Section 10:
Windstorms (Including Tornadoes)

Why are Windstorms a threat to Yamhill County?

When a strong windstorm strikes a community, it leaves behind a distinctive trail. Trees toppled over on buildings and cars, downed power lines crisscrossing the roads, and widespread power outages are a few of the signs that a windstorm has struck. After such an event, it can take communities days, weeks, or even longer to return to normal activities. In addition to costly structural damages, windstorms can cause injury or even death.

A windstorm in 1995 damaged numerous homes, businesses, and public facilities, generated tons of disaster-related debris, and cost local governments several million dollars to deal with the storm's impact throughout the state. Oregon received $2.8 million through the Federal Emergency Management Agency's (FEMA) Public Assistance program to repair and restore damaged infrastructure. Approximately $420,000 was allocated toward mitigation activities through FEMA's Hazard Mitigation Grant Program.

Similarly, a storm in February 2002 resulted in a Presidential Disaster Declaration for five Oregon Counties, and nine other counties, including Yamhill County, were declared contiguous Counties. Such a declaration allowed family farmers to apply for loans to assist with storm related damage.

Historical Windstorm Events

Regional

The Mid/Southern Willamette Valley, including Yamhill County, has experienced several powerful windstorms over the past several decades. Most of these storms resulted in building and property damage, utility failures, and in some cases injury or death. Table 10-1 outlines the most severe windstorms recorded in the region.

Table 10-1: Significant Wind Storms Affecting The Mid / Southern Willamette Valley, 1931-2002

Date	Affected Area	Characteristics
Apr., 1931	Western Oregon	Unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber.
Nov. 10-11, 1951	Statewide	Widespread damage; transmission and utility lines; Wind speed 40-60 mph; Gusts 75-80 mph
Dec., 1951	Statewide	Wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
Dec., 1955	Statewide	Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines
Nov., 1958	Statewide	Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees
Oct., 1962	Statewide	Columbus Day Storm; Oregon's most destructive storm to date. 116 mph winds in Willamette Valley. Estimated 84 houses destroyed, with 5,000 severely damaged. Total damage estimated at $170 million
Mar., 1971	Most of Oregon	Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane Co.
Nov., 1981	Most of Oregon	Highest winds since 10/62. Wind speed 71 mph in Salem. Marinas, airports and bridges severely damaged
Jan., 1990	Statewide	Heavy rain with winds exceeding 75-mph. Significant damage. One fatality.
Dec., 1995	Statewide	Followed path of Columbus Day Storm. Wind speeds 62 mph in Willamette Valley. Damage to trees (saturated soil a factor) and homes. (FEMA-1107-DR-OR)
Nov., 1997	Western Oregon	Wind speed 52 mph in Willamette Valley. Trees uprooted. Considerable damage to small airports.
Feb., 2002	Western Oregon	Strongest storm to strike western Oregon in several years. Many downed power lines (trees); damage to buildings; water supply problems (lack of power). Estimated damage costs: $6.14 million. (FEMA-1405-DR-OR)

Source: Taylor, George H., and Ray Hatton, The Oregon Weather Book (1999), pp.151-157, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon, February 7, 2002 (FEMA-1405-DR-OR)

Yamhill County

Windstorms have historically been a threat to Yamhill County and most of the storms described in Table 10-1 also impacted Yamhill County. The following storms, though not exclusive to Yamhill County, caused particularly severe damage to the County.

April 1931 Windstorm

This storm, with winds up to 40 mph and gales up to 75 mph, blew moving vehicles off roadways.[1] The storm consisted of northeastern winds that blew tons of dust from Eastern Oregon down the Columbia Gorge where it then settled over much of the Willamette Valley. The dust reduced visibility to distances less than one mile. The winds also caused several devastating fires. In Mehama, several buildings burned completely, including homes, a large store and the Stayton Bank. There were forest fires throughout the Willamette Valley, and one as large as 3,000 acres in Linn County, were whipped up by the winds.[2]

December 1951 Windstorm

This mid-century storm with winds recorded at 57 mph and gusts up to 76 mph resulted in four Oregon deaths. Power outages for up to a day were recorded at Union Hill, Waldo Hill, Victor Point, Scotts Mills, Silverton Hills and Marquem. The North and South Santiam highways and the Siuslaw highway were closed due to fallen trees.[3]

October 12, 1962 (The Columbus Day Storm)

The Columbus Day storm in 1962 produced sustained winds and gusts as high as 90 mph[4]. It was the most destructive windstorm ever recorded in Oregon, both in terms of loss of life and property damage. Damage was most severe in the Willamette Valley where the storm killed thirty-eight people and was responsible for three deaths in the county.[5] The storm caused upwards of $200 million in damage (over $800 million in today's dollars) statewide.[6] The storm swept across 75,000 square miles of Northern California, Oregon and Washington and carved a swath of destruction about a thousand miles long and 125 miles wide.[7]

The storm had its eye on Yamhill County and the Willamette Valley. The valley, framed by two mountain ranges, provided a natural funnel for the wind. Storm damage estimate for Yamhill County exceeded $15 million.8 Yamhill County was designated a "catastrophe area" by the insurance industry.[9] Several hundred farm buildings in the county were destroyed, and about 175,000 prune trees and 50,000 walnut trees were uprooted.[10] OSU Extension estimated that the county might have lost half its prune and walnut acreage.[11]

In downtown McMinnville, huge metal sheets off the roof of the First National Bank building sailed down Third Street.[12] Great pieces of metal from the roof of the Elks Lodge hurtled along the street.[13] Dayton teen-agers were headed to Salem in their car when trees were blown across the car on Wallace Road. Both teens died as a result of the accident.[14]

A 39-year-old contractor attempted to cover hay in a large barn on his farm west of McMinnville as protection from rain when a heavy beam collapsed, hitting him in the back. He died later in a hospital.[15] Streetlights were out at Fourth and Evans in McMinnville, when a

McMinnville resident was killed after being struck by an automobile.[16] His death was attributed to the storm.

Jack Coleman, Yamhill County American Red Cross director, said that almost all the buildings in the county incurred some damage and estimated average damage at about $300 per home.

Extensive damage occurred between McMinnville and Carlton, where a several-mile-wide swath cut across several farms.[17] Numerous power and telephone liens were downed in the storm.[18] McMinnville City Water and Light Department were kept busy replacing poles, clearing roads and restoring communications.[19] Approximately 200 trees were downed at Wortman Park during the storm.[20]

Hundreds of thousands of homes were without power for short periods of time, while others were without power for two to three weeks. More than 50,000 homes were seriously damaged, and nearly 100 were completely destroyed. The storm destroyed fruit and nut orchards and killed scores of livestock. 175,000 prune trees and 50,000 walnut trees, and sseveral hundred farm buildings were destroyed in the storm.[21]

March 25-26, 1971

This March windstorm produced winds up to 50 mph and hit the area particularly hard while also causing power outages for approximately 60 homes in the mid-Willamette Valley[22].

November 13-15, 1981

November 1981 saw two successive windstorms on the 13th and 14th. Sustained winds in the Willamette Valley reached 52 mph and gusts were recorded at 71 mph.[23] Eleven people were killed and $50 million in damage was reported as a result of the two storms. Numerous injuries resulted from wind-blown debris in western Washington and Oregon.[24]

Across the Pacific Northwest, hundreds of downed trees and power lines caused massive power outages and roof damage. The storm caused 500,000 Oregon residents to lose power[25].

December 12, 1995

This windstorm caused such widespread damage from downed trees and power and communication outages that Governor Kitzhaber declared a state of emergency for all of western Oregon and called 150 National Guard Troops to assist residents and public utility crews.[26]

The storm caused three deaths. The windstorm resulted in over one million dollars in damage in the mid-Willamette Valley.[27] Some of this damage included environmental damage as “millions of gallons of raw sewage” flowed into Salem area creeks and the Willamette River.[28]

In Salem, the National Weather Service reported average winds of 40 mph with gusts up to 59 mph. In the region between Salem and Corvallis, 7500 people lost phone service. In addition to power and

phone outages, Interstate 5 was shut down to truck traffic for several hours.[29]

February 7, 2002

The most recent of large windstorm events arrived in the Willamette Valley with wind gusts up to 70 mph causing 27,000 power outages statewide.[30] The severity of this storm prompted President Bush to issue Major Disaster Declarations for five Oregon Counties and nine other Oregon Counties were named contiguous Counties, allowing family farmers to receive loans to address storm related damage.[31] Polk and Marion Counties were two of the nine, named contiguous counties, but Yamhill was not named.

Characteristics of Windstorms in Yamhill County

The most frequent surface winds in Oregon are from the southwest. These widespread winds are associated with storms moving onto the coast from the Pacific Ocean. Winds coming from the south are the most destructive. The Columbus Day Storm of 1962 was an example of this type of windstorm. Chinook winds are strong easterly winds coming out of the Columbia Gorge. Chinook is a native Indian word meaning "snow eater." The Chinook wind is a warm dry wind that often leads to the rapid disappearance of snow, and can gust up to 100 miles per hour. The gusts are caused by rapid atmospheric pressure changes. Studies have shown that these changes can result in physiological and psychological reactions in humans such as headaches and increased irritability.

West winds generate from the Pacific Ocean and are strong along the coast, but slow down inland due to the obstruction of the Coastal and Cascade mountain ranges.[32] Prevailing winds in Oregon vary with the seasons. In summer, the most common wind directions are from the west or northwest; in winter, they are from the south and east. Local topography, however, plays a major role in affecting wind direction. For example, the north-south orientation of the Willamette Valley channels the wind most of the time, causing predominately north and south winds.[33]

Tornadoes

Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating winds and strong vertical motion, which possess remarkable strength and cause widespread damage. Wind speeds in excess of 300 mph have been observed within tornadoes, and it is suspected that some tornado winds exceed 400 mph. The low pressure at the center of a tornado can destroy buildings and other structures it passes over. Tornadoes are most common in the Midwest, and are more infrequent and generally small west of the Rockies. Nonetheless, Oregon and other western states have experienced tornadoes on occasion, many of which have produced significant damage and occasionally injury or death.

Based on data from 1950 to 1995, Oregon ranks 46th nationally for frequency of tornadoes, none for number of deaths and 34th for cost of damages.[34]

Oregon's tornadoes can be formed in association with large Pacific storms arriving from the west. Most of them, however, are caused by intense local thunderstorms. These storms also produce lightning, hail, and heavy rain, and are more common during the warm season from April to October.[35] Five tornadoes of note have struck Yamhill County.

McMinnville – February 19, 1926[36]

This tornado apparently felled many trees and destroyed a huge "dry house." From several accounts, it seems that there may have been four or five separate whirlwinds in a bunch that lowered from the storm.

McMinnville – May 25, 1971.[37]

This was a small, slow-moving tornado that touched down near a rural home. IT unroofed the barn and damaged the house. The tornado moved along a 0.4-mile long path damaging fir trees before lifting back into the cloud base. This was classified as a 'Gale' tornado (i.e., 40 to 72 mph, light damage), and caused between $500 and $5,000 worth of damage.

Amity – August 20, 1978[38]

This tornado cased small amounts of damage and was determined to be a tornado only after later visits and inspection of the area. It caused between $5,000 and $50,000 worth of damage.

Woodland Heights – April 18, 1984.[39]

A smaller tornado struck in Aurora destroying a machine shop and scattering its pieces over a half-mile area. It caused between $500 and $5,000 worth of damage.

Newberg – December 8, 1993[40]

This "Significant" tornado (i.e., 113 to 157 mph, considerable damage) was the most powerful tornado in Oregon in many years. It started as a cold front that came with a deep surface low along the coast that moved across the Willamette Valley. Six veal calves were killed, a dairy farm was damaged, roofs were blown off some small buildings, and many trees were broken. People reported that the funnel was sucking water from the Willamette River as it moved northeast. There, it greatly damaged a mobile home park. A tree at least two feet in diameter was snapped off six feet above the ground and hit a two-story house. Remarkably, no one was injured. This significant tornado caused anywhere between $500,000 and $5 million worth of damage.

Windstorm Hazard Assessment

Hazard Identification

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. Windstorms affect areas of the county with significant tree stands, as well as areas with exposed

property, major infrastructure, and aboveground utility lines. The lower wind speeds typical in the lower valleys are still high enough to knock down trees and power lines, and cause other property damage. Mountainous sections of the county experience much higher winds under more varied conditions. Because of the local nature of wind hazards in the mountains, a high-resolution wind speed map would be required to accurately identify the degree of wind hazard throughout the county. Such a map could identify wind hazards other than tree-falls, such as winds high enough to cause various degrees of structural damage. Unfortunately, high-resolution wind maps were not available at the time of this publication, so a precise wind hazard analysis could not be performed.

The characteristics of tornadoes are determined by the wind speed, and event duration. Tornadoes often occur quickly with a duration ranging from several minutes to several hours. The typical tornado damage path is about one or two miles, with a width of about 50 yards.[41] The largest tornado path widths can exceed one mile, and the smallest widths can be less than ten yards.[42] Widths can vary considerably during a single tornado, because the size of the tornado can change considerably during its lifetime.[43] Path lengths can vary from a single point to more than 100 miles.[44] More highly populated areas within the county are those at greatest risk during a tornado.

The probability of a major tornado occurring in Yamhill County is uncertain due to limited historical records. The National Weather Service, Portland Bureau, provides public warnings on tornadoes as appropriate.

Vulnerability Assessment

A vulnerability assessment that describes the number of lives and amount of property exposed to the wind hazard has not yet been conducted for Yamhill County windstorms. There are many issues related, however, to what is in danger within communities experiencing windstorms. Windstorms can cause power outages, transportation, and economic disruptions, and significant property damage and pose a high risk for injuries and loss of life. They can also be typified by a need to shelter and care for individuals impacted by the events. Several destructive windstorms, (most notably the 1962 Columbus Day storm and the December 12, 1995 windstorm) brought economic hardship and affected the life and safety of county residents. Future windstorms may cause similar impacts countywide.

Factors that should be included in windstorm risk analysis include: population and property distribution in the hazard area; the frequency of windstorm events; and information on the types of trees and failure rates most susceptible to windstorm events. When sufficient data is collected for hazard identification and vulnerability assessment, a risk analysis can be completed. Currently, insufficient data currently exists to complete a risk analysis.

Risk Analysis

Risk analysis is the third, and most advanced phase of a hazard assessment. It is conducted by use of mathematical models and relies on information compiled during hazard identification and vulnerability assessments. Factors included in windstorm and tornado risk analysis include population and property distribution in the hazard area, the frequency of windstorm events, and information on the types of trees and failure rates most susceptible to windstorm events. When sufficient data is collected for hazard identification and vulnerability assessment, a risk analysis can be completed. Insufficient data currently exists to complete a risk analysis.

Windstorm Community Issues

Property and Life

Windstorms have the ability to cause damage over 100 miles from the center of storm activity. Isolated wind phenomena in the mountainous regions have more localized effects. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage. The effects of wind speed are shown in Table 10-2.

Table 10-2. Effect of Wind Speed

Wind Speed (Mph)	Wind Effects
25-31	Large branches will be in motion.
32-38	Whole trees in motion; inconvenience felt walking against the wind.
39-54	Twigs and small branches may break off of trees; wind generally impedes progress when walking; high profile vehicles such as trucks and motor homes may be difficult to control.
55-74	Potential damage to TV antennas; may push over shallow-rooted trees, especially if the soil is saturated.
75-95	Potential for minimal structural damage, particularly to unanchored mobile homes; power lines, signs, and tree branches may be blown down.
96-110	Moderate structural damage to walls, roofs and windows; large signs and tree branches blown down; moving vehicles pushed off roads.
111-130	Extensive structural damage to walls, roofs, and windows; trees blown down; mobile homes may be destroyed.
131-155	Extreme damage to structures and roofs; trees uprooted or snapped.
Greater than 155	Catastrophic damage; structures destroyed.

Source: Washington County Office of Consolidated Emergency Management

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls of buildings. When severe windstorms strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

Infrastructure

Storm winds can damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds.

Yamhill County is susceptible to direct impacts on infrastructure and property. Windstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted.[45] Industry and commerce can suffer losses from interruptions in electric service and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damages and interrupted services.

Utilities

Historically, falling trees have been the major cause of power outages in Yamhill County. Windstorms can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. Thus, overhead power lines can be damaged even in relatively minor windstorm events. Utility lines brought down by summer thunderstorms have also been known to cause fires, which start in dry roadside vegetation. Falling trees can bring electric power lines down to the pavement, creating the possibility of lethal electric shock. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from windstorms as more life and property are exposed to risk.

Tree Failure and Resulting Power Line Outages

Tree failure is one of the leading causes of power outages during severe weather events. According to Portland General Electric (PGE), trees are the leading cause of storm-related power outages in PGE's service area.[46] Tables 10-3 and 10-4 are Tree Failure Profiles developed by PGE for two of the most common tree failures in the PGE service territory. The profiles are developed from the data collected and used by PGE foresters in targeting "at-risk" trees during routine vegetation maintenance cycles.

Table 10-3. Tree Failure Profile - Species: Douglas fir *(Psuedotsuga menziesii)*

Failed Part	Description of failure/ Tree characteristics	Associated defects/ Indicators	Environment	Management History
BRANCH Frequency: High	Small dia. branches from mature trees can sail up to 75 ft & wrap lines. Overhanging branch failure from snow/ice loading.	Evidence of previous branch failures.	Exposure to winds/gusts greater than 40 mph. Line downwind.	Side trimmed trees.
TRUNK Frequency: Low	Failure of multiple tops.	Old topping cut, previous break, decay present.	Wind or ice storms.	Previous topping.
	Interior trees, 3-8" dia.	Intermediate/sup-pressed trees.	Wind, snow/ice loading, recent exposure.	Thinning of stand, exposure as edge tree.
	Dead tree of any size in close proximity to line.	Entire tree dead for some time.	Line downwind.	
ROOT Frequency: High	Trees of all ages.	Evidence of other root failures.	Slight to moderate wind.	Site disturbance; leave trees from logging or development.
	Small, interior trees.	Poor taper, low live crown ratio, aggravating site characteristics.	Slight to moderate wind.	Thinning of stand; overstocked, unmanaged stands.

Source: Portland General Electric, Forester's Office, 2001.

Table 10-4. Tree Failure Profile - Species: Bigleaf Maple *(Acer macrophyllum)*

Failed Part	Description of failure/ Tree characteristics	Associated defects/ Indicators	Environment	Management History
BRANCH Frequency: High	Mature trees; scaffold branches; or during full leaf-out.	Decay present at multiple branch attachment. Co-dominant stems with included bark.	Heavy rains after leaf-out in spring; heavy fall rains. Exposure to winds/gusts greater than 30 mph. Line downwind, ivy covered.	Natural and previously pruned; history of side trimming.
TRUNK Frequency: Low	Trunk failure at base of tree up to 12 feet.	Decay present in trunk or at base.	On a slope, line downwind, or ivy covered.	In unmanaged or natural areas.

Source: Portland General Electric, Forester's Office, 2001.

Community Tornado Issues

Life and Property

Tornadoes generate tremendous force and associated wind speeds. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. These effects of

winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage. In the most serious events, whole buildings may be leveled or torn from foundations and carried airborne.

Debris carried along by tornadoes can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls of buildings. When tornadoes strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

The Fujita Tornado Damage Scale was developed in 1971, at the University of Chicago, as a means of estimating levels of tornado damage. The scale is used post-disaster to categorize tornadoes based on the damage inflicted. About 75 percent of all tornadoes fall within the "weak" end of the scale (F0 or F1).[47] Table 10-5 shows the various damage levels used to categorize tornadoes.

Table 10.5 Fujita Tornado Damage Scale

Scale	Wind Estimate (MPH)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: National Weather Service Storm Prediction Center

Infrastructure

Tornadoes can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Tornadoes can also damage buildings, power lines, and other property and infrastructure due to falling trees and branches and windblown debris. Roads blocked by fallen trees may

have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted.[48] Industry and commerce can suffer losses from interruptions in electric service and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from tornadoes related to both physical damages and interrupted services.

Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from tornadoes storms as more life and property are exposed to risk.

Mitigation Plan Goals

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

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 organization 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 AND 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.

Existing Mitigation Activities

State

One of the strongest and most widespread existing mitigation strategies pertains to vegetation clearance. **Oregon Line Safety Statute**, ORS 757.035, is the minimum legal standard in Oregon for the construction, operation and maintenance of electrical supply and signal lines. The law and rule applies to any person, company, agency, municipality, cooperative or association, their agents, lessees or acting trustees or receivers, appointed by any court, engaged in the management, operation, ownership, or control of electrical supply, and telecommunications equipment.

Failure to allow a utility company to comply with the law can result in liability to the homeowner for damages or injuries resulting from a vegetation hazard. Many insurance companies do not cover these types of damages if the policy owner has refused to allow the hazard to be eliminated. The power companies, in compliance with the above regulations, collect data about tree failures and their impact on power lines. This mitigation strategy assists the power company in preventing future tree failure. From the collection of this data, the power company can advise residents as to the most appropriate vegetative planting and pruning procedures.

Federal

National Weather Service

The Portland Office of the National Weather Service issues severe winter storm and tornado watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio and are forwarded to the local media for retransmission using the Emergency Alert System.

Windstorm (and Tornado) Mitigation Action Items

The mitigation action items for windstorms, which include tornadoes, were formulated through research of regional mitigation plans, natural hazards planning literature, and interviews with local stakeholders. Plan action items were refined through discussions with the mitigation plan steering committee and through an open house at which the county received comments from the public.

The windstorms mitigation action items provide direction on specific activities that organizations and residents in Yamhill County can undertake to reduce risk and prevent loss from windstorms. 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 windstorms in Yamhill County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Windstorm Action Items

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

ST-WS #1: Develop and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events.

Ideas for Implementation

- Partner with responsible agencies and organizations to design and disseminate education information to property owners to reduce risk from tree failure to life, property, commerce and utility systems;
- Develop partnerships between utility providers and county and local public works agencies to document known hazard areas and minimize risks;
- Identify and find solutions to potentially hazardous trees in urban areas, near utility corridors, and near vital infrastructure; and
- Partner with responsible agencies and organizations to develop landscaping and tree programs that have less impact on aboveground utility lines and roads.

Coordinating Organization:	Public Works, Community Development
Internal Partner:	GIS
External Partner:	Cities, USFS, BLM, State Parks, utility providers
Timeline:	2 years
Plan Goals Addressed:	Emergency Operations; Education & Outreach; Partnerships; Prevention; Natural Resources Utilization; Implementation

ST-WS #2: Develop and implement, or enhance strategies for debris management and/or removal after windstorm events.

Ideas for Implementation

- Develop coordinated management strategies for clearing roads of fallen trees, and clearing debris from public and private property;
- Coordinate with those local agencies responsible for debris removal and provide residents locations for debris disposal; and
- Notify area residents, business owners, and employees of alternative routes in case of road blockage.

Coordinating Organization:	Emergency Management
Internal Partner:	Public Works
External Partner:	ODOT, cities, regional recycling facilities
Timeline:	2 years
Plan Goals Addressed:	Emergency Operations; Partnerships; Preventive; Natural Resources Utilization; Implementation

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ST-WS #3: Maintain tree trimming for above-ground power lines.

Ideas for Implementation

- Coordinate with overhead utilities to evaluate tree trimming.

Coordinating Organization:	Public Works
Internal Partner:	Emergency Management
External Partner:	Overhead utilities, cities
Timeline:	Ongoing
Plan Goals Addressed:	Emergency Operations; Partnerships; Preventive; Natural Resources Utilization; Implementation

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Long-term (LT) Windstorm Action Items

Long-term windstorm 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-WS #1: Map and publicize locations around the county that have the highest incidence of extreme windstorms.

Ideas for Implementation

- Identify a responsible agency for central collection and reporting of storm data. Data collected should include:

1. Windstorm data (sustained speeds, gusts, storm durations) for localities throughout the county.
2. Maps of the locations within the county most vulnerable to high winds.
3. Injury and property damage estimates, including locations.

- Identify a responsible agency to collect and transfer data to the National Climate Data Center (NCDC), Oregon Climate Service (OCS), FEMA, or other agencies concerned with the incidence of storms, to help establish and maintain baseline and historic records of storm events; and
- Identify public infrastructure and facilities subject to damage or closure during windstorm events.

Coordinating Organization:	Emergency Management
Internal Partner:	Planning, GIS
External Partner:	FEMA, NCDC, OCS, NWS
Timeline:	5 years
Plan Goals Addressed:	Preventive; Natural Resources Utilization

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LT-WS #2 Support/encourage electrical utilities to use underground construction methods where possible to reduce power outages from windstorms.

Ideas for Implementation

- Increase the use of underground utilities where possible.

Coordinating Organization:	Public Works
Internal Partner:	GIS, Emergency Management
External Partner:	Utility companies
Timeline:	On-going
Plan Goals Addressed:	Preventive; Natural Resources Utilization

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LT-WS #3: Increase public awareness of windstorm mitigation activities.

Ideas for Implementation

- Collect existing information on public education materials for protecting life, property, and the environment from windstorm events;
- Identify and collect additional information and programs as necessary; and
- Distribute educational materials to County residents and public and private sector organizations regarding preparedness for no-power situations.

Coordinating Organization:	Emergency Management
Internal Partner:	Planning

External Partner: Utilities, cities, FEMA
Timeline: On-going
Plan Goals Addressed: Emergency Operations; Education & Outreach; Preventive; Natural Resources Utilization

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LT-WS #4: Support/encourage contractors, homeowners and electrical utilities to use windstorm resistant construction methods where possible to reduce damage and power outages from windstorms.

Ideas for Implementation

- Increase the use of underground utilities where possible;
- Provide guidance on wind-resistant construction methods; and
- Evaluate current building codes for efficiency in protecting structures from wind damage.

Coordinating Organization: Building
Internal Partner: Planning
External Partner: Cities, utilities
Timeline: 5 years
Plan Goals Addressed: Education and Outreach; Preventive

LT-WS #5: Develop and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events.

Ideas for Implementation

- Partner with responsible agencies and organizations to design and implement tree programs that reduce risk to life, property, and utility systems.

Coordinating Organization: Public Works
Internal Partner: Planning
External Partner: Utilities, cities
Timeline: On-going
Plan Goals Addressed: Preventive; Natural Resources Utilization

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LT-WS #6: Identify trees that are potentially susceptible to wind throw.

Ideas for Implementation

- Analyze current map of trees from any available sources (e.g., satellite imaging);
- Develop education material on tree species that are susceptible to wind throw; and
- Locate, evaluate and map hazardous trees in the county.

Coordinating Organization:	Planning
Internal Partner:	Emergency Management, GIS
External Partner:	Cities, overhead utilities
Timeline:	On-going
Plan Goals Addressed:	Preventive; Natural Resources Utilization

LT-WS #7: Encourage critical facilities to secure emergency power.

Ideas for Implementation

- Seek funding and capital improvements for emergency power supplies for all identified critical facilities.

Coordinating Organization:	Emergency Management
Internal Partner:	Community Development (Planning)
External Partner:	Cities, neighboring counties, Yamhill Fire Defense Board, police stations, water systems
Timeline:	On-going
Plan Goals Addressed:	Emergency Operations; Partnerships; Natural Resources Utilization; Implementation

LT-WS #8: Encourage harvesting of trees along utility and road corridors, preventing potential windstorm damage.

Ideas for Implementation

- Encourage the harvesting of trees along utility corridors and roads, which will prevent windstorm damage; and
- Encourage Federal, State and Local Agencies to harvest trees that have fallen during a winter storm, which will mitigate fire hazards, and could be used in fish enhancement projects.

Coordinating Organization:	Emergency Management
Internal Partner:	Planning, Public Works
External Partner:	Cities, utilities, FEMA, USFS, ODFW, DSL, BLM, ODOT, forest product industries
Timeline:	On-going
Plan Goals Addressed:	Preventive; Natural Resources Utilization

LT-WS #9: Encourage harvesting of trees that are blown down during a windstorm.

Ideas for Implementation

- Encourage the harvesting of trees blown down in a windstorm; and
- Encourage Federal, State and Local Agencies to harvest trees that have fallen during a windstorm, which will mitigate fire hazards, and could be used in fish enhancement projects.

Coordinating Organization:	Emergency Management
Internal Partner:	Planning, Public Works
External Partner:	Cities, utilities, FEMA, USFS, ODFW, DSL, BLM, ODOT, forest products industries
Timeline:	On-going
Plan Goals Addressed:	Preventive; Natural Resources Utilization

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LT-WS #10: Increase and maintain public awareness of severe windstorms and the benefits of mitigation activities through education aimed at households and businesses and increase targeting of special needs populations.

Ideas for Implementation

- Collect additional information and add to existing informational sources on public education materials for protecting life, property, and the environment from windstorm events;
- Distribute educational materials to County residents and public and private sector organizations regarding evacuation routes during road closures;
- Distribute audience-specific educational materials to schools, churches, and other public and private sector organizations;
- Develop methods of improving emergency warning system;

Coordinating Organization:	Emergency Management
Internal Partner:	Community Development
External Partners:	Utilities, cCities, American Red Cross, St. Vincent DePaul, Churches, ARES, Yamhill Fire Defense Board
Timeline:	On-going
Plan Goals Addressed:	Education & Outreach; Preventive; Partnerships

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Windstorm Resource Directory

State Resources

Oregon Department of Consumer and Business Services

The Building Codes Division of Oregon's Department of Consumer and Business Services is responsible for administering statewide building codes. Its responsibilities include adoption of statewide construction standards that help create disaster-resistant buildings, particularly for flood, wildfire, wind, foundation stability, and seismic hazards.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW, P.O. Box 14470, Salem, OR 97309
Phone: 503-373-4133
Fax: 503-378-2322
Website: http://www.cbs.state.or.us/external/bcd

Oregon Climate Service

The Oregon Climate Service collects, manages, and maintains Oregon weather and climate data. OCS provides weather and climate information to those within and outside the state of Oregon and educates the citizens of Oregon on current and emerging climate issues. OCS also performs independent research related to weather and climate issues.

Contact: Oregon Climate Service
Address: Strand Agriculture Hall 326, Corvallis, OR 97331-2209
Phone: 541-737-5705
Fax: 541-737-5710
Website: **http://www.ocs.orst.edu**
Email: **coas@oregonstate.edu**

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

The purpose of OEM is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in Oregon Revised Statutes Chapter 401 by planning, preparing, and providing for the prevention, mitigation, and management of emergencies or disasters that present a threat to the lives and property of citizens of and visitors to the state of Oregon.

Contact: Office of Emergency Management
Address: 3225 State Street, Salem, OR 97301
P.O. Box 14370, Salem, OR 97309-5022
Phone: 503-378-2911
Fax: 503-373-7833
Website: **http://www.osp.state.or.us/oem**

Federal Resources

Federal Emergency Management Agency (FEMA)

FEMA's mission 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: 130-228th St. SW, Bothell, WA 98021-9796
Phone: 425-487-4600
Fax: 425-487-4622
Website: http://www.fema.gov/regions/x/regx.shtm

National Weather Service, Portland Bureau

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters, and ocean areas for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure, which can be used by other governmental agencies, the private sector, the public, and the global community.

Contact: National Weather Service
Address: 5241 NE 122nd Ave, Portland, Oregon 97230-1089
Phone: 503-326-2340
Website: http://nimbo.wrh.noaa.gov/Portland

National Oceanic and Atmospheric Administration (NOAA)

NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.

Contact: National Oceanic and Atmospheric Administration
Address: 14th Street & Constitution Avenue, NW, Room 6217, Washington, DC 20230
Phone: 202-482-6090
Fax: 202-482-3154
Website: http://www.noaa.gov
Email: answers@noaa.gov

Additional Resources

American Red Cross

The American Red Cross is a humanitarian organization, led by volunteers, that provides relief to victims of disasters and helps people prevent, prepare for, and respond to emergencies. The Oregon Trail Chapter serves the residents of Clackamas, Clatsop, Columbia, Multnomah, Tillamook, Washington and Yamhill counties. The Oregon Trail Chapter provides a variety of community services that are

consistent with the Red Cross mission and meet the specific needs of this area, including disaster planning, preparedness, and education.

Contact: American Red Cross, Oregon Trail Chapter
Address: 3131 N Vancouver Ave, Portland, OR 97227-1560
P.O. Box 3200, Portland, OR 97208-3200
Phone: 503-284-1234
Fax: 503-284-4247
Website: http://www.redcross-oregontrail.org
Email: info@redcross-pdx.org

Institute for Business & Home Safety (IBHS)

IBHS was created as an initiative of the insurance industry to reduce damage and losses caused by natural disasters. Their website provides educational resources and on-line publications for insurers, businesses, and homeowners who are interested in taking the initiative to minimize future damages and losses.

Contact: Institute for Business and Home Safety
Address: 1408 North Westshore Boulevard - Suite 208 - Tampa, FL 33607
Phone: 813-286-3400
Fax: 813-286-9960
E-mail: info@ibhs.org
Website: http://www.ibhs.org/

Publications

Public Assistance Debris Management Guide, Federal Emergency Management Agency (July 2000).

The Debris Management Guide was developed to assist local officials in planning, mobilizing, organizing, and controlling large-scale debris clearance, removal, and disposal operations. Debris management is generally associated with post-disaster recovery. While it should be compliant with local and county emergency operations plans, developing strategies to ensure strong debris management is a way to integrate debris management within mitigation activities. The Public Assistance Debris Management Guide is available in hard copy or on the FEMA website.

Contact: FEMA Distribution Center
Address: 130 - 228th Street, SW, Bothell, WA 98021-9796
Phone: 800-480-2520
Fax: 425-487-4622
Website: http://www.fema.gov/rrr/pa/dmgtoc.shtm

Bilello, Joseph. June 2000. *Technology Transfer and Technology Place: Windstorm Mitigation Design Innovation for House Forms in Asia Pacific Architecture.*

The paper shares how adverse wind effects on buildings have been mitigated in Asia Pacific countries through design, particularly through the proper siting of buildings, appropriate materials selections, and

improvements to methods of construction. This paper has application to rural areas in the county where vulnerability to wind storms is highest.

Contact: Architecture Research Center, College of Architecture, Texas Tech University
Address: Box 42091, Lubbock, TX 97409-2091
Phone: 800-742-3136
Email: ArchitecturePrograms@ttu.edu
Website: http://www.arch.ttu.edu/arc/

Chubb Personal Insurance – Household Tips.
Preparing Your Home for Severe Windstorms is available from http://www.chubb.com/personal/html/helpful_tips_home_windstorm.html

The Hazard Tree Prevention Webpage

Educational modules present what it takes to keep trees healthy, safe, and beautiful, and prevent them from becoming hazardous. The Pacific Northwest Chapter of the International Society of Arboriculture and the Oregon Department of Forestry created the Hazard Tree Prevention Webpage with a grant from Oregon Emergency Management and the Federal Emergency Management Agency.

Website: http://www.pnwisa.org/htp/index.html

Reducing Windstorm Damage to Electric Utilities

Interagency Hazard Mitigation Team Report for the Western Oregon Windstorms of December 10-12, 1995 (FEMA-1107-DR-OR) OEM-FEMA

Website: ../../resources/print/community/pdf/FEMA_DR-OR/dr-1107.pdf

Reducing Windstorm Damage to Property and Electrical Utilities

Hazard Mitigation Survey Team Report for the Severe Windstorm in Western Oregon February 7, 2002 — (FEMA–1405-DR-OR) Prepared by Oregon Emergency Management and the Federal Emergency Management Agency

Website: ../../resources/print/community/pdf/FEMA_DR-OR/dr-1405.pdf

Windstorms - Endnotes

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