

**Section 6:
Flood**

History of Flooding in Yamhill County..... 2
 Repetitive Flood Losses in Yamhill County 4
 What Factors Create Flood Risk..... 5
 Floodplain Terminology 7
 Characteristics of Flooding in Yamhill County 8
 What is the Effect of Development on Floods? 9
 How Are Flood-Prone Areas Identified?..... 9
Flood Hazard Assessment 12
 Hazard Identification..... 12
 Vulnerability Assessment..... 12
 Risk Analysis 12
Community Flood Issues 13
 What is Susceptible to Damage During a Flood Event?..... 13
Existing Flood Mitigation Activities..... 16
Mitigation Plan Goals..... 21
Flood Mitigation Action Items..... 22
Flood Mitigation Resources 27
 County Resources 27
 State Resources 28
 Regional Resources 30
 Federal Resources 30
 Additional Resources..... 34

Why are Floods a Threat to Yamhill County?

In addition to the Willamette River, Yamhill County contains two other large rivers (North and South Yamhill Rivers) 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 county's most devastating floods of recent history occurred in 1996. In February 1996, prolonged precipitation accompanied by an early snowmelt caused many rivers and creeks throughout the Willamette River watershed to rise to 100-year flood levels. The Willamette River and many of its tributaries were filled beyond capacity, causing flooding in both rural and urban areas.

The 1996 floods caused a statewide loss of over \$280 million in damages, as 26 major rivers rose to flood stage. More than 100 Red Cross and Salvation Army shelters were opened, and 23,000 residents fled their homes. Seven casualties were reported, and 50 people were injured. An estimated 1,700 Oregonians lost their jobs due to flooding, and the Small Business Association (SBA) loaned Oregon businesses over \$40.5 million to assist with recovery efforts.¹

Although this flood was a large-scale disaster, it was not unprecedented. During the Christmas Flood of 1964, over \$157 million in damage was done, and 20 Oregonians lost their lives.²

Residents in Yamhill County share a statewide concern about flood issues. According to the NFIP, Oregon has 256 flood-prone communities within the 36 counties of the State. Although all of the counties in the State are vulnerable to flooding events, the risk of loss is much more pronounced in some counties than others.

History of Flooding in Yamhill County

The Willamette River basin has a long history of flooding. Many mid-Willamette Valley residents may be familiar with the legendary floods of the 19th Century. The largest flood on record on the Willamette occurred in 1861. It is difficult to know for sure because there were no measurements of volume taken at that time.

In January 1880, busy river port and site for the main shops and the turntables of the Willamette Valley Railroad Co.'s narrow-gauge Dayton-Sheridan track, was devastated by flood and fire.³ The January 1880 high water badly damaged the Yamhill River Bridge and washed out railroad tracks, and then fire destroyed the town's first flourmill, "a fine, eight-story structure."⁴

Since the 19th century, however, the construction of flood control dams in the 1940s and 1950s has changed the pattern of flooding significantly. Yamhill County has seen four major floods and three lesser floods during the last 40 years. The largest floods in the past century occurred in December 1955, December 1964, January 1965, January 1972, November

1973, January 1974, and January 1996. One of the most memorable floods during this time period, the “Christmas” flood of 1964, was rated “approximately a 100 year flood” by FEMA and was probably the most damaging in Oregon’s history.⁵

December 1964 - January 1965

The “Christmas” flood of 1964 was the largest flood to occur subsequent to major dam construction on the upper Willamette (1940s-50s). This flood occurred as a result of two storms, one on December 19, 1964 and the other on January 31, 1965. These storms brought record-breaking rainfall that exacerbated near record, early season low-elevation snow. The December 1964 flood peaked at 47,200 cubic feet per second (cfs) at Whiteson – 25 percent more than the previous highest recorded flow of January 1972. The 1996 flood was similar and peaked at about 47,000 cfs.⁶ The 1964 flood was equivalent to a 75-year event on the South Yamhill River near Whiteson.

The flooding caused ten deaths, \$5 million dollars of damage to State bridges and millions of dollars of damage in Yamhill County.⁷ There were hundreds of landslides, bridges and roads washed out, houses were damaged or destroyed, and thousands of people were forced to evacuate their homes. Governor Mark Hatfield declared the entire State an emergency disaster area, and called the flooding, “the worst disaster ever to hit the state.”⁸

January 1974

Heavy snow and freezing rain and a series of mild storms caused snowmelt and rapid runoff. The storms resulted in two fatalities and 13 injuries in Oregon.⁹ Nine counties in Oregon were declared disaster areas, and damages statewide exceeded \$65 million. Although not as hard hit as other counties, the Yamhill County Road Department applied a five-ton limit to all county and market roads.¹⁰

There were several county road closures due to slides and high water.¹¹ Some roads in the Sheridan/Willamina area were reported closed by slides, and the Wheatland ferry suspended operations due to high water.¹² Willamina and Grand Ronde schools were closed on January 15, 1974, because of high water and rain caused roads to be too soft to be safe for school buses.¹³

In several communities along the Willamette River, wastewater treatment plants exceeded capacity resulting in millions of gallons of raw sewage being discharged into the Willamette River.¹⁴

February 1986

This flood caused by a combination of heavy rains and snowmelt caused the Willamette River to crest at just over twenty-nine feet and within ten inches of flooding. Numerous homes flooded and highways closed.

February 1996

Residents of Yamhill County experienced more than one flood during 1996. During the period of February 5 through 9 of 1996, a combination of a deep snow pack, warm temperatures, and record-breaking rains caused streams

to rise to all-time flood record levels.¹⁵ River flood states were comparable in magnitude to the December 1964 flood, the largest in Oregon since flood control reservoirs were built in the 1940s and 1950s. The South Yamhill River at Whiteson crested at 47.5 feet on February 9th, three-tenths higher than the 1964 flood. Flood state for the South Yamhill River is 38 feet.¹⁶ Statewide there were seven flood related deaths¹⁷ and 150 people were evacuated from their homes.¹⁸

The City of Carlton's wastewater treatment facility overflowed into the North Yamhill River.¹⁹ The community of Grand Island was completely engulfed by the Willamette River's floodwaters.²⁰ Total damages within Yamhill County were approximately \$4.35 million.²¹

November 1996

Months after the flood of February 1996, Yamhill County experienced high water again. November 18-20, 1996, brought with it more flooding to county residents and added damage from the year's previous flood. Like February's storm, the "pineapple express," a weather system that draws large amounts of moisture from an area near Hawaii and deposits it on the West Coast, caused the heavy rain.²²

Damage from the 1996 flooding cost McMinnville's Park and Recreation Department \$57,000 to repair park roads, rebuild ball fields, and replace bleachers at Joe Dancer Park alone.

Rural areas of the county were also hit hard by November's deluge.

January 1997

This January storm was rooted in the last days of December 1996. Heavy rains once again caused flooding throughout the county. The Willamette River crested at twenty-nine feet, one foot above flood level. The South Yamhill River at McMinnville crested on January 1, 1997 at 55 feet – flood stage is 50 feet. Five thousand Mid-Willamette Valley residents lost power as high winds that accompanied the rain blew down power lines.

Repetitive Flood Losses in Yamhill County

The properties in and near the floodplains of Yamhill County are subject to flooding events almost annually. Since flooding is such a pervasive problem throughout the county, many residents have purchased flood insurance to help recover from losses incurred from flooding events. Flood insurance covers only the improved land, or the actual building structure. Although flood insurance assists in recovery, it can provide an inappropriate sense of protection from flooding. Many residents who have had flood damage rebuild in the same vulnerable areas, only to be flooded again. These properties are termed *repetitive loss* properties, and are very troublesome because they continue to expose lives and valuable property to the flooding hazard. Local governments as well as federal agencies such as FEMA recognize this pitfall in floodplain insurance, and attempt to remove the risk from repetitive loss of properties through projects such as acquiring land and relocating homes, or by elevating structures.

Continued repetitive loss claims from flood events lead to an increased amount of damage caused by floods, higher insurance rates, and contribute to the rising cost of taxpayer funded disaster relief for flood victims.²³

What Factors Create Flood Risk

Flooding occurs when climate (or weather patterns), geology, and hydrology combine to create conditions where water flows outside of its usual course. In Yamhill County, geography and climate combine to create seasonal flooding conditions.

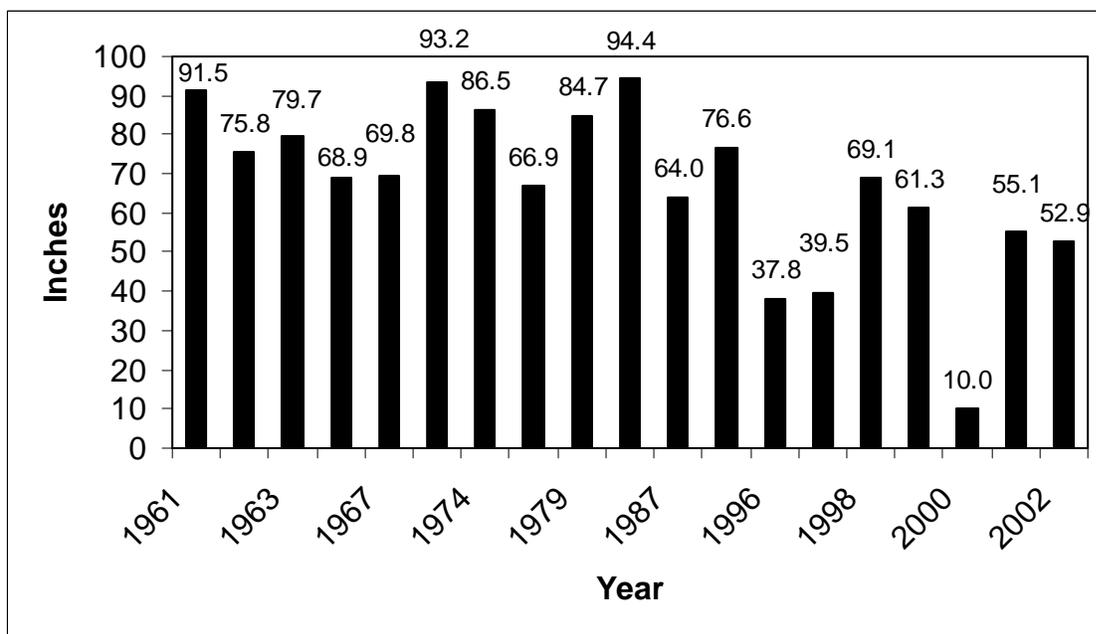
Precipitation

Because Yamhill County spans a wide range of climatic and geologic regions, there is considerable variation in precipitation, with elevation being the largest factor in precipitation totals. Elevation in Yamhill County ranges from approximately 3,423 feet at Trask Mountain in northwest Yamhill County to about 60 feet along the Willamette River in northeast Yamhill County. Correspondingly, the average monthly precipitation ranges from approximately fourteen inches in the highest elevations to approximately five inches in lower elevation areas of the County.²⁴

The amount of precipitation is not the only factor that influences peak flows. They are also influenced by withdrawals for irrigation and drinking water, stream and wetland modifications, changes in land use and water-related technology, and the removal of vegetation.²⁵ These factors not only affect the amount of water present in streams but also the rate of release of water into streams during a storm.

Flooding is most common from October through April, when storms from the Pacific Ocean, 60 miles away, bring intense rainfall to the area.²⁶ Yamhill County receives approximately 40.68 inches of rain on average each year²⁷ (see Figure 6.1). During winter months, rainfall totals average far higher than other months of the year. This results in high water, particularly in December and January. The larger floods are the result of heavy rains of two-day to five-day durations augmented by snowmelt at a time when the soil is near saturation from previous rains. Frozen topsoil also contributes to the frequency of floods.²⁸

Figure 6.1 Annual Precipitation, Yamhill County, Oregon, 1961-2002



Source: Oregon Climate Service

Data missing for the following incomplete years: 1964-1965, 1968-1971, 1973-1979, 1987, 1990, 1992-1994 – McMinnville station.

Geography

Yamhill County is within the Willamette River basin in the northwestern Willamette Valley. Yamhill County lies east of the Coast Range and west of the Willamette River. Generally, weather patterns move in a west to east direction. As such, most air masses that reach Yamhill County have moved for several days over the Pacific Ocean. When the air masses rise over the Coastal Range, they cool and become over saturated. The Coast Range and the Cascades to the east protect counties in the Willamette Valley. The Coast Range provides a buffer from eastward moving coastal storms and the Cascades shield the Willamette Valley from great masses of continental air moving westward that cause extreme temperatures east of the Cascades.²⁹

Soils

There are thirteen soil associations in Yamhill County ranging from well-drained silty loam soils to poorly drained silty clay loam soils and clay. In-depth information on the soils and their characteristics and locations can be found in the *Soil Survey of Yamhill County Area*.³⁰ In areas near the Willamette River, soils are often formed in alluvial and lacustrine materials that are prone to flooding in many places.³¹

Floodplain Terminology

Floodplain

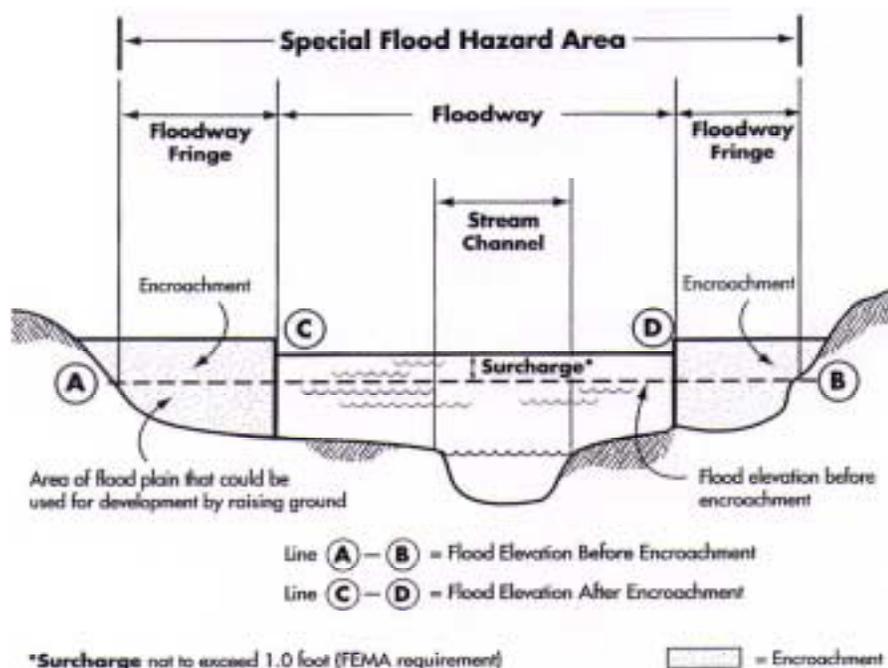
A floodplain is a land area adjacent to a stream, lake, tidal estuary or other water body that is subject to flooding. See Figure 6.2. This area, if left undisturbed, acts to store excess floodwater. The floodplain is made up of two sections: the floodway and the flood fringe.

Floodway

The floodway is one of two main sections that make up the floodplain. Unlike floodplains, floodways do not reflect a recognizable geologic feature and are defined for regulatory purposes by the National Flood Insurance Program, or NFIP, as “the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot”.

The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties. Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

Figure 6.2. Floodplain Schematic



Source: Floodplain Management in Missouri. (March 1999) Missouri Emergency Management Agency

Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. The flood fringe is subject to periodic inundation from flooding. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken. The Yamhill County Zoning Ordinance Section 901 details procedures for development within the floodplain. Development may be permitted in the flood fringe if it satisfies certain conditions and requirements regarding the height of the structure's main floor above floodwaters, 'flood proofing' construction, displacement of floodwaters, and similar matters. Placement of dwellings in the floodway is prohibited in Yamhill County. (Zoning Ordinance Section 901.09).

Base Flood Elevation (BFE)

The term "Base Flood Elevation" refers to the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced in the Flood Insurance Study report, or average depth of the base flood, usually in feet, above the ground surface.³² The ten-year (or one-percent) flood is sometimes referred to as 'base flood' or the 'regional flood', however, base flood elevations can be set at levels other than the 100-year flood. Yamhill County defines its Base Flood Level as "the level of which [a flood] has a one percent change of being equaled or exceeded in any given year. Commonly referred to as a 100-year flood."³³

Some communities choose to use higher frequency flood events as their base flood elevation for certain activities, while using lower frequency events for others. For example, for the purpose of stormwater management, a 25-year flood event might serve as the base flood elevation, while the 500-year flood event may serve as base flood elevation for the tie down of manufactured homes. The regulations of the NFIP focus on development in the 100-year floodplain.³⁴

Characteristics of Flooding in Yamhill County

Two types of flooding primarily affect Yamhill County: *urban* flooding and *riverine* flooding (see descriptions below). In addition, any low-lying area has the potential to flood. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a stormwater system's (ditch or sewer) capability to remove it.³⁵

Urban Flooding

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of the watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas than in rural or less developed areas. Adding these elements to the hydrological system can result in floodwaters that rise very rapidly and peak with violent force.

Most urban areas have a high concentration of impermeable surfaces that either collect water, or concentrate the flow of water into unnatural channels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris (i.e., yard waste), causing additional flooding.

Riverine Flooding

Riverine flooding is the over-bank flooding of rivers and streams, and is the most common flood hazard in Oregon. The natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers.³⁶

Examples of riverine flooding events are the flooding in February 1996 and December 1964 and January 1965.

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only one to three feet. These areas are generally flooded by low velocity sheet flows of water.

What is the Effect of Development on Floods?

When structures or fill are placed in the floodway, water is displaced. Development raises the base flood elevation by forcing the river to compensate for the flow space obstructed by the inserted structures and/or fill. When structures or materials are added to the floodway, and no fill is removed to compensate, serious problems can arise. Floodwaters may expand beyond historic floodplain areas. As a result, other existing floodplain areas may experience floodwaters that rise above historic levels.

Local governments must manage development in floodplains and floodways to assure that any encroachments in the floodway or floodplain are minimized. This can be accomplished by cut-and-fill balance and other methods to prevent the rise of pre-development flood levels. Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses, and other facilities. Careful attention must be paid to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events without exacerbating flood levels.

How Are Flood-Prone Areas Identified?

Flood maps and flood insurance studies are often used to identify flood-prone areas. The National Flood Insurance Program (NFIP) was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses by requiring regulations that focus on building codes and "sound floodplain management."³⁷ In Yamhill County, the NFIP and related building code regulations are in effect. NFIP regulations (44 Code of Federal Regulations (CFR) Chapter 1, Section 60.3) require that all new construction in floodplains must be elevated at or above base flood level. The Oregon

Building Code requires new construction to be elevated to one foot above the base flood elevation.

Communities participating in the NFIP may adopt regulations that are more stringent than those contained in 44 CFR 60.3, but not less stringent.³⁸ In Yamhill County, all homes and other buildings legally constructed in the floodplain after January 1974 must be mitigated to NFIP standards with the first floor being elevated at least one foot above base flood level, or in the case of non-residential buildings, flood proofed to at least one foot above the base flood level.

FIRM Maps and Flood Insurance Studies

Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by the Federal Emergency Management Agency (FEMA), which delineates Special Flood Hazard Areas or floodplains where National Flood Insurance Program regulations apply. The FEMA map is a Flood Hazard boundary map that indicates flood-prone areas. A structure's risk is based on the elevation of its lowest floor. The maps are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. These maps illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases, they also include base flood elevations (BFEs) and areas located within the 500-year floodplain.

Flood Insurance Studies and FIRMs produced for the National Flood Insurance Program (NFIP) provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. FEMA flood maps are not entirely accurate. These studies and maps represent flood risk at the point in time when FEMA completed the studies, and do not incorporate planning for floodplain changes in the future due to new development. Although FEMA is considering changing that policy, it is optional for local communities. It should be noted that artificial and natural changes to the environment have changed the course of many of the streams and rivers in Yamhill County, as well as their associated floodplain boundaries.³⁹

Flood Mapping Methods and Techniques

Although many communities rely exclusively on FIRM's to characterize the risk of flooding in their area, there are some flood-prone areas that are not mapped but remain susceptible to flooding. These areas include locations next to small creeks, local drainage areas, and areas susceptible to artificial flooding.

By looking at historic stream flow records it is possible to estimate likely flood recurrence and frequency. This presents the probability of a given flood level occurring in a given year. It is not, however, a forecast. For example, a 100-year flood has a one in 100 chance of occurring in any given year.

Flow records are essential for establishing accurate local probabilities. Some flow records in Oregon date back about 100 years. Most areas have a much shorter record to examine, though. Models have been developed to examine the relationship between precipitation and various land uses to predict flood recurrence levels without actual flow data; however, they are not commonly used. Even in areas where flow records exist, predicting floods is difficult.

The state climatologic service examines weather trends for Oregon and believes the state has a 20-year wet and 20-year dry cycle. The significance of this for flood information is that data collected from a stream for the past 30-year period may contain 20 years of relatively dry conditions, and flood predictions would be different from data collected during a 20-year wet period.

Sources of error in determining flood levels:

1. The length of time records have been kept is significant because of long-term cycles and gradual changes over time. For a record-keeping period of 25 years, there is an 85 percent confidence level that the statistics will accurately represent expected flood levels.
2. Conditions in the watershed may change over time. For example, increasing urbanization tends to increase impervious surfaces and the intensity of flooding for the same amount of rain. This means the mapped 100-year floodplain may be out of date.

In order to address lack of data, many jurisdictions have taken efforts to develop more localized flood hazard maps. One method that has been employed includes using high-water marks from flood events or aerial photos, in conjunction with the FEMA maps, to better reflect the true flood risk.

The use of GIS (Geographic Information System) is becoming an important tool for flood hazard mapping. FIRM maps can be imported directly into GIS, which allows for GIS analysis of flood hazard areas. Communities find it particularly useful to overlay flood hazard areas on tax assessment parcel maps. This allows a community to evaluate the flood hazard risk for a specific parcel during review of a development request. Coordination between FEMA and local planning jurisdictions is the key to making a strong connection with GIS technology for the purpose of flood hazard mapping.

FEMA and the Environmental Systems Research Institute (ESRI), a private company, have formed a partnership to provide multi-hazard maps and information to the public via the Internet. ESRI produces GIS software, including ArcView® and ArcInfo®. The ESRI web site contains information on GIS technology and downloadable maps. The hazards maps provided on the ESRI site are intended to assist communities in evaluating geographic information about natural hazards. Flood information for most Oregon communities is available on the ESRI web site. Visit <http://www.esri.com> for more information.

Flood Hazard Assessment

Hazard Identification

Hazard identification is the first phase of flood-hazard assessment. Identification is the process of estimating: (1) the geographic extent of the floodplain i.e., the area at risk from flooding; (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. Floodplain maps provide detailed information that can assist jurisdictions in making policies and land-use decisions. Map 4 shows 100-year floodplains within Yamhill County. Map 5 shows the hydrologic subbasins within the county.

Vulnerability Assessment

Vulnerability assessment is the second phase of flood hazard assessment. It combines the floodplain boundary, generated through hazard identification, with an inventory of the property within the floodplain. It identifies the number of properties at risk from flooding, and the dollar value of the property at risk. Floodplain data for Yamhill County can be used to conduct a preliminary vulnerability assessment for flood and drainage hazard areas.

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 Yamhill County should include two components:

- (1) The amount of loss to both property and life that may result from a flood event (defined through the vulnerability assessment); and,
- (2) The number of flood events expected to occur over time.

Within the broad components of a risk analysis, it is possible to predict the severity of damage from a range of events. For example, a risk analysis can be conducted for both 25-year (smaller storm) floodplains (Drainage Hazard Areas), and 100-year (larger storm) floodplains. Over time, the Drainage Hazard Areas will flood more often than areas within a 100-year floodplain, exposing properties in Drainage Hazard Areas to a greater risk of flood damage. Depending on the impacts resulting from a 25-year flood event versus a 100-year flood event, however, and the amount of life and property exposed to the different hazard events, the level of risk may vary.

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. GIS technology and flow velocity models make it possible to map the damage that can be expected from both flood events over time. It is also possible to pinpoint the effects of certain flood events on individual properties.

Community Flood Issues

What is Susceptible to Damage During a Flood Event?

The largest impact on communities from flood events is the loss of life and property. During certain years, property losses resulting from flood damage are extensive. Development in the floodplains of Yamhill County will continue to be at risk from flooding because flood damage occurs on a regular basis throughout the county.

Property loss from floods strikes both private and public property. Public sector impacts (e.g., impacts to water and sewer systems, roads, etc.) statewide resulted in approximately two-thirds of the estimated damage from the 1996 flood events.⁴⁰

Property Loss Resulting from Flooding Events

The type of property damage caused by flood events depends on the depth and velocity of the floodwaters. Faster moving floodwaters can wash buildings off their foundations and sweep cars downstream. Pipelines, bridges, and other infrastructure can be damaged when high waters combine with flood debris. Extensive damage can be caused by basement flooding and landslide damage related to soil saturation from flood events. Seepage into basements or daylight basements is common during flood events, not only in or near floodplains, but also on hillsides and other areas that are far removed from floodplains.⁴¹ Most flood damage is caused by water saturating materials susceptible to loss (e.g., wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances).

Homes

Homes in frequently flooding areas can also suffer damage to septic systems and drain fields. Homes in rural floodplain areas often depend on private sewage treatment systems, and inundation of these systems may result in leakage of wastewater into surrounding areas. In many cases, flood damage to homes renders them unlivable. The federal government provides disaster funding for people who cannot, or should not, live in their homes because of damage or other disaster-related reasons.⁴²

Manufactured Homes

Statewide, the 1996 floods destroyed 156 housing units. Of those units, 61 percent were manufactured homes and trailers.⁴³ Many older manufactured home parks are located in floodplain areas. Manufactured homes have a lower level of structural stability than site-built homes. A site-built home's foundation and building frame are put together on site as opposed to manufactured homes, which are prefabricated off site. Manufactured homes in floodplain zones must be anchored to provide additional structural stability during flood events. Due to confusion in the late 1980's resulting from multiple changes in NFIP regulations, there are some communities that do not actively enforce anchoring requirements. Lack of enforcement of manufactured home construction standards in floodplains can contribute to severe damages from flood events.

Business/Industry

Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customer access to a business as well as close down a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages may include funding to assist owners in elevating or relocating flood-prone business structures.⁴⁴

Public Infrastructure

Publicly owned facilities are a key component of daily life for all citizens of the county. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services. Government can take action to reduce risk to public infrastructure from flood events, as well as adopt public policy that reduces risk to private property from flood events.

There are a variety of drinking water, surface water, and wastewater service providers throughout the county. During flooding events, the infrastructure that supports the water service providers in the county can be damaged and sometimes destroyed.

Buildings and Roads

In the wake of the 1996 flood events, damage to public buildings statewide represented 34 percent of total public losses.⁴⁵ Of particular importance during flood events are facilities located in flood hazard areas that are critical to government response and recovery activities.

During natural hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. Road systems in Yamhill County are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks often traverse floodplain and floodway areas. Transportation agencies responsible for road maintenance are typically aware of the roads at risk from flooding.

Bridges

Bridges in Yamhill County are key points of concern during flood events for two primary reasons:

- (1) They are often important links in road networks, crossing water courses or other significant natural features; and,
- (2) They can be obstructions in watercourses, inhibiting the flow of water during flood events.

The bridges in Yamhill County are state, county, city, or privately owned. A state-designated inspector must inspect all state, county and city bridges every two years, but private bridges are not inspected, and can be very dangerous. The inspections are rigorous, looking at everything from seismic capability to erosion and scour. The smaller, more economically feasible repairs to county bridges are the responsibility of the Yamhill County Public Works Roads Division. The larger projects require funding through the

Highway Bridge Replacement and Rehabilitation program (HBRR). HBRR provides 80 percent of funding, and the county is responsible for twenty percent.

There are 133 bridges maintained by Yamhill County. Of these, 46 bridges have been appraised as being deficient by the Oregon Department of Transportation (ODOT) and in need of repair or replacement

Structurally deficient bridges are rated for deck, superstructure, substructure, culvert, retaining wall, structural condition and waterway adequacy. Functionally obsolete bridges are rated for deck geometry, under clearance, approach roadway alignment, structural condition and waterway adequacy. If a bridge is both structurally deficient and functionally obsolete, it is classified only as structurally deficient.

Structurally Deficient Bridges in Yamhill County:⁴⁶

- Willamina Creek Road, Willamina Creek, #01751A
- Dukes Landing Road, Mosquito Creek, #11794
- Greenfell County Park Road, Baker Creek, #11503
- Stone Road, Bryan Creek, #11650
- Rex Brown Road, Panther Creek, #11605 (planned for replacement in 2003)
- Old Railroad Grade, North Yamhill River, #11526
- Deer Creek Park Road, Deer Creek, #11501

Yamhill County lists 22 ‘functionally obsolete bridges’, and nine ‘concrete shear-cracked bridges.’ The county conducts routine maintenance on its bridges, which includes but is not limited to rebuilding approaches, partial deck replacements, and patch concrete spalling.⁴⁷

Stormwater System

Local drainage problems are common throughout the region. Some communities have drainage master plans, and local public works departments are often aware of local drainage threats. Problems are often present where open ditches enter culverts or go underground into storm sewers. In addition, high water tables in some areas can mean wet crawl spaces, yards, and basements after storms pass because the accumulated water does not drain quickly into a stream or storm sewer. Filled ditches and swales near buildings can inhibit or prevent the flow of water and compound these problems. Inadequate maintenance, especially following leaf accumulation in the fall, can also contribute to the flood hazard in urban areas.⁴⁸

Floods and Natural Systems

Maintaining and restoring natural systems help mitigate the impact of flood events on the built environment. High water can be beneficial to the natural processes within a floodplain, and can benefit riparian areas.

Natural Systems

Maintaining and restoring natural systems help to mitigate the impact of flood events on the built environment. Flooding changes the natural environment and hydrology of an affected area. High water can be beneficial to the natural processes within a floodplain, and can benefit riparian areas. The best flood control techniques work to control water using the natural features such as wetlands that assist in water storage and bank stability.

Riparian Areas

Riparian areas are important transitional areas that link water and land ecosystems. Vegetation in riparian areas is dependent on stream processes, such as flooding, and often is composed of plants that require large amount of water, such as willows and cottonwood trees. Healthy vegetation in riparian buffers can reduce streamside erosion. During flood events, high water can cause significant erosion. Well-managed riparian areas can reduce the amount of erosion and help protect water quality during flood events.

Existing Flood Mitigation Activities

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

County Programs

Yamhill County Codes. Yamhill County uses building codes, zoning codes, and various planning strategies to address the Oregon Land Use

Planning Goal 7, which aims at restricting development in areas of known hazards, and applying the appropriate safeguards.

- **Mitigation Requirements:** All habitable floors must be one foot above floodplain, and developers must complete a Floodplain Development Permit Application as outlined in Subsection 6.070 (Flood Management District) of the Zoning Ordinance.
- **Affected Properties:** All development in the floodplain.
- **Mitigation Requirements:** Subsections of Section 6.070 of the Land Division Ordinance prohibits this type of development in identified hazard areas.
- **Affected Properties:** Development in areas that could be prone to flooding, inadequate drainage, steep slopes, rock formations, earthquake activity, landmass instability, pollutants or other factors or conditions likely to be harmful to the safety, and general health of future residents or the general public.
- **Mitigation Requirements:** Protection of Water Resources (Comprehensive Land Use Plan Section II, Subsection C(k): Land use management practices and nonstructural solutions to problems of erosion and flooding are preferred to structural solutions.).
- **Affected Properties:** All development in riparian areas.

Yamhill County works to mitigate problems regarding flood issues when they arise. Funding, time and labor are often unavailable, causing the problems to go unresolved. Some areas in the county are more susceptible to flooding issues, and have incurred repetitive losses.

City of McMinnville Program: City of McMinnville allows nothing but parks and open space in the city's floodplains.⁴⁹ The city bars development in the floodplains of the North and South Yamhill Rivers, Cozine Creek, Baker Creek and their tributaries. McMinnville is on the "cutting edge" in managing floodplain development, according to Mark Eberlein, mitigation programs specialist with FEMA responsible for Oregon communities.⁵⁰ The city's ordinance helps lower costs to the federal agency of cleaning up after disasters, and reduces costs to the federal National Flood Insurance Program (NFIP). Since 1978, the flood insurance program has paid claims of \$223 for damage in McMinnville, compared to \$234,000 for Yamhill County as a whole and \$42.2 million statewide. McMinnville also has substantial uplands, compared to Sheridan, where significant parts of the city are in the floodplain.

Keeping development out of the floodplain means that the areas are available for floodwater storage, minimizing the impact of flooding on neighbors. Protecting the river's floodplain can also benefit wildlife, something that is becoming increasingly important with potential federal Endangered Species Act protections for steelhead in the Yamhill River system. Letting the river flow naturally through its floodplain increases fish habitat.

Regional Programs

Flood Management Projects. Flood management structures can assist in regulating flood levels by adjusting water flows upstream of flood-prone areas. There are over 49 dams in Yamhill County holding millions of gallons of water in reservoirs. Releases of water from major reservoirs are designed to protect Yamhill County from high floodwaters. The largest reservoirs in Yamhill County include the following, none of which are primarily used for flood management:

- McGuire Dam (McMinnville Water & Light) – 3,760 acre feet (Nestucca River)
- McMinnville’s Haskins Creek Impounding Reservoir – 325 acre-feet (Haskins Creek)
- Baker, E.R. Reservoir (Private) – 225 acre-feet (tributary to Chehalem Creek)
- Hawn Creek District Improvement Corporation’s Hawn Creek Reservoir – 153 acre-feet (Hawn Creek)
- Bailey Nurseries’ [private] Walker Dam – 145 acre-feet (Bryan Creek)

State Programs

Goal 7: Areas Subject to Natural Disasters and Hazards.

Goal 7 of the Statewide Planning Goals, administered by the Department of Land Conservation and Development, requires local governments to adopt flood protection policies and controls. Goal 7 requires local governments to identify hazards and adopt appropriate safeguards for land use and development.

State of Oregon Floodplain and Floodway Removal/Fill Law

The Oregon Removal/Fill Law,⁵¹ which is administered by the Oregon Department of State Lands, requires a permit for activities that would remove or fill 50 cubic yards or more of material in waters of the state (e.g., streams, lakes, wetlands). The purpose of the law, enacted in 1967, is to protect public navigation, fishery and recreational uses of the waters of the state. “Waters of the state” are defined as “natural waterways including all tidal and non-tidal bays, intermittent streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and non-navigable, including that portion of the Pacific Ocean that is in the boundaries of this state.”⁵² The law applies to all landowners, whether private individuals or public agencies.

Yamhill County complies with the removal/fill laws when designing and building facilities, and has related responsibilities when dealing with private development and other construction projects. Any permittee who has graded or filled or proposes to grade or fill more than 50 cubic yards in a wetland is referred to DSL, the USACE, and Oregon Department of Fish and Wildlife (ODFW) for permitting and consultation.

State Building Codes Division (BCD)

The Building Codes Division administers state building codes for one and two-family dwellings and manufactured dwellings. The BCD requires that the lowest living space in a dwelling be elevated at least one foot above the base flood elevation. Other buildings are also regulated and required to be elevated a minimum one foot above base flood elevation or flood proofed.

Wetlands

Many floodplain and stream-associated wetlands absorb and store stormwater flows, which reduces flood velocities and stream bank erosion. Preserving these wetlands reduces flood damage and the need for expensive flood control devices such as levees. When the storms are over, many wetlands augment summer stream flows by slowly releasing the stored water back to the stream system.⁵³ Wetlands are highly effective at removing nitrogen, phosphorous, heavy metals, and other pollutants from water. For this reason, artificial wetlands are often constructed for cleaning stormwater runoff and for tertiary treatment (polishing) of wastewater. Wetlands bordering streams and rivers and those that intercept runoff from fields and roads provide this valuable service free of charge.⁵⁴

Oregon's Wetlands Protection Program

Oregon's Wetlands Program was created in 1989 to integrate federal and state rules concerning wetlands protection with the Oregon Land Use Planning Program. The Wetlands Program follows a mandate to work closely with local governments and the Department of State Lands (DSL) to improve land use planning approaches to wetlands conservation. A Local Wetlands Inventory (LWI) is one component of that program. DSL also develops technical manuals, conducts wetlands workshops for planners, and works directly with local governments on wetlands planning tasks.

Oregon Wetlands Joint Venture

The Oregon Wetlands Joint Venture is a coalition of private conservation, waterfowl, fisheries, and agriculture organizations working with government agencies to protect and restore important wetland habitats.⁵⁵

Federal Programs

National Weather Service

The National Weather Service provides flood watches, warnings, and informational statements for rivers throughout Yamhill County.⁵⁶

National Resources Conservation Service (NRCS), US Department of Agriculture

NRCS provides a suite of federal programs designed to assist state and local governments and landowners in mitigating the impacts of flood events. The Watershed Surveys and Planning Program and the Small Watershed Program provide technical and financial assistance to help participants solve natural resource and related economic problems on a watershed basis. The Wetlands Reserve Program and the Flood Risk Reduction Program provide financial incentives to landowners to put aside land that is either a wetland resource, or that experiences frequent flooding. The Emergency Watershed Protection Program (EWP) provides technical and financial assistance to clearing debris from clogged waterways, restoring vegetation, and stabilizing riverbanks. The measures taken under EWP must be environmentally and economically sound and generally benefit more than one property.

Federal Emergency Management Agency (FEMA) Programs

The Federal Emergency Management Agency (FEMA) resulted from the consolidation of five federal agencies that were dealing with different types of emergencies. Since then, many states and local jurisdictions have accepted this approach and changed the names of their organizations to include the words "emergency management." FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, and technical assistance.⁵⁷

According to FEMA, breaking the disaster-rebuild-disaster cycle in the United States is the agency's top priority.⁵⁸ FEMA sometimes tries to find permanent ways to avoid paying for damages by, for example, purchasing homes and removing them from floodplains.

National Flood Insurance Program (NFIP)

Every community with identified flood hazards is a member of the program. Thus, these local governments are required to adopt the NFIP's minimum requirements. Flood insurance is available to citizens in communities that adopt and implement NFIP siting and building standards. The standards are applied to development that occurs within a delineated floodplain, a drainage hazard area, and areas subject to inundation during a base flood event, and properties within 250 feet of a floodplain boundary. These areas are depicted on federal Flood Insurance Rate Maps (FIRMs) that are available through FEMA. Oregon's Department of Land Conservation and Development (DLCD) is the state's NFIP-coordinating agency.

The Community Rating System (CRS)

The Community Rating System (CRS) recognizes community floodplain management efforts that go beyond the minimum requirements of the NFIP. Property owners within cities could receive reduced NFIP flood insurance premiums if their city implements floodplain management practices that qualify it for a CRS rating. As of 2003, the City of Sheridan is the only community in Yamhill County that participates in the Community Rating System, thereby receiving lower flood insurance rates.⁵⁹ For further information on the CRS, visit FEMA's website at <http://www.fema.gov/nfip/crs.htm>.

Mitigation Plan Goals

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

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

Goal #1: EMERGENCY OPERATIONS

Goal Statement: Coordinate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures and with various other agencies, as appropriate.

Goal #2: EDUCATION & OUTREACH

Goal Statement: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.

Goal #3: PARTNERSHIPS

Goal Statement: Develop effective partnerships with public and private sector organizations and significant agencies and businesses for future natural hazard mitigation efforts.

Goal #4: PREVENTIVE

Goal Statements:

- Develop and implement activities to protect human life, commerce, and property from natural hazards.
- Reduce losses and repetitive damage for chronic hazard events while promoting insurance coverage for catastrophic hazards.

Goal #5: NATURAL RESOURCES UTILIZATION

Goal Statement: Link natural resources management, land use planning, and watershed planning with natural hazard mitigation activities to protect natural systems and allow them to serve natural hazard mitigation functions.

Goal #6: IMPLEMENTATION

Goal Statement: Implement strategies to mitigate the effects of natural hazards.

Flood Mitigation Action Items

The following mitigation action items were formulated through researching regional and national mitigation plans and natural hazards planning literature, and interviews with local stakeholders. Refinement of the Plan's action items occurred through discussions with the mitigation plan steering committee and through an open house that presented the proposed items to the public.

The flood mitigation action items provide direction on specific activities that organizations and residents in Yamhill County 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.

This section lists action items identified to reduce the risk from flood impacts in Yamhill County. These action items are designed to meet the Yamhill County Natural Hazards Mitigation Plan Goals.

Short-term (ST) Flood Action Items

Short-term flood action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

- **ST-FL #1: Develop better flood warning systems.**

- *Ideas for Implementation*

- Coordinate with appropriate organizations to evaluate the need for more stream gauges that are tied into National Weather Service flood forecasting activities; and;
- Distribute information regarding flooding to the general public efficiently.

Coordinating Organization:	Emergency Management, Public Works
Internal Partner:	Planning
External Partners:	Yamhill Basin Council, Yamhill SWCD, cities, OSU Extension Service, USGS, WRD, DSL, OEM, USACE, private river gauges
Timeline:	1 to 2 years
Plan Goals Addressed:	Emergency Operations; Partnerships; Preventive; Implementation

ST-FL #2: Maintain an inventory of all permitted dams built for flood control purposes in the county.

- *Ideas for Implementation*
- Update appropriate seismic criteria and procedures for evaluating performance of existing dams (varies with each permitted dam Emergency Action Plan);
 - Susceptibility to damage from flood events and/or earthquakes
 - Amount of water impounded
 - Type of construction
 - Year completed
 - Repair work performed

Coordinating Organization: Emergency Management
 External Partner: Yamhill Basin Council, USACE, WRD, DEQ, ODFW, NRCS
 Timeline: 1 to 2 years
 Plan Goals Addressed: Emergency Operations; Partnerships; Natural Resources Utilization

ST-FL #3: Implement the steps needed for Yamhill County to become a participant in the NFIP’s Community Rating System.

- *Ideas for Implementation*
- County officials should review the requirements for CRS participation and assess the steps needed to obtain certification; and
- County officials should pursue certification under the CRS program.

Coordinating Organization: Yamhill County
 Internal Partners: Planning, Emergency Management
 External Partner: Cities, DLCD, FEMA, OEM, OECDD
 Timeline: 1 to 3 years
 Plan Goals Addressed: Partnerships; Preventive; Natural Resources Utilization; Implementation

Long-term (LT) Flood Action Items

Long-term flood action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authorities.

LT-FL #1: Update and improve the Flood Insurance Rate (FIRM) Maps for Yamhill County as funding becomes available.

- *Ideas for Implementation*

- Work with FEMA on specific areas to update as funding becomes available.

Coordinating Organization: Community Development/Planning
 Internal Partner: GIS
 External Partner: DLCD, FEMA
 Timeline: 3 to 5 years
 Plan Goals Addressed: Partnerships; Preventive; Natural Resources Utilization; Implementation

LT-FL #2: Enhance data and mapping for floodplain information in the county, and identify and map flood-prone areas outside of designated floodplains.

Ideas for Implementation

- Apply for FEMA’s cooperative technical partnership using two-foot contour interval floodplain mapping data;
- Encourage the development of floodplain maps for all local streams not currently mapped on Flood Insurance Rate Maps or county maps, with special attention focused on mapping rural and unincorporated areas. The maps can be used for planning, risk analysis, and emergency management. The maps should show:
 1. The expected frequency of flooding,
 2. The level of flooding, and
 3. The areas subject to inundation.
- Pursue certification under the CRS program;
- Maintain maps of covered streams and creeks, including digitizing and creating a set of aerial maps of Yamhill County to more easily ‘ground truth’ collected data;
- Identify mapped culverts that historically create flooding problems and target them for retrofitting;
- Prepare an inventory of rural drainage problems;
- Coordinate with local agencies and organizations to obtain flood data and mapping resources;
- Build databases for HAZUS programs;
- Integrate the Capital Improvement Plan process with GIS;
- Include a map layer with arrows to indicate direction of stream/creek flow; and
- Add creek names that are missing and coordinate the naming of unnamed creeks.

Coordinating Organization: Outside UGB: GIS, Planning & Building Divisions, Public Works, Cities

Inside UGB: Cities
Internal Partners: Emergency Management
External Partners: NRCS, Yamhill SWCD, FEMA
Timeline: 3 to 5 years (as funding allows)
Plan Goals Addressed: Partnerships; Preventive; Natural Resources Utilization

LT-FL #3 Seek funding to train elected officials and recorders in small towns who have no emergency management background.

Such training should include:

- Why every emergency operations center is important;
- What needs to be done in a natural hazards emergency;
- Who responds to natural hazards emergencies;
- Public safety roles i.e., fire versus police public safety.

Coordinating Organization: Emergency Management
External Partner: Yamhill Fire Defense Board, OEM, FEMA
Timeline: On-going
Plan Goals Addressed: Education & Outreach; Partnerships

LT-FL #4 Provide flood event education and outreach to households and businesses.

Ideas for Implementation

- Identify and map vulnerable populations;
- Create a flood education curriculum, a speaker-training program, and outreach aimed at specific populations i.e., schools, households, businesses, etc;
- Collaborate with existing program managers to develop a flood education component that supports fish habitat and water quality education curricula;
- Identify existing watershed education programs and determine which programs would support a flood education component;
- Identify and provide mitigation guidance to owners of properties at risk from flooding;
- Develop a contact list of households and/or businesses that may have an interest in flood mitigation or flood response issues;
- Recruit individuals to speak to households and businesses/employees about flood issues;
- Encourage development of outreach programs to business organizations that must manage for flood protection;
- Raise awareness level of property owners and developers that impacts upstream result in impacts downstream, and lack of stormwater best management practices can result in an increase in flooding events;

- Educate the public on the need for them to maintain their private water quality and water detention facilities;
- Consider implementing tax incentives for property owner maintaining their private facilities;
- Educate private property owners on restoring natural systems within the floodplain to manage riparian areas and wetlands for flood abatement;
- Erect “monuments” over piped creeks throughout the county and floodplain elevation markers to bring flood awareness to home and business owners who live near them;
- Develop a “Clean Stream” sponsorship program, using the “Friends of Fanno Creek” model. Erect signage recognizing individuals, households, businesses, and organizations committed to the ongoing care of a waterway section. Develop a brochure as an educational tool;
- Pursue certification under the CRS program.

Coordinating Organization: Yamhill County
 Internal Partner: Planning, GIS, Assessor’s Office, Emergency Management
 External Partner: IISOI, Yamhill Basin Council, Yamhill SWCD, DLCD, OEM, cities, OECDD
 Timeline: On-going
 Plan Goals Addressed: Education & Outreach; Partnerships; Natural Resources Utilization; Implementation

LT-FL #5: Seek funding to retrofit culverts in Yamhill County with pipes designed for 50 to 100-year flood intervals.

Ideas for Implementation

- Work with Local, State and Federal agencies involved with riparian habitat restoration, as larger culverts tend to be ‘fish friendly’; and
- County officials should pursue certification under the CRS program.

Coordinating Organization: Public Works
 Internal Partner: Planning, Emergency Management
 External Partners: Cities, DSL, ODFW, USFWS, Yamhill SWCD, Yamhill Basin Council, OSU Extension
 Timeline: 1 to 3 years
 Plan Goals Addressed: Partnerships; Preventive; Natural Resources Utilization; Implementation

LT-FL #6: Coordinate with Yamhill SWCD, Oregon Department of Geology and Mineral Industries (DOGAMI), and National Oceanic and Atmospheric Administration (NOAA) to identify funding sources for further study of the gravel accumulations in the Willamette River at Lambert Bend.

Note:

- Gravel accumulations near Lambert Bend have altered the stream flow and continue to erode the riverbank in this area. Approximately 200 acres of land and two gravel operations are at risk of significant losses unless some type of solution is developed. The Willamette River floodplain is vital to both the agricultural and aggregate industries.

Ideas for Implementation

- Identify funding sources to assist with restoring floodplain function in the Lambert Bend area (RM 65) of the Willamette River

Coordinating Organizations: Yamhill SWCD, DOGAMI, NOAA
 Internal Partners: Planning, Emergency Management
 External Partners: DSL, ODFW, DEQ, Yamhill Basin Council, OSU Extension
 Timeline: 1 to 3 years
 Plan Goals Addressed: Partnerships; Preventive; Natural Resources Utilization; Implementation

LT-FL #7: Mitigate repetitive flood loss properties.

Ideas for Implementation

- Elevate dwellings on repetitive flood-loss properties above the mean base flood elevation;
- Acquire the property when purchasing the property from the property owner is more feasible than repetitive reparations following flood loss;
- Relocate dwellings and other affected structures outside of the flood plain.

Coordinating Partners: Cities in Yamhill County, Yamhill County
 Internal Partner: Tax Assessor
 External Partners: FEMA, OEM
 Timeline: On-going
 Plan Goals Addressed: Partnerships; Preventive; Implementation

Flood Mitigation Resources

County Resources

Yamhill Basin Council

Contact: Jamie Sheahan, Coordinator

2200 SW 2nd Street

McMinnville, OR 97128

Phone: 503-434-7447

Facsimile: 503-472-2459

Email: sheahanj@co.yamhill.or.us

Web site: www.co.yamhill.or.us/ybc

Yamhill Soil & Water Conservation District

Contact: Tim Stieber, District Manager

2200 SW 2nd Street

McMinnville, OR 97128

Phone: 503-472-6403

Facsimile: 503-472-2459

Web site: www.yamhillswcd.org

State Resources

Oregon's Wetlands Protection Program

Oregon's Wetlands Program was created in 1989 to integrate federal and state rules concerning wetlands protection with the Oregon Land Use Planning Program. The Wetlands Program has a mandate to work closely with local governments and the Department of State Lands (DSL) to improve the land use planning approaches to wetlands conservation. A Local Wetlands Inventory (LWI) is one component of that program. DSL also develops technical manuals and works directly with local governments on wetlands planning tasks.

Contact: Department of State Lands

Website: <http://statelands.dsl.state.or.us/>

Oregon Wetlands Joint Venture

The Oregon Wetlands Joint Venture is a coalition of private conservation, waterfowl, fisheries, and agriculture organizations working with government agencies to protect and restore important wetland habitats.

Contact: Oregon Wetlands Joint Venture

Website: <http://wetlands.dfw.state.or.us/>

Department of Land Conservation and Development (DLCD)

DLCD administers the state's Land Use Planning Program. The program is based on 19 Statewide Planning Goals, including Goal 7, Areas Subject to Natural Disasters and Hazards, with stream flooding as one of its major focus. DLCD serves as the federally designated agency to coordinate floodplain management in Oregon. DLCD also conducts various landslide related mitigation activities. In order to help local governments address natural hazards effectively, DLCD provides technical assistance such as conducting workshops, reviewing local land use plan amendments, and working interactively with other agencies.

Contact: Natural Hazards Program Manager, DLCD

Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540

Phone: 503-373-0050

Fax: 503-378-6033

Website: <http://www.lcd.state.or.us/hazards.html>

Oregon Floodplain Coordinator: 503-373-0050 ext. 255

Oregon State Police (OSP) – Office of Emergency Management (OEM)

OEM administers FEMA's Hazard Mitigation Grant Program, which provides post-disaster monies for acquisition, elevation, relocation, and demolition of structures located in the floodplain. OEM also administers FEMA's Flood Mitigation Assistance Program. This program provides assistance for NFIP-insured structures only. OEM also helps local jurisdictions to develop hazard mitigation plans. OEM is heavily involved in flood damage assessment and works mainly with disaster recovery and hazard mitigation programs. OEM provides training for local governments through workshops on recovery and mitigation. OEM also helps implement and manage federal disaster recovery programs.

Contact: Office of Emergency Management
Address: 3225 State Street, Salem, OR 97301
Phone: 503-378-2911
Fax: 503-373-7833
Website: <http://www.osp.state.or.us/oem/>
OEM Hazard Mitigation Officer: 503-378-2911 ext. 22247
Recovery and Mitigation Specialist: 503-378-2911 ext. 22240

Oregon Department of Fish and Wildlife (ODFW)

ODFW's mission is to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations. ODFW regulates stream activity and engages in stream enhancement activities.

Contact: ODFW
Address: 3406 Cherry Avenue NE, Salem, OR 97303
Phone: 503-947-6000
Website: <http://www.dfw.state.or.us/>
Email: ODFW.Info@state.or.us

Oregon Department of State Lands (DSL)

DSL is a regulatory agency, responsible for administration of Oregon's Removal-Fill Law. This law is intended to protect, conserve, and make the best use of the state's water resources. It generally requires a permit from DSL to remove, fill, or alter more than 50 cubic yards of material within the bed or banks of waters of the state. Exceptions are in-state scenic waterways and areas designated essential salmon habitat, where a permit is required for all in-stream activity, regardless of size. DSL and the US Army Corps of Engineers may issue these permits jointly.

Contact: Department of State Lands
Address: 775 Summer Street NE, Suite 100, Salem, OR 97301-1279
Phone: 503-378-3805
Fax: 503-378-4844
Website: <http://statelands.dsl.state.or.us/>
Assistant Director: 503-378-3805, ext. 279
Western Region Manager: 503-378-3805, ext. 244

Oregon Water Resources Department (WRD)

The WRD's mission is to serve the public by practicing and promoting wise long-term water management. The WRD provides services through 19 water master offices throughout the state. In addition, five regional offices

provide services based on geographic regions. The Department's main administration is performed from the central office in Salem.

Contact: WRD
Address: 725 Summer Street SE, Salem, OR 97301-1271
Phone: 503-986-0900
Website: <http://www.wrd.state.or.us/index.shtml>

OSU Watershed Extension Program

The OSU Watershed Extension Program's mission is to increase the capacity of Oregon watershed groups and communities for conserving, improving, protecting and sustaining watershed functions and values. Increasing capacity is achieved through research-based education, skill-building projects, and new partnerships among residents, local organizations, businesses, agencies, and educational institutions.

Contact: Watershed Extension Program, Central Staff
Tara Nierenberg, Statewide Program Coordinator
Address: Oregon State University, Watershed Extension
307 Ballard Hall, Corvallis, OR 97331-3604
Phone: 541-737-8715
Email: Tara.Nierenberg@oregonstate.edu
Website: <http://seagrant.oregonstate.edu/wsep>

Regional Resources

Northwest Regional Floodplain Managers Association (NORFMA)

NORFMA is a nonprofit organization for regional networking and support on issues of environmental quality, economic sustainability, and scientific discovery on a watershed basis. The Association provides a channel for regional communication and cooperation in Oregon, Washington, Idaho, British Columbia and Alaska. NORFMA promotes educational programs on floodplain and watershed management topics, increases public awareness of the value and function of floodplains, and encourages government involvement in programs to reduce flood damages and to protect, manage, and restore floodplains.

The NORFMA website is a resource for floodplains, fisheries, and river engineering information for the Northwest. This site provides technical information, articles, and Internet links in the field of floodplain and fisheries management.

Contact: Christine Valentine, MFIP Coordinator – Oregon Regional Rep.
Address: Department of Land Conservation and Development (DLCD)
635 Capitol Street NE, Suite 150, Salem, OR 97301
Phone: 503-373-0050 ext. 250
Fax: 503-378-5518
Website: <http://www.norfma.org>

Federal Resources

Federal Emergency Management Agency (FEMA)

FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, and technical assistance. FEMA also operates the National Flood Insurance Program. The mission of FEMA is “to reduce loss of life and property and protect the

nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery." FEMA Region X serves the northwestern states of Alaska, Idaho, Oregon, and Washington.

Contact: FEMA, Federal Regional Center, Region 10
Address: 228th St. SW, Bothell, WA 98021-9796
Phone: 425-487-4678
Website: <http://www.fema.gov>

To obtain FEMA publications:
Phone: 800-480-2520

To obtain FEMA maps:
Contact: Map Service Center
Address: P.O. Box 1038, Jessup, Maryland 20794-1038
Phone: 800-358-9616
Fax: 800-358-9620

The National Flood Insurance Program

The National Flood Insurance Program (NFIP) Website is a subsection of the Federal Emergency Management Agency (FEMA) site (<http://www.fema.gov>). The NFIP information is intended for both the general public and the many organizations and agencies participating in the program. It includes information about the NFIP and other flood disaster assistance available from the Federal Government. It also provides access to the newly revised NFIP booklet: *Answers to Questions about the National Flood Insurance Program*.

Contact: The National Flood Insurance Program
Phone: 888-FLOOD29 or 800-427-5593
Website: <http://www.fema.gov/nfip>

United States Geological Survey (USGS)

The USGS website provides current stream flow conditions at USGS gauging stations in Oregon and throughout the Pacific Northwest. The Oregon USGS office is responsible for water resources investigations for Oregon and part of southern Washington. Their office cooperates with more than 40 local, state, and federal agencies in Oregon. Cooperative activities include water resources data collection and interpretive water availability and water quality studies.

Contact: USGS Oregon District Office
Address: 10615 S.E. Cherry Blossom Dr., Portland, OR 97216
Phone: 503-251-3200
Fax: 503-251-3470
Website: <http://oregon.usgs.gov>
Email: info-or@usgs.gov

USGS Water Resources

This web page offers current US water news; extensive current (including real-time) and historical water data; numerous fact sheets and other publications; various technical resources; descriptions of ongoing water survey programs; local water information; and connections to other sources of water information.

Contact: USGS Water Resources
Phone: 503-251-3200
Website: <http://water.usgs.gov> or <http://water.usgs.gov/public/realtime.html>
Email: info-or@usgs.gov

Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. The closest dam to Yamhill County owned by the Bureau of Reclamation is Scoggins Dam in Washington County. The Bureau prepares emergency action plans for events at the dam.

Contact: Bureau of Reclamation, Pacific Northwest Region
Address: 1150 N. Curtis Road, Boise, ID 83706-1234
Phone: 208-378-5021
Website: <http://www.pn.usbr.gov/contact/index.shtml>

Army Corps of Engineers

The Corps of Engineers administers a permit program to ensure that the nation's waterways are used in the public interest. Any person, firm, or agency planning to work in waters of the United States must first obtain a permit from the Army Corps of Engineers. In Oregon, joint permits may be issued with the Department of State Lands. The Corps is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation.

Contact: US Army Corps of Engineers-Portland District, Floodplain Information Branch

Address: P.O. Box 2946, Portland, OR 97208-2946 (mail)
Robert Duncan Plaza (in person)
333 SW First Avenue, Portland, OR 97204
Phone: 503-808-5150
Fax: 503-808-4875
Website: <http://www.nwp.usace.army.mil/>

National Resources Conservation Service (NRCS), US Department of Agriculture (USDA)

NRCS provides a suite of federal programs designed to assist state and local governments, and landowners in mitigating the impacts of flood events. NRCS assists owners of America's private land with conserving their soil, water, and other natural resources. NRCS delivers technical assistance based on sound science and suited to a customer's specific needs. NRCS partners with local conservation districts and serves almost every county in the nation, and the Caribbean and Pacific Basin. Participation in their programs is voluntary.

The Watershed Surveys and Planning Program and the Small Watershed Program provide technical and financial assistance to help participants solve natural resource and related economic problems on a watershed basis. The Wetlands Reserve Program and the Flood Risk Reduction Program provide financial incentives to landowners to put aside land that is either a wetland resource or experiences frequent flooding. The Emergency Watershed Protection Program (EWP) provides technical and financial assistance for clearing debris from clogged waterways, restoring vegetation, and stabilizing riverbanks. The measures taken under the EWP must be environmentally and economically sound and generally benefit more than one property.

Contact: USDA-NRCS, McMinnville Service Center
(Farm Service Agency, NRCS, Conservation District)
Address: 2200 SW Second Street, McMinnville, OR 97128-5444
Phone: 503-472-1474
Fax: 503-472-2459
Website: <http://www.nrcs.usda.gov/>

National Weather Service, Portland Bureau

The National Weather Service provides flood watches, warnings, and informational statements for rivers in Yamhill County. The NWS is the sole U.S. official voice for issuing warnings during life threatening weather situations. The NWS Portland Bureau provides river level information online and by phone.

Contact: National Weather Service, Portland Bureau
Address: 5241 NE 122nd Avenue, Portland, OR 97230-1089
Phone: 503-326-2340
Fax: 503-808-4875
Website: http://www.wrh.noaa.gov/Portland/public_hydro/

StormReady, National Weather Service

StormReady is a nationwide community preparedness program that uses a grassroots approach to help communities develop plans to handle all types of severe weather – from tornadoes to tsunamis. The program encourages communities to take a new, proactive approach to improving local hazards operations by providing emergency managers with clear-cut guidelines on how to improve their weather operations.

Contact: StormReady, National Weather Service
Phone: 503-261-9247
Email: Tyree.Wilde@noaa.gov
Website: <http://www.stormready.noaa.gov/>

Office of Hydrology, National Weather Service

The National Weather Service's Office of Hydrology (OH) and its Hydrological Information Center offer information on floods and other aquatic disasters. This site offers current and historical data including an archive of past flood summaries, information on current hydrologic conditions, water supply outlooks, an Automated Local Flood Warning Systems Handbook, Natural Disaster Survey Reports, and other scientific publications on hydrology and flooding.

Contact: Office of Hydrology, National Weather Service
Website: <http://www.nws.noaa.gov/oh> or <http://www.nws.noaa.gov/oh/hic/>

Additional Resources

The Association of State Floodplain Managers

The Association of State Floodplain Managers is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program, and flood preparedness, warning, and recovery. ASFPM fosters communication among those responsible for flood hazard activities, provides technical advice to governments and other entities about proposed actions or policies that will affect flood hazards, and encourages flood hazard research, education, and training. The ASFPM web site includes information on how to become a member, the organization's constitution and bylaws, directories of officers and committees, a publications list, information on upcoming conferences, a history of the association, and other useful information and Internet links.

Contact: The Association of State Floodplain Managers
Address: 2809 Fish Hatchery Road, Madison, WI 53713
Phone: (608) 274-0123
Fax: 608-274-0696
Website: <http://www.floods.org>

The Floodplain Management Association

The Floodplain Management website was established by the Floodplain Management Association (FMA) to serve the entire floodplain management community. It includes full-text articles, a calendar of up-coming events, a list of positions available, an index of publications available free or at

nominal cost, a list of associations, a list of firms and consultants in floodplain management, an index of newsletters dealing with flood issues (with hypertext links if available), a section on the basics of floodplain management, a list of frequently asked questions (FAQs) about the Website, and, of course, a copious catalog of Web links.

Contact: Floodplain Management Association
Website: <http://www.floodplain.org>
Email: admin@floodplain.org

FEMA's List of Flood Related Websites

This site contains a long list of flood related Internet sites from "American Heritage Rivers" to "The Weather Channel," and is a good starting point for flood information on the Internet.

Contact: Federal Emergency Management Agency.
Phone: 800-480-2520
Website: <http://www.fema.gov/nfip/related.htm>

Insurance Services Offices, Inc. (ISO)

The Building Codes Effectiveness Grading Schedule (BCEGS), developed and operated by ISO assesses the building codes in effect in a community and how the community enforces them, with special emphasis on mitigation of losses from natural disasters. In BCEGS, each community is assigned a grade of 1 (best) to 10 (no recognized program), with two ratings for each jurisdiction, commercial and residential. Coordinating floodplain management with local building codes has advantages with regard to permits, inspections, other developments such as grading, post-flood inspections, application of floodplain management requirements, special certifications, construction quality and modifications to existing buildings.

Contact: Insurance Services Offices, Inc. (ISO)
Government Relations Office
Address: 388 Market Street, Suite 750, San Francisco, CA 94111-5314
Phone: 415-434-4599 or 1-800-888-4476
Fax: 415-398-8064
Website: <http://www.iso.com/>
Email: info.sanfrancisco@iso.com

Publications

Planning for Natural Hazards: The Oregon Technical Resource Guide, Department of Land Conservation and Development (July 2000).

Produced by the Community Planning Workshop for the Department of Land Conservation and Development, this is a natural hazards planning and mitigation resource for Oregon cities and counties. It provides hazard-specific resources and plan evaluation tools. The document was written for local government employees and officials. The Technical Resource Guide includes a natural hazards comprehensive plan review, a hazard mitigation legal issues guide, and five hazard-specific technical

resource guides, including: flooding, wildfires, landslides, coastal hazards, and earthquakes. This document is available online. You can also write, call, or fax to obtain this document:

Contact: Natural Hazards Program Manager, Department of Land Conservation and Development
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: <http://www.lcd.state.or.us/hazards.html>

NFIP Community Rating System Coordinator's Manual. FEMA/NFIP. Indianapolis, IN.

This informative brochure explains how the Community Rating System works and what the benefits are to communities. It explains in detail the CRS point system, and what activities communities can pursue to earn points. These points then add up to the "rating" for the community, and flood insurance premium discounts are calculated based upon that "rating." The brochure also provides a table on the percent discount realized for each rating (1-10). Instructions on how to apply to be a CRS community are also included.

Contact: NFIP Community Rating System
Phone: 800-480-2520 or 317-848-2898
Website: <http://www.fema.gov/nfip/crs.htm>

Floodplain Management: A Local Floodplain Administrator's Guide to the NFIP. FEMA-Region 10. Bothell, WA.

This document discusses floodplain processes and terminology. It contains floodplain management and mitigation strategies, as well as information on the NFIP, CRS, Community Assistance Visits, and floodplain development standards.

Contact: National Flood Insurance Program
Phone: 800-480-2520
Website: <http://www.fema.gov/nfip/>

Morris, Marya. *Subdivision Design in Flood Hazard Areas.* PAS 473. Chicago, IL: APA. 1997.

This report explains planning techniques that minimize problems in a flood hazard area. Includes selected ordinances and policies.

Contact: American Planning Association, Planners Book Service
Address: 122 S. Michigan Ave., Suite 1600, Chicago, IL 60603
Phone: 312-786-6344
Fax: 312-431-9985
Website: www.planning.org

Flood Hazard Mitigation Planning: A Community Guide, (June 1997), Massachusetts Department of Environmental Management.

This informative guide offers a ten-step process for successful flood hazard mitigation. Steps include: map hazards, determine potential

damage areas, take an inventory of facilities in the flood zone, determine what is or is not being done about flooding, identify gaps in protection, brainstorm alternatives and actions, determine feasible actions, coordinate with others, prioritize actions, develop strategies for implementation, and adopt and monitor the plan.

Contact: Massachusetts Flood Hazard Management Program
Phone: 617-626-1250
Website: <http://www.magnet.state.ma.us/dem/programs/mitigate>

Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials, (February 1987), FEMA-116.

This guidebook offers a table on actions that communities can take to reduce flood losses. It also offers a table with sources for floodplain mapping assistance for the various types of flooding hazards. There is information on various types of flood hazards with regard to existing mitigation efforts and options for action (policy and programs, mapping, regulatory, non-regulatory). Types of flooding that are covered include alluvial fan, areas behind levees, areas below unsafe dams, coastal flooding, flash floods, fluctuating lake level floods, ground failure triggered by earthquakes, ice jam flooding, and mudslides.

Contact: Federal Emergency Management Agency
Phone: 800-480-2520
Website: <http://www.fema.gov>

Oregon Model Flood Damage Prevention Ordinance, (January 1999), FEMA/DLCD.

This is an example of how to write an ordinance that complies with NFIP/FEMA standards. Communities can simply adopt this ordinance, word for word, filling in the blanks specific to their community or jurisdiction.

Contact: Department of Land Conservation and Development (DLCD)
Phone: 503-373-0050
Website: <http://www.lcd.state.or.us/hazards.html>

Flood – Endnotes

¹ Oregon State Police, Oregon Emergency Management. 2000. Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan*.

² Id.

³ “County’s Past Burns Brightly.” *News Register*. September 10, 2002.

⁴ Id.

⁵ Marion County Emergency Management. Available on the World Wide Web (<http://publicworks.co.marion.or.us/emergencymanagement/>).

⁶ The USGS gauging station at Whiteson has documented flows on the South Yamhill River from 1941 to 1991. In 1991, the USGS moved their gauge to McMinnville at the Three-Mile Land Bridge.

⁷ Oregon Statesman. December 25, 1964.

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- ⁸ Carlson, Kathleen. "Christmas Week Flood Brings Major Flooding, December 1964." *Salem Online History Project*, available on the World Wide Web (<http://www.salemhistory.net/home.htm>)
- ⁹ *Oregon Statesman*. January 16, 1974. Page 1.
- ¹⁰ *News Register*. January 16, 1974. Page 1
- ¹¹ *Id.*
- ¹² *Id.*
- ¹³ *Id.*
- ¹⁴ *Oregon Statesman*. January 16, 17 1974.
- ¹⁵ Taylor, George H.. *The Great Flood of 1996*. Available on the World Wide Web at (<http://www.ocs.oregonstate.edu/index.html>). Accessed August 19, 2004.
- ¹⁶ *Id.*
- ¹⁷ "Walk to Mailbox Turns Deadly." *Statesman Journal*. February 18, 1996. Page E12.
- ¹⁸ *Statesman Journal*. February 7, 1996. pg. 1.
- ¹⁹ Burnham, Bryan. Public Works Director, City of Carlton. Personal Interview December 22, 2004.
- ²⁰ Putnam, Bret. Dayton RFPD Fire Chief. Personal Interview November 15, 2004.
- ²¹ Mid-Willamette Valley Council of Governments. February 1996. *Flood Economic Recovery Coordination Project for Marion, Polk, and Yamhill Counties Oregon*. FEMA DR-1099-OR. Salem, OR.
- ²² "Pineapple Express Drenches Oregon Again." *Statesman Journal*. November 20, 1996.
- ²³ National Flood Insurance Program. April 2002. Available on the World Wide Web (<http://www.fema.gov/nfip>).
- ²⁴ Meacham, James E. and Erick B. Steiner. November 2002. *Atlas of Oregon*. Eugene, OR: University of Oregon Press.
- ²⁵ Yamhill Basin Council, Yamhill and Polk Counties, Oregon. June 2001. *Chehalem Watershed Assessment*.
- ²⁶ Oregon State Police, Oregon Emergency Management. 2000. Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan*.
- ²⁷ Oregon Climate Service. Available on the World Wide Web (http://www.ocs.orst.edu/pub ftp/climate_data/tpcp/tpcp5384.up). Accessed August 9, 2004.
- ²⁸ Taylor, George H. and Chris Hannan. 1999. *The Climate of Oregon*. Corvallis, Oregon: Oregon State University Press.
- ²⁹ US Department of Agriculture, Natural Resources Conservation Service. January 1974. *Soil Survey of Yamhill Area, Oregon*. Washington, D.C.: U.S. Government Printing Office.
- ³⁰ *Id.*
- ³¹ *Id.*

-
- ³² Federal Emergency Management Agency. June 2003. Available on the World Wide Web (http://www.fema.gov/fhm/fq_term.shtm#frequent4).
- ³³ Yamhill County Webpage, Zoning Ordinance, Definitions (Section 200), available on the World Wide Web (http://co.yamhill.or.us/plan/planning/ordinance/zoning_0200). Accessed August 16, 2004.
- ³⁴ Oregon Department of Land Conservation and Development. July 2000. *Planning for Natural Hazards: The Oregon Technical Resource Guide*. Ch. 4.
- ³⁵ G&E Engineering Systems Report 32.07.01, Revision 0. September 23, 1998. *All Hazard Mitigation Plan*. Clackamas County, Oregon.
- ³⁶ OR Department of Land Conservation and Development. July 2000. *Planning for Natural Hazards: The Oregon Technical Resource Guide*. Ch. 4.
- ³⁷ FEMA, Region 10. *Floodplain Management: a Local Administrator's Guide to the National Flood Insurance Program*.
- ³⁸ Id.
- ³⁹ G&E Engineering Systems Report 32.07.01, Revision 0. September 23, 1998. *All Hazard Mitigation Plan*. Clackamas County, Oregon.
- ⁴⁰ Oregon State Police, Office of Emergency Management. June 2000. The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*.
- ⁴¹ Id.
- ⁴² Id.
- ⁴³ Id.
- ⁴⁴ Id.
- ⁴⁵ Oregon State Police, Office of Emergency Management. June 2000. The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*.
- ⁴⁶ Yamhill County Public Works, Yamhill County Bridges. Available on the World Wide Web <http://www.co.yamhill.or.us/pubworks/index.asp?sel=13>. Accessed September 17, 2004.
- ⁴⁷ Id.
- ⁴⁸ Metro. June 1999. *Regional Hazard Mitigation Policy and Planning Guide*. Portland, OR.
- ⁴⁹ Pat Forgey. March 4, 1999. "Other Floods Other Solutions." *News-Register*. McMinnville, Oregon.
- ⁵⁰ Id.
- ⁵¹ ORS 196.795-990
- ⁵² ORS 196.800(15)
- ⁵³ Oregon Department of State Lands. May 2001. *Wetlands Functions and Assessment*. Available on the World Wide Web <http://statelands.dsl.state.or.us/fact5.pdf>.
- ⁵⁴ Id.
- ⁵⁵ Oregon Wetlands Joint Venture. May 2001. Available on the World Wide Web (<http://www.dfw.state.or.us/ODFwhtml/Wetlands/about.htm>).
- ⁵⁶ <http://www.nws.noaa.gov/>
- ⁵⁷ <http://www.fema.gov>

⁵⁸ Pat Forgey. March 4, 1999. "Other Floods Other Solutions." *News-Register*. McMinnville, Oregon.

⁵⁹ FEMA Region X.