Process that:

- P** Establishes the method and schedule of monitoring, evaluating, and updating the mitigation plan within a three-year cycle,
- P** Identifies how the community will maintain public participation in the planning process, and
- P** Identifies a process for formal adoption of any plan revisions by the City of Salem. It is suggested that the Process outline and identify methods for obtaining funds to maximize benefits to all citizens within the community. However, this requirement is most important for areas that are State-designated as a "small and impoverished community" (note: Salem does not qualify as such a community).

Lead agency: Community Development Department

Deadline: tbd

6.0 REFERENCES – PARTIAL LIST

Specific To City Of Salem Area

- City of Salem, Salem Revised Code (SRC)
- City of Salem, 1992, Salem Comprehensive Plan (revised September 1999)
- City of Salem, 1997, Post Flood Report - Floods of February 7-9, 1996. Public Works Department
- City of Salem, 1990, Salem/Mill Creek, Oregon; Draft Feasibility Report on Flood Damage Reduction
- City of Salem, 1999, Emergency Management Plan
- City of Salem, 1999, Request for Proposals - Development of a Natural Hazard Mitigation Plan
- Marion County, 1999 (update), Manual for Completion of Hydrogeology Reviews and Studies in Compliance with Marion County Sensitive Groundwater Overlay Zone.
- Montgomery Watson, City of Salem, Stormwater Master Plan, September 2000.
- Montgomery Watson, City of Salem, Drainage System Improvement Plan: A Technical Supplement to the Stormwater Master Plan (September 2000)
- Montgomery Watson, City of Salem, Oregon Stormwater Management Program Plan: A Technical Supplement to the Stormwater Master Plan, September 2000
- Oregon Dept. of Land Conservation & Development, 1998, Oregon Model Flood Damage Prevention Ordinance.
- Oregon Dept. of Land Conservation & Development, 1999, Local Planning for Natural Hazards - Comprehensive Plan Evaluation Questionnaire (October draft)
- Oregon DOGAMI, 1996, Relative Earthquake Hazard Maps of the Salem East and Salem West Quadrangles, Marion and Polk Counties, Oregon (Dept. of Geology and Mineral Industries) GMS-105
- Oregon DOGAMI, 1999, Water-Induced Landslide Hazards, Western Portion of the Salem Hills, Marion County, Oregon, IMS-6
- Oregon DOGAMI, 1999, Water-Induced Landslide Hazards, Eastern Portion of the Eola Hills, Polk County, Oregon, IMS-7
- Oregon Revised Statutes (*see Section 7.1 (Appendix) of this Natural Hazard Mitigation Plan for details*)
- US Army Corps of Engineers, 1998, Hydrologic Engineering Management Plan (HEMP) For Salem/Mill Creek, Section 205 Study, CENWP-PE-HY (Draft, part of City of Salem Quality Plan for Salem, Mill Creek, Oregon).
- US Army Corps of Engineers, 1999, Salem, Oregon (Mill Creek), Section 205 Study: Hydrologic and Hydraulic Analysis (Draft Interim Report), DCAW57-96-0011 (Task 005).
- US Army Corps of Engineers, 2002, Salem, Oregon, Mill Creek Watershed Section 205 Flood Control Feasibility Study.
- US Geological Survey, 1989, Geologic map, Salem 1E x 2E quadrangle, I-1893.

Principal References

(Unknown), Annex to State of Oregon Natural Hazards Mitigation Plan Pursuant to Disaster No. FEMA-1061-DR-OR (July 8 and 9, 1995 Wasco County Flash Flood), undated.

Beaulieu, John, and Olmstead, Dennis, Risk Reduction for Communities with Geologic Hazards, A Guide: Salem Landslide Study as a Pilot Effort, State of Oregon, Oregon Department of Geology and Mineral Industries, Portland, OR, Draft of 3/18/99.

Beaulieu, John, Risk Reduction from Geologic Hazards in Oregon, presented at Oregon Emergency Managers Annual Meeting, Eugene, OR, Oregon Dept. of Geology and Mineral Industries, Portland, OR, 8/26/97.

Biennial Report for 1997 – 1999, from Oregon’s Department of Land Conservation and Development to the Seventieth Legislative Assembly, Reducing Risks and Costs of Natural Hazards, February, 1999, P. 26.

Booth, Derek B., Urbanization and Natural Drainage System--Impacts, Solutions, and Prognoses, *The Northwest Environmental Journal*, Vol. 7, No. 1, Spring/Summer 1991.

City of Vernonia, Hazard Mitigation Committee, Vernonia Natural Hazard Mitigation Plan, September 1996.

Federal Register, Federal Emergency Management Agency (FEMA), 44 CFR Parts 201 and 206, *Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule*, February 26, 2002.

FEMA, How to Determine Cost-Effectiveness of Hazard Mitigation Projects, Interim Edition, December, 1996, Mitigation Directorate

FEMA and Oregon State Police (Office of Emergency Management), Interagency Hazard Mitigation Team Report for the Crook County Flooding Disaster, FEMA DR-1221-OREGON, June 1998.

FEMA, Mitigation Directorate, Technical Information on Elevating and Relocating Residential Buildings in The State of Oregon, undated.

FEMA, Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, 1997.

FEMA, National Flood Insurance Program Community Rating System Example Plans (Washington, DC: FEMA, July 1996).

FEMA, The Project Impact Hazard Mitigation Guidebook for Northwest Communities, Washington, DC, 1998.

FEMA Region IV (with assistance from the Center for Urban and Regional Studies at the University of North Carolina-Chapel Hill), Local Natural Hazard Mitigation Planning Manual, Atlanta, GA: draft, undated.

FEMA Region X Interagency Hazard Mitigation Team, Interagency Flood Hazard Mitigation Report, In Response to the January 18, 1990 Disaster Declaration, State of Oregon, Tillamook and Clatsop Counties, FEMA-853-DR-OR, undated.

Goettel & Associates Inc., Regional All Hazard Mitigation Master Plan for Clackamas County, Draft (Partial), August 11, 1998.

Hofmeister, J., Slope Failure in Oregon During 1996/97 Storm Events, Department of Geology and Mineral Industries, 1999.

Interagency Hazard Mitigation Team Report, February 1996 Landslides & Stream Erosion (draft), FEMA 1099-DR-OR, undated.

Metro, Natural Hazard Mitigation Workshop Proceedings, March 13-14, 1997 (Portland, OR: Metro, undated).

Metro, Other Natural Hazards: Information in the Metro Region (Portland, OR: Metro, March 10, 1997).

National Research Council, Reducing Losses From Landsliding in the United States, National Academy Press, Washington, DC, 1985.

Oregon Department of Forestry , Landslides and Public Safety, Issue Paper, April 10, 1998.

Oregon Department of Forestry, 1999, Storm Impacts and Landslides of 1996 - Forest Practices Technical Report No. 4 (authored by E.R. Robinson, K.A. Mills, J. Paul, and L. Dent with the Oregon Department of Forestry and A. Skaugest, Oregon State University).

Oregon State Department of Geology and Mineral Industries, 1999, Geologic Hazards: Reducing Oregon's Losses (Special Paper 32 by John Beaulieu and Dennis Olmstead).

Oregon State Police, Office of Emergency Management, 1991, Action Plan to Mitigate Flood and Wind Hazards in Clatsop and Tillamook Counties, June 1991.

Oregon State Police (Oregon State Police, Office of Emergency Management)) and Federal Emergency Management Agency, Region 10, Hazard Mitigation: Early Implementation Strategy for the 1996 Oregon State Flood, DR-1099-OR (Salem, OR: OEM, March 15, 1996).

Oregon State Police (Oregon State Police (Office of Emergency Management)) and Federal Emergency Management Agency, Region 10, Homeowner's Landslide Guide (Salem, OR: OEM, undated).

Oregon State Police (Office of Emergency Management) and Federal Emergency Management Agency, Interagency Hazard Mitigation Team Report, FEMA-DR-1149-OR and FEMA-DR-1160-OR (Salem, OR: OEM, March 1997).

Oregon State Police (Office of Emergency Management) and Federal Emergency Management Agency, Reducing Windstorm Damage to Electric Utilities, Interagency Hazard Mitigation Team Report for the Western Oregon Windstorms of December 10-12, 1995 (FEMA-1107-DR-OR), undated.

Oregon State Police (Office of Emergency Management) and Federal Emergency Management Agency, Interagency Hazard Mitigation Team Report, FEMA-DR-1099-OR (February 1996 Flooding, Landslides, and Stream Erosion in the State of Oregon), (Salem, OR: OEM, 1996).

Oregon State Police (Office of Emergency Management), Elevation Guidelines for Oregon Flood Disasters DR-1099/1149/1160, and Flood Mitigation Assistance (FMA) Program, 3/19/98 revision.

Oregon State Police (Office of Emergency Management), Oregon Revised Statutes, Chapters 401, 445 and Others, 1993.

Oregon State Police (Office of Emergency Management), State of Oregon Natural Hazards Mitigation Plan (Salem, OR: OEM, 10/97).

Oregon State Police (Office of Emergency Management), 1996 (and revisions), Hazard Analysis (guidance and worksheets).

Oregon Natural Hazards Workgroup, 2002, Local Natural Hazard Mitigation Plans: An Evaluation Process, Oregon State Police (Office of Emergency Management) and Department of Land Conservation and Development (DLCD).

Oregon's Statewide Planning Goals & Guidelines, 1995 Edition, Goal 7: Areas Subject to Natural Disasters and Hazards, Department of Land Conservation and Development (DLCD), Salem OR, P. 11.

Oregon's Statewide Planning Goals & Guidelines, February 1, 2001 DRAFT, Goal 7: Areas Subject to Natural Disasters and Hazards, Department of Land Conservation and Development (DLCD), Salem OR, P. 3

Oregon's Statewide Planning Goals & Guidelines, September 28, 2001, Goal 7: Areas Subject to Natural Disasters and Hazards, Department of Land Conservation and Development (DLCD), Salem OR.

Portland State University, Department of Geology, Landslides in the Portland Area Resulting from the Storm of February, 1996: Inventory Map, Database and Evaluation, Draft (Portland, OR: PSU, April 6, 1998).

Protecting Our Region's Rivers, Floodplains and Wetlands, METRO Regional Services, Portland, OR, June, 1998.

Scofield, David and Jochim, Candace, Environmental, Groundwater and Engineering Geology: Applications from Oregon, Edited by Scott Burns, Portland State University, Engineering Geology of Transportation Routes in Oregon, Star Publishing Co., Belmont, CA, 1998, P. 193.

State of Oregon, Department of Land Conservation & Development, Report to the 70th Legislative Assembly, August 1999.

State of Oregon, Joint Interim Task Force on Landslides and Public Safety, Report to the 70th Legislative Assembly, October 7, 1998.

State of Oregon, Oregon Progress Board, Oregon Shines II: Updating Oregon's Strategic Plan (Salem, OR: OPB, January 21, 1997).

State of Oregon, State Flood Control Plan Task Force, Report to the 70th Legislative Assembly (undated).

Taylor, G.H. and Hatton, R.R., 1999, *The Oregon Weather Book - A State of Extremes* (Oregon State University Press).

University of Oregon, Community Planning Workshop, Implementation of Goal 7: An Evaluation and Discussion of Hazards Planning in Oregon, prepared for the Oregon Department of Land Conservation and Development, July 1998.

Wallin, Phil, Restoring the Floodplain of Oregon's Willamette River, *River Voices*, Summer 1997: 17-19.

Williams, Philip and Coulton, Kevin, Reducing Flood Risk and Restoring Salmon: A Blueprint for Oregon's Integrated River Management Strategy, Prepared for The U.S. Fish and Wildlife Service, Oregon State Office, Portland, OR.

Wold, Robert and Jochim, Candace, Landslide Loss Reduction: A Guide for State and Local Government Planning, Colorado Geological Survey, Dept. of Natural Resources, Denver, CO, 1989.

7.0 APPENDIX - INFORMATION AND RESOURCE COMPENDIUM

7.1 Additional Federal and State Government Mitigation Information

The Federal *Robert T. Stafford Relief and Emergency Assistance Act* provides a specific focus on loss prevention. Section 409 of the act and its implementing regulations (44 Code of Federal Regulations, Part 206, Subpart M, Hazard Mitigation Planning) requires states, as a condition for receiving any Federal disaster grant or loan, to evaluate the impacts of natural hazards within designated disaster areas, to identify actions that will reduce the effects of such hazards, and to prepare and implement hazard mitigation plans to fulfill the act's intent.

Further information about this act and implementing regulations can be obtained from the Federal Emergency Management Agency's web site: <http://www.fema.gov/mit>. The regulations for implementing Section 409 of the Stafford Act can be found in 44 CFR Section 206, Subpart M.

- P Within 15 days of any presidential major disaster declaration, a Federal Interagency Hazard Mitigation Team (IHMT) is required to submit a hazard mitigation report for the counties included in the declaration.
- P Within 90 days, and based on the IHMT report, the State Hazard Mitigation Officer (SHMO) must then revise the state's natural hazards mitigation plan taking into account lessons learned from the disaster.¹
- P In many cases, the SHMO will coordinate the preparation of separate event-specific mitigation plans, which become references to this plan so a connection and continuity is maintained throughout the program over time.
- P In addition to the above reference, Federal regulations governing floodplain management and the protection of wetlands are contained in 44 CFR Part 9.

Two teams are prescribed in the Federal regulations: the Hazard Mitigation Survey Team (HMST) and the Interagency Hazard Mitigation Team (IHMT). These are different from Oregon's Governor's Interagency Hazard Mitigation Team (GIHMT), but they do involve some of the same state agencies.

- P According to 44 CFR Section 206.401, the HMST means "the FEMA/State/Local survey team that is activated following disasters to identify immediate mitigation opportunities and issues to be addressed in the section 409 hazard mitigation plan. The team may include representatives of other Federal agencies, as appropriate."
- P In contrast, the IHMT focuses primarily on floods. The same regulation notes that this is "the mitigation team that is activated following flood related disasters pursuant to the July 10, 1980 Office of Management and Budget Directive on *Nonstructural Flood Protection Measures and Flood Disaster Recovery*, and the subsequent December 15, 1980 Interagency Agreement for

¹ Currently, the OEM is preparing Phase 2 text for the State plan to include revised sections on earthquakes and tsunami inundation.

Nonstructural Damage Reduction.” While this team’s report is essentially a Federal report, the team is a joint intergovernmental team that generally seeks to accomplish the following:

- P Identify areas of significant hazards.
- P Evaluate sites of significant hazards and determine impacts.
- P Identify areas of damage that would require reconstruction to the standards of the National Flood Insurance Program (NFIP) or to state regulation.
- P Review and evaluate any applicable land use regulations, construction standards, or other hazard mitigation measures.
- P Review and evaluate existing emergency plans, including warning and evacuation plans.
- P Review other pertinent information, such as urban renewal, rehabilitation or master plans.
- P Identify and evaluate measures to mitigate the disaster impacts.
- P Recommend appropriate hazard mitigation measures.
- P Coordinate and take action necessary to implement the recommendations.

While several Federal agencies have special disaster related authorities, such as the U.S. Army Corps of Engineers, Small Business Administration and the Department of Transportation, for purposes of this city-level hazard mitigation planning the most important legislative authority is Public Law 93-288, as amended, commonly known as “The Robert T. Stafford Disaster Relief and Emergency Assistance Act.” Now known as the “Disaster Relief Act,” it has three pertinent sections related to hazard mitigation:

- P Section 404: Defines the Hazard Mitigation Grant Program (HMGP). A matching fund program (currently 75% Federal and 25% non-Federal), it funds projects which are considered cost-effective and which substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster. If no unmet needs exist in the disaster area, remaining funds can be applied to projects anywhere in the state.
- P Section 406: Defines the Public Assistance Program, which provides funding to eligible government agencies for rebuilding destroyed or damaged public facilities. Funds for hazard mitigation can be included in approved projects during the rebuilding process.
- P Section 409: Requires that as a condition of receiving Federal disaster assistance, states must develop or revise hazard mitigation plans which evaluate natural hazards, and make recommendations for mitigating these hazards in the geographic areas receiving such assistance. Statewide plans that address multiple hazards and entire states also are covered under Section 409 which has been renamed to Section 322 of the amended Stafford Act.
- P The Stafford Act was amended by the Disaster Mitigation Act of 2000 (PL 106-390). FEMA released a new interim final regulation, dated February 26, 2002, on mitigation planning for state and local governments that implements the local mitigation plan requirements section of the amended Stafford Act. Note that per the new FEMA requirements, local jurisdictions must have plans approved by FEMA by November 1, 2004, to be eligible for Hazard Mitigation Grant Program project grants for Presidentially-declared disasters after this date. The final rule is expected to be issued in early 2003.

Selected mitigation-related federal authorities that address actions to help minimize future losses are noted below. Some can be taken during the “build-up” phase of a potential disaster, others have longer term pre-disaster mitigation possibilities, and some, while available only in Presidentially-declared situations, have

provisions that if applied have the potential for reducing future losses (e.g., a requirement to follow current building codes). Further information can be obtained from the *Catalog of Federal Disaster Assistance*, published by the General Services Administration (GSA); *Disaster Assistance: A Guide to Recovery Programs*, published by the FEMA (#229-4, November 1995), and the *Federal Response Plan*, also published by FEMA (April 1999). The selections include:

- P Small Business Act of 1953, as amended and others: Provides low-interest, long-term loans to repair or replace damaged personal and real property, but within specified limits. The “loans may be increased up to 20 percent for mitigating devices to protect real property from possible future disasters of the same kind.” In addition, the Small Business Administration outlined rules for hazard mitigation loans. In July of 1999, Congress enacted Public Law 106-24, which appropriated \$15 million to the Small Business Administration (SBA) for a pilot program to provide disaster mitigation loans to small businesses in support of FEMA’s community based initiative, previously referred to as, Project Impact. This rule amends SBA’s regulations allowing pre-disaster mitigation loans so that small businesses may install mitigation devices to prevent future damage. It states that mitigation can include such activities as elevating flood-prone structures; constructing retaining and sea walls; grading and contouring land; relocating utilities; and retrofitting and strengthening structures to protect them against high winds, earthquakes, floods, wildfires, and other natural hazards. Loans are available only to those small businesses located in pre-disaster mitigation communities, and applicants may borrow up to \$50,000 per year at four percent interest per year or less. The SBA amended its regulations again in October of 2002 to further implement the Pre-Disaster Mitigation Program. The new regulations require mitigation measure to conform with the priorities and goals of the State or local government’s mitigation plan. To demonstrate this, the applicant must obtain a written statement from the State or local Emergency Management Director confirming this fact. Applicants may also submit 4 years worth of projects within FY2003 since funding was delayed for FY2000, 2001, and 2002. Responsible agency: Small Business Administration.
- P Flood Control Act of 1941, as amended and others: While there must be an “immediate threat of unusual flooding,” authorized mitigation assistance of a temporary nature includes removal of waterway obstructions, actions to prevent the failure of dams, and “work necessary to prepare for abnormal snowmelt.” Responsible agency: Department of the Army, Office of the Chief of Engineers.
- P Fishery Conservation and Management Act of 1996: Project grants to eligible recipients can be used for various purposes, including “restoring fisheries or preventing future failures,” as long as the project meets specified criteria. Responsible agency: National Marine Fisheries Service.
- P Housing Act of 1949, as amended and others: Provides for direct loans to qualified lower income rural families “to meet emergency assistance needs resulting from natural disasters ... or improve dwellings in rural areas.” Responsible agency: Department of Agriculture, Rural Housing Service.
- P Federal-Aid Highway Program, 23 United States Code, as amended: Among a wide array of transportation-related activities, includes formula and project grants intended “to foster safe highway design” and “to replace or rehabilitate deficient or obsolete bridges,” including activities related to capital improvement projects for “safety reasons.” Responsible agency: Department of Transportation, Federal Highway Administration.

State of Oregon

Chaired by the Director of Oregon State Police (Office of Emergency Management) (OEM) or the Director's designee, the Hazard Mitigation Grant Review Board, a sub-committee of the Governor's Interagency Hazard Mitigation Team, is an intergovernmental body which reviews, ranks, and selects projects for funding under Section 404 of the Federal Stafford Act. It uses the hazard mitigation plans for the geographic area in question to evaluate proposed projects for funding. The criteria used are those of the Stafford Act and several specific Oregon criteria. The board may also be assembled to evaluate proposed hazard mitigation projects, for which no Federal grant funding is available, if the state has an interest in funding such projects.

The City of Salem, in the Salem Area Comprehensive Plan (SACP), recognizes that the State of Oregon Land Use Goals "are the final standard whereby provisions of the comprehensive plan are to be interpreted". The comprehensive plan is described in Oregon Revised Statute (ORS) 197.015(5), conforming to Statewide Planning Goals promulgated by the Oregon Land Conservation and Development Commission (LCDC.). The Commission's Goal 7 requires every community in an area subject to one or more natural hazards to have a comprehensive plan element that addresses that or those natural hazards.

During the development of community plans, there is a need to consider the primary natural hazards including floods (coastal and riverine), landslides, earthquakes and related hazards, tsunamis, coastal erosion, and wildfires.

LCDC adopted amendments to Statewide Planning Goal 7 on September 28, 2001, with an effective date of June 1, 2002. The amendments to Goal 7 establish a timeline and procedure for local governments to respond to certain new information on natural hazards. Goal 7 now requires local governments to evaluate the risk to people and property from the new hazard information and to allow an opportunity for citizens to review and comment on the information. Based on the evaluation and citizen comments, local governments will incorporate the new hazard information into their comprehensive land use plans as necessary.

When local governments respond to new hazards information through amendments to their comprehensive land use plans and implementing measures, the new Goal 7 language encourages them to:

- a. Avoid development in areas of natural hazards where the risk to people and property cannot be mitigated; and
- b. Prohibit siting of "critical facilities" (e.g., fire stations, hospitals) in hazard areas unless the facility is needed in the hazard area to provide emergency response services in a timely manner.

The new guidelines highlight the relationship of natural hazards to protection of natural resources, discuss the importance of coordinating land use decisions with emergency management programs, and encourage local governments to adopt measures that are more protective than the minimum National Flood Insurance Program changes.

Also of significance on a State level is preparation of the Oregon State Police (Office of Emergency Management) Plan (OEMP). This plan includes three volumes: Part I - Preparedness and Mitigation of the OEMP, which includes the plans and guidance necessary for the state to prepare to reduce the effects of a disaster, Part II - Emergency Operations Plan, and Part III, Relief and Recovery.

In addition, while addressing issues related to the 1996 floods and landslides, Governor Kitzhaber stated Oregon's policy commitment to hazard mitigation when he noted that *Oregon's policy focus is to learn from the flood and landslide events of 1996, and to apply this understanding to mitigate the loss of life and property from all future natural hazard events. As the recovery process proceeds, efforts will continue to reshape and articulate policies and plans in appropriate areas with mitigation as the cornerstone.* It was this disaster and an understanding of the intergovernmental and interagency relationships involved that led him to appoint the Governor's Interagency Hazard Mitigation Team (GIHMT).

Important state legislation, pertinent to hazard mitigation, has been adopted over many years. Some of the key chapters of the Oregon Revised Statutes (ORS) are summarized below:

- P ORS, Chapter 196: Deals with wetlands, and ORS 196.800 to 196.095 are concerned with filling and removing of materials from the "the beds and banks of the waters of this state." Many of these provisions have a tangential effect on floodplain management and flood hazard mitigation.
- P ORS, Chapter 197: Provides the basis for comprehensive land use planning in the State of Oregon, including provisions governing development in floodplains and in areas of geological hazard (Goal 7) which are intended to mitigate the effects of such hazards.
- P ORS, Chapter 401: Includes many of the state's emergency management statutes, one section of which states that the general purpose of the law is to "reduce the vulnerability of the State of Oregon to loss of life, injury to persons or property, human suffering, and financial loss resulting from emergencies."
- P ORS, Chapter 477: Addresses the fire protection of forests and vegetation, including sections on urban interface fire protection, hazard abatement, fire abatement, fire prevention, and related sections.
- P ORS, Chapter 516: Creates and defines the duties of the Department of Geology and Mineral Industries (DOGAMI). Section 516.030(3) directs DOGAMI to administer, on a cooperative basis, studies and programs that will "reduce the loss of life and property by understanding and mitigating geological hazards."
- P ORS Chapter 455: Provides legal authority for the Building Codes Division's (BCD) natural hazard mitigation activities in ORS 455.020 (code adoption), .220 (training), .440 (site soil analysis), .446 (construction in tsunami zones), .447 (seismic site hazard analysis), and .448-.449 (entry and inspection of earthquake damaged buildings).
- P ORS Chapter 527: Authorizes the statewide regulation of forest practices. The DOF provides leadership in forest policy and programs including forest fires and management of forest practices in order to mitigate hazards.
- P ORS Chapter 1103: Establishes policy for protection of public from rapidly moving landslides. Provides for landslide mapping by the state (DOGAMI and DOF). The law provides DLCD with grants in order to fund development of statewide model ordinances and model Transfer of Development Rights (TDR) measures necessary for local government to regulate in landslide areas. Local governments must regulate in mapped areas, but must adopt a TDR program if regulations result in landowner costs that would exceed certain amounts set in the ORS.
- P ORS Chapters 98.805-992, 368-039, 453, 476, 477: Authorizes a wide variety of education and training programs, inspections, investigative and information reports and other activities related to fire and hazardous materials incident prevention, safety, and management.

- P ORS Chapters 196 and 390: Defines the Division of State Land's (DSL) roles related to issue of removal and fill permits or enforcement actions on public and private waterways, wetlands, the Pacific Ocean, and other waters of the state.
- P ORS Chapter 527: Provides authority to the Department of Forestry (DOF) for insect and disease control for the purposes of protecting forested land resources.
- P ORS Chapter 540: Provides the Water Resources Department (WRD) statutory authorities for dam safety and a statewide hydrographic program for measuring river and stream flows.
ORS Chapter 569: Provides authority to the Department of Agriculture (DOA) for its water quality and soil conservation measures.
- P ORS Chapter 570: Provides authority to the Department of Agriculture for its pest and disease control programs.
- P ORS Chapter 810: Designates the Department of Transportation as the "road authority for all state highways" and specifies a wide range of maintenance, operations, and analysis activities related to hazard mitigation (e.g., drainage maintenance, culvert inventory, and bridge seismic retrofit program).

Local governments are represented by several associations that play important roles in hazard mitigation. These include the Association of Oregon Counties (AOC), League of Oregon Cities (LOC), Oregon Special Districts Association, and the Oregon State Police, Office of Emergency Management Association (OEMA). For example, the AOC, LOC, and OEMA sit on the Hazard Mitigation Grant Review Board, all advocate legislation and/or regulatory changes, and all provide contacts with their members as the need arises.

Under the authority amendments to The Stafford Act (by the Disaster Mitigation Act of 2000, PL 106-390), FEMA is in the process of preparing rules that implement local mitigation plan requirements. FEMA released a new interim final regulation, dated February 26, 2002. The new requirements took effect immediately, with the final rule expected by early 2003. As part of this process, the Oregon State Police Office of Emergency Management has developed criteria (with a checklist) for review of local plans. These criteria were under development during the development of the City of Salem Natural Hazard Mitigation Plan. OEM asked the City of Salem to incorporate their draft review criteria into issues addressed during preparation of the plan and future implementation of action items presented in the plan. The criteria for local mitigation planning outlined below will serve to eliminate the separate planning requirements for all other FEMA mitigation programs including flood mitigation assistance, the Community Rating System, Project Impact, and the HMGP. These draft criteria are presented in final form in the *State of Oregon, Local Natural Hazard Mitigation Plans: An Evaluation Process*, January 2002.

The local plan should include a risk assessment that has the following elements:

- P A discussion of past hazard events.
- P A description of the various hazard types threatening the community.
- P Maps outlining all natural hazard areas within the community.
- P An estimate of the type and number of structures within the community at risk for each hazard type, including residences, businesses, critical facilities (hospitals, fire stations, and storage sites for hazardous materials), and infrastructure (e.g., roads and utilities).

- P** A map and discussion of repetitive flood loss properties and potential mitigation activities for these properties.
- P** A summary of potential impacts on residents and the economy.
- P** An estimation of potential losses for each hazard type.
- P** Information on whether the community has had a Building Code Effectiveness Grading Report (BCEGS) performed by the Insurance Services Office, Inc., and, if so, what BCEGS score they received.

A local plan should also include a mitigation strategy that has the following elements:

- P** Description of local mitigation goals and objectives (should be linked to the State Plan) with proposed strategies, programs, and actions to reduce or avoid long term vulnerabilities to the identified hazards.
- P** A section that identifies, describes and prioritizes specific cost-effective mitigation projects and actions that will reduce damages from future natural disasters. This section should also include discussion of how these actions support the mitigation goals and priorities of the State and community.
- P** Most importantly, a description of activities to be conducted to ensure compliance with the NFIP including activities designed to reduce the number of NFIP targeted repetitive loss properties.

The following are draft criteria for local mitigation planning being developed by OEM. Local hazard mitigation plans shall:

- P** Demonstrate the community's commitment to reducing damages from future natural disasters through the development of partnerships with businesses, academia and other private and non-profit interests able to provide financial or technical assistance in support of the community's mitigation goals and priorities (this is based on FEMA's Project Impact initiative).
- P** Describe development trends within the community and discuss actions to mitigate disaster losses in these areas.
- P** Describe any interagency agreements necessary for plan implementation.
- P** Describe how the local plan will be implemented and administered by the local government, including discussion of how officials will approach and manage mitigation actions involving the acquisition of private property. This section should include descriptions of individual positions and agencies/departments with specific responsibilities in this regard, and identification of potential funding sources. This section should also include discussion of how coordination with the State will occur during plan implementation.

Present a Plan Maintenance Process that includes:

- P** The established method and schedule of monitoring, evaluating, and updating the mitigation plan within a three-year cycle.
- P** How the community will maintain public participation in the planning process.
- P** Plans for formal adoption of the Plan by the community.
- P** Methods for obtaining funds available under this program to maximize benefits to all citizens within the community that is State-designated as a "small and impoverished community" (note: Salem does not qualify as such a community).

7.2 All Hazard Assessment

City of Salem - Natural Hazard Mitigation Plan (NMP)		ALL-HAZARD ASSESSMENT					
	HAZARD						
QUESTION	Floods	Landslides	Earthquakes	Volcanic Eruptions	Severe Wind & Ice Storms	Urban-Wildland Interface Fires	Hazardous Materials Incidents
What is the continuing threat?	Buildings, fills, and other restrictions in the floodplain of Mill, Pringle and Claggett Creek, Willamette River, and other urban streams.	Existing development on historic/ancient slides, development exacerbating marginally stable slopes	The threat of the "big one" (maximum credible event)	Minimal	Overhead utilities, tree limbs, and falling trees.	Northwest & southwest areas, field and forest fires adjacent to the UGB (especially to the east)	Releases especially during floods, earthquakes, and storms; accidents/spills, resulting fish kills, stream pollution, groundwater impacts, and public exposure.
Have risk analyses been done?	FEMA & Corps mapping plus Section 205 study for Mill Creek mapping, no risk assessment	DOGAMI mapping, no risk assessment	DOGAMI & USGS area mapping	Yes, state wide	No	Conceptually	Databases of hazmat sites available but not in a map base. No risk analysis.
What triggered concern about this hazard originally?	1996 flood damage and injury/fatality	1996 slide damage and lawsuits	1990's quakes	Mt. St. Helens eruption in 1980	Seasonal events, especially December 1995	Previous drought conditions and short-term hot/dry weather	Willamette River basin studies of fish, local spills and accidents
What are the previous occurrences for this hazard? (Any commonly known history occurrences, and all disasters that resulted in a local, state or federal disaster declaration.)	<p>Dec. 29, 1937 Mill Creek Flood - 2nd largest peak flow on Mill Creek on record.</p> <p>Dec. 24, 1964 Christmas Flood, Rated "approximately a 100 yr. Flood" by FEMA and probably the most damaging in Oregon history with over \$157 million in losses, seven lives lost and thousands homeless. An unusually early and heavy snowpack in the lower elevations followed by warm weather and heavy rains combined to crest the Willamette River above flood levels. Most of the streams in Salem overflowed their banks.</p> <p>Jan. 11-16, 1974 Mill Creek Floods Flooded some residences and businesses. Demonstrated that the</p>	<p>Feb. 1996 South Salem, Damage to five homes near Heath Street and Aldous Avenue in Dorchester Heights.</p> <p>1997 West Salem, Damage to several homes on Gibsonwoods Court.</p>	<p>July 19, 1930: magnitude 5.0, 14.5 km NW of Salem</p> <p>Aug. 19, 1961: magnitude 4.1, 50.2 km SE of Salem, caused minor damage at Albany and Lebanon</p> <p>March 25, 1993: magnitude 5.6, Scotts Mills, 21 miles NE of Salem. It was Marion County's largest earthquake in</p>	1980 Mt. St. Helens	1962 Columbus Day Storm, Effects included more than 38 deaths, power outages for 2-3 weeks, damage to over 50,000 dwellings and \$170-200 million (\$800 million today) in damages. Salem sustained winds of 58 mph and a peak gust of 90mph.	<p>Recent acreage fires that threatened homes.</p> <p>1989 South River Road</p> <p>1991 Skyline Chinook Estates</p> <p>1993 Eola Hills</p> <p>1996 Viewcrest Fire</p> <p>2000 Battlecreek Fire</p> <p>2001 Landau Fire</p> <p>2002 Minto Brown</p>	<p>1967 Berheimer Fire with pesticides.</p> <p>1968 Star Ice, ammonia leak and explosion.</p> <p>1975 Ammonia railcar leak at Boise Cascade near City Hall.</p> <p>1979 Chlorine railcar at Salem Industrial Dr.</p> <p>1983 PCB transformers at 14th and Mill.</p> <p>1986 Gasoline spill, 41,700 gallons in Mill Creek, containment and control prevented spill from entering the</p>

City of Salem - Natural Hazard Mitigation Plan (NMP)		ALL-HAZARD ASSESSMENT					
	HAZARD						
QUESTION	Floods	Landslides	Earthquakes	Volcanic Eruptions	Severe Wind & Ice Storms	Urban-Wildland Interface Fires	Hazardous Materials Incidents
	<p>City of Salem is susceptible to significant flooding during a flood with a return frequency of less than 20yrs.</p> <p>1992 Summer "Flash" Flood on Clark Creek</p> <p>Feb. 1996, The combination of record-breaking rain, warm temperatures, and a deep snowpack led to the most severe flooding along the Salem area streams ever recorded. Federal and State disaster relief distributed \$1.7 million in grants, loans, and insurance claims to almost 2,000 applicants. Total damages from the flood have not been calculated.</p> <p>Nov. 1996/Jan. 1997 - Localized flooding on Mill Creek</p>		<p>recent recorded history and cause \$25-30 million in damages. No serious injuries were reported.</p> <p>February 8, 1995: magnitude 3.6, 12 km E of Woodburn</p> <p>November 25, 1999: magnitude 3.5, 7 km SE of Woodburn, OR</p>		<p>in damage.</p> <p>Dec. 12, 1995 Gov. declared State of Emergency. for Western OR. Severe winds, over 2ft. of rain and mudslides caused damages including loss of life, lost roofs, widespread power outages (estimated. 250,000 customers) and many downed trees blocking roadways and taking down utilities lines.</p>		<p>Willamette River.</p> <p>1988 State Pen. Fire with hazmat</p> <p>1995 I-5 & Mill Creek vinyl acetate truck accident.</p> <p>1992 Butadiene adhesive truck accident.</p> <p>2002 Gasoline tanker truck overturned on I-5, 11,000 gallons contained, 300 spilled.</p>
What happened as a result of previous events?	<p>Section 205 study and Stormwater Master Plan, land use restrictions, and update of FEMA FIRM in Mill Cr./Shelton Ditch system. Streambank Restoration and Flood Mitigation projects under various Federal programs. Revised City Emergency Response Plan and EOC Training.</p>	<p>Slide mapping and landslide ordinance regulating development</p>	<p>DOGAMI & USGS area mapping. Mid-1990's seismic risk assessment for City of Salem water and sanitary sewer system.</p>	<p>State studies</p>	<p>Revised draft of Emergency Response Plan (severe weather annex)</p>	<p>No significant events</p>	<p>Better understanding of haz mat storage sites at risk.</p>
Could losses from this hazard increase in the future? Why?	<p>Less likely due to land use restrictions in flood prone areas. Also increased community awareness</p>	<p>Less likely with increasing controls on land use and application of the new landslide ordinance</p>	<p>As development continues in high risk areas, many structures not up to code</p>	<p>Yes, as area grows</p>	<p>Yes, as area grows</p>	<p>Yes, as area grows and the interface narrows and left in fallow.</p>	<p>Yes, as industrial development continues in high hazard areas</p>

City of Salem - Natural Hazard Mitigation Plan (NMP)		ALL-HAZARD ASSESSMENT					
	HAZARD						
QUESTION	Floods	Landslides	Earthquakes	Volcanic Eruptions	Severe Wind & Ice Storms	Urban-Wildland Interface Fires	Hazardous Materials Incidents
What has been done to prevent losses to future development?	Guide future development during permit review process. Pursuant to adoption of the Stormwater Master Plan, a Stormwater Management Agreement has been agreed to by Salem, Keizer, and Marion County; and a staff-level working group is being established to address issues of mutual concern, including flooding.	Landslide ordinance and use of DOGAMI landslide hazard maps during permit application review.	Possible indirect benefit through application of landslide hazard maps during the permitting process.	Nothing	Undergrounding utilities and limiting use of certain tree species	Building ordinances (fire resistance roofing materials)	Fire Dept uses the State Fire Marshal's database and deploys hazmat response teams
What is being done to better protect existing development?	Planning for flood detention, monitoring, stream/habitat improvement, conveyance, and prioritization of same. Adoption of Erosion Prevention and Sediment Control ordinance to keep soils on-site and out of the drainage system, which preserves conveyance capacity and reduces threat of localized flooding.	See above	On-going initial inventory of unreinforced masonry buildings in downtown area.	Nothing	Tree maintenance/removal	Grass mowing, nuisance ordinances	Unclear
What actions should be taken in the future?	Model impacts of improvements. Relocate most costly uses out of susceptible areas. Work with agencies with jurisdiction beyond City limits and the UGB to place additional restrictions on development in floodplain. Increased flow monitoring and expansion of early warning system.	Relocate most costly uses outside prone areas.	Outline in HMP	Unclear if any actions are needed at the local level.	Assess facilities at risk.	Create fire resistance vegetative buffer	Encourage industry to use less and implement additional protections
Overall Vulnerability to Each Hazard - prioritize 1 (least important) through 7 (most)	7	4.5	5	1	3.5	2.25	4.75
Weighted Vulnerability (low=1, med=2, high=3)	3	3	1.5	1	2	1	2.5
SCORE	21	14	8	1	7	2	12

7.3 Essential Facility, Major Structure, Hazardous Facility, and Special Occupancy Structures per ORS 455.477 (excerpt)

From 455.447 - Regulation of certain structures vulnerable to earthquakes and tsunamis [note: ORS 455.446, ORS 455.447, and OAR Chapter 632 Div.5 apply to constructing such facilities in tsunami inundation zones (such zones do not exist within the Salem UGB)].

(1) As used in this section, unless the context requires otherwise:

- (a) “Essential facility” means:
 - (A) Hospitals and other medical facilities having surgery and emergency treatment areas;
 - (B) Fire and police stations;
 - (C) Tanks or other structures containing, housing or supporting water or fire-suppression materials or equipment required for the protection of essential or hazardous facilities or special occupancy structures;
 - (D) Emergency vehicle shelters and garages;
 - (E) Structures and equipment in emergency-preparedness centers;
 - (F) Standby power generating equipment for essential facilities; and
 - (G) Structures and equipment in government communication centers and other facilities required for emergency response.
- (b) “Hazardous facility” means structures housing, supporting or containing sufficient quantities of toxic or explosive substances to be of danger to the safety of the public if released.
- (c) “Major structure” means a building over six stories in height with an aggregate floor area of 60,000 square feet or more, every building over 10 stories in height and parking structures as determined by Department of Consumer and Business Services rule.
- (d) “Seismic hazard” means a geologic condition that is a potential danger to life and property which includes but is not limited to earthquake, landslide, liquefaction, tsunami inundation, fault displacement, and subsidence.
- (e) “Special occupancy structure” means:
 - (A) Covered structures whose primary occupancy is public assembly with a capacity greater than 300 persons;
 - (B) Buildings with a capacity greater than 250 individuals for every public, private or parochial school through secondary level or child care centers;
 - (C) Buildings for colleges or adult education schools with a capacity greater than 500 persons;
 - (D) Medical facilities with 50 or more resident, incapacitated patients not included in subparagraphs (A) to (C) of this paragraph;
 - (E) Jails and detention facilities.

7.4 Benefit-Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures

1.0 Introduction

This appendix outlines the basic criteria and approach to determining the economic feasibility of natural hazard mitigation measures. Determining the economic feasibility of mitigating natural hazards can be classified according to the type of decision being made and the perspectives of those involved. Examples are included at the end of this appendix.

Developing and evaluating a policy on mandating mitigation of natural hazards is a difficult process. After determining that a sufficient risk exists and that effective mitigation alternatives are possible, knowing whether mitigation is economically feasible is useful in selecting a mitigation plan or strategy. If a public decision is being made, economic feasibility takes on a special definition that differs from economically feasible decisions made in the private sector.

The economic question in the public sector is usually complicated because it involves estimating all of the economic benefits and costs, regardless of to whom they shall accrue. Economic benefits and costs are defined as true changes in economic efficiency. Economists have developed methods to evaluate the economic feasibility of public decisions. One such benefit-cost analysis procedure was prepared for and published by the Federal Emergency Management Agency (FEMA). These models were developed in conjunction with industry economists, engineers and public officials. They are generally accepted when making decisions regarding mitigating natural hazards.

The selection of mitigation projects to be funded can be made using three criteria: 1) maximum present value, 2) benefit-cost ratio, and 3) internal rate of return. Information on using the first two criteria result from a properly structured benefit-cost analysis.

The Maximum Present Value Criterion

The maximum present value criterion states that the optimal investment strategy is to select the set of projects that maximizes present value of future expenditures subject to the available budget. In benefit-cost analysis, those projects with the greatest benefits minus costs calculates this value. All projects or public investment alternatives must be evaluated simultaneously in this procedure.

Benefit/Cost Ratio

Selecting projects for public investment using the benefit-cost ratio criteria is similar to the maximum present value criterion if unlimited funds are available. The set of projects where benefits exceed costs would be the same as the projects selected by using the maximizing present value criterion.

Internal Rate of Return

The internal rate of return for a project or set of projects is that rate of discount that yields a present value of zero. This criterion yields the same results as the maximum present value criterion if capital is unlimited. If the supply of capital is limited, optimal project selection is attained by selecting those projects with the highest internal rate of return.

2.0 Benefit-Cost Models

Mandating specific standards to mitigate natural hazards in new construction represents a cost to building/land owners with a substantial portion of the benefits to be realized by the public. The decision to adopt new regulations and standards requires a formal benefit-cost analysis. The FEMA models were developed to provide this analysis.

Mandating the Mitigation of Privately Owned Buildings/Land

The FEMA benefit-cost model was to aid local, county and state planners in determining the economic feasibility of seismic rehabilitation programs. The model estimates the expected net present value of benefits of seismic rehabilitation derived from the following parameters:

- P building damages prevented
- P rental losses avoided
- P relocation expenses avoided
- P personal and proprietors' income losses avoided
- P business inventory damages prevented
- P personal property losses prevented.
- P value of casualties avoided

Procedures were developed to analyze a single building or a building inventory. The model was the result of an extensive two year research and development project. The model was also extensively tested. Nine seismic rehabilitation projects located in different cities throughout the country were analyzed using the single building model. An inventory of 67 Seattle-area buildings was analyzed.

Mandating the Mitigation of Publicly Owned Buildings

It may seem appropriate for public agencies to use full benefit-cost analysis to make decisions regarding rehabilitation, but that is usually not the case. Agencies commonly include only those benefits and costs that the agency is responsible for, and they tend to exclude those that are the responsibilities of other agencies or the private sector. When an agency is directed to perform a full benefit-cost calculation, the full range of each is considered. With this objective in mind, FEMA developed a benefit-cost model for publicly-owned buildings based on the earlier benefit-cost model for privately-owned buildings. The publicly-owned buildings model includes the value of avoiding lost public services.

The model provides a procedure of evaluating lost public services based on the quasi-willingness to pay principal. Data on the cost of service, payroll, and a post earthquake continuity premium are used to estimate the value of lost public services.

Public Cost Sharing of Mitigating Natural Hazards

The type of decision dictates the nature of the decision process. The first case is when the agency is faced with meeting established mitigation or construction standards. In those cases, the appropriate decision is a cost effectiveness analysis. The decision process objective cannot vary; the total benefits of the action, both public and private, have been implicitly embodied into the regulation or standard. The only issue for the agency to address is to select the best alternative to comply with the process goals. The decision process involves determining and estimating the costs to the agency of those alternatives. The alternative with the

least cost to the agency is usually selected. The agency must decide whether the benefits of mitigation exceed the costs if no regulation or standard is requiring the construction. The benefits in this case are the present value of the reduction in expected future property losses and downtime and disruption due to natural hazards and any other collateral benefits that may be gained from the construction, such as improved public services. The costs are the present value of all additional capital, operating and maintenance costs of the proposed project.

3.0 Mitigation Decisions

Investing by the private sector in a mitigation measure may occur on the basis of one or two reasons. First, it may be mandated by a regulation or standard, or second, it may be economically justified on its own merits.

Conforming to a Mitigation Standard

A building owner, be it a private entity or public agency, having to conform to a mandated standard may consider the following options:

1. Employ resources to change the standard as it relates to the owner's situation,
2. Request cost-sharing from public agencies,
3. Dispose of the building either by sale or demolition,
4. Change the designated use of the building to change the mitigation compliance requirement,
or
5. Evaluate the feasible alternatives to meet the standard and initiate the least-cost mitigation scheme.

The optimal decision will be made on the basis of selecting the most "cost effective" alternative that often can also be termed the "least-cost alternative".

Example: California's real estate disclosure laws (Civil Code, Section 1102 *et seq.*) require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards, to prospective purchasers. The seller must also disclose whether the property is located in an earthquake fault rupture zone. To comply with this law, you must disclose if your building has any of the design or construction flaws that will increase the risk of seismic damages.

Correcting some of these deficiencies is expensive and time consuming, but their existence can prevent the sale of the building. The law does not require either the seller or the buyer to correct the deficiencies. Therefore, the conditions of the sale regarding the deficiencies and the price of the building can be negotiated between the buyer and the seller. The economic decision to rehabilitate the structure would be based on an accurate estimate of the risk and the effectiveness of the project.

Mitigating Natural Hazards: The Private Decision

A building owner may also decide to reduce the risk of natural hazard based only on economic criteria. This decision is usually based on the results of an investment or capital budgeting analysis.

Owners deciding the economic feasibility of mitigation should consider the reductions in physical damages and financial losses. A partial list of avoided future losses follows:

1. Building damages
2. Building contents damage
3. Business inventory damages
4. Rental income losses
5. Relocation and disruption expenses
6. Proprietor's income losses

First, these can be estimated using observed prices, costs and engineering data. The difficult part is to correctly determine the effectiveness of the mitigation and the resulting reduction in future damages and losses.

Second, the damages and losses should include those that will be borne only by the owner. Also, the salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the owner's time horizon declines.

4.0 The Costs of Mitigation

The Costs of Mitigation. Mitigation projects have initial investment costs and recurring costs over the period of the investment. The project may also deteriorate (or be subject to destruction) over the relevant time horizon. The expected loss of the investment is approximated by multiplying the annual probability of destroying the investment times the value of the investment. Estimating deterioration can be captured by using normal depreciation schedules.

The following example benefit-cost analyses have been taken from *How to Determine Cost-Effectiveness of Hazard Mitigation Projects*, Interim Edition, December 1996, Mitigation Directorate, Federal Emergency Management Agency, Washington, DC.

The following example, *Table 11. Limited Data Module for Riverine Flooding*, shows an example benefit-cost analysis for a road culvert replacement project.

The following example, *Table 13. Full Data Module Printout for Riverine Flooding*, is for a flood hazard mitigation project to acquire and demolish structures subject to repetitive flood losses.

The following example, *Table 19. The Full Data Module Printout—Structural*, is for an earthquake hazard mitigation project to improve the resistance of an existing building's structural element.

Recognizing that some projects nearly always are cost-effective, the Federal Emergency Management Agency (FEMA) issued guidance to eliminate the need for conducting benefit-cost analyses for the types of mitigation projects listed.

7.5 Public Outreach Announcement

Hazard Mitigation Open House*

15 December 1999
4:30 p.m. - 7:00 p.m.

Al Loucks Lecture Hall Auditorium

City Library
585 Liberty St. SE
Salem, Oregon

AGENDA

- Open House----time to browse around and view printed and mapped materials and ask questions of Salem staff and Golder and Associates personnel (consultants for the project).
- **5:30 p.m.** Brief presentation on background, purpose of study, schedule, review of written and mapped material, together with questions, comments, and suggestions.
 - Introductions — Cecilia DeSantis Urbani
 - Purpose of Study and Schedule — Curt Schneider
 - Present Hazard Information Working Paper #1 — Golder and Associates
 - Questions and Answers — Golder and Associates and Salem staff
- P Open House continues
- P Adjourn

*Purpose of the Open House is to present: (1) area hazards inventory information and mapping (HIP #1) available to the public; (2) receive feedback as to the inventory information; and (3) to seek any comments citizens may have on goals, objectives and direction the study should follow (within the constraints of the grant).