



CITY OF MILWAUKIE

Natural Hazards Mitigation Plan Addendum

Prepared for

City of Milwaukie
10722 SE Main Street
Milwaukie, OR 97222

In cooperation with

Clackamas County Emergency Management
2200 Kaen Road
Oregon City, OR 97045

Adopted by City Council *Date*, 2009



FEMA

July 9, 2009

Honorable Lynn Peterson
Chair, Board of County Commissioners
Clackamas County
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 West Linn

City of Milwaukie

The list of approved jurisdictions has been updated to include the City of Milwaukie, which has recently adopted the City of Milwaukie Addendum to 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, who coordinates and administers these efforts for local entities.

Sincerely,

A handwritten signature in blue ink that reads "Mark Carey".

Mark Carey, Director
Mitigation Division

cc: Jeremy Ferguson, Mayor, City of Milwaukie
Dennis Sigrist, Oregon Emergency Management

Enclosure

KM:bb

RESOLUTION NO. 36-2009

**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MILWAUKIE, OREGON
ADOPTING CITY OF MILWAUKIE'S ADDENDUM TO THE CLACKAMAS COUNTY
NATURAL HAZARDS MITIGATION PLAN**

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

WHEREAS, the City Council of the City of Milwaukie recognizes the importance of reducing or eliminating those vulnerabilities for the overall good and welfare of the community, and

WHEREAS, the City of Milwaukie 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 Milwaukie 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 Milwaukie 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

THE CITY COUNCIL OF THE CITY OF MILWAUKIE RESOLVES AS FOLLOWS:

Section 1. The City Council of the City of Milwaukie hereby accepts and approves of its section of the Clackamas County Multi-Jurisdiction Hazard Mitigation Plan as a reasonable process to identify and plan for potential hazards in The City of Milwaukie and Clackamas County,

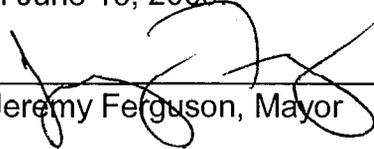
Section 2. The agency personnel of the City of Milwaukie are requested and instructed to pursue available funding opportunities for implementation of the actions and proposals designated therein,

Section 3. The City of Milwaukie will, upon receipt of such funding or other necessary resources, seek to implement the mitigation proposals identified by the jurisdiction's Hazard Mitigation Planning Committee, and

Section 4. The City of Milwaukie will continue to participate in the updating and expansion of the Clackamas County Multi-Jurisdiction Hazard Mitigation Plan in the years ahead, and

Section 5. The City of Milwaukie will further seek to encourage the businesses, industries and community groups operating within and/or for the benefit of the City of Milwaukie to also participate in the updating and expansion of the Clackamas County Multi-Jurisdiction Hazard Mitigation Plan in the years ahead.

Introduced and adopted by the City Council on June 16, 2009.



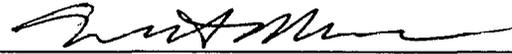
Jeremy Ferguson, Mayor

ATTEST:



Pat DuVal, City Recorder

APPROVED AS TO FORM:
Jordan Schrader Ramis PC



City Attorney

City of Milwaukee

Natural Hazards Mitigation Plan Addendum

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Section 1: Planning Process

The Milwaukie Natural Hazards Mitigation Plan Addendum ('addendum') includes resources and information to assist city residents, public and private sector organizations, and others interested in participating in planning for natural hazards. The addendum provides an assessment of all potential natural hazards and a list of mitigation actions to assist the city of Milwaukie in reducing risk and preventing loss from future natural hazard events. The city has developed this addendum to the Clackamas County Natural Hazards Mitigation Plan in an effort to take a more regional approach to planning for natural hazard scenarios. The city's first addendum was completed in 2003. In 2009, the city updated its addendum to Clackamas County's Natural Hazard Mitigation Plan.

1.1 Development of the 2003 Milwaukie Natural Hazards Mitigation Plan Addendum

In 2002 Clackamas County prepared a county-wide natural hazards mitigation plan. The county-wide planning process, which invited participation from Milwaukie residents, is described in Appendix B of the 2002 Clackamas County Natural Hazards Mitigation Plan. In 2003 the city of Milwaukie developed an addendum to Clackamas County's Natural Hazard Mitigation Plan. The city's planning process was a collaborative effort between city staff, public agencies within the city, non-profit organizations, the private sector, and regional and state organizations. The addendum development process was guided by a Hazard Mitigation Advisory Committee (HMAC). Milwaukie HMAC members included:

- Dave Church, North Clackamas School District
- Kevin Donegan, Clackamas County Fire District #1
- Craig Holman, City GIS Coordinator
- Cindy Kolomechuk, Clackamas County Office of Emergency Management
- Barb Kwapich, City Risk Manager
- Tom Larsen, City Building Official
- Lindsey Nesbitt, City Community Development Department
- Jack Perry, City Sewer Department
- Paul Roeger, City Engineering Department
- Jason Wachs, City Neighborhood Services Department

The Milwaukie HMAC had a regular meeting schedule to complete the planning process, and residents from the city of Milwaukie had an opportunity to participate in county-wide public workshops that were designed to gain citizen input.

The following special service districts in Milwaukie were given the opportunity to participate in the addendum's development and implementation.

- Clackamas Community College
- Clackamas Education Service District
- North Clackamas School District
- City of Milwaukie
- Clackamas County
- North Clackamas Parks and Recreation District
- Port of Portland
- Milwaukie Road District #4
- Metro Service District 2
- Clackamas County Vector Control
- Tri-met
- Oak Lodge Water District #4
- Clackamas County Sewer District #1

The Milwaukie City Council adopted Milwaukie’s Natural Hazards Mitigation Plan Addendum in September 2003. Thereafter, the HMAC met once in 2007 to discuss grant funding opportunities, as well as the five-year addendum update requirements.

1.2 Development of the 2009 Milwaukie Natural Hazards Mitigation Plan Addendum

Following the development of Clackamas County’s Natural Hazards Mitigation Plan in September 2002, four of the county’s sixteen cities, including Milwaukie, developed addenda to the county’s plan. In the fall of 2008, Clackamas County partnered with the Oregon Partnership for Disaster Resilience (OPDR) and Resource Assistance for Rural Environments (RARE) to update the four existing addenda, and to develop new addenda for the remaining twelve cities without plans. RARE provided a volunteer (‘RARE Participant’) to document and facilitate each of the cities’ planning processes. The RARE Participant was hired with funds made available through the Hazard Mitigation Grant Program.

From October 2008 through January 2009 Clackamas County Emergency Management and the RARE Participant worked with the city of Milwaukie to facilitate and document the five-year update of Milwaukie’s addendum to the Clackamas County Natural Hazards Mitigation Plan.

1.2.1 Who Participated in Developing the Addendum?

In 2008 the Milwaukie HMAC reconvened to update the city’s 2003 Natural Hazards Mitigation Plan Addendum. Three members from the original HMAC remained on the 2008/09 planning committee:

- Kevin Donegan, Clackamas County Fire District #1
- Barb Kwapich, City of Milwaukie Risk Manager
- Tom Larsen, Milwaukie Building Official

New HMAC members included:

- Brad Albert, Milwaukie Engineering Department
- Dave Butcher, Public Works Department
- Ted Evans, North Clackamas School District Director of Facilities
- Bob Jordan, Milwaukie Chief of Police

- Willie Miller, Milwaukie Facilities
- Beth Ragel, Milwaukie Community Services Program Coordinator
- Kate Rosson, Milwaukie GIS Coordinator
- Susan Shanks, Milwaukie Planning Department
- Jay Wilson, Clackamas County Emergency Management

1.2.2 Addendum Update Process

The city of Milwaukie held an introductory meeting on September 25, 2008 and invited Clackamas County Emergency Management to attend. The meeting was held to re-establish the Milwaukie Hazard Mitigation Advisory Committee in an effort to update Milwaukie’s addendum. Clackamas County Emergency Management discussed their role in the city of Milwaukie’s addendum update process and informed the city that a RARE Participant would be available to facilitate and document the addendum update process. Minutes from the September 25th meeting can be found in Appendix A, ‘Public Process’ of Milwaukie’s Addendum.

October 23rd, 2008: the RARE participant met with the Milwaukie HMAc to discuss FEMA’s requirements for the city’s addendum update process. The HMAc discussed whether or not the 2003 addendum’s schedule for implementation and maintenance should be revised. The HMAc also revisited the initial addendum’s mission & goals, and discussed updates to occur within Section 2 of the addendum (Community Profile).

November 13, 2008: the RARE Participant developed and facilitated a risk assessment meeting with the Milwaukie HMAc. The group discussed each of the natural hazards described within the addendum, and reviewed and updated the city’s list of community assets. Additionally, the group identified natural hazard events that occurred between September, 2003 and October, 2008. Lastly, the HMAc reviewed and updated the 2003 vulnerability assessment for each hazard.

December 11, 2008: the Milwaukie HMAc reviewed the addendum’s mitigation actions, and discussed whether actions were completed, or should be removed from the addendum. Additionally, the HMAc discussed reasons for why the remaining actions had not been implemented (i.e., mitigation actions that were not implemented between 2003 and 2009, but which the HMAc decided to keep in the addendum). Finally, the HMAc developed new mitigation actions to address vulnerabilities identified in the November 13th risk assessment meeting. The HMAc additionally modified the mitigation planning priority system (Section 5).

Minutes from each of Milwaukie’s 2008-09 HMAc meetings can be found in Appendix A of this addendum, ‘Public Process.’

1.2.3 2009 Update Changes by Section

This section details the changes made to each section. If a change is not described in this section, that portion of the addendum remained the same.

Section 1: Planning Process

What are the addendum’s mission and goals?

The city of Milwaukie adopted the same goals as the county during the 2003 addendum development process. During the county’s 2007 plan update process,

the county's goals were slightly modified to be read as action statements. Milwaukie's HMAC agreed to re-adopt the county's updated goal statements.

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

Schedules for addendum implementation and maintenance were altered in the 2009 update. The 2003 addendum proposed a series of three monthly meetings following the addendum's adoption, in addition to annual addendum update meetings. In an effort to create a more feasible schedule for addendum implementation and maintenance, Milwaukie's addendum now recommends quarterly HMAC meetings. The 'formal review' subsection has also been updated to include suggested meeting topics/questions.

Continued Public Involvement

The HMAC decided they did not need copies of the addendum made available on CD. This language was removed from the addendum.

Section 2: Community Profile

The Community Profile was updated to reflect the most recent data available. Three tables were added to the population & demographics section: Table 2.1, 'Population by Age,' Table 2.2 'Population by Race,' and Table 2.3 'Disabled Populations.' A map of Milwaukie within the Portland Metropolitan region was added under the land use and development section. A table showing employment by industry was added to the employment and industry section of the addendum. Additionally, new sub-sections were added to the Community Profile to provide a more in-depth look at the city of Milwaukie. The newly added sections discuss housing characteristics, historical and cultural resources, and existing plans and policies within the city of Milwaukie.

Section 3: Hazard Assessment

The 2003 addendum cited insufficient data for conducting risk analyses for natural hazards. Multi-Hazard (MH) Action #2 sought to address this need; however, the city was unable to implement MH Action #2 between 2003 and 2009 due to lack of staff time and resources.

'Community assets' were organized to reflect their location (i.e., within the city, county or state.) Schools were changed from 'critical facilities' to 'essential facilities,' and potential shelter sites were changed from the 'essential facilities' designation to be listed as 'critical facilities.' Finally, Table 3.2 was updated to list the number of facilities exposed to each hazard.

Section 4: Natural Hazards

Hazards were updated to reflect changes in hazard histories, damages, and mitigation efforts that occurred between 2003 and 2009. All information within the landslide, wildfire, and volcano sections remains the same. Where possible, maps were updated.

One flood mitigation action from the 2003 addendum was completed and moved to the 'existing mitigation strategies' paragraph of the flood hazard section. The following mitigation actions were added to the 2009 addendum: LT-FL#2 and LT-WF#1. All remaining actions were carried over from the 2003 addendum. No

actions from the 2003 addendum were deleted. Each action's 'status' (i.e., reasons for deferral) is noted as well. The city was unable to incorporate mitigation strategies and other risk assessment information into other planning mechanisms between 2003 and 2009. The HMAC will encourage the city's Community Development Department to further pursue cross-planning implementation strategies.

Section 5

The mitigation planning priority system was changed to reflect the group's desire to implement mitigation actions on an ad-hoc basis. The 2003 addendum ranked mitigation actions according to: 1) the priority of the hazard addressed; 2) addendum goals addressed; 3) criticality of need; 4) size of population served; and 5) the action's likelihood of success. The group determined that this system was confusing and unlikely to produce a mitigation action ranking that truly reflects the group's intentions. The new system allows the group to evaluate mitigation actions based on current conditions and resources.

1.3 Multi-Jurisdictional Planning Effort

The city of Milwaukie is dedicated to taking a regional approach to planning for natural hazards since hazards do not abide by jurisdictional boundaries. The city of Milwaukie has representation on the Clackamas County Hazard Mitigation Advisory Committee to ensure that the city's interests are represented in the county's larger scale planning effort. The city will partner with the county in the implementation of mitigation actions and work with other jurisdictions to reduce losses from future natural hazards as appropriate and practicable.

1.4 What is the Addendum's Mission?

The city of Milwaukie concurs with the mission statement of the Clackamas County Natural Hazards Mitigation Plan:

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 Addendum's Goals?

The city of Milwaukie concurs with the goals of Clackamas County Natural Hazards Mitigation Plan:

The plan goals describe the overall direction that Clackamas County agencies, organizations, and citizens can take to work toward mitigating risk from natural hazards. The goals are stepping-stones between the broad direction of the mission statement and the specific recommendations outlined in the mitigation actions.

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, 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 Addendum be Implemented, Monitored, and Evaluated?

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

1.6.1 Addendum Adoption

In 2003, the city of Milwaukie adopted its addendum to the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan.

The Milwaukie Natural Hazards Mitigation Plan Addendum will be updated every five years in accordance with the Disaster Mitigation Act of 2000, and in coordination with the county's plan update schedule.

The Milwaukie City Council will be responsible for adopting future updates and revisions to the city's addendum. This governing body has the authority to promote sound public policy regarding natural hazards.

1.6.2 Coordinating Body

The Milwaukie HMAC is responsible for coordinating implementation of the addendum's mitigation actions and undertaking future addendum updates.

Technical advisory committees as well as other ad hoc committees may be established to implement appropriate mitigation projects and tasks, and will be organized as needed by the convener. The attendees of these technical advisory committees will report on their actions at the regularly scheduled HMAC meetings.

The city manager or designee will assign representatives from appropriate city departments to staff the HMAC. In order to make this committee as broad and useful as possible, the HMAC will engage relevant organizations and agencies when needed.

1.6.3 Convener

Milwaukie's Public Works Operations Department will serve as the 'convener' for future HMAC meetings. The convener will assign tasks such as updating and presenting the addendum to committee members. Addendum implementation and evaluation will be a shared responsibility among all of the HMAC members.

1.6.4 Implementation through Existing Programs

The city of Milwaukie addresses statewide planning goals and legislative requirements through its comprehensive plan, capital improvements plan, zoning ordinances, and building codes. The addendum provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. Where possible, the city of Milwaukie will implement recommended mitigation actions through existing programs and procedures.

1.6.5 Formal Review Process

Milwaukie's Addendum to the Clackamas County Natural Hazards Mitigation Plan will be evaluated on a quarterly basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. The convener will be responsible for contacting HMAC members and organizing the quarterly meetings. HMAC members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the addendum.

The HMAc will meet quarterly over the next five years to: discuss strategies for implementing mitigation actions; identify and seek funding for the implementation of mitigation actions; and evaluate and update the addendum's content. The HMAc will additionally review the addendum's goals and mitigation actions to: 1) determine their relevance to changing situations within the city; 2) determine their relevance to (as well as changes in) state or federal policy; and 3) to ensure they are addressing current and unexpected conditions. The HMAc will also review the hazard assessment portion of the addendum (Section 4) to determine whether information should be updated or modified, given any new available data. Finally, the coordinating organizations responsible for various mitigation actions will report on the status of their projects.

Although the addendum will be revisited and potentially updated on a quarterly basis, the HMAc will be required to formally update the addendum every five years in accordance with the Disaster Mitigation Act of 2000. The city of Milwaukie participates in the Clackamas County Hazard Mitigation Advisory Committee. As such, the city intends to follow Clackamas County's five year plan update schedule. This ensures that the city's addendum coordinates with the county's plan and remains eligible for federal mitigation grant programs. The next addendum update is scheduled to occur in September 2012.

The Milwaukie HMAc should begin the five-year update process in the fall of 2011 to allow enough time for the review and update of the entire addendum by September 2012. The convener will assign one or more HMAc members with the responsibility of facilitating and/or documenting the addendum update process. When completed, the convener will submit the updated addendum to Oregon Emergency Management and the Federal Emergency Management Agency (FEMA) for review. Upon 'pre-approval' from FEMA, the Milwaukie City Council will be asked to adopt the updated addendum via resolution. After FEMA sees proof of local adoption, Milwaukie will receive 'formal' approval for its updated addendum. The five-year plan update process should always occur in tandem with the county's plan update process.

The following questions should guide the Milwaukie HMAc in updating the addendum every five years:

- Have public involvement activities taken place since the addendum was adopted?
- Are there new hazards that should be addressed?
- Have there been hazard events in the community since the addendum 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?
- Are there new high risk populations?

- Are there completed mitigation actions that have decreased overall vulnerability?
- Did the addendum document and/or address National Flood Insurance Program repetitive loss properties?
- Did the addendum identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?
- Did the addendum identify data limitations?
- Did the addendum identify potential dollar losses for vulnerable structures?
- Are the addendum goals still relevant?
- What is the status of each mitigation action?
- Are there new actions that should be added?
- Is there an action dealing with continued compliance with the National Flood Insurance Program?
- Are changes to the mitigation action prioritization, implementation, and/or administration processes needed?
- Do changes need to be made within the five year update schedule?
- Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?

1.6.6 Continued Public Involvement

The city of Milwaukie is dedicated to involving the public directly in the review and ongoing development of the addendum. The Community Services Director informed the seven neighborhood district associations about the 2003 addendum development process. Once completed, the 2003 addendum was presented at the September 16, 2003 City Council meeting. City Council meetings are open to the public, and the agenda is posted online one week before the meeting. After the initial 2003 addendum was adopted, it was uploaded to the city website, and was also made available via the county's website.

During the 2009 addendum update 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 Milwaukie's updated addendum were posted on OPDR's website to facilitate HMAC review. Once the HMAC created a final draft of the addendum a notice was placed in the monthly city newsletter, *The Pilot*, to ask for public comment on the addendum (see article language below). The public was directed to OPDR's website to review the plan, and asked to provide comments to the city for incorporation into the final plan draft. No comments were received.

The city recently convened a natural hazards mitigation review team—to complete a periodic review and update of our Natural Hazard Mitigation Plan. The review team included staff from various city departments, the School District, and the Fire District. Milwaukie was proud to be the first jurisdiction in Oregon to complete a plan in 2004. The plan assesses the risk for natural hazards such as floods, earthquakes, and storms and outlines strategies for handling such natural emergencies. The city would like your input on the plan. Please submit any comments or questions by Friday May 15th. The plan is available online here:

<http://www.oregonshowcase.org/index.cfm?mode=plans&page=clackamas>

The city of Milwaukie will ensure continued public awareness over the next five years by presenting the addendum to City Council for discussion and adoption. The final adopted and approved addendum will be posted on the city's website at www.cityofmilwaukie.or/publicsafety , on the county's emergency management website at <http://www.clackamas.us/emergency/publications.html>, and on the University of Oregon Libraries' Scholar's Bank Digital Archive. Additionally the Milwaukie Community Services Director will inform the seven neighborhood district associations about the updated addendum. If deemed necessary, the HMAC may call a public meeting, such as after a natural hazard.

1.7 What are the Mitigation Actions Identified by the City of Milwaukie?

The mitigation actions are a list of activities in which city staff, county agencies, and citizens can be engaged to reduce risk. Each mitigation action includes an estimate of the timeline for implementation. Short-term mitigation actions (ST) are activities that generally can be implemented with existing resources and authorities within one to two years. Long-term mitigation actions (LT) may require new or additional resources or authorities, and may take between one and five years to implement. The mitigation actions are organized within the following matrix, which lists all of the multi-hazard and hazard-specific actions included in the addendum.

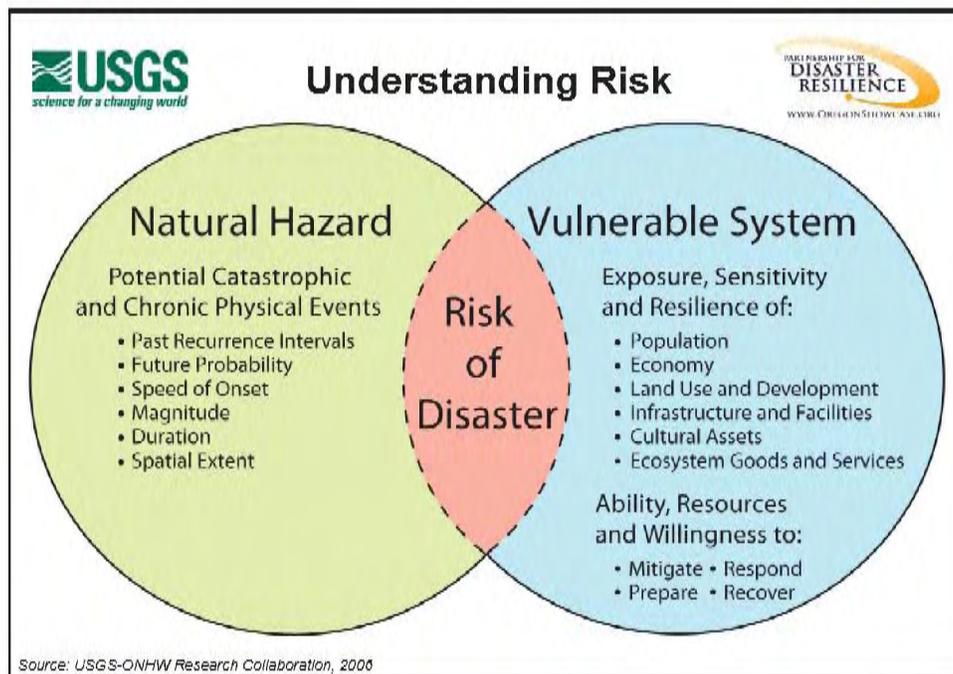
Mitigation Action	Mitigation Action Title	Coordinating Organization	Timeline	Alignment with Plan Goals				
				Protect Life and Property	Promote Public Awareness	Enhance Natural Systems	Encourage Partnerships and Implementation	Augment Emergency Services
LT Flood #1	Evaluate alternatives for reducing the flooding hazard for properties along Kellogg Creek, Johnson Creek, the Mount Scott Creek area, and the Willamette River.	Public Works Department, Engineering Department	Long Term 3-5 years	X	X	X	X	X
LT-Flood #2	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Engineering Department	Long Term Ongoing	X	X		X	
ST Landslide #1	Reduce the vulnerability of property owners in landslide-prone areas.	Building Department, Engineering Department	Short Term Ongoing	X	X	X	X	
LT Severe Storm #1	Bury power lines subject to failures.	Public Works Department, Engineering Department	Short Term Ongoing	X		X	X	X
LT Wildfire #1	Promote fire-resistant strategies for new developments	Building Department, Clackamas Fire District #1	Long Term Ongoing	X	X	X	X	X
LT Earthquake #1	Conduct seismic evaluations on identified critical/essential facilities and infrastructure.	Facilities Department, Building Department	Long Term 3-5 years	X			X	X
ST Multi Hazard #1	Improve vegetation management throughout the City.	Clackamas Fire District #1, Community Services	Short Term Ongoing	X	X	X	X	X
ST Multi Hazard #2	Ensure that there are adequate shelter facilities in hazard-free zones to serve Milwaukie residents	Clackamas Fire District #1 Emergency Manager	Short Term Ongoing	X	X		X	X
ST Multi Hazard #3	Improve network of communications during a disaster.	Information Systems Technology, Public Works	Short Term Ongoing	X	X		X	X

Mitigation Action	Mitigation Action Title	Coordinating Organization	Timeline	Alignment with Plan Goals				
				Protect Life and Property	Promote Public Awareness	Enhance Natural Systems	Encourage Partnerships and Implementation	Augment Emergency Services
ST Multi Hazard #4	Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.	CFD#1, Community Services	Short Term Ongoing	X	X	X	X	X
ST Multi Hazard #5	Promote CERT program activity in the area and recruit members for training.	Community Services, Clackamas Fire District #1	Short Term Ongoing	X	X		X	X
ST Multi Hazard #6	Develop and enhance strategies for debris management for all hazards.	Public Works Department	Short Term Ongoing	X	X	X	X	
LT Multi Hazard #1	Improve and obtain resources and equipment essential for responding to and recovering from disasters.	Public Works Department	Long Term Ongoing	X	X	X	X	
LT Multi Hazard #2	Improve the hazard assessment in the Milwaukie Natural Hazards Mitigation Plan.	City Geographic Information Systems, Hazard Mitigation Advisory Committee	Long Term Ongoing	X	X	X	X	X
LT Multi Hazard #3	Integrate the goals and action items from the Milwaukie Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning Department, Engineering Department	Long Term Ongoing	X	X	X	X	

Section 2: Community Profile

The following section describes the city of Milwaukie from a number of perspectives in order to help define and understand the city's vulnerability and resilience to natural hazards. Vulnerability is 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). Resilience is 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 city's vulnerability and resiliency at the time this addendum was developed. The information documented below, along with the hazard assessments located in Section 4: Natural Hazards should be used as the local level rationale for the city's mitigation strategies. The identification of actions that reduce the city's vulnerability and increase its resilience assist in reducing overall risk, as depicted in the area of overlap in Figure 1 below.

Figure 1 Understanding Riskⁱ



2.1 Geography and the Environment

The city of Milwaukie encompasses an area of 4.8 square miles and is located along the Willamette River in northwestern Clackamas County in Northwestern Oregon (Map 1). Milwaukie is an incorporated city on the southern border of Portland, Oregon's largest city. The city is within the Willamette River basin and has two major creeks flowing through it, Johnson Creek in the northern part of the city and Kellogg Creek in the southern part. Other tributaries include Mount Scott Creek in the southeastern part of the city; Minthorn Creek in the eastern industrial area,

which flows into Mount Scott Creek; and Spring Creek in the western part of the city, which flows into Johnson Creek.

Elevations in the city range from 205 feet near 59th Avenue and Monroe Street to a low of 4 feet on the shores of the Willamette River. Milwaukie is characterized by flat or gently hilly topography.

2.2 Population and Demographics

In 2000 the city of Milwaukie was home to a population of 20,490. According to the Portland State Population Research Center the estimated population of Milwaukie on July 1, 2008 was 20,915, a 2.1% change over the 2000 Census level. ⁱⁱ

Disaster impacts, in terms of loss and the ability to recover, vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. Portions of the city of Milwaukie’s residents fall into these special needs populations. In 1999, approximately 7.6% of Milwaukie’s population had an income below the poverty level. About 3.7% of the population speaks English less than “very well.” Additionally, 13.7% of the city’s population is 65 years of age and older.ⁱⁱⁱ More information on the city of Milwaukie’s special needs populations are shown in Tables 2.1 – 2.3.

Table 2.1 Community Age Groups from 1970 to 2000

Year	1970	1980	1990	2000
Under 5 years	1389	1263	1237	1306
5-19 years	4809	3840	3439	3874
20-44 years	5307	7104	7701	7548
45-64 years	3519	3548	3515	4946
65+ years	1275	2140	2800	2816
Median Age	28	30	35	37.7

Source: US Census, 2000. Median value is the middle value, not an average.

Table 2.2 Population by Race

Race	Population
White	18,271
Hispanic or Latino	813
Asian	483
Black or African American	182
American Indian and Alaska Native	171
Native Hawaiian and Other Pacific Islander	50
Some other Race	16
Two or more races	504

Source: U.S. Census, 2000

Table 2.3 Disabled Populations

Age	Number of People
5 to 15 years	120
16 to 64 years	4463
65 years and over	1922
Total percentage of population with disability	31.70%

Source: U.S. Census, 2000

2.3 Employment and Industry

Milwaukie is a major industrial center in the Portland metropolitan area containing one of the largest concentrations of warehousing and distribution industries in the region. The Milwaukie Industrial Park, Omark Industrial Park, and the Johnson Creek industrial area comprise over 300 acres of industrial land within the city. However, these areas are nearing capacity and very little land within the city is currently available for new industrial development.

Milwaukie's commercial lands are largely built up. New commercial development along Highway 224, McLoughlin Boulevard, and 82nd Avenue has lured many people away from downtown Milwaukie for purchasing comparison goods such as clothes, furniture and appliances. This is true for most small community commercial centers since comparison-shopping has increasingly occurred at large shopping centers. Downtown Milwaukie, however, has continued to attract commercial investment in the form of commercial service uses including banks, insurance, professional offices, and a new mixed use development containing a large residential component.

In 2000 the median household income for Milwaukie was \$43,635, while the median per capita income in 1999 was \$21,342.^{iv} As of 2003 approximately one-third of Milwaukie residents in the labor force were employed in Clackamas County. Milwaukie is part of a much larger metropolitan labor market, but local jobs are very important. Local jobs reduce commuting and energy costs related to commuting. They also stimulate the local economy. Table 2.4 lists the city's three largest employers:

Table 2.4 Three Largest Employers as of 2005

Employer	Product/Service	Number of Employees
Blount Inc/Oregon Cutting Systems Div.	Chain Saw Blades	1000-1500
Precision Castparts	Titanium & Steel Castings	500-1000
Providence Milwaukie	Health Care	250-500

Source: City of Milwaukie Community Development Department

As of 2009, over 150 residents conducted businesses from their homes. The city's regulations support and encourage home occupations, recognizing that they are a source of local employment, while at the same time protecting the residential character of the city's neighborhoods.

The city of Milwaukie has an array of employment industries, as shown below in Table 2.5:

Table 2.5 Employment by Industry, 2005



Source: Worksource Oregon Employment Department

2.4 Housing

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

The city of Milwaukie has 8,988 housing units of which 8,561 are occupied and 427 are vacant. Of these housing units 5,157, or 60.2%, are owner-occupied and 3,404, or 39.8%, are renter occupied. The median value of an owner-occupied home in 2000 was \$153,800.^v The median year-built of current housing structures is 1965, meaning much of the city's housing stock was built before stricter seismic building codes were put in place. Tables 2.6 and 2.7 show more detailed statistics on housing in Milwaukie.

Table 2.6 Housing Type

Housing Type	Percent
Single Family	67.9%
Multi-Family	31.1%
Mobile Home	1.0%

Source: US Census, 2000

Table 2.7 Housing Structure Age

Year Structure Built	Number of Structures	Percent of Total Structures
1990 to March 2000	926	10.2%
1980 to 1989	815	9.0%
1970 to 1979	1,765	19.5%
1960 to 1969	2,082	23.0%
1950 to 1959	1,597	17.6%
1940 to 1949	701	7.8%
Built 1939 or earlier	1,163	12.9%

Source: US Census, 2000

2.5 Land Use & Development

Although Milwaukie's history dates back to 1840, until the 1940's it was a small town of less than 2,000 people. With World War II came the development of the Milwaukie Industrial Park, and Milwaukie rapidly became a city with local jobs and an industrial tax base. During the 1950's, suburban growth spread to Milwaukie and to the south and east of the city's boundaries. New suburbs and large annexations added to the city's population and area into the 1960's. Although the city itself was growing rapidly, new residential development extended past Milwaukie, and was encouraged by the growth of sewer, water, and fire service districts.

Developing or fully developed residential areas now border the city. As new development has occurred further from the Portland core area, Milwaukie has become an inner, older suburb within the region. Map 1 shows the city's location in the Portland Metropolitan region. Although new development is still occurring, nearly 90 percent of the city's land area is already developed. Citizens are concerned about the lack of parks and open space as the remaining vacant land disappears. Traffic congestion on existing streets and highways is increasing, and new freeways outside of Milwaukie are opening up lands for residential and commercial development.



MILWAUKIE
Dogwood City of the West

Area Map Map #1

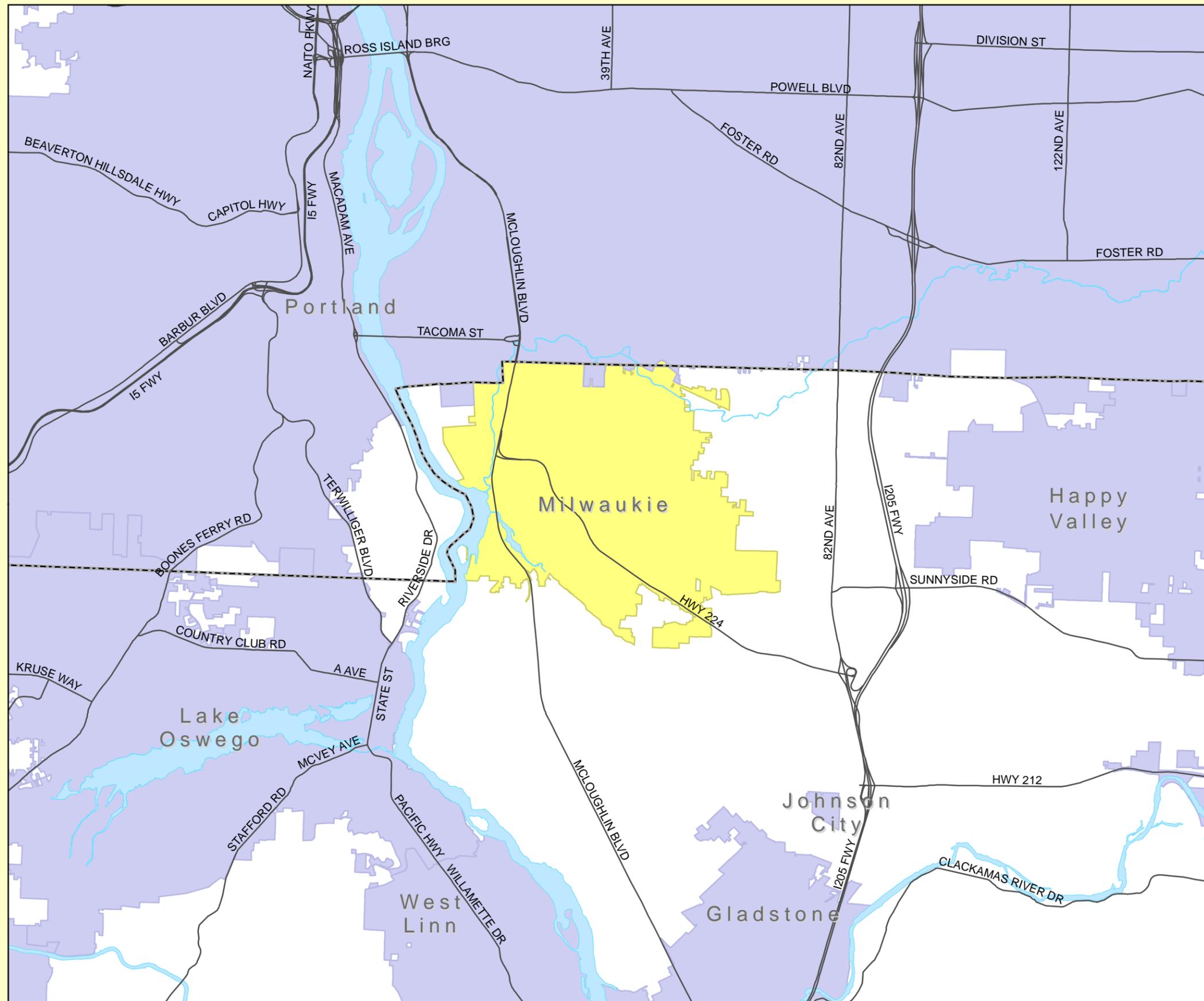
-  Major Road
-  County Boundary
-  Water Body
-  Milwaukie
-  Other City

Data Sources: City of Milwaukie GIS
Metro Data Resource Center

Date: December 2008

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2.6 Transportation

Milwaukie is accessible by two state highways, 99E (or McLoughlin Blvd.), running north to south in the western part of the city, and Highway 224, running west to east through the central part of the city. Public transportation in Milwaukie is provided by Tri-Met. Eleven bus routes go through the downtown Milwaukie transit center on a daily basis. Milwaukie is also bisected by the Union Pacific Railroad main line, which travels northwest to southeast carrying both passengers and freight.

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. Table 2.8 shows the different methods city residents use to travel to work.

Table 2.8 Transportation Used to Commute to Work

Means of Transportation	Number	Percent
Drove alone	8,245	76.1
Carpooled	1,197	11.1
Public Transportation	609	5.6
Worked at home	513	4.7
Walked	125	1.2
Other	69	.6
Bicycle	68	0.6
Motorcycle	8	.007

Source: US Census, 2000

2.7 Historical and Cultural Resources

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. The city's historic inventory, which is detailed in the Comprehensive Plan, includes:

- 30 Houses
- 5 Commercial Buildings
- 3 Schools
- 1 Cemetery
- 1 Church
- 1 City Hall
- 1 Water Works

Milwaukie offers an array of attractions for its citizens and visitors. Milwaukie attractions include:

- Bob's Red Mill
- Clackamas Live! Music Festival
- Dark Horse Comics Corporate Headquarters
- Milwaukie Art and Artisan Market

- Milwaukie Farmers Market
- Milwaukie Museum
- Riverfest
- Riverfront Park
- Sara Hite Memorial Rose Garden
- Spring Park and Elk Rock Island
- Springwater Trail
- Winter Solstice Event

2.8 Government Structure

The City Council is the policy making body for the city of Milwaukie. The Council is composed of a mayor and four councilors, all of which are elected from the city at large. The mayor and councilors appoint the city manager, city attorney, and municipal judge by a majority vote of the entire council. The city manager appoints all other city employees.^{vi}

The city of Milwaukie currently has the following departments which have a role in natural hazard mitigation:^{vii}

Office of the City Manager is responsible for taking charge of the daily supervision of City affairs.

Community Development oversees the following departments and services: Planning, Building Inspection, Engineering, Streets, Water, Sewer, Stormwater, Fleet Services, Fleet Reserve, Facility Maintenance and Public Parking Facilities.

Community Services focuses on increasing, improving, and facilitating communication between the city and its residents. The office helps the city improve the quality of service delivery by linking residents with service providers; conveying community needs and desires to elected and appointed officials; facilitating public participation in policy development; and by supporting neighborhood leadership and the organizational development of the city's neighborhood associations.

The Code Compliance Division is responsible for neighborhood preservation, code compliance, and nuisance abatement.

The Engineering Department works closely with the Public Works Department in maintaining the city's existing utilities and infrastructure and providing for future increased capacity. Tasks range from helping citizens locate sewer and water lines near their homes to the design and supervision of major street improvement projects.

The Planning Department regulates growth and development in the city of Milwaukie by administering the city's Comprehensive Plan and Municipal Code related to zoning and land division. Tasks range from implementing existing zoning regulations to assisting City Council with land use and growth planning policy development.

The Milwaukie Police Department is a full service law enforcement organization that has been dedicated to the citizens of the city of Milwaukie, in one form or another, since its inception in the year 1903. The department evolves through

constant introspection, citizen input, and City Council direction and is constantly examining the processes in order to find a way to “do it better.”

The Wastewater Division continues regular sewer line cleaning and inspection. It uses information from inspections for ongoing analysis of the sewer system components and capital needs assessment, and on the spot pipe rehabilitation to minimize sewer back-ups.

The Stormwater Division ensures that the city complies with the National Discharge Elimination System (NPDES) permit. The division monitors pollutants in surface water. The division also repairs, cleans, and maintains over 1,600 catch basins, 654 manholes, 198 drywells and approximately 37 miles, or 195,360 feet of pipes and ditches.

The Water Division is responsible for the supply and distribution of drinking water. It serves approximately 6,750 residential and commercial customers. The system is comprised of 100 miles of water lines, 3 storage reservoirs, 7 wells, 2 pressure boosting stations, and 2 treatment plants. The division ensures that the city’s water storage and distribution systems comply with all state and federal regulations.

2.9 Existing Plans and 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.

The Milwaukie Natural Hazards Mitigation Plan Addendum includes a range of recommended mitigation actions 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 addendum helps identify what resources already exist that can be used to implement the mitigation actions identified in the addendum. Implementing the addendum’s mitigation actions through existing plans and policies increase their likelihood of being supported and getting updated, and maximizes the city’s resources.

The following list documents the plans and policies already in place in the city of Milwaukie:

Plan: City of Milwaukie Emergencies Operations Plan

Date of Last Revision: September 1999

Author/Owner: City of Milwaukie

Description: The Emergency Operations Plan describes the conditions required for the declaration of a state of emergency within the city and names the individual authorized to declare that state of emergency.

Relation to Natural Hazard Mitigation: An emergency operations plan can be used to implement mitigation activities related to emergency situations.

Plan: City of Milwaukie Comprehensive Plan

Date of Last Revision: 2008

Author/Owner: City of Milwaukie

Description: Establishes broad city goals and specific policies which will realize or achieve those goals. The policies are intended to provide sufficient guidance for evaluating a wide variety of proposed actions, and for making decisions about matters covered by the Comprehensive Plan.

Relation to Natural Hazard Mitigation:

- Natural Hazards Element provides information on the floodplain, seismic activity, and weak foundation soils.
- Open Spaces, Scenic Areas, and Natural Resources Elements aim to protect these features and improve the quality of the environment.
- Agricultural and Forest Lands Element provides for the orderly conversion of semi-rural lands to urban uses while maintaining adequate open space to meet the needs of existing and future residents.
- Air, Water Quality, and Land Resources Elements direct the city to meet federal and state air, noise, and water quality standards.
- Land Use Element has the objective to utilize land in the city according to their relative measure of potential for building.
- Transportation and Public Facilities Elements detail plans for future growth, and the continual upgrade and maintenance of existing facilities.
- City Growth Element establishes a consistent framework for the city regarding municipal services and land uses within the urbanized, unincorporated territory surrounding the city.

Plan: City of Milwaukie Municipal Code

Date of Last Revision: 2008

Author/Owner: City of Milwaukie

Description: The purpose of the Municipal Code is to set rules and regulations on construction and activities within the city.

Relation to Natural Hazard Mitigation:

- Title 13, Public Services: This section details the municipal water system, drought and emergency water regulation, cross-connection control, sewer system, stormwater management, solid waste management, and capital improvements.
- Title 15, Buildings and Construction: This sections details the building codes, plumbing codes, building relocation, vacant lots, public facilities improvements, and public works standards.
- Title 16, Environment: This section details seismic conditions, weak foundation soils, air quality, noise, erosion control, and tree cutting.
- Title 17, Chapter 18.04, Flood Hazard Areas: The purpose of this chapter is to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed.
- Title 19, Zoning: The purpose of this title is to provide for the public health, safety, and general welfare of the citizens of the city through orderly community development.

2.10 Community Organizations and Programs

Social systems can be defined as community organizations and programs that provide social and community-based services, such as health care or housing assistance, to the public. In planning for natural hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public. Often, actions identified by the addendum involve

communicating with the public or specific subgroups within the population (e.g. elderly, children, low income). The county and its cities can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues, one of which could be natural hazard preparedness and mitigation.

The following list highlights community organizations within the city that may be potential partners for implementing mitigation actions:

- Friends of Clackamas Creek
- Friends of North Clackamas Park
- Johnson Creek Watershed Council
- Milwaukie Chamber of Commerce
- Milwaukie High School Habitat for Humanity
- Milwaukie High School National Honors Society
- Milwaukie Lions Club
- Milwaukie Rotary Club
- Seven Neighborhood District Associations
 - Ardenwald-Johnson Creek
 - Hector Campbell
 - Historic Milwaukie
 - Island Station
 - Lake Road
 - Lewelling
 - Linwood

Section 3: Hazard Assessment

3.1 Definition of 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.

Milwaukie conducted a hazard assessment for all of the hazards for which data was available. The three levels of a hazard assessment are as follows:

- 1) ***Hazard Identification*** identifies the geographic extent, the intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data. Milwaukie identified six major hazards that consistently affect this geographic area. These hazards – floods, landslides, wildfires, earthquakes, wind and winter severe storms, and volcanoes – were identified through an extensive process that utilized input from the HMAC. The geographic extent of each of the identified hazards has been identified by the Milwaukie GIS department using the best available data, and is illustrated by the maps listed in Table 3.1.
- 2) ***Vulnerability Assessment/Inventorying Assets*** combines hazard identification with an inventory of the existing (or planned) properties 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 the specific hazard sections.
- 3) ***Risk Analysis/Estimating Potential Losses*** involves estimating the damages, 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 in which to measure the effects of hazards on assets. Unfortunately, there is insufficient data for conducting a risk analysis for all natural hazards affecting Milwaukie. However, this need is identified in the action plan, and a complete risk assessment will be conducted when resources are available.

Table 3.1 List of Hazard Mitigation Plan Maps

Map #	Type of Map	Section of the Addendum
1	Map of Milwaukie in Region	Section 2
2	Critical Facilities	Section 3
3	Essential Facilities	Section 3
4	Infrastructure	Section 3
5	FEMA NFIP 100-Year Floodplain & 1996 Flood Inundation	Section 4
6	Landslide Hazards	Section 4
7	Storm (Sanding and Plowing Routes)	Section 4
8	Wildfire Hazards	Section 4
9	Earthquake Hazards	Section 4

3.2 Hazard Assessment Mapping Methodology

The information used to identify the hazards was derived from digital databases on Milwaukie's Geographic Information System, (GIS). Milwaukie obtains its data from Clackamas County, Metro, and produces some data in-house.

To identify the city's exposure to each hazard, the hazard areas were intersected with the facilities layers. The facilities and infrastructure located within each specific hazard zone were then reported. For the evaluations of estimated monetary damage assessment, the city did the same type of overlay with the city's tax lot data.

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 the environmental integrity of Milwaukie. The exposure of community assets to natural hazards is provided in Table 3.2. The community assets are defined as follows:

Critical Facilities: Facilities and infrastructure necessary for emergency response efforts (Map 2).

▪ **Fire Stations:**

City

- Public Safety Building (Clackamas County Fire District)

County:

- Lake Road Station
- Oak Lodge Station

▪ **Law Enforcement:**

City

- Public Safety Building

County

- County Sheriff

State

- Oregon State Police

▪ **Hospitals:**

City

- Milwaukie Providence Hospital
- County*

- Kaiser Permanente Hospital
- Willamette Falls Hospital

Essential Facilities: Facilities and infrastructure that supplement response efforts (Map 3).

▪ **City Buildings:**

- Milwaukie City Hall
- Public Safety Building
- Public Facilities Building
- Milwaukie Center
- Ledding Library
- Old Fire Station
- Old Shop

▪ **County Buildings:**

- Kellogg Treatment Plant

▪ **Potential Shelter Sites:**

- Milwaukie Lutheran Church
- St. Johns Catholic Church
- St. Johns Episcopal Church
- Milwaukie First Baptist Church
- Romanian Baptist Church
- Clackamas Christian Center
- Milwaukie Center
- School Gyms
- Ledding Library

▪ **Schools:**

- Milwaukie High School
- Rowe Junior High
- Ardenwald Elementary
- Hector Campbell Elementary
- Linwood Elementary
- Milwaukie Elementary
- Seth Lewelling Elementary
- Portland Waldorf School
- St. Johns School
- School Transportation Center

Infrastructure: (Map 4).

▪ **Bridges:**

City

- Milport Road across Johnson Creek
- 17th Avenue across Johnson Creek

County

- Oatfield Road across Kellogg Creek
- Rusk Road across Mount Scott Creek
- 55th Avenue across Johnson Creek
- Stanley Avenue across Johnson Creek
- 60th Avenue across Johnson Creek
- Linwood Avenue across Johnson Creek

Portland

- Ochoco Street across Johnson Creek
- Johnson Creek Blvd. across Johnson Creek

State of Oregon

- McLoughlin Blvd. across Johnson Creek N. of city
- McLoughlin Blvd. across Kellogg Creek
- McLoughlin off-ramp to Hwy. 224 across Johnson Creek
- Hwy. 224 across Johnson Creek, McLoughlin Blvd. & Main
- Hwy. 224 across railroad tracks and 26th Avenue
- Hwy. 224 across Mount Scott Creek

▪ **Transportation Corridors:**

- McLoughlin Blvd.
- Highway 224
- Harrison St/42nd Ave./King Rd.
- Lake Road
- Oatfield Road
- Linwood Avenue
- 17th Avenue
- 32nd Avenue
- River Road
- Johnson Creek Boulevard

▪ **Water Treatment Facilities**

- 7 City Wells
- Aeration Packed Towers – 5 @ two locations
- Elevated Water Storage Tank – 40th & Harvey
- Concrete Storage Tank – 40th & Harvey
- Ground Level Metal Tank – Stanley & Harlow
- Sewerage Pump Stations – 5

▪ **Other Utilities**

- NW Natural pipelines
- PGE Substations (One is at edge of Lake / Harmony; a second is on the East end of Johnson Creek)
- Qwest facility in Oatfield
- Satellite & Communication Towers

Table 3.2 identifies the number of critical facilities and infrastructure exposed to each of the natural hazards affecting the city of Milwaukie. The implications of

exposure to the various hazards are outlined in each of the hazards sections. Additional tax lot information is also included in the hazard specific sections.

Table 3.2 Milwaukie Vulnerability Assessment

Hazard	Critical Facilities Exposed	Infrastructure Exposed
Flood	0	15 Bridges
Landslide	0	0
Wildfire	0	1 Bridge
Severe Storm	N/A	N/A
Earthquake	3	6 Bridges
Volcano	N/A	N/A

Source: City of Milwaukie GIS



MILWAUKIE
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Critical Facilities Map #2

-  Bridges
-  Fire Stations
-  Hospital
-  Police Station
-  Schools
-  Wells
-  Transportation Networks
-  Water Body
-  City Boundary

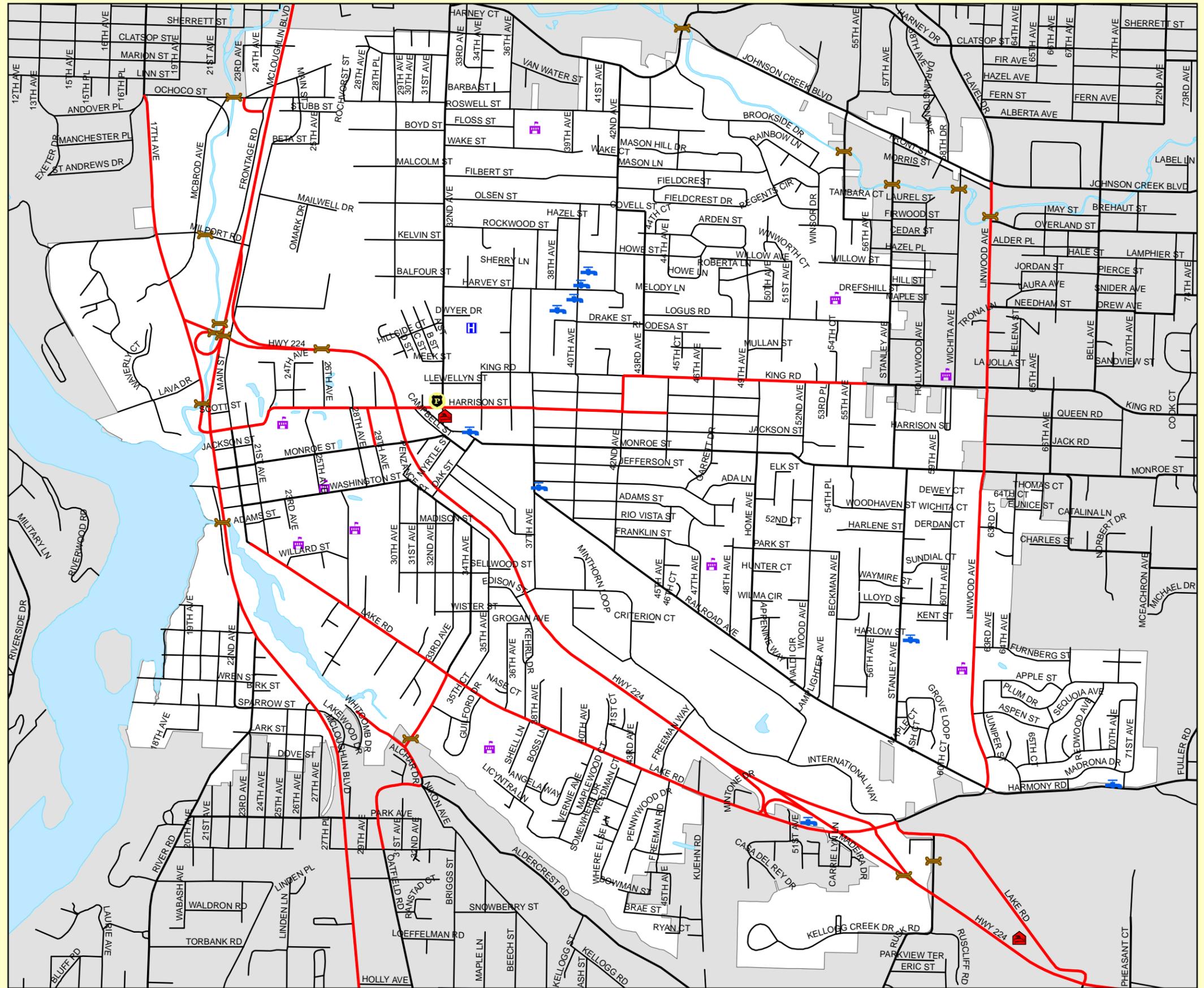
Data Sources: City of Milwaukie GIS
Metro Data Resource Center

Date: December 2008

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0 500 1,000 2,000 3,000 4,000 5,000 Feet





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Essential Facilities Map #3

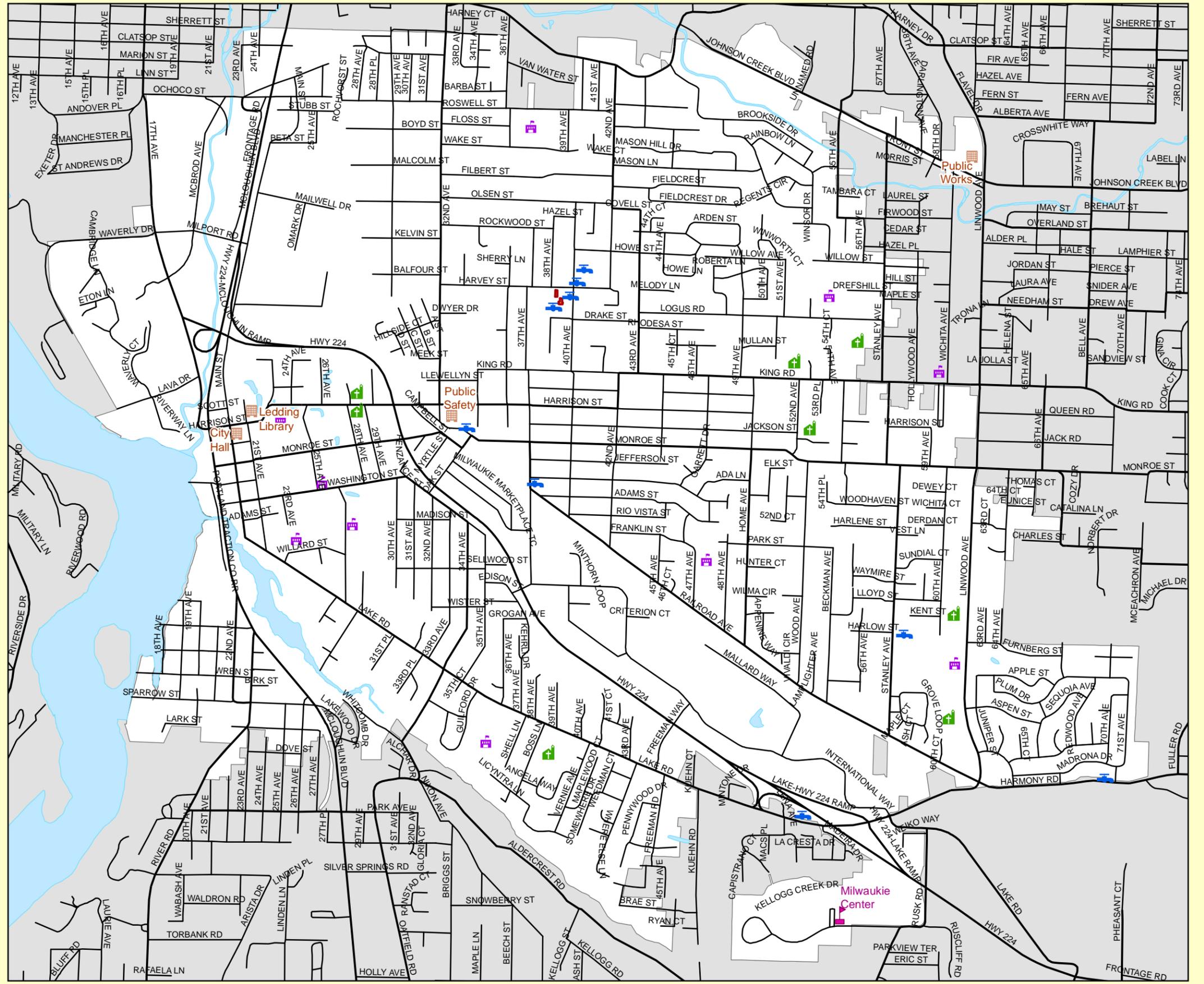
-  Water Wells & Pumps
-  Potential Shelters, City Buildings
-  Potential Shelters, Schools/Gyms
-  Potential Church Shelters
-  Milwaukie Center
-  Old Fire Station/Old Shop
-  Water Body
-  City Boundary

Data Sources: City of Milwaukie GIS
Metro Data Resource Center

Date: December 2008

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Infrastructure Map #4

- Sewer Pumps
- Metal Water Tank
- ▶ Kellogg Sewer Treatment
- ▲ Elevated Water Tank
- Concrete Water Tank
- Aeration Towers
- City Wells
- ✚ Cell Towers & Antenna
- ⚙ Bridges
- ↔ Critical Transportation Networks
- Water Body
- City Boundary

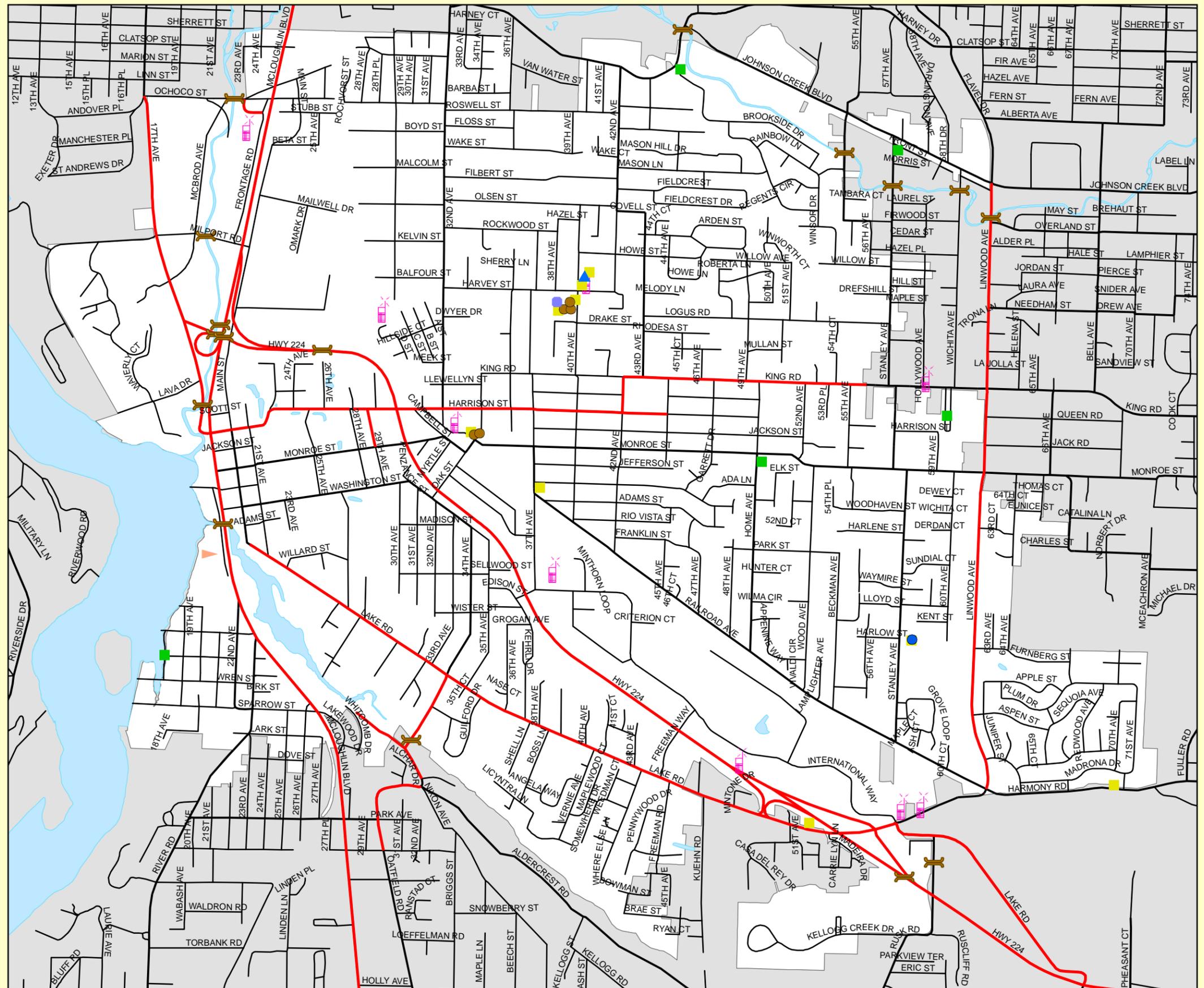
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Section 4: Natural Hazards

4.1 Flooding

The city of Milwaukie has one large river and 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. The river, creeks, and tributaries include:

- Willamette River
- Johnson Creek
- Kellogg Creek
- Mount Scott Creek
- Minthorn Creek
- Spring Creek

4.1.1 Flooding Profile

The historical large-scale flooding events have been described in Section 6 of the Clackamas County Natural Hazards Mitigation Plan, and are applicable to the city of Milwaukie. A few events between 2003 and 2009 require further explanation.

From December 2nd to 3rd, 2007 excessive rainfall required Clackamas County Water Environment Services to bypass treatment processes at the Kellogg Wastewater Treatment facility because the plant could not treat both the normal flows of wastewater and the excessive flows from the storm. As a result of the bypass, untreated wastewater was released into the Willamette River.

The December 2nd-3rd storm also raised the water level of Johnson Creek to flood stages, requiring the closure of the Millport Bridge between Frontage Road and McBrod Avenue. The water level came close to the deck of the bridge but never crested the bridge.

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

4.1.2 Flooding Hazard Assessment

Hazard Identification

Hazard identification is the first step of a flood hazard assessment. Identification is the process of estimating: (1) the geographic extent of the floodplain; (2) the intensity of the flooding that can be expected in specific areas of the floodplain; and (3) the probability of occurrence of flood events. This process usually results in the creation of a floodplain map.

The city of Milwaukie is a regular participant in the National Flood Insurance Program (NFIP), with 50 policies in force at a value of \$12,763,600. Milwaukie's most recent Community Assistance Visit was March 31, 1999, and the city's most

current effective Flood Insurance Rate Map (FIRM) date is June 17th, 2008 (initial FHBM 4/05/1974).^{viii} The geographic extent of the flooding hazard was determined using the designated FEMA NFIP 100-year floodplain data, as well as the inundation line for the 1996 flood. Map 5 illustrates the flood hazard area for Milwaukie. Map 5 shows there are 148 acres identified in the FEMA 100 year floodplain, which is 4.83% of the city's 3,067 acres.

Vulnerability Assessment

A vulnerability assessment is the second step of a flood hazard assessment. It combines the floodplain boundary, generated through hazard identification, with an inventory of the property within the floodplain. Understanding the population and property exposed to natural hazards will assist in reducing risk and preventing loss from future events. Milwaukie's HMA estimates the city's vulnerability to flooding to be 'low', meaning less than 1% of the population and assets would be affected. This estimate is lower than the county's 'moderate' rating because Milwaukie has relatively low exposure to flooding compared to other cities in Clackamas County.

The amount of property in the floodplain, as well as the value of those properties can be calculated to provide a working estimate for potential flood losses. Table 4.1 below shows the number of tax lots, acres, and value of tax lots in the floodplain, as well as the property affected during the 1996 flood. This information was calculated by overlaying tax lot data on top of the floodplain map. The data serves to provide an estimate for potential flood losses.

Table 4.1 Property Assessment:

Floodplain	Tax Lots	Acres	Value*
FEMA100-year & 1996 Combined	244	302	\$245,620,594
FEMA 100 year	241	299	\$240,796,830
1996 Only	169	194	\$184,960,330

*Value of property in the 100-year floodplain may include property in tax lots that intersect the floodplain, including property that does not physically reside in the floodplain itself.
Source City of Milwaukie GIS

While the area of land in the floodplain is not great, the potential damage to property can be significant as it could impact residential, commercial and public properties. Flooding can affect building foundations, seep into basements, and damage interiors and exteriors of buildings. The extent of damage is dependent upon the velocity and depth of the water, and items carried in the flood waters, such as fallen trees. Overflowing of the city sewer system during flooding can cause further damage to properties.

The FEMA 100-year floodplain map shows that 1.3 miles of the transportation network could be affected in a flood. Bridges are the critical infrastructure located within the floodplain; however there is no fiscal impact data available for bridges. Bridge closures during a major flooding event can be a significant impediment to the traffic flow in and out of the city. Not all entry and exit routes, however, would be cut off. McLoughlin Boulevard is a major transportation route between Portland and cities such as Milwaukie, Oak Grove and Oregon City. Flooding on McLoughlin

Bldv would have a significant impact on residents and commuters in these cities going to and from Portland.

Risk Analysis

Risk analysis is the third and most advanced phase of a hazard assessment. It builds upon the hazard identification and vulnerability assessment.

A flood risk analysis for Milwaukie should include two components: (1) the number of lives, and the value of property that may incur losses from a flood event (defined in the vulnerability assessment); and (2) the number and type of flood events expected to occur over time.

Flow velocity models can assist in predicting the amount of damage expected from different magnitudes of flood events. The data used to develop these models is based on hydrological analysis of landscape features. Changes in the landscape, often associated with human development, can alter the flow velocity and the severity of damage that can be expected from a flood event. Using GIS technology and flow velocity models such as multi-hazard HAZUS, it is possible to map the damage that can be expected from flood events over time. It is also possible to pinpoint the effects of certain flood events on individual properties.

At the time of publication of this addendum update, data was insufficient to conduct a risk analysis for flood events in Milwaukie. The city has addressed this issue in mitigation action LT-MH#2 in section 4.7 and will be completing a flood risk analysis as data and resources become available.

4.1.3 Repetitive Flood Loss

The city of Milwaukie works to mitigate problems regarding flood issues when they arise. Some areas in the city are more susceptible to flooding issues and have incurred repetitive losses, meaning they have had two or more NFIP claims in the past ten years. According to the most current data from the Oregon Department of Land Conservation and Development, six properties in Milwaukie have suffered from repetitive losses. The total NFIP payments are listed in Table 4.2.

Table 4.2 Milwaukie Repetitive Loss Claims

Property	Total Building Payments	Total Contents Payment	Total Paid
Property 1	\$90,040.40	\$0.00	\$90,040.40
Property 2	\$25,152.64	\$8,237.49	\$33,390.13
Property 3	\$5,057.82	\$0.00	\$5,057.82
Property 4	\$27,462.79	\$0.00	\$27,462.79
Property 5	\$17,351.20	\$0.00	\$17,351.20
Property 6	\$99,669.38	\$1,144.97	\$100,814.35

Source: Oregon Department of Land Conservation and Development

4.1.4 Existing Flood Mitigation Activities

Flood mitigation activities listed here include current mitigation programs and activities that are being implemented by city of Milwaukie agencies or organizations.

City of Milwaukie Codes Pertaining to Flooding

Milwaukie Municipal Code Title 18 Flood Hazard Regulation (Ord 1899)

It is the purpose of this chapter to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

- A. To protect human life and health;
- B. To minimize expenditure of public money and costly flood control projects;
- C. To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- D. To minimize prolonged business interruptions;
- E. To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;
- F. To help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;
- G. To ensure that potential buyers are notified that property is in an area of special flood hazard;
- H. To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions; and
- I. To maintain the functions and values of floodplains such as allowing for storage and conveyance of stream flows through existing and natural flood conveyance systems.

Milwaukie Comprehensive Plan, Chapter 3 Environmental and Natural Resources (Ord 1666)

GOAL STATEMENT: To prohibit development that would be subject to damage or loss of life from occurring in known areas of natural disasters and hazards without appropriate safeguards.

Milwaukie's future role will primarily be as a residential community with considerable employment opportunities. This future, however, is not incompatible with the conservation of the city's remaining natural resources of land, air, water, and the natural environment. The wise use and management of these resources is particularly important in Milwaukie because the city is almost completely developed and few areas remain in a natural state. The protection of these natural resources is essential if residents are to experience the city's pleasures and amenities, which can only be enjoyed when nature is close at hand. The Comprehensive Plan elements which address these issues include:

- Natural Hazards Element
- Historic Resources Element
- Open Spaces, Scenic Areas, and Natural Resources Element
- Agricultural and Forest Lands Element
- Air, Water and Land Resources Quality Element

Policies in each of these elements, as well as the technical studies and inventories documented in the Resources and Environment, Parks and Open Space, Land Use and Transportation working papers, and the Neighborhood Blockwalk, comply with Statewide Planning Goals 3, 4, 5, 6, and 7 (reference Oregon Administrative Rules 660, Division 15).

Flood Mitigation Projects

- Projects completed by the Johnson Creek Watershed Council:
 - Tree Plantings along the creek in various places including the most recent planting at ODS.
 - Storm water detention near Milport.
- To improve stormwater management the city of Milwaukie lined the interiors of all pipes along the 18th Avenue infiltration line. This mitigation project minimizes the amount of groundwater that infiltrates into sewer lines and helps reduce the overall amount of water going into the wastewater treatment plant, thus reducing the chance of overflow of the sewer system.
- In 2004 the city of Milwaukie updated their Storm Water Master Plan. This was a mitigation action in the 2003 plan.
- In 2006 Clackamas County Water Environment Services partnered with eight community groups to restore the Three Creeks area – including Mount Scott, a tributary to Kellogg Creek and the Willamette. The group reshaped the stream channel to make it more natural; removed invasive species; planted thousands of native plants to stabilize; and put in lard wood and boulders to stabilize the channel and provide habitat for fish. The groups also removed trash and transient camps that polluted the streams during floods.

4.1.5 Flood Mitigation Actions

The flood mitigation actions provide direction on specific activities that organizations and residents in the city of Milwaukie can undertake to reduce risk and prevent loss from flood events. Each mitigation action is followed by ideas for implementation, which can be used by the HMAC and local decision makers in pursuing strategies for implementation.

LT-FL#1: Evaluate alternatives for reducing the flooding hazard for properties along Kellogg Creek, Johnson Creek, the Mount Scott Creek area, and the Willamette River.

Ideas for Implementation:

- Identify repetitive flood loss properties and discuss mitigation strategies with property owners.

Coordinating Organization: Public Works, Engineering

Timeline: 3-5 years

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Deferred from 2003 addendum.* Action was not implemented due to lack of organizational authority. The 2009 addendum added “Engineering” as a coordinating organization.

LT-FL#2: Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.

Coordinating Organization: Engineering

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Partnerships and Implementation

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



MILWAUKIE
Dogwood City of the West

Flood Hazard Zones FEMA & 1996 Overlay Map #5

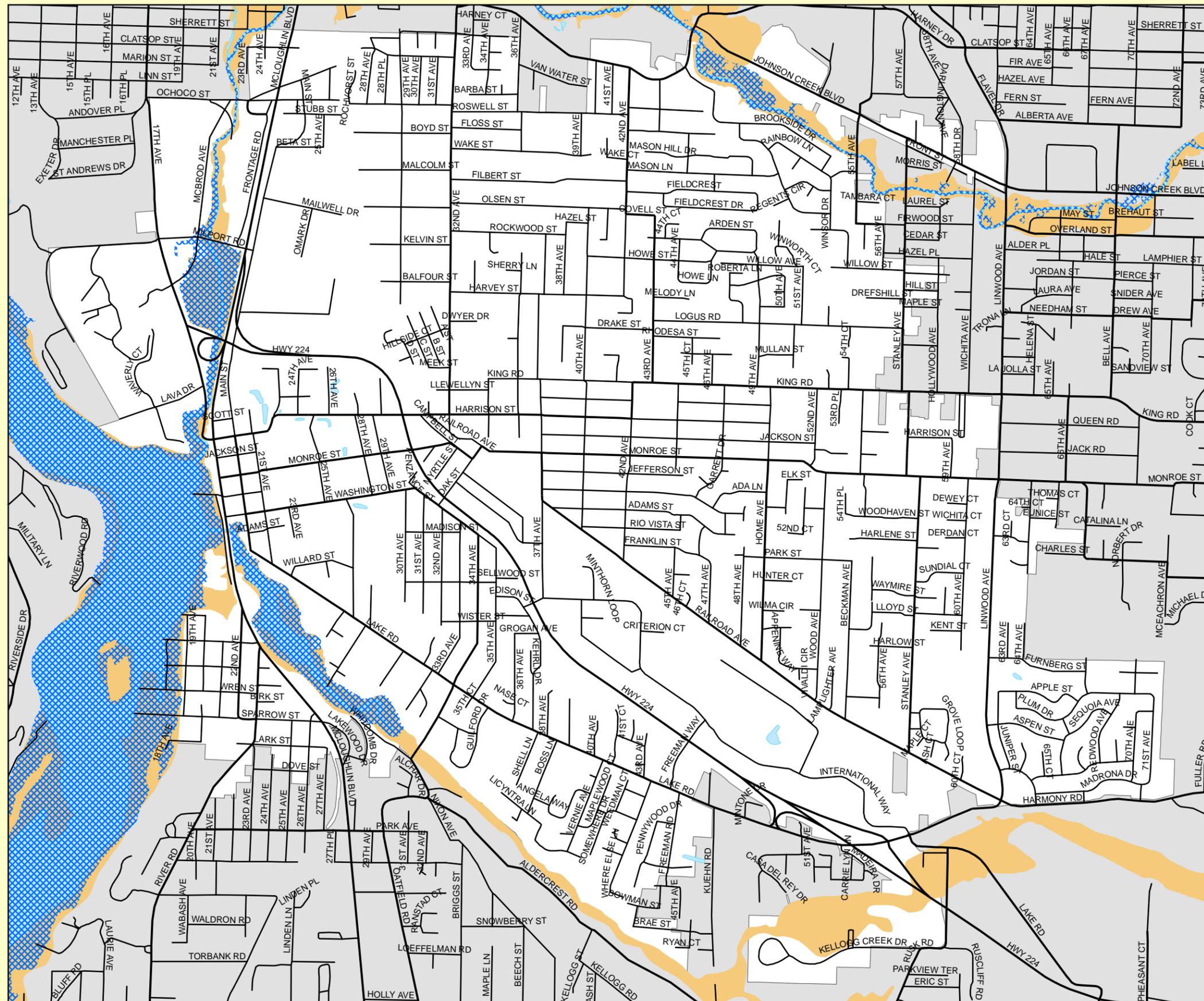
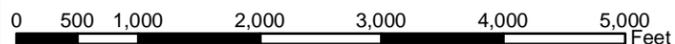
-  1996 Flood Extent
-  FEMA 100 Year Flood
-  Water Body
-  City Boundary

Data Sources: City of Milwaukie GIS
Metro Data Resource Center

Date: December 2008

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4.2 Landslide

4.2.1 Landslide Profile

The historical landslide events have been described in Section 7 of the Clackamas County Natural Hazards Mitigation Plan, and are applicable to the city of Milwaukie. As such, the events will not be repeated here.

The probability of landslide events in Milwaukie was determined using scientific data, historical occurrences, and local knowledge. Milwaukie's HMAC estimates that the probability of landslides occurring is 'low,' meaning one event is likely within a 75-100 year period. This estimate is lower than the county's 'high' probability estimate, and is based on the city's relatively level terrain.

4.2.2 Landslide Hazard Assessment

Hazard Identification

An essential step towards mitigation of landslide hazards is to identify the hazardous locations. Landslide events within the city have not significantly impacted residents or caused major property damage. Mapping landslide and debris flow allows the city to estimate damages within a given location and to help prevent future losses in landslide prone areas. The geographic extent of the landslide hazard was illustrated using percent slope, soil type, and bedrock type. The landslide hazard is depicted on Map 6, and shows that landslides may affect 7.66% of the city's land area.

Vulnerability Assessment and Risk Analysis

While a quantitative vulnerability assessment is not available for the city at this time, there are many qualitative factors that point to potential vulnerability. Potential landslide hazard areas were defined as slopes with 20% grade or greater. Using this method, 7.68% of Milwaukie's land has potentially unstable slopes which may be vulnerable to landslides. Landslide loss estimates are shown in Table 4.3.

Table 4.3. Landslide Loss Estimates in Milwaukie

	Lots	Acres	Value
Critical features affected by landslides	0	0	\$0
Property by tax lot:	23	26.2	\$20,274,856

Source: City of Milwaukie Geographic Information System

Landslide events within the city have not significantly impacted residents or caused major property damage in the past but landslides could potentially inhibit traffic flow, cause damage to roads, and damage buildings. Erosion to hillside areas can take place during heavy rain. The HMAC estimates the vulnerability of landslides is 'low,' meaning less than 1% of the population and community assets would be affected. This is in agreement with the county's 'low' vulnerability rating.

Factors included in assessing landslide risk include population and property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, soil characteristics, and precipitation intensity. This type of analysis could generate estimates of the damages to the city of Milwaukie

due to a specific landslide or debris flow event. At the time of publication of this addendum update, Milwaukie was unable to perform a quantitative risk assessment due to insufficient data and lack of software needed to conduct this type of analysis. The city has addressed this issue in mitigation action LT-MH#2 in section 4.7 and will be completing a risk assessment as data and resources become available.

4.2.3 Existing Landslide Mitigation Activities

Landslide mitigation activities listed here include current mitigation programs and activities that are being implemented by the city of Milwaukie's agencies or organizations.

City of Milwaukie Codes Pertaining to Landslides

Milwaukie Comprehensive Plan, Chapter 3 Environmental and Natural Resources (Ord 1666)

GOAL STATEMENT: To prohibit development that would be subject to damage or loss of life from occurring in known areas of natural disasters and hazards without appropriate safeguards.

Milwaukie's future role will primarily be as a residential community with considerable employment opportunities. This future, however, is not incompatible with the conservation of the city's remaining natural resources of land, air, water, and the natural environment. The wise use and management of these resources is particularly important in Milwaukie because the city is almost completely developed and few areas remain in a natural state. The protection of these natural resources is essential if residents are to experience the pleasures and amenities which can only be enjoyed when nature is close at hand. The Plan elements which address these issues include:

- Natural Hazards Element
- Historic Resources Element
- Open Spaces, Scenic Areas, and Natural Resources Element
- Agricultural and Forest Lands Element
- Air, Water and Land Resources Quality Element

Policies in each of these elements, as well as the technical studies and inventories documented in the Resources and Environment, Parks and Open Space, Land Use and Transportation working papers, and the Neighborhood Blockwalk, comply with Statewide Planning Goals 3, 4, 5, 6, and 7 (reference Oregon Administrative Rules 660, Division 15).

Municipal Code Chapter 17.40 Section 17.40.010 Environmental Standards (Ord 1440)

Developments approved through this title must conform to the requirements of the environmental protection subpart of the community development ordinance (Title 16 of this code). Particular note should be made regarding requirements relating to excavation in landslide-prone areas.

Municipal Code Chapter 16.28 Erosion Control (Ord 1899)

Temporary and permanent measures for all construction projects shall be required to lessen the adverse effects of erosion and sedimentation. The owner or his/her agent, contractor, or employee, shall properly install, operate and maintain both temporary and permanent works as provided in this section or in an approved plan, to protect the environment during the useful life of the project. These erosion control rules apply to all lands within the city of Milwaukie.

4.2.4 Landslide Mitigation Actions

The landslide mitigation actions provide direction on specific activities that organizations and residents in Milwaukie can take to reduce risk and prevent loss from landslide events. Each mitigation action is followed by ideas for implementation, which can be used by the HMAC and local decision makers in pursuing strategies for implementation.

LT-LS #1: Reduce the vulnerability of property owners in landslide-prone areas.

Ideas for Implementation:

- Conduct a study to identify appropriate mitigation strategies in the area including but not limited to: Tideman Johnson Park, Waverly Heights, and Island Station.
- Develop public information about risks when building on potential or historical landslide areas.

Coordinating Organization: Building and Engineering

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Natural Systems, Partnerships and Implementation

Status: *Deferred from 2003 addendum.* Action was not implemented due to lack of organizational authority. The 2009 update placed Building and “Engineering as the new coordinating organization.



MILWAUKIE
Dogwood City of the West

Potential Landslide Hazard Zones Map #6

 Landslide Hazard Zones

Slope

-  0% - 9.99%
-  10% - 14.99%
-  15% - 19.99%
-  20% - 24.99%
-  25% - 34.99%
-  35% - 100%
-  No Data

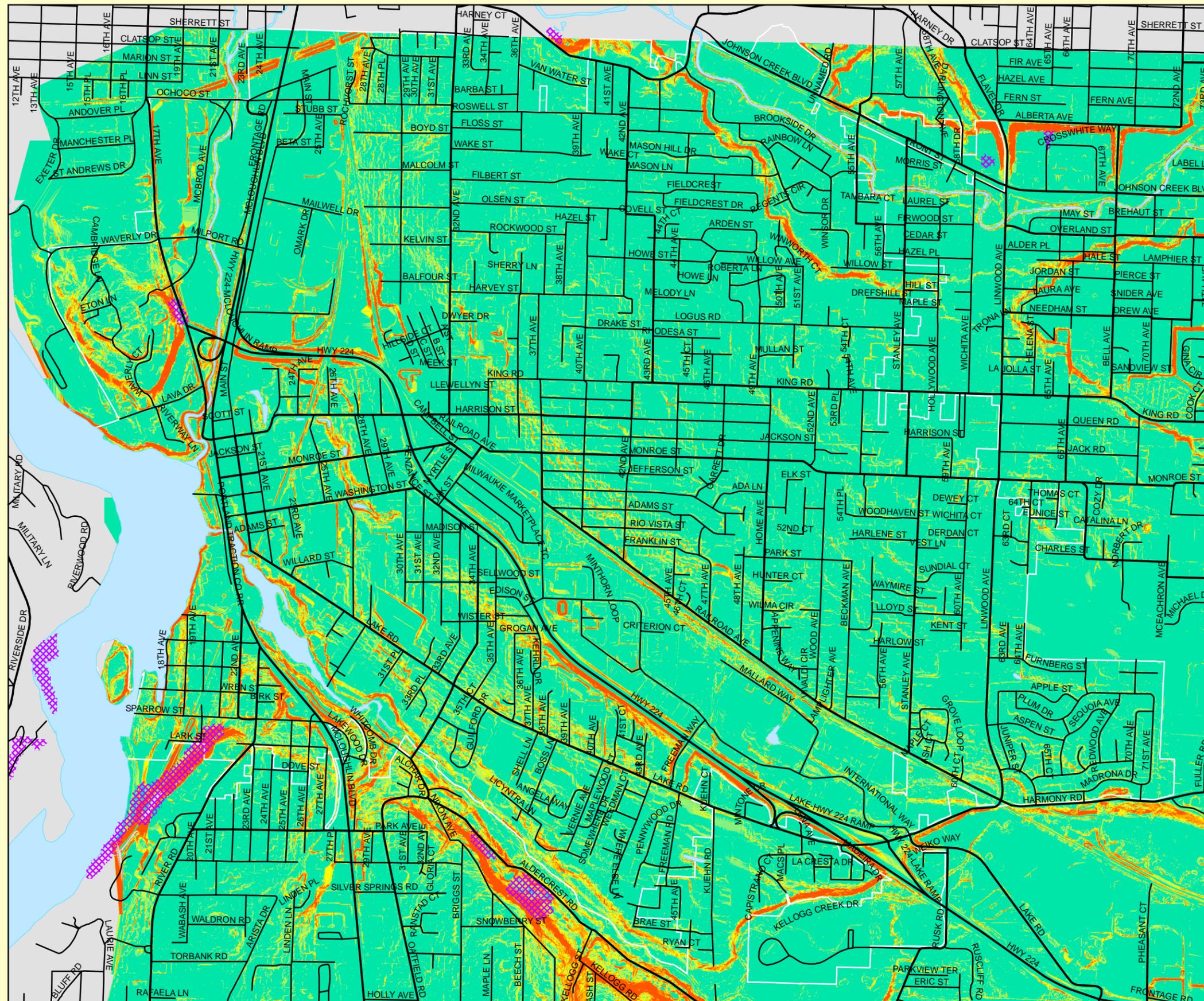
Data Sources: City of Milwaukie GIS
Metro Data Resource Center
Clackamas County WES

Date: December 2008

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4.3 Severe Storms: Wind and Winter

4.3.1 Severe Winter Storm Profile

The historical severe winter storm events have been described in Section 9 of the Clackamas County Natural Hazards Mitigation Plan, and are applicable to the city of Milwaukie. As such, the events will not be repeated here.

The probability of winter storm events in Milwaukie was determined using scientific data, historical occurrences, and local knowledge. Milwaukie's HMAC estimates that the probability of severe winter storms occurring is 'high', meaning one incident is likely within a 10 to 35 year period. This is in agreement with the county's 'high' probability estimate.

4.3.2 Severe Windstorm Profile

The historical severe windstorm events have been described in Section 10 of the Clackamas County Natural Hazards Mitigation Plan, and are applicable to the city of Milwaukie. One wind storm requires further explanation.

The December 14th to 15th, 2006 wind storm caused extensive power outages and communications systems failures in the city. The wastewater lift station lost power and a back up generator needed to be used. The storm also caused numerous trees to fall, requiring cars to be detoured.

The probability of windstorm events in Milwaukie was determined using scientific data, historical occurrences, and local knowledge. Milwaukie's HMAC estimates that the probability of severe windstorms occurring is 'high,' meaning one incident is likely within a 10 to 35 year period. This estimate is higher than the county's 'moderate' probability estimate.

4.3.3 Severe Storm Hazard Assessment: Hazard Identification

The severe storm hazard is difficult to illustrate cartographically. However, the city of Milwaukie has developed a map denoting regular sanding and plowing routes, which represents those areas that require resources to reduce the effect of the severe storm hazard. However, the snow plowing and sanding routes map (Map 7) does not accurately portray the geographic extent of the severe storms in Milwaukie, as the entire city would be affected by large-scale storm events.

Vulnerability Assessment

The HMAC estimates the vulnerability to severe storms is 'high,' meaning more than 10% of the population and assets would be affected. This is higher than the county's 'moderate' rating because history has shown that most of Milwaukie's population and community assets are affected in severe storm events.

The city of Milwaukie has identified 10.9 miles of streets and roadways that would be sanded, and 17.6 miles of streets and roadways that would be plowed during severe winter weather. The city has not done a study on actual number of individuals or property that can be affected during a severe winter storm. Severe storms can bring power outages and cause transportation and economic disruptions.

Specific problems for residences in the city include downed electrical wires, trees, and tree limbs that cause both major and minor property damage as well as a threat to life. Downed wires and trees can make accessibility to residences by Police and Fire difficult.

Risk Analysis

Factors that should be included in a storm risk analysis include population and property distribution in the hazard area, the frequency of storm events, information on the types of trees and failure rates more susceptible to severe storm events, and information on utilities and infrastructure that may be impacted by severe storms. Modeling software is required to predict potential losses from a particular storm event. At this time, Milwaukie is unable to perform a quantitative risk assessment due to insufficient data. The city has addressed this issue in mitigation action LT-MH#2 in section 4.7 and will be completing a risk assessment as data and resources become available.

4.3.4 Existing Severe Storm Mitigation Activities

The city has designated sanding and plowing routes. All new subdivision development is required to place telephone, cable and power lines underground, and new single lot development is required to have service lines from the street to the home underground. Placing power and service lines underground reduces the likelihood of trees or tree branches falling into a service line, thus causing services to be cut off.

City of Milwaukie Codes Pertaining to Severe Storms

Municipal Code Chapter 8.04 Nuisances Section 8.04.10 Snow and Ice Removal.

This code states that owners and persons in charge of property must remove snow or ice, or cover ice with a suitable material to assure safe travel within the first hours of daylight after snow has fallen.

Municipal Code Chapter 8.04 Nuisances Section 8.04.110 Weeds and noxious growth – Dead or decaying trees or tree limbs.

This code states that dead, decaying or unsafe trees or tree limbs may present safety hazards and are considered nuisances.

4.3.5 Severe Storm Mitigation Actions

The severe storm mitigation actions provide direction on specific activities that organizations and residents in Milwaukie can undertake to reduce risk and prevent loss from severe storm events. Each mitigation action is followed by ideas for implementation, which can be used by the HMAC and local decision makers in pursuing strategies for implementation.

LT-SS #1: Bury vulnerable power lines subject to failures.

Ideas for Implementation:

- Partner with PGE to obtain funding to bury power lines for critical facilities within the city;

- Partner with PGE to continue hazardous tree inventory and mitigation programs; and
- Partner with major businesses and employers to encourage undergrounding of power lines.

Coordinating Organization: Public Works and Engineering

Timeline: 3-5 Years

Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Deferred from 2003 addendum.* Action was not implemented due to limited resources. The 2009 update added “Engineering” as a new coordinating organization.



MILWAUKIE
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Severe Storm Sand & Plow Routes Map #7

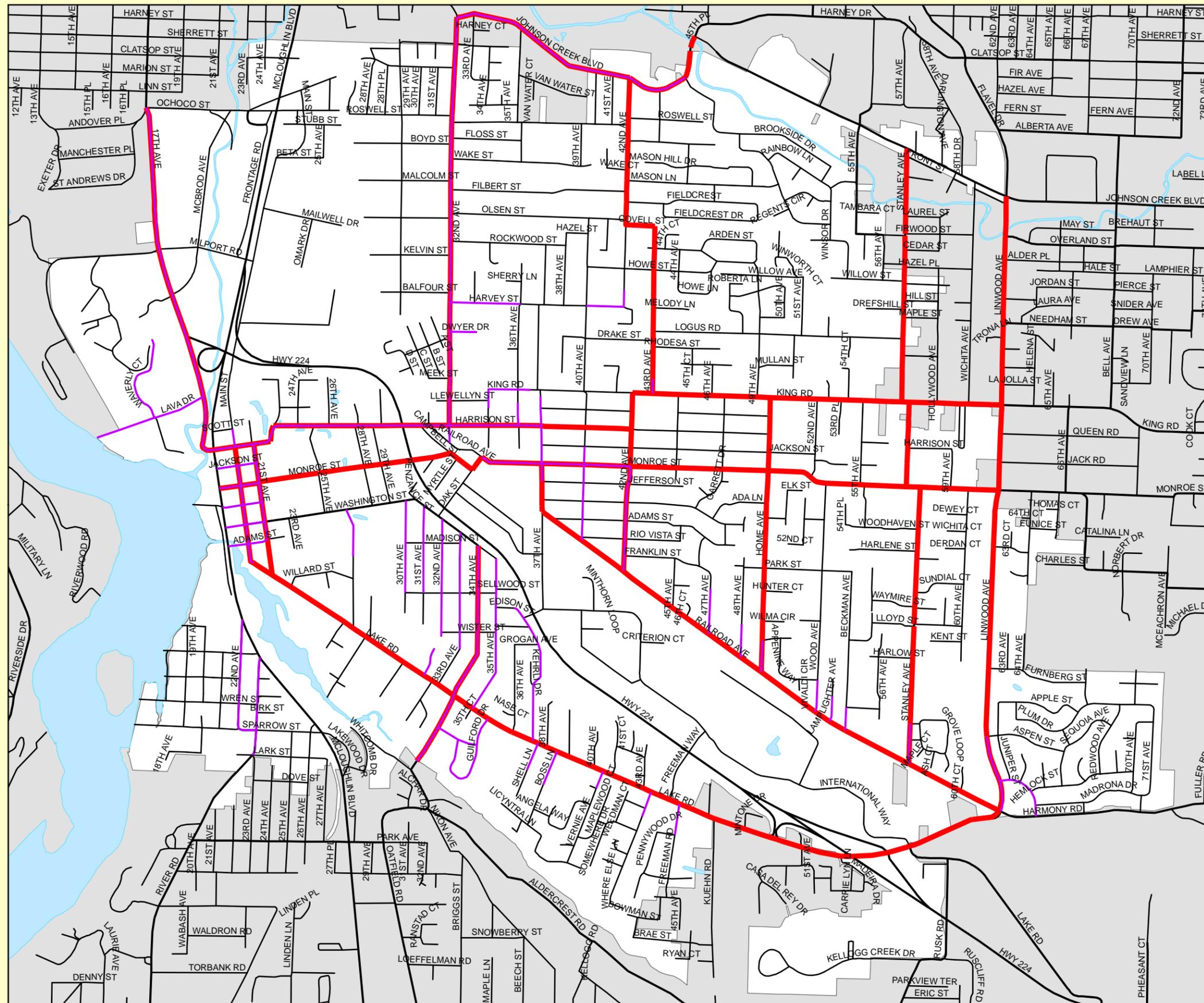
-  Sanding Route
-  Plowing Route
-  Minor Road
-  Major Road
-  Water Body
-  City Boundary

Data Sources: City of Milwaukie GIS
Metro Data Resource Center

Date: December 2008

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4.4 Wildfire

4.4.1 Wildfire Profile

Statistics provided by Clackamas County Fire District #1 show that Milwaukie had 207 brush and grass fires from 2003 until 2009. Most of these fires occurred along streets and highways, cared-for plots of land, or in residential back yards. Only 14 fires occurred in open lands or fields, but none of these were large-scale or considered wildfires. The large-scale wildfires affecting the region are described in Section 8 of the Clackamas County Natural Hazards Mitigation Plan.

The probability of wildfire events in Milwaukie was determined using scientific data, historical occurrences, and local knowledge. Milwaukie's HMAc estimates that the probability of wildfires occurring is 'high', meaning one incident is likely within a 10 to 35 year period. This estimate is higher than the county's 'moderate' probability estimate because Milwaukie has not had a large fire in recent years, thus allowing fuel load to build.

4.4.2 Wildfire Hazard Assessment

Hazard Identification

Wildfire hazard identification data is based upon fuels, weather, and topography, and was generated from Clackamas County GIS. The wildfire hazard in Milwaukie is shown on Map 8. The map identifies 624.77 acres, or 20.4% of all land being at high risk to wildfire hazard.

Vulnerability Assessment

The HMAc estimates that the city's vulnerability to wildfires is 'low,' meaning less than 1% of the population and community assets would be affected by a wildfire event. This estimate is lower the county's 'moderate' rating because Milwaukie does not have a large urban-wildland interface. Past wildland-urban interface fires have shown that property can be easily damaged or destroyed when structures, vegetation and other flammables merge. Other items that might affect the outcome of a wildfire are access to the location and to water, response time from the fire station, as well as the availability of personnel and equipment. Weather, such as hot dry winds and drought, can also play a part in a wildfire.

Table 4.4 Wildfire Loss Estimates in Milwaukie

	Lot	Acres	Value
Critical Features	1	1.15	\$6,384,284
	Bridge at Hwy 224 & SE 26 th Ave.		No data available
Property By Tax Lot	839	623.62	\$527,646,102

Source: City of Milwaukie Geographic Information System

Risk Analysis

Key factors included in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence, and weather, as well as occurrences of drought. At the time of publication of this addendum, data and modeling software were insufficient to

conduct a risk analysis. The city has addressed this issue in mitigation action LT-MH#2 in section 4.7 and will be completing a risk assessment as data and resources become available.

4.4.3 Existing Wildfire Mitigation Activities

The city of Milwaukie works with Clackamas County Fire District #1 to mitigate problems regarding wildfire issues when they arise. Currently the city does not allow backyard burning due to requirements of DEQ (back yard burning is a key contributor to fires in the interface). Also, the county Fire Defense Board provides daily burn messages and restrictions for the community to prevent interface fires. This information is provided from both the State Department of Forestry and the US Forest Service for all regions of the state.

City of Milwaukie Codes Pertaining to Wildfires

Municipal Code Chapter 8.04 Nuisances Section 8.04.110 Weeds and Noxious Growth.

This code mentions controlling vegetation before becoming a fire hazard.

Local Fire Prevention/Education Programs

The city of Milwaukie contracts with the Clackamas County Fire District for all fire prevention and education. They provide the community with the following.

- Counseling juvenile fire-setters
- Teaching fire prevention in schools
- Conducting CPR classes
- Teaching proper use of fire extinguishers
- Coordinating educational programs with other agencies, hospitals, and schools
- Answering citizens' questions

Additionally, Clackamas County Fire District #1 identified alternative water sources such as ponds and reservoirs to access during emergencies.

4.4.4 Wildfire Mitigation Actions

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

ST-WF#1: Inventory and map alternative firefighting water sources and encourage the development of additional sources.

Status: Completed, 2005. See “existing wildfire mitigation activities” above for success story.

LT-WF#1: Promote fire-resistant strategies for new and existing developments.

Ideas for Implementation:

- Continue to coordinate with the fire department to ensure that site plans are reviewed for future building sites;
- Continue to require street design that facilitates the movement of fire fighting equipment; and
- Continue to review roofing standards and develop recommendations for promoting non-combustible roofing.

Coordinating Organization: Building and CFD#1

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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



MILWAUKIE
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Wildfire Hazards Map #8

-  Grass & Wild Fires, 2003-2008
-  High Fire Risk
-  Moderate Fire Risk
-  Water Body
-  City Boundary

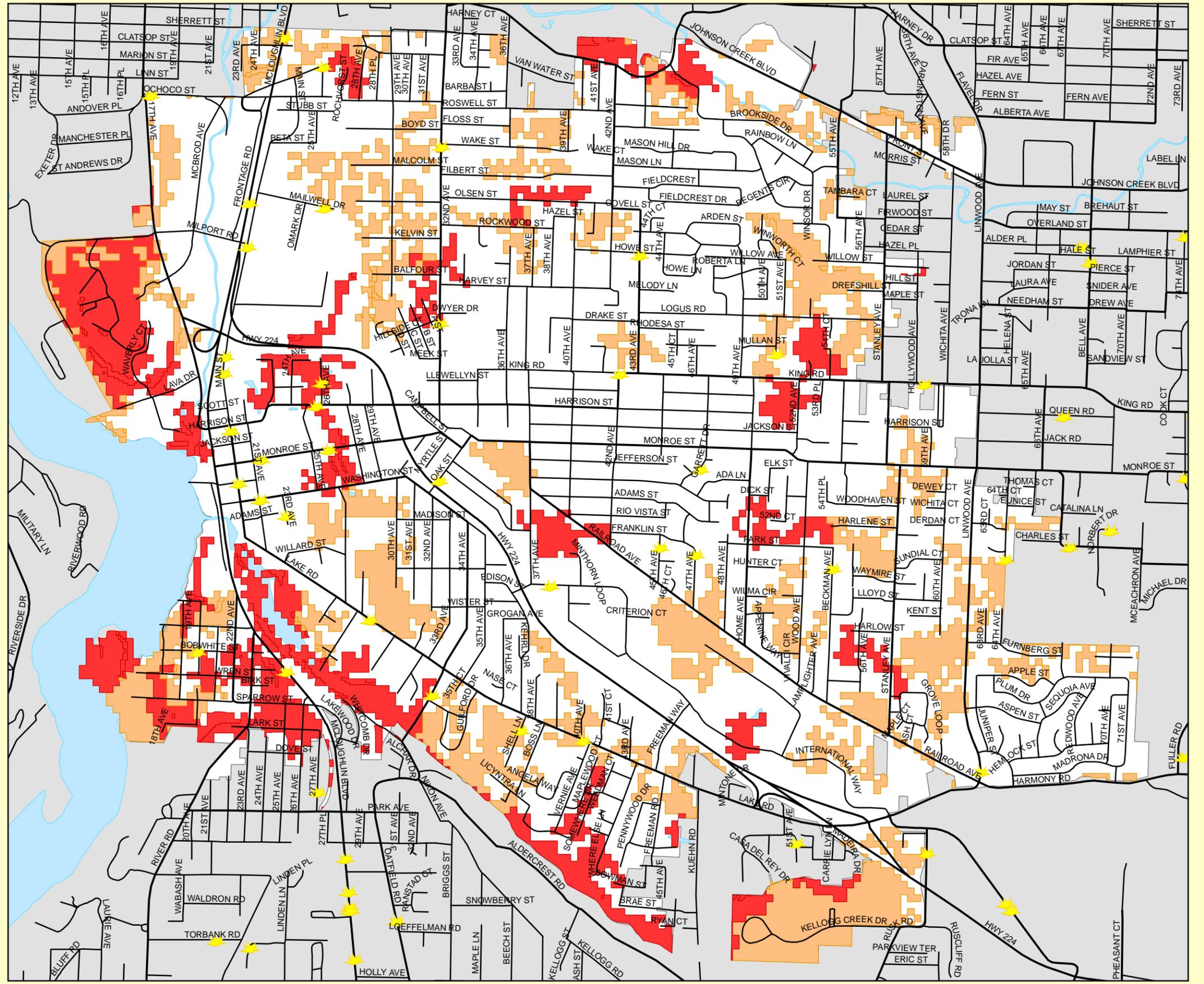
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4.5 Earthquake

4.5.1 Earthquake Profile

The historical earthquake events have been described in Section 11 of the Clackamas County Natural Hazards Mitigation Plan, and are applicable to the city of Milwaukie. As such, the events will not be repeated here.

There have been about 16 events over 4.0M in the past 150 years, meaning that this area averages about 1 crustal earthquake every 10 years. Subduction zone earthquakes in the Pacific Northwest have a return interval of about 500 years. The last record of a major subduction zone earthquake was in 1700.

The probability of earthquake events in Milwaukie was determined using scientific data, historical occurrences, and local knowledge. Milwaukie's HMAc estimates that the probability of earthquakes occurring is 'high,' meaning one incident is likely within a 10 to 35 year period. This is in agreement with the county's 'high' probability estimate.

4.5.2 Earthquake Hazard Assessment

Hazard Identification

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.

The geographic extent of the earthquake hazard in Milwaukie was illustrated using data derived from DOGAMI, and shows the relative earthquake hazard. The relative hazards were determined by slope, soils, and bedrock characteristics. The original dataset shows the hazards in four relative hazard zones, and the city broke earthquake hazard information into two categories, moderate and severe. The data is reflected on Map 9.

Vulnerability Assessment

The HMAc estimates that the community's vulnerability to earthquake is 'high,' meaning more than 10% of the population and assets would be affected by a major event. This is in agreement with the county's rating.

In 2007 DOGAMI released the results of the Statewide Seismic Needs Assessment, which evaluated the collapse potential of education and emergency services buildings. The report found that buildings on eight school campuses had a collapse potential of 'high' or 'very high' in the event of a high magnitude earthquake. School campuses with buildings at 'high' risk of collapse include Campbell Elementary, Jennings Lodge Elementary, Milwaukie Elementary, Rowe Middle School, and New Urban High School. School campuses with buildings at 'very high' risk of collapse include Linwood Elementary, Milwaukie Elementary, Wichita Elementary, Jennings Lodge Elementary, and Clackamas Community College Harmony Campus. 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>.

The city identifies potentially vulnerable critical features in Table 4.5. Critical features in the “high quake hazard” zone include 5 bridges, 1 city building and one fire station. Features in the “moderate quake hazard” zone include 1 bridge, 1 city building, 1 school and totals less than 1% of the city’s area. In total, 30% of tax lot area is at moderate risk, and 11.4% of tax lot area is at high risk, as indicated in Table 4.6.

Table 4.5 Critical Features Potentially Vulnerable

Category	Lot	Acres	Value*
Moderate	1	11.5	\$6,695,030
High	2	5.4	\$4,874,177

*Excludes Bridges

Source: City of Milwaukie Geographic Information System

Table 4.6 Tax Lots Potentially Vulnerable

Category	Lot	Acres	Value
Moderate	1974	919	\$934,639,183
High	349	393	\$318,993,293

Source: City of Milwaukie Geographic Information System

The area vulnerable to earthquake is larger than any other hazard identified and potentially could produce more damage to property and life. The amount of damages, however, is related to the magnitude of an earthquake. Older buildings and the city’s sewer system are most vulnerable. Earthquakes also shift soil that could cause landslides. Transportation routes and the city’s economy can also be impacted if roads and businesses are forced to close down while repairs to infrastructure and buildings are made. Demand on resources such as Police, Fire and Public Works would also increase.

Risk Analysis

The county plan provides a quantitative analysis of nine potential earthquake scenarios for the county. This analysis includes an estimation of fatalities, direct damage losses, number of buildings in complete damage state, and number of people requiring shelter. Milwaukie does not have the resources to conduct a local risk assessment for the earthquake analysis, so the data reported in the county plan is the best quantitative assessment for the earthquake hazard in Milwaukie.

4.5.3 Existing Earthquake Mitigation Activities

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

City of Milwaukie Codes Pertaining to Earthquakes

Milwaukie Comprehensive Plan, Chapter 3 Environmental and Natural Resources (Ord 1666)

GOAL STATEMENT: To prohibit development that would be subject to damage or loss of life from occurring in known areas of natural disasters and hazards without appropriate safeguards.

Milwaukie's future role will primarily be as a residential community with considerable employment opportunities. This future, however, is not

incompatible with the conservation of the city's remaining natural resources of land, air, water, and the natural environment. The wise use and management of these resources is particularly important in Milwaukie because the city is almost completely developed and few areas remain in a natural state. The protection of these natural resources is essential if residents are to experience the pleasures and amenities, which can only be enjoyed when nature is close at hand. The plan elements which address these issues include:

- Natural Hazards Element
- Historic Resources Element
- Open Spaces, Scenic Areas, and Natural Resources Element
- Agricultural and Forest Lands Element
- Air, Water and Land Resources Quality Element

Policies in each of these elements, as well as the technical studies and inventories documented in the Resources and Environment, Parks and Open Space, Land Use and Transportation working papers, and the Neighborhood Blockwalk, comply with Statewide Planning Goals 3, 4, 5, 6, and 7 (reference Oregon Administrative Rules 660, Division 15).

Municipal Code Chapter 16.12 Seismic Conditions (Ord 1439)

Section 16.12.020 Building requirements.

Construction of new commercial, industrial and multifamily structures shall conform to the requirements of the Oregon Structural Specialty Code requirements for Seismic Zone 3.

Construction of single-family residences and duplexes shall conform to the requirements of the Oregon One and Two Family Dwelling Specialty Code for Seismic Category D1

The Public Works Director through the Building Inspector shall ensure compliance with the requirements of this chapter. Plans submitted with applications for building permits shall be reviewed for compliance with the requirements of this chapter.

Earthquake Mitigation Projects

Since 2003 the city of Milwaukie has constructed numerous structures to be earthquake safe. The following is a list of these major developments:

- North Main Village (Residential)
- Oak Street Square (Commercial/Retail)
- International Way Business Center
- King Road Shopping Center
- Ardenwald Elementary School
- Water Tower at 40th Avenue and Harney Drive
- Milwaukie High School – Fine Arts Center
- Linwood Elementary – Main Office and Gym

The city also demolished two buildings that posed a serious threat during earthquakes, Southgate Theater and Cash Spot. The old Ardenwald Elementary School campus is scheduled to be demolished in fall 2009.

4.5.4 Earthquake Mitigation Actions

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

LT-EQ#1: Conduct seismic evaluations on identified critical/essential facilities & infrastructure.

Ideas for Implementation:

- Obtain funding to perform evaluations;
- Prioritize seismic upgrades based on criticality of need and population served.
- Implement appropriate structural and non-structural mitigation strategies.

Coordinating Organization: Facilities Department, Building

Timeline: 3-5 Years

Plan Goals Addressed: Protect Life and Property, Emergency Services, Partnerships and Implementation

Status: *Partially Complete*. Schools, hospitals, fire stations, and police stations were evaluated through DOGAMI's rapid visual screenings. The school district hired a consultant to reevaluate the schools designated as high risk in this study.



MILWAUKIE
Dogwood City of the West

Earthquake Hazard Map #9

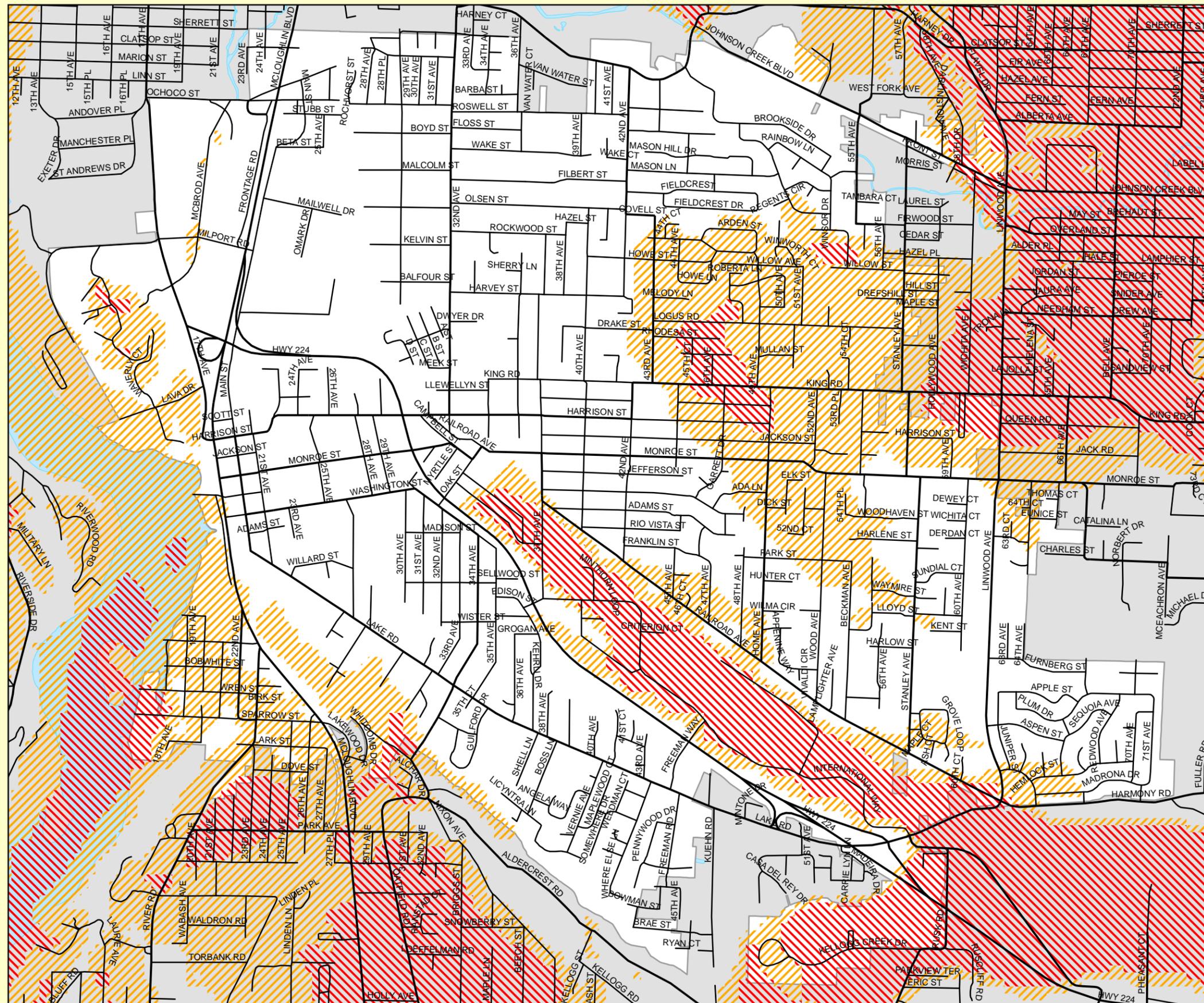
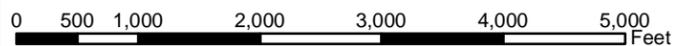
-  Moderate Quake Hazard
-  High Quake Hazard
-  Water Body
-  City Boundary

Data Sources: City of Milwaukie GIS
Metro Data Resource Center

Date: December 2008

The information depicted on this map is for general reference only. The City of Milwaukie cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties, expressed or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying this product. However, notification of errors would be appreciated.

GIS Coordinator
City of Milwaukie
3200 SE Harrison Street
Milwaukie, OR 97222
(503) 786-7498



4.6 Volcanic Eruption

4.6.1 Volcanic Eruption Profile

The historical volcanic eruption events have been described in Section 12 of the Clackamas County Natural Hazards Mitigation Plan and are applicable to Milwaukie. As such, the events will not be repeated here.

The probability of volcanic eruptions in Milwaukie was determined using scientific data, historical occurrences, and local knowledge. Milwaukie's HMAC estimates that the probability of a volcanic eruption is 'low,' meaning no more than one event is likely to occur in a 75-100 year period. This is in agreement with the county's probability estimate of 'low.'

4.6.2 Volcanic Eruption Hazard Assessment

The hazard assessment in the Clackamas County Natural Hazards Mitigation Plan best describes the volcano hazards for the Milwaukie area. As such, the information will not be repeated here.

4.6.3 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.

4.6.4 Volcanic Eruption Mitigation Actions

Milwaukie will not be undertaking any local volcanic eruption mitigation activities, but will partner with the county in the implementation of identified mitigation strategies.

4.7 Multi-Hazard

Multi-Hazard Mitigation Actions (MH)

Multi-hazard mitigation actions are those activities that pertain to more than one of the six hazards in the mitigation plan: flood, landslide, wildfire, severe storm: wind and winter, earthquake, and volcanic eruption.

ST-MH#1: Improve vegetation management throughout the city.

Ideas for Implementation:

- Partner with Union Pacific to manage vegetation along the railroad;
- Encourage planting of native species along the waterways;
- Encourage planting to help stabilize steep slopes;
- Remove hazardous trees and tree branches; and
- Utilize new wildland/urban interface mapping data to target property owners in vulnerable areas, and disseminate education materials focusing on improvements to vegetation coverage on slopes, defensible space, fire-resistant landscaping, and appropriate brush burning techniques.

Coordinating Organization: CFD#1 Community Services

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Partially Complete / Deferred*. Code enforcement on nuisances has improved.

Clackamas Fire District #1 was designated as the new coordinating organization.

ST-MH#2: Ensure that there are adequate shelter facilities in hazard-free zones to serve Milwaukie residents.

Ideas for Implementation:

- Identify and contact potential shelter sites to see if there is an interest in becoming a designated Red Cross shelter site.
- Maintain relationship with Red Cross to renew and maintain shelters in the city and develop other sites as needed

Coordinating Organization: Clackamas Fire District #1 Emergency Manager

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation

Status: *Partially Complete / Deferred*. The city worked with the Red Cross to get 5-6 potential facilities inspected. Clackamas Fire District #1 was designated as the new coordinating organization.

ST-MH#3: Improve network of communications during a disaster.

Ideas for Implementation:

- Address 800 MHz communication deficiencies;

- Work with the Oregon OEM office of emergency management and the UASI communications working group to resolve 800 MHz communication inoperability;
- Improve communication between school officials and parents by updating school emergency contact information for parents/children every 3 months;
- Supply schools with communication equipment necessary for emergency situations;
- Post bulletins on the internet for school emergency info, community bulletin board on cable, etc.;
- Partner with REM tech and REG on the Emergency Alert System (EAS); and
- Educate citizens and other agencies within the city of Milwaukie on use of the Code Red system.

Coordinating Organization: Information Systems Technology and Public Works

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation

Status: *Partially Complete / Deferred*. The city successfully recruited and trained Amateur Radio Operators and identified their 800 MHz communication deficiencies, but funding is still needed to fix those deficiencies. The school district now posts emergency notices on their website. The city now has reverse 9-1-1 capabilities and two variable message sign trailers for use communications in a disaster. The coordinating organization was changed from the HMAC to Information Systems Technology and Public Works as these organizations have a better ability to fulfill the tasks of this mitigation action.

ST-MH#4: Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.

Ideas for Implementation:

- Disseminate hazard related information to the public;
- 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 for public education and outreach;
- Add emergency preparedness and response curriculum to school programs; and
- Develop public education flyers as billing inserts.

Coordinating Organization: Community Services, CCFD#1

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Partially Complete / Deferred*. Hazard maps were made available to the public via the city's website. Clackamas Fire District #1 held disaster preparedness training in schools, senior centers and to city employees. The coordinating organization was changed from the HMAC to Community Services and Clackamas Fire District #1, as these organizations have a better ability to fulfill the tasks of this mitigation action.

ST-MH#5: Promote CERT program activity in the area and recruit new members for training.

Ideas for Implementation

- Provide information about the CERT program to Milwaukie residents through local publications, neighborhood organizations, churches, etc.;
- Identify needs of local CERT programs and obtain funding to purchase CERT supplies.
- Encourage neighborhood associations to sponsor CERT teams; and
- Create CERT teams of city employees.

Coordinating Organization: Community Services, Clackamas Fire District #1

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation

Status: *Partially Complete / Deferred*. Regular CERT trainings were offered for residents, but no formal teams were established. City employees were provided CERT training as well. Community Services was added as a coordinating organization to assist Clackamas Fire District #1 in outreach efforts. Additional “ideas for implementation” were added for the 2009 update.

ST-MH#6: Develop and enhance strategies for debris management for all hazards.

Ideas for Implementation:

- Create an inventory of equipment needed for each hazard;
- Develop agreements with other jurisdictions, businesses, and tree service outfits to share equipment and manage debris during disasters; and
- Work with regional partners to develop a debris removal plan.

Coordinating Organization: Public Works

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Partially Complete / Deferred*. A partnership for a debris removal plan is being developed with the UASI group and Metro. One idea for implementation was added for the 2009 update.

LT-MH#1: Improve and obtain resources and equipment essential for responding to and recovering from disasters.

Ideas for Implementation:

- Contact local facilities that have large trucks that could serve as water tenders in emergency situations, or purchase water tenders for the city;
- Partner with national guard, local businesses, contractors and developers;

- Obtain funding to purchase one fixed generator for the Lava Drive pump station; and
- Obtain funding to purchase one storage trailer for emergency supplies.

Coordinating Organization: Public Works

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Partially Complete / Deferred*. Action was moved from short-term to long term.

Three drinking water bladders were obtained from UASI for the Metro area to use. Boring Water District obtained a generator which Milwaukie can request to use through mutual aid agreements. The city now owns a portable 250kw generator for the Lava Drive pump station.

LT- MH#2: Improve the hazard assessment in the Milwaukie Natural Hazards Mitigation Plan.

Ideas for Implementation:

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

Coordinating Organization: City Geographic Information Systems, HMAC

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

Status: *Partially Complete / Deferred*. The city received better elevation data from Clackamas County. FEMA updated floodplain maps in 2007. DOGAMI assessed the schools, hospitals, fire stations, and police stations for seismic risk. The HMAC was added as an additional coordinating organization.

LT-MH#3: Integrate the goals and mitigation actions from the Milwaukie Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.

Ideas for Implementation:

- Use the mitigation addendum to help the city's Comprehensive Plan and Municipal Code meet State Land Use Planning Goal 7;
- Use the mitigation actions identified in the NHMP to inform the city's Capital Improvement Plan; and
- Partner with other organizations and agencies with similar goals to promote the adoption of more disaster resistant building codes.

Coordinating Organization: Planning Department and Engineering Department

Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems

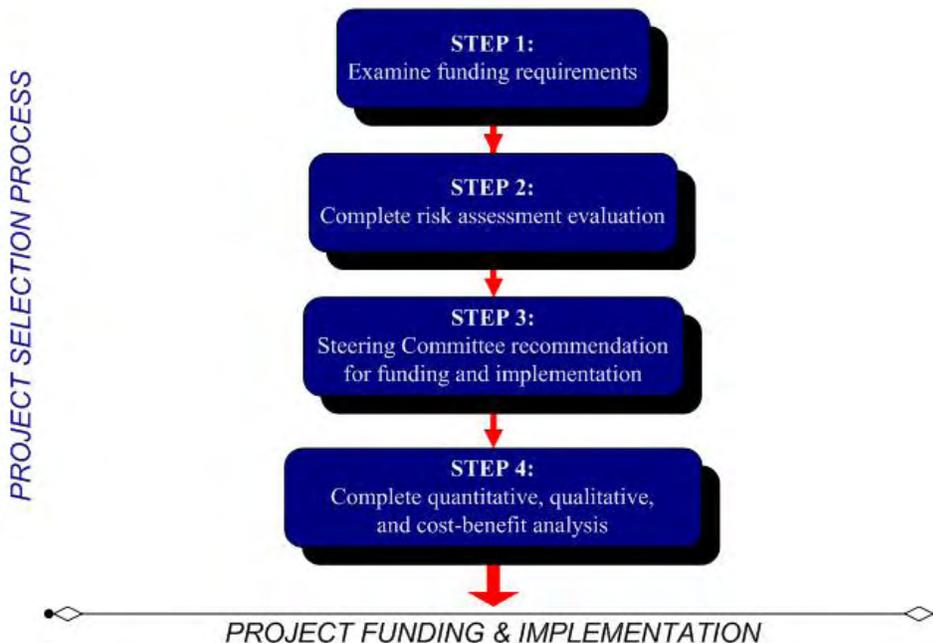
Status: *Partially Complete / Deferred*. City plans are updated constantly to reflect new information. A Spring Park Master Plan was adopted which called for better vegetation management in the park. New codes were adopted in 2009 to reflect EOC changes and improvements. Action moved from short-term to long-term. Planning Department and Engineering Department were designated as the new coordinating organizations.

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.

Figure 5.1: Project Prioritization Process

Action Item and Project Review Process



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

Step 1: Examine Funding Requirements

The 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

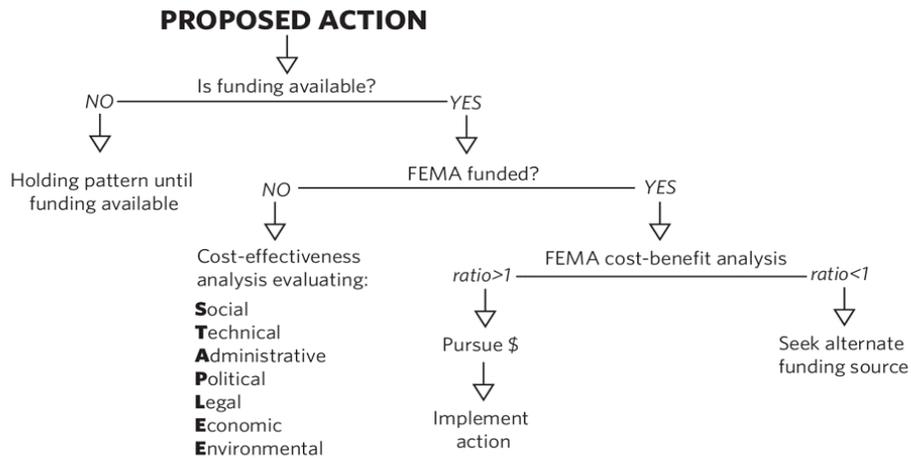
Based on the steps above, the HMAC will recommend whether or not the mitigation activity should be moved forward. If the HMAC decides to move forward with the action, the coordinating organization designated in Section 4 of this addendum will be responsible for taking further action and, if applicable, 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 in order to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project's cost effectiveness. The 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 for a description of the STAPLE/E evaluation methodology.

Section 6: Resource Directory

Clackamas County Resource Directory from the County's Natural Hazards Mitigation Plan is considered to be a very comprehensive resource listing. The city of Milwaukie has chosen to use the county's directory but has modified it to provide contact information for local agencies, organizations, and departments that may address natural hazard mitigation activities in Milwaukie. This resource directory provides a listing of potential partners for the implementation of mitigation actions. The city's HMAC will continue to add contact information for organizations as new partners are identified.

Agency	Contact Information	Type of Assistance
City of Milwaukie City Manager's Office	City Manager Phone: 503-786-7501 Fax: 503-652-4433	Aministration; Emergency Operations; Public Information; Financing
City of Milwaukie Engineering	Engineering Director Phone: 503-786-7601 Fax: 503-774-8236	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support
City of Milwaukie Facilities	Maintenance Coordinator Phone: 503-786-7621 Fax: 503-774-8236	Plan Implementation; Emergency Operations; Emergency Response; Public Safety
City of Milwaukie Community Services	Phone: 503-786-7508 Fax: 503-653-2444 Email: commsvs@ci.milwaukie.or.us	Public Information
City of Milwaukie Planning	Planning Director Phone: 503-786-7652 Fax: 503-774-8236	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support
City of Milwaukie Police	Phone: 503-786-7500 Fax: 503-786-7426 Email: police@ci.milwaukie.or.us	Emergency Operations; Emergency Response; Public Information; Public Safety; Technical Support
City of Milwaukie Risk/EOC	Risk Manager Phone: 503-786-7504 Fax: 503-653-2444	Plan Implementation; Emergency Operations; Emergency Response; Public Information; Public Safety; Technical Support
City of Milwaukie Sewer	Operations Supervisor Phone: 503-786-7615 Fax: 503-774-8236	Plan Implementation; Emergency Operations; Emergency Response; Public Safety
City of Milwaukie Storm Water	Operations Supervisor Phone: 503-786-7615 Fax: 503-774-8236	Plan Implementation; Emergency Operations; Emergency Response; Public Safety
City of Milwaukie Streets	Operations Supervisor Phone: 503-786-7617 Fax: 503-774-8236	Emergency Operations; Emergency Response; Public Safety
City of Milwaukie Structural Safety	Building Official Phone: 503-786-7611 Fax: 503-774-8236	Plan Implementation; Emergency Operations; Emergency Response; Public Safety
City of Milwaukie Wastewater	Operations Supervisor Phone: 503-786-7615 Fax: 503-774-8236	Emergency Operations; Emergency Response; Public Safety; Technical Support
City of Milwaukie Water	Operations Supervisor Phone: 503-786-7617 Fax: 503-774-8236	Emergency Operations; Emergency Response; Public Safety; Technical Support
Clakamas Fire District #1	Administration Division Phone: 503-742-2600 Fax: 503-742-2870	Plan Implementation; Emergency Operations; Emergency Response; Public Information; Public Safety; Technical Support
Clackamas County Emergency Management	Phone: 503-655-8378 Fax: 503-655-8531 http://www.clackamas.us/emergency/	Coordination; Emergency Operations; Emergency Response, Public Safety; Financing; Technical Support
City of Portland Office of Emergency Management	Phone: 503-823-4375 Fax: 503-823-3903 http://www.portlandonline.com/oem/	Coordination; Emergency Response, Public Safety; Technical Support
City of Lake Oswego	Planning and Development Phone: 503-635-0290 Fax: 503-635-0269	Coordination; Emergency Response; Public Safety; Technical Support
City of West Linn	Planning Department Phone: 503-656-4211 Fax: 503-656-4106	Coordination; Emergency Response; Public Safety; Technical Support
City of Gladstone	Phone: 503-656-5225 Email: bannick@ci.gladstone.or.us	Coordination; Emergency Response; Public Safety; Technical Support
City of Happy Valley	Planning Department Phone: 503-783-3800 Fax: 503-658-5174	Coordination; Emergency Response; Public Safety; Technical Support
North Clackamas County Chamber of Commerce	Phone: 503-654-7777 Fax: 503-653-9515 Email: info@yourchamber.com	Public Information
Multnomah County - Emergency Management	Phone: 503-988-6700 Fax: 503-988-5710	Coordination; Emergency Response; Public Safety; Technical Support

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- ⁱ USGS - Partnership for Disaster Resilience Research Collaborative, 2006.
- ⁱⁱ Portland State Population Research Center. March 2008. *2007 Oregon Population Report*.
<http://www.pdx.edu/media/p/r/PRC_2007_Population_Report2_rev.pdf>
- ⁱⁱⁱ US Census 2000. <www.census.gov>
- ^{iv} Worksource Oregon. 2005. *Labor Market Information*
- ^v US Census 2000. <www.census.gov>
- ^{vi} City of Milwaukie. 2008. *City of Milwaukie City Council*.
<<http://www.cityofmilwaukie.org/council/council.html>>
- ^{vii} City of Milwaukie. 2008. *City Departments* <<http://www.cityofmilwaukie.org/departments/citydepts.html>>
- ^{viii} Department of Land Conservation and Development, March 2009.

Appendix A

Planning & Public Process

Natural Hazard Mitigation Meeting

09/25/08

City Hall Conference Room

Attended:

Barb Kwapich – City Admin

Susan Shanks - Planning,

Dave Butcher - Operations,

Tom Larsen – Building,

Kevin Donegan – CFD1;

Jay Wilson - Clackamas County.

Brad Albert - Engineering,

Willie Miller - Facilities,

Beth Ragel – Community Services;

Bob Jordan – Police,

Ted Evans & Ron Stewart – NCSD,

Absent: Kate Rosson – GIS

1. Discussed basis for this meeting is to re-establish a working group for this program to do required review/update.
2. Introduced members. It was suggested that we include a PIO or establish a line of communication that could information out to the public. It was noted that Beth Ragel, from Community Services is our liaison to the neighborhoods. When the original plan was developed this contact with the NDAs was the method chosen to involve citizens. We can decide later if we want to modify this. Beth indicated that she would work with Grady as needed.
3. Jay Wilson from Clackamas County EOC provided information on our partnership with them and the intern that would be starting in October to help entities in the County complete reviews of their existing plans or to complete development of NHMPs. He indicated that Milwaukie was one of the first on the list to get help to review their plan. The intern will purpose a 'crosswalk' for us to follow in the review process. There were several questions addressed to Jay by Susan and Kevin that he will get answers to us prior to our next meeting.
4. We agreed to meet again on October 23rd at 1:30 PM. We agreed everyone would bring copies of the current plan to the next meeting. Sections 1 and 2 are more administrative in nature and should be reviewed with purposed additions and changes emailed to Barb Kwapich prior to the next meeting.

Meeting: Milwaukie Natural Hazard Mitigation Plan Update Meeting #1
Date: October 23, 2008
Time: 1:30 pm – 3:30 pm
Location: Milwaukie City Hall

MINUTES

1. Meeting Attendees
 - a. Barb Kwapich, City Risk Manager
 - b. Kate Rosson, Milwaukie GIS Coordinator
 - c. Ted Evans, North Clackamas School District Director of Facilities
 - d. Brad Albert, Milwaukie Engineering Department
 - e. Tom Larsen, Milwaukie Building Official
 - f. Bob Jordan, Milwaukie Chief of Police
 - g. Beth Ragel, Milwaukie Community Services Program Coordinator
 - h. Laurel Reimer, Clackamas County Emergency Management
 - i. Jay Wilson, Clackamas County Emergency Management
2. Project Overview (Laurel and Jay)
 - a. Partnership for Disaster Resilience Overview
 - i. Oregon Partnership for Disaster Resilience (OPDR) is an applied research center housed at the University of Oregon's Community Service Center and has hired a RARE participant, Laurel Reimer, to work with the City of Milwaukie to update the Milwaukie Natural Hazards Mitigation Plan (NHMP). Communities are required to update their mitigation plans every five years if they want to remain eligible for Federal Pre-Disaster Mitigation (PDM) Funding and Flood Mitigation Assistance (FMA) program funding. Milwaukie's current version of the mitigation plan is set to expire in October 2008.
 - b. 5 Year Update Requirements
 - i. There are four requirements for every plan update, today we will be discussing two of them
 - Planning Process
 - This section describes the process communities use to review and analyze each section of the plan and how the public has stayed involved over the previous five years since the plan's adoption. Much of this section will be updated as this planning process continues.
 - Risk Assessment
 - This section describes each of the specific hazards facing Milwaukie (flood, fire, etc).

- We will need to discuss occurrences of hazards addressed in the previous plan and new occurrences of hazards since the plan was adopted 5 years ago.
- We will discuss newly identified hazards (if any) not mentioned in the previous plan.
- We will discuss new hazard-related information such as maps, studies, and reports that provide updated information on hazards in Milwaukie.
- We will discuss any deficiencies identified in the previous plan and address any items that have not been resolved.
- We will need to include an updated inventory of the structures affected by each hazard.
- Maps will need to be updated accordingly
- We will focus on this section at our next meeting.
- Mitigation Strategy
 - This section reaffirms or updates the plan goals based on current conditions. We will discuss this in two meetings from now and come up with action items.
- Plan Maintenance Process
 - This will be the bulk of what we talk about today. We will go through the previous plan’s method and schedule for monitoring, evaluating, and updating the plan based on what has been done in the last 5 years. We will then come up with a way you would like to proceed for the next 5 years.

3. Planning Process (Laurel)

- a. In this section we will be documenting who participated in the plan update process, how many meetings occurred and what happened at each meeting, and what changes were made to the plan. Laurel will complete most of this after this meeting and then we can review it together at a later meeting.
 - i. Barb Kwapich gave Jay and Laurel a list of all the participants who will be updating the plan. They are:
 - Brad Albert, Milwaukie Engineering Department
 - Dave Butcher, Public Works Director
 - Kevin Donegan, Clackamas County Fire District #1
 - Ted Evans, North Clackamas School District Director of Facilities
 - Bob Jordan, Milwaukie Chief of Police
 - Barb Kwapich, City Risk Manager
 - Tom Larsen, Milwaukie Building Official
 - Willie Miller, Milwaukie Facilities
 - Beth Ragel, Milwaukie Community Services Program Coordinator
 - Laurel Reimer, Clackamas County Emergency Management
 - Kate Rosson, Milwaukie GIS Coordinator
 - Susan Shanks, Milwaukie Planning Department
 - Jay Wilson, Clackamas County Emergency Management

- ii. Special Service Districts
 - The group determined the existing group was inclusive enough and did not require the involvement of the special service districts stated in the previously adopted plan.

4. Discussion of Plan Mission and Goals (Laurel)

- a. At this meeting the group reviewed the updated county mission and goals and agreed to adopt the county’s updated mission and goals.

- i. County Mission

- “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.”

- ii. County Goals

- “The plan goals describe the overall direction that Clackamas County agencies, organizations, and citizens can take to work toward mitigating risk from natural hazards. The goals changed only slightly from 2002 to include an action word in each goal. Each action items is associated with the goals it addresses to ensure that the goals are being considered in plan implementation.
 - Protect Life and Property
 - Enhance Natural Systems
 - Augment Emergency Services
 - Encourage Partnerships for Implementation
 - Promote Public Awareness”

5. Plan Implementation, Monitoring, and Evaluation (Laurel)

- a. In this section we will discuss how the plan has been monitored, evaluated and updated since the plan was originally adopted in 2003.

- i. Coordinating Body

- This is the group that was intended to meet between the plan’s initial adoption and now. What we need to talk about is whether of not this is still the appropriate group to serve as the coordinating body, what the roles of the coordinating body will serve, and if you want to make any changes to this group.
 - The Hazard Mitigation Advisory Committee (HMAC) is still the appropriate group to serve as the coordinating body.
 - The previous plan stated the HMAC would convene monthly for the first three months of plan implementation and no less than quarterly after that.
 - i. These actions were not implemented
 - ii. The group determined they should meet quarterly for the next five years
 - iii. The group determined they can choose to convene following a disaster, or when deemed necessary, to review and revise the plan as needed.

- The phrase “...develop new mitigation strategies to reduce losses from natural hazards” will be changed to say “discuss mitigation strategies to reduce losses from natural hazards”
 - The previous plan stated the City Manger will assign appropriate representatives to the HMAc. It was recommended to add a representative from the Neighborhood Associations, Police Department, and business community or Chamber of Commerce.
 - i. The City Manager or his designee will still have this task
 - ii. The group determined representatives from the Neighborhood Association and business community were not necessary.
 - iii. A representative from the Police Department was added to the HMAc
- ii. Convener
- This section describes who is responsible for convening the HMAc, and states the tasks of the convener.
 - The previous plan designated the Planning Director as the convener
 - i. The group determined the engineering department to be a more appropriate convener because that department has more influence over natural hazard mitigation processes within the city
 - The group agreed the convener will be responsible for facilitating the HMAc meetings
 - The group agreed that plan implementation and evaluation will be a shared responsibility among all of the Natural Hazard Advisory committee Members
- iii. Implementation through Existing Plans
- FEMA requires that NHMP identify local planning mechanisms. Existing plans already have support from local residents, businesses and policy makers. Many existing plans also get updated regularly and can easily adapt to changing needs and conditions. Mitigation is a shared responsibility so it’s best implemented through a variety of plans.
 - The group added zoning ordinances to the list of plans which the NHMP can be implemented into.
- iv. Formal Review Process
- FEMA requires a community to describe the method and schedule for monitoring, evaluating, and updating the plan. Today we need to find out what has been done since the plan was adopted, how the plan was updated and monitored, etc. We should also talk about how you’d like to modify this review process. If some of these items were not

- iv. The current Community Services Program Coordinator will inform the 7 Neighborhood District Associations about the plan.
- v. The HMAC may call a public meeting when deemed necessary, such as after a natural hazard

6. Community Profile (Laurel)

- a. This section provides valuable information about the City of Milwaukie so the reader of the Natural Hazard Mitigation Plan has a better understanding of the city. Laurel will go through and update most of this plan with the most recent data available, but there are two sections she would like to ask you about:

- i. Historical and Cultural References

- A list of historical resources can be found as Appendix 1 to the Comprehensive Plan
 - The group identified four main attractions in the city
 - Annual Milwaukie Daze Parade
 - Farmers Market
 - Riverfront with boat ramps
 - Riverfront Park

- ii. Community Organizations and Programs

- These are groups/programs that may be potential partners for implementing mitigation actions
 - Rotary Club
 - Neighborhood District Associations
 - Milwaukie hopes to start a CERT group
 - Laurel will research more groups and present to the group at the next planning meeting

7. Next Steps: Hazard Identification and Vulnerability Assessment (Laurel)

- a. Next meeting is set for November 13, 2008 from 1:00 to 5:00pm



Meeting: Milwaukie Natural Hazard Mitigation Plan Update Meeting #2
Date: November 13, 2008
Time: 1:00 pm – 5:00 pm
Location: Milwaukie City Hall

MINUTES

1. Meeting Attendees
 - a. Barb Kwapich, City Risk Manager
 - b. Kate Rosson, Milwaukie GIS Coordinator
 - c. Jim Colt, Milwaukie Police Captain
 - d. Dave Butcher, Milwaukie Asset Management Technician
 - e. Brad Albert, Milwaukie Engineering Department
 - f. Tom Larsen, Milwaukie Building Official
 - g. Susan Shanks, Milwaukie Senior Planner
 - h. Beth Ragel, Milwaukie Community Services Program Coordinator
 - i. Laurel Reimer, Clackamas County Emergency Management
2. Local Match Grant Agreement
 - a. There is a new form to keep track of hours spent working on the natural hazard mitigation plan update. Laurel will mail these forms to Barb and Barb will distribute them to the participants of the meeting and mail them back to Laurel.
3. Presentation and Identification of hazard history and mitigation activities
 - a. Community Assets
 - i. The replacement Ardenwald School is under construction. The new school will house 550 students in one two-story building. The new building is seismically sound.
 - ii. It was noted that Kaiser Permanente and Willamette Falls Hospitals are not in the city, but the city uses them. It is suggested that the plan include a subsection or special notation for facilities that are not within city limits but are used by they city.
 - iii. It was noted that some facilities list street locations. The group decided that they do not want to include street locations.
 - iv. The group decided to add groups to the list of community organizations. These include the Chamber of Commerce, Johnson Creek Watershed Council, Friends of North Clackamas Park, and Friends of Clackamas Creek.
 - v. Johnson Creek Bridge is now being rebuilt
 - vi. Elevated water storage tower is now seismically upgraded
 - vii. The group pointed out a misspelling – “Quest” should be spelled “Qwest”
 - b. Hazard History and Mitigation Activities
 - i. Laurel discussed the hazards events detailed in the county’s 2007 NHMP update and asked the group to comment on the impacts felt in Milwaukie
 - ii. Flood
 - December 2-3, 2007: Excessive rainfall began Sunday morning and continued throughout the day on Monday required Water Environment Services to bypass treatment processes at the Kellogg Wastewater Treatment facility because the plant could not treat both the normal flows of wastewater and the excessive flows from the storm. As a result of the bypass untreated

wastewater was released into the Willamette River. Also, two manholes began surcharging near the Jefferson Street Boat Ramp.

- Mitigation: 18th Ave. infiltration line – the city lined the interiors of all the pipes to minimize the amount of groundwater that infiltrates into the sewer lines. This helps reduce the amount of water that goes into the treatment plant, which reduces the chance of overflow of the sewer system
 - December 3, 2007 – The Millport Bridge between Frontage Road and McBrod Avenue closed because the rising water of Johnson Creek was approaching the deck of the bridge that spans the creek. The water never reached the deck and no mitigation efforts were taken.
 - The GIS Department will update the flood maps
 - The group determined flood probability to be high and vulnerability to be low.
- iii. Landslide
 - The group reported part of a bank fell in December 2003 or January 2004 but nothing was impacted and no mitigation efforts were used.
 - The group determined landslide probability to be low and vulnerability to be low.
 - Kate will update the landslide map to reflect more updated risk
- iv. Wildfire
 - The group had no new fire history
 - Kevin Donegan of Clackamas Fire District 1 was not in attendance. The group did not feel comfortable determining the probability or vulnerability of a wildfire without consulting him. Laurel will contact Kevin for this data.
- v. Winter Storm
 - The group remembered a few days when the city offices were closed but did not have specific dates.
 - The operations group will update the GIS department on the new sanding routes.
- vi. Wind Storm
 - In the December 14-15th 2006 storm Milwaukie had trees down and needed to detour cars. Power went out in many places in the city, including the sewer lift station. Communications went down as well.
 - The group determined wind storm probability to be high and vulnerability to be high.
- vii. Earthquake
 - No new history
 - Building codes are the same as in the 2003 plan
 - The group came up with a list of major developments that have been constructed to be earthquake safe
 - North Main Village (residential)
 - Oak Street Square (commercial/retail)
 - International Way Business center
 - King Road Shopping Center
 - Ardenwald School
 - Water Tower at 40th and Harney Drive
 - Milwaukie High School - Fine Arts Center
 - Linwood Elementary – Main Office and Gym

- Two buildings were demolished that posed threats
 - Southgate Theater
 - Cash Spot
 - The old Ardenwald school will be demolished once the new school is constructed, scheduled for Fall 2009
 - The group determined earthquake probability to be high and vulnerability to be high.
- viii. Volcano
- The group determined probability to be low and vulnerability to be high
- c. Mitigation Planning Priority System
- i. The group was not able to determine how the previous planning prioritization scoring took place. The group decided to table this process so Laurel can research the process further. This will be discussed at the next meeting.
4. Next Meeting
- a. The next meeting will start at 1:30 on December 11th, not 1:00

Appendix B

Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Community Service Center's Oregon Partnership for Disaster Resilience 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 Mitigation*. 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.

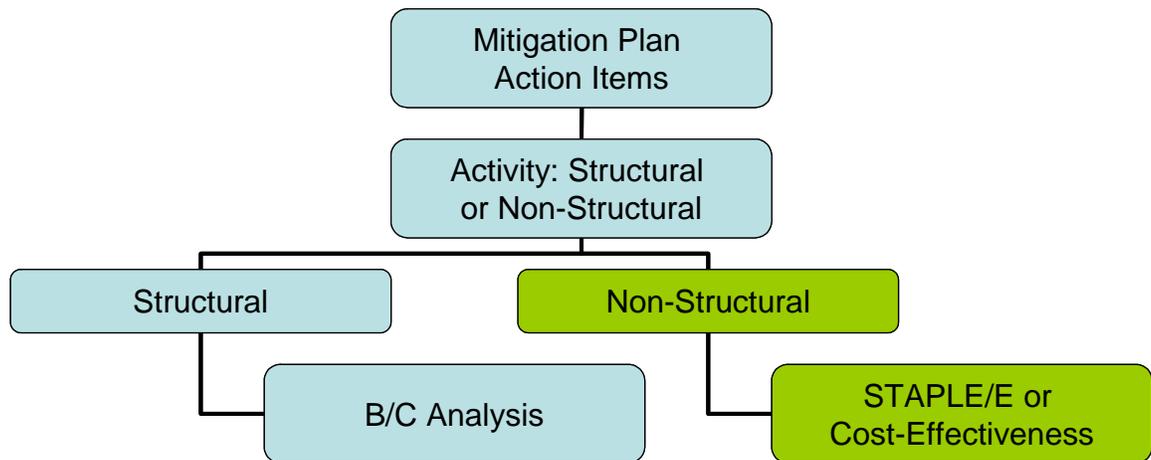
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 Partnership for Disaster Resilience 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

CUREe Kajima Project, *Methodologies For Evaluating The Socio-Economic Consequences Of Large Earthquakes*, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997.

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation Projects*, Riverine Flood, Version 1.05, Hazard Mitigation Economics Inc., 1996.

Federal Emergency Management Agency *Report on Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

Goettel & Horner Inc., *Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in The City*

of Portland, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

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

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

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

Risk Management Solutions, Inc., *Development of a Standardized Earthquake Loss Estimation Methodology*, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., *A Benefit/Cost Model for the Seismic Rehabilitation of Buildings*, Volumes 1 & 2, Federal Emergency Management Agency, FEMA Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects*, 1993.

VSP Associates, Inc., *Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model*, Volume 1, Federal Emergency Management Agency, FEMA Publication Number 255, 1994.