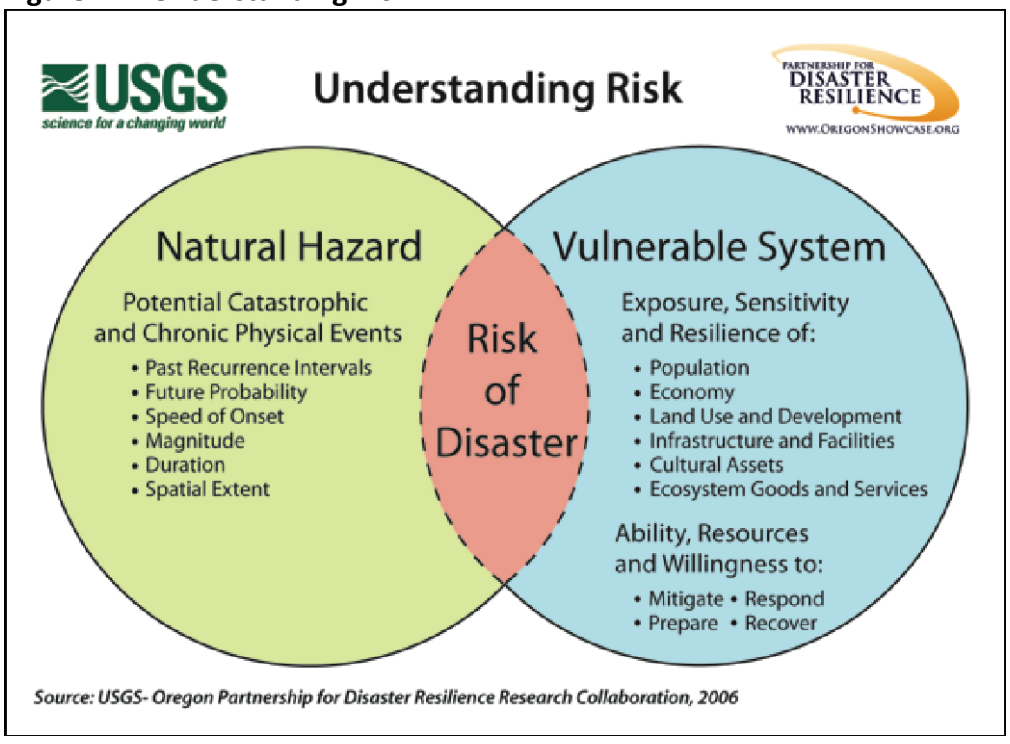
All-Hazard Risk Assessment

This section of the NHMP addresses 44 CFR 201.6(c)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk begins with the identification of hazards that can impact the jurisdiction. Included in the hazard assessment is an evaluation of potential hazard impacts – type, location, extent, etc. The second step in the risk assessment process is the identification of important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places, and drinking water sources. The last step is to evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The information presented below, along with community characteristics presented in the *Community Profile* will be used as the local level rationale for the risk reduction actions identified in the *Mitigation Strategy*. The risk assessment process is graphically depicted in Figure 2.1 below. Ultimately, the goal of hazard mitigation is to reduce the area where hazards and vulnerable systems overlap.

Figure 2.1: Understanding Risk



Source: Oregon Partnership for Disaster Resilience

Hazard Identification

The first step in the risk assessment process is hazard identification. Identifying hazards present in the county and their potential impacts is a way to look ahead towards the future and identify possible mitigation projects. Being cognizant of which hazards will most affect the county and identifying the generalized locations of these events will allow residents, as well as county staff and emergency managers to be prepared as much as possible. Sherman County identifies eight natural hazards that could potentially have an impact on the county. These hazards include: drought, earthquake, flood, landslide/debris flow, volcanic event, wildfire, windstorm, and winter storm. Table 2.1 categorizes the hazards identified by the county and compares it to the regional hazards identified in the State of Oregon NHMP for the Mid-Columbia Region, which includes Sherman County.

Table 2.1: Sherman County Hazard Identification

Sherman County Hazards*	Oregon NHMP Region 5: Mid-Columbia Regional Hazards
Drought	Drought
Earthquake	Earthquake
Flood	Flood
Landslide/ Debris Flow	Landslide/Debris Flow
Volcanic Event	Volcano-Related Hazards
Wildfire (WUI)	Fires in Urban/Wildland Interface
Windstorm	Windstorm
Winter Storm	Winter Storm

Source*: Sherman County NHMP Steering Committee, Updated March 28, 2018
Source^: State of Oregon Natural Hazards Mitigation Plan, Region 5: Mid-Columbia

Federal Disaster Declarations

Looking at the past events that have occurred in the county can provide a general sense of the hazards that have caused significant damage in the county. Where trends emerge, disaster declarations can help inform hazard mitigation project priorities.

President Dwight D. Eisenhower approved the first federal disaster declaration in May 1953 following a tornado in Georgia. Since then, federally declared disasters have been approved within every state as a result of natural hazard related events. As of August 2, 2018, FEMA has approved a total of 33 major federal disaster declarations, two emergency declarations, and 37 fire management assistance declarations in Oregon.[1] A Presidential Major Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities.[2] When governors ask for presidential declarations of major disaster or emergency,

[1] Federal Emergency Management Agency. Declared Disasters by Year or State. http://www.fema.gov/news/disaster_totals_annual.fema#markS. Accessed August 2, 2018.

[2] Federal Emergency Management Agency. The Disaster Process and Disaster Aid Programs. "A Presidential Major Disaster Declaration." http://www.fema.gov/hazard/dproc.shtm.

they stipulate which counties in their state they want included in the declaration. Table 2.2 summarizes the four major disasters declared for Sherman County by FEMA since 1953. The table shows that all of the major disaster declarations in Sherman County have been weather related.

Table 2.2: FEMA Major Disaster Declarations - Sherman County

Declaration Number:	Declaration (Amendment) Date:	Incident(s):	Incident(s) Period:	Individual Assistance:	Public Assistance Categories:
DR-1632	20-Mar-2006	Severe Storms, Flooding, Landslides and Mudslides	18-Dec-2005 to 21-Jan-2006	None	A, B, C, D, E, F, G
DR-1510	19-Feb-2004 (4-Mar-2004)	Severe Winter Storms	26-Dec-2003 to 14-Jan-2004	None	A, B, C, D, E, F, G
DR-1099	9-Feb-1996	Severe Storms, Flooding	4-Feb-1996 to 21-Feb-1996	None	A, B, C, D, E, F, G
DR-184	24-Dec-1964	Heavy Rain, Flooding	24-Dec-1964	Yes	A, B, C, D, E, F, G

Source: FEMA, Oregon Disaster History, Major Disaster Declarations

Federal Emergency Declarations

An Emergency Declaration is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring.[3] Table 2.3 lists the only federal emergency declaration for the county. In April 1977, a drought was declared for much of Oregon including Sherman County.

Table 2.3: FEMA Emergency Declarations - Sherman County

Declaration Number:	Declaration (Amendment) Date:	Incident(s):	Incident(s) Period:	Individual Assistance:	Public Assistance Categories:
EM-3039	29-Apr-1977	Drought	-	None	A,B

Source: FEMA, Oregon Disaster History, Emergency Declarations

The following subsections summarize the characteristics and extent of each hazard. For additional information on each hazard, refer to Section 3: Hazard Chapters in the 2012 State of Oregon Natural Hazards Mitigation Plan.

[3] Federal Emergency Management Agency. The Disaster Process and Disaster Aid Programs. "An Emergency Declaration." http://www.fema.gov/hazard/dproc.shtm

Drought

CHARACTERISTICS

Droughts are not uncommon in Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state in both summer and winter months. Droughts appear to be recurring and they can have a profound effect on the economy, particularly the hydro-power and agricultural sectors. Although drought may not cause significant impacts to non-farming communities, the financial impact affects the economic stability of the county. The environmental consequences also are far-reaching. They include insect infestations in forests and the lack of water to support endangered fish species. In recent years, the state has addressed drought emergencies through the Oregon Drought Council. This interagency (state/federal) council meets to discuss forecasts and to advise the Governor as the need arises.

The Oregon State University Extension Service published a report in June 1979 following the 1977 drought. Highlights of the survey findings indicate that the 1977 drought affected ranches in Easter Oregon in the following ways[4]:

- 80-percent of ranchers affected
- Three million AUM's* forage lost
- 210,000 tons feed purchased
- 862,000 AUM's forage leased
- 69,000 tons reduced hay sales
- 89,000 AUM's salvaged from grain crops
- 115,000 animals sold
- 41 million gallons of water hauled

Other affects and adjustments include reduced rate of gain of cattle, delayed breeding, herd health problems, damaged grain crops and water development and equipment investments.

*AUM – Animal Unit Months: is the amount of forage needed to sustain one cow and her calf, one horse or five sheep or goats for a month.[5]

LOCATION/EXTENT

All of Sherman County is subject to a drought hazard.

SIGNIFICANT DROUGHTS

Table 2.4 below identifies significant drought that have impacted Sherman County.

[4] Oregon State University Extension Services. "Effects of the 1977 Drought on Eastern Oregon Ranches." June 1979. http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/4743/SR%20no.%20555_ocr.pdf?sequence=1.

[5] U.S. Bureau of Land Management. Oregon/Washington. Rangelands/Grazing. http://www.blm.gov/or/resources/rangelands/index.php.

Table 2.4: Significant Droughts

Time Period	Description
1904 to 1905	A statewide drought period for approximatley 18 months.
1917 to 1931	A 15 year dry period in Oregon punctuated by brief wet spells in 1920, 1921, and 1927.
1939 to 1941	Three year period of intense drought in Oregon.
1959 to 1964	Drought period primarily affecting eastern Oregon.
1977	A Federal Emergency Decleration was made on April 29, 1977 for 19 counties in Oregon including Sherman County due to drought conditions.
1985 to 1997	Generally a dry period with statewide droughts in 1992 and 1994.
2003	The Governor issued a state of drought emergency, Executive Order No. 03-09, in Sherman County on August 15, 2003.
2005	The Governor issued a state of drought emergency, Executive Order No. 05-06, for six counties including Sherman County.
2008	The Governor issued a drought emergency for Sherman County, Executive Order No. 08-022.
2015	The Governor issued a drought emergency for Sherman County, Executive Order No. 15-07.

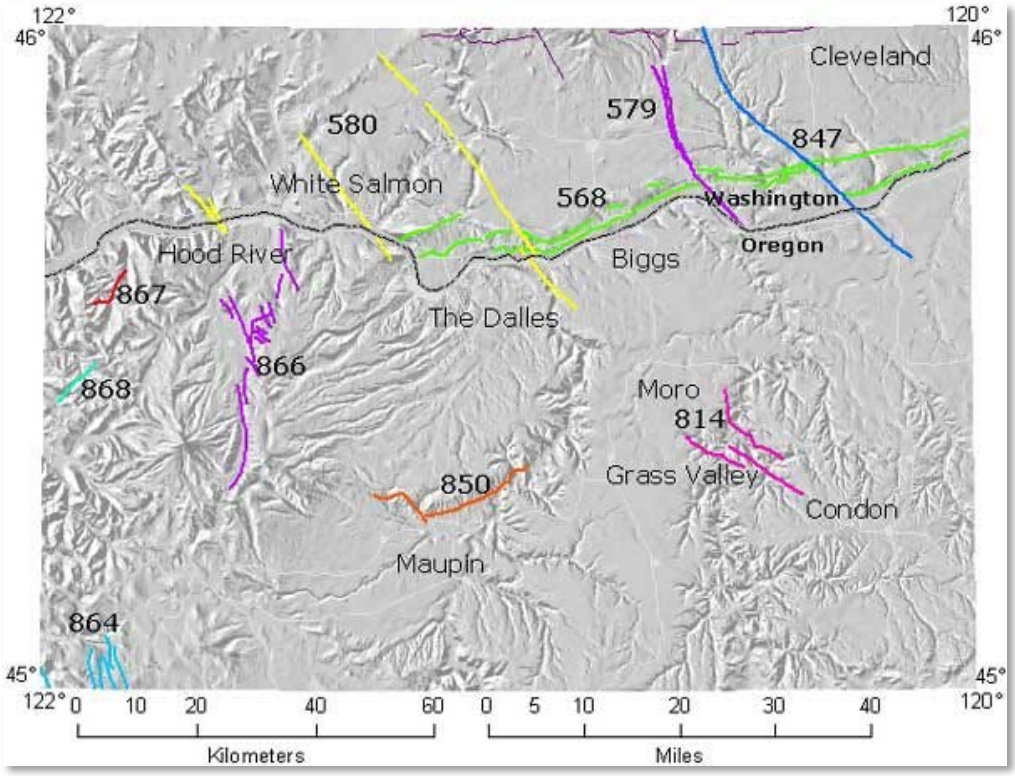
Source: State of Oregon Natural Hazards Mitigation Plan, Region 6: Central Oregon; Oregon Water Resources Department, Public Declaration Status Report.

Earthquake

CHARACTERISTICS

The geographical position of this region makes it susceptible to earthquakes from three sources: subduction zone, intraplate, and crustal events. However, given its location Sherman County is most susceptible to crustal earthquakes, with less potential for impacts from subduction or intraplate events. This suggests Sherman County can most likely expect shorter duration events with low levels of ground shaking and limited liquefaction (Region 5 Profile; DOGAMI). Figure 2.2 shows identified faults located in Sherman County and the surrounding area. Table 2.5 describes the faults located within the county.

Figure 2.2: Regional Fault Map



Source: U.S. Geological Survey (USGS), Quaternary Fault and Fold Database, The Dalles 1° X 2° Sheet

Table 2.5: Class A and B Faults Located in Sherman County

Name	Class	Fault ID	Primary County, State	Length (km)	Most recent deformation	Slip-rate category
Faults near The Dalles	A	580	Hood River County, Oregon	69 km	Quaternary (<1.6Ma)	Less than 0.2 mm/yr
Unnamed faults northwest of Condon	B	814	Gilliam County, Oregon	22 km	Quaternary (<1.6Ma)	Less than 0.2 mm/yr

Source: U.S. Geological Survey (USGS), Quaternary Fault and Fold Database, The Dalles 1° X 2° Sheet

LOCATION/EXTENT

Areas within Sherman County typically have low ground shake amplification, very low liquefaction susceptibility and moderate earthquake-induced landslide susceptibility. Areas identified with higher ground shake amplification, liquefactions and earthquake-induced landslides are located along the Deschutes River valley, John Day River valley as well as in northern portions of the county near the Columbia River. There have been no previous occurrences of earthquakes documented in Sherman County. Actual earthquake damage

can vary significantly, depending on the nature and severity of the event, localized soils, and structural vulnerability. Most injuries result from flying/falling building contents and debris.

Flood

CHARACTERISTICS

The most common type of flooding is associated with unseasonably warm, rainy weather during the winter months that can quickly melt snow. This condition has produced devastating floods throughout the region. The warm winter weather events most often occur from December through February and can ultimately affect the entire county. Flash floods and waterspouts are a substantial summer phenomenon and are associated with intense local thunderstorms. Other flood events are linked to normal seasonal snowmelt and run-off from agricultural fields.

There are several rivers in the region that produce natural extreme flood conditions. Surprisingly, the Columbia River is not one of them, nor is the lower Deschutes River or the John Day River. The Columbia River is regulated by upstream dams, so it does not present much of a problem. This is partly reflected in the federal flood insurance rate maps for the various communities along the river. However, a swollen Columbia River can back up tributary streams to the point where they constitute a significant hazard. This has occurred on a number of occasions. The lower Deschutes River and John Day River (Columbia River tributaries) are confined to fairly deep canyons with small floodplains. Consequently, they do not present the flood problems associated with smaller rivers.

LOCATION/EXTENT

A majority (80 to 100-percent) of Sherman County is subject to a variety of flood conditions. Areas particularly susceptible to flooding include Gerklin Canyon, Grass Valley Canyon, Hay Canyon, Helm Spring, Barnum Creek, Biglow Road, China Hollow Lane, Dehler Lane, Kaseberg Lane, McDermid Estate Lane, McDonald Ferry Lane, McNab Lane, Welk Road and Medler.

The hazard is primarily located with the 100 year and 500 year flood zones on the FEMA flood insurance rate maps. The probability of the hazard occurring within these zones is 1 in 100 years and 1 in 500 years. Base flood elevations have also been determined for the 100 year flood zone. The extent of the hazard can be viewed spatially on the flood hazard maps (FIRM).

SIGNIFICANT FLOODS

January 1923 – Widespread flooding in the Mid-Columbia Region. The weather was unseasonable warm with intense rain. Heavy rain melted snow rapidly and caused flooding throughout the region.

January 1933 – Widespread flooding again in the Mid-Columbia Region. Heavy rain melted snow rapidly and caused flooding throughout the region.

December 1955 - Widespread flooding again in the Mid-Columbia Region. Heavy rain melted snow rapidly and caused flooding throughout the region.

December 1964 – Record breaking floods throughout the Mid-Columbia Region. Intense rain melted heavy snow packs that caused terrible flood damage.

February 1986 - The weather was unseasonable warm with intense rain. Heavy rain melted snow rapidly and caused flooding throughout the region.

Winter 1996/1997 – Flooding caused damage to many highways in Sherman County.

August 2003 – Flash floods in Rufus. City Hall, emergency services, and three residential basements flooded. Road damage was also reported.

Table 2.6: Historical Flood Records Deschutes River at Moody, 1898-2009 Above Major Flood Stage (12 ft)

Date Crest	Gage Height (ft)	Streamflow (cfs)
8-Feb-1996	12.08	70,300
22-Dec-1964	11.80	67,300
7-Jan-1923	10.20	43,600

Source: National Oceanic and Atmospheric Administration,
National Weather Service, Northwest River Forecast Center, 1930-2009

Landslide/Debris Flow

CHARACTERISTICS

The general term *landslide* refers to a range of geologic failures including slides, flows, falls, topples and spreads. Most slope failures in Sherman County are complex combinations of these distinct types, but the generalized groupings provide a useful means for framing discussion of slide characteristics, identification methods and potential mitigation alternatives. These basic types are combined with the type of geologic material to form the common landslide names such as debris flow and rock fall.

Some landslides can move at rapid rates and thus pose life threats. These are commonly channelized debris flows, debris avalanches and rock falls. These types of rapidly moving landslides are common throughout the region, especially along the steep slopes in the Columbia River Gorge.

LOCATION/EXTENT

Seismic activity could increase landslide danger, particularly at Maddy's Hump, which is located one-mile east of Biggs and could potentially impact Interstate Highway 84. Other locations susceptible include Biggs Canyon, Cottonwood Canyon, Fulton Canyon, Scotts Canyon, Shearers Grade, Locus Grove, Mud Hollow, U.S. Highway 30, Oregon Route 206 and Oregon Route 216.

SIGNIFICANT LANDSLIDES/DEBRIS FLOWS

February 1996 – A severe storm caused landslides in Sherman County. FEMA declared a Federal Disaster in 27 counties in Oregon including Sherman County.

March 2006 - A severe storm caused landslides in Sherman County. FEMA declared a Federal Disaster for counties in Oregon including Sherman County.

Volcanic Event

CHARACTERISTICS

Sherman County is the situated east of the Cascade Mountain Range, which derived from volcanic activity. Within this range of mountains are several active and potentially active volcanoes. Mount Saint Helens, an active volcano in this chain, erupted violently in 1980 and began erupting steam and ash again during fall 2004 and spring 2005. Mt Hood, Mt. Jefferson and Mt. Adams are all potentially active volcanoes close to the region. Volcanic activity can produce many types of hazardous events including landslides, fallout of tephra (volcanic ash), lahars, pyroclastic flows and lava flows.[6] Pyroclastic flows are fluid mixtures of hot rock fragments, ash and gases that can move down the flanks of volcanoes at speeds of 50 to more than 150 kilometers per hour (30 to 90 miles per hour).[7] Lahars or volcanic debris flows are water-saturated mixtures of soil and rock fragments and can travel very long distances (over 100 km) and travel as fast as 80 kilometers per hour (50 miles per hour) in steep channels close to a volcano.[8] These hazards can affect very small local zones (only meters across) to areas hundreds of kilometers downwind.

Geoscientists have provided some estimates of future activity in the vicinity of Crater Rock, a well-known feature on Mt. Hood. They estimate a 1 in 300 chance that some dome activity will take place in a 30-year period (1996-2026). For comparison, the 30-year probability of a house being damaged by fire in the United States is about 1 in 90. The probability of 1 cm or more of tephra fall-out from eruptions anywhere in the Cascade Range in Sherman County is 1 in 1,000.[9]

LOCATION/EXTENT

Fallout from an eruption in the Cascade Mountain Range can affect the entire county.

Wildfire (WUI)

CHARACTERISTICS AND BRIEF HISTORY

Sherman County contains a diverse set of wildfire hazard and risk situations. Conditions throughout the county are conducive to large and fast moving wildfires. Several Wildland Urban Interface (WUI) areas exist with the potential for property and human life loss during a wildfire event. Following are conditions and concerns found in portions of the county which contribute to the wildfire threat and potential for catastrophic losses:

- The John Day River Canyon and the Deschutes River Canyon with numerous side canyons, all with very steep slopes.

---

[6] State of Oregon Emergency Management, Natural Hazard Mitigation Plan, NHMP Region 5: Mid-Columbia, February 2012.

[7] Ibid

[8] Ibid

[9] Ibid

- Large remote areas with no or limited vehicle access.
- Residential developments next to areas with heavy fuel loads. Some homes in these areas do not have adequate defensible space around them.
- Climatic and topographic conditions conducive for large wildfires. Hot and dry conditions exist during the fire season throughout the county. Some portions, especially in the Columbia River Gorge area, have frequent high winds which can contribute to fast moving fires that are difficult to control. Much of the county has moderate to steep slopes which add to the rate of wildfire spread and suppression difficulty.
- Large agricultural areas planted to mainly grain plus significant Conservation Reserve Program (CRP) fields. Both of these agricultural types have the potential for fast moving fires which can destroy valuable crops in short periods of time.
- Risk factors for starting wildfires. A major railroad and Interstate Highway 84 along the Columbia River represent significant ignition sources. Lightning has ignited frequent fires in the recent past. Power lines, debris burning and equipment use add to the risk. Most wildfires in the county are human caused.
- All volunteer fire districts have limited number of volunteers and resources.

LOCATION/EXTENT

Countywide, in particular there are areas of most concern include breaks of the John Day River, breaks of the Deschutes River, wheat fields, natural vegetation areas, homesteads adjacent to Bureau of Land Management (BLM) land and along various canyons throughout the county (i.e. John Day River Canyon, Deschutes River Canyon). Many fires also occur along the railroad lines along the north part of the county.

SIGNIFICANT WILDFIRES

1983 – The Moro Fire

2018 - Substation Fire.

Windstorm

CHARACTERISTICS

Sherman County, particularly the northern section of the county, experiences extreme wind events along with most other counties located along the Columbia River. The most persistent high winds occur along the Columbia River Gorge, so much so that these areas have special building code standards. All manufactured homes in Region 5 (which includes Sherman County) that are within 30 miles of the Columbia River must meet special anchoring (i.e., tie-down) standards (Section 307: Wind Resistance). The Columbia Gorge is the most significant east-west gap in the mountains between California and Canada. It serves as a funnel for east and west winds, where direction depends solely on the pressure gradient. Once set in motion, the winds can attain speeds of 80 mph, halt truck traffic, and

damage a variety of structures and facilities. In Moro, the average wind speed is highest, 9.9-mph, in April.[10]

LOCATION/EXTENT

Countywide, in particular windstorms affect the northern part of the county along the Columbia River.

SIGNIFICANT WINDSTORMS

April 1957 – A tornado caused minor damage to rangeland.

November 1951 – Widespread damage from winds up to 60 mph with gusts of up to 80 mph. Winds caused damage to transmission and utility lines.

December 1955 - Widespread damage from winds up to 65 mph. Winds caused damage to buildings and utility lines.

November 1958 - Widespread damage from winds up to 50 mph with gusts of up to 71 mph. Winds caused road closures due to fallen tress.

October 1962 – Columbus Day Storm – The most destructive windstorm in Oregon's history.

Winter Storm

CHARACTERISTICS

Communities in Sherman County are known for cold winter conditions. This is advantageous in at least one respect: in general, the region is prepared, and those visiting the region during the winter usually come prepared. However, there are occasions when preparation cannot meet the challenge. Drifting, blowing snow has brought highway traffic to a standstill. Along U.S. Highway 97, south drifting snow (at mile post 22) and blizzard conditions have caused traffic to be completely halted. Also, windy and icy conditions have closed Oregon's principal east-west transportation route, Interstate Highway 84, for hours. In these situations, travelers must seek accommodations, sometimes in communities where lodging is very limited. If motels become overwhelmed, Sherman County is prepared to house travelers in schools, local fire departments and churches.[11] Furthermore, during the winter, heat, food and the care of livestock are everyday concerns. Access to farms and ranches can be extremely difficult and present a serious challenge to local emergency managers.

LOCATION/EXTENT

Freezing canyons and highways (i.e. Hay Canyon, John Day Canyon), U.S. Highway 97 south of mile post 22 experiences icy conditions and low visibility. In addition, Sherman County is plagued by icy roads, fog, low visibility and snow, particularly on the main highways (206E,

[10] U.S. Department of Agriculture. "Soil Survey of Sherman County Oregon." Issued 1999.

[11] Sherman County Emergency Operations Plan. 2.1.2.8 Severe Weather-Winter Storm. Page 2-5.

97 and I-84). Drifting snow is a major problem along with freezing canyon and highway roads.

SIGNIFICANT WINTER STORMS

December 1861 – Storm produced between one and three feet of snow.

January 1916 – Very heavy snowfall, especially in the mountains from two separate storms.

January and February 1937 – Deep snow drifts.

January 1950 – Record snow falls with considerable property damage.

March 1960 – Winter storms caused many automobile accidents.

January 1969 – Heavy snow falls.

January 1980 – Series of storms which resulted in many injuries and power outages.

February 1985 – Heavy snow in mountains; downed power lines.

February 1986 – Central and Eastern Oregon received heavy snows resulting in broken power lines and traffic accidents.

March 1988 – Strong winds with heavy snows.

February 1990 – Heavy snows.

Winter of 1992-1993 – Very heavy snow.

Winter of 1998-1999 – Significant snow accumulation throughout Oregon.

December 26, 2003 through January 14, 2004 – FEMA declared a Federal Disaster for several Oregon counties including Sherman County on February 13, 2004.

Hazard Probability

Probability is the likelihood of future occurrence within a specified period of time. Sherman County evaluated the best available probability data to develop the probability scores presented below. For the purposes of this plan, the county utilized the Oregon Emergency Management Hazard Analysis methodology probability definitions to determine hazard probability. The definitions are:

LOW = More than 10 years between an individual event. Scores between 0 and 3 points

MEDIUM = 5 to 10 years between an individual event. Scores between 4 and 7 points

HIGH = One event likely within the next 5 years. Scores between 8 and 10 points

Table 2.7 presents the relative probability scores for each of the natural hazards present in Sherman County.

Table 2.7: Natural Hazard Probability Assessment Summary – Sherman County

Threat Event/Hazard	Severity	Weight Factor	Subtotal
Wildfire (WUI)	10	7	70
Droughts	10	7	70
Droughts	10	7	70
Wind storms	5	7	35
Floods	3	7	21
Landslides	3	7	21
Earthquakes	1	7	7
Volcanic Events	1	7	7

Source: Source: Sherman County NHMP Steering Committee, Updated March 28, 2018

Community Vulnerability

Natural disasters occur as a predictable interaction among three broad systems: natural environment (e.g., climate, rivers systems, geology, forest ecosystems, etc.), the built environment (e.g., cities, buildings, roads, utilities, etc.) and societal systems (e.g., cultural institutions, community organization, business climate, service provision, etc.). A natural disaster occurs when a hazard impacts the built environment or societal systems and creates adverse conditions within a community.

It is not always possible to predict exactly when natural disasters will occur or the extent to which they may impact the community. However, communities can minimize losses from disaster events through deliberate planning and mitigation, as well as by identifying distinct vulnerabilities.[12] Several factors that are commonly considered variables in a community's collective vulnerability to disaster are listed below.

Populations

VULNERABLE POPULATIONS

A characteristic of disasters is that they exceed the ability of emergency response agencies to provide assistance promptly. In a major disaster, members of the public may be on their own for several days. Individuals may need to go for several days without utilities and food and water sources. Disasters may also isolate individuals by damaging transportation routes. Not all people are able to respond to these conditions appropriately. Many people are in vulnerable populations that may have difficulty following official instructions and taking protective actions. For instance, someone who is developmentally disabled or deaf may not be able to hear or understand instructions on sanitation, evacuation routes or shelter locations. Table 2.8 outlines specific vulnerable populations and general county-wide concerns along with the hazards that are most likely to impact them.

[12] State of Oregon Emergency Management, Natural Hazard Mitigation Plan, NHMP Region 5: Mid-Columbia, February 2012

Vulnerable populations are those groups that possess specific characteristics that inhibit their ability to prepare for, respond to or recover from a disaster. These include elderly and youth populations, transient populations, disabled and mentally ill populations as well as low income populations. These groups are more heavily impacted because they may lack the necessary knowledge, skills, social support structures or the mental and physical abilities necessary to take care of themselves. Historically, vulnerable populations present a special challenge to emergency managers and response agencies and they are more likely to be victims of a disaster. Fortunately, many people that fall into one of these categories have families, friends, neighbors and other caretakers that will be able to assist them. But many of them do not have adequate support and those who do may not be able to rely on it in a major event.

ELDERLY

According to figures from the U.S. Census Bureau, in 2016 persons 65 and older made up 24.4-percent of the population in Sherman County. The most recent data from the 2010 Census indicates that 13.5-percent of all housing units are occupied by individuals 65 or older who live alone. Nationwide, as the baby boomer generation enters their 60's, the senior population is expected to dramatically increase.

TOURISTS

Tourists along Interstate Highway 84 and U.S. Highway 97 along the Journey Through Time Scenic Byway are particularly vulnerable to numerous hazards. This is because they are usually unfamiliar with the region and its hazards and they typically lack the resources needed to take care of themselves in a disaster. For example, a tourist who is unfamiliar with Sherman County may have difficulty using evacuation routes or finding shelters. A light traveling tourist would also not have their own supply of food, water, flashlights, radios and other supplies that locals can use to take care of themselves in a disaster. Finally, tourists usually do not have a local support structure of family, friends and neighbors that most of us rely on.

DISABLED

According to 2012-2016 American Community Survey 5-Year Estimates from the U.S. Census Bureau, 311 (18.2-percent) persons five years of age or older in Sherman County have some form of a disability (either hearing, vision, cognitive, ambulatory, self-care or independent living difficulty).

LOW-INCOME

According to U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates, 17.7-percent of people and 24.6-percent of children live below the poverty level across the county. However, both of these levels have increased since 2010, with the number of children living below the poverty level increasing by 4.4-percent. Not having sufficient financial resources during and after a disaster can be great disadvantage. Lower income people are more likely to live in mobile homes or other homes that are less able to resist

damage from flooding, windstorms, and severe weather. Low-income people tend to have the greatest difficulty recovering from a disaster.

Table 2.8: Vulnerable Population

Natural Hazard Mitigation Plan Issue: Vulnerable Populations								
Sherman County Asset Identification	**Drought**	**Earthquake**	**Flood**	**Landslide**	**Volcanic Event**	**Wildfire**	**Wind Storm**	**Winter storm**
Sagewind Manor Assisted Living Facility, Moro, OR.			X		X		X	X

Sagewind Manor

Sagewind Manor is a senior independent living facility in Moro, owned and operated by Mid-Columbia Housing Authority/Cascade Housing Authority. The manor has 12 one-bedroom apartments.

Economy

Sherman County is highly susceptible to economic disturbance from natural hazards. A substantial amount of the region's economy is based off of agriculture, recreation, and environmental services that can be severely disrupted by various hazards. In Table 2.9 below, Sherman County NHMP Steering Committee identified specific economic issues along with the hazards that most likely impact them.

Table 2.9: Vulnerable Economies in Sherman County

Natural Hazard Mitigation Plan Issue: Economy								
Sherman County Asset Identification	**Drought**	**Earthquake**	**Flood**	**Landslide**	**Volcanic Event**	**Wildfire**	**Wind Storm**	**Winter storm**
Mid Columbia Producers, Inc.	X		X		X	X	X	
Wind Farms		X				X		
Oregon Raceway						X		
Azure Standard	X					X	X	X

Mid-Columbia Producers, Inc.

Mid-Columbia Producers, Inc. is a farmer owned cooperative, with their main office in Moro, Oregon and satellite offices in Hermiston and Bend, Oregon. Their mission is to provide stakeholders with industry leading products, services, and specialized knowledge, to maximize profits that sustain our communities and grow our company.

They operate three grain barge loading facilities on the Columbia River located in Arlington, The Dalles and Biggs, Oregon. Their 16 inland elevators are located in Wasco, Sherman, Gilliam, and Morrow counties of Oregon and Klickitat County Washington. They also operate farm stores are located in Wasco, Oregon, and Goldendale, Washington, as well as, cardlock, bulk fuel, bulk lubricant, packaged products, and tanker deliveries out of Moro, Bend, and Hermiston.[13]

Wind Farms

Wind farms in the northeast section of Sherman County serve as an additional economic driver.

Wind fuels the 321-megawatt Klondike Wind Farm located four miles southeast of Wasco, as well as the 450-megawatt Biglow Canyon Wind Farm just to the north. The first three phases of the Klondike project, owned by Iberdrola Renewables, use 44 Siemens 2.3 MW wind turbines and 146 GE 1.5 MW wind turbines. These wind farms supply clean, renewable electricity to Portland General Electric, Bonneville

[13] Mid-Columbia Producers, Inc. http://www.mcpcoop.com

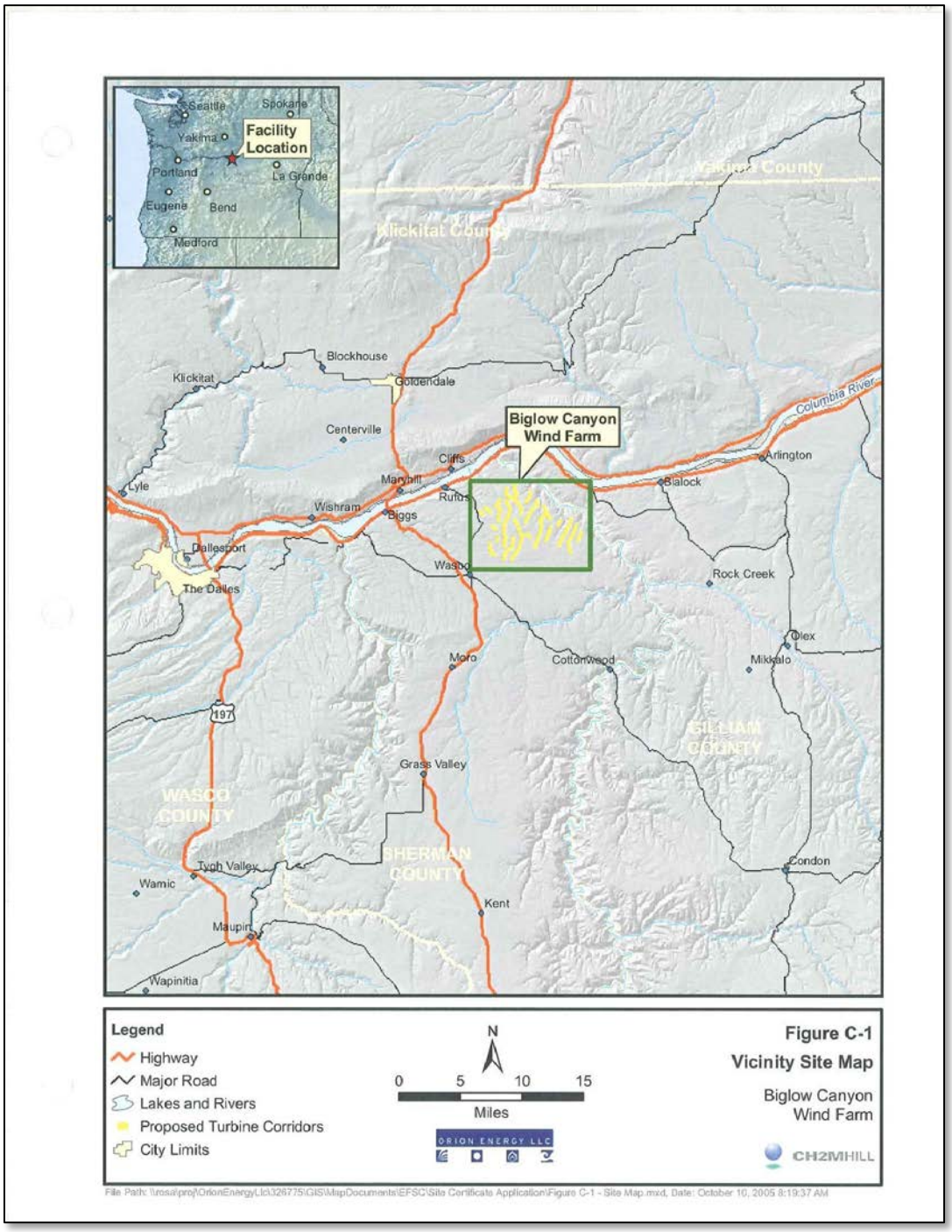
Power Administration, Eugene Water & Electric Board, and other power companies region wide. The Biglow Canyon project, owned by PGE, is one of the largest wind farms in all of the Western United States.

The Golden Hills Wind Project is approved (Fig 2.X) and will have up to 125 wind turbines and a maximum capacity of 400 megawatts. It has a site boundary of approximately 29,500 acres. The facility has not yet been built and construction must begin by June 18, 2020.

Harvesting a clean, renewable source of energy helps meet the Northwest's demand for cost-competitive electric power while benefiting our rural economies. The American Wind Energy Association estimates that each megawatt of wind power provides enough energy to light up 300 average American homes each year. Local communities benefit from jobs, property taxes from wind farm owners, annual lease payments to property owners, energy supply security, and tourist appeal.[14]

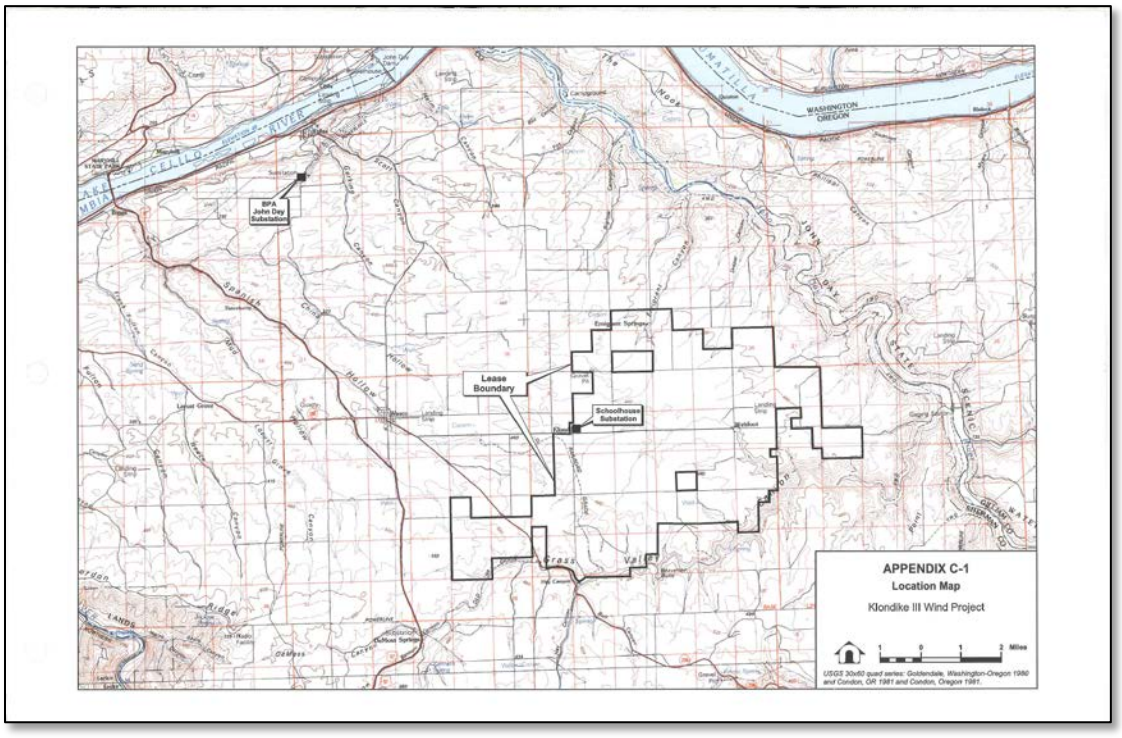
[14] Sherman County website. https://www.co.sherman.or.us/wind-power/

Figure 2.X: Biglow Canyon Wind Farm



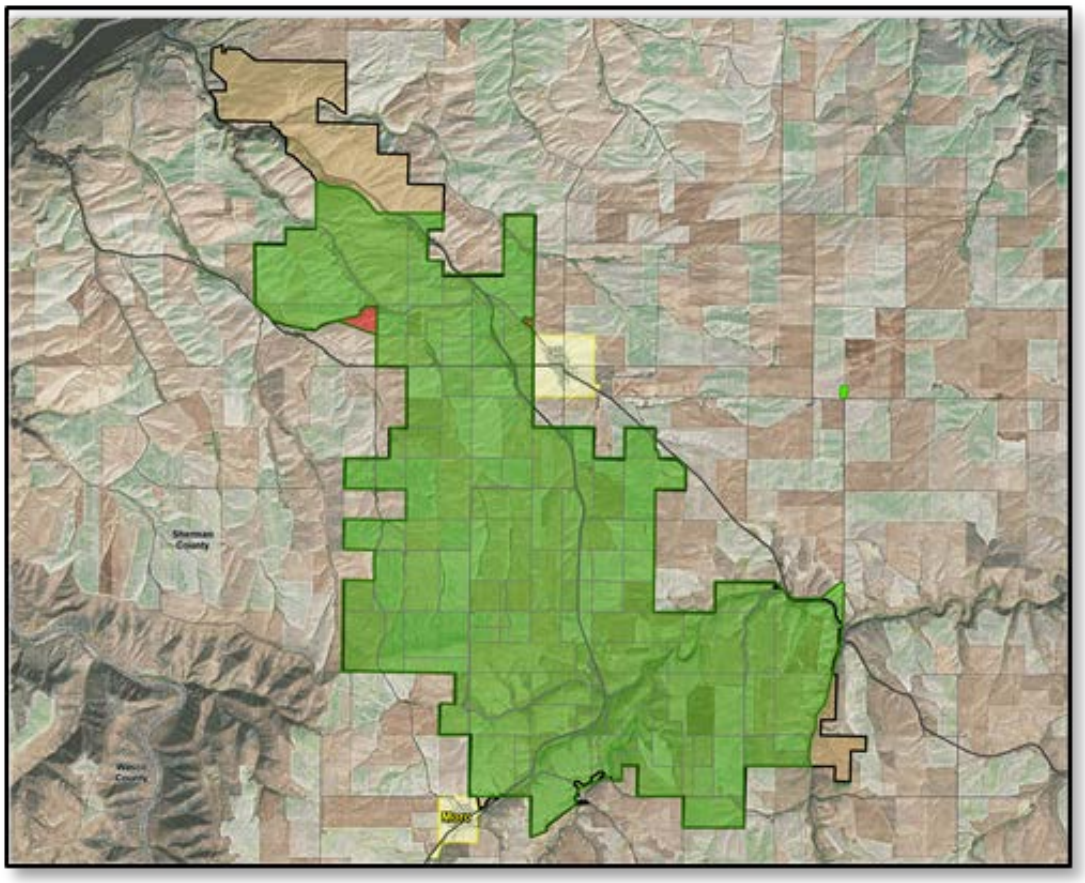
Source: Oregon Department of Energy. https://www.oregon.gov/energy/facilities-safety/facilities/Pages/Facilities-Under-EFSC.aspx

Figure 2.X: Klondike Wind Farm



Source: State of Oregon, Department of Energy. https://www.oregon.gov/energy/facilities-safety/facilities/Pages/KWP.aspx

Figure 2.X: Golden Hills Wind Farm



Source: Oregon Department of Energy. https://www.oregon.gov/energy/facilities-safety/facilities/Pages/Facilities-Under-EFSC.aspx

Oregon Raceway

Oregon Raceway Park is a 2.3-mile dedicated road course facility in Grass Valley, Oregon that hosts competitive automobile, kart and motorcycle events. It opened in 2008. [15]

Azure Standard

Azure Standard is a privately held farming company based across the Deschutes River in Dufur (Wasco County) with their growing land in Sherman County. According to their website, they are an organic industry pioneer. What started out as an organic farm over 40 years ago, has since grown into the largest independent natural and organic food distributor in the country. Azure now delivers more than 14,000 non-GMO and organic products direct to families, manufacturers and retailers across the nation, including Hawaii and Alaska.

Land-use and Development

To accommodate growth, communities engaged in mitigation planning should address infrastructure and service needs, specific engineering standards, and building codes.

[15] Source: https://en.wikipedia.org/wiki/Oregon_Raceway_Park

Eliminating or limiting development in hazard prone areas, such as floodplains, can reduce vulnerability to hazards, and the potential loss of life, injury, and property damage. Communities in the process of developing land for housing and industry need to ensure that land-use and protection goals are being met to prevent future risks.[16] State law requires that cities and the county jointly manage Urban Growth Areas, delineated by a city's Urban Growth Boundary (UGB) that identifies lands needed to meet population and economic demands for growth within a 20-year period.

Critical Facilities and Infrastructure

Transportation networks, systems for power transmission, and critical facilities such as hospitals and police stations are all vital to the functioning of a county. Due to the fundamental role that infrastructure plays both pre- and post-disaster, it deserves special attention in the context of creating more resilient communities. Table 2.12 below lists specific and general county-wide and city critical infrastructure and services concerns along with the hazards that are most likely to impact them.

[16] Source: State of Oregon Emergency Management Plan, Region 5: Mid-Columbia Regional Profile, February 2012

Table 2.12: Vulnerable Critical Infrastructure & Services in Sherman County

Natural Hazard Mitigation Plan Issue: Vulnerable Critical Infrastructure & Services									
Sherman County Asset Identification	**Address**	**Drought**	**Earthquake**	**Flood**	**Landslide**	**Volcanic Event**	**Wildfire**	**Wind Storm**	**Winter storm**
Sherman County									
Sherman County Courthouse (includes County Sheriff)	500 Court Street Moro, OR 97039 (building is new and old sections)						X		X
Sherman Elementary School	65912 High School Loop, Moro, OR 97039			X					
Sherman Junior/High School	65912 High School Loop, Moro, OR 97039			X					
Power System							X	X	X
Biggs Bridge	Sam Hill Memorial Bridge, Wasco, OR 97065		X					X	X
John Day Dam	John Day Dam, Goldendale, WA 98620		X	X					
Radio Repeater – Gordon Ridge	67820 Gordon Ridge Rd., Moro, OR 97065						X	X	X
Radio Repeater - Erskine	67820 Sayers Rd. Grass Valley, OR 97029								
Biggs Jct. Wastewater Facility	91585 Biggs Rufus Hwy Wasco, OR 97065		X	X	X		X	X	X
Sherman County Medical Clinic	110 Main St., Moro, OR 97039		X				X	X	X
Sherman County Ambulance	309 Dewey Street PO Box 351 Moro, OR 97039		X	X			X		X
Sherman County Emergency Management	309 Dewey Street PO Box 351 Moro, OR 97039		X	X			X		X
Cellular Tower – Kent Site (T-Mobile & Verizon)	95185 Dobie Point Lane, Kent, OR 97033						X	X	
City of Grass Valley									
South Sherman Fire	South Sherman Fire & Rescue 412 Mill St. Grass Valley, OR 97029			X	X		X		X
City Water Supply (2 Wells & Reservoir)	300 Sharp St. Grass Valley, OR	X		X	X				X
City Hall	2nd St, Grass Valley, OR 97029			X	X		X		X
Cellular Tower – Squire Cemetery Site (Verizon Wireless)	63772 Hwy 97. Grass Valley, OR 97039						X	X	
Cellular Tower – Grass Valley Elevator MCP (US Cellular)	202 SW Krusow St., Grass Valley, OR 97029						X	X	
City of Moro									
City of Moro Fire Department	309 Dewey Street PO Box 351 Moro, OR 97039			X			X		X
Moro Rural Fire District	309 Dewey Street PO Box 351 Moro, OR 97039			X			X		X
City Water Supply – Hart Well	207 Weaver St., Moro, OR 97039	X					X		
City Water Supply – Cemetery Well	500 Azure Ln., Moro, OR 97039	X					X		
City Water Supply – City Hall Site	101 Dewey St., Moro, OR 97039								
City Water Supply – Reservoir	603 Columbus St., Moro, OR 97039								
City Wastewater Treatment Facility				X					
City Hall	104 First Street - New City Hall Moro, OR 97039							X	X
Cellular Tower – Spencer Site - American Towers (T-Mobile)	66903 Hwy 97, Moro, OR 97039						X	X	
Cellular Tower – DeMoss Site (Verizon)	67241 Henrichs Rd., Moro, OR 97039						X	X	
Cellular Tower – Gordon Ridge Site (US Cellular)	67804 Gordon Ridge Moro, OR 97039						X	X	
City of Rufus									
City Water Supply – Well #1:	200 East 2nd St. Rufus, OR 97050	X	X		X		X	X	X
City Water Supply – Well #3 and Reservoir	101 China Hollow Rd. Rufus, OR 97050	X	X		X		X	X	X
North Sherman Fire Rufus Station	400 Main St, 97065 Rufus, United States		X	X	X		X		X
City Wastewater Facility	600 Biggs Rufus Hwy. Rufus, OR 97050		X	X			X	X	X
City Hall	304 W 2nd St, Rufus, OR 97050		X	X			X	X	X
Public Works Department	400 Main St, 97065 Rufus, United States		X	X			X		X
City of Wasco									
City of Wasco Water Supply	711 Dunlap/Biggs St/Yates St	X	X				X	X	X
City Wastewater treatment facility	100 Old Hwy 97, Wasco, OR 97065	X	X				X	X	X
North Sherman Fire Wasco Station	411 Yates St., Wasco, OR 97065						X	X	X
City Hall	1017 Clark St, Wasco, OR 97065			X			X	X	X
Wasco School Events Center	903 Barnett St., Wasco, OR 97065		X	X			X	X	X
Wasco State Airport	1009 Scott St, Wasco, OR 97065		X	X			X	X	X
Cellular Tower – Ray Smith Site (Verizon Tower)	69940 Clark Rd., Wasco, OR 97065						X	X	

Seismic vulnerability assessments have highlighted the need for seismic retrofit of critical facilities. In 2006 the Oregon Department of Geology and Mineral Industries conducted a statewide seismic needs assessment survey using rapid visual screening. Table 2.13 identifies the results on critical facilities located in Sherman County. FEMA recommends that all buildings with a score of 2.0 or less should be considered to have inadequate performance during the anticipated maximum seismic event.[17]

In the 2014 NHMP, three facilities in Sherman County were identified as having collapse potential* scores of 2.0 or less. Two of those facilities, the South Sherman Elementary School in Grass Valley and the Sherman County Courthouse in Moro, were identified as having high collapse potential (greater than 10-percent). One facility, the Sherman Junior/Senior High School in Moro, had a moderate collapse potential (greater than 1-percent). Since the 2014 Sherman County NHMP was completed, these three critical facilities have either been replaced or are no longer in use by a vulnerable population.

Sherman County Success Story: Since the 2014 Sherman County NHMP was completed, the three critical facilities most at risk of collapse in a seismic event have either been replaced or are no longer in use by a vulnerable population. These include the South Sherman Elementary School, Sherman Junior/Senior High School and Sherman County Courthouse.

***Collapse Potential –** A RVS score of 2.0 represents that there is a 1 in 100 chance (1-percent probability), that the building will collapse due to ground motion caused by the maximum considered earthquake. A score of 0.0 implies a 1 in 1 chance (100-percent probability). FEMA recommends that all buildings with a score of 2.0 or less should be considered to have inadequate performance during the anticipated maximum seismic event. DOGAMI has refined the relative rank of the RVS score into four categories: Very High (RVS less than or equal to zero, 100-percent probability of collapse), High (RVS from 0.1 to 1.0, greater than a 10-percent probability of collapse), Moderate (RVS from 1.1 to 2.0, greater than a 1-percent probability of collapse) and Low (RVS greater than or equal to 2.1, probability of collapse less than 1-percent). New construction is deemed to have low collapse potential. Sites that have been or are planned to have seismic rehabilitation are deemed to have moderate collapse potential. Sites that were missed during the field screening are deemed to have high collapse potential.

[17] Statewide Seismic Needs Assessment. Appendix I: Spreadsheet and Site Summary Report Data Field Definitions.

Table 2.13: Statewide Seismic Needs Assessment Using Rapid Visual Screening (RVS)

City	Facility Name	Inspection Date	Final Score	FEMA-154 Collapse Potential	Status as of 2019
Grass Valley	South Sherman Elementary School	28-Jun-06	0.3	**High (>10%)**	Building no longer a school. Used now for hemp production
Grass Valley	South Sherman Rural Fire Protection District	28-Jun-06	3.3	Low (<1%)	No change in use
Moro	Sherman Junior/Senior High School	28-Jun-06	1.1	Moderate (>1%)	New Pre-K through Senior High School building complex
Moro	Moro Rural Fire Protection District	28-Jun-06	3.2	Low (<1%)	No change in use
Moro	Sherman County Courthouse	28-Jun-06	0.6	**High (>10%)**	New County Courthouse adjacent to old one. Old Courthouse still in use.
Rufus	Rufus Volunteer Fire Department	28-Jun-06	2.6	Low (<1%)	No change in use. Facility name is now: North Sherman Rural Fire Protection District - Rufus Station
Wasco	North Sherman Elementary School	28-Jun-06	2.7	Low (<1%)	Facility is now owned by the City of Wasco and operates as the Wasco School Events Center
Wasco	North Sherman County Rural Fire Protection District	28-Jun-06	2.3	Low (<1%)	No change in use

Source: Oregon Department of Geology and Mineral Industries, Statewide Seismic Needs Assessment, 2006.
Status as of 2019 source: County Emergency Manager and County Planning Director.

Vulnerability Summary

Vulnerability is a measure of the exposure of the built environment to hazards. The exposure of community assets to hazards are critical in the assessment of the degree of risk a community has to each hazard. Identifying the facilities and infrastructure at risk from various hazards can assist the county in prioritizing resources for mitigation, and can assist in directing damage assessment efforts after a hazard event has occurred. The exposure of county assets to each hazard and potential implications are explained in each hazard section.

Vulnerability is the percentage of population and property likely to be affected under an "average" occurrence of the hazard. Sherman County evaluated the best available vulnerability data to develop the vulnerability scores presented below. For the purposes of this plan, the county utilized the Oregon Emergency Management Hazard Analysis methodology vulnerability definitions to determine hazard probability. The definitions are:

LOW = less than 1-percent affected scores between 0 and 3 points.

MEDIUM = between 1 and 10-percent affected scores between 4 and 7 points.

HIGH = more than 10-percent affected scores between 8 and 10 points.

Table 2.14 presents the vulnerability scores for each of the natural hazards present in Sherman County. As shown in the table, a high vulnerability is not scored with any of the identified hazards within the county. Instead, Sherman County identifies medium vulnerability scores for the following hazards; drought, flood, landslide/debris flow, wildfire, windstorm and winter storm. In addition, Sherman County has low vulnerability scores for both earthquake and volcanic event.

Table 2.14: Community Vulnerability Assessment Summary – Sherman County

Threat Event/Hazard	2014 Severity	2019 Severity	Weight Factor	2014 Subtotal	2019 Subtotal	2014 Vulnerability	2019 Vulnerability
Drought	5	8	5	25	40	Medium	High
Earthquake	2	10	5	10	50	Low	High
Flood - Riverine	6	5	5	30	25	Medium	Medium
Landslide/Debris Flow	6	2	5	30	10	Medium	Low
Volcanic Event	3	5	5	15	25	Low	Medium
Wildfire (WUI)	7	10	5	35	50	Medium	High
Windstorm*	5	5	5	25	25	Medium	Medium
Winter Storm	5	9	5	25	45	Medium	Medium

Source: Sherman County NHMP Steering Committee Meeting, March 28, 2018

National Flood Insurance Program (NFIP)

Risk Assessment - §201.6(c)(2)(ii): "All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods."

Sherman County, the City of Grass Valley, the City of Rufus and the City of Wasco participate in the National Flood Insurance Program (NFIP). Flood Insurance Rate Maps (FIRMs) for Sherman County, the City of Grass Valley and the City of Rufus are current as of September 1984; FIRMs for the City of Wasco are current as of September 1989 and FIRMs for the City of Moro are current of January 1950. Table 2.15 shows that as of August 14, 2018 there were just 2 National Flood Insurance Program (NFIP) policies in force with a total value of over $410-thousand. Between 1978 and August 14, 2018, there were zero NFIP claims.

Table 2.15: NFIP Summary Table

Jurisdiction	FIRM Date	NFIP Status^	# NFIP Policies	Total Coverage	Total Premium	# NFIP Claims	Total Paid
Sherman County	Sep-84	P	0	$0.00	$0.00	0	$0.00
Grass Valley	Sep-84	P	0	$0.00	$0.00	0	$0.00
Moro	Jan-50	NP	0	$0.00	$0.00	0	$0.00
Rufus	Sep-84	P	1	$140,000.00	$285.00	0	$0.00
Wasco	Sep-89	P	1	$270,200.00	$501.00	0	$0.00
Totals			**4**	**$410,000.00**	**$786.00**	**0**	**$0.00**

Source: FEMA Community Information System (CIS) database; ^ P = Participating, NP = Not Participating

Table 2.16 illustrates that as of August 14, 2018 Sherman County and the cities of Grass Valley, Moro, Rufus and Wasco have zero repetitive flood loss properties. Sherman County's last Community Assistance Visit was April 1985. The City of Rufus's last Community Assistance Visit was April 1985. Neither Sherman County nor the cities of Grass Valley, Moro, Rufus, or Wasco are members of the Community Rating System (CRS).

Table 2.16: NFIP Repetitive Loss and Severe Repetitive Loss Summary

Jurisdiction	# SRL Properties-Validated	# SRL Properties-Pending	# RL Properties
Sherman County	0	0	0
Grass Valley	0	0	0
Moro	0	0	0
Rufus	0	0	0
Wasco	0	0	0
Totals	0	0	0

Source: FEMA Community Information System (CIS) database

Risk Assessment

The Steering Committee discussed the hazards that impact Sherman County at their meeting on March 28, 2018. All members present agreed that addressing all of the participating jurisdictions hazards in one Hazard Vulnerability Analysis (HVA) for the plan was acceptable as it would be efficient and collaborative. This is a departure from the 2014 NHMP where each participating jurisdiction developed separate HVA's.

The Steering Committee noted that wildfires are the hazard of most concern in Sherman County, followed by Winter Storms and Drought. This ranking is unchanged from the 2014 NHMP.

Table 2.17 presents the entire updated hazard analysis matrix for Sherman County. The hazards are listed in rank order from high to low. The table shows that hazard scores are

influenced by each of the four categories combined. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.[18]

With considerations for past historical events, the probability or likelihood of a particular hazard event occurring, the vulnerability to the community, and the maximum threat or worst case scenario, wildfire, winter storms and drought rank as the top natural hazards of concern in Sherman County. Earthquakes, windstorms and floods make-up the next three highest ranked hazards, while volcanic events and landslide/debris flows make up the lowest ranked hazards in the matrix.

One would think that hazards with a more prominent history and a higher likelihood of occurring in the future should be ranked high. However, if such hazards do not have a high vulnerability or threat to the community, the score will remain relatively low. For example, the data indicates that windstorms occur more frequently in the county compared to flood events. However, since Sherman County is potentially more vulnerable to flood events, especially in a worst case scenario event, the overall threat score for flood is greater than that of windstorm. The hazard scores are influenced by not one or two of the categories, but all four combined.

Table 2.17: Hazard Analysis Matrix – Sherman County

	History			Probability			Vulnerability			Maximum Threat			
Hazard	Severity	Weight Factor	Subtotal	Severity	Weight Factor	Subtotal	Severity	Weight Factor	Subtotal	Severity	Weight Factor	Subtotal	Total Threat Score
Wildfire	10	2	20	10	7	70	10	5	50	10	10	100	240
Winter Storm	10	2	20	10	7	70	9	5	45	10	10	100	235
Drought	10	2	20	10	7	70	8	5	40	9	10	90	220
Earthquakes	1	2	2	1	7	7	10	5	50	10	10	100	159
Windstorms	3	2	6	5	7	35	5	5	25	8	10	80	146
Floods	3	2	6	3	7	21	5	5	25	8	10	80	132
Volcanic Events	1	2	2	1	7	7	5	5	25	4	10	40	74
Landslides	3	2	6	3	7	21	2	5	10	3	10	30	67

Source: Sherman County NHMP Steering Committee, Updated March 28, 2018.

[18] Oregon Emergency Management. Hazard Analysis Methodology. Page 1. May 2008.