

RESOLUTION NO. 843

A RESOLUTION ADOPTING A NATURAL HAZARDS MITIGATION PLAN.

WHEREAS, the City of Canby has experienced property damage and threats to the welfare and safety of its residents from flooding, landslides, and severe storms over the past several years and is subject to the additional hazards of earthquakes, volcanic activity, fires and hazardous materials; and

WHEREAS, the Canby Fire District in cooperation with Clackamas County and the City's Emergency Operations Center team has prepared a recommended *Natural Hazards Mitigation Plan* to address these issues; and

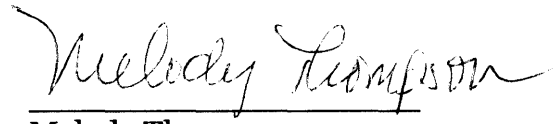
WHEREAS, the *Natural Hazards Mitigation Plan* has been circulated for review to citizens and representatives of various agencies;

NOW THEREFORE, IT IS HEREBY RESOLVED by the City Council of the City of Canby, as follows:

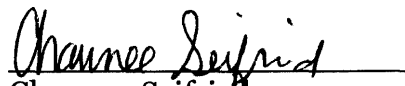
- (1) The Natural Hazards Mitigation Plan Addendum, attached as Exhibit "A," is hereby adopted as an official plan of the City of Canby.

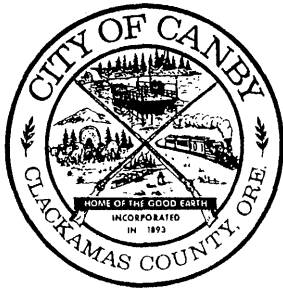
This resolution will take effect on September 17, 2003.

ADOPTED this 17th day of September, 2003 by the Canby City Council.


Melody Thompson
Mayor

ATTEST:


Chaunee Seifried
City Recorder, Pro-Tem



The City Of Canby

Natural Hazards Mitigation Plan Addendum

Prepared for

City of Canby
P.O. Box 930
118 N. Holly Street
Canby, OR 97013

In cooperation with

Clackamas County Emergency Management
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Oregon City, OR 97045

The City of Canby Natural Hazards Mitigation Plan Addendum

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Section 1:

Planning Process

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

Who Participated in Developing the Plan?

The City of Canby Natural Hazards Mitigation Plan is the result of a collaborative effort between the City of Canby public agencies, non-profit organizations, the private sector, and regional and state organizations. A project Emergency Management Committee (EMC) guided the process of developing the plan. The EMC was comprised of representatives from:

- Canby Chamber of Commerce
- Canby Community Emergency Response Teams
- Canby Finance Department
- Canby Fire District NO. 62
- Canby Police Department
- Canby Public Works
- Canby School District
- Canby Telephone Company
- Canby Utility Board
- Canby Waste Water Treatment Plant
- Clackamas Amateur Radio Emergency Service
- Clackamas County Emergency Management
- First Student Transportation

Multi-Jurisdictional Planning Effort

The City of Canby is dedicated to taking a regional approach to planning for natural hazards. The City of Canby has representation on the Clackamas County Emergency Management Committee to ensure that the city's interests are represented in the larger scale planning effort. The city will partner with the county in implementation of appropriate action items, and will work with other jurisdictions to reduce losses from future natural hazards.

Planning Process

The Canby EMC had a regular meeting schedule to complete the planning process, and the residents of the City of Canby had an opportunity to participate in the county-wide public workshops designed to gain citizen input. The planning process is described in Appendix B of the Clackamas County Natural Hazards Mitigation Plan.

What is the Plan Mission?

The City of Canby concurs with the mission statement developed during the Clackamas County planning process.

What are the Plan Goals?

The City of Canby concurs with the goals developed during the Clackamas County planning process.

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

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

Plan Adoption

The Canby City Council will be responsible for adopting the Multi-Jurisdictional Clackamas County Natural Hazards Mitigation Plan including the City of Canby Addendum. This governing body has the authority to promote sound public policy regarding natural hazards.

Coordinating Body

The City of Canby currently has an Emergency Management Committee (EMC) that deals with preparedness, mitigation, response, and recovery. The EMC meets on the second Tuesday of every month from 12:00pm-2:00pm. The Canby EMC will be responsible for coordinating implementation of plan action items and undertaking the formal review process. The Canby Natural Hazard Mitigation Plan will be on the agenda for every meeting to discuss the implementation of mitigation strategies, evaluate the effectiveness of the plan, and develop new mitigation strategies to reduce losses from natural hazards.

Due to the nature of this project-based committee, technical advisory committees as well as other ad hoc committees may be established to implement appropriate mitigation projects and tasks, and will be held as needed. The attendees of these technical advisory committees will report on their actions to the EMC at the regularly scheduled meetings.

The City Council will assign representatives from appropriate city agencies, including, but not limited to, the current EMC members. In order to make this committee as broad and useful as possible, the EMC will engage other relevant organizations and agencies in hazard mitigation. The recommendations for adding to the Emergency Management Committee include a representative from the business community and a Chamber of Commerce representative.

Convener

A representative from Canby Fire District No. 62 will serve as a *convener* to facilitate the EMC meetings, and will assign tasks such as

updating and presenting the Plan to the members of the committee. Plan implementation and evaluation will be a shared responsibility among all of the Natural Hazard Advisory Committee Members.

Implementation through Existing Programs

The City of Canby addresses statewide planning goals and legislative requirements through its Comprehensive Land Use Plan, Capital Improvement Plans, and Building Codes. The Natural Hazard Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. The City of Canby will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

Economic Analysis of Mitigation Projects

The Federal Emergency Management Agency's approaches to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages and costs later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, the EMC will use a FEMA-approved benefit/cost analysis approach to analyze and prioritize mitigation action items. For other projects and funding sources, the EMC may use other approaches to understand the costs and benefits of each action item and develop a prioritized list. For more information regarding economic analysis of mitigation action items, refer to Appendix C of the Clackamas County Natural Hazards Mitigation Plan.

Formal Review Process

The City of Canby Addendum to the Clackamas County Natural Hazards Mitigation Plan will be evaluated on an annual 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 the EMC members and organizing the annual meeting. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan.

The committee will review the goals and action items to determine their relevance to changing situations in the city, as well as changes in state or federal policy, and to ensure they are addressing current and

expected conditions. The committee will also review the hazard assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised.

The convener will assign the duty of updating the plan to one or more committee members. The designated committee members will have ninety days to make appropriate changes to the Plan before submitting it to the EMC members, and presenting it to the City Council. The EMC will also notify all holders of the plan when changes have been made. Every five years, the convener or designee will submit the updated plan to the State Hazard Mitigation Officer and the Federal Emergency Management Agency for review and approval.

Continued Public Involvement

The City of Canby is dedicated to involving the public directly in review and updates of the Hazard Mitigation Plan. The public will have the opportunity to provide feedback about the Plan through a variety of forums. Copies of the Plan will be catalogued and kept at City Hall, the Planning Department, the Police Department, the Chamber of Commerce, the Public Library and the Fire Station. In addition, the plan and any proposed changes will be posted on the city website. This site will also contain an email address and phone number to which people can direct their comments and concerns.

A public meeting will also be held after each annual evaluation or when deemed necessary by the EMC. The meetings will provide the public a forum for which they can express its concerns, opinions, or ideas about the Plan. The EMC will be responsible for using city resources to publicize the annual public meetings and maintain public involvement through the webpage, and the Canby Herald Newspaper.

What are the Mitigation Strategies Identified by the City of Canby?

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

Section 2: Community Profile

Geography and the Environment

The City of Canby is located in the Willamette Valley, which is the population center of the State of Oregon. The valley is nestled between the Coast and Cascade Mountain Ranges and is from 20 to 40 miles wide and is 130 miles long extending from Eugene-Springfield in the south to Portland in the north. The Canby area is bordered to the west and south by the Molalla River and to the north by the Willamette River. The confluence of the Molalla River and Willamette River occurs just north of the City.

The City of Canby is located on a relatively flat terrace and, with few exceptions, only gentle changes in the topography of less than 30 feet occur within the City limits and Urban Growth Boundary (between 140 to 170 feet above mean sea level). The southwest portion of the City drops abruptly at the Molalla River to an elevation of approximately 80 feet. This is very evident when approaching the City from the west on Knights Bridge Road or Highway 99 E or from the south across Goods Bridge on Ivy Street. This drop along the Molalla River establishes a natural boundary for the area.

At the northern border of the Urban Growth Boundary, the topography gradually changes. This area slopes to the Willamette River, dropping from an elevation of approximately 130 feet to 100 feet at the City's wastewater treatment facility. To the east of Canby, the topography changes very little until beyond the urban growth boundary, where the ground has undulating gentle hills in the southeastern areas and steep rocky cliffs in the northeastern areas along the Willamette River.

The City of Canby lies in the heart of very productive agricultural lands, and has used drywells to manage of storm water runoff generated from agriculture and development. When dry wells are ineffective, storm water is permitted to drain to surface water drainage ways or is collected and conveyed to the adjacent Molalla and Willamette Rivers.

Major Rivers

Willamette River

The Willamette River is the major waterway in the Willamette Valley draining a total of 11,500 square miles. The Willamette provides significant recreational opportunities, serves as a major transportation link, provides water for agricultural, municipal and industrial uses and provides habitat for significant wildlife populations. The Canby Ferry provides transportation across the Willamette, and is one of three ferries still in operation on the Willamette River.

Molalla River

The floodplains of the Molalla River provide an important habitat for waterfowl, wading birds, deer, small mammals, reptiles and amphibians. Today, logging and recreational uses are the primary activities in the upper reaches of the Molalla River. All of Canby's drinking water originally comes from the Molalla River. The Molalla River watershed area is 344 square miles and is located within Clackamas County, Oregon. Its headwaters start southwest of Mt. Hood and its North Fork tributary begins 0.6 miles southeast of Cougar Lake.

Climate

The climate in the Canby area is temperate. Summers are warm with daily temperatures averaging from 70°F to 75°F with occasional hot days where the temperature exceeds 100°F. Winters are cool with average daily temperatures of about 40°F. Freezing temperatures occur periodically throughout the winter with lows in the teens.

Due to the temperate climate, snowfall is rare, but can occur annually. Accumulations of from 1 to 4 inches of snow have been recorded during December and January. Unofficially, accumulations of as much as 12 inches of snow have been reported in the Canby area for short periods.

Normal rainfall, as recorded at the North Willamette Experimental Station for the period from 1961 through 1990, averages 41 inches per year. The driest months of the year are July and August with normal precipitation of less than 1 inch per month. During these two months, several weeks may pass without precipitation. The balance of the year, frequent rain showers occur with the wettest months being November, December, and January. During these months rainfall normally exceeds 6 inches per month.

Minerals and Soils

The United States Department of Agriculture Soil Conservation Service (SCS) information was used in identifying soil types in Canby. The classifications of each soil type, indicates the effects the soil features will have on the infiltration and drainage of storm water in the Canby area.

The predominate soils are Canderly Sandy Loam consist of deep, somewhat excessively drained soils on terraces to a depth of 60 inches or more. These soils have moderately rapid permeability of from 2.0 to 6.0 inches per hour and have an available water capacity of about 5.5 to 7.0 inches. Runoff from this series is slow and the hazard of water erosion is slight.

Latourell Loam Series are also present here and are deep, well drained soils and have a moderate permeability similar to that of the Canderly soils. Latourell soils have a greater water availability than that of the Canderly series with a range of about 8 to 12 inches. Runoff from this

series is also slow and the hazard of water erosion is again slight. Depth to ground water is generally greater than 60 inches.

Only two small inclusions of Amity Silt Loam are present in the Canby area. These are somewhat poorly drained soils, having a moderately slow permeability of from 0.6 to 2.0 inches per hour in the upper layer declining to from 0.2 to 0.6 inches per hour in the lower. This soil can extend to a depth of 60 inches or more. The Depth to Water Table is from 6 to 18 inches in the winter and spring.

The McBee Silt Clay Loam is only present in one isolated location Northeast of Canby. This is a deep moderately well drained soil having a moderate permeability of from 0.6 to 2.0 inches per hour. Runoff is slow and the hazard from erosion is slight. However, the water table is generally at a depth of from 24 to 36 inches in the winter and early spring, and the soils are located in areas subject to occasional but brief periods of flooding in the winter.

Other Significant Geologic Features

Continued erosion by Willamette Valley river systems, as well as earth-shaping earthquakes and weathering of the area through geologic time has carved the Willamette Valley into the shape it is today. In the Canby area, this has resulted in a terrace overlooking the Willamette and Molalla Rivers. The significant geologic features in the Canby areas are described in the Clackamas County Natural Hazard Mitigation Plan.

Population and Demographics

As shown in Table 2-1, Canby's population grew at a rapid pace between 1970 and 1980, far more rapidly than either the Portland metropolitan area, or the State of Oregon overall. Canby's rapid population growth slowed significantly between 1980 and 1990 (to approximately the same rate metropolitan Portland was experiencing). Canby's growth is now increasing much like it did in the 1970's, with growth rates outpacing the Portland metropolitan area. Canby's population growth continues to be significantly higher than the State of Oregon.

Table 2-2 shows that Canby's population continued to grow rapidly in the 1990's. According to the U.S. Census, Canby's population was 12,790 in 2000. This reflects a 42.4 percent increase in Canby's population between 1990 and 2000. This compares to a 12.7 percent increase for the State of Oregon during the same time.

Table 2-1. Population of Canby, Portland, and Oregon 1970-1999

Year	Canby	Percent Change	Portland Metro	Percent Change	Oregon	Percent Change
1970	3,818		824,926		2,091,533	

1980	7,659	101%	1,242,645	51%	2,633,105	26%
1990	8,983	17%	1,477,895	19%	2,842,321	8%
2000	12,790	42%	1,874,449	27%	3,421,399	20%

Source: Oregon Office of Economic Analysis (www.oes.das.state.or.us/econ.htm)¹; PSU Center for Population Research and Census U.S. Bureau of Census ²

Table 2-2. Canby and Oregon Population Estimates

Year	Canby	Percent Change	Oregon	Percent Change
1990	8,983		2,842,321	
1991	9,370	4.3%	2,930,000	3.1%
1992	9,565	2.1%	2,970,000	1.7%
1993	9,815	2.6%	3,038,000	2.0%
1994	10,405	6.0%	3,082,000	1.4%
1995	10,855	4.3%	3,132,000	1.6%
1996	11,430	5.3%	3,181,000	1.6%
1997	11,725	2.6%	3,217,000	1.1%
1998	12,465	6.3%	3,267,550	1.6%
1999	12,595	1.0%	3,300,800	1.0%
2000	12,790	1.5%	3,421,399	3.7%
1990-2000 Total Population Growth	3,807	42.4%	579,078	20.4%
1990-2000 Average Annual Growth Rate (AAGR)	3.6%		1.95	

Source: Oregon Office of Economic Analysis (www.oes.das.state.or.us/econ.htm)³

Oregon Economic Development Department forecasts that Canby's population will grow at an average rate of 2.8 percent until 2001 in the one-mile radius around the center of town, at 99E and Ivy (an area slightly smaller than current city limits). Within the five to ten mile radius of the town's center, the average annual growth rate until 2001 is projected to be slightly lower, at 2.6 percent. Note that the 2001 population projection is smaller than the 2000 Census count (Table 2-3). The projections shown in Table 2-3 were completed in 1997 and underestimated population growth in Canby.

Table 2-3. Canby Population Estimates and Projections: One, Five, and Ten Mile Radius

Year	1 Mile Radius	5 Mile Radius	10 Mile Radius
1990	8,264	22,968	130,292
1996	9,938	27,205	152,530
2001	11,198	30,300	168,598
AAGR*	2.8%	206%	2.4%

Source: Oregon Economic Development and Equifax National Decision Systems
Average Annual Growth Rate⁴

The 2000 Census population for Canby and the City's coordinated population forecast (Table 2-4). Projections show that Canby is expected to grow significantly in the next 20 years, reaching 21,000 by 2020. This is a 64 percent increase from the 2000 population of 12,790, and represents a five percent average annual growth rate between 2000 and 2020.

Table 2-4. Canby 5, 10, and 15 year Population Forecast

Year	Population
2000	12,790
2020	21,000
Change	8,210
Percent Change	64.2%
AAGR	5.1%

Source: PSU Center for Population Research and Census Canby Land Needs Study (OTAK 1999)⁵

Land and Development

The City of Canby Planning and Building Department enforce building and zoning codes to promote public safety and preserve the quality of life in Canby. Canby is predominately residential, with a variety of other land uses interspersed. Map #2 shows the land use zones for the City.

According to the Canby School District Enrollment Projection Update, Canby will be indirectly affected by decisions made by Metro, the planning authority for the Portland metropolitan region. One of the biggest issues Metro is facing, as part of the planning process for creating its comprehensive plan (the 2040 Plan), is the placement of its Urban Growth Boundary (UGB). Metro is leaning toward zero or minimal expansion of the UGB, in order to encourage greater housing density and preserve existing farmland and open space.

While Canby lies outside of Metro's UGB and is beyond its jurisdiction, the City will nonetheless be affected by Metro's boundary decisions. If little or no adjustment is made to the Portland Metropolitan UGB, land values within the boundary are likely to appreciate more rapidly over time. Canby, with its available land and proximity to the Portland metropolitan area may over time, become even more attractive to developers and prospective homeowners.

Canby has developed a comprehensive plan for its industrial growth. The Canby Industrial Park has been developed with water, electricity, natural gas, sewer, communications and road access. Within the city limits, 154 acres have been designated for light industrial use and 25 acres for heavy industrial use. Within Canby's urban growth boundary, another 240 acres is designated for light industry and 70 acres for

heavy industry. Total figures are 394 acres for light industrial use and 94 for heavy industrial.

Housing and Community Development

Housing ownership patterns in Canby have been changing for the last 15 years. Although single-family housing has dominated housing statistics historically, records show variability in the percentage of permits issued for single-family dwellings with large numbers of permits issued for multiple-family housing in 1989, 1993, and 1997.

Canby experienced an increase in renter-occupied housing between 1990 and 2000. In 1990, nearly 65 percent of households were owner-occupied and 35 percent were renter-occupied; 2000 estimates show a slight decrease of owner-occupied households to about 64 percent. This trend is a result of a number of factors, including the increase in multiple family housing construction in Canby.

Canby's landscape and population is changing rapidly, and its park and recreation system has been attempting to respond to these changes. Canby is quickly leaving its agricultural roots behind and becoming more similar to its metropolitan neighbors to the north in its affluence, ethnic diversity and rate of growth. Some of the major socioeconomic and land use trends affecting the future provision of park and recreation services in Canby are as follows:

- Canby is experiencing population growth at a significantly higher rate than the statewide average. By the year 2020, the City's coordinated population projection indicates Canby will have 21,000 residents, resulting in a 64 percent increase from 2000. This influx of residents will increasingly strain Canby's ability to provide quality parks and recreation facilities.
- Single and multi-family housing is being developed at a rapid pace, especially on the fringes of the urbanized area. Portland's land use policies could increase the demand for additional housing in and around Canby in the future as people seek homes in less dense urban areas.
- The residents least served by park and recreation facilities live in Canby's far northwest, northeast, and south neighborhoods.
- Canby's population is aging, following statewide and nationwide trends. Many sections of Canby's population area are growing, especially those in the 5 to 17, 45 to 54, and 55 to 64 year old age brackets. People between 45 and 64 years old continue to be one of the fastest growing segments of the population. Because there is a correlation between age and mobility limitations, meeting the needs of mobility-limited residents, as they age, will become increasingly important.
- The number of children in Canby is also increasing as the population increases. Birth rates are rising and families are

moving to Canby with young children. There will be an increase in elementary and high school enrollment levels in the near future, which will increase the need for park and recreation facilities and programs for youths.

- Canby is growing more ethnically diverse. The Hispanic population is the largest and fastest growing minority population in Canby. Hispanic children comprise 9.5 percent of Canby School District's enrollment. Because of this growth, understanding and meeting the park and recreation needs of minority residents is becoming increasingly urgent.

Employment and Industry

Canby is an excellent area for local and commercial businesses. The City of Canby is relatively self-sufficient regarding public utilities. Canby Telephone Association provides technologically advanced telecommunications services. Canby operates its own electric and water service (uncommon in Oregon), enabling lower utility rates as compared to other Oregon cities. The business district includes a thriving downtown core as well as flourishing businesses along Highway 99E. A broad spectrum of products, services and specialty stores meet the shopping and business needs within the community.

The Canby area has a multitude of attractions tied to the bountiful nursery industry, which attract thousands of visitors annually. Many festivals and special events are organized by these enterprises. In Clackamas County, 75 percent of the nursery acreage is in the vicinity of Canby.

Transportation and Commuting Patterns

The Union Pacific rail line, which divides Canby by separating the North side from the South, passes through Canby twenty four times a day. In addition, more than eight different commercial truck lines serve the motor freight needs of business and industry in Canby. Intrastate freight rates for truckers are regulated by the Oregon Public Utility Commission, which considers Canby as inside Portland's local cartage zone. This results in lower rates for shipments to and from Portland.

The Portland International Airport meets the national and international transportation needs of Canby area residents and businesses, and is about 45 minutes from Canby. Aurora State Airport is located 5 miles west of Canby. The Mulino Airport lies approximately 8 miles southeast of Canby.

Canby Area Transit (CAT) is a local transit service allowing the community to utilize a shuttle service to scheduled route locations from Canby. This transit service also provides frequent shuttle service to area businesses and neighborhoods.

The Canby Ferry, one of three ferries still in operation on the Willamette River, can transport nine vehicles per trip across the Willamette River to Wilsonville. This Ferry is a unique tourist attraction in Canby.

The City of Canby is accessible from the Interstate 5 corridor and Interstate 205 via State Highway 99E. The transportation system provides direct connections to the surrounding communities of Oregon City, Woodburn and Salem as well as the greater Portland metropolitan area. Commuter traffic volumes are very high: 1999 Average Daily Traffic (ADT) figures indicate 18,400 vehicles on Highway 99E at the eastern Canby city limits and 25,700 vehicles on Highway 99E at western City limits at the Molalla River.

Section 3:

Hazard Assessment

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. The three levels of a hazard assessment are as follows:

- 1) ***Hazard Identification*** identifies the geographic extent and intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data. City of Canby identified six major hazards that consistently affect this geographic area. These hazards – floods, landslides, wildfires, earthquakes, severe storms: wind and winter, and volcanoes – were identified through an extensive process that utilized input from the EMC. The geographic extent of each of the hazards has been identified by the City of Canby EMC using the best available data and local knowledge, and is illustrated in Figure 3-1.
- 2) ***Vulnerability Assessment/Inventorying Assets*** combines hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard. A complete listing of the community assets exposed to each hazard is located in Table 3-2. 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 damage, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. Unfortunately, there is insufficient data for conducting a risk analysis for the natural hazards affecting Incorporated Municipality. However, this need is identified in the action plan, and a complete risk assessment will be conducted when the resources are available.

Federal Requirements for a Hazard Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 CFR Part 201.6 (c) (2) includes a requirement for hazard assessment.

This hazard assessment requirement is intended to provide information that will help communities to identify and prioritize mitigation activities that will reduce losses from the identified hazards. The federal criterion for hazard assessments and information on how the City of Canby Natural Hazard Mitigation Plan meets those criteria is outlined in Table 3-2 below.

Table 3-1. Federal Criteria for Hazard Assessment

Section 322 Requirement	How is this addressed?
Identifying Hazards	The City of Canby has submitted a map (Figure 3-1), which is the result of the tabletop exercise conducted by the Canby EMC.
Profiling Hazard Events	The hazard sections of the Clackamas County Natural Hazard Mitigation Plan provide documentation for all of the large-scale hazard events affecting the region. Where data is available, City of Canby has provided local impacts from historical hazard events.
Assessing Vulnerability: Identifying Assets	Table 3-2 documents the community assets that are vulnerable to natural hazards. A more detailed description of the vulnerability of these assets is located in the specific hazard sections.
Assessing Vulnerability: Estimating Potential Losses	Using the best available data, an estimate of potential losses from natural hazards is located in the hazard specific sections.
Assessing Vulnerability: Analyzing Development Trends	The Community Profile section of this plan provides a description of the development trends in City of Canby.

Hazard Assessment Mapping Methodology

The City of Canby EMC identified the hazards to be included in this plan through a series of round table discussions. In order to further identify particular areas prone to each of the six hazards addressed in this plan, the EMC conducted a table top mapping exercise, capitalizing on local knowledge and experience from the committee members.

Due to lack of resources and data, the City of Canby could not develop any digital maps at this time, and acknowledges Figure 3-1 as the best representation for the local hazards. This map has been included in this document, and is the basis for the vulnerability assessment. The following color scheme was used to illustrate the various hazards zones and community assets:

Hazards: Colored Pencil

- Flood: Dark Blue
- Wind/Winter Storm: Light Blue
- Landslide: Brown
- Earthquake: Red
- Wildfire: Orange
- Volcano: No local exposure.

Community Assets: Marker

- Critical Facilities and Infrastructure: Red
- Essential Facilities and Infrastructure: Purple
- Vulnerable Populations: Pink
- Cultural/Historical Assets: Light Blue
- Economic Assets/Population Centers: Yellow

- Environmental Assets: Light Purple
- Hazardous Materials: Orange

Community Assets: Vulnerability Assessment

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and environmental integrity of City of Canby. The exposure of community assets to natural hazards is provided in Table 3-3, City of Canby Vulnerability Assessment. The community assets were defined as follows:

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

- Fire Station 62 (EOC #1)
- City of Canby Public Works Building (EOC#2)
- Fire Station 65 (EOC #3)
- Telephone Central Station
- Water Treatment Facilities (including reservoirs, intake structures and raw water pump houses)
- City Hall Complex
- Canby Area Transportation and City of Canby Finance Building
- 3 Power Substations
- Canby Utility
- Waste Water Treatment Facilities

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

- Canby High School-Red Cross Shelter
- Trost Middle School-Red Cross Shelter
- Canby Christian-Red Cross Shelter
- Adult Center-Red Cross Shelter
- United Methodist Church-Red Cross Shelter
- Medical Clinics
- Clackamas County Fairgrounds
- First Student Transportation

Critical Infrastructure: Infrastructure that provides services for City of Canby.

- Telephone Lines
- Gas Lines
- Power Lines
- Transportation Networks
- Bridges
- Railroads
- Water Treatment, Storage and Distribution Lines
- Wastewater Collection
- NW Natural Pipeline Data
- Pacific Pride Storage Tanks
- Communication Towers

Vulnerable Populations: Locations serving populations that have special needs or require special consideration.

- Mobile Home Parks
- Riverside Recreational Vehicles
- Canby Senior Center
- Hope Village
- Rackleff House
- Adult Foster Homes
- Countryside Living
- Canby Area Schools

Cultural or Historical Assets: These assets include those facilities that augment or help define community character, and if lost would represent a significant loss for the community.

- Three Rivers Farm
- Macksburg Church
- Fine Arts Center
- Canby Depot Museum
- Barlow House
- Canby Chapel
- Riverside School
- Canby Ferry
- Clackamas County Fairgrounds

Economic Assets/ Population Centers: ***Economic Centers*** are those businesses that employ large numbers of people, and provide an economic resource to City of Canby. If damaged, the loss of these economic centers could significantly affect economic stability and prosperity. ***Population Centers*** usually are aligned with economic centers, and will be if particular concern for evacuation/notification during a hazard event.

- Johnson Controls
- Shimadzu
- JV North West
- Fred Meyer
- Safeway
- Thriftway
- SR Smith
- Sprague Controls
- Potter Industries
- Willamette Plastics
- Wilson Construction (transient)
- Post Office
- All multi-family dwelling structures
- Canby Grove
- Redwood Terrace Apartments
- Pat's Acres Race Track
- Pioneer Industrial Park

- First Student Transportation
- Churches
- Canby School District

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

- Wait Park
- Canby Community Park
- Bottom Lands
- Willow Creek
- Molalla River State Park
- Eco Park

Hazardous Materials: Those sites that store, manufacture, or use potentially hazardous materials.

- BBC Steel
- Wilco
- JB North West
- Beco Welding
- Rail Road
- Johnson Controls Inc.
- SR Smith
- Pacific Pride Fuel Storage Tanks
- Wastewater Treatment Facility
- Water Treatment Facility
- Oregon Bag

Table 3-3. City of Canby Vulnerability Assessment

Hazard	% Land Area	% Pop.	Critical Facilities	Essential Facilities	Critical Infrastructure	Public & Private Centers	Cultural/Historical Assets	Environmental Assets	High Value Sites
Flood	<5%	<1%	<ul style="list-style-type: none"> •Public Works •Raw Water Pump Houses 	<1%	<ul style="list-style-type: none"> •Water Intake Structure and Lines •Bridges (particularly Knight's Bridge and Goods Bridge) •Culverts •Vale Garden Road •Anderson Road •HWY 170 & HWY 99 E 	<ul style="list-style-type: none"> •Willow Creek •Canby Grove •Redwood Terrace Apartments •Pat's Race Track 	<1%	<ul style="list-style-type: none"> •Canby Community Park •Willow Creek •Molalla River State Park •Bottom Lands . Wetlands 	<ul style="list-style-type: none"> •Waste Water Treatment Facility •Rail Road
Landslide	<1%	<1%	<1%	<1%	<ul style="list-style-type: none"> •Main Water Lines on Bluff Area •Electric Power Lines 	<ul style="list-style-type: none"> •Hot Off the Press •Few Residential Properties •Wilson Const. 	<1%	<ul style="list-style-type: none"> •Molalla River State Park •New park •Molalla Forest Park 	100%
Earthquake	100%	100%	100%	100%	100%	100%	<1%	<1%	<1%
Windstorm	<5%	<ul style="list-style-type: none"> •Mobile Home Parks 	<ul style="list-style-type: none"> •Public Works •Sewerage Treatment Facility •3 Power Substations 	100%	<ul style="list-style-type: none"> •Electric Power Lines •Telephone Lines 	<ul style="list-style-type: none"> •99E from South Elm to South Ivy Lane 	<1%	<1%	<1%
Severe Winter Storm	<5%	<1%	<ul style="list-style-type: none"> •Public Works •Sewer Treatment Facility 	100%	<ul style="list-style-type: none"> •Telephone Lines •Electric Power Lines •Water Lines 	<ul style="list-style-type: none"> •99E from South Elm to South Ivy Lane 	<1%	<1%	<1%
Wildfire	<5%	<1%	<ul style="list-style-type: none"> •Public Works •Water Intake Structure •Sewerage Treatment Facility 	<1%	<1%	<1%	<1%	<ul style="list-style-type: none"> •Canby Community Park 	<1%
Volcano (Up to 100% Depending on climatic conditions)	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%

Section 4: Natural Hazards

Flooding

The City of Canby has several large rivers and smaller tributaries that are susceptible to annual flooding events. However, the City of Canby's flooding hazards are less of a concern than many of the other hazards represented in this mitigation plan. In fact, according to Oregon Emergency Management, the City has no repetitive loss properties on file at this time.

Flooding Profile

The probability of flooding events in Canby was determined using scientific data, historical occurrences, and local knowledge. The probability of flooding in Canby is described in Chapter Five.

The historical large-scale flooding events have been described in Section 6 of the County Plan, and are applicable to City of Canby. As such, the events will not be repeated here.

Flooding Hazard Assessment

Hazard Identification

Although the FEMA Flood Insurance Rate Maps (FIRMs) illustrating the 100-year floodplain were not digitally available for the hazard assessment, the Canby Emergency Management Committee (EMC) used the 1996 flood inundation line in the tabletop mapping exercise, which is indicative of the 100-year flooding area for the hazard analysis. Using this inundation line in combination with local knowledge, the map shows approximately five percent or less of the total land area in Canby as being exposed to the flood hazard. Canby has indicated the need for digital floodplain maps in the action plan, which would improve the flooding hazard assessment.

Vulnerability Assessment

The Canby EMC has completed a vulnerability assessment using the table top mapping methodology described in Section 3. For a complete listing of the community assets exposed to the flooding hazard, please refer to table 3-3; for an illustration of the flooding hazard, please refer to figure 3-1.

Approximately five percent of the total land area in Canby is exposed to the flooding hazard, and in some areas, this hazard presents some potential life safety hazards. The multi-family housing structures that may have flooding issues are the Redwood Terrace Apartment Complex,

and Canby Grove. The water treatment facility main river intake structure, the sewerage treatment facility, and the City's public works facility are critical facilities that have had flooding problems, both in regard to infrastructure exposed and interruption of service. Bridges and culverts are also vulnerable to flooding because debris and sediment can choke culverts and undermine bridges, causing surface water drainage problems. Canby relies on bridges for transportation and connection to other main Highways. Canby could potentially be isolated if the bridges were to fail.

Potential flooding events may affect less than one percent of the identified essential facilities, less than one percent of cultural or historical assets, and less than five percent of large economic centers. Environmental assets vulnerable to floods include the bottomlands, Canby Community Park, and Willow Creek. These environmental assets could become choked with debris and sediment deposited during and after flooding events, or they could be adversely effected by hazardous material leaks from the Water and Wastewater treatment facilities or the materials being transported by the railroad.

Risk Analysis

Due to insufficient data, Canby is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in the action items, and will be completing a risk assessment as data and resources become available.

Repetitive Flood Loss

City of Canby works to mitigate problems regarding flood issues when they arise. Throughout history, some areas in the city are more susceptible to flooding issues and have incurred repetitive losses, meaning that they have had greater than two NFIP claims in the past ten years. According the most current data from Oregon Emergency Management, there are no properties in Canby that meet the criteria for repetitive loss at this time.

Existing Flood Mitigation Activities

Incorporated Municipality Codes Pertaining to Flooding

Policy No. 2-H: Canby shall continue to participate in and shall actively support the Federal Flood Insurance Program.

Implementation Measures:

- A) Continue to enforce the provisions of the "H" overlay zone which restricts development in areas of the identified flood hazards.
- B) In reviewing development proposals, prevent the creation of additional building sites in hazardous locations, encourage the clustering of development in the most appropriate locations, and require proof from a registered surveyor or engineer that proposed buildings will have habitable floor elevations at least one foot above the flood levels identified in the engineer's mapping.

Flood Mitigation Projects

Emerald Park is an area designated as open space along the Willamette River. The development of this park has enhanced the wetlands in the area, which will assist in flood water retention. Willow Creek wetlands also assist in reducing flood waters by increasing the infiltration capacity of the soils in this area.

Flood Mitigation Action Items

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

ST-FL#1: Evaluate & upgrade surface water management infrastructure and identify appropriate mitigation strategies.

Ideas for Implementation

- Develop storm water grate management system to keep grates open and clear of debris.

Coordinating Organization: Public Works

Timeline: Ongoing

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

County Action Items

Addressed: ST-MH #2; LT-FL #3

LT-FL#1: Identify mitigation strategies to address flooding issues in bottom lands.

Ideas for Implementation:

- Protect source water intake structures (2 pumping stations: Springs Gallery, River Caisson Building).

Coordinating Organization: Canby Utility

Timeline: 3-5 Years

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

County Action Items

Addressed: ST-MH#5; ST-WS#1, LT-WS#2

LT-FL#2: Conduct study to identify strategies to reduce stream bank erosion along Molalla River for protecting critical infrastructure and residential properties.

Coordinating Organization: Canby Utility and Public Works

Timeline: 3-5 Years

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

County Action Items Addressed: ST-MH#5; ST-WS#1, LT-WS#2

LT-FL#3: Identify strategies to vulnerability of repetitive flood loss properties, including areas that are outside City limits such as Canby Grove, Alder Creek, Vale Garden Road, and Anderson Road.

Coordinating Organization: Emergency Management Committee

Timeline: 3-5 Years

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

County Action Items Addressed: ST-MH#5; ST-WS#1, LT-WS#2

Landslide

Landslide Profile

The probability of landslide events in Canby was determined using scientific data, historical occurrences, and local knowledge. The probability of landslides in Canby is described in Chapter Five.

The historical large-scale landslide events have been described in Section 6 of the County Plan, and are applicable to City of Canby. As such, the events will not be repeated here.

Landslide Hazard Assessment

Hazard Identification

Canby does not have many steep or unstable slopes that constitute a major landslide hazard. There is no digital data that identifies potential landslide areas in the Canby area at this time. However, the Canby Emergency Management Committee used local knowledge to determine the location of historically active and potentially unstable slopes, and has identified less than one percent of the land area in Canby as subject to landslides.

Vulnerability Assessment

Although less than one percent of the land area is subject to landslides, there are a few steep slopes that have the potential of failure. The area along the Molalla River between Knights Bridge Road and 99E is susceptible to the landslide hazard. Canby Utility's main river intake, Springs Gallery and pump houses located in this potentially unstable area are critical facilities that could impede emergency response efforts. Additionally, Hot Off The Press (an economic center), and a few residential properties are in this hazard zone.

Risk Analysis

Due to insufficient data, Canby is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in the action items, and will be completing a risk assessment as data and resources become available.

Existing Landslide Mitigation Activities

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

Incorporated Municipality Codes Pertaining to Landslides

Policy No. 1-H: Canby shall restrict urbanization in areas of identified steep slopes.

Implementation Measures:

- A) Continue to regulate property divisions to prevent the creation of lots in areas which are inaccessible or unbuildable because of steep slopes.
- B) The Planning Commission may require a certified statement from a registered engineer or engineering geologist prior to construction in areas of steep slopes identified by "H" overlay zoning.

Landslide Mitigation Projects

The City of Canby has identified steep slopes that may be susceptible to the landslide hazard, but no mitigation projects have been completed at this time.

Landslide Mitigation Action Items

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

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

Ideas for Implementation:

- Conduct a study to identify appropriate mitigation strategies for problem areas including buildings and infrastructure in the bluff area; and
- Develop public information to emphasize economic risk when building on potential or historical landslide areas.

Coordinating Organization: Emergency Management Committee

Timeline: 3-5 Years

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

County Action Items

Addressed: ST-LS#1; LT-LS#2

Wildfire

Wildfire Profile

The probability of wildfire events in Canby was determined using scientific data, historical occurrences, and local knowledge. The probability of wildfire in Canby is described in Chapter Five.

The historical large-scale wildfire events have been described in Section 6 of the County Plan, and are applicable to City of Canby. As such, the events will not be repeated here.

Wildfire Hazard Assessment

Hazard Identification

There is no wildland/urban interface mapping data available for Canby at this time. However, complete coverage of the wildland/urban interface for the Canby area will be available in the summer of 2003. This data will be incorporated into the Canby plan when available. For the purposes of this plan, the Canby Emergency Management Committee used local knowledge to identify areas that interface with vegetation that is prone to wildfire. The potential wildfire areas are shown in orange.

Vulnerability Assessment

The wildfire hazard is located in the northeast and southwest portions of Canby. To the northeast, the sewerage treatment facility and public works are located near the interface. In the southwest corner, the water treatment facility is also near the interface. One particular area just west of Ivy St. has a high concentration of trees and scrubby vegetation, but there is little exposure to development here.

Risk Analysis

Due to insufficient data, Canby is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in the action items, and will be completing a risk assessment as data and resources become available.

Existing Wildfire Mitigation Activities

The Canby Fire District covers 52 square miles with a population of 32,000. The district is comprised of a suburban mix of residential properties, light industry and agriculture, which includes the entire city limits of Canby. Canby Fire has made public awareness a top priority with fire prevention and education services. Annually, wildfire guides are distributed to the districts urban homeowners to educate them in pre-fire prevention activities by the Fire District personnel and CERT teams.

Incorporated Municipality Codes Pertaining to Wildfires

Canby Municipal Code No. 8.12.060 Weeds and noxious growth.

No owner or person in charge of property may permit weeds or other noxious vegetation to grow upon his property. It shall be the duty of an owner or person in charge of property to cut down or to destroy weeds or other noxious vegetation as often as needed in order to prevent the weeds or noxious vegetation from becoming unsightly or from becoming a fire hazard or from maturing or going to seed.

Local Fire Prevention/Education Programs

The Canby Fire Department offers the following fire prevention/education services for its residents.

- Home fire safety inspections
- Assistance developing home fire escape plans
- Business inspections
- Woodstove installation inspections
- Free smoke detectors
- Fire extinguisher operation classes
- Community Emergency Response Team training
- School, church, and civic groups fire safety education presentations
- Fire cause determinations
- Urban interface training on defensible space
- Proper rural addressing of residences

Wildfire Mitigation Action Items

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

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

Ideas for Implementation:

- Identify Locations for installation of dry hydrant systems;
- Identify irrigation ditches, streams and rivers where access may be provided for fire dept. draft sites;
- Provide funding for development of draft sites for individual property owners;
- Identify areas where a cooperative emergency water supply for fire fighting can be stored, min. 2,500 gallons (above or below ground level);
- Educate property owners in WF area of the need for alternate power for existing wells in case of power failure; and
- Develop universal signage for the location of adequate water supply for fire district.

Coordinating Organization: Canby Fire

Timeline: 3-5 Years

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

County Action Items

Addressed: ST-WF#3

Severe Storms: Wind and Winter

Severe Storm Profile

The probability of severe storm events in Canby was determined using scientific data, historical occurrences, and local knowledge. The probability of severe storm in Canby is described in Chapter Five.

The historical large-scale severe storm events have been described in Section 6 of the County Plan, and are applicable to City of Canby. As such, the events will not be repeated here.

Severe Storm Hazard Assessment:

Hazard Identification

The severe wind and winter storm hazard was identified by locating areas where trees and vegetation align with utility and power lines, shown in blue and purple. This method was used because the majority of the severe storm events in Canby result in power outages due to damaged power distribution and/or transmission lines from vegetation failure or weight of ice and snow. Although the area susceptible to the severe storm hazard in Canby is relatively low (less than five percent of the land area), the cumulative effects from these storms can impact the entire city.

Vulnerability Assessment

Severe storms can be life threatening, cause major infrastructure damage, and can be difficult to manage in terms of response and recovery. Winter storms can cover the road networks with snow and ice, impeding transportation to schools and medical facilities. Winter storms and windstorms can topple trees, down power lines, and cause widespread power outages. Canby public works, water treatment facilities, sewerage treatment facilities and Fire Station #62 (EOC) are critical facilities that are located adjacent to vulnerable vegetation and power lines. Canby Utility, Public Works, and Canby Telephone would be strained during a severe storm event as they work to clear roads and repair or replace power distribution and/or transmission lines, and maintain telephone lines for communication. Additionally, the area along 99E from South Elm to South Ivy St. is particularly vulnerable to damaged power lines from vegetation failure.

Risk Analysis

Due to insufficient data, Canby is unable to perform a quantitative risk assessment at this time. The City has addressed this issue in the action items, and will be completing a risk assessment as data and resources become available.

Existing Severe Storm Mitigation Activities

Canby Utility works to identify areas for tree trimming that can cause power line outages, and put life and property at risk.

Severe Storm Mitigation Action Items

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

LT-SS #1: Attain funding to bury power lines subject to frequent failures to reduce power outages from the windstorm and severe winter storm hazard where possible.

Ideas for Implementation:

- Partner with PGE to continue hazardous tree inventory and mitigation programs; and
- Ensure that there are back up underground lines to major businesses & employers.

Coordinating Organization: Canby Utility

Timeline: 3-5 Years

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

County Action Items

Addressed: ST-MH#5; ST-WS#1, LT-WS#2

Earthquake

Earthquake Profile

The probability of earthquake events in Canby was determined using scientific data, historical occurrences, and local knowledge. The probability of earthquake in Canby is described in Chapter Five.

The historical large-scale earthquake events have been described in Section 6 of the County Plan, and are applicable to City of Canby. As such, the events will not be repeated here.

Earthquake Hazard Assessment

Hazard Identification

There is very little digital data regarding the earthquake hazard for Canby because the city is outside of the METRO urban growth boundary, where many scientific studies have been concentrated. However, DOGAMI is currently completing an earthquake hazard and secondary earthquake hazards mapping project for the entire County, including Canby. Canby will be incorporating this new data when it is available.

For the purposes of locating the earthquake hazard areas in Canby, historic earthquake and geology maps developed by DOGAMI were reviewed. According to IMS-4, the soil type in Canby is primarily unconsolidated sediments, increasing the likelihood of ground shaking amplification and liquefaction.⁶ Additionally, DOGAMI Bulletin 99 study shows a fault running parallel to Molalla Forest Road (shown in red), indicating a potential seismic risk.⁷ The location of this fault line may serve to increase the effect of an earthquake in Canby.

Vulnerability Assessment

Due to the soil type, location of a local fault line, and lack of seismically retrofitted structures, the entire city of Canby is vulnerable to the earthquake hazard. Many vulnerable populations would have to be evacuated and housed following a large earthquake, including all of the mobile home parks, adult care facilities, and schools. Although the liquefaction potential of the soils in this area is relatively low⁸, the majority of the critical and essential facilities and infrastructure would be vulnerable to ground shaking and amplification. Additionally, all of the economic and high population centers would incur considerable damage from a high magnitude earthquake. The primary reason for the high level of vulnerability to this hazard is because the majority of the buildings and infrastructure were built before the new seismic codes standards were adopted. Additionally, an earthquake hazard could cause hazardous material leaks from all of the sites that store or use hazardous materials (for complete listing of identified community assets exposed to the earthquake hazard, please refer to Section 3).

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. Canby does not have the resources to conduct a local risk assessment for the earthquake analysis, therefore the data reported in the county plan is the best quantitative assessment for the earthquake hazard in Canby.

Existing Earthquake Mitigation Activities

The City of Canby has adopted the Unified Building Code (UBC), which sets the minimum design and construction standards for new buildings.

The Canby School District has developed seismic preparation procedures and conducts drills in accordance with the Office of Emergency Management guidelines. These drills include familiarization with routes and methods of exiting the building and methods of duck, cover and hold during an earthquake.

Earthquake Mitigation Action Items

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

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

Ideas for Implementation:

- Attain funding to perform evaluations;
- Prioritize seismic upgrades based on criticality of need and population served; and
- Partner with agencies responsible for maintaining the bridges surrounding Canby to upgrade them to meet current seismic code.

Coordinating Organization: Emergency Management Committee

Timeline: 3-5 Years

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

County Action Items

Addressed: ST-MH#5; ST-MH#6; LTEQ#1

Volcanic Eruption

Volcano Profile

The probability of volcanic eruptions in Canby was determined using scientific data, historical occurrences, and local knowledge. The probability of volcanic eruptions in Canby is described in Chapter Five.

The historical large-scale volcanic eruptions have been described in Section 6 of the County Plan, and are applicable to City of Canby. As such, the events will not be repeated here.

Volcanic Eruption Hazard Assessment

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

Existing Volcanic Eruption Mitigation Activities

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

Volcanic Eruption Mitigation Action Items

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

Multi-Hazard

Multi-Hazard Action Items (MH)

Multi-hazard action items are those activities that pertain to all seven hazards in the mitigation plan: flood, landslide, wildfire, severe winter storm, windstorm, earthquake, and volcanic eruption.

ST -MH#1: Increase the medical resources capable of handling with large-scale medical needs.

Ideas for Implementation:

- Develop community outreach and education programs regarding first aid and CERT teams;
- Continue to train and retrain school staff members in first aid (dept analysis to identify training needs);
- Attain funding for Emergency Medical Technician supplies;
- Coordinate with medical clinics in Canby; and
- Identify facilities that have cold storage capabilities.

Coordinating Organization: Emergency Management Committee
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation
County Action Items Addressed: ST-MH#5; ST-MH #2

ST-MH#2: Update and revise the Canby Emergency Operations Plan.

Coordinating Organization: Canby Fire District/ City of Canby
Timeline: 1-2
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation
County Action Items Addressed: LT MH #1; ST-MH#5; ST-MH #2

ST-MH # 3: Ensure that there are adequate shelter facilities in hazard-free zones to serve Canby residents.

Ideas for Implementation:

- Identify and contact Non-Red Cross potential shelter sites to ensure that they are prepared for disaster scenarios;
- Identify resource needs at shelter sites & attain funding to equip emergency shelter sites; and
- Contact Red Cross Shelter Sites to renew and maintain agreements annually.

Coordinating Organization: Canby Fire District
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation
County Action Items Addressed: ST-MH#5; ST-MH #2

ST-MH#4: Improve mass transportation capacity for transporting people during disasters.

Ideas for Implementation:

- Partner with local organizations that have the capacity to transport large numbers of people such as schools, city transit, farmers, adult center, Hope Village, churches, Canby Ford, Tri-Met, and other outside sources.

Coordinating Organization: Emergency Management Committee
Timeline: 1-2
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation
County Action Items Addressed: ST-MH#5

ST-MH#5: Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.

Ideas for Implementation:

- Gather hazard related information and public information materials, and disseminate to public through local publications;
- Identify property owners in hazard zones, and conduct a target mailing to disseminate hazard information; and
- Publicize hazard information as the seasons for the hazards approach.

Coordinating Organization: Emergency Management Committee
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation
County Action Items Addressed: LT-MH#1; LT-MH#2; ST-LS#1; LT-SWS#1; LT-WS#3; LT-EQ#2; LT-WF#3

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

Ideas for Implementation:

- Develop a Debris Management Plan; and
- Partner with neighboring jurisdictions and organizations to manage debris during disasters.

Coordinating Organization: Public Works

Timeline: 1-2 Years

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

County Action Items

Addressed: ST-SWS #1; ST WS #2; ST-MH#5

ST-MH #7: Improve the hazard assessment in the Canby Natural Hazard Mitigation Plan.

Ideas for Implementation:

- Attain funding to contract with the County to provide digital GIS hazard layers and a vulnerability assessment;
- Continue to update the hazard assessment as the County and/or Canby acquires better data; and
- Contract with the County or other service provider to conduct quantitative risk analysis for the natural hazard in Canby.

Coordinating Organization: Emergency Management Committee

Timeline: Ongoing

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

County Action Items

Addressed: ST-MH #2; LT-MH#3; LT-FL #1; ST-LS#1; LT-WF #1; LT-WS#1; ST-EQ#1

ST-MH#8: Improve network of communications during a disaster.

Ideas for Implementation:

- Recruit and provide training for Amateur Radio Operators;
- Address 800 MHz communication deficiencies;
- Update school emergency contact information for parents/children every 3 months;
- Attain funding to purchase a portable base station for the schools;
- Identify local communication resources and/or lack of resources;
- Obtain local disaster radio station to disseminate emergency info.; and
- Purchase interoperable radio communications system.

Coordinating Organization: Emergency Management Committee

Timeline: 1-2 Years

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

Emergency Services, Partnerships and
Implementation

County Action Items

Addressed: ST-MH#5; ST-MH #2; LT-MH#1; ST-WF#1

ST-MH#9: Integrate the goals and action items from the Canby Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate.

Ideas for Implementation:

- Use the mitigation plan to help the City's Comprehensive Land Use Plan meet State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards;
- Integrate the City's mitigation plan into current capital improvement plans to ensure that development does not encroach on known hazard areas;
- Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; and
- Incorporate Canby Mitigation Plan into deed restrictions and CC&Rs where appropriate.

Coordinating Organization: Emergency Management Committee

Timeline: Ongoing

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

County Action Items

Addressed: ST-MH#1; ST-LS#2; LT-LS#2; LT-WS#4

ST-MH#10: Promote CERT team activity in the area and recruit new members for training.

Ideas for Implementation

- Provide information about the CERT program to Canby residents through local publications;
- Attain funding for resources to train and equip current and potential CERT teams; and
- Encourage Business Emergency Response Teams.

Coordinating Organization: Canby Fire District

Timeline: Ongoing

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

County Action Items

Addressed: ST-MH#4; LT-MH#1; LT-MH#2; ST-WF#1

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

Ideas for Implementation:

- Develop partnerships with local business to share resources and equipment;
- Attain funding to purchase portable generators and transfer systems for all potential shelter sites;
- Attain funding for portable lighting, a dump truck (12 yard), centrifugal water pumps & purification systems, potable water tenders, portable potable water storage (trailers), portable toilets, boats; and
- Develop a resource inventory for emergency response equipment.

Coordinating Organization: Public Works

Timeline: 3-5 Years

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

County Action Items

Addressed: LT MH #1; ST-MH#5; ST-MH #2

LT-MH # 2: Increase preparedness of key businesses and economic centers to reduce losses, ensure continuity of service, and promote economic prosperity in Canby.

Ideas for Implementation:

- Work with targeted vulnerable economic centers to conduct drills and disseminate information about disaster preparation and response;
- Encourage local businesses to conduct business impact analysis for reduction of upstream and downstream losses;
- Identify strategies for informing local businesses such as chamber newsletter or lunch forums; and
- Identify insurance incentives for businesses that participate in disaster preparedness.

Coordinating Organization: Emergency Management Committee

Timeline: Ongoing

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

County Action Items

Addressed: ST-MH#4; ST-MH#5

Section 5:

Mitigation Planning Priority System

Action Item Prioritization Methodology

The Canby Emergency Management Committee has prioritized the identified mitigation strategies in order to better allocate resources for plan implementation. The criteria used for prioritizing the action items are the plan goals, hazards addressed, criticality of need, population served, and likelihood of success.

Although this methodology provides a guide for the EMC in terms of implementation, the EMC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new situations arise, such as capitalizing on funding sources that could pertain to an action item that is not the highest priority.

Step 1: Prioritize Plan Goals

The Canby mitigation goals including Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, and Partnerships and Implementation were considered during each phase of the mitigation planning process. As the mitigation action items were developed, the EMC identified which plan goals were addressed by each action item. The EMC ranked the plan goals to determine the priorities for Canby, and each goal was given a score of one point to five points, in ascending order. The points for the plan goals were then totaled for each action item. The prioritized plan goals are as follows:

- 5 Points: Protect Life and Property
- 4 Points: Emergency Services
- 3 Points: Public Awareness
- 2 Points: Partnerships and Implementation
- 1 Point: Natural Systems

Step 2: Prioritize Hazards

The natural hazards addressed by the Canby Natural Hazard Mitigation Plan were prioritized using the FEMA-accepted hazard analysis methodology for Emergency Operations Plans. This methodology considers the history of the hazard, the vulnerability to the hazard, the maximum threat of the hazard (worst case scenario), and the probability of the hazard. Each of these criteria was weighted, and the final score was used for prioritizing the hazards. The following is a full description of the methodology used:

Categories Considered:

HISTORY:	The record of occurrences of previous major emergencies or disasters (weight factor = 2).
LOW	0 - 1 event per 100 years
MEDIUM	2 - 3 events per 100 years
HIGH	4 + events per 100 years
VULNERABILITY:	The percentage of population and property likely to be affected (weight factor = 5).
LOW	< 1% affected
MEDIUM	1 - 10% affected
HIGH	> 10% affected
MAXIMUM THREAT:	The maximum percentage of population and property that could be impacted under a worst case scenario (weight factor = 10).
LOW	< 5% affected
MEDIUM	5 - 25% affected
HIGH	> 25% affected
PROBABILITY:	The likelihood of occurrence within a specified period of time (weight factor = 7).
LOW	> 1 chance per 100 years
MEDIUM	> 1 chance per 50 years
HIGH	> 1 chance per 10 years
Severity Ratings:	
LOW	= 1 - 3 points
MEDIUM	= 4 - 6 points
HIGH	= 7 - 10 points

Although the methodology used allows Canby to quantify and compare natural hazards, it is flawed in that it compares hazards with high probabilities and relatively low consequences with hazards that have low probabilities and high consequences. The EMC took this into consideration during the prioritization process, and the results are shown in table 5-1. The hazards were given a score of one point to seven points, in increasing order of importance. The Multi-Hazard action items were given the highest score (7), as they address more than one hazard. The points for the hazard scores were then totaled for each action item.

Table 5-1 Natural Hazard Prioritization Score

Hazard	Total Score	Hazard Score
Multi-Hazard	-	7
Earthquake	202	6
Severe Storms: Wind and Winter	190	5
Flood	161	4
Wildfire	159	3
Landslide	146	2
Volcano	100	1

Step 3: Incorporate Criticality of Need, Large Number of Population Served, Likelihood of Success

The final score for each action items was computed by summing the plan goal score and the hazard score. The committee then considered the criticality of need, the number of population served, and the likelihood of success. The EMC was given an opportunity to add five points the action item that has a high criticality of need, four points were given to the action item that has a high probability of success, and three points were given to an action item that serves a large number of the population. The prioritized action items are as follows:

Table 5-2. Action Item Prioritization Score

<i>Existing Resources</i>		<i>Funding Required</i>	
Short-Term Multi-Hazard #3	34	Short-Term Multi-Hazard #1	49
Short-Term Multi-Hazard #10	19	Long-Term Earthquake #1	49
Short-Term Multi-Hazard #7	15	Short-Term Multi-Hazard #8	35
Short-Term Multi-Hazard #9	15	Long-Term Multi-Hazard #1	24
Short-Term Multi-Hazard #4	13	Long-Term Wildfire #1	21
		Long-Term Severe Storm #1	20
		Short-Term Multi-Hazard #2	19
		Short-Term Flood #1	19
		Long-Term Flood #3	19
		Long-Term Landslide #1	17
		Short-Term Multi-Hazard #5	15
		Long-Term Flood #2	15
		Long-Term Multi-Hazard #2	13
		Short-Term Multi-Hazard #6	12
		Long-Term Flood #1	12

Section 6: Resource Directory

The Canby Resource Directory is a supplement to the Clackamas County Master Resource Directory. It provides contact information for local that are currently involved in hazard mitigation activities. The Emergency Management Committee may look to the organizations in the Resource Directories for partnership opportunities and technical assistance in action item implementation.

The Emergency Management Committee will continue to add contact information for organizations currently engaged in hazard mitigation activities. This section may also be used by various community members interested in hazard mitigation information and projects.

Canby Natural Hazards Mitigation Plan Endnotes

¹ Oregon Office of Economic Analysis (www.oes.das.state.or.us/econ.htm)¹.

² PSU Center for Population Research and Census U.S. Bureau of Census.

³ Oregon Office of Economic Analysis (www.oes.das.state.or.us/econ.htm).

⁴ Oregon Economic Development and Equifax National Decision Systems Average Annual Growth Rate.

⁵ PSU Center for Population Research and Census Canby Land Needs Study (OTAK, 1999).

⁶ Madin, Ian P. and Zhenming Wang. *Relative Earthquake Hazard Maps Report*. (1999) DOGAMI.

⁷ Schlicker, Herbert G. and Christopher T. Finlayson. *Geology and Geologic Hazards of Northwestern Clackamas County, Oregon*. (1979) DOGAMI Bulletin 99.

⁸ *All Hazard Mitigation Plan Clackamas County, Oregon*. G&E Engineering Systems Report 32.07.01, Revision 0. September 23, 1998.