Section 10:
Windstorms (Including Tornadoes)

Why are Windstorms a threat to Polk 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 caused local governments to spend 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. While Polk County did not receive a Presidential Disaster Declaration for this storm, many other counties in the state did, illustrating the severity of these storms.

The hazard mitigation grant mitigated future losses to utility infrastructure. The grant assisted utilities in developing tree-trimming practices, right-of-way clearing policies, and in sharing techniques that reduce power line breakage by improved and alternate attachments to poles. A consumer-oriented program was also initiated to assist property owners in selecting trees that are power line friendly.

Similarly, a storm on February 7 and 8, 2002, resulted in a Presidential Disaster Declaration for five Oregon Counties.[1] Nine other counties were declared contiguous counties affected by the storm. Such a declaration allowed family farmers to apply for loans to assist with storm-related damage.

Why are Tornadoes a Threat to Polk County?

Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere.[2] A tornado is a vortex of rotating winds and strong vertical motion that possesses remarkable strength and can cause almost unbelievable damage. Wind speeds in excess of 300 miles per hour have been observed within tornadoes, and it is suspected that some tornado winds exceed 400 mph.[3] While most common in the Midwest, Oregon and other western states have experienced tornadoes on occasion, many of them producing significant damage and occasionally causing injury and death. Tornadoes can pose a significant threat to life and property, and can topple trees over buildings and power lines causing power outages, and disruption of essential services. In addition to strong

winds, the low-pressure system associated with tornadoes can literally explode buildings that it passes over.[4]

Historical Windstorm Events

Regional

The Mid/Southern Willamette Valley, including Polk County has experienced 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 below outlines the most severe windstorms recorded in the region.

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

DATE	AFFECTED AREA	CHARACTERISTICS
April 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
December 1951	Statewide	Wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
December 1955	Statewide	Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines
November 1958	Statewide	Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees
October 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
March 1971	Most of Oregon	Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane Co.
November 1981	Most of Oregon	Highest winds since 10/62. Wind speed 71 mph in Salem. Marinas, airports and bridges severely damaged
January 1990	Statewide	Heavy rain with winds exceeding 75 mph. Significant damage. One fatality
December 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)
November 1997	Western Oregon	Wind speed 52 mph in Willamette Valley. Trees uprooted. Considerable damage to small airports.
February 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. 1999. *The Oregon Weather Book*, pp.151-157; Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon, February 7, 2002 (FEMA-1405-DR-OR)

Polk County

Windstorms have historically been a threat to Western Oregon, and most of the storms described in Table 10-1 impacted Polk County. The following storms, though not isolated to Polk County, caused especially severe damage to the county.

April 1931 Windstorm

This windstorm downed trees along the Falls City-Valsetz Road and caused intermittent power outages. It also brought a pale gray dust that covered the land and filtered into homes and buildings. In Dallas, the dust limited visibility to only a few blocks[5].

October 12, 1962 (The Columbus Day Storm)

The infamous Columbus Day windstorm brought wind gusts of up to 90 miles per hour and was related to two deaths in Polk County. The high winds damaged approximately 75 percent of homes in Dallas and collapsed a barn, killing fifty head of cattle. In Independence, the winds fanned a fire that destroyed a ranch. In Monmouth, the Oregon College of Education (Western Oregon University) received damages estimated at $275,000 (in 1962 dollars). Throughout the county, 50 percent of the older prune orchards and 85 percent of other prune orchards were destroyed by the storm. In addition to property damage, 932 telephone outages occurred in Dallas, 6,400 in Salem, and across the state there were 53,100 phone outages[6].

November 13-15, 1981

Sometimes referred to as the "Friday the 13th Storm", this windstorm was the most powerful since the Columbus Day Storm of 1962. This windstorm produced gusts up to 70 miles per hour; the *Itemizer Observer* reported that it "knocked out electric power to large parts of the county, brought down dozens of trees, felled power lines and poles, removed roofs and scattered debris across the county.[7]" Although the storm did not cause major damage, its effects were widespread: several buildings were damaged and toppled trees blocked the Falls City-Valsetz Road.[8] Numerous injuries resulted from wind-blown debris in western Washington and Oregon.[9]

December 12, 1995 Windstorm

This windstorm caused such widespread damage from downed trees and power and communication outages that Governor Kitzhaber declared a state of emergency in all of western Oregon[10]. One hundred and fifty National Guard troops were called on to assist residents and public utility crews.[11] In Salem, the National Weather Service reported average winds of 40 miles per hour with gusts up to 59 miles per hour. In the region between Salem and Corvallis, 7500 people lost phone service. Fortunately, damage was comparatively light in Polk County. As one headline in the *Itemizer*

Observer read, "Ice and Winds Ravage Adjacent Areas, but Leave Polk County Unscathed."[12]

February 7, 2002

The most recent of large windstorm events arrived in the Willamette Valley with wind gusts up to 70 miles per hour causing 27,000 power outages statewide.[13] The severity of this storm prompted President Bush to issue Major Disaster Declarations for five Oregon Counties. Nine other Oregon counties were named contiguous counties, allowing family farmers to receive loans to address storm-related damage.[14]

Historical Tornado Events

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.[15] No injuries or deaths were reported during this period. Although infrequent, several significant tornado events have occurred within Northwestern Oregon and Polk County.

Northwestern Oregon Region

January 19, 1887

In the first reported tornado in Oregon, a local resident described a small tornado in the vicinity of Cottage Grove. The tornado twisted a four-foot diameter fir tree from its roots, picked up a couple of sheep and carried them for 200 yards, and tore down fences.[16]

February 26, 1904

A tornado struck the vicinity of Mount Tabor in east Portland. Four houses were destoyed and others were moved off their foundations. Damage totalled $5,000.[17]

February 19, 1926

A small tornado near McMinnville felled many tress and destroyed a huge "dry house". Several accounts indicate that there may have been four or five whirlwinds in a group.[18]

September 8, 1938

A tornado was first spotted south and east of Halsey. The *Oregonian* on September 8, 1938, featured a photograph of the tail of the tornado dropping earthward from black thunder clouds in Brownsville.[19]

January 20, 1953

On this date, a tornado struck Corvallis. The twister, which suddenly appeared out of dark clouds at 8 a.m., struck the downtown area. During its brief presence, it "exploded" one building, passed close to the Roosevelt School, and then crossed the Willamette River before disappearing. Accompanying the tornado were rain and hail, which fell in sheets, causing more damage to businesses than did the twister.[20]

April 12, 1957

A very strong storm system reached northern Oregon between April 12th and 14th, bringing heavy rains and wind gusts up to 70 miles per hour. On the 12th, a dark storm cloud appeared near Sandy, southeast of Portland. Heavy rain and hail began to fall. As the storm moved east from Sandy, a funnel cloud appeared and touched ground as a 50-foot wide tornado. Large fir trees, 18 to 36 inches in diameter, were twisted off or snapped 30 to 40 feet off the ground. A large barn under construction was lifted off its foundation and carried several hundred feet in the air, before falling to the ground and shattering in pieces. Roofs of homes and barns were damaged and several outbuildings were carried a considerable distance before being destroyed.[21]

April 5, 1972

On this date, possibly the most destructive tornado in Oregon occurred. The tornado touched down near Portland at the south shore of the Columbia River damaging four pleasure boat moorages on Marine Drive, 50 cabin cruisers, boathouses and dock shelters. It then crossed the Columbia drawing water up with it. The tornado continued on its nine-mile long path through Vancouver, Washington, where it caused six deaths, 300 injuries and at least $5 million dollars in damage.[22]

March 22, 1994

On this date, a small tornado touched down near a shopping area in Albany. It blew out a store window and damaged some merchandise inside, but overall damage was very limited.[23]

January 1996

In January 1996, and apparent tornado struck the Oregon coast near Lincoln City. Police reported a number of windows broken, windows exploded outward, and a number of fish deposited on land, apparently after being lifted out of the water by the tornado.[24]

Polk County

One significant tornado occurred in Polk County.

November 11, 1925

At approximately 11 a.m., a tornado began a few miles southwest of Salem in Polk County and traveled east-northeast for about five miles. Most of the tornado's path was in Marion County. Damage occurred to a few buildings and trees, while the total damage was merely a few thousand dollars. It is quite evident that the storm was a rather poorly defined tornado, which reached the ground at a few places in a five-mile path extending from just north of Independence to a point in the Liberty district, just to the southwest of Salem. At no place was the path well outlined, as for the most part damage was confined to old weak structures. No serious injuries were reported. Some damaged buildings showed

the effects of the sudden expansion of the air in the buildings against the reduced pressure outside.[25]

Characteristics of Windstorms in Polk 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 generated from the Pacific Ocean are strong along the coast, but slow down inland due to the obstruction of the Coastal and Cascade mountain ranges.[26] 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.[27]

Tornadoes

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.[28]

Windstorm and Tornado Hazard Assessment

Hazard Identification

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 miles per hour. 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. Foothill sections of the county experience 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.[29] The largest tornado path widths can exceed one mile, and the smallest widths can be less than ten yards.[30] Widths can vary considerably during a single tornado, because the size of the tornado can change considerably during its lifetime.[31] Path lengths can vary from a single point to more than 100 miles.[32] More highly populated areas within the county are those at greatest risk during a tornado.

The probability of a major tornado occurring in Polk 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 wind hazards or to elements of tornadoes has not yet been conducted for Polk County. There are many issues related to what is in danger within communities experiencing windstorms and tornadoes. Windstorms and tornadoes can cause power outages, transportation, and economic disruptions, and significant property damage and pose a high risk for injuries and loss of life. Major utilities cite windstorms as one of the two biggest natural hazards that affect their infrastructure – ice storms is the second.[33] 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 and tornado risk analysis include: population and property distribution in the hazard area; the frequency of tornadoes and windstorm events; infrastructure that may be impacted by tornadoes or windstorms; 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.

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.

Community Windstorm 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 present 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.

Polk 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.[34] 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 Polk County. Windstorms can cause flying debris and

downed utility lines. For example, tree limbs breaking in winds of only 45 miles per hour can be thrown over 75 feet. As a result, 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.[35] 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.[36] 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; Portland General Electric Co.©

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

Failed Part	Description of failure/ Tree characteristics	Associated defects/	Environment	Management History

		Indicators		
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; Portland General Electric Co.©

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).[37] Table 10-1 shows the various damage levels used to categorize tornadoes.

Table 12.1 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.[38] 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 and Existing Activities

Mitigation Plan Goals

Plan goals are broad statements of direction and help focus future efforts. Goals are important because they are a bridge between the far-reaching, overall mission and the individual action items identified to reduce Polk County's risk from flood, landslide,

wildfire, severe winter storm and windstorm, drought, expansive soils and seismic and volcanic events.

Goal #1: PUBLIC EDUCATION AND AWARENESS

Provide public information and education/awareness to all residents of the county concerning natural hazard areas and mitigation efforts.

Goal #2: PREVENTIVE AND IMPLEMENTATION

Develop and implement activities to protect human life, commerce, property and natural systems.

Goal #3: COLLABORATION AND COORDINATION

Strengthen hazard mitigation by increasing collaboration and coordination among citizens, public agencies, non-profit organizations, businesses, and industry.

Goal #4: FUNDING AND PARTNERSHIPS

Seek partnerships in funding and resources for future mitigation efforts.

Goal #5: EMERGENCY OPERATIONS

Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

Goal #6: NATURAL RESOURCES UTILIZATION

Link land use planning, development criteria, codes, and natural resources and watershed planning with natural hazard mitigation.

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 windstorm and tornado mitigation action items were formulated through researching regional mitigation plans and 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 windstorm and tornado mitigation action items provide direction on specific activities that organizations and residents in Polk County can undertake to reduce risk and prevent loss from windstorm events and tornadoes. 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 and tornadoes in Polk County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Windstorm and Tornado Action Items

Short-term windstorm and tornado action items include general mitigation activities that agencies are capable of implementing within 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, 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 above-ground utility lines and roads.

Coordinating Organization:	Emergency Management – Hazard Mitigation Team
Internal Partners:	Public Works, Community Development, GIS
External Partners:	Cities, ODF, BLM, ODOT, Utility providers
Timeline:	2 years
Plan Goals Addressed:	Public Education & Awareness; Preventive & Implementation; Funding & Partnerships; Natural Resources Utilization

ST-WS #2: 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 local agencies responsible for debris removal and provide residents locations for debris disposal; and

- Notify area residents, business owners, and employees of alternative routes i.e., detours in case of road blockage

Coordinating Organization:	Emergency Management – Hazard Mitigation Team
Internal Partner:	Public Works/Roads
External Partners:	ODOT, cities, regional recycling facilities
Timeline:	2 years
Plan Goals Addressed:	Preventive & Implementation; Collaboration & Coordination; Funding & Partnerships; Emergency Operations; Natural Resources Utilization

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ST-WS #3: Maintain tree trimming near aboveground power lines.

Ideas for Implementation

- Coordinate with overhead utilities to evaluate tree trimming.

Coordinating Organization:	Public Works
Internal Partners:	Emergency Management – Hazard Mitigation Team, Community Development
External Partners:	Overhead Utilities, Cities
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation; Collaboration & Coordination; Emergency Operations; Natural Resources Utilization

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Long-term (LT) Windstorm and Tornado Action Items

Long-term windstorm and tornado 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 Polk 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 Polk County.

  2. Maps of the locations within Polk 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 – Hazard Mitigation Team
Internal Partners:	Planning, GIS
External Partners:	FEMA, NCDC, OCS, NWS
Timeline:	5 years
Plan Goals Addressed:	Preventive & Implementation

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 Partners:	Emergency Management – Hazard Mitigation Team, GIS
External Partner:	Utility companies
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation

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

Ideas for Implementation

- Collect existing information on public education materials for protecting life, property, and the environment from windstorm and tornado 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 – Hazard Mitigation Team
Internal Partners:	Planning
External Partners:	Utilities, cities, FEMA
Timeline:	On-going
Plan Goals Addressed:	Public Education & Awareness; Preventive & Implementation; Emergency Operations; 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:	Community Development/Building
Internal Partner:	Planning
External Partner:	Cities
Timeline:	5 years
Plan Goals Addressed:	Public Education & Awareness; Preventive & Implementation

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

Ideas for Implementation

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

- Develop partnerships between utility providers and county and local public works agencies to document known hazard areas.

Coordinating Organization:	Public Works
Internal Partners:	Community Development/Planning
External Partners:	Utilities, cities
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation; 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 educational materials on tree species that are susceptible to wind throw; and

- Locate hazardous trees and add to map.

Coordinating Organization:	Community Development
Internal Partner:	GIS
External Partners:	Cities, Overhead Utilities
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation; Natural Resources Utilization

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

Ideas for Implementation

- Seek funding and capital improvements for emergency power sources for critical facilities.

Coordinating Organization:	Emergency Management – Hazard Mitigation Team
Internal Partner:	Community Development/Planning
External Partners:	Cities, other counties, Polk Fire Defense Board, police stations, water systems
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation; Collaboration &Coordination; Funding & Partnerships

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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 – Hazard Mitigation Team
Internal Partners:	Planning, County Administrator's Office
External Partners:	Cities, Utilities, FEMA, USFS, ODFW, DSL, BLM, ODOT, forest products industries
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation; Natural Resources Utilization

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

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 – Hazard Mitigation Team
Internal Partners:	Planning, County Administrator's Office

External Partners:	Cities, Utilities, FEMA, USFS, ODFW, DSL, BLM, ODOT, forest products industries
Timeline:	On-going
Plan Goals Addressed:	Preventive & Implementation; Natural Resources Utilization

LT-WS #10: Increase and maintain public awareness of severe windstorms and tornadoes 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, commerce, property, and the environment from windstorm events;

- Distribute educational materials to County residents and public and private sector organizations regarding evacuation routes i.e., detours 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 – Hazard Mitigation Team
Internal Partner:	Community Development
External Partners:	Utilities, Cities, American Red Cross, Churches, Oregon Voluntary Organizations Active in Disaster, ARES, Fire Defense Board
Timeline:	On-going
Plan Goals Addressed:	Public Education & Awareness; Preventive & Implementation; Funding & Partnerships

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Windstorm and Tornado 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: Oregon State University
Strand Ag Hall Room 326, Corvallis, OR 97331-2209
Phone: 541-737-5705
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
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 our 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: 130-228 St. SW, Bothell, WA 98021-9796
Phone: 425-487-4678
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
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 Willamette Chapter serves the residents of Marion and Polk counties. The Willamette Chapter provides a variety of community services which 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, Willamette Chapter
Address: 675 Orchard Heights Rd NW, Suite 200, Salem OR
Phone: 503-585-5414
Fax: 503-362-3904
Website: http://www.redcross-salem.org
Email: rc@redcross-salem.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/

International Society of Arboriculture

The International Society of Arboriculture is a worldwide professional organization dedicated to fostering a greater appreciation for trees and to promoting research, technology, and the professional practice of arboriculture.

Contact: International Society of Arboriculture
Address: P.O. Box 3129, Champaign, IL 61826-3129
Phone: 217.355.9411
Fax: 217.355.9516
E-mail: isa@isa-arbor.com
Website: www.isa-arbor.com

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 79409-2091
Phone: 806-742-3136

E-Mail: Architecture.Programs@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

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[1] United States. Office of the President. *Presidential Declaration of a Major Disaster for the State of Oregon* (FEMA-1405-DR), dated March 12, 2002, and related determinations. The counties declared: Coos, Curry, Douglas, Lane, and Linn.

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[3] Id.

[4] Taylor, George. "Weather Matters." *Mid-Valley Sunday*: March 28, 1999.

[5] *Itemizer Observer*. April 1931: Vol. 56 No. 17.

[6] *Itemizer Observer*. October 18, 1962: Vol. 87, No. 42, pages 1, 2, 4.

[7] *Itemizer Observer*. November 18, 1981: Vol. 106, No. 47, page 1.

[8] *Itemizer Observer*. November 18, 1981: Vol. 106 No. 47, pages 1, 8.

[9] Taylor, George H. and Raymond R. Hatton. 1996. *The Oregon Weather Book*. Corvallis, OR: Oregon State University Press. Page 153.

[10] *The Statesman Journal*. December 12, 1995.

[11] *Statesman Journal*. December 14, 1995.

[12] *Itemizer Observer*. December 13, 1995.

[13] *Statesman Journal*. February 9, 2002.

[14] US Department of Agriculture. Available on the World Wide Web http://www.fsa.usda.gov/or/Notice/Flp104.pdf

[15] National Severe Storms Forecast Center.

[16] Taylor, George H. Chris Hannan. 1999. *The Oregon Weather Book*.

[17] Id.

[18] Id.

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[20] Taylor, George. "Weather Matters." *Mid-Valley Sunday*: March 28, 1999.

[21] Taylor, George H. and Chris Hannan. *The Oregon Weather Book*.

[22] Taylor, George. "Weather Matters." *Mid-Valley Sunday*: March 28, 1999.

[23] Id.

[24] Id.

[25] American Meteorological Society Monthly Weather Review, November 1925.

[26] National Weather Service, Portland Bureau. Available on the World Wide Web http://www.wrh.noaa.gov/Portland. Accessed February 2002.

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[28] Taylor, George H., Holly Bohman, and Luke Foster. August 1996. *A History of Tornadoes in Oregon.* Oregon Climate Service. Corvallis, OR: Oregon State University. Available on the World Wide Web http://www.ocs.orst.edu/pub_ftp/reports/book/tornado.html

[29] National Severe Storms Laboratory.

[30] Id.

[31] Id.

[32] Id.

[33] Ford, Dave. Public Information Office, Portland General Electric. Personal Interview. February 3, 2005.

[34] Interagency Hazard Mitigation Team. 2000. *State Hazard Mitigation Plan*. Oregon State Police – Office of Emergency Management. Salem, OR.

[35] Winfrey, Greg. Chief of the Rogue River Rural Fire Protection District. Personal interview. March 2001.

[36] Portland General Electric Web page, http://www.portlandgeneral.com/safety_and_outage/tree_maint/trees_and_outages.asp. Accessed May 2003.

[37] The Tornado Project.

[38] Interagency Hazard Mitigation Team. 2000. *State Hazard Mitigation Plan*. Oregon State Police – Office of Emergency Management. Salem, OR.