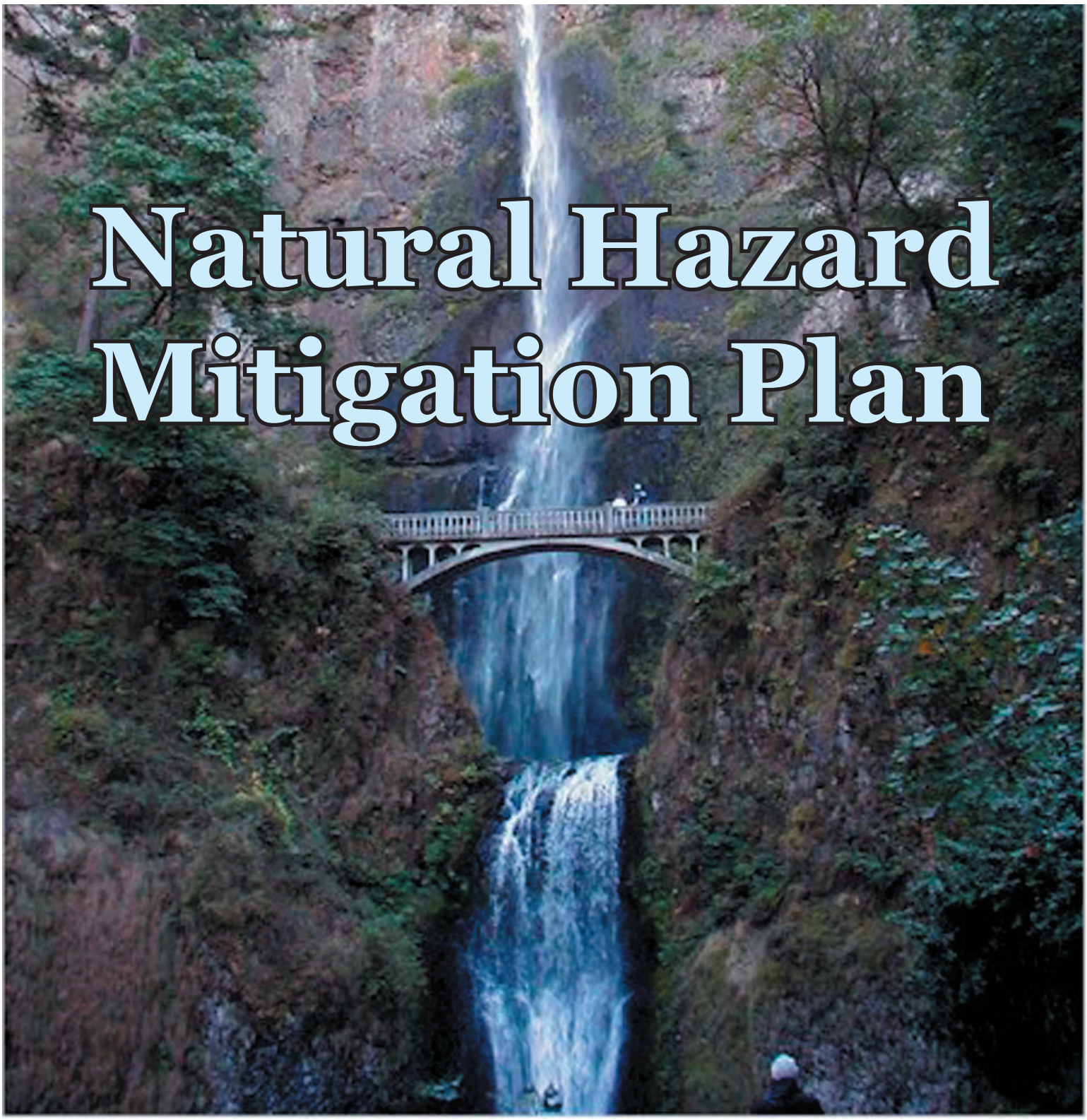
# Natural Hazard Mitigation Plan



## Multnomah County Office of Emergency Management

## April 2006

# Executive Summary

Multnomah County, Oregon developed this Natural Hazards Mitigation Plan in an effort to reduce future loss of life and property resulting from natural disasters. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the County. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the County, it is possible to minimize the losses that can result from natural disasters. The plan should be viewed as a living document that provides the County a system for long-term risk reduction from natural hazards. The plan's architecture allows the County to review and update sections based on new data. The new data can be incorporated into the plan through a simple process that does not require a full plan update, resulting in a plan that remains relevant and current. Additionally, the plan has been developed in a way that will allow and encourage the County's local jurisdictions, special districts, and other partners can build upon the plan to develop their own locally-specific addendum to the County plan.

The plan is non-regulatory in nature, meaning that it does not set forth any new County policies. It does, however, (1) provide a starting point or foundation for coordination and collaboration among agencies and the public in the County, (2) identify and prioritize future mitigation activities, (3) establish an official process for future development and implementation of mitigation activities, and (4) assist in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other County plans and programs, including the Multnomah County Comprehensive Plan, Capital Improvement Program, and emergency operations plan, as well as the State of Oregon Natural Hazards Mitigation Plan.

## HOW IS THE PLAN ORGANIZED?

The Mitigation Plan contains five main sections, hazard annexes, and resource appendices. The main plan document includes the following sections:

1. Introduction,
2. Community Profile,
3. Risk Assessment Summary,
4. Mitigation Plan Mission, Goals and Action Items, and
5. Plan Implementation

It also contains a series of six hazard-specific risk assessment summaries covering the following hazards: Earthquake, Flood, Landslide, Volcanic Events, Wildfires and Severe Weather. Lastly the plan has three resource appendices covering planning process; economic analysis (e.g. benefit cost analysis); and common acronyms.

# WHO PARTICIPATED IN DEVELOPING THE PLAN?

Community involvement was an important component of creating this plan. A broad base of stakeholders were consulted or included directly in every stage of the process. Members of the community provided meaningful input through a number of channels; the team organized the following opportunities for community participation:

- Steering committee members. A steering committee was convened to oversee the plan development process. Some of the individuals involved in creating the first mitigation document were included in the steering committee, though others were added to the list. The steering committee consisted of the following individuals:
    - Robert Maestre, Multnomah County Department of CommunityServices (Steering Committee Chair)
    - Curt Anderson, Reynolds School District
    - Helen Barkley, County Property Liability Program
    - Chuck Beasley, County Land Use Planning
    - Stevie Bullock, Multnomah County Emergency Management
    - Cathy Harrington, City of Gresham Emergency Management
    - Matthew Krusemark, County GIS
    - Bruce McClelland, Multnomah County Drainage District
    - Scott Salmon, Multnomah County Emergency Management
    - Jon Schrotzberger, Multnomah County Facilities
    - Keely Thompson, City of Gresham Utilities
    - Donna Tyner, Port of Portland Risk Management
- Stakeholder interviews were conducted to obtain more in-depth information about vulnerabilities and the actions that can be taken to reduce loss, the project team interviewed key stakeholders. Participants included representatives of County departments, as well as representatives of school districts, utilities, and other special interests who have the authority to make risk-reduction decisions
- Public Forum was held to identify vulnerability issues that the community faces, and to devise actions that address those issues. Participants included key stakeholders from county agencies, businesses, non-profit organizations, and other groups.

# WHAT IS THE PLAN MISSION AND GOALS?

The plan mission and goals help to guide the direction of future activities aimed at reducing risk and preventing losses from natural hazards. The plan goals serve as checkpoints as County departments, agencies, special districts, and partnering organization begin implementing mitigation action items.

## MISSION STATEMENT

The mission of the Multnomah County Natural Hazards Mitigation Plan is:

*Create a disaster resilient County.*

## PLAN GOALS

**I. Maintain a comprehensive, countywide risk assessment.**

Identify, document, evaluate, and update the County's risk exposure and vulnerability to natural hazards.

**II. Reduce risk to people, property and environment.**

Involve citizens, property owners (both public and private), special districts, businesses, and communities in taking action to reduce risk and repetitive losses from Earthquake, Flood, Landslide/Debris Flow, Wildfires and Severe Weather; while promoting insurance coverage and preparedness for catastrophic natural hazards –now and for future generations.

**III. Support a disaster resilient economy.**

Promote sustainable and disaster resilient business practices by providing education, training opportunities, and resilient infrastructure (road, rail, and utilities) for County business owners large and small.

**IV. Promote public education, awareness, and understanding of risk.**

Increase public participation and enhance partnerships through education, outreach, and coordination of a diverse and representative group of the County's population.

**V. Develop and maintain collaborative partnerships and funding strategies for implementing the mitigation plan.**

Develop partnerships and coordination activities focused on strengthening communication and increasing participation between County departments, public agencies, citizens, non-profits organizations, special districts, businesses, and communities that assist in implementing mitigation actions and documenting mitigation success stories.

# HOW ARE THE ACTION ITEMS ORGANIZED?

The plan identifies action items developed through various plan inputs, data collection and research. The action items identified by the plan are intended to move the County towards achieving the plan's goals. Action items address both multi-hazard (MH) and hazard-specific issues.

To facilitate implementation, each action item is described in a worksheet, which includes information on key issues addressed, ideas for implementation, coordinating and partner organizations, timeline, and plan goals addressed

# HOW WILL THE PLAN BE IMPLEMENTED?

The plan implementation and maintenance section of Multnomah County's Natural Hazard Mitigation Plan details the oversight structure and the formal process that will ensure that the plan remains an active and relevant document. The following components define the County's strategy for maintenance and implementation:

- **Plan adoption** describes the process for formal review and adoption of the plan.
- **Monitoring and implementing the plan** establishes roles and responsibilities for maintenance, reporting, and implementation through existing programs.
- **Project prioritization process** describes the four step process that will be used to prioritize activities and ensure that mitigation dollars are used cost–effectively.
- **Plan maintenance and public involvement** defines a semi-annual and five-year schedule for (1) monitoring, reporting, and evaluating current and new action items, (2) incorporating new information related to the risk assessment, and (3) continuing public outreach.

## COORDINATING BODY

The County's Hazard Mitigation Technical Advisory Committee (HMTAC) is responsible for coordinating implementation of plan action items and undertaking the formal plan review and update process. The HMTAC consists of representatives from County departments, private industry, non profit organizations and public agencies. Members of the steering committee include:

- County Emergency Management
- County Department of Community Services
- County Land Use Planning
- County GIS

- County Property Liability Program
- Multnomah County Drainage District
- Multnomah County Facilities
- Port of Portland Risk Management
- City of Gresham Emergency Management

The HMTAC, selected by the County Emergency Manager and appointed by the County Commissioners, will serve as the working committee and meet quarterly to (1) outline future work, (2) review department progress and (3) coordinate implementation. They will develop the agenda for the annual meetings and provide progress reports to the County Emergency Manager on a regular basis.

## CONVENER

After the Multnomah County Commission adopts the County's Natural Hazard Mitigation Plan the County Emergency Manager and Hazard Mitigation Advisory Committee become responsible for plan implementation. The Emergency Manager serves as convener to facilitate the steering committee meetings, and will assign tasks such as updating and presenting the plan to the members of the committee. Plan implementation and evaluation will be a shared responsibility among all the advisory committee members.

## PROJECT PRIORITIZATION PROCESS

The County's plan identify a process for prioritizing potential actions. Potential mitigation activities will often come from a variety of sources; therefore, the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment. The four steps of the project prioritization process include:

1. Examining funding requirements;
2. Completing a risk assessment evaluation;
3. Completing quantitative or qualitative assessments and economic analysis; and
4. Providing a recommendation.

## PLAN MAINTENANCE AND UPDATE

The plan includes a schedule and recommended tasks to assist the County in maintaining and updating the plan. The schedule includes semi-annual and annual meetings as well as a five-year update.

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| ***Multnomah County Natural Hazard Mitigation Plan Action Items - Organized by Goal*** | | | | | | | | | |
| ***Goal 1 (Risk Assessment) action items*** | | | | | | | | | |
| ST 1.1 | Acquire LIDAR data (Airborne Light Detection and Ranging) to improve hazard mapping in Mulltnomah County | Multnomah County Emergency Management / *Land Use Transportation Division, Information Technology / GIS* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 1.2 | Develop and implement inundation modeling for the urban managed floodplain managed by the combined Drainage Districts | Multnomah County Emergency Management | ST | | ✓ | | | | |
| ST 1.3 | Update Hillside Development Overlay Zone maps to identify areas of recurring loss. | Multnomah County Community Services Department / *Multnomah County Emergency Management* | ST | ✓ | | ✓ | | | |
| ST 1.4 | Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for the wildfire hazard | Land Use and Transportation Division / *Multnomah County Emergency Management* | ST | | | | | | ✓ |
| ST 1.5 | Acquire heat intensity imaging of levees | Multnomah County Emergency Management | ST | | ✓ | | | ✓ | |
| LT 1.6 | Update Flood Insurance Rate Maps(FIRM) and participate in FEMA's map modernization process. | Land Use and Transportation Division / *Multnomah County Emergency Management* | LT | | ✓ | | | | |
| LT 1.7 | Update and maintain the County's risk assessment. | Multnomah County Emergency Management and the Hazard Mitigation Technical Advisory Committee | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| ***Goal 2 (Reduce Risk) action items*** | | | | | | | | | |
| ST 2.1 | Complete seismic upgrades for Mt. Hood Community College gymnasium and Main Academic Center (shelter sites). | Multnomah County Emergency Management | ST | ✓ | | | | | |
| ST 2.2 | Upgrade Multnomah County Drainage District Command Center | Multnomah County Emergency Management | ST | ✓ | ✓ | | | ✓ | |
| ST 2.3 | Develop a funding strategy to reduce the risk of loss to the critical infrastructure of the Willamette River bridges managed by Multnomah County from seismic and landslide hazards. | Multnomah County Emergency Management / Board of Commissioners | ST | ✓ | | ✓ | | | |
| ST 2.4 | Seismic upgrades Multnomah County Courthouse | Multnomah County Facilities & Property Management *County Sheriff, District Attorney, Board of County Commissioners.* | ST | ✓ | | | | | |
| ST 2.5 | Analyze each repetitive loss property to identify viable mitigation options. | Land Use and Transportation Division | ST | | ✓ | | | | |
| LT 2.1 | Evaluate current zoning codes to incorporate mitigation principles related to flood and landslide. | Land Use and Transportation Division | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 2.2 | Explore the development of management strategies to preserve the function of the floodplain | Land Use and Transportation Division | LT | | ✓ | | | | |
| LT 2.3 | Qualify Multnomah county for the FEMA Community Rating System (CRS) program | Multnomah County Emergency Management / *Land Use Planning and Transportation Division* | LT | | ✓ | | | | |
| LT 2.4 | Assess, design, and repair County waterways that are in danger of failure due to high water. | Multnomah County Emergency Management | LT | | ✓ | | | ✓ | |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| LT 2.5 | Develop a food distribution contingency plan. | Multnomah County Emergency Management / *Departments of Planning and Transportation* | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 2.6 | Create mechanisms and incentives for home retrofit, including grants and tax incentives | Multnomah County Emergency Management / *Multnomah County Commissioners* | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 2.7 | Develop acquisition and management strategies to preserve parks, trails, and open space in the floodplain. | Environmental Services Division | LT | | ✓ | | | | |
| LT 2.8 | Develop and implement programs to keep trees from threatening lives, property, and public infrastructure from severe weather events | Multnomah County Emergency Management | LT | | | | | ✓ | |

## *Goal 3 (Disaster Resilient Economy) action items*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ST 3.1 | Develop and implement the Multnomah County Information Technology Disaster Recovery Plan | Multnomah County Information Technology Infrastructure Group / *County Business Units* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 3.2 | Encourage small businesses to undertake business continuity planning. | Multnomah County Emergency Management | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 3.3 | Install fiber optic communications network to fill 7,000 foot gap in existing conduit path for emergency communications and transportation data. | Multnomah County Emergency Management | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 3.1 | Provide secondary power grids to flood protection storm water pump stations | Multnomah County Emergency Management | LT | | ✓ | | | ✓ | |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| LT 3.2 | Create a back-up river crossing system that uses barges or ferries to assure that people and goods can cross the river if the bridges are down. | Multnomah County Emergency Management / *Multnomah County Land Use and Transportation* | LT | ✓ | | | | ✓ | |
| LT 3.3 | Assess the condition of and, if necessary, replace or repair the stormwater infrastructure under major County transportation routes, such as I-84 and Marine Drive. | Multnomah County Emergency Management | LT | | ✓ | | | | |
| ***Goal 4 (Education and Awareness) action items*** | | | | | | | | | |
| ST 4.1 | Develop public official information kit that can be distributed to elected officials and community decision makers. The kit should include pertinent information regarding the Natural Hazard Mitigation Plan as well as the risk the County faces. | Multnomah County Emergency Management / *Hazard Mitigation Technical Advisory Committee* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 4.2 | Develop and distribute a Natural Hazard Community Resource Maps and risk reduction tips that include instructions about how to prepare and reduce risks posed by natural hazards. | Multnomah County Emergency Management / *Land Use and Transportation Divsion and GIS* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 4.3 | Conduct earthquake awareness and mitigation outreach assistance | Multnomah County Emergency Management | ST | ✓ | | | | | |
| ST 4.4 | Research ways to create and disseminate a message that will cause people to act to reduce individual risk. Target education and outreach actions to reach marginalized populations. | Multnomah County Emergency Management / Public Affairs Office | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 4.5 | Involve the public in updating the Natural Hazard Mitigation Plan | Multnomah County Emergency Management / *Hazard Mitigation Technical Advisory Committee* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| ***Goal 5 (Plan implementation) action items*** | | | | | | | | | |
| ST 5.1 | Develop formal agreements (such as Memoranda of Understanding) with internal (departments) and external partners (non-profits, cities, and state agencies) to work together on risk reduction efforts in the County. | Mutlnomah County Commissioners and Hazard Mitigation Technical Advisory Committee / *Multnomah County Emergency Management and Land Use and Transportation Divisior* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 5.2 | Encourage and support the development of local community plan addenda to the County Natural Hazard Mitigation Plan | Hazard Mitigation Technical Advisory Committee and Land Use and Transportation Division | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| St 5.3 | Develop a web-based or other electronic communication tool for the Hazard Mitigation Technical Advisory Committee and for the public to comment on the plan | Multnomah County Emergency Management and Hazard Mitigation Technical Advisory Committee | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 5.4 | Establish mitigation benchmarks to assist in evaluating and updating the plan. | Land Use and Transportation Division and Hazard Mitigation Technical Advisory Committee | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

# Table of Contents

Section 1

# Introduction

This section provides an overview of the plan's key components and explains its purpose. It has the following subsections:

- **Why develop a mitigation plan** describes the framework for mitigation planning in general.
- **What is mitigation planning?** describes mitigation in general terms, differentiating it from preparedness or response planning.
- **Policy framework for natural hazard in Oregon** describes the state and federal policies that guide natural hazard mitigation planning efforts applicable to Multnomah County.
- **Brief history of mitigation in Multnomah County** describes previous mitigation and mitigation planning efforts that have taken place.
- **How was the plan developed?** describes the steps taken in the development of the plan.
- **How is the plan organized?** provides a reader's guide to the remainder of the plan.

## WHY DEVELOP A MITIGATION PLAN?

Multnomah County, Oregon developed this Natural Hazards Mitigation Plan in an effort to reduce future loss of life and property resulting from natural disasters. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the County. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the County, it is possible to minimize the losses that can result from natural disasters. The plan should be viewed as a living document that provides the County a system for long-term risk reduction from natural hazards. The plan's architecture allows the County to review and update sections based on new data. The new data can be incorporated into the plan through a simple process that does not require a full plan update, resulting in a plan that remains relevant and current. Additionally, the plan has been developed in a way that will allow and encourage the County's local jurisdictions, special districts, and other partners can build upon the plan to develop their own locally-specific addendum to the County plan.

A natural disaster occurs when a natural hazard impacts people or property and creates adverse conditions within a community. This plan focuses on the primary natural hazards that could affect Multnomah County, Oregon, which include earthquake, flood, landslide, volcanic hazards, and severe weather. The dramatic increase of the costs associated with natural disasters over the past decades has fostered interest in identifying and implementing effective means of reducing vulnerability. This Natural Hazards Mitigation Plan is intended to assist

Multnomah County in reducing its risk from natural hazards by identifying resources, information, and strategies for risk reduction.

The plan is non-regulatory in nature, meaning that it does not set forth any new County policies. It does, however, (1) provide a starting point or foundation for coordination and collaboration among agencies and the public in the County, (2) identify and prioritize future mitigation activities, (3) establish an official process for future development and implementation of mitigation activities, and (4) assist in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other County plans and programs, including the Multnomah County Comprehensive Plan, Capital Improvement Program, and emergency operations plan, as well as the State of Oregon Natural Hazards Mitigation Plan.

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

# WHAT IS NATURAL HAZARD MITIGATION?

Natural hazard mitigation is defined as permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through long- and short-term strategies. Example strategies include planning processes, policy changes, new programs or projects, and other activities. Mitigation is the responsibility of individuals, private businesses and industries, state and local governments, and the federal government.[i]

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

# POLICY FRAMEWORK FOR NATURAL HAZARDS IN OREGON

Planning for natural hazards is an integral element of Oregon's statewide land use planning program, which began in 1973. All Oregon cities and counties have comprehensive plans and implementing ordinances that are required to comply with the statewide planning goals. The challenge faced by state and local governments is to keep this network of local plans coordinated in response to the changing conditions and needs of Oregon communities.

Statewide land use planning Goal 7: Areas Subject to Natural Hazards, calls for local plans to include inventories, policies, and ordinances to guide

development in hazard areas. Goal 7, along with other land use planning goals, has helped to reduce losses from natural hazards. Through risk identification and the recommendation of risk-reduction actions, this plan aligns with the goals of the County's Comprehensive Plan, and helps the County meet the requirements of statewide land use planning Goal 7.

Though the primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions, resources also exist at the state and federal levels. Some of the key agencies in this area include Oregon Emergency Management (OEM), Oregon Building Codes Division (BCD), Oregon Department of Forestry (ODF), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Department of Land Conservation and Development (DLCD).

The Disaster Mitigation Act of 2000 (DMA 2000) is the latest federal legislation addressing mitigation planning. The legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. As such, this Act established a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Section 322 of the Act specifically addresses mitigation planning at the state and local levels. States and local communities must have approved mitigation plans in place in order to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for individuals' level of risk and capabilities.[ii] The County's planning process was designed to address the above listed requirements as well as the National Flood Insurance Program (NFIP) requirements aimed at reducing repetitive loss due to flooding events.

# BRIEF MITIGATION PLANNING AND PROJECTS HISTORY FOR MULTNOMAH COUNTY

This plan is not the first mitigation effort Multnomah County has carried out to reduce risk and exposure to natural hazards. The County's previous efforts include:

- Post 1996 flood activities, including bank hardening and levy repair and upgrades
- Project Impact and other educational outreach programs
- Retrofits to bridges and overpasses
- Updates in building code to restrict development in floodplains and include requirements for seismic retrofits

More detailed information about past mitigation efforts is contained in Section 3: Risk Assessment summary.

# HOW WAS THIS PLAN DEVELOPED?

The planning process used to create Multnomah County's Natural Hazards Mitigation Plan was developed using a planning process created by the Community Service Center's Oregon Natural Hazard Workgroup at the University of Oregon.[iii] The planning process was designed to:

- Result in a plan that is DMA 2000 compliant
- Meet the NFIP and Flood Mitigation Assistance Program requirements,
- Coordinate with the State's mitigation plan and activities of the Partners for Disaster Resistance & Resilience, and
- Build a network of jurisdictions and organizations that can play an active role in plan implementation.

The County hired a consultant team from ECONorthwest to assist with the remaining steps in the planning process. Together with the consultants, the County added detail to an existing risk assessment and devised a scope of work that would result in a plan that complies with guidelines for plan adoption from the Federal Emergency Management Agency. The County decided to write a plan that would cover the County, rather than writing a multi-jurisdictional plan. The following is a summary of four major activities included in the planning process.

## 1. PLANNING PROCESS

Multnomah County laid the groundwork for this planning process in 2004, when they produced the document *Multnomah County Natural Hazard Mitigation Plan*[1]. This document identified hazards that affect the County and some of the jurisdictions within it, and provided the preliminary vulnerability analysis for this plan. The plan was produced in collaboration with input from about 30 individuals representing different city and County agencies and businesses. Hazards experts were also consulted in this process. The planning process described here built upon that work and other County efforts.

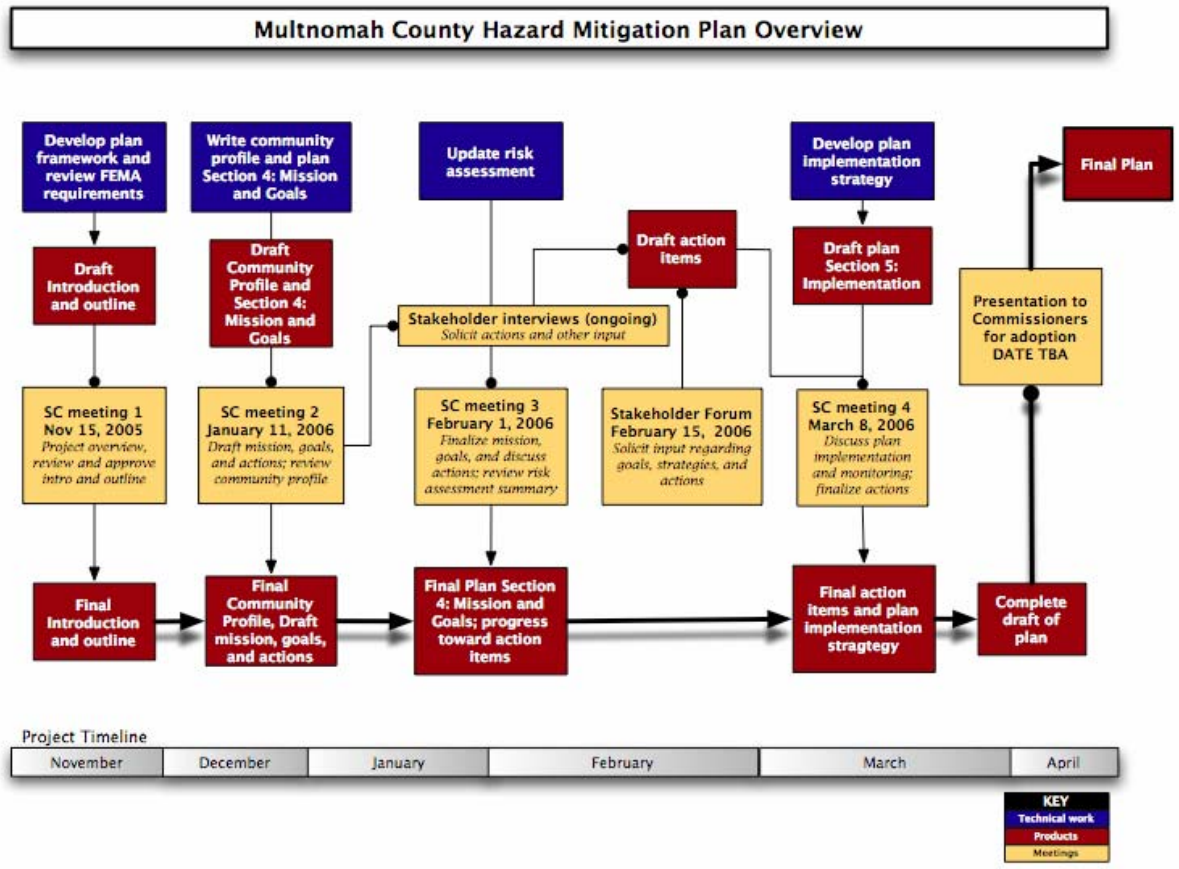
Figure A-1 provides an overview of the process that the steering committee when through to produce Multnomah County's Natural Hazard Mitigation Plan. The committee held a total of four work sessions, during which they reviewed and approved draft sections of the plan, planned the public stakeholder forum, and reviewed and approved the plan's mission, goals, and action items. The County contracted with ECONorthwest to assist in plan production; ECO worked with the steering committee to draft and finalize all plan sections. Additionally, ECO conducted all stakeholder interviews, and facilitated the public stakeholder forum.

[1] Available on-line at www.co.multnomah.or.us/dbcs/emergency_mgmt/Nat_Hazard_Plan.pdf.

The steering committee members worked with their colleagues and other stakeholders to draft all of the action items that are included in the plan.

Additional plan-input activities—the public stakeholder forum and interviews—are described in greater detail Appendix A of this plan.

**Figure A-1. Multnomah County Natural Hazard Mitigation Plan process and timeline, 2006**




Source: ECONorthwest, 2006

## INVOLVING KEY PARTNERS

Community involvement was an important component of creating this plan. A broad base of stakeholders were consulted or included directly in every stage of the process. Members of the community provided meaningful input through a number of channels; the team organized the following opportunities for community participation:

- **Steering committee members.** A steering committee was convened to oversee the plan development process. Some of the individuals involved in creating the first mitigation document were included in the steering

committee, though others were added to the list. The steering committee consisted of the following individuals:

- Robert Maestre, Multnomah County Department of Community Services (Steering Committee Chair)
- Curt Anderson, Reynolds School District
- Helen Barkley, County Property Liability Program
- Chuck Beasley, County Land Use Planning
- Stevie Bullock, Multnomah County Emergency Management
- Cathy Harrington, City of Gresham Emergency Management
- Matthew Krusemark, County GIS
- Bruce McClelland, Multnomah County Drainage District
- Scott Salmon, Multnomah County Emergency Management
- Jon Schrotzberger, Multnomah County Facilities
- Keely Thompson, City of Gresham Utilities
- Donna Tyner, Port of Portland Risk Management

## STEERING COMMITTEE WORK SESSIONS

The following provides a brief overview of each of steering committee meetings. Additional documentation (meeting agendas and notes) for each of the steering committee meetings is included in Appendix A.

### WORK SESSION 1: NOVEMBER 15, 2005

In this first meeting, steering committee members were introduced to FEMA requirements. They also reviewed and approved introductory sections of the plan.

### WORK SESSION 2: JANUARY 11, 2006

At his meeting, steering committee members discussed the agencies, businesses, and nonprofit organizations that should be represented at the stakeholder forum and in the interviews. Additionally, they reviewed and approved the draft community profile section of the plan, and discussed the goals and mission for the plan.

### WORK SESSION 3: FEBRUARY 1, 2006

Steering committee members approved the goals and mission for the plan, reviewed a draft of the risk assessment, and spent the bulk of the meeting discussing plans for the stakeholder forum.

### WORK SESSION 4: MARCH 8, 2006

At this final steering committee meeting, members approved the remaining sections of the plan, and spend the majority of the meeting discussing and finalizing action items.

## STAKEHOLDER INTERVIEWS

To get more in-depth information about vulnerabilities and the actions that can be taken to reduce loss, the project team interviewed key stakeholders. Participants included representatives of County departments, as well as representatives of school districts, utilities, and other special interests who have the authority to make risk-reduction decisions. Interviewees included:

- Steve Fedje, USDA—Natural Resource Conservation Service
- Bill Burns, Oregon Department of Geology and Mineral Industries
- Donna Tyner, Port of Portland
- Chuck Beasley, Multnomah County Land Use Planning
- Jon Schrotzberger, Multnomah County Facilities
- Bob Eaton, Dave Hendricks, and Bruce McClelland, Multnomah County Drainage District

## PUBLIC STAKEHOLDER FORUM

A public forum was held to identify vulnerability issues that the community faces, and to devise actions that address those issues. Participants included key stakeholders from county agencies, businesses, non-profit organizations, and other groups. Attendees were:

- Steering committee members: Cathy Harrington, Keely Thompson, Matthew Krusemark, Bruce McClelland, Chuck Beasley, Robert Maestre, and Stevie Bullock
- Neil Kennedy, Tualatin Valley Water District
- Michael Greisen, Scappoose Rural Fire District
- Randy Aden, U.S. Bank
- Gregg Larson, Boeing
- Josh Townsley, Sauvie Island Drainage Improvement Co.
- Jennifer Kaden, Columbia River Gorge Commission
- Jeri Shumate, 211 info
- Tom McCausland, City of Gresham DES
- Vance Hardy, Lusted Water District
- John Harris, City of Gresham

- John Pettis, City of Gresham
- Corky Collier, Columbia Corridor Association
- Terry Taylor, Gresham-Barlow School District
- Karen Reynolds, Mt Hood Community College

### DOCUMENT REVIEW

The draft plan was made available on the Multnomah County Website for review and comment before it was finalized. Further, it was disseminated to other key stakeholders to assure that the plan meets the needs of the whole community.

### DESCRIBING THE COMMUNITY

Together with the consultant team, the County developed a community profile in an effort to gain a better understanding of the community assets that might be at risk from natural hazards. Local and state data, along with data from the U.S. Census, were used to create the regional profile.

## 2. RISK ASSESSMENT: IDENTIFYING AND CHARACTERIZING THE HAZARDS

The risk assessment in the plan builds upon the vulnerability assessment completed in earlier mitigation planning efforts. The vulnerability assessment was completed by a consultant team from TetraTech Inc, and used the FEMA-developed software "HAZUS-MH" to identify vulnerable structures and assign a vulnerability score for each of the hazards that could impact the County. This vulnerability assessment is included in the hazard-specific annexes of this plan.

This plan summarizes the vulnerability assessment and references the Technical Resource Guide and the State of Oregon Natural Hazard Mitigation Plan to identify and characterize the hazards. The risk assessment covers earthquake, flood, landslide, volcano wildfire, and severe weather.

## 3. MITIGATION STRATEGIES

The Steering Committee developed the plan's goal in a series of workshops led by the consultant team. The goals built upon the risk assessment and the results of the stakeholder forum key stakeholder interviews.

### DEVELOPING PLAN MISSION, GOALS, AND ACTIONS

The steering committee developed action items during workshop sessions. The steering committee discussed the ideas generated in the stakeholder forum and interviews to develop a comprehensive list of actions that will meet the plan's goals.

### 4. ADOPTION AND PLAN MAINTENANCE:

The implementation plan was developed in a steering committee workshop once the remainder of the plan had been completed. The steering committee determined which agency should have responsibility for overseeing plan implementation, how frequently the plan should be updated, and who should be involved in the update process.

## HOW IS THE PLAN ORGANIZED?

Each section of the mitigation plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing Multnomah County's citizens, businesses, and the environment. Combined, the sections work together to create a mitigation plan that furthers the community's mission to [reduce risk and prevent loss from future natural hazard events]. This plan structure enables stakeholders to use the section(s) of interest to them.

### THE MITIGATION PLAN

- **Section 1: Introduction** briefly describes the County's mitigation planning efforts and the methodology used to develop the plan. It also includes information about the steering committee's role, and how stakeholders provided input.
- **Section 2: Community Profile** briefly describes the County in terms of demographic, economic, and development trends as well as geography and environment, housing and transportation. The Community Profile also documents existing plans, policies, and programs, as well as completed mitigation activities.
- **Section 3: County Risk Assessment Summary** describes the risk assessment process and summarizes the best available local hazard data. It is organized according to the federal requirements for a risk assessment: hazard identification; profiling hazard events; and vulnerability assessment/inventorying assets.
- **Section 4: Mitigation Plan Goals and Action Items** describes the plan components that guide implementation of the identified mitigation strategies. This section also documents the plan vision, mission, goals, objectives, and actions.
- **Section 5: Plan Maintenance** provides information on the implementation and maintenance of the plan. It describes the process for prioritizing projects, and includes a suggested list of tasks for updating the plan to be completed at the annual and 5-Year review meetings.

## HAZARD-SPECIFIC ANNEXES

The purpose of the hazard-specific annexes is to provide additional resources and documentation of the hazards and vulnerability in Multnomah County. There is one annex for each of the hazards covered in the plan.

The hazard annexes consist of the regional risk assessments from the State Natural Hazard Mitigation Plan as well as the hazard chapters from the Technical Resource Guide. The State regional risk assessments include information on hazard characteristics, hazard history, probability, and vulnerability. The Technical Resource Guide chapters provide hazard specific information on a statewide basis for the following topics: hazard history, hazard type and characteristics, hazard identification, hazard related legal issues, mitigation examples and best practices, and resources. Where extensive local data is available beyond the scope of information provided in Section 3, the additional local data is located in the annex.

The hazard annexes also include hazard-specific sections from a previous risk assessment completed for Multnomah County.

In addition to the State Risk Assessment and Planning for Natural Hazards: Oregon Technical Resource Guide information, the Earthquake Annex also includes a seismic risk assessment report provided by DOGAMI.

## RESOURCE APPENDICES

The resource appendices are designed to provide users of the Multnomah County Natural Hazards Mitigation Plan with additional information to assist them in understanding the contents of the mitigation plan, and provide them with potential resources to assist with plan implementation.

- **Process appendix** provides documentation of the process used to arrive at the goals and action items included in Multnomah County's Natural Hazard Mitigation Plan.
- **Economic Analysis of Natural Hazard Mitigation Projects** describes the Federal Emergency Management Agency's (FEMA) requirements for benefit cost analysis in natural hazards mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities.
- **List of Acronyms** provides a list of acronyms for county, regional, state and federal agencies and organization that may be referred to within the Multnomah County Natural Hazards Mitigation Plan.

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[i] Massachusetts Department of Environmental Management. 1999. "Hazard Mitigation: Managing Risks, Lowering Costs. http://www.state.ma.us/dem/programs/mitigate/whatis.htm Accessed 8/2/02

[ii] (ONHW 2002)

[iii] More information on the Oregon Natural Hazards Workgroup can be found at http://darkwing.uoregon.edu/~onhw

Section 2

# Community Profile

This section provides information on the characteristics of Multnomah County; it describes the demographic, economic, and development trends in the County, as well as the geography, environment, housing characteristics and transportation. Many of these community characteristics can affect how natural hazards impact communities, and can affect how communities choose to plan for natural hazard mitigation. Considering these characteristics during the planning process can assist in identifying appropriate measures for natural hazard mitigation. This section also outlines the existing plans, policies, and programs that can be used to implement mitigation activities, as well as any previous mitigation efforts undertaken by the community.

This section has the following subsections:

- Geography and climate
- Population and demographics
- Employment and economic conditions
- Housing in Multnomah County
- Land and development
- Transportation and commuting patterns
- Critical facilities and infrastructure
- Historic and cultural resources

## GEOGRAPHY AND CLIMATE

Multnomah County is the smallest county in Oregon (465 square miles). It is bound by Columbia County and the Columbia River on the North, Washington County on the West, Clackamas County on the south, and Hood River County on the east. Multnomah County is a mix of highly dense urban settings within the city limits of Portland in the west and open, rural land outside the urban growth boundary. It contains the Columbia Gorge National Scenic Area and a portion of the Mt. Hood National Forest. Several additional large volcanoes surround the County, including Mount St. Helens and Mount Adams. The County lies about 70 miles east of the Pacific Coast.

### RIVERS AND LAKES

The Columbia River creates the northern boundary of Multnomah County. The Columbia's extensive headwaters drain much of the northwestern United States (Montana, Idaho, Wyoming, parts of Washington, and Nevada) as well as parts of British Columbia. The Columbia River system has the fifth largest drainage basin in North America, and has been the major regional transportation network throughout Oregon's history.[i] The Bonneville Dam, one of the largest

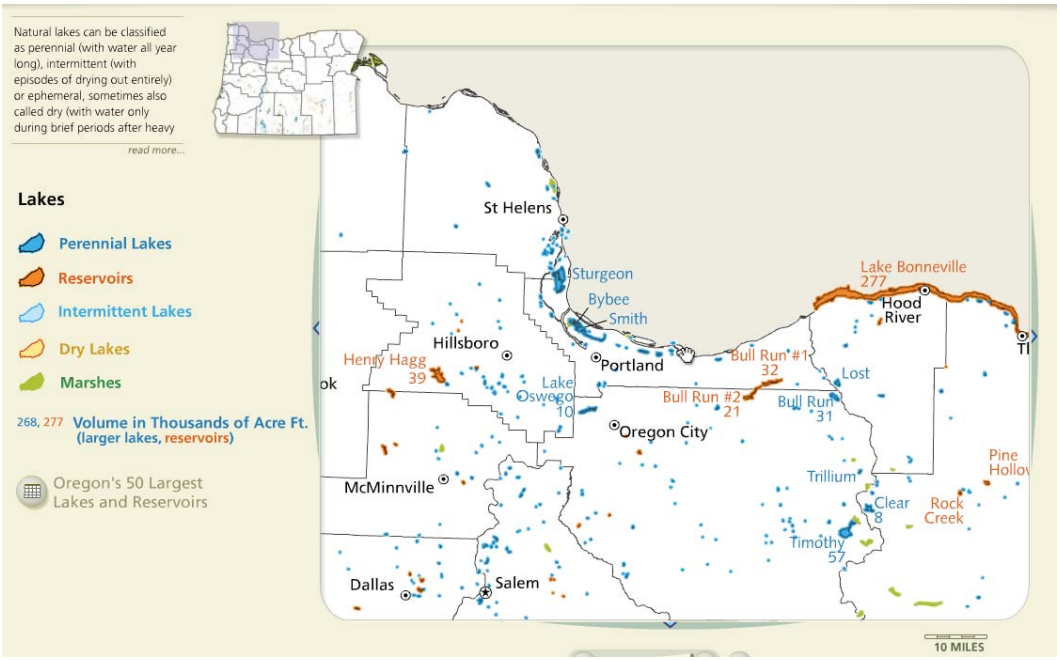
dams on the Columbia River, stores 277,000 acre feet of water near the eastern border of the County. Several smaller, locally operated dams are located nearer to Portland.

The western portion of Multnomah County is located in the Willamette River Basin, which is approximately 11,460 square miles. The Willamette River Basin is the largest watershed in the state, with 13 major tributaries joining between its headwaters at Waldo Lake (southeast of Eugene) and the confluence with the Columbia River at Kelley Point. Though the City of Portland only occupies 1% of the Willamette River's drainage basin, its 17 square miles are the most urbanized and heavily used of all in the basin. Approximately 60 miles of ditches, the Columbia Slough, and a series of smaller sloughs throughout and surrounding the City protect Portland from flood damages. This system also protects parts of unincorporated Multnomah County, and the Cities of Fairview, Gresham, and Troutdale.

The Sandy River (with tributaries the Salmon River, Zigzag River, and Bull Run River) runs down from Mt. Hood to its confluence with the Columbia River between Troutdale and Wood Village. The 100 year floodplain along this river is mapped and designated as a flood hazard area. Multnomah County Zoning Ordinance requires any new construction or substantial improvement to existing construction to be mitigated against flood hazards.

The County has several lakes, including Smith and Bybee Lakes in North Portland, and several smaller intermittent lakes that do not typically have water in them during drier months. These lakes are the remnants of old river channels. Figure 2-1 below shows their locations.

**Figure 2-1. Multnomah County Lakes**




Source: Atlas of Oregon CD ROM, 2002, University of Oregon Press

## CLIMATE

In Multnomah County, several climactic factors contribute to hazard vulnerability: heavy winter rains can result in flooding and contribute to landslide vulnerability, while cold snaps can result in ice and snow storms.

The National Climatic Data Center has established climate zones in the US for areas that have similar temperature and precipitation characteristics. Oregon's latitude, topography, and proximity to the Pacific Ocean give the state diversified climates. All of Multnomah County is in Zone 2. The climate in Zone 2 generally consists of wet winters and dry summers. In 2001, 89% of the precipitation occurred between October and May; 11% of the annual rainfall occurred between June and September, and 4% occurred in July and August.[ii] There is an average of only five days per year of measurable snow, with snowfall accumulations rarely measuring more than two inches at lower elevations in Portland (though some higher elevation areas of the County receive more).[iii] Table 2-1 describes the monthly average precipitation and temperature in Multnomah County.

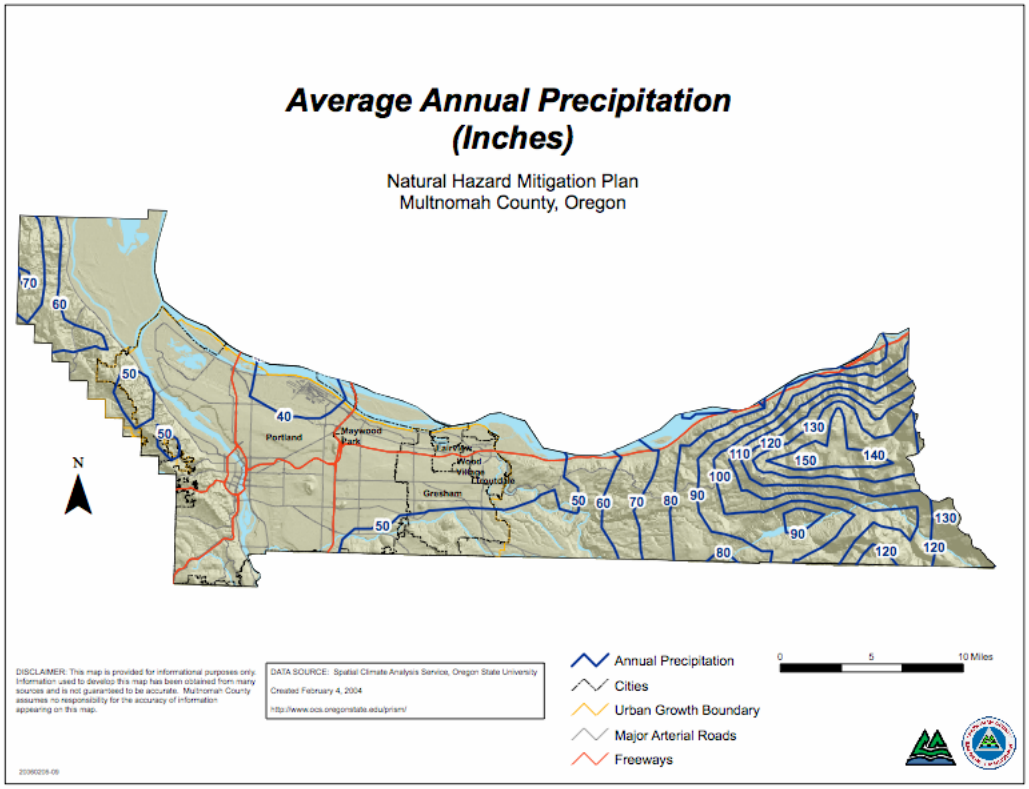
**Table 2-1. Monthly Average Precipitation (inches) and temperature (degrees Fahrenheit), Multnomah County, Oregon**

| Month | Average precipitation | Average snowfall | Average high | Average low | Average temperature |
|---|---|---|---|---|---|
| January | 7.2 | 6.1 | 45.6 | 34.2 | 39.9 |
| February | 6.1 | 5.1 | 50.3 | 35.9 | 43.1 |
| March | 5.1 | 4.4 | 55.7 | 38.6 | 47.2 |
| April | 3.9 | 3.3 | 60.5 | 41.9 | 51.2 |
| May | 2.9 | 2.7 | 66.7 | 47.5 | 57.1 |
| June | 2.1 | 1.9 | 72.7 | 52.6 | 62.7 |
| July | 0.9 | 0.8 | 79.3 | 56.9 | 68.1 |
| August | 1.1 | 1.0 | 79.7 | 57.3 | 68.5 |
| September | 2.1 | 1.9 | 74.6 | 52.5 | 63.6 |
| October | 3.8 | 3.4 | 63.3 | 45.2 | 54.3 |
| November | 7.7 | 6.5 | 51.8 | 39.8 | 45.8 |
| December | 8.0 | 6.8 | 45.4 | 35 | 40.2 |
| *Annual average* | *4.2* | *3.7* | *62.1* | *44.8* | *53.5* |

Source: Oregon Climate Service, 2005, based on data from 1971-2000.
Note: The precipitation and snowfall measurements in Table 2-1 are the average of measurements at four stations throughout the County, 2 located in Portland, one at Bonneville Dam, and one in Troutdale. The Bonneville Dam substation consistently receives more precipitation and snowfall than the three other substations in the County. All temperatures are based on measurements at a Portland station.

As is evident in Figure 2-2 below, higher elevations tend to receive more rain each year than do the valleys. Hillside locations also tend to be more prone to landslides, a situation which is exacerbated by the increased levels of rainfall.

**Figure 2-2. Average annual precipitation, Multnomah County, Oregon**



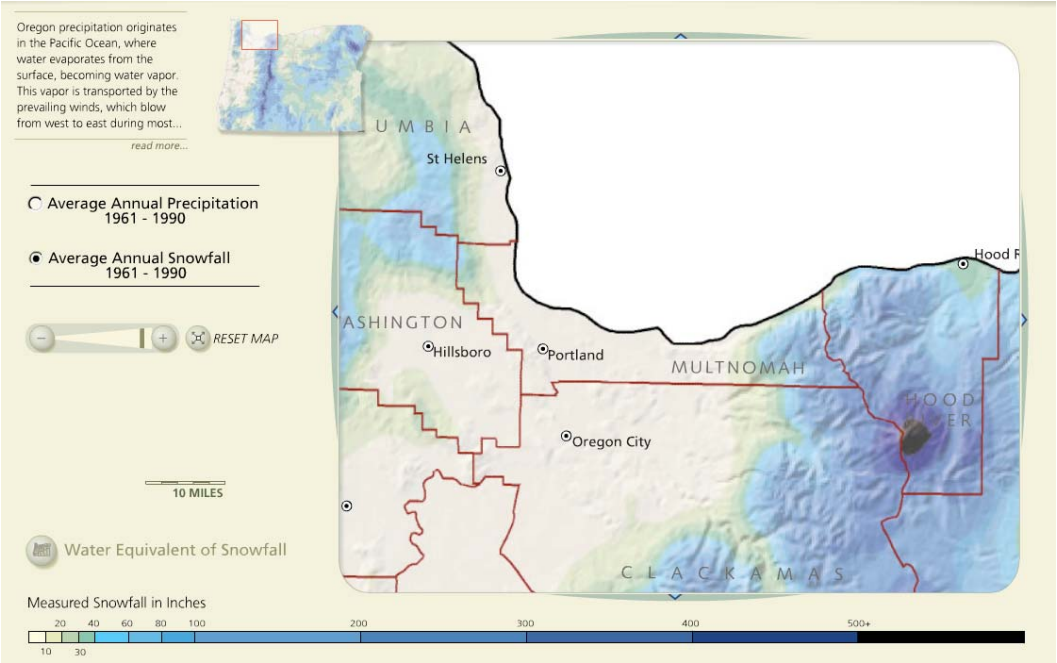

Source: Multnomah County GIS, 2006

Most of the winds that come from the west are subdued by the time they reach the Portland area because of the influence of the Coast Range. The most destructive winds are those which blow from the south, parallel to the major mountain ranges.[iv] Some winds blow from the east, but most often do not carry the same destructive force as those from the Pacific Ocean. Severe storms affecting Multnomah County with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March.[v]

While snow is relatively rare in western Oregon, the Columbia Gorge provides a low-level passage through the mountains. Cold air, which lies east of the Cascades, often moves westward through the Gorge, and funnels cold air into the Portland Area. If a wet Pacific storm happens to reach the area at the same time, larger than average snow events may result.[vi] This situation may also result in ice storms.[vii] Like snow storms, ice storms are characterized by cold temperatures and moisture, but subtle changes can result in varying types of ice formation, including freezing rain, sleet, and hail.[viii]

Figure 2-3 shows the annual snowfall for Multnomah County. The more mountainous eastern portion of the County receives more snow than the urbanized areas in the west.

**Figure 2-3. Average annual snowfall, 1961-1990, Multnomah County**




Source: Atlas of Oregon CD ROM, 2002, University of Oregon Press

## MINERALS AND SOILS

Several common natural hazards are related to soil stability and water retention. These hazards include landslides, erosion, flooding, and liquefaction resulting from an earthquake. Mineral and soil compositions are important factors for determining whether Portland is prone to hazards such as landslides.

Soils on the west side of the Willamette River vary from clay loam with low permeability and relatively high erosion potential to gravelly loams, which are relatively well drained and moderately permeable. The flat areas along the west bank of the Willamette River are urban and highly disturbed, and many consist of unstable fill.

On the east side of the Willamette River, soils are highly variable; similar to the west side, however, they are generally urban and highly disturbed. Much of the area along the Columbia River has been filled with dredged sand, which drains very well. In undisturbed areas along the Columbia River, percolation rates are very slow.

There are some highly hydric soils along the banks of the Columbia and the Willamette River, which indicate the presence of wetlands. Hydric soils are flooded or saturated at or near the soil surface for long periods of time. These soil types help to absorb the energy of floodwaters and often are part of mapped floodplains. Many of these areas subsequently do not allow new development, and any existing development is more susceptible to flooding. During an earthquake, some of these soils could be subject to liquefaction.

Less densely populated areas in the eastern portion of Multnomah County are built on soils that are generally unsuited to cultivation but more stable. The Universal Building Code Soils east of the Sandy River are either soft rock or rock, both of which are soil types less susceptible to earthquake damage.

## SIGNIFICANT GEOLOGIC FACTORS

Most of the Pacific Northwest lies within the Cascadia Subduction Zone (Figure 2-1), where the Juan de Fuca and North American plates meet. The convergence of these tectonic plates puts most areas of western Oregon and Washington at risk for a catastrophic earthquake with a magnitude of 8.0 or higher. Portland lies in this area of risk.

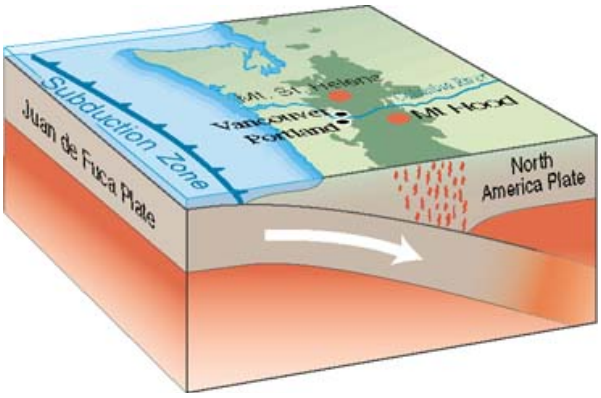



**Figure 2-4 Cascadia Region Subduction**

Another earthquake risk is the Portland Hills fault, which may be capable of generating moderately large earthquakes. As a result of the subduction zone, there are active volcanoes nearby, including Mt. St. Helens in southwest Washington, and Mt. Hood. Major eruptions of these volcanoes may cause significant ash fall in the Portland area.

Several smaller faults are located in the central part of the County.

# POPULATION AND DEMOGRAPHICS

Multnomah County is growing. Table 2-2 shows that, between 1990 and 2000, the County population increased 13%. Nearly all of that growth has been in incorporated jurisdictions. The City of Fairview, for example, quadrupled its population between 1990 and 2000, growing at about 24% per year. Portland, the largest jurisdiction within Multnomah County, grew at about 2% per year, though some of that growth was a result of annexation of previously unincorporated areas of Multnomah County (see Note 3 below Table 2-2).

**Table 2-2. Population and population growth in Multnomah County and its jurisdictions**

| | Population | | | Change | | |
|---|---|---|---|---|---|---|
| | *2004 (estimate)* | *2000* | *1990* | *Number* | *Percent* | *AAGR* |
| Multnomah County | 685,950 | 660,486 | 583,887 | 102,063 | 17% | 1% |
| Incorporated | n/a | 644,440 | 521,224 | n/a | n/a | n/a |
| Unincorporated | n/a | 16,046 | 62,663 | n/a | n/a | n/a |
| Fairview | 9,250 | 7,561 | 2,391 | 6,859 | 287% | 10% |
| Gresham | 94,250 | 90,205 | 68,235 | 26,015 | 38% | 2% |
| Lake Oswego | n/a | 2,274 | 2,253 | 21 | 1% | 0% |
| Maywood Park | 750 | 777 | 781 | -31 | -4% | 0% |
| Portland | 550,560 | 526,986 | 436,898 | 113,662 | 26% | 2% |
| Troutdale | 14,380 | 13,776 | 7,852 | 6,528 | 83% | 4% |
| Wood Village | 2,870 | 2,860 | 2,814 | 56 | 2% | 0% |

Source: U.S. Census Bureau, 2000 and Multnomah County GIS. 2004 population estimate from the Population Research Center, Portland State University
Note #1: Lake Oswego and Portland figures include only the population in Multnomah County. The portion of Lake Oswego's 2004 estimate that is within the County is unknown, so the growth numbers for Lake Oswego are between 1990 and 2000 rather than 1990 and 2004.
Note #2: AAGR is "Average Annual Growth Rate"
Note #3: Between 1990 and 2000, the Portland boundaries changed substantially. Most of the reduction of the population in unincorporated areas is due to expansion of Portland City boundaries. Figures here show the change in the 2000 boundaries.

The region and the County are projected to continue to grow. Metro, the Portland area regional government, forecasts that the region[ix] should expect a total population of 2,821,000 by the year 2030, an increase of about 58% over the 2000 population.[x] In 2000, Multnomah County had about 37% of the region's population. If it maintains roughly the same percentage of regional population over time, by 2030, the Multnomah County population would be just over one million people.[xi] The location and demographic make-up of this growth will be a critical factor in determining Multnomah County's future hazard vulnerability.

## SPECIAL NEEDS GROUPS

The impact in terms of loss and the ability to recover varies among population groups following a disaster. In any population, some have more resources (financial, physical, and social) to prepare for, respond to, and recover from a disaster. Of this number, a disproportionate burden is placed upon special needs groups, particularly low-income populations, minorities, and the elderly. Plans that inadequately address the social system component of the community implicitly assume that hazards strike demographically homogenous populations. This is very rarely the case. This section describes Multnomah County's vulnerable populations and special needs groups.

### LOW-INCOME POPULATIONS

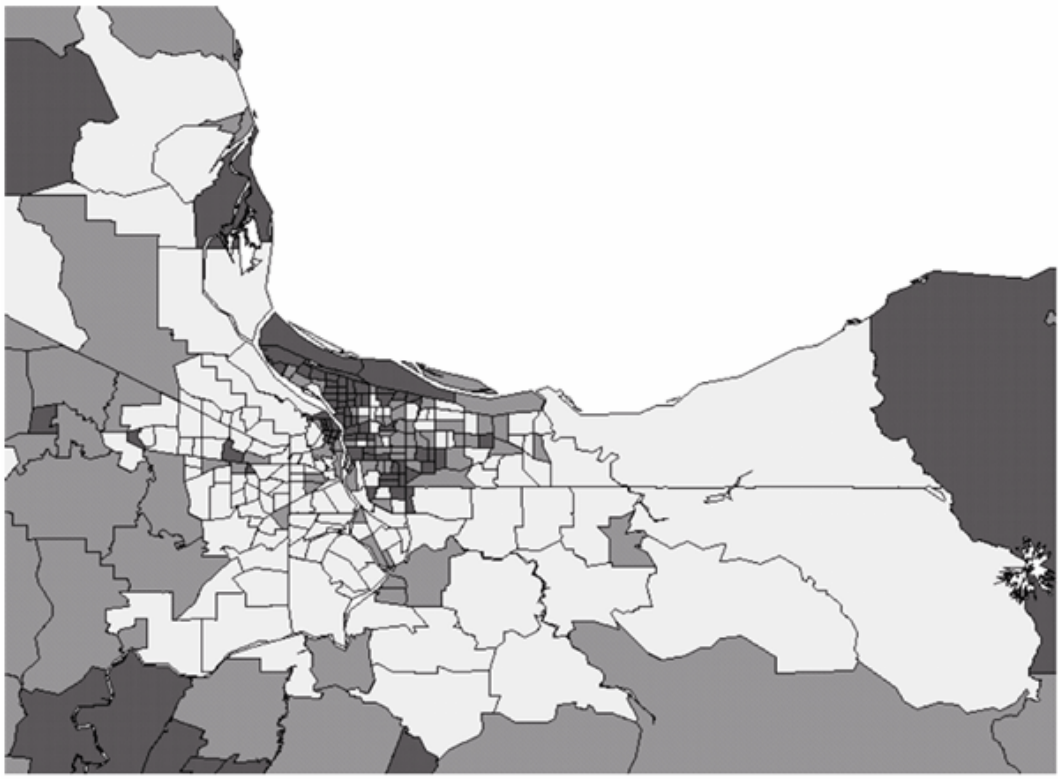
Because the poor typically occupy the more poorly built and inadequately maintained housing of any given community, they are more likely to experience the damaging effects of storms and other disasters. Mobile or modular homes, for example, are more susceptible to damage in windstorms and floods than other

types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of unreinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Poor people's homes are more likely to be destroyed in an earthquake and less likely to be rebuilt after one.[xii]

In addition to living in more vulnerable housing stock, the location of less expensive housing often means increased exposure for inhabitants. Potential sites of technological hazards (chemical spills, etc., which can occur as a secondary effect of a natural hazard event) are more often surrounded by low-income housing[xiii], and trailer and mobile home parks are frequently located in low-lying floodplain areas susceptible to inundation. This means that anyone who is poor in the United States is more likely to become homeless after a disaster.[xiv]

In 2004, about 17% of individuals in Multnomah County were living in poverty, an increase from 13% in 2000. More people live in poverty in Multnomah County than in Oregon as a whole (14.1%) or the United States (13.1%).[xv] These residents are less likely to live in housing that can withstand natural hazards, and are less likely to have the resources to prepare for and recover from a disaster. Figure 2-5 shows that these residents are concentrated in and near the City of Portland.

**Figure 2-5. Distribution of impoverished households, Portland Metropolitan area**



Source: A Portrait of Poverty in Oregon, Oregon State University Extension Service, publication #EM8743.
Note: The lightest areas on the maps have the lowest poverty rates (under 8.4 percent). The medium gray areas have poverty rates of 8.4 to 14 percent. Dark gray areas have poverty rates above 14 percent.

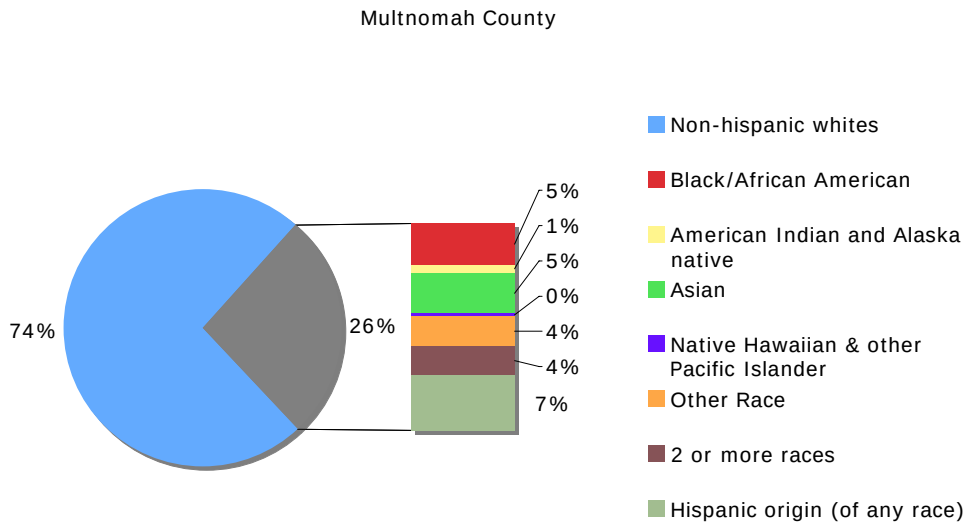
## ETHNIC MINORITIES

Many researchers have focused on the increased disaster vulnerability that ethnic minorities experience in the United States.[xvi] Their research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during an event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Further, because higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound their vulnerability.

Several studies have found that minorities experience higher morbidity rates than the general public in disaster events.[xvii] Morbidity rates are often directly correlated with safe housing. Housing damage levels are directly related to ethnicity for two reasons. First, ethnic communities tend to be segregated, so that residential patterns are determined in large part by ethnicity. Second, types of construction and housing location are determined by costs and the ability to pay.

Figure 2-6 shows the distribution of minority populations in Multnomah County. The majority of the population is white. The next largest portion of the population is of Hispanic origin.

**Figure 2-6. Ethnic and minority populations in Multnomah County, Oregon, 2000**




Source: U.S. Census Bureau, 2000.

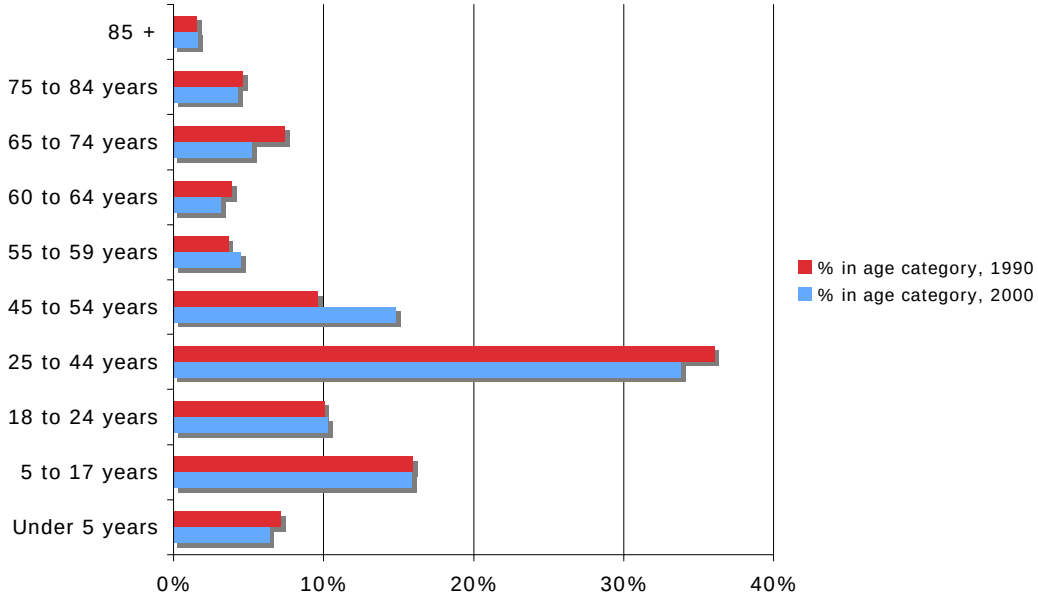
Ethnic minorities are much more likely to live in the incorporated areas of Multnomah County. In 2000, 93% of unincorporated Multnomah County was white, while 79% of incorporated area populations were white.[xviii]

## ELDERLY POPULATIONS

The elderly are also disproportionately impacted. The vulnerability of elderly populations can vary quite significantly based on health, age, and economic security. As a group, however, elderly are more apt to lack the physical and economic resources necessary for response, and are more likely to suffer health-related consequences and be slower to recover.[xix] They are more likely to have vision, hearing, and/or mobility impairments, and more likely to experience mental impairment or dementia. Furthermore, they are more likely to live in assisted-living facilities, where emergency preparedness occurs at the whim of operators.[xx] Certainly, the elderly require specific planning attention, an especially important consideration given the current aging of the American population.

Figure 2-7 shows the ages of Multnomah County residents in 1990 and 2000. The percent of people over the age of 85 did not change substantially between 1990 and 2000, but there was a marked increase among residents between the ages of 45 and 54 years. The trend suggests that the number of elderly will be increasing in coming years.

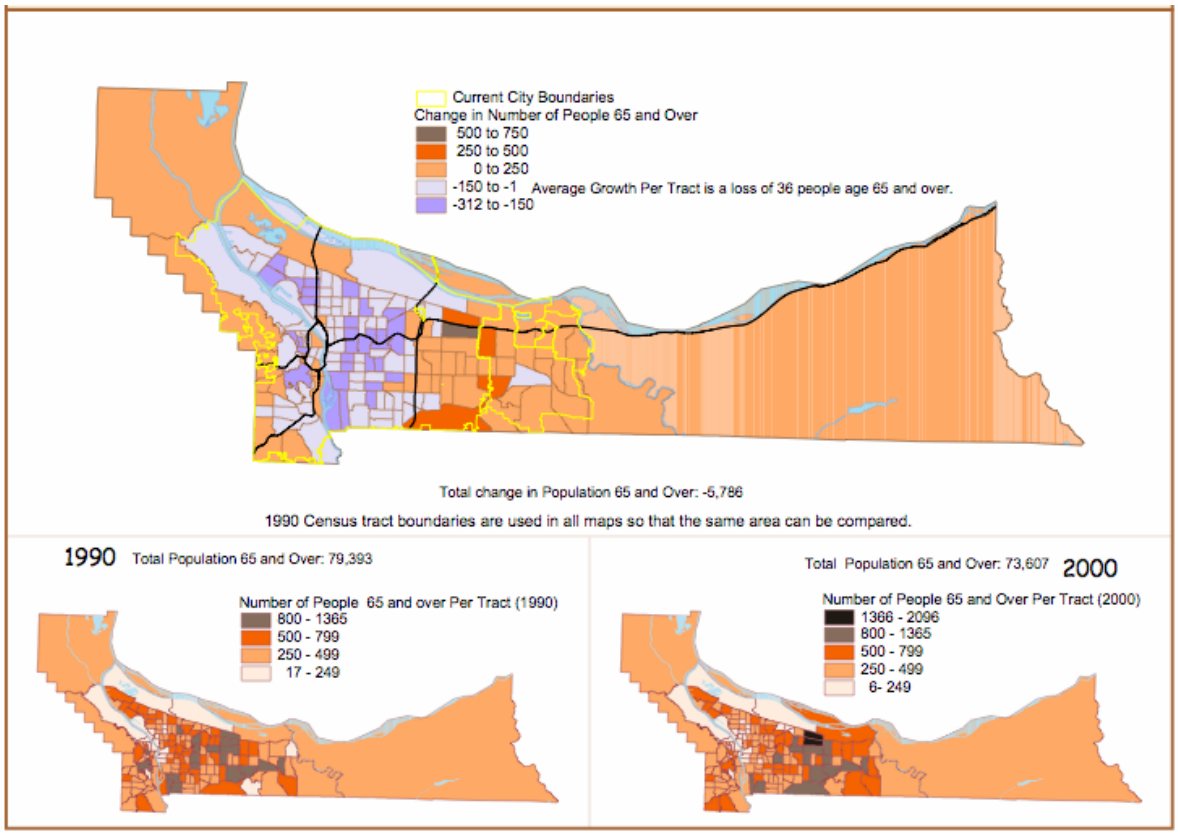
**Figure 2-7. Ages of Multnomah County residents, 1990 and 2000**




Source: U.S. Census Bureau, 2000 and 1990.

Between 1990 and 2000, people over the age of 65 left Portland and the more urban areas at the same time that the population over 65 in the outlying areas of the County increased. Figure 2-8 shows this change in greater detail. The trend suggests that more people over the age of 65 are not living in urbanized areas. Further, some areas north and east of Portland in Central Multnomah County appear to have a higher concentration of people over the age of 65 than other areas.

**Figure 2-8. Change in the number of people over 65 from 1990 to 2000**




Source: Multnomah County GIS, using data from the U.S. Census, 1990 and 2000

# EMPLOYMENT AND ECONOMIC CONDITIONS[xxi]

Multnomah County operates within a regional economy that includes the surrounding counties: Clackamas, Washington, and Clark (in Washington State). Any hazard that caused an economic impact in Multnomah County could have a ripple effect that impacts the regional economy. In a larger disaster event that impacted the whole region (such as an earthquake or a severe winter storm), the state economy would certainly be impacted as well. For these reasons, this section considers the regional economy, rather than the economy of Multnomah County.

The Portland-Vancouver metropolitan area had a total non-farm employment of nearly 1 million persons.[xxii] The total economic output of the region was almost $77 billion in 2002.[xxiii] Total output in the region expanded from $38.7 billion in 1992 to 76.9 billion in 2002, an annual rate of increase of 7.1% per year over the decade; Portland was the tenth fastest growing of the nation's 50 largest metropolitan areas during this decade.

Over the past economic cycle, beginning with the national recession that started in 2001, the Portland-Vancouver region experienced a more severe economic decline than Oregon, Washington, or the national economy. After two years of job losses totaling over 50,000, however, the region is beginning to recover. While all major industries will add jobs over the next 10 years, most are forecast to grow more slowly than in the past.

The main issues of concern to most citizens when they think about the economy are *jobs* and *income*.

## JOBS

Since the economic downturn began in 2001, the Portland-Vancouver metropolitan region has had higher unemployment than the rest of the country. The Portland-Vancouver PMSA was hit harder than the state during the downturn, but has also recovered more quickly. The Portland-Vancouver metropolitan area's unemployment decreased from 8.2% in January of 2004 to 6.6% in January of 2005. While these numbers show a marked improvement, nonetheless unemployment in the region remains much higher than other west coast cities. Seattle's January 2005 unemployment was 5.6%, San Francisco's was 5.3%, and Los Angeles' was 5.7%.[xxiv]

In the future, the high tech industry, electronics, transportation, metals, healthcare, administrative, finance and retail trade sectors will continue to grow and develop to provide goods, services, and work opportunities for the residents of Multnomah County and the region.[xxv]

## INCOME

Table 2-3 shows the median family incomes for various areas. The median family income in the region was about $57,000 in 1999, which is higher than both the Oregon and United States income figures. Multnomah County's median income, however, is lower than the regional average at $51,000.

**Table 2-3. Median family income, various areas, 1999**

| Area | Median family income |
|---|---|
| Oregon | $48,680 |
| United States | $50,046 |
| Portland-Vancouver Region | $56,856 |
| *Multnomah County* | *$51,118* |

Source: U.S. Census Bureau, 2000
Note: In this table, the Portland-Vancouver region includes Clark County, Multnomah County, Clackamas County, and Washington County.

# HOUSING IN MULTNOMAH COUNTY

Housing development types and year-built dates are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard stick-built homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant

designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

**Table 2-4. Housing types in Multnomah County, 2000**

| Housing type | Percent |
|---|---|
| Single-family | 60% |
| Multi-family | 38% |
| Mobile homes | 2% |
| Boat, RV, Van, etc | Less than 1% |

Source: U.S. Census Bureau, Profile of Housing Characteristics, 2000

**Table 2-5. Year of construction for housing in Multnomah County, 2000**

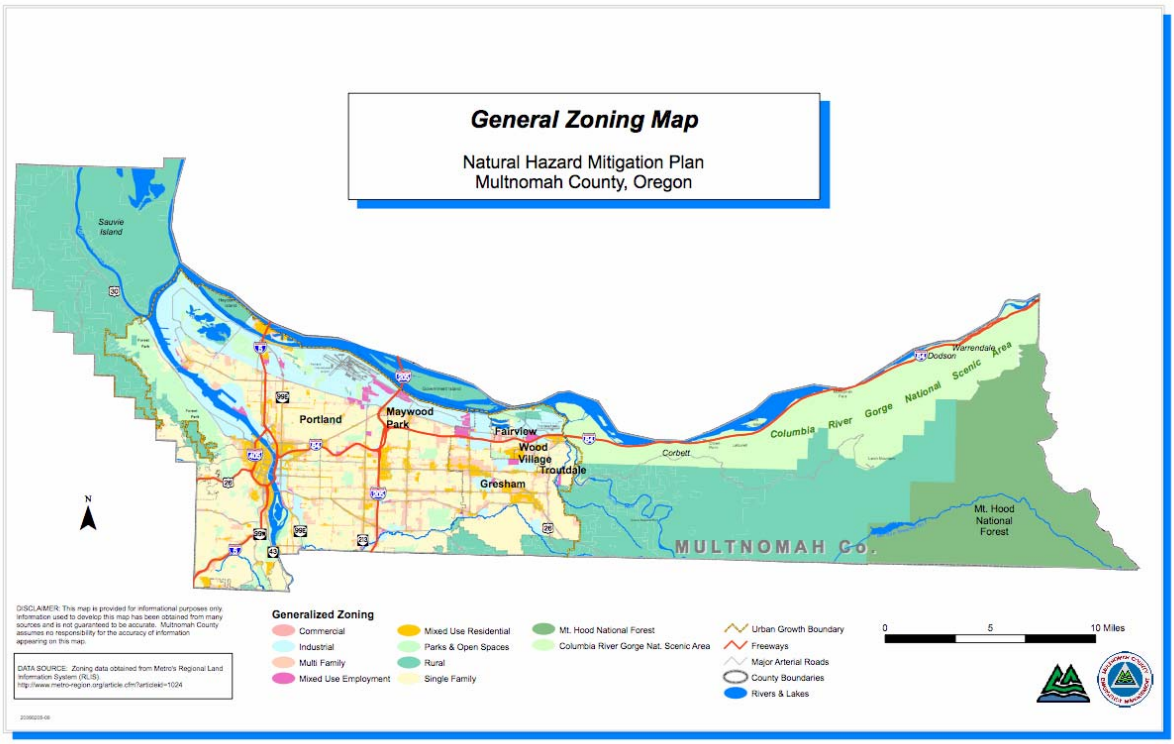
| Year | Percent of housing stock |
|---|---|
| Pre-1939 to 1959 | 53% |
| 1960-1979 | 27% |
| 1980-2000 | 20% |

Source: U.S. Census Bureau, Profile of Housing Characteristics, 2000

# LAND AND DEVELOPMENT

Figure 2-9 shows the generalized zoning for Multnomah County. The County is a mix of urban development within the Metro Urban Growth Boundary, and rural uses, including Forest, Agricultural, and Federal and Indian lands in the eastern portion of the County.

## Figure 2-9. Generalized zoning for Multnomah County, 2002




Source: Multnomah County GIS, 2006

The land within the County has an assessed value (for taxation purposes) of $46,349,776,337.[xxvi] Approximately 6,263 properties have a building value greater than $0 in unincorporated Multnomah County, which means that these properties probably have structures on them and may have residents living on them that would require services in a hazard event.

One advantage of Oregon's system of land-use management is that new development happens predictably within the urban growth boundaries (UGBs) of the state's jurisdictions. This means that most of the growth that is predicted to occur in Multnomah County will occur within the County's incorporated jurisdictions, including Portland, Gresham, Troutdale, and other cities. Future development areas that have been brought into the UGB but have not yet developed under urban zoning have been identified to accommodate the County's expected growth. Those areas are Pleasant Valley and Springwater in east Multnomah County, and the west half of Bonny Slope in west county. Bonny Slope is approximately 160 acres, Pleasant Valley is 1532 acres, and Springwater is 1272 acres.

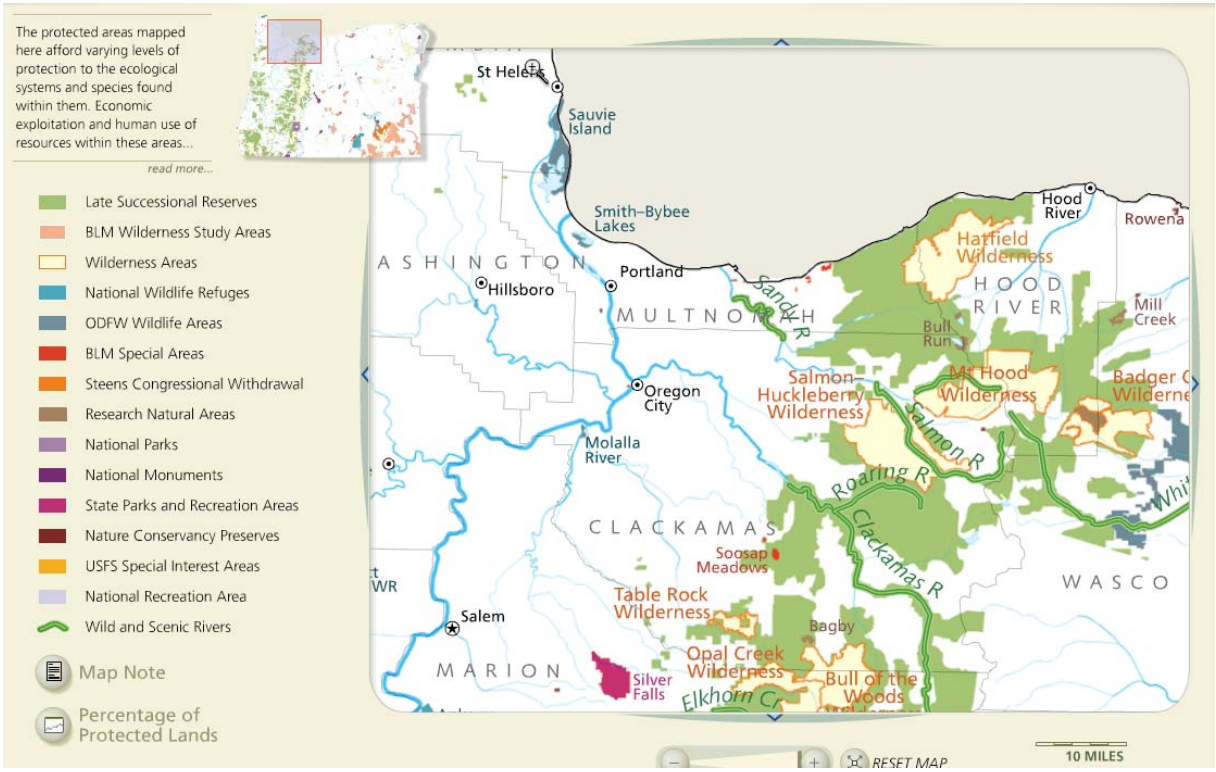
The new development in these areas will have access to urban services, including sewer, water, roads, electricity, and emergency services. Additionally, the development is less likely to occur in areas at the urban-wildland fringe, and will be subject to those jurisdictions' land use and building code regulations, which restrict growth in mapped floodplains and landslide loss areas.

Because rural lots are outside of the UGB, are relatively large, and are not zoned for new development, the supply of developable land outside of the UGB is nearly fixed. Reflecting this lack of supply, just 19 permits for new single-family development were issued in unincorporated Multnomah County in 2005.

The Columbia River Gorge National Scenic Area has its own Management Plan[xxvii], effective as of June 1993. Multnomah County reviews land development proposals for compliance with the scenic, cultural, natural and recreational resource guidelines of the Management Plan as implemented through the Multnomah County Zoning Code.

There are also several protected areas within the County that are subject to special land use regulations that restrict certain types of development. These protected areas are shown in Figure 2-9 below. Such special protections are also useful for limiting development in hazard prone areas, such as along the Sandy River (designated a Wild and Scenic River).

**Figure 2-10. Protected areas within Multnomah County, 2002**




Source: Atlas of Oregon CD ROM, 2002, University of Oregon Press

# TRANSPORTATION AND COMMUTING PATTERNS

The impact of a natural hazard event can disrupt automobile traffic and shut down local transit systems across the region and make evacuation difficult. Hazards such as localized flooding can render roads unusable. A severe winter storm has the potential to disrupt the daily routines of thousands of people.

According to the U.S. Census Bureau, the average commute for workers in Multnomah County is about 24 minutes each way. About 66% of workers commute alone, while 18% used public transportation, walked, or biked. The area is serviced by a regional transit system (Tri-met) that provides both bus and light rail service through the greater Portland Metropolitan area. The light rail system (MAX) provides mass transportation between Hillsboro (in Washington County) and Gresham. Residents living in the rural areas outside the Tri-met service area rely on automobiles and state and country roads.

Future population growth may strain transportation systems, though, relative to other regions, the region has been aggressive in its plans for public transportation systems. Tri-met has plans in place to extend the MAX light rail.

Earthquakes have the potential to greatly disrupt transportation systems in the County because most bridges are not seismically retrofitted. Incapacitated bridges can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to clients. In Multnomah County, there are 504 bridges, with the following ownership:

- 333 state highway bridges
- 44 County highway bridges
- 126 city or municipal highway bridges
- 1 Historic covered bridge

The County has three major expressways: I-5 runs north/south through Portland Metropolitan Area, and is the main passage for automobiles and trucks traveling from Washington to California. I-84 is the main transportation route for automobiles and trucks traveling from Oregon to central and eastern states. It intersects with I-5 in Portland. I-205 is a bypass route for north/south traffic on I-5; it intersects with I-5 in Clackamas County and winds northeast through Multnomah County. It re-connects with I-5 in Washington State. Several state highways also run through the County, including Highway 99, 26, and 30.

A series of maps at the end of this section (Figures 2-11 through 2-14) show other important transportation infrastructure under County jurisdiction: principal arterials, major, minor and rural arterials, major collectors, and others. All of these roads are important for emergency response vehicles and other trips after an emergency.

In addition to commuter traffic on roads and light rail lines, the Port of Portland[xxviii] operates four marine terminals, Oregon's primary commercial airport, three general aviation airports (Troutdale, Hillsboro and Mulino) and seven commercial / industrial business parks.

The Port's maritime operation exports more wheat than any other port in the United States. It is the second largest grain exporting center in the world. In addition, the Port is ninth in terms of total tonnage, the fifteenth largest container port and the third highest volume auto port in the country.

The Port serves more than 12 million passengers annually at Portland International Airport (PDX) and over a quarter million tons of air cargo. PDX provides service from 30 carriers, with over 519 passenger flights daily. Portland serves as a hub for both Alaska Airlines and Horizon Air. Portland provides weekly nonstop all cargo air service to Asia and Europe on Korean Air and Cargolux Airlines.[xxix]

# CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. They typically include police and fire stations, public works facilities, sewer and water facilities, hospitals, bridges and roads (described above), and shelters. Railroad and shipping lanes are critical to post-event economic recovery. Telecommunications infrastructure (including electric and cable lines, phone lines, and wireless internet transponders) are critical during both the response and recovery phases. Damaged facilities that could cause serious secondary impacts may also be considered critical.

According to the State of Oregon Natural Hazard Mitigation Plan, critical facilities in Multnomah County include:

- 8 hospitals (1833 beds)
- 11 police stations
- 43 Fire and rescue stations
- 8 school districts, 2 community colleges, 5 universities
- 1 250 MW power plant
- 17 dams (8 of which are considered high threat)

Additionally, correctional institutions, public services buildings, law enforcement centers, courthouses, juvenile services buildings, and other public facilities may be considered critical facilities. The Multnomah County Risk Assessment details these critical facilities.

# HISTORIC AND CULTURAL RESOURCES

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

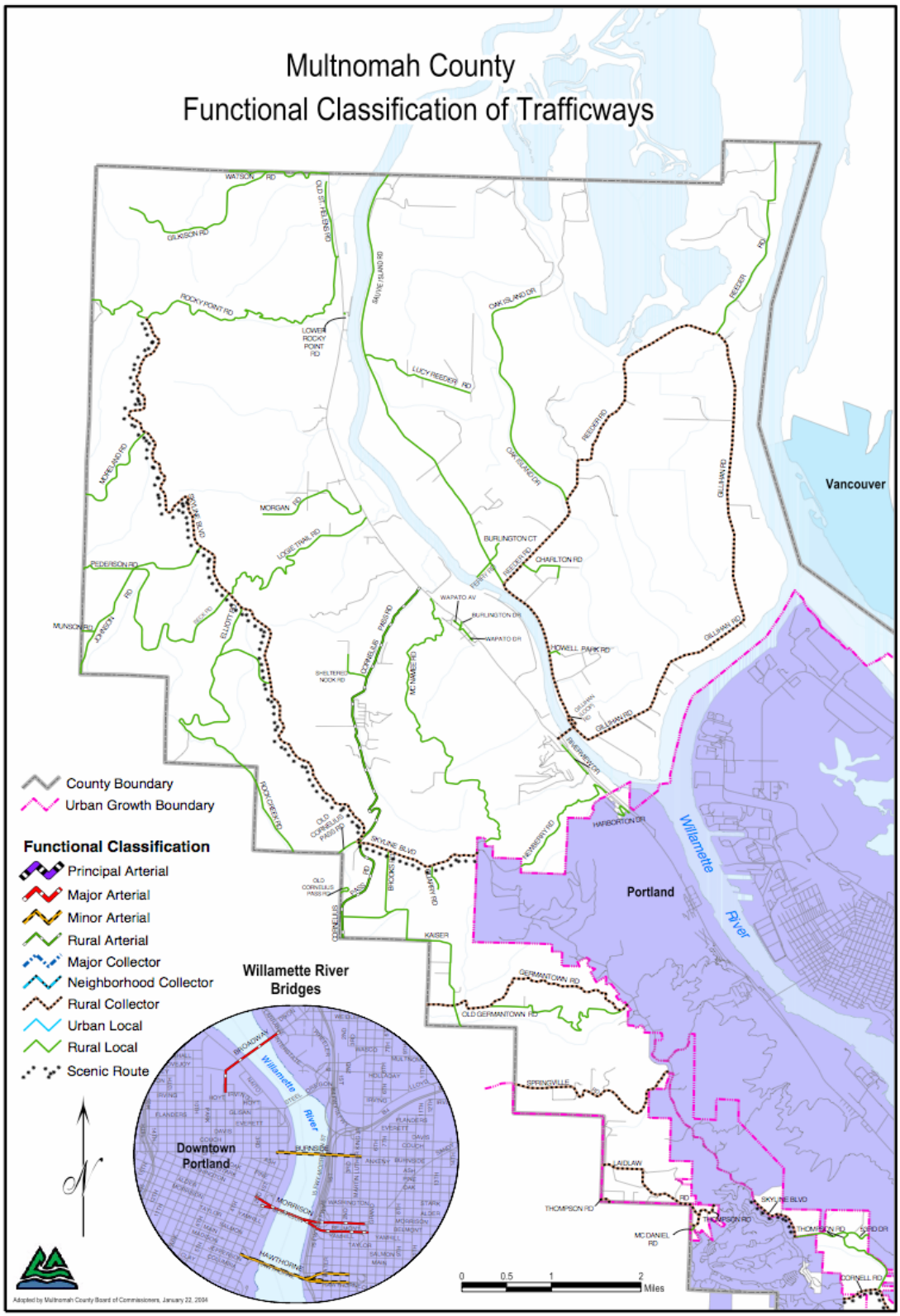
The County maintains an inventory of historic resources[xxx]. The inventory includes a total of 57 properties. County regulations specifically protect 14 designated properties:

- Bybee-Howell House
- Old Germantown Road Schoolhouse

- Pleasant Home Cemetery
- Mountain View Cemetery
- Columbia Grange
- Menucha
- Portland Women's Forum State Park
- View Point Inn
- Vista House
- Graff House
- Old Columbia River Highway
- Bridal Veil Inn
- Multnomah Falls Lodge
- Bonneville Dam

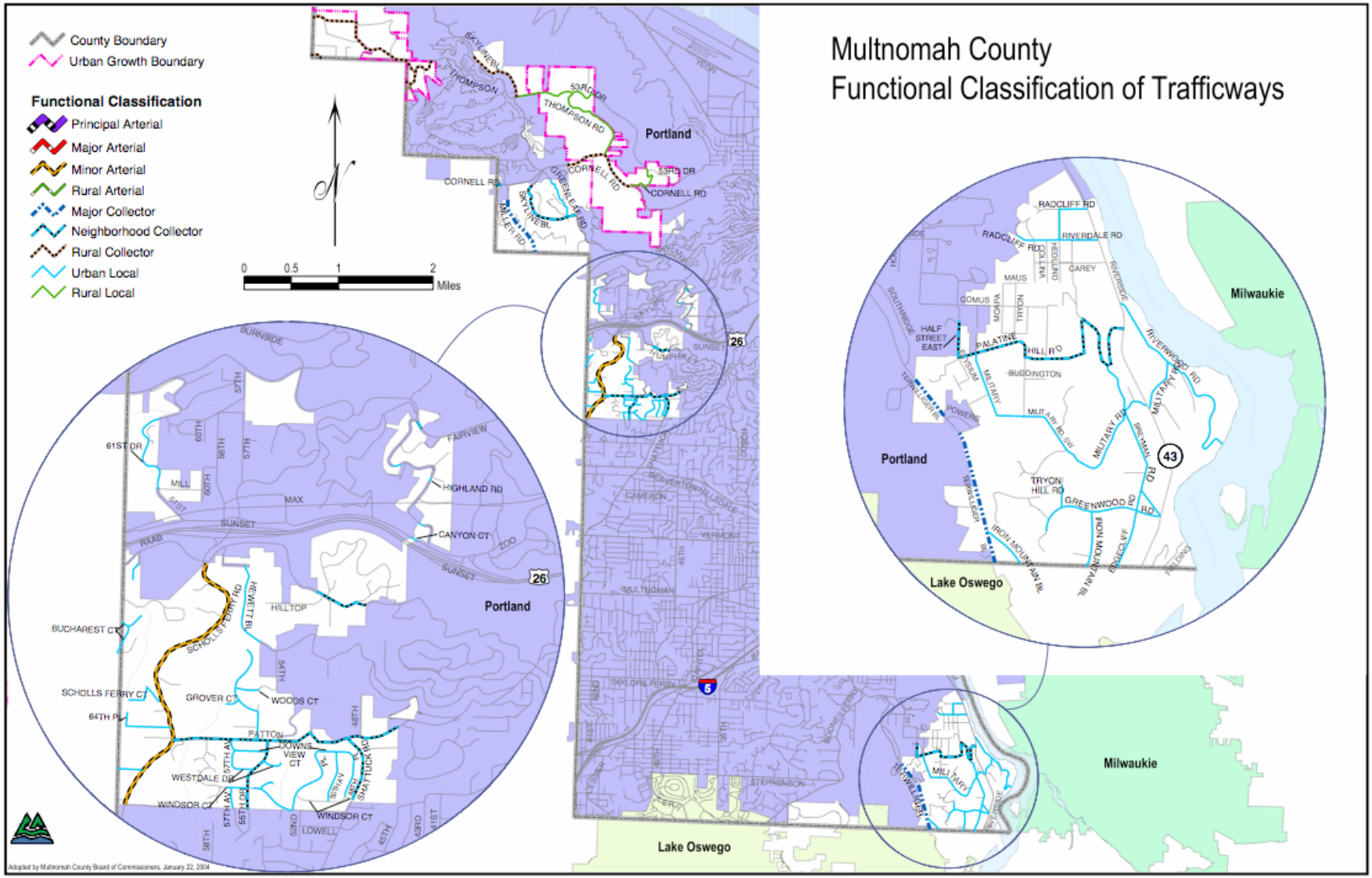
Most of these properties are located in the eastern portion of the County, near the Columbia Gorge. An additional 43 properties are listed as Resources Recommended for Designation; these properties were found by the County to be significant but are not protected with the Historic Preservation overlay zone. These 43 properties are located throughout the County.

**Figure 2-11. District 1 Arterials, Collectors, and local roads, Multnomah County, 2005**



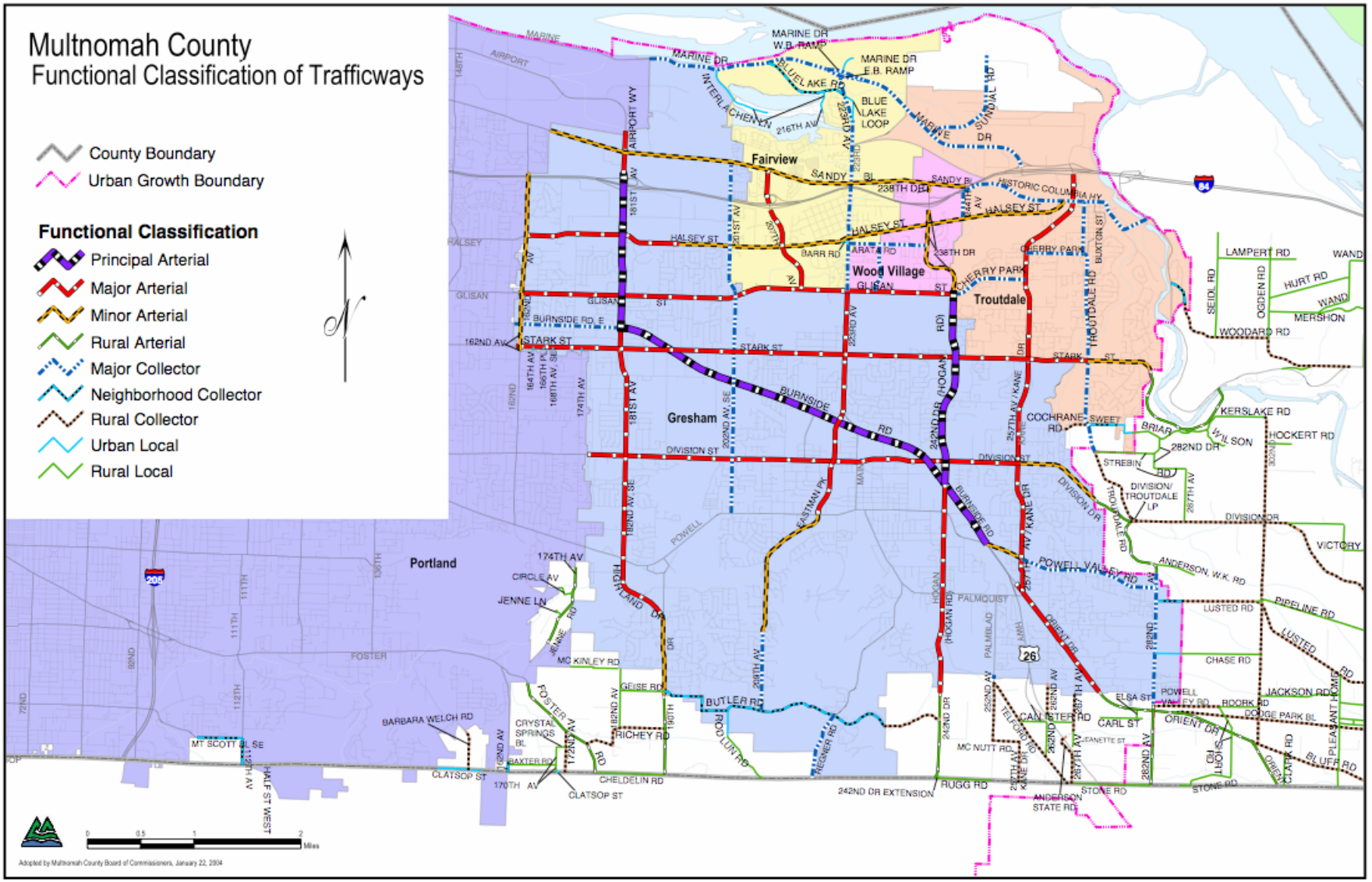

Source: Multnomah County

**Figure 2-12. District 2 Arterials, Collectors, and local roads, Multnomah County, 2005**



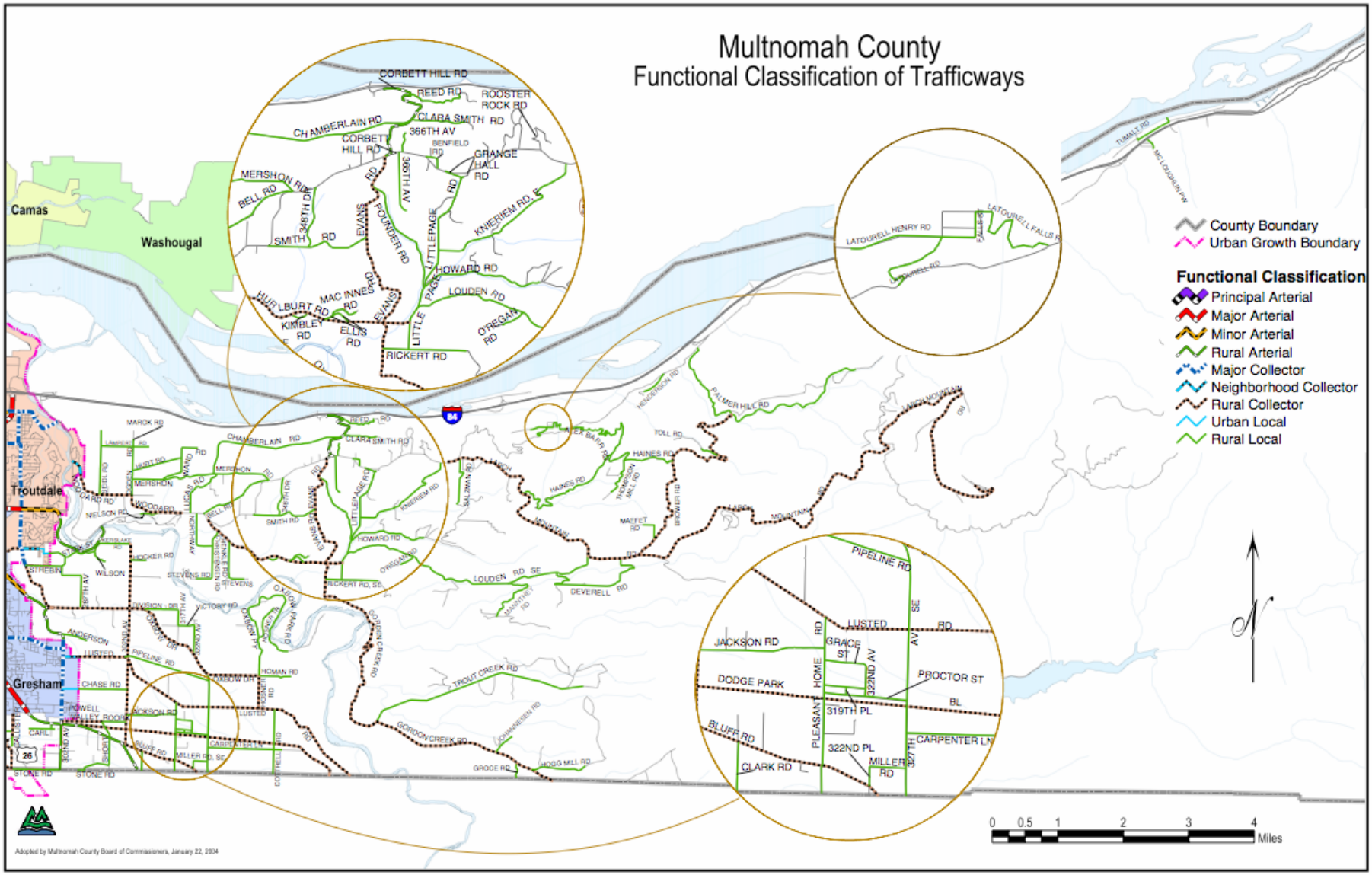

Source: Multnomah County

**Figure 2-13. District 4 Arterials, Collectors, and local roads, Multnomah County, 2005**




Source: Multnomah County

**Figure 2-15. District 5 Arterials, Collectors, and local roads, Multnomah County, 2005**




Source: Multnomah County

[i] William G. Loy, Atlas of Oregon.
[ii] Ibid.
[iii] National Weather Service, Portland Bureau, (March 2001). http://www.wrh.noaa.gov/Portland/snowstorm.html
[iv] Ibid.
[v] Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (2000) Oregon State Police – Office of Emergency Management.
[vi] Taylor, George H. and Hannan, Chris, *The Oregon Weather Book*, (1999) Oregon State University Press.
[vii] Ibid.
[viii] Ibid.
[ix] Metro defines the region as a four-county area: Multnomah, Clackamas, Washington, and Clark Counties.
[x] Metro. *Economic Report to the Metro Council: Proposed Final Draft: 2000 – 2030 Regional Forecast,* September, 2002.
[xi] Metro produces population forecasts for areas smaller than the four-county region, and will produce one for Multnomah County. At the time of this report's writing, however, these forecasts were not available.
[xii] Bolin and Stanford, 1991
[xiii] Mileti, 1999
[xiv] Ibid.
[xv] American Community Survey, U.S. Census Bureau, 2004 data
[xvi] Bolin, 1991 and 1994, Morrow, 1999, Fothergill, et al, 1999, Steinberg, 2000
[xvii] Fothergill, et al., 1999
[xviii] U.S. Census Bureau, 2000. Note that these totals include Hispanic and Latino populations as part of the white population.
[xix] Morrow, 1999
[xx] Bay Area Regional Earthquake Preparedness Project, 1992
[xxi] This section summarized from the Portland-Vancouver Comprehensive Economic Development Strategy, August 2005.
[xxii] Portland Metro Labor Trends, Oregon Employment Department, April 2005 estimates for February 2005.
[xxiii] Global Insight, http://www.usmayors.org/metroeconomies/0703/metroecon_appendix_0703.pdf
[xxiv] Bureau of Labor Statistics, Civilian labor force and unemployment by state and metropolitan area. Available on-line at http://www.bls.gov/news.release/metro.t01.htm. Accessed April 21, 2005.
[xxv] Oregon State Natural Hazard Mitigation Plan, Region 2 Profile, November 2003.
[xxvi] Multnomah County Summary of Assessments and Taxes, 2005 – 2006.
[xxvii] Available on-line at http://www.co.multnomah.or.us/dbcs/LUT/land_use/CRGNSAPlan/Home/NSAMP_Home.html
[xxviii] The Port of Portland, 2006
[xxix] The Port of Portland, 2006
[xxx] Koler/Morrison Planning, for the Division of Planning and Development. *Multnomah County, Oregon Historic Context Statement.* 1990.

# Section 3 Risk Assessment Summary

The risk assessment is an important part of the Multnomah County Natural Hazards Mitigation Plan. The purpose of this section is to define the risk assessment process and to summarize the risk assessment findings for each hazard that can impact the County. Each hazard is also covered in a Hazard Annex at the end of the plan. The annexes cover:

- **Detailed local hazard information**. These include previous disaster reports, local ordinances, hazard related studies and reports.
- **Previous risk-assessment work conducted in the County.** This document (titled the *Multnomah County Natural Hazard Mitigation Plan*) has been reviewed by FEMA and approved preliminarily as the risk assessment portion of the County's plan. The FEMA checklist that discusses this risk assessment is also included in the hazard annexes.
- **State Natural Hazard Mitigation Plan Regional Hazard Assessments**. Each hazard assessment includes information on the hazard's characteristics, history, and probability, and the infrastructure and people who are vulnerable.
- **Technical Resource Guide Hazard Specific Planning Chapters**. These hazard-specific chapters describe the more technical aspects of hazard risk. They are designed at a statewide level to assist local governments as they develop long-term plans and hazard-specific ordinances to implement their plans.

The natural hazards addressed in this plan include: drought, earthquakes, floods, landslides/debris flows, volcanic events, wildfires, and severe weather. For each of these hazards, this summary identifies:

- The location of the hazard (What area is likely to be affected)
- The extent of the hazard at that location (How many people and how much infrastructure could be impacted by the hazard?)
- Previous occurrences of hazard events
- Risk, probability, and vulnerability estimates
- Previous mitigation efforts

Additionally, for most hazards, this summary includes a map of the areas in Multnomah County that are most likely to experience the hazard.

## WHAT IS A RISK ASSESSMENT?

The risk assessment process is used to identify and evaluate the impact of natural hazards on the human-built environment, businesses, social structure and services, and the natural environment of a community. Based on the best available

data, risk assessments provide information about the areas where the hazards may occur, the value of existing land and property in those areas, and an analysis of the potential risk to life property, and the environment that may result from natural hazard events. Specifically, the following elements are present in a risk assessment:

1) ***Hazard Identification*** identifies the geographic extent of the hazard, the intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data. Multnomah County identified six major hazards that consistently affect or threaten its geographic area. These hazards – earthquakes, floods, landslides/debris flows, volcanic events, wildfires, and winter storms – were identified through a process that utilized input from a project steering committee, subject matter experts, the State Natural Hazard Risk Assessments, and historical records.

2) ***Profiling Hazard Events*** describes the causes and characteristics of each hazard, how they have affected the County in the past, and what part of the County's population, infrastructure, and environment have historically been vulnerable to each specific hazard. A profile of each hazard addressed in this plan from the State Natural Hazard Risk Assessment is provided in the plan's hazard annexes. For more information on the history of hazard specific events, please see the hazard specific annex.

3) ***Vulnerability Assessment/Inventorying Assets*** combines the hazard identification with an inventory of existing (or planned) property and population that would be exposed to a hazard. Critical facilities are of particular concern because they provide essential products and services that are necessary to preserve the welfare and quality of life in Multnomah County and fulfill important public safety, emergency response, and/or disaster recovery functions.

4) ***Risk Analysis/Estimating Potential Losses*** involves estimating the damage, injuries, and financial losses likely to be sustained from hazard events in a geographic area over a given period of time. This level of analysis typically involves using mathematical models, such as HAZUS. The two measurable components of risk analysis are magnitude of the impact that may result from the hazard event and the likelihood of the hazard occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. Where available, the best available data was used to determine the magnitude and likelihood of future natural hazard events. Where sufficient data was available, quantitative estimates for potential losses are included in the Hazard Annexes.

5) ***Assessing Vulnerability/Analyzing Development Trends*** provides a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions. This plan provides a comprehensive description of the characteristics of Multnomah County in Section 2: Community Profile.

The profile includes a description of the community's land use and development trends.

# RISK ASSESSMENT SUMMARY

This section provides an overview of the risk assessment for the natural hazards affecting Multnomah County. A more complete risk assessment is contained in the Hazard Annexes.

Risk assessment data is continually improving; scientists and others who calculate risk will continue to refine their assessment of the threat that natural hazards pose to Multnomah County. This risk assessment summary is a strategy for communicating risk as it is understood at the time of publishing this version of Multnomah County's Natural Hazard Mitigation Plan. Its data and methods will be updated and improved in future iterations of this plan.

## EARTHQUAKE RISK SUMMARY

| Location of Hazard: | Extent of Hazard at the Location: |
|---|---|
| All of Multnomah County is vulnerable to earthquakes from crustal faults and from the Cascadia Subduction Zone. Areas near rivers or other areas with softer soils are more likely to experience liquefaction. Development in these areas is especially vulnerable to damage. The maps in this section shows both relative earthquake hazard risk and soils subject to liquefaction. | All of Multnomah County's infrastructure (both private and public) and population is vulnerable to earthquakes. Infrastructure built on soils subject to liquefaction (see maps at the end of this section) is more likely to experience severe damage. The risk assessment in the hazard annex details the critical infrastructure and lifelines that are vulnerable. |

Previous Occurrences of the Hazard Within the Community:

Fifty-six significant earthquakes occurred in or near Multnomah County between 1872 and 1999. Events centered outside of the County have also impacted infrastructure and populations in the County. The following is a list of events that occurred in or impacted the County.

- Multiple M 8 – 9.0 subduction zone quakes, the most recent of which occurred in January 1700. Effects in Multnomah County are largely unknown; though the County certainly experienced ground shaking as a result of this quake, the relative lack of development probably limited damage.
- M 5.2 quake centered in Portland area (Oct., 1877). Ground-shaking felt throughout the region. Chimney damage was reported.
- M 5.0 quake centered in Portland area (Feb. 1892). No major damage reported.
- M 4.5 quake in the Portland area (Dec, 1941). Shattered windows and cracked plaster in Hillsboro and Sherwood.
- M 7.1 event near Olympia Washington (1949). Though significant damage was reported in Washington, damage in Multnomah County was minor.
- M 4.5 event in Portland area (Dec, 1953). Cracked plaster and caused objects to fall

in Portland.

- M 5.0 quake in Portland area (Nov, 1961). Most damage reported was cracked plaster.
- M 5.5 quake in the Portland area (Nov, 1962). Shaking lasted up to 30 seconds, causing cracked chimneys, broken windows. Furniture moved in houses.
- M 4.5 quake in the Portland area (Dec, 1963). Little damage experienced, though books and pictures fell in North Plains (in Washington County, west of Portland).
- M 6.5 event in Seattle-Tacoma (1965). Shaking felt in the County.
- M 5.6 quake near Scotts Mills (Clackamas County, March, 1993). $30 million in damage throughout the region, including Oregon Capitol Building in Salem.
- M 6.8 Nisqually quake near Olympia, Washington (2001). This quake was felt in the County, but no major damage was reported.

**Local Community's Self-Completed Earthquake Hazard Risk Rating:**

240: High Risk

**Community's Probability a Future Hazard Event:**

High probability (one incident likely within a 10 to 35 year period)

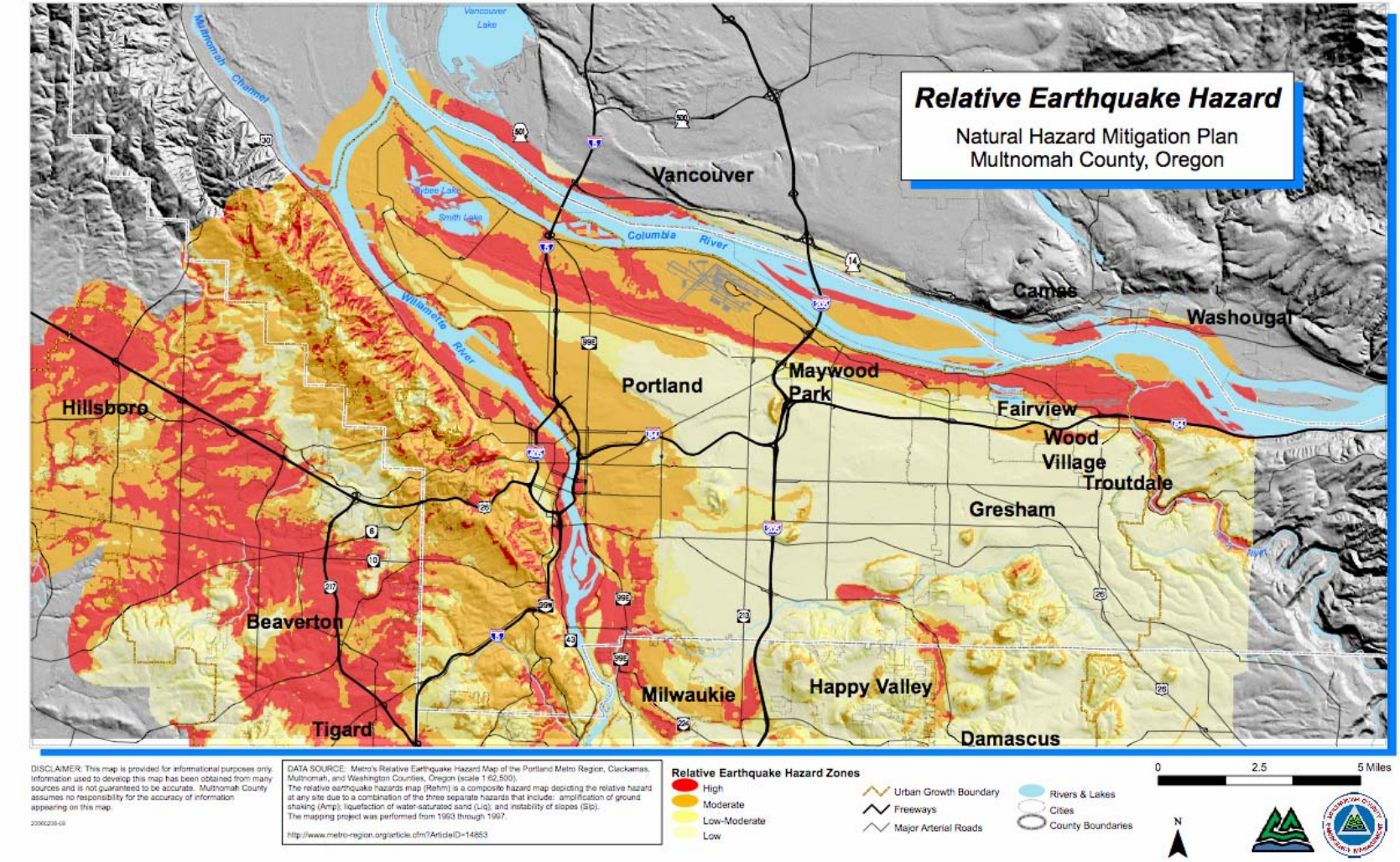
**Community's Vulnerability to a Future Hazard Event:**

High vulnerability (More than 10% of the population and infrastructure would be affected)

**Previous Mitigation Efforts:**

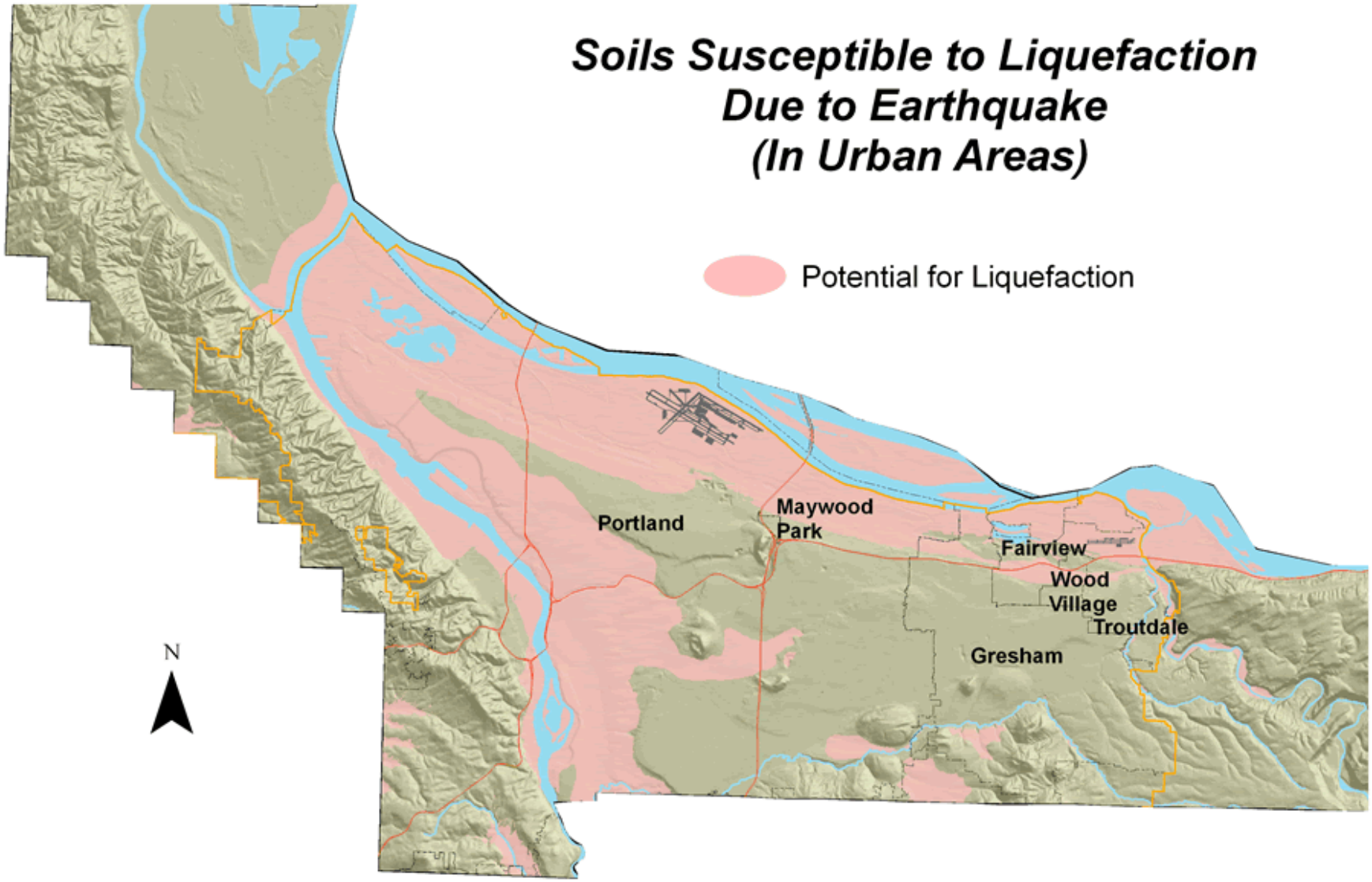
- Building codes and permitting in Multnomah County are administered through an intergovernmental agreement with the City of Portland and the City of Gresham. The codes require new construction in unincorporated Multnomah County to meet Universal Building Code requirements for seismic readiness.

**Figure 3-1. Relative earthquake hazard risk, Multnomah County, 2006**




Source: Multnomah County GIS, 2006

**Figure 3-2. Soils subject to liquefaction, Multnomah County, 2006**




Source: Multnomah County GIS

## FLOOD RISK SUMMARY

| Location of Hazard: | Extent of Hazard at the Location: |
|---|---|
| The flood maps show the locations of the County's 100- and 500-year floodplains. The Columbia, Willamette, Sandy, the Multnomah Channel, Columbia Slough, and some smaller tributaries (such as Johnson Creek and Fairview Creek) have mapped floodplains. | According to Multnomah County's risk assessment, 634 people reside in flood areas, and approximately 36% of the community's critical facilities are vulnerable to flooding. Approximately 11% of the community's lifelines are exposed, 26% of the community's public infrastructure, and 2% of the private economy on business sector are vulnerable to flooding. |

Previous Occurrences of the Hazard Within the Community:

Multnomah County shares a statewide concern regarding flood events. According to the National Flood Insurance Program (NFIP), Oregon has 256 flood-prone communities throughout the state's 36 counties.[i] That number includes a majority of Oregon's 240 incorporated communities and counties, of which the County is one. Flooding can cause severe damage to public and private property and pose a threat to life and safety. Oregon's largest economic loss from natural disasters resulted from flooding.[ii] Damage during the Christmas Flood of 1964 totaled over $157 million dollars, and 20 Oregonians lost their lives.[iii]

Significant flooding has been recorded in the Willamette and Columbia Basins at least 14 times since 1861. Some major floods have forced evacuations in urbanized areas, destroyed bridges, and inundated roads. The following is a list of events that occurred in or impacted the County.

- 1862, a rain-on-snow weather system resulted in widespread flooding in the Willamette River Basin.
- 1894, a rain-on-snow event resulted in the largest flood ever observed on the Columbia River. The Willamette River at Portland crested at 31.6 feet. Despite the magnitude, Portland and other urbanized areas experienced little damage.
- 1923, a rain-on-snow event caused flooding along the Willamette and Columbia Rivers, with widespread damage to roads and railroads.
- 1937, the Willamette basin experienced considerable flooding and some associated landslides.
- 1945, a rain-on-snow event caused flooding in the Willamette basin and throughout Northwest Oregon with considerable flood damage.
- 1948, a snow melt event in June cause the Willamette River at Portland to flood and crest at 31.6 feet. The Columbia River also flooded, causing about 25 deaths. Vanport (near Portland) was completely destroyed.
- 1964/65, record-breaking December rain coupled with snowmelt caused flooding throughout the state. The Willamette River at Portland crested at 29.8 feet. The Columbia River also flooded. Flooding caused the evacuation of thousands, destroyed scores of

bridges and secondary roads, and caused $157 million in damages and 17 deaths.

- 1972, the Willamette and Sandy Rivers flooded, resulting in widespread damage and five fatalities.
- 1974, flooding throughout western Oregon resulting from rain-on-snow event. Willamette River at Portland crested at 25.7 feet. Nine counties were declared disasters.
- 1978, widespread flooding affected the Willamette basin and rivers in NW Oregon.
- 1986, snowmelt resulted in flooding throughout the state of Oregon. Numerous homes were evacuated.
- 1987, flooding along the Willamette and its tributaries resulted in mudslides, flooded highways, and damaged homes.
- 1990, ten rivers in eight western Oregon counties were flooded in a rain-on-snow weather event. Many bridges were washed away.
- 1996, the Willamette River at Portland crested at 30.2 feet. This flood event caused statewide damage. Thousands were forced into shelter, hundreds of homes were destroyed, and the City of Portland was forced to erect makeshift barriers to prevent floodwaters from entering downtown. Multnomah County was among the 27 counties covered by a disaster declaration.

Local Community's Self-Completed Flood Hazard Risk Rating:

147: Average Risk

Community's Probability a Future Flood Event:

Moderate

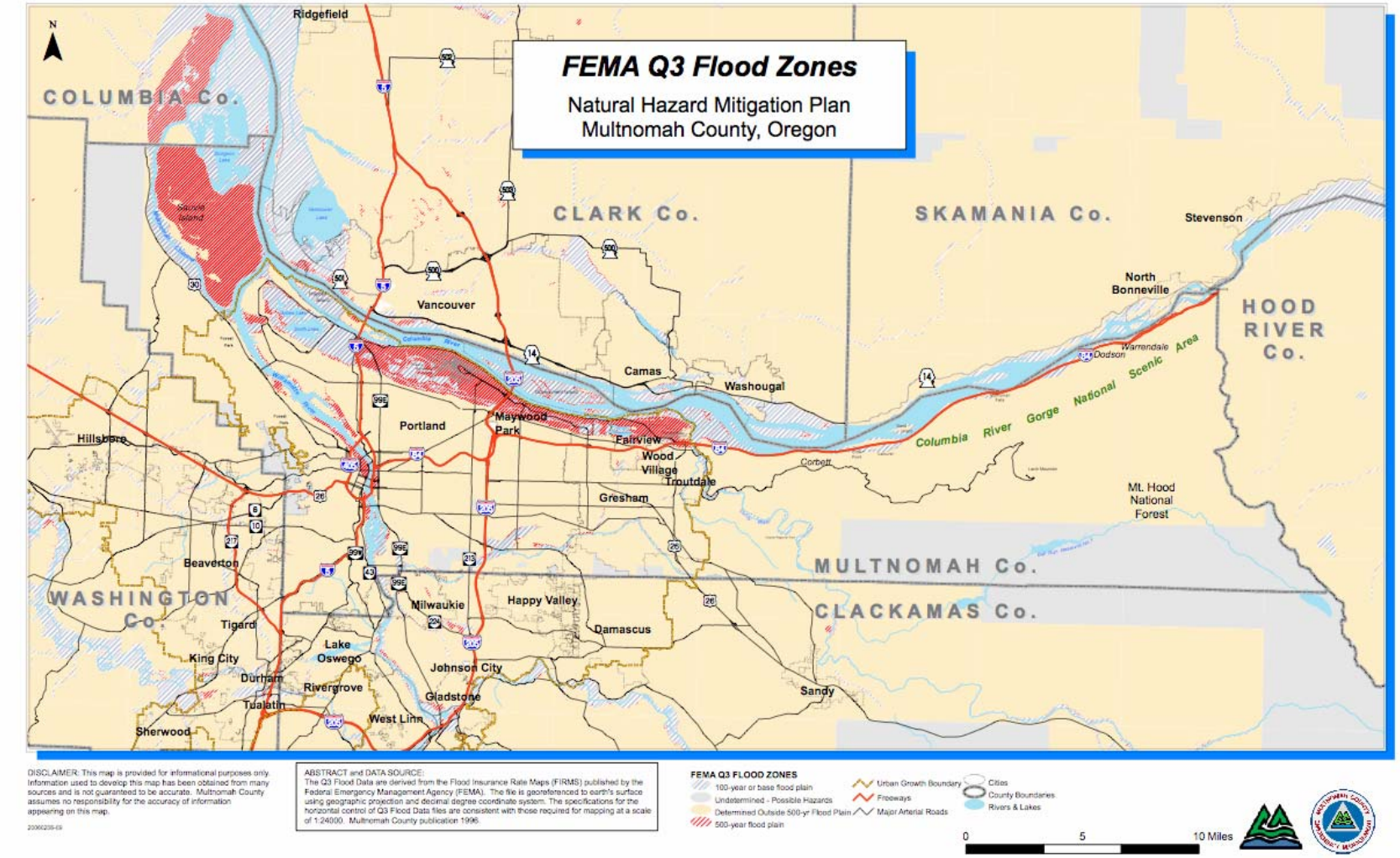
Community's Vulnerability to a Future Flood Event

Moderate (1-10% affected)

Previous Mitigation Efforts:

- The County created a park / wetland estuary to control downstream flooding in the Johnson Creek watershed.
- County residents who live in the floodplain participate in the National Flood Insurance Program.
- The County bought at-risk property in Warrendale-Dodson area to reduce the number of people living in the floodplain and in the path of landslides.
- New construction is limited within the floodplain.

**Figure 3-3. 100- and 500-year floodplains, Multnomah County, 2006**




Source: Multnomah County GIS, 2006, Based on FEMA Q3 flood zone data

## LANDSLIDES RISK SUMMARY

| Location of Hazard: | Extent of Hazard at the Location: |
|---|---|
| The locations of the rapidly moving landslide hazard areas in Multnomah County are shown in the map at the end of this subsection. These areas are concentrated along the hilly northwestern edge of the County and along the edges of the County's buttes. The Warrendale/Dodson area in the northeast corner of the County also experiences elevated risk for rapidly moving landslides. These areas are shown on two maps at the end of this section on landslides. | According to Multnomah County's risk assessment, 634 people reside in flood/slide areas. Approximately 36% of the community's critical facilities are vulnerable to landslides. Approximately 11% of the community's lifelines are exposed, 26% of the community's public infrastructure, and 2% of the private economy on business sector are vulnerable to flooding and landslides. |

Previous Occurrences of the Hazard Within the Community:

Landslides are a relatively common hazard in Multnomah County, and are often associated with heavy rainstorms and flooding. During the floods of 1996, landslides closed I-84 and required the evacuation of the Dodson-Warrendale area. Statewide, 17 homes were destroyed by landslides and 64 were badly damaged. Many of these slides occurred on clear cuts that damaged logging roads. Several roads are recognized as being frequently closed from landslides. These are:

- Gordon Creek Rd. (land settlements and active slide area)
- Mannthey Rd. (land settlements)
- Oxbow Park Rd. (land settlements going down hill into park)
- Stark St. hill (continuous rock falling from slope)
- Newberry Rd. (land settlements)
- Rocky Point Rd. (land settlements)

Other notable landslide/debris flow incidents follow:

- March 1972, three motorists were injured in a slide on I-5 near Portland.
- September 1990, four highway workers were injured in a landslide near Troutdale.

Local Community's Self-Completed Landslide Hazard Risk Rating:

240: High Risk

Community's Probability a Future Landslide Event:

High (one incident likely within a 10 to 35 year period)

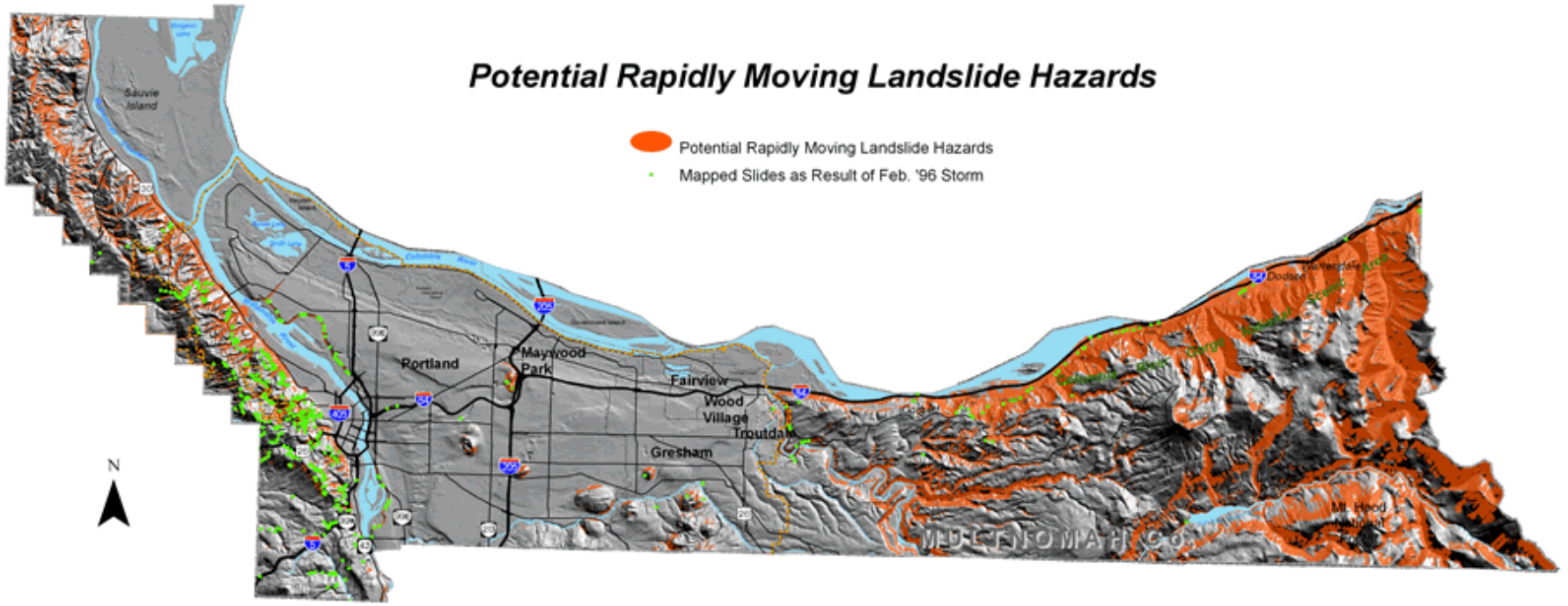
Community's Vulnerability to a Future Landslide Event:

High (More than 10% of the population and infrastructure would be affected)

Previous Mitigation Efforts:

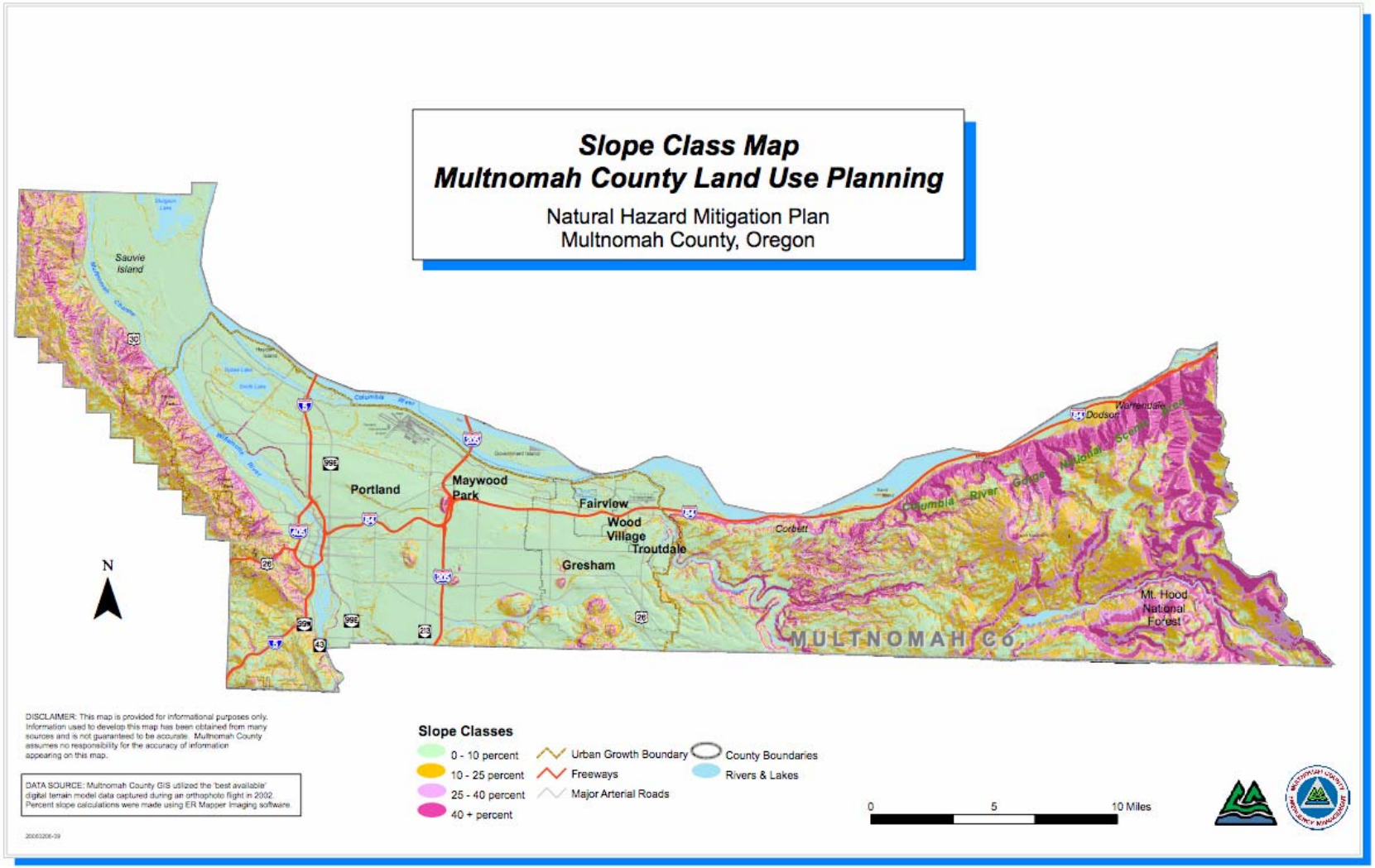
- The county conducted buyouts of properties in the Warrendale & Dodson area to reduce the number of people living in landslide risk areas.

**Figure 3-4. Areas of potential rapidly moving landslides, Multnomah County, 2006**




Source: Multnomah County GIS, 2006, based on data from the Oregon Department of Geology and Mineral Industries

**Figure 3-5. Steep slope areas (potentially subject to landslides), Multnomah County, 2006**




Source: Multnomah County GIS, 2006

## VOLCANIC RISK SUMMARY

| Location of Hazard: | Extent of Hazard at the Location: |
|---|---|
| There are five major volcanoes in the Cascade region that are in relative proximity and pose a potential threat to the County: Mount St. Helens, Mount Hood, Mount Rainier, Mount Adams, and Mount Jefferson. All are known or suspected to be active, and most have geological records that indicate past histories of explosive eruptions with large ash releases. Mount Hood and Mount St. Helens pose the greatest threat. The hazard annex provides more information about where the threat is the greatest. | According to the County's risk assessment, 100% of the community's population, critical facilities, lifelines, public infrastructure, and private economy and business sector are vulnerable to the effects of a volcanic eruption. Some parts of the County are additionally vulnerable to lahars and debris flows resulting from an eruption. Those areas are shown on the map at the end of this section on volcanoes. |

Previous Occurrences of the Hazard Within the Community:

The eastern boundary of Multnomah County is the crest of the Cascade Mountains, an area of known volcanic activity. The history of volcanic activity is contained in its geologic history, and the age of the volcanoes vary considerably. Mt. Saint Helens erupted in May 1980, followed by five smaller explosive eruptions over a period of five months. An historic eruption that was about five times larger than the 1980 eruption occurred in 1480 A.D. Mount St. Helens continues to be active. However, it is difficult to predict recurrence intervals or probabilities for the Cascade volcanoes, which are characterized by long periods of quiescence and intermittent activity.

Local Community's Self-Completed Volcanic Event Hazard Risk Rating:

240: High Risk

Community's Probability a Future Volcanic Event:

High (One incident likely within a 10 to 35 year period)

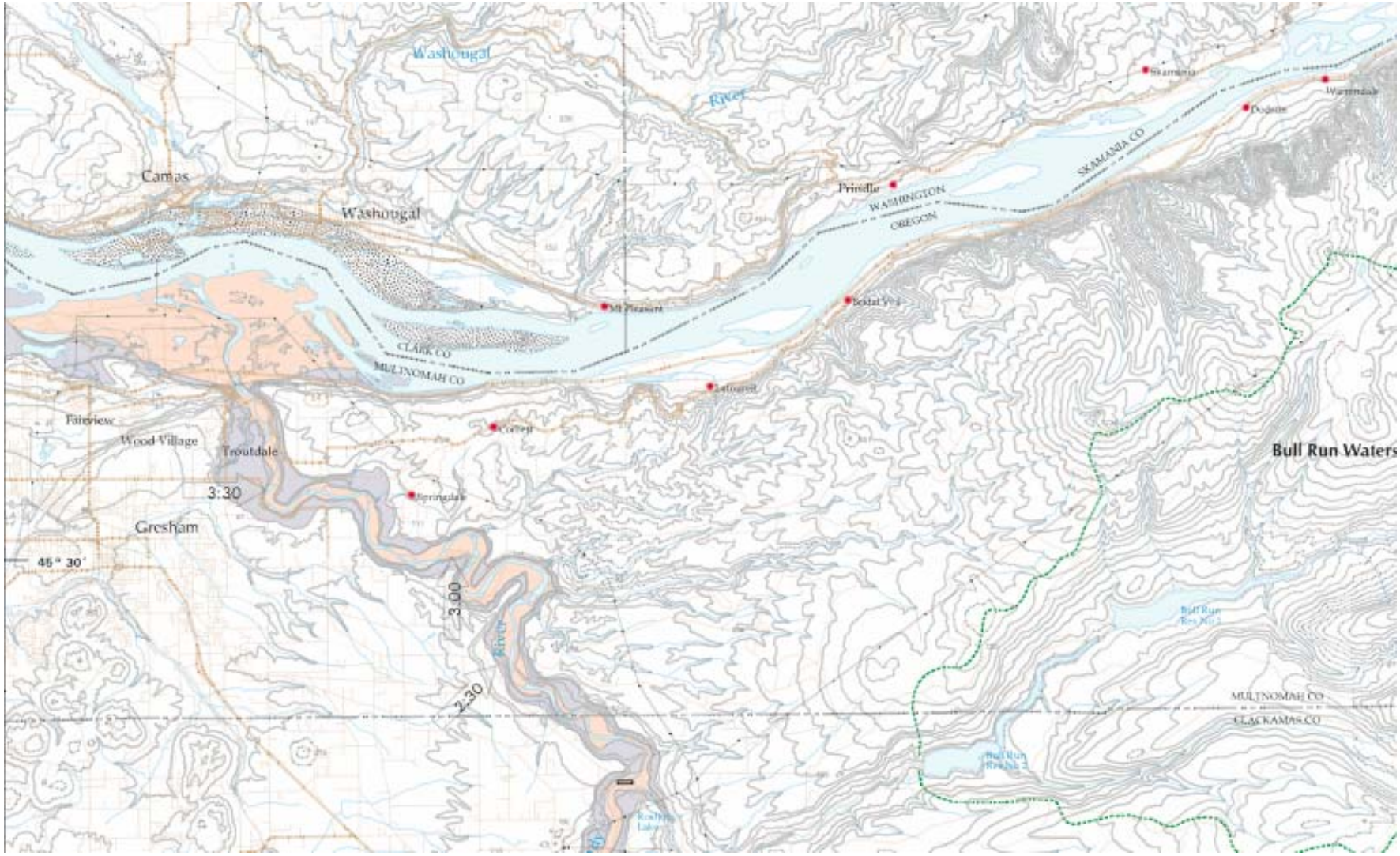
Community's Vulnerability to a Future Volcanic Event:

High (More than 10% of population or assets likely to be affected)

Previous Mitigation Efforts:

- The State of Oregon has identified areas in Multnomah County that may be affected by lahars. Most of these areas are in the Sandy River 100 year floodplain, where new home construction is limited.

**Figure 3-6. Areas potentially subject to lahars, Multnomah County, 2006**




Source: Oregon Department of Geology and Mineral Industry, Available online at: http://vulcan.wr.usgs.gov/Volcanoes/Hood/Hazards/OFR97-89/framework.html
Note: Map legend on next page.

## EXPLANATION

This volcano–hazards–zonation map delineates the relative degree of hazard near Mount Hood from future eruptions and other hazardous geologic events. Eruptive events are characterized by extrusion of lava domes and, less likely, of lava flows. Collapse of growing lava domes generates pyroclastic flows that can melt snow and ice to produce lahars and floods. Landslides of altered rock from high on Mount Hood can be triggered by eruptions, but can also occur without eruptive activity. Such landslides, called debris avalanches, also produce lahars. Eruptions of Mount Hood, as well as other volcanoes in the Cascade Range, generate tephra clouds that are transported by wind and can affect areas hundreds of kilometers (hundreds of miles) away.

Boundaries between hazard zones do not represent sharp changes in hazards. Rather, the degree of hazard decreases gradually in a down–valley direction and more rapidly as height above valley floors increases.

Numerals in brackets refer to end notes in booklet.

### Proximal Hazard Zones

Areas subject to rapidly moving, devastating pyroclastic flows and surges, lahars, and debris avalanches that can sweep out to the hazard boundary in less than 30 minutes. Also subject to ballistic projectiles and lava flows. Subdivided into two zones depending on vent location.

Hazard zone PA — vent at or near Crater Rock, which is considered the most likely case during future eruptions. The 30–year probability of an eruption affecting a substantial portion of zone is estimated to be 1 in 15 to 1 in 30 [4]

Hazard zone PB — vent on east, north, or west flank, or the summit (a summit vent also would endanger zone PA). The 30–year probability of an eruption affecting a substantial portion of zone is estimated to be about 1 in 300 [4]

Major valleys that pyroclastic flows and lahars would follow from lava–dome collapses on the upper flanks or summit. As an eruptive episode progresses, one or more of these valleys might become filled with debris, so that pyroclastic flows and lahars could then spill into adjacent valleys and affect a broader sector of a hazard zone. Also includes areas that are affected frequently (several times or more per century) by small lahars and debris avalanches generated by storms and rapid snowmelt

### Distal Hazard Zones

Valleys heading on Mount Hood that are subject to lahars and debris avalanches. Marks along the valley floor show the estimated travel time for lahars of the size used to define zones DA and DB. Subdivided into three zones on the basis of vent location, event magnitude, and probability of inundation.

Hazard zone DA — Areas along Sandy River and its tributaries and White River that are subject to lahars generated by eruptions at vent located at or near Crater Rock and to debris avalanches and related lahars generated from steep upper flanks on west and south sides of Mount Hood. The 30–year probability of inundation of a substantial portion of zone is about 1 in 15 to 1 in 30 [4, 5]

Hazard zone DB — Areas along Hood River that are subject to lahars generated by eruptions at vents located on upper east or north flanks and to debris avalanches and related lahars of about 50 million cubic meters. The 30–year probability of inundation of a substantial portion of this zone is about 1 in 300 [4, 6]

Areas along Sandy and Hood Rivers subject to inundation by a debris avalanche and lahar of about 500 million cubic meters, which is considered to be among the largest magnitude events possible at Mount Hood [9]. Estimated 30–year probability of such an event is very low—less than 1 in 3000

Columbia River islands and areas along the Washington shore that could be affected by bank erosion and flooding induced by lahars and sediment–rich floods from Sandy and Hood Rivers during and immediately following eruptions

1:30 Estimated travel time for lahars in hours:minutes [3]

Diversion structure for irrigation or power canal

Conduit crossing for irrigation, power, or municipal water

Railroad bridge across White River

Major electric-power transmission line

Boundaries of municipal watersheds of Portland (Bull Run) and The Dalles

## WILDFIRE RISK SUMMARY

| Location of Hazard: | Extent of Hazard at the Location: |
|---|---|
| Wildfire is of the greatest concern in the wildland/urban interface areas. In Multnomah County, these areas include Bonneville, Burlington, East Metro, Holbrook, Lower Columbia Gorge, the Portland Metro area, Shelternoon, Skyline, and the Dodson-Warrendale area. See the map in this section for more information. | Though there have been no major losses due to wildfires to date, the County is still vulnerable to losses from fires. 3100 residents could be affected by a fire, and about 10% of the critical facilities are vulnerable. Approximately 12% of the community's infrastructure lifelines are vulnerable, though none of the public infrastructure and less than 1% of the community's private economy is vulnerable. |

Previous Occurrences of the Hazard Within the Community:

The largest wildfire known to have impacted Multnomah County occurred in 1902, when the Columbia fire burned 170,000 acres. A fire also burned along Mocks Crest in Portland in 2003; the fire threatened homes and businesses.

Fires in the Deschutes and Ochoco National Forests near Multnomah County have also impacted County infrastructure. Both required the closure of Highway 20.

Local Community's Self-Completed Wildfire Hazard Risk Rating:

240: High risk

Community's Probability a Future Wildfire Event:

High (at least one incident likely within a 10 to 35 year period)

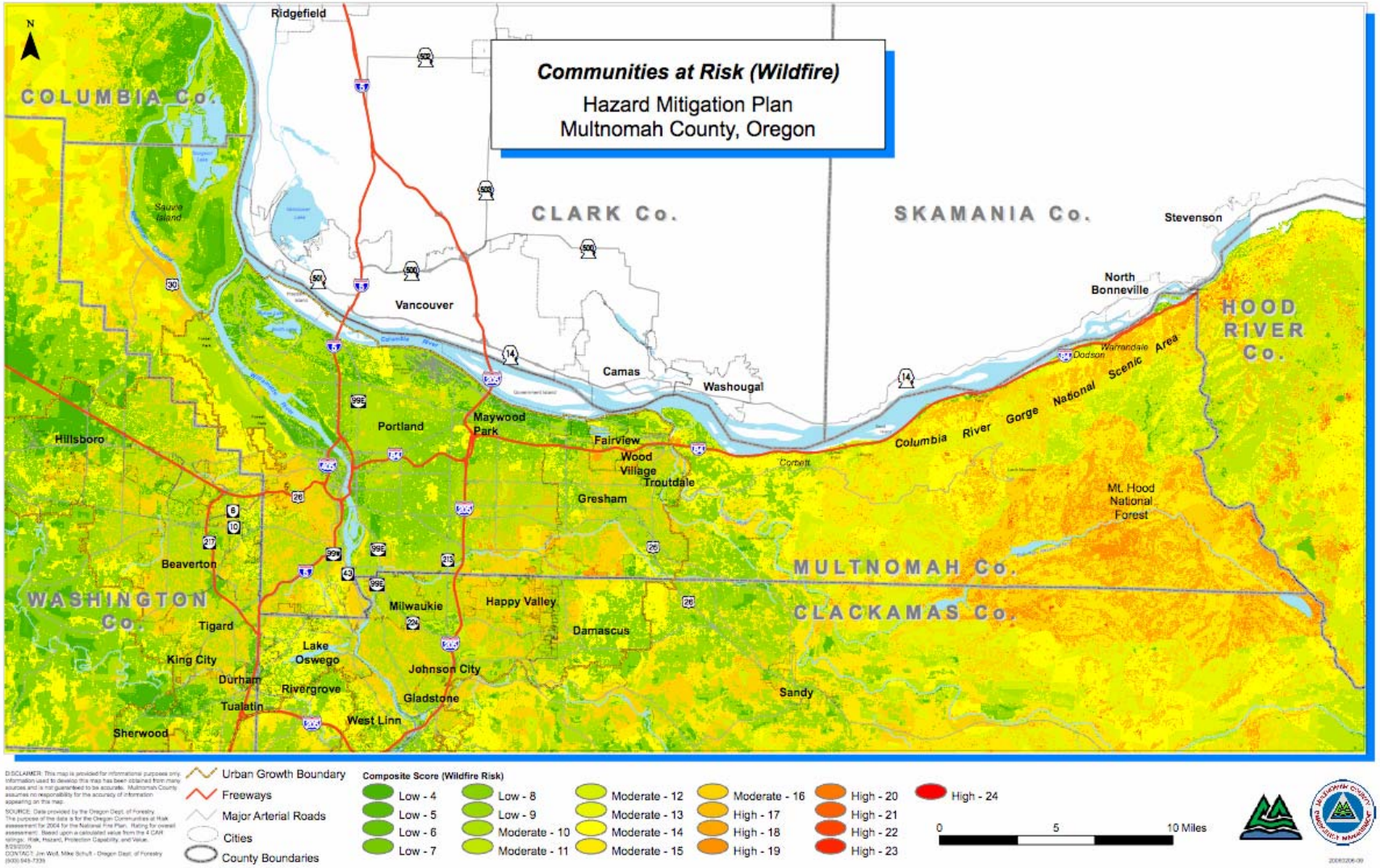
Community's Vulnerability to a Future Wildfire Event:

High (More than 10% of the population or assets affected)

Previous Mitigation Efforts:

- Few mitigation efforts have been undertaken to reduce wildfire risk.

**Figure 3-7. Wildland / Urban Interface areas, Multnomah County, 2006**




Source: Multnomah County GIS, 2006, based on data from the Oregon Department of Forestry

## SEVERE WEATHER RISK SUMMARY

| Location of Hazard: | Extent of Hazard at the Location: |
|---|---|
| All of the County's infrastructure and population are at risk from severe weather (wind, snow, and ice storms). Snow and ice are more common at higher elevations. | The Multnomah County risk assessment states that 100% of the County's population, critical facilities, infrastructure lifelines, public infrastructure, and private economy and business sector are vulnerable to snow storms. |

Previous Occurrences of the Hazard Within the Community:

- December 1861. Statewide snowfall varied between 1 and 3 feet. This storm affected the Willamette Valley.
- 1862, 1866, 1884, 1885,1890, 1892, and 1895. Severe winter conditions and some record-breaking snow fall (especially in 1892) affected the area.
- 1927, 1936, 1937, 1943, and 1949. Heavy snowfalls were recorded in western Oregon.
- April 1931. A windstorm with unofficial wind speeds reported at 78 miles per hour affected most of western Oregon. This storm damaged fruit orchards and timber.
- January 1950 (Friday the 13$^{th}$ storm). Five days of snow and fluctuating temperatures resulted in snow and freezing rain. Roads and schools were closed, power lines were knocked down, and communication ties were severed. Deep snowdrifts closed all highways west of the Cascades and through the Columbia Gorge. Hundreds of thousands of dollars in damage to public and private property occurred.
- December 1951. A statewide windstorm with wind speeds 60 mph in the Willamette Valley caused widespread damage to transmission and utility lines, and damaged some buildings.
- 1956, 1960, and 1962. Packed snow and ice caused many automobile accidents throughout the region.
- November 1958. Every major highway was blocked by fallen trees during this windstorm, which affected the entire state with gusts up to 71 mph.
- October 1962. The Columbus Day storm caused an estimated $170 million in damage. Winds in the Willamette Valley as high as 116 mph. An estimated 84 homes were destroyed, with 5,000 severely damaged.
- December 1985. Heavy snowfall throughout the Willamette Valley
- February 1990. A storm affected the entire state; average snowfall in the Willamette Valley was about 4 inches.
- December 1992. Heavy snow in Western Oregon closed I-5.
- February 1993. Western Oregon received record snowfalls.
- December 1995. A windstorm affected the entire state; in the Willamette Valley,

winds reached 62 mph.

- November 1997. A windstorm affecting western Oregon uprooted trees and caused considerable damage to small airports. Wind speeds topped 52 mph.
- Winter 1998-9. A series of storms affected the entire state, creating one of the snowiest winters on record.
- February 2002. A strong storm struck Western Oregon causing $6.14 million in damages. Many downed power lines and trees, damage to buildings. Power outages cause some water supply problems.
- December 2003 and January 2004. Snow and ice shut down the City of Portland and much of the surrounding area. Twenty-six counties (including Multnomah) received FEMA assistance.

Local Community's Self-Completed Severe Weather Hazard Risk Rating:

NOTE: Local communities were not asked to rate the winter storm hazard in the state plan. Multnomah County rated its risk for windstorms at 240 (high).

Community's Probability a Future Severe Weather Event:

High (One incident likely within a 10 to 35 year period)

Community's Vulnerability to a Future Winter Storm Event:

High (more than 10% of the population affected)

Previous Mitigation Efforts:

- Multnomah County has identified emergency snow and ice routes, and has plans in place to work with local jurisdictions to assure the most efficient flow of traffic and emergency response vehicles possible during an event.

## FLOOD ENDNOTES

[i] The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon State Police – Office of Emergency Management, June 2000).

[ii] *Planning for Natural Hazards: The Oregon Technical Resource Guide,* Department of Land Conservation and Development (July 2000), Ch. 4.

[iii] Ibid.

# Section 4 Mitigation Plan Mission, Goals, and Action Items

This section provides information on the process used to develop the mission, goals, and action items addressed in the mitigation plan. It also describes a framework that focuses the plan on developing successful mitigation strategies which can be integrated into existing County plans, policies, and procedures. This approach will promote collaboration with the County's external partners. This section has the following subsections:

- **Framework** describes how mission statements, goals, and action items work together to direct mitigation activities within the County, as well as the process that was used to develop the mission, goals, and actions contained in Multnomah County's plans.
- **Natural hazard mitigation mission** describes the purpose of a mission statement and provides the mission for Multnomah County's plan.
- **Mitigation plan goals** describes the purpose of goal statements and provides the goals for this plan.
- **Mitigation plan action items** describes the components of action items included in this plan.
- **Mitigation plan action item matrix** provides all of the action items included in the plan.

## FRAMEWORK

The Natural Hazard Mitigation plan framework is designed to provide the County with a comprehensive, dynamic, cost-effective approach for partners – both public and private – to bring together the human and financial resources needed to enhance, develop, and implement mitigation activities countywide. It is also designed to support the goals and actions that the County has described through other planning processes.

The Federal Emergency Management Agency's guide on mitigation asserts that mitigation "goes well beyond the scope of traditional emergency management and touches areas of planning, development, economics, education, critical care, and cultural facilities" (FEMA 2001). For mitigation to succeed, it must be thought of as a component that needs to be integrated into the existing plans, policies, and operational procedures within the County. The mitigation plan takes a systems approach to understanding the county's risk exposure to natural hazards. The framework has three parts: Mission, Goals, and Action Items:

- *Mission*. The mission statement states the purpose and defines the primary function of Multnomah County's Natural Hazards Mitigation plan. The mission is an action-oriented statement of the plan's reason to exist. It is

broad enough that it need not change unless community environmental or policy changes drive the need for a change in mission.

- *Goals*. Our goals drive our actions; they represent the general end toward which the County's effort is directed. Goals identify how the County intends to work toward mitigating risk from natural hazards. They do not specify how the County will achieve an acceptable level of performance. The goals guide development of the specific actions recommendations to be undertaken after planning.
- *Action Items.* The action items are detailed recommendations for activities that County departments, citizens and others could engage in to reduce risk.

The mission, goals, and action items highlighted in this plan support many of Multnomah County's other plans and programs, including the Comprehensive Plan, Capital Improvement Plan, and state building codes. Additionally, the goals and action items in this plan are aligned with the County's FY 2006 priority-based budgeting approach. This approach asked Multnomah County citizens to prioritize the government functions they expect the County to undertake. The County's six priority areas were developed through an extensive process and are:

- **Basic Living Needs**: All Multnomah County residents and their families have their basic living needs met.
- **Safety**: To feel safe at home, work, school, and at play.
- **Accountability**: Government to be accountable at every level.
- **Thriving Economy**: Multnomah County to have a thriving economy.
- **Education**: All children in Multnomah County to succeed in school.
- **Vibrant Communities**: To have clean, healthy neighborhoods with a vibrant sense of community.

All of these goals compliment the goals of the Natural Hazard Mitigation Plan. At the same time, implementation of the Natural Hazard Mitigation Plan will further the County's progress toward achieving the priorities outlined in the County's budget.

# NATURAL HAZARD MITIGATION MISSION

## MISSION STATEMENT

The mission of the Multnomah County Natural Hazards Mitigation Plan is to:

*Create a disaster resilient County.*

# MITIGATION PLAN GOALS

The plan goals help to guide the direction of future activities aimed at reducing risk and preventing loss from natural hazards. The goals listed here serve as checkpoints as County departments, agencies, special districts, and partnering organization begin implementing mitigation action items.

The County's project steering committee reviewed the state's goals and made recommendations during meetings on January 11 and February 1, 2006 to adapt them to the County's needs. The following are the goals for the Multnomah County's Natural Hazards Mitigation plan.

## PLAN GOALS

I. **Maintain a comprehensive, countywide risk assessment.**
   Identify, document, evaluate, and update the County's risk exposure and vulnerability to natural hazards.

II. **Reduce risk to people, property and environment.**
   Involve citizens, property owners (both public and private), special districts, businesses, and communities in taking action to reduce risk and repetitive losses from Earthquake, Flood, Landslide/Debris Flow, Wildfires and Severe Weather; while promoting insurance coverage and preparedness for catastrophic natural hazards –now and for future generations.

III. **Support a disaster resilient economy.**
   Promote sustainable and disaster resilient business practices by providing education, training opportunities, and resilient infrastructure (road, rail, and utilities) for County business owners large and small.

IV. **Promote public education, awareness, and understanding of risk.**
   Increase public participation and enhance partnerships through education, outreach, and coordination of a diverse and representative group of the County's population.

V. **Develop and maintain collaborative partnerships and funding strategies for implementing the mitigation plan.**
   Develop partnerships and coordination activities focused on strengthening communication and increasing participation between County departments, public agencies, citizens, non-profits organizations, special districts, businesses, and communities that assist in implementing mitigation actions and documenting mitigation success stories.

# MITIGATION PLAN ACTION ITEMS

The mitigation plan identifies short and long-term action items to mitigate the impacts of natural hazards. These action items were developed through data collection, research and extensive stakeholder outreach. Funding for mitigation plan activities will be sought from local, state, and federal grant programs, including the Federal Emergency Management Agency's Hazard Mitigation Grant Program and Pre-Disaster Mitigation Competitive Grant Program, as funds are made available. Action items address both multi-hazard and hazard specific issues for the hazards addressed in this plan.

**Action Item Proposal Form**

| | |
|---|---|
| **Proposed Action Item Identification:** *(Example* MH #1 – for Multi-Hazard #1; or FH #3 – for Flood Hazard #3.) | **Alignment with Plan Goals:** (*List Goals the action helps to achieve.*) |
| **Proposed Action Title:** | |
| **Rationale for Proposed Action Item:** *(What critical issues will the action address?)* | |
| **Ideas for Implementation:** | |
| **Coordinating Organization:** | |
| **Internal Partners:** | **External Partners:** |
| **Timeline:** | **If available, estimated cost:** |
| Short Term (0-2 years) / Long Term(2-4 or more years) | |
| **Form Submitted by:** | |

To facilitate plan implementation, each action item in the plan is documented on a single action item form (shown to the left). Any new action items identified and adopted in the future will be documented using the same form. The form includes critical information on the rationale or fact base for the proposed action, ideas for implementation, coordinating and partner organizations, timeline, and plan goals addressed. This approach (develop by the University of Oregon's Natural Hazards Workgroup) provides better documentation of the proposed action and keeps together all of the essential information needed to implement the action. This approach also promotes a more inclusive and dynamic approach of County stakeholders being able to introduce action items both during and after the planning process by simply filling out the form and submitting it to the coordinating body for review and inclusion into the plan.

## ACTION ITEM STRUCTURE

### RATIONALE FOR PROPOSED ACTION ITEM

The rationale describes the critical issues that the action item will address. It presents the logic and the fact base behind the action item: why is it important that this action item be implemented?

### IDEAS FOR IMPLEMENTATION

For each action item, the form asks for some ideas for implementation, which serve as the starting point for taking action. This information offers a transition from theory to practice. Ideas for implementation could include: (1) collaboration

with relevant organizations, (2) alignment with the county's six priority areas, and (3) applications to new grant programs.

The ideas for implementation are just that: ideas. They do not necessarily prescribe the exact steps that the County or its partners should take to implement a particular action item. When an action is to be implemented, more work will be needed to determine the exact course of the action; some of the ideas listed on the action item form may be not feasible and new ideas can be added during the plan maintenance process. (For more information on how this plan will be implemented and evaluated, see Section 5).

#### COORDINATING ORGANIZATION

The coordinating organization is the public agency with authority to implement the identified action. It can also be an agency that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation.

#### INTERNAL PARTNERS

Internal partner organizations are departments within the County that may be able to assist in the implementation of an action item by providing relevant resources (time, budget, staff, data, etc.) to the coordinating organization.

#### EXTERNAL PARTNERS

External partner organizations or jurisdictions can assist the County in implementing the action items in various functions. They may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations.

The internal and external partner organizations listed in the Mitigation Plan are potential partners recommended by the project steering committee, but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and or resources towards completion of the action items.

#### TIMELINE

Action items include both short- and long-term activities. Each action item includes an estimate of the timeline for implementation. *Short-term action items* (ST) are activities that County departments may implement with existing resources and authorities within one to two years. *Long-term action items* (LT) may require new or additional resources and/or authorities, and may take more than two years to implement.

### PLAN GOALS ADDRESSED

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

# MITIGATION PLAN ACTION ITEMS MATRIX

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| ***Multnomah County Natural Hazard Mitigation Plan Action Items - Organized by Goal*** | | | | | | | | | |
| ***Goal 1 (Risk Assessment) action items*** | | | | | | | | | |
| ST 1.1 | Acquire LIDAR data (Airborne Light Detection and Ranging) to improve hazard mapping in Mulltnomah County | Multnomah County Emergency Management / *Land Use Transportation Division, Information Technology / GIS* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 1.2 | Develop and implement inundation modeling for the urban managed floodplain managed by the combined Drainage Districts | Multnomah County Emergency Management | ST | | ✓ | | | | |
| ST 1.3 | Update Hillside Development Overlay Zone maps to identify areas of recurring loss. | Multnomah County Community Services Department / *Multnomah County Emergency Management* | ST | ✓ | | ✓ | | | |
| ST 1.4 | Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for the wildfire hazard | Land Use and Transportation Division / *Multnomah County Emergency Management* | ST | | | | | | ✓ |
| ST 1.5 | Acquire heat intensity imaging of levees | Multnomah County Emergency Management | ST | | ✓ | | | ✓ | |
| LT 1.6 | Update Flood Insurance Rate Maps(FIRM) and participate in FEMA's map modernization process. | Land Use and Transportation Division / *Multnomah County Emergency Management* | LT | | ✓ | | | | |
| LT 1.7 | Update and maintain the County's risk assessment. | Multnomah County Emergency Management and the Hazard Mitigation Technical Advisory Committee | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| ***Goal 2 (Reduce Risk) action items*** | | | | | | | | | |
| ST 2.1 | Complete seismic upgrades for Mt. Hood Community College gymnasium and Main Academic Center (shelter sites). | Multnomah County Emergency Management | ST | ✓ | | | | | |
| ST 2.2 | Upgrade Multnomah County Drainage District Command Center | Multnomah County Emergency Management | ST | ✓ | ✓ | | | ✓ | |
| ST 2.3 | Develop a funding strategy to reduce the risk of loss to the critical infrastructure of the Willamette River bridges managed by Multnomah County from seismic and landslide hazards. | Multnomah County Emergency Management / Board of Commissioners | ST | ✓ | | ✓ | | | |
| ST 2.4 | Seismic upgrades Multnomah County Courthouse | Multnomah County Facilities & Property Management *County Sheriff, District Attorney, Board of County Commissioners.* | ST | ✓ | | | | | |
| ST 2.5 | Analyze each repetitive loss property to identify viable mitigation options. | Land Use and Transportation Division | ST | | ✓ | | | | |
| LT 2.1 | Evaluate current zoning codes to incorporate mitigation principles related to flood and landslide. | Land Use and Transportation Division | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 2.2 | Explore the development of management strategies to preserve the function of the floodplain | Land Use and Transportation Division | LT | | ✓ | | | | |
| LT 2.3 | Qualify Multnomah county for the FEMA Community Rating System (CRS) program | Multnomah County Emergency Management / *Land Use Planning and Transportation Division* | LT | | ✓ | | | | |
| LT 2.4 | Assess, design, and repair County waterways that are in danger of failure due to high water. | Multnomah County Emergency Management | LT | | ✓ | | | ✓ | |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| LT 2.5 | Develop a food distribution contingency plan. | Multnomah County Emergency Management / *Departments of Planning and Transportation* | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 2.6 | Create mechanisms and incentives for home retrofit, including grants and tax incentives | Multnomah County Emergency Management / *Multnomah County Commissioners* | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 2.7 | Develop acquisition and management strategies to preserve parks, trails, and open space in the floodplain. | Environmental Services Division | LT | | ✓ | | | | |
| LT 2.8 | Develop and implement programs to keep trees from threatening lives, property, and public infrastructure from severe weather events | Multnomah County Emergency Management | LT | | | | | ✓ | |

## *Goal 3 (Disaster Resilient Economy) action items*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ST 3.1 | Develop and implement the Multnomah County Information Technology Disaster Recovery Plan | Multnomah County Information Technology Infrastructure Group / *County Business Units* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 3.2 | Encourage small businesses to undertake business continuity planning. | Multnomah County Emergency Management | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 3.3 | Install fiber optic communications network to fill 7,000 foot gap in existing conduit path for emergency communications and transportation data. | Multnomah County Emergency Management | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LT 3.1 | Provide secondary power grids to flood protection storm water pump stations | Multnomah County Emergency Management | LT | | ✓ | | | ✓ | |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| LT 3.2 | Create a back-up river crossing system that uses barges or ferries to assure that people and goods can cross the river if the bridges are down. | Multnomah County Emergency Management / *Multnomah County Land Use and Transportation* | LT | ✓ | | | | ✓ | |
| LT 3.3 | Assess the condition of and, if necessary, replace or repair the stormwater infrastructure under major County transportation routes, such as I-84 and Marine Drive. | Multnomah County Emergency Management | LT | | ✓ | | | | |
| ***Goal 4 (Education and Awareness) action items*** | | | | | | | | | |
| ST 4.1 | Develop public official information kit that can be distributed to elected officials and community decision makers. The kit should include pertinent information regarding the Natural Hazard Mitigation Plan as well as the risk the County faces. | Multnomah County Emergency Management / *Hazard Mitigation Technical Advisory Committee* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 4.2 | Develop and distribute a Natural Hazard Community Resource Maps and risk reduction tips that include instructions about how to prepare and reduce risks posed by natural hazards. | Multnomah County Emergency Management / *Land Use and Transportation Divsion and GIS* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 4.3 | Conduct earthquake awareness and mitigation outreach assistance | Multnomah County Emergency Management | ST | ✓ | | | | | |
| ST 4.4 | Research ways to create and disseminate a message that will cause people to act to reduce individual risk. Target education and outreach actions to reach marginalized populations. | Multnomah County Emergency Management / Public Affairs Office | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 4.5 | Involve the public in updating the Natural Hazard Mitigation Plan | Multnomah County Emergency Management / *Hazard Mitigation Technical Advisory Committee* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Goals & Short Term (ST) or Long Term (LT) | Action Item | Coordinating Organization / *Internal Partners* | Timeline | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Earthquake | Flood | Landslide | Volcanic Event | Severe Weather | Wildfire |
| ***Goal 5 (Plan implementation) action items*** | | | | | | | | | |
| ST 5.1 | Develop formal agreements (such as Memoranda of Understanding) with internal (departments) and external partners (non-profits, cities, and state agencies) to work together on risk reduction efforts in the County. | Mutlnomah County Commissioners and Hazard Mitigation Technical Advisory Committee / *Multnomah County Emergency Management and Land Use and Transportation Divisior* | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 5.2 | Encourage and support the development of local community plan addenda to the County Natural Hazard Mitigation Plan | Hazard Mitigation Technical Advisory Committee and Land Use and Transportation Division | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| St 5.3 | Develop a web-based or other electronic communication tool for the Hazard Mitigation Technical Advisory Committee and for the public to comment on the plan | Multnomah County Emergency Management and Hazard Mitigation Technical Advisory Committee | ST | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ST 5.4 | Establish mitigation benchmarks to assist in evaluating and updating the plan. | Land Use and Transportation Division and Hazard Mitigation Technical Advisory Committee | LT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Section 4

# Action Items

| Goal 1 Action Item: ST 1.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Acquire LIDAR data (Airborne Light Detection and Ranging) for hazards mapping in Multnomah County. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- To properly update the county's paper Flood Insurance Rate Maps (FIRMs) to a modern format including detailed flood hazard modeling, high-resolution topographic data is required. FEMA has proposed to update the county's paper maps that at this time, due to the lack of high-resolution topographic data, that they will only be able to scan the paper maps to a digital map format.
- Varying levels of digital elevation data does exist throughout the county and the communities within the county, for example some of the City of Portland has high-resolution topographic LIDAR data. However, this high-resolution topographic LIDAR data is not seamless across the county. LIDAR would help to create a seamless high-resolution topographic dataset that could be used by various Federal, State, Local and Regional government agencies, Universities, Non-Profits, etc., for many hazard mapping and modeling applications including, but not limited to, updating Flood Insurance Rate maps (DFIRMs).
- FEMA even defines the technical requirements and product specifications for the uses of LIDAR for this purpose on their website as they are used to working with the data to update the maps: http://www.fema.gov/fhm/mm_a4b4.shtm
- Most importantly, this high-resolution topographic data would also help to locate hazard problem areas for mitigation and planning purposes and would assist in updating the county's Natural Hazard Mitigation Plan over time.

**Ideas for Implementation:**

- Coordinate with Federal, State, Local and Regional government agencies, Universities, Non-Profits, etc., to find suitable funding in order to acquire LIDAR suitable for hazard mapping that would covering all communities within Multnomah County.
- A regional success story comes from partners in the State of Washington, called the Puget Sound LIDAR Consortium (http://pugetsoundlidar.ess.washington.edu/). The consortium was formed around the issue of earthquake hazards. It has helped to bridge partnerships between the USGS and local jurisdictions.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| County Office of Emergency Management<br>Land Use Transportation Division<br>Information Technology/GIS | Federal, State, Local and Regional government agencies, Universities, non-profits, and Dept. of Geology and Mineral Industries. |
| **If available, estimated cost:** | **Form Submitted by:** |
| Estimated between $250,000 – 500,000 depending on number of partners. | Multnomah County Geographic Information Systems |

## Goal 1 Action Item: ST 1.2

Develop and implement inundation modeling for the urban managed flood plain managed by the combined Drainage Districts

**Hazards Addressed**

| Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
|---|---|---|---|---|---|
| | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- Inundation models will be used to define what areas and facilities will be flooded at various flood stages on the Columbia, Willamette, and Sandy Rivers in the unlikely event of a levee failure of the levee system which protects the urban managed flood plain in Multnomah County.
- This model will also be used to identify critical facilities such as evacuation routes, public drinking water systems, storm water pump stations, etc. and to develop evacuation routes if evacuation is required.
- The State Natural Hazard Mitigation Plan's Risk Assessment is based upon local hazard data. The implementation of inundation modeling would allow the County to improve its risk assessment, which can be utilized to update the State Plan's Risk Assessment.
- This action will also assist in meeting Goal 1 of the State Natural Hazard Mitigation Plan which calls for description and evaluation Oregon's vulnerability to natural hazards.

**Ideas for Implementation:**

- Partner with other agencies to fund development of the inundation model.
- Partner with other agencies to apply and receive grant money to fund this project.
- Partner with state and federal partners in the Flood Map Moderation program

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management |

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | SDIC, Pen1, Pen2, USACOE, FEMA, Multnomah County Drainage District No.1, Port of Portland |
| **If available, estimated cost:** | **Form Submitted by:** |
| $110,000.00 | Multnomah County Drainage District |

| Goal 1 Action Item: ST 1.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Update Hillside Development Overlay Zone maps to identify areas of reoccurring loss. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | | ✓ | | | |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having a high risk of landslides or debris flows in certain areas. Implementing mitigation principles through identification of areas where landslides have a history of reoccurring can help reduce losses.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings [201.6(c)(3)(*ii*)]. Evaluating and enhancing zoning codes would address the future built environment and would also help further the objectives of Oregon Statewide Land Use Planning Goal 7 - Areas Subject to Natural Disasters and Hazards
- The County landslide hazard zone mapping has not been reviewed or updated since its inception in 1990, does not identify repetitive loss areas, and should be reviewed in light of the experience of losses since that time.
- New data from DOGAMI is available; this should be the basis of updated maps.
- The State Natural Hazard Mitigation Plan's Risk Assessment is based upon local hazard data. Updating the Hillside Development Overlay Zone maps would allow the County to improve its risk assessment, which can be utilized to update the State Plan's Risk Assessment.

**Ideas for Implementation:**

- Identify by mapping areas of repetitive landslide or debris flows.
- Include information from County road maintenance staff and ODOT staff to identify road infrastructure subject to loss in the past. Trouble spots for roads may include Cornelius Pass Rd., Corbett Hill Rd., and Historic Columbia River Highway.
- Consider structural approaches to reducing repetitive loss in the identified areas.

| **Coordinating Organization:** | Multnomah County Community Services Department |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Emergency Management | Oregon Department of Transportation, Dept. of Geology and Mineral Industries, Dept. Land Conservation and Development. |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Community Services Department |

## Goal 1 Action Item: ST 1.4

| Hazards Addressed | | | | | |
|---|---|---|---|---|---|
| Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | | | | ✓ |

Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs to reduce wildfire risk.

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County reported itself as having a high risk of 240. Promoting home site assessments for locations within Multnomah County's WUI can assist property owners in identifying their vulnerability to WUI fire and identifying mitigation activities. Assisting property owners with this may increase the likelihood that property owners would share responsibility for WUI fire mitigation on their properties and implement mitigation activities. Such actions can assist the County in reducing its overall WUI fire risk.
- Promoting home site assessments for locations within County's WUI can assist property owners in identifying their vulnerability to WUI fire and identifying mitigation activities. Assisting property owners with this may increase the likelihood that property owners would share responsibility for WUI fire mitigation on their properties and implement mitigation activities. Such actions can assist the County in reducing its overall WUI fire risk.
- Promoting home site assessment programs would be a way to conduct outreach to inform homeowners of the county's risk to WUI fire and keep them involved in the County's efforts to mitigate that risk.
- The State Natural Hazard Mitigation Plan's Risk Assessment is based upon local hazard data. Promoting home site assessment would allow the County to better understand wildfire risks, which can be utilized to update the State Plan's Risk Assessment.

**Ideas for Implementation:**

- Determine if the home site assessments would be free for homeowners; free if they participate in a County survey, attend a community forum, etc.; or offered at a reduced cost to homeowners.
- Work with partners to identify at-risk communities to target for the program.
- Work with partners to develop home site assessment programs. Components of the program could include:
  - Determining what the assessments of home sites would include, and who would be responsible for conducting them.
  - Determining if there is a need to prioritize at-risk communities based on vulnerability, and begin the program in the most vulnerable, highest priority communities first.
  - Identifying and developing the most appropriate methods of communication to reach at-risk homeowners.
- Identify funding sources to fund the program.

| **Coordinating Organization:** | Land Use and Transportation Division |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Emergency Management | Local Cities, Rural Fire Districts, Oregon Dept. of Forestry, State Fire Marshall, and Oregon Emergency Management. |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Land Use and Transportation Division |

| Goal 1 Action Item: ST 1.5 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Acquire heat intensity imaging of levees | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- The levees are built to be saturated with water during high water events on the Columbia and Willamette Rivers'. Once saturated minor seeps and sand boils occur which are monitored to be sure that levee integrity is not compromised. Radiometric Cameras can take heat intensity imaging photos of the levees during high water on the Columbia River. These images will be a great tool in identifying and finding the origin of minor seeps and sand boils which occur in the levee system. These seeps and boils can then be analyzed by Geo-Technical Engineers to determine the risk if any and subsequent actions taken to the levee system maintained by MCDD.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates the County's probability for a future flood event is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood event is high.

**Ideas for Implementation:**

- Explore funding opportunities and potential partners.
- Have the photos taken and analyzed.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | Multnomah County Drainage District |
| **If available, estimated cost:** | **Form Submitted by:** |
| $20,000.00 | Multnomah County Drainage District |

| Goal 1 Action Item: LT 1.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Update Flood Insurance Rate Maps (FIRM) and participate in FEMA's flood map modernization program. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having a high flood risk rating of 220 out of 240. Updated Flood Insurance Rate Maps can assist the County in more accurately predicting its risk to a future flooding event. Better predictions can assist the County to better identify mitigation strategies to reduce its flood risk.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates the County's probability for a future flood event is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood event is high. Updated Flood Insurance Rate Maps can assist the County in more accurately predicting its risk to a future flooding event. Better predictions can assist the County to better identify mitigation strategies to reduce its flood risk.
- Current FIRM do not accurately represent the flood risk in the County in all places. The Disaster Mitigation Act of 2000 requires communities to identify geographic extent of hazards known to impact the community [201.6(c)(2)(*i*)]. Updated Flood Insurance Rate Maps can assist the County better defining the flood hazard within the community given the development that has taken place since the current FIRMS were created.
- The State Natural Hazard Mitigation Plan's Risk Assessment is based upon local hazard data. Updating FIRMS would allow the County to better understand flood risks, which can be utilized to update the State Plan's Risk Assessment.

**Ideas for Implementation:**

- Contact the State Floodplain Manager at DLCD to get more information on the Flood Map Modernization Program. Work with FEMA during the Map Modernization process.
- Assist FEMA update the County's FIRMs.
- Consider working with area partners to obtain LIDAR mapping to better define flood elevations.

| **Coordinating Organization:** | Land Use and Transportation Division |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Emergency Management | Local Cities, Insurance Companies, Federal Emergency Management Agency, and Oregon Emergency Management. |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Land Use and Transportation Division |

| Goal 1 Action Item: LT 1.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Update and maintain the County risk assessment. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- Maintaining an accurate risk assessment assures that the County's action items remain relevant and address realistic risks.
- The County's understanding of risk and vulnerability is constantly improving.
- The State Natural Hazard Mitigation Plan's Risk Assessment is based upon local hazard data. Updating and maintaining the County's risk assessment will assist the State maintain Enhanced Plan status, which ultimately benefits communities in increased levels of post-disaster funding.

**Ideas for Implementation:**

- Consider new risk assessment data and its implications for action item prioritization annually (as defined in the plan maintenance section).
- At least every five years, conduct a full re-evaluation of the risk assessment.
- Look to partners for new hazards data (DOGAMI, OEM, DLCD, FEMA, ODF, USGS)

| | |
|---|---|
| **Coordinating Organization:** | Hazard Mitigation Technical Advisory Committee and Multnomah County Emergency Management |

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | Oregon Emergency Management, Dept. of Geology and Mineral Industries, Dept. Land Conservation and Development, Oregon Dept. of Transportation, Oregon Dept. of Forestry, and USGS |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Hazard Mitigation Technical Advisory Committee |

| Goal 2 Action Item: ST 2.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Seismic upgrades for Mt. Hood Community College gymnasium and Main Academic Center<br>26000 SE Stark Street,<br>Gresham, OR. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | | | | | |

**Rationale for Proposed Action Item:**

- Mt. Hood Community College is the cultural and higher education center for East County. Both the forty-year-old gymnasium and thirty-nine to twenty-nine year-old academic center are Red Cross shelter sites. The college is also the triage site for Mt. Hood Medical Center, 0.25 miles west of the college. Seismic upgrades are necessary to assure the use of these building in a disaster and in the recovery process for East County.
- The State Board of Education and Department of Geology and Mineral Industries conducted a preliminary assessment of the college buildings in August 2005 to determine how well the buildings met FEMA 154 standards. The Academic Center scored 0.1, the Allied Health addition to the main academic center scored 0.7, and the gymnasium scored 0.7. These buildings met the FEMA 178 criteria for upgrades.
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.
- In a self-completed hazard analysis, Multnomah County reported itself as having a high risk ( 240 out of 240) for the earthquake hazard. Implementing seismic upgrades will reduce the County's overall exposure and reduce the impact earthquakes would have on the community.

**Ideas for Implementation:**

- Seismic upgrades are estimated at $50.00 sq. ft.
- Academic Center, completed 6-70, 194, 070 sq. ft. $9.7 M
- Allied Health addition, completed 9-76, 63,074 sq. ft $3.15 M
- Gymnasium completed 9-70, 69,355 sq. ft. $3.5 M

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management |

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | Mount Hood Community College, City of Gresham |
| **If available, estimated cost:** | **Form Submitted by:** |
| See above | Karen Reynolds, Environmental Health and Safety Coordinator<br>503.491.7495 reynoldk@mhcc.edu |

| Goal 2 Action Item: ST 2.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Upgrade Multnomah County Drainage District Command Center | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- Facilities assessments have indicated the need to upgrade Multnomah County Drainage District's (MCDD) Command Center to improve the reliability of MCDD's Command Center Systems and give MCDD the ability to respond to and continue Emergency Operations in the event of a power outage.
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.

**Ideas for Implementation:**

- Explore possible funding sources.
- Purchase and install updated maps, 2 way hand held radios with NOAA capabilities, external containers for emergency supplies, and back up generator for MCDD EOC.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | Multnomah County Drainage District |
| **If available, estimated cost:** | **Form Submitted by:** |
| $80,000.00 (generator estimated at $60,000) | Multnomah County Drainage District |

| Goal 2 Action Item: ST 2.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop a funding strategy to reduce the risk of loss to the critical infrastructure of the Willamette River bridges managed by Multnomah County from seismic and landslide hazards. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | | ✓ | | | |

**Rationale for Proposed Action Item:**

- Multnomah County has completed a seismic analysis of the risk of loss to the bridges, updated in March of 2005. Based on the Seismic Evaluation Study of Willamette River Bridges, five of the structures have been identified as having high risk for damage from seismic events, and one bridge is known to also be subject to loss from landslide hazard.
- These bridges are all critical infrastructure to the Portland metropolitan area because they provide the transportation links across the river in the center of the metropolitan area. The Burnside Bridge is also a part of an identified emergency Lifeline Route.

**Ideas for Implementation:**

- Identify which Phase I projects can best use Hazard Mitigation funding base on risk and the County captial imporovements plan.
- Develop Pre-Disaster Mitigation Grant proposal based on the captial imporovements plan assessment and priority for seismic upgrades.

| **Coordinating Organization:** | Multnomah County Emergency Management / Board of Commissioners |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| DBCS Bridges | Cities<br>State Agencies |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Emergency Management |

| Goal 2 Action Item: ST 2.4 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Seismic upgrades Multnomah County Courthouse<br>1021 SW 4th Ave,<br>Portland, OR. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- The historic 1914 Multnomah County Courthouse houses the 38 judicial officers of the 4th Judicial Circuit Court and their 292 support staff; the District Attorney and 229 staff members; 38 Sheriff personnel involved in detainee transport and security; and approximately 132,000 County residents (20% of County population) are summoned to the building each year for jury duty. With the Court processing 50% of the civil and criminal cases in the State of Oregon and providing all the municipal services for the City of Portland, the building is a critical link for the City, County, and State's public safety system and would provide massive chaos if lost in a natural disaster.
- Van Domelen/Looijenga/McGarrigle/Knauf, a structural engineering firm, conducted a preliminary assessment of the 300,000 sq ft building in 1991. The building ranked an Rw value of 5 or a base shear value of 5.1 million pounds for a zone 2b. With current City of Portland code for essential buildings beginning at 6.4 million pounds, the existing building is deficient. Seismic upgrades were estimated in 1991 dollars at $16 million. The County is currently reflecting a total deferred maintenance budget of $64 million for the building. $29.6 million of that is considered seismic improvements. Other safety issues within the Courthouse include ADA compliance, Fire/Life/Safety issues, security requirements, and antiquated equipment.

**Ideas for Implementation:**

- The County has no way of addressing seismic issues while building is in its overcrowded and functioning state.
- Replacing the building with a new facility would allow the County to move all the functions to a new location and then improve the historic building while in a vacant state.
- A 500,000 sq ft replacement building's construction costs have been estimated at $158 million or $316 per sq ft.
- Moving costs are estimated to be $1.5 million (assumes only move costs does not include any equipment, modular furniture, furniture, or etc.)
- Full renovation and seismic upgrade for the existing historic building has been estimated at $80 million or $267 per sq ft.

| **Coordinating Organization:** | Multnomah County Facilities & Property Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| County Sheriff, District Attorney, Department of County Management, Board of County Commissioners. | State of Oregon Chief Justice, Presiding Court Judge, State Court Administrator, City of Portland, METRO, Oregon State Bar Association, Multnomah Bar Association, Portland Business Alliance, City of Gresham, and Portland Development Commission. |
| **If available, estimated cost:** | **Form Submitted by:** |
| $238,000,000 | Multnomah County Facilities & Property Management |

| Goal 2 Action Item: ST 2.5 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Analyze each repetitive loss property to identify viable mitigation options. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | | |

**Rationale for Proposed Action Item:**

- According to the state-maintained database on repetitive loss properties and analysis conducted by Multnomah County's GIS department,
- Multnomah County Natural Hazard Mitigation Plan Multnomah County has 11 repetitive loss properties. Generally, they are located as follows:
  - One property within the City of Troutdale along the lower Beaver Creek floodplain
  - Two properties within the City of Portland, in the Willamette River floodplain between Ross Island and the Sellwood Bridge.
  - Eight properties are located in the middle reaches of the Johnson Creek watershed. They are generally located in the Pleasant Valley area, a pocket of unincorporated Multnomah County that is planned to be incorporated into the City of Gresham.

**Ideas for Implementation:**

- Use insurance claim data from FEMA and OEM to identify properties in the City that have filed more than one National Flood Insurance Program (NFIP) insurance claim. Some properties that have experienced repetitive flood damage may not be enrolled in the NFIP (e.g., properties not in the floodplain, but experiencing damage from urban flooding). Data concerning these properties may be more difficult to obtain;
- Map and analyze each repetitive loss property to develop appropriate mitigation actions.
- Consider identified properties for mitigation activities. Funding for mitigation may be available through FEMA's Hazard Mitigation Grant or Flood Mitigation Assistance programs; and
- Prioritize properties for mitigation activities using a benefit/cost analysis.

| **Coordinating Organization:** | Land Use Transportation Division |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Emergency Management<br>Information Technology/GIS | Oregon Emergency Management and Dept. Land Conservation and Development |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | |

| Goal 2 Action Item: LT 2.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Evaluate current zoning codes to incorporate mitigation principles that reduce the loss from flood and landslide. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Implementing mitigation principles through existing zoning codes allows the County to reduce the duplication of efforts.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings [201.6(c)(3)(ii)]. Evaluating and enhancing zoning codes would address the future built environment and would also help further the objectives of Oregon Statewide Land Use Planning Goal 7 - Areas Subject to Natural Disasters and Hazards
- The County landslide hazard zone has not been reviewed or updated since its inception in 1990 and should be reviewed in light of the experience of losses since that time.
- Statewide planning Goal 7, requires local governments to adopt comprehensive planning programs (i.e., inventories, maps, policies, and implementing ordinances) to address natural hazards; including riverine flood hazards. Local governments are deemed to comply with Goal 7 for flood hazards if they adopt and implement local floodplain programs that meet the minimum NFIP requirements. This action would allow the County to move towards exceeding the NFIP requirements.

**Ideas for Implementation:**

- Identify mitigation principles missing from existing zoning codes, or existing codes that mitigation principles could be added to, specific to flood and landslide.
- Research the possibility for implementing mitigation principles them through zoning codes, and implement if possible.
- Consider including a property buy out approach to areas of reoccurring loss from flood and landslide.

| | |
|---|---|
| **Coordinating Organization:** | Land Use and Transportation Division |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Emergency Management | Planning Commission, City of Gresham, City of Portland, and Board of County Commissioners |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Land Use and Transportation Division |

| Goal 2 Action Item LT 2.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Explore the development of management strategies to preserve the function of the floodplain | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | | |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having a high flood risk rating of 220 out of 240. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates the County's probability for a future flood event is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood event is high. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings [201.6(c)(3)(*ii*)]. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.

**Ideas for Implementation:**

- Continue involvement in Johnson Creek and other floodplain management programs
- Identify the functions of the floodplain that are important to Multnomah County.
- Identify the departments and agencies responsible for maintaining and preserving those functions.
- Work with those departments and agencies to develop management strategies for preserving those functions.
- Develop methods for monitoring, evaluating, and updating those management strategies.

| **Coordinating Organization:** | Land Use and Transportation Division |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | City of Portland<br>FEMA<br>DSL<br>ODFW<br>OWRD<br>Watershed Councils |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Land Use and Transportation Division |

| Goal 2 Action Item LT 2.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Qualify Multnomah County for the FEMA Community Rating System (CRS) program | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | | |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having a high flood risk rating of 220 out of 240. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.
- Participation in the CRS program can assist the County in more accurately predicting its risk to a future flooding event.
- County participation in the CRS program reduces insurance rates for home owners located in the floodplain.
- Statewide planning Goal 7, requires local governments to adopt comprehensive planning programs (i.e., inventories, maps, policies, and implementing ordinances) to address natural hazards; including riverine flood hazards. Local governments are deemed to comply with Goal 7 for flood hazards if they adopt and implement local floodplain programs that meet the minimum NFIP requirements. This action would allow the County to move towards exceeding the NFIP requirements.

**Ideas for Implementation:**

- Contact the State and FEMA to obtain more information on the Community Rating System Program
- Develop a work program to meet the CRS requirements.
- Consider a program to prevent localized flooding of transportation infrastructure including culverts in floodplain areas.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Land Use and Transportation Division | Insurance Companies<br>Local Cities<br>FEMA<br>OEM |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Land Use and Transportation Division |

| Goal 2 Action Item: LT 2.4 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Assess, design, and repair County waterways that are in danger of failure due to high water. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- During flooding certain points of a waterway are prone to failure and potential damage to the built environment. Finding those points and reinforcing them to withstand a major flood could keep transportation and utilities from failing.
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.

**Ideas for Implementation:**

- Contract a hydrogeologist/geomorphologist to inventory and analyze potential failure points.
- Contract design build firm to do design, permitting, and construction.
- Prioritize high risk waterways for implementation
- This project would be executed in partnership with the U.S. Dept. of Agriculture, Natural Resource Conservation Service.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| To be determined | Soil and Water Conservation Districts, Army Corps of Engineers, Division of State Lands |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Steven Fedje, District Conservationist USDA-NRCS |

| Goal 2 Action Item: LT 2.5 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop and a food distribution contingency plan. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- If a hazard event requires prolonged recovery, feeding the urban populations of Multnomah County could become difficult. This is especially true if major roadways and bridges are harmed.
- Increase the self-reliance of the population within the metropolitan confines. Community gardens, CSA's, urban agriculture enterprises establish multiple food sources.

**Ideas for Implementation:**

- Support the Diggable City Project, return 4-H program with emphasis on self-reliance, storage and food production. Have a food distribution contingency plan developed to distribute perishable food.
- The plan should focus on:
  - Maintaining transportation lines from food production and distribution facilities in and around Portland.
  - Support of urban agriculture
- Plan should be developed in collaboration with the U.S. Department of Agriculture – Natural Resource Conservation Service

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| All Hazard Mitigation Technical Advisory Committee Members | City of Portland, OSU Extension, Soil and Water Conservation Districts, City of Portland |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Steven Fedje, District Conservationist USDA-NRCS |

| Goal 2 Action Item: LT 2.6 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Create mechanisms and incentives for home retrofit, including grants and tax incentives | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- Home retrofits can reduce the loss of life and property in earthquake events, but many people do not have the money necessary to undertake these projects in their homes.
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.

**Ideas for Implementation:**

- Work with County Commissioners to create tax incentives for property owners with retrofits in place.
- Develop grant programs to assist property owners (including owners of for-rent units) as they retrofit their homes.
- Consider Seattle's home retrofit program (Regional Home Retrofit) as a model for this program.

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Commissioners, Building Code Enforcement | Home Depot and other private partners, City of Gresham, City of Portland |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Stakeholder Forum group |

| Goal 2 Action Item: LT 2.7 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop acquisition and management strategies to preserve parks, trails, and open space in the floodplain. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | | |

**Rationale for Proposed Action Item:**

- To manage the resource more effectively and efficiently by, both:
  - Proactively preventing / avoiding future problem re: new development
  - Making necessary corrections / modification re: existing development

- In a self-completed hazard analysis, Multnomah County rated itself as having a high flood risk rating of 220 out of 240. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.
- Statewide planning Goal 7, requires local governments to adopt comprehensive planning programs (i.e., inventories, maps, policies, and implementing ordinances) to address natural hazards; including riverine flood hazards. Local governments are deemed to comply with Goal 7 for flood hazards if they adopt and implement local floodplain programs that meet the minimum NFIP requirements. This action would allow the County to move towards exceeding the NFIP requirements.

**Ideas for Implementation:**

- Develop a comprehensive strategy for acquiring and managing floodplain openspace in the County, including establishment of GRC's to prevent, control, mitigate illegal encroachment onto County-owned openspace (includes inventory of illegal encroachments, development of educational materials to gain voluntary mitigation, before resorting to enforcing City code(s))
- Develop a partnership involving County agencies regional flood mitigation organizations
- Identify sites where environmental restoration work can benefit flood mitigation, fish habitat, and water quality; and
- Work with landowners to develop flood management practiced that provide healthy fish habitat

| | |
|---|---|
| **Coordinating Organization:** | Environmental Services Division |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Emergency Management | Neighborhood Associations; appropriate watershed councils, FEMA, ODFW, City of Gresham, Nature Conservancy |
| **If available, estimated cost:** | **Form Submitted by:** |
| $100,000 | Environmental Services Division |

| Goal 2 Action Item LT 2.8 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop a vegetation management program to manage areas within and adjacent to right of ways in order to reduce the risk to tree failure and property damage. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | | | | ✓ | |

**Rationale for Proposed Action Item:**

- To increase public safety in parks, trails, and open spaces
- To protect private and city owned property
- To reduce the County's liability exposure
- To obtain the most effective and efficient utilization of County maintenance personnel and resources
- To minimize / prevent future hazard exposure, through improved plan development and review processes (e.g., allow Parks OPS a more active role in plan review, when County and/or private development occurs within and/or adjacent to Parks, trails, and/or openspaces, having the potential for direct and/or indirect impacts on Parks operations and maintenance responsibilities).
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.

**Ideas for Implementation:**

- Develop landscape and street tree standards that have fewer impacts on County and private properties and infrastructure
- Develop a closer working relationship / better collaboration between all affected County departments / divisions, utility providers, and developers
- Work with State agencies, insurance providers, utility providers and other interested parties to identify best management practices.
- Build upon the State Natural Hazard Mitigation Plan's Windstorm action items.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Public Works, Information Technology Services / GIS | Neighborhood Associations; PGE; City of Gresham; appropriate watershed councils |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Emergency Management |

| Goal 3 Action Item: ST 3.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop and implement Multnomah County Information Technology Disaster Recovery Planning | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- In the event of a natural disaster or other emergency it is important that access to the County's business systems be restored in a planned, systematic and meaningful way. Currently, IT has the primary County data center located in SE Portland, with backup equipment located near the downtown area. Should there be an emergency or natural disaster, IT's ability to restore service in a responsive way is limited by the lack of an enterprise-wide plan, defined service priorities or the equipment to make it happen. This project will create a cross-departmental plan to bring critical business systems back online then implement it.
- This plan addresses the critical issue of restoring critical County services to the public by providing the ability to access electronic data and telecommunications systems in a planned, systematic and timely manner.

**Ideas for Implementation:**

- The County has identified a 3-level disaster recovery strategy that addresses the need to bring systems and data back online, with each level building on the one below it. The initial plan will be created by working with all County business units to determine critical systems, their impact on the community and any resources that must be accessed during the course of emergency management.
- The first level will develop an enterprise-wide plan to address disaster recovery then purchase and implement localized network redundancy to a secondary disaster recovery site that currently contains a limited amount of redundant equipment. This level will allow business functions to be restored within 60-90 days of an event.
- The second level builds on the infrastructure created at Level 1 and includes the purchase of equipment and circuits that will allow data and business systems to be recovered within 7-14 days of a disaster. The systems and data, when brought back online, will be no older than 3 days.
- The third and highest level of DR protection will utilize a dedicated, live backup location out of the immediate geographic area which will ensure that data, when back online, will be no older than 1 day from the time of the event. This level will also ensure that the systems will be available within 3 days of the disaster. This option provides Wide Area Network access to the Disaster recovery site from internal business locations and Internet access for external partners.
- In order to implement a level 3 solutions, levels 1 and 2 must also be purchased and implemented.

| **Coordinating Organization:** | Multnomah County Information Technology - Infrastructure Group |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| County Business Units | City of Portland, Critical Vendors, |
| **If available, estimated cost:** | **Form Submitted by:** |
| All Costs are approximate:<br>Level 1: $182,000.00<br>Level 2: Level 1 plus additional $658,900.00<br>Level 3: Level 1 and 2 plus additional $335,800.00 Total of all 3 Levels: $1,176,700.00 | IT Planning & Administration - Multnomah County |

| Goal 3 Action Item: ST 3.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Establish training and outreach program to promote private business continuity planning | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- Multnomah County operates within a regional economy that includes the surrounding counties: Clackamas, Washington, and Clark (in Washington State).
- Any hazard that caused an economic impact in Multnomah County could have a ripple effect that impacts the regional economy.
- Small businesses often don't have the resources (time, money, and experience) to plan to maintain business functions after a disaster occurs. These businesses are an important part of our regional economy
- In a larger disaster event that impacted the whole region (such as an earthquake or a severe winter storm), the regional economy would certainly be impacted as well.
- In the future, the high tech industry, electronics, transportation, metals, healthcare, administrative, finance and retail trade sectors will continue to grow and develop to provide goods, services, and work opportunities for the residents of Multnomah County and the region
- Utilizing training and outreach to promote business continuity planning will assist in meeting the State Natural Hazard Mitigation Plan's Goal 2 - Motivate the public, private sector, and government agencies to mitigate against the effects of natural hazards through information and education.

**Ideas for Implementation:**

- Establish a diverse working group of both public and private partners to oversee the development of this program.
- Evaluate and utilize established models and other educational materials for business continuity planning, such as the Institute for Business & Home Safety Open for Business Tool-Kit
- Partner with the statewide efforts such as the Partners for Disaster Resistance & Resilience: Oregon Showcase State Initiative to implement training programs.

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Business permitting agency | IBHS, Small Business groups, chambers of commerce |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Stakeholder forum group |

| Goal 3 Action Item: ST 3.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Install fiber optic communications network to fill 7,000 foot gap in existing conduit path for emergency communications and transportation data. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- Following the installation of a secondary fiber optic system by ODOT in 2006, The City of Gresham and Multnomah County will be lacking a critical 7,000 foot connection to the new system, creating a gap in the regional communications network for emergency communications and traffic control for the entire East County area.
- This connection to the network via an alternate path would provide additional networking capacity and provide redundancy necessary to support critical emergency and transportation related information for all of east Multnomah County.

**Ideas for Implementation:**

- Work with ODOT and Multnomah County to install 7,000 foot connection.

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management |

| **Internal Partners:** | **External Partners:** |
|---|---|
| To be determined | ODOT and City of Gresham |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | City of Gresham Transportation Services |

| Goal 3 Action Item: LT 3.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Provide secondary power grids to flood protection storm water pump stations. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | ✓ | |

**Rationale for Proposed Action Item:**

- Facilities assessments have shown that not all District flood control pump stations are connected to secondary power grids. Secondary power grids to pump stations will provide an additional layer of redundancy that will improve the reliability of the flood protection provided by these pump stations. In a power outage power to these pump stations could be routed by the power company from another sub station in the event one sub station went down to restore pumping capabilities before flooding can occur.
- Much of the land within the drainage district is industrial or other employment land; major flooding in the area would impact the regional economy.
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.

**Ideas for Implementation:**

- Explore possible funding sources. Coordinate with power companies to provide secondary power grids.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Engineering | Pacific Power and Light, Portland General Electric, Multnomah County Drainage District |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Drainage District |

| Goal 3 Action Item LT 3.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Create a back-up river crossing system of barges or ferries | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | | | | ✓ | |

**Rationale for Proposed Action Item:**

- Earthquakes have the potential to greatly disrupt transportation systems in the County because most bridges are no seismically retrofitted.
- Incapacitated bridges can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to clients.
- In Multnomah County, there are 504 bridges, with the following ownership:
  - 333 state highway bridges
  - 44 County highway bridges
  - 126 city or municipal highway bridges
  - 1 Historic covered bridge.
- The County has three major expressways: I-5 funs north/south through Portland Metropolitan Area, and is the main passage for automobiles and trucks traveling from Washington to California. I-84 is the main transportation route for automobiles and trucks traveling from Oregon to central and eastern states. It intersects with I-5 in Portland. I-205 is a bypass route for north/south traffic on I-5; it intersects with I-5 in Clackamas County and winds northeast through Multnomah County. It re-connects with I-5 in Washington State.
- Only one bridge provides access to Sauvie Island, a major regional agricultural area that could provide food to the region in the event of a disaster.

**Ideas for Implementation:**

- Provide a system redundancy through ferries or barges.
- Ferries could operate year round as public transportation. A nonprofit organization (Rivers West) is currently working to get ferries in operation as public transportation. Partner with this organization in the plan development stage to assure that their ferries would be available in an emergency if bridges were compromised.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Land Use and Transportation | Rivers West (Capt. Peter Wilcox) |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Rivers West |

| Goal 3 Action Item: LT 3.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Assess the condition of and, if necessary, replace or repair the stormwater infrastructure under major County transportation routes, such as I-84 and Marine Drive. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | | ✓ | | | | |

**Rationale for Proposed Action Item:**

- The UPRR line is a main line that supports a major link for economic growth and commerce. It is critical that this line remain operational at all times. Prevention of such hazard can be achieved by assessing the condition and repair/replacement of the underlying stormwater infrastructure. Flooding of the railway and/or railway ballast is an imminent yet avoidable hazard to the operation of this mainline.
- Highway 84 is also a major commerce link. Natural flooding hazard prevention is critical to the region.
- The implementation of prioritized local mitigation activities assists the State in meeting Goal 3 of the State Natural Hazard Mitigation Plan – Coordinate and establish priorities for natural hazard mitigation programs and activities at all levels in the State of Oregon.

**Ideas for Implementation:**

- Assess condition of storm line(s)
- Determine safety/risk hazard
- Rehabilitate or replace storm line(s)
- Abandon existing storm line(s)
- Stormwater trunk lines exist in multiple locations in Gresham:
  - NE Airport Way
  - NE 190th Avenue
  - NE 194th Avenue (2 Crossings)
  - NE 162nd Avenue
- Other locations throughout the County

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| To be determined | UPRR, ODOT, FEMA, Stormwater Division, DES Gresham |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | City of Gresham, DES |

| Goal 4 Action Item: ST 4.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop public official information kit that can be distributed to elected officials and community decision makers. The kit should include pertinent information regarding the Natural Hazard Mitigation Plan and Steering Committee and its activities as well as facts and figures on the Natural Hazards the County is facing. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Informing elected officials of their role in the County's risk mitigation efforts, not only increases officials' awareness of the county's hazard risks, but assists elected officials in making more informed decisions regarding hazards. More informed decisions regarding natural hazards assist the County in reducing its overall risk to the hazards addressed in the NHMP.
- Mitigation is a shared responsibility between local, state, and federal government; citizens; businesses; non-profit organizations; and others. Informing elected officials of their role in the County's risk mitigation efforts, not only increases the public's awareness of the county's hazard risks, but also helps the County reduce its risk to the hazards addressed by the NHMP.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Multnomah County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Informing elected officials of their role in the County's risk mitigation efforts, not only increases officials' awareness of the county's hazard risks, but assists elected officials in making better informed decisions regarding hazards. More informed decisions regarding natural hazards assist the County in reducing its overall risk to the hazards addressed in the NHMP.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(*ii*)]. Providing information to public officials about Linn County's risk to the hazards addressed in the NHMP would assist the elected officials in making more informed decisions regarding natural hazards. More informed decisions regarding natural hazards assist the County in reducing its overall risk to the hazards addressed in the NHMP.

**Ideas for Implementation:**

- Identify pertinent information to provide to and share with elected officials regarding the hazards addressed in the NHMP.
- Provide annual report on mitigation activities as outlined in Section 5 of the plan
- Develop strategies for delivering the information to elected officials. Such methods could include:
  - o Quick reference fact sheets.
  - o Mailing such materials out to elected officials.
  - o Informing elected officials of the existence of hazard related materials.
- A County-sponsored seminar for elected officials regarding hazards.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Hazard Mitigation Technical Advisory Committee | State agencies |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Emergency Management |

| Goal 4 Action Item: ST 4.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop and distribute a Natural Hazard Community Resource Maps and risk reduction tips that include instructions about how to prepare and reduce risks posed by natural hazards. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- It is vital that for the County to have a broad public outreach and information program so that its residents are aware of the potential hazards and how to avoid or respond to them.
- In a self-completed hazard analysis, Multnomah County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Providing information to the public in order to help them independently manage their response to hazard events can improve survivability during post disaster period.
- Coordinating of outreach effort could leverage resources and allow for a more comprehensive approach.
- Utilizing map products as outreach materials will assist in meeting the State Natural Hazard Mitigation Plan's Goal 2 - Motivate the public, private sector, and government agencies to mitigate against the effects of natural hazards through information and education.

**Ideas for Implementation:**

- Identify public outreach professionals who might be involved in this process.
- Develop a mitigation marketing plan to identify areas where coordinated efforts could maximize outreach impact.
- Utilize maps and graphic that can also assist with preparedness such as Identifying evacuation routes.
- Research existing publications and use maps to communicate risk and vulnerability
- Focused on self-help, preparedness and risk reduction. Identify business partners for outreach opportunities.
- Include instructions of how to prepare for natural disasters in advance, and what to do during and after the event.
- Consider a web-based tool that connects directly to mitigation and / or preparedness resources.

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management / Information Technology/GIS |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Hazard Mitigation Technical Advisory Committee | Oregon Emergency Management, Federal Emergency Management Agency, Rockwood Weed & Seed program, school districts, churches, apartment owners/mangers, Oregon congressional reps. Etc. |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Emergency Management |

| Goal 4 Action Item: ST 4.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Earthquake Awareness and Mitigation Assistance Outreach | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | | | | | |

**Rationale for Proposed Action Item:**

- According to the U.S. Census and other demographic information, the City of Gresham has a high concentration of lower income/poor households who speak little or no English. These include Hispanic and Russian/eastern European immigrant populations that are concentrated in the Rockwood/west Gresham area. Many live in apartments and other rental housing.
- A special outreach effort is needed to make these groups aware of the potential for a destructive earthquake, how to prepare for such an emergency, what actions to take to minimize injury, etc. In addition, there may be an opportunity to offer financial and technical assistance to do seismic upgrades of apartments, schools and other critical structures.
- Creating local awareness campaigns will assist in meeting the State Natural Hazard Mitigation Plan's Goal 2 - Motivate the public, private sector, and government agencies to mitigate against the effects of natural hazards through information and education.

**Ideas for Implementation:**

- Develop an earthquake awareness brochure in Spanish, Russian, etc. that can be distributed in mail with utility bills, etc. or distributed at meetings, churches, schools, etc. Brochures should discuss the potential for seismic damage, what to expect during an earthquake, what to do during an earthquake, and how to prepare an emergency kit for the home, etc.
- Hold awareness meetings in apartment complexes, schools, etc. Get apartment managers/owners, school principals, etc. involved in preparing an earthquake action plan for each facility.
- Establish a low or no interest revolving loan fund to do seismic upgrades of apartments, schools and other structures that have high concentrations of people.
- Have free technical assistance available to help people upgrade their structures.
- Coordinate with state agencies such as Oregon Emergency Management and Department of Geology and Mineral Industries on the statewide April earthquake awareness campaign.

| **Coordinating Organization:** | Multnomah County/City of Gresham |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Fire & Emergency Services, Urban Renewal, DES, CEDD<br>Multnomah County: Emergency Management | Oregon Emergency Management,<br>Department of Geology and Mineral Industries,<br>Federal Emergency Management Agency, Rockwood Weed & Seed program, school districts, churches, apartment owners/mangers, Oregon congressional reps. |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | City of Gresham |

| Goal 4 Action Item: ST 4.4 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Research ways to Create and disseminate a message that will cause people to act to reduce personal risk. Target education and outreach message to reach marginalized populations. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- Multnomah County is growing, between 1990 and 2000, the County population increased 13%.
- In any population, some have more resources (financial, physical, and social) to prepare for, respond to, and recover from a disaster.
- Of this number, a disproportionate burden is placed upon special needs groups, particularly low-income populations, minorities, and the elderly.
- Plans that inadequately address the social system component of the community implicitly assume that hazards strike demographically homogenous populations.
- People are aware of risk but many do not take actions required to reduce risk. For example, only 13% of County residents actually have 72 hour kits.
- Targeting and effective message to the populations most at risk could reduce risk significantly.

**Ideas for Implementation:**

- Establish an outreach and awareness working group
- Establish a seasonal awareness campaign that leverages off statewide effort for earthquake, wildfire, and flood.
- Identify trusted source to carry the message.
- Partner with grass roots and top level leaders to assure that the message is appropriate and targeted.
- Focus outreach to community groups
- Door to door education campaign by volunteer groups
- Education through the schools (teach kids to reach their parents)
- Education through church groups
- Partner with large businesses for resources.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Hazard Mitigation Technical Advisory Committee | Social service agencies that work with at risk populations; community groups; American Red Cross |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Stakeholder forum group |

| Goal 4 Action Item: ST 4.5 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Involve the public in updating the Natural Hazard Mitigation Plan | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- The general public is an important stakeholder in natural hazard mitigation planning; involving them in the planning process will lead to a more realistic and responsive plan.
- Public participation is also a requirement of the Federal Emergency Management Agency.
- The Disaster Mitigation Act of 2000 [201.6(c)(4)(iii)] requires that local natural hazard mitigation plans identify how the public will continue to be involved in the plan. Implementing the ideas below would assist in meeting this requirement.

**Ideas for Implementation:**

- Design and implement an online system for collecting public comment on the plan.
- Work with Portland Office of Emergency Management to learn how they developed their system.
- Incorporate comments from the website into County's Natural Hazard Mitigation Plan.
- Continue outreach to the public regarding mitigation activities and plan updates, and incorporate these comments into the yearly review of the plan.

| **Coordinating Organization:** | Multnomah County Emergency Management |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Hazard Mitigation Technical Advisory Committee | City of Portland<br>The public |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Multnomah County Emergency Management |

| Goal 5 Action Item: ST 5.1 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop formal agreements (such as Memorandums of Understanding, MOUs) with internal (departments) and external partners (e.g. non-profit organizations, cities, and state agencies) to work together on risk reduction efforts in the County. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Developing formal agreements with internal and external partners could assist the partners in collaborating and sharing the responsibility of natural hazard mitigation. Such actions to form collaborative partnerships and commitments to mitigation can assist the County in reducing its risk to the natural hazards addressed by the NHMP.
- Encourages communities to confirm and clarify responsibilities through formal agreements in order to implement the plan.
- Mutual Aid Agreements are commonly used in the emergency management field to pre-arrange assistance with other agencies or jurisdictions in case of an event. This concept, under the term "Memorandum of Understanding" could be applied to pre-disaster mitigation to confirm collaboration on natural hazard mitigation activities.
- The Disaster Mitigation Act of 2000, Section 201.6(c)(4)(ii), requires that plans include a maintenance plan to ensure that the plan is implemented as intended. The MOUs will help ensure that internal and external partners collaborate in implementing risk reduction activities.

**Ideas for Implementation:**

- Create a signature page for the Natural Hazard Mitigation Plan that must be signed by all County department heads indicating that they have received the plan and intent to assist in its implementation
- Identify and pursue MOUs with potential external partners such as non-profit organizations or state and federal agencies that may be able to assist in implementing pre-disaster mitigation activities.
- Renew MOUs as needed so that they can be updated to reflect the changing needs and conditions of the community and internal and external partners; have both internal and external partners resign the updated MOUs each calendar year.

| **Coordinating Organization:** | Multnomah County Board of Commissioners / Hazard Mitigation Technical Advisory Committee |
|---|---|

| **Internal Partners:** | **External Partners:** |
|---|---|
| Emergency Management and Land Use and Transportation Division | To be determined |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Hazard Mitigation Technical Advisory Committee |

| Goal 5 Action Item: ST 5.2 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Encourage and support the development of local community plan supplements to the County Natural Hazard Mitigation Plan | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Supporting the development of local community plans allows for better risk assessment data collection at the local level. Better local risk assessment data improves the county's risk assessment data. Improved county risk assessment data assists the county in better identifying at-risk areas and methods for mitigating those risks, helping the county reduce its overall risk to hazards.
- The County plan only covers unincorporated Multnomah County and not incorporated communities. Supporting the development of such local city plans that will supplement the County plan and improve the data and coverage of the County NHMP. Such actions can assist the County in reducing its overall risk to hazards addressed by the NHMP.

**Ideas for Implementation:**

- Hold a forum to inform incorporated communities about the FEMA planning requirements.
- Assist communities with the mitigation planning process. Possible methods include:
  - Develop or acquire existing materials with information about the natural hazard mitigation planning process that could be distributed to project directors and emergency managers of city plans.
  - Provide links on the County's website for plan documents, and include an e-mail address and/or phone number that communities can contact for questions or assistance.
- A County-hosted workshop to provide information and assistance to project managers and emergency managers involved in city plans.

| | |
|---|---|
| **Coordinating Organization:** | Hazard Mitigation Technical Advisory Committee and County Planning and Building Departments |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Hazard Mitigation Technical Advisory Committee | Local Cities<br>FEMA<br>OEM |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Hazard Mitigation Technical Advisory Committee |

| Goal 5 Action Item: ST 5.3 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Develop a web-based or other electronic communication tool for the Hazard Mitigation Technical Advisory Committee and for the public to comment on the plan | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- An electronic tool would assure that all HMTAC members are able to rapidly communicate with one another as projects are prioritized and implemented, leading to real-time discussion of issues.
- This tool could allow for more rapid response to funding availability as projects are implemented, as well as facilitate discussion when no regular meetings are scheduled.
- Such tools are relatively cheap and easy to implement, and often do not require the purchase of additional software or hardware.
- The Disaster Mitigation Act of 2000 [201.6(c)(4)(iii)] requires that local natural hazard mitigation plans identify how the public will continue to be involved in the plan. Creating a formal method for public input would assist in meeting this requirement.

**Ideas for Implementation:**

- Email or blogged conversations would supplement, but not replace, the meetings described in Section 5 of this plan.
- Consider existing software and hardware before looking to new programs.

| | |
|---|---|
| **Coordinating Organization:** | Multnomah County Emergency Management / Hazard Mitigation Technical Advisory Committee |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Hazard Mitigation Technical Advisory Committee | To be determined |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Hazard Mitigation Technical Advisory Committee |

| Goal 5 Action Item: ST 5.4 | Hazards Addressed | | | | | |
|---|---|---|---|---|---|---|
| Establish mitigation benchmarks to assist in evaluating and updating the plan. | Earthquake | Flood | Landslide | Volcanic | Severe Weather | Wildfire |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Rationale for Proposed Action Item:**

- In a self-completed hazard analysis, Multnomah County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Establishing mitigation benchmarks can assist the County in more effectively and efficiently updating and evaluating its plan, helping the County reduce its risk to the hazards addressed by the NHMP.
- The ways in which natural hazards affect communities cannot be completely predicted and are subject to change. As risk assessment information changes or is updated, the predictions for how natural hazards will affect a community also change. Establishing benchmarks will provide an opportunity to incorporate new and updated risk assessment data into Multnomah County's NHMP, assisting the County in mitigating the affects of natural hazards addressed by the Plan.
- The Disaster Mitigation Act of 2000 requires that communities describe how they will monitor, evaluate and update their plans within a five-year cycle [201.6(c)(4)(*i*)]. Establishing benchmarks will assist the County in evaluating and updating its plan, and allow the County to easily identify what has been accomplished and what remains to be completed.

**Ideas for Implementation:**

- Research existing federal requirements for five-year cycle of plan monitoring, evaluation, and updating. Incorporate any appropriate requirements into Multnomah County's mitigation benchmarks.
- Identify and document potential mitigation benchmarks
- The Steering Committee will convene annually to evaluate existing bench marks and identify any modifications or adjustments that need to be made to existing benchmarks.
- Partner with appropriate state agencies for assistance in developing appropriate benchmarks.
- Incorporate identified benchmarks into all Plan review and evaluation meetings.

| | |
|---|---|
| **Coordinating Organization:** | Hazard Mitigation Technical Advisory Committee and Land Use and Transportation Division |

| **Internal Partners:** | **External Partners:** |
|---|---|
| Multnomah County Emergency Management | To be determined |
| **If available, estimated cost:** | **Form Submitted by:** |
| N/A | Hazard Mitigation Technical Advisory Committee |

Section 5

# Plan Maintenance and Implementation

The plan maintenance section of Multnomah County's Natural Hazard Mitigation Plan details the oversight structure and the formal process that will ensure that the plan remains an active and relevant document. This section is divided into the following parts, which together define the County's strategy for maintenance and implementation:

- **Plan adoption** describes the process for formal review and adoption of the plan.
- **Monitoring and implementing the plan** establishes roles and responsibilities for maintenance, reporting, and implementation through existing programs.
- **Project prioritization process** describes the four step process that will be used to prioritize activities and ensure that mitigation dollars are used cost–effectively.
- **Plan maintenance and public involvement** defines a semi-annual and five-year schedule for (1) monitoring, reporting, and evaluating current and new action items, (2) incorporating new information related to the risk assessment, and (3) continuing public outreach.

## PLAN ADOPTION

### FORMAL ADOPTION PROCESS

The Multnomah County Board of Commissioners is responsible for adopting and revising the County's Natural Hazards Mitigation Plan. This governing body has the authority to promote sound public policy regarding natural hazards. Once the plan has been adopted, the County Emergency Manager will be responsible for submitting it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management will then submit the plan to the Federal Emergency Management Agency (FEMA) for review. This review will address the federal criteria outlined in FEMA Final Rule 44 CFR Part 201. Upon acceptance by FEMA, Multnomah County will gain eligibility for Hazard Mitigation Grant Program funds.

# MONITORING AND IMPLEMENTING THE PLAN

## COORDINATING BODY

The County's Hazard Mitigation Technical Advisory Committee (HMTAC) is responsible for coordinating implementation of plan action items and undertaking the formal plan review and update process. The HMTAC consists of representatives from County departments, private industry, non profit organizations and public agencies. Members of the steering committee include:

- County Emergency Management
- County Department of Community Services
- County Land Use Planning
- County GIS
- County Property Liability Program
- Multnomah County Drainage District
- Multnomah County Facilities
- Port of Portland Risk Management
- City of Gresham Emergency Management

The HMTAC, selected by the County Emergency Manager and appointed by the County Commissioners, will serve as the working committee and meet quarterly to (1) outline future work, (2) review department progress and (3) coordinate implementation. They will develop the agenda for the annual meetings and provide progress reports to the County Emergency Manager on a regular basis.

Additionally, to make the coordination and review of Multnomah Natural Hazard Mitigation Plan as broad and useful as possible, the HMTAC will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items. The members of this review board are (but not limited to):

- School Districts representation
- A representative from American Red Cross: Oregon Trail Chapter
- Representatives from each incorporated city
- An insurance industry representative

- A professional organization representative such as the Home Builders, architect affiliate, or property management organization

- A business community or major industry representative, such as Columbia Corridor Association or Boeing

- Subject matter experts for specific hazards

- State agency representatives such as Department of Geology and Mineral Industries and Department of Forestry

- Representation from environmental organizations

- Representative from METRO

The HMTAC will review the Multnomah Natural Hazard Mitigation Plan at least once each year, after the plan is approved by FEMA and adopted by the County Commissioners. These meetings will provide an opportunity to discuss the progress of the action items in the plan, and maintain the partnerships that are essential for the sustainability of the Natural Hazard Mitigation Plan.

## CONVENER

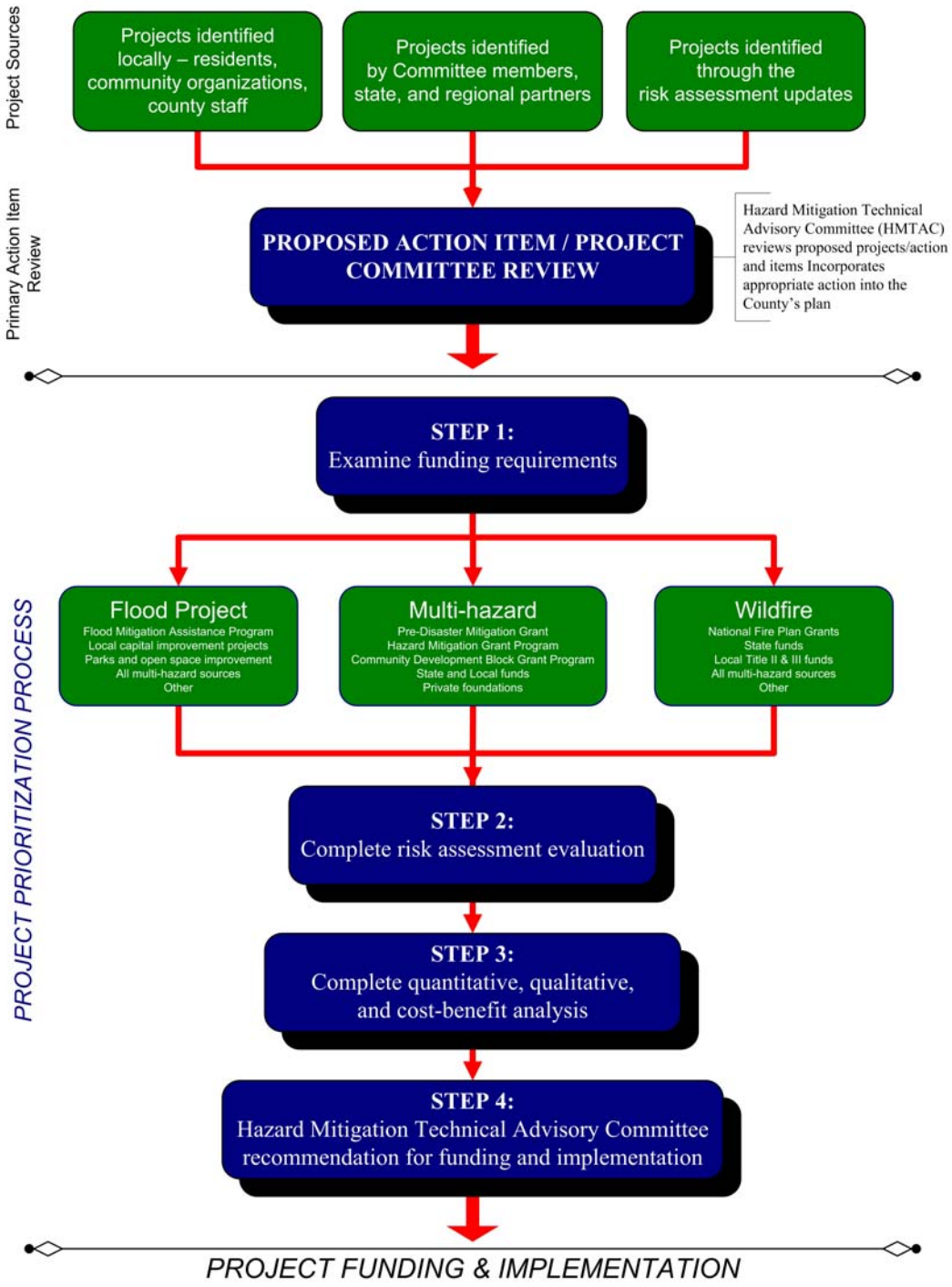
The Multnomah County Commission adopted the County's Natural Hazard Mitigation Plan July 2006 at which point the County Emergency Manager and Hazard Mitigation Advisory Committee became responsible for plan implementation. The Emergency Manager serves as convener to facilitate the steering committee meetings, and will assign tasks such as updating and presenting the plan to the members of the committee. Plan implementation and evaluation will be a shared responsibility among all the advisory committee members.

# PROJECT PRIORITIZATION PROCESS

The Disaster Mitigation Act of 2000 (via the Pre-Disaster Mitigation Program) requires that County identify a process for prioritizing potential actions. Potential mitigation activities will often come from a variety of sources; therefore, the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment.

Depending on the potential project's intent and implementation methods, several funding sources may be appropriate. Examples of mitigation funding sources include, but are not limited to: FEMA's Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance (FMA) program, National Fire Plan (NFP), Title II funds, Title III funds, Community Development Block Grants (CDBG), local general funds, and private foundations. Some of these examples are used in the figure 5.1 on the next page to illustrate the project development and prioritization process.

## Figure 5.1: Project Prioritization Process Overview




Source: Community Service Center's Oregon Natural Hazards Workgroup at the University of Oregon, 2006

## Step 1: Examine funding requirements

The Hazard Mitigation Technical Advisory Committee will identify how best to implement individual actions into the appropriate existing plan, policy, or program. The committee will examine the selected funding stream's requirements to ensure that the mitigation activity would be eligible through the funding source. The HMTAC may consult with the funding entity, Oregon Emergency Management, or other appropriate state or regional organization about the project's eligibility.

## Step 2: Complete risk assessment evaluation

The second step in prioritizing the plan's action items was to examine which hazards they are associated with and where these hazards rank in terms of community risk. The committee will determine whether or not the plan's risk assessment supports the implementation of the mitigation activity. This determination will be based on the location of the potential activity and the proximity to known hazard areas, historic hazard occurrence, and the probability of future occurrence documented in the Plan. To rank the hazards, community's natural hazard risk assessment was utilized. This risk assessment identified various hazards that may threaten community infrastructure and population in a range from:

- No/Low
- Limited
- Moderate
- High
- Severe

The rank ordering of hazards by risk follows:

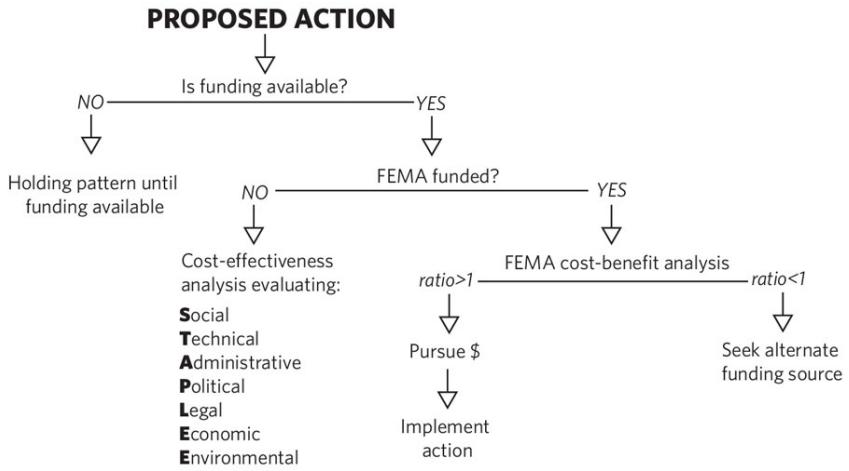
1. Flood
2. Earthquake
3. Severe weather
4. Wildland / urban interface fire
5. Volcano ash
6. Landslides

Each of the action items in the plan addresses risk from one or more of these hazards.

## Step 3: Complete quantitative and qualitative assessment, and economic analysis

The third step is to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 5.2 shows decision criteria for selecting the method of analysis.

### Figure 5-2. Project prioritization process overview




Source: Community Service Center's Oregon Natural Hazards Workgroup at the University of Oregon, 2006

If the activity requires federal funding for a structural project, the HMTAC will use a Federal Emergency Management Agency- approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit cost ratio of greater than one in order to be eligible for FEMA grant funding.

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

STAPLE/E technique has been tailored for natural hazard action item prioritization by the University of Oregon's Oregon Natural Hazards Workgroup. See *Appendix B: Economic Analysis of Natural Hazard Mitigation Projects* for a description of the STAPLE/E evaluation methodology.

### Step 4: Committee recommendation

Based on the steps above, the committee will recommend whether or not the mitigation activity should be moved forward. If the committee decides to move forward with the action, the coordinating organization designated for the activity will be responsible for taking further action and documenting success upon project completion. The Hazard Mitigation Technical Advisory Committee will convene a meeting to review the issues surrounding grant applications and shared knowledge and or resources. This process will afford greater coordination and less competition for limited funds.

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

## PLAN MAINTENANCE, IMPLEMENTATION, AND PUBLIC INVOLVEMENT

To assure that the plan remains relevant, the County has established an annual maintenance schedule. Plan maintenance is a critical component of the Natural Hazard Mitigation Plan. Proper maintenance of the plan will ensure that this plan will benefit Multnomah County efforts to reduce the risks posed by natural hazards. While it is unlikely that the plan's mission and goals will change significantly over time it is almost assured that the plan's strategies and actions will required periodic review and refinement.

The HMTAC and local staff will be responsible for implementing this process in addition to maintaining and updating the plan through a series of meetings outlined in the maintenance schedule below.

**Table 5.1: Plan maintenance meeting schedule**

| Semi-annual meeting | Annual Meeting | Five-year review |
|---|---|---|
| - Committee members provide action item progress report<br>- Review all action items<br>- Identify new issues<br>- Evaluate funding opportunities and prioritize potential projects<br>- Develop grant proposals<br>- Document and publicize success stories | - Evaluate and update risk assessment based upon new data<br>- Establish annual work plan for continued public outreach<br>- Review action items<br>- Prioritize potential projects<br>- Report to County Commissioners<br>- Document successes and lessons learned | - Review plan update questions<br>- Update Sec 1 through 5 based upon new data<br>- Document and publicize success stories |

## IMPLEMENTATION THROUGH EXISTING PROGRAMS

Many of the Natural Hazards Mitigation Plan's recommended actions are consistent with the goals and objectives of existing plans and policies within the County. Where possible, the County will implement the Natural Hazards Mitigation Plan's recommended actions through existing plans and policies. Additionally, many of these plans are updated regularly, and can adapt to changing conditions and needs. Implementing the Natural Hazards Mitigation Plan's action items through such plans and policies increases their likelihood of being supported and implemented.

The following existing plans, programs, and policies were identified and documented as having connections to natural hazard mitigation actions defined in the plan.

***Multnomah County Comprehensive Framework Plan***

- **Plan Owner:** The Land Use Planning Department
- **Plan Description:** The County's Comprehensive Framework Plan is a summary of the County's land use mission. It consists of 41 policies with implementation strategies. The Framework provides general guidance about the way land use planning should function in the County. It helps unify the comprehensive plans and zoning ordinances for each of the five areas within the County.
- **Plan cycle:** The Framework is updated as needed.
- **Relation to hazard mitigation:** The Natural Hazard Mitigation Plan mission statement and goals should be cohesive with and align with the mission and goals of the County's Comprehensive Plan.

Action items might be included as policies or strategies within the plan.

***Multnomah County Comprehensive Plans***

- **Date of last revision:** Ranging from October 1996 to January 2005
- **Plan Owner:** The Land Use Planning Department
- **Plan Description:** Multnomah County has five comprehensive plans that cover the following unincorporated areas: East of the Sandy River, West of the Sandy River, Sauvie Island, West Hills, and the Columbia River Gorge. These plans generally function independently of each other to govern the land use planning process in each of these areas.
- **Plan cycle:** The plans are updated as needed or required by the DLCD.
- **Relation to hazard mitigation:** The comprehensive plans contain policies to address Goal 7 requirements.

***Multnomah County Code of Ordinances, Vol. 2: Land Use Ordinances***

- **Date of last revision:** October 2005
- **Plan Owner:** The Land Use Planning Department
- **Plan Description:** The general purpose of this code is to set forth and coordinate county regulations governing the development and use of land in unincorporated areas of Multnomah County.
- **Plan cycle:** It is reviewed as needed by the Planning Commission and the Board of Commissioners
- **Relation to hazard mitigation:** Action items initiated by the natural hazard mitigation plan that change the development code must also be consistent with the goals of the county's land use ordinances.

***Building Code***

The Land Use Planning Department is responsible for administering the building codes in the County. After the adoption of the mitigation plan, they will work with the State Building Code Division to make sure that the city enforces the minimum standard established in the State Building Code. In addition, the steering committee will work with other agencies at the state level to review, develop and ensure building codes that are adequate to mitigate or prevent damage by natural hazards. This is to ensure life-safety criteria are met for new construction.

- **Date of last revision:** January 2005
- **Plan Owner:** Building Division
- **Plan Description:** The State Building Code's purpose is to set forth and coordinate city regulations governing the construction of buildings and infrastructure
- **Plan cycle:** Every three years. Plan reviewed every January

- **Relation to hazard mitigation:** Inspections of new construction are intended to ensure compliance with Building Code and development code provisions that related to hazard mitigation

***Transportation System Plan for the Urban Pockets of Unincorporated Multnomah County***

Multnomah County's Transportation System Plan for the Urban Pockets of Unincorporated Multnomah County works to coordinate transportation planning between the County and the City of Portland. The Plan identifies opportunities to extend and connect streets to provide safe, convenient, and reasonably direct routes for all modes and identify transportation infrastructure needs for the unincorporated areas of the County.

The Transportation Capital Improvements Program identifies the transportation improvements needed to accommodate existing and future development in the County. The CIP identifies and prioritizes transportation infrastructure that is necessary to support a thriving economy. The CIP projects needs and improvements through 2009.

**Date of last revision:** June 30, 2005

- **Plan Owner:** Multnomah County Transportation Planning Division
- **Plan Description:** The Transportation System Plan (TSP) establishes a set of street classification maps that define applicable conversions of Multnomah County street classifications to the City of Portland's policy designations. The document identifies opportunities to extend and connect streets, develop a master street plan to foster connectivity, and resolve differences between the City and County's street classification systems.
- **Plan cycle:** The project list in the TSP will be updated periodically, at a minimum of five-year intervals through Multnomah County Capital Improvement Program.
- **Relation to hazard mitigation:** Action items related to transportation and natural hazard mitigation may be inserted into the TSP project list at the discretion of the County Board of Commissioners.

***Transportation Capital Improvements Plan and Program***

- **Date of last revision:** January 2005
- **Plan Owner:** Land Use and Transportation Program
- **Plan Description:** The objective of the Capital Improvement Plan is to identify and set priorities for road, bicycle, pedestrian, culvert (fish passage), bridge projects, and related improvements necessary to maintain and enhance the County transportation system, which provides the basic infrastructure necessary to support a thriving economy.
- **Plan cycle:** Five-year cycle

- **Relation to hazard mitigation:** Action items may be inserted into the Capital Improvement Plan as approved by the Board of Commissioners.

***Emergency Operations Plan***

The Emergency Operations Plan (EOP) outlines the roles and responsibilities of the departments and personnel for Multnomah County during major emergencies or disasters. The Plan also provides a clear line of succession in the case of executive vacancy resulting from loss of life, incapacitation, or injury.

The Plan sets forth a strategy and operating guidelines adopted by the County for managing its response and recovery activities during disasters and emergencies. The Plan consists of the following sections: administration of the day-to-day duties of County agencies; activation of the Emergency Operation Center; response to an emergency or disaster; recovery of County infrastructure and facilities; hazard specific guidelines; intergovernmental agreements for development and maintenance of EOPs for certain cities; and information about departmental EOPs. The hazard specific guidelines section provides a hazard analysis and checklists for activation of the Emergency Operation Center for each type of hazard based on the severity of the event.

- **Date of last revision:** November 2002
- **Plan Owner:** County Chair
- **Plan Description:** The EOP provides a framework to guide the efforts of Multnomah County in responding to and initiating recovery from major emergencies and/or disasters. The plan describes the roles and responsibilities of county agencies in managing response operations in a coordinated manner and establishes a program for comprehensive resource management.
- **Plan cycle:** There is no scheduled maintenance/update of the EOP.
- **Relation to hazard mitigation:** The County's Natural Hazard Mitigation Plan mission and goals work together with the Emergency Operations Plan to coordinate responses to disasters.

***Regional Public Health Emergency Response Plan***

Multnomah County's Health Department coordinates the Regional Public Health Emergency Response Plan for the county health departments within the Portland Metropolitan area. The Plan focuses on response to emergencies that might significantly impact the health of residents within the Metropolitan area. While hazard events are not directly covered within this plan, secondary effects of hazard events, such as contagious disease or exposure to hazardous materials are covered in this plan.

- **Date of last revision:** 2005
- **Plan Owner:** Multnomah County Health Department

- **Plan Description:** The purpose of the plan is to provide a framework for response to a public health emergency in the Portland Metropolitan area. The plan focuses on response to public health emergencies, such as contagious diseases, bioterrorism, or hazardous materials accidents.
- **Plan cycle:** The plan is reviewed annually
- **Relation to hazard mitigation:** While this plan deals largely with response, mitigation plan action items could prompt response plan updates or improvements.

***Regional Business Plan***

The Regional Business Plan was created through collaboration between business and public leaders. The Plan establishes a vision and strategies for creating a metropolitan economy that is built upon sustainability, innovation, openness, and individualism. This Plan relates to natural hazards because of the likelihood of economic disruption caused by a hazard event.

- **Date of last revision:** 2006
- **Plan Owner:** Regional Business Plan Steering Committee
- **Plan Description:** Regional Business Plan attempts to describe the economy of the Portland region, create public-private partnerships to promote economic activities, and help build a strong and sustainable regional economy that yields family wage jobs. The plan provides a common framework for business and government to work together, as well as providing specific action-oriented initiatives for building a strong and sustainable regional economy.
- **Plan cycle:** There is no scheduled maintenance/update of the Regional Business Plan.
- **Relation to hazard mitigation:** The Natural Hazards Mitigation Plan should address problems and concerns of businesses resulting from hazard events. These concerns may result in the insertion of action items in the Regional Business Plan.

## CONTINUED PUBLIC INVOLVEMENT

Multnomah County is dedicated to involving the public directly in the review and updates of the Natural Hazard Mitigation Plan. The Hazard Mitigation Advisory Committee members are responsible for the annual review and update of the Plan. The success of the plan implementation partially relies on the public's interest and willingness to become involved in natural hazard mitigation. Their willingness to become involved relies on the visibility and public's understanding of the issue before any behavioral change happens. To date, two goals and six action items directly related to public involvement have been included in the plan. They are:

***Goal 4 (Education and Awareness) action items***

- **Short-Term Action 4.2**: Develop and distribute a Natural Hazard Community Resource Maps and risk reduction tips that include instructions about how to prepare and reduce risks posed by natural hazards.
- **Short-Term Action 4.3**: Conduct earthquake awareness and mitigation outreach assistance
- **Short-Term Action 4.4**: Research ways to create and disseminate a message that will cause people to act to reduce individual risk. Target education and outreach actions to reach marginalized populations.
- **Short-Term Action 4.5**: Involve the public in updating the Natural Hazard Mitigation Plan.

***Goal 5 (Plan implementation) action items***

- **Short-Term Action 5.1**: Develop formal agreements (such as Memoranda of Understanding) with internal (departments) and external partners (non-profits, cities, and state agencies) to work together on risk reduction efforts in the County.
- **Short-Term Action 5.3**: Develop a web-based or other electronic communication tool for the Hazard Mitigation Technical Advisory Committee and for the public to comment on the plan

Additionally, the public will have the opportunity to provide feedback about the plan. Copies of the plan will be catalogued and kept at appropriate agencies in the city. The existence and location of these copies will be publicized in the quarterly county newsletter which reaches all of the homes in the County. The Plan also includes the address and the phone number of the County's Department of Emergency Management, which is responsible for keeping track of public comments on the plan.

In addition, copies of the plan and any proposed changes will be posted on the Partners for Disaster Resistance & Resilience web site maintained by the University of Oregon Natural Hazard Workgroup. This site will also contain an email address and phone number to which people can direct their comments and concerns.

Because the plan's action items are implemented through existing plans, policies, and procedures, the public will additionally have an opportunity to comment on mitigation action items at every plan update cycle. These include the Comprehensive Plan updates, Capital Improvement Program review, and priority-based budgeting process. All public meetings where portions of the Mitigation Plan are discussed will provide the public a forum for which they can express concerns, opinions, or ideas about the plan and parts of it. The County Public Information Officer will be responsible for using County resources to publicize meetings where the public can provide input and to maintain public involvement through the Web page and newspapers.

## FIVE-YEAR REVIEW OF PLAN

This plan will be updated every five years, as required in the Disaster Mitigation Act of 2000. During this plan update, the HMTAC should ask the following questions to determine what actions are necessary to update the Plan. The convener will be responsible for convening the Committee to address the questions outlined below.

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

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

# Flood Annex

This annex contains information related to flooding to supplement the risk assessment summary in Section 3 of Multnomah County's Natural Hazard Mitigation plan. Like the other annexes to this plan, it is designed to have new policies, plans, and data sources related to annexes added in future plan updates and revisions. The annex contains:

- Additional risk information and documentation needed to meet the requirements of the National Flood Insurance Reform Act of 1994 (NFIRA), Sections 1366 and 1367 (42 U.S.C. 4101)
- Multnomah County policies related to mitigating the flood hazard
- Flood-related sections from a previously-completed Multnomah County risk assessment
- Multnomah County Drainage District 2006 High Water Response Plan
- The *State of Oregon Enhanced Natural Hazards Mitigation Plan* section related to flooding in the region surrounding Multnomah County
- The *Technical Resource Guide* section on flood hazards, developed by the Oregon Natural Hazard Workgroup, which provides hazard-specific information on a statewide basis for the following topics: hazard history, hazard type and characteristics, hazard identification, hazard related legal issues, mitigation examples and best practices, and resources This resource can be found online at www.Oregonshowcase.org

# DOCUMENTATION TO ADDRESS THE REQUIREMENTS OF THE FLOOD MITIGATION ACT

This section of the flood annex describes where Multnomah County's Natural Hazard Mitigation Plan meets the requirements of the FMA, and, when necessary, provides additional information to support the flood risk assessment and action items included in the plan. It is organized by FMA requirement, as outlined in the CFR.

## PLAN PROCESS

*CFR §78.5(a) requires communities to describe the planning and public involvement process that led to the development of the plan.*

This FMA requirement was met through the planning and public involvement process undertaken during the development of the Multnomah County Natural Hazard Mitigation Plan, which covered the flood hazard (among others). This process is described in Section 1 of the plan, as well as in the resource appendix on plan process.

## EXISTING FLOOD HAZARD

*CFR §78.5(b) requires communities to provide a description of the existing flood hazard and identification of the flood risk, including estimates of the number and type of structures at risk, repetitive loss properties, and extent of flood depth and damage potential.*

This FMA requirement is met in part through the risk assessment documentation in Section 3: Risk Assessment Summary and the remaining documentation in this flood annex. Specifically, documentation and maps of the 100- and 500-year floodplain in Section 3:

- Describe the existing flood hazard
- Identify Multnomah County's flood risk
- Describe the extent of flood depth

Damage potential and the number and type of structures at risk are estimated and documented in the flood section of Multnomah County's previous risk assessment. This section is included as part of this hazard-specific annex on flooding. Additionally, this information is summarized in Section 3 of the plan. Action items in Multnomah County's Natural Hazard Mitigation Plan relate to updating and improving the information in this previous risk assessment.

To meet the requirements of the FMA, however, this section of the flood annex provides additional information related to repetitive loss properties.

- According to the state-maintained database on repetitive loss properties and analysis conducted by Multnomah County's GIS department,

Multnomah County has 11 repetitive loss properties.[1] Generally, they are located as follows:

- One property within the City of Troutdale along the lower Beaver Creek floodplain,
- Two properties within the City of Portland, in the Willamette River floodplain between Ross Island and the Sellwood Bridge, and
- Eight properties are located in the middle reaches of the Johnson Creek watershed. They are generally located in the Pleasant Valley area, a pocket of unincorporated Multnomah County that is planned to be incorporated into the City of Gresham.

## FLOODPLAIN MANAGEMENT GOALS

*CFR §78.5(c) requires communities to document their goals for managing the floodplains within the area covered by the plan.*

The goals for managing Multnomah County's floodplain are the same as those for mitigating hazard risk in general. They are documented in Section 4 of the Multnomah County Natural Hazard Mitigation Plan.

## COST EFFECTIVENESS

*CFR §78.5(d) requires communities to identify and evaluate the cost effectiveness and technical feasibility of mitigation actions considered in the plan.*

All of the action items documented in Multnomah County's Natural Hazard Mitigation Plan must be evaluated for cost effectiveness before implementation. Section 5 describes that process in general terms, while a more specific process is outlined in an appendix to the plan.

## STRATEGY FOR REDUCING RISK

*CRF §78.5(e) requires communities to present a strategy for reducing flood risks and continued compliance with the NFIP, procedures for ensuring implementation, reviewing progress, and recommending revisions.*

These requirements are all met in Multnomah County's Natural Hazard Mitigation Plan, as follows:

- **Strategy for reducing risk.** All action items related to reducing flood risk and continued compliance with the NFIP are included in Section 4 of the plan.
- **Procedures for ensuring implementation, reviewing process, and recommending revisions.** Flood mitigation action items will be implemented, reviewed, and revised using the same process as the other

[1] As of 12/2005.

action items in Multnomah County's plan. This process is documented in Section 5 of the plan. With this flood annex meeting FMA plan requirements, Multnomah County will be eligible to apply for FMA project grant funding to address, for example, mitigation to repetitive loss properties.

## DOCUMENTATION OF ADOPTION

*CFR §78.5(f) requires communities to provide documentation of the formal adoption process for the plan.*

The Multnomah County Board of Commissioners adopted the flood mitigation action items at the same time that they formally adopted the whole Multnomah County Natural Hazard Mitigation Plan. The adoption is documented in Section 1 of the mitigation plan.

# POLICY 14: DEVELOPMENT LIMITATIONS

## INTRODUCTION

Many natural features impose limitations on development and, if not recognized in the development process, they can create public health and safety hazards. For example, flood plains perform important water storage functions and, if filled, force the water into other lands formerly not affected. These newly affected areas may have buildings which will be flooded. Erosive soils create stream siltation and can affect water quality and fish life habitat. A high water table can preclude septic tanks from functioning properly and create ground water pollution. These are important features which must be considered.

The purpose of this policy is to protect the public health and safety and to ensure that development does not create an "on-site" or "off-site" public harm. It is not intended to prohibit development, except where design and construction techniques cannot provide for a safe development.

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## POLICY 14

The County's policy is to direct development and land form alterations away from areas with development limitations, except upon a showing that design and construction techniques can mitigate any public harm or associated public cost and mitigate any adverse effects to surrounding persons or properties. Development limitations areas are those which have any of the following characteristics:

A. Slopes exceeding 20%;

B. Severe soil erosion potential;

C. Land within the 100 year flood plain;

D. A high seasonal water table within 0-24 inches of the surface for three or more weeks of the year;

E. A fragipan less than 30 inches from the surface;

F. Land subject to slumping, earth slides or movement.

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## STRATEGIES

A. As a part of the ongoing planning program, the County should continue to:

1. Identify areas with development limitations; and

2. Establish a process for reviewing development proposals in these areas.

B. The following should be addressed in the preparation of the Community Development Title:

1. **The Zoning Code** should include:

   a. Standards for development within the 100 year flood plain, recognizing the standards and criteria established by the Federal Emergency Management Agency. The Flood Plain should be applied to all areas within the 100 year flood plain as designated by the U. S. Army Corps of Engineers, U. S. Soil Conservation Service, and any special studies prepared by the County;

   b. Approved criteria for conditional uses which address the need to avoid or mitigate hazardous conditions;

   c. Provisions which allow the density, which would have been permitted in hazardous areas if it were not for the restrictions, to be transferred on-site or to adjoining property if held in the same ownership and if developed as a planned development.

2. County development standards should include provisions for:

   a. Geologic impact analysis utilizing the County's Geologic and Slope Hazard Study;

   b. Sediment and erosion control;

   c. Drainage; and

   d. Retention of vegetation and significant natural or habitat areas where these will mitigate natural hazards.

# CHAPTER 29: BUILDING REGULATIONS

§§:

## *FLOOD HAZARD REGULATIONS (Excluding West of Sandy River Plan Area)*

(Ord. 931, passed, 04/15/1999)

### § 29.600- PURPOSES.

The purposes of the Flood Hazard Standards are to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas and to allow property owners within unincorporated Multnomah County to participate in the National Flood Insurance Program.
(Ord. 931, passed, 04/15/1999)

### § 29.601 DEFINITIONS.

For the purpose of this subchapter, the following definitions shall apply:

***ALTERATION***. To modify, change or make different.

***DEVELOPMENT***. Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations located within the areas shown within 100-year flood boundary as identified on the Flood Boundary and Floodway Maps and the Flood Insurance Rate Maps as published by the Federal Emergency Management Agency (FEMA) and any watercourse.

***ELEVATION CERTIFICATE***. The document used to certify the FIRM Zone and base flood elevation of the development area of a property, and to determine the required elevation or floodproofing requirements of new and substantially improved structures.

***ENCROACHMENT***. To fill, construct, improve, or develop beyond the original bank line of the watercourse. Bank stabilization or restoration of a watercourse which does not protrude beyond the original banks line is not considered an encroachment by this subdistrict.

***FLOODWAY***. The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

***RECREATIONAL VEHICLE***. A vehicle which is built on a single chassis, 400 square feet or less when measured at the largest horizontal projection, self-propelled or permanently towable by a light duty truck and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

***SUBSTANTIAL DAMAGE***. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

***SUBSTANTIAL IMPROVEMENT***. Any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either:

(1) Before the improvement or repair is started; or

(2) If the structure has been damaged and is being restored, before the damage occurred. For the purposes of this definition substantial improvement is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The costs to repair must be calculated for full repair to "before-damage" condition, even if the owner elects to do less. The total costs to repair include both structural and finish materials and labor.

(3) Substantial Improvement does not, however, include either:

(a) The portion of any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by local

building officials and which are the minimum necessary to assure safe living conditions or

(b) Any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

***WATERCOURSE***. Natural and artificial features which transport surface water. Watercourse includes a river, stream, creek, slough, ditch, canal, or drainageway.
(Ord. 931, passed, 04/15/1999)

**§ 29.602 AREAS AFFECTED.**

(A) The provisions of MCC 29.600 - 29.611 shall apply to all areas within the 100-year flood boundary as identified on the Flood Boundary and Floodway Maps and the Flood Insurance Rate Maps as published by the Federal Emergency Management Agency (FEMA) and any watercourse as defined by MCC 29.601.

(1) These maps may be periodically revised or modified by FEMA in accordance with prescribed procedures pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 92-234). In order to employ the best available information and maintain compliance with Federal Flood Insurance Program regulations, Multnomah County shall utilize any such revisions or modifications upon their effective date.

(2) On the Multnomah County Zoning Map, all areas depicted as being Flood Fringe (FF), Floodway (FW) or Flood Hazard (FH) with this ordinance are repealed from requiring a Flood Hazard Permit.
(Ord. 931, passed, 04/15/1999)

**§ 29.603 PERMITS.**

(A) No structure, dwelling or manufactured home shall be erected, located, altered, improved, repaired or enlarged and no other new development including but not limited to grading, mining, excavation and filling shall occur on lands within the 100-year flood boundary unless a Floodplain Development Permit specifically authorizing the proposal has been obtained from Multnomah County.

(1) Improvements to a structure, dwelling or mobile home, which does not require a land use permit, grading permit or building permit, are exempted from obtaining a Flood Hazard Permit.

(B) Alterations, modifications or relocations to any watercourse as defined in MCC 29.601 are subject to a Flood Hazard permit and the Watercourse Relocation requirements of MCC 29.609.

(1) Regular maintenance of ditches and dikes within the Sauvie Island Drainage District is exempted from obtaining a Flood Hazard Permit.
(Ord. 931, passed, 04/15/1999)

**§ 29.604 EXEMPTION FROM DEVELOPMENT STANDARDS.**

The following are exempt:

(A) Land may be exempted from the requirements of MCC 29.606 upon review and approval by the Director of an acceptable elevation survey, certified by a State of Oregon Registered Professional Engineer or Land Surveyor, which demonstrates that the entire subject parcel is at least one foot above the base flood level.

(B) The reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Historic Sites Inventory may be permitted without regard to the requirements of MCC 29.606.

(C) Forest practices conducted under the Forest Practices Act.
(Ord. 931, passed, 04/15/1999)

**§ 29.605 APPLICATION INFORMATION REQUIRED.**

An application for development subject to a Floodplain Development Permit shall include the following:

(A) A map showing the property line locations, the boundaries of the 100 year floodplain on the parcel, roads, and driveways, existing structures, watercourses and the location of the proposed development(s), topographic elevations for the pro-

posed development and areas of grading or filling required for the project.

(B) Detailed construction drawings showing compliance with the development standards specified in MCC 29.606. A licensed engineer or architect shall stamp the plans and include a statement that the plans meet the requirements of MCC 29.606.

(C) An elevation certificate signed by a Registered Professional Land Surveyor, Engineer or Architect. The certificate shall be accompanied by a plan of the property which shows the location and elevation of a benchmark on the property.

(D) A written narrative specifying building materials and methods that will be utilized to comply with the requirements of the Floodplain Permit.

(E) Evidence that the applicant has obtained, when necessary, prior approval from those Federal, State and/or local governmental agencies with jurisdiction over the proposed development.
(Ord. 931, passed, 04/15/1999)

**§ 29.606 DEVELOPMENT STANDARDS.**

The following standards shall apply to all new construction, substantial improvement or other development in areas within the 100-year flood boundary:

(A) All Structures.

(1) All new construction and substantial improvement shall:

(a) Comply with Oregon State Building Codes.

(b) Have the electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

(c) Use materials resistant to flood damage.

(d) Using methods and practices that minimize flood damage.

(e) For areas that are fully enclosed below the lowest floor and that are subject to flooding, shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.

1. Designs for meeting this requirement must either be certified by a registered professional engineer or architect and must meet or exceed the following minimum criteria:

a. A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.

b. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

(B) Residential Structures.

New construction and substantial improvement of any residential structure, including manufactured homes, shall:

(1) Have the lowest floor, including basement, elevated to at least one foot above the base flood level as indicated on the Elevation Certificate. For purposes of this section, an unfinished garage (either attached or detached) may be considered a non-residential structure.

(2) Be placed on a permanent foundation and shall be anchored to resist flotation, collapse and lateral movement by providing tie downs (anchor bolts, seismic tie-downs) and anchoring as specified in OAR 814-23-005 through 080 and State of Oregon 1 and 2 Family Dwelling Specialty Code, as appropriate to the construction type.

(3) Conduct an as-built elevation survey of the lowest floor. This survey shall be completed by a State of Oregon Registered Professional Engineer or Land Surveyor and must certify that the structure's lowest floor was elevated to at least one foot above the base flood level.

(a) The as-built elevation survey shall be submitted to Multnomah County Land Use Planning prior to occupancy of the structure.

(b) Prior to issuance of a building permit or start of development, a performance bond or cash deposit of $1000.00 shall be required to assure that the as-built elevation survey is submitted. The deposit/bond may be used to obtain the elevation survey, without notice, if it is not completed and submitted prior to occupancy of the dwelling. The performance bond or cash deposit shall be released upon submittal of the as-built elevation survey, unless utilized to obtain compliance.

(C) Nonresidential Structures.

New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall:

(1) Have the lowest floor including basement, elevated at least one foot above the base flood level; or, together with attendant utility and sanitary facilities, shall:

(a) Be floodproofed such that the structure, including the attendant utility and sanitary facilities, shall be substantially impermeable to the passage of water to an elevation at least one foot above the base flood level; and

(b) Have structural components capable of withstanding hydrostatic and hydrodynamic loads, effects of buoyancy, flood depths, pressures, velocities and other factors associated with the base flood; and

(c) Be certified by a registered professional engineer or architect that the standards of this subsection are satisfied.

(2) Provide an as-built elevation survey of the lowest floor completed by a State of Oregon Registered Professional Engineer or Land Surveyor certifying that the structure's lowest floor was elevated to at least one foot above the base flood level; or submit a stamped documentation by a State of Oregon Registered Professional Engineer certifying the structure has been built in compliance with MCC 29.606(C)(1)(a) though (c).

(a) The as-built elevation survey or stamped documentation shall be submitted to Multnomah County Land Use Planning prior to occupancy of the structure.

(b) Prior to issuance of a building permit or start of development, a performance bond or cash deposit of $1000.00 shall be required to assure that the as-built elevation survey or stamped documentation is submitted. The bond/deposit may be used to obtain the elevation survey or documentation, without notice, if it is not completed and submitted prior to occupancy or use of the structure or development. The performance bond or cash deposit shall be released upon submittal of the as-built elevation survey or stamped documentation, unless utilized to obtain compliance.

(D) On Site Waste Disposal Systems, Wells, Water Systems and Sewer Systems.

All new and replacement water and sewer systems, including on-site waste disposal systems, shall be designed to:

(1) Minimize infiltration of floodwaters into the system;

(2) Minimize discharge from systems into floodwaters;

(3) Avoid impairment or contamination during flooding.

(E) Recreational Vehicles in Campground or Recreational Development

Recreational vehicles utilized on sites within Zones A1-A30, AH and AE on the community's FIRM shall either:

(1) Be on the site for fewer than 180 consecutive days, or

(2) Be fully licensed and ready for highway uses, on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions; or

(3) Meet the requirements of section 29.606(A) and (B).
(Ord. 931, passed, 04/15/1999)

## § 29.607 FLOODWAY REQUIREMENTS.

In areas identified as floodway on the Flood Boundary and Floodway Maps, the following restrictions, in addition to the requirements of MCC 29.606, shall apply:

(A) No development shall be permitted that would result in any measurable increase in base flood levels.

(1) Encroachment into the floodway is prohibited, unless a detailed step backwater analysis and conveyance compensation calculations, certified by a Registered Professional Engineer, are provided which demonstrates that the proposed encroachment will cause no measurable increase in flood levels (water surface elevations) during a base flood discharge.
(Ord. 931, passed, 04/15/1999)

## § 29.608 PROCEDURE WHEN BASE FLOOD ELEVATION DATA IS NOT AVAILABLE.

(A) For the purposes of administering MCC 29.606 in areas where detailed base flood elevation data has not been provided by FEMA, the Land Use Planning Division shall obtain, review and utilize any base flood elevation and floodway data available from federal, state or local sources to assure that the proposed construction will be reasonably safe from flooding and may exercise local judgment based on historical data.

(B) In areas where detailed base flood elevation data has not been provided by FEMA, all proposals for subdivisions or other new developments greater than 50 lots or five acres, whichever is less, shall provide detailed base flood elevation data and floodway data.
(Ord. 931, passed, 04/15/1999)

## § 29.609 WATERCOURSE RELOCATION AND ALTERATION.

Prior to approving any relocation, encroachment or alteration of a watercourse, the Land Use Planning Division shall provide mailed notice of the proposal to adjoining communities and to the Department of Land Conservation and Development Floodplain Coordinator. Copies of such notice shall also be provided to the Federal Insurance Administration.

(A) No relocation, encroachment or alteration of a watercourse shall be permitted unless a detailed hydraulic analysis, certified by a Registered Professional Engineer, is provided which demonstrates that:

(1) The flood carrying capacity for the altered or relocated portion of the watercourse will be maintained;

(2) The area subject to inundation by the base flood discharge will not be increased;

(3) The alteration or relocation will cause no measurable increase in base flood levels.
(Ord. 931, passed, 04/15/1999)

## § 29.610 COUNTY RECORDS.

Multnomah County or its designee shall obtain and maintain on file the actual elevation (in relation to NGVD) of the lowest floor, including basement, of all new or substantially improved structures in areas subject to the provisions of this Section.

(A) For all new or substantially improved floodproofed structures in areas subject to the provisions of this Section, Multnomah County shall obtain and maintain on file the actual elevation (in relation to NGVD) of the floodproofing and shall also maintain the floodproofing certifications required pursuant to MCC 29.606(C)(1)(b)-(d).
(Ord. 931, passed, 04/15/1999)

## § 29.611 REVIEW AND APPROVAL FEE.

A fee for a flood plain review is imposed and the amount will be set by Board resolution.
(Ord. 944, Added, 04/13/2000, Ord. 945 amended Ord. 944 to add effective date of 6/1/2000)

## *WEST OF SANDY RIVER FLOOD HAZARD REGULATIONS*

### § 29.620- PURPOSES.

The purposes of the Flood Hazard Standards are to promote the public health, safety and general welfare, to reduce the risk of flooding and maintain the functions and values of floodplains such as allowing for the storage and conveyance of stream flows through existing and natural flood conveyance systems, and to minimize public and private losses due to flood conditions in specific areas and to allow property owners within the West of Sandy River Plan Area of unincorporated Multnomah County to participate in the National Flood Insurance Program.(Title 3)
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

### § 29.621 DEFINITIONS.

For the purpose of this subchapter, the following definitions shall apply:

***ALTERATION.*** To modify, change or make different.

***DEVELOPMENT***. Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations located within the areas shown within 100-year flood boundary as identified on the Flood Boundary and Floodway Maps and the Flood Insurance Rate Maps as published by the Federal Emergency Management Agency (FEMA), the area of inundation for the February 1996 flood, and any watercourse.

***DESIGN FLOOD ELEVATION***. The elevation of the 100-year flood as defined by FEMA Flood Insurance Rate Maps, or in areas without maps, the elevation of the 25-year storm, or the edge of mapped flood prone soils or similar methodologies.

***ELEVATION CERTIFICATE***. The document used to certify the FIRM Zone and base flood elevation of the development area of a property, and to determine the required elevation or floodproofing requirements of new and substantially improved structures.

***ENCROACHMENT***. To fill, construct, improve, or develop beyond the original bank line of the watercourse. Bank stabilization or restoration of a watercourse which does not protrude beyond the original banks line is not considered an encroachment by this subdistrict.

***FLOOD MANAGEMENT AREA***. All lands contained within the 100-year flood boundary as identified on the Flood Boundary and Floodway Maps and the Flood Insurance Rate Maps as published by the Federal Emergency Management Agency (FEMA), and the area of inundation for the February 1996 flood.(Title 3)

***FLOODWAY***. The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

***RECREATIONAL VEHICLE***. A vehicle which is built on a single chassis, 400 square feet or less when measured at the largest horizontal projection, self-propelled or permanently towable by a light duty truck and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

***SUBSTANTIAL DAMAGE***. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

***SUBSTANTIAL IMPROVEMENT***. Any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either:

(1) Before the improvement or repair is started; or

(2) If the structure has been damaged and is being restored, before the damage occurred. For the purposes of this definition substantial improvement is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The costs to repair must be calculated for full repair to "before-damage" condition, even if the owner elects to do less. The total costs to repair include both structural and finish materials and labor.

(3) Substantial Improvement does not, however, include either:

(a) The portion of any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by local building officials and which are the minimum necessary to assure safe living conditions or

(b) Any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

***WATERCOURSE***. Natural and artificial features which transport surface water. Watercourse includes a river, stream, creek, slough, ditch, canal, or drainageway.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

**§ 29.622 AREAS AFFECTED.**

(A) The provisions of MCC 29.620 - 29.630 shall apply within the West of Sandy River Plan Area to all areas within the 100-year flood boundary as identified on the Flood Boundary and Floodway Maps and the Flood Insurance Rate Maps as published by the Federal Emergency Management Agency (FEMA), the area of inundation for the February 1996 flood, and any watercourse as defined by MCC 29.621.(Title 3)

(1) These maps may be periodically revised or modified by FEMA in accordance with prescribed procedures pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 92-234). In order to employ the best available information and maintain compliance with Federal Flood Insurance Program regulations, Multnomah County shall utilize any such revisions or modifications upon their effective date.

(2) On the Multnomah County Zoning Map, all areas depicted as being Flood Fringe (FF), Floodway (FW) or Flood Hazard (FH) with this ordinance are repealed from requiring a Flood Hazard Permit.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

**§ 29.623 PERMITS.**

(A) No structure, dwelling or manufactured home shall be erected, located, altered, improved, repaired or enlarged and no other new development including but not limited to grading, mining, excavation and filling shall occur on lands within Flood Management Areas unless a Floodplain Development Permit specifically authorizing the proposal has been obtained from Multnomah County.

(1) Improvements to a structure, dwelling or mobile home, which does not require a land use permit, grading permit or building permit, are exempted from obtaining a Flood Hazard Permit.

(B) Alterations, modifications or relocations to any watercourse as defined in MCC 29.621 are subject to a Flood Hazard permit and the Watercourse Relocation requirements of MCC 29.629.

(1) Regular maintenance of ditches and dikes within the Sauvie Island Drainage District is exempted from obtaining a Flood Hazard Permit.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

**§ 29.624 EXEMPTION FROM DEVELOPMENT STANDARDS.**

The following are exempt:

(A) Land may be exempted from the requirements of MCC 29.626 upon review and approval by the Director of an acceptable elevation survey, certified by a State of Oregon Registered Professional Engineer or Land Surveyor, which demonstrates that the entire subject parcel is at least one foot above the base flood level.

(B) The reconstruction, rehabilitation or restoration of structures listed on the National Register of

Historic Places or the State Historic Sites Inventory may be permitted without regard to the requirements of MCC 29.626.

(C) Forest practices conducted under the Forest Practices Act.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

## § 29.625 APPLICATION INFORMATION REQUIRED.

An application for development subject to a Floodplain Development Permit shall include the following:

(A) A map showing the property line locations, the boundaries of the 100 year floodplain on the parcel, roads, and driveways, existing structures, watercourses and the location of the proposed development(s), topographic elevations for the proposed development and areas of grading or filling required for the project.

(B) Detailed construction drawings showing compliance with the development standards specified in MCC 29.626. A licensed engineer or architect shall stamp the plans and include a statement that the plans meet the requirements of MCC 29.626.

(C) An elevation certificate signed by a Registered Professional Land Surveyor, Engineer or Architect. The certificate shall be accompanied by a plan of the property which shows the location and elevation of a benchmark on the property.

(D) A written narrative specifying building materials and methods that will be utilized to comply with the requirements of the Floodplain Permit.

(E) Evidence that the applicant has obtained, when necessary, prior approval from those Federal, State and/or local governmental agencies with jurisdiction over the proposed development.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

## § 29.626 DEVELOPMENT STANDARDS.

The following standards shall apply to all new construction, substantial improvement or other development in Flood Management Areas:

(A) General Development Standards

(1) Development, excavation and fill shall be performed in a manner to maintain or increase flood storage and conveyance capacity and not increase design flood elevations.

(2) All fill placed at or below the design flood elevation in Flood Management Areas shall be balanced with at least and equal amount of soil material removal.

(3) Excavation shall not be counted as compensating for fill if such areas will be filled with water in non-storm winter conditions.

(4) Temporary fills permitted during construction shall be removed.

(5) Uncontained areas of hazardous materials as defined by DEQ shall be prohibited in Flood Management Areas.(Title 3)

(B) All Structures.

(1) All new construction and substantial improvement shall:

(a) Comply with Oregon State Building Codes.

(b) Have the electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

(c) Use materials resistant to flood damage.

(d) Using methods and practices that minimize flood damage.

(e) For areas that are fully enclosed below the lowest floor and that are subject to flooding, shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.

1. Designs for meeting this requirement must either be certified by a registered professional engineer or architect and must meet or exceed the following minimum criteria:

a. A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.

b. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

(C) Residential Structures.

New construction and substantial improvement of any residential structure, including manufactured homes, shall:

(1) Have the lowest floor, including basement, elevated to at least one foot above the base flood level as indicated on the Elevation Certificate. For purposes of this section, an unfinished garage (either attached or detached) may be considered a non-residential structure.

(2) Be placed on a permanent foundation and shall be anchored to resist flotation, collapse and lateral movement by providing tie downs (anchor bolts, seismic tie-downs) and anchoring as specified in OAR 814-23-005 through 080 and State of Oregon 1 and 2 Family Dwelling Specialty Code, as appropriate to the construction type.

(3) Conduct an as-built elevation survey of the lowest floor. This survey shall be completed by a State of Oregon Registered Professional Engineer or Land Surveyor and must certify that the structure's lowest floor was elevated to at least one foot above the base flood level.

(a) The as-built elevation survey shall be submitted to Multnomah County Land Use Planning prior to occupancy of the structure.

(b) Prior to issuance of a building permit or start of development, a performance bond or cash deposit of $1000.00 shall be required to assure that the as-built elevation survey is submitted. The deposit/bond may be used to obtain the elevation survey, without notice, if it is not completed and submitted prior to occupancy of the dwelling. The performance bond or cash deposit shall be released upon submittal of the as-built elevation survey, unless utilized to obtain compliance.

(D) Nonresidential Structures.

New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall:

(1) Have the lowest floor including basement, elevated at least one foot above the base flood level; or, together with attendant utility and sanitary facilities, shall:

(a) Be floodproofed such that the structure, including the attendant utility and sanitary facilities, shall be substantially impermeable to the passage of water to an elevation at least one foot above the base flood level; and

(b) Have structural components capable of withstanding hydrostatic and hydrodynamic loads, effects of buoyancy, flood depths, pressures, velocities and other factors associated with the base flood; and

(c) Be certified by a registered professional engineer or architect that the standards of this subsection are satisfied.

(2) Provide an as-built elevation survey of the lowest floor completed by a State of Oregon Registered Professional Engineer or Land Surveyor certifying that the structure's lowest floor was elevated to at least one foot above the base flood level; or submit a stamped documentation by a State of

Oregon Registered Professional Engineer certifying the structure has been built in compliance with MCC 29.626(D)(1)(a) through (c).

(a) The as-built elevation survey or stamped documentation shall be submitted to Multnomah County Land Use Planning prior to occupancy of the structure.

(b) Prior to issuance of a building permit or start of development, a performance bond or cash deposit of $1000.00 shall be required to assure that the as-built elevation survey or stamped documentation is submitted. The bond/deposit may be used to obtain the elevation survey or documentation, without notice, if it is not completed and submitted prior to occupancy or use of the structure or development. The performance bond or cash deposit shall be released upon submittal of the as-built elevation survey or stamped documentation, unless utilized to obtain compliance.

(E) On Site Waste Disposal Systems, Wells, Water Systems and Sewer Systems.

All new and replacement water and sewer systems, including on-site waste disposal systems, shall be designed to:

(1) Minimize infiltration of floodwaters into the system;

(2) Minimize discharge from systems into floodwaters;

(3) Avoid impairment or contamination during flooding.

(F) Recreational Vehicles in Campground or Recreational Development

Recreational vehicles utilized on sites within Zones A1-A30, AH and AE on the community's FIRM shall either:

(1) Be on the site for fewer than 180 consecutive days, or

(2) Be fully licensed and ready for highway uses, on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions; or

(3) Meet the requirements of MCC 29.626(B) and (C).
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

## § 29.627 FLOODWAY REQUIREMENTS.

In areas identified as floodway on the Flood Boundary and Floodway Maps, the following restrictions, in addition to the requirements of MCC 29.626, shall apply:

(A) No development shall be permitted that would result in any measurable increase in base flood levels.

(1) Encroachment into the floodway is prohibited, unless a detailed step backwater analysis and conveyance compensation calculations, certified by a Registered Professional Engineer, are provided which demonstrates that the proposed encroachment will cause no measurable increase in flood levels (water surface elevations) during a base flood discharge.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

## § 29.628 PROCEDURE WHEN BASE FLOOD ELEVATION DATA IS NOT AVAILABLE.

(A) For the purposes of administering MCC 29.626 in areas where detailed base flood elevation data has not been provided by FEMA, the Land Use Planning Division shall obtain, review and utilize any base flood elevation and floodway data available from federal, state or local sources to assure that the proposed construction will be reasonably safe from flooding and may exercise local judgment based on historical data.

(B) In areas where detailed base flood elevation data has not been provided by FEMA, all proposals for subdivisions or other new developments greater than 50 lots or five acres, whichever is less, shall

provide detailed base flood elevation data and floodway data.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

## § 29.629 WATERCOURSE RELOCATION AND ALTERATION.

Prior to approving any relocation, encroachment or alteration of a watercourse, the Land Use Planning Division shall provide mailed notice of the proposal to adjoining communities and to the Department of Land Conservation and Development Floodplain Coordinator. Copies of such notice shall also be provided to the Federal Insurance Administration.

(A) No relocation, encroachment or alteration of a watercourse shall be permitted unless a detailed hydraulic analysis, certified by a Registered Professional Engineer, is provided which demonstrates that:

(1) The flood carrying capacity for the altered or relocated portion of the watercourse will be maintained;

(2) The area subject to inundation by the base flood discharge will not be increased;

(3) The alteration or relocation will cause no measurable increase in base flood levels.
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

## § 29.630 COUNTY RECORDS.

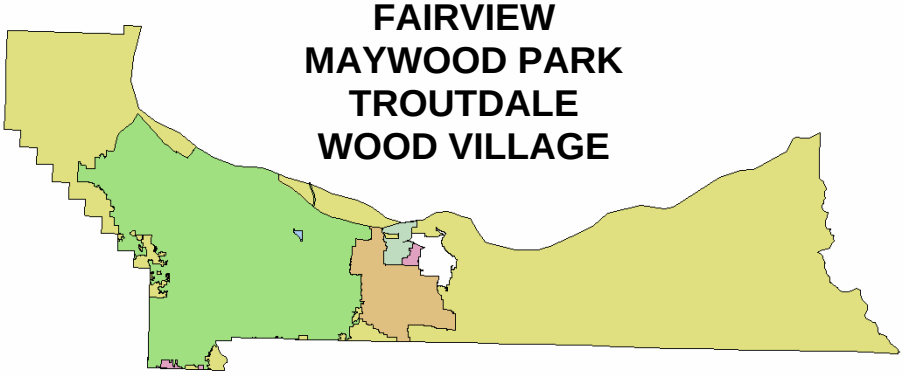
Multnomah County or its designee shall obtain and maintain on file the actual elevation (in relation to NGVD) of the lowest floor, including basement, of all new or substantially improved structures in areas subject to the provisions of this Section.

(A) For all new or substantially improved floodproofed structures in areas subject to the provisions of this Section, Multnomah County shall obtain and maintain on file the actual elevation (in relation to NGVD) of the floodproofing and shall also maintain the floodproofing certifications required pursuant to MCC 29.626(D)(1)(b) and (c).
(Ord. 996, Added, 10/31/2002, eff. 1/1/2003)

# MULTNOMAH COUNTY

# Flood Hazard Assessment

**IN PARTNERSHIP WITH THE CITIES OF:**
**GRESHAM**
**FAIRVIEW**
**MAYWOOD PARK**
**TROUTDALE**
**WOOD VILLAGE**



# Hazard Analysis

This Section serves to identify each hazard/threat confronting the jurisdiction. Hazards will be grouped into the following categories:

- Flooding
- Landslides, or Debris Flows
- Earthquake
- Volcano
- Wildfires & Urban Interface Fires
- Winter Storms
- Severe Weather

The development of Mitigation Projects centers on the prioritization of the three basic Strategies:

1. Life Safety, safeguarding and sustaining human life.
2. Property Preservation, protecting critical infrastructures, thus ensuring sustainable communities.
3. Environmental Conservation, enabling supportive environments and healthy ecosystems.

Each hazard will be analyzed as follows:

1. Hazard Definition
2. Hazard Description
3. Hazard History & Costs
4. Risk Assessment
5. Severity Score (this scoring was developed by the State of Oregon Office of Emergency Management)
6. Jurisdiction Vulnerabilities

## FLOODING

### 1. General Definition.

Flooding is simply an overflowing of water onto normally dry land and is one of the most significant and costly of natural disasters. Flooding tends to occur in the Fall to early Spring because of the “Pineapple Express” and is typified by rapid snow melt in the lower elevations due to an increase in ambient air temperature, and precipitation temperature.

### 2. Description.

Flooding occurs when climate (or weather patterns), geology, and hydrology combine to create conditions where water flows outside of its usual course. In Multnomah County, geography and climate conditions combine to create chronic seasonal flooding conditions. Precipitation Flooding is most common from October through April, when storms from the Pacific Ocean, 60 miles away, bring intense rainfall to the area. Multnomah County receives approximately 40 inches of rain on average each year most of which occurs during these seven months. Rain totals are measured for the ‘water year’, from October 1st of one year to September 30th the following year. During the rainy season, monthly rainfall totals average far higher than other months of the year. The average annual precipitation for Portland is 36.30 inches. Approximately 81% of this precipitation falls during the seven months between October and April. The consistent, drenching precipitation of the rainy season saturates Multnomah County and often fills the Willamette River and its tributaries. When rivers and streams rise and exceed their channel capacity, water spills out onto the surrounding floodplain. Multnomah County typically experiences flooding after more than three days of heavy rainfall (i.e., saturated conditions). Climatic Conditions - low-level snows and prolonged ice events - have significant impacts on flooding events in Multnomah County. The 1996 flood was greatly exacerbated by a multi day freeze and snowfall that preceded the rain. The frozen ground limited absorption of the rainfall (for more information on snow and ice events see *Severe Winter Storm* below).

Two types of flooding primarily affect Multnomah County: riverine flooding and urban flooding. In addition, any low-lying area has the potential to flood. Flooding of developed areas may occur when the amount of rainfall and runoff exceeds a storm water system's (ditch or sewer) capability to remove it. Riverine flooding, the over bank flooding of rivers and streams, is the largest single form of flooding in Multnomah County. Rivers and streams in the County regularly overflow their banks and inundate low-lying areas. The natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically

results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100- year flood with flood depths of only 1 to 3 feet. These areas are generally flooded by low velocity sheet flows of water. Urban Flooding As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. The percentage of urbanized land is growing each year. Urbanization of the watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise very rapidly and peak with what is often violent force. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

## 3. Hazard History & Cost

Significant historic flooding has been recorded for the Willamette and Columbia River basins in 1861, 1880, 1881, 1894, 1909, 1913, 1927, 1928, 1942, 1946, 1948, 1961, 1964/1965, and 1996. Historic flood inundation levels for the Willamette River at Portland occurred in 1894 (35.1 feet above flood stage warning, 1948 (31.6 feet), 1964 (29.8 feet), 1974 (25.7), and 1996 (30.2 feet). Major past events include floods in 1948 on the Lower Columbia River in the Portland/Vancouver area that caused about 25 deaths in December 1964 And January 1965 that forced the evacuation of thousands, destroyed scores of bridges and secondary roads, caused the Willamette River at downtown Portland to have a flood stage of 29.8 feet, caused $157 million in damages, and caused 17 deaths; and statewide floods in 1996 that caused 5 deaths, forced thousands into shelter, destroyed hundreds of homes, caused damages in excess of $280 million, and forced the City of Portland to erect makeshift barriers to prevent flood waters from moving into the downtown area. The Floods of 1996 also caused landslides, or debris flows, that closed I-84 and forced the evacuation of Dodson and Warrendale. Twenty-seven counties, including Multnomah, were eventually covered by a disaster declaration due to the 1996 floods.

Many residents who have suffered damage rebuild in the same vulnerable areas, only to be flooded again. These properties are termed repetitive loss properties, and are troublesome because they continue to expose lives and property to flooding and landslides.

## 4. Risk Assessment.

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

Using a scale of 1 (one) to 10 (ten) with ten being the greatest severity, each hazard is rated in the following categories:

- *History (Weight Factor=2)*
  This is an analysis of the records of occurrences of previous major emergencies or disasters that affected the County.
- *Vulnerability (Weight Factor=5)*
  The percentage of the population and property likely to be effected by a hazard.
- *Maximum Threat (Weight Factor=10)*
  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By multiplying the severity rating by the weight factors a sub score for the history, vulnerability, maximum threat, and probability for each hazard is achieved. Adding the sub score will produce a total score for that hazard.

**The Risk Assessment for Flood:**

| | CNTY | MPARK | FVIEW | TDALE | WVILL | COG |
|---|---|---|---|---|---|---|
| **HX** | **20** | **2** | **20** | **20** | **10** | **20** |
| **VULN.** | **50** | **5** | **50** | **50** | **50** | **50** |
| **MXTHRT** | **100** | **10** | **100** | **100** | **20** | **100** |
| **PROB.** | **70** | **7** | **70** | **70** | **7** | **70** |
| **TOTAL** | **240** | **24** | **240** | **240** | **87** | **240** |

**HX=History/VULN= Vulnerability/ MXTHRT=Maximum Threat/ PROB=Probability**

**CNTY=County/MPARK=Maywood Park/FVIEW=Fairview/TDALE=Troutdale/WVILL=Wood Village/COG=Gresham**

**5. Severity Score.**

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Floods for Multnomah County is: 240***

***The Severity Score for Floods for Maywood Park is: 24***

***The Severity Score for Floods for Fairview is: 240***

***The Severity Score for Floods for Troutdale is: 240***

***The Severity Score for Floods for Wood Village is: 87***

***The Severity Score for Floods for Gresham is: 240***

*H + V + MT + P = Severity Score*

**6. Jurisdiction Vulnerabilities**.

a. *Population*

634 people reside in flood areas.

b. *Critical Facilities*

(1) Approximately ***36*** percent of the community's critical facilities are vulnerable.

(2) Definition / Description:

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after a flood.

.

(3) The specific critical facilities vulnerable in Multnomah County are:

- 3 County Law Enforcement Buildings
- 3 County Correctional Facilities
- 8 Critical County Facilities

c. *Infrastructure Lifelines*

(1) Approximately ***11*** percent of the community's infrastructure lifelines are vulnerable.

(2) Definition / Description:

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Floods can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after a flood to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public. Residents in Multnomah County commute frequently by automobiles and public transportation such as buses and light rail. Floods can greatly damage bridges and roads, hampering the movement of people and goods. T

(3) The specific infrastructure lifelines vulnerable in Multnomah County are:

- 1 Airport
- 31 Bridges
- 8 Rail Network Carriers
- 13 Arterials, Secondary, and Side Road Networks.

d. *Public Infrastructure*

(1) Approximately ***26*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description:

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these

facilities become crucial in providing support and services, which allow the continuity of business, government, and society. Damaged infrastructure strongly affects the economy of the community – it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

(3) The specific public infrastructure vulnerable in Multnomah County are:

- 40 County Support Facilities
- 1 Water Providers and Distribution Support Facilities

e. *Private Economy and Business Sector*

(1) Approximately ***2*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description:

Flooding activity can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Landslide and flooding activity can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses.

(3) The specific private economy and business sector vulnerable in Multnomah County are:

- 1 Grocery Stores
- 5 Restaurants
- 17 Private Businesses/Corporations

**Multnomah County Drainage District (MCDD)**
**EMERGENCY RESPONSE PLAN**

## PURPOSE

The purpose of this plan is to develop protocols for the Districts and other agencies to follow in the event of high water on the Columbia River or high water elevations internally due to heavy rain or other events that may lead to high water elevations.. Often times an external and internal event may occur simultaneously. During such an event it will be important for District Staff to be prepared to take actions that will keep the District Facilities functioning to protect life, property, and the environment.

## MCDD EXTERNAL COLUMBIA RIVER HIGH WATER EVENT STAGES

### External Event

A external event is deemed to occur whenever Columbia River, Vancouver Gauge levels are expected to exceed 24 feet NGVD(MSL). All elevations in this plan are in NGVD1929 Datum.

Multnomah County Drainage District No.1 (MCDD), Peninsula Drainage District No.1 (PEN1), Peninsula Drainage District No.2 (PEN2), and Sandy Drainage Improvement Company (SDIC) (Districts) facilities are designed to handle a 100-year 24 hour rain event.

This plan will be implemented whenever the weather forecast or river forecast predicts water elevations to reach predetermined elevations identified in this plan. The plan will remain in force until the water elevations receded below elevations identified in the plan.

### River Levels and Weather Service

Real time and forecast weather and river levels can be found at
**http://www.nwrfc.noaa.gov/**

The Vancouver Gauge on the Columbia can be found at
**http://www.nwrfc.noaa.gov/river/station/flowplot/flowplot.cgi?VANW1**

**NOTE:** The Vancouver Gauge uses Columbia River Datum. To convert to NGVD you need to add 1.82

### Stage Event Water Elevations

- Columbia River- Water Elevations (NGVD)

| | | |
|---|---|---|
| Stage 1: | 18.0 to 23.5 | 10 year event |
| Stage 2: | 23.6 to 25.8 | 50 year event |
| Stage 3: | 27.4 to 28.9 | 100 year event |
| Stage 4: | 29.0 and above | 500 year event |

- Lower Columbia Slough-Water Elevations (NGVD)

| | | |
|---|---|---|
| Stage 1: | 18 to 21.8 | 10 year event |
| Stage 2: | 21.9 to 25.8 | 50 year event |
| Stage 3: | 25.9 to 27.5 | 100 year event |
| Stage 4: | 27.6 to 32.2 | 500 year event |

**Response to Columbia River Stages**

**Stage 1: 18 to 23.5 feet 10 year event**

MCDD field staff will make daily inspections of all levee systems and report back any and all conditions to the Incident commander. It is expected that at these river levels, all monitoring, surveillance, and reporting will be handled by MCDD staff. When river levels are expected to reach 19 ft contact Graphics Packaging. River and weather forecast will be checked daily (see contact information below).

**Stage 2: 23.6 to 27.3 feet 50 year event**

EOC will be established at MCDD and 24 hour operation and surveillance will go into effect. MCDD will contact the United States Army Corps of Engineers (USACOE) and request the USACOE liaisons to be stationed at the MCDD EOC. Communication will be established with the following agencies and they will be notified that the EOC has been established at MCDD.

City of Portland
City of Fairview
City of Gresham
City of Troutdale
Port of Portland
Multnomah County

Additional man power for levee monitoring may be requested from the City of Portland Water Bureau, City of Portland Maintenance Bureau, Port of Portland Maintenance Crew, Riverside Golf Course, or Heron Lakes Golf Course. Additional manpower should be requested through the Port of Portland or the City of Portland EOC.

Where possible the following positions will be staffed in three eight hour shifts. Duties of positions that are not staffed will be the responsibility of the Incident Commander. Depending on the size and duration of the event additional positions may be staffed from outside the Drainage District Staff. Staff members should be in the briefing room 1 hour prior to the start of their shift and for the last hour of their shift for briefing. Shifts will be from 0600 hrs to 1400 hrs, 1400 hrs to 2200 hrs, and 2200 hrs to 0600 hrs.

**Shift Staffing Requirements**

**0600 to 1400**
**Command Staff**
- Incident Commander
- Operations Chief
  - Safety Officer

**General Staff**
- Planning
  - Finance
  - Logistics
- Operations
  - Field Crew
- Liaison
  - Communication/Information/Public Relations/Media

**1400 to 2200**
**Command Staff**
- Incident Commander
- Operations Chief
  - Safety Officer

**General Staff**
- Planning
  - Finance
  - Logistics
- Operations
  - Field Crew
- Liaison
  - Communication/Information/Public Relations/Media

**2200 to 0600**
**Command Staff**
- Incident Commander

**General Staff**
- Operations
  - Field Crew (Levee Monitors)

When the Columbia River is expected to reach an elevation of 23 feet at the Vancouver Gauge (Columbia River Datum) or 24.8 feet (NGVD) the concrete panels need to be placed at PEN1 in three locations.

1) Contact Bill Long City of Portland EOC and request a 7.5 ton boom truck and minimum three man crew to install panels.
2) Contact City of Portland EOC and request closing of N. Marine Drive at 3400 N. Marine Drive.

3) Concrete panels need to be placed in the sea wall at PEN1, these panels are located on the river side of the sea wall adjacent to the two openings across Marine Drive from 2989 N. Marine Dr. Flint Inc. and 3400 N. Marine Dr. Graphic Packaging.
4) The concrete stop logs located at Graphic Packaging 3400 NE Marine Drive also need to be placed across Marine Drive and the road closed.
5) The concrete panels that close the entrance road to Morgan CFS at 12220 N Portland Road and rail spur will also need to be installed. These panels are located at the entrance road to Morgan CFS next to the railroad overpass. The steel posts are next to the panels in a locked container. (Keys to the container are in the lock box at MCDD in the mechanical room, and with Steve Luna MCDD, and with Bill Long COP Maintenance Bureau).
6) Contact Graphics Packaging, Morgan CFS, and Peninsula Terminals and notify them that the panels will be in place and the spur line and access road will be closed and the sea wall and Marine Drive will be closed.

Check weather and river forecasts daily.

**Stage 3: 27.4 to 28.9 feet 100 year event**

Areas of concern will have already been identified for all areas and surveillance will be increased for those areas. If an emergency has been declared by the Governor, MCDD will request night time infer red aerial surveillance of the levees by the United States Army National Guard. River and weather forecasts will be checked daily.

**Stage 4: 29.0 feet and above 500 year event**

The levee designs for PEN1 and PEN2 are not adequate for the 500 year event. Precautions will be made to ready all Districts for evacuation. If evacuation is required call 911 and request the Police activate the evacuation plan.

**Levee Monitoring**

During a flood emergency, monitoring of levee conditions is necessary to be sure that emergency maintenance is initiated quickly so that small problems don't become large problems. Monitoring assignments will be conducted as described in this plan or as recommended by the Incident Commander and Operations Chief. The Corps of Engineers representatives and the City EOC will be advised of any and all incident observations.

Primary source of monitoring personnel will be Water Bureau crews if available. Monitoring of main levee sections topped by roadways and or paved bike paths

will be done by Water Bureau maintenance crews under the direction of the Operations Chief. Direction of effort will come from MCDD's Incident Commander, Operations Chief and Corps of Engineers representatives, developed in consultation with the City EOC and Water Bureau management.

If Water Bureau crews are not available, MCDD will recruit volunteers from allied organizations. These volunteers will be organized and directed under the MCDD Incident Command chain.

Monitoring of the back levees which are not topped by main roads (mostly on the Columbia Slough or south sides of the districts) may be accomplished by MCDD and other staff of local enterprises who know the area and how to gain access through private properties. These local personnel will be under the direction of the Operations Chief or as assigned by the Incident Commander.

All monitoring crews will be trained by MCDD staff for:

- What to look for
- How and to whom to report to
- How to construct emergency stabilization and containment for sloughing, seeps, boils, etc.

A great advantage of using Water Bureau crews is that they are already outfitted for fieldwork, including radio and cell phone equipment, work trucks with hand tools and have safety and other relevant training.

**Outfitting Volunteer Monitoring Crews**

Volunteers for Marine Drive and Portland Road levee monitoring will need the following minimum equipment:

- rain gear
- safety vest
- flash light with extra batteries
- sturdy shoes
- vehicle
- cell phone
- with extra battery, battery eliminator and charger
- water bottle
- Sandbagging operations brochure
- Map of the area to be patrolled

**Levee Repairs**

Repairs will be directed according to priorities established by the MCDD Incident Commander in consultation with the Operations Chief and the Corps of Engineers staff.

## MCDD INTERNAL STORM EVENT RESPONSE

### Interior Ditches - Normal Water Elevations

Interior ditch water elevations are regulated by the pump stations. Staff gauge readings are shown in real time data on the SCADA system. These staff gauge readings will give elevations for normal flows and will help determine if apparent problems are occurring in reaches between gauge stations. Pumps are turned off and on based on set points programmed in the SCADA system. Water elevations may vary depending on which mode the individual pump stations are in but should remain between the designated set points. If water elevations exceed the high water alarm set point the alarm will appear on the SCADA computer screen. If water elevations fall below the low water alarm set point the alarm will appear on the SCADA computer screen and the pumps will be automatically shut off by the PLC in the pump station.)

**Multnomah Drainage District #1 (Designated Set Points)**

| | |
|---|---|
| Pump Station #1 - | 5.0 to 8.7 |
| Pump Station #2 - | 2.5 to 4.5 |
| Broadmoore Pump Station - | 2.0 to 4.5 |
| Airtrans Pump Station - | 1.6 to 2.3 |
| Pump Station #4 - | 7.0 to10.5 |
| 181st Pump Station - | NA |
| Fairview Lake Pump Station - | NA |

**Peninsula Drainage District #2**

| | |
|---|---|
| NE Schmear Rd Pump Station - | -1.0 to 2.0 |
| NE 13th Pump Station - | -1.5 to 3.0 |

**Peninsula Drainage District #1**

| | |
|---|---|
| Portland International Raceway Pump Station | 2.0 to 4.5 |
| Vanport Wetlands Pump Station | 2.0 to 4.2 |

**Sandy Drainage Improvement Co.**

Sandy Pump Station - 6.5 to 9.5

**Pump Monitoring**

MCDD, Pen 1, SDIC and Pen 2 have established 100 year flood plain elevations of 14', 11', FIRM and 5' NGVD respectively,

Following is a list of all pumping facilities for the districts and water elevations that will impact the Districts. The list is divided into primary pumping plants and secondary plants. Primary plants are the main de-watering stations for the system and require a priority status to the secondary stations. The secondary stations service specific sub-basins within the districts. In cases of failure, either electrical or mechanical, the primary stations will take priority status for getting back on line. If a major power outage occurs during the storm event, refer to the **Emergency Contacts and Phone Numbers** section for contacts and available emergency generation for the stations.

**Multnomah Drainage District #1**

**Primary Pumping Facilities**

Pump Station #1

| | |
|---|---|
| Up to 11.9’ | No impact to sub basin |
| 12.0’ & up | PDX east taxiway storm drainage system becomes nonfunctional |
| 14.0’ & above | Isolated flooding will occur within the sub basin. Areas will be identified with new aerials in the near future. |

Pump Station #4

| | |
|---|---|
| Up to 12.0’ | No impact to sub basin |
| 12.0’ & above | Isolated flooding east of NE 142nd to NE 185th Structures will not be impacted. |

**Secondary Pumping Facilities:**

Pump Station #2

| | |
|---|---|
| Up to 5.0’ | No impact to sub basin |
| 5.0’ & above | Isolated flooding to Riverside Golf & Country Club & East of NE 33rd North of NE Elrod Rd. |
| 7.0’ & above | Isolated flooding along NE Elrod Rd. and the Port of Portland’s’ Southwest Quad area. Possible impact to POP drainage system in this area. |

Broadmoor Pump Station

| | |
|---|---|
| 5.0’ & above | Isolated flooding to Broadmoor Golf Course. |

| | |
|---|---|
| 6.0’ & above | Isolated flooding and possible impacts to the Port of Portland’s’ storm drainage system in the Southwest Quad area. |

Airtrans Pump Station

| | |
|---|---|
| Up to 6.0’ | No impact to sub basin |
| 6.0’ & above | Possible impact to POP storm drainage system on the south side of the terminals. |

181st Pump Station

| | |
|---|---|
| Up to 14.0’ | No impacts to sub basin |

Fairview Lake Pump Station

| | |
|---|---|
| Up to 12.0’ | Isolated flooding to property to the North and East. |
| 12.0’ & above | The pump motor is in danger of submergence. |

**Peninsula Drainage District #2**

NE Schmeer Rd Pump Station

| | |
|---|---|
| Up to 3.5’ | No impact to sub basin |
| 3.5’ & above | Possible storm sewer backup in Delta Park Business area. |
| 5.0’ & above | Flooding will occur in sub basin. |

NE 13th Pump Station

| | |
|---|---|
| Up to 4.5’ | Isolated flooding to sub basin. |
| 5.0’ & above | Flooding to sub basin will occur. |

**Peninsula Drainage District #1**

PIR Pump Station

| | |
|---|---|
| Above 6’ | Isolating flooding to sub basin. |

Vanport Wetland Pump Station

| | |
|---|---|
| Above 6’ | Possible storm drain system flooding at Portland Expo Center lower parking area |

.

**Sandy Drainage Improvement Company**

Sandy Pump Station

| | |
|---|---|
| Up to 12.0’ | Isolated flooding to sub basin. |

## EMERGENCY CONTACTS AND PHONE NUMBERS

**Army National Guard - By the Governor only**

MCDD will also utilize cooperatively provided equipment from the Port of Portland, Fairview and other cooperating organizations as they do in normal circumstances. If additional sources are required, MCDD will turn to the City EOC and/or the Portland Airbase for assistance.

**Construction Materials:**

MCDD maintains supply of construction materials from a list of regular suppliers. MCDD will obtain emergency contact names and numbers for all supplies which may be required on an emergency basis. MCDD may also obtain supplies through cooperative relationships with organizations such as the Port of Portland. MCDD will attempt to use these normal sources first unless urgency, communications or availability problems preclude it. In such cases, MCDD will turn to the City of Portland EOC for logistics assistance for these materials

**Emergency Generators**

There are 10 pumping stations that maintain the water level of the Columbia Slough from Sandy to Kelly Point at the Willamette River. The pumping facilities in this plan do not make accommodations for in-place back-up power supplies or generation systems, except at Pump Station 6 (Airtrans) for the Port of Portland (PORT). The selection to provide on-site generation is the decision of the **Incident Commander**. The method for providing power during a 'Major Power Outage' to any of the pump stations requires direct connection to existing feeder cables serving the respective facilities. A qualified generator supplier and/or contractor is required to move in and set up the emergency generator system(s). The set up and supply of an emergency generation system shall be complete with on-site maintenance and operation, the required auxiliaries such as cabling, circuit protection, fuel, water, oil and the like. The power shall be supplied at 60 hertz at the rated kw, voltage, and phase as indicated in Table II of this section. The connection to the pump stations shall be with direct connected copper cables to existing transformer secondary conductors for the 2,300v. systems at Pump Stations 1 and 4; and to the load side of the existing Service Entrance equipment for the 480 and 240v. pumping stations. The Generator/Contractor firm shall coordinate all activities with the **Incident Commander** and serving Utilities. The direction of the **Incident Commander** shall be binding and final.

The district has a Telemetry or SCADA (Supervisory Control And Data Acquisition) system to monitor and control all pump stations except Pen1, KGW. This system consists of a central Personal Computer (PC) at the districts main office and a radio modem network consisting of 9 pump stations and two (2) RF signal repeater sites at White Satin Sugar and Portland International Airport parking level 7. All pump stations and the repeater sites have UPS backup that will maintain power to the PLC and modems for approximately 90 minutes. The monitoring and control is through the 902-98MHz frequency hopping spread spectrum radio modems and Programmable Logic Controllers (PLC), which start and stop pumps based on Mode selection and Forebay water level control. Safety and emergency floats are 'hard wired' to prevent dry pumping and overflow of the Forebay. The SCADA systems monitor pump and station Flow in CFS, the Level in feet using NGVD reference and pump operation in hours showing starting and stopping times. This data is recorded to a database for future review of performance. Additionally, alarm conditions such as motor failure, low and high water levels, electrical system failures, station security, and the like also displayed and logged to a data-base, on the PC, for future reference and review of performance.

Should there be loss of power to a pumping station(s), the **Incident Commander** shall determine the duration the station can be out of service. If conditions require emergency power, a diesel-powered generator(s) shall be deployed to the respective pump station as directed by the **Incident Commander**. To operate a pump or pump station under emergency power conditions the following loads and generator or generators are required. To connect to the respective load, cable from the generator(s) shall be connected to the incoming side of the respective pump station electrical system. See

Table II, below, for suggested generator loading and connection method. The final generator sizing shall be the responsibility of the Generator Supplier/Contractor.

## PRIORITY

The priority for selection of which pump station(s) shall be provided with emergency generator power shall be the decision of the **Incident Commander**.

# REGION 2
# Northern Willamette Valley / Portland Metro[1]
# Hazards Assessment

[1] Includes the counties of Columbia, Clackamas, Multnomah and Washington.

# FLOOD

## Characteristics and Brief History

The northern Willamette Valley (including the Portland Metro area) has a lengthy flood history. The Willamette and Columbia Rivers have produced numerous floods, some of which are shown in Table 9. Most Willamette River flooding is a winter phenomenon. The common pattern includes the accumulation of heavy wet snow in higher elevations followed by a mild, rainy, weather system. The resulting snowmelt on saturated or frozen ground sometimes produces devastating flood conditions. These conditions would be worse were it not for many dams (used for, among other purposes, flood control) on the upper reaches of the Willamette and some of its tributaries.

The Columbia River Estuary is the second largest river in the United States and the largest river to flow into the eastern North Pacific.[2] Columbia River floods usually occur in the early summer and are associated with seasonal runoff from melting snow. Although unusually extreme, the Vanport Flood (1948) provides an example of such an event. The 20-day flood was the greatest single disaster in the recorded history of the Columbia River Basin. The toll was 32 dead and 7 missing in the Portland area. Flooding occurred when the Columbia River broke through a dike surrounding the community of Vanport and forced 50,000 people to evacuate their homes. Economic losses reportedly exceeded $100 million. Vanport, a Vancouver-Portland suburban community[3], was not rebuilt. Prolonged winter rain, debris dams, and breeched dikes have produced flood conditions at several Columbia County locations. Tidal influences are observed on the Columbia River inland to the Bonneville Dam and on the Willamette in Portland.

A very common Willamette Valley phenomenon involves tributary stream back-up during periods of high water. In short, tributary streams cannot enter swollen main stem rivers during periods of high water. This forces the tributary streams out of their banks with predictable results. During the February 1996 flood, dams controlled Columbia River flows. This allowed the Willamette River to enter the Columbia, averting flooding in downtown Portland. Other streams produced widespread flooding throughout the region. Table 10 summarizes the sources of flooding for each of the major rivers in the region.

[2] Columbia River Estuary, NOAA.

[3] The largest public housing project ever built in the United States, PCC (Portland Community College).

## TABLE 9. SIGNIFICANT FLOODS

| DATE | LOCATION | DESCRIPTION | TYPE OF FLOOD |
|---|---|---|---|
| 12/1861 | Coastal Rivers | The “Great Flood”; largest flood of known magnitude on the Willamette River. Every town on the river was flooded or washed away. Widespread damage. | Rain on snow (ROS) / snow melt (SM) |
| 12/1862 | Willamette River Basin | Widespread flooding. | ROS |
| 02/1890 | Willamette Basin | Second largest flood of known magnitude. Water levels in Portland: 22.3 ft. | ROS |
| 06/1894 | Main stem Columbia | Largest flood ever observed on the river. Current small in Portland. Little damage. | SM |
| 01/1923 | Willamette & Columbia Rivers | Rain and mild weather. Widespread damage to roads & railroads. | ROS |
| 12/1937 | Willamette Basin | Considerable flooding; landslides. | ROS |
| 12/1945 | Willamette Basin / NW Oregon | Very warm temperatures. Considerable flood damage. | ROS |
| 06/1948 | Main stem of the Columbia | Vanport near Portland was completely destroyed. | SM |
| 12/1955 | Columbia River & Willamette Basin | Strong winds / flooding. Five fatalities. | ROS |
| 12/1964 | Entire State | Record-breaking December rainfall. Widespread damage. Warm temperatures. | ROS |
| 01/1972 | Willamette and Sandy Rivers | Widespread damage. Many fish destroyed, buildings, etc. Five fatalities. | ROS |
| 01/1974 | Western Oregon | Mild storms followed heavy snow and freezing rain. Nine counties declared disasters. | ROS |
| 01/1978 | Willamette River and NW Oregon | Intense rain / snowmelt. Widespread flooding. | ROS |
| 02/1986 | Entire state | Numerous homes evacuated. Intense rain and melting snow. | SM |
| 02/1987 | Western Oregon | Willamette and tributaries. Mud slides, flooded highways, damaged homes. | ROS |
| 01/1990 | Western Oregon | Ten rivers in eight counties flooded. Many bridges washed away. | ROS |
| 02/1996 | NW Oregon | Warm temperatures / record breaking rains. Widespread flooding[4] | ROS |
| 12/1996 | Western Oregon | Mild subtropical moisture led to extensive flooding. 14 county disaster. | ROS |

Source: Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book,* Pp. 96-10.

## TABLE 10. PRINCIPAL RIVERINE FLOOD SOURCES

| Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|
| Willamette River & Tributaries | Clatskanie R | Columbia and Willamette Rivers & Tributaries | Willamette River and Tributaries |
| Abernethy Cr | Columbia R | Sandy River | Tualatin River |
| Clackamas River | Conyers Cr | Multnomah Channel | Fanno Cr |
| Clear Cr | McNulty Cr | Johnson Cr | Summer Cr |
| Dear Cr | Milton Cr | Fairview Cr | Ash Cr |
| Eagle Cr | Multnomah Ch | Columbia Slough | Rock Cr |
| Johnson Cr | Nehalem Cr | Ponding within Drainage Dist. #1 | Cedar Cr |
| Kellogg Cr | Rock Cr | Beaver Cr | Butternut Cr |
| Milk Cr | Scappoose Cr | Fairview Cr | Dawson Cr |
| Molalla River | | Kelley Cr | Beaverton Cr |
| Mt. Scott Cr | | Mitchell Cr | Bronson Cr |
| Nyberg Slough | | | Willow Cr |
| Oswego Channel | | | Cedar Mill Cr |
| Phillips Cr | | | Johnson Cr |
| Pudding River | | | Dairy Cr |
| Salmon River | | | McKay Cr |
| Sandy River | | | Council Cr |
| Still Cr | | | Gales Cr |
| Tualatin River | | | Wapato Cr |
| Zig Zag River | | | Nyberg Slough |
| Tickle Cr | | | |

Source: FEMA, Benton County Flood Insurance Study (FIS), 08/15/96, FEMA, Lane County FIS, 06/02/99, FEMA, Linn County FIS, 09/29/86, FEMA, Marion County FIS, 07/13/01, FEMA, Polk County FIS, 12/19/95, FEMA, Yamhill County FIS, 09/30/83

## Probability

The Federal Emergency Management Agency (FEMA) has mapped most flood-prone streams in Oregon. The maps depict the 1% flood (100-year) upon which the National Flood Insurance Program is based. All of the Region 2 counties have Flood Insurance Rate Maps (FIRM); however, some of the maps are old and could be outdated. The FIRM maps were issued at the following times: Clackamas, July 19,2000; Multnomah March 18, 1986; Washington, March 18, 1987; Columbia, September 16, 1988.

A cursory examination of Table 9 above provides some indication of flooding in Region 2. Significant flooding occurs on a fairly regular basis, at least once every 5-7 years (not all flooding is shown in Table 9). Despite this knowledge, flood losses continue to be high.

## Vulnerability

The probability that Region 2 will experience floods and the region's vulnerability to their effects are depicted in Table 11 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

**TABLE 11. Vulnerability and Probability Assessment of Floods**

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | H | M | M | M |
| Probability | H | M | M | H |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

# PLANNING FOR NATURAL HAZARDS:
## *Flood TRG*

July 2000

***Oregon Departmentof Land Conservation & Development***
635 Capitol Street NE, Suite 150
Salem, OR 97301
503-373-0050

***Community Planning Workshop***
Community Service Center
1209 University of Oregon
Eugene, OR 97403
541-346-3889

**Special Acknowledgements to:**

***Community Planning Workshop Researcher:***

**Lori Olson** — *Community and Regional Planning; Public Policy and Management Masters Candidate*

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**Joseph Murray** — *Oregon State Police, Office of Emergency Management*
**Dennis Sigrist** — *Oregon State Police, Office of Emergency Management*

## Table of Contents



## *Section 1:*
## Introduction to the Flood Technical Resource Guide

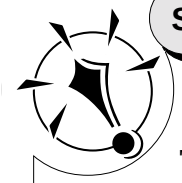
Many Oregon communities have areas that are subject to flooding. Communities commonly allow development within flood prone areas; however, such development is subject to certain regulations. This guide is intended to serve as a resource and planning tool for local governments in developing land use strategies that reduce the risks posed by flood hazards. This guide provides background information on flood hazards, information on state and federal laws that address flooding in Oregon, and technical information and data sources on reducing the risk of flooding. The guide is designed to help your local government address flood hazard issues through effective comprehensive plan inventories, policies and implementing measures.

### 1.1 The Threat of Flood Hazards to Oregon Communities

Floods occur throughout the United States causing loss of life and property, and disrupting families and communities. Communities particularly at risk are those located in low-lying areas, near water.[1] A single flood event can cause millions of dollars in property damage, and pose a significant threat to human life and safety.[2] The economic impacts of flooding on businesses, private citizens, the public sector, and infrastructure (e.g., roads and bridges) can be significant, and Oregon's largest economic loss from natural disasters has resulted from flooding. Businesses are often forced to close or curtail their operations, some are unable to reopen for weeks or months, and many never reopen. Business owners and employees lose money in sales, damaged inventory, and wages. Individual property owners experience both property and structural losses.[3] Understanding flood hazards and how they occur will help reduce the risk these threats pose to Oregon communities.

Flood damage to infrastructure has a devastating effect on local recovery efforts. Damage to federal, state, county and local roads and bridges can leave communities stranded and without access to critical services such as police, fire, and hospitals. Damage to water and sewage treatment plants can result in serious pollution and drinking water contamination when raw sewage or other pollutants are released and carried by floodwaters. Erosion, mudslides, and the carrying of large debris by floodwaters create dangerous or unstable ground conditions, which may pose serious threats to development.[4]

Flash floods represent even greater safety risks than riverine floods because of the rapid onset, the high velocity of water, and the huge debris load carried by floodwaters. Multiple flood crests can occur from a series of fast moving storms. The rapid rise in water level and force may cause motorists to underestimate the depth and velocity of floodwaters, causing stalled and flooded vehicles and loss of life by drowning.



**Sidebar**

**Organization of the Natural Hazards Technical Resource Guide**

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goals 2, 7, 17 and 18, a resource directory and land use tools matrix for hazard mitigation.

### *1.2 How to Use the Flood Technical Resource Guide:*

The Flood Technical Resource Guide provides information to help communities in Oregon plan for flood hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about flood hazards.

**Section 2:**
**Is Your Community Threatened by Flood Hazards?**

Section 2 presents an overview of the causes and characteristics of floods, and provides information to assist communities in flood hazard identification.

**Section 3:**
**What are the Laws in Oregon for Flood Hazards?**

Section 3 summarizes current laws that Oregon communities are required to address for flood hazards.

**Section 4:**
**How can Your Community Reduce Risk from Flood Hazards?**

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from flood hazards.

**Section 5:**
**How are Oregon Communities Addressing Flood Hazards?**

Section 5 examines how several communities are implementing programs to reduce risk from flood hazards. These examples illustrate plan policies and implementing measures for floods.

**Section 6:**
**Where can Your Community find Resources to Plan for Flood Hazards?**

Section 6 is a resource directory listing contacts, programs, and documents that planners, local governments and citizens can use to access additional information on flood hazards.

## *Section 2:*
## Is Your Community Threatened by Flood Hazards?

Flood hazards can cause severe property damage and loss of life. Identifying hazard areas is a key step in developing effective plan policies and implementing measures. This section assists local planners and decision makers in understanding how floods may affect current and future development. An overview of the causes and characteristics of floods is included, along with information on identifying flood hazards in your community.

### *2.1 A Brief History of Flooding in Oregon*

Oregon has a detailed history of flooding. Flood records date back to the 1860s. Oregon's deadliest recorded flood occurred in Heppner in 1903. A June 15th storm dropped 1.5 inches of rain within a 20-minute period. The storm was centered in the headwater area of Willow Creek near Heppner in Northeastern Oregon. Within minutes, a 5-foot wall of water and debris poured through Heppner with enough velocity to rip homes off of their foundations. These floodwaters claimed 247 lives.[5]

The 1948 flood destroyed the entire city of Vanport (now Delta Park). Record flow levels on the Columbia River caused the structural failure of a dike. Vanport was destroyed in minutes and was never rebuilt. Over 19,000 people lost their homes and 18 people lost their lives.[6]

Many of Oregon's flood records were set during the December 1964 and January 1965 "Christmas Flood." Damage from this flood event totaled over $157 million dollars and twenty Oregonians lost their lives. From December 20th through the 24th of 1964, the most severe rainstorm to occur in Central Oregon, and one of the most severe west of the Cascades, left many areas with two-thirds their normal annual rainfall in five days. This was augmented by snowmelt in the mountains and valleys. The ensuing floods destroyed hundreds of homes and businesses, forced the evacuation of thousands of people, destroyed at least 30 bridges and washed out hundreds of miles of roads and highways.[7]

A similar flood event occurred in February 1996. Following an extended period of unseasonably cold weather and heavy snowfall in the Pacific Northwest, warming temperatures and rain began thawing the snowpack and frozen rivers throughout Oregon. On February 6, a strong subtropical jet stream hit Oregon. This warm, humid air mass brought record rainfall amounts, quickly melting the snowpack. At least 25 rivers reached flood stage. Many reached flood levels comparable to those of the 1964 flood. Twenty-seven of Oregon's 36 counties were declared a presidential disaster due to this event. Statewide, damages totaled over $285 million.[8]

**Tip Box**

**Hazard Inventories**

Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities, and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

## Table 1. Historic Flooding in Oregon

| DATE | LOCATION (RIVER) | COMMENTS |
|---|---|---|
| September 1861 | Klamath, Willamette and Umpqua | |
| March 1876 | Columbia | |
| June 1880 | Columbia | |
| January 1881 | Willamette Basin | |
| December 1882 | Umatilla | |
| June 1884 | John Day | |
| January - February 1890 | Willamette Basin | |
| May - June 1894 | Columbia River Basin | Rain on snow pack; highest flood stage ever recorded at Vancouver, WA (33.6 feet) |
| June 1903 | Willow Creek | Flash flood in Heppner; 247 people killed |
| April 1904 | Silvies and Klamath | |
| March 1906 | Umatilla | |
| February 1907 | Western Oregon and John Day | |
| November 1909 | Deschutes, Willamette, Santiam, Umpqua, Coquille and Rogue | |
| March 1910 | Powder and Malheur | |
| June 1913 | Columbia | |
| January 1923 | Clackamas, Santiam, Sandy, Deschutes, Hood and McKenzie | Record flood levels |
| February 1925 | Malheur | |
| February 1927 | Klamath, Willamette, Umpqua, Rogue and Illinois | Major flooding |
| May 1928 | Columbia | |
| March 1931 | Umatilla, Sandy, Clackamas and Santiam | |
| March 1932 | Malheur, Grande Ronde, John Day and Umpqua | |
| January 1933 | Coquille | |
| November - December 1942 | Willamette Basin | 10 deaths; $34 million in damages |
| December 1945 | Coquille, Santiam, Rogue and McKenzie | 9 deaths; many homes destroyed in Eugene area |

## Table 1. Historic Flooding in Oregon, continued

| DATE | LOCATION (RIVER) | COMMENTS |
|---|---|---|
| December 1946 | Willamette, Clackamas, Luckiamite, and Santiam | |
| May June 1948 | Columbia River | Rain on snow pack; destroyed city of Vanport |
| March 1952 | Malheur, Grand Ronde, and John Day | Highest flood stages on these rivers in 40 years |
| December 1955 | Rogue, Umpqua, Coquille | 11 deaths; major property damage |
| July 1956 | Central Oregon | Flash floods |
| February 1957 | Southeastern Oregon | $3.2 million in flood damages |
| December 1961 | Willamette Basin | $3.8 million in flood damages |
| March 1964 | Oregon Coast | Tsunami claims four lives |
| December 1964 - January 1965 | Pacific Northwest | Rain on snow; record flood on many rivers |
| December 1967 | Central Oregon Coast | Storm surge |
| January 1972 | Western Oregon | Record flows on coastal rivers |
| January 1974 | Western Oregon | $65 million in damages |
| November - December 1977 | Western Oregon | Rain on snow event; $16.5 million in damages |
| December 1981 | Umpqua and Coquille | |
| January 1982 | Tillamook County | |
| February 1982 | Malheur and Owyhee Basins | Cyclical playa floods on Malheur & Harney Lakes |
| 1979 to present | Harney County Lakes | Damages totaling $280 million |
| February 1996 | Nearly statewide | High velocity flows, damage from erosion and undermining of structures |
| January 1997 | Jackson, Josephine and Douglas Counties | |
| May June 1998 | Crook County and Prineville | Heavy rainfall and high tides |
| December 1998 | Tillamook County | |
| November 1999 | Tillamook and Lincoln Counties | |

Source: State Hazard Mitigation Plan, Oregon State Police – Office of Emergency Management

## *2.2 What are the Types of Flood Hazards?*

Many types of flooding occur in Oregon. They include riverine flooding, flash flooding, urban flooding, coastal flooding, and playa flooding.

### 2.2.1 Riverine Floods

Riverine floods - overbank flooding of rivers and streams - are the most common of all natural disasters. Most communities in the United States have the potential to experience this type of flooding after spring rains, heavy thunderstorms, or snowmelt. These floods can be slow or fast-rising, but generally develop over a period of days.[9]

Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over wide geographic areas, causing flooding in hundreds of smaller streams, which then drain into the major rivers.[10] The most severe flooding conditions generally occur when direct rainfall is augmented by snowmelt. If the soil is saturated or frozen, stream flow may increase due to the inability of the soil to absorb additional precipitation.[11]

Almost every county in Oregon experiences riverine flooding. In fact, Oregon has over 250 flood-prone communities. The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with the melting of snow in the Cascade and Coast Ranges. Most of Western Oregon is highly susceptible to riverine flooding, especially Coos, Tillamook and Columbia Counties, as well as the western drainages of the Cascade Range.[12] Examples of riverine flood events occurred in February of 1996, and the “Christmas Floods” that occurred during December of 1964 and January of 1965.[13]

### 2.2.2 Flash Floods

Flash floods are a major cause of weather-related deaths in the United States. Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods occur with little or no warning and can reach full peak in only a few minutes.[14]

Topography, soil conditions and ground cover are all important factors that contribute to flash flooding.[15] Flash floods are most common in arid and semi-arid areas where there is steep topography, little vegetation and intense but short-duration rainfall. Flash floods occur in both urban and rural settings, principally along smaller rivers and drainage ways. Flash floods occur quickly in smaller waterways, or drainage streams that do not typically carry large amounts of water.[16] Flash floods usually occur in the summer during the thunderstorm season.[17]

In flash flood situations, waters not only rise rapidly, but also generally move at high velocities and often contain large amounts of debris. In some situations, a flash flood may arrive as a fast moving wall of debris, mud and water. Occasionally,

floating debris or ice can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back by the ice jam or debris dam can cause flooding upstream. Subsequent flash flooding can occur downstream if the obstruction suddenly releases. Areas subject to flash floods are often less obvious than those located on a typical riverine floodplain. Flash floods, however, may be associated with recognizable locations such as canyons or arroyos.[18]

Central and Eastern Oregon are the areas of the state most susceptible to flash flooding, particularly due to the arid climate, steep topography and low vegetative cover found there.[19] The most notorious flash flood in Oregon was the June 1903 event in Heppner.[20]

### 2.2.3 Shallow Area Flooding

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only 1 to 3 feet. These areas are generally flooded by low velocity sheet flows of water.[21]

### 2.2.4 Urban Flooding

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. This transition from pervious to impervious surfaces results in more water running off instead of filtering into the ground. Thus, water moves faster to watercourses, with resulting water levels rising above historic, pre-development levels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with yard waste causing additional, localized flooding.[22]

Another cause of urban flooding is grading associated with development. Grading may cause changes in drainage direction from one property to another. Although this is a small, isolated impact of development, it may be significant to the adjacent property owner.

### 2.2.5 Coastal Flooding

Coastal flooding occurs in low-lying coastal areas, and is caused by heavy rain, large waves, or even tsunamis triggered by underwater seismic events. The areas susceptible to this intense wave action are termed high velocity zones, or "V-zones". Special regulations apply for development in these areas. For more details, refer to the discussion on "V-zones" later in this section.

**TRG Key**

For more comprehensive information on coastal flooding hazards, see the Coastal Technical Resource Guide.

### 2.2.6 Playa Flooding

Playa flooding results from greater than normal runoff into a closed basin. Closed basin systems are those areas that have one or more rivers emptying into one or more lakes that have no outlet. In these situations, water leaves the system primarily through evaporation. Thus, if annual precipitation in the basin increases significantly, evaporation is not enough to

reduce water levels. Lake levels rise and inundate the surrounding properties.

The best-known example of playa-basin flooding in Oregon occurs at Malheur and Harney Lakes in Harney County. In higher than average precipitation years, the lakes flood adjacent ranches and public roads. Malheur and Harney Lakes flooded during the years 1979 to 1986, and then gradually receded. During the wetter years of 1997 to 1999, these lakes again flooded.[23]

## *2.3 What are some Terms Related to Flooding?*

### 2.3.1 Floodplain

A floodplain is a land area adjacent to a river, stream, lake, estuary or other water body that is subject to flooding. These areas, if left undisturbed, act to store excess flood water. The floodplain is made up of two sections: the flood fringe and the floodway (See Figure 1).[24]

### 2.3.2 Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For National Flood Insurance Program (NFIP) purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures, so that flood flows are not obstructed or diverted onto other properties.[25] The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot (See Figure 1)."[26] Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

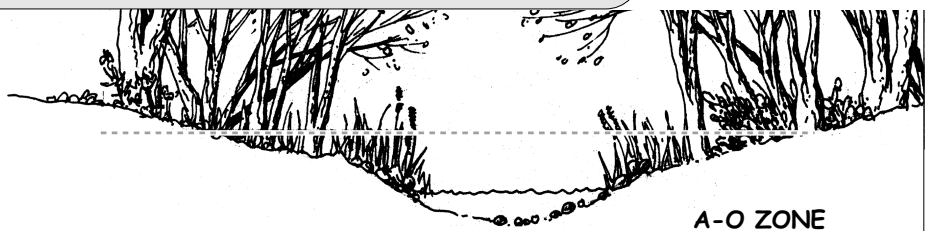
### 2.3.3 Development

For floodplain ordinance purposes, development is broadly defined to mean "any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials."[27] The definition of development for floodplain purposes is generally broader and includes more activities than the definition of development used in other sections of local land use ordinances.

### 2.3.4 The Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken (See Figure 1).

**Figure 1: Cross-section of the Floodplain**



| AREA | FLOOD FRINGE | FLOODWAY | A-O ZONE FLOOD FRINGE |
|---|---|---|---|
| DESCRIPTION | Shallow flooding usually standing or slow moving water. | Usually fast-moving water. Area reserved to conduct water of a 100-yr. flood out of the area. | |
| USE LIMITS | Construct residential buildings above base flood elevation. Other buildings may be flood-proofed. | No fill or structure that would cause any rise in base flood elevation. | |

Source: *Department of Land Conservation and Development. A Citizen's Guide to the Oregon Coastal Management Program. Salem, Ore.: Oregon Department of Land Conservation and Development (1997) p. 15.*

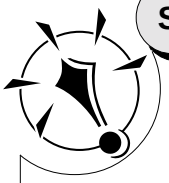
### 2.3.5 Base Floods and Base Flood Elevations

Flooding occurs for different reasons and at varying levels. "Base Flood" is defined by the NFIP regulations (44 CFR 59) as "the flood having a 1 percent chance of being equaled or exceeded in any given year." This flood is referred to as the 100-year flood. Determination of the 100-year flood is based on a statistical analysis of record flood flows, some dating back to the 1860's.

The term "Base Flood Elevation" refers to the elevation (normally measured in feet above sea level), which the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities choose to use higher frequency flood events as their base flood elevation for certain activities, using lower frequency events for others.[28] For example, for the purpose of stormwater management, a 25-year flood event might serve as the base flood elevation, while the 500-year flood event may serve as base flood elevation for the tie down of mobile homes.[29] The regulations of the National Flood Insurance Program focus on development in the 100-year flood plain.

**Flood Key**

See Section 4 of this guide for information on stormwater management.



**Sidebar**

**Mapleton, Oregon and the 1996 Flood Event**

Mapleton, a small community in Oregon's Coast Range, was one of the many communities affected by the 1996 Oregon Floods. Like many communities, most of Mapleton's development historically occurred in the floodplain. The Mapleton flood is an example of the intense chain of destruction that can be caused by flooding events when a community is built within the boundaries of the 100-year floodplain: "…(A) number of docks, outbuildings and mobile homes were washed away. Mud slides and floodwaters cut off the community completely. Several feet of floodwaters filled the floors of many homes and businesses. Mapleton's water system was completely knocked out by the flood. This not only raised health concerns, but hampered response and recovery operations until service was restored. Wells were also contaminated. At least one or two homes were completely destroyed by mudslides and over 30 homes and a number of businesses suffered serious water damage…"[32]

### *2.4 What is the Effect of Development on Floods?*

When development is located in the floodplain, it may cause flood waters to rise higher than before development, particularly if that development is located within the floodway. When structures or fill are placed in the floodway, water is displaced. Development raises the base-flood elevation by forcing the river to compensate for the flow space obstructed by the inserted structures. Over time, when structures or materials are added to the floodway and no fill is removed to compensate, serious problems can arise. Floodway development is currently regulated and local governments must require engineer certification that proposed developments will not cause the base flood (100-year flood) elevation to rise.[30] Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses and other facilities. Careful attention must be paid to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events.

In highly urbanized areas increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of stormwater management systems to ensure that these runoff waters are dealt with effectively.[31]

### *2.5 How are Flood-Prone Areas Identified?*

Flood insurance studies and Flood Insurance Rate Maps (FIRMs) are often used in characterizing and identifying flood prone areas.

#### 2.5.1 Floodplain Maps and Flood Insurance Studies

Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by the Federal Emergency Management Agency (FEMA), which delineates Special Flood Hazard Areas or floodplains where National Flood Insurance Program regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.[34]

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood and floodway areas. In some cases they may include 100-year base flood elevations (BFEs) and areas located within the 500-year floodplain.[35]

Flood Insurance Studies and FIRMs produced for the National Flood Insurance Program (NFIP) provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. *They do not reflect changes within the study area that might affect flooding since*

*the studies.* For example, many of Oregon's metropolitan areas have had significant population increases resulting in increased development during the past 20 years. Development changes the hydrology of urban streams as an increase in impervious surfaces results in greater runoff volumes and velocities. In order to address changing conditions, some communities have adopted higher regulatory standards such as Metro's balanced cut and fill requirements and Tillamook County's requirement that new homes and substantial improvements to existing homes be elevated at least 3 feet above the base-flood elevation. [36]

Although many communities rely exclusively on FIRMs to characterize the risk of flooding in their area, some jurisdictions develop their own flood hazard maps. They use high-water marks from flood events or aerial photos, in conjunction with the FEMA maps to better reflect the true flood risk for their communities (See case study on Talent in Section 5 of this guide).[37]

Geographic Information Systems (GIS) are increasingly becoming an important tool for flood hazard mapping. FIRMs can be imported directly into GIS, which then allows for GIS analysis of flood hazard areas. Communities find it particularly useful to overlay flood hazard areas on tax assessment parcel maps.[38] This allows a community to evaluate the flood hazard risk for a specific parcel during review of a development request. Coordination between FEMA and local technical experts is the key to making a strong connection with GIS technology for the purpose of flood hazard mapping.

FEMA and the Environmental Systems Research Institute (ESRI) have formed a partnership to provide multi-hazard maps and information to the public via the internet. ESRI produces GIS software, including ArcView© and ArcInfo©. The ESRI web site has information on GIS technology, as well as downloadable maps and other resources. The hazards maps provided on the ESRI site will assist communities in evaluating geographic information about natural hazards. Flood information for most Oregon communities is available on the ESRI web site. Visit **http://www.esri.com** for more information.

**Sidebar**

**The 100-Year Flood Myth**

This long-standing myth actually has two parts, and neither is true. The first is that every flood is a 100-year flood. The second is that the 100-year flood occurs only once every 100 years.

Often, floods that crest at a level well below that of the 100-year flood are incorrectly termed "100-year floods." This common misuse in flood designation leads people to the conclusion that an event that is supposed to happen only every 100 years is happening every time flood waters spill over the river bank. The reality is that the majority of floods consist of lesser frequency events such as the one-year, five-year or ten-year floods. The 100-year flood is not a frequent event and has only a one percent chance of being equaled or exceeded during any given year.[33]

Recent decades have seen an increase in 100-year flood events. For example, the Mississippi River Basin and parts of Southern Louisiana have had at least two 100-year events in the last decade. Because flooding depends on variables that cannot be accurately predicted, determination of exactly where the 100-year flood levels are is not an exact science. Factors such as climate change and changes to the built environment can have dramatic effects and communities should periodically review flood plain boundaries.

**Tip Box**

**Evaluating Development in Flood Hazard Areas**

When an individual walks into a local planning office with a proposed development, there are several steps that must be taken in order to identify the floodplain designation for that property and evaluate whether or not development can occur. A detailed description of this process can be found in Section 4 of this guide.

### 2.5.2 How to Read Flood Maps

Flood Insurance Rate Maps (FIRMs) are presented in a variety of formats. Many of the flood maps produced since January 1985 include floodway and floodplain management information that was not shown on older versions of flood maps. Many new Flood Maps also present simplified flood insurance risk zone designations. The most common scales are one inch = 500 feet, one inch = 1,000 feet, and one inch = 2,000 feet. The jurisdictions covered may include partial or entire counties or individual cities.

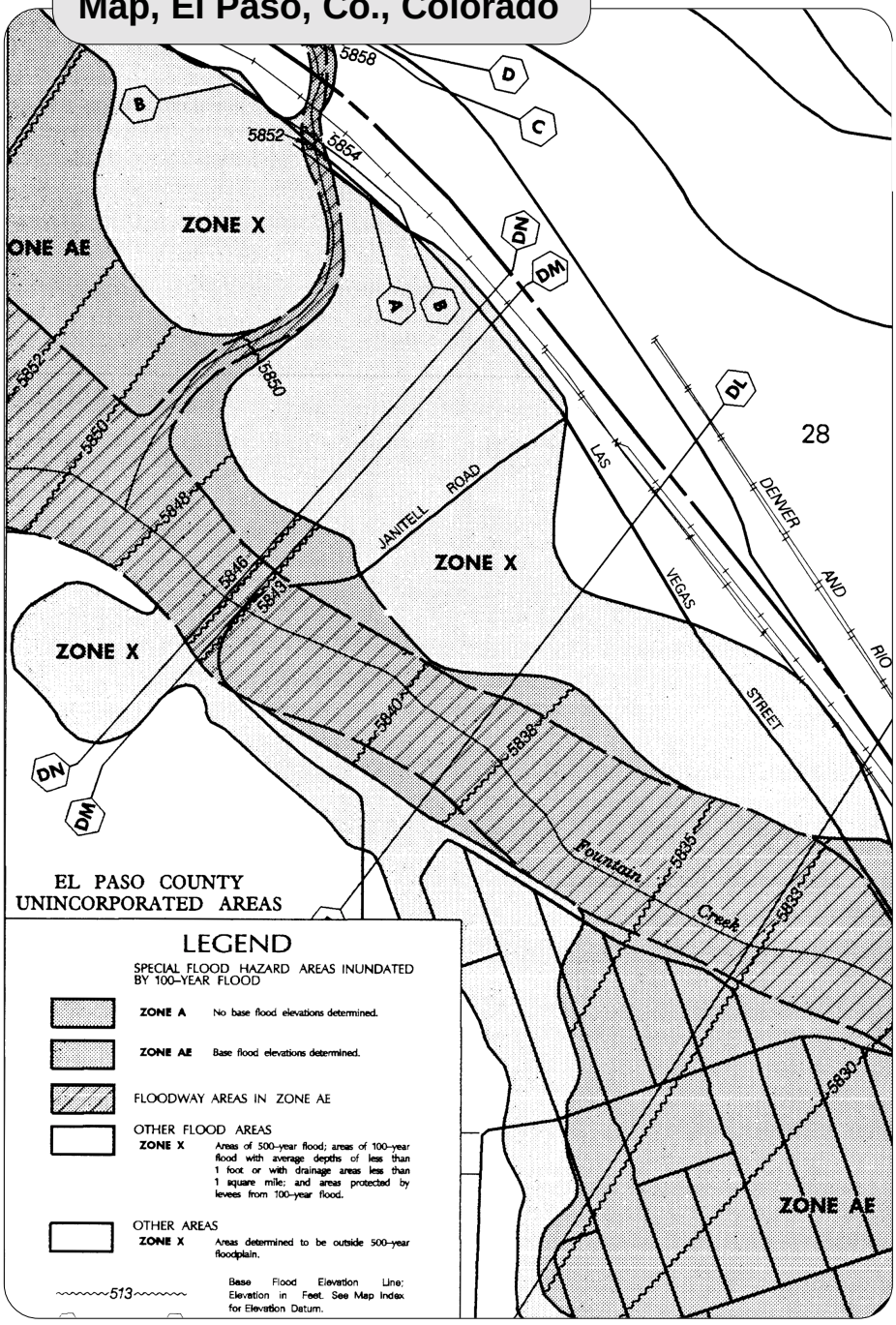
When a flood map cannot be presented on one page, it is produced on several pages. Those pages are known as panels. Panels depict flood hazards in a community. Each panel includes a title box that contains the name of the community, the panel number, and other information. All panels include seven items that also appear on the index. They are:

- Community name
- Community number
- Panel number/community panel number/map number
- Corporate limit or county boundary line
- North arrow
- Effective or revised date
- Map scale

Elevation reference marks are found on flood maps. These marks identify points where a ground elevation is established by survey. Elevations are usually expressed in feet; for some communities, however, the elevations are shown in meters. Descriptions of the marks, including their elevations are provided. These surveyed elevations are used to determine the base flood elevation.

Flood Hazard Area designations appear as dark and light tints. Dark tints indicate areas of increased flood hazards; light tints indicate areas of lesser flood hazards. Floodplain boundaries show the limits of the 100- and 500-year floodplains. Most flood maps cover only one community.[39]

## Digital Flood Insurance Rate Map, El Paso, Co., Colorado




Source: *Federal Emergency Management Agency. Multi-Hazard Identification and Risk Assessment. Washington, D.C.: FEMA (1997) p. 141.*

### Sidebar

**Questions to ask about Floodplain Mapping**

- How do I know if my flood map is up to date?
- Where can my community get more flood maps?
- Is the floodway mapped in my community?

FEMA's map distribution center can answer questions and provide additional copies of flood maps. They can be contacted at (800)358-9616.

- How do I get my map updated?

FEMA establishes priorities for remapping. Contact FEMA Region X's mitigation division at (425)487-4678 for information.

Individual property owners who wish to demonstrate that their property or structures are not located in a special flood hazard areas should submit a Letter of Map Amendment or a Letter of Map Revision for land that is out of the floodplain because of the placement of fill. Forms for Letters of Map Amendment and Map Revision are available on FEMA's website (**www.fema.gov/nfip/forms.htm**) or from the Oregon Floodplain Program coordinator (503)373-0050.

### *2.6 Summary of Flood Hazards in Oregon*

Many different types of flood hazards exist in Oregon, and their effects can be devastating. By understanding flood hazards, communities will be better prepared and equipped to plan for floods in the future.

Once flood hazards are identified, communities can review functional plans such as those for natural resources, open space, and master plans to integrate flood hazard information. To identify flood hazards in your community and to develop an inventory of flood hazards, use the following resources:

- ❒ *Existing flood maps* and information, including FIRMs, Flood Boundary-Floodway Maps, and FEMA Flood Insurance Studies (digital flood maps on FEMA or ESRI web sites)
- ❒ *FEMA Region 10* for information about recent map revisions or amendments. Contact information can be found in Section 6 of this guide.
- ❒ *Historical documents* such as "official" high water marks, aerial photos taken during flood events, newspaper articles or interview with local officials and residents on storm events and hazards over the past decade.
- ❒ *Soil maps* can show whether there are wet or "hydric" soils in your community. Wet soils may be indicative of historic flooding.
- ❒ *Other organizations* such as USGS or local watershed councils may have relevant flood data for your community.

**TRG Key**

Chapter 2: Elements of a Comprehensive Plan provides information on three phases of hazard assessment: hazard identification, vulnerability assessment and risk analysis.

**Planning for Natural Hazards: Reviewing your Comprehensive Plan**

The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment will examine identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following in determining whether or not its comprehensive plan has adequately inventoried flood hazards.

- ❒ Are there flood hazards in your community?
- ❒ Does your comprehensive plan hazard inventory describe floods in terms of the geographical extent, the severity and the frequency of occurrence?
- ❒ Has your community conducted a community wide vulnerablity assessment?

## *Section 3:*
## What are the Laws in Oregon for Flood Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with "known" natural hazards. This section of the Flood Technical Resource Guide presents current laws that Oregon communities are required to address.

### *3.1 Oregon Laws Related to Flood Hazards*

#### 3.1.1 Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning goal that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states that "Developments subject to damage or that could result in loss of life shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards..."

In addition to the requirement "To protect life and property from natural disasters and hazards," Statewide Planning Goal 7 includes specific guidelines for local governments to address in responding to flood hazards. For example, Goal 7 guidelines include a specific preference for the use of non-structural techniques to minimize flood hazards. The guidelines state, "In planning for floodplain areas, uses that will not require protection through dams, dikes and levies should be preferred over uses that will require such protection." The guidelines also suggest that land uses that are least subject to loss of life and property damage, such as parks and open spaces should be encouraged in the floodplain. Finally, to avoid obstructing floodwater flow, no development should occur in the floodway portion of the floodplain.[40]

**TRG Key**

Information on Goal 7 and additional floodplain development guidelines can be found in Appendix A of the Natural Hazard Technical Resource Guide.

#### 3.1.2 Goal 17: Coastal Shorelands

Goal 17 is concerned with conservation and protection, as well as appropriate development of Oregon's coastal shorelands. It aims to reduce the hazard to human life and property, and the adverse effects upon water quality and fish and wildlife habitat resulting from the use and enjoyment of Oregon's coastal shorelands.

#### 3.1.3 Goal 18: Beaches and Dunes

The purpose of Goal 18 is to conserve, protect, and where appropriate, to either develop on or restore the resources and benefits of coastal beach and dune areas. It is also concerned with reducing the hazard to human life and property from natural or man-induced actions associated with these areas. [41]

**TRG Key**

Additional development standards related to flooding apply in coastal areas where velocity zones, or V-zones, have been mapped. Refer to Section 3 of the Coastal Hazards Technical Resource Guide for additional information on V-zone requirements, coastal shorelands and beaches and dunes.

**Tip Box**

**Division of StateLand Permits**

When reviewing applications for development in floodplains, local governments should determine whether or not Oregon Division of State Lands (DSL) permits are required. These permits generally go through a joint review by DSL and the Army Corps of Engineers. In the case of an application for a floodway development permit, the DSL should always be contacted. Also, local governments will be asked to sign-off on DSL permits to ensure that the proposed activity is consistent with the local comprehensive plan and implementing ordinances.[43] Division of State Lands contact information is included in Section 6.

### 3.1.4 Division of State Lands (DSL) Fill and Removal Permit Program

Oregon's Removal-Fill Law (ORS 196.800-990) requires individuals who remove or fill 50 cubic yards or more in "waters of the state" to obtain a permit from the DSL. "Waters of the state" are defined as "natural waterways including all tidal and non-tidal bays, intermittent streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and non-navigable, including that portion of the Pacific Ocean which is in the boundaries of this state." In State Scenic Waterways or areas designated by DSL as essential indigenous anadromous salmonid habitat, most removal-fill activities require a permit, regardless of the number of cubic yards affected.[42] In addition, the Oregon Department of Environmental Quality is responsible for water quality certification under section 401(a) of the Clear Water Act. This certification is required as part of the DSL permitting process.

### 3.1.5 Oregon State Building Codes

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. The One- and Two- Family Dwelling Code and the Structural Specialty Code contain requirements to elevate a building at least one foot above the base flood elevation. These codes also contain provisions for flood proofing, underfloor drainage, and directing stormwater away from buildings. The building department that has jurisdiction generally coordinates with others to ensure that permit applications for new construction meet these requirements. Verification of the floor elevation is obtained during the permitting and inspection process. ORS 455.447 and the State Structural Code establish restrictions on the location of essential facilities in tsunami inundation zones along the coast subject to flooding following an earthquake. Essential facilities include hospitals, fire and police stations, emergency response facilities, and special occupancy structures, such as large schools. State building codes do not cover facilities constructed in public right-of-ways or waterways used to control flooding.[44]

**Sidebar**

**The Oregon Plan for Salmon and Watersheds**

"The Oregon Plan" is the state's program to restore native salmon and trout populations and to improve water quality. The overall goal of the Oregon Plan is to restore fish populations to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits. The plan consists of four essential elements:

- Coordinated federal and state agency programs,
- Community based actions,
- Monitoring of program accomplishments, and
- Application of appropriate corrective changes based on monitoring results.

Many efforts under the Oregon Plan will benefit local floodplain management efforts. Protection of wetlands for clean water and improved habitat will also result in more flood storage. Riparian area protection and setbacks from shorelines provide a greater floodplain area and reduce streambank erosion. Designation of floodplain areas as open space will help improve water quality and habitat conditions but will also keep structures out of hazardous areas. For more information on the Oregon Plan, contact (503)378-3589 or see **http://www.oregon-plan.org.**

## *3.2 Federal Policies and Programs Related to Flooding*

### 3.2.1 The National Flood Insurance Program (NFIP)

The function of the NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost, and to encourage the location of new development away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains.

Congress created the NFIP in 1968 to minimize response and recovery costs and to reduce the loss of life and damage to property caused by flooding. The NFIP is administered by the Federal Emergency Management Agency (FEMA). The two fundamental objectives of the NFIP are to:

1. Ensure that new buildings will be free from flood damage; and
2. Prevent new developments from increasing flood damage to existing properties.[45]

**Tip Box**

**Benefits of the National Flood Insurance Program**

The primary benefits of the NFIP are to:

1. Provide flood insurance coverage not generally available in the private market;
2. Stimulate local floodplain management to guide future development;
3. Emphasize less costly nonstructural flood control regulatory measures over structural measures; and
4. Reduce costs to the federal government by shifting the burden from the general taxpayer to floodplain occupants.

**Tip Box**

**Good Record Keeping**

FEMA and the Oregon NFIP Coordinator periodically review community enforcement of their floodplain ordinance to ensure compliance with federal NFIP regulations. Keeping good records is essential to this process. Some record keeping tips for communities are:

1. Keep two copies of all floodplain development permits. One in the tax assessor's property file (by parcel number or street address) and one in a chronological file with all other floodplain development permits.
2. Set up a tracking system to ensure that a copy of the final, as-built elevation certificate is returned for your files. Establish a system that works for you and your building inspector.
3. Consider requiring a specific floodplain development permit.

**Community Participation in the NFIP**

Community participation in the NFIP requires the adoption and enforcement of a floodplain management ordinance that controls development in the floodplain. This type of ordinance has been accepted by Land Conservation and Development Commission (LCDC) as sufficient to comply with Statewide Planning Goal 7 for flood hazards. To ensure that a community is in compliance with the NFIP and Oregon state law, a jurisdiction is required to do the following:

1. Require development permits for all proposed construction and other development within the community's designated 100-year floodplain;
2. Review permits to be sure that sites are reasonably safe from flooding;
3. Review subdivision proposals to determine whether the project is safe from flooding and provides adequate drainage;
4. Require residential structures to have the lowest floor (including basement) elevated to at least one foot above Base Flood Elevation (BFE);
5. Require non-residential structures to have the first floor elevated or flood proofed to one foot above BFE;
6. Require manufactured homes to be elevated and anchored;
7. Require water supply systems to be designed to eliminate infiltration of flood waters;
8. Require new replacement sanitary sewage systems be designed to minimize or eliminate infiltration of flood waters;
9. Ensure flood carrying capacity of altered or relocated watercourses is maintained;
10. Maintain records of all development permits;
11. Verify and document elevations of new or substantially improved structures; and
12. Properly address development in coastal "Velocity Zones."[46]

**General NFIP Flood Insurance Information**

Important points for cities and counties to understand about the flood insurance provided through the NFIP are:

1. Federal flood insurance is only available in those communities that participate in the NFIP. In Oregon, all communities with federally mapped flood hazards are eligible to participate.
2. Flood insurance is required for federally backed mortgages to purchase or build structures located in any Special Flood Hazard Area.
3. Communities must participate in, and be in good standing with the NFIP, to receive federal disaster assistance in identified floodplains.
4. Flood insurance can be purchased from any insurance agency.
5. Flood insurance can be purchased for any building, regardless of where the structure is located, if the community participates in the NFIP.

**TRG Key**

Refer to Section 3 of the Coastal Technical Resource Guide for more information on Velocity Zones.

6. The NFIP does not cover basement contents or finished portions of a basement.
7. Rates are subsidized for pre-FIRM buildings; actuarial rates apply to post-FIRM structures.
8. There is a waiting period of 30 days before insurance coverage takes effect.
9. There is no waiting period when transferring titles of properties to new owners.[47]

**NFIP Community Assistance Visit (CAV)**

Once a jurisdiction is successfully participating in the NFIP, FEMA or the Oregon Floodplain Coordinator will, every two to four years, conduct a Community Assistance Visit (CAV) to assess how well the community is administering its local floodplain ordinance. The visit ensures compliance with NFIP requirements. In addition, by meeting with local officials, checking building permits and elevation documentation, and touring the flood hazard areas, a CAV evaluates the community's floodplain management program relative to the provisions, stipulations and recommendations of the NFIP. Following the CAV, a follow-up letter is sent to the chief elected official, and a report is filed with FEMA regarding the findings of the visit and any necessary follow-up activities.[48]

**Flood Key**

Refer to the sidebar on elevation certificates in this section.

### 3.2.2 FEMA Region X's Policy on Fish Enhancement Structures in the Floodway

The Federal Emergency Management Agency (FEMA) regulates development in the floodway. The regulations require that a community prohibit encroachments (including fill, new construction, and other development) within the floodway unless it is demonstrated by engineering analysis that the proposed encroachment will not result in any increase in flood levels during the occurrence of a 100 year flood event.

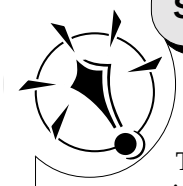
The recent designation of several northwest salmon and steelhead runs as threatened or endangered has resulted in an increased effort to restore fish habitat. Restoring habitat often involves placing structures in stream. These structures, including fish weirs, log drops, root wads and small rock deflectors are "encroachments" when placed in mapped floodways. A literal interpretation of the FEMA floodway standard may require a relatively expensive "no-rise" analysis that might exceed the cost of the habitat enhancement project.

In order to encourage habitat enhancement projects while still providing communities with information needed to make appropriate floodplain management decisions, FEMA Region X will allow communities to rely on the judgment of a qualified professional regarding the impact of fish enhancement structures on flood elevations. Qualified professionals include hydrologists and hydraulics professionals and staff of fisheries, natural resource or water resource agencies. This will minimize the cost of getting a "no-rise" analysis. However, the community, while making use of the professionals' advice, must still

**Tip Box**

**Community Rating System**

The Community Rating System (CRS) is a program operated by the NFIP that recognizes communities who go beyond the minimum requirements of the National Flood Insurance Program (NFIP). CRS offers reduced flood insurance premiums for communities who adopt higher standards and encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness. Detailed information on the CRS program can be found in Section 4 of this guide.



**Sidebar**

**Elevation Certificates**

The Elevation Certificate is a form published by the Federal Emergency Management Agency required to be maintained by communities participating in the National Flood Insurance Program (NFIP). The NFIP requires local governments to obtain certificates for all new construction in floodplains and to keep the certificates on file.

Elevation certificates are used to:

1. Record the elevation of the lowest floor of all newly constructed buildings located in the floodplain.
2. Determine the proper flood insurance rate for floodplain structures.

Local governments must insure that elevation certificates are filled out correctly for structures built in floodplains. Certificates must include:

1. The location of the structure (tax parcel number, legal description) and use of the building.
2. The Flood Insurance Rate Map panel number and date, community name and source of base flood elevation date.
3. Information on the building's elevation.
4. Signature of a licensed surveyor or engineer.

make the ultimate decision on whether to allow the habitat enhancement structure.

For more information on the policy on fish enhancement structures in the floodway, contact FEMA Region X at (425)487-4682.

### 3.2.3 Army Corps of Engineers Permit Program

The U.S. Army Corps of Engineers is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation. The Corps administers a permit program to ensure that the nation's waters are used in the public interest, and requires any person, firm, or agency planning work in the waters of the United States to first obtain a permit from the Corps. Permits are required even when land next to or under the water is privately owned. It is a violation of federal law to begin work before a permit is obtained and penalties of fines and/or imprisonment may apply. Examples of activities in waters that may require a permit include: construction of a pier, placement of intake and outfall pipes, dredging, excavation and depositing of fill. Permits are generally issued only if the activity is found to be in the public interest. In Oregon, permits for development of these activities are issued jointly by the Oregon Division of State Lands (DSL) and the U.S. Army Corps of Engineers**.** As mentioned in the discussion of DSL permits, local planning agencies are required to sign off on any permits issued by DSL and the U.S. Army Corps of Engineers and water quality certification is required by the Department of Environmental Quality.[50] Contact information for the U.S. Army Corps of Engineers is provided in Section 6.

### *3.3 Summary of State and Federal Flood Laws and Programs*

**State Laws**

- ❒ Oregon Statewide Planning Goal 7
- ❒ Oregon Statewide Planning Goal 17
- ❒ Oregon Statewide Planning Goal 18
- ❒ Division of State Lands Fill and Removal Permit Program
- ❒ Oregon State Building Codes

**Federal Policies**

- ❒ National Flood Insurance Program
- ❒ FEMA Region X's Policy on Fish Enhancement Structures in the Floodway
- ❒ Army Corps of Engineers Permit Program

A number of state and federal agencies are involved in regulating land use in and near floodplains. Local planning departments are the main point of contact for development permits issued by cities and counties. Communities also need to coordinate their review of floodplain development permits with other agencies. For example:

1. Permits for new structures in the floodplain should be coordinated with the building inspection program having authority;
2. Floodway development permits should by coordinated with Division of State Lands and the Army Corps of Engineers;
3. Development on the coast needs to comply with local land use requirements to implement State Planning Goals 17 and 18.[51]

**Planning for Natural Hazards: Reviewing your Comprehensive Plan**

Statewide Planning Goal 2 requires that comprehensive plan policies be supported by an adequate factual base. Section 3 of the Flood Technical Resource Guide describes laws that communities are required to address in their comprehensive plans.

Your community should ask the following questions after identifying flood hazards in your area:

- ❒ Does your community's comprehensive plan contain an inventory of flood hazards, a vulnerability assessment and policies addressing flood hazards?
- ❒ Has your community's comprehensive plan been updated to reflect the latest information on flood hazards in your community and the current laws for flood hazards?
- ❒ Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in flood hazard areas?

**Flood Key**

Section 2 of this Guide provides information that can assist your community in identifying flood hazards.

## *Section 4:*
## How can Your Community Reduce Risk from Flood Hazards?

Avoiding development in hazard areas is the most effective way to reduce risk. There are, however, many areas in Oregon where some degree of hazard is unavoidable. Communities in vulnerable areas should manage and reduce their risk from flood hazards if the risk cannot be completely eliminated. Section 4 describes methods to evaluate site-specific development and other implementing measures to reduce risk from flood hazards. Implementing measures are the ordinances and programs used to carry out decisions made in the comprehensive plan. They include zoning ordinances, and other land use regulations, which directly regulate land use activities.

### *4.1 How can Your Community Plan for Flood Hazards?*

It is possible to plan, at least to some degree, for flood hazards. The nature of your community's response will depend on severity of the hazard. Avoiding, or significantly limiting development in flood areas through zoning and careful planning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

To successfully plan for a flood hazard, consider the following steps:

- ✓ **Identify the hazard**
  Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.
- ✓ **Avoid the hazard**
  Restrict development in flood prone areas. For areas with high density and potential for severe property damage or loss of life, this option should be followed.
- ✓ **Evaluate site-specific development**
  Communities can require evaluation of site-specific development in flood hazard areas. Section 4 describes techniques for evaluating development.
- ✓ **Implement risk reduction measures through land use planning**

  Minimizing development in flood hazard areas through low density and regulated development can reduce risk of property damage and loss of life. Section 4.3 provides information on specific land use planning and zoning measures.
- ✓ **Implement additional non-regulatory measures**
  Additional mitigation strategies and non-regulatory measures can further reduce risk from flood hazards. Section 4.5 provides information on additional mitigation activities.

**TRG Key**

Chapter 2: Elements of a Comprehensive Plan provides information on hazard identification, vulnerability assessment and risk analysis that can be used for site-specific development.

### 4.2 What is the Process for Evaluating Development in Flood Hazard Areas?

After a proposed development is submitted to the local planning office, the first step is to identify the floodplain designation for the property. This review includes the following steps:

1. The planner examines the FIRM or other flood area maps to determine where the property is in relation to the flood hazard areas. If the property is in the floodplain or floodway, the planner will give instructions on the permitting procedure and requirements for these areas. Most development in the floodway is usually prohibited.
2. Permits are required for any development in the floodplain. Development, as defined by the NFIP regulations, includes residential, non-residential, fill/grading/excavation, and other non-structural development. Permits must be issued before any development occurs.
3. The local government must determine whether an elevation certificate is required. Elevation certificates are required for new residential construction.
4. Local governments must review floodplain development permits for compliance with their comprehensive plan and other land use requirements.
5. The local government can issue a floodplain development permit like a zoning permit without opportunity for public comment. Alternatively, a local government could process such a permit review as a conditional use with opportunity for public comment.
6. Local governments must offer opportunity for other interested local agencies to comment (e.g., emergency managers and natural resource program managers).

**Tip Box**

**NFIP Development Standards**

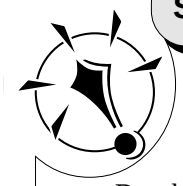
The National Flood Insurance Program (NFIP) does not prohibit floodplain development, but rather guides development in floodplain areas to lessen the economic loss and social disruption caused by flood events. The NFIP establishes minimum standards for floodplain development that are implemented and enforced through local floodplain development ordinances.

### 4.3 What Land Use Tools are used for Floodplain Management?

Land use planning and zoning are powerful tools that communities can use to further reduce flood risks. The following are land use tools communities can use to reduce risk from flood hazards.

#### 4.3.1 Overlay Zones

Most Oregon communities use floodplain overlay zones to implement their flood ordinances.[52] Overlay zones are independent zones that co-exist with the base-zoning district. Development is usually in accordance with the uses allowed by the base-zoning district. Parcels that fall within the overlay zone are subject to the regulations of the base zone and the additional regulations of the overlay zone. For example, a community could create an overlay zone for high flood hazard districts and establish additional requirements for those districts. Such requirements might include rules for new development, or limit reconstruction in the hazard area.[53] The city of Talent in southern Oregon is using a floodplain, parks and greenway overlay to achieve its floodplain management goals.



**Sidebar**

**Transfer of Development Credits**

Deschutes County had significant population growth in the late 1980s and 1990s. Much new development occurred in southern Deschutes County including new housing in areas like the SunRiver resort community. The area is characterized by numerous small (less than two acre) lots that were created prior to adoption of Oregon's Statewide Land Use laws. These rural areas are not served by community water or sewer systems. Pollution of the area's groundwater with nitrates from septic systems is a major issue and a constraint on new development. Approximately 1800 of the undeveloped residential lots have water tables at 2 feet or less so installing additional septic tanks is unlikely.

In order to promote development in other areas (areas not constrained by polluted groundwater), Deschutes County is exploring the possibility of a "Transfer of Development Credits" program. Owners of each of the 1800 lots would be granted a development credit that they could then sell for development at another location. The original lot would be left undeveloped although the owner could use it for recreational or other purposes. For more information on the Deschutes County project, see: **http://newberry.deschutes.org/CDDW** and look for information on the Regional Problem Solving Program or contact the Deschutes County Planning Department at (541)388-6575.

### 4.3.2 Incentive Zoning

Incentive zoning allows developers to exceed limitations imposed upon them by regulations, in exchange for specific concessions. For example, if developers avoid developing in the floodplain, the local government might allow them to build on other portions of their land at a higher density than is allowed by the current zoning designation.[54] Transfer of Development Rights (TDRs) and Transfer of Development Credits are examples of powerful incentives to curb development in floodplains. TDRs are enabled by Oregon State Law, but have not yet been used for floodplain management in Oregon.

### 4.3.3 Performance Zoning

Performance zoning sets standards for the allowable impact of development. The standards usually specify limits to certain environmental conditions, like the amount of traffic or pollution generated. Usually this technique is used in conjunction with standard zoning. For example, a performance standard may limit the number of times a structure can be rebuilt after multiple flood events.[55]

### 4.3.4 Incorporating Flood Mitigation Requirements into Subdivision Regulations

These types of regulations govern the division of land for sale or development. Sometimes certain fees may be incorporated into these types of regulations. For example, developers who wanted to subdivide a property located in a high flood-risk area could be required to pay developer exactions, impact fees or other system development charges.[56] Subdivision regulations combined with a fee extraction can serve to discourage development in the floodplain. In Polk County, Oregon no subdivisions are allowed in the floodplain. If a developer proposes to subdivide to a high density, as is characteristic of a subdivision, that developer must generate maps to prove that his property does not lie within the boundaries of the floodplain.[57] Three mitigation approaches that can be included in subdivision regulations include:

1. *Cluster Development* is the concentration of structures on one part of a lot to preserve the remainder of the property for open space. Cluster development usually is permitted only under planned unit development procedures. Clustering offers the potential for savings in some areas: the sewer and water lines and streets needed to serve a cluster may be much shorter than those necessary for a traditional subdivision of comparable density.[58] Cluster development provides the opportunity to avoid developing in hazard areas by maximizing development in non-hazard areas.
2. *Performance Bonds* are bonds required of a subdivider or developer to ensure that specified improvements be carried out after approval for the development is given by the local government. Performance bonds are widely used for a broad range of improvements sidewalks, streets, curbs,

storm sewers, street lighting, etc. They are one type in a broader category known as surety bonds.[59] Performance bonds could be used to improve drainage practices or implement other mitigation techniques.

3. A *Site Plan* is a detailed map of a proposed development site. Many subdivision and zoning ordinances require that a site plan accompany any application for a partition, variance, conditional use, zone change, or other quasi-judicial action. The standards for the drafting of such maps are usually defined in the community's zoning and subdivision ordinances. At a minimum, site plans should have a consistent scale (described on the plan), a north arrow, and a title or legend, and should show property lines, the locations of buildings, and the presence of roads, streams, and other major features of the landscape.[60] If a flood hazard is present, you can use the site plan to determine the location of the permitted development in relation to the hazard area.

## *4.4 What can Your Community do to Strengthen its Flood Ordinance?*

**Flood Key**

Refer to Section 6 of this guide for contact information for FEMA and the NFIP.

All Oregon communities participating in the National Flood Insurance Program (NFIP) have adopted floodplain development ordinances. Many communities have adopted the Oregon Model Floodplain Development Ordinance prepared by the Federal Emergency Management Agency (FEMA). This model ordinance meets the minimum requirements for local jurisdictions to participate in NFIP. The model ordinance is available from FEMA Region X, the Oregon Floodplain Coordinator, or online at: **www.lcd.state.or.us/issues/rural.htm.**

Communities are encouraged by FEMA and DLCD to adopt floodplain management standards in addition to those required by the NFIP to address local concerns and flood conditions. Communities may benefit from these higher standards through participation in the Community Rating System. Residents in these communities may enjoy reduced insurance premiums due to their community's enactment of ordinances that go beyond the minimum NFIP requirements.

The following are examples of some of the regulations that Oregon communities are adopting, as well as some examples of language being used by communities as they try to strengthen their flood management ordinances.

### 4.4.1 Adopt Stricter Elevation Requirements

The NFIP requires that new structures in the floodplain be elevated to or above base flood elevation. Oregon State Building Codes require such structures to be elevated to one foot above base flood elevation. Based on historic flood levels or other information, some communities have chosen to adopt a more protective standard, to safeguard the lives and property of their citizens.

For example, Tillamook County, along Oregon's north coast, requires residential structures to be elevated three feet above the base flood elevation. Marion County, Oregon requires elevation to two feet above the base flood elevation. This extra "margin of safety" provides added protection to new development, particularly in situations where maps may be incomplete or outdated.

### 4.4.2 Prohibit Development in Floodways

Floodways include the normal stream channel and those areas closest to the stream channel. A floodway's function is to move water out of a community as quickly as possible. Therefore, the NFIP regulations require that development will not encroach on the mapped floodway areas. Current federal regulations require engineer certification that development in the floodway area will cause no rise in the base flood elevation. Some Oregon communities have gone beyond this general requirement to prohibit any development or "encroachment" in the floodway area. For example, a local government could adopt ordinance language stating:

> "Above ground structures are not allowed in the (jurisdiction) floodway as delineated by the Federal Emergency Management Agency on (date of floodway map)."

In some cases, local governments allow no new development in floodways with the exception of local public works activities (e.g., utilities, bridges, etc.). For example:

> "Floodways are established in Special Flood Hazard Areas to transport the waters of a 100-year flood out of the community as quickly as possible with minimal flood damage. Floodways are most often mapped in urban areas, including in small cities. Encroachments on the floodway generally produce a rise in base flood elevation and contribute to other hydraulic problems. Accordingly _____ (city/county) prohibits encroachment on designated floodways except for public works projects pursuant to section xx (below)."
>
> "_____ (city/county) recognizes that utilities, flood prevention structures and improvement projects that are in the public's best interest must sometimes encroach on designated floodways. In compliance with Federal Emergency Management Agency requirements, (44 CFR s. 65.12), _____ (city/county) will permit floodway encroachments under the following conditions:
> The city/county finds that the proposed public works project is in the public interest; and FEMA has approved the proposed project."

In some cases, certain types of activities or uses are prohibited in floodways. For example:

> *"No filling operations of any kind shall be allowed in the floodway."*

Washington State prohibits any and all new construction or substantial improvements in floodways. County and city flood management ordinances must be approved by the state. Any ordinance that does not restrict land uses within designated floodways, including the prohibition of construction or reconstruction, repair, or replacement of residential structures, may be disapproved by the state.[61]

### 4.4.3 Adopt Hazardous Material Provisions

Hazardous materials when inundated by a flood event can be released into the environment and harm community members as well as wildlife. Local governments may want to include a provision banning storage of hazardous materials in the 100-year floodplain. Hazardous material can be defined as a combustible, flammable, corrosive, explosive, toxic or radioactive substance that is potentially harmful to humans and the environment.

### 4.4.4 Adopt Water Quality Provisions

Floodplain development ordinances can be used to address community concerns such as protection of water quality and the preservation of open space. When addressing these concerns in their floodplain ordinance, communities need be sure that the concern is identified up front, in the discussion of the intent and purpose section of the ordinance.

It may be appropriate for local governments to address water quality issues through their floodplain development ordinance since floodplain development impacts water quality in several ways. The filling of floodplains and increased impervious surface results in the loss of infiltration capacity and increased velocity of stormwater runoff. Use of fill may also disturb riparian areas. Although floodplain development ordinances are primarily designed to reduce flood insurance claims through site development standards, local floodplain management can be done in a manner that protects and enhances water quality.

There are a number of options available to help local governments address water quality concerns through their floodplain development ordinances. Adding language to the purpose section of a floodplain ordinance specific to the water quality is one option:

> "To protect and enhance water quality by restricting or prohibiting uses which cause increased flood heights or velocity or lead to increased erosion on site or downstream."

Water quality issues associated with floodplain management can also be addressed through performance standards required for floodplain development (e.g., balanced cut and fill requirements). Information relating to watershed management and water quality issues can be found through local

**Tip Box**

**Water Quality Model Code**

Oregon's Departments of Land Conservation and Development and Environmental Quality will issue a Water Quality Model Code and Guidebook in fall 2000. For more information, contact DLCD at (503)373-0050.

watershed councils or through the Oregon Watershed Enhancement Board (OWEB). See Section 4.5.1 for more information on how OWEB and watershed councils can provide assistance in flood mitigation.

### 4.4.5 Improve Maps of the Flood Hazard Area

In order to participate in the National Flood Insurance Program, local governments must include a reference to the Flood Insurance Administration's (FIA's) Flood Insurance Study and the Flood Insurance Rate Maps in their flood development ordinance. However, many of these maps are almost twenty years old and do not reflect flood hazards associated with new development. A community might include a broader area for floodplain management based on historic flood records, including aerial photos to better protect its residents from flooding. Oregon's Marion County has done this, and it has improved their maps significantly. An example of the possible ordinance language that can be used is:

*"The Ordinance shall apply to all areas of special flood hazard areas within the jurisdiction of _____. The areas of special flood hazard identified by the Federal Insurance Administration in a scientific and engineering report entitled "The Flood Insurance Study for the _____" dated _____, 19__, and as amended, with accompanying Flood Insurance Maps, as amended are hereby adopted by reference and declared to be a part of this ordinance. The flood hazard areas also include areas identified and mapped by (jurisdiction) that were not studied by the Flood Insurance Administration. The report and maps are incorporated in the overlay zone by this reference and are on file _____."*

### 4.4.6 Strengthen Setback Requirements

The National Flood Insurance program does not require a specific setback requirement for new development along waterbodies. Statewide Planning Goal 17 requires a setback from coastal shorelands. Local governments may apply Statewide Planning Goal 5 provisions for "safe harbor" riparian area protection in their ordinances as a means to enhance floodplain management and reduce flood damages. See Section 6 for information on Goals 17 and 5 and how to contact the Department of Land Conservation and Development.

Under a typical setback ordinance, new development is required to be set back from the top of the bank of a stream or river or from a mapped floodway line. Setback distances will vary depending upon the site conditions (again, see the safe harbor for Goal 5). The following are some of the benefits of maintaining a riparian buffer area:

- Setbacks provide an added margin of safety by keeping structures away from the higher velocity flood forces that are closest to the main stream channel;
- Setbacks reduce flood losses caused by stream bank failure (erosion damage) when stream channels migrate; and

- Setbacks provide the benefits of a riparian buffer along stream channels to protect fish and wildlife habitats and improve water quality.

### 4.4.7 Consider the Effect of Proposed Development on Existing Development

The NFIP program regulations do not specifically require local governments to consider the impact of proposed floodplain development on existing development (although this is required for development in a floodway). Some jurisdictions evaluate the effects of floodplain development on existing development and stream velocity. For example, "Any proposal for development within the Flood Plain Special Purpose District shall be accompanied by documentation prepared by a registered civil engineer demonstrating to the satisfaction of the manager that the development:

- Will not result in an increase in floodplain area on other properties; and
- Will not result in an increase in erosive velocity of the stream that may cause channel scouring or reduced slope stability downstream of the development."

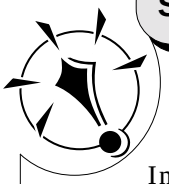
Communities may want to consider this type of ordinance if they expect a large amount of new development in their flood hazard areas.

### 4.4.8 Regulation of Fill in the Floodplain

The current NFIP regulations allow local governments to permit the placement of fill material in the mapped floodplain. Placement of fill results in a net loss of floodplain storage. Water can no longer infiltrate and instead runs off at a higher velocity while carrying pollutants. One option for local governments to reduce the loss of floodplain storage and slow down the movement of pollutants to waterways is to limit fill in the floodplain. Ordinance language could:

- Prohibit all new fill in floodplain areas. (This could be limited to those areas with water quality limits or areas with prime habitat);
- Limit new fill in floodplain areas by requiring "compensatory storage." One option is to require balanced "cut and fill." That is, for every, *x* cubic yards of material you put in the floodplain, *x* cubic yards must be removed. METRO, the Portland metropolitan-area planning agency, has required this.

For example, a local code could require developers to compensate for the loss of conveyance storage caused by filling in the floodplain by removing an equal amount of material in the floodplain near the development. Some jurisdictions require balanced cut and fill on the property seeking the development permit. Others require that balanced cut and fill be accomplished on a watershed level.



**Sidebar**

**Stormwater Management Program**

In 1987, the U.S Environmental Protection Agency's (EPA) Clean Water Act was amended to require implementation of a comprehensive national program to address non-agricultural sources of stormwater discharges. Stormwater discharges are the runoff of water from industrial sites, construction activities and through municipal storm sewer systems that drain directly into lakes, streams and coastal waters. Measures used to address water quality problems associated with stormwater should also minimize the impact of uncontrolled stormwater runoff on flood levels and landslides.

Implementation of EPA's stormwater regulations is through the existing NPDES (National Pollutant Discharge Elimination System) water quality permitting program. EPA has adopted the program in two phases. The first phase required permits for industrial stormwater discharges, runoff from construction sites disturbing five acres or more of land and large municipal systems.

**TRG Key**

Additional information on critical facilities planning can be found in Chapter 2 of this guide: Elements of a Comprehensive Plan.

### 4.4.9 Improve Stormwater Management

Most communities are already engaging in some type of stormwater management. Communities can conveniently incorporate their flood mitigation goals into the stormwater management design process. They can do this through the design of water retention and detention facilities and by setting performance standards.

### 4.4.10 Protection of Natural and Beneficial Floodplain Functions

One of the goals of the National Flood Insurance Program is to protect the natural and beneficial functions of floodplains. Natural and beneficial floodplain functions include both the natural infiltration capacities of floodplains, as well as minimizing the pollutants that can enter waters from floodplain development activities. Though nothing in the model ordinance specifically addresses this issue, a variety of options are available to local governments;

- Prohibit all activities in the floodplain that may be hazardous to public health or water quality (e.g., septic systems, storage of hazardous materials, location of landfills, etc.).
- Require new floodplain developments to avoid or minimize disruption to shorelines, stream channels and stream banks (e.g., setback requirements).
- Adopt regulations pursuant to a Habitat Conservation Plan approved by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.[62]

### 4.4.11 Discourage Placement of Critical Facilities in Floodplains

Jurisdictions can prohibit certain types of critical uses in floodplains (e.g.,hospitals, fire stations, etc). This is important to ensure that these vital services are not lost in the event of a flood. Careful planning should occur to ensure that these facilities are not sited in floodplains. If your critical facilities are already located in a floodplain, pre-disaster planning before a flood event is crucial to ensuring that these services are not incapacitated. It is also important to consider and evaluate factors such as:

- Are police or ambulance vehicles going to be cut off from sections of the community?
- Will critical services be able to access the entire population in the event of a disaster?
- What possible routes of travel might be incapacitated?

Communities might need to determine if alternate routes are available and how that will effect service delivery.

## *4.5 What are Some Additional Flood Mitigation Activities?*

### 4.5.1 Build Partnerships with Watershed Councils

Watershed councils are locally organized, voluntary groups established to improve the condition of watersheds. Watershed councils are a source of data and technical assistance for communities as they develop their inventories and flood mitigation plans. Council members can serve as technical advisors to local planners attempting to deal with watershed and flood processes. Watershed councils can also help communities seek funding for mitigation projects.

Councils offer local residents the opportunity to independently evaluate watershed conditions and identify opportunities to restore or enhance conditions in their riparian areas. They bring varied interests together in a non-regulatory setting to form a common vision for the ecological and economic sustainability, and livability of their watershed. The councils provide a voice for local people in natural resource management decisions, including floodplain management.[63]

Watershed councils offer a view of the watershed as a natural system. They are resources for communities as they develop their flood mitigation plans. Making connections between the natural environment, floodplain processes, and floodplain mitigation can lead to dramatic improvements in floodplain management. For a list of all the watershed councils in Oregon visit: **http://www.4sos.org/group/gweb_wscs.htm** on the Internet.

### 4.5.2 Develop Flood Mitigation Plans

A flood mitigation plan addresses the hazard risk to communities located partially or entirely in a floodplain. These plans help communities to address the flood hazard by developing goals and strategies for flood hazard mitigation within the community.[64] Talent, Oregon has developed such a plan. It includes an assessment of the flood hazard in their community, goals for how to better manage flood hazards, a discussion of existing mitigation activities and a list of recommended activities for the future. One of their mitigation activities includes a long-term effort to acquire flood prone properties through purchase, donation, or other mechanisms.[65]

In developing these plans it is important to remember that floodplains are natural phenomena. As such, they are best addressed in ways that preserve their natural function in the ecosystem. For example, as floodplain boundaries rarely fall within a single jurisdiction, these types of plans are likely to be addressed most effectively through regional government bodies.

### 4.5.3 Participate in NFIP's Community Rating System

The Community Rating System (CRS) is operated under the National Flood Insurance Program (NFIP). The NFIP provides flood insurance to homes and businesses located in floodplains at a reasonable cost, and encourages the movement of develop-

ment away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains. For more detailed information on the NFIP, turn to Section 2 of this guide.

CRS recognizes community efforts that go beyond the minimum standards of the NFIP. This recognition is in the form of reduced flood insurance premiums for communities that adopt such standards. CRS encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness. There are over 900 communities participating in CRS nationwide. Some of the benefits of CRS are listed below.

**CRS Benefits**

- Flood insurance premium reductions, ranging from 5% to 45%. The higher the CRS rating a community achieves, the greater the premium discount.
- Floodplain management activities enhance public safety and reduce damages to private property and public infrastructure.
- Communities can evaluate the effectiveness of their floodplain management program against a national benchmark.
- Implementation of some CRS activities makes communities eligible for other funding sources (See the end of this section for information on funding sources).

Participation in the CRS is voluntary. There are minimum requirements in order to participate.

- Your community must be in compliance with the rules and regulations of the NFIP.
- The community's chief executive (mayor, County Board of Commissioners) must appoint a CRS coordinator.
- Communities must require and keep all NFIP elevation certificates on file.
- Communities with repetitive losses must develop and implement a floodplain mitigation plan.

The CRS rating system is based on the ranking of community activities within four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. Communities engaging in these types of activities receive points according to a schedule developed for the CRS. CRS ratings are assigned based upon the number of points earned. The majority of CRS communities are in Class 8 or Class 9. A Class 8 rating earns about a $40 savings in flood insurance premiums per insurance policy, per year. Only three communities out of 900 have achieved Class 5 status. The system is summarized in Table 2, below. CRS handbooks are available from your local FEMA representative or by calling (800)427-4661. See Section 6 for information on how to obtain this document.

*Table 2. Summary of Points and Insurance Rate Discounts under CRS*

| Credit Points | Class | Premium Reductions |
|---|---|---|
| 0-499 | 10 | 0 |
| 500-999 | 9 | 5% |
| 1000-1499 | 8 | 10% |
| 1500-1999 | 7 | 15% |
| 2000-2499 | 6 | 20% |
| 2500-2999 | 5 | 25% |
| 3000-3499 | 4 | 30% |
| 3500-3999 | 3 | 35% |
| 4000-4599 | 2 | 40% |
| 4500+ | 1 | 45% |

**Tip Box**

**Benefits of the Community Rating System's Methodology**

Even if a jurisdiction is not ready to officially apply to be a part of CRS, the CRS flood mitigation planning standards are very useful for assessing local needs with regard to floodplain management and hazards planning in general. In addition, if a community begins to use CRS methodologies now, it will only expedite the process later when a CRS application is filed.[67] For more information on CRS, refer to Section 6 of this guide for contact information for the Oregon Floodplain Coordinator at DLCD.

**Sidebar**

**Oregon CRS Communities**

As of January 2000, 16 Oregon jurisdictions are participating in the CRS program.[66] The requirements of Statewide Planning Goal 7 and the State Building Codes make it relatively easy to achieve a Class 9 CRS rating. Communities are required to create and implement policies that address flood hazards. Achieving a higher CRS rating, however, requires a greater effort from communities. Local communities, particularly smaller communities with limited resources, must weigh the costs and benefits of putting forth this effort. It is important to consider the realities of available resources, the number of structures at risk, and number of insurance policies in the community, when deciding whether or not to participate in voluntary flood mitigation programs such as the CRS.

| Oregon Communities | CRS Rating |
|---|---|
| Albany | 8 |
| Ashland | 8 |
| Cannon Beach | 7 |
| Central Point | 8 |
| Corvallis | 8 |
| Douglas County | 8 |
| Eugene | 8 |
| Grants Pass | 9 |
| Jackson County | 8 |
| Medford | 9 |
| Polk County | 9 |
| Rogue River | 8 |
| Roseburg | 8 |
| Scappoose | 8 |
| Stanfield | 9 |
| Talent | 8 |

### 4.5.4 Fee Simple Acquisition of Land and Buyouts

Though this is usually the most expensive method of mitigation, it is also the most effective in terms of a flood mitigation strategy. Once the land in the floodplain is purchased outright by a local government entity, all development can be prohibited, and the land can be officially designated as open space. There are four types of buyouts:

1. Basic buyouts, which have no relocation element;
2. Buyout and infill programs which encourage the relocation of structures outside of the floodplain;
3. Buyout and reorganization plans which create new subdivisions where the moved structures are relocated; and
4. Buyout and complete relocation, which involves the construction of an entire new town, using new or relocated old buildings.[68]

FEMA's Hazard Mitigation Grant Program, administered in Oregon by the Oregon State Police (OSP) - Office of Emergency Management (OEM), is one funding source for such buyouts. In Oregon the HMGP has funded the acquisition of two homes in Talent, a hotel in Tillamook, and two homes in Keizer. A number of homes along Johnson Creek in Portland have been bought out with funds provided by the city and FEMA. These areas are now free from development and are being held as open space in perpetuity.[69]

### 4.5.5 Use of Easements

Easements restrict certain activities on properties. When an easement is granted, certain activities or land uses are no longer available to the property owner. They are usually given up in exchange for some type of compensation. Easements foregoing the right to develop a property can be either sold or granted to local jurisdictions or other organizations by property owners. This is described as "acquiring a negative easement against development." This can be extremely useful to local communities by providing a mechanism for de facto acquisition of undeveloped floodplain lands, and at a lower price than fee-simple acquisition.

When granting an easement, landowners sign a legal document giving up the right to some use of their property (for example, the ability to subdivide), and they are potentially eligible for certain financial benefits. Easements can be purchased by a community or donated by the property owner. A decrease in property value with a corresponding decrease in property taxes usually follows, as the property no longer has the legal ability to be used to its full development potential. So, the property owner gets some financial gain from his land, while the entire community benefits by having that land as protected open space.[70]

### 4.5.6 Use of Tax Incentives

Differential tax assessment can be used to provide an incentive for landowners who own undeveloped land in the floodplain to keep it undeveloped. If taxes for floodplain lands are differentially low, the owner has a financial incentive to keep it as open space. Tax abatements can also be used in this fashion, as well as to encourage developers to integrate mitigation into their developments. For example, abatements, subsidies or other economic incentives have been used for floodproofing programs.[71]

**Flood Key**

Refer to Section 6 of this guide for information on how to contact OEM.

## *4.6 What Funding Programs are Available to Communities?*

### 4.6.1 Hazard Mitigation Grant Program (HMGP)

The HMGP administered by the Federal Emergency Management Agency (FEMA) provides grants to states and local governments to implement long-term hazard mitigation measures after a federal major disaster declaration. It is important to stress that the HMGP is available only after a federal disaster declaration has been made. When such an event occurs, and these monies become available, they can be used to implement important and innovative flood mitigation projects. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented immediately, during disaster recovery. FEMA can fund up to 75 percent of the eligible costs of each project. Eligible applicants are state and local governments, special districts, Native American nations and organizations, and certain private non-profit organizations. Individual homeowners and businesses may not apply directly to the program, but a community may apply on behalf of homeowners and businesses. An example of an HMGP project would be the purchasing of property located in the floodplain to prevent future damage.[72]

The OSP - Office of Emergency Management (OEM) is the state agency responsible for administering the HMGP.

### 4.6.2 Flood Mitigation Assistance Program (FMA)

Flood Mitigation Assistance (FMA) program funds are made available by FEMA to states on an annual basis. The Oregon FMA program provides grants to communities for projects that reduce the risk of flood damage to structures that have flood insurance coverage. This funding is available for flood mitigation planning and implementation of mitigation measures only. The Oregon State Police - Office of Emergency Management (OEM) is the administrator of the FMA program and is responsible for selecting projects for funding. The State then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf. [73] Use the resource directory at the end of this guide to contact OEM for more information.

**Sidebar**

**Flood Mitigation Assistance Program**

To be eligible for a Flood Mitigation Assistance Program project grant, a community must have a FEMA-approved mitigation plan. FEMA recommends a basic flood mitigation process consisting of the following activities:

1. Public Involvement
2. Coordination with other agencies or organizations
3. Flood hazard area inventory
4. Problem identification
5. Review of possible mitigation actions
6. State or local adoption following a public hearing

An example of a community engaging in such activities is Lincoln County. As a result of destructive flooding in November of 1999, Lincoln County applied for and was awarded, a Hazard Mitigation Grant from the OSP-OEM for elevating or relocating damaged structures and developing a flood mitigation plan.

### 4.6.3 Emergency Watershed Protection Program (EWP)

EWP is a Natural Resource Conservation Service (NRCS) program designed to relieve imminent hazards to life and property caused by floods, fires, windstorms and other natural occurrences. EWP provides funds for projects such as: removing debris from stream channels, reshaping and protecting eroded banks, correcting damaged drainage facilities, repairing levees and structures, and purchasing floodplain easements. If your community suffers severe damage from a natural disaster it may qualify for assistance under the EWP program. Public and private landowners are eligible for assistance but must be represented by a project sponsor. City and county governments, general improvement districts and conservation districts are the most common sponsors of EWP projects. Sponsors are responsible for providing land rights to do the repair work and securing permits, as well as furnishing the local cost share and accomplishing the installation of work.[74] See Section 6 of this guide for information on how to contact the NRCS to obtain more information on this program.

### 4.6.4 Oregon Watershed Enhancement Board (OWEB)

The Oregon Watershed Enhancement Board (OWEB) administers two grant programs that provide funds for mitigation and improvement projects that approach natural resources management from a whole-watershed perspective. Floodplain management fits that profile. OWEB encourages projects that foster interagency cooperation, include other sources of funding, provide for local stakeholder involvement, include youth and volunteers and promote learning about watershed concepts. OWEB's goal is to help Oregonians improve the state's watersheds. The primary functions of OWEB are to provide technical assistance, administer a grant program, promote education and public awareness about watershed enhancement benefits, concepts and techniques, and to support the work of local watershed councils.[75] For more information refer to Section 6 for contact information.

### 4.7 Summary: Reducing Your Community's Risk from Flood Hazards

Section 4 describes a range of methods and programs communities can use to reduce risk to life and property from flood hazards.

- *Land use tools for floodplain management* include performance zoning, overlay zones, incentive zoning and subdivision regulations. These tools can be used by communities to improve floodplain management and flood mitigation.
- *Flood Development Ordinances* can be constructed and several different standards can be adopted to improve floodplain management. Some of the examples are: 1) the adoption of stricter elevation requirements, 2) the prohibition of development within the floodway, and 3) the adoption of water quality provisions.
- *Additional methods for flood mitigation* include developing a flood mitigation plan, building partnerships with local watershed councils, participating in NFIP's Community Rating System (CRS), use of fee-simple land acquisition, easements and tax incentives.
- *Potential Funding Programs* include the Hazard Mitigation Grant Program (FEMA-Oregon OEM), Flood Mitigation Assistance Program (FEMA-Oregon OEM), Emergency Watershed Protection Program (NRCS) and Oregon Watershed Enhancement Board Grant Program (OWEB).

**Planning for Natural Hazards: Reviewing your Comprehensive Plan**

Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your community should ask the following questions in assessing the adequacy of your comprehensive plan in addressing flood hazards.

- Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to flood hazards?
- Has your community implemented a process for evaluating site-specific development in flood hazard areas?

## *Section 5:*
## How are Oregon Communities Addressing Flood Hazards?

This section provides information on the flood programs of two Oregon jurisdictions and describes implementation processes that were used for flood mitigation and addressing development in flood prone areas.

### *5.1 Innovative Approaches to Flood Mitigation in Umatilla County, Oregon*

Umatilla County has taken an innovative approach in developing their flood mitigation plan. The county's mitigation plan addresses the variety of flood hazards in their community. Their efforts provide an example of how effective a community can be in developing flood mitigation strategies, and offers lessons for other jurisdictions to consider in developing their own flood hazard mitigation plans.

#### Background

Flooding in 1996 and 1997 caused widespread erosion of agricultural lands, road damage, and structural damage in Umatilla County. The severity of those events underscored a need for county-wide flood response planning and flood mitigation measures. The county has moved from the use of levees, dikes and reservoirs, which were the primary methods for flood control during the 1970's. In recent years, non-structural methods such as the use of floodplain development regulations have provided a viable alternative to costly structural flood controls.

Umatilla County is an interesting case study because of its susceptibility to a variety of flood types; riverine, flash, and, to some extent, urban. The county has observed that all of these types can occur as part of the same flood event. For example, the foothills of the Blue Mountains experience flash flooding that can contribute to typical riverine flooding of the Umatilla River, and in some instances cause urban flooding. Umatilla County has developed flood preparedness and mitigation strategies to address these types of flood events.

#### Umatilla County's Flood Mitigation Plan

The County's Flood Mitigation Plan was developed through the combined efforts of the Umatilla County Emergency Management staff, several local and state agencies, and the Umatilla County Planning Commission before adoption by the Umatilla County Board of Commissioners.

Some of the policies in the plan include:

- Review uses of floodplain/floodway as part of periodic review.
- Seek updated and improved floodplain mapping.
- Explore options for acquiring land or establishing easements.
- Provide additional information on elevation and floodproofing options.

- Promote streambank stabilization and bioengineering efforts countywide.
- Evaluate the county's river gauge network.
- Provide ground information to the National Weather Service to better predict risk.
- Adopt a county emergency flood response plan.

Some of the mitigation policies were initiated as the result of immediate need, such as the flooding along Mill Creek, some by regulatory requirements, as in the revised floodplain standards in the county's development code, and some by local initiative, such as new floodplain mapping for the city of Athena.

### Implementation

Since the development of the Flood Mitigation Plan, Umatilla County has revised the county's floodplain zoning to conform to FEMA guidelines. The county purchased a former home site in the floodway of Mill Creek and facilitated the elevation of other homes along Mill Creek as well as funded the design and construction of a more flood resistant bridge. The county has been a supporter of the multi-agency bioengineering/streambank stabilization project along McKay Creek and the enhancement of the river gauge system. The county also worked with the National Weather Service Pendleton Office to promote the volunteer "Weather Watchers Network." FEMA and the Army Corps of Engineers have provided new or revised floodplain maps for Mill Creek and for the City of Athena's Urban Growth Area. In 1998, the county adopted an Emergency Flood Response Plan as an annex of the Emergency Operations Plan.

Umatilla County has not had any recent flood events to "test" these new policies. However, they are confident that when flooding occurs in the future, the county's efforts will prove worthwhile, particularly along Mill Creek where physical structures in the floodway have been removed, elevated, or redesigned and rebuilt. Despite their confidence, Umatilla County continues to work on other aspects of their Flood Mitigation Plan.

Through this process Umatilla County has come to realize the importance of fostering a close working relationship between local emergency managers and their local planning department counterparts. Mitigation has to be based upon these two agencies' cooperative efforts, which was easy in Umatilla County as the two are part of the same department. This is not true in many other cities and counties. It is imperative that close coordination occur in order to provide the links necessary between preparedness and response [emergency management] and mitigation [planning and land use regulation].[76]

### *5.2 Going Beyond Minimum Requirements in Talent, Oregon*

Talent offers an example of how a small town with minimal resources can be extremely effective in planning for flood hazards. Talent's flood ordinance exemplifies how a community can exceed regulatory standards to better protect itself from a flood disaster.

#### Background

After the 1997 New Year's Day flood struck Southern Oregon, the City of Talent went to work. They did a survey of the problem areas in the floodplain, based almost entirely upon field observation volunteers, to document areas damaged by floodwaters and record high water marks. Using FEMA Hazard Mitigation Grant Program (HMGP) funds, the city developed a Stormwater Master Plan and Stormwater Design Standards. As a condition of their HMGP grant, the city also adopted a Flood Hazard Mitigation Plan. Subsequently, they applied to participate in the Community Rating System and will be a Class 8 community when the approval process is complete.

The city also had GIS maps prepared by the county GIS office that overlaid FIRM areas on the tax lot map. This allows staff to make more accurate determinations of flood hazard areas, and makes it possible for citizens to see for themselves how the regulatory floodplain relates to their property. After the 1997 flood event, it became clear to the city that Wagner Creek, the creek that runs through the city, did not perform as the FEMA Flood Insurance Rate Map said it would. This prompted the city planner and engineer to increase their efforts to get FEMA to do a detailed study of Wagner Creek for new FIRM maps. A better model was needed of the hydrologic characteristics of the basin, as well as consideration of changes in the basin and determinations of base flood elevations for unmapped areas inside the city and three miles up Wagner Creek. Geology students from the nearby university did a preliminary survey of high water marks. The FEMA study is currently underway and will provide the City of Talent with the most current and accurate information possible regarding its flood area inventory, so that the city can continue to improve its floodplain management efforts.

#### City of Talent Flood Damage Prevention Ordinance

The city used the State of Oregon's model ordinance as a base for its Flood Damage Prevention Ordinance. It enhanced the model by increasing the elevation standards for development in the floodplain to two feet above base flood elevation. This allows the city to receive extra points in the NFIP Community Rating System program, which maintains lower insurance rates for their community.

Their ordinance goes beyond current standards by requiring tie downs for mobile homes inside the 500-year floodplain. The standard in the model ordinance applies only inside the 100-year floodplain. The city also continues to look for opportunities to achieve permanent open space designation along the creeks in their area, especially the opportunity to purchase land outright.

The Talent Zoning Ordinance includes special setbacks from streams. New construction must be set back 50 feet from inventoried "locally significant" wetlands and riparian areas. New construction must also be set back 35 feet from the floodway. The stricter standard is controlling. Structures that lie within those setback areas are nonconforming, and are subject to the same regulation of expansion and replacement of other nonconforming uses.

Some of Talent's Flood Damage Prevention Ordinance includes:

**Section 5.2.1 Residential Construction**

a) New construction and substantial improvement or any residential structure shall have the lowest floor, including basement, elevated *two feet above the base flood elevation.*

**Section 5.2.2 Nonresidential Construction**

New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor, including a basement floor, *elevated two feet above the base flood elevation*; or, together with requirements for utility and sanitary facilities set out below, shall: a) Be floodproofed so that below the flood protection level (*two feet above base flood level*), the structure is watertight with walls substantially impermeable to the passage of water.

**Section 5.2.3 Manufactured Homes**

b) Manufactured homes to be placed or substantially improved on sites in an existing manufactured home park located in and A or B Zone on the community's FIRM that are not subject to the above manufactured home provisions shall be elevated so that:

i) The lowest floor of the manufactured home is elevated *two feet above the base flood elevation*, and the chassis is securely anchored to an adequately designed foundation system to resist flotation, collapse, and lateral movement.

**Section 5.0 Provisions for Flood Hazard Reduction**

5.1 General Standards: In areas of special flood hazards, the following standards are required:

5.1.1 Anchoring is required for all substantial improvements, and new and replacement dwellings in the regulatory floodplain or in the *500-year floodplain*, as follows:

a) All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

b) All manufactured homes must likewise be anchored to prevent flotation, collapse, or lateral movement, and shall be installed using methods and practices that minimize flood damage. Anchoring methods may include, but are not limited to, use of over-the-top or frame ties to ground anchors (Reference FEMA's "Manufactured Home Installation in Flood Hazard Areas" guidebook for additional techniques).

**Section 5.3 Floodways**

5.3.1 No new or replacement structures or substantial improvements are allowed within thirty-five feet of the floodway, as established in Article 12 of the Talent Zoning Ordinance.

### Implementation of Talent's Flood Damage Prevention Ordinance

Currently, the moratorium on new construction in Talent due to water supply constraints has prevented implementation of new standards, except in the case of replacement manufactured homes in parks. The basic "on-the-ground" implementation procedure is simple. Developers must apply for a floodplain development permit. If the permit request is for development that meets or exceeds the city's standards as set forth in this ordinance, and complies with any other relevant regulation, the development will be approved. Talent also has made use of the Hazard Mitigation Grant Program to obtain the funding that allows them to implement their stormwater master plan and design standards. This small community has been able to utilize many resources in order to achieve great results in floodplain management.

### 5.3 Summary: Lessons from Oregon Communities Addressing Flood Hazards

- *Umatilla County's* flood mitigation plan reflects lessons the community learned that can benefit other jurisdictions including the following:
  - A shift from the community's reliance on structural flood controls to non-structural mitigation measures (updated local ordinances, elevations of existing structures).
  - A partnership between local emergency managers and planning department staff. Close coordination is the key to ensuring successful flood risk reduction.
- *Talent* offers an example of how a small town with minimal resources can be extremely effective in planning for flood hazards. Talent's flood ordinance exemplifies how a community can exceed regulatory standards to better protect itself from a flood disaster.

**Planning for Natural Hazards: Reviewing your Comprehensive Plan**

Your comprehensive plan should be coordinated with and reflect comprehensive plans and implementing measures of other communities within your region. Natural hazards do not respect community boundaries making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plan, your community should ask the following questions in developing plan policies for flood hazards:

- What plan policies should be added or amended to assist your community in addressing flood hazards?
- Are there communities that face similar flood threats that have developed ordinances or non-regulatory programs that could be adopted by your community?
- Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park and transportation districts)?

## *Section 6:*
## Where can Your Community Find Resources to Plan for Flood Hazards?

This section is a resource directory including contacts, programs, documents and Internet resources available to communities as they plan for flood hazards.

### *6.1 State Agency Resources*

#### Department of Land Conservation and Development (DLCD)

DLCD administers the State's Land Use Planning Program. The program is based on 19 Statewide Planning Goals, including Goal 7, related to natural hazards. DLCD also serves as Oregon's federally designated agency to coordinate floodplain management in Oregon. DLCD maintains contact with flood prone communities throughout the state in order to help them meet the requirements of the NFIP and to ensure that they are prepared in case of flood. DLCD offers information on the NFIP, CRS and other FEMA - related programs. They also offer training courses on various flood mitigation programs.

**Contact:** Department of Land Conservation and Development
**Address:** 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
**Phone:** (503) 373-0050
**Fax:** (503) 378-6033
**Website:** http://www.lcd.state.or.us

**Oregon Floodplain Coordinator:** (503) 373-0050 ext. 255

**Sidebar**

The Governor's Interagency Hazard Mitigation Team (GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

### Oregon State Police (OSP)-Office of Emergency Management (OEM)

OEM administers FEMA's Hazard Mitigation Grant Program, which provides monies for acquisition, elevation, relocation, and demolition of structures located in the floodplain. OEM also administers FEMA's Flood Mitigation Assistance Program. This program provides assistance for NFIP insured structures only. OEM also helps local jurisdictions to develop local hazard mitigation plans. OEM is heavily involved in flood damage assessment and works mainly with disaster recovery and hazard mitigation programs. OEM provides training for local governments through workshops on recovery and mitigation. OEM also helps implement and manage federal disaster recovery programs.

**Contact:** Office of Emergency Management
**Address:** 595 Cottage Street NE, Salem, OR 97310
**Phone:** (503) 378-2911
**Fax:** (503) 588-1378
**Website:** http://www.osp.state.or.us/oem/

**OEM Hazard Mitigation Officer:** (503) 378-2911 ext. 247

**Recovery and Mitigation Specialist:** (503) 378-2911 ext. 240

### Division of State Lands (DSL)

DSL is a regulatory agency, responsible for administration of Oregon's Removal-Fill Law. This law is intended to protect, conserve and allow the best use of the state's water resources. It generally requires a permit from DSL to remove, fill or alter more than 50 cubic yards of material within the bed or banks of waters of the state. Exceptions are in State Scenic Waterways and areas designated essential salmon habitat, where a permit is required for all instream activity, regardless of size. These permits may be issued jointly by DSL and the U.S. Army Corps of Engineers. Contact the DSL with specific questions regarding this permit process.

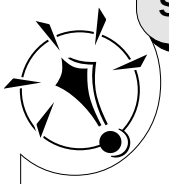
**Contact:** Division of State Lands
**Address:** 775 Summer Street NE, Suite 100, Salem, OR 97301-1279
**Phone:** (503) 378-3805
**Fax:** (503) 378-4844
**Website:** http://statelands.dsl.state.or.us/

**Assistant Director:** (503) 378-3805, ext. 279

**Eastern Region Manager:** (541) 388-6033

**Western Region Manager:** (503) 378-3805, ext. 244

**Sidebar**



**Project Impact: Building Disaster Resistant Communities**

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.[77]

Benton, Deschutes, and Tillamook Counties, and Multnomah County with the City of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the Oregon State Police - Office of Emergency Management in Salem.[78] For more information about Project Impact visit **http://www.fema.gov**

### Oregon Watershed Enhancement Board (OWEB)

OWEB is a potential funding source for communities wanting to do flood mitigation projects and other watershed activities/improvements. The mission of the Oregon Watershed Enhancement Board is to promote and implement programs to restore, maintain and enhance watersheds in the State of Oregon in order to protect the economic and social well being of the state and its citizens. Contact OWEB directly for more information on its grant programs.

**Contact:** Oregon Watershed Enhancement Board
**Address:** 255 Capitol St. NE, Salem, Oregon 97310
**Phone:** (503) 378-3589
**Fax:** (503) 378-3225
**Website:** http://www.4sos.org/group/gweb.html

**Program Manager:** ext. 831

**Program Representative:** ext. 825

**Program Representative:** ext. 826

### State Division of Building Codes, Department of Consumer and Business Services

The Oregon Building Codes Division (BCD) adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. To find out more information about codes that affect development in floodplains contact BCD or your local building department.

**Contact:** Building Codes Division
**Address:** 1535 Edgewater Street NW, P.O. Box 14470, Salem, OR 97309-0404
**Phone:** (503) 378-4133
**Fax:** (503) 378-2322
**Website:** http://www.cbs.state.or.us/bed/

### Oregon Department of Environmental Quality

The Department of Environmental Quality (DEQ) is responsible for protecting and maintaining Oregon's environmental quality, predominately through programs delegated by the U.S. Environmental Protection Agency (USEPA) to the state. Of particular interest to local government for floodplain management purposes are regulations recently issued by USEPA and administered by DEQ for urban stormwater management. In addition to meeting water quality goals, proper stormwater management can help local governments address flood hazards. DEQ also may assist communities in watershed restoration efforts and other activities beneficial to floodplain management. Information on regional office location can be obtained through DEQ's Portland Office.

**Contact:** Water Quality Division
**Address:** 811 SW 6th Ave., Portland, OR 97204-1390
**Phone:** (503) 229-5279
**Fax:** (503) 229-6993
**Website:** http://www.deq.state.or.us

### State of Oregon Water Resources Department (WRD)

WRD manages the state's Dam Safety Program. Dam failures, though uncommon, can result in catastrophic flooding. WRD can provide technical assistance to local governments on issues of dam safety.

**Address:** 1158 12th St. NE, Salem, OR 97301-4172
**Phone:** (503) 378-8455
**Fax:** (503) 378-2496
**Website:** http://www.wrd.state.or.us

### Oregon Department of Fish and Wildlife (ODFW)

ODFW can provide assistance to local governments in evaluating the effects of floodplain and floodway development on fish and wildlife species and habitat. In particular, your community should contact area Fish and Wildlife staff to help review floodway development permits. To obtain information on area office location, use the following contact information.

**Address:** 2501 SW First Ave., Portland, OR 97207
**Phone:** (503) 872-5268
**Website:** http://www.dfw.state.or.us

## 6.2 Federal Agency Resources

### Federal Emergency Management Agency (FEMA)

FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, technical assistance, and also operates the National Flood Insurance Program. FEMA's mission is "to reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery". FEMA Region X serves the northwestern states of Alaska, Idaho, Oregon and Washington.

**Contact:** FEMA, Federal Regional Center, Region 10
**Address:** 130-228th St. SW, Bothell, WA 98021-9796
**Phone:** (425) 487-4678
**Website:** http://www.fema.gov

**To obtain FEMA publications, Phone:** (800) 480-2520

**To obtain FEMA maps,**
**Contact:** Map Service Center
**Address:** P.O. Box 1038, Jessup, Maryland 20794-1038
**Phone:** (800) 358-9616
**Fax:** (800) 358-9620

### Army Corps of Engineers

The Army Corps of Engineers administers a permit program to ensure that the nation's waters are used in the public interest. Any person, firm, or agency planning to work in waters of the United States must first obtain a permit from the Army Corps of Engineers. In Oregon, joint permits may be issued with the Division of State Lands. The Corps is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation. For more specific information on this permitting program and how it affects your community contact the Portland district office.

**Contact:** U.S. Army Corps of Engineers-Portland District, Floodplain Information Branch
**Address:** P.O. Box 2946, Portland, OR 97208-2946
**Phone:** (503) 808-4874
**Fax:** (503) 808-4875
**Website:** http://www.nwp.usace.army.mil/

### National Weather Service

**National Oceanic and Atmospheric Administration, U.S. Department of Commerce**

The National Weather Service mission is to provide weather and flood watches and warnings, and public forecasts and advisories primarily for the protection of life and property. The Weather Service collects, interprets and disseminates up-to-date hydrologic data including information of the magnitude and frequency of past and expected water flows. The Weather Service website provides current forecasts and warnings as well as a link to the Emergency Managers Weather Information Network. Oregon has three weather service stations: Portland, Pendleton, and Medford. The Boise station serves southeastern Oregon.

**Contact:** National Weather Service - Portland
5241 NE 122nd Avenue
Portland, OR 97230
(503)326-2340
**Website:** http://www.nws.noaa.gov

### Natural Resource Conservation Service (NRCS)

NRCS operates many programs dealing with the protection of floodplain resources. The two most closely related to flooding are the Watershed Surveys and Planning Program and the Flood Risk Reduction Program, administered through the Farm Service Agency. NRCS also provides technical assistance to property owners, including methods to reduce streambank erosion. NRCS is a federal agency whose mission is to "provide leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment."

**Contact:** Natural Resource Conservation Service, Oregon State Branch
**Address:** 101 S.W. Main Street, Suite 1300, Portland, OR 97204-3221
**Phone:** (503) 414-3200
**Fax:** (503) 414-3103
**Website:** http://www.or.nrcs.usda.gov/Welcome.html

### United States Geological Survey (USGS)

The USGS provides hydrologic forecasts including flood warnings, watches, forecasts, and related information for regions of the Pacific Northwest. They provide flood risk maps showing flood potential, watches, and warnings in Oregon and nationwide. On their website they provide current streamflow conditions at USGS gauging stations in Oregon and throughout the Pacific Northwest, for up-to-the-minute information on water levels. The Oregon USGS office is responsible for water-resources investigations for Oregon and part of southern Washington. Their office cooperates with more than forty local, state, and federal agencies in Oregon. Cooperative activities include water-resources data collection and interpretive water-availability and water-quality studies.

**Contact:** USGS Oregon District Office
**Address:** 10615 S.E. Cherry Blossom Dr., Portland, OR 97216
**Phone:** (503) 251-3200
**Fax:** (503) 251-3470
**Website:** http://www.usgs.gov

## 6.3 Recommended Flood Publications

The following list groups publications into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should have in its resource library. Secondary documents are those that provide useful information to communities, but that may not be as easy to access. Technical documents are those that focus on a specialized aspect of flood hazard mitigation, and may require interpretation by a scientist or engineer.

### Primary Resources

These documents represent the principal resources communities can use to better plan for flood hazards. They are key tools for reducing the risks associated with flood prone areas.

NFIP Community Rating System Coordinator's Manual. FEMA/NFIP. Indianapolis, IN: FEMA

> This informative brochure explains how the Community Rating System works and what the benefits are to communities. It explains in detail the CRS point system, and what activities communities can do in order to earn points. These points then add up to the "rating" for the community, and flood insurance premium discounts are calculated based upon that "rating". The brochure also provides a table on the percent discount realized for each rating (1-10). Instructions on how to apply to be a CRS community are also included.
>
> *To obtain this resource*: visit **http://www.fema.gov**, call 1-(800)480-2520, or call the CRS office in Indianapolis at (317) 848-2898.

Floodplain Management: A Local Floodplain Administrator's Guide to the NFIP. FEMA-Region 10. Bothell, WA: FEMA

> This document discusses floodplain processes and terminology. It contains floodplain management and mitigation strategies, as well as information on the NFIP, CRS, CAVs and floodplain development standards.
>
> *To obtain this resource:* call FEMA at (800)480-2520.

Flood Hazard Mitigation Planning: A Community Guide. Massachusetts Department of Environmental Management. (June 1997)

This informative guide offers a ten-step process for successful flood hazard mitigation. Steps include: map hazards, determine potential damage areas, take an inventory of facilities in the flood zone, determine what is or is not being done about flooding, identify gaps in protection, brainstorm alternatives and actions, determine feasible actions, coordinate with others who are doing this, prioritize actions, develop strategies for implementation, and adopt and monitor the plan.

*To obtain this resource:* You may download an electronic version at **http://www.magnet.state.ma.us/dem/programs/mitigate/guide.htm**. For a hard copy of this guidebook contact the Massachusetts Flood Hazard Management Program (FHMP) at (617) 626-1250.

Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials. FEMA-116. (Feb 1987)

This guidebook offers a table on actions that communities can take to reduce flood losses. It also offers a table with sources for floodplain mapping assistance for the various types of flooding hazards. There is information on various types of flood hazards with regard to existing mitigation efforts and options for action (policy and programs, mapping, regulatory, non-regulatory). Types of flooding which are covered include alluvial fan, areas behind levees, areas below unsafe dams, coastal flooding, flash floods, fluctuating lake level floods, ground failure-triggered by earthquakes areas, ice jam flooding and mudslides.

*To obtain this document:* call FEMA at 1-800-480-2520.

Oregon Model Flood Damage Prevention Ordinance. FEMA/DLCD. (Jan 1999)

This is an example of how to write an ordinance that complies with NFIP/ FEMA standards. Communities can simply adopt this ordinance, word for word, filling in the blanks specific to their community or jurisdiction.

*To obtain this resource:* A copy of this ordinance is on the DLCD's website: **www.lcd.state.or.us** or contact the Oregon DLCD for more information, (503) 373-0050.

### Secondary Resources

These documents provide additional information and tools for reducing the risks associated with flood prone areas.

Answers to Questions About Substantially Damaged Buildings. FEMA-213. (May 1991)

Answers to Questions About the National Flood Insurance Program. FIA-2. (March 1992)

Community Flood Mitigation Planning Guidebook. Wisconsin Department of Natural Resources. (Nov 1995)

**Tip Box**

**The Oregon Floodplain Coordinator has:**

- FEMA elevation certificates and other forms
- Technical assistance and public outreach materials
- Data on the number of insurance policies in your community
- Oregon's model floodplain development ordinance and examples of other regulatory language

Cities Under Water. Raymond J. Burby. (1988) University of Colorado Institute of Behavioral Science.

Floodplain Management in Northern Illinois. Illinois Department of Natural Resources. (December 1996)

Homeowners Guide to Retrofitting. FEMA-312. (1998)

How to Use a Flood Map to Protect Your Property. FEMA-258. (May 1995)

Manufactured Home Installation in Flood Hazard Areas. FEMA-85 (September 1985).

### Technical Resources

The documents listed here focus on the technical aspects of flood hazard mitigation. They may require interpretation by a technical specialist.

Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings. (1995)

Managing Floodplain Development in Approximate Zone A Areas- A Guide for Obtaining and Developing Base (100-year) Flood Elevations. FEMA-265. (July 1995)

## *6.4 Internet Resources*

### The National Flood Insurance Program

http://www.fema.gov/nfip

The National Flood Insurance Program (NFIP) Web site is a subsection of the Federal Emergency Management Agency (FEMA) site (**http://www.fema.gov**). The NFIP information is intended for both the general public and the many organizations and agencies participating in the program. It includes much information about the NFIP and other flood disaster assistance available from the federal government. It also provides access to the newly revised NFIP booklet: Answers to Questions about the National Flood Insurance Program.

### The Association of State Floodplain Managers

http://www.floods.org

The Association of State Floodplain Managers (ASFPM) is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program, and flood preparedness, warning, and recovery. ASFPM fosters communication among those responsible for flood hazard activities, provides technical advice to governments and other entities about proposed actions or policies that will affect flood hazards, and encourages flood hazard research, education, and training. The ASFPM web site includes information on how to become a member, the organization's constitution and bylaws, directories of officers and committees, a publications list, information on upcoming conferences, a history of the association, and other useful information and Internet links.

### USGS Water Resources

http://water.usgs.gov

http://water.usgs.gov/public/realtime.html

This page offers current U.S. water news; extensive current (including real-time) and historical water data; numerous fact sheets and other publications; various technical resources; descriptions of ongoing survey water programs; local water information; and connections to other sources of water information.

### Office of Hydrology, National Weather Service

http://www.nws.noaa.gov/oh

http://www.nws.noaa.gov/oh/hic/

The National Weather Service's Office of Hydrology (OH) and its Hydrological Information Center offer information on floods and other aquatic disasters. This site offers current and historical data including an archive of past flood summaries, information on current hydrologic conditions, water supply outlooks, and an Automated Local Flood Warning Systems Handbook, Natural Disaster Survey Reports, and other scientific publications on hydrology and flooding.

### The Floodplain Management Association

http://www.floodplain.org

The Floodplain Management Web site was established by the Floodplain Management Association (FMA) to serve the entire floodplain management community. It includes full-text articles, a calendar of upcoming events, a list of positions available, an index of publications available free or at nominal cost, a list of associations, a list of firms and consultants in floodplain management, an index of newsletters dealing with flood issues (with hypertext links if available), a section on the basics of floodplain management, a list of frequently asked questions (FAQs) about the Web site, and, of course, a copious catalog of Web links.

### Northwest Regional Floodplain Managers Association (NORFMA)

http://www.norfma.org/

This site is a resource for floodplains, fisheries and river engineering information for the Northwest. This site provides technical information, articles and Internet links in the field of floodplain and fisheries management.

### FEMA's List of Flood Related Web Sites

http://www.fema.gov/nfip/related.htm

This site contains a long list of flood related Internet sites from "American Heritage Rivers" to "The Weather Channel," and is a good starting point for flood information on the Internet.

**HazLit Database (Univeristy of Colorado, Boulder)**

http://www.colorado.edu/hazards/litbase/hazlit.htm

The Natural Hazards Research and Applications Information Center at the University of Colorado, Boulder provides this library, which houses one of the most extensive collections of social science hazards literature in the world. This non-lending library is an important resource for practitioners who need information on different aspects of hazards and disasters. The collection includes approximately 22,000 catalogued items, including books, serials, reports, journal articles, videotapes, and compact discs. The database is comprehensive and is an excellent resource for communities looking for information on hazards.

### Planning for Natural Hazards: Reviewing your Comprehensive Plan

Coordination and consistency is essential to implementing plan policies that reduce flood risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- ❒ Have you made use of technical information and assistance provided by agencies to assist your community in planning for flood hazards?
- ❒ What documents or technical assistance does your community need to find to further understanding of flood hazards and begin the process of assessing community risk from flood hazards?

## Flood Endnotes:

[1] Federal Emergency Management Agency Virtual Library, Backgrounder: Floods and Flash Floods, http://www.fema.gov/library/flood.htm (March 2000)

[2] Oregon Cascades West Council of Governments. (Nov 1996) Cascade West Region of Oregon and the February Flood of 1996.

[3] (ibid.)

[4] (ibid.)

[5] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[6] (ibid.)

[7] (ibid.)

[8] (ibid.)

[9] Federal Emergency Management Agency Virtual Library, Backgrounder: Floods and Flash Floods, http://www.fema.gov/library/flood.htm (March 2000)

[10] Multi Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy. Federal Emergency Management Agency. (1997)

[11] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[12] Murray, Joseph. Personal Interview. Feb 9,2000.

[13] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[14] Federal Emergency Management Agency Virtual Library, Backgrounder: Floods and Flash Floods, http://www.fema.gov/library/flood.htm (March 2000)

[15] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[16] (1987) Federal Emergency Management Agency. Reducing Losses in High Risk Flood Hazard Areas- A Guidebook for Local Officials.

[17] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[18] (ibid.)

[19] Murray, Joseph. Personal Interview. Feb 9,2000

[20] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[21] (ibid.)

[22] (ibid.)

[23] (ibid.)

[24] (ibid.)

[25] Federal Emergency Management Agency, Region 10. Floodplain Management: a Local Administrator's Guide to the National Flood Insurance Program. (no date on document)

[26] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[27] Code of Federal Regulations. 44CFR59.1

[28] Federal Emergency Management Agency, Region 10. Floodplain Management: a Local Administrator's Guide to the National Flood Insurance Program. (no date on document)

[29] Kincaid, Nancy. Personal Interview. 27 April 2000

[30] Beier, Ann. Personal Interview. 27 April 2000.

[31] (ibid.)

[32] Oregon Cascades West Council of Governments. (Nov 1996) Cascade West Region of Oregon and the February Flood of 1996.

[33] The 100 Year Flood Myth. FEMA , Region 10. Date Unknown.

[34] Last Update: 24 April 2000. <http://www.fema.gov/nfip/readmap.htm> (10 May 2000)

[35] Multi Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy. Federal Emergency Management Agency. (1997)

[36] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[37] (ibid.)

[38] Beier, Ann. Personal Interview. 23 May 2000

[39] Last update 24 April 2000. <http://www.fema.gov/nfip/readmap.htm> (10 May 2000)

[40] Oregon's Statewide Land-Use Planning Goals and Guidelines. (1995) Oregon Department of Land Conservation and Development.

[41] (ibid.)

[42] Oregon Removal-Fill Permit Program Brochure. Division of State Lands.

[43] Beier, Ann. Personal Interview. 23 May 2000

[44] Collins, Peggy, Personal Interview. 10 May 2000

[45] Federal Emergency Management Agency National Flood Insurance Program (NFIP), http://www.fema.gov/nfip (March 2000)

[46] (ibid.)

[47] (ibid.)

[48] (ibid.)

[49] Beier, Ann. Personal Interview. 15 May 2000.

[50] Army Corps of Engineers Regulatory Permit Program Brochure. (1989) United States Army Corps of Engineers.

[51] Beier, Ann. Personal Interview. 23 May 2000

[52] Fancey Mark. Personal Interview. 27 April 2000

[53] Tools and Techniques for Land-use Planning- DRAFT. (1998) Brower, David. State of North Carolina.

[54] (ibid.)

[55] (ibid.)

[56] (ibid.)

[57] Fancey Mark. Personal Interview. 27 April 2000

[58] Land-Use Planning in Oregon. Rohse, Mitch, (1987) Oregon State University Press.

[59] (ibid.)

[60] (ibid.)

[61] Washington State Statutes, Chapter 86.16, “Floodplain Management”, section 86.16.041.

[62] Beier, Ann. Personal Interview. 23 May 2000

[63] Governor’s Watershed Enhancement Board. <www.4sos.org/group/gweb.html>

[64] Tools and Techniques for Land-use Planning-DRAFT. (1998) Brower, David State of North Carolina.

[65] Kincaid, Nancy. Personal Interview.

[66] Beier, Ann. Personal Interview. 4 Feb 2000.

[67] Kincaid, Nancy. Personal Interview. 27 April 2000.

[68] Tools and Techniques for Land-use Planning. Brower, David State of North Carolina.

[69] Kincaid, Nancy; Beier, Ann; & Fancey, Mark. Personal Interview. 27 April 00

[70] Tools and Techniques for Land-use Planning. Brower, David State of North Carolina.

[71] (ibid.)

[72] Federal Emergency Management Agency Hazard Mitigation Grant Program, http://www.fema.gov/mit/grant.htm> (March 2000)

[73] Federal Emergency Management Agency Flood Mitigation Assistance Program, http://www.fema.gov/mit/fldmitast.htm#fludmit (March 2000)

[74] National Resources Conservation Service (NRCS) http://www.or.nrcs.usda.gov (May 2000)

[75] Governor’s Watershed Enhancement Board. http://www.4sos.org/group/gweb.html (March 2000)

[76] Olson, Dennis. Personal Interview. 15 May 2000.

[77] Federal Emergency Management Agency. http://www.fema.gov (March 2000)

[78] Murray, Joseph. Personal Interview. 9 Feb 2000.

# Earthquake Annex

This annex contains information related to earthquakes to supplement the risk assessment summary in Section 3 of Multnomah County's Natural Hazard Mitigation plan. Like the other annexes to this plan, it is designed to have new policies, plans, and data sources related to annexes added in future plan updates. The annex contains:

- Multnomah County policies related to earthquake mitigation
- Earthquake-related sections from a previously-completed Multnomah County risk assessment
- The *State of Oregon Natural Hazard Mitigation Plan* section related to earthquakes in the region surrounding Multnomah County
- The *Technical Resource Guide* section on landslides, developed by the Oregon Natural Hazard Workgroup, which provides hazard-specific information on a statewide basis for the following topics: hazard history, hazard type and characteristics, hazard identification, hazard related legal issues, mitigation examples and best practices, and resources. This resource can be found online at www.Oregonshowcase.org

# POLICY 14: DEVELOPMENT LIMITATIONS

## INTRODUCTION

Many natural features impose limitations on development and, if not recognized in the development process, they can create public health and safety hazards. For example, flood plains perform important water storage functions and, if filled, force the water into other lands formerly not affected. These newly affected areas may have buildings which will be flooded. Erosive soils create stream siltation and can affect water quality and fish life habitat. A high water table can preclude septic tanks from functioning properly and create ground water pollution. These are important features which must be considered.

The purpose of this policy is to protect the public health and safety and to ensure that development does not create an "on-site" or "off-site" public harm. It is not intended to prohibit development, except where design and construction techniques cannot provide for a safe development.

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## POLICY 14

The County's policy is to direct development and land form alterations away from areas with development limitations, except upon a showing that design and construction techniques can mitigate any public harm or associated public cost and mitigate any adverse effects to surrounding persons or properties. Development limitations areas are those which have any of the following characteristics:

A. Slopes exceeding 20%;

B. Severe soil erosion potential;

C. Land within the 100 year flood plain;

D. A high seasonal water table within 0-24 inches of the surface for three or more weeks of the year;

E. A fragipan less than 30 inches from the surface;

F. Land subject to slumping, earth slides or movement.

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## STRATEGIES

A. As a part of the ongoing planning program, the County should continue to:

1. Identify areas with development limitations; and

2. Establish a process for reviewing development proposals in these areas.

B. The following should be addressed in the preparation of the Community Development Title:

1. **The Zoning Code** should include:

   a. Standards for development within the 100 year flood plain, recognizing the standards and criteria established by the Federal Emergency Management Agency. The Flood Plain should be applied to all areas within the 100 year flood plain as designated by the U. S. Army Corps of Engineers, U. S. Soil Conservation Service, and any special studies prepared by the County;

   b. Approved criteria for conditional uses which address the need to avoid or mitigate hazardous conditions;

   c. Provisions which allow the density, which would have been permitted in hazardous areas if it were not for the restrictions, to be transferred on-site or to adjoining property if held in the same ownership and if developed as a planned development.

2. County development standards should include provisions for:

   a. Geologic impact analysis utilizing the County's Geologic and Slope Hazard Study;

   b. Sediment and erosion control;

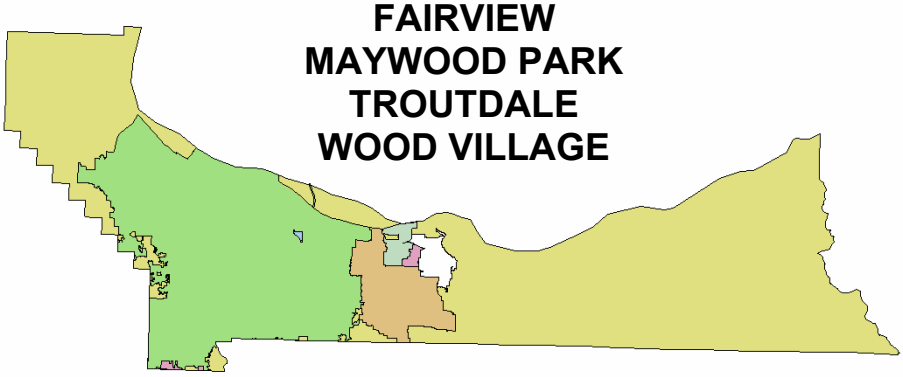
   c. Drainage; and

   d. Retention of vegetation and significant natural or habitat areas where these will mitigate natural hazards.

# MULTNOMAH COUNTY

## Earthquake Hazard Assessment

**IN PARTNERSHIP WITH THE CITIES OF:**
**GRESHAM**
**FAIRVIEW**
**MAYWOOD PARK**
**TROUTDALE**
**WOOD VILLAGE**



# Hazard Analysis

This Section serves to identify each hazard/threat confronting the jurisdiction. Hazards will be grouped into the following categories:

- Flooding
- Landslides, or Debris Flows
- Earthquake
- Volcano
- Wildfires & Urban Interface Fires
- Winter Storms
- Severe Weather

The development of Mitigation Projects centers on the prioritization of the three basic Strategies:

1. Life Safety, safeguarding and sustaining human life.
2. Property Preservation, protecting critical infrastructures, thus ensuring sustainable communities.
3. Environmental Conservation, enabling supportive environments and healthy ecosystems.

Each hazard will be analyzed as follows:

1. Hazard Definition
2. Hazard Description
3. Hazard History & Costs
4. Risk Assessment
5. Severity Score (this scoring was developed by the State of Oregon Office of Emergency Management)
6. Jurisdiction Vulnerabilities

# EARTHQUAKE

## 1. General Definition

An earthquake is a naturally induced shaking of the ground, caused by the fracture and sliding of rock within the Earth's crust. The magnitude is determined by the dimensions of the rupturing fracture (fault) and the amount of displacement that takes place. The larger the fault surface and displacement, the greater the energy. In addition to deforming the rock near the fault, this energy produces the shaking and a variety of seismic waves that radiate throughout the Earth.

## 2. Description

Northwest Oregon, including Multnomah County, is subject to what geologists term, 'the Triple Threat" of earthquakes. The three types of earthquakes which may be experienced by Oregon are: Lower Plate(deep) earthquakes. These quakes range from 6.0-7.5 on the Richter scale. These quakes originate at depths of 28-37 miles. Such earthquakes characteristically lack aftershocks. Crustal (shallow) earthquakes are generally between the 5.7 to 6.3 ranges on the Richter scale and originate at depths of 0-19 miles. These earthquakes usually have associated aftershocks. Subduction zone (along plates) are termed 'giant' or 'great' quakes, which range from 8.0 to 9.5 on the Richter scale. In the Northwest, subduction quakes could occur in the Cascadia subduction zone along the Juan de Fuca Plate. They occur as strains built up from centuries of plate convergence are suddenly released. Ground motions resulting from a subduction zone earthquake would cause relatively strong shaking over very large areas of the Pacific Northwest, including the Puget Sound and Willamette Valley regions. Recent evaluation of the earthquake threat in Oregon indicates the area may experience a 'great' subduction zone earthquake. Damage from this type of quake would be major to catastrophic. Soils mapping of the area from Hillsboro to Gresham, identifies a potential for major damage. This area has mostly silt -type soil that is subject to liquefaction (a process that takes place during an earthquake which causes sands and silts to lose strength and behave as viscous fluids rather than solids.)

## 3. Hazard History & Costs

The Metro 1999 study cites research indicating that "major geologic structures capable of magnitude (*M)* 7 earthquakes" underlie the Portland study area. Since 1820, 7000 earthquake have been documented in Oregon. Fifty-six significant earthquakes occurred in or near the Portland study area between 1872 and 1999. Severe earthquakes occurred in 18777, 1880, 1953, 1962, and 1993. Strong Pacific Northwest

earthquakes also include an *M* 7.4 North Cascades event, and *M* 6.8 earthquake in 1873, a 1949 *M* 7.1 event near Olympia, Washington, a 1965 *M* 6.5 event in Seattle-Tacoma, and a 2001 Nisqually quake that caused over $2 Billion in property damage. Regional earth quakes, such as the deep, intra-plate Nisqually Earthquake of 2001 are felt widely in northwest Oregon

## 4. Risk Assessment

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

The following categories are used in conducting this hazard analysis.

- *History (Weight Factor=2)*
  This is an analysis of the records of occurrences of previous major emergencies or disasters that affected the County.
- *Vulnerability (Weight Factor=5)*
  The percentage of the population and property likely to be effected by a hazard.
- *Maximum Threat (Weight Factor=10)*
  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By adding the severity rating by the weight factors associated with the categories above, a sub score for the history, vulnerability, maximum threat, and probability for each hazard can be achieved. Adding the sub score will produce a total score for that hazard.

**The Risk Assessment for Earthquake is:**

a. *History*: **20**

b. *Vulnerability:* **50**

c. *Maximum Threat:* **100**

d. *Probability:* **70**

***THIS IS A COUNTY WIDE EVENT***

**5. Severity Score.**

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Earthquake for Multnomah County is: 240***

*H + V + MT + P = Severity Score*

**20 + 50 + 100 + 70 = 240**

**6. Jurisdiction Vulnerabilities.**

a. *Population*

Approximately ***100*** percent of the community's population is vulnerable.

b. *Critical Facilities*

(1) Approximately ***100*** percent of the community's critical facilities is vulnerable.

(2) Definition / Description:

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event. Many critical facilities are housed in older buildings that are not up to current seismic codes. In Multnomah County, critical facilities are identified as the following; City Halls, Fire Stations, Police/Law Enforcement locations, Hospitals, Correctional facilities, Airports, and County Facilities.

(3) The specific critical facilities vulnerable in Multnomah County are:

- 4 County Law Enforcement Buildings
- 5 Municipal Administration Bldgs. (City Halls)
- 7 County Correctional Facilities
- 19 Critical County Facilities
- 3 Municipal Police Departments

c. *Infrastructure Lifelines*

(1) Approximately ***100*** percent of the community's infrastructure lifelines are vulnerable.

(2) Definition / Description:

Lifelines are the connections between communities and outside services. They include ground transportation systems, rail networks, and airports. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after an earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public. Residents in Multnomah County commute frequently by automobiles and public transportation such as buses and light rail. An earthquake can greatly damage bridges and roads, hampering the movement of people and goods. Damaged infrastructure strongly affects the economy of the community – it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers. The Bonneville Dam located in the Columbia River Gorge of Multnomah County, may be subjected to strong ground shaking as a result of moderate to very large earthquakes nearby. Landslides around the gorge rim are numerous. There are many active slide sites, and their stability during an earthquake is uncertain.

(3) The specific infrastructure lifelines vulnerable in Multnomah County are:

- 1 Airport
- 31 Bridges
- 8 Rail Network Carriers
- 430 Arterials, Secondary, and Side Road Networks.

d. *Public Infrastructure*

(1) Approximately ***100*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description:

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these facilities become crucial in providing support and services, which allow the continuity of business, government, and society.

(3) The specific public infrastructure vulnerable in Multnomah County are:

- 112 County Support Facilities
- 24 Child Care Centers
- 15 Assisted Living Centers
- 8 Water Providers and Distribution Support Facilities

e. *Private Economy and Business Sector*

(1) Approximately ***100*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description:

Seismic activity can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses.

(3) The specific private economy and business sector vulnerable in

Multnomah County are:

- 9 Bakeries
- 4 Food Caterers
- 46 Contract Food Service Providers

- 34 Grocery Stores
- 20 Hardware Stores
- 146 Restaurants
- 806 Private Businesses/Corporations

# REGION 2
# Northern Willamette Valley / Portland Metro[1]
# Hazards Assessment

[1] Includes the counties of Columbia, Clackamas, Multnomah and Washington.

# EARTHQUAKE

## Characteristics and Brief History

The geographic position of Region 2 makes it susceptible to earthquakes from four sources: (1) the off-shore Cascadia Fault Zone, (2) deep intraplate events within the subducting Juan de Fuca plate, (3) shallow crustal events within the North America Plate, and (4) earthquakes associated with renewed volcanic activity. All have some tie to the subducting or diving of the dense, oceanic Juan de Fuca Plate under the lighter, continental North America Plate. Stresses occur because of this movement and there appears to be a link between the subducting plate and the formation of volcanoes some distance inland from the off-shore fault zone.

As crustal faults slip, they can produce earthquakes with magnitudes (M) up to 7.0 and can cause extensive damage, which tends to be localized in the vicinity of the area of slippage. Deep intraplate earthquakes occur at depths between 30 and 100 kilometers below the earth's surface. They occur in the subducting oceanic plate and can approach M7.5. Subduction zone earthquakes pose the greatest hazard. They occur at the boundary between the descending oceanic Juan de Fuca Plate and the overriding North American Plate. This area of contact, which starts off the Oregon coast, is known as the Cascadia Subduction Zone (CSZ). The CSZ could produce an earthquake up to 9.0 or greater.

Region 2 has had seven crustal earthquakes of magnitude 4 or greater since 1877 (Table 3). The region's largest earthquakes were the 1877 M5.3 and the 1962 M5.2. In addition, the region has been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered outside the area. A few examples are in Table 3. There is good reason to believe that the most devastating future earthquakes would probably originate along shallow crustal faults in the region and along the Cascadia Fault Zone. Deep-seated intraplate events, as occurred near Olympia, Washington in 1949 and 2001 (Table 3), could generate magnitudes as large as M7.5, but have been rare in the region's historical record.

Earthquake associated hazards include severe ground shaking, liquefaction of fine-grained soils, and landslides. The severity of these effects depend on several factors, including the distance from the earthquake source, the ability of soil and rock to conduct seismic energy and the degree (angle) and composition of slope materials. Earthquakes produced through volcanic activity could reach magnitudes of 5.2. However, the Cascade volcanoes are some distance away from populated centers, which tends to lessen the concern.

Earthquake risk throughout Region 2 is reflected in the Uniform Building Code's (UBC) earthquake hazard maps (i.e., seismic zones 1-4). The higher the numerical designation, the more stringent the building standards become. Region 2 is within UBC Seismic Zone 3.

## TABLE 3. SIGNIFICANT EARTHQUAKES

| DATE | LOCATION | SIZE (M) | COMMENTS |
|---|---|---|---|
| Approximate Years 1400 BCE*, 1050 BCE, 600 BCE, 400, 750, 900 | Offshore, Cascadia Subduction Zone (CSZ) | Probably 8.0 –9.0 | Based on studies of earthquake and tsunami at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.<br><br>* BCE: Before the Common Era |
| January, 1700 | CSZ | Approx. 9.0 | Generated a tsunami that struck Oregon, Washington, and Japan; destroyed Native American villages along the coast |
| October, 1877 | Portland area | 5.2 | Two events were reported that day. The estimated felt area was approximately 41,000 square kilometers. Chimney damage reported |
| February, 1892 | Portland area | 5.0 | No major damage occurred |
| December, 1941 | Portland area | 4.5 | Felt by most Portland residents. Shattered windows and cracked plaster in Hillsboro and Sherwood. |
| April, 1949 | Olympia, WA | 7.1 | Significant damage in Washington. Minor damage in NW Oregon |
| December, 1953 | Portland area | 4.5 | Cracked plaster and caused objects to fall in Portland. |
| November, 1961 | Portland area | 5.0 | Principal damage from cracked plaster |
| November, 1962 | Portland area | 5.5 | Shaking lasted up to 30 seconds; chimneys cracked; windows broken; furniture moved |
| December, 1963 | Portland area | 4.5 | Books and pictures fell in Plains |
| March 25, 1993 | Scotts Mills | 5.6 | On Mt. Angel-Gales Creek fault. $30 million damage (including Oregon Capitol Building in Salem) (FEMA-985-DR-OR) |
| February, 2001 | Nisqually, WA | 6.8 | Felt in the region, no damage reported |

Source: Wong, Ivan and Jacqueline Bolt, November 1995, A Look Back at Oregon's Earthquake History, 1841-1994, *Oregon Geology* pp. 125-139.

## Probability

The Cascadia Subduction Zone generates an earthquake on average every 500-600 years. However, as with any natural process, the average time between events can be misleading. Some of the earthquakes may have been 150 years apart with some closer to 1,000 years apart (DOGAMI, 1999). The last one was approximately 300 years ago. Establishing a probability for crustal earthquakes is difficult because of the small number of recorded events. However, based on the seven M4 and greater earthquakes centered in the region during the last 125 years, an average recurrence interval would be 22 years. The time interval between individual events varied from one to 49 years. Earthquakes generated by volcanic activity in Oregon's Cascade Range are possible, but are unpredictable.

## Vulnerability

Region 2 is especially vulnerable to earthquake hazards for two reasons: (1) much of the area is susceptible to earthquake-induced landslides, liquefaction, and severe ground shaking, and (2) the region contains the bulk of Oregon's population and built environment.

The Oregon Department of Geology and Mineral Industries (DOGAMI) has developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) the Cascadia Subduction Zone (CSZ), and (2) combined crustal events (500-year model). Both models utilize HAZUS, a software program developed by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes. The CSZ event is based on a potential M8.5 earthquake generated off the Oregon coast. The model does not take into account a tsunami, which probably would develop from such an event. The 500-year crustal model does not look at a single earthquake (as in the CSZ model); it encompasses many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. Neither model takes unreinforced masonry buildings into consideration.

DOGAMI investigators caution that the models contain a high degree of uncertainty and should be used only for general planning purposes. Despite their limitations, the models do provide some approximate estimates of damage. Results are found in Table 4.

Metro[1] has likewise evaluated earthquake potential and losses for its three-county area (Clackamas, Multnomah, Washington). The analysis (1998) included an inventory of over 50,000 commercial and multi-family dwellings at risk. Single-family dwellings within the Metro boundary were not evaluated because their structural similarity (Metro, 1998).

[1] Metro is the elected regional government that serves more than 1.3 million residents in Clackamas, Multnomah, and Washington counties, and the 24 cities in the Portland metropolitan area.

Other useful resources for planning for earthquakes include the following:

- **Maps of earthquake hazard areas:** DOGAMI has mapped urban areas and relative Environmental Quality hazard maps for all of the Region 1 counties except Lane and Lincoln counties. DOGAMI has only mapped urban areas for these two counties.
- **Map of coastal critical facilities vulnerable to hazards:** DOGAMI has developed these maps for all Region 1 counties.
- **Environmental Geology of Land Use Geology maps:** DOGAMI has developed these maps for all Region 1 counties.
- **Nuclear energy/hazardous waste sites inventories**: No Region 1 counties have nuclear facilities.

## TABLE 4. PROJECTED DOLLAR LOSSES BASED ON A M8.5 SUBDUCTION EVENT AND A 500-YEAR MODEL

| | A. 8.5 CSZ EVENT | | | | B. 500-YEAR MODEL | | | |
|---|---|---|---|---|---|---|---|---|
| **COUNTIES►** | **Multnomah** | **Washington** | **Columbia** | **Clackamas** | **Multnomah** | **Washington** | **Columbia** | **Clackamas** |
| INJURIES | 1,521 | 555 | 36 | 128 | 8,659 | 2,910 | 150 | 1,402 |
| DEATHS | 28 | 10 | 0 | 2 | 186 | 62 | 3 | 29 |
| DISPLACED HOUSEHOLDS | 2,803 | 2,062 | 94 | 426 | 13,777 | 7,666 | 326 | 2,525 |
| ECONOMIC LOSSES FOR BUILDINGS[2] | $1.9 billion | $931 million | N/A | $316 m | $9.2 billion | $3.8 billion | $267 mil | $2.1 billion |
| OPERATIONAL "DAY AFTER" THE QUAKE | | | | | | | | |
| Fire Stations | 78% | 66% | Unknown | 84% | N/A[3] | * | * | * |
| Police Stations | 76% | 64% | 45% | 84% | N/A | * | * | * |
| Schools | 81% | 64% | 63% | 84% | * | * | * | * |
| Bridges | 94% | 79% | 82% | 90% | * | * | * | * |
| ECONOMIC LOSSES TO | | | | | | | | |
| Highways | $21 million | $15 m | $2 mil | $6 m | $437 m | $61 m | $10 mil | $74 m |
| Airports | $2 million | $5 m | $2 mil | $3 m | $12 m | $23 m | $8 mil | $32 m |
| Communications | $3 million | $752,000 | $97,000 | $232,000 | $31 m | $4 m | $950,000 | $4 m |
| DEBRIS GENERATED (THOUSANDS OF TONS) | 1,598 | 763 | 57 | 237 | 6,745 | 2,817 | 184 | 1,588 |

Source: DOGAMI, 1999, Special Paper 29: Earthquake Damage in Oregon

Table 4 Notes:

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

[2]There are numerous un-reinforced masonry structures (URMs) in Oregon, the currently available default building data does not include any URMs. Thus, the reported damage and loss estimates may seriously under-represent the actual threat" (page 126 – 1998, DOGAMI)

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

The probability that Region 2 will experience earthquakes and the region's vulnerability to their effects are depicted in Table 5 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

## TABLE 5. Vulnerability and Probability Assessment for Earthquakes

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | H | H | H | M |
| Probability | H | M | H | M |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

# Wildfire Annex

This annex contains information related to wildfires to supplement the risk assessment summary in Section 3 of Multnomah County's Natural Hazard Mitigation plan. Like the other annexes to this plan, it is designed to have new policies, plans, and data sources related to annexes added in future plan updates. The annex contains:

- Multnomah County policies related to wildfire mitigation
- Wildfire-related sections from a previously-completed Multnomah County risk assessment
- The *State of Oregon Natural Hazard Mitigation Plan* section related to wildfire in the region surrounding Multnomah County
- The *Technical Resource Guide* section on wildfire, developed by the Oregon Natural Hazard Workgroup, which provides hazard specific information on a statewide basis for the following topics: hazard history, hazard type and characteristics, hazard identification, hazard related legal issues, mitigation examples and best practices, and resources. This resource can be found online at www.Oregonshowcase.org

(D) The following shall not be deemed a Lot of Record:

(1) An area of land described as a tax lot solely for assessment and taxation purposes;

(2) An area of land created by the foreclosure of a security interest;

(3) A *Mortgage Lot.*

(4) An area of land created by court decree.

(Ord. 1033, Amended, 05/13/2004; Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 982, Amended, 05/16/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.2280 LOT SIZE FOR CONDITIONAL USES

Lots less than the minimum specified in MCC 33.2260 (A) may be created for the uses listed in MCC 33.2220 (S) and 33.2230 (D) (1) through (6), (9) through (13), and (16) and (E) (1) through (4), after approval is obtained pursuant to MCC 33.2245 and based upon:

(A) A finding that the new lot is the minimum site size necessary for the proposed use;

(B) The nature of the proposed use in relation to its impact on nearby properties; and

(C) Consideration of the purposes of this district.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.2285 OFF-STREET PARKING AND LOADING

Off-street parking and loading permitted as an accessory use shall be provided as required by MCC 33.4100 through 33.4220.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.2290 ACCESS

Any lot in this district shall abut a street, or shall have other access deemed by the approval authority to be safe and convenient for pedestrians and for passenger and emergency vehicles.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.2305 DEVELOPMENT STANDARDS FOR DWELLINGS AND STRUCTURES

Except as provided for the alteration, replacement or restoration of dwellings under MCC 33.2220 (D) and (E) and 33.2225 (B), all dwellings and structures located in the CFU district after January 7, 1993 shall comply with the following:

(A) The dwelling or structure shall be located such that:

(1) It has the least impact on nearby or adjoining forest or agricultural lands and satisfies the minimum yard and setback requirements of 33.2260 (C) through (G);

(2) Adverse impacts on forest operations and accepted farming practices on the tract will be minimized;

(3) The amount of forest land used to site the dwelling or other structure, access road, and service corridor is minimized;

(4) Any access road or service corridor in excess of 500 feet in length is demonstrated by the applicant to be necessary due to physical limitations unique to the property and is the minimum length required; and

(5) The risks associated with wildfire are minimized. Provisions for reducing such risk shall include:

(a) The proposed dwelling will be located upon a tract within a fire protection district or the dwelling shall be provided with residential fire protection by contract;

(b) Access for a pumping fire truck to within 15 feet of any perennial water source on the lot. The access shall meet

the driveway standards of MCC 33.2305 (D) with permanent signs posted along the access route to indicate the location of the emergency water source;

(c) Maintenance of a primary and a secondary fire safety zone on the subject tract.

1. A primary fire safety zone is a fire break extending a minimum of 30 feet in all directions around a dwelling or structure. Trees within this safety zone shall be spaced with greater than 15 feet between the crowns. The trees shall also be pruned to remove low branches within 8 feet of the ground as the maturity of the tree and accepted silviculture practices may allow. All other vegetation should be kept less than 2 feet in height.

2. On lands with 10 percent or greater slope the primary fire safety zone shall be extended down the slope from a dwelling or structure as follows:

| Percent Slope | Distance In Feet |
|---|---|
| Less than 10 | Not required |
| Less than 20 | 50 |
| Less than 25 | 75 |
| Less than 40 | 100 |

3. A secondary fire safety zone is a fire break extending a minimum of 100 feet in all directions around the primary safety zone. The goal of this safety zone is to reduce fuels so that the overall intensity of any wildfire is lessened. Vegetation should be pruned and spaced so that fire will not spread between crowns of trees. Small trees and brush growing underneath larger trees should be removed to prevent the spread of fire up into the crowns of the larger trees. Assistance with planning forestry practices which meet these objectives may be obtained from the State of Oregon Department of Forestry or the local Rural Fire Protection District. The secondary fire safety zone required for any dwelling or structure may be reduced under the provisions of MCC 33.2260 (F) and 33.2310.

4. No requirement in 1., 2., or 3. above may restrict or contradict a forest management plan approved by the State of Oregon Department of Forestry pursuant to the State Forest Practice Rules; and

5. Maintenance of a primary and a secondary fire safety zone is required only on land surrounding the dwelling that is owned or controlled by the home owner.

(d) The building site must have a slope less than 40 percent.

(B) The dwelling or structure shall:

(1) Comply with the standards of the applicable building code or as prescribed in ORS 446.002 through 446.200 relating to mobile homes;

(2) If a mobile home, have a minimum floor area of 600 square feet and be attached to a foundation for which a building permit has been obtained;

(3) Have a fire retardant roof; and

(4) Have a spark arrester on each chimney.

(C) The applicant shall provide evidence that the domestic water supply is from a source authorized in accordance with the Department of Water Resources Oregon Administrative Rules for the appropriation of ground water (OAR 690, Division 10) or surface water (OAR 690, Division 20) and not from a Class 11 stream as defined in the Forest Practices Rules.

(1) If the water supply is unavailable from public sources, or sources located entirely on the property, the applicant shall provide evidence that a legal easement has been obtained permitting domestic water lines to cross the properties of affected owners.

(2) Evidence of a domestic water supply means:

(a) Verification from a water purveyor that the use described in the application will be served by the purveyor under the purveyor's rights to appropriate water; or

(b) A water use permit issued by the Water Resources Department for the use described in the application; or

(c) Verification from the Water Resources Department that a water use permit is not required for the use described in the application. If the proposed water supply is from a well and is exempt from permitting requirements under ORS 537.545, the applicant shall submit the well constructor's report to the county upon completion of the well.

(D) A private road (including approved easements) accessing two or more dwellings, or a driveway accessing a single dwelling, shall be designed, built, and maintained to:

(1) Support a minimum gross vehicle weight (GVW) of 52,000 lbs. Written verification of compliance with the 52,000 lb. GVW standard from an Oregon Professional Engineer shall be provided for all bridges or culverts;

(2) Provide an all-weather surface of at least 20 feet in width for a private road and 12 feet in width for a driveway;

(3) Provide minimum curve radii of 48 feet or greater;

(4) Provide an unobstructed vertical clearance of at least 13 feet 6 inches;

(5) Provide grades not exceeding 8 percent, with a maximum of 12 percent on short segments, except as provided below:

(a) Rural Fire Protection District No. 14 requires approval from the Fire Chief for grades exceeding 6 percent;

(b) The maximum grade may be exceeded upon written approval from the fire protection service provider having responsibility;

(6) Provide a turnaround with a radius of 48 feet or greater at the end of any access exceeding 150 feet in length;

(7) Provide for the safe and convenient passage of vehicles by the placement of:

(a) Additional turnarounds at a maximum spacing of 500 feet along a private road; or

(b) Turnouts measuring 20 feet by 40 feet along a driveway in excess of 200 feet in length at a maximum spacing of 1/2 the driveway length or 400 feet whichever is less.

(Ord. 1033, Amended, 05/13/2004; Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.2310 EXCEPTIONS TO SECONDARY FIRE SAFETY ZONES AND FOREST PRACTICES SETBACKS

(A) The secondary fire safety zone and forest practices tract setbacks for dwellings and structures may be reduced pursuant to the provisions of 33.2310 (B) when:

(1) The tract on which the dwelling or structure is proposed has an average lot width or depth of 330 feet or less, or

(2) The dwelling or structure is proposed to be located within 130 feet of the centerline of a public or private road serving two or more properties including the subject site; or

(3) The proposed dwelling or structure is intended to be located within 130 feet of a legally existing dwelling or structure.

(B) Exceptions to secondary fire safety zones and forest practices setbacks shall only be granted upon satisfaction of the following standards:

(1) If the proposed secondary fire safety zone is between 50 and 100 feet, the dwelling or structure shall be constructed in accordance with the International Fire Code Institute Urban– Wildland Interface Code Section 505 Class 2 Ignition Resistant Construction as adopted August, 1996, or as later amended, or

(2) If the proposed secondary fire safety zone is less than fifty feet, the dwelling or structure shall be constructed in accordance with the International Fire Code Institute Urban-Wildland Interface Code Section 504 Class 1 Ignition Resistant Construction as adopted August, 1996, or as later amended, and

(3) There shall be no combustible fences within 12 feet of the exterior surface of the dwelling or structure; and

(4) A dwelling shall have a central station monitored alarm system if the secondary fire safety zone equivalents of MCC 33.2310 (B) (1) are utilized, or

(5) A dwelling shall have a central station monitored 13D sprinkler system if the secondary fire safety zone equivalents of MCC 33.2310 (B) (2) are utilized.

Exception: Expansions of existing single family dwellings as allowed by MCC 33.2220 (D) shall not be required to meet this standard, but shall satisfy the standard of MCC 33.2305 (B) (3) above.

(6) All accessory structures within the fire safety zone setbacks required by MCC 33.2305 shall have a central monitored alarm system.

(7) All accessory structures within 50 feet of a building containing shall:

(a) Have a central monitored alarm system;

(b) Have exterior walls constructed with materials approved for a minimum of one-hour-rated fire-resistive construction, heavy timber, log wall construction or constructed with noncombustible materials on the exterior side.

(8) When a detached accessory structure is proposed to be located so that the structure or any portion thereof projects over a descending slope surface greater than 10 percent, the area below the structure shall have all underfloor areas enclosed to within 6 inches of the ground, with exterior wall construction in accordance with Section 504.5 of the International Fire Code Institute Urban– Wildland Interface Code Class 1 Ignition Resistant Construction as adopted August, 1996, or as later amended, or underfloor protection in accordance with Section 504.6 of that same publication.

Exception: The enclosure may be omitted where the underside of all exposed floors and all exposed structural columns, beams and supporting walls are protected as required for exterior one-hour-rated fire-resistive construction or heavy-timber construction.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

**§ 29.012 Fire Apparatus Means of Approach - Standards For Private Streets and Private Driveways Serving New and Replacement One- And Two-Family Dwellings.**

(A) Private streets and private driveways shall meet the standards in this section for fire apparatus access to new and replacement one- and two-family dwellings. The purpose of these standards is to establish minimum criteria for evaluating the adequacy of fire apparatus access during the review of building permit applications for proposed one- and two-family dwellings.

(1) Review and determination of compliance with the standards in § 29.012, or more stringent standards adopted by the fire protection service provider, shall be made by the Fire Marshal or designated fire official of that service district. If the Fire Marshal, or designee, fails to review and make a determination of compliance, then the building official shall, after consultation with the appropriate fire official, make a determination of compliance.

(2) The standards in this section implement the requirements in OAR 918-480-0100 through 918-480-0120 (2002), appropriate use of alternate methods of construction in the One and Two-Family Specialty Code.

(3) An alternative to the minimum requirements of (D) below may be allowed by the building official, after consultation with the fire official, subject to the requirements of § 29.013.

(B) As used in § 29.012, "private street" and "private driveway" shall have the meanings given in the land division definition parts of the applicable Zoning Code Chapter of the Multnomah County Code.

(C) A building permit application for a new or replacement one- or two-family dwelling shall include sufficient information to determine compliance with the standards of § 29.012. A review form evaluating the proposal and signed by the applicable fire official shall also be submitted with the permit application.

(1) For those fire protection service districts that have adopted more stringent standards than given in (D) below, the more stringent standards shall prevail. The signed review by a fire district official shall state if the proposal is in compliance with the most stringent standards, either the district or those in (D) below.

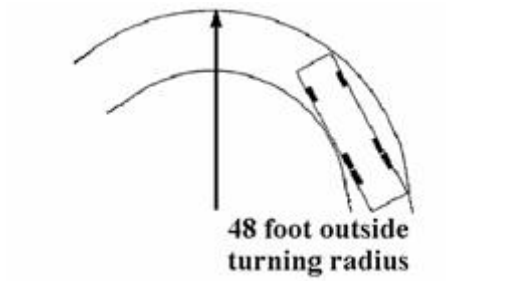
(2) Where there may be a conflict between the standards of this section and development standards in the county Zoning Code, the more stringent standard shall be utilized. The Planning Director shall provide this information to the building official with copies of any land use decision.

(D) Fire apparatus access requirements. The following standards shall apply to private streets and private driveways:

(1) Vehicle weight: Be built and maintained with an all weather driving surface that supports a gross vehicle weight of 50,000 pounds or the weight of the heaviest commonly used apparatus used by the fire protection

service provider serving the subject property, whichever is greater. Bridges, culverts and other structures shall also be required to meet this requirement. Written verification of compliance with the Gross Vehicle Weight standard may be required from an Oregon Professional Engineer.

(2) Curve radius: Have an outside radius that is no less than 48 feet on all curves along the driveway or private street.




(3) Vertical clearance: Have a vertical clearance of no less than 13 feet 6 inches.

(4) Width: Be built and maintained from the public road to the end turnaround near the dwelling to a minimum unobstructed width, (including gate opening widths), of:

(a) 12 feet for a private driveway to a single dwelling;

(b) 12 feet for a private street to two dwellings;

(c) 20 feet for a private street to three or more dwellings***;*** and

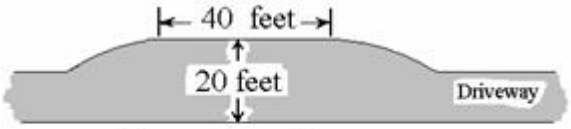
(d) 20 feet for all "accessways," regardless of the number of dwellings served. An "accessway" is a private street that is a separate tract of land that is owned in common by the abutting property owners for access and was approved under the provisions of the land division code after October 19, 1978.

(e) The Fire Marshal, or designee, may approve an off-site built and maintained width of less than 20 feet, but not less than 12 feet in width, for a private street as given in (c) above. That approval, however, may not be applied to a required improvement width that is part of a Multnomah County land use decision.

(5) Turnaround: Private streets and private driveways with lengths greater than 150 feet shall be built and maintained with a turn-around at or near the end of not less than 48 foot outside turning radius. Turnarounds may be circular or one of the variations of the hammerhead design (such as "T," one-sided, or "Y").

(6) Turnouts: No turnouts are required on private streets and private driveways that are improved to 20 feet or more in width as required by (D)(1) above. On private streets and private driveways that are improved to less than 20 feet in width, that are also greater than 200 feet in length, turnouts shall be built and maintained to:

(a) Measure 20 feet in width for a length of 40 feet with adequate transitional curve radii at each end;




Turnout dimensions on private driveway of less than 20 feet in width.

(b) Have a maximum spacing of one-half the driveway length or 400 feet, whichever is less; and

(c) Where visibility is limited, the maximum spacing between turnouts shall be reduced appropriately.

(7) Grades: Shall not exceed an overall average grade of 12 percent with a maximum grade of 15 percent for lengths of no more than 200 feet.

(8) Distance to House: Shall reach to within 150 feet of all portions of the exterior wall of the first story of the dwelling as measured by an approved route around the exterior.

(Ord. 1049, Add, 09/16/2004)

**§ 29.013 Alternate Method of Fire Protection - One- And Two-Family Dwellings.**

Pursuant to OAR 918-480-0100 through 918-480-0120 (2002), the building official may allow an alternate to the minimum requirements of the One- and Two-Family Dwelling Specialty Code as authorized by ORS 455.610, which may include, but is not limited to, installation of an automatic fire sprinkler system. That decision may be made where it is determined the fire apparatus means of approach to a property or the fire fighting water supply serving a property, does not meet the local standards adopted in accordance with the applicable fire code and state building code requirements. Before allowing the use of an alternative method of fire protection, the building official shall ensure the following criteria have been met:

(A) The alternate, such as an automatic fire sprinkler system, shall be at the request of the applicant;

(B) For lots of record created before January 1, 2002, the building official shall, prior to authorizing an alternate allowing the development of a parcel that could not otherwise be developed because it cannot meet adopted fire apparatus access standards or fire fighting water supply standards pursuant to § 29.012 and § 29.003(B), consult with the fire official having authority to approve an alternate;

(C) For lots of record created on or after January 1, 2002, the building official shall confirm the fire official having authority has:

(1) Approved the alternate to adopted fire apparatus access standards for shared private roads, private driveways or fire fighting water supply standards pursuant to § 29.012 and § 29.003(B), during the land use approval process; and

(2) The approved alternate has been recorded on the property deed or on a recorded deed restriction as a requirement for future construction.

(D) Providing the requirements of this rule are met, the local building official is authorized to enforce the

conditions of an approved alternate method of construction when it is part of the building construction; and

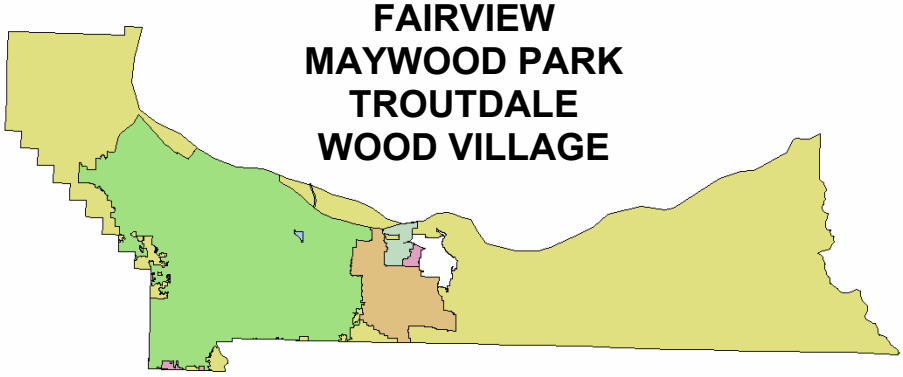
(E) When the approved alternate is a fire sprinkler system, the minimum standard for installation within one- and two-family dwellings shall be the 1999 Edition, or the most current version, of NFPA 13-D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes (NFPA is the National Fire Protection Association, Inc).

(Ord. 1049, Add, 09/16/2004)

# MULTNOMAH COUNTY

# Wildfire Hazard Assessment

**IN PARTNERSHIP WITH THE CITIES OF:**
**GRESHAM**
**FAIRVIEW**
**MAYWOOD PARK**
**TROUTDALE**
**WOOD VILLAGE**



# Hazard Analysis

This Section serves to identify each hazard/threat confronting the jurisdiction. Hazards will be grouped into the following categories:

- Flooding
- Landslides, or Debris Flows
- Earthquake
- Volcano
- Wildfires & Urban Interface Fires
- Winter Storms
- Severe Weather

The development of Mitigation Projects centers on the prioritization of the three basic Strategies:

1. Life Safety, safeguarding and sustaining human life.
2. Property Preservation, protecting critical infrastructures, thus ensuring sustainable communities.
3. Environmental Conservation, enabling supportive environments and healthy ecosystems.

Each hazard will be analyzed as follows:

1. Hazard Definition
2. Hazard Description
3. Hazard History & Costs
4. Risk Assessment
5. Severity Score (this scoring was developed by the State of Oregon Office of Emergency Management)
6. Jurisdiction Vulnerabilities

## WILDFIRES & URBAN INTER-FACE FIRES

### 1. General Definition

Wildfire is a rapid, persistent chemical reaction that releases heat and light, especially the exothermic combination of a combustible substance with oxygen. Wildfires present a significant potential for disaster in the southwest, a region of relatively high temperatures, low humidity, low precipitation and during the spring, moderately strong daytime winds. Combine these severe burning conditions with people or lightning and the stage is set for the occurrence of large, destructive wildfires.

### 2. Description

Fires are a natural part of the ecosystem in Oregon but present a substantial hazard when threatening life and property in growing communities. Although wildfires are more common to the arid areas of Eastern Oregon, there is still potential for losses due to wildland-urban interface fires in Multnomah County. Wildfire is defined as any fire occurring on wildlands that requires suppression response. The wildfire hazard is often characterized by an increased fire risk in the urban interface zone. The interface is the urban-rural fringe where homes and other structures are built into a densely forested or natural landscape. If left unchecked, it is likely that fires in these areas will threaten lives and property.

### 3. Hazard History

To date there have been no major losses due to wild land/ urban interface fires in Multnomah County since records have been kept. Thus, while the area has been spared the impacts of fires, it is prudent to expect that such a fire represents a threat and could occur in Multnomah County. While no specific events have impacted Portland a number of significant wildfires/ urban interface fires occurred during 2002 & 2003 in the national forests (Deschutes and Ochoco) west and south of Multnomah County. These necessitated road closures on Highway 20. The recent sever wild land /urban interface fires illustrate this point. In 1991, the Multnomah Falls fire did serve as a wake-up call to the hazard and reality of an urban interface fire to residents of Corbett & Bridal Veil.

## 4. Risk Assessment

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

The following categories are used in conducting this hazard analysis.

- *History (Weight Factor=2)*
  This is an analysis of the records of occurrences of previous major emergencies or disasters that affected the County.
- *Vulnerability (Weight Factor=5)*
  The percentage of the population and property likely to be effected by a hazard.
- *Maximum Threat (Weight Factor=10)*
  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By adding the severity rating by the weight factors associated with the categories above, a sub score for the history, vulnerability, maximum threat, and probability for each hazard can be achieved. Adding the sub score will produce a total score for that hazard

.

**The Risk Assessment for Wildfire/Urban Interface is:**

| | CNTY | MPARK | FVIEW | TDALE | WVILL | COG |
|---|---|---|---|---|---|---|
| HX | 20 | 2 | 2 | 20 | 2 | 2 |
| VULN. | 50 | 5 | 5 | 50 | 5 | 5 |
| MXTHRT | 100 | 10 | 10 | 100 | 10 | 10 |
| PROB. | 70 | 7 | 7 | 70 | 7 | 7 |
| TOTAL | 240 | 24 | 24 | 240 | 24 | 24 |

**HX=History/VULN= Vulnerability/ MXTHRT=Maximum Threat/ PROB=Probability**

**CNTY=County/MPARK=Maywood Park/FVIEW=Fairview/TDALE=Troutdale/WVILL=Wood Village/COG=Gresham**

**5. Severity Score**

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Floods for Multnomah County is: 240***

***The Severity Score for Floods for Maywood Park is: 24***

***The Severity Score for Floods for Fairview is: 24***

***The Severity Score for Floods for Troutdale is: 240***

***The Severity Score for Floods for Wood Village is: 24***

***The Severity Score for Floods for Gresham is: 240***

*H + V + MT + P = Severity Score*

**6. Community Vulnerabilities**

a. *Population*

3100 residents could be affected by a Wildfire/Urban Interface fire.

b. *Critical Facilities*

(1) Approximately ***10*** percent of the community's critical facilities is vulnerable.

(2) Definition / Description:

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional during/after an urban-interface fire and/or forest fire event.

(3) The specific critical facilities vulnerable in Multnomah County are:

- 4 Fire Stations

c. *Infrastructure Lifelines*

(1) Approximately ***12*** percent of the community's infrastructure lifelines are vulnerable.

(2) Definition / Description:

Lifelines are the connections between communities and outside services. They include ground transportation systems, air, and rail networks. Urban-interface fires and forest fires can cause power lines to fall, roads and railways to be closed, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after and/or during a urban-interface fire and forest fires, to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.

(3) The specific infrastructure lifelines vulnerable in Multnomah County are:

- 9 Bridges
- 47 Arterials, Secondary, and Side Road Networks.

d. *Public Infrastructure*

(1) Approximately ***0*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description:

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these facilities become crucial in providing support and services, which allow the continuity of business, government, and society. Damaged infrastructure strongly affects the economy of the community – it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

(3) The specific public infrastructure vulnerable in Multnomah

County are:

e. *Private Economy and Business Sector*

(1) Approximately ***less than one*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description:

Urban-interface fire and forest fire activity can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Urban-interface fire activity can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses.

(3) The specific private economy and business sector vulnerable in Multnomah County are:

- 3 Grocery Stores
- 6 Restaurants

# REGION 2
# Northern Willamette Valley / Portland Metro[1]
# Hazards Assessment

[1] Includes the counties of Columbia, Clackamas, Multnomah and Washington.

# FIRES IN THE WILDLAND/URBAN INTERFACE

## Characteristics and Brief History

There is extensive forested land in Columbia, Clackamas, Multnomah, and Washington counties, both in undeveloped National Forest land and developing urban/wildland interface areas. All of it is at risk, but especially within the interface areas. In recent years, the cost of fire suppression has risen dramatically. A large number of homes have been threatened or burned, more fire fighters have been placed at risk, and fire protection in wildland areas has been reduced. These factors have prompted the passage of Oregon Senate Bill (SB) 360 (Forestland / Urban Interface Protection Act, 1997). This bill: (1) establishes legislative policy for fire protection, (2) defines urban/wildland interface areas for regulatory purposes, (3) establishes standards for locating homes in the urban/wildland interface, and (4) provides a means for establishing an integrated fire protection system.

Table 6 describes significant fires affecting the region.

### TABLE 6. SIGNIFICANT FIRES

| Year | Name of Fire | Counties | Acres Burned | Remarks |
|---|---|---|---|---|
| 1902 | Columbia | Clackamas / Multnomah | 170,000 | |

Source: Brian Ballou, 2002, A Short History of Oregon Wildfires, Oregon Department of Forestry, unpublished.

## Probability

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

This document defines wildfire as an uncontrolled burning of forest, brush, or grassland. Wildfires have always been a part of these ecosystems, sometimes with devastating effects. Wildfire may result from natural causes (e.g., lightening strikes), a mechanical failure (Oxbow Fire), or human-causes (unattended campfire, debris burning, or arson). Most wildfires can be linked to human carelessness.

The intensity and behavior of wildfire depends on a number of factors including fuel, topography, weather, and density of development. There are a number of often-discussed strategies to reduce the negative impacts of these phenomena. They include land-use regulations, management techniques, site standards, building codes, and a recently passed Oregon Forestland-Urban Interface Fire Protection Act (1997).

All of these things have a bearing on a community's ability to prevent, withstand, or recover from a wildfire event.

## Vulnerability

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

Each year a significant number of people build homes within or on the edge of the forest (urban/wildland interface), thereby increasing wildfire hazards. In Oregon, there are about 240,000 homes worth around $6.5 billion within the urban/wildland interface. Such development has greatly complicated firefighting efforts and significantly increased the cost of fire suppression.

A number of Region 2 communities (incorporated and unincorporated) are within or adjacent to areas subject to serious wildfire hazards. These communities have been designated "Interface Communities" and are shown in Table 7. A detailed community inventory of factors that affect vulnerability is important in assessing risk and is beyond the scope of the statewide assessment.

When assessing the risks from natural hazards, established mitigation practices already provide benefits in reduced disaster losses. It is important for communities to understand the benefits of past mitigation practices when assessing their risks, being mindful of opportunities to further reduce losses.

Possible mitigation practices include:

- Identify and map current hazardous forest conditions such as fuel, topography, etc.;
- Identify forest / urban interface communities - List of interface communities, Federal Register, 08/17/01. V. 66, N. 160;
- Identify and map Forest Protection Districts;
- Identify and map water sources;
- Implement effective addressing system in rural forested areas;
- Clearly mark evacuation routes;
- Identify and locate seasonal forest users. Initiate information program through schools, summer camps, forest camping grounds, lodges, etc;

- Identify and map bridges that can (and can not) support the weight of emergency vehicles. This is a basic requirement for fire suppression;
- Form committees to implement Oregon Senate Bill 360. This is required in Oregon Senate Bill 360; and
- Create road standards in interface areas to reflect fire suppression needs. Roads must be wide enough for fire suppression vehicles to turn around. Road grades cannot be too steep for large, heavy vehicles.

## TABLE 7. WILDLAND/URBAN INTERFACE COMMUNITIES

| COUNTIES | | | |
|---|---|---|---|
| **Clackamas** | **Columbia** | **Multnomah** | **Washington** |
| Beaver Creek | Alston | Bonneville | Buxton |
| Bull Run | Clatskanie | Burlington | Cherry Grove |
| Cedarhurst Park | Columbia City | East Metro | Gales Creek |
| Colton | Deer Island | Holbrook | Gaston |
| Dickey Prairie | Goble | Lower Columbia Gorge | Glenwood |
| Eagle Creek | Mist-Birkenfeld | Portland Metro | Stimson Mill |
| Estacada | Pittsburg | Shelternoon | Timber |
| Fallsview | Prescott | Skyline | Tualatin Valley |
| Firgrove | Qunicy | Warrendale | |
| Government Camp | Rainier | | |
| Hoodland Corridor | St. Helens | | |
| Maple Grove | Scappoose | | |
| Molalla | Spitzenburg | | |
| Molino | Swedetown | | |
| Redland | Vernonia | | |
| Sandy | Warren | | |
| Springwater | Yankton | | |
| Timber Grove | | | |

Source: August 17, 2001, *Federal Register*, v.66, n. 160

The probability that Region 2 will experience fires in interface areas and the region's vulnerability to their effects are depicted in Table 8 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

### TABLE 8. Vulnerability and Probability Assessment for Fires in Interface Areas

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | M | M | H | M |
| Probability | L | M | H | M |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

# Landslide Annex

This annex contains information related to landslides to supplement the risk assessment summary in Section 3 of Multnomah County's Natural Hazard Mitigation plan. Like the other annexes to this plan, it is designed to have new policies, plans, and data sources related to annexes added in future plan updates. The annex contains:

- Multnomah County policies related to landslide mitigation
- Landslide-related sections from a previously-completed Multnomah County risk assessment
- The *State of Oregon Natural Hazard Mitigation Plan* section related to landslides in the region surrounding Multnomah County
- The *Technical Resource Guide* section on landslides, developed by the Oregon Natural Hazard Workshop, which provides hazard specific information on a statewide basis for the following topics: hazard history, hazard type and characteristics, hazard identification, hazard related legal issues, mitigation examples and best practices, and resources. This resource can be found online at www.Oregonshowcase.org

# POLICY 14: DEVELOPMENT LIMITATIONS

## INTRODUCTION

Many natural features impose limitations on development and, if not recognized in the development process, they can create public health and safety hazards. For example, flood plains perform important water storage functions and, if filled, force the water into other lands formerly not affected. These newly affected areas may have buildings which will be flooded. Erosive soils create stream siltation and can affect water quality and fish life habitat. A high water table can preclude septic tanks from functioning properly and create ground water pollution. These are important features which must be considered.

The purpose of this policy is to protect the public health and safety and to ensure that development does not create an "on-site" or "off-site" public harm. It is not intended to prohibit development, except where design and construction techniques cannot provide for a safe development.

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## POLICY 14

The County's policy is to direct development and land form alterations away from areas with development limitations, except upon a showing that design and construction techniques can mitigate any public harm or associated public cost and mitigate any adverse effects to surrounding persons or properties. Development limitations areas are those which have any of the following characteristics:

A. Slopes exceeding 20%;

B. Severe soil erosion potential;

C. Land within the 100 year flood plain;

D. A high seasonal water table within 0-24 inches of the surface for three or more weeks of the year;

E. A fragipan less than 30 inches from the surface;

F. Land subject to slumping, earth slides or movement.

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## STRATEGIES

A. As a part of the ongoing planning program, the County should continue to:

1. Identify areas with development limitations; and

2. Establish a process for reviewing development proposals in these areas.

B. The following should be addressed in the preparation of the Community Development Title:

1. **The Zoning Code** should include:

   a. Standards for development within the 100 year flood plain, recognizing the standards and criteria established by the Federal Emergency Management Agency. The Flood Plain should be applied to all areas within the 100 year flood plain as designated by the U. S. Army Corps of Engineers, U. S. Soil Conservation Service, and any special studies prepared by the County;

   b. Approved criteria for conditional uses which address the need to avoid or mitigate hazardous conditions;

   c. Provisions which allow the density, which would have been permitted in hazardous areas if it were not for the restrictions, to be transferred on-site or to adjoining property if held in the same ownership and if developed as a planned development.

2. County development standards should include provisions for:

   a. Geologic impact analysis utilizing the County's Geologic and Slope Hazard Study;

   b. Sediment and erosion control;

   c. Drainage; and

   d. Retention of vegetation and significant natural or habitat areas where these will mitigate natural hazards.

## *HILLSIDE DEVELOPMENT AND EROSION CONTROL - HD*

### § 33.5500- PURPOSES

The purposes of the Hillside Development and Erosion Control subdistrict are to promote the public health, safety and general welfare, and minimize public and private losses due to earth movement hazards in specified areas and minimize erosion and related environmental damage in unincorporated Multnomah County, all in accordance with ORS 215, LCDC Statewide Planning Goal No. 7 and OAR 340– 41– 455 for the Tualatin River Basin, and the Multnomah County Comprehensive Framework Plan Policy No. 14. This subdistrict is intended to:

(A) Protect human life;

(B) Protect property and structures;

(C) Minimize expenditures for rescue and relief efforts associated with earth movement failures;

(D) Control erosion, production and transport of sediment; and

(E) Regulate land development actions including excavation and fills, drainage controls and protect exposed soil surfaces from erosive forces; and

(F) Control stormwater discharges and protect streams, ponds, and wetlands within the Tualatin River and Balch Creek Drainage Basins.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

### § 33.5505 PERMITS REQUIRED

**Hillside Development Permit:** All persons proposing development, construction, or site clearing (including tree removal) on property located in hazard areas as identified on the "Slope Hazard Map", or on lands with average slopes of 25 percent or more shall obtain a Hillside Development Permit as prescribed by this subdistrict, unless specifically exempted by MCC 33.5510.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

### § 33.5510 EXEMPT LAND USES AND ACTIVITIES

The following are exempt from the provisions of this Chapter:

(A) Development activities approved prior to February 20, 1990; except that within such a development, issuance of individual building permits for which application was made after February 20, 1990 shall conform to site-specific requirements applicable herein.

(B) General Exemptions – Outside the Tualatin River and Balch Creek Drainage Basins, all land-disturbing activities outlined below shall be undertaken in a manner designed to minimize earth movement hazards, surface runoff, erosion, and sedimentation and to safeguard life, limb, property, and the public welfare. A person performing such activities need not apply for a permit pursuant to this subdistrict, if :

(1) Natural and finished slopes will be less than 25 percent;and,

(2) The disturbed or filled area is 20,000 square feet or less; and,

(3) The volume of soil or earth materials to be stored is 50 cubic yards or less; and,

(4) Rainwater runoff is diverted, either during or after construction, from an area smaller than 10,000 square feet; and,

(5) Impervious surfaces, if any, of less than 10,000 square feet are to be created; and,

(6) No drainageway is to be blocked or have its stormwater carrying capacities or characteristics modified.

(C) Categorical Exemptions – Notwithstanding MCC 33.5510 (A) and (B) (1) through (6), the following activities are exempt from the permit requirements, except that in the Tualatin River Drainage Basin, activities which effect water quality shall require a Permit pursuant to OAR 340-41-455 (3):

(1) An excavation below finished grade for basements and footings of a building, retaining wall, or other structure authorized by a valid building permit. This shall not exempt any fill made with the material from such excavation, nor exempt any excavation having an unsupported finished height greater than five feet.

(2) Cemetery graves, but not cemetery soil disposal sites.

(3) Excavations for wells, except that sites in the Tualatin Basin shall require Erosion Control Plans for spoils or exposed areas consistent with OAR 340-41-455 (3).

(4) Mineral extraction activities as regulated by MCC 33.6500 through 33.6535, except that sites in the Tualatin Basin shall require Erosion Control Plans for spoils or exposed areas consistent with OAR 340-41-455 (3).

(5) Exploratory excavations under the direction of certified engineering geologists or geotechnical engineers.

(6) Routine agricultural crop management practices.

(7) Residential gardening and landscape maintenance at least 100-feet by horizontal measurement from the top of the bank of a watercourse, or the mean high watermark (line of vegetation) of a body of water or wetland.

(8) Emergency response activities intended to reduce or eliminate an immediate danger to life, property, or flood or fire hazards.

(9) Forest practices as defined by ORS 527 (The State Forest Practices Act) and approved by the Oregon Department of Forestry.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.5515 APPLICATION INFORMATION REQUIRED

An application for development subject to the requirements of this subdistrict shall include the following:

(A) A map showing the property line locations, roads and driveways, existing structures, trees with 8-inch or greater caliper or an outline of wooded areas, watercourses and include the location of the proposed development(s) and trees proposed for removal.

(B) An estimate of depths and the extent and location of all proposed cuts and fills.

(C) The location of planned and existing sanitary drainfields and drywells.

(D) Narrative, map or plan information necessary to demonstrate compliance with MCC 33.5520 (A). The application shall provide applicable supplemental reports, certifications, or plans relative to: engineering, soil characteristics, stormwater drainage, stream protection, erosion control, and/or replanting.

(E) A Hillside Development permit may be approved by the Director only after the applicant provides:

(1) Additional topographic information showing that the proposed development to be on land with average slopes less than 25 percent, and located more than 200 feet from a known landslide, and that no cuts or fills in excess of 6 feet in depth are planned. High groundwater conditions shall be assumed unless documentation is available, demonstrating otherwise; or

(2) A geological report prepared by a Certified Engineering Geologist or Geotechnical Engineer certifying that the site is suitable for the proposed development; or,

(3) An HDP Form– 1 completed, signed and certified by a Certified Engineering Geolo-

gist or Geotechnical Engineer with his/her stamp and signature affixed indicating that the site is suitable for the proposed development.

(a) If the HDP Form– 1 indicates a need for further investigation, or if the Director requires further study based upon information contained in the HDP Form–1, a geotechnical report as specified by the Director shall be prepared and submitted.

(F) Geotechnical Report Requirements

(1) A geotechnical investigation in preparation of a Report required by MCC 33.5515 (E) (3) (a) shall be conducted at the applicant's expense by a Certified Engineering Geologist or Geotechnical Engineer. The Report shall include specific investigations required by the Director and recommendations for any further work or changes in proposed work which may be necessary to ensure reasonable safety from earth movement hazards.

(2) Any development related manipulation of the site prior to issuance of a permit shall be subject to corrections as recommended by the Geotechnical Report to ensure safety of the proposed development.

(3) Observation of work required by an approved Geotechnical Report shall be conducted by a Certified Engineering Geologist or Geotechnical Engineer at the applicant's expense; the geologist's or engineer's name shall be submitted to the Director prior to issuance of the Permit.

(4) The Director, at the applicant's expense, may require an evaluation of HDP Form– 1 or the Geotechnical Report by another Certified Engineering Geologist or Geotechnical Engineer.

(G) Development plans shall be subject to and consistent with the Design Standards For Grading and Erosion Control in MCC 33.5520 (A) through (D). Conditions of approval may be imposed to assure the design meets those standards.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.5520 GRADING AND EROSION CONTROL STANDARDS

Approval of development plans on sites subject to a Hillside Development Permit shall be based on findings that the proposal adequately addresses the following standards. Conditions of approval may be imposed to assure the design meets the standards:

(A) Design Standards For Grading and Erosion Control

(1) Grading Standards

(a) Fill materials, compaction methods and density specifications shall be indicated. Fill areas intended to support structures shall be identified on the plan. The Director or delegate may require additional studies or information or work regarding fill materials and compaction;

(b) Cut and fill slopes shall not be steeper than 3:1 unless a geological and/or engineering analysis certifies that steep slopes are safe and erosion control measures are specified;

(c) Cuts and fills shall not endanger or disturb adjoining property;

(d) The proposed drainage system shall have adequate capacity to bypass through the development the existing upstream flow from a storm of 10-year design frequency;

(e) Fills shall not encroach on natural watercourses or constructed channels unless measures are approved which will adequately handle the displaced streamflow for a storm of 10-year design frequency;

(2) Erosion Control Standards

(a) On sites within the Tualatin River Drainage Basin, erosion and stormwater control plans shall satisfy the requirements of OAR 340. Erosion and stormwater control plans shall be designed to perform as prescribed by the currently adopted edition of the "*Erosion Prevention & Sediment Control Plans Technical Guidance Handbook (1994)*" and the "*City of Portland Stormwater Quality Facilities, A Design Guidance Manual (1995)*". Land-disturbing activities within the Tualatin Basin shall provide a 100-foot undisturbed buffer from the top of the bank of a stream, or the ordinary high watermark (line of vegetation) of a water body, or within 100-feet of a wetland; unless a mitigation plan consistent with OAR 340 is approved for alterations within the buffer area.

(b) Stripping of vegetation, grading, or other soil disturbance shall be done in a manner which will minimize soil erosion, stabilize the soil as quickly as practicable, and expose the smallest practical area at any one time during construction;

(c) Development Plans shall minimize cut or fill operations and ensure conformity with topography so as to create the least erosion potential and adequately accommodate the volume and velocity of surface runoff;

(d) Temporary vegetation and/or mulching shall be used to protect exposed critical areas during development;

(e) Whenever feasible, natural vegetation shall be retained, protected, and supplemented;

1. A 100-foot undisturbed buffer of natural vegetation shall be retained from the top of the bank of a stream, or from the ordinary high watermark (line of vegetation) of a water body, or within 100-feet of a wetland;

2. The buffer required in 1. may only be disturbed upon the approval of a mitigation plan which utilizes erosion and stormwater control features designed to perform as effectively as those prescribed in the currently adopted edition of the *"Erosion Prevention & Sediment Control Plans Technical Guidance Handbook (1994)*" and the "*City of Portland Stormwater Quality Facilities, A Design Guidance Manual (1995)*" and which is consistent with attaining equivalent surface water quality standards as those established for the Tualatin River Drainage Basin in OAR 340;

(f) Permanent plantings and any required structural erosion control and drainage measures shall be installed as soon as practical;

(g) Provisions shall be made to effectively accommodate increased runoff caused by altered soil and surface conditions during and after development. The rate of surface water runoff shall be structurally retarded where necessary;

(h) Sediment in the runoff water shall be trapped by use of debris basins, silt traps, or other measures until the disturbed area is stabilized;

(i) Provisions shall be made to prevent surface water from damaging the cut face of excavations or the sloping surface of fills by installation of temporary or permanent drainage across or above such areas, or by other suitable stabilization measures such as mulching or seeding;

(j) All drainage provisions shall be designed to adequately carry existing and potential surface runoff to suitable drainageways such as storm drains, natural watercourses, drainage swales, or an approved drywell system;

(k) Where drainage swales are used to divert surface waters, they shall be vegetated or protected as required to minimize potential erosion;

(l) Erosion and sediment control devices shall be required where necessary to prevent polluting discharges from occurring. Control devices and measures which may be required include, but are not limited to:

1. Energy absorbing devices to reduce runoff water velocity;

2. Sedimentation controls such as sediment or debris basins. Any trapped materials shall be removed to an approved disposal site on an approved schedule;

3. Dispersal of water runoff from developed areas over large undisturbed areas.

(m) Disposed spoil material or stockpiled topsoil shall be prevented from eroding into streams or drainageways by applying mulch or other protective covering; or by location at a sufficient distance from streams or drainageways; or by other sediment reduction measures;

(n) Such non-erosion pollution associated with construction such as pesticides, fertilizers, petrochemicals, solid wastes, construction chemicals, or wastewaters shall be prevented from leaving the construction site through proper handling, disposal, continuous site monitoring and clean-up activities.

(o) On sites within the Balch Creek Drainage Basin, erosion and stormwater control features shall be designed to perform as effectively as those prescribed in the *"Erosion Prevention & Sediment Control Plans Technical Guidance Handbook (1994)"*. All land disturbing activities within the basin shall be confined to the period between May first and October first of any year. All permanent vegetation or a winter cover crop shall be seeded or planted by October first the same year the development was begun; all soil not covered by buildings or other impervious surfaces must be completely vegetated by December first the same year the development was begun.

(B) Responsibility

(1) Whenever sedimentation is caused by stripping vegetation, regrading or other development, it shall be the responsibility of the person, corporation or other entity causing such sedimentation to remove it from all adjoining surfaces and drainage systems prior to issuance of occupancy or final approvals for the project;

(2) It is the responsibility of any person, corporation or other entity doing any act on or across a communal stream watercourse or swale, or upon the floodplain or right-of-way thereof, to maintain as nearly as possible in its present state the stream, watercourse, swale, floodplain, or right-of-way during such activity, and to return it to its original or equal condition.

(C) Implementation

(1) Performance Bond – A performance bond may be required to assure the full cost of any required erosion and sediment control measures. The bond may be used to provide for the installation of the measures if not completed by the contractor. The bond shall be released upon determination the control measures have or can be expected to perform satisfactorily. The bond

may be waived if the Director determines the scale and duration of the project and the potential problems arising therefrom will be minor.

(2) Inspection and Enforcement. The requirements of this subdistrict shall be enforced by the Planning Director. If inspection by County staff reveals erosive conditions which exceed those prescribed by the Hillside Development, work may be stopped until appropriate correction measures are completed.

(D) Final Approvals

A certificate of Occupancy or other final approval shall be granted for development subject to the provisions of this subdistrict only upon satisfactory completion of all applicable requirements.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

## § 33.5525 HILLSIDE DEVELOPMENT AND EROSION CONTROL RELATED DEFINITIONS

(A) *Certified Engineering Geologist* – Any person who has obtained certification by the State of Oregon as an engineering geologist.

(B) *Cut:*

(1) An excavation;

(2) The difference between a point on the original ground surface and the point of lowest elevation on the final grade;

(3) The material removed in excavation work.

(C) *Development Area* – The total area of alteration of the naturally occurring ground surface resulting from construction activities whether permanent or temporary.

(D) *Drainage Area* – The subject property together with the watershed (acreage) contributing water runoff to and receiving water runoff from the subject property.

(E) *Drainageway* – Any natural or artificial stream, swale, creek, river, ditch, channel, canal or other open water-course.

(F) *Earth Movement* – Any type of land surface failure resulting in the downslope movement of material . The term includes, but is not limited to, soil creep, mudflow, rockslides, block failures, and massive landslides.

(G) *Erosion* – The wearing away or removal of earth surface materials by the action of natural elements or forces including, but not limited to, wind, water or gravity.

(H) *Excavation* – Any act by which earth, sand, gravel, rock or any similar material is dug into, cut, quarried, uncovered, removed, displaced, relocated or bulldozed, including the conditions resulting therefrom.

(I) *Fill:*

(1) Any act by which earth, sand, gravel, rock or similar material is pushed, placed, dumped, stacked, pulled, transported, or in any way moved to a new location above the existing natural surface of the ground or on the top of a stripped surface, including the condition resulting therefrom.

(2) The difference in elevation between a point on the original ground surface and the point of higher elevation on a finished grade.

(3) The material used to make a fill.

(J) *Geotechnical Engineer* - A Civil Engineer, licensed to practice in the State of Oregon, who by training, education and experience is competent in the practice of geotechnical or soils engineering practices.

(K) *Geotechnical Report* – Any information required in addition to Form 1 which clarifies the

geotechnical conditions of a proposed development site. Examples of this would be reports on test hole borings, laboratory tests or analysis of materials, or hydrologic studies.

(L) *Grading* – Any stripping, cutting, filling, stockpiling or any combination thereof, including the land in its cut or filled condition.

(M) *HDP Form– 1* – The form required for specified developments subject to the Hillside Development and Erosion Control subdistrict. It contains a geotechnical reconnaissance and stability questionnaire which must be filled out and certified by a Certified Engineering Geologist or Geotechnical Engineer.

(N) *Land-disturbing Activities* – Any act which alters earth, sand, gravel, or similar materials and exposes the same to the elements of wind, water, or gravity. Land-disturbing activities includes: excavations or fills, site grading, and soil storage.

(O) *Mulch* – Materials spread over the surface of the ground, especially freshly graded or exposed soils, to prevent physical damage from erosive agents such as storm water, precipitation or wind, and which shield soil surfaces until vegetative cover or other stabilization measures can take effect.

*(P) Ordinary High Water Mark* – Features found by examining the bed and banks of a stream and ascertaining where the presence and action of waters are so common and usual, and so long maintained in all ordinary years, as to mark upon the land a character distinct from that of the abutting upland, particularly with respect to vegetation. For streams where such features cannot be found, the channel bank shall be substituted. In braided channels and alluvial fans, the ordinary high water mark shall be measured to include the entire stream feature.

(Q) *Slope:*

(1) Any ground whose surface makes an angle from the horizontal; or

(2) The face of an embankment or cut section.

(R) *Slope Hazard Map* – A series of maps maintained and updated from time to time by the Office of the Director, Department of Business and Community Services;

(S) *Spoil Material* – Any rock, sand, gravel, soil or other earth material removed by excavation or other grading activities.

(T) *Stream* – Areas where surface waters flow sufficient to produce a defined channel or bed. A defined channel or bed is indicated by hydraulically sorted sediments or the removal of vegetative litter or loosely rooted vegetation by the action of moving water. The channel or bed need not contain water year-round. This definition is not meant to include irrigation ditches, canals, stormwater runoff devices or other entirely artificial watercourses unless they are used to convey Class 1 or 2 streams naturally occurring prior to construction. Those topographic features resembling streams but which have no defined channels (e.g. swales) shall be considered streams when hydrologic and hydraulic analyzes performed pursuant to a development proposal predict formation of a defined channel after development.

(U) *Stream Protection* – Activities or conditions which avoid or lessen adverse water quality and turbidity effects to a stream.

(V) *Topographic Information* – Surveyed elevation information which details slopes, contour intervals and drainageways. Topographic information shall be prepared by a registered land surveyor or a registered professional engineer qualified to provide such information and represented on maps with a contour interval not to exceed 10 feet.

(W) *Vegetation* – All plant growth, especially trees, shrubs, grasses and mosses.

(X) *Vegetative Protection* – Stabilization of erosive or sediment-producing areas by covering the soil with:

(1) Permanent seeding, producing long-term vegetative cover;

(2) Short-term seeding, producing temporary vegetative cover;

(3) Sodding, producing areas covered with a turf or perennial sod-forming grass; or

(4) Netting with seeding if the final grade has not stabilized.

(Y) *Water Body* – Areas permanently or temporarily flooded which may exceed the deepwater boundary of wetlands. Water depth is such that water, and not the air, is the principal medium in which prevalent organisms live. Water bodies include rivers, creeks, lakes, and ponds.

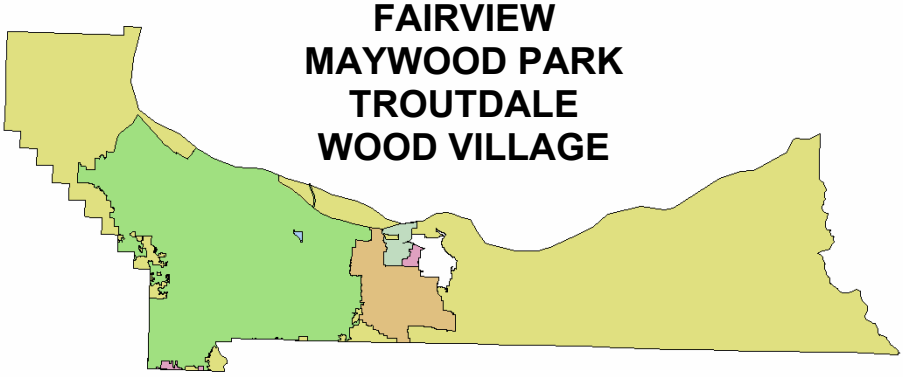
(Z) *Watercourse* – Natural and artificial features which transport surface water. Watercourse includes a river, stream, creek, slough, ditch, canal, or drainageway.

(Ord. 997, Repealed and Replaced, 10/31/2002; Ord. 953 §2, Reorg&Renum, 11/30/2000)

# MULTNOMAH COUNTY

# Landslide Hazard Assessment

**IN PARTNERSHIP WITH THE CITIES OF:**
**GRESHAM**
**FAIRVIEW**
**MAYWOOD PARK**
**TROUTDALE**
**WOOD VILLAGE**



# Hazard Analysis

This Section serves to identify each hazard/threat confronting the jurisdiction. Hazards will be grouped into the following categories:

- Flooding
- Landslides, or Debris Flows
- Earthquake
- Volcano
- Wildfires & Urban Interface Fires
- Winter Storms
- Severe Weather

The development of Mitigation Projects centers on the prioritization of the three basic Strategies:

1. Life Safety, safeguarding and sustaining human life.
2. Property Preservation, protecting critical infrastructures, thus ensuring sustainable communities.
3. Environmental Conservation, enabling supportive environments and healthy ecosystems.

Each hazard will be analyzed as follows:

1. Hazard Definition
2. Hazard Description
3. Hazard History & Costs
4. Risk Assessment
5. Severity Score (this scoring was developed by the State of Oregon Office of Emergency Management)
6. Jurisdiction Vulnerabilities

## LANDSLIDES, OR DEBRIS FLOWS

### 1. General Definition.

Landslides or debris flows are generally earth and debris that have become loose due to the combination of gravity and loose natural anchoring.

### 2. Description.

Landslides, or debris flows, often go hand-in-hand in Multnomah County, since flood conditions often precede a landslide/ debris flow event.

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year. The best estimates of the direct and indirect costs of landslide damage in the United States range between $1 billion to $2 billion annually. In Oregon, a significant number of locations are at risk to dangerous landslides. While not all landslides result in private property damage, many landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life.

Landslides can be broken down into two categories: (1) rapidly moving; and (2) slow moving. Rapidly moving landslides (debris flows and earth flows) present the greatest risk to human life, and persons living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Rapidly moving landslides have also caused most of the recent landslide-related injuries and deaths in Oregon. A rapidly moving debris flow in Douglas County killed five people during the storms of 1996. Slow moving landslides can cause significant property damage, but are less likely to result in serious human injuries.

### 3. Hazard History & Cost

In 1996, landslides caused 5 deaths, forced thousands into shelter, destroyed hundreds of homes, caused damages in excess of $280 million. The Floods of 1996 also caused landslides, or debris flows, that closed I-84 and forced the evacuation of Dodson and Warrendale. Twenty-seven counties, including Multnomah, were eventually covered by a disaster declaration due to the 1996 floods.

Many residents who have suffered damage rebuild in the same vulnerable areas, only to be flooded again. These properties are termed repetitive

loss properties, and are troublesome because they continue to expose lives and property to flooding and landslides.

## 4. Risk Assessment.

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

Using a scale of 1 (one) to 10 (ten) with ten being the greatest severity, each hazard is rated in the following categories:

- *History (Weight Factor=2)*
  This is an analysis of the records of occurrences of previous major emergencies or disasters that affected the County.
- *Vulnerability (Weight Factor=5)*
  The percentage of the population and property likely to be effected by a hazard.
- *Maximum Threat (Weight Factor=10)*
  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By multiplying the severity rating by the weight factors a sub score for the history, vulnerability, maximum threat, and probability for each hazard is achieved. Adding the sub score will produce a total score for that hazard.

**The Risk Assessment for Landslide is:**

| | CNTY | MPARK | FVIEW | TDALE | WVILL | COG |
|---|---|---|---|---|---|---|
| HX | 20 | 2 | 2 | 2 | 2 | 20 |
| VULN. | 50 | 5 | 5 | 5 | 5 | 50 |
| MXTHRT | 100 | 10 | 10 | 10 | 10 | 100 |
| PROB. | 70 | 7 | 7 | 7 | 7 | 70 |
| TOTAL | 240 | 24 | 24 | 24 | 24 | 240 |

**HX=History/VULN= Vulnerability/ MXTHRT=Maximum Threat/ PROB=Probability**

**CNTY=County/MPARK=Maywood Park/FVIEW=Fairview/TDALE=Troutdale/WVILL=Wood Village/COG=Gresham**

**5. Severity Score.**

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Floods for Multnomah County is: 240***

***The Severity Score for Floods for Maywood Park is: 24***

***The Severity Score for Floods for Fairview is: 24***

***The Severity Score for Floods for Troutdale is: 24***

***The Severity Score for Floods for Wood Village is: 24***

***The Severity Score for Floods for Gresham is: 24***

*H + V + MT + P = Severity Score*

**6. Jurisdiction Vulnerabilities**.

a. *Population*

634 people reside in flood/slide areas.

b. *Critical Facilities*

(1) Approximately ***36*** percent of the community's critical facilities are vulnerable.

(2) Definition / Description:

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after a landslide.

.

(3) The specific critical facilities vulnerable in Multnomah County are:

- 3 County Law Enforcement Buildings
- 3 County Correctional Facilities
- 8 Critical County Facilities

c. *Infrastructure Lifelines*

(1) Approximately ***11*** percent of the community's infrastructure lifelines are vulnerable.

(2) Definition / Description:

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Landslides can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after a landslide to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public. Residents in Multnomah County commute frequently by automobiles and public transportation such as buses and light rail. A landslide and/or debris flow can greatly damage bridges and roads, hampering the movement of people and goods. The Bonneville Dam, located in the Columbia River Gorge of Multnomah County, may be subjected to landslides and/or debris flows as a result of vulnerable areas nearby. Landslides around the gorge rim are numerous. There are many active slide sites, and their stability is uncertain.

(3) The specific infrastructure lifelines vulnerable in Multnomah County are:

- 1 Airport
- 31 Bridges
- 8 Rail Network Carriers
- 13 Arterials, Secondary, and Side Road Networks.

d. *Public Infrastructure*

(1) Approximately ***26*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description:

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these facilities become crucial in providing support and services, which

allow the continuity of business, government, and society. Damaged infrastructure strongly affects the economy of the community – it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

(3) The specific public infrastructure vulnerable in Multnomah County are:

- 40 County Support Facilities
- 1 Water Providers and Distribution Support Facilities

e. *Private Economy and Business Sector*

(1) Approximately ***2*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description:

Landslide and flooding activity can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Landslide and flooding activity can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses.

(3) The specific private economy and business sector vulnerable in Multnomah County are:

- 1 Grocery Stores
- 5 Restaurants
- 17 Private Businesses/Corporations

# REGION 2
# Northern Willamette Valley / Portland Metro[1]
# Hazards Assessment

[1] Includes the counties of Columbia, Clackamas, Multnomah and Washington.

# LANDSLIDES / DEBRIS FLOWS

## Characteristics and Brief History

Landslides and debris flows always have and always will shape Oregon's landscape. Landslides become problematic, however, when people place buildings and infrastructure in harm's way. Additionally, development practices can cause or contribute to the severity of landslides.

There are several categories of landslides, based on configuration (slide mechanism), slide materials, and rate of movement. Some slides are ancient, deep-seated, and slow moving. Others move rapidly as a mass of rock, mud, and large woody debris. All can be problematic when in the vicinity of buildings and infrastructure. Fast-moving landslides, or debris flows, occur throughout Oregon, but are especially noteworthy in the Cascade and Coast Ranges.

Debris flows (mudslides, mudflows, debris avalanches) are a common type of rapidly moving landslide that generally occur during intense rainfall on previously saturated ground. They usually begin on steep hillsides as slumps or slides that liquefy, accelerate to speeds as great as 35 mph or more, and flow down slopes and channels onto gently sloping ground. Their consistency ranges from watery mud to thick, rocky, mud-like wet cement, dense enough to carry boulders, trees, and automobiles. Debris flows from different sources can combine in canyons and channels, where their destructive power is greatly increased. In general, slopes that are over 25% or have a history of landslides might signal a landslide problem.

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

In Multnomah County (including the city of Portland) landslide activity has been a recurring problem for many years. In February 1996, landslide activity that occurred in Portland and the Dodson-Warrendale area (east Multnomah County) was notable and severely impacted homeowners and transportation routes. In fact, Interstate-84 in the Columbia River Gorge was closed for a number of days by fast moving debris flows that covered the roadway and the east-west railroad tracks.

Oregon's landslide/debris flow warning system primarily involves three state and one federal agency: the Oregon Department of Forestry (ODF), the Oregon Department of Geology and Mineral Industries (DOGAMI), the Oregon Department of Transportation (ODOT), and the National Oceanic and Atmospheric Administration (NOAA). The warning system is triggered by rainfall and monitored in areas that have been determined to be hazardous.

As the lead agency, ODF is responsible for forecasting and measuring rainfall from storms that may trigger debris flows. Advisories and warnings are issued as appropriate. Information is broadcast over NOAA weather radio and on the Law Enforcement Data System. DOGAMI provides additional information on debris flows to the media; ODOT provides information concerning the location of landslides / debris flows, alternate transportation routes, etc.

Counties with the highest percentage of reported landslides are: Lane (24%), Douglas (11%), Linn (10%), Tillamook (9%), Lincoln (8%), and Multnomah (7%).[5] Table 12 describes the history of more significant landslides and debris flows in the area.

**TABLE 12. NOTABLE LANDSLIDE / DEBRIS FLOWS**

| DATE | INCIDENT |
|---|---|
| 03/1972 | Three motorists were injured in a mud and rockslide on Interstate 5 near Portland |
| 10/1984 | Two children were killed in a rockslide along Interstate 84 near Cascade Locks. The cost of stabilizing the slide area a few years later eventually reached $4 million |
| 09/1990 | Four highway workers were injured in a landslide near Troutdale |
| 02/1996 | Heavy rains and rapidly melting snow contributed to hundreds of landslides / debris flows across the state. Many occurred on clear cuts that damaged logging roads. Interestate-84 closed at Dodson-Warrendale. (FEMA-1099-DR-OR) |

Source: ODOT Emergency Operations Plan, May, 2002; Interagency Hazard Mitigation Team Report, FEMA-1099-DR-OR, June, 1997; Interagency Hazard Mitigation Team Report, FEMA-1149-DR-OR, March, 1997; George Taylor and Ray Hatton, The Oregon Weather Book, 1999

## Probability

The probability of rapidly moving landslide occurrence depends on a number of factors; these include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows); consequently, the Oregon Department of Forestry tracks storms during the rainy season, monitors rain gages and snow melt, and issues warnings as

[5] Hofmeister, 2000, *Slope Failures in Oregon*; and DOGAMI, Special Paper 34.

conditions warrant. Given the correlation between precipitation / snow melt and rapidly moving landslides, it would be feasible to construct a probability curve. The installation of slope indicators or the use of more advanced measuring techniques could provide information on slower moving slides.

## Vulnerability

Since 1950, at least 21 deaths have been attributed to rapidly moving landslides (i.e., debris flows). Statistically, the risk of being killed is relatively low (about .02 fatalities per 1,000 people/ year). However, the risk would be greater for that segment of the population that lives, works, or commutes through high hazard debris flow areas. The Oregon Department of Forestry has mapped all the steep slopes in Region 2 counties. The risk to any individual depends on the level of exposure and the amount of time spent in a hazardous area [6]

The probability that Region 2 will experience landslide and the region's vulnerability to their effects are depicted in Table 13 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials. The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, the county either did not assess the probability and vulnerability for the hazard or found it to be of minimal concern. These instances are noted in the chart below with a dash ( - ).

### TABLE 13. Vulnerability and Probability Assessment for Landslides

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | L | - | H | L |
| Probability | H | - | H | L |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

[6] Henkle, J.C., and Keith Mills, 2002.

# Severe Weather Annex

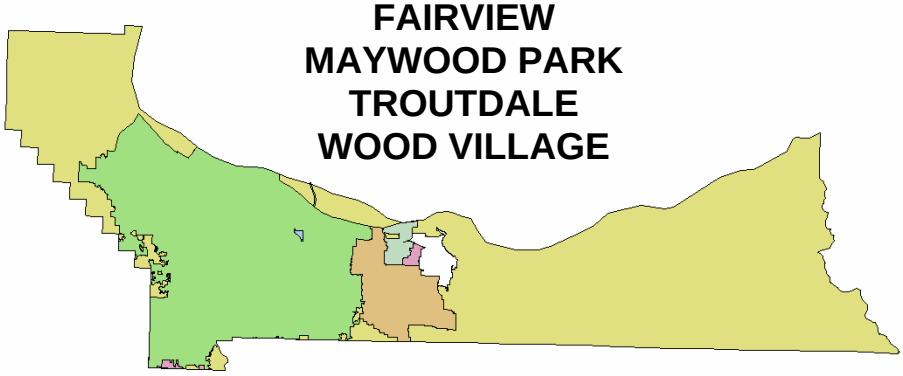
This annex contains information related to severe weather to supplement the risk assessment summary in Section 3 of Multnomah County's Natural Hazard Mitigation plan. Like the other annexes to this plan, it is designed to have new policies, plans, and data sources related to annexes added in future plan updates. The annex contains:

- Severe weather-related sections from a previously-completed Multnomah County risk assessment
- The *State of Oregon Natural Hazard Mitigation Plan* section related to severe weather in the region surrounding Multnomah County

# MULTNOMAH COUNTY

# Severe Weather Hazard Assessment

**IN PARTNERSHIP WITH THE CITIES OF:**
**GRESHAM**
**FAIRVIEW**
**MAYWOOD PARK**
**TROUTDALE**
**WOOD VILLAGE**



# Hazard Analysis

This Section serves to identify each hazard/threat confronting the jurisdiction. Hazards will be grouped into the following categories:

- Flooding
- Landslides, or Debris Flows
- Earthquake
- Volcano
- Wildfires & Urban Interface Fires
- Winter Storms
- Severe Weather

The development of Mitigation Projects centers on the prioritization of the three basic Strategies:

1. Life Safety, safeguarding and sustaining human life.
2. Property Preservation, protecting critical infrastructures, thus ensuring sustainable communities.
3. Environmental Conservation, enabling supportive environments and healthy ecosystems.

Each hazard will be analyzed as follows:

1. Hazard Definition
2. Hazard Description
3. Hazard History & Costs
4. Risk Assessment
5. Severity Score (this scoring was developed by the State of Oregon Office of Emergency Management)
6. Jurisdiction Vulnerabilities

## WINTER STORMS

### 1. General Definition

Winter storm is defined as a cold wind accompanied by blowing snow; freezing rain or sleet, cold temperatures, and possibly low visibility and drifting snow. The storms often make roads impassable. Residents, travelers and livestock may become isolated or stranded without adequate food, water and fuel supplies short. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation; house fires occur more frequently in the winter due to lack of proper safety precautions.

(1) **Description**

Multnomah County is subject to a number of severe local storms such as freezing rain, high winds, snow and hail. An ice storm (freezing rain) can occur when rains fall out of warm moist upper layers of atmosphere into a cold, dry layer near the ground. The rain freezes on contact with the cold ground and accumulates on exposed surfaces. This occurs every few years and usually lasts a day to several days. The cold combined with freezing rain can cause a destructive ice build-up. In addition, high winds have contributed to wide spread disruption and destruction within Multnomah County.

d. **Hazard History.**

Destructive storms, producing heavy snow and paralyzing ice, have occurred throughout Multnomah County's history, most notably in 1937 and 1950. A serious storm in February 1937 resulted in the death of five people in the Portland area. Record snowfalls in Portland created snowdrifts up to 25 feet in height, and a low temperature of 17 degrees Fahrenheit. Schools and businesses were closed and flood damage was reported in downtown Portland basements as the snow melted. All major highways were closed, shutting off the main transportation arteries for travel and business.

The "Friday the 13th" storm produced "devastating wind and snow" over a five day period in January 1950. During the night of January 12, the temperature fluctuated "wildly, accompanied by thunder" and heavy snow. The temperature dropped about 20 degrees, then rose 20 degrees, and then dropped another 20 degrees within a 5-hour time span. Snow melted and then refroze as it hit the ground, creating dangerously icy roads.

Power lines were knocked down, communications were severed, and roads and schools were closed.

Records kept since 1892 document a number of significant snow events in Multnomah County.

***January 1950***
There were three severe storms in January 1950, with very little time separating them. Their net effect was a nearly continuous storm. The storm had severe effects on infrastructure, residents, and businesses across the state. Deep snow drifts closed all highways west of the Cascades and through the Columbia River Gorge. Sleet that turned to freezing rain caused unsafe conditions on highways and damaged trees and power lines. During a severe sleet event on January 18, hundreds of motorists were stranded in the Columbia River Gorge. The stranded motorists had to be rescued by train, even though all rail traffic had considerable difficulty and many delays in getting through the Gorge. Freezing rain downed many trees and power lines, creating widespread power outages across northwestern Oregon. Hundreds of thousands of dollars in damage to public and private property occurred.

***January/February 1937***
While the January/February 1937 storm had statewide impacts, heavy snowfalls were largely confined to the western slopes of the Cascades and the Willamette Valley. Deep snowdrifts blocked major highways and most minor roads in northern Oregon and the Cascade mountain passes for several days.

***December 1919***
The December 1919 snowstorm was the third heaviest snowfall producing storm to hit Oregon on record. The Columbia River froze over, closing the river to navigation from the confluence with the Willamette River upstream. The snowstorm affected nearly every part of the state, with heavy snow falling over a widespread area.

***January 1909***
A six-day storm in January 1909 brought many locations more snow than is normally accumulated in an entire year.

***December 1892***
From December 20 to 23, 1892, substantial snow fell across most of northern Oregon, with the greatest snowfall reported over northwestern Oregon, where storm totals ranged from 15 to 30 inches.

d. **Risk Assessment**

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

The following categories are used in conducting this hazard analysis.

- *History (Weight Factor=2)*
  This is an analysis of the records of occurrences of previous major emergencies or disasters that affected the County.
- *Vulnerability (Weight Factor=5)*
  The percentage of the population and property likely to be effected by a hazard.
- *Maximum Threat (Weight Factor=10)*
  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By adding the severity rating by the weight factors associated with the categories above, a sub score for the history, vulnerability, maximum threat, and probability for each hazard can be achieved. Adding the sub score will produce a total score for that hazard.

**The Risk Assessment for Winter Storms is:**

a. *History:* **12**

b. *Vulnerability:* **35**

c. *Maximum Threat*: **100**

d. *Probability:* **56**

***THIS IS A COUNTY WIDE EVENT***

e. **Severity Score**

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Winter Storm is: 203***

*H + V + MT + P = Severity Score*

**12 + 35 + 100 + 56 = 203**

## 6. Jurisdiction Vulnerabilities

a. *Population*

Approximately ***100*** percent of the community's population is vulnerable.

*b. Critical Facilities*

(1) Approximately ***100*** percent of the community's critical facilities is vulnerable.

(2) Definition / Description

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after and during severe weather.

(3) The specific critical facilities vulnerable in Multnomah County are:

- 4 County Law Enforcement Buildings
- 5 Municipal Administration Bldgs. (City Halls)
- 7 County Correctional Facilities
- 19 Critical County Facilities
- 3 Municipal Police Departments

*c. Infrastructure Lifelines*

(1) Approximately ***100*** percent of the community's infrastructure lifelines are vulnerable.

(2) Definition / Description:

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Severe weather can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after and during severe weather to allow for rescue and recovery efforts and to relay important information to the public.

(3) The specific infrastructure lifelines vulnerable in Multnomah County are:

- 1 Airport
- 31 Bridges
- 8 Rail Network Carriers
- 430 Arterials, Secondary, and Side Road Networks

*d. Public Infrastructure*

(1) Approximately ***100*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description:

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these facilities become crucial in providing support and services, which allow the continuity of business, government, and society.

(3) The specific public infrastructure vulnerable in Multnomah County are:

- 112 County Support Facilities
- 24 Child Care Centers
- 15 Assisted Living Centers
- 8 Water Providers and Distribution Support Facilities

*e. Private Economy and Business Sector*

(1) Approximately ***100*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description

Severe weather can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Severe weather can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses.

(3) The specific private economy and business sector vulnerable in Multnomah County are:

- 4 Food Caterers
- 46 Contract Food Service Providers
- 34 Grocery Stores
- 20 Hardware Stores
- 146 Restaurants
- 806 Businesses/Corporations

## SEVERE WEATHER

### 1. General Definition

#### 7. Description

Multnomah County is subject to a number of severe local storms such high winds that occur when a low pressure from pulls air from east side of Oregon through the Columbia River Gorge and into the valley area. In addition, high winds have contributed to wide spread disruption and destruction within Multnomah County.

##### h. Hazard History.

The "Friday the 13th" storm produced "devastating wind and snow" over a five day period in January 1950. During the night of January 12, the temperature fluctuated "wildly, accompanied by thunder" and heavy snow. The temperature dropped about 20 degrees, then rose 20 degrees, and then dropped another 20 degrees within a 5-hour time span. Snow melted and then refroze as it hit the ground, creating dangerously icy roads. Power lines were knocked down, communications were severed, and roads and schools were closed.

***January 1950***
There were three severe storms in January 1950, with very little time separating them. Their net effect was a nearly continuous storm. The storm had severe effects on infrastructure, residents, and businesses across the state. Deep snow drifts closed all highways west of the Cascades and through the Columbia River Gorge. Sleet that turned to freezing rain caused unsafe conditions on highways and damaged trees and power lines. During a severe sleet event on January 18, hundreds of motorists were stranded in the Columbia River Gorge. The stranded motorists had to be rescued by train, even though all rail traffic had considerable difficulty and many delays in getting through the Gorge. Freezing rain downed many trees and power lines, creating widespread power outages across northwestern Oregon. Hundreds of thousands of dollars in damage to public and private property occurred.

i. **Risk Assessment**

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

The following categories are used in conducting this hazard analysis.

- *History (Weight Factor=2)*
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  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By adding the severity rating by the weight factors associated with the categories above, a sub score for the history, vulnerability, maximum threat, and probability for each hazard can be achieved. Adding the sub score will produce a total score for that hazard.

**The Risk Assessment for Severe Weather is:**

a. *History:* **12**

b. *Vulnerability:* **35**

c. *Maximum Threat*: **100**

d. *Probability:* **56**

***THIS IS A COUNTY WIDE EVENT***

7. **Severity Score**

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Sever Weather is: 203***

*H + V + MT + P = Severity Score*

**12 + 35 + 100 + 56 = 203**

## 6. Jurisdiction Vulnerabilities

a. *Population*

Approximately ***100*** percent of the community's population is vulnerable.

*b. Critical Facilities*

(1) Approximately ***100*** percent of the community's critical facilities is vulnerable.

(2) Definition / Description

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after and during severe weather.

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Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Severe weather can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after and during severe weather to allow for rescue and recovery efforts and to relay important information to the public.

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(1) Approximately ***100*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description:

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these facilities become crucial in providing support and services, which allow the continuity of business, government, and society.

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- 8 Water Providers and Distribution Support Facilities

*e. Private Economy and Business Sector*

(1) Approximately ***100*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description

Severe weather can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Severe weather can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses.

(3) The specific private economy and business sector vulnerable in Multnomah County are:

- 4 Food Caterers
- 46 Contract Food Service Providers
- 34 Grocery Stores
- 20 Hardware Stores
- 146 Restaurants
- 806 Businesses/Corporations

# REGION 2
# Northern Willamette Valley / Portland Metro[1]
# Hazards Assessment

[1] Includes the counties of Columbia, Clackamas, Multnomah and Washington.

# WINDSTORMS

## Characteristics and Brief History

Extreme winds (other than tornadoes) are experienced in all of Oregon's eight regions. The most persistent high winds occur along the Oregon Coast and the Columbia River Gorge; these areas have special building code standards. Homes in Multnomah County with full exposure to the Columbia River Gorge must be designed for 90 mph wind gusts. This is not the case in the Willamette Valley, although high winds are not uncommon. A majority of the destructive surface winds in Oregon are from the southwest. Under certain conditions, very strong east winds may occur, but these usually are limited to small areas in the vicinity of the Columbia River Gorge or other low mountain passes.

The much more frequent and widespread strong winds from the southwest are associated with storms moving onto the coast from the Pacific Ocean. If the winds are from the west, they may be stronger on the coast than in the interior valleys because of the north-south orientation of the Coast Range and Cascades. These mountain ranges obstruct and slow down the westerly surface winds. The most destructive winds are those which blow from the south, parallel to the major mountain ranges. The Columbus Day Storm of 1962 was a classic example of such a storm, and its effects were so devastating that it has become the benchmark from which other windstorms in Oregon are measured.

An historic overview of other significant storms in Region 2 would include those in Table 16 (below).

**TABLE 16. SIGNIFICANT WINDSTORMS**

| DATE | AFFECTED AREA | CHARACTERISTICS |
|---|---|---|
| Apr., 1931 | Western Oregon | Unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber. |
| Nov. 10-11, 1951 | Statewide | Widespread damage; transmission and utility lines; Wind speed 40-60 mph; Gusts 75-80 mph |
| Dec., 1951 | Statewide | Wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines. |
| Dec., 1955 | Statewide | Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines |
| Nov., 1958 | Statewide | Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees |
| Oct., 1962 | Statewide | Columbus Day Storm; Oregon's most destructive storm to date. 116 mph winds in Willamette Valley. Estimated 84 houses destroyed, with 5,000 severely damaged. Total damage estimated at $170 million |
| Mar., 1971 | Most of Oregon | Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane Co. |
| Nov., 1981 | Most of Oregon | Highest winds since 10/62. Wind speed 71 mph in Salem. Marinas, airports and bridges severely damaged |
| Jan., 1990 | Statewide | Heavy rain with winds exceeding 75 mph. Significant damage. One fatality |
| Dec., 1995 | Statewide | Followed path of Columbus Day Storm. Wind speeds 62 mph in Willamette Valley. Damage to trees (saturated soil a factor) and homes. (FEMA-1107-DR-OR) |
| Nov., 1997 | Western Oregon | Wind speed 52 mph in Willamette Valley. Trees uprooted. Considerable damage to small airports. |
| Feb., 2002 | Western Oregon | Strongest storm to strike western Oregon in several years. Many downed power lines (trees); damage to buildings; water supply problems (lack of power). Estimated damage costs: $6.14 million. (FEMA-1405-DR-OR) |

Source: Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book*; and FEMA-1405-DR-OR: February 7, 2002, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon.

## Probability

The recurrence interval of a windstorm on the order of the Columbus Day Storm is about 100 years (Taylor, 2002); a windstorm on the order of the February 7, 2002 event has a 10 to 12 year recurrence interval.

## Vulnerability

Many buildings, utilities, and transportation systems within Region 2 are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands. It also is true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels where trees have been planted or left for aesthetic purposes. Structures most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair. The Oregon Department of Administrative Service's inventory of state-owned and operated buildings includes an assessment of roof conditions as well as the overall condition of the structure. Oregon Emergency Management has arranged this information by county.

Fallen trees are especially troublesome. They can block roads and rails for long periods, which can affect emergency operations. In addition, up-rooted or shattered trees can down power and/or utility lines and effectively bring local economic activity and other essential facilities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. Many roofs have been destroyed by uprooted ancient trees growing next to a house. In some situations, strategic pruning may be the answer. Prudent counties will work with utility companies in identifying problem areas and establishing a tree maintenance and removal program.

Additional considerations include ferry systems and bridges, which may be closed during high wind periods.

The probability that Region 2 will experience windstorms and the region's vulnerability to their effects are depicted in Table 17 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

## TABLE 17. Vulnerability and Probability Assessment of Windstorms

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | M | H | H | H |
| Probability | M | M | H | H |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

# WINTERSTORMS

## Characteristics and Brief History

Severe winter weather in Region 2 can be characterized by extreme cold, snow, ice, and sleet. Although such conditions may be expected in the Cascade Mountains and eastern Oregon, they are considered to be unusual on the Willamette Valley floor. This is where the problem begins. Some Region 2 communities are unprepared, financially and otherwise, despite the fact that periods of cold occur with some regularity (Table 18). This is particularly true in the vicinity of Portland, where frigid air sometimes moves westward through the Columbia River Gorge. During these periods, it is not unusual for northern Willamette Valley communities to receive snow or ice storms ("silver thaws"). Severe weather conditions do not last long in Region 2; consequently, winter-preparedness is often relegated to a low priority.

## Probability

Winterstorms occur with some frequency in Region 2. An historical summary of extreme winter conditions in Region 2 is shown in Table 18.

## TABLE 18. SIGNIFICANT WINTERSTORMS

| DATE | LOCATION | CHARACTERISTICS |
|---|---|---|
| Dec., 1861 | Statewide | Snowfall varied between 1 and 3 feet. Did not leave Willamette Valley floor until late February |
| 1862, 1866, 1884, 1885,1890, 1892, 1895 | Portland area / Northern Willamette Valley | Severe winter conditions, especially in the Portland area. Some record-breaking snowfalls |
| Jan., 1916 | Statewide | Two snow storms, each totaling 5 inches or more |
| Dec., 1919 | Portland area | 3rd heaviest snowfall on record. Columbia River froze, closing navigation |
| 1927, 1936. 1937, 1943,1949 | Portland area, western Oregon | Heavy snowfalls recorded |
| Jan., 1950 | Statewide | Heaviest snowfall since 1890. Many highway closures. Considerable property damage. |
| 1956, 1960, 1962, | Western Oregon | Packed snow became ice. Many automobile accidents throughout the region |
| Mar., 1960 | Statewide | Snowfall: 3-12 inches, depending on location |
| Jan., 1969 | Statewide | Record-breaking snow falls.$3-4 million in property damage |
| Jan., 1980 | Statewide | A series of storms bringing snow, ice, wind, and freezing rain. Six fatalities. |
| Feb., 1985 | Statewide | Western valleys received between 2-4 inches of snow; Massive power failures (tree limbs broke power lines) |
| Dec., 1985 | Willamette Valley | Heavy snowfall throughout valley |
| Mar., 1988 | Statewide | Strong winds and heavy snow |
| Feb., 1989 | Statewide | Heavy snowfall and record low temperatures. |
| Feb., 1990 | Statewide | Average snowfall from one storm about 4 inches (Willamette Valley) |
| Dec., 1992 | Western Oregon | Heavy snow. Interstate Highway closed. |
| Feb., 1993 | Western Oregon | Record snowfalls |
| Winter 1998-9 | Statewide | Series of storms. One of the snowiest winters in Oregon history |

Source: Taylor, George and Hatton, Ray, 1999, *The Oregon Weather Book*, pp.119-122.

## Vulnerability

The probability that Region 2 will experience winterstorms and the region's vulnerability to their effects are depicted in Table 19 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

### TABLE 19. Vulnerability and Probability Assessment of Winterstorms

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | H | H | H | H |
| Probability | H | M | H | H |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

# Volcano Annex

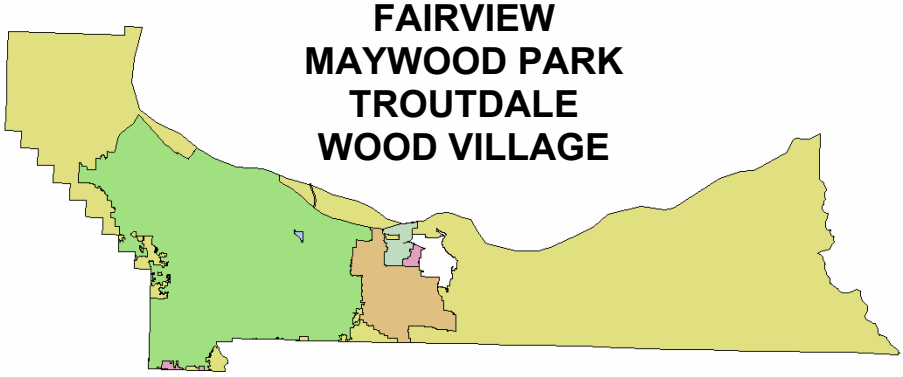
This annex contains information related to volcanic hazards to supplement the risk assessment summary in Section 3 of Multnomah County's Natural Hazard Mitigation plan. Like the other annexes to this plan, it is designed to have new policies, plans, and data sources related to annexes added in future plan updates. The annex contains:

- Volcanic hazard-related sections from a previously-completed Multnomah County risk assessment
- The *State of Oregon Natural Hazard Mitigation Plan* section related to volcanic hazards in the region surrounding Multnomah County

# MULTNOMAH COUNTY

# Volcano Hazard Assessment

**IN PARTNERSHIP WITH THE CITIES OF:**
**GRESHAM**
**FAIRVIEW**
**MAYWOOD PARK**
**TROUTDALE**
**WOOD VILLAGE**



# Hazard Analysis

This Section serves to identify each hazard/threat confronting the jurisdiction. Hazards will be grouped into the following categories:

- Flooding
- Landslides, or Debris Flows
- Earthquake
- Volcano
- Wildfires & Urban Interface Fires
- Winter Storms
- Severe Weather

The development of Mitigation Projects centers on the prioritization of the three basic Strategies:

1. Life Safety, safeguarding and sustaining human life.
2. Property Preservation, protecting critical infrastructures, thus ensuring sustainable communities.
3. Environmental Conservation, enabling supportive environments and healthy ecosystems.

Each hazard will be analyzed as follows:

1. Hazard Definition
2. Hazard Description
3. Hazard History & Costs
4. Risk Assessment
5. Severity Score (this scoring was developed by the State of Oregon Office of Emergency Management)
6. Jurisdiction Vulnerabilities

# VOLCANO

## 1. General Definition

Volcano eruptions result in flows of lava, debris, emissions of toxic gases and extensive deposits of airborne particles and ash.

## 2. Description

Multnomah County and the Pacific Northwest lie on the “Ring of Fire,” an area of very active volcanic activity surrounding the Pacific Basin. Volcanic eruptions occur regularly along the Ring of Fire, in part, because of the movement of the Earth’s tectonic plates. The Earth’s outermost shell, the lithosphere, is broken into a series of slabs known as tectonic plates. These plates are rigid, but they float on a hotter, softer layer in the Earth’s mantle. As the plates move about on the layer beneath them, they spread apart, collide, or slide past each other. Volcanoes occur most frequently at the boundaries of these plates and volcanic eruptions occur when the hotter, molten materials, or magma, rise to the surface. The primary threat to lives and property from active volcanoes is from violent eruptions that unleash tremendous blast forces, generate mud and debris flows, and produces flying debris and ash clouds. The immediate danger area in a volcanic eruption generally lies within a 20- mile radius of the blast site. However, impacts can extend 100 miles or more from the eruption site. Although there are no active volcanoes in Multnomah County, there are a number of active volcanoes within the 100-mile danger area that do pose a threat to county residents and property. The threat they pose is associated primarily with ash fall. Population growth in Multnomah County and the Pacific Northwest near the region’s many volcanoes has led scientists to identify the volcanoes of the Cascades Range as having the greatest potential.

## 3. Hazard History & Costs

There are five major volcanoes in the Cascade region that are in relative proximity and pose a potential threat to Multnomah County. They include Mount St. Helens, Mount Hood, Mount Rainier, Mount Adams, and Mount Jefferson. Of the five, all are known or suspected to be active and most have geological records that indicate past histories of explosive eruptions with large ash releases. Only Mount Hood has no geological evidence of large explosive events, though it still poses a threat of ash releases to Multnomah County. Mount Hood and Mount St. Helens pose the greatest threat to Multnomah County in terms of potential impact, and are described in more detail below.

Mount Hood is located about 50 miles southeast of Portland. It has been recurrently active over the past 50,000 years. It has had two significant eruptive periods in recent times; one about 1,500 years ago and another about 200 years ago. While Mount Hood has shown no recent signs of volcanic activity, scientists predict the next eruption will consist of small explosions generating pyroclastic flows, ash clouds, and lahars (mud and debris flows).

Mount St. Helens, located in southwestern Washington about fifty miles northeast of Portland, is fifty thousand years old. Over the past 521 years, it has produced four major explosive eruptions and dozens of smaller eruptions.

The May 18, 1980 eruption was followed by five smaller explosive eruptions over a period of five months. A series of 16 dome-building eruptions through October 1986 constructed the new, 880 foot high, lava dome in the crater formed by the May 18, 1980 eruption. An historic eruption occurring in 1480 A.D. was about five times larger than the May 18, 1980 eruption.

The May 18, 1980 eruption of Mount St. Helens was preceded by about two months of precursor activity, including dome building, minor earthquakes, and venting of gasses. The lateral blast, debris avalanche, and mudflows associated with the eruption caused extensive loss of life and widespread destruction of property. The eruption triggered a Richter magnitude 5.1 earthquake about one mile beneath the volcano. In the six-year period after the initial eruption, hundreds of small ash emissions at Mount St. Helens occurred. The eruption of Mount St. Helens took the lives of 57 people and nearly 7,000 big game animals. All birds and most small mammals in the area were killed, as were twelve million Chinook and Coho salmon fingerlings that perished when their hatcheries were destroyed. Damage to the built environment within the immediate hazard vicinity included twenty-seven bridges, about two hundred homes, more than 185 miles of highways and roads, and fifteen miles of railways. Ash from the eruption column and cloud spread across the United States in three days and circled around the Earth in fifteen days. Detectable amounts of ash were noted in an area covering 22,000 square miles. Debris flows quickly filled the Toutle and Cowlitz Rivers and ultimately flowed into the Columbia River at Longview, Washington. The debris blocked the main shipping channel in the Columbia, stranded ships in port, and closed the ports of Portland, Vancouver, and Kalama for over a month. Several water and sewage treatment facilities were also damaged or destroyed. The estimated damage attributed to the eruption was $1.1 billion. A few millimeters of ash fell onto Multnomah County during small events on May 25, June 12, and October 16-18, 1980. The May 25 event left ash covering buildings, vehicles, lawns, streets, and agricultural fields.

For days, even weeks afterward, residents and government officials worked to clear away the fine powder. Local hospitals treated a large number of patients suffering from respiratory problems attributed to the ash. They handed out surgical masks to help filter the ash, but the masks were largely ineffective. Residents and government officials worked aggressively to remove the ash deposits by flushing them into storm drains or sweeping them up and hauling them to landfill sites. Parks and outdoor swimming pools were particularly hard hit. Pools had to be drained and the filters cleaned. Ash also worked its way into equipment causing premature failures or requiring unscheduled maintenance.

## 4. Risk Assessment

The Hazard Analysis endeavors to apply a quantitative approach to comparing the hazards that threaten the County in order to develop a relative hazard, or risk assessment.

The following categories are used in conducting this hazard analysis.

- *History (Weight Factor=2)*
  This is an analysis of the records of occurrences of previous major emergencies or disasters that affected the County.
- *Vulnerability (Weight Factor=5)*
  The percentage of the population and property likely to be effected by a hazard.
- *Maximum Threat (Weight Factor=10)*
  The maximum percentage of population and property that could be impact under a worst-case scenario.
- *Probability (Weight Factor=7)*
  The likelihood of occurrence within a specified period of time.

By adding the severity rating by the weight factors associated with the categories above, a sub score for the history, vulnerability, maximum threat, and probability for each hazard can be achieved. Adding the sub score will produce a total score for that hazard.

**The Risk Assessment for Volcano is:**

***THIS IS A COUNTY WIDE EVENT***

a. *History:* **20**

b. *Vulnerability:* **50**

c. *Maximum Threat:* **100**

d. *Probability* **70**

## 5. Severity Score

The Severity Score factors the elements of risk: History (H), Vulnerability (V), Maximum Threat (MT) and Probability (P) to create an index which allows for the prioritization of mitigation activities based on the level of risk.

***The Severity Score for Volcano for Multnomah County is: 240***

*H + V + MT + P = Severity Score*

**20 + 50 + 100 + 70 = 240**

## 6. Jurisdiction Vulnerabilities

a. *Population*

Approximately ***100*** percent of the community's population is vulnerable.

b. *Critical Facilities*

(1) Approximately ***100*** percent of the community's critical facilities are vulnerable.

(2) Definition / Description

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after a volcanic event. Many critical facilities are housed in older buildings that are not up to current seismic codes, and they may fail in volcanic related seismic activity.

(3) The specific critical facilities vulnerable in Multnomah County are:

- 4 County Law Enforcement Buildings
- 5 Municipal Administration Buildings (City Halls)
- 7 County Correctional Facilities
- 19 Critical County Facilities
- 3 Municipal Police Departments

c. *Infrastructure Lifelines*

(1) Approximately ***100*** percent of the community's infrastructure lifelines are vulnerable.

(2) Definition / Description

Lifelines are the connections between communities and outside services. They include ground transportation systems, rail networks, and airports. Ground shaking and amplification, tied to volcanic activity can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease.

Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after a volcanic event to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public. In Multnomah County, the following lifelines have been identified as: Highways and Interstates, Bridges, Airports, and Rail Roads..

(3) The specific infrastructure lifelines vulnerable in Multnomah County are:

- 1 Airport
- 31 Bridges
- 8 Rail Network Carriers
- 430 Arterials, Secondary, and Side Road Networks.

d. *Public Infrastructure*

(1) Approximately ***100*** percent of the community's public infrastructure is vulnerable.

(2) Definition / Description

Public infrastructure is defined as facilities that support the underlying community. During times of emergency or disaster these facilities become crucial in providing support and services, which allow the continuity of business, government, and society.

(3) The specific public infrastructure vulnerable in Multnomah County is:

- 112 County Support Facilities
- 24 Child Care Centers
- 15 Assisted Living Centers
- 8 Water Providers and Distribution Support Facilities

e. *Private Economy and Business Sector*

(1) Approximately ***100*** percent of the community's private economy and business sector is vulnerable.

(2) Definition / Description

Volcanic eruptions can disrupt the normal flow of commerce and daily human activity without causing severe physical harm or damage. Ash that is a few inches thick can halt traffic, and cause rapid wear of machinery, clog air filters, block drains, creeks, water intakes, and impact agriculture. Removal and disposal of large volumes of deposited ash can also have significant impacts on government and business. The interconnectedness of the region's economy can be disturbed after a volcanic eruption. The Mount St. Helens' May 1980 eruption demonstrated the negative affect on the tourism industry. Conventions, meetings, and social gatherings were canceled or postponed in cities and resorts throughout Washington and Oregon in areas not initially affected by the eruption.

(3) The specific private economy and business sector vulnerable in Multnomah County are:

- 9 Bakeries
- 4 Food Caterers
- 46 Contract Food Service Providers
- 34 Grocery Stores
- 20 Hardware Stores
- 146 Restaurants
- 806 Private Businesses/Corporations

# REGION 2
# Northern Willamette Valley / Portland Metro[1]
# Hazards Assessment

[1] Includes the counties of Columbia, Clackamas, Multnomah and Washington.

# VOLCANO-RELATED HAZARDS

## Characteristics and Brief History

The eastern boundaries of Clackamas and Multnomah counties coincide with the crest of the Cascade Mountains. Volcanic activity in the Cascades will continue, but questions regarding how, to what extent, and when remain. Most volcano-associated hazards are local (e.g., explosions, debris, lava, and pyroclastic flows). However, lahars can travel considerable distances down stream valleys, and wind-borne tephra (ash) can blanket areas many miles from the source.

There is virtually no risk from volcanoes in Washington County, although normal prevailing winds could shift and carry ash into that area. Clackamas and Multnomah counties are at risk and should consider the impact of volcano-related activity on small mountain communities, dams, reservoirs, energy-generating facilities, and highways. These counties also should consider probable impacts on the local economy (e.g., wood products and recreation). The communities of Government Camp, Rhododendron, and Zigzag merit special attention.

The history of volcanic activity in the Cascade Range is contained in its geologic record, and the age of the volcanoes vary considerably. Some lava flows on Washington's Mt. Rainier are thought to be older than 840,000 years; Mt. Saint Helens erupted in May 1980, and continues to be active. In short, all of the Cascade volcanoes are characterized by long periods of quiescence and intermittent activity. And these characteristics make predictions, recurrence intervals, or probability very difficult to attain.

## Probability

Region 2 communities are closest to Mt. Hood (Clackamas County), a "composite" volcano. Composite volcanoes have wide ranging modes of eruption, making future volcanic activity difficult to predict definitively. Mt. Hood's eruptive history can be traced to late Pleistocene times (15-30,000 years ago) and will no doubt continue. However, the central question remains: When?

The most recent series of events (1900-2000) consisted of small lahars and debris avalanches; steam explosions and minor tephra falls occurred between 1856 and 1865. Mt. Hood's recent history also includes tephra, dome building, lahars, pyroclastic flows and steam explosions. These occurred approximately 200 years ago. Geoscientists have provided estimates of future activity in the vicinity of Crater Rock, a well-known feature on Mt. Hood. They estimate a 1 in 300 chance that some dome activity will take place in a 30-year period (1996-2026). For comparison, the 30-year probability of a house being damaged by fire in the United States is about 1 in 90 (Scott, W.E., et al., 1997)

The probability of 1 cm or more of tephra fall-out from eruptions throughout the Cascade Range include: Clackamas County: between 1 in 500 to 1 in 1000; Multnomah County: between 1 in 500 to 1 in 1,000; Washington County: between 1 in 1,000 to 1 in 5,000 (Sherrod, David et al, 1997). Mt. St. Helens is less than 50 air miles from some Columbia County communities and is still active. Prevailing wind direction is of paramount importance. Because the prevailing winds are westerly in Columbia County, the risk of air borne tephra is considerably reduced. The risk of Columbia County receiving 1 cm or more of tephra varies between 1 in 5,000 to 1 in 10,000 (Sherrod, David et al, 1997).

Table 14, below, summarizes the probability of volcano-related hazards for each county. Debris from the 1980 eruption of Mt. St. Helens impacted the shipping channel on the Columbia River by reducing water depth (dredging was required).

**TABLE 14. PROBABILITY OF VOLCANO-RELATED HAZARDS**

| Volcano Related Hazards | Washington | Multnomah | Clackamas | Columbia | Remarks |
|---|---|---|---|---|---|
| Tephra (volcanic ash) (annual probability of 1cm or more accumulation from eruptions throughout the Cascade Range) | 1 in 5,000 to 1 in 10,000 | 1 in 1,000 to 1 in 5,000 | 1 in 1,000 to 1 in 5,000 | 1 in 5,000 to 1 in 10,000 | USGS Open File Report (OFR 97-513) |
| Lahar | No Risk | Source: Mt. Hood | Source: Mt. Hood | No Risk | USGS Open File Report (OFR 97-89) |
| Lava flow | No Risk | No Risk | Source: Mt. Hood | No Risk | USGS Open File Report (OFR 97-89) |
| Debris flow / avalanche | No Risk | Source: Mt. Hood | Source: Mt. Hood | Mt. Saint Helens* | USGS Open File Report (OFR 97-89) |
| Pyroclastic flow | No Risk | No Risk | Source: Mt. Hood | No Risk | USGS Open File Report (OFR 97-89) |

Source: USGS Open File Report (OFR 97-89).

## Vulnerability

The probability that Region 2 will experience volcanic events and the region's vulnerability to their effects are depicted in Table 15 below. These scores are based on an analysis of risk conducted by county

emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

### TABLE 15. Vulnerability and Probability Assessment Volcanic Hazards

| | Clackamas | Columbia | Multnomah | Washington |
|---|---|---|---|---|
| Vulnerability | H | H | H | H |
| Probability | L | L | H | L |

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

# Plan Process

The key to the success of any plan is the *process* that was used to create it. Multnomah County designed its plan process to involve stakeholders that represent multiple County and local government agencies, nonprofit and business partners, and hazards experts from throughout the state.

This appendix documents the meetings that were held as the plan was created, and is designed to supplement the process descriptions included in Section 1 of the plan. It includes agendas, meeting notes, and other critical information. It has the following parts:

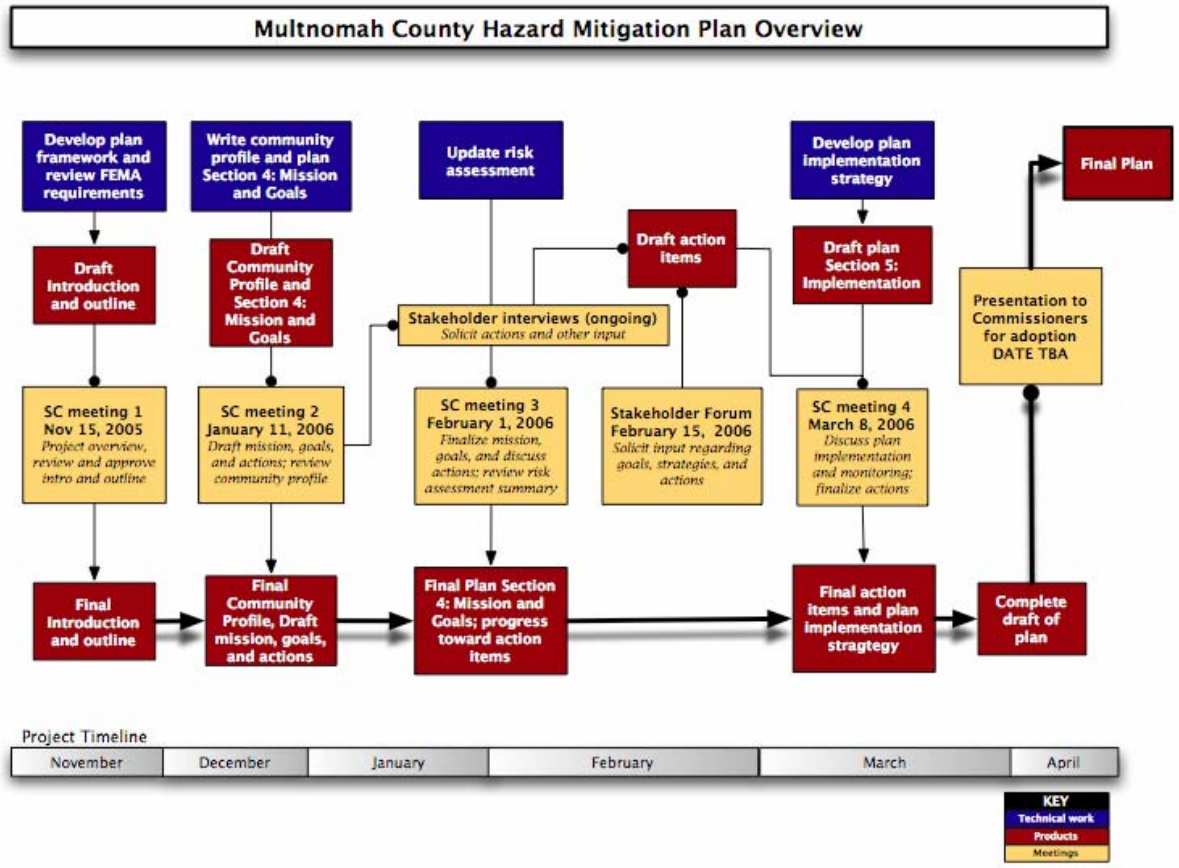
- Process overview
- Steering Committee meetings
- Stakeholder forum
- Stakeholder interviews

## PROCESS OVERVIEW

Figure A-1 provides an overview of the process that the steering committee when through to produce Multnomah County's Natural Hazard Mitigation Plan. The committee held a total of four work sessions, during which they reviewed and approved draft sections of the plan, planned the stakeholder forum, and reviewed and approved the plan's mission, goals, and action items. The County contracted with ECONorthwest to assist in plan production; ECO worked with the steering committee to draft and finalize all plan sections. Additionally, ECO conducted all stakeholder interviews, and facilitated the stakeholder forum. The steering committee members worked with their colleagues and other stakeholders to draft all of the action items that are included in the plan.

Additional plan-input activities—the stakeholder forum and interviews—are described in greater detail in the remainder of this appendix as well as Section 1 of this plan.

**Figure A-1. Multnomah County Natural Hazard Mitigation Plan process and timeline, 2006**




Source: ECONorthwest, 2006

# STEERING COMMITTEE WORK SESSIONS

This section of the appendix provides a brief overview of each of steering committee work session. Additional documentation (meeting agendas and notes) for each of the steering committee meetings is included at the end of this appendix.

## WORK SESSION 1: NOVEMBER 15, 2005

In this first meeting, steering committee members were introduced to FEMA requirements. They also reviewed and approved introductory sections of the plan.

## WORK SESSION 2: JANUARY 11, 2006

At his meeting, steering committee members discussed the agencies, businesses, and nonprofit organizations that should be represented at the stakeholder forum and in the interviews. Additionally, they reviewed and

approved the draft community profile section of the plan, and discussed the goals and mission for the plan.

### WORK SESSION 3: FEBRUARY 1, 2006

Steering committee members approved the goals and mission for the plan, reviewed a draft of the risk assessment, and spent the bulk of the meeting discussing plans for the stakeholder forum.

### WORK SESSION 4: MARCH 8, 2006

At this final steering committee meeting, members approved the remaining sections of the plan, and spend the majority of the meeting discussing and finalizing action items.

## PUBLIC STAKEHOLDER FORUM

### PURPOSE AND PROCESS

The purpose of the forum was to gather information about community assets and potential mitigation action items, to be integrated into Multnomah County's Natural Hazard Mitigation Plan. Forum attendees were asked to brainstorm potential issues associated with risk reduction related to the County's current and future population, infrastructure, economy, historical resources, and others, and prioritize them according to their importance for risk reduction. In small groups, they discussed what actions the County might take to reduce risk given the issues that they had identified. An agenda is included at the back of this appendix that provides additional information.

### ATTENDEES

In addition to meeting facilitators (ECONorthwest's Andre LeDuc, Lorelei Juntunen, and Beth Goodman), forum attendees were:

| Name | Organization |
|---|---|
| Neil Kennedy | Tualatin Valley Water District |
| Michael Greisen | Scapoose Rural Fire District |
| Randy Aden | U.S. Bank |
| Gregg Larson | Boeing |
| Josh Townsley | Sauvie Island Drainage Improvement |
| Jennifer Kaden | Columbia River Gorge Commission |
| Jeri Shumate | 211 info |
| Keely Thompson | City of Gresham Utilities |
| Cathy Harrington | City of Gresham Emergency Management |
| Tom McCausland | City of Gresham DES |
| Vance Hardy | Lusted Water District |
| John Harris | City of Gresham |
| John Pettis | City of Gresham |

| | |
|---|---|
| Matthew Krusemark | Multnomah County GIS |
| Corky Collier | Columbia Corridor Association |
| Bruce McClelland | Multnomah County Drainage District |
| Bill Burns | Oregon Department of Geology |
| Terry Taylor | Gresham-Barlow School District |
| Karen Reynolds | Mt. Hood Community College |
| Robert Maestre | Multnomah County |
| Stevie Bullock | Multnomah County Emergency Management |

# FORUM RESULTS

## HIGH PRIORITY MITIGATION ISSUES

The following are the most frequently mentioned issues that stakeholder forum attendees felt should be the County's top priority when seeking to reduce risk. The issues at the top of the list were mentioned with greater frequency than the issues at the bottom of the list.

- Create a coordinated message that will cause people in the County to act to reduce their personal and business-related hazard risk. It is particularly important that this message targets the County's traditionally underrepresented groups (minorities, those in poverty, small business owners, etc.).
- Assure that bridges, railroads, airports, and other key transportation routes are mitigated to reduce impact to the regional economy in the event of a large-scale disaster.
- Acquire and use better data to describe risk and vulnerability
- Given expected population growth in the County, assure that new development occurs in locations that are, to the extent possible, hazard free.
- Consider the resilience of the affordable housing stock (both privately- and publicly-owned). This will require a focus on renters and property owners in outreach campaigns.
- Focus on public infrastructure: water, sewer, telecommunication networks, etc.

## ACTION ITEMS

Based on this issue identification process described above, stakeholder forum attendees drafted action items. The steering committee reviewed these action items during their March 8th meeting, made any adjustments necessary, and included them in Section 4 of the Multnomah County Natural Hazard Mitigation Plan. Action items that were devised as part of the stakeholder forum process are identified as such in the plan. See Section 4 for more detail.

# STAKEHOLDER INTERVIEWS

## PURPOSE AND PROCESS

Stakeholder interviews are a community involvement method that can be used to gain input from a variety of community members who might not normally be involved in the planning process. Interviews were conducted either in person or on the phone.

Stakeholder interviews allow communities to collect information on critical issues, needs, current activities, and opportunities for collaboration related to natural hazard mitigation. Involving stakeholder input in the planning process:

- Builds ownership and community support for the plan
- Helps ensure that the final plan will reflect the community's priorities
- Begins to foster the collaboration that will be necessary for successful plan implementation and maintenance

The language of the Disaster Mitigation Act of 2000 requires that the planning effort provide an opportunity for the community to be involved in developing the plan. Inviting stakeholders to participate in the interviews provides this opportunity.

These questions provide a general list of the questions that were asked at interviews. Specific interviews were tailored to take advantage of the specialized knowledge of the interviewee; each interviews included all or some of the questions here, as well as others not listed here

Interviews began with a description of the planning process and requirements, and some discussion about why stakeholder interviews are important and why the interviewee has been contacted.

- Tell me a little about the scope of your job. Does your work relate to natural hazard mitigation directly?
- What are the most important community assets to protect from damage during a hazard event?
- What types of natural hazards are likely to affect the community or infrastructure with which you work?
- How is growth and development in the community contributing to natural hazard events?
- How can your organization contribute to regional coordination to reduce risk from natural hazards?
- What activities will assist the community in reducing risk and preventing loss from future natural hazard events?
- Do you see new ways for agencies, organizations or individuals to participate or coordinate to reduce risk from natural hazards? Do you see any gaps in the County's current system for reducing risk?

Interviewers noted any potential action items or mitigation issues that interviewees described. The steering committee discussed these findings at their second and third stakeholder meetings, and incorporated the results into the plan as appropriate.

## INTERVIEWEES

The consultant team that worked with Multnomah County to develop the plan conducted a series of one-on-one interviews to identify mitigation and vulnerability issues and develop action items. Interviewees included:

- Steve Fedje, USDA—Natural Resource Conservation Service
- Bill Burns, Oregon Department of Geology and Mineral Industries
- Donna Tyner, Port of Portland
- Chuck Beasley, Multnomah County Land Use Planning
- Jon Schrotzberger, Multnomah County Facilities
- Bob Eaton, Dave Hendricks, and Bruce McClelland, Multnomah County Drainage District

# OFFICE of EMERGENCY MANAGEMENT

# MULTNOMAH COUNTY, OREGON

## Multnomah County Natural Hazard Mitigation Plan

### Agenda: Steering Committee Meeting

Tuesday, November 15, 2005

### WELCOME AND INTRODUCTION (15 MINUTES)

- Welcome and introductions (Tom Simpson, Mult. Co. Emergency Management and Robert Maestre, Steering Committee Chair, Dept. of Community Services)

### PLAN OVERVIEW (40 MINUTES)

- What is mitigation?
- Overview of process, products, and timeline (Andre LeDuc, ECONorthwest)
- Key products: mitigation action items (Andre LeDuc and Lorelei Juntunen)
- Feedback from the steering committee (all)

### BREAK (10 MINUTES)

### OVERVIEW OF HAZARD RISK (15 MINUTES)

- Previous mitigation efforts (Scott Salmon, Mult. Co. Emergency Management)
- Risk assessment (Scott)
- Feedback from steering committee (all)

### PLAN REQUIREMENTS (40 MINUTES)

- Review of FEMA guidelines (Andre)
- How the document will meet FEMA guidelines: Review of plan outline and Introduction (Andre)
- How previous and future planning efforts feed into the plan (Andre)

### NEXT STEPS (10 MINUTES)

- Next meeting dates; meeting close (Andre and Robert)

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**November 16, 2005**

**TO:** **Hazard Mitigation Plan Steering Committee**
**FROM:** **Lorelei Juntunen**
**SUBJECT:** **NOTES FROM NOVEMBER 15 STEERING COMMITTEE MEETING**

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This memorandum contains draft notes from the Multnomah County Natural Hazard Mitigation Plan Steering Committee meeting held Tuesday, November 15, 2005. It has the following sections, which follow the meeting's agenda:

- Welcome and introduction
- Plan overview
- Overview of hazard risk
- Plan requirements
- Next steps

Meeting attendees were:

- Helen Barkley, Multnomah County Risk Management
- Chuck Beasley, Multnomah County Planning
- Robert Maestre, Multnomah County Transportation and Planning
- Keely Thompson, City of Gresham Utilities
- Tom Simpson, Multnomah County Emergency Management
- Scott Salmon, Multnomah County Emergency Management
- Donna Tyner, Port of Portland
- Andrea Westersund, Multnomah County GIS

## WELCOME AND INTRODUCTION

Robert Maestre, Steering Committee chair, welcomed everyone and led a brief round of introductions. He emphasized that the final mitigation plan will be a useful and necessary product, and that Steering Committee meetings will be product-oriented and will only occur as necessary.

Tom Simpson thanked everyone for making the time in their schedules to be present. He added that this process will emphasize integration among existing plans and plans in other jurisdictions.

All 36 counties in Oregon use the same process and methodology for completing their Natural Hazard Mitigation Plans. This leads to greater collaboration among jurisdictions, and, ultimately, to greater mitigation success.

## PLAN OVERVIEW

Andre provided a general overview of mitigation planning, beginning with a description of mitigation. He defined mitigation as risk reduction. Any activities that reduce our exposure to hazards, so that response and recovery are not necessary, can be termed mitigation. Mitigation is not emergency response, nor is it long-term recovery.

He added that mitigation plans are not regulatory, but rather are strategic in nature. The plan will be adopted by County Commission via resolution, and none of the actions contained in it will be unfunded mandates. More specifically, the plan includes strategies that, when funding becomes available, the County can implement to reduce loss from disasters.

Completing a plan makes the County eligible to compete for federal funds through the Pre-Disaster Mitigation Grant Program. Chuck asked how much money is actually available. Andre answered that, last year, $150 million were appropriated last year. This year, that amount was reduced to $50 million, largely in response to the unplanned expenditures necessary for response to Hurricanes Katrina and Rita. In the next funding cycle, however, the amount is expected to go back to $150 million if not higher. Having a plan in place also makes the County eligible for post-disaster funds; no jurisdiction can accept mitigation dollars without having a plan in place.

The plan should be considered a long-term plan; plans are typically updated every five years, but the model that we will be using is built on a system that allows for continual updates.

Robert suggested a letter to County Commissioners and the districts (school, utility, etc), introducing the mitigation plan and letting them know that they must adopt it. There was general agreement that this was a good idea. Andre added that we could include information about the stakeholder forum, and make sure that we send the letter to the people we'd like to invite to the forum to ask for nominations. ECO will work with Robert and Tom to draft this letter.

Andre discussed the outline of the document and the action item form.

Donna asked how the mitigation plan will fit in with the Critical Infrastructure Plan, which is related to anti-terrorism threats. Critical infrastructure are also vulnerable to natural hazards. Tom added that the Action Item Proposal form should be used to capture any idea, regardless. The Multnomah County Hazard Plan document is designed to meet Federal requirements, but it also recognizes that local level governments are looking for more flexible uses in the plan. The plan has been structured to allow for hazard annexes to be added to the plan, so that other work that local jurisdictions are undertaking can be included in the plan.

## OVERVIEW OF HAZARD RISK

Scott provided an overview of mitigation activities that have happened in the County in the past. These included:

- The construction of a flood control system on Johnson Creek

- Land buy-out in the Dodson-Warrendale area
- Implementation of *Project Impact*, which provided education
- Elevation of a roadway on Sauvie Island after the floods of 1995-96

Scott also described the previous County Hazard Mitigation Plan, which will be the basis of the risk assessment that will be used in this planning process.

## PLAN REQUIREMENTS

Robert asked who champions the plan to make sure that it is implemented and that it continues to be in the public eye. Andre answered that Section 5 of the mitigation plan will address this issue, and that part of the role of the steering committee will be to devise that process during a later meeting.

Tom added that hazard mitigation is not on the political radar screen in the County, and that this process is important for assuring that everyone is aware of the need for mitigation. The people who attend the stakeholder forum/etc. will have a raised awareness of the need for mitigation as well as the type of projects that the County might undertake.

Andre described the FEMA criteria and FEMA's prior review of the plan.

Robert asked us to consider who should be invited to the stakeholder forum; the group brainstormed and suggested representatives of the following organizations as possibilities:

- Homebuilders Assoc.
- Real estate industry
- Metro
- School Districts
- Gorge Commission
- Drainage Districts
- Hospital
- Utilities (electrical, gas, water, sewer, telephone services, TV/etc.)
- Tri-met
- Association of delivery services or other transportation groups
- County Health Department
- Corbett NERT
- Neighborhood associations
- Oregon Dept. of Agriculture
- OR Dept of Forestry
- Weather services (forecasting), NOAA
- Regional Emergency Management Group
- Elected officials
- Community colleges
- Religious organizations
- USGS
- ODOT
- County transportation
- Rotary Clubs/civic organizations
- CAERS
- Business Continuity Planning Association
- Regional Water Providers Assoc (have a response coordinator)
- Oregon chapter of the American Planning Association

- Architects/engineers
- Watershed councils – EcoTrust, Trout Unlimited, SOLV
- Land trusts

ECO will take this list and make some recommendations to the Steering Committee about who should be included in the stakeholder forum and which should be interviewed.

Robert added that he'd like to see the concept of public-private partnerships included in the plan.

## NEXT STEPS

Assignments for Steering Committee members in the coming weeks:

- Think about potential action items, and distribute the action item form to anyone who might have ideas for action items.
- Review Section 1 and send any comments or additions to ECO. We are especially interested in knowing about any previous mitigation efforts that have occurred.

Robert said that he preferred that the process for prioritization of action items that the steering committee sets up should be non-political. There was general agreement with this statement.

# OFFICE of EMERGENCY MANAGEMENT

# MULTNOMAH COUNTY, OREGON

## Multnomah County Natural Hazard Mitigation Plan

### Agenda: Steering Committee Meeting

Wednesday, January 11, 2006

### WELCOME AND UPDATE (20 MINUTES)

- Welcome (Steve Bullock, Mult. Co. Emergency Management, and Robert Maestre, Steering Committee Chair)
- Project update and meeting purpose (Andre LeDuc, ECONorthwest)

### STAKEHOLDER FORUM AND INTERVIEWS (15 MINUTES)

- Finalize list of participants and interviewees (Andre)
- Forum invitation procedures

### REVIEW OF DRAFT SECTION 2: COMMUNITY PROFILE (15 MINUTES)

- Overview of community profile (Lorelei Juntunen, ECONorthwest)
- Questions and comments (All)

### BREAK (10 MINUTES)

### REVIEW OF DRAFT SECTION 4: MISSION, GOALS, AND ACTION ITEMS (15 MINUTES)

- Discussion and approval (All, facilitated by Andre and Lorelei)

### DISCUSSION: DRAFT MISSION AND GOALS (35 MINUTES)

- Draft mission and Goals for Multnomah County
- Discussion and approval (All, facilitated by Andre and Lorelei)

### NEXT STEPS (10 MINUTES)

- Next meeting dates; meeting close (Andre and Robert)

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**January 12, 2006**

**TO:** **Hazard Mitigation Plan Steering Committee**
**FROM:** **Lorelei Juntunen**
**SUBJECT:** **NOTES FROM JANUARY 11 STEERING COMMITTEE MEETING**

---

This memorandum contains draft notes from the Multnomah County Natural Hazard Mitigation Plan Steering Committee meeting held Wednesday, January 11, 2006.

Meeting attendees were:

- Chuck Beasley, Multnomah County Planning
- Steve Bullock, Multnomah County Emergency Management
- Cathy Harrington, City of Gresham Emergency Management
- Matthew Krusemark, Multnomah County GIS
- Robert Maestre, Multnomah County Transportation and Planning
- Scott Salmon, Multnomah County Emergency Management
- Jon Schrotzberger, Multnomah County Facilities and Property Management
- Dennis Sigrist, Oregon Emergency Management
- Keely Thompson, City of Gresham Utilities
- Donna Tyner, Port of Portland
- Andre LeDuc, ECONorthwest
- Lorelei Juntunen, ECONorthwest

## ACTION ITEM FORM DISCUSSION

Andre described the categories included on the action item proposal form in greater detail, based on the information in the draft of *Section 4: Mitigation Plan Mission, Goals, and Action Items*. The action items are the heart of the natural hazard mitigation plan, and it is important that the Steering Committee provide all of the information that the proposal form requests:

- *Rationale for the proposed action item* describes the critical issues that the action item will address and presents the fact base behind the action.

- *Ideas for implementation* serve as the starting point for taking action.

- *Coordinating organization* is the public agency with authority to implement the identified action.

- *Internal partners* are County departments that may have resources (time, budget, staff, data) to contribute to implementing the action.

- *External partners* are non-County departments organizations – nonprofits, departments in other jurisdictions, special service districts, private businesses, etc – that may have resources to contribute to implementing the action.

- *Timeline describes when the action item might be completed.* Short-term actions are activities that County departments may implement in one or two years; long-term actions may require new resources and take more than two years to implement.

Andre pointed out that it may be beneficial to list projects that are already planned or underway in the plan, to provide a track record of mitigation success.

## STAKEHOLDER FORUM

Andre and Lorelei presented a draft list of invitees for the stakeholder forum, to be held February 15, 2006. Cathy felt that the list was too "Portland-centric" and suggested several names that could be added (US Bank, Boeing, CARES). Her suggestion led to a broader discussion about the purpose of the forum: are we inviting people who will be able to contribute and implement action items, or are we inviting people we would like to inform about the ongoing mitigation planning efforts in the County who might have some thoughts about actions to contribute?

After discussion, Robert suggested that we restructure the forum to focus primarily on information dissemination and issue identification, rather than on action item development. The forum would be 75% information sharing and 25% brainstorming process to identify mitigation issues and action items. A broader set of stakeholders (those who should be made aware of the mitigation planning process) should be invited. The Committee agreed.

Andre asked the steering committee to help with preparations for the forum by:

- Making sure that the list includes all of the appropriate people.

- Volunteering to make phone calls to invite people to the forum, especially if they have a connection to a specific person or agency. The invites will be more effective if they come from Steering Committee representatives than from consulting firm representatives.

- Being present at the forum to help with facilitation and to provide input.

Donna added that Steering Committee members should follow up with the people that they invite to the forum to discuss and solidify any action items. There was general agreement that this is a good way to proceed.

Lorelei will send out an electronic version of the stakeholder forum list to gather input from steering committee members about who should be invited. The Steering Committee should complete and return the forum by January 18. Lorelei will compile the list and divvy up calling responsibilities among the Steering Committee members.

## COMMUNITY PROFILE

Due to time constraints, this discussion was tabled for the next Steering Committee meeting. The Committee was asked to review the draft and provide comments to Lorelei before the next meeting to limit the amount of discussion necessary.

## MISSION AND GOALS

Andre presented the draft mission and goals in Section 4, which ECO devised by considering the mission and goals of other Multnomah County strategic plans (including the County's FY 2006 budgeting priorities) and hazard mitigation plans in other jurisdictions. Connecting the mitigation plan to other County plans makes it more likely that the projects will be implemented, especially since the mitigation plan is a non-regulatory plan.

Robert suggested adding a goal related to financing implementation; he would like to see people use the plan to bring money into the County. Andre suggested that the concept be integrated into Goal V: Collaborative partnerships. Robert agreed.

Robert suggested simplifying the mission statement to read: Create a disaster resilient County. The committee generally agreed that this much shorter version of the mission statement accurately described the overarching purpose of the mitigation plan.

Robert requested that the concept of maintaining transportation routes (especially roads and rail) be added to Goal III: Support a disaster resilient economy.

Lorelei will send an electronic version of this section of the report to steering committee members. They should suggest any major changes before the next meeting (February 1, 2006). The mission and goals will be discussed and finalized at that next meeting.

## NEXT STEPS

Assignments for Steering Committee members in the coming weeks:

- Review Sections 2 and 4, and provide comments. We will discuss Section 4 and finalize the mission and goals at the next Steering Committee Meeting.
- Add to the list of people to invite to the Stakeholder Forum, and return to Lorelei no later than January 18th. She will compile a list and divide up invitation duties among the steering committee members.
- Continue to work with colleagues to devise action items for the plan.

The next meeting is scheduled for February 1, 2006, from 1:30 p.m. to 4:00 p.m.

# OFFICE of EMERGENCY MANAGEMENT

# MULTNOMAH COUNTY, OREGON

## Multnomah County Natural Hazard Mitigation Plan

### Agenda: Steering Committee Meeting

Wednesday, February 1, 2006

### WELCOME AND UPDATE (20 MINUTES)

- Welcome (Stevie Bullock, Mult. Co. Emergency Management, and Robert Maestre, Steering Committee Chair)
- Project update and meeting purpose (Andre LeDuc, ECONorthwest)
- Action item development check-in (All)

### FINALIZE COMMUNITY PROFILE (15 MINUTES)

- Discussion and approval (All, facilitated by Lorelei)

### FINALIZE MISSION AND GOALS (15 MINUTES)

- Discussion and approval (All, facilitated by Andre)

### BREAK (10 MINUTES)

### REVIEW OF DRAFT SECTION 3: RISK ASSESSMENT SUMMARY (25 MINUTES)

- Overview of Section 3 (Andre)
- Discussion and approval (All, facilitated by Andre)

### STAKEHOLDER FORUM (45 MINUTES)

- Invitation process check-in (All)
- Review of draft agenda (Andre)
- Discussion and approval (All, facilitated by Andre and Lorelei)

### NEXT STEPS (10 MINUTES)

- Next meeting dates; meeting close (Andre and Robert)

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**February 3, 2006**

**TO:** **Hazard Mitigation Plan Steering Committee**
**FROM:** **Lorelei Juntunen**
**SUBJECT:** **NOTES FROM FEBRUARY 1 STEERING COMMITTEE MEETING**

---

This memorandum contains draft notes from the Multnomah County Natural Hazard Mitigation Plan Steering Committee meeting held Wednesday, February 1, 2006.

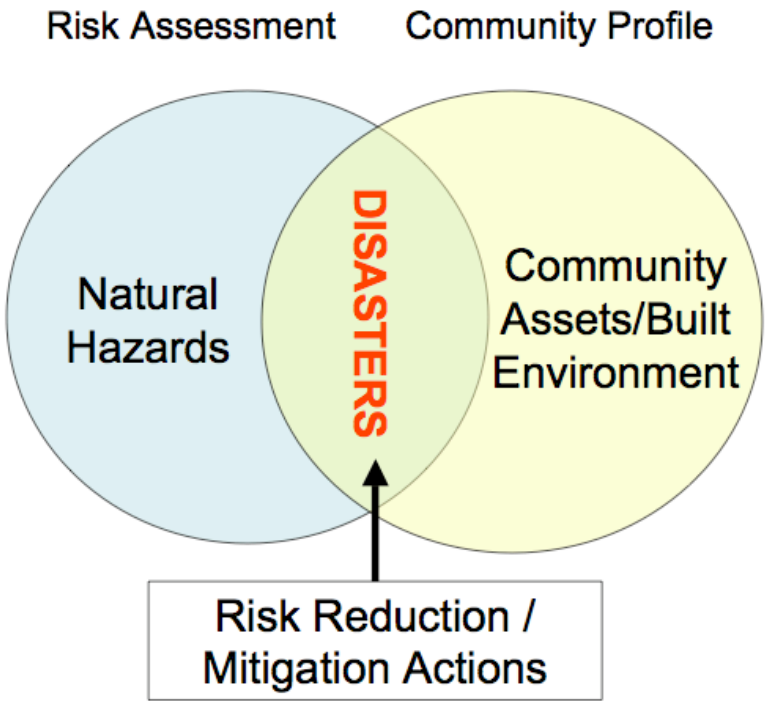
Meeting attendees were:

- Chuck Beasley, Multnomah County Planning
- Steve Bullock, Multnomah County Emergency Management
- Cathy Harrington, City of Gresham Emergency Management
- Matthew Krusemark, Multnomah County GIS
- Robert Maestre, Multnomah County Transportation and Planning
- Bruce McClelland, Multnomah County Drainage District
- Scott Salmon, Multnomah County Emergency Management
- Keely Thompson, City of Gresham Utilities
- Donna Tyner, Port of Portland
- Andre LeDuc, ECONorthwest
- Lorelei Juntunen, ECONorthwest

## PROJECT UPDATE

After Robert welcomed everyone to the meeting, Andre provided a brief update on progress since the last meeting. He introduced a diagram (shown in Figure 1) that depicts the interaction between natural systems and community assets. This diagram helps to visualize the approach that Multnomah County's plan takes to hazard mitigation and action item development.

**Figure 1. Systems approach to disaster planning**




Source: ECONorthwest, 2006

Andre reminded the steering committee that, ultimately, the goal of the plan is the development of action items that address the overlap between natural hazards and community assets / the built environment. A natural hazard that does not affect the community does not need to be mitigated. The plan is organized to document the hazards (Section 3: Risk Assessment) and the community assets/built environment (Section 2: Community Profile) that could be vulnerable to hazards, and to then build action items that address the assets that are vulnerable to natural hazards.

## ACTION ITEM DEVELOPMENT CHECK-IN

The Steering Committee members reported on their progress toward the creation of action items. Most members of the committee had either held or were planning to hold meetings with colleagues to discuss potential action items. The next steering committee meeting will largely be dedicated to finalizing these action items.

## COMMUNITY PROFILE

Lorelei led a brief discussion of Section 2: Community Profile. Steering Committee members had been asked to review the section prior to the meeting and provide comments. Steering committee members suggested some changes, mostly to the section that documents critical facilities and infrastructure. Specifically, they decided to add the following to the list in Section 2:

- Communications infrastructure

- PDX International airport
- Water pipelines
- Rail facilities

They also decided to make the following changes:

- Add a brief paragraph that describes the upcoming regional effort to create a Critical Infrastructure Plan
- Discuss the importance of the Bull Run Reservoir
- Add the forestry and nursery industries to the sections' discussion of employment and economic conditions.

With these changes made, the steering committee approved Section 2.

## MISSION AND GOALS

Andre led a discussion of Section 4: Mitigation Plan Mission, Goals, and Action Items. Steering committee members had been asked to review the section prior to the meeting and provide comments. Robert suggested several changes to the wording of plan goals that address economy and public education. The committee agreed with his changes, and approved Section 4: Mission and Goals.

## RISK ASSESSMENT

Andre and Lorelei led a discussion of the draft Section 3: Risk Assessment. The steering committee discussed the local community's self-completed hazard risk rating, which may require updating in the future. The steering committee should pay particular attention to the hazard history and previous mitigation efforts in their review. The committee will receive an electronic version of this document, and should provide any comments to Lorelei by February 24.

## STAKEHOLDER FORUM

The steering committee members each shared their progress with invitation to the stakeholder forum. Preliminarily, it appears that about 15 to 20 people have confirmed attendance.

Andre then led an overview of the agenda for the stakeholder forum. The committee generally agreed with the approach that the agenda laid out. The committee will be prepared to be active participants in discussion at the stakeholder forum, but will probably not be asked to facilitate any small group discussions.

## NEXT STEPS

Assignments for Steering Committee members in the coming weeks:

- Continue to invite people to the stakeholder forum on February 15.
- Review Section 3 and provide comment

- Develop action items and forward to Lorelei

The next meeting is scheduled for March 8, 2006, from 1:30 p.m. to 4:00 p.m. The meeting will probably be held in the Multnomah County building at 501 SE Hawthorne.

# OFFICE of EMERGENCY MANAGEMENT

# MULTNOMAH COUNTY, OREGON

## Multnomah County Natural Hazard Mitigation Plan
## Stakeholder Forum

**February 15, 2006**
**9:00 a.m. to 12:00 p.m.**

### WELCOME AND OVERVIEW (10 MINUTES)

- Welcome and forum overview (Robert Maestre, Steering Committee Chair, Multnomah County Dept. of Community Services)

### OVERVIEW OF STATE AND REGIONAL PLANNING EFFORTS (20 MINUTES)

- What is natural hazard mitigation planning? How does Multnomah's plan connect to other planning efforts in the state and region? (Andre LeDuc, ECONorthwest)

### THE MULTNOMAH COUNTY PLAN (15 MINUTES)

- Presentation of the Plan Outline (Robert)

### DISCUSSION OF RISK AND EXPOSURE (20 MINUTES)

- Description of natural hazards affecting Multnomah County (Bill Burns, DOGAMI)

- Overview of County Risk Assessment (Andre)

### BREAK (15 MINUTES)

### FACILITATED PROCESS (1 HOUR 30 MINUTES)

- Community assets and risk exposure (All)

- Facilitated group process to identify mitigation issues, discuss action items, and assess priorities (All)

### CLOSE AND NEXT STEPS (10 MINUTES)

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# OFFICE of EMERGENCY MANAGEMENT

# MULTNOMAH COUNTY, OREGON

## Multnomah County Natural Hazard Mitigation Plan

### Agenda: Steering Committee Meeting

Wednesday, March 8, 2006

### WELCOME AND UPDATE (10 MINUTES)

- Welcome (Stevie Bullock, Mult. Co. Emergency Management, and Robert Maestre, Steering Committee Chair)
- Project update and meeting purpose (Andre LeDuc, ECONorthwest)

### STAKEHOLDER FORUM RESULTS (10 MINUTES)

- Results summary (Lorelei Juntunen, ECONorthwest)

### SECTION 3: RISK ASSESSMENT (10 MINUTES)

- Overview of final Risk Assessment (Lorelei)
- Discussion and approval (All, facilitated by Lorelei)

### ACTION ITEM DISCUSSION (1 HOUR, 30 MINUTES)

- Overview of action items
- Discussion and approval of specific action items
- Prioritization of actions

### SECTION 5: PLAN IMPLEMENTATION (25 MINUTES)

- Section 5 overview (Andre)
- Discussion and approval (All, facilitated by Andre)

### NEXT STEPS (10 MINUTES)

- Meeting close (Andre and Robert)

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**March 8, 2006**

**TO:** **Multnomah County Natural Hazard Steering Committee**
**FROM:** **Lorelei Juntunen**
**SUBJECT:** **NOTES OF THE MARCH 8TH STEERING COMMITTEE**

This memorandum contains the notes of the Multnomah County Natural Hazard Mitigation Steering Committee meeting, held March 8th, from 11:30 to 2:00 p.m. at the Multnomah County Building at 501 SE Hawthorne.

## STAKEHOLDER FORUM RESULTS

Lorelei briefly presented the results of the stakeholder forum, which was held February 15, 2006. Twenty-one people attended the forum; representatives of government, business, and non-profit organizations from throughout the County attended the forum. Key mitigation issues identified at the forum included:

- Educating the public about risk; specifically, creating messages that will cause individuals to act to reduce risk
- Finding better data to understand the County's risk and vulnerability
- Identifying critical infrastructure and acting to protect it

## SECTION 3: RISK ASSESSMENT

Lorelei introduced the final risk assessment for discussion and approval. Chuck mentioned that there are several places where landslides are a recurring problem for the County's transportation system, which should be included in the risk assessment. This is especially true in the Cornelius Pass area. Andre mentioned that this can be added in later iterations of the plan, but we can also add it now if there are specific points that should be added as a recurring event. Chuck said that he would research the locations and email the information to Lorelei.

Robert mentioned that January 2006, Cornelius Pass experienced a landslide. That specific information can be added into Section 3. Matt added that there are aeas that are prone to landslides, but they aren't technically reoccurring.

Robert said that he felt the hazard scores are high, and Kathy wondered if it isn't better that they are high to support grant applications. Stevie said that it's important to make sure that the scores

are realistic so that, in grant applications, the County can show where its priorities lie. Lorelei said that there is an action item to update the hazard scores for the next round of planning.

The Steering Committee approved Section 3, with the inclusion of the landslide changes from Chuck.

## SECTION 5: PLAN IMPLEMENTATION

Andre described the draft of Section 5: Plan Implementation. He pointed out that the section is largely prescriptive, and is organized to meet FEMA requirements for plan implementation and maintenance. It lays out a description of what body will convene meetings, who will be on the standing body that updates and maintains the plan, how often they will meet, and what topics will be covered at each meeting. It also describes the existing plans, policies, and procedures that can be used to implement the plan.

Section 5 describes how projects are prioritized for implementation. The standing implementation body (called the Hazard Mitigation Technical Advisory Committee, or HMTAC) will use a four-step process to determine which actions should be implemented:

- Step 1: Examine funding requirements
- Step 2: Complete risk assessment evaluation
- Step 3: Complete quantitative, qualitative, and cost-benefit analysis
    - Structural projects w/federal funds require a quantitative process. The method is laid out in detail in FEMA requirements.
    - Qualitative, cost-effectiveness analysis for other projects. The plan lays out one method for doing this (the STAPLE/E approach) in an appendix. This process asks for an evaluation of cost effectiveness in each of seven categories: Social, Technical, Administrative, Political, Legal, Economic, and Environmental. In each of these categories, the analysis considers the
- Step 4: Committee recommendation

Robert asked if the HMTAC has the authority to throw out action items. Andre said that, yes, if the risk assessment data changes, or if the committee feels that the action item does not adequately address a known risk, the HMTAC can eliminate action items.

The plan maintenance description lays out a process for updating the plan, which includes bi-annual meetings. In these meetings, action items and funding opportunities are considered, and develop grants. Annually, the TAC should consider data for the risk assessment. Andre said that he would advocate holding one work session per year with the County Commissioners, and that the HMTAC be officially recognized as a standing body that reports to the Commission.

Every five years, the HMTAC must be fully updated (all sections made current).

Finally, Section 5 describes a process for continued public involvement as the plan is updated and implemented. This is a federal requirement.

Robert suggested the use of a blog to create a virtual HMTAC. Convener is web-master, so that anyone who needs to be involved can communicate. This makes the plan even more real-time. Stevie mentioned that Multnomah County has some software that was used previously that would assist in this kind of an organization. Andre said that we can describe this in Section 5, but we should also write an action item.

Andre said that ECo will be working on finishing up comments w/Stevie and Robert, and will send it out to the group.

## ACTION ITEM DISCUSSION

The group discussed and amended the action items that were collected through the Steering Committee Members, the Stakeholder Interviews, and the Stakeholder Forum. All changes were approved and incorporated into the final action items.

# Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the University of Oregon's Oregon Natural Hazards Workgroup and it outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan,* (Oregon State Police – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigatio*n. This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to provide the details of economic analysis methods that can be used to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

## Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred. Evaluating possible natural hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various

mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

## What are Some Economic Analysis Approaches for Evaluating Mitigation Strategies?

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the there methods is outlined below:

### Benefit/cost Analysis

Benefit/cost analysis is a key mechanism used by the state Office of Emergency Management (OEM), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoided future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e., the net benefits will exceed the net costs) to be eligible for FEMA funding.

### Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

#### Investing in public sector mitigation activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions which involve a diverse set of beneficiaries and non-market benefits.

#### Investing in private sector mitigation activities

Private sector mitigation projects may occur on the basis of one of two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies;
2. Dispose of the building or land either by sale or demolition;
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchasers. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

## STAPLE/E Approach

Conducting detailed benefit/cost or cost-effectiveness analysis for every possible mitigation activity could be very time consuming and may not be practicle. There are some alternate approaches for conducting a quick evaluation of the proposed mitigation activities which could be used to identify those mitigation activities that merit more detailed assessment. One of these methods is the STAPLE/E Approach.

Using STAPLE/E criteria, mitigation activities can be evaluated quickly by steering committees in a systematic fashion. This criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation item in your community. The second chapter in FEMA's How-To Guide "Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies" as well as the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process" outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E Approach from the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process".

**Social**: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?

- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

**Technical**: The city or county public works staff, and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

**Administrative**: Elected officials or the city or county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

**Political**: Consult the mayor, city council or county planning commission, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

**Legal**: Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

**Economic**: Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?

- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

**Environmental**: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

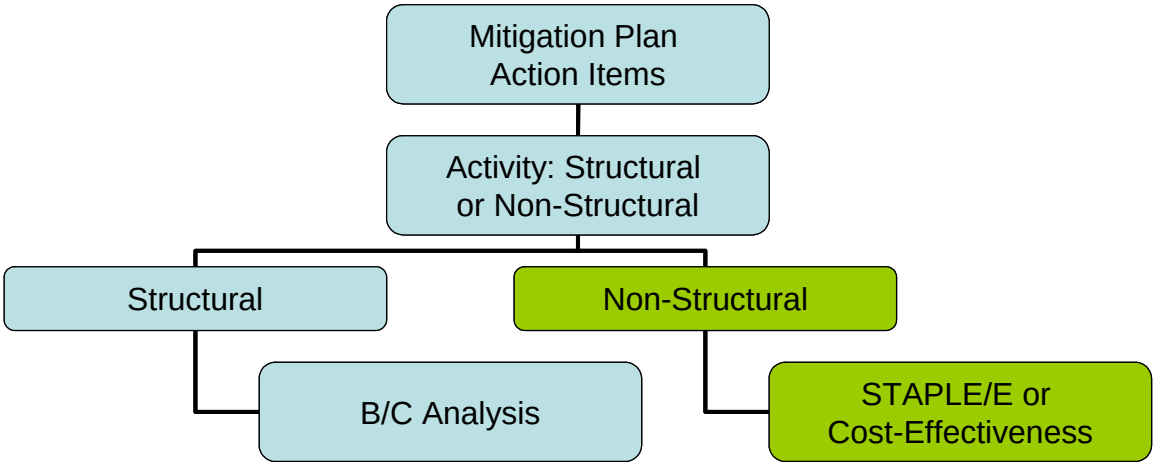
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed Benefit/Cost Analyses.

## When to use the Various Approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

**Figure A.1: Economic Analysis Flowchart**




Source: Community Service Center's Oregon Natural Hazards Workgroup at the University of Oregon, 2005

## Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating mitigation activities is outlined below. This framework should be used in further analyzing the feasibility of prioritized mitigation activities.

### 1. Identify the Activities

Activities for reducing risk from natural hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation project can assist in minimizing risk to natural hazards, but do so at varying economic costs.

### 2. Calculate the Costs and Benefits

Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate activities. Potential economic criteria to evaluate alternatives include:

- ***Determine the project cost.*** This may include initial project development costs, and repair and operating costs of maintaining projects over time.
- ***Estimate the benefits.*** Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical

durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.

- ***Consider costs and benefits to society and the environment.*** These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- ***Determine the correct discount rate.*** Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

### 3. Analyze and Rank the Activities

Once costs and benefits have been quantified, economic analysis tools can rank the possible mitigation activities. Two methods for determining the best activities given varying costs and benefits include net present value and internal rate of return.

- ***Net present value***. Net present value is the value of the expected future returns of an investment minus the value of expected future cost expressed in today's dollars. If the net present value is greater than the project costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- ***Internal Rate of Return***. Using the *internal rate of return* method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

## Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or land owners as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided
- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor's income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

### Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

### Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. Many communities are looking towards developing multi-objective projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

## Resources

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