The City of Lake Oswego, Oregon

Natural Hazards Mitigation Plan Addendum

Prepared for
FEMA Region X
130-228th Street
Bothell, WA 98021

Oregon Office of Emergency Management
595 Cottage Street NE
Salem, OR 97310

Prepared by
City of Lake Oswego
P.O. Box 369
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In Cooperation with
Clackamas County Emergency Management
2200 Kaen Road
Oregon City, OR 97045

April 8, 2010

U.S. Department of Homeland Security
Region X
130 228th Street, SW
Bothell, WA 98021-9796

FEMA

April 8, 2010

Honorable Lynn Peterson,
Chair, Board of County Commissioners
2051 Kaen Road
Oregon City, Oregon 97045

Dear Chair Peterson:

On October 19, 2007, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) approved the *Clackamas County Natural Hazards Mitigation Plan Update 2007* as a multi-jurisdictional local plan as outlined in 44 CFR Part 201. With approval of this plan, the following entities are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through October 19, 2012:

Clackamas County	**City of Canby**	**City of Damascus**
City of Estacada	**City of Gladstone**	***City of Happy Valley***
City of Johnson City	***City of Lake Oswego***	**City of Milwaukie**
City of Oregon City	**City of Sandy**	**City of West Linn**
City of Wilsonville		

The list of approved jurisdictions has been updated to include the cities of Happy Valley and Lake Oswego, which have recently adopted the *Clackamas County Natural Hazards Mitigation Plan Update 2007*. To continue eligibility the plan must be reviewed, revised as appropriate, and resubmitted within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact our State counterpart, Oregon Emergency Management, which coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

cc: Dennis Sigrist, Oregon Emergency Management

KM:bb

RESOLUTION 10-21

A RESOLUTION OF THE LAKE OSWEGO CITY COUNCIL ADOPTING THE CITY OF LAKE OSWEGO ADDENDUM TO THE CLACKAMAS COUNTY NATURAL HAZARDS MITIGATION PLAN

WHEREAS, the City of Lake Oswego is vulnerable to the human and economic costs of natural, technological and societal disasters; and

WHEREAS, the City Council of the City of Lake Oswego recognizes the importance of reducing or eliminating these vulnerabilities for the overall good and welfare of the community; and

WHEREAS, the City of Lake Oswego has participated in the development of the Clackamas County Multi-Jurisdiction Natural Hazard Mitigation Plan, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities ; and

WHEREAS, the City of Lake Oswego's representatives and staff have identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Lake Oswego to the impacts of future disasters; and

WHEREAS, these proposed projects and programs have been incorporated into the Clackamas County Multi-Jurisdiction Natural Hazard Mitigation Plan that has been prepared and promulgated for consideration and implementation by the cities of Clackamas County;

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Lake Oswego that:

Section 1. The Lake Oswego City Council hereby approves and adopts the City of Lake Oswego Natural Hazards Mitigation Plan Addendum to the Clackamas County Multi-Jurisdiction Natural Hazard Mitigation Plan, in the form attached as Exhibit A.

Section 2. Effective Date. This Resolution shall take effect upon passage.

Considered and enacted at the meeting of the City Council of the City of Lake Oswego on the 23rd day of March, 2010.

AYES: Mayor Hoffman, Johnson, Jordan, Hennagin, Olson, Tierney

NOES: none

EXCUSED: Moncrieff

ABSTAIN: none

Jack D. Hoffman, Mayor

ATTEST:

Robyn Christie, City Recorder

APPROVED AS TO FORM:

David D. Powell, City Attorney

The City of Lake Oswego
Natural Hazards Mitigation Plan Addendum

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Section 1:
Planning Process

The City of Lake Oswego Natural Hazards Mitigation Plan includes resources and information to assist City residents, public and private sector organizations, and others interested in participating in planning for natural hazards. The mitigation plan provides a list of activities that may assist the City of Lake Oswego in reducing risk and preventing loss from future natural hazard events. Lake Oswego has developed this plan as an addendum to the Clackamas County Natural Hazards Mitigation Plan in an effort to take a more regional approach to planning for natural hazard scenarios.

1.1 Development of the 2004 Addendum

In 2004, the City of Lake Oswego developed an addendum to Clackamas County's Natural Hazards Mitigation Plan. The planning process was a collaborative effort between public agencies within the City, non-profit organizations, the private sector, and regional and state organizations. A Hazard Mitigation Advisory Committee (HMAC) guided the process of developing the plan. The HMAC was comprised of the following representatives:

- Jenelle Byram, Lake Oswego Community Development – Engineering/GIS
- Carole Dickerson, Lake Oswego Public Affairs
- Dan Duncan, Lake Oswego Police
- Dennis Egner, Lake Oswego Community Development – Planning
- Larry Goff, Lake Oswego Fire
- Bob Kincaid, Lake Oswego City Manager's Office
- Jerry King, Lake Oswego Community Development – Engineering
- Jerry Knippel, Lake Oswego Maintenance/Special Projects
- Cindy Kolomechuk, Clackamas County Emergency Management
- Joel Komarek, Lake Oswego Community Development – Engineering
- Stephan Lashbrook, Lake Oswego Community Development
- Susan Millhauser, Lake Oswego Community Development – Planning
- Jim Sanders, Lake Oswego Parks

The Lake Oswego HMAC held regularly scheduled meetings to complete the planning process. Residents of the City of Lake Oswego had an opportunity to participate in County-wide public workshops designed to gain citizen input, as well as one local workshop conducted on April 6, 2003. The planning process is described in Appendix B of the Clackamas County Natural Hazards Mitigation Plan.

The City of Lake Oswego held a Natural Hazards Mitigation Plan public workshop on April 6, 2003, from 7:00 to 9:00 p.m. at City Hall. The purpose of this workshop was to engage Lake Oswego residents in the mitigation planning process. The HMAC targeted active community members such as the Community Emergency Response Teams (CERT) to ensure attendance. Workshop attendees had an opportunity to visit a variety of hazard stations to learn more about potential local hazards, and voice concerns about community vulnerabilities. At each hazard station a member of the HMAC was available to answer questions and document community input for incorporation into the Lake Oswego Natural Hazards Mitigation Plan. Additionally, at a subsequent CERT general training session,

the HMAC presented information about the mitigation planning process to members that were unable to attend.

The following special service districts and neighboring jurisdictions were given the opportunity to participate in the addendum's development and implementation:

- Alto Park Water District
- City of Lake Oswego
- City of Portland
- Clackamas Community College
- Clackamas County
- Clackamas County Vector Control
- Clackamas Education Service District
- Clean Water Services
- Dunthorpe-Riverdale Service District #1
- Glenmorrie Cooperative Association
- Lake Grove Fire District 57
- Lake Grove Park District
- Lake Grove Water District
- Lake Oswego Corporation
- Lake Oswego School District 7J
- Lake Oswego Urban Renewal District
- Metro Service District 2
- Multnomah County
- Palatine Hill Water District #26
- Port of Portland
- Portland Community College
- Portland School District 1J
- Rivergrove Water District #14
- Riverdale-Dunthorpe Fire District JT-11
- Riverdale School District 51J
- Skylands Water Company
- Southwood Park Water District #21
- Tigard-Tualatin School District 23J
- TriMet
- Tualatin Valley Fire and Rescue
- Washington County
- Water Environment Service District
- West Linn-Wilsonville School District 3J

The plan was presented to the City Council in a study session on April 13, 2004 and approved by City Council to be submitted to FEMA on April 20, 2004. The final version of the addendum was formally adopted by City Council on August 3, 2004. After the addendum was adopted, the Lake Oswego Fire Department brought copies of the NHMP to various public presentations to inform the public of the addendum's existence and purpose. Additional copies were made available at City Hall, as well as the City's website and Clackamas County Emergency Management's website.

The HMAC met in 2005 to discuss the development of a Pre-Disaster Mitigation grant that would fund seismic upgrades to City Hall. The HMAC applied for and received the grant, in the amount of $187,500.[i]

1.2 2009 Plan Update

In the fall of 2007, the Oregon Partnership for Disaster Resilience (OPDR / the Partnership) at the University of Oregon's Community Service Center partnered with Oregon Emergency Management, Resource Assistance for Rural Environments (RARE), Clackamas County, and cities within Clackamas County to develop a Hazard Mitigation Grant Program (HMGP) planning grant proposal. The City of Lake Oswego joined the Partnership by signing a memorandum of understanding for this project. FEMA awarded the Partnership with a grant to support the development and update of city addenda in Clackamas County, and Lake Oswego's local planning efforts began in March, 2009. RARE provided a staff person ('RARE Participant') to facilitate and document the City's addendum development process.

Who Participated in Developing the Plan?

From March through May, 2009 Clackamas County Emergency Management and the RARE Participant worked with the City of Lake Oswego to facilitate and document the five-year update of Lake Oswego's Addendum to the Clackamas County Natural Hazards Mitigation Plan. The RARE Participant, in partnership with Clackamas County Emergency Management, facilitated and documented the plan update process. The HMAC was comprised of two representatives from the 2004 plan's development:

- Dan Duncan, Lake Oswego Police Department
- Larry Goff, Lake Oswego Fire Department

New HMAC members include:

- Rob Amsberry, City of Lake Oswego Engineering Division
- Leslie Hamilton, Lake Oswego Planning Department
- Bonnie Hirshberger, Lake Oswego Public Affairs Department
- Laurel Reimer, Clackamas County Emergency Management/RARE
- Brad Stein, City of Lake Oswego City Manager's Office
- Ed Wilson, Lake Oswego Fire Department
- Jay Wilson, Clackamas County Emergency Management

Plan Update Process

The RARE Participant and Clackamas County Emergency Management developed and facilitated two plan update meetings with the Hazard Mitigation Advisory Committee on March 17 and May 11, 2009. Minutes from both plan update meetings can be found in Appendix A of this plan.

March 17, 2009: the RARE Participant facilitated a meeting with Lake Oswego's HMAC to discuss the reasons and benefits of having a natural hazards mitigation plan. Additionally, the HMAC discussed updates to the plan's maintenance strategy and risk assessment, as well as the plan's mission and goals. Lastly, the group discussed updates to each of the natural hazard sections within the plan, and reviewed and updated the City's list of community assets.

May 11, 2009**:** the RARE Participant facilitated a final meeting with the HMAC to discuss the following: 1) the plan's maintenance and formal review processes; 2) the status of the plan's mitigation actions; and 3) the incorporation of new mitigation actions that addressed vulnerabilities identified in the March 17, 2009 meeting.

Changes by Section

Section 1: Planning Process

Development of the 2004 Addendum

This section was added to differentiate between the 2004 and current plan development processes.

What are the Plan's Mission and Goals?

During the County's 2007 plan update process, the County goals changed slightly to include an action word in each goal statement. The City of Lake Oswego has chosen to adopt the same mission and goals as the County. As such, the City's mission and goals have been altered to reflect the slight change in the County's goals.

How Will the Plan be Implemented, Monitored, and Evaluated?

Sets of bullet points were added to describe the duties of the coordinating body and convener in more detail.

Economic Analysis of Mitigation Projects

This section was removed from the plan because this information is now detailed in Section 5.

Formal Review Process

The section was subdivided into two sections: semi-annual meetings and the five year update. The HMAC will now meet semi-annually instead of quarterly. The plan will be formally reviewed once every five years and the HMAC will follow the County's plan update schedule in accordance with the Disaster Mitigation Act of 2000. The update process will now begin one year before the plan is due. The general tasks stated in the formal review process remain the same, and the HMAC added some additional information to better facilitate future five-year plan update processes.

Continued Public Involvement

The HMAC decided that holding annual public meetings did not serve the plan's best interests or needs. Instead, the HMAC will hold public meetings when necessary, such as after a natural disaster event, or during five-year plan update processes. All other public involvement strategies remain the same.

A section titled *What are the Mitigation Strategies Identified by Lake Oswego* was removed because the committee felt its location would be better suited in Section 5: Mitigation Planning Priority System.

Section 2: Community Profile

The Community Profile was updated to reflect the most recent data available. Figure 2-1, "Understanding Risk" was added at the introduction to the community profile. Tables 2-1 and 2-2 were updated to include 2008 population information, and Table 2-3 Population by Race was added to the 2.3 Population and Demographics subsection. Table 2-5 Housing Units by Structure Type was added to the "Housing and Community Development" subsection. The following tables and sections were updated with information from the 2006-2008 American Community Survey:

- Household income information in the "Population and Demographics" subsection
- Table 2-4 Housing - Lake Oswego compared to Clackamas County
- Table 2-6 Occupations of Employed Civilians Aged 16 and Over in the "Employment and Industry" subsection
- Transportation and Commuting Patterns section

Additionally, the plan now includes sub-sections that list Historic and Cultural Resources, Government Structure, and Existing Plans and Policies. The purpose of these additions is to identify important community assets and to begin identifying processes by which mitigation requirements can be incorporated into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.

Section 3: Hazard Assessment

The subsection entitled "Federal Criteria for Hazard Assessment" was removed. The HMAC felt this section did not add to the plan in any meaningful way.

The HMAC reviewed and updated the list of community assets. All fire stations are now listed under "critical facilities." Schools are listed under "essential facilities" and the subtitle "all City facilities" was added to help organize the assets. The Willamette Shore Trolley and Portland & Western Railroad were added under "critical infrastructure."

The table detailing land area and community assets exposed to each hazard no longer includes the area exposed to each hazard. The layout has changed and the table now includes environmental assets.

Section 4: Natural Hazards

Tables detailing the total acres, number of structures, and value of land and buildings affected by each hazard were removed from each hazard subsection because the committee felt the method used to gather and display the data was subjective. Additionally, the value of land and structures can change dramatically between plan updates, meaning the numbers in the plan may not be truly representative of current City conditions. Instead, the plan now lists the community assets affected by each hazard, as this information is most relevant for the purposes of identifying mitigation strategies.

Updated hazard sections now include documentation of hazard events that occurred between 2004 and 2009, including damages and mitigation efforts that resulted. Hazard histories did not change for wildfire, earthquake, or volcano but all other hazards have new historical information. New mitigation efforts were identified for all hazards except volcano. Additionally, each hazard section now includes probability and vulnerability estimates as compared to the Clackamas County Natural Hazards Mitigation Plan.

Many of the City's 2004 mitigation strategies have not yet been completed and are still included in the plan. For all actions that have been deferred, the HMAC made minor changes, if any (e.g., changes to coordinating organization, timeline, or ideas for implementation). Deferred actions were not completed due to lack of staff resources and/or time. Each action now has a 'status' description as well. Two multi-hazard action items were completed and moved to the 'existing mitigation strategies' portions of Section 4 below. The following action items were added to the 2009 addendum: ST-MH#5, ST-MH#6, LT-MH#2, LT-MH#3, ST-FL#1, and ST-WF#1.

Four action items were removed from the plan. Two actions were removed because they focused on preparedness, response, and recovery. Since these actions were not focused on mitigation, the HMAC decided to remove them from the natural hazards mitigation plan. Another action item was removed because it dealt with repetitive loss flood properties. Lake Oswego has no repetitive flood loss properties, so this action item was not applicable. Another action item called for researching and implementing a wildfire early warning detection system. These systems were researched and it was determined a

warning system was not practical at this time. Currently, CodeRED (reverse 9-1-1 system) can be used to contact citizens for early warning.

Section 5: Mitigation Planning Priority System

The mitigation planning priority system was changed to reflect the group's desire to review action items during semi-annual meetings, rather than ranking the action items at this time. The previous system required the group to rank action items when updating the addendum using hazard priority, plan goals addressed, and criticality of need, number of population served, and likelihood of success as ranking criteria. The group determined this system was confusing and unlikely to produce an action item ranking that truly reflects the group's intentions. The new system allows the group to evaluate action items based on current conditions and resources.

1.3 Multi-Jurisdictional Planning Effort

The City of Lake Oswego is dedicated to taking a regional approach to planning for natural hazards. The City of Lake Oswego has representation on the Clackamas County Hazard Mitigation Advisory Committee to ensure that the City's interests are represented in the larger scale planning effort. The City will partner with the County in implementation of appropriate action items, and will work with other jurisdictions and public and private entities to reduce losses from future natural hazards.

1.4 What is the Plan Mission?

The City of Lake Oswego concurs with the mission statement developed during the Clackamas County planning process:

The mission of the Clackamas County Natural Hazards Mitigation Plan is: "To promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the County towards building a safer, more sustainable community."

1.5 What are the Plan Goals?

The City of Lake Oswego agrees with the goals developed during the Clackamas County planning process, and has slightly revised the emergency services section to include the Community Emergency Response Team (CERT).

Protect Life and Property

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

Promote Public Awareness

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Enhance Natural Systems

- Balance watershed planning, natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

Encourage Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

Augment Emergency Services

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, citizen emergency response teams, non-profit organizations, business, and industry.
- Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

1.6 How Will the Plan be Implemented, Monitored, and Evaluated?

The plan maintenance process includes a schedule for implementing, monitoring, evaluating, and reviewing this plan addendum. It is essential to have this process to ensure plan sustainability.

Plan Adoption

The Lake Oswego City Council will be responsible for adopting the multi-jurisdictional Clackamas County Natural Hazards Mitigation Plan and the Lake Oswego Addendum. This governing body has the authority to promote sound public policy regarding natural hazards.

Coordinating Body

The Lake Oswego Hazard Mitigation Advisory Committee (HMAC) will serve as the coordinating body for Lake Oswego's Natural Hazards Mitigation Plan. The City Manager's Office will assign additional representatives to the HMAC as needed. Roles and responsibilities of the coordinating body include:

- Serving as the local evaluation committee for funding programs such as the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program, and Flood Mitigation Assistance Program;

- Prioritizing and recommending funding for natural hazard risk reduction projects;
- Encouraging stakeholders and relevant hazard mitigation organizations and agencies to implement and/or report on implementation of the plan's identified action items;
- Evaluating and updating the Natural Hazards Mitigation Plan following a disaster;
- Evaluating and updating the Natural Hazards Mitigation Plan in accordance with the prescribed maintenance schedule; and
- Developing and coordinating ad hoc and/or standing subcommittees. The HMAC will engage relevant organizations, agencies, and/or neighboring communities as technical advisers in hazard mitigation as needed.

Convener

The City Manager's Office will serve as the plan's convener. Roles and responsibilities of the convener include:

- Coordinating natural hazards mitigation plan meeting dates, times, locations, agendas, and member notification;
- Facilitating and documenting semi-annual natural hazards mitigation plan meetings;
- Serving as a communication conduit between the coordinating body and the public and/or key plan stakeholders;
- Identifying emergency management-related funding sources for natural hazard mitigation projects;
- Facilitating the incorporation, maintenance, and update of the City's natural hazard risk GIS data elements;
- Utilizing the risk assessments as a tool for prioritizing proposed natural hazard risk reduction projects; and
- Facilitating and documenting the plan's five-year update.

Implementation through Existing Programs

This plan is strategic and non-regulatory in nature, meaning it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the City; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other City plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, Building Codes, as well as the Clackamas County Natural Hazards Mitigation Plan, and the State of Oregon Natural Hazards Mitigation Plan. The mitigation actions described in Section 4 below are intended to be implemented through existing plans and programs within the City. Implementation opportunities are further defined in action items (see Sections 4 and 5) when applicable. Likewise, successful implementation is documented within the "existing mitigation strategies" for each hazard chapter of Section 4, when applicable.

Formal Review Process

Plan maintenance is a critical component of the natural hazards mitigation plan addendum. Proper maintenance of the plan ensures that this plan will maximize the City's efforts to reduce the risks posed by natural hazards. This section includes a process to ensure that regular review and update of the plan occurs. The City Manager's Office and HMAC are responsible for implementing this process.

Semi-Annual Meetings

The HMAC will meet on a semi-annual basis in the spring and fall of each year to review, implement and update information in the addendum. During the first meeting of each year, the HMAC will:

- Document hazard events that occurred in the previous fall and winter months;
- Prepare public education pieces for the upcoming spring and summer month hazards;
- Discuss funding opportunities for the implementation of mitigation strategies;
- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general; and
- Identify issues that may not have been identified when the plan was developed.

During the second meeting of each year, the HMAC will:

- Document hazard events that occurred in the previous spring and summer months;
- Prepare public education pieces for the upcoming fall and winter month hazards;
- Review existing and new risk assessment data, and incorporate this information into the plan;
- Document success in implementing mitigation actions and/or applying for funding;
- Discuss the addition and/or subtraction of mitigation actions from the plan;
- Discuss methods for continued public involvement;
- Document successes and lessons learned during the year; and
- Generate a list of members that should be included in future meetings.

The City Manager's Office will be responsible for organizing, facilitating, and documenting the outcomes of semi-annual meetings.

Five-Year Review of Plan

Local mitigation plans must be updated and resubmitted to the Federal Emergency Management Agency (FEMA) for approval every five years in order to maintain eligibility for federal hazard mitigation assistance programs. Plan updates must demonstrate that progress has been made in the past five years for local mitigation plans to fulfill commitments outlined in the previously approved plan.

This plan will be updated every five years in accordance with the Disaster Mitigation Act of 2000. Because this is an addendum to the Clackamas County Natural Hazards Mitigation Plan, the addendum must be updated in conjunction with the County's five-year plan update schedule. As such, Lake Oswego must update this addendum by September 2012 (and then again five years thereafter). Sufficient time should be allocated for plan update activities and FEMA review, meaning the City should begin the plan update process by September 2011. Additional time will be needed if the City intends to pursue application for mitigation planning grants, and/or contracting for technical or professional services.

During the five-year plan update process, the City must review and revise its plan to reflect changes in development, progress in mitigation efforts, and changes in priorities. The following questions should help the HMAC in determining how the mitigation plan should be updated (i.e., questions must be addressed in the plan update):

- Have public involvement activities taken place since the plan was adopted?

- Are the plan goals still relevant?
- Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?
- Are there new hazards that should be addressed?
- Have there been hazard events in the community since the plan was adopted?
- Have new studies or previous events identified changes in any hazard's location or extent?
- Has vulnerability to any hazard changed?
- Have development patterns changed? Is there more development in hazard prone areas?
- Do future annexations include hazard prone areas?
- Did the plan identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?
- Are there new high risk populations?
- Did the plan document and/or address National Flood Insurance Program repetitive loss properties?
- Is there an action item dealing with continued compliance with the National Flood Insurance Program?
- Did the plan identify data limitations?
- Did the plan identify potential dollar losses for vulnerable structures?
- What is the status of each mitigation action?
- Are there completed mitigation actions that have decreased overall vulnerability?
- Are there new action items that should be added?
- Are changes to the action item prioritization, implementation, and/or administration processes needed?
- Do changes need to be made to the five year update schedule?

The City Manager's Office will be responsible for organizing the HMAC to address plan update needs. The HMAC will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements.

Continued Public Involvement & Participation

The City of Lake Oswego is dedicated to involving the public in the review and ongoing development of the Natural Hazards Mitigation Plan. During the addendum development process, OPDR's website (www.OregonShowcase.org) served as an outreach tool to the community. OPDR's website was used to provide local contact information and updates on the planning process. Additionally, drafts of Lake Oswego's addendum were posted on OPDR's website to facilitate HMAC review. Once the HMAC created a final draft of the addendum, the City announced the HMAC plan and requested comments from the public (see outreach language below). The City used several means to request public comments including announcements in the November Hello LO newsletter which is distributed to all households in Lake Oswego; in the October 22 and November 12 LO Down, an electronic newsletter that is emailed to over 6,000 people; in the Lake Oswego Review; on the City's main website; emails to CERT and ARES members; and direct discussion with Lake Corporation and the Lake Oswego School District. The public could link to a draft of the plan to review and provide comments to the City for incorporation into the final addendum. Several comments regarding the risk assessment and mitigation strategy were received and considered in the final version of the addendum.

The City encourages citizens to review and provide comments on Lake Oswego's Natural Hazards Mitigation Plan update. The plan, available at www.ci.oswego.or.us/fire/emerman.htm, includes resources and information to assist City residents, public and private sector organizations, and others interested in participating in planning for natural hazards. In addition, the plan provides a list of activities that may assist the City in reducing risk and preventing loss from future natural hazard events. For questions or to provide feedback, please contact Brad Stein, City of Lake Oswego Management Analyst, at bstein@ci.oswego.or.us or 503-697-7415 before November 13. Once updated, the Plan will be submitted to FEMA for approval.

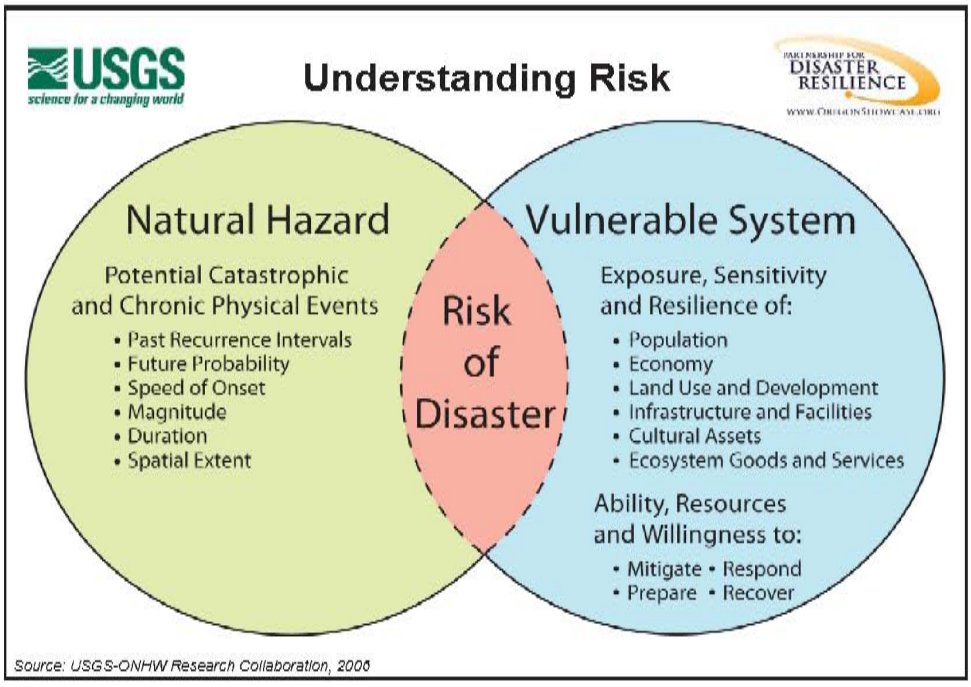
The City of Lake Oswego will ensure continued public input and involvement over the next five years. The public will have the opportunity to provide feedback on the plan though a variety of forums. The City's monthly printed newsletter, Hello LO, electronic newsletter (LO Down), and website will be used to share information about the plan and subsequent updates, along with contact information to facilitate public feedback. The plan will be posted on the City's website at <http://www.ci.oswego.or.us/fire/emerman.htm> and on the County's emergency management website at <http://www.clackamas.us/emergency/publications.html>. Additionally, copies will be made available at the Lake Oswego Library on CD-ROM for check-out. Copies of the plan will also be distributed to appropriate City agencies, boards, and commissions, HMAC members, and City Council members. The City Manager's Office will continue to advertise the plan at all public events. The final adopted and approved plan will be posted on the University of Oregon Libraries' Scholar's Bank Digital Archive.

A public meeting will also be held when deemed necessary by the HMAC, such as after a natural disaster. The meetings will provide the public with a forum through which they can express concerns, opinions, or ideas about the plan. The HMAC will be responsible for advertising the public meetings and maintaining public involvement through the webpage and Hello LO.

Section 2:
Community Profile

The following section describes the City of Lake Oswego from a number of perspectives in order to help define and understand the City's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the hazard assessments located in Section 3: Hazard Assessment should be used as the local level rationale for the City's mitigation strategies. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 2-1 below.

Figure 2-1: Understanding Risk[ii]



2.1 Geography and the Environment

The City of Lake Oswego covers an area of about 11 square miles in the northwestern corner of Clackamas County, and lies in the eastern portion of the Tualatin Valley. There are three major drainage basins within Lake Oswego's Urban Services Boundary: Oswego Lake, the Tualatin River, and the Willamette River. Lake Oswego has a complex geography with many steep, wooded hillsides and streams that flow from the higher areas into the Tualatin River, Oswego Lake and the Willamette River. Oswego Lake is the City's largest physical feature and its geographic center. The Willamette River forms the eastern boundary of the City, and the Tualatin River is located to the south.

Major Rivers and Water Bodies

Oswego Lake

Oswego Lake is three and a half miles long, with the main portion covering 385 acres, and an additional seven acres in West Bay and 28 acres in Lakewood Bay. The Lake is a reservoir, and is privately owned and managed by the Lake Oswego Corporation, commonly known as The Lake Corporation. The Lake Corporation has owned and maintained the Lake since 1942. Rolling hills, steep hillsides, and rocky bluffs surround Oswego Lake, with elevations ranging from 98 feet on the Lake to 970 feet on Mt. Sylvania to the north. The surrounding hills are bisected by many streams that direct surface water into Oswego Lake, the most notable of which is Springbrook Creek.

Before the pioneer settlement period in the 1860s, Oswego Lake was a natural, smaller body of water, fed by streams and springs. It was called Waluga Lake by the Clackamas Indians, meaning "wild swan". Early settlers called it "Sucker Lake" for a type of whitefish that may have dwelled in its warm waters. The lake was renamed "Oswego Lake", after the turn of the century, by the owner of the Oregon Iron & Steel Company, to promote surrounding residential real estate development as a supplement to the lake's primary use as a reservoir.[iii]

The lake has commercial and industrial functions important to the culture of the community. The Oswego Canal was dug between the lake and the Tualatin River to increase water flow and raise the reservoir's level. The lake was used for a short time on a trial basis to transport people and goods between the Willamette and Tualatin Rivers, via ferry boat across the lake and horse drawn railroad cars along the canal's bank. Lake waters that flow into Oswego Creek were used to operate the Durham sawmill when Oswego was first settled. Much more significantly, the increased flow was used to operate first iron and then steel foundries operated by Oregon Iron & Steel Company. A hydroelectric power generating plant was built on Oswego Creek in 1909, and the Lake Corporation continues to operate this plant today, selling surplus power to PGE. A spillover dam was completed in 1921 that raised the lake and greatly increased its size, creating Blue Heron Bay and West Bay on the west end of the lake, and Lakewood Bay on the east end.[iv]

There are a few remaining undeveloped natural areas surrounding the lake at the mouths of streams, and forested areas on steep slopes. A few natural riparian areas and small pockets of wetlands remain along the streams which enter the lake. These natural edges are important for wildlife nesting, food, and shelter. The remaining forest is typically Douglas Fir on the north-facing slopes, and Oak/Madrone and Fir on the south-facing rocky bluffs. These remaining forested areas provide perch sites for birds of prey such as osprey and heron.

The lake is also an important habitat for resident and migratory waterfowl including dabblers, diving ducks, Canada geese, and great blue heron. Fish species in the lake include bass, catfish, bluegill, carp, crappie, and yellow ring tail perch.[v]

In addition to its natural resource values, Oswego Lake is a multiple-use facility that serves the community in a variety of roles. It is a hydroelectric reservoir at the center of a 7,400 acre drainage basin. The lake receives the majority of its water from streams, storm drain outfalls, and surface runoff. Also, there is a City sanitary sewer interceptor below

the lake's normal surface water elevation that has been constructed at an engineered grade to convey sewage to the Tryon Creek Sewage Treatment Plant.[vi]

The lake offers shoreline recreation opportunities to specific residents at the Lake Grove Swim Park and the Lake Oswego Swim Park. A City park at Lakewood Bay offers visual access, but not physical access, to the lake. Oswego Lake is heavily used for water-related recreation by lakeside residents and others with lake easements recognized by the Lake Corporation. The lake is also valued by residents for its open space and aesthetic aspects, and for its historical and cultural importance. Residents consider the lake to be a vital part of Lake Oswego's identity, and a valuable natural resource.[vii]

Tualatin River

The Tualatin River is a tributary to the Willamette River Watershed, entering the Willamette River at river mile 28.5. The Tualatin River drainage basin is approximately 43 miles long and 29 miles wide and covers an area of 712 square miles.[viii] Annually, more than 1.1 million acre-feet of water flow out of the Tualatin River Watershed into the Willamette River. Nearly 85 percent of this flow is discharged from November through March, and less than three percent typically is discharged from June through October.[ix]

The Tualatin River Watershed is a low elevation, low gradient drainage area. Mountains form the perimeter, separating it from the Pacific Ocean to the west. The Tualatin River headwaters originate in the Coast Range and tributaries flow from the Tualatin Mountains, a spur of the Coast Range rising up to 1,000 feet. These hills form a barrier to the valley on the north and east. The southern rim is formed by the Chehalem and Parrett Mountains (1,630 and 1,240 feet maximum elevations, respectively). After dropping about 2,700 feet over its first 14 miles, the river meanders through the rest of its 83 mile route.[x]

Nearly half the watershed is a broad alluvial valley where elevations are between 100 and 200 feet. There are only four low notches in the wall of mountains around the Tualatin River basin. The Tualatin River drains into the Willamette River through a steep, walled canyon, falling about 50 feet over its last three miles beyond the dam at Lake Oswego. The other notches are found at Wapato Lake, Fields Bridge which is the mouth of the Tualatin, Oswego Notch, and at Tonquin. Through these low spots, prehistoric floods filled the Tualatin River basin with approximately 500 feet of water. Scabland channels from these floods can still be seen at Tonquin.[xi]

Willamette River

A description of the Willamette River basin is provided in the Community Profile found on page 2-2 in the Clackamas County Natural Hazards Mitigation Plan. As such, the information will not be repeated here.

2.2 Climate

Lake Oswego is located in the northwestern portion of Clackamas County. Temperatures, measured at an elevation of 100' range from a monthly average low of 35°F in the winter months to a high of 82°F in the summer months. The coldest month is January and the hottest month is August. Historically, the wettest month is December and the driest month is July. The average annual precipitation is 47 inches.[xii]

2.3 Population and Demographics

Lake Oswego is the largest city in Clackamas County, with a 2008 population estimate of 38,835.[xiii] Between 1990 and 2008, the population of Lake Oswego increased by about 27%. Disaster impacts in terms of loss and the ability to recover vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. A small portion of Lake Oswego's population falls into these categories. According to the 2006-2008 American Community Survey, the median age in Lake Oswego was 42.1 years, with 22.5% of the population 17 years or younger, and 13.4% of the population 65 years and older.[xiv]

Table 2-1. City of Lake Oswego Population[xv]

Year	1990	2000	2008
Population	30,570	35,278	38,835

Table 2-2. Community Age Groups[xvi]

	2000	2008
Under 5 years	1,746	1,692
5-19 years	7,660	7,750
20-44 years	10,911	11,246
45-64 years	10,943	12,813
65+ years	4,018	5,202
Median Age	41.2	42.1

The majority of Lake Oswego's residents are white, with Asian being the largest minority population, as detailed in Table 2-3

Table 2-3. Population by Race[xvii]

Race	Number	Percent
White	34,700	96.5
Asian	2,022	5.2
Two or More Races	1,352	3.5
Hispanic or Latino	1,177	3.0
Other Race	436	1.1
Black	191	0.5
American Indian and Alaska Native	107	0.3

The 2006 to 2008 American Community Survey found 4.3% of Lake Oswego families had an income below the poverty level, while median household income was $83,486. This is $31,311 above the estimated national median household income of $52,175 and $22,161 above the Clackamas County average of $61,325.[xviii] Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

2.4 Land and Development

Land use planning involves the consideration and balancing of many different factors and issues to make the best decisions for the community both for the short and long-term. The

goals and policies of the Lake Oswego Comprehensive Plan (1994) are intended to guide the community in making these decisions. The plan is intended for use by all those that engage in the City's development including: local officials; persons with development interests; state, regional, and federal agencies; neighborhood and community groups; and citizens of all interests. Lake Oswego's quality of life and unique character depends, to a great extent, upon the character of development and the City's ability to provide needed and desired services. The Comprehensive Plan and implementing regulations are important tools to accomplish these objectives.

The following broad policy issues are addressed by the Land Use Planning element of the Comprehensive Plan:

- All development shall conform to applicable land use regulations and City codes;
- All development shall be adequately served by the full range of public facilities and services;
- Development shall occur at densities appropriate to the scale and character of Lake Oswego's neighborhoods and shall provide for preservation of open spaces and natural resources; and
- City-wide, natural resources shall be protected and open space shall be provided concurrent with development.

2.5 Housing and Community Development

Lake Oswego is considered one of the finest residential areas in Oregon. Unlike some communities its size, Lake Oswego offers full-service police and fire protection, a nationally recognized library, and an award-winning senior center. It also provides planning and zoning regulation, building inspection and regulation, street maintenance and improvement, and water, sewer, and surface water services. The schools in the City rate among the best in the County, with more than 80% of high school students going on to attend college.[xix]

Between 1970 and 2000, there was more than a threefold increase in the number of housing units built in Lake Oswego. In 2008, the estimated median value of owner-occupied housing was $540,000, nearly $200,000 higher than the Clackamas County median value of $342,000 (Table 2-4).[xx]

Table 2-4. Housing – Lake Oswego Compared to Clackamas County[xxi]

Total Housing Units	1970	1980	1990	2000	2008 estimate	Median Value of Owner-Occupied Housing, 2008
Lake Oswego	5,113	8,715	13,123	15,668	16,950	$540,000
Clackamas County	49,159	84,424	109,003	136,954	151,334	$342,000

The 2006-2008 American Community Survey estimates there are 16,950 housing units in Lake Oswego. Of these, 15,667 housing units are occupied and 1,283 housing units are vacant. The survey estimates 11,591 units are owner-occupied and 4,076 are renter-occupied, with a 7.6% vacancy rate.[xxii]

Housing type and year-built dates are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile

homes, for example, are generally more prone to wind and water damage than standard wood frame 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 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.

Fortunately, 73.3% of the housing stock in Lake Oswego was built after 1970 and the vast majority of housing is wood-frame construction. Single family homes comprise 70%, while multi-family homes make up 29% of housing. Mobile homes make up only 0.1% of housing (Table 2-5.).

Table 2-5. Housing Units by Structure Type[xxiii]

Units in Structure	Number	Percent
Singe family detached	10,443	61.6
Single family attached	1,516	8.9
Multi-family	4,968	29.0
Mobile Home	23	0.1

2.6 Employment and Industry

Lake Oswego is primarily a residential community, but there is some commercial development and light manufacturing. The City's five largest employers include the Lake Oswego School District, City of Lake Oswego, Waggener Edstrom, Inc., Stanford's Restaurant, and Micro Systems Engineering, Inc.[xxiv] Most of the City's businesses are located downtown near the Willamette River on the City's eastern boundary, or on the west end in Lake Grove near Interstate 5. Tables 2-6 and 2-7 identify the employment and industry figures for Lake Oswego residents.

Table 2-6. Occupations of Employed Civilians Aged 16 Years and Over[xxv]

Occupation	Total	Percent
Management, professional, and related occupations	11,676	58.7
Sales and office occupations	4,632	23.3
Service occupations	2,117	10.6
Production, transportation, and material moving occupations	1,016	5.1
Constructions, extractions, maintenance, and repair occupations	401	2.0
Farming, fishing, and forestry occupations	58	0.3

Table 2-7. Industry of Employed Civilians Aged 16 Years and Over[xxvi]

Industry	Number	Percent
Educational, health and social services	5,028	25.3
Professional, scientific, management, administrative, and waste management services	3,254	16.4
Finance, insurance, real estate, and rental and leasing	2,551	12.8
Arts, entertainment, recreation, accommodation and food services	1,801	9.0
Manufacturing	1,760	8.8
Retail trade	1,582	7.9
Other services (except public administration)	864	4.3
Public administration	632	3.2
Information	587	2.9
Wholesale trade	583	2.9
Transportation and warehousing, and utilities	579	2.9
Construction	576	2.9
Agriculture, forestry, fishing and hunting, and mining	105	0.5

2.7 Transportation and Commuting Patterns

Lake Oswego is served by a mixture of municipal road systems, county roads, state and federal highways, and regional public transportation. Interstate 5 to the west of Lake Oswego and State Highway 43 at the east end of the City provide regional access to and from the City. TriMet provides local and regional bus service. The Portland and Western Railroad passes through the City, serving local and regional industry. The Willamette Shore Trolley travels between Lake Oswego and Portland, to the north, providing recreational and sightseeing opportunities.

Transportation is an important consideration when planning for emergency service provisions. Growth within the City will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. How people travel to work is indicative of the prevalence of single occupancy vehicle travel, and can help predict the amount of traffic congestion and the potential for accidents. According to the 2006-2008 American Community Survey, 78% of Lake Oswego residents (16 years old and over) drove to work alone, 6.0% carpooled, 3.6% used public transit, 2.0% walked, 1% bicycled, and less than 1% commuted by other means. An estimated 8.6% of residents work from home.

2.8 Historic & Cultural Resources

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

Conway House	Worthington House	Sacred Heart School
Johnson Barn	Mulder House	Warren House
Smith House	Parelius House	Brown-Vose House
Collard House	Jantzen Estate	Vose House

Carl House	Larson House	Platts House
Tug Masters House	Waldorf House	Rosentreter House
Carman House	F. Davidson House	Murphy Company Building
Drew House	Lueg House	Christie School
Van Houten House	Eastman House	Pioneer Cemetery
Laidlaw House	Sundeleaf House	St. Catherine's Dormitory
Shepard House	McCall House	Flavia Hall
White House	Angler's Club	Aquinas Hall
Odd Fellows Hall	Carter House	Education Hall
Twinings House	Rogers Building I and II	Iron Furnace Chimney
Erickson House	Bickner Building	Tualatin-Oswego Canal
Clara Weinstein House	Lakewood School	Marylhurst Cemetery/Alter
McWaters House	Hofer House	Bryant Home Marker
Davidson House	Harris House	Old Mine Trail
Lake Oswego Hunt Club	Parron House	Marylhurst Administration Building
Klose House	Allen House I and II	Methodist Episcopal Church
Black House	Cleary House	Lake Oswego Country Club
Log Hoist	Worker's Cottage	
Peg Tree	Rogers House	

2.9 Government Structure

The Lake Oswego City Charter establishes a Council-Manager form of government, which vests policy authority in a volunteer City Council, and administrative authority for day-to-day operations in an appointed, professional City Manager. The Lake Oswego City Council consists of a Mayor and six Councilors who serve four-year terms. At least three Council positions are up for election every two years. Councilors are elected at-large. The three candidates who receive the highest number of votes are elected to the vacant seats. The Council meets regularly on the first and third Tuesdays of each month at City Hall. The agenda of each meeting includes time for citizen comment.[xxvii]

The City of Lake Oswego currently has the following departments which have a role in natural hazard mitigation:[xxviii]

Building is responsible for plan review and inspections on commercial, industrial and residential developments, as well as fire life and safety plan review.

Engineering manages the design and construction of the City's infrastructure, including surface water, water, wastewater collection, and transportation. In addition, the Engineering Division provides technical support for the Willamette Shore Trolley, oversees the Water Treatment Plant, and provides GIS mapping services.

Fire provides emergency response to more than 50,000 citizens within the City of Lake Oswego and three adjoining contract districts. Emergency services include fire suppression, emergency medical response, hospital ambulance transportation, water & dive rescue operations, hazardous materials incidents, and disaster response. Non-emergency services include fire prevention and inspection services, code enforcement, public safety education services/CPR training, fire extinguisher use, residential safety

surveys, home fire escape planning, emergency and disaster preparedness planning and training for citizens (CERT), and fire and life safety education in Lake Oswego schools.

Maintenance Services provides many of the basic urban services to the citizens of Lake Oswego, including water sanitary sewer and storm drainage systems, and their maintenance and repair. The Department is also responsible for streets.

Planning is responsible for all long range and current planning for new development, as well as the City's natural resource, geologic hazard and floodplain overlay zones. It is also responsible for implementation of the Comprehensive Plan.

Police is a full service law enforcement organization dedicated to the citizens of the City of Lake Oswego. The Department is made up of 43 sworn officers and 30 non-sworn personnel.

2.10 Existing Plans & Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Such existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.[xxix]

Lake Oswego's Addendum to the Clackamas County Natural Hazards Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the City's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the City's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the City's resources.

The following are the plans and policies already in place in Lake Oswego:

Plan: Lake Oswego Comprehensive Plan
Date of Last Revision: September 21, 1999
Author/Owner: City of Lake Oswego
Description: The Comprehensive Plan guides the community in making short and long-term land use decisions for the City.
Relation to Natural Hazards:

- Goal 5: Open Spaces, Historic & Natural Areas
- Goal 6: Air, Water & Land Resources Quality
- Goal 7: Areas Subject to Natural Disasters & Hazards
- Goal 11: Public Facilities & Services
- Goal 12: Transportation
- Goal 15: Willamette River Greenway

Plan: Lake Oswego Community Development Code and City Code
Date of Last Revision: April, 2009
Author/Owner: City of Lake Oswego
Description: The Community Development Code provides the principal means for the implementation of the Comprehensive Plan.

Relation to Natural Hazards:

- Community Development Code, Article 50.16 Sensitive Lands Overlay District
- Community Development Code, Article 50.40 Drainage Standard for Ministerial and Minor Development
- Community Development Code, Article 50.41 Drainage Standard for Major Development
- Community Development Code, Article 50.42 Weak Foundation Soils
- Community Development Code, Article 50.43 Hillside Protection
- Community Development Code, Article 50.44 Flood Management Area
- Community Development Code, Article 50.45 Building Design
- Lake Oswego Code, Chapter 38 Utility Code (Sewer, Water and Surface Water Management)
- Lake Oswego Code, Chapter 52 Erosion Control
- Lake Oswego Code, Chapter 55 Trees

Plan: Lake Oswego Building Code
Date of Last Revision: June 6, 2006
Author/Owner: City of Lake Oswego
Description: The purpose of the Building Code is to set minimum regulations on development and construction activities within the City.
Relation to Natural Hazard Mitigation:

- Article 45.09 Various Codes – adopts a number of Oregon State Codes
- Article 45.16 Earthwork Control

Plan: Lake Oswego Clean Streams Plan
Date of Last Revision: Fall 2009
Author/Owner: Otak, Inc for the City of Lake Oswego
Description: The Clean Streams Plan focuses on policies, standards, and projects City-wide, and seeks to protect streams, lakes, and rivers throughout the City.
Relation to Natural Hazard Mitigation: The Clean Streams Plan can be used to implement mitigation activities related to emergency situations. The plan includes a list of potential capital improvement projects meant to improve the City's surface water systems.

Plan: Lake Oswego Capital Improvements Plan
Date of Last Revision: June 16, 2009
Author/Owner: City of Lake Oswego
Description: The Capital Improvements Plan forecasts the City's capital needs over a five-year period based on various City-adopted long-range plans, goals, and policies.
Relation to Natural Hazard Mitigation: The Capital Improvements Plan can be used to implement mitigation activities related to emergency situations.

Section 3:
Hazard Assessment

3.1 What is a Hazard Assessment?

Conducting a hazard assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment that may result from natural hazard events. Hazard assessments are subject to the availability of hazard-specific data. The City of Lake Oswego conducted a hazard assessment for all of the hazards for which data were available. The three components of a hazard assessment are as follows:

1) ***Hazard Identification*** identifies the geographic extent and intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data. The City of Lake Oswego identified six major hazards that have the potential to affect this geographic area. These hazards – floods, landslides, severe storms (wind and winter), wildfires, earthquakes, and volcanoes – were identified through an extensive process that utilized input from the Hazard Mitigation Advisory Committee. The geographic extent of each of the identified hazards has been mapped by the City of Lake Oswego GIS Department using the best available data.

2) ***Vulnerability Assessment/Inventorying Assets*** combines hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard. A complete listing of the community assets is listed in the following section. Additionally, a more detailed description of the vulnerability of these assets is located in Table 3-1 and in each specific hazard section.

3) ***Risk Analysis/Estimating Potential Losses*** involves estimating the damage, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework with which to measure the effects of hazards on assets. Unfortunately, there is insufficient data for conducting a risk analysis for the natural hazards affecting the City of Lake Oswego. However, this need is identified in action item ST-MH #4, and risk assessments will be completed when resources are available.

3.2 Hazard Assessment Mapping Methodology

The information used to identify the hazards was derived from digital databases on Lake Oswego's Geographic Information System (GIS). Lake Oswego obtains its data from Clackamas County, Metro, the Department of Geology and Mineral Industries (DOGAMI), and the Federal Emergency Management Agency (FEMA). Lake Oswego produces some data in-house as well.

3.3 Community Assets: Vulnerability Assessment

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and natural resources in Lake Oswego. The exposure of community assets to natural hazards is provided in the hazard

sections below. The community assets are defined as follows, and are shown in Figures 3-1, 3-2, and 3-3:

Critical Facilities: Those facilities and infrastructure necessary for emergency response efforts.

- City Hall: Dispatch, Law Enforcement
- Fire Stations: Main Fire Station is the EOC
  - Station 210 Westlake Fire Station
  - Station 211 Jean Road Fire Station
  - Station 212 South Shore Fire Station
  - Station 214 Main Fire Station & Administration Offices
- Adult Community Center: Emergency short-term shelter
- City Maintenance Facility

Essential Facilities: Those facilities and infrastructure that supplement response efforts.

- Churches: Shelter Sites
- Schools: Potential Shelter Sites
  - Marylhurst University
  - Lake Oswego High School
  - Lakeridge High School
  - Lake Oswego Junior High
  - Waluga Junior High
  - Bryant Elementary
  - Forest Hills Elementary
  - Hallinan Elementary
  - Lake Grove Elementary
  - Oak Creek Elementary
  - Palisades Elementary
  - River Grove Elementary
  - Uplands Elementary
  - Westridge Elementary
- All City Facilities
  - West End Building
  - Lake Oswego Library: Shelter
  - Lake Oswego Tennis Center: Shelter
  - Lake Oswego Municipal Golf Course

Critical Infrastructure: Infrastructure that provides services for the City of Lake Oswego.

- Tryon Creek Wastewater Treatment Plant and main lines
- Oswego Lake sanitary sewer interceptor
- Oswego Lake dam and headgate
- Water treatment plant, water pumping stations, major water lines, reservoirs, water intake on Clackamas River
- Portland General Electric substations
- NW Natural gas pipelines and gas substations
- Fiber optic lines
- Communications towers
- Highway 43 (State Street), McVey Avenue, Stafford Road: Regional Emergency Transportation Route
- Transportation networks, including major roads and all bridges including Country Club Road, Boones Ferry Road, and Kruse Way

- Portland & Western Railroad
- Willamette Shore Trolley

Environmental Assets: Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic and functional services for the community.

- Oswego Lake
- Willamette River
- Tualatin River
- Tryon Creek State Park
- Canal Acres Natural Area
- Hallinan Natural Area
- Bryant Woods Park
- Cook's Butte Park
- Freepons Park
- Foothills Park
- George Roger Park
- Glenmorrie Park
- Iron Mountain Park
- Lake Grove Swim Park
- Lake Oswego Swim Park
- Millennium Park
- River Run Park
- Roehr Park
- Rossman Park
- Southwood Park
- Springbrook Park
- Waluga Park
- Westlake Park
- Lake Oswego Hunt Club
- Oswego Lake Country Club Golf Course

Table 3-1. Lake Oswego Community Assets Exposed to Natural Hazards

Hazard	Exposed Assets
Flood	**Critical Facilities:** none **Essential Facilities:** -Marylhurst University **Critical Infrastructure:** -Water intake facility on the Clackamas River -Tryon Creek Wastewater Treatment Plant -Wastewater main lines: Foothills area, Lakeview Blvd, Old River Rd., Blue Heron & Oswego Canals, Springbrook Creek -Oswego Lake sanitary sewer interceptor -Oswego Lake dam and headgate -Major water lines: State Street/Hwy 43, Lakewood Bay; Main transmission main at North Shore Road, Iron Mountain Road, and Brookside Road -Main transmission main at North Shore Road, Iron Mt. Blvd. and Brookside Road -PGE substation: Foothills -NW Natural gas pipeline: Bryant Rd. & McVey Ave -Fiber optic line: State Street/Hwy 43 & McVey Ave -Regional Emergency Transportation Route: State Street/Hwy 43 & McVey Ave. - Water intake facility at Clackamas River **Environmental Assets:** Canal Acres Natural Area, River Run Park, Bryant Woods Park, Lake Grove Swim Park, Iron Mountain Park, Lake Oswego Hunt Club, Tryon Creek State Park, Foothills Park, Millennium Park, Roehr Park, George Rogers Park, and Lake Oswego Swim Park
Landslide	**Critical Facilities:** -Adult Community Center **Essential Facilities:** -Hallinan Elementary, Westridge Elementary **Critical Infrastructure:** -Wastewater main lines: Old River Rd., Tributary to Tryon Creek east of Boca Raton Dr -Major water lines: State Street/Hwy. 43, George Rogers Park, Oak St., South Shore Blvd, Iron Mountain Blvd. -Fiber optic line: State Street/Hwy 43 -Regional Emergency Transportation Route: State Street/Hyw 43 **Environmental Assets:** George Rogers Park, Iron Mountain Park, Lake Oswego Hunt Club, and Lake Oswego Swim Park
Wildfire	**Critical Facilities:** -Adult Community Center, South Shore Fire Station -Westside Baptist Church, Triumphant King Lutheran Church, Lake Grove Presbyterian, Church of Jesus Christ of Latter Day Saints (Kruse Oaks), First Church of Christ Scientist, Lake Chapel Foursquare Church **Essential Facilities:** -Forest Hills Elementary, Oak Creek Elementary **Environmental Assets:** Southwood Park, Waluga Park, River Run Park, Bryant Woods Park, Cooks Butte Park, Iron Mountain Park, Springbrook Park, Roehr Park, George Rogers Park, Freepons Park, Lake Grove Swim Park, Canal Acres Natural Area, and Hallinan Natural Area
Earthquake	**Critical Facilities:** -Adult Community Center, City Hall, Main Fire Station **Essential Facilities:** -Westridge Elementary, Lake Grove Elementary, Our Lady of the Lake School, Marylhurst University -Church of Jesus Christ of Latter Day Saints (Kruse Oaks & Westlake), Our Lady of the Lake Church, Unity World Healing Center, Lake Chapel Foursquare Church **Critical Infrastructure:** -Wastewater main lines: Old River Rd., Tributary to Tryon Creek east of Boca Raton Dr -Major water lines: State Street/Hwy 43 **Environmental Assets:** Iron Mountain Park, Canal Acres Natural Area, River Run Park, Glenmorrie Park, Foothills Park, Roehr Park, Rossman Park, and Tryon Creek State Park

Figure 3-1

LAKE OSWEGO AREA CRITICAL FACILITIES

- Adult Community Center
- City Maintenance Shops
- City Hall
- Fire Station
- Lake Oswego Urban Services Boundary
- Streams

0 0.25 0.5 0.75 1 Miles

July 2009 *City of Lake Oswego*

Figure 3-2

LAKE OSWEGO AREA ESSENTIAL FACILITIES

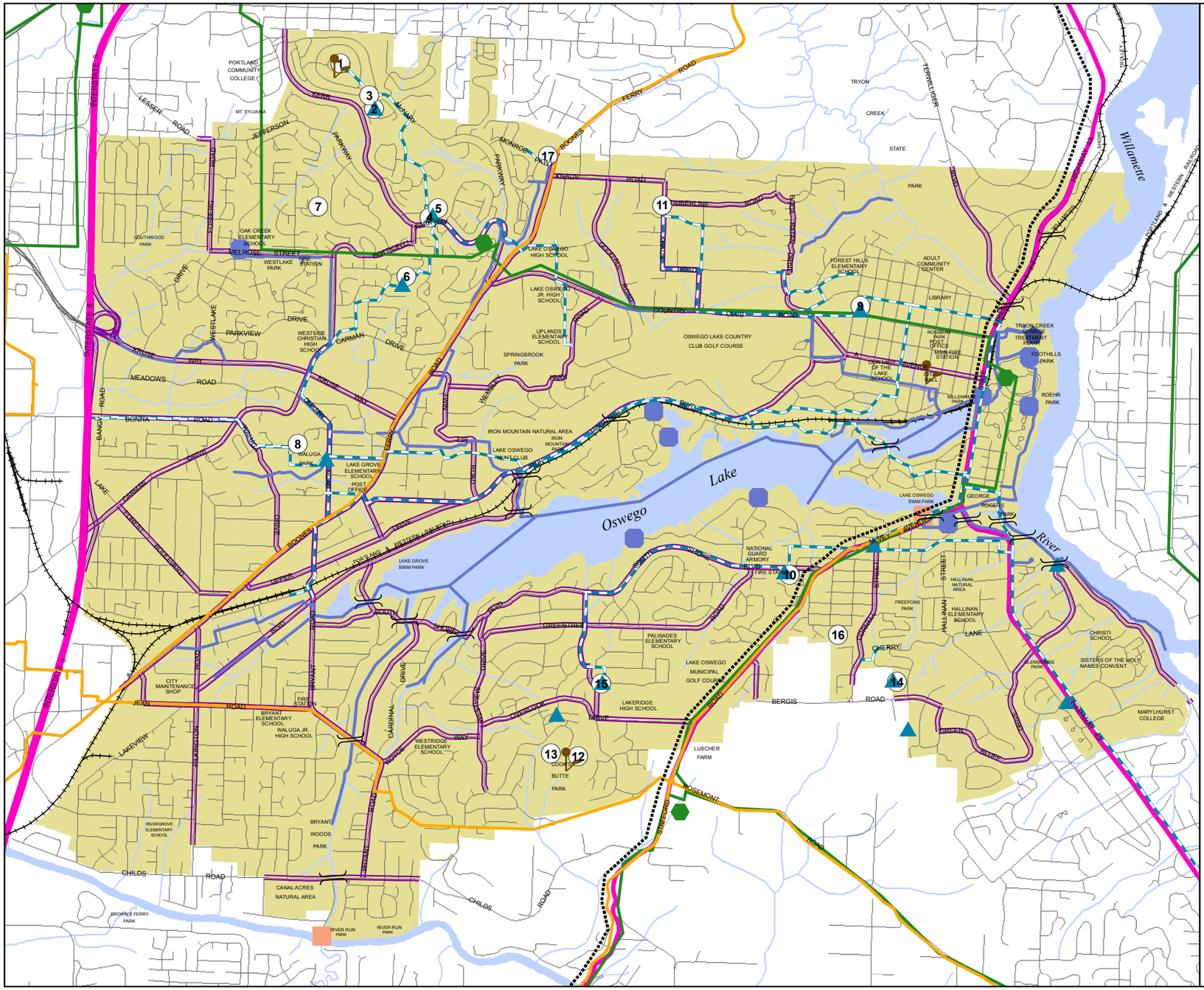
- Library-Shelter
- Tennis Center-Shelter
- Schools-Potential Red Cross Shelter
- City Facilities
- Lake Oswego Urban Services Boundary
- Streams

0 0.25 0.5 0.75 1 Miles

July 2009 *City of Lake Oswego*

Figure 3-3

LAKE OSWEGO AREA INFRASTRUCTURE



- Wastewater Treatment Plant
- Wastewater Lift Station
- Wastewater Main Line
- Water Pumping Station
- Major Water Line
- (1) Reservoir
- Regional Emergency Transportation Route
- Major Road
- Bridge
- Power Substation
- Powerline
- Gas Line
- Fiber Optic Line
- Communications Tower
- Oswego Lake Dam & Headgate
- Lake Oswego Urban Services Boundary
- Stream

0 0.25 0.5 0.75 1 Miles

July 2009 *City of Lake Oswego*

Section 4:
Natural Hazards

4.1 Flooding

Lake Oswego has two large rivers and several smaller tributaries that are susceptible to annual flooding events. Flooding poses a threat to life and safety, and can cause severe damage to public and private property.

Flooding Profile

The City of Lake Oswego has been impacted by floods several times since incorporating in 1910. Minor flooding is experienced on a near yearly basis, but is generally only an inconvenience. There have been at least six events in the past fifty years which have caused widespread damage.

Willamette River

The highest recorded flood levels on the Willamette River occurred in December 1861; however, water levels rose high enough at least six times in the past fifty years to cause damage to structures on Foothills Road, Fielding Road, Stampher Road and other riverfront areas. These Willamette River floods reached a height ranging from 30.0 feet to 41.4 feet (NGVD -National Geodetic Vertical Datum) on December 25, 1964 at Oswego Pointe. Approximately 40 to 50 structures within the City limits are vulnerable when levels exceed the 100-year flood elevation of 34.0 feet.

Tualatin River, Oswego Canal and Oswego Lake

The highest recorded flood levels on the Tualatin River were recorded on February 10, 1996. The period of record on this river only extends back to 1928. As measured from the Oswego Canal Inlet gage, this record flood reached an elevation of 120.12 feet (NGVD) as measured at the Oswego Canal Inlet gage. Waters that normally flow from the Tualatin River into the Oswego Canal are regulated by the canal headgate structure which has a top of headgate height of 113.6 feet. Once Tualatin River levels exceed the top of headgate, the water flows unimpeded into the canal and northward to Oswego Lake. When the river reaches a level of 117.5 feet, water begins to leave the north banks of the Tualatin near the 5400 block of Dogwood Drive and then migrates across Sycamore Avenue eventually rejoining the main Oswego Canal near Childs Road and Bryant Woods Park. At this time, the Lake Corporation's ability to release water at the east end of Oswego Lake is outstripped by the flows entering the lake from the Oswego Canal and the lake level begins to rise uncontrollably.

At the height of the 1996 flood, the Oswego Canal rose 4.2 feet above normal summer levels at the South Shore Bridge, about 13 feet higher than normal at the Bryant Road Bridge, and exceeded normal by nearly 18 feet at the Childs Road Bridge.

Oswego Lake rose to 102.60 feet (NGVD) during the 1996 flood, at which point water was crossing McVey Avenue and State Street. The water that crossed State Street flowed down Foothills Road, through the Oswego Pointe Apartments, and into the Willamette River.

Dozens of homes, businesses, and boathouses were damaged by these floodwaters. Properties along Dogwood Drive, Melissa Drive, Canal Road, Pioneer Court, Bryant

Road, Cardinal Drive, Kelok Road, Sarah Hill Lane, Lake Haven Drive, Canal Circle, many homes surrounding Oswego Lake (including all bays and canals), businesses along State Street from the railroad crossing south to North Shore Road, plus many apartments, businesses, and carports in the Oswego Pointe area all experienced severe water and structural damage.

Heavy rains following a severe winter storm from January 1 to 2, 2009 contributed to a sewer interceptor overflow on Cardinal Drive near Oswego Canal. Approximately 226,000 gallons of wastewater were sent out of the sewer system. Maintenance crews were able to capture about 75% of the discharge using vacuum trucks.

Record flooding is usually accompanied by low elevation snows in the Coast and Cascade Mountain foothills. Often snow is on the ground at the 1,000' elevation and sometimes it is even present all the way down to sea level. Larger than normal snow depths in the middle, easily melted, elevations such as 2000' to 3,500' are another major source of water runoff. These depths are frequently observed at the Saddle Mountain Snowtel station located at 3,250' in the Coast range of western Washington County. Both the 1964 and 1996 floods were preceded by a period of sub-freezing temperatures that caused the soils of the drainage basins to solidify and become relatively impervious.

Finally, there is a rainfall pattern known as the "Pineapple Express" which brings very heavy and warm rains from the southwest. These warm rains begin their journey from parts of the Pacific near Hawaii, holding their heat and moisture until making landfall along the Oregon coast. As an example, at 1 A.M. on the morning of February 8, 1996, the temperature had risen to 61°F with a driving rain following a period of freezing conditions. This warm rain storm preceded the flood crest on the Willamette River by 2½ days.

Characteristics of Flooding

The two basic categories of floods that Lake Oswego is subject to are:

Flash Floods

Flash floods of short duration often occur after intense local rainstorms and can be associated with late-summer (August through September) thunderstorms. These events generally last less than two hours and can damage properties and structures located very close to small streams such as Springbrook Creek, Lost Dog Creek, or can even be generated by run-off from steep street sections.

Riverine Flooding

Riverine floods have a much greater duration. Often, the conditions which precede this type of flooding can be observed 10 to 20 days in advance of the flood crest. Although very heavy rains over a period of five to ten days can bring the Willamette and Tualatin Rivers to flood stage, the worst flooding requires several other conditions.

In general, the rivers have taken twice as long to recede to bank full levels as they did to rise above them. Major forms of this type of flooding can be anticipated from the beginning of December until the end of February, with mid to late January being the peak season.

An additional type of flooding which occurred before the Columbia River dams were in place is a spring-melt condition which caused the Willamette River to back up, resulting in

moderate flooding along the Willamette River in May and June. The last time this type of flooding was experienced in Lake Oswego was during the "Vanport" flood of May 30 through June 10, 1948.

Flooding Hazard Assessment

Hazard Identification

The geographic extent of the flooding hazard in Lake Oswego has been mapped by the City of Lake Oswego GIS Department, as shown in Figure 4-1 on page 37, using the best available data. The City's Flood Management Area (FMA) boundary and FEMA 100-year floodplain were used to identify and map the flood hazard and perform the flood hazard analysis. The FMA includes the FEMA 100-year floodplain around Oswego Lake (including its bays and canals north of Bryant Road), and the 1996 flood inundation boundary along the Tualatin and Willamette Rivers, and canals south of Bryant Road.

The probability of flooding events in Lake Oswego was determined using scientific data, historical occurrences, and local knowledge. The HMAC estimates that the probability of floods occurring is 'high,' meaning one event is likely within a 10 year period. This estimate is in agreement with the County's 'high' probability estimate.

Vulnerability Assessment

The City of Lake Oswego GIS Department has completed an analysis, using the best available data, as a component of the vulnerability assessment described in Section 3: Hazard Assessment. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure maps with each hazard map, and identifying where assets and hazards intersected. The HMAC estimates the City's vulnerability to flooding is 'moderate,' meaning between 1% and 10% of the community's population and assets would be affected. This is in agreement with the County's 'moderate' estimate.

The only essential facility located in the floodplain is Marylhurst University, as it is located along the banks of the Willamette River. While no critical facilities are located in the floodplain, a number of critical infrastructure and environmental assets are exposed to the flood hazard. Exposed critical infrastructure includes Tryon Creek Wastewater Treatment Plant, Oswego Lake sanitary sewer interceptor, Oswego Lake dam and headgate, Highway 43, McVey Avenue, wastewater main lines, water lines, NW Natural gas pipelines, the fiber optic line along Highway 43, several wastewater lift stations, and the Foothills power substation. Exposed environmental assets include Canal Acres Natural Area, River Run Park, Bryant Woods Park, Lake Grove Swim Park, Iron Mountain Park, Lake Oswego Hunt Club, Tryon Creek State Park, Foothills Park, Millennium Park, Roehr Park, George Rogers Park, and Lake Oswego Swim Park.

The Tryon Creek Wastewater Treatment Plant, located in the Foothills area, is located on a parcel that is affected by the Flood Management Area. In off-peak hours, the facility is remotely operated, reducing potential life safety issues from a flood hazard. However, flood conditions that result in a change in hydraulics could affect the operation of the facility.

The water transmission main from the intake on the Clackamas River in Gladstone is susceptible to flooding hazards. The transmission main is buried in the peninsula but can be exposed in a large flood, making it susceptible to damage. Additionally, prolonged periods of rain can cause the sewer interceptor system to back up and flow out of

manholes and into Oswego Lake or onto streets near the lake. Such spills violate the Federal Clean Water Act.

The three wastewater main lines located in the Foothills area are elevated above ground level, potentially increasing susceptibility to flood damage. Other exposed infrastructure including wastewater main lines, natural gas pipeline and fiber optic lines are buried, decreasing their vulnerability to damage from flood hazards. However, these service lines and pipes could be exposed in large flooding events and become susceptible to damage. Hazardous flood conditions could potentially limit or delay access for the purposes of operation or repair. The fiber optic line located in Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest along Stafford Road. This route crosses a bridge on McVey Road (Oswego Lake Outlet/McVey Ave. Bridge) that could be potentially affected during flood conditions. Culverts located along the Emergency Transportation Route could also be affected during hazardous conditions as flood waters could exceed the hydraulic capacity of the facility.

The City of Lake Oswego is a participant in the National Flood Insurance Program (NFIP) with 376 policies in force at a value of $98,262,500.[xxx] Lake Oswego's most recent Community Assistance Visit was August 28, 2003 and the City's most current effective Flood Insurance Rate Map (FIRM) date is June 17th, 2008 (initial FHBM 6/14/1974). At this time 52 claims have been paid, amounting to $3,579,453. Three substantial damage claims have been made since 1978. No repetitive loss properties are located within Lake Oswego City limits.

Risk Analysis

Due to insufficient data, Lake Oswego is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in action item ST-MH #4, and will be completing a risk assessment as data and resources become available.

Existing Flood Mitigation Activities

Flood mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

Lake Oswego Codes Pertaining to Flooding

The following Lake Oswego codes, plans, and policies pertain to flooding:

1) Lake Oswego Comprehensive Plan, Goal 7 - Areas Subject to Natural Disasters and Hazards, Section 1, Flood Hazards. The Goal of Section 1, Flood Hazards states: "The City shall protect life and property from flood hazards."

The Federal Emergency Management Agency (FEMA) provides the City with mapped floodplain information which identifies floodplain elevations and areas subject to flooding. Lake Oswego participates in the National Flood Insurance Program, which is administered by FEMA. This program allows residents of Lake Oswego to obtain federally subsidized flood insurance. In order to be eligible to participate in this program, the City adopted floodplain development standards in 1988 that met FEMA standards. In June 2008, the City adopted revised floodplain management standards and adopted updated FEMA Flood

Insurance Rate Maps (FIRM) as well as the updated Flood Insurance Study (FIS) in compliance with FEMA, state, and Metro standards.

2) Lake Oswego Community Development Code, Article 50.44 Flood Management Area. This portion of the Community Development Code implements the Goal 7 policies of the Comprehensive Plan and regulates development within the floodplain. The purpose of Article 50.44 is to:

- Promote the public health, safety and general welfare;
- Minimize public and private losses due to flood conditions in specific areas; and
- Maintain eligibility of properties within the City to participate in the National Flood Insurance Program.

3) Lake Oswego City Code and Charter, Chapter 52 - This chapter aims to control erosion at its source as a means of maintaining and improving water quality and minimizing water pollution, downstream flooding, and wildlife habitat damage.

4) Lake Oswego Bridge Inspections and Records Manual - This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Overall, bridges throughout the City are old and in need of upgrading. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Flooding Response Activities

During past flood events, the City's response included notification of property owners of impending flooding. Generally, the City has provided 24 to 36 hour notice. Notices have been followed by evacuations of people and, to a limited extent, personal property. Since 2006 the City has used a reverse 911 emergency notification system called CodeRED to notify citizens of emergency incidents.

Attempts at sandbagging have been only partially effective. In areas where a good initial plan is communicated to volunteers, adequate supplies are available, and waters do not exceed 2 feet in depth, sandbagging can help. City staff members sandbag critical facilities and provide access to sand and sandbags for the public.

Flood Mitigation Projects

Lake Oswego is in the final design stages of the Lake Oswego Interceptor System (LOIS), and work has already begun on the out of lake work. The LOIS system will replace the interceptor sewer line located in Oswego Lake. The existing interceptor is undersized, resulting in overflows during heavy rains, and is vulnerable during an earthquake. Replacement of the interceptor is critical to ensuring the environmental protection of Oswego Lake and maintaining sewer service for residents. This project represents the completion of an action that was identified in Lake Oswego's 2004 mitigation plan addendum.

The Engineering Division is developing a drainage improvement plan for the First Addition Neighborhood. Currently, due to a lack of designed neighborhood-wide drainage system, rainwater does not drain properly and streets can flood in this neighborhood. The improvements include the design and construction of new storm drainage systems throughout the neighborhood. The new drainage systems will help to reduce the amount

of roadway sediments and pollutants entering into the drainage system, by utilizing various methods such as pollution control manholes and catch basins, infiltration swales, and compost filters.

In 2003 Lake Oswego commissioned a study, "Evaluation of Flood Management Alternatives for Oswego Lake and Canal" (Pacific Water Resources, Inc., June, 2003) which detailed strategies to help alleviate flooding of Oswego Lake. In the fall of 2009, the City completed a surface water master plan called the "Clean Streams Plan," a completed action item from the 2004 mitigation plan.

After the 1996 flood event the City of Lake Oswego commissioned a study, "Lakewood Bay Flood Protection at North Shore Road Bridge" (Pacific Water Resources, June 30, 2000), to evaluate the event of the 1996 flood and what impacts would be experienced by the main part of Oswego Lake if Lakewood Bay were isolated during a similar flood event. During a flood event, blocking the inlet of Lakewood Bay would stop flood waters from filling the bay and overtopping State Street (Highway 43), as occurred in 1996. During the 1996 flood, State Street was flooded and blocked for over a day, affecting emergency access to the eastern part of Lake Oswego.

During the flood event in 1996, the primary cause of the flooding in the Foothills Road area was due to two sources. Both of these sources have since been mitigated, as described below:

1) A low point in the levy behind (north of) the Tryon Creek Treatment Plant allowed flood waters from the Tryon Creek/Willamette River to overtop the levy and enter the Foothills Road area. The City of Portland has since made repairs and improvements to address the problem.

2) A large diameter storm drain pipe that receives runoff from an area of downtown (200+ acres) drains through the Toklat Industries parking lot and discharges into Tryon Creek. Flood waters from the Tryon Creek/Willamette River system backed up through this storm system, surcharging the manholes and catch basins, contributing to the flooding in the Foothills Road area. Subsequently, this problem has been rectified. Redundant check valves have been installed on the storm pipes to prevent back up, and two pump stations have been designed and built that will accept the runoff generated in the upstream drainage basin and "force" it into the drain pipe and through the submerged outlet.

The smaller pump station is an electric submersible pump, designed to handle runoff that accumulates at the Lakeshore Concrete site. Should power fail during a flood event, the pump is positioned so a trailer-mounted portable generator can be plugged into the control panel to provide backup power.

The other pump station is located at the north end of Toklat Industries parking lot. These are two variable speed pumps with a combined capacity of 5,000 GPM. Each pump is powered by a Ford six-cylinder engine, fueled with natural gas. In the event of a loss of supply of natural gas, the backup power source is a power take-off (PTO) drive that is mounted on the vertical drive shaft of the pumps. City Maintenance staff would then mobilize a piece of equipment that employs hydraulics (such as a back-hoe, tractor, or dump truck,) and plug in the quick-connect hoses (stored on site) into the PTO and the piece of mobile equipment.

These pumps were installed in the late 1990's and City Maintenance staff is familiar with their operation. These systems are inspected and exercised on a regular basis.

Flood Mitigation Action Items

The flood mitigation action items provide direction on specific activities that organizations and residents in Lake Oswego can undertake to reduce risk and prevent loss from flood events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

ST-FL#1: Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.

Ideas for Implementation:

- Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits;
- Conduct an assessment of the floodplain ordinances to ensure they reflect current flood hazards and situations, and meet NFIP requirements; and
- Coordinate with the County to ensure that floodplain ordinances and NFIP regulations are maintained and enforced.

Coordinating Organization: Planning and Engineering Departments
Timeline: Short-term ongoing
Status: *Added during the 2009 plan update.* This will be an ongoing action.

LT-FL#1: Reduce the vulnerability in the Foothills area to the flooding hazard.

Ideas for Implementation

- Consider making improvements to the dike system in the Foothills district to reduce the local flooding hazard; and
- Consider large-scale floodplain restoration in the Foothills area through acquisition and/or management strategies.

Coordinating Organization: City Manager's Office
Timeline: Long-term ongoing
Status: *Partially Complete / Deferred.* The City discussed solutions for the area but determined they will not proceed with actions until there is more development in the area. The 2009 update placed the City Manager's Office as the new coordinating organization, and the timeline was changed to long-term.

LT-FL#2: Implement alternatives for reducing the flooding hazard for properties along Oswego Lake and canals.

Ideas for Implementation

- Evaluate and implement recommendations for reducing the flooding hazard identified in the "Evaluation of Flood Management Alternatives for Oswego Lake

and Canal" (Pacific Water Resources, 2003), particularly modifications to Lake Corporation dam, headgate, and spillway; and
- Explore public/private partnerships to implement flood mitigation strategies

Coordinating Organization: Engineering
Timeline: 3-5 years
Status: *Partially Complete / Deferred.* In preparation for the LOIS project, the City purchased two properties that encroached on the spillway. Procurement of these properties reduces the flooding risk in the City. The Oswego Lake Corporation has contacted FEMA and done initial design work to open up the dam during flooding events, which would reduce flooding for lake properties because the dam can release all potential flood waters. The 2009 update added the second idea for implementation.

LT-FL#3: Pursue participation in the Community Rating System (CRS) program by identifying the requirements that are currently being met and those that need to be addressed.

Ideas for Implementation
- Contact FEMA to identify process for entering CRS;
- Coordinate flood prevention strategies with the County and other neighboring jurisdictions that currently participate in the CRS program; and
- Conduct public outreach and education to potential affected property owners regarding the reduction of insurance premiums resulting from compliance to the CRS program goals and objectives.

Coordinating Organization: Engineering
Timeline: 3-5 years
Status: *Deferred from 2004 addendum.* The Community Rating System (CRS) was researched but not implemented due to lack of staff time and resources. Planning was removed as a coordinating organization.

Figure 4-1

LAKE OSWEGO AREA FLOOD HAZARDS

- Lots Affected by Floodplain
- FEMA 100 Year Floodplain
- FEMA Year Floodplain (No Base Elevation Established)
- Lake Oswego Flood Management Area
- Lake Oswego Urban Services Boundary
- Streams

Data Sources Include: 2008 FEMA Flood Insurance Rate Maps, 1996 Inundation Boundary, City of Lake Oswego 1996 Floodplain Studies

0 0.25 0.5 0.75 1 Miles

July 2009 ***City of Lake Oswego***

4.2 Landslide

Landslides and soil erosion hazards exist at different locations within the Lake Oswego Urban Services Boundary because of the presence of hilly terrain, steep ridges, and ravines underlain by unstable geology and overlain by soils which have low carrying capacity for structures. The stability of soils on a hillside is generally dependent upon the slope, the amount of precipitation, vegetative cover, and the underlying geology. However, hillsides are constantly in motion, due to gravity and effects of weathering and erosion. Any time the load on a susceptible hillside is increased or the stabilizing vegetation altered, erosion or landslides can occur. These disturbances can also increase surface water runoff and affect water quality through erosion and siltation.

Landslide Profile

The causes and characteristics of landslide hazards are adequately documented in the County's plan (see pages 7-1 to 7-13 of the 2002 Clackamas County Natural Hazards Mitigation Plan and pages 33 to 39 of the 2007 update). The historical landslide events have been described in the County plan as well, and are applicable to Lake Oswego. As such, a description of these events will not be repeated here. Three events require further explanation:

- In December 2007, a rain event led to three slides on Iron Mountain and Green Bluff. The slides led to road closures and debris removal. A catchment basin was damaged from one slide but no other property was damaged.

- On February 2, 2008 a landslide in George Rogers Park led to the closure of the pathway between George Rogers Park and Old River Road for five months. The landslide, originating on private property, occurred on the slope above the pathway and deposited approximately 50 cubic yards of material onto the pathway.

- On January 2, 2009 a large landslide originated from the slopes above Green Bluff Drive in the Marylhurst area and slid into a home on Woodhurst Place just after 1:00am. Twenty-one homes and twenty-eight people were evacuated, while five people were transported to the hospital. The Adult Community Center was opened to accommodate families in need of shelter. A second slide down the hill from Green Bluff damaged another home and the right of way. A third slide on Oak Street deposited earth onto the road and diverted runoff to the properties downhill.

Additional landslide events occurred in 2004 on Kerr Parkway, Del Prado, and Oak Terrace; in 2006 on Royce Way, Oak Street, and Laurel Street; in 2007 on Eagle Crest and Glenmorrie; and in 2008 on Green Street. These were smaller landslide events that required clean up by Public Works and/or private property owners, but no major damages were sustained.

Landslide Hazard Assessment

Hazard Identification

The geographic extent of the landslide hazards in Lake Oswego has been mapped by the City of Lake Oswego GIS Department, as shown in Figure 4-2 on page 42, using the best available data. Landslide data was developed by the State Department of Geology and Mineral Industries (DOGAMI), 2008 Statewide Landslide Information Database for Oregon, and DOGAMI 2003 IMS-22 Potentially Rapidly Moving Landslides. Less than

five percent of Lake Oswego is located within Multnomah County, including the northern portion of the Mountain Park neighborhood. However, landslide data for Multnomah County is not currently available. The location and extent of Lake Oswego's landslide hazards are also documented within Clackamas County's Natural Hazards Mitigation Plan. The County's plan includes maps for debris flow hazards, slump and earth flows, and percent slope.

The probability of landslide events in Lake Oswego was determined using scientific data, historical occurrences, and local knowledge. The HMAC estimates that the probability of landslides occurring is 'high,' meaning one event is likely within a 10-35 year period. This estimate is in agreement with the County's probability rating.

Vulnerability Assessment

The City of Lake Oswego GIS Department has completed an analysis using the best available data as a component of the vulnerability assessment described in Section 3: Hazard Assessment. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure maps with each hazard map, and identifying where assets and hazards intersected. The HMAC estimates the vulnerability of landslides is 'low,' meaning less than 1% of the population and assets would be affected. This is in agreement with the County's 'low' rating.

The Adult Community Center, a critical facility, is exposed to landslide hazards as it is in close proximity to a potential landslide area. However, the portion of the parcel that contains the Adult Community Center is relatively flat, while the undeveloped rear portion of the parcel is at the top of a steep slope leading down to Tryon Creek, thereby minimizing risks of the facility to the landslide hazard. The Hallanan School and Westridge Elementary are essential facilities exposed to the landslide hazard.

Exposed infrastructure including wastewater main lines, major water lines and fiber optic lines are buried, decreasing their vulnerability to damage from landslide hazards. However, hazardous landslide conditions could potentially damage the infrastructure and limit or delay access for the purposes of operation or repair. The City's fresh drinking water supply comes from the water treatment plant in West Linn, with the water intake located on the Clackamas River in Gladstone. The water line from the City's water treatment plant located in West Linn enters the City along Highway 43 and runs north through George Rogers Park, an area vulnerable to landslide hazards. The fiber optic line located in Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region. Exposed environmental assets include George Rogers Park, Iron Mountain Park, Lake Oswego Hunt Club, and Lake Oswego Swim Park.

The regional Emergency Transportation Route follows State Highway 43 from the north City limits, and continues south on State Street to McVey Avenue, and then southwest along Stafford Road. At the northern City limits, the Emergency Transportation Route along State Street passes through a potential landslide area, possibly impacting access to and from the City.

Due to unavailability of data, landslide hazards were not mapped for the portion of Lake Oswego in Multnomah County, primarily the northern part of the Mountain Park neighborhood. However, it should be noted that this portion of the City contains steep slopes that are potentially susceptible to landslide hazards. Additionally, a

communications tower that is used for emergency communications is located in this area on Mt. Sylvania.

Risk Analysis
Due to insufficient data, Lake Oswego is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in action item ST-MH#4, and will be completing a risk assessment as data and resources become available.

Existing Landslide Mitigation Activities

Landslide mitigation activities listed here include current mitigation programs and activities that are being implemented by the City of Lake Oswego agencies or organizations.

City of Lake Oswego Codes Pertaining to Landslides
The following Lake Oswego codes, plans, and policies pertain to landslides:

1) Lake Oswego Comprehensive Plan, Goal 7 – Areas Subject to Natural Disasters and Hazards, Section 3, Landslides, Erosion and Unstable Soils. The Goal of Section 3, Landslides, Erosion and Unstable Soils states: "The City shall protect life and property from hazards associated with landslides, soil erosion, and unstable soils".

2) The following portions of the Community Development Code and City Code implement the Goal 7, Section 3 policies of the Comprehensive Plan, regulating development on steep slopes, erosion control, and earthwork control:

- Community Development Code, Article 50.40 Drainage Standard for Minor Development;
- Community Development Code, Article 50.41 Drainage Standard for Major Development;
- Community Development Code, Article 50.42 Weak Foundation Soils;
- Community Development Code, Article 50.43 Hillside Protection;
- Lake Oswego Code, Chapter 52 Erosion Control; and
- Lake Oswego Building Code (LOC Chapter 45), Article 45.16 Earthwork Control.

Additionally, Article 50.16 of the Community Development Code, Sensitive Lands Overlay Districts, manages the impacts of development on lands with environmental and natural resource significance in order to protect the functions and values of wetlands, stream corridors, and tree groves within the Lake Oswego City limits. Many of these significant resources are associated with hillsides, ravines, and ridge lines.

3) Lake Oswego City Code and Charter, Chapter 52 – This chapter aims to minimize the amount of sediment and other pollutants reaching the surface water management system as a result of construction, grading, excavating, clearing and any other activity which causes or accelerates erosion

4) Lake Oswego Bridge Inspections and Records Manual. This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Additionally, the

manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Landslide Mitigation Projects

City of Lake Oswego staff has been tracking recent research by DOGAMI and related state legislation regarding rapidly moving landslide hazards. The City now has LIDAR data and maps from DOGAMI. The City will be reviewing and evaluating the results of this mapping and modeling, and will update City codes and ordinances, if appropriate.

In 2005 the Engineering Department solicited proposals from qualified geotechnical engineering firms to provide an analysis of the slide area in Rockinghorse Lane and to make recommendations for alternatives to improve drainage in the area.

After the George Rogers Park slide in 2008, private property owners above the pathway built a steel gabion retaining wall to stabilize the slope. A temporary debris catchment basin was built on Green Bluff and the City worked with the property owners to stabilize the embankment and roadway where the lower slide on Green Bluff occurred.

Landslide Mitigation Action Items

The landslide mitigation action items provide direction on specific activities that organizations and residents in Lake Oswego can undertake to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

ST-LS#1: Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.

Ideas for Implementation:

- Evaluate the results from the DOGAMI Rapidly Moving Landslide Hazard mapping effort and incorporate appropriate amendments into City planning documents and relevant codes;
- Develop public information to emphasize economic risk when building on potential or historical landslide areas; and
- Disseminate information in the City newsletter and City website on unstable slopes, historical landslide areas, and mitigation strategies.

Coordinating Organization: Engineering & Planning Departments
Timeline: 1-2 years
Status: *Partially Completed* / *Deferred.* The City encourages citizens to look at the hazard maps and talk with geotechnical experts for new developments. In some instances landowners are required to have a geotechnical expert inspect the property. The City also now has LIDAR information.

Figure 4-2

LAKE OSWEGO AREA LANDSLIDE HAZARDS

Percent Slopes

- 0 - 9.9%
- 10% - 14.9%
- 15% - 19.9%
- 20% - 34.9%
- > 35%
- Landslides
- Debris Flows
- Potential Landslides
- Streams

Data Sources Include: DOGAMI 2008 Statewide Landslide Information database for Oregon, DOGAMI 2003 IMS-22 Potentially Rapidly Moving Landslides

0 0.25 0.5 0.75 1 Miles

July 2009 *City of Lake Oswego*

4.3 Wildfire

Wildfire Profile

The causes and characteristics of wildfire hazards are adequately described within the Clackamas County Natural Hazards Mitigation Plan. Likewise, historical large-scale wildfire events have been described in Section 8 of the County's plan, and are applicable to the City of Lake Oswego as well. As such, the events will not be repeated here. Available records and oral history make no note of any homes in the Lake Oswego area ever being completely destroyed by a wildfire. The Fire Department has extinguished every wildfire to date before severely damaging any homes. The community has been fortunate with the early detection of wildfires thus far.

The lack of large-scale wildfires in this area translates to an increasing fuel load every year for approximately the last 100 years. With the increasing fuel loads, drier fall weather patterns, and increasing number of people and homes, the possibility and exposure to the wildfire hazard is increasing, as seen in wildfire events like the Portland bluff fires in 2001.

Wildfire Hazard Assessment

Lake Oswego's character and identity are closely tied to its natural assets and scenic resources. The City of Lake Oswego provides programs that protect open space, scenic resources, and wildlife habitat on public and private property throughout the City, including native woodlands, open fields, and tree groves. As in other parts of Clackamas County, as described in the County plan, Lake Oswego's urbanized areas coincide with natural areas and open spaces. In some Lake Oswego neighborhoods, private lots abut public land, public and private open space, and natural areas where brush and other fuels have been accumulating for years, increasing wildfire exposure and risk. The following areas have been identified as having the highest wildfire potential:

- Iron Mountain Bluff;
- Palisades;
- Cooks Butte;
- Mountain Park;
- Tryon Creek State Park;
- Springbrook Park; and
- Waluga Park.

The City has a long history of protecting tree groves and other natural features within the community. These green features provide an essential part of the overall community character, while also providing abundant habitat for native species. Recognizing the importance of these features, this plan does not anticipate the removal of valued natural resources as a means of reducing wildfire risks. Rather, this plan recommends further research and the preparation of an Urban Forest Fire Management Plan that will address both wildfire and habitat protection. It should also be noted that much of the understory brush within the forested parts of the community consists largely of non-native plant species, the removal of which could actually benefit the forests while reducing wildfire risks.

Hazard Identification

The geographic location and extent of the wildfire hazard in Lake Oswego has been mapped by the City of Lake Oswego GIS Department, as shown in Figure 4-3 on page 47, using the best available data. Wildfire hazard data (Relative Wildfire Hazards Risk Areas,

2003) was provided by Clackamas County. The relative wildfire hazard risk areas result from a state model that involves fuels, slope, and weather. Additionally, portions of Lake Oswego are within Multnomah County, including the northern portion of the Mountain Park neighborhood. However, wildfire data from Multnomah County is not currently available.

The probability of wildfire events in Lake Oswego was determined using scientific data, historical occurrences, and local knowledge. The HMAC estimates that the probability of wildfire events is 'moderate', meaning one incident is likely to occur in a 35 to 75 year period. This is in agreement with the County's 'moderate' probability rating.

Vulnerability Assessment

The City of Lake Oswego GIS Department has completed an analysis, using the best available data, as a component of the vulnerability assessment described in Section 3: Hazard Assessment. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure maps with each hazard map, and identifying where assets and hazards intersected. The HMAC estimates that the City's vulnerability to wildfire is 'moderate,' meaning 1% to 10% of the population and assets could be affected in a large-scale event. This estimate is in agreement with the County's 'moderate' rating.

The Adult Community Center, a critical facility, is exposed to a high hazard wildfire area. The rear (northern) portion of the parcel is covered with trees, and slopes steeply down to Tyron Creek, potentially exposing the facility and limiting its availability as an emergency short-term site in the event of a wildfire. The South Shore Fire Station is another critical facility in the high wildfire hazard zone. Essential facilities exposed to high wildfire hazard include Oak Creek Elementary, Westridge Elementary, Hallinan Elementary, Uplands Elementary, Forest Hills Elementary, the area west of Lake Oswego Jr. High, portions of the Marylhurst University campus, and a number of churches, which could potentially serve as Red Cross shelter sites.

Exposed infrastructure including wastewater main lines, major water lines, natural gas pipeline and fiber optic lines are buried, decreasing their vulnerability to damage from wildfire hazards. However, wildfire conditions could potentially limit or delay access for the purposes of operation or repair. The City's fresh drinking water supply comes from a water treatment plant in West Linn, with the water intake located on the Clackamas River in Gladstone. The water line from the City's water treatment plant in West Linn enters the City along Highway 43/State Street and runs north through George Rogers Park. This alignment includes areas that could be vulnerable to wildfire hazards. The fiber optic line located along Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region. Operation of and access to other exposed infrastructure including the Oswego Lake headgate, several water pumping stations and reservoirs, a PGE substation in the Mountain Park area and communications towers used for emergency communications located on Cook's Butte and Mt. Sylvania, could be potentially impacted during a wildfire hazard.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest to and along Stafford Road. The Emergency Transportation Route passes through several high wildfire hazard areas, at the northern City limits along State Street and McVey Avenue to the south, possibly impacting access to and from the City.

Not surprising, a number of Lake Oswego's parks and open spaces are considered high wildfire hazards. These include Southwood Park, Waluga Park, River Run Park, Bryant Woods Park, Cooks Butte Park, Iron Mountain Park, Springbrook Park, Roehr Park, George Rogers Park, Freepons Park, Lake Grove Swim Park, Canal Acres Natural Area, and Hallinan Natural Area.

For the portion of Lake Oswego in Multnomah County, primarily the northern part of the Mountain Park neighborhood, Lake Oswego Fire Department staff has determined that due to the steep slopes and wooded character of this neighborhood, the wildfire hazard ranges from moderate to high.

Risk Analysis

Due to insufficient data, Lake Oswego is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in action item ST-MH#4, and will be completing a risk assessment as data and resources become available.

Existing Wildfire Mitigation Activities

The City of Lake Oswego Fire Department works to mitigate problems regarding wildfire issues when they arise. Wildfire mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

City of Lake Oswego Codes Pertaining to Wildfires

The following Lake Oswego codes, plans, and policies pertain to wildfires:

1) The City of Lake Oswego Community Development Code (LOC Chapter 50) specifies site development standards, such as lot setback, coverage, depth, and corner vision; landscape and tree planting and removal standards; and structure height.

2) The City of Lake Oswego Building Code (LOC Chapter 45) regulates building materials and fire flow and sprinkler requirements.

3) The Uniform Fire Code and City Code regulate the removal of fuels that could be a fire hazard, and regulate burning with permits and burning bans when needed due to high fire hazard.

Local Fire Prevention/Education Programs

The Lake Oswego Fire Department participated in creating the County's Community Wildfire Protection Plan. Fire prevention staff also works with the Clackamas County Fire Prevention Co-op that includes the U.S. Forest Service and Oregon Department of Forestry as members. The Lake Oswego Fire Department fire prevention staff conducts a range of public education activities, including wildland fire education programs. Additionally, the City of Lake Oswego's Community Emergency Response Team (CERT) program includes wildland fire prevention in its training program.

The City of Lake Oswego has a hydrant system that covers most of the area Lake Oswego Fire Department protects. The Fire Department continues to look for locations that will enhance wildland urban interface protection. For example, the City recently added hydrants to the Iron Mountain Bluff area after firefighters determined the need for increased protection from wildfire. Additionally, school remodels must now include the installation of sprinkler systems upgrades. Lastly, the City works to eradicate non-native

plant species and manages invasive species, reducing the fuel load in the City's open spaces.

Wildfire Mitigation Action Items

The wildfire mitigation action items provide direction on specific activities that organizations and residents in Lake Oswego can undertake to reduce risk and prevent loss from wildfire events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

LT-WF#1: Promote fire-resistant strategies and the use of non-combustible roofing materials by evaluating and making recommendations to current code to encourage noncombustible roofing standards in high fire-hazard areas.

Ideas for Implementation:

- Encourage property owners to use noncombustible roofing materials;
- Require street design that facilitates the movement of fire fighting equipment;
- Promote use of sprinkler systems in residential construction; and
- Maintain awareness of potential City growth into the wildland urban interface.

Coordinating Organization: Fire & Planning Departments
Timeline: Long-term Ongoing
Status: *Partially Completed / Deferred.* The City and Fire Department already encourage the use of non-combustible roofing materials. They also encourage neighborhood associations to stop requiring cedar shake roofs. The 2009 update added three ideas for implementation.

LT-WF# 2: Develop and implement an Urban Forest Fire Management Plan.

Ideas for Implementation:

- Develop a vegetation inventory for areas believed to be at risk of wildfire.
- Target areas of brush and implement management strategies that are consistent with habitat protection requirements;
- Replace flammable non-native vegetation with native plants that are less flammable; and
- Enhance water storage facilities and water distribution systems (including hydrants) to serve the wild land/urban interface.

Coordinating Organization: Fire Department
Timeline: 3-5 years
Status: *Partially Completed / Deferred.* The City has an Urban Forest Annex in their Emergency Operations Plan and it is updated when the EOP is updated. The City works with the Portland Fire Bureau to plan for Trillium Creek. Work has been done to remove non-native species in City parks. Several hydrants were installed to assist in structural and wildfire fighting efforts.

Figure 4-3

LAKE OSWEGO AREA WILDFIRE HAZARDS

Hazard Level:

- High
- Moderate
- None
- Lake Oswego Urban Services Boundary
- Streams

Data Sources Include: Clackamas County 2003 Relative Wildlife Hazard Risk Areas

0 0.25 0.5 0.75 1 Miles

July 2009 *City of Lake Oswego*

4.4 Severe Storm: Wind and Winter

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, location, extent and impacts of the severe storm hazard in the City of Lake Oswego. Severe storm information can be found on pages 9-1 to 10-7 of the 2002 Clackamas County Natural Hazards Mitigation Plan, and pages 46 to 50 in the 2007 plan update.

Severe Storm Profile

The historical severe windstorm and winter storm events are described in the County plan, and are applicable to Lake Oswego. Three events require further explanation.

- From December 1 to 2, 2007 a rain storm brought strong winds to the City. A number of tree branches and other debris fell onto roads, requiring a large cleanup effort for City staff.

- From December 13 to 26, 2008 Oregon was struck with the largest winter storm in forty years. The storm led to significant power outages, eight water main breaks, and hazardous road conditions. The City contracted forces to assist in snow removal efforts.

- On January 17, 2009 high winds toppled a 120 foot tree onto a car. The high winds left debris in many streets and required a clean up effort by Public Works.

Severe Storm Hazard Assessment

Hazard Identification

Severe storms present a significant threat to Lake Oswego residents, property, and infrastructure. Although there is very little data to spatially represent this hazard, the location and extent of severe storms includes all of Lake Oswego.

The probability of severe storm events in Lake Oswego was determined using scientific data, historical occurrences, and local knowledge. The HMAC estimates that the probability of severe winter storm and wind storms events is 'high', meaning one incident is likely to occur in a 10 to 35 year period. The winter storm probability rating is in agreement with the County's rating, however Lake Oswego's wind storm rating is higher than the County's 'moderate' rating. History of wind storms in Lake Oswego shows that they occur frequently enough to warrant the 'high' probability rating.

Vulnerability Assessment

Severe storms can be life threatening, cause major infrastructure damage, and can be difficult to manage in terms of response and recovery. Winter storms can cover the road networks with snow and ice, impeding transportation to schools and medical facilities. Winter storms and windstorms can topple trees, down power lines, and cause widespread power outages. Pipes can burst in cold weather and sewer interceptors can overflow in heavy rains when the earth becomes saturated with snowmelt, or if the soil freezes and reduces permeability.

The HMAC estimates a 'moderate' vulnerability to severe storms, meaning between 1% and 10% of the population and assets would be affected. This rating agrees with the County's 'moderate' winter storm vulnerability rating, but is higher than the County's 'low' vulnerability rating for wind storms. Lake Oswego's wind storm vulnerability is

higher than the County's rating because the City has a dense urban tree canopy. Because of this, much of the City's population and community assets are affected in severe wind storm events.

While severe winter storm data is not available to illustrate severe storm hazard areas, City staff has noted several areas in Lake Oswego that are particularly vulnerable. In the past, falling trees, downed power lines, and icy roads have caused problems in the downtown, Palisades, Mountain Park, and Lake Grove areas, and along South Shore Road. Primarily, these areas have tall trees that present problems. Additionally, in Mountain Park, the combination of steep roads and icy conditions hampered emergency response efforts.

In the event of a severe winter storm, the City uses identified sanding routes to coordinate response activity and concentrate resources during an event. These identified routes are shown in Figure 4-4 on page 52, Winter Sanding Routes.

Risk Analysis

Due to insufficient data, Lake Oswego is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in action item ST-MH#4, and will be completing a risk assessment as data and resources become available.

Existing Severe Storm Mitigation Activities

Severe wind and winter storm mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

City of Lake Oswego Codes Pertaining to Severe Wind and Winter Storms

The following Lake Oswego codes, plans, and policies pertain to severe wind and winter storms:

1) Lake Oswego Emergency Operations Plan and Related Annexes, Severe Weather Emergency Annex. This plan describes how the City of Lake Oswego's emergency operations system will operate during emergencies involving severe storm conditions within the City and contract districts. The plan is designed to meet Clackamas County, state, and federal government emergency plans.

The plan describes the roles and responsibilities of all local responders within the City of Lake Oswego. It identifies who will be in charge of responding in the event of an incident and how the response will be handled. It provides guidelines for coordinating emergency services. It also describes how Lake Oswego will coordinate with:

- Adjacent jurisdictions;
- Mutual aid in some areas;
- State agencies;
- Federal agencies; and
- Industry (snow removal).

2) Lake Oswego City Building Evacuation Plan. The building evacuation plan is based on the adopted state program. The plan establishes evacuation procedures, including the designation and training of evacuation coordinators.

3) Lake Oswego Bridge Inspections and Records Manual. This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a

natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Severe Wind and Winter Storm Mitigation Projects

Undergrounding utilities is required for all new development. The primary step taken for severe wind or winter storm events is preparedness. Lake Oswego CERT teams are trained in how to assist in severe storm events. Each year, the City of Lake Oswego Maintenance Services conducts the following activities:

- Inventories existing stockpile of sanding materials and replenishes as necessary;
- Performs routine maintenance and inspection of all sanders, plows, dump trucks, loaders, and chain saws;
- Provides training on sander/snowplow operations; and
- Provides training on:
  - Winter driving safety;
  - Chain saw safety – operation and personal protective equipment; and
  - Working around downed power lines.

Once a storm hits, Lake Oswego has designated sanding and plowing routes that give priority to arterials and emergency response routes. Local streets have the lowest priority because they serve the fewest citizens. The CodeRED reverse 911 system can be used to inform citizens of hazard areas resulting from severe storms and encourage citizens to stay sheltered inside. The City website and public information line provide citizens with up to date information about the storm.

Severe Storm Mitigation Action Items

The severe wind and winter storm mitigation action item provides direction on specific activities that organizations and residents in Lake Oswego can undertake to reduce risk and prevent loss from severe winter storm events. The action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

LT-SS # 1: Reduce frequency and duration of power outages from the severe wind and winter storm hazards where possible.

Ideas for Implementation:

- Partner with Portland General Electric, or subsequent electrical utility, to continue hazardous tree inventory and mitigation programs;
- Where possible, during redevelopment construction, promote under grounding of utilities;
- Identify strategies to establish redundant access to the utility grid to increase the reliability of critical infrastructure; and
- Identify critical facilities for backup power generation

Coordinating Organization: Engineering and Planning
Timeline: Ongoing
Status: *Partially Complete / Deferred.* Many lift stations have built in power generators and the remainders use portable generators. Undergrounding utilities is required for all new building, and a private business on Boones Ferry voluntarily undergrounded utilities. The last idea for implementation was added in the 2009 update.

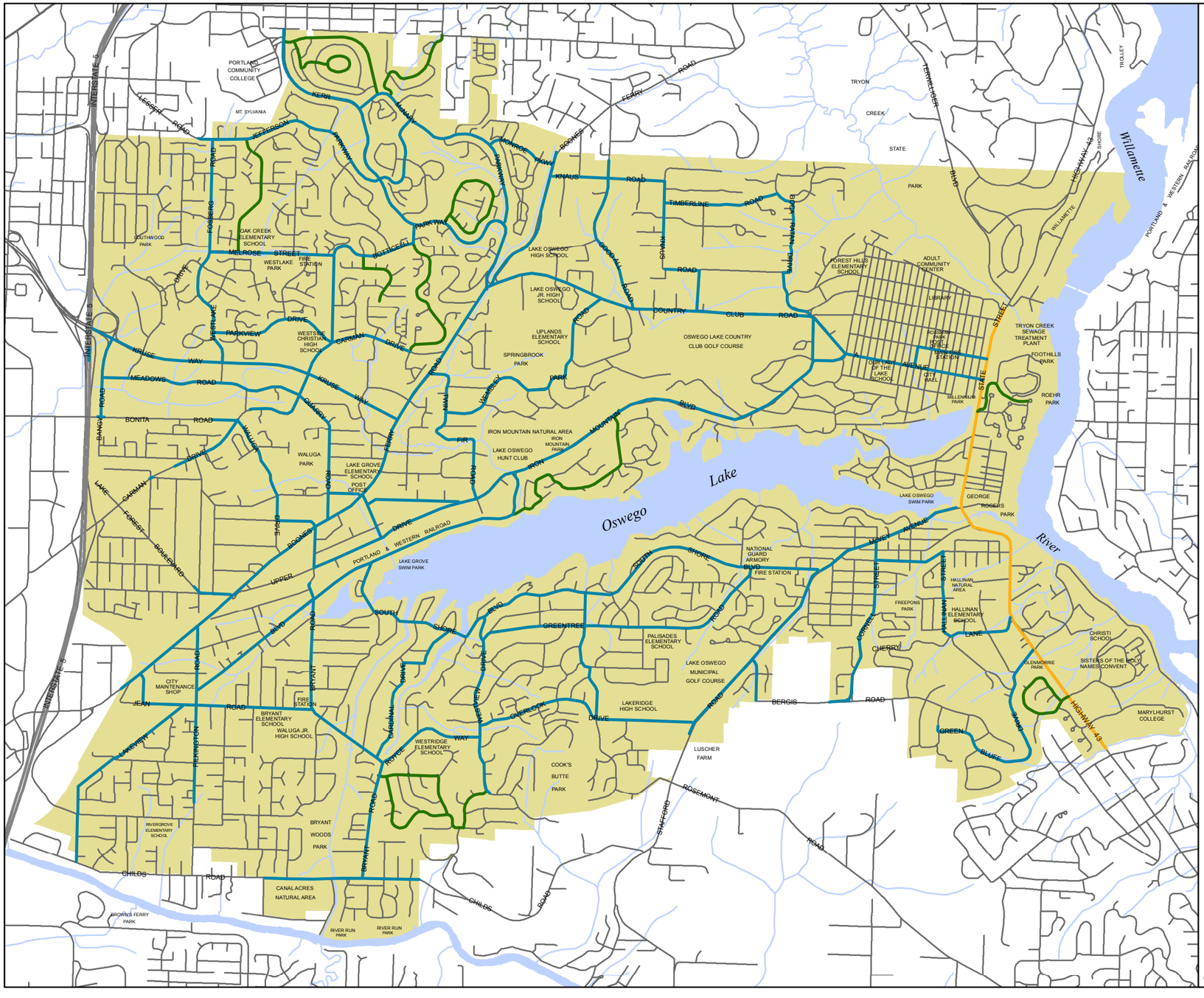


Figure 4-4

LAKE OSWEGO AREA POSSIBLE WINTER SANDING ROUTES

Ability to maintain roadways under adverse winter conditions depends on many factors including, but not limited to: equipment, staffing, and other resources; specific weather conditions; and topography.

This map does not guarantee that any street will be maintained in a safe and drivable condition during winter weather events.

Snow Routes

- 1st Priority
- 2nd Priority
- State Street*
- Lake Oswego Urban Services Boundary
- Streams

*Primary obligation belongs to ODOT

Regardless of priority, the City may deem specific roads or road segments unsafe for plowing or other maintenance activity during a winter weather event and may close the road until it can be safely plowed and/or sanded.

Data Sources Include: City of Lake Oswego Data

0 0.25 0.5 0.75 1 Miles

October 2009 ***City of Lake Oswego***

4.5 Earthquake

Earthquake Profile

Clackamas County's Natural Hazards Mitigation Plan adequately describes the causes and characteristics of earthquake hazards for the region. Likewise, the County's plan adequately documents past earthquake occurrences. Historical records count over 56 earthquakes in the Portland area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Three potential source zones capable of generating damaging earthquakes are thought to exist in the region. These include the Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

- Portland Hills Fault Zone: a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment.[xxxi] The fault zone extends along the eastern margin of the Portland Hills for a distance of 25 miles, and lies just east of Lake Oswego.
- Gales Creek-Newberg-Mt. Angel Structural Zone: a 50-mile-long zone of discontinuous, NW trending faults that lies southwest of the City. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment.[xxxii]
- Cascadia Subduction Zone: a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year.[xxxiii] Scientists have recently found evidence that11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D. [xxxiv]

Earthquake Hazard Assessment

Hazard Identification

The geographic extent of the earthquake hazards in Lake Oswego has been mapped by the City of Lake Oswego GIS Department, as shown in Figure 4-5 on page 58, using the best available data. Earthquake data was developed by the State Department of Geology and Mineral Industries (DOGAMI), GMS-91 – Relative Earthquake Hazard Map of the Lake Oswego Quadrangle, Clackamas and Multnomah Counties, Oregon, 1995; and DOGAMI Bulletin 99 – Earthquake Faults, 1979. Zone A denotes the highest hazard areas in Lake Oswego, decreasing down to zone D. The relative earthquake hazard zones, A – D, are a composite of data that depicts the relative hazard of a site due to a combination of the following effects: amplification of ground shaking by a "soft" soil column; liquefaction of water-saturated sand, creating areas of "quicksand"; and instability of slopes triggered by the shaking of an earthquake. Zones that are expected to have the most pronounced damage in any serious earthquake are shown as having the greatest relative hazard.

The HMAC estimates the probability of an earthquake occurring is 'high,' meaning one event is likely to occur within a 10-35 year period. This is in agreement with the County's 'high' rating as well. Paleoseismic studies along the Oregon coast indicate that the state

has experienced seven Cascadia Subduction Zone (CSZ) events possibly as large as M9 in the last 3,500 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. Since Clackamas County's Natural Hazards Mitigation Plan was updated in 2007, better earthquake probability estimates have surfaced. Scientists now estimate that the chance in the next 50 years of a great subduction zone earthquake is between 10 and 20 percent assuming that the recurrence is on the order of 400±200 years.[xxxv] Crustal and deep intraplate earthquakes remain difficult to predict.

Vulnerability Assessment

The HMAC estimates that the City's vulnerability to an earthquake is 'high,' meaning more than 10% of the population and assets would be affected in a large-scale event. This is in agreement with the County's rating.

The City of Lake Oswego GIS Department completed an analysis, using the best available data, as a component of the vulnerability assessment described in Section 3: Hazard Assessment. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure maps with each hazard map, and identifying where assets and hazards intersected.

City Hall, the Main Fire Station and the Adult Community Center are the critical facilities exposed to relative earthquake hazard Zone A, the highest hazard zone. City Hall, which contains the City's law enforcement and emergency dispatch facilities, and the Maintenance Building (also a critical facility) are not up to seismic standards. Seismic design standards range from Seismic Zone 1 to Seismic Zone 4. Seismic Zone 4 is the highest design standard achievable. The Main Fire Station, which houses the Emergency Operations Center (EOC), was built to Seismic Zone 4 standards, a step above the required standard for Seismic Zone 3. The Adult Community Center, which would serve as an emergency short-term shelter, has not had any seismic upgrades and does not meet modern seismic standards.

Several Essential Facilities are located in the high earthquake hazard zone. These facilities include Marylhurst University, Westridge Elementary, Lake Grove Elementary, Our Lady of the Lake School, and a number of churches, which could potentially serve as Red Cross shelter sites.

Operation of and access to exposed infrastructure including the Oswego Lake headgate, City water pumping stations, a PGE substation and the communications towers located at City Hall, could potentially be impacted during an earthquake. Other exposed infrastructure including wastewater main lines, major water lines, natural gas pipeline and fiber optic lines are buried, however they are also vulnerable to damage from earthquake hazards, potentially limiting or delaying access for the purposes of operation or repair. The fiber optic lines located along Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region.

The City's fresh drinking water supply comes from the water treatment plant in West Linn and is located in earthquake hazard Zone A (highest hazard), while the water intake located on the Clackamas River in Gladstone is located in Zone C. The water line from the West Linn water treatment plant enters Lake Oswego along Highway 43, which crosses through earthquake Zone A. The water treatment plant and the intake have been upgraded to earthquake Zone 4 standards. There are 16 reservoirs serving Lake Oswego.

The three newest reservoirs, Touchstone II, McNary II, and Palisades II, were constructed to earthquake Zone 4 standards.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest to and along Stafford Road. The Emergency Transportation Route passes through earthquake hazard Zone A at the northern City limits along State Street, possibly impacting access to and from the City.

Additionally, a number of the City's environmental assets are exposed to the high earthquake hazard. These include Iron Mountain Park, Canal Acres Natural Area, River Run Park, Glenmorrie Park, Foothills Park, Roehr Park, Rossman Park, and Tryon Creek State Park.

In 2007 DOGAMI released the results of the Statewide Seismic Needs Assessment, which evaluated the collapse potential of K-12 and emergency services buildings. The report found that Bryant Elementary, Forest Hills Elementary, Lake Grove Elementary, Lake Oswego Junior High, Oak Creek Elementary, River Grove Elementary, and Waluga Junior High all received a 'high' (>10%) collapse potential rating. Additional information and findings from this report can be found at http://www.oregongeology.org/sub/projects/rvs/OFR-O-07-02-SNAA-onscreen.pdf.

Risk Analysis

Due to insufficient data, Lake Oswego is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in action item ST-MH#4, and will be completing a risk assessment as data and resources become available.

Existing Earthquake Mitigation Activities

Earthquake mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

A primary mitigation objective is to construct or upgrade critical and essential facilities and infrastructure to withstand future earthquake events. The Main Fire Station, a critical facility which serves as the City's Emergency Operations Center (EOC), was constructed to Seismic Zone 4 standards. The South Shore Fire Station recently underwent seismic upgrades, and upgrades have been completed at the West Lake and Jean Road Fire Stations to harden the apparatus bays. Seismic upgrades have also been made to the City's water treatment plant to ensure it remains operational after a magnitude seven earthquake. Additionally, school remodels must now include seismic upgrades and the installation of sprinkler systems. Seismic studies were completed for City Hall and the police station building, City maintenance facilities, and the sewer interceptor system.

City of Lake Oswego Codes Pertaining to Earthquakes

The following Lake Oswego plans, policies, and codes pertain to earthquakes:

1) Lake Oswego Comprehensive Plan, Goal 7 - Areas Subject to Natural Disasters and Hazards, Section 2 Earthquake Hazards. The Goal of Section 2, Earthquake Hazards states: "The City shall protect life and property from earthquake hazards."

2) Lake Oswego Building Code (LOC Chapter 45). Section 45.09 of the Building Code lists the various State of Oregon Codes adopted into the City's Building Code, including, but not limited to:

- Oregon Structural Specialty Code;
- UBC Grading Code;
- Oregon One And Two Family Dwelling Code;
- Oregon Manufactured Dwelling Park Rules;
- Oregon Manufactured Home Installations Rules; and
- ICBO Uniform Code for the Abatement of Dangerous Buildings.

3) Lake Oswego Emergency Operations Plan and Related Annexes, Earthquake Annex. This plan describes how the City of Lake Oswego's emergency operations system will operate during emergencies involving earthquake conditions within the City and contract districts. The plan is designed to meet Clackamas County, state, and federal government emergency plans.

The plan describes the roles and responsibilities of all local responders within the City of Lake Oswego. It identifies who will be in charge of responding in the event of an incident and how the response will be handled. It provides guidelines for coordinating emergency services. It also describes how Lake Oswego will be in charge of an incident. It provides guidelines for coordinating emergency services

4) Lake Oswego City Building Evacuation Plan. The building evacuation plan is based on the adopted state program. The plan establishes evacuation procedures, including the designation and training of evacuation coordinators.

5) Lake Oswego Bridge Inspections and Records Manual. This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Preparedness

The City of Lake Oswego has an established Community Emergency Response Team (CERT) program that has trained members since 1995 in mitigation as well as preparedness and response. The City's Emergency Management Program works with community groups, businesses, residential facilities, and public and private schools in promoting earthquake preparedness and mitigation.

Earthquake Mitigation Action Items

The earthquake mitigation action item provides direction on specific activities that organizations and residents in Lake Oswego can undertake to reduce risk and prevent loss from landslide events. The action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation. Plan goals and County action items addressed are also noted for the action item.

LT-EQ#1: Conduct seismic evaluations on identified critical/essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.

Ideas for Implementation:

- Obtain funding to perform evaluations;
- Gain funding to retrofit/replace City Hall as a model project for other critical facilities in Lake Oswego; and
- Prioritize seismic upgrades based on criticality of need and population served.

Coordinating Organization: City Manager's Office
Timeline: 3-5 years
Status: *Partially Completed / Deferred.* City Hall was evaluated. All fire stations have been evaluated and had retrofit work done to apparatus bays. The roof diaphragm of the South Shore Fire Station was tied into walls. Water tanks and communications equipment were hardened and/or secured.

Figure 4-5

LAKE OSWEGO AREA EARTHQUAKE HAZARDS

Hazard Zones

- Zone A (hi hazard)
- Zone B
- Zone C
- Zone D (low hazard)
- Fault
- Streams

Data Sources Include: DOGAMI 1995 Relative Earthquake Hazard, DOGAMI 1979 Bulletin 99 Earthquake Faults

0 0.25 0.5 0.75 1 Miles

July 2009 ***City of Lake Oswego***

4.6 Volcanic Eruption

Volcano Profile

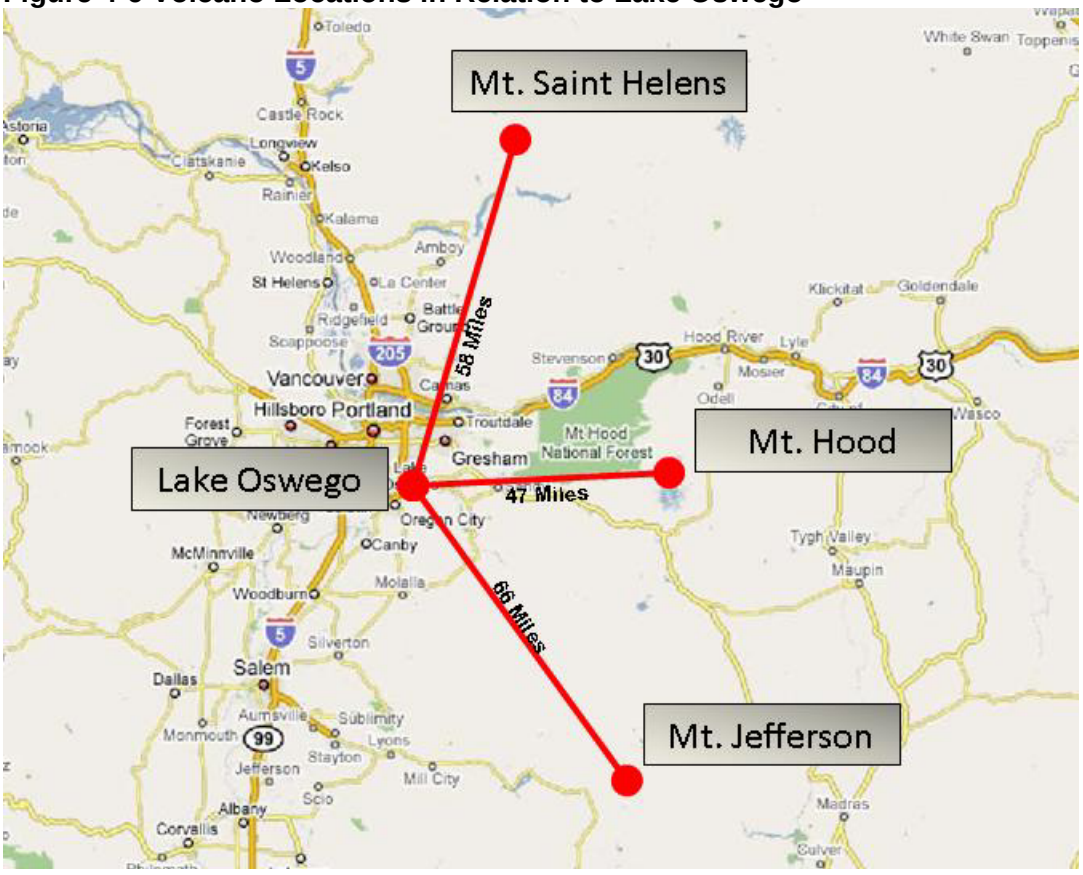
The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, history, location, extent and impacts of volcanic eruptions affecting the City of Lake Oswego. Descriptions of the volcano hazard can be found on pages 12-1 to 12-13 of the 2002 Clackamas County Natural Hazards Mitigation Plan and pages 61 to 64 of the 2007 plan update.

The probability of volcanic eruptions in Lake Oswego was determined using scientific data, historical occurrences, and local knowledge. The HMAC estimates the probability of a volcanic eruption to be 'low', meaning one incident is likely within a 75 to 100 year period. This is in agreement with the County's 'low' rating.

Volcanic Eruption Hazard Assessment

Immediate danger areas for volcanic eruptions lie within a 20-mile radius of the blast site, and ashfall is likely to affect communities downwind of the eruption. Mount Hood, Mount Jefferson, and Mount Saint Helens are the closest of the cascade volcanoes to Lake Oswego (see Figure 4-6 below). Additionally, Mount Adams is located north of Mount Hood, and the Three Sisters lie to the south of Mount Jefferson.

Figure 4-6 Volcano Locations in Relation to Lake Oswego



Due to Lake Oswego's distance from volcanoes, the City is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or

lahars). Depending on wind patterns, however, the City may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash.

Mount Jefferson's last eruptive episode culminated about 15,000 years ago. The volcano is capable of large explosive eruptions, meaning areas downwind are at risk of experiencing ashfall. The largest eruption of Mount Jefferson occurred between 35,000 and 100,000 years ago, and caused ash to fall as far away as the present-day town of Arco in southeast Idaho. Although an event has not occurred in a long time, experience at explosive volcanoes elsewhere suggests that Mount Jefferson cannot be regarded as extinct.[xxxvi]

Mount Hood's last eruption ended shortly before the arrival of Lewis and Clark in 1805. When Mount Hood erupts again, it will severely affect areas on its flanks and far downstream in the major river valleys that head on the volcano. Likewise, volcanic ash may fall on areas up to several hundred kilometers downwind.[xxxvii] Please see Clackamas County's Natural Hazards Mitigation Plan for more details regarding Mt. Hood and Mt. Jefferson, as well as additional Cascade volcanoes.

The HMAC estimates that Lake Oswego has a 'high' vulnerability to volcanic eruptions, meaning more than 10% of the population could be affected in a large-scale event. This is in agreement with the County's 'high' vulnerability rating as well.

Hazards related to volcanic eruptions (i.e., potential community impacts) are adequately described in the Clackamas County Natural Hazards Mitigation Plan. Although the City of Lake Oswego is unlikely to experience lahars or lava flows, tephra (sand-sized or finer particles of volcanic rock that is ejected rapidly into the air from volcanic vents) drifts downwind from the explosions and can form a blanket-like deposit of ash. Tephra is a public health threat, and can damage agriculture and transportation systems (i.e., aircraft and on-the-ground vehicles). Tephra can also clog drainage systems and create major debris management problems. Within Lake Oswego, public health would be a primary concern, and keeping transportation routes open/accessible would be important as well.

Existing Volcanic Eruption Mitigation Activities

The existing volcanic hazard mitigation activities are conducted at the County, regional, State, and Federal levels and are described in the Clackamas County Natural Hazards Mitigation Plan. As such, the information will not be repeated here.

Volcanic Eruption Mitigation Action Items

The City of Lake Oswego does not believe that implementing volcano-related mitigation activities will be cost-effective at this time. As such, the City has not identified volcanic-eruption mitigation action items. Lake Oswego will partner with Clackamas County, however, on the implementation of mitigation strategies that benefit both jurisdictions.

4.7 Multi-Hazard

Multi-Hazard Action Items (MH)

Multi-hazard action items are those activities that could pertain to any of the six hazards in the mitigation plan: flood, landslide, wildfire, severe wind and winter storm, earthquake, and volcanic eruption. The multi-hazard mitigation action items provide direction on specific activities that organizations and residents in Lake Oswego can undertake to reduce risk and prevent loss from multi-hazard events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

ST-MH#1: Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.

Ideas for Implementation:

- Gather hazard related information and public information materials, and disseminate to public through local publications;
- Identify property owners in the hazard zones, and conduct a target mailing to disseminate hazard information;
- Conduct public education as hazard seasons approach;
- Target Neighborhood Associations to sponsor CERT teams;
- Include hazard information on the City website; and
- Include insurance information in public outreach and education materials.

Coordinating Organization: Fire & Public Affairs
Timeline: Ongoing
Status: *Partially Complete.* Before hazard seasons articles have been written for "Hello LO," the official City newsletter mailed monthly to all households and business within City limits, and the "LO Down," an online newsletter published twice a month. The NHMP is posted online and the Fire Department brings a copy to events they attend. The Fire Department offers CERT classes and delivers hazard presentations to neighborhood associations. Red Cross publications are disseminated by the Fire Department. Lake Oswego partners with Clackamas County to produce the "Emergency Preparedness Calendar," which provides information about the hazards most likely to occur each month. Ideas for implementation numbers 3 to 7 were added in 2009.

ST-MH#2: Integrate the goals and action items from the Lake Oswego Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.

Ideas for Implementation:

- Use the mitigation plan to help the City's Comprehensive Land Use Plan meet State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards;
- Educate and inform citizens on development standards and ensure development does not encroach on hazard areas without prior mitigation; and
- Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level.

Coordinating Organization: Planning and Engineering
Timeline: Ongoing

Status: *Partially Complete / Deferred.* The City updated areas of the development code that protect natural resources, updated the flood plain ordinance with the adoption of the new maps and FEMA studies, and is in the process of completing a new sensitive lands ordinance. The Planning and Engineering Departments were designated as the new coordinating organizations. The second "idea for implementation" now refers to development standards, not Capital Improvement Plans.

ST-MH#3: Address wireless communication deficiencies locally and regionally.

Ideas for Implementation:

- Assess current deficiencies and identify appropriate technologies to address deficiencies; and
- Obtain funding for purchasing and installing necessary equipment and infrastructure.

Coordinating Organization: Lake Oswego 9-1-1 Communications (LOCOM)
Timeline: 1 – 2 years
Status: *Partially Complete / Deferred.* The City has received grants and is pursuing additional grants to purchase, install, and maintain communications equipment and infrastructure. All but one radio tower has been turned on. The action item has been expanded to include all wireless communications, not just 800 MHz.

ST-MH#4: Continue to update and improve the hazard assessment in the Lake Oswego Natural Hazards Mitigation Plan.

Ideas for Implementation:

- Obtain funding to gather more localized hazard data to illustrate the geographic extent of natural hazards in Lake Oswego;
- Update the vulnerability assessment as new development occurs or as new hazard data is developed; and
- Contract with the County or other service provider as needed to conduct a risk analysis for Lake Oswego.

Coordinating Organization: Engineering/GIS
Timeline: Short-term ongoing
Status: *Partially Complete / Deferred.* The City updated their floodplain maps based on the new FEMA maps. The City also received LIDAR data (for future incorporation into GIS map products).

ST-MH#5: Identify and pursue funding opportunities to develop and implement hazard mitigation activities.

Ideas for Implementation:

- Develop incentives for special service districts, citizens, and businesses to pursue hazard mitigation projects;
- Allocate City resources and assistance to mitigation projects when possible; and
- Partner with other organizations and agencies to identify grant programs and foundations that may support mitigation activities.

Coordinating Organization: Fire and City Manager's Office
Timeline: Short-term ongoing

Status: *Added during the 2009 update.* Yet to be completed.

ST-MH#6: Improve vegetation management throughout the City.

Ideas for Implementation:

- Partner with rail entities and ODOT to control vegetation along transportation corridors;
- Identify appropriate practices for eliminating English ivy and other invasive species;
- Maintain healthy urban canopy;
- Maintain vegetative coverage for slope stability; and
- Coordinate with watershed councils and others

Coordinating Organization: Planning and Parks
Timeline: Short-term ongoing
Status: *Added during the 2009 update.* Yet to be completed.

LT-MH#1: Obtain funding for implementing the Clean Stream Plan's infrastructural improvement recommendations.

Ideas for Implementation:

- Allocate City resources and assistance to Clean Streams Plan projects when possible;
- Include projects detailed in the Clean Streams Plan into the Capital Improvement Program; and
- Identify grant programs and City funding that may support Clean Streams Plan projects.

Coordinating Organization: Engineering
Timeline: 5 years
Status: *Partially Completed / Deferred.* Catch basin and manhole water quality retrofits were completed.

LT-MH#2: Update the Wastewater Master Plan.

Ideas for Implementation:

- Identify deficiencies in the wastewater system;
- Identify mitigation strategies for hazard impacts; and
- Obtain funding to update the plan and implement projects identified in the plan.

Coordinating Organization: Engineering
Timeline: 5 years
Status: *Added during the 2009 update.* Yet to be completed.

LT-MH#3: Upgrade Oswego Lake wastewater system.

Ideas for Implementation

- Research and obtain more robust backup power systems to reduce the chance of pump station failures;
- Obtain adequate funding for wastewater system replacement costs;
- Acquire easements; and

- Identify and obtain funding for addressing hazard potentials

Coordinating Organization: Engineering
Timeline: 5 years
Status: *Added during the 2009 update.* Note: the Palisades pump station now has permanent backup power. The Lake Oswego Interceptor System project is underway.

Section 5:
Mitigation Planning Priority System

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

5.1 Action Items

Short and long-term action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens and others could engage in to reduce risk. Full action item descriptions are located in the corresponding hazard section of this addendum. Descriptions include ideas for implementation, and coordinating / partner organizations.

- ST-MH#1: Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.
- ST-MH#2: Integrate the goals and action items from the Lake Oswego Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.
- ST-MH#3: Address wireless communication deficiencies locally and regionally.
- ST-MH#4: Continue to update and improve the hazard assessment in the Lake Oswego Natural Hazards Mitigation Plan.
- ST-MH#5: Identify and pursue funding opportunities to develop and implement hazard mitigation activities.
- ST-MH#6: Improve vegetation management throughout the City.
- LT-MH#1: Obtain funding for implementing the Clean Stream Plan's infrastructural improvement recommendations.
- LT-MH#2: Update the Wastewater Master Plan.
- LT-MH#3: Upgrade Oswego Lake wastewater system.
- LT-FL#1: Reduce the vulnerability in the Foothills area to the flooding hazard.
- LT-FL#2: Implement alternatives for reducing the flooding hazard for properties along Oswego Lake and canals.
- LT-FL#3: Pursue participation in the Community Rating System (CRS) program by identifying the requirements that are currently being met and those that need to be addressed.
- LT-FL#4: Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.
- ST-LS#1: Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.
- ST-WF#1: Promote fire-resistant strategies for new developments.

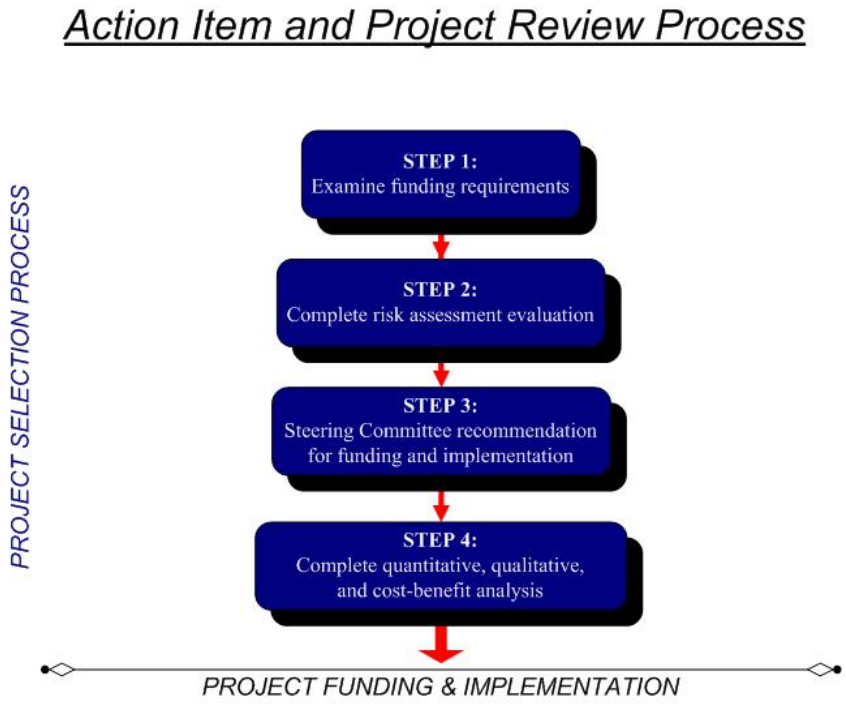
- LT-WF#1: Promote the use of non-combustible roofing materials by evaluating and making recommendations to current code to encourage noncombustible roofing standards in high fire-hazard areas.
- LT-WF#2: Develop and implement an Urban Forest Fire Management Plan.
- LT-SS#1: Reduce frequency and duration of power outages from the severe wind and winter storm hazards where possible.
- LT-EQ#1: Conduct seismic evaluations on identified critical/essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.

Note: the City of Lake Oswego does not believe that implementing volcano-related mitigation activities will be cost-effective at this time. As such, the City has not identified volcanic-eruption mitigation action items. Lake Oswego will partner with Clackamas County, however, on the implementation of mitigation strategies that benefit both jurisdictions.

5.2 Project Prioritization Process

The Disaster Mitigation Act of 2000 (via the Pre-Disaster Mitigation Program) requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment. Figure 5-1 illustrates the project prioritization process.

Figure 5-1 Project Prioritization Process



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

Step 1: Examine Funding Requirements

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

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

Step 2: Complete Risk Assessment Evaluation

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

Step 3: Committee Recommendation

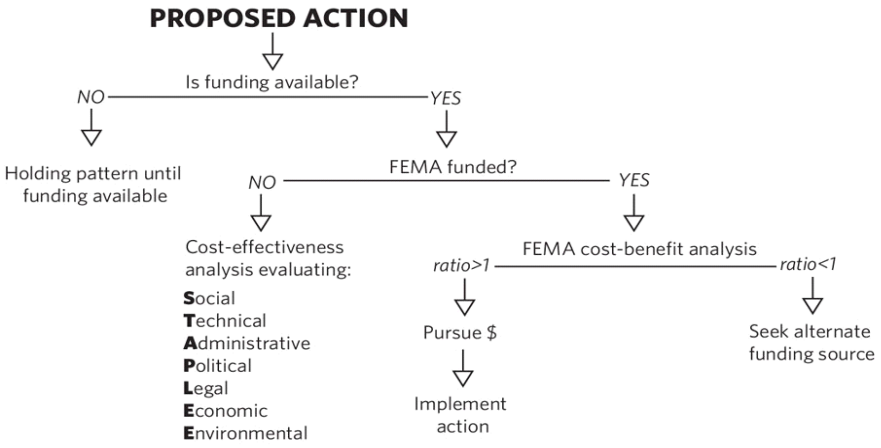
Based on the steps above, the HMAC will recommend whether or not the mitigation activity should be moved forward. If the HMAC decides to move forward with the action, the coordinating organization designated on the action item form will be responsible for taking further action and, if applicable, documenting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

The HMAC 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 HMAC to consider mitigation strategies as new opportunities arise, such as funding for action items that may not be of the highest priority. This methodology is used by the HMAC to prioritize the plan's action items during the annual review and update process.

Step 4: Complete Quantitative and Qualitative Assessment, and Economic Analysis

The fourth step is to identify the costs and benefits associated with natural hazard mitigation strategies, measures or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity assists in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards provides decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 5-2 shows decision criteria for selecting the appropriate method of analysis.

Figure 5-2 Benefit Cost Decision Criteria



Source: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2006.

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

Section 6:
Resource Directory

In addition to the County Master Resource Directory, the following list provides contact information for local agencies, organizations, and departments that may address natural hazard mitigation, and could be potential partners in implementation of Lake Oswego's mitigation action items. The HMAC has determined that potential partnerships could apply for all hazards and has assigned general categories of assistance for each partner. The HMAC will continue to add contact information for organizations as new partners are identified.

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
All Hazards	Alto Park Water District	Contact: Alto Park Water District 1124 SW Englewood Lake Oswego, OR 97034	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Bethlehem Church	Contact: Bethlehem Church 17979 Stafford Rd. Lake Oswego, OR 97034 Phone: 503-638-8660	Shelter; Public Information
All Hazards	Christ Church Episcopal Parish	Contact: Christ Church Episcopal Parish 1060 Chandler Rd. Lake Oswego, OR 97034 Phone: 503-636-5618	Shelter; Public Information
All Hazards	Church of Jesus Christ of Latter-Day Saints	Contact: Church of Jesus Christ of LDS 1271 Overlook Dr. Lake Oswego, OR 97034 Phone: 503-639-7066	Shelter; Public Information
All Hazards	Church of Jesus Christ of Latter-Day Saints	Contact: Church of Jesus Christ of LDS Portland Oregon Temple 13600 Kruse Oaks Blvd. Lake Oswego, OR 97035 Phone: 503-639-7066	Shelter; Public Information
All Hazards	Church of Jesus Christ of Latter-Day Saints	Contact: Church of Jesus Christ of LDS Lake Oswego Stake Center 14903 Westlake Dr. Lake Oswego, OR 97035 Phone: 503-620-8417	Shelter; Public Information
All Hazards	City of Lake Oswego - City Manager's Office	Contact: City Manager 380 A Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0215 Fax: 503-697-6594 Web: www.ci.oswego.or.us	Administration; Emergency Operations; Public Information; Financing
All Hazards	City of Lake Oswego - Engineering; Surveying and Mapping/GIS	Contact: City Engineer 380 A Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0270 Fax: 503-635-0269 Web: www.ci.oswego.or.us	Emergency Operations; Public Information; Public Safety; Technical Support
All Hazards	City of Lake Oswego - Fire Community Emergency Response Team (CERT)	Contact: Chief or Emergency Manager Main Station - 300 B Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0275 Fax: 503-635-0376 Web: www.ci.oswego.or.us	Emergency Operations; Emergency Response; Public Information; Public Safety; Technical Support

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
All Hazards	City of Lake Oswego - Maintenance Services	Contact: Director 5705 Jean Road P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0280 Fax: 503-697-7411 Web: www.ci.oswego.or.us	Emergency Operations; Emergency Response; Public Safety
All Hazards	City of Lake Oswego Parks and Recreation	Contact: Director 4101 Kruse Way P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-697-6500 Fax: 503-697-6579 Web: www.ci.oswego.or.us	Emergency Operations; Public Information
All Hazards	City of Lake Oswego - Planning and Development	Contact: Director of Community Development 380 A Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0290 Fax: 503-635-0269 Web: www.ci.oswego.or.us	Emergency Operations; Public Information; Technical Support
All Hazards	City of Lake Oswego - Police	Contact: Chief 380 A Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0250 Fax: 503-697-7406 Web: www.ci.oswego.or.us	Emergency Operations; Emergency Response; Public Information; Public Safety
All Hazards	City of Lake Oswego - Public Affairs	Contact: Director 380 A Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0236 Citizen Information Line: 503-697-0257 Fax: 503-699-6594 Web: www.ci.oswego.or.us	Emergency Operations; Public Information; Technical Support
All Hazards	City of Lake Oswego - Redevelopment Agency	Contact: Director 380 A Avenue P.O. Box 369 Lake Oswego, OR 97035 Phone: 503-635-0235 Fax: 503-635-0269 Web: www.ci.oswego.or.us	Public Information; Technical Support

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
All Hazards	City of Lake Oswego – Water Treatment Plant	Contact: Chief Operator 4260 SW Kenthorpe Way West Linn, OR 97068 Phone: 503-635-0394 Fax: 503-697-7424	Emergency Operations; Public Information; Public Safety; Technical Support
All Hazards	City of Milwaukie	Contact: City of Milwaukie 6101 SE Johnson Creek Blvd. Portland, OR 97206 Phone: 503-786-7555 Web: www.cityofmilwaukie.org	Coordination; Emergency Response; Public Safety; Technical Support (WTP)
All Hazards	City of Portland	Contact: City of Portland 1120 SW Fifth Ave. Portland, OR 97204 Phone: 503-823-4000 Web: www.ci.portland.or.us	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	City of Rivergrove	Contact: City of Rivergrove 5311 SW Childs Rd. P.O. Box 1104 Lake Oswego, OR 97035 Phone: 503-639-6919 Fax: 503-639-0899	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	City of Tigard	Contact: City of Tigard 13125 SW Hall Blvd. Tigard, OR 97223 Phone: 503-639-4171 Fax: 503-684-7297 Web: www.tigard-or.gov	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	City of Tualatin	Contact: City of Tualatin 18880 SW Martinazzi Ave. Tualatin, OR 97062 Phone: 503-692-2000 Fax: 503-692-5421 Web: www.ci.tualatin.or.us	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	City of West Linn	Contact: City of West Linn 22500 Salamo Rd. West Linn, OR 97068 Phone: 503-657-0331 Fax: 503-650-9041 Web: www.ci.west-linn.or.us	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Clackamas County Emergency Management	Contact: Emergency Manager 2200 Kaen Road Oregon City, OR 97045 Phone: 503-723-4848 Web: www.co.clackamas.or.us/emerg	Coordination; Emergency Response; Public Information; Public Safety; Financing; Technical Support
All Hazards	Dunthorpe-Riverdale Service District #1 (a component of	Contact: Dunthorpe-Riverdale Service District #1 501 SE Hawthorne, 4th floor	Coordination; Emergency Response; Public Safety; Technical Support

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
	Multnomah County)	PO Box 14700 Portland, OR 97293 Phone: 503-823-4000	
All Hazards	First Church of Christ Scientists	Contact: First Church of Christ Scientists 1751 Country Club Rd. Lake Oswego, OR 97034 Phone: 503-636-1667	Shelter; Public Information
All Hazards	Friends of Tryon Creek State Park	Contact: Executive Director c/o Tryon Creek State Park 11321 SW Terwilliger Blvd. Portland, OR 97219 Phone: 503-636-4398 Web: www.tryonfriends.org	Coordination; Public Information; Technical Support
All Hazards	Glenmorrie Cooperative Association	Contact: Glenmorrie Cooperative Association PO BOX 451 Lake Oswego, OR 97034	Coordination; Technical Support
All Hazards	Home Builders Association of Metropolitan Portland	Contact: Home Builders Association of Metropolitan Portland 15555 SW Bangy Road, Suite 301 Lake Oswego, OR 97035 Phone: 503-684-1880 Web: www.homebuildersportland.com/	Coordination; Public Information; Technical Support
All Hazards	Hope Community Church	Contact: Hope Community Church 14790 Boones Ferry Rd. Lake Oswego, OR 97035 Phone: 503-635-4880	Shelter; Public Information
All Hazards	House of Worship	Contact: House of Worship 3890 Upper Dr. Lake Oswego, OR 97035 Phone: 503-635-7659	Shelter; Public Information
All Hazards	Jehovah's Witnesses	Contact: Jehovah's Witnesses 12433 Boones Ferry Rd. Lake Oswego, OR 97035 Phone: 503-246-7289	Shelter; Public Information
All Hazards	Korean United Methodist Church	Contact: Korean United Methodist Church 18788 Pilkington Rd. Lake Oswego, OR 97035 Phone: 503-684-7070	Shelter; Public Information
All Hazards	Lake Bible Church	Contact: Lake Bible Church 4565 Carman Rd. Lake Oswego, OR 97035 Phone: 503-699-9840	Shelter; Public Information
All Hazards	Lake Chapel Foursquare Church	Contact: Lake Chapel Foursquare Church 796 1st St. Lake Oswego, OR 97034 Phone: 503-636-3804	Shelter; Public Information

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
All Hazards	Lake Family Fellowship	Contact: Lake Family Fellowship 17555 Bryant Rd. Lake Oswego, OR 97035 Phone: 503- 635-3518	Shelter; Public Information
All Hazards	Lake Grove Christian Church	Contact: Lake Grove Christian Church 15751 Quarry Rd. Lake Oswego, OR 97035 Phone: 503-636-3796	Shelter; Public Information
All Hazards	Lake Grove Fire District 57	Contact: Lake Grove Fire District 57 Board Member 16400 Bryant Rd. Lake Oswego, OR 97035 Phone: 503-624-9716	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Lake Grove Park District (managed by Lake Oswego School District)	Contact: Lake Oswego School District P.O. Box 70 Lake Oswego, OR 97034 Phone: 503-534-2300	Coordination; Public Information
All Hazards	Lake Grove Presbyterian Church	Contact: Lake Grove Presbyterian Church 4040 Sunset Dr. Lake Oswego, OR 97035 Phone: 503-636-5656	Shelter; Public Information
All Hazards	Lake Grove Water District	Contact: Lake Grove Water District PO Box 1173 Lake Oswego, OR 97035 Phone: 503-636-1617 Fax: 503-635-5066	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Lake Oswego Chamber of Commerce	Contact: Executive Director 242 B Avenue P.O. Box 368 Lake Oswego, OR 97034 Phone: (503) 636-3634 Web: www.lake-oswego.com	Coordination; Public Information
All Hazards	Lake Oswego Corporation / Lake Patrol	Contact: Lake Oswego Corporation 698 McVey Ave. PO Box 203 Lake Oswego Oregon 97034 Phone: 503-636-1422 Fax: 503-636-3226 Web: www.lakecorp.com	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Lake Oswego Jehovahs Witnesses	Contact: Lake Oswego Jehovahs Witnesses 4801 Jean Rd. Lake Oswego, OR 97035 Phone: 503-246-7289	Shelter; Public Information
All Hazards	Lake Oswego Neighborhood Action Coalition	Contact: Community Planning Department, City of Lake Oswego P.O. Box 369	Coordination; Public Information

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
		Lake Oswego, OR 97034 Phone: 503-635-0290 Fax: 503-635-0269 Web: www.ci.oswego.or.us/plan/Neighborhoods/	
All Hazards	Lake Oswego Recognized Neighborhood Associations	Contact: Community Planning Department, City of Lake Oswego P.O. Box 369 Lake Oswego, OR 97034 Phone: 503-635-0290 Fax: 503-635-0269 Web: www.ci.oswego.or.us/plan/Neighborhoods/	Coordination; Public Information
All Hazards	Lake Oswego Review	Contact: Publisher 400 2nd Street Lake Oswego, OR 97034 Phone, newsroom: 503-635-8811 Fax, newsroom: 503-635-8817 Web: www.lakeoswegoreview.com	Coordination; Public Information
All Hazards	Lake Oswego School District	Contact: Superintendent P.O. Box 70 Lake Oswego, OR 97034 Phone: 503-534-2300 Fax: 503-534-2030 Web: www.losd.loswego.k12.or.us/Default.htm	Coordination; Shelter; Public Information
All Hazards	Lake Oswego United Church	Contact: Lake Oswego United Church of Christ 1111 Country Club Rd. Lake Oswego, OR 97034 Phone: 503-635-4348	Shelter; Public Information
All Hazards	Lake Oswego United Methodist	Contact: Lake Oswego United Methodist 1855 Southshore Blvd. Lake Oswego, OR 97034 Phone: 503-636-8423	Shelter; Public Information
All Hazards	Metro Service District 2 (METRO) Executive Office Data Resource Center	Contact: 600 NE Grand Ave. Portland, OR 97232 Phone: 503-797-1700	Information Coordination; Financing; Public Information; Technical Support
All Hazards	Mountain Park Church	Contact: Mountain Park Church 40 McNary Pkwy. Lake Oswego, OR 97035 Phone: 503-635-3443	Shelter; Public Information
All Hazards	Multnomah County Department of Business & Community Services (GIS, Land Use Planning, Transportation)	Contact: County Manager 501 SE Hawthorne Blvd., 4th Floor Portland, OR 97214 Phone: 503-823-4000 Fax: 503-823-6868 Web: www.co.multnomah.or.us	Coordination; Technical Support
All Hazards	Multnomah County -	Contact: Emergency Manager	Coordination; Emergency Response; Public

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
	Emergency Management	501 SE Hawthorne Blvd. Suite 600 Portland, OR 97233 Phone: 503-988-6700 Web: www.co.multnomah.or.us	Safety; Technical Support
All Hazards	Multnomah County - Sheriff	Contact: Sheriff Administrative Office 501 SE Hawthorne Blvd., Suite 350 Portland, OR 97214 Phone: 503-988-4300 Fax: 503-988-4320 Web: www.co.multnomah.or.us	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Oregon Water Resources Department Dam Safety	Contact: Dam Safety Coordinator 158 12th St. NE Salem, OR 97310 Phone: 503-378-8455 Fax: 503-378-2496 Web: www.wrd.state.or.us/index.shtml	Coordination; Public Safety; Technical Support
All Hazards	Our Lady of the Lake Church	Contact: Our Lady of the Lake Church 650 A Ave. Lake Oswego, OR 97034 Phone: 503-636-7687	Shelter; Public Information
All Hazards	Our Savior's Lutheran Church	Contact: Our Savior's Lutheran Church 2000 Country Club Rd. Lake Oswego, OR 97034 Phone: 503-635-4563	Shelter; Public Information
All Hazards	Palatine Hill Water District #26	Contact: Palatine Hill Water District Board Member P.O. Box 1193 Lake Oswego, OR 97034 Phone: 503-223-5181	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Port of Portland	Contact: Executive Director P.O. Box 3529 Portland, OR 97208 Phone: 503-944-7000 Fax: 503-944-7080 Web: www.portofportland.com	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Portland Community College	Contact: President P.O. Box 19000 Portland, OR 97280 Phone: 503-244-6111 Web: www.pcc.edu	Coordination; Shelter; Public Information
All Hazards	Portland & Western Railroad, Inc.	Contact: President 650 Hawthorne Ave. SE, Suite C-320 Salem, OR 97301 Phone: 503-365-7717 Fax: 503-365-7787	Coordination; Emergency Response; Public Safety; Technical Support

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
		Web: http://members.trainorders.com/dan.sheets	
All Hazards	Portland School District 1J	Contact: Superintendent 501 North Dixon Street Portland, Oregon, 97227 Phone: 503-916-2000 Web: www.pps.k12.or.us/	Coordination; Public Information
All Hazards	River West Church	Contact: River West Church 1595 Greentree Rd. Lake Oswego, OR 97034 503-699-2226	Shelter; Public Information
All Hazards	Riverdale School District 51J	Contact: Superintendent 11733 SW Breyman Ave. Portland, OR 97219 Phone: 503-636-8611 Fax: 503-635-6342 Web: www.riverdale.k12.or.us/	Coordination; Public Information
All Hazards	Riverdale-Dunthorpe Fire District JT-11	Contact: Chief 12203 SW Tryon Hill Road Portland, OR 97219 Phone: 503 635-0275	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Rivergrove Water District #14	Contact: Rivergrove Water District 17725 SW Boones Ferry Road Lake Oswego, OR 97035 Phone: 503-635-6041 Fax: 503-699-9423	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	St. Anne's Chapel at Marylhurst University	Contact: St. Anne's Chapel 17600 Pacific Hwy. Marylhurst, OR 97036 Phone: 503-697-8730	Shelter; Public Information
All Hazards	Skylands Water Company	Contact: Skylands Water Company Board President PO Box 451 Lake Oswego, OR 97034 Phone: 503-636-7203	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Southwood Park Water District c/o Tualatin Valley Water District	Contact: Southwood Park Water District 1850 SW 170th Ave. Beaverton, OR 97075 Phone: 503-642-1511 Web: http://www.tvwd.org/	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Three Rivers Land Conservancy	Contact: Director PO Box 1116 Lake Oswego, OR 97035 Phone: 503-699-9825 Fax: 503-699-9827 Web: www.trlc.org	Coordination; Financing; Public Information; Technical Support
All Hazards	Tigard-Tualatin School District 23J	Contact: Superintendent	Coordination; Public Information

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
		6960 SW Sandburg St. Tigard, OR 97223 Phone: 503-431-4000 Web: www.ttsd.k12.or.us	
All Hazards	TriMet Administrative Offices	Contact: General Manager 4012 SE 17th Ave. Portland, OR 97202 Phone: 503-962-7505 Web: http://www.trimet.org	Coordination; Emergency Response; Public Information; Public Safety; Technical Support
All Hazards	Triumphant King Lutheran Church	Contact: Triumphant King Lutheran Church 4700 Lamont Wy. Lake Oswego, OR 97035 Phone: 503-636-3436	Shelter; Public Information
All Hazards	Tryon Creek State Natural Area	Contact: Tryon Creek State Natural Area 11321 SW Terwilliger Blvd. Portland, OR 97219 Phone: 503-636-9886 Web: www.oregonstateparks.org/park_144.php Contact: Oregon State Parks Area 2 Field Office P.O. Box 500 Portland OR 97207 Phone: 503-731-3293 Fax: 503-731-3296 Web: www.prd.state.or.us/	Coordination; Public Information; Technical Support
All Hazards	Tryon Creek Watershed Council	Contact: Chair 11321 SW Terwilliger Blvd Portland, OR 97219 Phone: 503-636-4398 x 121 Web: http://tcwc.tryonfriends.org	Coordination; Public Information; Technical Support
All Hazards	Tualatin Valley Fire and Rescue	Contact: Fire Chief 20665 SW Blanton St. Aloha, OR 97007 Phone: 503-649-8577 Fax: 503-642-4814 Web: http://www.tvfr.com	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Unity World Healing Center	Contact: Unity World Healing Center 366 3rd St. Lake Oswego, OR 97034 Phone: 503-697-9765	Shelter; Public Information
All Hazards	Washington County County Administrator, Government Relations, Land Use & Transportation	Contact: County Administrator 155 N First Ave. Hillsboro, OR 97124 Phone: 503-846-8685 Web: www.co.washington.or.us	Coordination; Technical Support

Hazard Mitigation Resource Directory

Hazard	Agency	Contact Information	Type of Assistance
All Hazards	Washington County Clean Water Services	Contact: Director 155 N First Ave., Suite 270 Hillsboro, OR 97124 Phone: 503-681-3600 Fax: 503-681-3603 Web: www.cleanwaterservices.org/	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	Washington County Emergency Management	Contact: Emergency Management Director 20665 SW Blanton. Aloha, OR 97007 Phone: 503-642-0371 Fax: 503-642-4814 Web: www.co.washington.or.us	Coordination; Emergency Response; Public Safety; Technical Support
All Hazards	West Linn-Wilsonville School District 3J	Contact: Superintendent 22210 SW Stafford Road P.O. Box 35 West Linn, Oregon 97068 Phone: 503 673-7000 Fax: 503 673-7001 Web: www.wlwv.k12.or.us/	Coordination; Public Information
All Hazards	Westside Baptist Church	Contact: Westside Baptist Church 1679 Southshore Blvd. Lake Oswego, OR 97034 Phone: 503-697-3128	Shelter; Public Information
All Hazards	Willamette Shore Trolley	Willamette Shore Trolley 311 N. State St. Lake Oswego, OR 97034 Phone: 503-697-7436	Coordination; Public Information
All Hazards	Young Nak Presbyterian Church	Contact: Young Nak Presbyterian Church 1040 C Ave. Lake Oswego, OR 97034 Phone: 503-697-4777	Shelter; Public Information

[i] FY 2005 Pre-Disaster Mitigation Grant Recipients http://www.fema.gov/government/grant/pdm/fy05_pdm_grant_recipients.shtm

[ii] USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

[iii] Comprehensive Plan of the City of Lake Oswego. Adopted December, 1994.

[iv] Ibid.

[v] Ibid.

[vi] Ibid.

[vii] Ibid.

[viii] Tualatin River Watershed Council, http://www.trwc.org/watershed.html (accessed February 12, 2009).

[ix] Ibid.

[x] Ibid.

[xi] Ibid.

[xii] Lake Oswego Community Profile, Oregon Business Development Department. http://www.orinfrastructure.org/profiles/LakeOswego/ (accessed January 13, 2009).

[xiii] American Community Survey 2006-2008. http://www.census.gov/acs/www/ (accessed February, 2010).

[xiv] Ibid.

[xv] Ibid.

[xvi] Ibid.

[xvii] Ibid.

[xviii] Ibid.

[xix] City of Lake Oswego. http://www.ci.oswego.or.us/ (accessed February 13, 2009).

[xx] American Community Survey 2006-2008. http://www.census.gov/acs/www/ (accessed February, 2010).

[xxi] Ibid.

[xxii] Ibid.

[xxiii] Ibid.

[xxiv] Chamber of Commerce and Clackamas County. Quoted in the City of Lake Oswego Comprehensive Annual Financial Report. June 30, 2009.

[xxv] American Community Survey 2006-2008. http://www.census.gov/acs/www/ (accessed February, 2010).

[xxvi] Ibid.

[xxvii] City of Lake Oswego Website, http://www.ci.oswego.or.us/, accessed April 23, 2009

[xxviii] Ibid.

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

[xxx] Federal Emergency Management Agency Policy and Claim Statistics for Flood Insurance (as of 4/30/09). http://www.fema.gov/business/nfip/statistics/pcstat.shtm

[xxxi] Madin, Ian, 1990. *Earthquake-hazard geology maps of the Portland metropolitan area, Oregon; text and map explanation: Portland, OR.* Oregon Department of Geology and Mineral Industries.

[xxxii] Yeats, R.S., Graven, E.P., Werner, K.S., Goldfinger, C., and Popowski, T., 1996. *Tectonics of the Willamette Valley, Oregon.* U.S. Geological Survey Professional Paper 1560.

[xxxiii] Goldfinger, C., L. D. Kulm, R. S. Yeats, C. Hummon, G. J. Huftile, A. R. Niem, C. G. Fox, and L. C. McNeill, 1996. *Oblique strike-slip faulting of the Cascadia submarine*

forearc: the Daisy Bank fault zone off central Oregon, in Subduction Top to Bottom, G. E. Bebout, D. Scholl, S. Kirby and J. P. Platt (Editors), American Geophysical Monograph 96, 65–74.

[xxxiv] The Cascadia Region Earthquake Workgroup, 2005. *Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario.* http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf

[xxxv] National Oceanic and Atmospheric Administration, 1993. *Tsunamis affecting the West Coast of the United States: 1806-1992*.

[xxxvi] United States Geological Survey, Cascades Volcano Observatory. Vancouver, Washington. http://vulcan.wr.usgs.gov/

[xxxvii] Ibid.

Appendix A: Planning and Public Process

The following appendix documents Lake Oswego's natural hazards mitigation planning and public involvement processes.

Work Sessions

Public Outreach

Meeting: Lake Oswego Natural Hazard Mitigation Plan Meeting 1
Date: March 17, 2009
Time: 10:00am to 3:00pm
Location: Main Fire Station

MINUTES

1. Meeting Attendees
    a. Rob Amsberry, City of Lake Oswego Engineering Department
    b. Dan Duncan, Lake Oswego Police Department
    c. Larry Goff, Lake Oswego Fire Department
    d. Leslie Hamilton, Lake Oswego Planning Department
    e. Bonnie Hirshberger, Lake Oswego Public Affairs Department
    f. Elizabeth Papadopoulos, Lake Oswego Maintenance Department
    g. Laurel Reimer, Clackamas County Emergency Management
    h. Ed Wilson, Lake Oswego Fire Department
    i. Jay Wilson, Clackamas County Emergency Management

2. Overview of Natural Hazards Mitigation Plans
    a. Laurel explained the "disaster cycle" to the group, stating that after an event the cycle goes from response to recovery to mitigation and finally to preparedness. Laurel emphasized that the natural hazards mitigation plan (NHMP) focuses on the mitigation portion of the disaster cycle. Mitigation is making adjustments now that increase the resiliency of the city in the long-term.
    b. Laurel then showed the group the "understanding risk" diagram, saying natural hazards are chronic and potential events. We cannot always predict or control them, and they will happen. 'The vulnerable system' is all of the built environment and population in the City of Lake Oswego. These are things that can be controlled. The 'natural hazard' bubble represents the physical events affecting the city, and these are events that cannot be controlled. The 'risk of disaster' is the overlap between natural hazards and vulnerable systems. The goal of a NHMP is to decrease the amount of overlap between the vulnerable system and natural hazards so humans can limit or mitigate any issues that can arise from the area of overlap.
    c. Lastly, Laurel explained why existing plans, policies, community organizations and programs are helpful for NHMPs. Ideally mitigation would be an element of every city plan, making it easier to infuse mitigation planning into numerous facets of the city. In the mean time, it is good to identify the plans that could have natural hazard mitigation elements in the future when those plans are updated. Community organizations and programs can be used to implement natural hazard preparedness and mitigation strategies.

3. Planning Process Discussion
    a. Laurel asked what the group would like to be referred to as.
        i. The group will still be referred to as the Hazard Mitigation Advisory Committee (HMAC)
    b. Laurel asked the group if they would like to update their mission and goals or concur with the County's Mission and Goals.
        i. The HMAC concurred with the county's mission and goals.
    c. Addendum Adoption
        i. The Lake Oswego City Council will adopt the addendum.
    d. Laurel asked the group who will be the Coordinating Body.
        i. The Hazard Mitigation Advisory Committee (HMAC) will be the coordinating body.
    e. Laurel asked who will serve as the Convener
        i. Lake Oswego Fire Department will still serve as convener.
    f. Laurel asked the group what the HMAC has done since the addendum was adopted in 2004
        i. The HMAC met once in 2005 to discuss a grant to fund upgrades to City Hall. The group applied for and received the grant.
    g. Laurel asked what public involvement has taken place, and what the HMAC would like to do to keep the public involved.
        i. The Lake Oswego Fire Department always brings a copy of the NHMP to public presentations to inform the public of the addendum's existence, purpose, and lets the public know where they can find copies of the addendum.
        ii. The addendum is currently available on the city's website.
        iii. The city will use the city newsletter, Hello LO, to share information about the addendum. The addendum will be available on the city website and at the Lake Oswego Library on CD-ROM for citizen check-out. Copies will be distributed to appropriate city agencies, boards and commissions, HMAC members, and City Council members. The HMAC can call a public meeting when deemed necessary, such as after a hazard event.

4. Critical/Essential Facilities & Infrastructure
    a. Laurel asked the group to review and update the list of critical and essential facilities & infrastructure from the 2004 addendum.
    b. Critical Facilities
        i. Laurel suggested listing out the schools and fire stations for the 2009 addendum, rather than stating "fire stations" and "schools". The HMAC agreed to list them out for the 2009 addendum.
        ii. The Adult Community Center was changed from being a primary shelter to an emergency short-term shelter.

c. Essential Facilities
    i. The Lake Oswego Tennis Center and Library will be moved under the "City Facilities" title
    ii. The Lake Oswego Municipal Golf Course was added and will be listed under "City Facilities"
    iii. The Parks and Recreation/West End Building will be listed as West End Building
d. Critical Infrastructure
    i. Country Club Road, Boones Ferry Road, and Kruse Way were added as "major local roads"
    ii. Portland Western rail road, and the Willamette Shore Trolley were added
    iii. NW Natural gas substations added

5. Mitigation Planning Priority System Discussion
    a. Laurel overviewed the mitigation planning priority system used in the 2004 addendum and overviewed an alternative priority system the city could employ.
    b. The group determined that they did not want to rank their action items using the point system from the 2004 addendum because that system was subjective and confusing. This will be talked about further at the second planning meeting.
    c. The updated addendum will use the OPDR ranking system because it allows for more flexibility in following through on action items.

6. Hazard Identification
    a. Laurel created a handout detailing each of the following hazards: flood, landslide, wildfire, earthquake, severe storm, and volcano. The group went over each hazard and added information on impacts, history, mitigation efforts, and compared Lake Oswego's probability and vulnerability to the county's ratings. The details on the handout will not be included in the minutes, only those items that were added at the meeting.
    b. Better communications will be added as a mitigation effort for all hazards (CERT, city website, public information line).
    c. Flood
        i. History
            1. The county plan is sufficient
            2. On January 2, 2009 the sewer interceptor overflowed on Cardinal Lane, sending approximately 226,000 gallons of wastewater out of the system. Maintenance captures about 75% of the discharge using vacuum trucks.
        ii. Impacts

1. Take out the statement “facility itself is located above the floodplain” for Tyron Creek Wastewater Treatment Plant because it flooded in 1996
2. The water transmission main from the intake on the Clackamas River can get flooded. The line is buried in the peninsula and can be exposed when a big flood hits, making it susceptible to damage
3. The Foothills pump stations can be flooded
4. Various service lines and pipes can be exposed and damaged or break in high water.
5. Sustained heavy rains that saturate the ground lead to sewer interceptor overflows

iii. Mitigation Steps Taken

1. Take out the line about the new park in the Foothills area because the plan to raise portions of the park cannot be done
2. A “flood management alternatives for Oswego Lake” study was completed in 2003 and detailed what could be done to help alleviate flooding of Oswego Lake
3. New NFIP rate maps were adopted in June 2008
4. Surface water master plan, called the “Clean Streams Plan” in the final phases of being updated
5. Code Red system emergency notification system (reverse 911) in use since 2006

iv. Probability – High, in agreement with the county

v. Vulnerability – Moderate, in agreement with the county

d. Landslide

i. History

1. Elizabeth will find the dates of additional slide events
2. A 2007 or 2008 rain event led to three slides on Iron Mountain, Green Bluff, and Oak Street. The slides led to road closures and debris removal. A catchment basin was damaged on one slide but no other property was damaged.
3. February 2, 2008: a landslide in George Rogers Park led to the closure of the pathway between George Rogers Park and Old River Road for 5 months. The landslide occurred on the slope above the pathway and deposited approximately 50 cubic yards of material onto the pathway. The private property owners above the pathway built a steel gabion retaining wall to stabilize the slope.

4. January 2, 2009: Just after 1:00am a large landslide originated from the slopes above Green Bluff Drive in the Marylhurst area. 21 homes and 28 people were evacuated, and 5 people were transported to the hospital. The Adult Community Center opened to accommodate families in need of shelter. A second slide down the hill from Green Bluff damaged another home and the right of way. Another slide on Oak Street deposited earth onto the road and diverted runoff into the properties down below.

ii. Impacts
    1. All utilities located in slide areas (water lines, communications systems, fiber optics, gas lines, etc) may be damaged and/or disrupted in slide events

iii. Mitigation
    1. In 2005 City Engineering staff solicited proposals from qualified geotechnical engineering firms to provide an analysis of the slide area in Rockinghorse Lane and to make recommendations for alternatives to improve drainage in the area.
    2. The city has DOGAMI LIDAR data and maps
    3. A debris catchment basement was built on Green Bluff
    4. The city is looking to stabilize a catch basement on the lower slide on Green Bluff
    5. The private property owners above the George Rogers pathway built a steel gabion retaining wall to stabilize the slope.

iv. Probability: High, in agreement with county

v. Vulnerability: Low, in agreement with county

e. Wildfire

i. History
    1. The county plan is sufficient

ii. Impacts
    1. Those listed in the handout are sufficient

iii. Mitigation Steps Taken
    1. Lake Oswego Fire Department participated in the creation of the Clackamas County Community Wildfire Protection Plan
    2. Additional fire hydrants are installed in interface areas when needed
    3. The city has a program to reduce non-native vegetation, therefore reducing fuel load
    4. The city adopted the 2007 Oregon Fire Code

iv. Probability: Moderate, in agreement with county
v. Vulnerability: Moderate, in agreement with county

f. Severe Storm: Wind and Winter
   i. History
      1. December 1-2, 2007: a winter storm brought down a number of trees in the city and required a big clean up effort
      2. December 13-26, 2008: the worst winter storm event to hit Oregon in 40 years. The storm was a Presidentially-declared disaster. The storm uprooted many trees and led to significant power outages and road closures. 8 water mains broke. Maintenance contracted out to assist city staff with snow removal.
      3. January 1-2, 2009: The winter storm saturated soils and led to landslides on Green Bluff Drive, Iron Mountain and Oak Street, requiring 21 homes to be evacuated. A sewer interceptor overflowed at Cardinal Drive. The storm downed multiple trees on Oak Street, leading to its closure between Dyer Street and Hwy 43.
      4. January 17, 2009: A wind storm toppled trees. One tree fell on top of a car on Kruse Way, severely injuring the passenger.
   ii. Impacts
      1. Pipes can break in cold weather
      2. After severe storms Lake Oswego is more susceptible to flooding and landslides
   iii. Mitigation Efforts
      1. The city can use Code Red to inform citizens of sewer interceptor overflows
      2. Maintenance now has a plowing priority system. Arterials and emergency response routes are cleared first, then secondary streets, and finally local streets are plowed. Some streets are too steep to plow so the city can choose to close the street if conditions are unsafe for driving.
      3. Maintenance constantly monitors and restocks inventory – not necessarily done in the fall.
   iv. Probability: High for wind, High for winter – in agreement with county
   v. Vulnerability: High for winter, in agreement with county. Moderate for wind, higher than the county's 'low' rating because Lake Oswego has many trees lining and

overhanging transportation routes, history shows more than 1% of the population is affected in wind storms.

g. Earthquake
    i. A sentence describing the zones 1-4 and A-D designations needs to be added to the plan.
    ii. History
        1. The county plan is sufficient
    iii. Impacts
        1. The Oswego Lake sanitary sewer interceptor is located in the floodplain (2004 plan says it isn't)
        2. All utilities located in earthquake areas (water lines, communications systems, fiber optics, gas lines, etc) may be damaged and/or disrupted in slide events
        3. City Hall, Maintenance main office, and Maintenance truck barn buildings are not up to seismic standards. City hall houses the Police Department and 911 dispatch center.
    iv. Mitigation Efforts
        1. Three of the four Fire Department apparatus bases had retrofitting on the bay area.
        2. The city did an evaluation of seismic conditions of city facilities
        3. Maintenance did an evaluation too
    v. Probability: High, in agreement with county
    vi. Vulnerability: High, in agreement with county
h. Volcano
    i. History
        1. County plan is sufficient
    ii. Impacts
        1. County plan is sufficient
        2. The biggest problem for Lake Oswego will be ash in the water supply
        3. Vehicles and buildings with HVAC will also have problems
        4. County plan does not list respiratory issues related to ash, but this will be an issue especially for elderly citizens
    iii. Probability: Low, in agreement with county
    iv. Vulnerability: High, in agreement with county

7. Maps
    a. A discussion on what should be added to maps arose at the end of the meeting. It was noted that churches should be taken off the

maps, and all items added to the list of critical/essential facilities need to be included on the maps

b. The Main Fire Station should be designated on the maps as the EOC

8. Next Time: Action Items
    a. Laurel let the group know that the next meeting will focus on action items. We will review the action items from the 2004 addendum and detail what has been accomplished, what should be taken out, and what should be added.
    b. Larry encouraged the group to really think about action items before the next meeting because only action items listed in the NHMP are eligible for mitigation grant money. Mitigation grant money will be available soon because of the recent winter storm event.

Natural Hazard Mitigation Plan Update Meeting 1

City o Lake Oswego
March 17, 2009
10:00 am to 3:00 pm

First	Last	Agency	Job Title	Email	Roundtrip Mileage
Elizabeth	Papadopoulos	L.O. Maintenance	Director	epapadopoulos@ci.oswego.or.us	9
Leslie	Hamilton	LO Planning	Assoc. Planner	lhamilton@ci.oswego.or.us	
Rob	Amsberry	CLO Engineering	Eng. Tech	ramsberry@ci.oswego.or.us	—
Larry	Goff	LOFD	Asst. Chief	lgoff@ci.oswego.or.us	
Ed	Wilson	LOFD	Fire Chief	ewilson@ci.oswego.or.us	—
Dan	Duncan	LOPD	Police Chief	duncan@ci.oswego.or.us	
Bonnie	Hirshberger	LO Public Affairs	Citizen Information	bhirshberger@ci.oswego.or.us	—

Meeting: Lake Oswego Natural Hazard Mitigation Plan Meeting 2
Date: May 11, 2009
Time: 8:30am to 12:00pm
Location: Lake Oswego Main Fire Station

MINUTES

1. Meeting Attendees
    a. Rob Amsberry, City of Lake Oswego Engineering Department
    b. Dan Duncan, Lake Oswego Police Department
    c. Larry Goff, Lake Oswego Fire Department
    d. Leslie Hamilton, Lake Oswego Planning Department
    e. Bonnie Hirshberger, Lake Oswego Public Affairs Department
    f. Elizabeth Papadopoulos, Lake Oswego Maintenance Department
    g. Laurel Reimer, Clackamas County Emergency Management
    h. Ed Wilson, Lake Oswego Fire Department

2. Formal Review Process and Plan Maintenance
    a. The City Manager will assign representatives to the Hazard Mitigation Advisory Committee (HMAC).
    b. The special service districts from 2004 were not invited to participate in the 2009 update. The phrase "At this time, additional representatives from the Lake Oswego School District and Lake Oswego Corporation will be invited to attend Advisory Committee meetings" will be removed.
    c. The HMAC will no longer meet quarterly and instead meet twice a year – once in the spring and again in the fall. This will provide the committee an opportunity to prepare for the upcoming hazard seasons and detail any hazard events from the previous season.
    d. The NHMP will be informally evaluated at the semiannual meetings, rather than a formal evaluation annually.
    e. The NHMP will be formally evaluated and updated once every five years in conjunction with the county's update. This puts the next update for September, 2012. The HMAC will begin updating the NHMP one year before the update is due.
    f. The convener will be responsible for initiating the evaluation process. The convener will also be responsible for updating the plan and submitting it to FEMA.
    g. Laurel provided a list of questions to ask in subsequent evaluations. The group agreed to put this list of questions in the plan.

3. Review Anatomy of an Action Item
    a. Laurel explained each part of an action item before going over the sheet of existing and proposed action items.

4. Update and Brainstorm Action Items
    a. Laurel provided the group with a handout of the 2004 action items and proposed action items.
    b. The group reviewed and revised the action items from the 2004 plan to discuss what had or hadn't been completed. The group updated the "ideas for implementation", coordinating organization, and timeline if needed.
    c. Laurel included proposed action items on the handout. The group discussed each action item to determine if they wanted to keep, alter, or delete it.
    d. See the attached handout for the final list of action items.

5. Next Steps
    a. Laurel will input what the group discussed into the plan.
    b. Once maps are completed Laurel will need the data derived from them to complete the plan.
    c. Laurel will email the completed draft to the committee and they will have two weeks to review and edit.
    d. The Oregon Partnership for Disaster Resilience will also review the final draft and make edits.
    e. Laurel will then compile all edits and email back out to the group for a final review.
    f. Once the final review is done the plan goes to FEMA for initial review.

NHMP Meeting #2 — May 11, 2009 — 8:30–12:00

First	Last	Agency	Title	Miles
Larry	Goff	Fire	Assistant Chief	0
Rob	Amsberry	L.O./Engineering	Surface Water Mngt.	~~0~~
Bonnie	Hirshberger ✓	Public Affairs	Citizen Information	~~0~~
Leslie	Hamilton	Planning	Assoc. Planner	0
Elizabeth	Papadopoulos	Maintenance	Director	0
Ed	Wilson	Fire	Fire Chief	~~0~~
Dan	Dunan	LOPD	Police Chief	0

Hello LO

November 2009

In This Issue

THE OFFICIAL NEWSLETTER OF THE CITY OF LAKE OSWEGO

Neighbors Helping Neighbors - Success!

On Saturday, October 17, the community once again pulled together for another successful Neighbors Helping Neighbors event.

To the more than 100 volunteers, including Mayor Hoffman and Councilor Tierney, that washed, hauled, weeded, mowed and trimmed the yards of 39 seniors and neighbors with limited mobility; you were amazing and because of you the third Neighbors Helping Neighbors event was a success!

We want to thank Kirby Ness of Allied Waste Management and S & H Logging for the unwavering commitment to collect and dispose all of the debris, leaving each home and our community a better place!

We also want to thank the Lake Oswego United Methodist Church for the goodie bags for each of the volunteers along with the McVey and State Street Starbucks who provided the coffee and cocoa to kick-start the day! We appreciate your kindness and generosity.

Special thanks to the dozens of City of Lake Oswego staff who arrived and stepped up to volunteer and help the community they serve. Although many live outside the Lake Oswego community, they supported this event and believe neighbors do help neighbors.

We are grateful to the many, many volunteers who joined us from the beginning until the end and made it a memorable and successful day for us all!

For more information on this event, to get involved in the event scheduled for early spring 2010, or to request assistance, please visit www.nhn-lo.com or call the Citizen Information Center at 503-635-0257.

Shop Lake Oswego

Promote your community and celebrate the holiday season by shopping in Lake Oswego! Many businesses have planned special events and open houses to kick off the season. Explore Lake Oswego's unique shopping as you enjoy the many special events planned, all while supporting your neighbors and keeping your community strong. For a list of planned events, please visit www.ci.oswego.or.us or call the Citizen Information Center at 503-635-0257.

Green Challenge - LO Meets its Goal!

Lake Oswego residents and businesses took the Green Power Challenge and exceeded it! The recently concluded two-month long Green Power Community Challenge resulted in more than 300 new residential and business signups for renewable power through our local electric utility, Portland General Electric. More than 12% of the electricity purchased in the community is now clean, renewable energy.

The Green Power Challenge is a program of the U.S. Environmental Protection Agency, and is designed to promote environmental sustainability and reduce carbon dioxide emissions through the use of renewable power. For more information and links to enroll (it's never too late to sign up), go to: www.ci.oswego.or.us/plan/Sustainability/Sustainability_Current_News.htm.

4-Wheel Drivers Needed

The Adult Community Center is recruiting individuals with 4-wheel drive vehicles to deliver Meals-On-Wheels during periods of inclement winter weather. Currently, approximately 70 senior and disabled Lake Oswegans are dependent on this program.

The Center makes every effort to prepare and deliver nutritious hot meals around noon 3 days a week, 52 weeks a year, unless extreme weather causes unsafe road conditions for volunteers and staff. Meals-On-Wheels clients received a 2-day emergency food pack in October to be used should the community experience such extreme weather.

If you are able to help or would like additional information, please contact Berta Derman at 503-675-6394 or via email bderman@ci.oswego.or.us.

Natural Hazards Mitigation Plan

The City encourages citizens to review and provide comments on Lake Oswego's "Draft" Natural Hazards Mitigation Plan, available online at: www.ci.oswego.or.us/fire/emerman.htm. For questions or to provide feedback on the Plan, please contact Brad Stein, City of Lake Oswego Management Analyst, at bstein@ci.oswego.or.us or 503-697-7415 before November 13. Once updated, the Plan will be submitted to FEMA for approval.

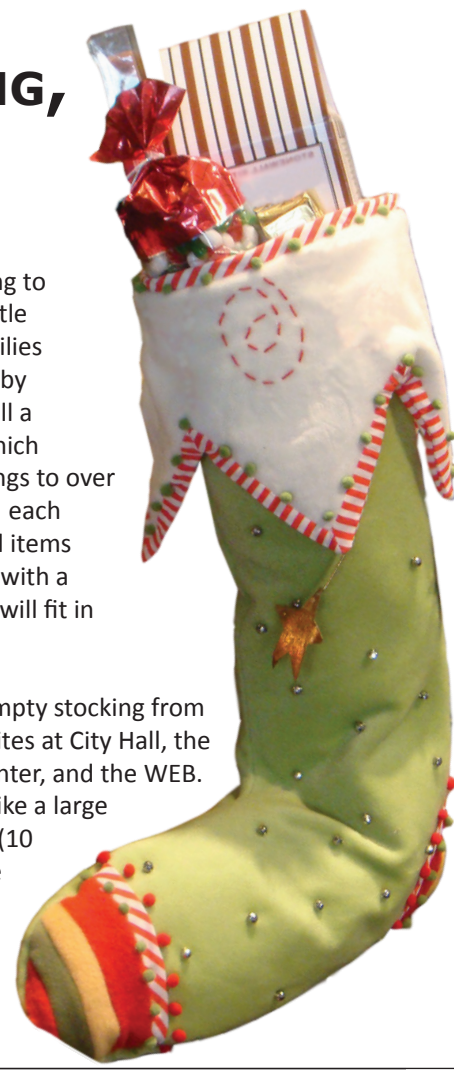
Wastewater Rates

In April, City Council requested an in-depth study of the City's wastewater utility and the rates needed to fund the system in the future. Two opportunities are coming up for citizens to learn about the study or provide input to Council on rate design:

- To learn about the study, come to the Council Study Session on November 17 in the Council Chambers
- To provide your input, come to the Public Hearing on December 1.

For more information, call Joel Komarek at 503-697-6588.

Fill a Stocking, Fill a Heart



Join the City in helping to make the season a little brighter for local families in Clackamas County by participating in the Fill a Stocking program, which provides filled stockings to over 2000 families in need each year. Basic household items are requested, along with a few special gifts that will fit in each stocking.

You can pick up an empty stocking from one of our drop-off sites at City Hall, the Adult Community Center, and the WEB. If your group would like a large number of stockings (10 or more), contact the Citizen Information Center, 503-635-0257. Please return filled stockings by December 5.

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Neighborhood News Fall 2009

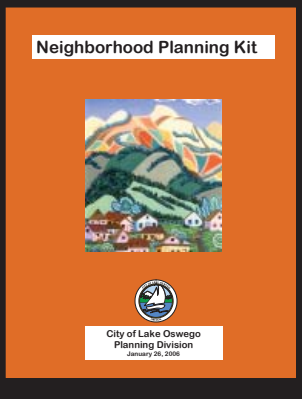
Neighborhood Planning Program Gets an Overhaul

The last issue of Neighborhood News outlined the process for assessing the neighborhood planning program. Since that time the Neighborhood Plan Work Group has completed an overhaul of the City's Neighborhood Planning Kit that revises and clarifies the neighborhood planning process. The new kit contains step-by-step instructions for developing a plan. It provides content guidance, including questions to consider during plan development. The kit also outlines a new structure for how a neighborhood plan relates to the comprehensive plan and community development code. Additionally, the kit set outs the process by which plan projects are submitted for inclusion in the City's Capital Improvements Program. In other words, the kit outlines a clear process for implementing the plan.

The draft Planning Kit will be discussed with the Planning Commission on Monday, November 23.

Staff plans to hold an informational meeting about the new planning process in January. At that time staff will also provide criteria for neighborhoods to consider while crafting the application for staff assistance to create a neighborhood plan. The City hopes to begin one or more new neighborhood action plans by the end of March.

The chart to the right provides a brief overview of the revised planning process.



PHASE 1: Pre-Planning
- Recruit Planning Committee that's representative of neighborhood
- Develop Work Plan with staff

PHASE 2: Outreach & Vision Development
- Neighborhood Survey
- Kick-off Event
- Demographic and Character Analyses
- Neighborhood Workshop
- Draft Vision
- Open House

PHASE 3: Chapter Development
Drafting of plan chapter content in the following phases:
I) Profile
- Inventory & Analysis
- Objectives
- Policies

II) Action Steps
III) Action Chart

PHASE 4: Acceptance/Adoption
- NA Board approves
- NA General membership adopts
- Planning Commission recommends
- City Council accepts/adopts

Code changes to be considered for adoption along with plan.

PHASE 5: Implementation
- Ongoing implementation of action steps with neighborhood as champion

Are You Prepared?

Would you and your neighbors like to become part of the team of citizens trained to be first responders in the event of a serious community-wide disaster...fight small fires, search for trapped victims, learn disaster medicine and psychology? Emergency medical personnel may not be able to help everyone immediately, communication systems may be down, roads may be impassable, and there will likely be a heavy demand on all emergency services.

Learn how to help. Become a member of Lake Oswego's Certified Emergency Response Team (CERT). The Fire Department offers training to all residents. Either sign up for the next class or recruit 20 people and have your own class. Call 503.635.0275 to reserve your spot.

Also, the City is in the process of updating its Natural Hazards Mitigation Plan (http://www.ci.oswego.or.us/fire/documents/DRAFTLO20NHMP20Update_091509.pdf)which includes resources and information to assist city residents, public and private sector organizations, and others interested in participating in planning for natural hazards. In addition, the plan provides a list of activities that may assist the City in reducing risk and preventing loss from future natural hazard events.

The City encourages citizens to review and provide comments on the plan. For more information or to provide feedback, please contact Brad Stein, City of Lake Oswego Management Analyst, at 503-697-7415 before November 13.

Hot Topic! Sensitive Lands in Lake Oswego

One of the qualities that makes Lake Oswego such a special place is its unique setting within its natural landscape. The City of Lake Oswego and residents together share a commitment to protect the natural beauty and environment of our area. For many years, the City has led efforts to beautify neighborhoods, and protect streams, wetlands, and wildlife to help improve the region's quality of life.

The Planning Department has established a nine-member Second Look Task Force to review the Sensitive Lands chapter of the Community Development Code in the context of its environmental and regulatory purposes, and provide recommendations to the Department for changes that:

* Maintain or improve the current level of environmental protection.
* Maintain compliance with Metro and State standards
* Increase flexibility for property owners.
* Simplify or clarify the code or permit application process.

For more information regarding the sensitive lands program, visit the City's website at http://www.ci.oswego.or.us/plan/nature/Sensitive_Lands_Homepage.htm

Welcome Skylands & Birdshill!

The Birdshill and Skylands areas recently became officially recognized Lake Oswego neighborhoods. Both of the neighborhoods consist primarily of land located in the county, so they also became county recognized Community Planning Organizations. Birdshill is located in the northeast corner of the City's urban services boundary along Highway 43 and Skylands is located along the southeast boundary adjacent to the Glenmorrie neighborhood and the Stafford basin.
The City now has 22 officially recognized neighborhood associations!

Neighborhood Association Liability Insurance: A Benefit for Recognized Associations

Through the City of Lake Oswego, recognized neighborhood associations are eligible for basic liability insurance coverage at no cost through the Neighborhood Coalition of Lake Oswego, Inc (NCLO). The NCLO was formed in 1999 to provide insurance coverage for neighborhood association meetings and events and is served by a board of neighborhood representatives.

A simple insurance application form is available on the City's web site. Your association is encouraged to complete this form for all of your meetings and events and return it to your neighborhood planners for approval by NCLO President, Mirella Rizzatti. If you have questions about the types of activities that are covered by the insurance policy, contact your neighborhood planners and they will contact the insurance company.

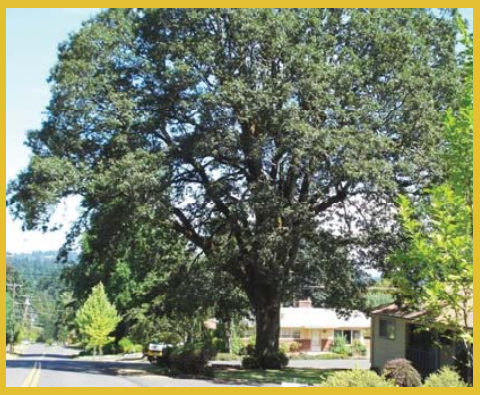
The application form and additional details on the insurance and application filing guidelines can be found on the City's web site at: http://www.ci.oswego.or.us/plan/neighbor.htm

Upcoming Events Mark Your Calendar

Heritage Tree Dedications
Friday, November 20, 4:00 p.m.
Two Heritage Trees, an Oregon White Oak and a European White Birch, will be celebrated with placement of heritage plaques in Hallinan Heights.

These trees stand tall while the land around them has changed over the decades. They give our town great beauty, health, and strength. The Oak and Birch have been admired by residents, neighbors, and the wider community throughout generations. Join us at the dedication ceremony under the stately limbs of our living heritage.

Meet at the Oregon White Oak at 1305 Cornell Street then we will take a very short walk over to the European White Birch at 1117 Spruce Street For more information contact Nicole Roskos, Community Forestry Coordinator, at nroskos@ci.oswego.or.us or (503) 675-2543.



Wednesday, December 9th @ 4:00
Pre-Application Training
Staff is aware that many neighborhood associations have new board members who may want to be trained so they can attend pre-application conferences for potential development in their neighborhoods. Staff will send a notice to the neighborhood chairs regarding the training sometime in November. Now is good time to let your chair know if you would like to attend.

Neighborhood Association Toolbox: Developing an Annual Work Plan

Many neighborhood associations hold their annual elections each fall, making it a great time of year to sit down with your board and get organized for the year ahead.

Work plans allow neighborhood associations to review past successes, develop a shared set of values as a group, plan activities for the upcoming year, and discuss ways to improve any challenges the group may be facing. Achieving goals, planning events and recruiting volunteers will be easier if you take some time to outline your expectations and objectives in advance, and establish a plan to accomplish them. A little planning can go a long way to help your association stay strong and successful!

If you recently elected new board members, this is also a good time to discuss everyone's interests in serving on the board.

Here are some questions to help guide your discussion and the development of your work plan:

Start with discussing general interests and reviewing the situation:
- Why did you become a board member?
- What have been the association's biggest successes?
- What are the biggest challenges?
- What could be done to improve the association and overcome these challenges?

Then discuss your overall mission:
- What is the neighborhood's purpose, role and obligation to the neighborhood? (You may have additional roles outside of the responsibilities outlined in the City's Citizen Involvement Guidelines)

And move on to the specific ways that you'll carry out this mission:
- What are the core projects and activities the association would like to pursue this year?

For each project or activity, answer the following questions:
- What is the purpose of this activity?
- Is there a need for it in the community?
- Does it build community?
- What are the tasks involved?
- How much time is needed to plan and accomplish the tasks? Is money is required?
- What resources are available to help the association accomplish the tasks?
- Are enough volunteers available and willing to do the work?

Once you have your final list of activities or goals, look at the calendar and note the key dates for each item. This should include your general membership and board meetings, and the draft meeting topics and decisions for each.

A sample Work Plan can be viewed on the City's web site at:
http://www.ci.oswego.or.us/plan/Neighborhoods/default.htm

Third Neighbors Helping Neighbors: A Huge Sucess!

Neighbors Helping Neighbors is a program that aims to help fellow neighbors who are over 70 years of age or those who have limited mobility. Volunteers help those in need with a variety of yard services such as, yard clean-up, limited debris removal, and tree/shrub trimming for individuals who live within the Lake Oswego city limits.

Dawn D'Haeze, the chair of the McVey-South Shore Neighborhood Association, started the program in 2008. Dawn's aim was to build

community and help those in need. The first event had a handful of volunteers. The third NHN event held on October 17th had more than 100 volunteers, including Mayor Hoffman and Councilor Tierney. Volunteers washed, hauled, weeded, mowed, and trimmed the yards of 39 seniors and neighbors with limited mobility. Thanks to all of you that volunteered. You made the event a huge success!

Lake Oswego Neighborhood Links & Contacts

(Click on the Links)

View land use and annexation applications that have been submitted to the City.
http://www.ci.oswego.or.us/plan/land.htm

Sign up to receive LO's quarterly "Neighborhood News" letter.
https://www.ci.oswego.or.us/tools/ListService/

Learn about upcoming City events and neighborhood association meetings from LO's Community Calendar.
http://www.ci.oswego.or.us/cal/wc082008.htm

Learn more about the neighborhood planning program and LO's neighborhood associations.
http://www.ci.oswego.or.us/plan/neighbor.htm

Contact Neighborhood Planning Staff
http://www.ci.oswego.or.us/tools/email/?2801

Just how many Lakewood kids can fit on the trampoline?

Every summer for years the Lakewood Neighbors have enjoyed potluck dinners every Thursday evening at the Yacht Club Easement. The kids often end the day with an evening swim.

Appendix B
Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Community Service Center's Oregon Natural Hazards Workgroup at the University of Oregon. It has been reviewed and accepted by the Federal Emergency Management Agency as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan,* (Oregon State Police – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard 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 practicable. 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 set of criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation item in your community. The second chapter in FEMA's How-To Guide "Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies" as well as the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process" outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E Approach from the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process".

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical: The city or county public works staff, and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

Administrative: Elected officials or the city or county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political: Consult the mayor, city council or county planning commission, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

Legal: Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

Economic: Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?

- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

Environmental: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

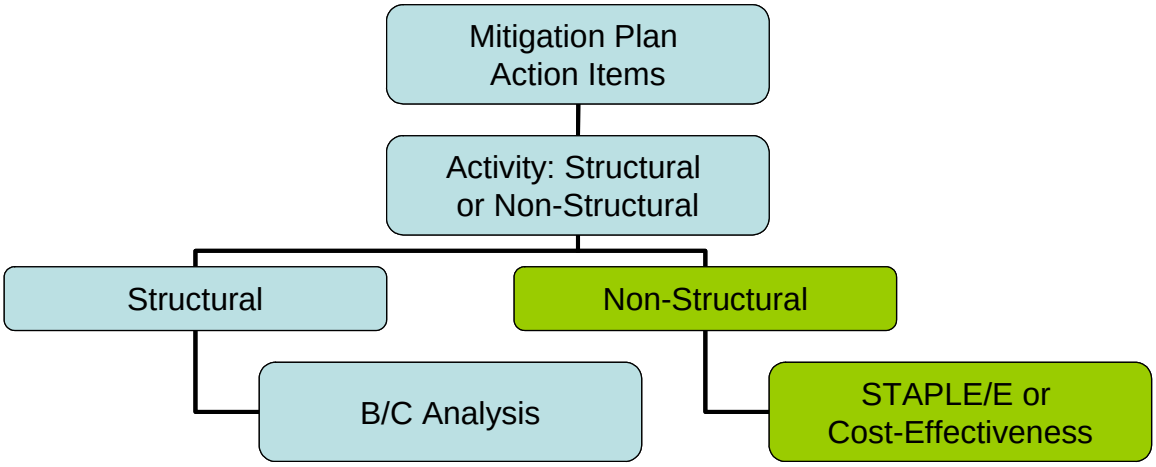
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed Benefit/Cost Analyses.

When to use the Various Approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

Figure A.1: Economic Analysis Flowchart



Source: 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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Goettel & Horner Inc., *Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in The City of Portland*, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects* Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures*, Robert Olson Associates, Prepared for Oregon State Police, Office of Emergency Management, July 1999.

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