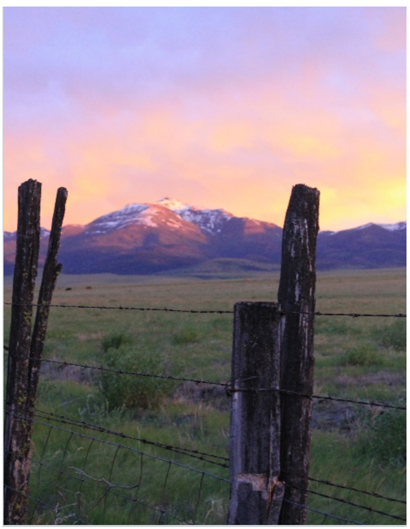
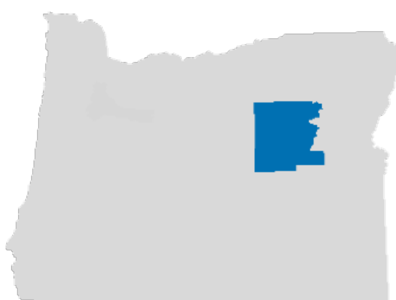





Grant County, Oregon

MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

- Grant County
- Grant Soil and Water Conservation District



- City of John Day
- Grant County Education Service District

FEMA

Effective September 3, 2020 through September 2, 2025

The *2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan* is a living document that will be reviewed and updated periodically. It will be integrated with existing plans, policies, and programs. The Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved NHMP to receive federal funds for pre- and post-disaster mitigation grants.

Comments, suggestions, corrections, and additions are encouraged to be submitted from all interested parties.

For further information and to provide comments, contact:

Paul Gray, Emergency Manager
Grant County Emergency Management Department
201 S Humbolt Street
Canyon City, OR 97820
Phone 541-575-0990

Grant County developed this Multi-Jurisdictional Natural Hazards Mitigation Plan through a partnership funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program. In 2017, the Department of Land Conservation and Development (DLCD) received a Pre-Disaster Mitigation Grant (PDMC-PL-10-OR-2017-002) from FEMA through the Oregon Office of Emergency Management (OEM) to assist Grant County with the NHMP.

Acknowledgments

Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan Update Steering Committee

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Ted Williams, Chair, Emergency Manager
Scott Myers, County Judge
Hilary McNary, former Planning Director
Shannon Springing, current Planning Director
Haley Walker, Grant County Regional Airport Manager

City of John Day
Nicholas Green, City Manager
Daisy Goebel, Planner

City of Canyon City
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GRANT COUNTY
MULTI-JURISDICTIONAL
NATURAL HAZARDS MITIGATION PLAN

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Volume I: Basic Plan

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U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021-8627

FEMA

October 6, 2020

The Honorable Scott W. Meyers
County Judge, Grant County, OR
201 S. Humbolt Street
Suite 280
Canyon City, Oregon 97820

Dear Judge Meyers:

On September 3, 2020, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Grant County Multi-Jurisdictional Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through September 2, 2025, through your state.

Grant County	Grant County Education Service District
City of John Day	Grant Soil and Water Conservation District

The updated list of approved jurisdictions includes the Grant Soil and Water Conservation District and Grant County Education Service District that recently adopted the Grant County Multi-Jurisdictional Hazard Mitigation Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval, please contact Joseph Murray, State Hazard Mitigation Planner with the Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities. If you have questions regarding FEMA's mitigation grant programs, please contact Amie Bashant, State Hazard Mitigation Officer with the Oregon Military Department, Office of Emergency Management, at 503-378-4660.

Sincerely,

Kristen Meyers, Director
Mitigation Division

cc: Amie Bashant, Oregon Office of Emergency Management

Enclosure

JS:vl/cf

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I. INTRODUCTION

This section provides a general introduction to natural hazard mitigation planning in Grant County. This section contains a general discussion about what natural hazard planning is, including a discussion of how the plan addresses the federal requirements contained in 44 Code of Federal Regulations (CFR) 201.6(b) and how the plan fits within the Oregon planning policy framework. There is a description of the process for updating the *2014 Northeast Oregon Multi-jurisdictional Natural Hazard Mitigation Plan* and a brief summary of the physical, economic and social features of Grant County that relate to hazard mitigation planning. The section concludes with a general description of how the plan is organized.

Natural Hazard Mitigation Planning

What is Natural Hazard Mitigation?

The Federal Emergency Management Agency (FEMA) defines mitigation as ". . . the effort to reduce loss of life and property by lessening the impact of disasters . . . through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk."[1] Said another way, natural hazard mitigation is a method of permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through long and short-term strategies. Example strategies include projects, such as seismic retrofits to critical facilities and flood mitigation projects; and education and outreach to targeted audiences, such as the elderly. Natural hazard mitigation is the responsibility of the "Whole Community" – individuals and families; private businesses and industries; non-profit groups; schools and academia; media outlets; faith based and community organizations; and federal, state, and local governments.[2]

Completing mitigation actions detailed in this plan will benefit Grant County in a number of ways including reduced loss of life, property, essential services, critical facilities and economic hardship when natural hazards occur; reduced short-term and long-term recovery and reconstruction costs following natural hazard events; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

Why Develop an NHMP?

It is impossible to predict exactly when natural hazard events will occur, or the extent to which they will affect community assets. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

The dramatic increase in the costs associated with natural disasters over the past decades fostered interest in identifying and implementing effective means of reducing vulnerability. Grant County was one of the four counties the *2014 Northeast Oregon Multi-jurisdictional Natural Hazard Mitigation Plan*

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[1] FEMA, What is Mitigation? http://www.fema.gov/what-mitigation, accessed January 17, 2020,

[2] FEMA, *Whole Community*, https://www.fema.gov/whole-community, accessed January 17, 2020.

(*2014 NHMP*) included. The Grant County elected officials, citizens and other stakeholders, along with the City of John Day, the Grant Soil and Water Conservation District, and the Grant County Education Service District worked together to update that plan. This *2020 Grant County Natural Hazards Mitigation Plan* (*2020 NHMP*) aims to continue the purpose of that plan, that is to reduce future loss of life and damage to property resulting from natural hazards.

In addition to Grant County's interest in establishing a comprehensive community-level natural hazard mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved NHMP in order to receive federal funds for mitigation projects.

Local and federal approval of this plan ensures that the county and listed cities will remain eligible for pre- and post-disaster mitigation project grants.

What Federal Requirements Does This Plan Address?

The Disaster Mitigation Act of 2000 (DMA2K) a key piece of federal legislation addressing mitigation planning. It reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. As such, this Act established the Pre-Disaster Mitigation (PDM) grant program and requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP).

Section 322 of the Act specifically addresses mitigation planning at the state and local levels. State and local jurisdictions must have approved mitigation plans in place in order to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that proposed mitigation measures are based on a sound planning process that accounts for the risk to the individual and their capabilities. Chapter 44 Code of Federal Regulations (CFR), section 201.6, also requires a local government to have an approved mitigation plan in order to receive HMGP project grants.[3]

Development of the *2014 NHMP* update was pursued in compliance with subsections from 44 CFR 201.6 guidelines. These four subsections address plan requirements, the planning process, plan content, and plan review.

- Subsection (a) provides an outline of the overall plan requirements, including an overview of general plan components, exceptions to requirements, and multi-jurisdictional participation.
- Subsection (b) outlines the requirements of the planning process, with particular focus on public involvement in the update process, as well as the role of local agencies, organizations and other relevant entities in the development process, as well as standards for adequate levels of review and incorporation of existing plans and policies.
- Subsection (c) outlines requirements concerning the plan update's content, including an overview of necessary components for the update's planning process, risk assessment, mitigation strategy, plan maintenance, and overall process documentation.

[3]Code of Federal Regulations. Chapter 44. Section 201.6, subsection (a). 2010

- Subsection (d) outlines the steps and agencies required for proper review of the plan before finished plans are adopted by their respective communities.[4]

The resulting *2020 NHMP* must be submitted to Oregon's Office of Emergency Management (OEM) for initial plan review, and then it is submitted to FEMA for review and federal approval. Once FEMA provides the Approval Pending Adoption letter, the Grant County and each of the jurisdictions and special districts must formally adopt the *2020 NHMP*. Once the local jurisdictions and special districts have provided resolutions showing the adoption of the *2020 NHMP*, FEMA will send an approval letter with the dates of the *2020 NHMP* approval. The approval period is for five years.

Additionally, the Emergency Management Performance Grant (EMPG), which helps fund local emergency management programs, also requires a FEMA-approved NHMP.

What is the Policy Framework for Natural Hazards Planning in Oregon?

Planning for natural hazards is an integral element of Oregon's statewide land use planning program, which began in 1973. All Oregon cities and counties have comprehensive plans and implementing ordinances that are required to comply with the statewide planning goals. The challenge faced by state and local governments is to keep this network of local plans coordinated in response to the changing conditions and needs of Oregon communities.

Statewide land use planning Goal 7: Areas Subject to Natural Hazards calls for local plans to include inventories, policies and ordinances to guide development in or away from hazard areas. Goal 7, along with other land use planning goals, has helped to reduce losses from natural hazards. Through risk identification and the recommendation of risk-reduction actions, this plan aligns with the goals of the jurisdiction's Comprehensive Plan, and helps each jurisdiction meet the requirements of statewide land use planning Goal 7.

The primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions. However, resources exist at the state and federal levels. Some of the key agencies in this area include Oregon Military Department – Office of Emergency Management (OEM), Oregon Building Codes Division (BCD), Oregon Department of Forestry (ODF), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Department of Land Conservation and Development (DLCD).

How was the Update to the NHMP Developed?

The 2020 Grant County Natural Hazard Mitigation Plan Steering Committees with the collaboration of DLCD staff updated the *Northeast Oregon Multi-Jurisdictional Natural Hazards Mitigation Plan* dated February 2014 (*2014 NHMP*) that was approved by FEMA on June 5, 2014 and was valid through June 4, 2019. The City of John Day Addendum comprised a portion of that plan. The City of Canyon City developed an addendum to that plan that was approved by FEMA on May 5, 2017 pending adoption by Canyon City elected officials. The now expired *2014 NHMP* covered four counties (Baker, Grant, Union and Wallowa Counties), whereas the current plan focuses exclusively on Grant County. Plan holders for this update, the 2020 *Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan* (*2020 NHMP*),

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[4] ibid, subsection (c). 2010

include Grant County, the City of John Day, the Grant Education Service District and the Grant Soil and Water Conservation District.

A steering committee representative of the whole community was formed by the project managers. The 2020 Grant County NHMP Steering Committee included Grant County officials and officials from the City of John Day. Representatives from all cities within the county and non for profit organizations were invited to attend. Participation by the director of Blue Mountain Forest Partners, a Canyon City Council member, the member of the Oregon Department of Forestry, and members of the public rounded out the representation in public meetings. Sign in sheets for meetings and meeting agendas are included in Appendix B.

The 2020 Grant County NHMP Steering Committee formally convened on seven occasions (March 14, 2019, May 23, 2019, July 18, 2019, September 9, 2019, February 14, 2019, April 10, 2019 and May 12, 2020) with the project manager, a DLCD Natural Hazard Planner, in person and via conference call to discuss and revise the plan. Two additional opportunities for participation in the process were provided by FEMA during the Risk MAP process (webinars July 26-August 1, 2019 and the Discovery meeting on September 13, 2019) for a total of nine public meetings. In addition, the DLCD Natural Hazard Planner spoke on the phone and emailed the Emergency Manager and convener of the Steering Committee regularly throughout the process. During the development of the plan, the individual filling the role of project manager for DLCD changed, but the project management functions of administration, plan drafting and organization continued to be fulfilled. Steering committee members contributed data, maps and time doing outreach and advocacy for the plan and in collaboration with the DLCD planner they reviewed and updated the community profile, risk assessment, action items and implementation plan.

An open public involvement process is essential to the development of an effective plan. The planning process included opportunities for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the plan during development demonstrating the use of a comprehensive approach to reducing the effects of natural disasters.

The Emergency Manager encouraged participation in the update process by making direct contact with constituents and city staff during the course of his work throughout the county. This early direct contact was followed up by posting flyers, updates and meeting dates on the county's Emergency Management webpage. Word of mouth is a prevalent method of "getting the word out" in Grant County. The daily work of the Emergency Manager to engage with the communities of Grant County and to promote the process of public engagement to update the plan were invaluable, if less easily documented. Further details of the public engagement process are available in Volume III, Appendix B: Planning Process.

The following plans were consulted during the preparation of the *2020 NHMP*, are referenced throughout the plan and are also integrated into the mitigation actions contained in Volume I: Basic Plan, Section III and referenced in Volume III: Appendix C: Mitigation Action Worksheets.

- Grant County Comprehensive Plan, 1999
- Grant County Land Development Code, 2019
- Grant County Community Wildfire Protection Plan, dated August 2013. This plan is currently being updated.

- Grant County Emergency Operations Plan, dated June 2019.
- Grant County Regional Airport Master Plan, dated December 2018.
- Grant County Transportation System Plan, June 1997
- Blue Mountain Hospital Community Health Needs Assessment Implementation Plan, 2019.
- John Day Comprehensive Plan, 2003
- John Day Zoning Code, 2012
- John Day Innovation Gateway Plan

The *2020 NHMP* will be maintained and implemented by an Implementation Committee to be comprised of representatives of each of the jurisdictions in the county along with representatives of special districts such as the Grant Soil and Water Conservation District and the Grand Education Service District. This committee will be convened by the Emergency Manager and will meet at least annually to review progress on the mitigation action items. The entire plan will be updated prior to its expiration in five years from the effective date. Details of the plan implementation strategy are the subject of Section IV of this document.

Profile of Grant County

A brief profile of Grant County physical geography, population demographics, economic environment and infrastructure facilities are provided here as an introduction. Greater detail on these topics can be found in Appendix A: Community Profile of this plan and other plans referenced herein.

Grant County is located in the northeastern portion of the state and is bordered by Morrow, Umatilla, and Union Counties on the north, Baker and Malheur Counties on the east. Harney County on the south and Crook and Wheeler Counties on the east. The total area of Grant County is 4,528 square miles (11,727 square km). A significant portion of the county (70%) is federally or state owned with about 50% of the area of the county being part of the Ochoco or Malheur National Forests.

The geography of Grant County consists of the rugged Blue Mountain range, which is a part of the Columbia River Plateau. Grant County features river canyons and high plateaus, which are interspersed with wide grasslands. The headwaters of the John Day, Malheur, North Fork John Day, and Silvies Rivers all originate within Grant County[5].

The John Day River is a tributary of the Columbia River and drains from the Blue Mountains before entering the Columbia River Gorge. The John Day River is the longest free flowing river in the United States. The John Day River system represents the watershed for most of Grant County, primarily the northern half, drained by the four forks of the John Day River.[6] The John Day River is the principle source of flooding in Grant County.

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[5] Williams, M.C., Anthony, L. H., and O'Brien, F.

[6] Grant County CWPP 2013 "2.2 Existing Conditions"

The Silvies River extends through the southern portion of Grant County into Harney County and drains approximately 1,275 square miles of the northern Harney Basin. The headwaters are near the flank of the Aldrich Mountains and the river runs roughly south where it empties into Malheur Lake, near Burns, Oregon. At the confluence with the tributary Bear Creek, new flood mapping is in preparation for the vicinity of the City of Seneca.

The southwestern portion of the county contains the headwaters of the Malheur River. The Malheur River rises in the southern Blue Mountains of southern Grant County, south of Strawberry Mountain in the Strawberry Mountain Wilderness. It flows south through Malheur National Forest, then southeast past Drewsey, through Warm Springs Reservoir and eventually flows in to the Snake River.

The county is located predominantly within the northeast climatological division divided from the southwestern portion of Grant County which is in the south central climatological division as defined by the US Weather Service, generally an arid to temperate region. Vegetation in Grant County varies from rangelands characterized by sagebrush and grasses to heavily forested areas. Forests in the southern part of the county generally consist of vast stands of ponderosa pine while areas in the northern portion of the county are represented by more mesic species that densely cover mountain slopes[7].

Precipitation in the communities of Grant County ranges from approximately 11" annually in Dayville to over 21" annually in Austin. Snowfall ranges widely depending on elevation with as little as 6" in Dayville to as much as 87" in Austin. The snow pack is vital to recharge aquifers, resulting in spring run-off, and in-stream flows of water throughout the year.

Average temperatures in the county range from the warmest community, Monument, with average daily highs/lows of 90°/50 °F in July and 42°/22 °F in January; to the coolest community, Seneca, with average daily highs/lows of 80°/38 °F in July and 33°/8 °F in January[8].

The county is primarily livestock country with vast spring, summer and fall temperature ranges. In addition to beef cattle, which are the dominant livestock interest, there is also extensive raising of sheep, dairy herds, horses and swine. Field crops grown on commercial basis include potatoes, alfalfa, wheat, oats, barley and onions.

The population of Grant County was 7,445 according to the 2010 U.S. Census (2010a) and decreased to 7,176 according to the American Fact Finder 2018 Population Estimate. The county's largest community is the City of John Day and the county seat is the City of Canyon City. Most of the residents in the county reside along the John Day River (Figure 1)

The demographic composition and economic environment of Grant County has been well covered in the *2014 NHMP* and the 2014 Community Wildfire Protection Plan, so this plan refers you to the detailed demographic data in that plan[9]. We will highlight aspects of the profile of Grant County residents that pertain to the mitigation of natural hazards here and provide a bit more depth in Appendix A – Community Profile.

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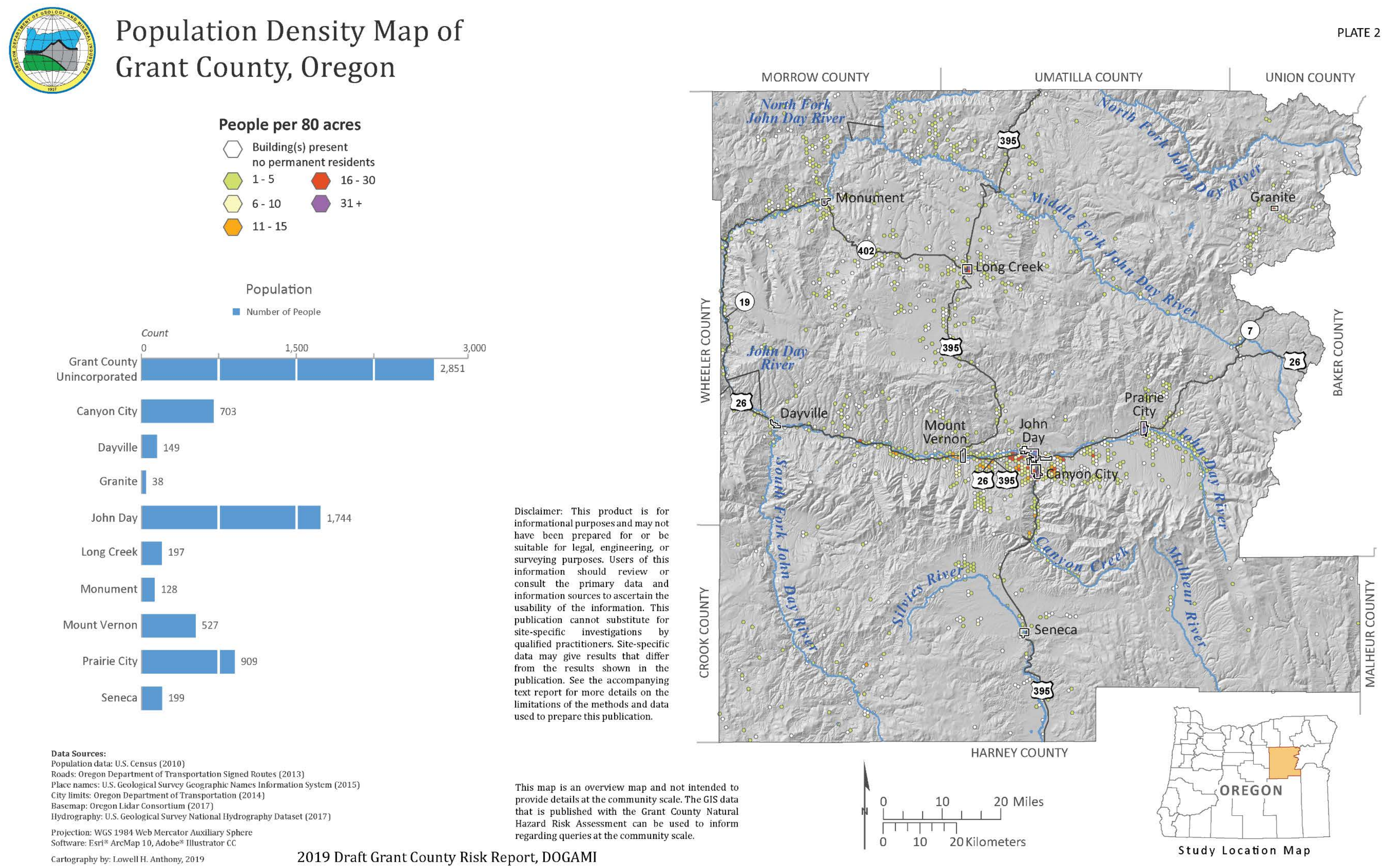
[7] Ibid

[8] Ibid

[9] 2014 Northeast Oregon Multi-jurisdictional Natural Hazard Mitigation Plan, OPDR.

The demographic composition of the county remains largely unchanged. The population is aging and the vulnerabilities that accompany aging remain notable in this plan. Similarly in some cities in Grant County the proportion of the population living below the poverty line continues to be greater than the average for the State of Oregon, so the needs of this group of residents should continue to be a demographic group that this plan addresses.

Figure 1. Population Density of Grant County



Source: DOGAMI Risk Assessment

Grant County's assets are tied to its natural resources and recreation these assets may be more vulnerable to natural disasters and can suffer environmental damages. The economy of Grant County historically has been mainly forest products, agriculture and livestock, hunting, and recreation. Since 2005, there has been a significant decline in the forest products infrastructure in the county due primarily to the lack of consistent and stable supply of suitable raw materials. Two sawmill facilities have closed and utilization of noncommercial material for clean chips and/or hog fuel is inconsistent. Reductions in federal forest grazing permits acres, due to changes in management direction and litigation, have also influenced the local livestock industry as well[10].

Surface transportation in Grant County is handled mainly by two US highways: Highway 26 and Highway 395. These highways are used predominantly by through traffic traveling across the state. Local traffic volumes are higher in the urban areas of cities. Highway 26 is aligned in an east-west fashion through the center of the county, providing access to the larger cities of Prineville, Madras, and Bend (via Highway 97) to the west and the cities of Baker City (via Highway 7) and Ontario to the east. The Grant County Transportation District operates a regional bus service known as The People Mover. In 2018, it transported 37,450 total passengers.

Grant County has two public use airports, the Grant Regional Airport and the Monument Municipal Airport. The Monument Municipal Airport is owned by the City of Monument and consists of a single asphalt runway. The Grant County Regional Airport (GCRA), and also known as Ogilvie Field, is a 335 acre county-owned, public use airport. The GCRA is also the helibase and training center for the United States Forest Service (USFS) Malheur Forest's rappeller firefighters. It is staffed year around with peak operations generally occurring from May through October. The County also has three private airstrips which could be used in a natural disaster. Additional details on these topics can be found in Volume III, Appendix A.

How is the Plan Organized?

Each volume of the mitigation plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing county and city residents, businesses, and the environment. Combined, the sections work in synergy to create a mitigation plan that furthers the community's mission to reduce or eliminate long-term risk to people and their property from hazards and their effects. This plan structure enables stakeholders to use the section(s) of interest to them.

Volume I: Basic Plan

Section 1: Introduction

The Introduction briefly describes the reasons for updating the 2014 Northeast Oregon Multi-jurisdictional Natural Hazard Mitigation Plan, the methodology used to update that plan, a brief introduction to the features of the community that impact hazard risk assessment and mitigation actions, and a description of how the plan is organized.

Section 2: Risk Assessment

Section 2 provides the factual basis for the mitigation strategies contained in Section 3. This section includes a brief description of community sensitivities and vulnerabilities and an overview of the hazards

[10] 2014 Grant County CWPP

addressed in this plan. The Risk Assessment allows readers to gain an understanding of the nature and extent of each of the natural hazards Grant County is subject to. The vulnerability of each of the jurisdictions within Grant County is assessed using the FEMA approved Oregon Emergency Management Methodology. This methodology assesses risk and vulnerability while catalyzing awareness and discussion about the county's history of natural hazard events.

Section 3: Mitigation Strategy

This section documents the plan vision, mission, goals, and actions and also describes the components that guide implementation of the identified mitigation strategies. Actions are based on community vulnerability and resilience factors and the hazard assessments in Section 2 and the Hazard Annexes (Volume II).

Section 4: Plan Implementation and Maintenance

This section provides information on the implementation and maintenance of the plan. It describes the process for prioritizing projects, and includes a suggested list of tasks for updating the plan to be completed at the semi-annual and five-year review meetings.

Volume II: Hazard Annexes

The Risk Assessment chapter provides substantial detail on the features of the natural hazards addressed in this plan. These annexes are meant to supplement that information. In particular the Landslide Annex draws from the recent Landslide Guide produced by DLCD and DOGAMI to provide a better understanding of the potential for this hazard to result in damage to people or property in Grant County. Not all the hazards are covered here. There is a focus on information that was not available in the 2014 NE OR MJ NHMP.

The hazard specific annexes included with this plan are the following:

- Wildfire,
- Flood,
- Drought, and
- Landslide

Volume III: Mitigation Resources

The resource appendices are designed to provide the users of the 2020 Grant County NHMP with additional information to assist them in understanding the contents of the mitigation plan, and provide them with resources to assist with plan implementation.

Appendix A: Community Profile

The community profile describes the participating counties and cities from a number of perspectives in order to help define and understand the vulnerabilities of Grant County residents as well as the community's resilience to natural hazard events. The information in this section represents a snapshot in time of the current vulnerability and resilience factors in the county when the plan was updated. Vulnerability factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). This section also provides information on the jurisdictions' participation in the National Flood Insurance Program (NFIP).

Appendix B: Planning and Public Process

This appendix includes documentation of all the countywide public processes utilized to develop the plan. It includes invitation lists, agendas, sign-in sheets, and summaries of Steering Committee meetings as well as any other public involvement methods.

Appendix C: Action Item Forms

This appendix contains the detailed action item forms for each of the high priority short term mitigation strategies identified in this plan. These forms are intended to serve as project briefs that can be expanded into grant applications.

Appendix D: Future Climate Projection Report – Oregon Climate Change Research Institute

This appendix contains the report prepared by the Oregon Climate Change Research Institute that evaluates the likely changes to climate in Grant County in the coming decades.

Appendix E: Economic Analysis of Natural Hazard Mitigation Projects

This appendix describes a method of prioritizing natural hazard mitigation projects and benefit/cost analysis in natural hazards mitigation. The Partnership for Disaster Resilience developed this appendix. It has been reviewed and accepted by the Federal Emergency Management Agency (FEMA) as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Appendix F: Grant Programs and Resources

This appendix lists state and federal resources and programs by hazard.

Appendix G: Natural Hazard Risk Report for Grant County, Oregon

This appendix contains the 2019 report prepared by the Department of Geology and Mineral Industries (DOGAMI) analyzing risk of geologic hazards, flooding and wildfire for Grant County.

II. RISK ASSESSMENT

A. What is a Risk Assessment?

This chapter serves as the factual basis for Grant County to address Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. In addition, this section of the Natural Hazards Mitigation Plan (NHMP) addresses 44 CFR 201.6(b)(2) - Risk Assessment.

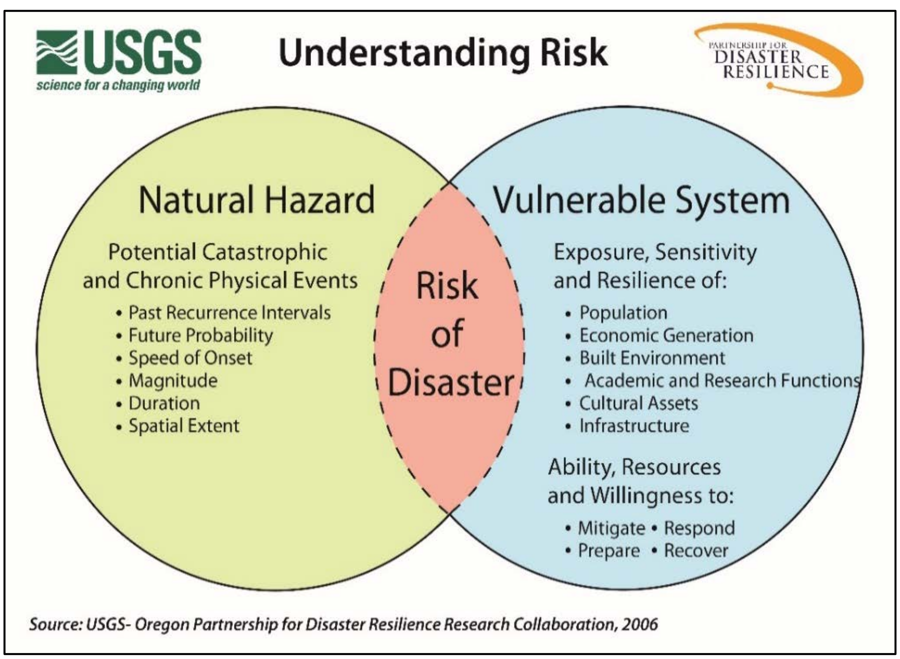
A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the graphic in Figure 2.

Assessing natural hazard risk has three phases:

- **Phase 1**: Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places, and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by each community.

The information presented below, along with hazard specific information presented in the Hazard Annexes and community characteristics presented in the Community Profile Appendix, will be used as the local level rationale for the risk reduction actions identified in Section III – Mitigation Strategy. Ultimately, the goal of hazard mitigation is to reduce the area where hazards and vulnerable systems overlap.

Figure 2. Understanding Risk



Source: Oregon Partnership for Disaster Resilience

The first phase, **hazard identification**, involves the identification of the geographic extent of a hazard, its intensity, and its probability of occurrence. This level of assessment typically involves producing a map. The outputs from this phase can also be used for land use planning, management, and regulation; public awareness; defining areas for further study; and identifying properties or structures appropriate for acquisition or relocation.[11]

The second phase, **vulnerability assessment**, combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, and attempts to predict how different types of property and population groups will be affected by the hazard. This step can also assist in justifying changes to building codes or development regulations, property acquisition programs, policies concerning critical and public facilities, taxation strategies for mitigating risk, and informational programs for members of the public who are at risk.[12]

The third phase, **risk analysis**, involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through the vulnerability assessment, and (2) the likelihood or probability of the harm occurring.

The following risk assessment draws upon three sources:

- the *2014 Northeast Oregon Natural Hazard Mitigation Plan*,
- a risk analysis exercise called the Hazard Vulnerability Analysis (HVA) conducted with the Grant County NHMP Steering Committee, and
- the *Natural Hazard Risk Report for Grant County, Oregon,* an analysis performed by the Department of Geology and Mining Industries (DOGAMI) using a risk assessment software program for analyzing potential losses from floods, landslides and earthquakes called HAZUS-MH.[13] This report is included as an appendix in Volume III.

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[11] Burby, R.1998.Cooperating with Nature. Washington, DC: Joseph Henry Press.

[12] Ibid.

[13] Hazards U.S. – Multi-Hazard (HAZUS-MH) is a software program that joins current scientific and engineering knowledge with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs.

B. Hazard Identification

The hazards facing Grant County are summarized here to provide context to the following sections on vulnerability assessment and risk analysis, however additional detail for Wildfire, Flood, Drought and Landslide hazards regarding characteristics, location and extent of each hazard can be found in Volume II, Hazard Annexes.

1. Wildfire

Characteristics

Wildfires are a natural part of the ecosystem in Oregon. However, wildfires can present a substantial hazard to life and property in growing communities, because often development occurs in the wildland-urban interface (WUI). The most common wildfire hazard factors include: hot, dry, and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, its behavior is influenced by numerous conditions, including fuel, topography, weather, drought, and development.[14] The negative impact of smoke on air quality is a secondary impact of wildfire. Post-wildfire geologic hazards can also present risk. These usually include flood, debris flows, and landslides.

Location/Extent

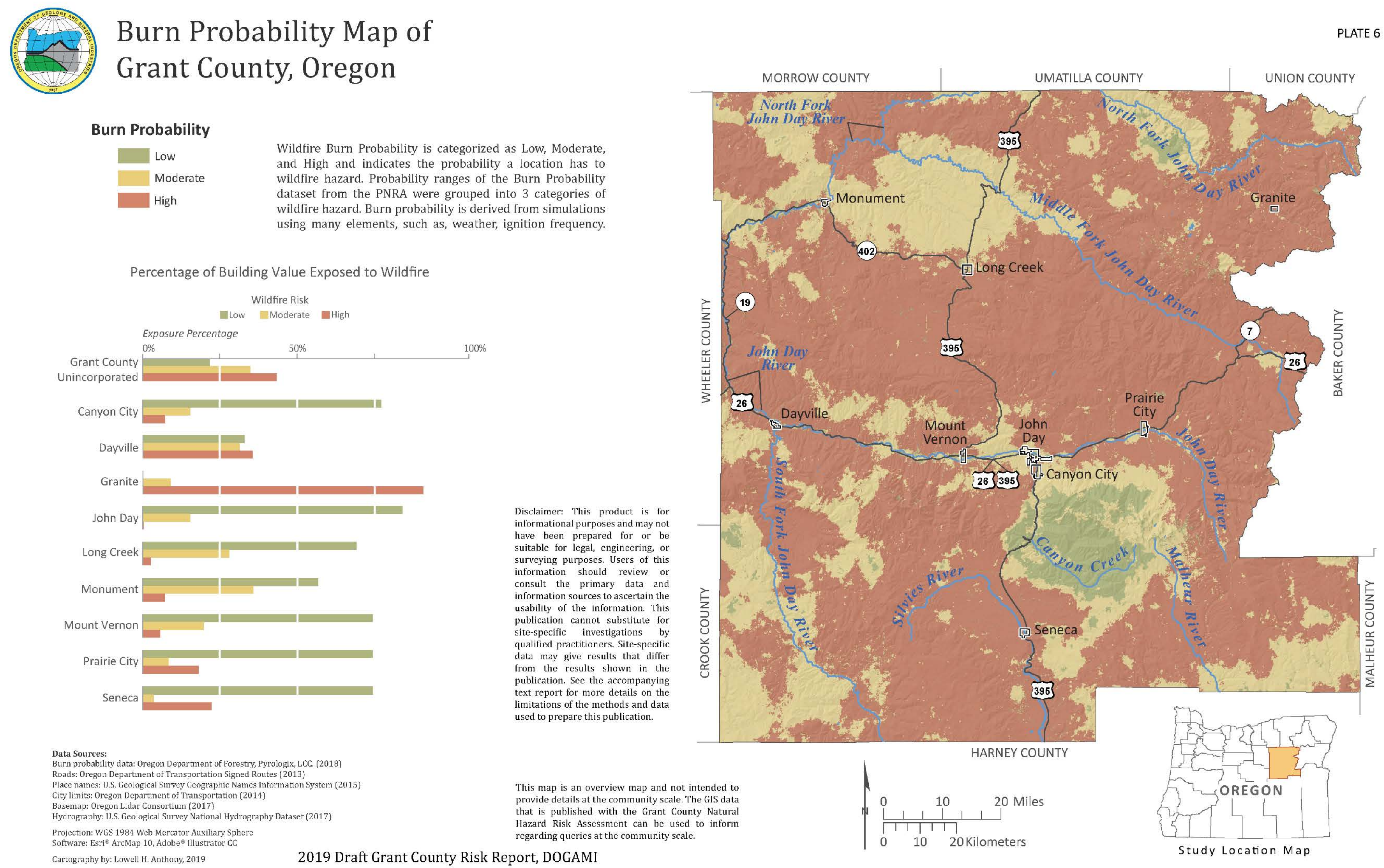
According to both the DOGAMI vulnerability assessment and the local vulnerability assessment, there is potential for loss due to WUI fires in Grant County. Fire prone areas cover a large portion of the county and are present in developed areas in the county. The primary areas of exposure to this hazard are in the forested unincorporated areas of the county that have not already experienced recent burns. These areas are represented in the Figure 3 contained in the DOGAMI Natural Hazard Risk Assessment[15] .

DOGAMI's risk analysis utilized the Burn Probability dataset contained in the US Forest Service's Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results developed for the States of Oregon and Washington to analyze the extent of wildfire hazard risk in Grant County. The Burn Probability dataset was categorized into low, moderate and high hazard zones for the county.

[14] Pyrologix LLC, 2018, Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results, final report, report to Oregon Department of Forestry and others, 86 p. http://oe.oregonexplorer.info/externalcontent/wildfire/reports/20170428_PNW_Quantitative_Wildfire_Risk_Assessment_Report.pdf

[15] Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report for Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

Figure 3. Burn Probability Map of Grant County, Oregon



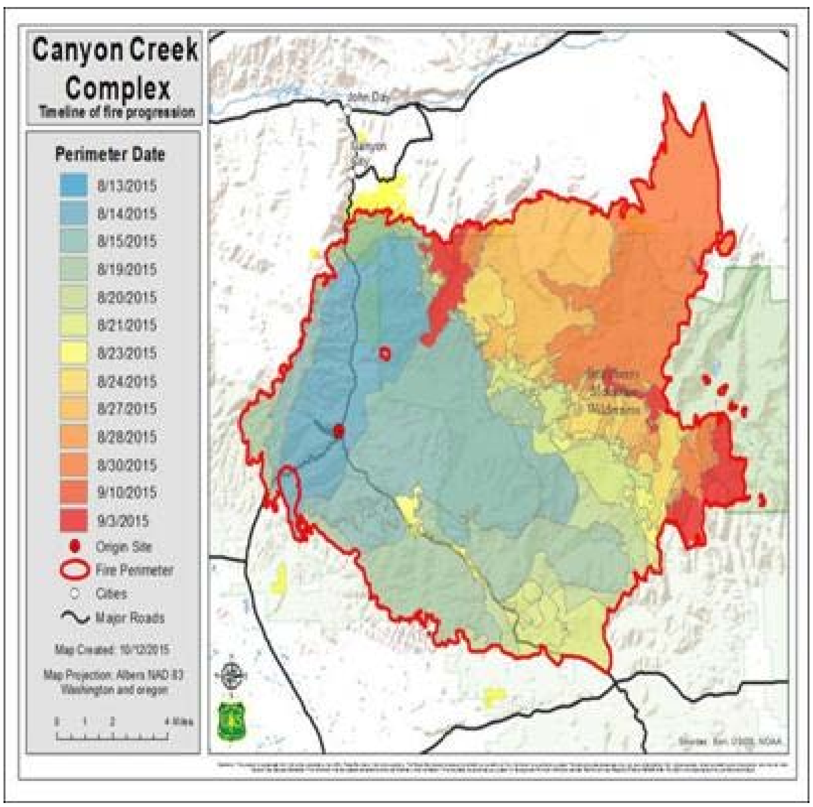
Source: Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report for Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

Wildfire Events 2014-2019

The most significant wildfire to occur in Grant County since 2014 was the Canyon Creek Complex fire that began on August 12, 2015. The following chronology is drawn from the US Forest Service Canyon Creek Complex, Malheur National Forest, Overview and Frequently Asked Questions. "The Berry Creek and Mason Springs fires were two of 12 fires ignited by lightning on August 12 on the Malheur National Forest. Pushed by strong winds, the Berry Creek and Mason Springs fires merged together to become the Canyon Creek Complex on August 14, 2015.

The complex remained active for the next three weeks, with runs of 20,000 acres to the southeast, 11,600 acres down Pine Creek and 17,600 acres down Indian Creek toward Prairie City. By September 4, the fire had increased to more than 110,000 acres and destroyed 43 primary residences. The Fire was declared controlled on November 5, 2015; suppression costs to this point are approximately $31 Million." [16] Figure 4 shows the timeline of the fire's progression.

Figure 4. Canyon Creek Complex, Timeline of Fire Progression



Source: US Forest Service Canyon Creek Complex, Malheur National Forest, Overview and Frequently Asked Questions https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd503421.pdf, consulted January 2020

[16] US Forest Service Canyon Creek Complex, Malheur National Forest, Overview and Frequently Asked Questions https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd503421.pdf, consulted January 2020

The Canyon Creek Complex originated with two fires out of the 193 fires catalogued by the Oregon Department of Forestry through the Fire List. This Fire List queried for fires in Grant County from February 2014, the publication date of the 2014 Northeast Oregon Natural Hazard Mitigation Plan, through January 2020 reports that 190,308 acres burned in those 193 fires.[17] The Canyon Creek Complex fire represents nearly 58% of the acreage burned in this seven year period.

Full details of the hazard posed by wildfire can be found in Volume II, Wildfire Annex.

2. Winter Storm

Characteristics

Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting Northeast Oregon typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March.[18]

Winter storm events are relatively common in eastern Oregon, where the air is generally cold enough for snow and ice, when a Pacific storm is associated with an air mass from the Gulf of Alaska, a major snowstorm may ensue.

Like snow, ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation, including freezing rain, sleet, and hail. Freezing rain can be the most damaging of ice formations. While sleet and hail can create hazards for motorists when it accumulates, freezing rain can cause the most dangerous conditions within a community. Ice buildup can bring down trees, communication towers, and wires creating hazards for property owners, motorists, and pedestrians alike.

Location/Extent

All of Grant County is vulnerable to winter storms and impacts typically extend region-wide. The magnitude or severity of severe winter storms is determined by a number of meteorological factors including the amount and extent of snow or ice, air temperature, wind speed, and event duration.

Winter Storm Events 2014-2019

Twenty-five Heavy Snow or Ice Storm events in Grant County were logged by the National Oceanic and Atmospheric Administration's (NOAA) National Center for Environmental Information storm

[17] https://apps.odf.oregon.gov/DIVISIONS/protection/fire_protection/fires/FIRESlist.asp#main-content, consulted January 2020

[18] Interagency Hazard Mitigation Team.2012- Oregon Natural Hazards Mitigation Plan. Salem, OR: Oregon Military Department – Office of Emergency Management

event database[19]. One of these winter storm events resulted in the Oregon Governor declaring a State of Emergency.

Executive Orders 17-02 and 17-06 declared the winter storms that began January 11, 2017 and continued through March 2017 resulted in "critical transportation failures, loss of power and communications capabilities, and evacuations and sheltering needs. This storm system damaged state highways, throughout the jurisdictions with scour, washouts, sinkholes, serious debris flows and mudslides."[20] NOAA's storm event database reports that 0.5" of ice accumulated at Seneca in Grant County by 10 AM on January 18, 2017[21].

3. Flood

Characteristics

The principal types of flood that occur in Grant County include snow melt (spring) floods resulting from rapid snowmelt, occasionally augmented by rainfall, riverine, and local flash floods. Damaging conditions that accompany flooding, but which do not meet the FEMA definition of flooding, include ground water intrusion during conditions of high rainfall. Further details on the characteristics of these types of flooding can be found in Volume II, Flood Annex.

Location/Extent

The location and extent of flooding hazard are represented by the Flood Insurance Rate Maps issued by FEMA, in conjunction with their Flood Insurance Studies (FIS). Flood records are often not well documented, particularly in unincorporated areas because their floodplains are sparsely developed[22]. Only a portion of the watercourses in Grant County are covered by regulatory floodplains as shown by the FIRMs. Selection of areas to map for flood risk and flood insurance requirements are made based on the number of structures and people at risk, therefore, the areas shown on the FIRMs (and in Figure 5 below) represent areas currently mapped by FEMA of flood risk where people or property may be at risk for damage.

Revisions to the FIRMs have taken place for Canyon Creek and John Day through a Letter of Map Revision (LOMR) effective October 17, 2019 and are under way for Bear Creek and the Silvies River in and around Seneca. A portion of the revised FIS and FIRM Panel 410070001C through LOMR 19-10-0438P-410077 includes areas of Canyon Creek and the John Day River. Flood mapping updates are underway for the Silvies River at Seneca with nine new preliminary FIRM panels issued 5/31/2019, but they have not yet been finalized. Seneca has not previously had regulatory mapped floodplains.

The location and extent of damage due to ground water intrusion is not as easily mapped as flooding hazard is. The construction of critical facilities such as Grant Union High School on highly

[19] NOAA Storm Event Database, consulted January 2020.

[20] Executive Order No. 17-06, Office of the Governor, State of Oregon, April 13, 2017

[21] NOAA Storm Event Database, consulted January 2020.

[22] Grant County Flood Insurance Rate Study, NFIP, 5/18/1982

permeable fill material has resulted in ground water intrusion into portions of the building. This condition makes the use of Grant Union High School as a shelter facility dependent on the presence of this condition.

Figure 5. Flood Hazard Map of Grant County, Oregon

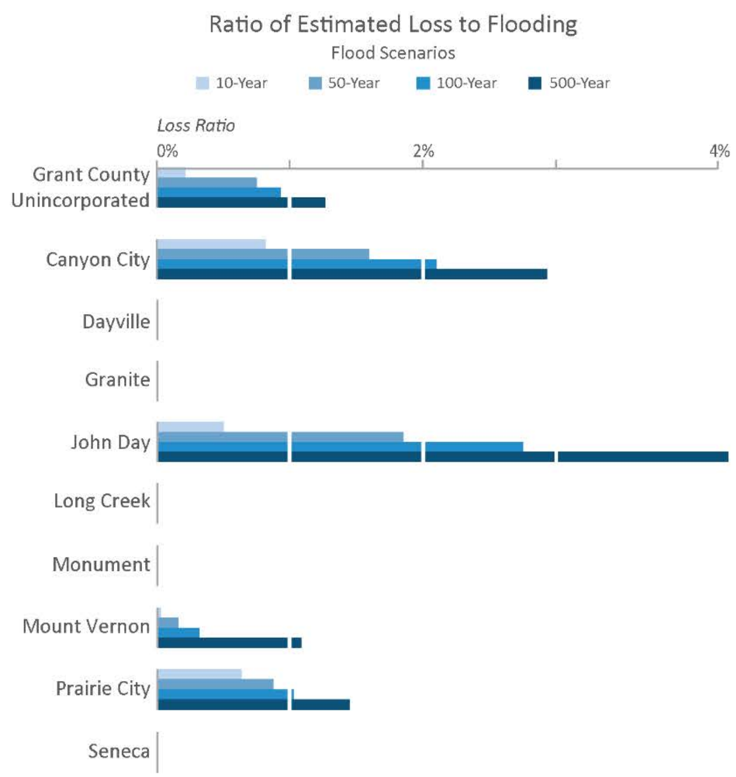
Flood Hazard Map of Grant County, Oregon

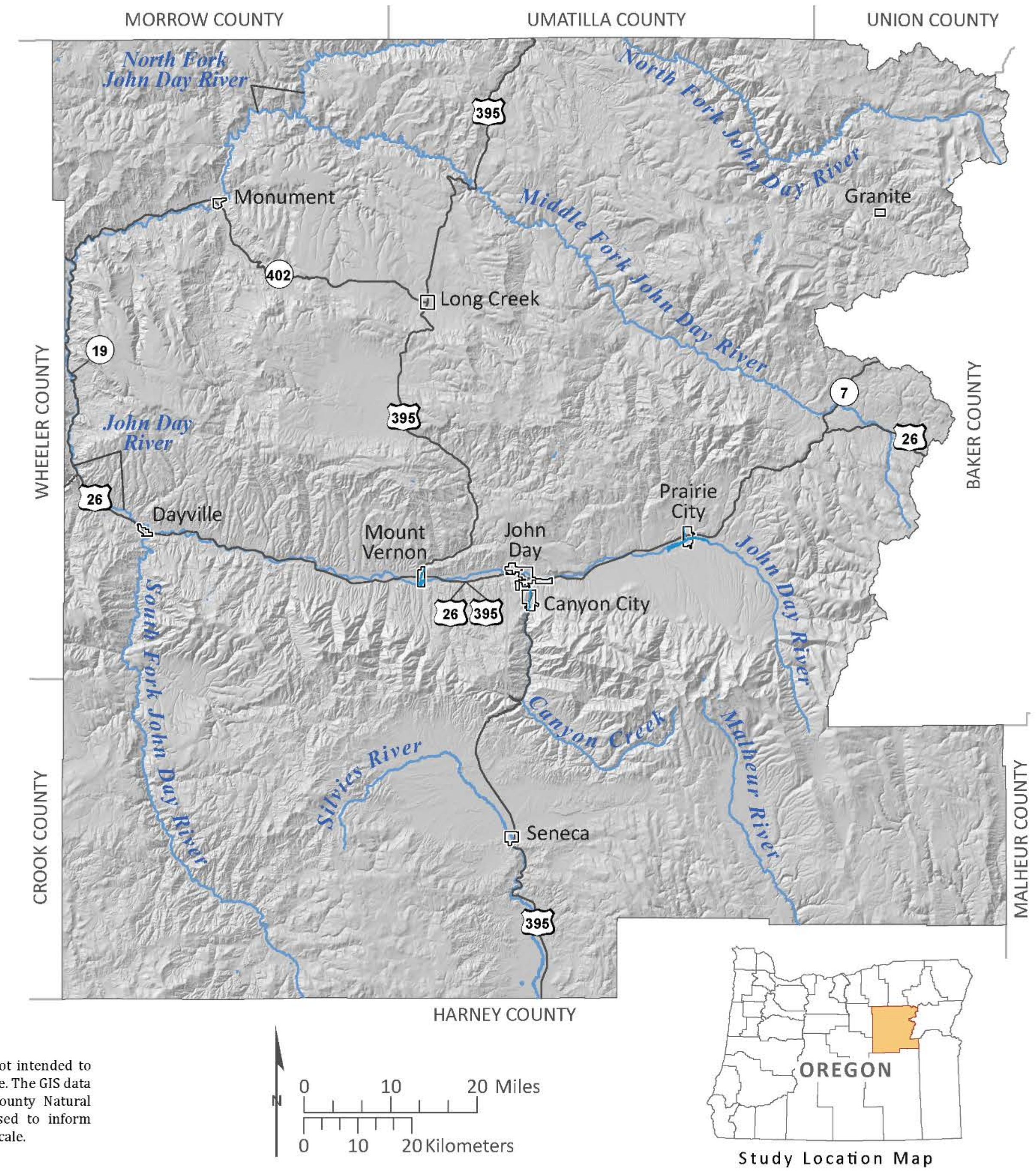
PLATE 4

Flood Hazard Zone

100-Year Flood (1% annual chance)

The flood hazard data show areas expected to be inundated during a 100-year flood event. Flooding sources include riverine. Areas are consistent with the regulatory flood zones depicted in Grant County's Digital Flood Insurance Rate Maps.





Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

Data Sources:
Flood hazard zone (100-year): Grant County Flood Insurance Rate Map (1982, 1987, 1988, and 2019)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

Cartography by: Lowell H. Anthony, 2019

This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Grant County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

2019 Draft Grant County Risk Report, DOGAMI

Source: Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report for Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

Flooding Events 2014-2019

In the six years since the completion of the 2014 Northeast Oregon Natural Hazard Mitigation Plan that included Grant County, the county has experienced spring flooding in three of those years. In March 2014 Grant County, as well as Union and Umatilla Counties, experienced heavy rainfall across much of the northern Blue Mountains throughout the first week of March. March 9, 2014 saw very heavy rain with snow levels around 6,000 feet elevation. This allowed for a significant increase in runoff, which led to a quick rise in rivers. In May 2018 Grant County, as well as Wallowa County saw heavy rain from slow moving thunderstorms that caused rock slides and water on roadways within an area that included Mount Vernon, John Day and Canyon City. In April 2019 snow water equivalents near 200% of normal in the Blue Mountains coupled with warm temperatures and near record rainfall totals for April produced significant river flooding across eastern Oregon. This spring flooding resulted in a federal disaster declaration (DR-4452) for Grant, Wheeler and Umatilla Counties[23].

Full details of the hazard posed by flooding can be found in Volume II, Flood Annex.

4. Drought

Characteristics

Droughts are not uncommon in Oregon, particularly in eastern Oregon. Droughts tend to be an economic hazard, particularly damaging to the hydro-power and agricultural sectors. Agriculture makes up a particularly large portion of Grant County businesses and drought therefore affects the economic stability of the region. 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 Readiness Council. This interagency 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 (EM-3039). Highlights of the survey findings indicate that the 1977 drought affected 80% of ranches in eastern Oregon, decreased forage, increased purchase of feed, reduced rate of gain of cattle, delayed breeding, herd health problems and increased water hauling and equipment investments.[24]

Connections between drought conditions and the susceptibility of landscapes to wildfires have been the subject of research across the United States and across the globe. The unusually hot and dry summer in parts of the northern hemisphere has turned fields and forests into fuel for fires which

[23] National Climate Data Center Storm Events Database http://www.ncdc.noaa.gov/stormevents

[24] 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. Northeast Oregon's cow herd production alone decreased more than 37%.

are raging from the Arctic to the Mediterranean and West Coast of North America[25]. More of a concern to members of the Steering Committee, however, is the condition of the forests in Grant County. Steering Committee members note the overly dense forest stands and the presence of ladder fuels in the forest understory as more important factors in the frequency and intensity of wildfire[26].

Location/Extent

The extent of drought events depends upon the degree of moisture deficiency, and the duration and size of the affected area. Typically, droughts occur as regional events and often affect more than one city and county.

The incidence of drought in Oregon is between eight and twelve years.[27] Grant County is susceptible to droughts because of its location east of the Cascades and within the high desert. The region experiences dry conditions annually during the summer months from June to September.

Drought Events 2014-2019

US Drought Monitor records data that contribute to drought, which data indicate that Grant County was in a condition of moderate drought or worse for more than 40% of the past ten years. For the period between January 2014 and December 2019, US Drought Monitor data represented in Figure 6 shows all of Grant County to have experienced extreme drought from July 28, 2015 through December 29, 2015[28]. The Oregon Governor issued three Executive Orders at the request of the county and based on recommendations by the Drought Readiness Council and the Water Supply Availability Committee in 2014, 2015 and 2018. These Executive Orders declared that dry conditions presented hardships for Grant County, that crops and agricultural investments were at risk, that animals and plants that rely on Oregon's surface water supplies were threatened and that the risk of wildfires is greatly increased.

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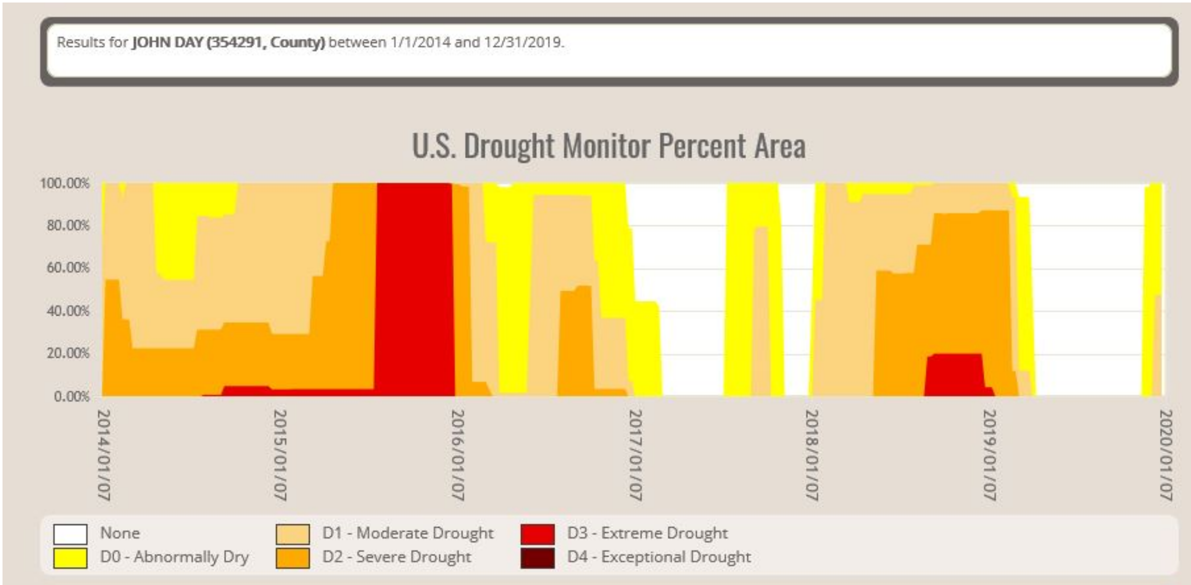
[25] World Meteorological Organization. "Drought and heat exacerbate wildfires", July 2018, https://public.wmo.int/en/media/news/drought-and-heat-exacerbate-wildfires

[26] Minutes from February 14, 2020 Grant County NHMP Steering Committee meeting

[27] Oregon Natural Hazards Mitigation Plan (2012) Region 7: Regional Profile

[28] US Drought Monitor https://droughtatlas.unl.edu/Data/Climate.aspx The United States Drought Monitor (USDM) map is a composite index that has been released on a weekly basis since 1999.

Figure 6. Periods of drought in Grant County from January 2014 through December 2019



Source: Drought Atlas https://droughtatlas.unl.edu/Data/Climate.aspx consulted January 2020

Full details of the hazard posed by drought can be found in Volume II, Drought Annex.

5. Windstorm

Characteristics

Extreme winds occur throughout Oregon, and most communities have some level of vulnerability to windstorms. Windstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among other impacts. 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. Windstorms can trigger flying debris, which can also damage utility lines; overhead power lines can be damaged even in relatively minor windstorm events. Industry and commerce can suffer losses from interruptions in electric service and from extended road closures.

Although rare, tornados can and do occur in Oregon, with recorded events happening in all four counties and a particularly destructive tornado in Wallowa County.[29] Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating winds and strong vertical motion, which possess remarkable strength and cause

[29] Taylor, George H. & Chris Hannan, The Climate of Oregon, OSU Press, 1999. The 1968 Wallowa County event was considered to be a category 7 in damages, ranging between $5 million and $50 million in destruction of timber land.

widespread damage. Smaller wind events, often known as, "dust devils", are fairly common in Northeast Oregon and pose some risk to the local community.

Windstorms or gusting wind can exacerbate the risk of wildfire spread. This was a factor in the conflagration of the Canyon Creek Complex fire in 2015.

Location/Extent

The damaging effects of windstorms may extend for distances of 100 to 300 miles from the center of storm activity. Windstorms in Grant County usually occur from October to March. The extent of windstorms is determined by their track, intensity (the air pressure gradient they generate), and local terrain. More intense windstorms generally occur within the valley corridors.[30]

Oregon and other western states experience tornadoes on occasion, many of which have produced significant damage and occasionally injury or death. Most of the tornadoes that develop in Oregon 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.[31]

Windstorm Events 2014-2019

The NOAA Storm Event Database records several high wind events in Grant County during the planning period. December 11, 2014 and February 6, 2015 saw winds gusting to 73 mph (64 knots) throughout the county. High winds accompanying thunderstorms were recorded in Dayville on June 28, 2015. Wildfires were also recorded in the county during this time and may have been exacerbated by the high winds and lightening that accompanies thunderstorms. High winds and thunderstorms were recorded in John Day on June 26, 2017. The following summer a funnel cloud was recorded in Seneca on May 20, 2018.

Windstorms have caused damage to critical facilities in Grant County. The water supply system in Prairie City sustained damage to its electrical components and to some of its mechanical components due to an intense, short duration windstorm. The city was able to secure some grant funding to repair the system, but this repair is still on going. The public works director for Prairie City was able to work together with the City of John Day to ensure that sufficient water was on hand for firefighting during the time that the water system was out of commission.

6. Landslide

Characteristics

Landslides are downhill movements of rock, debris, or soil. There are many different types of landslides in Oregon. In Grant County, the most common are debris flow, shallow-, and deep-seated landslides. Landslides can occur in many sizes, at different depths, and with varying rates of movement. Generally, they are large, deep, and slow moving or small, shallow, and rapid. Some

[30] Natural Hazards Mitigation Plan Risk Assessment Meetings

[31] Taylor, George H., Holly Bohman, and Luke Foster. August 1996. A History of Tornadoes in Oregon. Oregon Climate Service. Corvallis, OR: Oregon State University.

factors that influence landslide type are hillside slope, water content, and geology. Many triggers can cause a landslide: intense rainfall, earthquakes, or human-induced factors like excavation along a landslide toe or loading at the top. Landslides can cause severe damage to buildings and infrastructure. Fast-moving landslides may pose life safety risks and can occur throughout Oregon[32].

Location/Extent

Staff from Oregon's Department of Geology and Mineral Industries (DOGAMI) have developed a database of landslide information for use in understanding the risk of landslides across the state of Oregon. The Statewide Landslide Information Layer for Oregon [SLIDO], release 3.2[33] is an inventory of mapped landslides in the state of Oregon. SLIDO is a compilation of past studies; some studies were completed very recently using new technologies, like LiDAR[34]-derived topography, and some studies were performed more than 50 years ago. Consequently, SLIDO data vary greatly in scale, scope, and focus and thus in accuracy and resolution across the state. Landslide inventory mapping for Grant County was done before LiDAR was available for high-accuracy mapping.

Many communities in Grant County have some exposure to landslide risk. Communities that developed in terrain with moderate to steep slopes or at the base of steep hillsides may be at risk to landslides. These areas are illustrated in Figure 7 below. While these areas are highly prone to landslides, a large percentage of the populated areas are not within these zones as they are currently mapped. The percentage of building value exposed to very high and high landslide susceptibility is approximately 10% for the entire study area, but the threat is elevated for buildings in these hazard zones.

The Steering Committee members recognize areas in the county that are susceptible to rock fall and express concern about the consequences of a large scale landslide in these areas. In particular, areas within Canyon Creek where fuel tanks are currently stored is an example of a localized area that poses potential for damage due to landslide.

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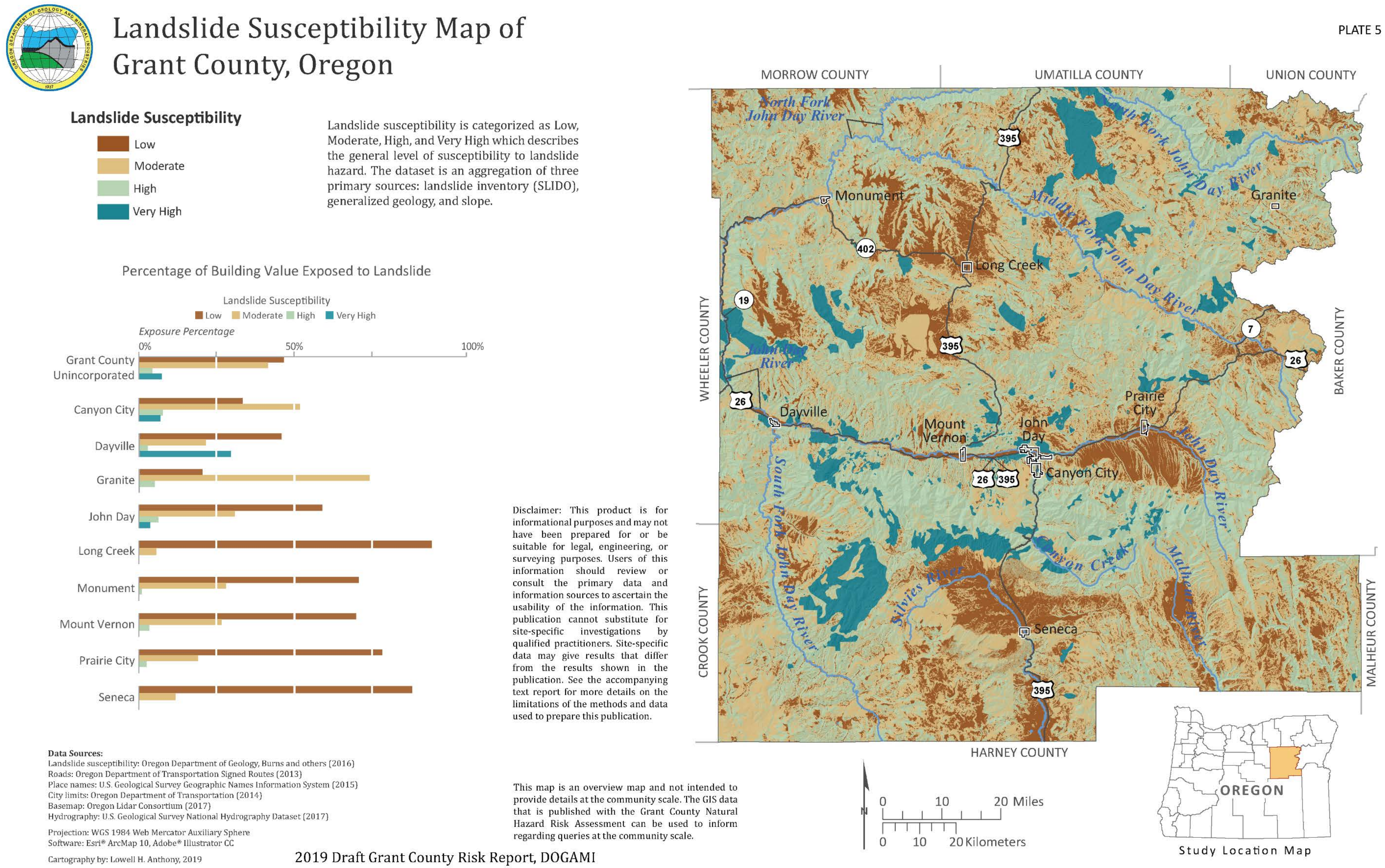
[32] Burns, W. J., Mickelson, K. A., and Madin, I. P., 2016, Landslide susceptibility overview map of Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-16-02, 48 p. https://www.oregongeology.org/pubs/ofr/p-O-16-02.htm

[33] Burns, W. J., and Watzig, R. J., 2014, Statewide landslide information layer for Oregon, release 3 [SLIDO-3.0]: Oregon Department of Geology and Mineral Industries, 35 p., 1:750,000, geodatabase.

[34] LiDAR, which stands for Light Detection and Ranging, is a remote sensing technology that functions by illuminating a target with a pulsed laser and measuring the round-trip time (Time of Flight) of reflected pulses with a sensor to determine its distance.

Figure 7. Landslide Susceptibility Map

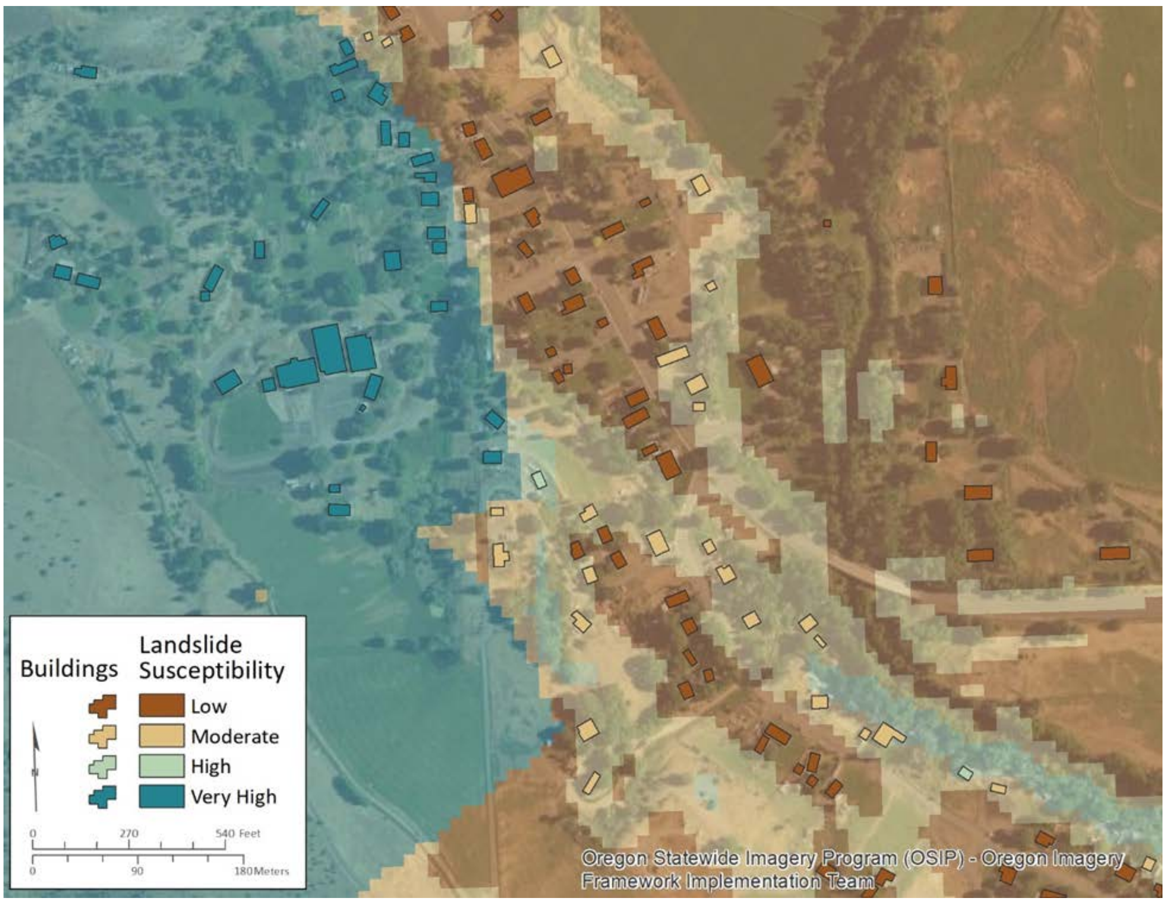


Source: Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

The Grant County Natural Hazard Risk Assessment prepared by DOGAMI identified locations within the county that are comparatively more vulnerable or at greater risk to landslide hazard:

- The western portion of the City of Dayville is at greater risk to landslide hazard than other communities in Grant County. See Figure 8.
- Buildings in and near the City of John Day are exposed to very high landslide hazard in the steep areas north of the John Day airport. See Figure 9.
- A cluster of residential buildings east of the downtown portion of Canyon City are exposed to very high landslide hazard.
- Some communities in Grant County may be at higher or lower risk than what the data show, LiDAR-based landslide mapping would provide a better understanding of the risk[35].

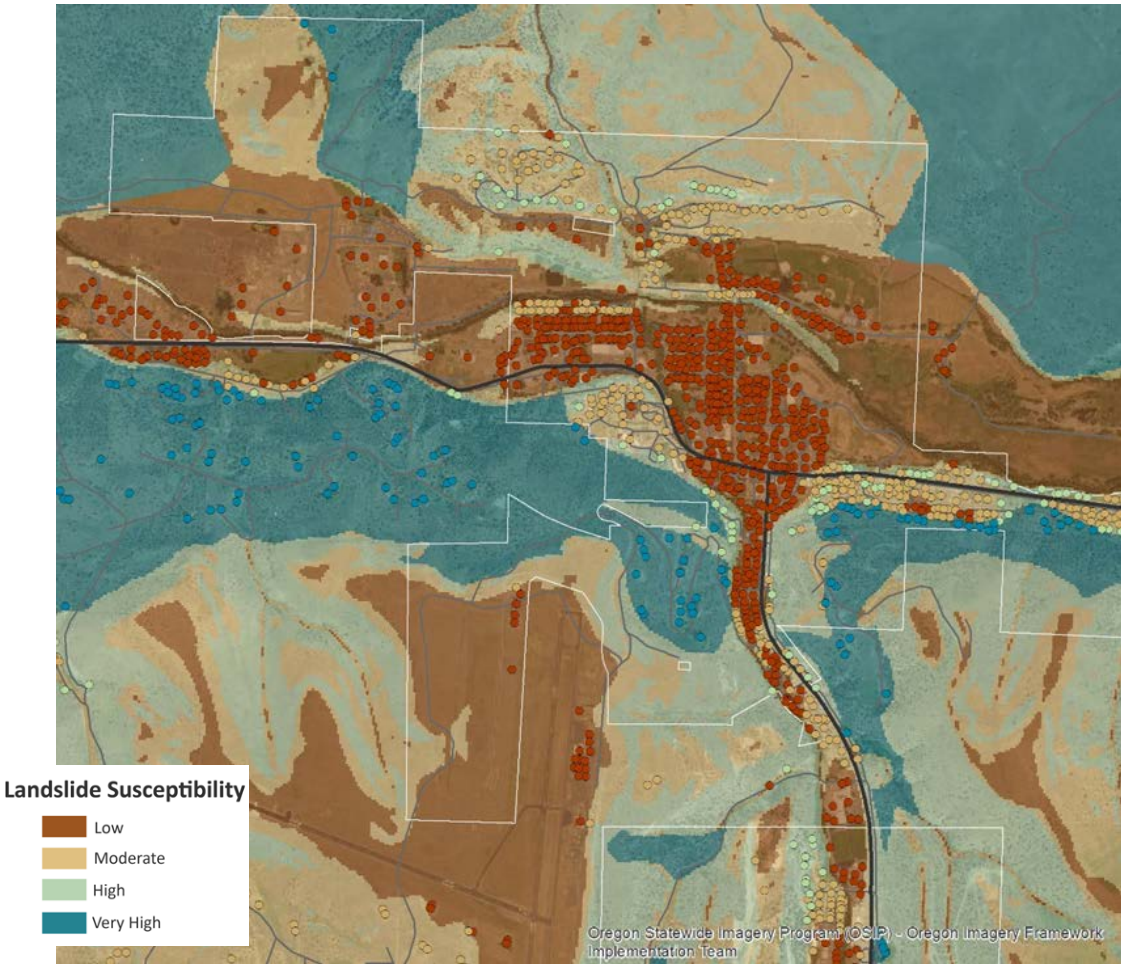
Figure 8. Landslide susceptibility areas and building exposure example in the City of Dayville



Note: Points represent buildings. Colors correspond to susceptibility exposure.
Source: Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report for Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

[35] Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries, p. 28

Figure 9. Building landslide exposure overlaying landslide susceptibility in John Day and Canyon City



Note: Points represent buildings. Colors correspond to susceptibility exposure.

Source: Powerpoint presentation to Grant County NHMP Steering Committee, Matt Williams, DOGAMI

Landslide Events 2014-2019

No landslides were reported in Grant County during this period.

Full details of the hazard posed by landslides can be found in Volume II, Landslide Annex.

7. Volcanic Event

Characteristics

Northeast Oregon (and the greater Pacific Northwest) lays within the "ring of fire", an area of very active volcanic activity surrounding the Pacific Basin. Volcanic eruptions occur regularly along the ring of fire, in part because of the movement of the Earth's tectonic plates. Volcanic eruptions have the potential to coincide with numerous other hazards including ash fall, earthquakes, lava flows, pyroclastic flows, lahars and debris flows, and landslides. Ash fall is likely the only hazard that could have the potential to impact Grant County directly.

Location/Extent

Direct risk from local volcano-associated hazards is not a consideration for Grant County because the volcanic Cascade Mountain Range is not close enough to the county to cause damage. Mt. St. Helens is about 250 air miles from the City of Enterprise, consequently placing that community at risk. Mt. Jefferson, located 150 miles west of John Day, it is a possible, but unlikely source of ash fall or airborne tephra (rock fragments and particles ejected by a volcanic eruption). The effects of airborne tephra or ash fall may including disruption of engines of motor vehicles and health impacts to vulnerable populations, such as people with asthma.

Volcanic Events 2014-2019

None.

8. Earthquake

Characteristics

An earthquake is a sudden movement of material on each side of a fault in the earth's crust that abruptly releases strain accumulated over a long period of time. The movement along the fault produces waves of strong shaking that spread in all directions. Oregon is underlain by a large and complex system of faults that can produce damaging earthquakes. Although smaller faults produce smaller earthquakes, they are often close to populated areas, and damage can be extensive to nearby buildings[36].

Two potential earthquake-induced hazards are liquefaction and landslides. Liquefaction occurs when loose, saturated soils substantially lose bearing capacity due to ground shaking, causing the soil to behave like a liquid; this action can be a source of tremendous damage. If an earthquake causes strong shaking in populated areas, it may result in causalities, economic disruption, and extensive property damage.

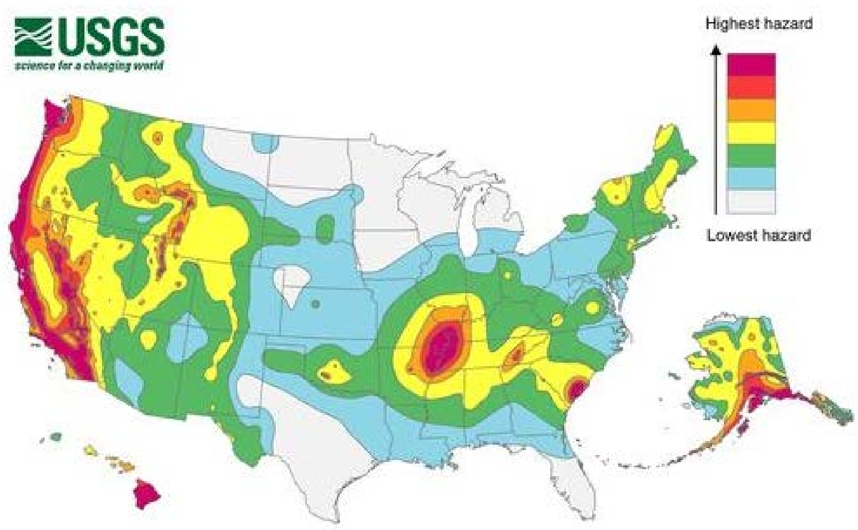
DOGAMI used a national map of seismic hazard created by the USGS and is used in within the HAZUS®-MH earthquake model[37]. The relative hazard for earthquake in northeastern Oregon is low

[36] Madin, I. P., and Burns, W. J., 2013, Ground motion, ground deformation, tsunami inundation, coseismic subsidence, and damage potential maps for the 2012 Oregon Resilience Plan for Cascadia subduction zone earthquakes: Oregon Department of Geology and Mineral Industries Open-File Report O-13-06, 36 p. 38 pl., GIS data. https://www.oregongeology.org/pubs/ofr/p-O-13-06.htm

[37] Petersen, M.D., Moschetti, M.P., Powers, P.M., Mueller, C.S., Haller, K.M., Frankel, A.D., Zeng, Yuehua, Rezaeian, Sanaz, Harmsen, S.C., Boyd, O.S., Field, Ned, Chen, Rui, Rukstales, K.S., Luco, Nico, Wheeler, R.L., Williams, R.A., and Olsen, A.H., 2014, Documentation for the 2014 update of the United States national seismic hazard maps: U.S. Geological Survey Open-File Report 2014–1091, 243 p., https://dx.doi.org/10.3133/ofr20141091

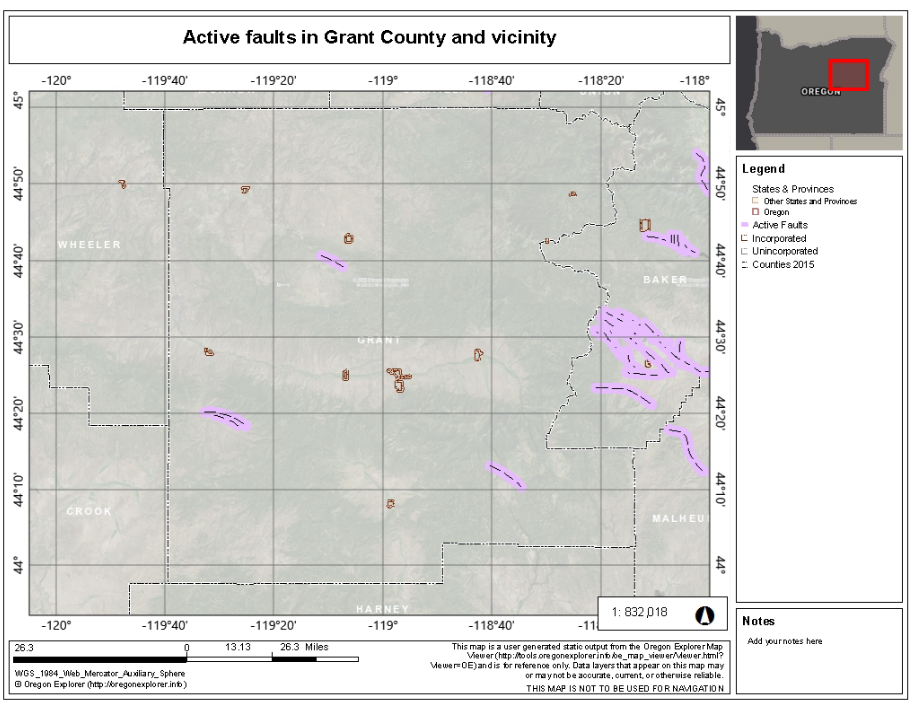
as is shown by the USGS map of seismic hazard in Figure 10. The active faults in Grant County and vicinity are shown in Figure 11.

Figure 10. USGS National Seismic Hazard Map



Source: USGS https://www.usgs.gov/media/images/2018-long-term-national-seismic-hazard-map

Figure 11. Active Faults in Grant County and Vicinity



Source: Oregon Explorer Planner's Map View application

Location/Extent

DOGAMI reports that because an earthquake can affect a wide area, it is unlike other hazards in this report — every building in Grant County, to some degree, would be affected by it[38]. The report estimates impacts from an earthquake using a scenario with a 2% probability of occurrence in a 50 year period and a magnitude set at 6.7 to develop the loss estimate. The scenario run in HAZUS®-MH was based on formulas that estimate damage in five damage states (none, low, moderate, extensive, and complete). These damage states are correlated to loss ratio that are then multiplied by the building dollar value to obtain a loss estimate.

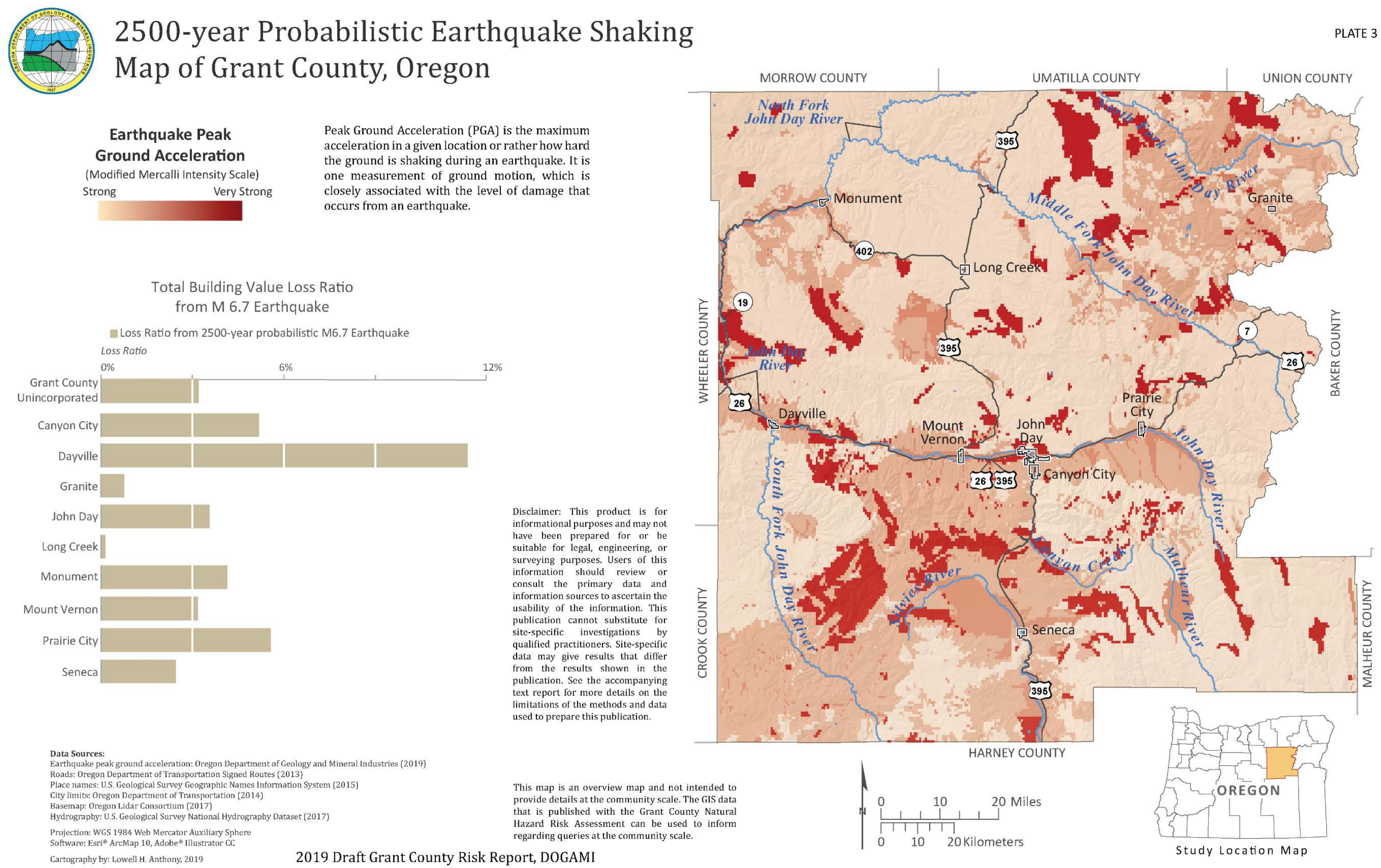
The results indicate that Grant County would incur a moderate amount of damage from an earthquake similar to the one simulated in this report. These results were heavily influenced by earthquake-induced landslides and liquefaction. This is evidenced by low loss estimates throughout the county, but with higher loss estimates occurring in areas with high or very high landslide or liquefaction susceptibility. This analysis is represented in Figure 12 showing where earthquake shaking from a magnitude 6.7 event might occur in Grant County.

Seismic Events 2014-2019

Grant County has not experienced damaging earthquakes in the past 40 years.

[38] Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

Figure 12. Locations of impact by M 6.7 Earthquake



Source: Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

C. Vulnerability Assessment

Vulnerability assessment is the second phase of this Risk Assessment. Vulnerability assessment endeavors to identify important community assets and system vulnerabilities. Vulnerabilities include both physical assets such as businesses, homes, roads and critical infrastructure like drinking water sources, and public service and health service establishments as well as community assets including people, historic places, and environmental assets.

The Steering Committee engaged in an exercise called the Hazard Vulnerability Assessment to identify the relative vulnerability of Grant County to the hazards identified in phase one of the Risk Assessment and to describe the aspects of the community that are most at risk. A description of this exercise and its results are contained in the Risk Analysis, Local Risk Assessment section. In addition, the Natural Hazard Risk Report for Grant County, Oregon prepared by DOGAMI analyzed the exposure of people and property to four of the eight identified hazards by overlaying high hazard areas with existing structures. This data is included in the Risk Analysis section entitled DOGAMI Risk Assessment.

1. Hazard Vulnerability Assessment

The Grant County Steering Committee identified eight natural hazards that could have an impact on the people and property in the county. These hazards include wildfire, winter storms, floods, droughts, volcanic events, wind storms, landslide, and earthquakes. Each is discussed briefly above and the top four hazards (Wildfire, Flood, Drought and Landslide) are discussed in detail within the Hazard Annexes (Volume II).

Local assessment of relative hazard vulnerability was accomplished using a methodology developed by the Federal Emergency Management Agency (FEMA) in 1983. It was subsequently refined by the Oregon Office of Emergency Management (OEM) and shared with local jurisdictions across Oregon. It is called the “Local Risk Assessment Methodology” or “OEM Methodology” in this Plan. Although nearly every jurisdiction in Oregon uses this process, the range of values is relative subjective it is not meant to compare one jurisdiction to another.

In this local risk assessment methodology, four aspects characterizing risk – history, vulnerability, maximum threat, and probability – are assessed by a group or an individual by assigning a ranking as to severity.

History is the record of previous occurrences where a rankings represent the following:

Low: 0-1 event in the past 10 years
Medium: 2-3 events in the past 10 years
High: 4+ events in the past 10 years

Vulnerability is an assessment of the percentage of the population and property likely to be affected during an occurrence of an incident where a ranking represents the following:

Low: <1% affected
Medium: 1 – 10% affected

High: >10% affected

Maximum Threat is an assessment of the highest percentage of the population or property which could be impacted under a worst-case scenario.

Low: <5% affected
Medium: 5 – 25% affected
High: >25% affected

Probability is a measure of the likelihood of a future event occurring within a specified period of time.

Low: more than 10 years between events
Medium: from 5 to 10 years between events
High: likely within the next 5 years

Each of these aspects are assigned a weight. History is weighted by a factor of 2; vulnerability is weighted by a factor of 5; maximum threat is weighted by a factor of 10 and probability is weighted by a factor of 7. The rankings are multiplied by their assigned weighting factors and then combined resulting in a Risk Score for each hazard. This methodology produces Risk Scores that range from 24 to 240. Conducting this analysis is a useful early step in planning for hazard mitigation, response, and recovery. The OEM Methodology does not predict the occurrence of a particular hazard, but it does "quantify" the relative risk of one hazard compared with another.

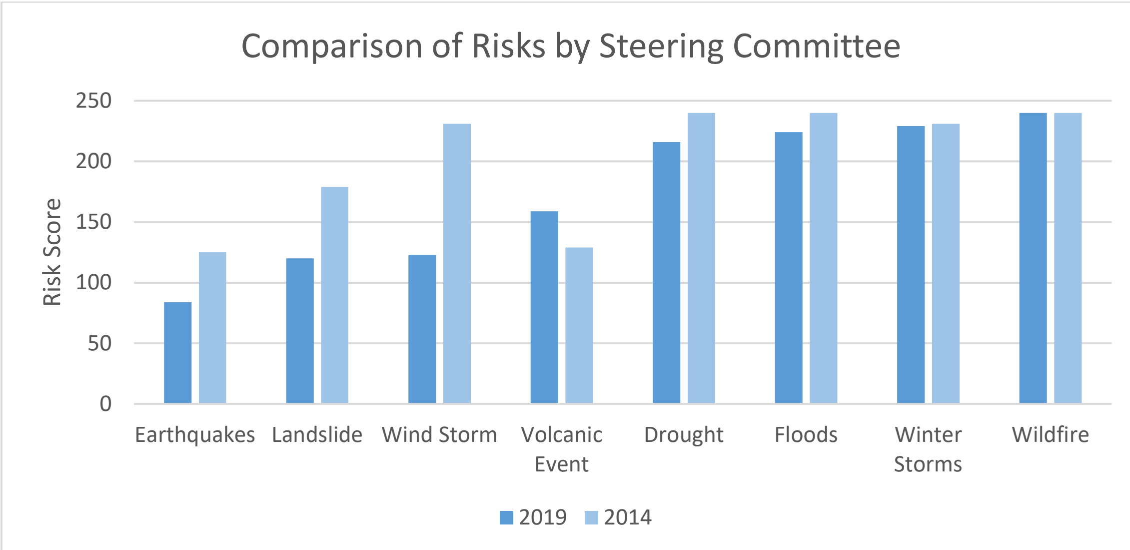
A group exercise was conducted at the May 23, 2019 Steering Committee meeting to rank these hazards using the OEM methodology. The results are presented in Table 1 below. Figure 13 displays the ranking of each of these hazards according to the group of twelve members present at that meeting as compared with the ranking reported in the 2014 Northeast Oregon Regional Natural Hazards Mitigation Plan.

Table 1. Hazard Vulnerability Analysis results from May 23, 2019

Hazards	History WF = 2		Vulnerability WF = 5		Max Threat WF = 10		Probability WF = 7		Risk Score
Wildfire	2 x	10	5 x	10	10x	10	7 x	10	240
Winter Storms	2 x	8	5 x	10	10 x	10	7 x	9	229
Floods	2 x	8	5 x	9	10 x	10	7 x	9	224
Droughts	2 x	9	5 x	9	10x	9	7 x	9	216
Volcanic Events	2 x	1	5 x	10	10 x	10	7 x	1	158
Wind Storms	2 x	5	5 x	1	10 x	8	7 x	4	123
Landslides	2 x	10	5 x	2	10 x	2	7 x	10	120
Earthquakes	2 x	1	5 x	5	10 x	5	7 x	1	84

Source: Results of OEM Methodology exercise with 2019 Grant County NHMP Steering Committee

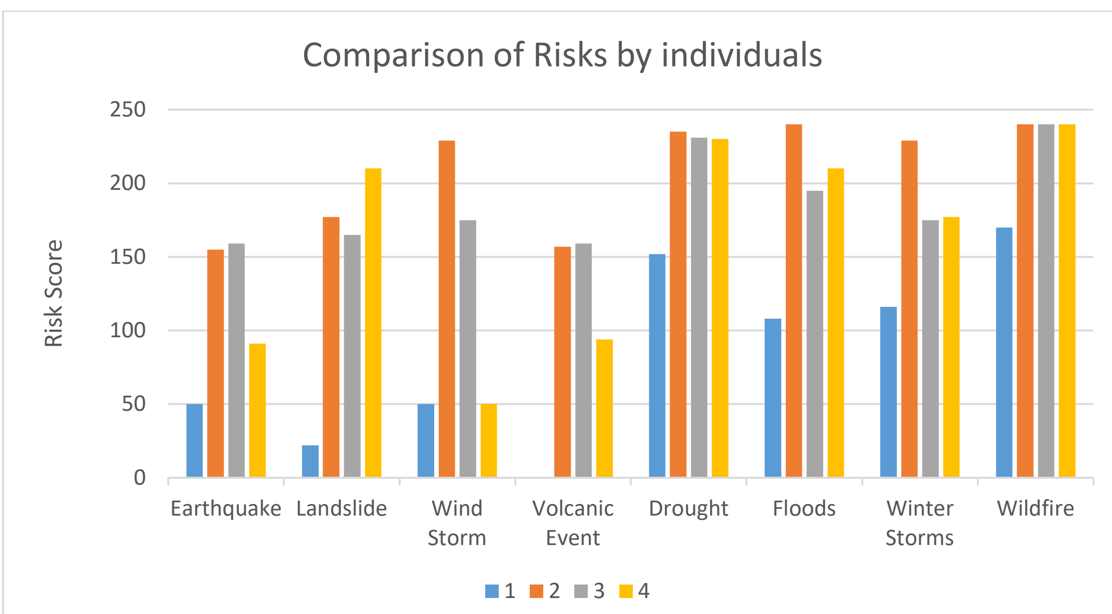
Figure 13. Comparison of OEM methodology risk assessment scores 2014 and 2019



Source: 2014 NE Oregon Regional NHMP and 2019 Grant County Steering Committee

Each individual's perception of the threat a natural hazard poses varies according to the individual's experience and location. Several individual Steering Committee members completed the OEM Risk Analysis worksheets on their own. The range of Risk Score for these individual analyses ranged widely. Figure 14 presents these individual Risk Scores as evaluated by four members of the 2019 NHMP Steering Committee. In general, however, the relative importance of drought, floods, winter storms and wildfire confirm the consensus reached by the Steering Committee as a group.

Figure 14. Risk Scores of four individuals from the 2019 Grant County NHMP Steering Committee



Source: 2019 Grant County NHMP Steering Committee

The Steering Committee discussed the assets of the community that are valued the most and those that are most vulnerable to the impacts of natural hazards. This discussion centered around vulnerable groups of people, economic drivers of Grant County vulnerable to natural hazards, features of the built environment and the natural environment that are vulnerable to the impacts of natural hazards.

The Steering Committee (SC) recognized that children and the elderly are particularly vulnerable, children because they “rely on others for care for and protection” and the elderly because they have a “limited ability to react during a natural hazard event” and both groups have increased needs for care. Vulnerability may also vary with the type of natural hazard. People who suffer from asthma or other lung condition may not be particularly affected by flooding, however, smoke from wildfire could put these people in a vulnerable position. Others noted that the poor are people who are particularly vulnerable to the impacts of natural hazards. “These are the people who are unable to maintain or to move to decent shelter on a good day. If we get a heavy snow, these are the constituents that have their roofs collapse among other emergencies and do not have the resources to solve the problem.” However, SC members also note that all residents of Grant County are vulnerable to some extent due to the “limited county ingress and egress, minimal local emergency resources, lack of long term energy and food security.” One member of the SC committee described how resilience is important to the youth of Grant County with the following: “The variety of natural hazards affect a large portion of the population and quite possibly all Grant County citizens. As a result, the citizens fall into a cycle of having one tragedy followed by another followed by another and this is deteriorating to their lifestyle which ultimately will drive people away. These are the people who we need to stay and feel safe so they can contribute to the positive solutions resulting in a vibrant community with something to offer its citizens including our vulnerable youth.”[39]

SC members highlighted the importance of ranchers and loggers as drivers of the Grant County economy and as a group particularly vulnerable to the impacts of natural hazards events based on their reliance on the forests and grasslands of the county to make a living. These industries are “dependent on the availability of renewable natural resources”, noted one SC member. The impact on natural resources due to a natural hazard event will also affect the tourism industry in Grant County. The SC noted that fuel for vehicles and businesses that sell fuel are important during a natural hazard event for moving people and materials to safety[40].

Aspects of the natural environment that SC members highlighted as valuable to Grant County and vulnerable to the impact of natural hazards reflect the natural resource based economy of Grant County. One member of the SC noted the following: “Forest, agriculture, water streams – provide the natural resource elements that support the county’s primary industries and harbors critical habitats for endangered species, along with ample populations of game species to support robust recreational opportunities.” Specifically mentioned by another SC member were water resources, specifically in Prairie City and outlying towns[41].

Features of the built environment that are the most valued in the community include cultural, educational, health and safety buildings and infrastructure such as roads and bridges. In particular, the SC members noted “The Kam Wah Chung (National Heritage site) is extremely valued in Grant County

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[39] Notes from May 23, 2019 Grant County Steering Committee meeting
[40] Ibid.
[41] Ibid.

due to the large visitor population. This is an aging facility and services cannot continue or grow with the current tourist numbers. Additionally, the current facility is located near a river which is known to have high waters and occasional flooding." School buildings are both vulnerable and valuable to the residents of Grant County based on the responses of the SC members. One member said of the schools "All schools in Grant County are extremely outdated but do not have the financial resources (or support from ballot measures) to build new facilities. They have enormous facility issues including leaking, flooding, and otherwise which can potentially create safety issues for students and staff", and another SC member noted specifically that Grant Union High School is located in a floodplain. Another SC member noted that schools are the "largest buildings in most towns that can accommodate people to inform them of situations, provide shelter, or supply materials." In Long Creek, "the main building is the local school. It is the hub of the community. If a natural disaster does occur, it will be the school that is the focal point for command and control as we as emergency shelter. The SC members reported that the hospital, airport, fire and police departments, emergency responders' facilities, Forest Service building, churches, and grocery stores are valuable features of the built environment in Grant County. Similarly infrastructure including potable water systems (particularly in Prairie City), wastewater treatment facilities, utilities in general, Highways 19, 26, and 395, bridges, telecommunication facilities and irrigation infrastructure that supports agricultural production were named by the SC members as valuable infrastructure that may be vulnerable to impacts from natural hazard events[42].

2. Community Vulnerability Assessment

Community vulnerabilities are an important aspect of the NHMP risk assessment. For more in-depth information regarding specific community vulnerabilities, reference Appendix A: Community Profile.

Populations

The demographic qualities of a community's population such as age, income, and household composition are factors that can influence a community's ability to cope, adapt to and recover from natural disasters. People with special needs, particularly children, the elderly, disabled people, and low-income families bear a disproportionate burden when a natural hazard occurs. Communities can develop strategies to improve the safety of these population groups in the face of natural hazards.

Vulnerabilities

- The Steering Committee identified age (children and the elderly) as one of the most significant socio-economic indicators of vulnerability in the Grant County. Based on the 2018 results of the US Census' American Community Survey 5-year estimates, 7,183 people lived in Grant County. Of this population 4.6% or 327 people were children under five years old and 3.4% or 244 people are adults 85 years or older. The old-age dependence ratio, a comparison of the oldest (65 and over) members of the county as compared to the population younger than 65, shows that the population of Grant County is older than Oregon as a whole[43].

[42] Ibid.

[43] US Census Bureau, American Community Survey 5-year estimates, https://data.census.gov consulted May 2020

- The American Community Survey 5-year estimates data for 2018 indicates that there were a total of 3,294 households in Grant County. Of these, 1,087 were 1-person households. Of these 1-person households, 52.7% or 573 households are people over 65 years old living alone[44].
- The Steering Committee identified people living in poverty as a vulnerable population. Of all families in Grant County, 7.6% are families whose income in the preceding 12 months was below the poverty level. Of families headed by a female householder with children under 17 years old 38.2% were living in poverty. These statistics compare favorably to families living in poverty in Oregon as a whole, however extensive research over the past 30 years has revealed that it is generally the poor who tend to suffer worst from disasters and impoverished people are more likely to live in hazard-exposed areas and less likely to invest in risk-reducing measures[45].
- The median household income in Grant County is $45,357; this is just over 28% lower than the State of Oregon median income of $63,426[46].
- Between 2010 and 2018, Grant County's population decreased by 166 people, representing a decrease of 2.26%. This is a trend that continues from the 2014 NE Oregon NHMP.

In summary, Grant County has a number of vulnerable population groups to consider in developing mitigation strategies for natural hazards. The proportion of the population over 85 years old is greater in Grant County than in Oregon as a whole. Although the proportion of children in Grant County is lower than in Oregon as a whole, children, like the elderly, are often among the most vulnerable to the impacts of natural hazards. Grant County has a higher percentage of one-person households, and one-person households with people over the age of 65 than that found in Oregon as a whole. Although the county has a smaller proportion of families living in poverty than in Oregon as a whole, these people are disproportionately affected by natural hazards because of their lack of access to financial resources. The median income in Grant County is less than that in Oregon as a whole reflecting the resource scarcity of county residents.

Table 2. Selected demographics of Grant County compared to Oregon totals (2018)

	Grant County	Oregon
Age		
Population under 5 yrs. old	4.6% (327 children)	5.5%
Population over 85 yrs. old	3.4% (244 elderly)	1.9%
Old-age dependency ratio: Ratio of those over 65 to the rest of the population	53.0	28.7
Households		

[44] Ibid.

[45] Risk Driver: Poverty and inequality; Prevention Web; https://www.preventionweb.net/risk/poverty-inequality consulted January 2020

[46] American Fact Finder, US Census Bureau, 2017 American Community Survey https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml, consulted January 2020

One-person households	33.0% (1,087 households)	27.3%
One-person households over 65 yrs old	17.4% (573 households)	11.9%
Income		
Families living in poverty	7.6%	8.0%
Single parent families headed by women with children under 17	38.2%	56.5%
Median household income	$45,357	$63,426

Source: US Census Bureau, American Community Survey 5-year estimates, https://data.census.gov

Economy

Economic diversification, employment and industry are measures of economic capacity. However, economic resilience to natural disasters is far more complex than merely restoring employment or income in the local community. Building a resilient economy requires an understanding of how the component parts of employment sectors, workforce, resources and infrastructure are interconnected in the existing economic picture. The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families and the community to absorb disaster impacts for a quick recovery. The Economic Opportunities Analysis, June 2019, prepared by Johnson Economics for the Cities of Grant County, Oregon provides information on current and anticipated future economic diversification with implications for employment and changes in industry profiles.

The Economic Opportunities Analysis reports that in 2017 in Grant County there were an estimated 3,780 jobs in the county. A significant proportion of Grant County's economy is based on natural resources. The employment base in Grant County has a higher share of self-employment, including farms and other self-proprietorships. Local employment is highly seasonal reflecting the county's relatively high proportion of agricultural employment. Employment tends to peak in August and September during peak harvest periods and falling to lowest levels by mid-winter. The forestry industry has been a significant economic driver in Grant County, however, the industry has seen a sharp decline in production largely attributable to declines in production from public lands since 1993. In recent years, private timber production has also decreased. These declines aside, the Eastern and Central Oregon region has been actively pursuing new and ongoing opportunities in the industry, including small diameter timber, biomass, and engineered wood products[47].

Another sector of the Grant County economy that is based on the county's natural resources is tourism comprised of amenity retail, recreation, and hospitality sectors. The John Day Valley is surrounded by the Blue and Ochoco Mountains and the Strawberry Range, national forest lands. Regional outdoor recreation in Grant County includes camping, hiking, hunting, fishing and rafting. The natural resource base of these industries are vulnerable to the impacts of natural hazards[48].

Vulnerabilities

- The establishments based on and employment in natural resource and mining industries are more than seven times as prevalent in Grant County as they are on a

[47] Johnson, J. and Buckley, B., Economic Opportunities Analysis, June 2019, p. 8-12
[48] Ibid., p. 25

national scale. Ranching, farming, logging, mining and other natural resource based businesses are major components of the natural resource sector in Grant County[49]. Natural hazards may impact the resources of this sector to a greater extent than most other sectors.

- More than 40 percent of rural Oregon employment is concentrated in natural resources, leisure and hospitality (tourism), and government. Together those three sectors make up around 27 percent of the employment in urban Oregon[50].

- Rural areas of Oregon have higher unemployment rates and less diverse economies than metro areas. This leaves them more vulnerable to economic shocks and recessions[51].

- Grant County has a high share of land owned by the federal government. The Oregon Employment Division reports in 2017 that 62% of Grant County was owned by the federal government and 1% was owned by the state; the remainder was privately owned[52].

Environment

The capacity of the natural environment is essential in sustaining all forms of life including human life, yet it often plays an underrepresented role in community resiliency to natural hazards. The natural environment includes land, air, water and other natural resources that support and provide space to live, work and recreate.[53] Natural capital such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. When natural systems are impacted or depleted by human activities those activities can adversely affect community resilience to natural hazard events. These same natural systems are viewed by private landowners as economic resources, particularly in a natural resource dependent industry such as ranching or logging.

Vulnerabilities

- Extended periods of drought affect vulnerability to wildfire, snowpack and agricultural irrigation.

- Temperatures in the Grant County vary widely from summer to winter. The county usually experiences freezing winters -- Seneca has experienced the coldest temperature on record for the state of Oregon at -54°F; and summers can be blistering approach daytime high temperatures as high as 119°F.

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[49] Ibid., p. 20-21

[50] Oregon Employment Division, The Employment Landscape of Rural Oregon. May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

[51] Ibid.

[52] Ibid.

[53] Mayunga, J. 2007. Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer Academy for Social Vulnerability and Resilience Building.

- Management objectives vary between forest land owners. The Governor's Council on Wildfire Response report discusses the differing objectives of higher elevation forests federally owned forest land managed around restoration and conservation objectives and utilized for ecological, scenic and social/recreational values as compared to lower elevation lands owned by a wide range of private land owners whose objectives are frequently different than the federal land management agencies. Harmonizing common fire policy across these distinct ownerships—whether about use of fire as a tool or about smoke, suppression or salvage—has presented historic challenges. These challenges reflect on the vulnerability of the forested landscapes[54].

- Climate change is projected to have an impact on one of northeast Oregon's primary competitive advantage: agriculture.

National Flood Insurance Program (NFIP)

The Grant County Flood Insurance Rate Maps (FIRMs), like much of eastern Oregon, are not available in a digital format. Below is a recap of current information related to the NFIP in Grant County and the incorporated cities from the FEMA Community Information System database accessed by the author in April 2020. For more details see the Flood Annex section of the Hazard Annexes.

Grant County and incorporated cities:
- Have 61 National Flood Insurance Program (NFIP) policies in force with a total of $11,384,200 of value;
- Have 11 paid claims totaling $51,094;
- Are not members of the Community Rating System (CRS);
- There are no repetitive loss structures in Grant County. A single repetitive loss property exists in John Day; no severe repetitive loss building claims;[55] and
- The last Community Assistance Visit (CAV) in Grant County was on April 26, 2019 with the City of John Day; Community Assistance Contacts (CACs) were held in Grant County and Canyon City in May 2019

Critical Facilities and Infrastructure

Critical facilities (i.e. police, fire, and government facilities), housing supply and physical infrastructure are critical during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster. Following a disaster, communities may experience isolation from surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available resources.

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[54] Governor's Council on Wildfire Response; November 2019: Report and Recommendations; https://www.oregon.gov/gov/policy/Documents/FullWFCReport_2019.pdf

[55] John Schelling, FEMA Region X personal communication, May 2020

Vulnerabilities

- The DOGAMI Risk Assessment found that Several of Grant County's critical facilities are at risk to flood hazard. The report estimated that 18% of Grant County's 39 critical facilities area at risk to be non-functioning due to a 100-year flood. These include the following: Grant Union High School, Grant County Road Department, Oregon Dept. of Transportation, John Day Radio Station KJDY, Oregon Dept. of Forestry, Oregon Trail Electric Co-op, and the USFS Malheur District Office[56].

- DOGAMI has also found that 5 critical facilities are exposed to high wildfire hazard. These include the following: Dayville Sewage Treatment Facility, Grant Union High School, Dayville Fire Department, Dayville School, and Prairie City Sewage Treatment Facility[57].

- Few of Grant County's critical facilities are at risk to landslides or earthquake, however the only hospital in the area is one of those facilities. The structures susceptible to landslide damage include the following: Blue Mountain Hospital, and Dayville School. The structures susceptible to earthquake damage include the following: Oregon Dept. of Transportation, Dayville School, Monument School, Prairie City School, Mount Vernon Fire Department, Mount Vernon Public Works, and Oregon Telephone Corporation[58].

- It is critical to maintain the quality of built capacity (transportation networks, critical facilities, utility transmission, etc.) throughout the area. There are two major highways that run through the Northeast region. I-84 is a major transportation corridor that connects Portland with eastern Oregon and beyond. State Highway 82 connects the very northeastern part of the State with I-84. Local roads that provide ingress and egress to isolated communities, the City of Granite for example, are key features of the county's infrastructure that are critical to recovery from natural hazard events.

- Based on U.S. Census data, more than 80% of the residential housing in the county was built prior to current seismic building standards of 1990 and nearly 72% were constructed prior to the local implementation of the flood elevation requirements of the 1970's (county FIRMs were not completed until the 1980s).

Recent and Future Development

Development pressure in Grant County is not high, however the Grant County and the City of John Day note a few areas where new subdivisions or road improvements and opportunity areas have been approved or identified since the completion of the *2014 NHMP*. In Grant County, a subdivision east of the City of Long Creek (Keeney Estates) that was previously in dispute has now been approved through a

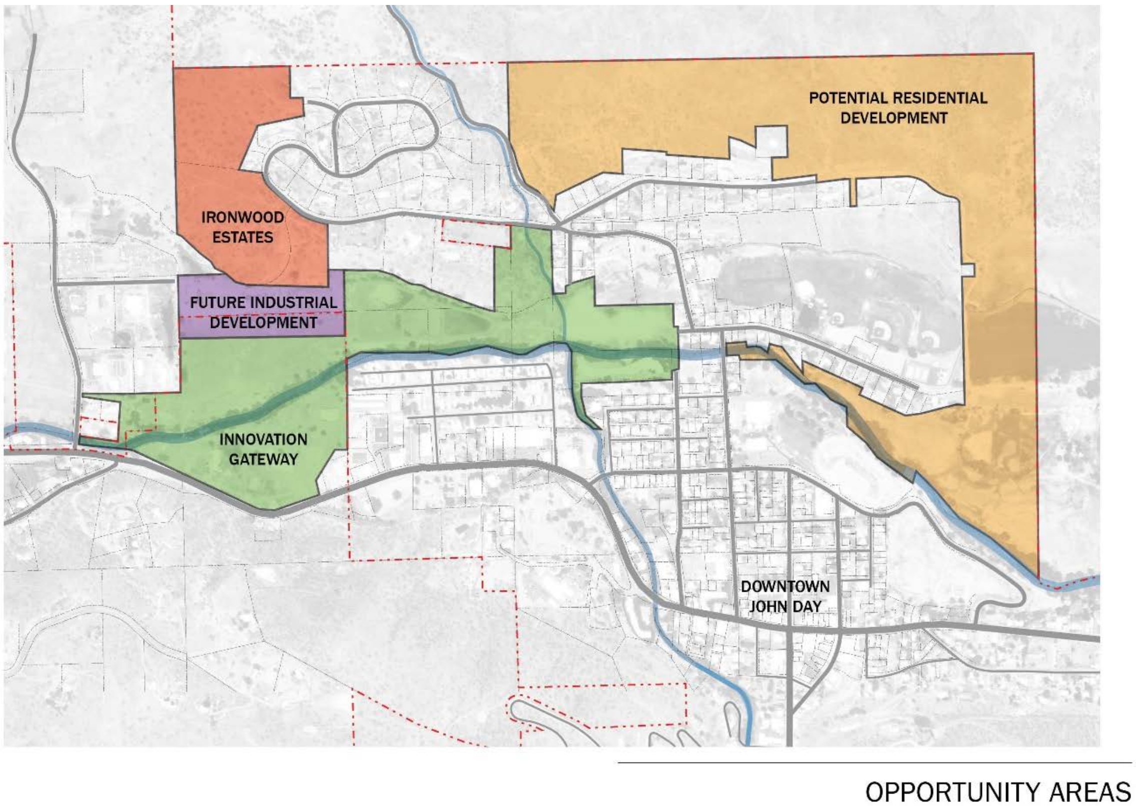
[56]Williams, M. C., Anthony, L. H. and O'Brien, F., 2019 unpublished, Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Oregon Department of Geology and Mineral Industries

[57] Ibid.

[58] Ibid.

Measure 37 claim is now selling lots that are starting to be developed.[59] In the City of John Day, opportunity areas have been identified and new street locations have been identified to allow further development within the city limits. Much of these areas are in Special Flood Hazard Areas and some are in John Day's Geohazard Overlay due to landslide susceptibility (Figure X).[60]

Figure 15. Opportunity Areas for development in the City of John Day, OR



D. Risk Analysis

Risk analysis involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. The following risk analysis for Grant County draws from two sources, the DOGAMI Natural Hazard Risk Report, prepared as part of FEMA's Risk MAP project (Volume III, Appendix G), and the vulnerability and probability components of the Hazard Vulnerability Assessment completed with the Steering Committee using the OEM Methodology detailed previously in Section C. Vulnerability Assessment.

[59] Shannon Springer, Grant County Planner, personal communication, May 2020

[60] Nicholas Green, John Day City Manager, personal communication, May 2020

1. Local Risk Assessment

The local Hazard Vulnerability Assessment does not provide damage, injury and cost estimates likely to be incurred, however, it does reflect the perceptions of the Steering Committee members about the vulnerability of the community to each of the hazards, the probability of their occurrence and a method of ranking the relative importance of the hazards to the Grant County NHMP Steering Committee members.

The graph shown in Figure 13 represents the final scores of the OEM Methodology exercise for both 2019 and 2014. The components of risk analyzed by the Steering Committee to yield these Risk Scores are composed of four factors: history, vulnerability, maximum threat, and probability. Each of these factors is multiplied by a weight factor (WF). The ranking agreed upon by the Steering Committee for Vulnerability reflects their answers to the question "What percentage of the population and property is likely to be affected during an occurrence of an incident?" Table 1 above shows that the Grant County NHMP Steering Committee (SC) believes that wildfire, winter storms, and volcanic events would result in the most damage to people and property receiving rankings of 10 followed closely by floods and droughts which received rankings of 9. Landslides were ranked at 2 out of 10 indicating that the SC believes these incidents to pose less of a threat to people and property.

The probability factor represents the SC's assessment of the likelihood of an incident occurring. Landslide is scored highly for probability indicating that the SC believed it to be likely within the next 5 years, whereas, Volcanic Events are scored very low for probability indicating that the SC believes that more than 10 years will pass between events. The most probable hazards according to the results of this exercise are Wildfire and Landslide ranked at 10, followed closely by Winter Storms, Floods, and Droughts ranked at 9.

The DOGAMI Risk Report is able to estimate damage, injuries, and costs likely to be incurred by an occurrence. These results may confirm or contradict the assessment of the Steering Committee.

2. DOGAMI Risk Report

Oregon Department of Geology and Mineral Industries (DOGAMI) conducted a natural hazard risk assessment in 2019 as part of the FEMA Risk MAP process. The risk assessments contained in DOGAMI's *Natural Hazard Risk Report for Grant County, Oregon* quantify the impacts of four of the eight natural hazards analyzed by the 2019 NHMP Steering Committee. The hazards assessed in DOGAMI's report included wildfire, flood, landslide and earthquake. The full report is included in Volume III as an Appendix G.

The risk assessment was performed by completing three main tasks: compiling an asset database, identifying and using best available hazard data, and performing natural hazard risk assessment.

In the first task, DOGAMI created a comprehensive asset database for Grant County by synthesizing assessor data, U.S. Census information, Hazus®-MH general building stock information, and building footprint data. This work resulted in a single dataset of building points and their associated building characteristics. With these data DOGAMI was able to conduct highly accurate hazard analysis on a building-by-building basis.

The second task was to identify and use the most current and appropriate hazard datasets for Grant County. Most of the hazard datasets used in this report were created by DOGAMI and some were produced by using high-resolution LiDAR topographic data. Each hazard dataset for Grant County were the best available at the time of writing.

In the third task, DOGAMI performed risk assessments using Esri® ArcGIS Desktop® software. They used two risk assessment approaches: (1) estimated loss (in dollars) to buildings from flood and earthquake scenarios using FEMA Hazus®-MH methodology, and (2) calculated number of buildings, their value, and associated populations that are exposed to earthquake and flood inundation scenarios, or susceptible to varying levels of hazard from landslides and wildfire.

Wildfire

The data source used by DOGAMI to quantify risk from wildfire is the Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results (PNRA)[61]. It is a comprehensive report that includes a database developed by the United States Forest Service (USFS) for the states of Oregon and Washington. The steward of this database in Oregon is the Oregon Department of Forestry (ODF). The database was created to assess the level of risk residents and structures have to wildfire. For this project, the Burn Probability dataset, a dataset included in the PNRA database, was used to measure the risk to communities in Grant County.

Using guidance from ODF, DOGAMI categorized the Burn Probability dataset into low, moderate, and high-hazard zones for the wildfire exposure analysis. Probability ranges of the Burn Probability dataset from the PNRA were grouped into 3 categories of wildfire hazard. Burn probability is derived from simulations using many elements, such as, weather, ignition frequency, ignition density, and fire modeling landscape[62].

Burn probabilities were grouped into 3 hazard categories:

- Low wildfire hazard (0.0001 – 0.0002 or 1/10,000 – 1/5,000)
- Moderate wildfire hazard (0.0002 – 0.002 or 1/5,000 – 1/500)
- High wildfire hazard (0.002 – 0.04 or 1/500 – 1/25)

DOGAMI overlaid the buildings layer and critical facilities on each of the wildfire hazard zones to determine exposure. In certain areas no wildfire data is present which indicates areas that have minimal risk to wildfire hazard (see Table 3). The total dollar value of exposed buildings Grant County is reported below. DOGAMI also estimated the number of people threatened by wildfire. Land value losses due to wildfire were not examined for this project.

[61] Pyrologix LCC, 2018
[62] Ibid.

Table 3. Wildfire Exposure

			(all dollar amounts in thousands)					
			High Hazard			Moderate Hazard		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Unincorp. Grant County	4,933	1,169,279	2,204	506,634	43%	1,889	407,764	35%
Canyon City	439	114,298	41	8,478	7.4%	93	17,614	15%
Dayville	166	33,364	72	11,883	36%	37	10,469	31%
Granite	115	15,264	102	13,870	91%	13	1,394	9.1%
John Day	1,065	339,542	10	1,335	0.4%	197	52,616	16%
Long Creek	208	46,914	10	1,232	2.6%	78	13,194	28%
Monument	143	32,015	15	2,313	7.2%	54	11,502	36%
Mount Vernon	398	73,681	29	4,189	5.7%	99	14,601	20%
Prairie City	731	169,267	160	30,393	18%	72	14,167	8.4%
Seneca	219	35,692	49	7,938	22%	14	1,321	3.7%
Total Study Area	8,417	2,029,317	2,692	588,264	29%	2,546	544,641	27%

Source: Williams, M. C., Anthony, L. H. and O'Brien, F., DOGAMI 2019

DOGAMI chose the high hazard category as the primary scenario for this report because it represents the areas that have the highest potential for losses. However, a large amount of loss would occur if the moderate hazard areas were to burn, as some communities have ~20–30% of exposure to moderate wildfire hazard. Other communities have even higher exposure to wildfire hazard. Still, the focus of this section is on high hazard areas within Grant County to emphasize the areas where lives and property are most threatened.

Grant Countywide wildfire exposure (High risk):

- Number of buildings: 2,692
- Exposure Value: $588,264,000
- Ratio of Exposure Value: 29%
- Critical facilities exposed: 5 (including Grant Union HS, Dayville School and Fire Dept.)
- Potentially Displaced Population: 1,446[63]

For this risk assessment, the building locations were compared to the geographic extent of the wildfire hazard categories. Several communities in Grant County have a high percentage of buildings and residents exposed to high wildfire hazard. The primary areas of exposure to this hazard are in the forested unincorporated areas of the county that have not already experienced recent burns (see Figure 3). Wildfire hazard is based on conditions that can change on an annual basis, so local knowledge and understanding of wildfire risk may need to be considered when determining mitigation actions. The

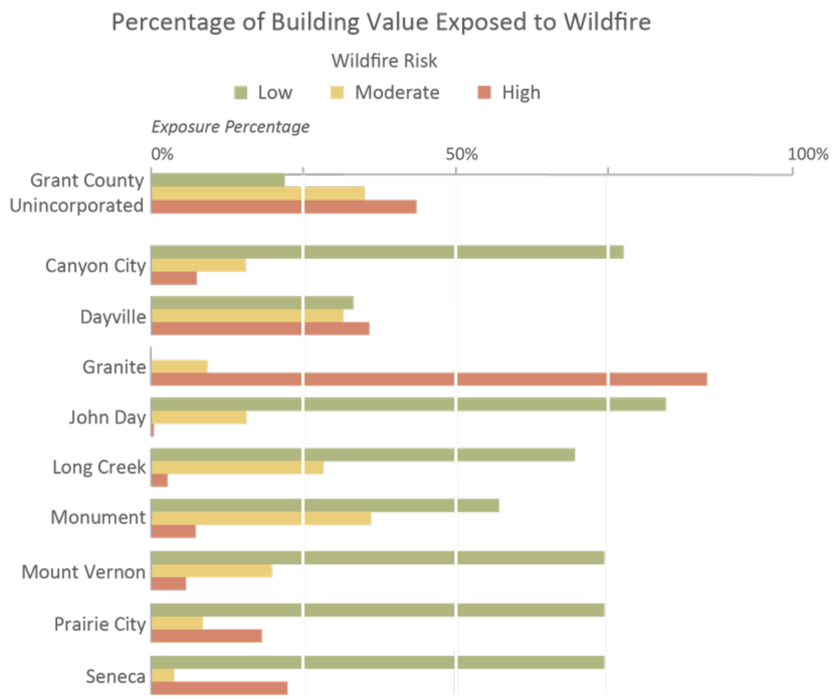
[63] Williams, M. C., Anthony, L. H. and O'Brien, F., DOGAMI 2019

communities of Dayville, Granite, and the unincorporated county have the highest percentage of exposure to high wildfire hazard within Grant County. Figure 15 illustrates the distribution of exposure to wildfire with the different communities of Grant County.[64]

The *Natural Hazard Risk Report for Grant County, Oregon* by DOGAMI identified locations within Grant County that are comparatively more vulnerable or at greater risk to wildfire hazard:

- Wildfire risk is high for many of homes in the forested area south the John Day airport.
- The communities of Dayville, Granite, and the unincorporated county are most at risk to high wildfire hazard compared to other Grant County communities.
- Prairie City and Seneca have a considerable amount of exposure to high wildfire hazard.

Figure 16. Wildfire hazard exposure by community



Source: Williams, M. C., Anthony, L. H. and O'Brien, F., DOGAMI 2019

The DOGAMI analysis does not address one of the principle losses experienced from wildfire, that of standing timber. The Oregonian reporting on the Canyon Creek Complex fire on Sunday, August 14, 2016 reported that following the blaze, private landowners "found themselves in a race against the U.S. Forest Service to get their wood into the area's only remaining mill…Looking to maximize the value of its burned timber, the Forest Service expedited its tree cutting after the fire. The glut swamped the Malheur Lumber Co. with millions of board feet of timber further depressed a weak market for pine

[64] Ibid.

logs. By the spring, the government's logging had frozen out private land owners." The article reports that the rush to remove trees before the weather warmed was motivated by fear of the spread of blue stain fungus carried on the heads of bark beetles that render the wood worthless. By April 2016 the mill had stopped accepting trees from private owners and by summer 2016 the value of timber crashed[65].

Flood

The Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) for Grant County were made effective in the 1980's, with some areas updated and, at the time of writing, still pending in 2019 for local adoption[66] [67] [68] [69] [70]; these were the primary data sources for the flood risk assessment. Further information regarding NFIP related statistics can be found at FEMA's website: https://www.fema.gov/policy-claim-statistics-flood-insurance. This was the only flood data source that DOGAMI used in the analysis, but flooding does occur in areas outside of the detail mapped areas. Flood issues like flash flooding, ice jams, post-wildfire floods, and dam safety were not looked at in this report.

The John Day Wastewater Treatment facility was not flagged by the DOGAMI report as being at risk from any of the natural hazards evaluated in this plan, however, the city considers it to be at risk. The wastewater lagoons are currently located in the 100-year floodplain approximately 80 feet from the John Day River and may pose a public health issue. The facility is currently under Administrative Review by the Oregon Department of Environmental Quality. The City of John Day has developed an innovative plan for a new facility that would reclaim wastewater for hydroponic agriculture rather than discharging the effluent in to the John Day River and would be located outside the floodplain for increased safety from flooding.

Depth grids, developed by DOGAMI in 2019 and based on the effective and pending map data, were used in this risk assessment to determine the level to which buildings are impacted by flooding. Depth grids are raster GIS datasets where each digital pixel value represents the depth of flooding at that location within the flood zone (Figure 16). Though considered draft at the time of this analysis, the depth grid data are the best available flood hazard data. Depth grids for four flooding scenarios (10-, 50, 100-, and 500-year) were used for loss estimations and, for comparative purposes, exposure analysis.

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[65] Gunderson, L. and Sickinger, T., (2016, August 14). Burned; Poor planning and tactical errors fueled a wildfire catastrophe, *The Oregonian*

[66] Federal Emergency Management Agency, 1987, Flood insurance study: City of Mount Vernon, Grant County, Oregon: Washington D.C., Flood Insurance Study Number 410080V000, v.1, 24 p https://map1.msc.fema.gov/data/41/S/PDF/410080V000.pdf?LOC=abbb351c56a37a66da8f9e07ec83dbb5

[67] Federal Emergency Management Agency, 1988, Flood insurance study: City of Prairie City, Grant County, Oregon: Washington D.C., Flood Insurance Study Number 410082V000, v.1, 26 p. https://map1.msc.fema.gov/data/41/S/PDF/410082V000.pdf?LOC=e4a8b1a29543ab7de4a93bd106e211d2

[68] Federal Emergency Management Agency, 2019a, Pending flood insurance study: Unincorporated Areas, Grant County, Oregon: Washington D.C., Flood Insurance Study Number 410074, Letter of Map Revision 19-10-0438P https://map1.msc.fema.gov/data/41/L/19-10-0438P-410074.pdf?LOC=ae449b7b4a6460d7351ae40b3b2f75f2

[69] Federal Emergency Management Agency, 2019b, Pending flood insurance study: City of Canyon City, Grant County, Oregon: Washington D.C., Flood Insurance Study Number 410075, Letter of Map Revision 19-10-0438P https://map1.msc.fema.gov/data/41/L/19-10-0438P-410075.pdf?LOC=02a01f964f244e2c75b61405f89808b9

[70] Federal Emergency Management Agency, 2019c, Pending flood insurance study: City of John Day, Grant County, Oregon: Washington D.C., Flood Insurance Study Number 410077, Letter of Map Revision 19-10-0438P https://map1.msc.fema.gov/data/41/L/19-10-0438P-410077.pdf?LOC=74fe6d41cab60737632d0484be58442e

Building loss estimates are determined by Hazus-MH by overlaying building data over a depth grid. Hazus-MH uses individual building information, specifically the first floor height above ground and the presence of a basement, to calculate the loss ratio from a particular depth of flood.

For the Grant County, occupancy type attributes were derived from the tax lot database for most buildings. Where individual building information was not available from assessor data, DOGAMI used oblique imagery and street level imagery to estimate these important building attributes. Only buildings in a flood zone or within 500 feet (152 meters) of a flood zone were examined closely to attribute buildings with more accurate information for first-floor height and basement presence. Because the analysis accounted for building first-floor height, buildings that have been properly elevated above the flood level were not given a loss estimate—but the analysis counted residents in those structures as displaced. The analysis did not look at the duration that residents would be displaced from their homes due to flooding.

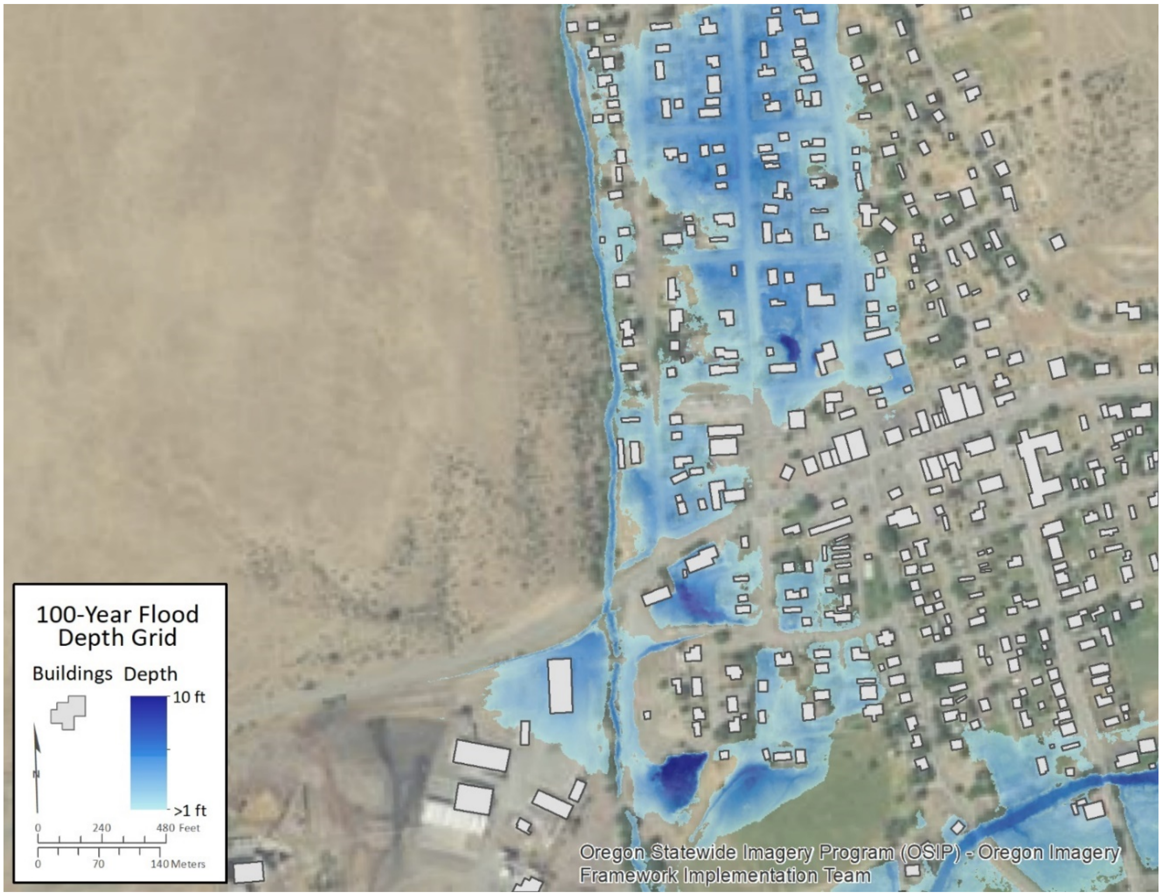
Since there are not vast floodplains within Grant County, there are only a few areas where buildings are vulnerable to flooding. However, in areas where flooding does occur it is a recurrent issue. For this risk assessment, we imported Grant County structure information data and depth grids into Hazus-MH and ran a flood analysis for the four flood scenarios (10-, 50-, 100-, and 500-year). The analysis used the 100-year flood as the primary scenario for reporting the flood results (Figure 16 below and Figure 5). The 100-year flood has traditionally been used as a reference level for flooding and is the standard probability that FEMA uses for regulatory purposes[71].

Grant Countywide 100-year flood loss:

- Number of buildings damaged: 488
- Loss Estimate: $20,261,000
- Loss Ratio: 1.0%
- Damaged critical facilities: 7 (including Grant Union HS, Grant Co. Road Dept. and ODOT)
- Potentially Displaced Population: 799

[71] Federal Emergency Management Agency, 2013, NFIP flood studies and maps, unit 3 in Managing floodplain development through the National Flood Insurance Program (Home Study Course): Washington, D.C., 59 p. https://www.fema.gov/media-library-data/20130726-1535-20490-4172/unit3.pdf

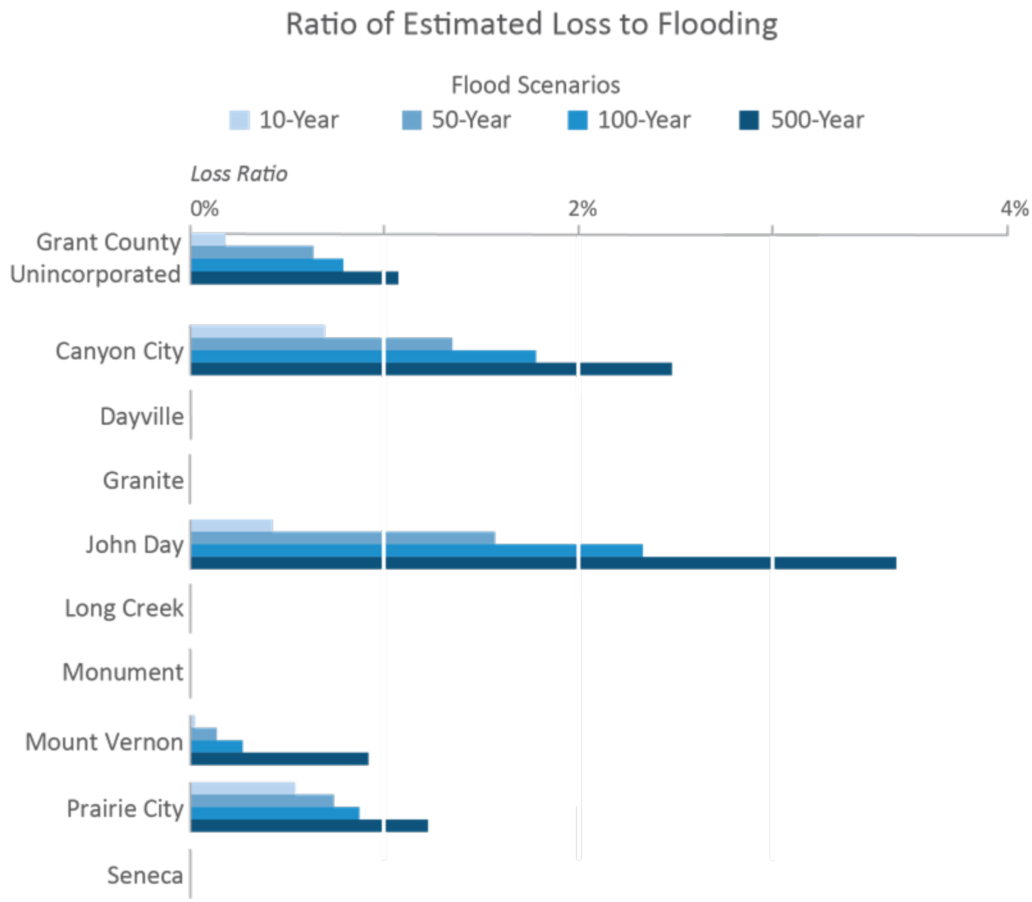
Figure 17. Flood depth grid example, portion of the City of Prairie City



Source: : Williams, M. C., Anthony, L. H. and O'Brien, F., DOGAMI 2019

The Hazus-MH loss estimate of the 100-year flood scenario for Grant County is approximately $20 million. While the overall loss ratio for flood damage in Grant County is only 1%, 100-year flooding has a major impact to Grant County where development exists near streams that are prone to flooding. In situations with communities where most residents are not within flood designated zones, the loss ratio may not be as helpful as the actual replacement cost and number of residents displaced to assess the level of risk from flooding. The Hazus-MH analysis also provides useful flood data on individual communities so that planners can identify problems and consider which mitigating activities will provide the greatest resilience to flooding (Figure 17).

Figure 18. Flood loss estimates by community



Source: : Williams, M. C., Anthony, L. H. and O'Brien, F., DOGAMI 2019;
Note: pending floodplain mapping for Seneca was not completed at the time of this analysis.

Separate from the Hazus-MH flood analysis, DOGAMI did an exposure analysis by overlaying building locations on the 100-year flood extent. A large number (703 buildings) of Grant County's buildings were found to be within designated flood zones. By comparing the number of non-damaged buildings from Hazus-MH with exposed buildings in the flood zone, DOGAMI estimated the number of buildings that could be elevated above the level of flooding. Of the 703 buildings that are exposed to flooding, the analysis estimate that 215 are above the height of the 100-year flood. This evaluation can also shed some light on the number of residents that might have mobility or access issues due to surrounding water.

DOGAMI identified locations within Grant County that are comparatively more vulnerable or at greater risk to flood hazard:

- Flooding along Canyon Creek for many buildings in Canyon City and John Day is a frequent problem.
- Flooding is a persistent problem for buildings along the John Day River within the City of John Day and further downstream west of John Day.
- Several buildings in Prairie City are impacted by flooding from Dixie Creek upstream from the Highway 26 bridge.

Landslide

The Statewide Landslide Information Layer for Oregon [SLIDO], release 4.0 [72] is an inventory of mapped landslides in the state of Oregon. SLIDO is a compilation of past studies; some studies were completed very recently using new technologies, like LiDAR-derived topography, and some studies were performed more than 50 years ago. Consequently, SLIDO data vary greatly in scale, scope, and focus and thus in accuracy and resolution across the state. Landslide inventory mapping for Grant County was done before LiDAR was available for high-accuracy mapping.

Burns and others (2016) used SLIDO inventory data along with maps of generalized geology and slope to create a Landslide Susceptibility Overview Map of Oregon that shows zones of relative susceptibility: Very High, High, Moderate, and Low. SLIDO data directly define the Very High landslide susceptibility zone, while SLIDO data coupled with statistical results from generalized geology and slope maps define the other relative susceptibility zones.[73] Statewide landslide susceptibility map data have the inherent limitations of SLIDO and of the generalized geology and slope maps used to create the map. Therefore, the statewide landslide susceptibility map varies significantly in quality across the state, depending on the quality of the input datasets. Another limitation is that susceptibility mapping does not include some aspects of landslide hazard, such as runout, where the momentum of the landslide can carry debris beyond the zone deemed to be a high hazard area.

DOGAMI used the data from the statewide landslide susceptibility map[74] in this report to identify the general level of susceptibility of given area to landslide hazards, primarily shallow and deep landslides. We overlaid building and critical facilities data on landslide susceptibility zones to assess the exposure for each community. The total dollar value of exposed buildings was summed for Grant County and is reported below. We also estimated the number of people threatened by landslides. Land value losses due to landslides were not examined for this report, in addition to potentially hazardous unmapped areas that may pose real risk to communities.

DOGAMI's risk analysis for Grant County combined high and very high susceptibility zones as the primary scenarios to provide a general sense of community risk for planning purposes. DOGAMI staff determined that it was useful to combine exposure for both susceptibility zones to accurately depict the level of landslide risk to communities. These susceptibility zones represent areas most prone to landslides with the highest impact to the community.

For this risk assessment DOGAMI staff compared building locations to geographic extents of the landslide susceptibility zones. The exposure results shown below are for the high and very high susceptibility zones.

Grant Countywide landslide exposure (High and Very High susceptibility):

- Number of buildings: 1,035
- Exposure Value: $205,629,000
- Ratio of Exposure Value: 10%
- Critical facilities exposed: 2 (including Blue Mountain Hospital and Dayville School)
- Potentially Displaced Population: 1,080

[72] Burns, W. J., and Watzig, R. J., 2014, Statewide landslide information layer for Oregon, release 3 [SLIDO-3.0]: Oregon Department of Geology and Mineral Industries, 35 p., 1:750,000, geodatabase.
[73] Burns, W. J., Mickelson, K. A., and Madin, I. P., 2016, Landslide susceptibility overview map of Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-16-02, 48 p. https://www.oregongeology.org/pubs/ofr/p-O-16-02.htm
[74] Ibid.

Earthquake

Hazus-MH offers two scenario methods for estimating loss from earthquake, probabilistic and deterministic.[75] A probabilistic scenario uses U.S. Geological Survey (USGS) National Seismic Hazard Maps which are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions as a result of all possible earthquake sources (USGS, 2017). A deterministic scenario is based on a specific seismic event from a clearly defined source, such as a Cascadia Subduction Zone magnitude 9.0 event.

DOGAMI selected the probabilistic scenario method because there is no clearly defined dominant seismic source for the area and it best suited estimating the level of seismic risk. This method was used along with the database of structures and critical facilities so that loss estimates could be calculated on a building-by-building basis. The USGS 2500-year probabilistic map[76] provides the Hazus-MH earthquake model with ground shaking parameters, peak ground velocity, spectral acceleration at 1.0 second period and 0.3 second period that have been integrated together. DOGAMI set the magnitude to 6.7 within Hazus-MH for the scenario used in this report. Additional seismic inputs utilized in the earthquake scenario were liquefaction susceptibility and NEHRP site classification derived from the Oregon Resilience Plan (ORP)[77] and landslide susceptibility. [78]

ecause an eart ua e can affect a wide area, it is unli e ot er azards in t is report — every building in Grant County, to some degree, would be affected by it. Hazus-MH loss estimates for each building are based on a formula where coefficients are multiplied by each of the five damage state percentages (none, low, moderate, extensive, and complete). These damage states are correlated to loss ratios that are then multiplied by the building dollar value to obtain a loss estimate[79] Figure 18 shows the loss estimates by community for Grant County from a 2500-year probabilistic magnitude 6.7 event.

[75] Federal Emergency Management Agency, 2012b, Hazus®-MH 2.1 Technical manual, Earthquake model: Washington, D.C., 718 p. https://www.fema.gov/media-library-data/20130726-1820-25045-6286/hzmh2_1_eq_tm.pdf

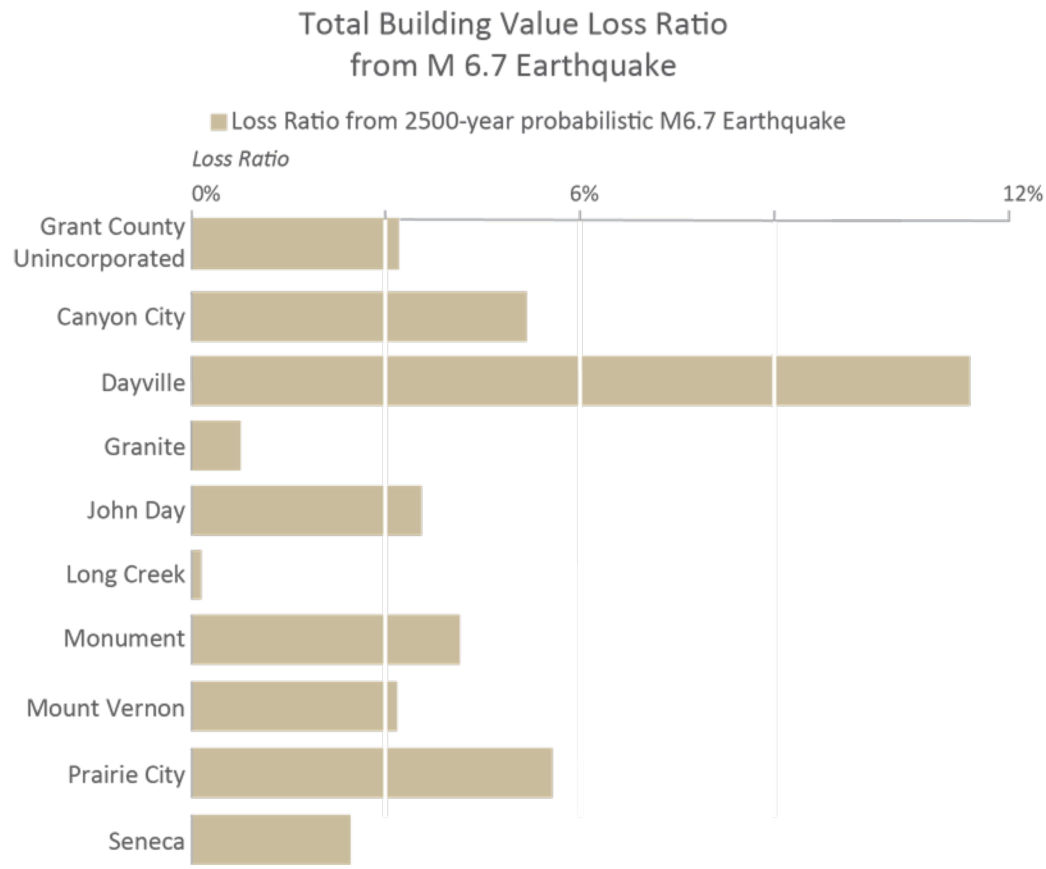
[76] Petersen, M.D., Moschetti, M.P., Powers, P.M., Mueller, C.S., Haller, K.M., Frankel, A.D., Zeng, Yuehua, Rezaeian, Sanaz, Harmsen, S.C., Boyd, O.S., Field, Ned, Chen, Rui, Rukstales, K.S., Luco, Nico, Wheeler, R.L., Williams, R.A., and Olsen, A.H., 2014, Documentation for the 2014 update of the United States national seismic hazard maps: U.S. Geological Survey Open-File Report 2014–1091, 243 p., https://dx.doi.org/10.3133/ofr20141091

[77] Madin, I. P., and Burns, W. J., 2013, Ground motion, ground deformation, tsunami inundation, coseismic subsidence, and damage potential maps for the 2012 Oregon Resilience Plan for Cascadia subduction zone earthquakes: Oregon Department of Geology and Mineral Industries Open-File Report O-13-06, 36 p. 38 pl., GIS data. https://www.oregongeology.org/pubs/ofr/p-O-13-06.htm

[78] Burns, W. J., Mickelson, K. A., and Madin, I. P., 2016

[79] FEMA, 2012

Figure 19. Loss Estimates by Community from a 2500-year M 6.7 Earthquake



Source: Burns, W. J., Mickelson, K. A., and Madin, I. P., 2016

In keeping with earthquake damage reporting conventions, we used the ATC-20 post-earthquake building safety evaluation color-tagging system to represent damage states.[80] Red-tagged buildings correspond to a Hazus-MH damage state of "complete," which means the building is uninhabitable. Yellow-tagged buildings are in the "extensive" damage state, indicating limited habitability. The number of buildings in each damage state is based on an aggregation of probabilities per community and does not represent individual buildings.[81]

Critical facilities were considered non-functioning if the Hazus-MH earthquake analysis showed that a building or complex of buildings had a greater than 50-percent chance of being at least moderately damaged[82].

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[80] Applied Technology Council, 2015, Rapid visual screening of buildings for potential seismic hazards: A handbook (3rd ed.): Redwood City, Calif., FEMA Publication 154. https://www.fema.gov/media-library-data/1426210695633-d9a280e72b32872161efab26a602283b/FEMAP-154_508.pdf

[81] FEMA 2012

[82] Ibid.

The number of potentially displaced residents from the scenario earthquake is based on the number of red-tagged and a percentage of yellow-tagged residences that were determined in the Hazus-MH earthquake analysis results.

Grant County 2500-year probabilistic M6.7 earthquake results:

- Number of red-tagged buildings: 76
- Number of yellow-tagged buildings: 328
- Loss estimate: $72,885,000
- Loss ratio: 3.6%
- Non-functioning critical facilities: 7 (Dayville School, Monument School and Prairie City School)
- Potentially displaced population: 78

The results indicate that Grant County would incur a moderate amount of damage from an earthquake similar to the one simulated in the DOGAMI report. These results were heavily influenced by earthquake-induced landslides and liquefaction. This is evidenced by low loss estimates throughout the county, but with higher loss estimates occurring in areas with high or very high landslide or liquefaction susceptibility.

Risk assessments conducted by DOGAMI typically include analysis of scenarios that show if buildings could be seismically upgraded to moderate or high code, the impact of the earthquake event would be reduced. While these upgrades can decrease earthquake vulnerability, the benefits are minimized in landslide and liquefaction areas, where buildings would need additional geotechnical mitigation to have an effect on losses. This simulation was not done for Grant County because assessor information was limited on the construction date of buildings which informs the design level, a key attribute necessary for this simulation. While this simulation was not done, seismic retrofits can greatly reduce vulnerability to earthquake hazards. Special considerations may be applied to critical facilities with regards to seismic retrofits.

DOGAMI identified locations within Grant County that are comparatively more vulnerable or at greater risk to the 2500-year probabilistic M6.7 earthquake hazard:

- Portions of Dayville that are within very high landslide hazard, show elevated potential of damage from earthquake. The damages calculated in Hazus-MH are primarily from earthquake-induced landslides.
- A high percentage of inhabited areas of Grant County are along the John Day River and Canyon Creek, which generally correspond to liquefiable soils.

Summary

The purpose of the DOGAMI study is to provide a better understanding of potential impacts from the natural hazards of wildfire, flood, landslide and earthquake at the community scale. The report accomplish this by using the latest natural hazard mapping and loss estimation tools to quantify expected damage to buildings and potential displacement of permanent residents. The comprehensive and fine-grained approach to the analysis provides new context for the county's risk reduction efforts. Based on the results of this study we note several important findings:

1. **Hazus®-MH earthquake analysis show a moderate amount of damage and losses for the study area**—The results indicate that Grant County would incur a moderate amount of damage (3.6%) from an earthquake similar to the one simulated in this report. Areas of landslide and liquefaction have some influence on the damage results. This is evidenced by low loss estimates throughout the county, but with higher loss estimates occurring in areas with high or very high landslide or liquefaction susceptibility. Dayville, which is exposed to very high landslide hazard, could see 4.7% in losses in the 2500-year probabilistic earthquake scenario.
2. **Flooding is a recurrent problem for some communities in Grant County**—Most of the development in Grant County is located within or adjacent to the floodplain of the John Day River and its tributaries. Many buildings in the study area, primarily within this floodplain, are vulnerable to flooding. We estimate a moderate amount of damage from flooding overall due mainly to the flooding along the John Day River and Canyon Creek. For only the buildings within the area of 100-year inundation, an average of 9% loss was calculated. During a 100-year flood event, most of the communities of Grant County are expected to sustain losses under 1% of total building value. The City of Canyon City and John Day being the exception to this with approximately 2% of estimated loss to total building value.
3. **Elevating structures in the flood zone reduces vulnerability**—Flood exposure analysis was used in addition to Hazus®-MH loss estimation to identify buildings that were not damaged but were within the area expected to experience a 100-year flood. By using both analyses in this way, the number of elevated structures within the flood zone could be quantified. This showed possible mitigation needs in flood loss prevention and the effectiveness of past activities. John Day, Mount Vernon, and Prairie City were identified as communities with a large number of buildings in the floodplain elevated above the estimated flood height.
4. **New landslide mapping would increase the accuracy of future risk assessments**—Exposure analysis was used to assess the threat from landslide hazard. Landslide is a widespread hazard for much of the undeveloped portions of the county. Most of the very high and high landslide risk occurs along the steep portions of the John Day River valley within the Cities of John Day and Dayville. The landslide hazard data used in this risk assessment was created before modern mapping technology and future risk assessments using LiDAR derived landslide hazard data would provide more accurate results. Earthquake analysis would also benefit from better landslide mapping since Hazus®-MH analysis uses landslide probability as an input dataset.
5. **Wildfire is a natural hazard threat for many areas in Grant County**—Exposure analysis shows that buildings throughout the study area are at high risk to wildfire hazard. The communities within the county have a minimum of 30% of exposure to at least moderate wildfire hazard and some communities are at much greater risk. The communities of Granite, Dayville, and Monument are particularly at risk to high wildfire hazard. Additionally, wildfire risk is high throughout the unincorporated county.

6. **Several of Grant County's critical facilities are at risk to flood hazard**—Critical facilities were identified and were specifically examined within this report. We have estimated that 18% of Grant County's 39 critical facilities at risk to be non-functioning due to a 100-year flood. DOGAMI has also found that 5 critical facilities are exposed to high wildfire hazard. For comparative purposes, almost zero of Grant County's critical facilities are at risk to landslides or earthquake, however, one of those structures is the only hospital in Grant County, the Blue Mountain Hospital.
7. **Biggest displacement to population was wildfire**—Displacement of permanent residents from natural hazards was quantified within this report. We estimate that of the 7,445 total residents in Grant County 19% of the population or 1,446 residents could be potentially displaced due to wildfire. Landslide hazard is a potential threat to 15% (1,080) of permanent residents, and flood hazard makes 11% (799) vulnerable to displacement.
8. **Community needs can be prioritized**—Each community within Grant County was assessed for natural hazard exposure and loss. This allowed for comparison of risk between communities and impacts from each natural hazard. In using Hazus®-MH and exposure analysis, these results can assist in developing plans that address the concerns for those individual communities.

III. MITIGATION STRATEGY

A. Introduction

The Mitigation Strategy establishes a policy framework and implementation pathway for reducing risk from natural hazards over the long term. This section outlines Grant County's strategy to reduce or avoid long-term vulnerabilities to the hazards in the Risk Assessment. This section also presents a mission, goals, and mitigation actions to reduce risk of damage from these hazards. The Grant County Natural Hazards Mitigation Plan (NHMP) Steering Committee reviewed the *2014 Northeast Oregon Multi-Jurisdictional NHMP (2014 NHMP)* and retained the mission statement but revised goal statements. The Steering Committee reviewed and updated the mitigation actions from the 2014 plan adding some new actions while marking some actions completed. Additional planning process documentation is in *Appendix B: Planning and Public Process* providing detail on the process by which the Steering Committee accomplished this work.

B. Mission and Goals

The mission of the *2014 NHMP* stated the broad purpose of the plan in language adaptable to future changes made to the plan. The Grant County NHMP Steering Committee reviewed the mission statement of the prior plan and agreed it accurately describes the overall purpose and intent of this NHMP. The Steering Committee agreed to retain it in revised form.

The mission of the 2020 Grant County NHMP is as follows:

Mission: To create a disaster-resilient Grant County

Mitigation plan goals are more specific statements of direction that Grant County form a bridge between the broad mission statement and particular mitigation actions. The goals listed here serve as checkpoints for agencies and organizations when implementing mitigation actions. They are not numbered to indicate any priority ranking, merely as a way to reference them.

2020 Grant County NHMP Goals

1: Protect human welfare, property, and natural resources

2: Increase the resilience of local and regional economies

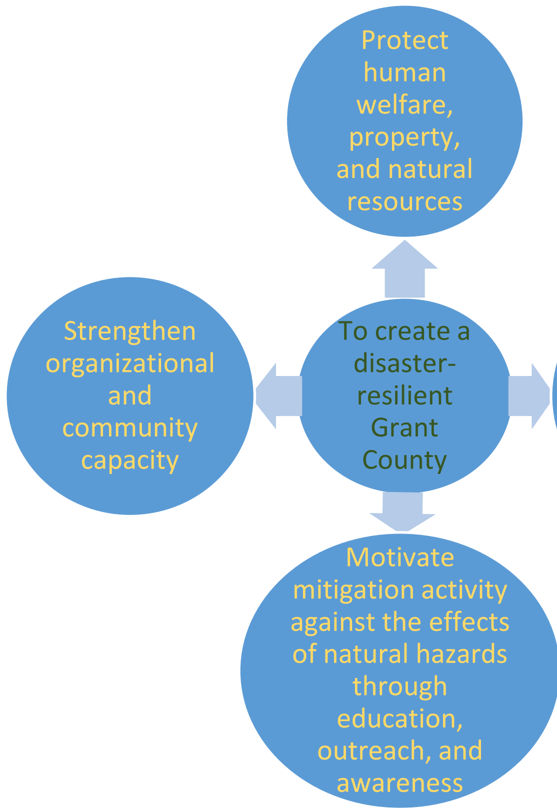
3: Motivate mitigation activity against the effects of natural hazards through education, outreach, and awareness

4: Strengthen organizational and community capacity

Public participation was a key aspect in developing the NHMP goals in previous plans. Meetings with the Steering Committee, stakeholder interviews, surveys, and public workshops all served as methods to obtain input and priorities in developing goals for reducing risk and preventing loss for natural hazards in Grant County.

Public participation was also a key aspect in this update to the NHMP. The Grant County NHMP Steering Committee reviewed the existing four multi-jurisdictional goals and decided to concentrate them into four succinct goals. The graphics in Figure 19 illustrate the relationship between the mission and the goals.

Figure 20. Relationship between the mission and the goals of the Grant County NHMP



Source: Grant County NHMP Steering Committee work product

C. Mitigation Actions

Mitigation actions are specific actions, projects, activities, or processes that reduce risk to people, property, and the environment from the impacts of natural hazard events. The 2014 Northeast Oregon Multi-Jurisdictional NHMP contains mitigation actions for the entire region covered by that plan. Mitigation actions identified through the planning process are an important part of the mitigation plan. They are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. They address both multi-hazard (MH) and hazard-specific issues.

The 2020 Grant County NHMP Steering Committee considered a subset of the mitigation actions contained in the 2014 Northeast Oregon Multi-Jurisdictional NHMP by selecting those actions that pertain to Grant County. This list of actions was the basis for development of the 2020 Grant County NHMP mitigation action list.

Development of the mitigation action list was a multi-step, iterative process that involved brainstorming, discussion, review, and revisions. The bulk of this work occurred during the fourth Steering Committee meeting held on September 9, 2019 and during the Risk MAP Discovery meeting held September 13, 2019.

One of the first steps was to discuss the status of the mitigation actions from the *2014 Northeast Oregon Multi-jurisdictional NHMP*. The Steering Committee went through each mitigation action and ascertained if the action was completed or in progress.

- *Completed mitigation actions* are accomplishment and are noted as such in the table.
- *No longer included mitigation actions* were removed from the table due to resource constraints or other factors.
- *Mitigation actions that were retained* were retained in full or modified to more accurately reflect the current situation.
- During this process, *new mitigation actions* were also identified.

Of the thirty-two actions that were carried over from the *2014 NHMP*, four of those actions were removed and four actions were completed. Thirty-three new actions were added. These new actions were refinements or more specific actions based on existing action descriptions many of which were identified through the Risk MAP Discovery process conducted by FEMA during the course of the plan update process.

This plan identifies 57 mitigation actions. These actions are prioritized into High Priority (33 actions), Medium Priority (16 actions) and Low Priority (8 actions). Within each priority ranking, the actions are further divided primarily into Long Term, Medium Term and Short Term time frames for action. Some actions are in progress and this is also noted under the Timeline column.

Appendix C contains a Table 1 which lists each of the 2020 Mitigation Actions and identifies the corresponding mitigation action item number from the *2014 NHMP* along with current prioritization.

The mitigation actions must be prioritized to respond to the Disaster Mitigation Act of 2000 requirement for this. The priority ranking and timeframe from the *2014 NHMP* were considered when assigning priority and timeframe to the *2020 NHMP* Mitigation Actions. Regarding the timeframe within which the mitigation action is planned, resource availability, including such factors as staff time and funding, are part of the categorization of whether the action is short- or long-term. The Grant County SC assigned timeframes based on the following criteria.

- *Short-term actions* are activities that may be implement with existing resources and authorities in one to two years.
- *Medium-term and Long-term actions* are those that may require new or additional resources and/or authorities.
- *Routine activities* are those that are currently in process and will continue to be implemented on a recurring basis during the next planning period.

Prioritization was assigned on a separate basis within each timeframe. There are high priority items within the short term, medium term and long term timeframes.

A selection of the 2020 Mitigation Actions are detailed in Mitigation Action Item Worksheets located in Appendix C. For each High Priority Mitigation Actions a Mitigation Action Item Worksheet was developed. These Worksheets identifying the rationale for the project, ideas for implementation, and potential coordinating and partner organizations. The Mitigation Action Item Worksheets are intended to assist jurisdictions in developing grant applications to conduct mitigation actions. Grant County, the City of John Day, the Grant Soil and Water Conservation District and the Grant Education Services District and other jurisdictions that develop addenda to the plan can use these summaries of potential projects to prioritize projects and to seek grant funding for them.

Table 4. 2020 Grant County MJ NHMP Mitigation Actions

Multi-Hazard Action Items	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
								1	2	3	4
MH 1	Completed	Complete Continuity of Operations Plan (COOP) for Grant County.		Interested City Managers and/or City Council; County Commissioners, Emergency Management	Relevant Public Works and Emergency Services / Emergency Management, Law Enforcement, Fire Department, Department of Homeland Security, County Roads Departments, ODOT, relevant private industries, OEM	Short Term (0-3 years)	Completed	X	X	X	X
MH 2	High	Incorporate the Natural Hazards Mitigation Plan into the Comprehensive Plan (State Planning Goal 7)	All	County/ City Planning Department	OR Department of Land Conservation and Development, OR Office of Emergency Management, Federal Emergency Management Agency	Medium Term (4-7 years)	Deferred				X
MH 3	High	Inform public officials about mitigation awareness and the Natural Hazards Mitigation Plan as part of plan maintenance and implementation.	All	County Steering Committee Convener	Counties, cities, special districts, and Grant County Wildfire Protection Coordinator	Routine (an action done on a regular basis)	Routine			X	
MH 4	High	Develop and implement education and outreach programs to increase public awareness of the risk associated with natural hazards. Specifically target vulnerable populations	All	Emergency Services / Emergency Management	Grant County Wildfire Protection Coordinator, Eastern Oregon Head Start, Chambers of Commerce, American Red Cross, Oregon Education Association, Families First, Grant and Harney County Casa, Oregon Rural Action, County Extension Offices, Eastern Oregon Medical Associates, Elks Lodge, Girl Scouts of the USA, Greater Prairie City Community Association, People Mover, Community Connections of Northeast Oregon	Routine (an action done on a regular basis)	Routine	X		X	
MH 4.1	Medium	Training on how to use HAZ-VU and the Department of Geology and Mineral Industries (DOGAMI) Landslide Mapping Guide to educate property owners. Education is needed for plan review and building permits in high landslide risk zones.	Grant County	DOGAMI, DLCD	Grant Soil and Water Conservation District	Short Term (0-3 years)	New Action				X
MH 4.2	Medium	Improve disaster-related public notifications, including: • flood awareness recommendations outside of reverse 911, • Installation of a reader board near Dayville City Hall to inform residents and others driving through the city, • maintain communication during extended power outages. • leverage evacuation plans by improving notification.	Dayville, Grant County	Participating Cities	FEMA, OEM	Medium Term (4-7 years)	New Action			X	

Multi-Hazard Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
MH 4.3	**Medium**	Request training to support disaster preparedness and response to identify roles and responsibilities for staff and volunteers and provide training for city staff to improve skill at communicating regarding risk of natural hazards.	Long Creek, Seneca	Participating Cities	DLCD, OEM	Routine (an action done on a regular basis)	New Action			X	
MH 5	**High**	Enhance communication and response coordination among all of the incorporated areas in Grant County.	All	Emergency Services / Emergency Management; Consolidated Dispatch Center	County Planning Departments, Local fire departments and fire districts, Bureau of Land Management, Oregon Department of Forestry, Oregon Department of Transportation, OSU Extension, Amateur Radio Emergency Services, OSP, FBI, Public Works, USFS, local irrigation districts	Routine (an action done on a regular basis)	Was MH #6 in 2014 Plan. Mechanism in place with the NE Oregon fire chiefs. John Day, OR is the defacto hub for group.				X
MH 6	**High**	Create a position for a Countywide Hazards Mitigation Project Coordinator	Grant County	County Commission	Planning and Emergency Services / Emergency Management, Local Steering Committees, Oregon Natural Hazards Workgroup, Oregon Emergency Management	Long Term (8-10 years)	Deferred			X	X
MH 7	**High**	Develop a warning and emergency evacuation protocol for vulnerable populations	Grant County	Emergency Services/ Emergency Management	Community Connections of Northeast Oregon, Blue Mountain Hospital, American Red Cross, People Mover, Assisted living facilities, Elks lodge, public libraries, National Organization on Disability	Short Term (0-3 years)	In progress	X			X
MH 7.1	**Medium**	Improve the county website and outreach process specific to: • Identifying how all hazards align with evacuation routes. • Identifying and adding shelter information for all hazards in each community to the website, especially as they relate to evacuation routes.	Grant County	Emergency Services/ Emergency Management	Grant County Administrative Services/webmaster	Short Term (0-3 years)	New Action	X		X	
MH 7.2	**Medium**	Explore the reverse 911 program and other real-time communication for hard to reach and low-lying areas for people who have minimal technology and communication methods. This would supplement the existing Alert Sense program already implemented in the county to push out alerts to mobile devices for those who sign up for them.	Grant County	Emergency Services/ Emergency Management	OEM	Short Term (0-3 years)	New Action	X			
MH 8	**High**	Ensure that critical airport services are available in the event of an emergency. Critical elements include: adequate fuel systems, appropriate lighting, functioning weather services, ground-access to the airport, and safe runways/taxiway infrastructure	Grant County	Grant County Regional Airport	Grant County, USFS, City of John Day, Oregon Trail Electric, Blue Mountain Hospital, St. Charles Hospital, Oregon Dept. of Aeronautics, FAA	Routine (an action done on a regular basis)	Routine	X	X		X

Multi-Hazard Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
MH 9	**High**	Expand the existing geographical information system (GIS) for the county and secure funding for expansion of the GIS system.	All	Grant Soil and Water Conservation District	County Planning Department, County Court, Emergency Management, County Wildfire Coordinator, DLCD/OEM	Short Term	This is Wildfire Mitigation Strategy #2 from the current Grant County CWPP.	X			X
MH 10	**High**	Complete a road hazard assessment to address existing road situations which could result in problems for evacuation of residents and limit fire apparatus response during a wildfire situation.	All	County Road Dept, Rural Fire Districts, Grant County Sheriff's Office, ODF	County Court, Emergency Management, County Wildfire Coordinator, USFS	Short Term	This is Wildfire Mitigation Strategy #5 from the current Grant County CWPP.	X	X		X
MH 11	**Medium**	Explore emergency food storage options for county communities for periods when transportation corridors and delivery logistics are compromised for extended periods of time.	All	Emergency Management	County Court, Oregon Office of Emergency Management, FEMA, OSU Extension Offices.	Medium Term (4-7 years)	New Action	X		X	X
MH 11.1	**Low**	Provide for a stock of supplies and backup generators for each local shelter location.	Long Creek, Prairie City, Dayville, Grant County	Emergency Management		Medium Term (4-7 years)	New Action	X	X		
MH 12	**Medium**	Collect new LiDAR data for both flood hazard and landslide hazard mapping in the listed locations as outlined in the Risk MAP Discovery report particularly in the southwest and northeast areas of Grant County and near the following: • Silvies Watershed to complete the confluence area of Bear Creek and the Silvies River, •Monument and John Day, • North, Middle, and South Forks of the John Day River.	Grant County	DOGAMI	FEMA, DOGAMI, DLCD, OEM, Grant SWCD	Short Term (0-3 years)	New Action	X			X
Drought Action Items	**Priority**	**Proposed Action Title**	**Jurisdictions Involved**	**Lead Agency**	**Partner Organization(s)**	**2020 Timeline**	**2020 Status**	**Plan Goals**			
								1	**2**	**3**	**4**
DR 1	**Medium**	Identify incentive programs to increase water efficiency among agricultural water users	Grant County	County Water Masters, Natural Resources Conservation Service	Relevant utility companies, county public works departments, ditch companies, landowners, irrigation districts, soil and water conservation districts, Fresh Water Trust, US Environmental Protection Agency's WAVE program,	Routine (an action done on a regular basis)	Routine	X			X
DR 2	**Medium**	Identify incentive programs to Increase water efficiency among municipal water users	All	Participating Cities	Relevant utility companies, city public works departments, County, wastewater treatment facilities, US Environmental Protection Agency's WAVE program	Routine (an action done on a regular basis)	Routine	X			X

Drought Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
DR 2.1	**High**	Requesting an irrigation ditch assessment, with consideration of the following details: • The goal is to increase the resilience of the irrigation ditch - improving the ditch so that it is no longer a flood hazard and can be utilized during a wildfire. • Background: The ditch is primarily used for agriculture and irrigation and is funded by the local ditch association. There have been several blowouts. The ditch was damaged in recent floods. Previous funding was provided through residential fee increases. • The city would like to develop a plan for improvement and determine project funding opportunities. The city would like to collaborate with the Oregon Water Resources and Fish & Wildlife departments.	Dayville	Dayville	Grant SWCD, OR Water Resources Dept and OR Dept of Fish and Wildlife, DLCD/OEM	Short Term (0-3 years)	New Action	X			X
DR 2.2	**High**	The city has obtained funding and is completing the improvement of the city's well fields to provide more water for both consumption and wildfire protection.	Prairie City	Prairie City	USDA, Business Oregon	In progress	New Action	X			X
DR 3	**High**	Develop community drought emergency plans and policies	All	County Emergency Services / Emergency Management; Interested Cities	Water Resources Departments, County and City Governments, County and City Planning Departments, Public Works Departments, John Day, Natural Resources Conservation Service, Relevant Irrigation Districts, OSU Extension Office, US Department of Agriculture	Routine (an action done on a regular basis)	Routine	X	X		X
Earthquake Action Items	**Priority**	**Proposed Action Title**	**Jurisdictions Involved**	**Lead Agency**	**Partner Organization(s)**	**2020 Timeline**	**2020 Status**	**Plan Goals**			
								1	**2**	**3**	**4**
EQ 1	**Low**	Perform an earthquake risk evaluation on all critical buildings not listed in the DOGAMI RVS report. Specifically including the Fire Station and City Hall buildings in Prairie City and downtown stone masonry buildings. Dayville and Long Creek schools also have not been slated for retrofitting proposals yet.	All	Emergency Management	County Public Works Departments, Interested Cities, Business Oregon, Relevant utility companies, DOGAMI	Long Term (8-10 years)	Modified	X	X		
EQ 2	**Completed**	Seismically retrofit the John Day Fire Department to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options		The City of John Day, Emergency Management	County Public Works Departments, Business Oregon, DOGAMI, OEM, FEMA, ODE		Completed - building rebuilt.	X			
EQ 3	**Completed**	Seismically retrofit Mount Vernon Middle School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options		John Day SD 3, Emergency Management	County Public Works Departments, Business Oregon, DOGAMI, OEM, FEMA, ODE		Removed - School closed and sold.	X			

Earthquake Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
EQ 4	**High**	Seismically retrofit Prairie City School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Prairie City	Prairie City 4 School District, Emergency Management	County Public Works Departments, Prairie City, Business Oregon, DOGAMI, OEM, FEMA, ODE	Short Term (0-3 years)	Funding granted in 2019; construction permit issued.	X			
EQ 5	**Completed**	Seismically retrofit Grant Union High School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options		John Day SD 3, Emergency Management	County Public Works Departments, Grant County, Business Oregon, DOGAMI, OEM, FEMA, ODE		Completed	X			
EQ 6	**High**	Seismically retrofit Humboldt Elementary School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Canyon City	John Day SD 3, Emergency Management	County Public Works Departments, Canyon City, Business Oregon, DOGAMI, OEM, FEMA, ODE	Short Term (0-3 years)	In progress	X			
EQ 7	**High**	Seismically retrofit Seneca Elementary School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Seneca	John Day SD 3, Emergency Management	County Public Works Departments, City of Seneca, Business Oregon, DOGAMI, OEM, FEMA, ODE	Short Term (0-3 years)	Retain	X			
EQ 8	**High**	Seismically retrofit Monument School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Monument	Monument SD 8, Emergency Management	County Public Works Departments, City of Monument, Business Oregon, DOGAMI, OEM, FEMA, ODE	Short Term (0-3 years)	Retain	X			

Flood Action Items	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
								1	2	3	4
FL 1	**Medium**	Explore flood mitigation opportunities for homes, infrastructure and critical facilities subject to flooding.	All	Relevant City and County Public Works Departments, Emergency Services and Emergency Management	DLCD NFIP Coordinator, County Roads Departments, Public Works Departments, County Planning Departments; City of John Day, Silver Jackets, Relevant water treatment facilities, Federal Emergency Management Agency, Homeowner, Army Corps of Engineers, Oregon Department of Fish and Wildlife, Department of State Lands, ODOT	Short Term (0-3 years)	Deferred	X			
FL 1.1	**High**	Move the waste water treatment plant out of the SFHA. This $12-14 million project is planned to be completed in 2020-21.	John Day	John Day	USDA, EPA	Short Term (0-3 years)	Design phase funded; seeking construction funding	X	X		
FL 1.2	**Medium**	Create a transportation route that connects the bridges in John Day. There are two bridges that are not connected by streets. Both bridges are small and failing.	John Day	John Day	Oregon Department of Transportation, Federal Highway Administration	Short Term (0-3 years)	New Action	X	X		
FL 1.3	**High**	Re-engineer, re-construct, and deepen the USACE river channel that is causing a contamination problem and reduce flooding. The goal is to create a community greenway.	John Day	John Day	FEMA, OEM and EPA	Medium Term (4-7 years)	New Action	X	X		

Flood Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
FL 1.4	**Medium**	Update and replace Bridge Street and Patterson Bridge. Bridge scouring is occurring along Dixie Creek and Canyon Creek. There is a need to add another bridge to service residential areas and provide improved evacuation routes. The city has questions about how, where, and who can help support and fund these mitigation projects.	John Day	John Day	Oregon Department of Transportation, Federal Highway Administration	Medium Term (4-7 years)	New Action	X			
FL 1.5	**Medium**	Explore opportunities to mitigate flood risk to homes from the Canyon Creek floodplain.	John Day, Canyon City, Grant County	Participating Cities and Grant County	Housing and Urban Development's CDBG program	Medium Term (4-7 years)	New Action	X			
FL 1.6	**Low**	Explore opportunities to mitigate flood risk to schools near flood hazard areas near Canyon City, including the high school.	John Day	Grant County School District	Housing and Urban Development's CDBG program	Long Term (8-10 years)	New Action	X			
FL 1.7	**High**	Conduct river restoration and flood mitigation projects to protect vital transportation infrastructure at risk, including bridge access to critical resources. Specific examples include: • access to the wastewater treatment plant and water source in Seneca and • stream restoration on Dixie Creek in Prairie City in the area of the bridge across Oregon Highway 26 where the channel is becoming choked with silt and willows.	Monument, Seneca, Prairie City, Grant County	Cities of Monument and Seneca		Long Term (8-10 years)	New Action	X	X		
FL 1.8	**High**	Implement best practices for post-wildfire stream stabilization efforts in Dixie Creek and other streams adjacent to recent burn areas. For example, previous efforts to slow stream flow by placing unanchored woody debris in stream beds (Oliver Creek is an example) has resulted in further damage to streams and their fisheries during intense summer storms that can cause mudflows from burned areas.	Prairie City, Grant County	Prairie City, Grant County	USFS, OR Dept. of Environmental Quality, County Wildfire Coordinator, local fire districts	Medium Term (4-7 years)	New Action	X			
FL 1.9	**High**	Address erosion around footings, aprons and abutments. Specific areas include the abutments of the Main Street and Bridge Street bridges across the John Day River in Prairie City.	Prairie City	Prairie City Public Works		Long Term (8-10 years)	New Action	X			
FL 2	**High**	Explore the costs and benefits for participation in the NFIP's Community Rating System	All	Interested Cities and Counties	County and city planning departments, county emergency services / emergency management, county public works, Silver Jackets, FEMA, DLCD	Short Term (0-3 years)	Deferred	X	X		

Flood Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
FL 3	**High**	Increase awareness concerning the NFIP program.	All	Local floodplain managers, County Emergency Managers	City Planning Departments, Emergency Services / Emergency Management, NFIP Floodplain Coordinator (DLCD), insurers, realtors, FEMA, County Extension Offices, Eastern Oregon Medical Associates, Elks Lodge, Girl Scouts of the USA , Greater Prairie City Community Association, People Mover, Community Connections of NEOR (Any community organizations capable of distributing information), Blue Mountain Eagle, ACOE	Short Term (0-3 years)	Deferred			X	X
FL 4	**High**	Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	All	Relevant City and County Public Works Departments, Emergency Management, City Managers, County Planning Departments	County Roads Departments, Public Works Departments, City of John Day, Army Corps of Engineers, DOGAMI, DAS-GEO, elected officials	Short Term (0-3 years)	In progress	X	X		X
FL 4.1	**High**	New flood analysis is requested with the following details: • all areas of development within or near flood hazard areas, • along Highway 26 and Zone D areas, • expand mapping extent along the North, Middle, and South Forks for the John Day River, • expand mapping extent in the unmapped areas south of Canyon City, • extend mapping to better tie into the Silvies flood map above Seneca and Bear Creek, • re-map the area where the Canyon Meadows Dam once was, and • re-map floodway in populated areas.	Grant County	Grant County floodplain manager, FEMA	Grant SWCD	Short Term (0-3 years)	New Action in progress	X	X		X
FL 4.2	**Low**	Requesting updated flood studies that will be leveraged during the upcoming Comprehensive Plan update. Specifics include: • Map undeveloped areas as they are being considered for future development. • Flooding in John Day impacts Dayville. • Most flooding occurs in areas with little population.	Dayville	Local floodplain managers, FEMA		Medium Term (4-7 years)	New Action	X	X		X

Flood Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
FL 4.3	**High**	Funding is needed for river gauges for the Silvies River and Bear Creek where flooding commonly occurs at the confluence at the north end of the city. Data on flow and river gauges for the Silvies River and Bear Creek would support mitigation efforts to reduce debris flow and flooding that strands residents.	Seneca			**Medium Term (4-7 years)**	New Action	X	X		
FL 4.4	**Medium**	Requesting an update to the flood maps that would improve existing gaps in the SFHA and increase the understanding of flood risk in the north end of town at the confluence of Bear Creek and Silvies River.	Seneca, Grant County	Local floodplain managers, FEMA		**Short Term (0-3 years)**	New Action	X	X		
FL 5	**High**	Explore mitigation opportunities for the Canyon City bridge (Bridge #7)	Canyon City	Grant County	ODOT, ACOE, Silver Jackets, John Day School District 3, Canyon City	Medium Term (4-7 years)	In progress	X			
Landslide Action Items	**Priority**	**Proposed Action Title**	**Jurisdictions Involved**	**Lead Agency**	**Partner Organization(s)**	**2020 Timeline**	**2020 Status**	**Plan Goals**			
								1	**2**	**3**	**4**
LS 1	**Low**	Identify, obtain, and evaluate detailed risk assessments in landslide prone areas and develop mitigation strategies to reduce the likelihood of a potential hazardous event.	All	County Public Works Department	County Planning Department, ODOT, DOGAMI, USGS, irrigation district	Long Term (8-10 years)	Deferred	X	X	X	
LS 1.1	**Low**	Create updated and more detailed hazard maps incorporating the most recent LiDAR data into the current geohazard overlay.	John Day, Grant County	City of John Day, Grant County	DOGAMI	Short Term (0-3 years)	New Action	X	X	X	
LS 1.2	**Medium**	Landslide risk assessments to address the concern of being located within a valley.	Monument	City of Monument	DOGAMI	Short Term (0-3 years)	New Action	X	X	X	
Severe Weather Action Items	**Priority**	**Proposed Action Title**	**Jurisdictions Involved**	**Lead Agency**	**Partner Organization(s)**	**2020 Timeline**	**2020 Status**	**Plan Goals**			
								1	**2**	**3**	**4**
SW #1	**Low**	Participate in the NOAA Storm Ready Program	Grant County	Emergency Services / Emergency Management	County Public Works Departments, County Roads Departments, Interested Cities, NOAA, NWS (Pendleton or Boise), HAMM, Oregon Department of Transportation, local fire departments, American Red Cross, local radio stations, USGS	Long Term (8-10 years)	Deferred	X			
SW #2	**Medium**	Shorten spans and anchor poles on utility lines in high wind or heavy icing areas	Grant County	NE Oregon Electric Cooperatives	County Emergency Management, County Public Works, Electric Trail, Columbia Power, Other relevant utility companies	Routine (an action done on a regular basis)	Routine	X			

Windstorm Action Items	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals 1	2	3	4
WS 1	**Removed**	Adopt additional regulations governing residential construction to prevent wind damage. Currently in compliance with State of Oregon regulations.		Grant County Planning Department	Planning Commission, participating cities.	Long Term (8-10 years)	Removed due to reticence to exceed existing requirements of state building codes	X			X
Wildfire Action Items	**Priority**	**Proposed Action Title**	**Jurisdictions Involved**	**Lead Agency**	**Partner Organization(s)**	**2020 Timeline**	**2020 Status**	**Plan Goals 1**	**2**	**3**	**4**
WF 1	**High**	Advocate for the implementation of the actions identified in the Community Wildfire Protection Plan.	All	County Steering Committee Convener, Emergency Management	County Emergency Services / Emergency Management, County Planning Departments, Local Public Safety Coordinating Council (LPSCC), Oregon Department of Forestry, Bureau of Land Management, local fire departments, OSU Extension Services, US Forest Service, Soil and Water Conservation Districts, Oregon Department of Fish and Wildlife; Homeowners in Wildland/Urban Interface zones.	Routine (an action done on a regular basis)	Routine	X			X
WF 2	**High**	Implement CWPP's at the zone level. Grant County has been divided into nine separate "zones" for the purposes of the revised CWPP. This methodology was devised to better recognize differences in topography, vegetation, and fire prevention resources within communities throughout the county. Each zone within the county will be encouraged to develop a local CWPP reflecting specific needs and hazards for that area. Each zone will have the opportunity to implement the Firewise Communities USA program.	All	County Wildfire Coordinator	County Steering Committee Convener, Emergency Management, County Court	Medium Term (4-7 years)	In Progress. This is Wildfire Mitigation Strategy #3 in the current CWPP.	X	X	X	X
WF 3	**High**	Evaluate and update the county emergency management system county wide.	All	Grant County Communications Task Force	County Steering Committee Convener, Emergency Management	Routine (an action done on a regular basis)	New Action. This is Wildfire Mitigation Strategy #4 in the current CWPP.	X	X	X	X
WF 4	**High**	Assist Rural Fire Districts in attratcing volunteer firefighters, upgrading their firefighting equipment, facilities, and training needs.	All	County Wildfire Coordinator	ODF, Fire Chiefs, Emergency Management, County Court, USFS, BLM.	Routine (an action done on a regular basis)	New Action. This is Wildfire Mitigation Strategy #7 in the current CWPP.	X			X

Wildfire Action Items (cont'd)	Priority	Proposed Action Title	Jurisdictions Involved	Lead Agency	Partner Organization(s)	2020 Timeline	2020 Status	Plan Goals			
WF 5	High	Encourage and support collaborative efforts between the USFS, BLM, and communities at risk from wildfires. Help identify needed hazard fuel reduction work on federal lands within the WUI.	All	County Wildfire Coordinator	USFS, BLM and local communities.	Routine (an action done on a regular basis)	New Action. This is Wildfire Mitigation Strategy #8 in the current CWPP.	X		X	
WF 6	High	Continue county-wide wildfire education and prevention efforts as described in the 2012 CWPP.	All	County Wildfire Coordinator	ODF, USFS, BLM, Fire Chiefs, Emergency Management, County Court, Grant-Harney Fire Prevention Cooperative.	Routine (an action done on a regular basis)	New Action. This is Wildfire Mitigation Strategy #8 in the current CWPP.	X	X	X	X
Volanic Event Action Items	**Priority**	**Proposed Action Title**	**Jurisdictions Involved**	**Lead Agency**	**Partner Organization(s)**	**2020 Timeline**	**2020 Status**	**Plan Goals 1**	**2**	**3**	**4**
VE 1	Low	Continue to support ongoing study of probability of volcanic eruption and potential impact.	All	Emergency Management	Hospital, Public Works, Planning Department. USGS, DOGAMI, FEMA, OEM, DLCD, OSU Cascades	Routine (an action done on a regular basis)	In progress	X	X		X

Source: Grant County 2020 MJ NHMP Steering Committee work product

D. Integration

Integrating natural hazards mitigation actions into existing planning processes improves the ability of a community to implement the NHMP and to achieve risk reduction. Common planning processes where hazard mitigation action may be integrated include foundational documents, such as the Comprehensive Plan; land use regulation, such as zoning and development codes; infrastructure planning; capital improvement plans; and emergency planning instruments, such as Emergency Operations Plans and Continuity of Operations Plans. Grant County and its incorporated cities have existing plans, codes, programs and resources in place that relate to natural hazards.

Such integration is possible when these plans, policies and codes are consulted during the development of the NHMP and any updates to it. During the process of this NHMP update, the plans and codes consulted by the author include those in italics in Table 5 below including the Grant County Comprehensive Plan, Emergency Operations Plan, Community Wildfire Protection Plan, Land Development Code and Flood Ordinance, the City of John Day Comprehensive Plan, Development Code, Flood Hazard Ordinance and Innovation Gateway Area Plan, the Canyon City Flood Hazard Ordinance, the Grant County Regional Airport Master Plan, and the Blue Mountain Hospital Community Health Needs Assessment Implementation Plan. These plans were consulted to understand the future developments envisioned by partner agencies and organizations. Areas of intersection identified include the flood mitigation actions included in the Innovation Gateway Area of John Day and plans for additional runways at the Grant County Regional Airport.

The Natural Hazards Mitigation Plan includes a range of recommended action items that, when implemented, may reduce the county's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the county's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the county's resources. Incorporating the NHMP into the Comprehensive Plan strengthens the provisions within the plan. Revising zoning regulations to identify hazardous areas and identify strategies for development is another method of implementing the goals of the NHMP.

Governmental Capacity

Grant County departments involved in natural hazard mitigation include the following:

Emergency Management: The Emergency Management Program works to minimize the effects of major emergencies and disasters on the community.

Planning: The Grant County Planning Department provides planning and zoning information to the public and other government agencies. Additional responsibilities include reviewing development proposals, administering and enforcing land use laws, regulations, and ordinances, reviewing applications for land use actions, and conducting comprehensive planning studies and research.

Road Department: The Grant County Road Department works to provide roadways that are safe, efficient, and economical to maintain.

Fire Departments and Fire Districts: The fire departments of Dayville, John Day and Canyon City recruit both experienced and inexperienced individuals who wish to serve as a volunteer Firefighter or Emergency Medical Technician (EMT) in the Grant County, Oregon fire system.

Health Department: The Grant County Health Department provides a wide range of public health services including emergency preparedness, health education and primary care services.

Economic Development: The Department of Economic Development provides a variety of services to existing and prospective businesses.

Grant County Regional Airport: The Grant County Regional Airport (GCRA) is a county-owned, public use airport and is also the helibase and training center for the United States Forest Service (USFS) Malheur Forest's rappeller firefighters. It is staffed year around with peak operations generally occurring from May through October.

OSU Extension Service: The Oregon State University (OSU) Extension Service provides research-based knowledge and education that strengthens Grant County's economy, sustains natural resources, and promotes healthy communities, families, and individuals.

Watermaster: The District 4 Watermaster's Office serves the Upper John Day Basin including the upper main stem of the John Day River to Kimberly, Oregon as well as the North Fork, Middle Fork and South Fork of the John Day River and tributaries.

Other county social and transportation services are listed below in the section on Community Organizations and Programs.

The City of John Day employs a City Manager and includes a Planning Department as well as a Public Works Department along with volunteer commissions. Smaller cities employ commensurately smaller staff. Typically all of these jurisdictions have staff who fill multiple roles.

The following are existing plans and policies already in place within the community

Table 5. Existing Plans, Codes and Ordinances. Year is year acknowledged or last revision.

Jurisdiction	Document	Year
Grant County	*Grant County Comprehensive Plan*	1999
Grant County	*Emergency Operations Plan*	2019
Grant County	*Transportation System Plan*	1997
Grant County	*Community Wildfire Protection Plan*	2013
Grant County	*Land Development Code*	2019
Grant County	*Flood Ordinance*	2016
Grant County	*GCRA Master Plan*	2019

Jurisdiction	Document	Year
Canyon City	Comprehensive Plan	1999
Canyon City	Zoning Ordinance	1999
Canyon City	*Flood Hazard Ordinance*	1987
Dayville	Comprehensive Plan	1985
Dayville	Zoning Ordinance	1981
Dayville	Flood Hazard Ordinance	1984
Granite	Comprehensive Plan	1986
John Day	*Comprehensive Plan*	2003
John Day	*Development Code*	2012
John Day	Transportation System Plan	1996
John Day	Street Network Plan	2009

Jurisdiction	Document	Year
John Day	Main Street Revitalization Plan	2017
John Day	*Flood Hazard Ordinance*	2019
John Day	*Innovation Gateway Area Plan*	2019
Long Creek	Comprehensive Plan	1999
Long Creek	Zoning Ordinance	1999
Long Creek	Flood Hazard Ordinance	1984
Monument	Comprehensive Plan	1985
Monument	Zoning Ordinance	1998
Monument	Flood Hazard Ordinance	1984
Mount Vernon	Comprehensive Plan	1985

Jurisdiction	Document	Year
Mount Vernon	Zoning Ordinance	1995
Mount Vernon	Flood Hazard Ordinance	1987
Prairie City	Comprehensive Plan	1985
Prairie City	Zoning Ordinance	1995
Prairie City	Flood Hazard Ordinance	1988
Seneca	Comprehensive Plan	1998
Seneca	Zoning Ordinance	1984
Seneca	Flood Hazard Ordinance	1984
Blue Mountain Hospital Dist.	Community Health Needs Assessment Implementation Plan	2019

Source: Oregon Blue Book and jurisdictions' websites

The Grant County Emergency Operations Plan includes assignment of responsibility among current county staff for the range of natural hazards the EOP prepares for. It is recommended that these plans be implemented and maintained in concert.

Community Organizations and Programs

In planning for natural hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public. Social systems can be defined as community organizations and programs that provide social and community-based services, such as health care or housing assistance, to the public. Community organizations and programs are another avenue through which the mitigation strategy is integrated into the existing capacity of the community to implement specific mitigation actions.

Often, actions identified by the plan involve communicating with the public or specific subgroups within the population (e.g. elderly, children, low income). The County can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues, one of which could be natural hazard preparedness and mitigation.

Table 6. Grant County Community Organizations and Programs

Community Organization or Program	Description	Address	Phone number/ Website
Blue Mountain Hospital & Hospice	Blue Mountain Hospital offers medical services in John Day. It operates a clinic and hospice services.	170 Ford Rd, John Day, OR 97845	541-575-1311 www.bluemountainhospital.org
Blue Mountain Forest Partners	Blue Mountains Forest Partners is a diverse group of stakeholders who work together to create and implement a shared vision to improve the resilience and well-being of forests and communities in the Blue Mountains.		541-620-2546 https://www.bluemountainsforestpartners.org/
Child Care Resources and Referral	CCR&R is a program of Umatilla Morrow Head Start, Inc. that provides free local	116 NW Bridge St John Day, OR 97845	541-575-1112

	resources to support quality care and early education		
Elks Lodge BPOE #1824	The Fraternal Order of Elks is a non-political, non-sectarian and strictly American fraternity. The Order spends more than $80,000,000 every year for benevolent, educational and patriotic community-minded programs	140 NE Dayton St John Day, OR 97845	541-575-1824 https://www.elks.org/lodges/home.cfm?LodgeNumber=1824
Families First	Families First was formed in 1999 and incorporated in 2000 as a private non profit to provide parenting education in Grant County, Oregon.	401 S Canyon Blvd John Day, OR 97845	541-575-1006 https://www.familiesfirstofgrantcounty.com
Grant & Harney County Casa	The mission of Grant-Harney County CASA is to train and support volunteers who will provide all abused and neglected children in Grant and Harney Counties a voice in juvenile court, and to educate the community regarding its responsibility for abused and neglected children.	835 S. Canyon Blvd John Day, OR 97845	541-575-5574 https://www.grantharneycasa.org
Grant County Chamber of Commerce	Organization that supports the small businesses and economic life of residents of Grant County	301 W Main St John Day, OR 97845	541-575-0547 https://www.gcoregonlive.com
Grant County Extension Office	The Oregon State University Extension Service provides research-based knowledge and education that strengthens Grant County's economy, sustains natural resources, and promotes healthy communities, families, and individuals.	116 NW Bridge Street, Suite 1 John Day, OR 97845	541-575-1911 https://extension.oregonstate.edu/grant
Senior Citizens Community Center and Programs	The Grant County Senior Program goals are to establish linkages within the community in order for seniors and disabled persons to meet their daily survival needs and remain in their homes in a safe and healthy environment for as long as possible.	142 NE Dayton Street John Day, OR 97845	541-575-1825 https://www.gcoregonlive.com/members/grant-county-senior-programs/
Greater Prairie City Community Association	The GPCCA is a group of local business owners and community members who work to enhance the livability and economic well-being for the 910 residents of Prairie City.	PO Box 758 Prairie City, OR 97869	Email: smithhowdytown@yahoo.com https://www.prairiecityoregon.com/prairie-city-oregon-gpcca.html
Northeast Oregon Housing Authority	NEOHA is dedicated to enhancing the qualify of life for residents located in Union, Baker, Grant, and Wallowa County. These goals are accomplished through the promotion of economic development, home-ownership, and self-sufficiency opportunities while working with community partners whose goals are similarly aligned.	2608 May Lane La Grande, OR 97850	541-963-5360 https://www.neoha.org/
People Mover	The People Mover is a Public Transportation service available to anyone in Grant County.	229 NE Dayton St John Day, OR 97845	541-575-2370 https://grantcountypeoplemover.com/

Shie Elem Golden Heritage	Hospice Care	200 SW Brent Drive John Day, OR 97845SW Brent Dr John Day, OR 97845	541-575-0957(866) 839-0926
Strawberry Wilderness Family Clinic	Strawberry Wilderness Community Clinic provides a full range of medical services to Grant County. The clinic is situated on the second floor of Blue Mountain Hospital.	180 Ford Rd John Day, OR 97845	541-575-0404 https://www.bluemountainhospital.org/
Valley View Assisted Living and Memory Care	Assisted Living and Memory Care	112 NW Valley View Dr John Day, OR 97845	541-239-3889 https://www.valleyviewliving.net/

E. Tools and Assets

Beyond the planning process and other processes available for integration, each jurisdiction has a variety of tools and assets available for implementing natural hazards mitigation. Both human assets and financial tools are currently available or potentially available in the future to Grant County, the City of John Day and the special districts that form this plan.

Among the human assets currently in place, both Grant County and the City of John Day employ Land Use Planners and Floodplain Managers. Grant County employs an Emergency Management staff, a Surveyor and a Road Master. The City of John Day services include a public works department.

None of the jurisdictions employ a Civil Engineer, a GIS expert or a Grant Writer. To the extent that these functions are carried out in Grant County and John Day, they are rolled into the existing staff positions of the jurisdictions. The ability of these jurisdictions to move mitigation strategy actions forward may be improved by incorporating skills in these areas from other staff or from local, state or regional partners.

There are a wide range of federally funded, state funded or non-profit grant programs that may be accessed to accomplish mitigation actions. Navigating the landscape of grant funding for local mitigation projects requires significant time and effort. FEMA's 2013 publication Mitigation Funding: A Resource for Funding Mitigation Projects is a useful guide to federal funding. State funding sources for mitigation projects include the Oregon Business Infrastructure Finance Authority and Oregon Department of Environmental Quality Clean Water State Revolving fund. Other local sources of funding for local projects may include the following:

Capital Improvement funding,
Use of the authority to levy taxes,
Water, Sewer, Electric, Gas Fees
Impact Fees
General Obligation bonds
Special Tax Bonds

Appendix F: Grant Programs and Resources contains a summary of information on grant funding.

The City of John Day has utilized a range of tools to plan for, fund and begin implementation of integrated projects that incorporate community revitalization with hazard mitigation actions. The city has a redevelopment project that connects the downtown area to what will become a recreation and open space that includes improvement of transportation infrastructure specifically new bike paths and a. The Innovation Gateway Area Plan has utilized Transportation Growth Management grant funds from the Oregon Department of Transportation and the Department of Land Conservation and Development to begin area development planning for 90 acres along both sides of the John Day River. A portion of the site was purchase from the DR Johnson Lumber Company. Features of the plan include relocation of the city's wastewater treatment facility which is currently located in the 100-year floodplain, restoration of the floodplain to increase flood storage in open space areas and improvements to local streets and bridges in the area.

F. Prioritizing Natural Hazard Mitigation Projects

Prioritization of mitigation projects involves not only public input on relative importance and attention to funding streams from federal and state agencies, but also an analysis of the costs and benefits of the project. Three approaches for conducting economic analysis of natural hazard mitigation projects that have been developed by the Oregon Partnership for Disaster Resilience fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. Appendix E: Economic Analysis of Natural Hazard Mitigation Projects summarizes information on these methods of prioritizing based on a research paper developed by the Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center.

IV. PLAN IMPLEMENTATION AND MAINTENANCE

The Plan Implementation and Maintenance section details the formal process that will ensure that the *2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan* (*2020 NHMP*) remains an active and relevant document. The initial section outlines assets, capabilities and success stories that support the ability of the county to implement actions in the plan during the planning period. The plan implementation and maintenance process includes a schedule for monitoring and evaluating the plan annually, as well as producing an updated plan every five years. This section also describes how Grant County and the City of John Day will integrate public participation throughout the plan maintenance and implementation process.

A. Assets, Capabilities and Success Stories

Hazard planning implementation requires drawing on existing community assets and capabilities. Some comments made by participants in the process are shared below with respect to the valuable human, economic, built environment and natural environment assets in Grant County. For a compiled list of the building assets of the jurisdictions considered by DOGAMI in the Risk Assessment of this plan, please see Volume III, Appendix A: Community Profile

Participants in the Grant County NHMP process reported that the human assets they value most are "those people who are involved and invested in the community. Those that provide positive suggestions and solutions to the many challenges we face." The challenges named included natural hazards, and health care, sociological, economic, accessibility, and connectivity issues. Others noted that 'the economic drivers valued most and are the most vulnerable are our youth. Our young people are those we are teaching to be leaders of this community." This participant expressed concern about the challenges of life in Grant County and how limited economic opportunity may drive those youth and their aging parents away from the county. Participants acknowledged the value of the forest, agriculture and water resources to Grant County stating that these "provide the natural resource elements that support the county's primary industries and harbors critical habitats for endangered species, along with ample populations of game species to support robust recreational opportunities." The value of Grant County's water resources for consumption and fire-fighting were also highlighted.

Many participants expressed how much they value the capabilities of emergency responders, hospital workers, airport management, and law enforcement personnel noting that "medical personal (are) needed to help people who are inured and give others piece of mind" and that law enforcement are "able to react to a high stress situation and work with the people around to resolve issues".

Others noted that forest service employees, loggers, and government employees work to address natural hazard issues, both to mitigate pro-actively and in response to disasters. Of forest service employees, one participant noted "They are an embedded part of our community. The forest surrounds our community and the forest service is quick to be identified as the protective agency for our natural environment and first line of defense for our residence."

The public sector is one of the county's biggest human assets. The City Manager in John Day has spearheaded a multi-faceted project that both addresses flooding mitigation and supports community development. The Innovation Gateway project in John Day[83] is an example of a pro-active, integrated project that address public health, environmental health, hazard mitigation and economic issues. The municipalities in Grant County are willing and able to provide mutual aid to respond to hazard events. The public works departments and governments of the City of John Day and Prairie City cooperated to solve a need for emergency water supply following damage to the water system in Prairie City in the summer of 2015.[84]

These community assets and capabilities along with a demonstrated ability to work together for the benefit of the whole community is support the ability of jurisdictions of Grant County to utilize this plan to mitigate risks to natural hazards in the future.

B. Implementing the Plan

The 2020 *Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan* will be formally adopted following approval by FEMA. The success of the *2020 NHMP* depends on how well the mitigation actions in Table 4 are implemented. In an effort to promote active implementation of the mitigation actions a coordinating body for plan maintenance and implementation will be formed, a convener will be designated, the identified activities will be prioritized and evaluated, and the plan will be implemented through existing plans, programs, procedures, and policies.

Plan Adoption

Once the 2020 *Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan* is locally reviewed and ready, the Plan Convener and DLCD will submit it to the State Hazard Mitigation Officer at Oregon's Office of Emergency Management (OEM). OEM will review the plan and submit it to the Federal Emergency Management Agency (FEMA) Region X for review. This review addresses the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201.6 and detailed in the FEMA Review Tool.

Upon pre-approval by FEMA, indicated by a letter provided from FEMA to Grant County called the "Approval Pending Adoption" (APA) the Grant County Board of Commissioner and other jurisdictions that have signed agreements to participate in this plan (the City of John Day, Grant Education Services District and Grant Soil and Water Conservation District) will then formally adopt the *2020 NHMP* via resolution. Once FEMA is provided with final resolution documentation for the first of these jurisdictions to adopt the plan, FEMA will issue a formal letter of approval indicating the effective dates of the plan. Following adoption by the other jurisdictions and districts adopting the plan a revision of this letter will be issued, however the effective dates of the plan will be the same for all. Following adoption of the FEMA approved NHMP, those jurisdictions (Grant County, the City of John Day, the Grant Education Service District and the Grant Soil and Water Conservation District) will be eligible to apply for FEMA Hazard Mitigation Assistance (HMA) pre- and post- disaster funds.

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[83] https://www.cityofjohnday.com/planning/page/oregon-pineinnovation-gateway-area-plan

[84] Personal communication with Grant County Emergency Manager, February 2020.

These funds are distributed through the Pre-Disaster Mitigation (PDM) program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program. Additional resources for mitigation project grant funding can be found in Volume III, Appendix E – Grant Programs and Resources

The final copy of the *2020 NHMP* will be produced once the FEMA approval letters and the copies of the resolutions of approval from Grant County, the City of John Day and the two special districts are received by the project manager. These documents will be incorporated into the document and the effective dates of the plan will be added. The final document will be provided to each jurisdiction and district for posting on their websites and for use as plan implementation begins.

The accomplishment of the *2020 NHMP* goals and actions depends upon regular Steering Committee participation and support from county and city leadership. Thorough familiarity with the *2020 NHMP* will result in the efficient and effective implementation of mitigation actions and a reduction in the risk and the potential for loss from future natural hazard events.

Convener

The Steering Committee determined at its April 10, 2020 meeting that the Grant County Emergency Manager will take responsibility for plan implementation and will facilitate the *2020 NHMP* Implementation Committee meetings. The Emergency Manager will lead the committee, assign tasks as appropriate, and solicit assistance from DLCD and OEM as needed. Plan implementation and evaluation should be a shared responsibility among all of the Implementation Committee members. The convener's responsibilities may include:

- Coordinating 2020 NHMP Implementation Committee meeting dates, times, locations, agendas, and member notification;
- Documenting the discussions and outcomes of Implementation Committee meetings;
- Serving as a communication conduit between the Implementation Committee and the public/stakeholders;
- Identifying funding sources for natural hazard mitigation projects or seek assistance from OEM and DLCD to do so; and
- Utilizing the Risk Assessment chapter and the Project Prioritization guidelines in Appendix D as a tool for prioritizing Mitigation Actions from Table 4.

Coordinating Body

The Grant County Emergency Manager, acting as convener will facilitate meetings of the NHMP Implementation Committee to maintain, update, and implement the *2020 NHMP*. The coordinating body may be composed of members of the NHMP Steering Committee and other representatives of the whole community. The Implementation Committee members' responsibilities include:

- Attending future plan maintenance and plan update meetings (or designating a representative to serve in your place);
- Prioritizing Mitigation Actions listed in Table 4 and assisting in seeking funding for mitigation projects.

- Evaluating and updating the Natural Hazards Mitigation Plan within the five year life of the plan;
- Developing and coordinating ad hoc and/or standing subcommittees as needed; and
- Coordinating public involvement activities.

To make the coordination and review of the *2020 NHMP* as broad and useful as possible, the Grant County Emergency Manager should engage stakeholders to implement the identified mitigation actions. Specific organizations have been identified as partners for most of the mitigation actions listed in Table 4 in the *2020 NHMP*; these are identified in Table 6 and a selection are described in the more detailed Mitigation Action Item Forms found in Appendix C.

Implementation through Existing Programs

The *2020 NHMP* includes mitigation actions that, when implemented, are intended to reduce loss from hazard events throughout Grant County. Within the *2020 NHMP*, FEMA requires the identification of existing plans, programs, and policies that might be used to implement these mitigation actions.

Grant County and the City of John Day currently address Oregon's Statewide Planning Goals and legislative requirements through their comprehensive land use plans, capital improvement plans, mandated standards, and building codes. Because plans, programs, procedures, and policies already in existence often have support from local residents, businesses, and policy-makers, Grant County and the City of John Day should incorporate the mitigation actions from the *2020 NHMP* into those existing plans and programs. Many land use, comprehensive, and strategic plans are updated regularly, and can adapt easily to changing conditions and needs. Implementing the mitigation actions from the *2020 NHMP* through such plans and policies increases their likelihood of being supported and implemented.

Examples of plans, programs or agencies that may be used to implement mitigation actions:

- City and County Budgets
- Community Wildfire Protection Plans
- Comprehensive Land Use Plans
- Economic Development Action Plans
- Zoning Ordinances & Building Codes
- Emergency Operations Plans and Continuity of Operations Plans (COOP)

The specific plans that presently exist and relate to the *2020 NHMP* are listed in Table 6. For additional examples of plans, programs, policies, procedures and agencies that may be used to implement mitigation actions, refer to the Appendix C: Mitigation Action Worksheets.

C. Steps in Plan Implementation

Plan implementation is a critical component of the *2020 NHMP*. The Implementation Committee comprised of local staff and other partners are responsible for implementing the plan over the five years it remains in effect. Below are steps that can be used to carry out the Mitigation Actions developed and evaluated by the Steering Committee.

Meetings

The Implementation Committee should include members of the 2020 Grant County NHMP Steering Committee. If this implementation committee can be joined with other emergency management or hazard plan implementing bodies, Grant County may find efficiencies by cooperating in carrying the mitigation actions in this plan. In other counties in eastern Oregon the NHMP Implementation coordinating body also fills the role of Emergency Management Team (EMT) and the Local Emergency Preparedness Committee (LEPC). Whatever form the Implementation Committee takes, it should set a meeting schedule and convene regularly.

During the first meeting, the NHMP Implementation Committee could:

- Review existing action items to determine appropriateness for funding;
- Educate new members about the plan and mitigation in general;
- Identify issues that may not have been identified when the plan was developed; and
- Prioritize potential mitigation projects using the methodology described in Volume II, Appendix D.

During the second meeting the NHMP Implementation Committee could:

- Review status and progress of the mitigation actions;
- Document the status of the mitigation actions;
- Review existing and new risk assessment data;
- Discuss already held and upcoming public involvement events; and
- Document successes and lessons learned during the year.

These meetings are an opportunity for each jurisdiction and organization to report back to Grant County and the NHMP Implementation Committee on progress that has been made on mitigation actions in the NHMP and to develop new ways to mitigate the risk of damage from natural hazards.

The Grant County Emergency Manager as convener should be responsible for documenting the outcome of the regular meetings. A method the Implementation Committee may use to prioritize mitigation projects is described in Volume III, Appendix E "Evaluating Hazard Mitigation Projects" and briefly below in the "Project Prioritization Process" section.

The regularly scheduled meetings of the NHMP Implementation Committee provides an excellent forum for discussions such as those on the status of mitigation actions, new data, and opportunities for funding. An active and well documented implementation process will support the five year update process.

Continued Public Involvement & Participation

The participating jurisdictions and special districts have been dedicated to involving the public directly during the update process for the *2020 NHMP*. In addition to the members of the NHMP Implementation Committee, other members of the public should continue to have the opportunity to provide feedback about the *2020 NHMP*. Public notification and updates on the objectives and progress of the 2020 NHMP Implementation Committee is important to keep the community aware of the actions being taken or funding being sought by the group to implement the 2020 NHMP Mitigation Actions.

Among the ways to continue the public outreach begun during the plan update, the coordinating body can:

- Post copies of their meeting notices and agendas on the organizations' websites;
- Submit articles to the local newspaper informing the public about meetings where they can participate in the process and can provide feedback; and
- Use existing newsletters such as those from schools and flyers in regular mailings such as for utility bills to inform the public about meetings where they can participate in the process and can provide feedback.

The 2020 *NHMP* is posted on the County's website at : https://grantcountyoregon.net/182/Emergency-Management

The NHMP will also be archived and posted on the University of Oregon Libraries' Scholar's Bank Digital Archive at https://scholarsbank.uoregon.edu and on the Oregon Department of Land Conservation and Development's website at https://www.oregon.gov/lcd/Pages/index.aspx.

Five-Year Review of Plan

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. **With FEMA approval granted in 2020, the Grant County Multi-Jurisdictional NHMP would be due to be updated prior to expiration in 2025.**

Table 7 below offers a 'toolkit' of relevant questions that can assist the convener of the next NHMP update. It may be of use in determining which plan update activities should be discussed during regularly-scheduled plan maintenance meetings, and which activities require additional meeting time and/or the formation of sub-committees as the Implementation Committee works to implement the plan.

Table 7. Natural Hazards Mitigation Plan Update Toolkit

Question	Yes	No	Plan Update Action
Is the planning process description still relevant?			Modify this section to include a description of the plan update process. Document how the planning team reviewed and analyzed each section of the plan, and whether each section was revised as part of the update process. (This toolkit will help you do that).
Do you have a public involvement strategy for the plan update process?			Decide how the public will be involved in the plan update process. Allow the public an opportunity to comment on the plan process and prior to plan approval.
Have public involvement activities taken place since the plan was adopted?			Document activities in the "planning process" section of the plan update
Are there new hazards that should be addressed?			Add new hazards to the risk assessment section
Have there been hazard events in the community since the plan was adopted?			Document hazard history in the risk assessment section
Have new studies or previous events identified changes in any hazard's location or extent?			Document changes in location and extent in the risk assessment section
Has vulnerability to any hazard changed?			Document changes in vulnerability in the risk assessment section
Have development patterns changed? Is there more development in hazard prone areas?			Document changes in vulnerability in the risk assessment section
Do future annexations include hazard prone areas?			Document changes in vulnerability in the risk assessment section
Are there new high risk populations?			Document changes in vulnerability in the risk assessment section
Are there completed mitigation actions that have decreased overall vulnerability?			Document changes in vulnerability in the risk assessment section
Did the plan document and/or address National Flood Insurance Program repetitive flood loss properties?			Document any changes to flood loss property status
Did the plan identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?			1) Update existing data in risk assessment section, or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update
Did the plan identify data limitations?			If yes, the plan update must address them: either state how deficiencies were overcome or why they couldn't be addressed
Did the plan identify potential dollar losses for vulnerable structures?			1) Update existing data in risk assessment section, or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update
Are the plan goals still relevant?			Document any updates in the plan goal section
What is the status of each mitigation action?			Document whether each action is completed or pending. For those that remain pending explain why. For completed actions, provide a 'success' story.
Are there new actions that should be added?			Add new actions to the plan. Make sure that the mitigation plan includes actions that reduce the effects of hazards on both new and existing buildings.
Is there an action dealing with continued compliance with the National Flood Insurance Program?			If not, add this action to meet minimum NFIP planning requirements
Are changes to the action item prioritization, implementation, and/or administration processes needed?			Document these changes in the plan implementation and maintenance section
Do you need to make any changes to the plan maintenance schedule?			Document these changes in the plan implementation and maintenance section
Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?			If the community has not made progress on process of implementing mitigation into existing mechanisms, further refine the process and document in the plan.

Source: Oregon Partnership for Disaster Resilience, 2010.

Volume II: Hazard Annexes

Photo of burning bridge by Irene Jerome, Photo of flooding bridge by Blue Mountain Eagle.

Volume II: Hazard Annexes

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WILDFIRE HAZARD ANNEX

Causes and Characteristics of Wildfire

Countywide exposure

- Number of buildings: **2,692**
- Exposure Value: **$588,264,000**
- Ratio of Exposure Value: **29%**
- Critical facilities exposed: **5**
- Potentially Displaced Population: **1,446**

The majority of wildfires primarily occur in Eastern and Southern Oregon. Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property particularly in the state's growing rural communities. Wildfire is defined as am uncontrollable burning of forest, brush, or rangeland. Fire has always been a part of high desert ecosystems and can have both beneficial and devastating effects.[1]

Wildfires threaten valued forest and agricultural lands and individual home sites. State or federal firefighters provide the only formal wildfire suppression service in some areas, and they do not protect structures as a matter of policy. As a result, many rural dwellings have no form of fire protection. Once a fire has started, homes and development in wildland settings complicate firefighting activities and stretch available human and equipment resources. The loss of property and life, however, can be minimized through cooperation, preparedness, and mitigation activities.

Wildfire ranked first in the risk score in the local risk assessment Hazard Vulnerability Analysis (HVA) for the *2020 Grant County Multi-Jurisdictional NHMP* out of the eight natural hazards that the Grant County NHMP Steering Committee identified.

Grant County has a lengthy history (see Table 2 Significant Historic Wildfires) of wildfire in both wildlands and in wildland-urban interface (WUI) areas.

WUI areas are where the human developed areas meet the undeveloped areas; it is a transition area. Figure 1 illustrates the WUI area in Grant County. If population in this region grows, development in the WUI may increase. Concern is warranted when development patterns increase the threat of wildfire to life and property. Nearly 3,700 sq. mi. or 2.4 million acres are considered WUI areas in Oregon, which is about 3.8% of the state. Of the nearly 1.7 million total homes in Oregon, over 603,000 or 36%, are in the WUI.[2]

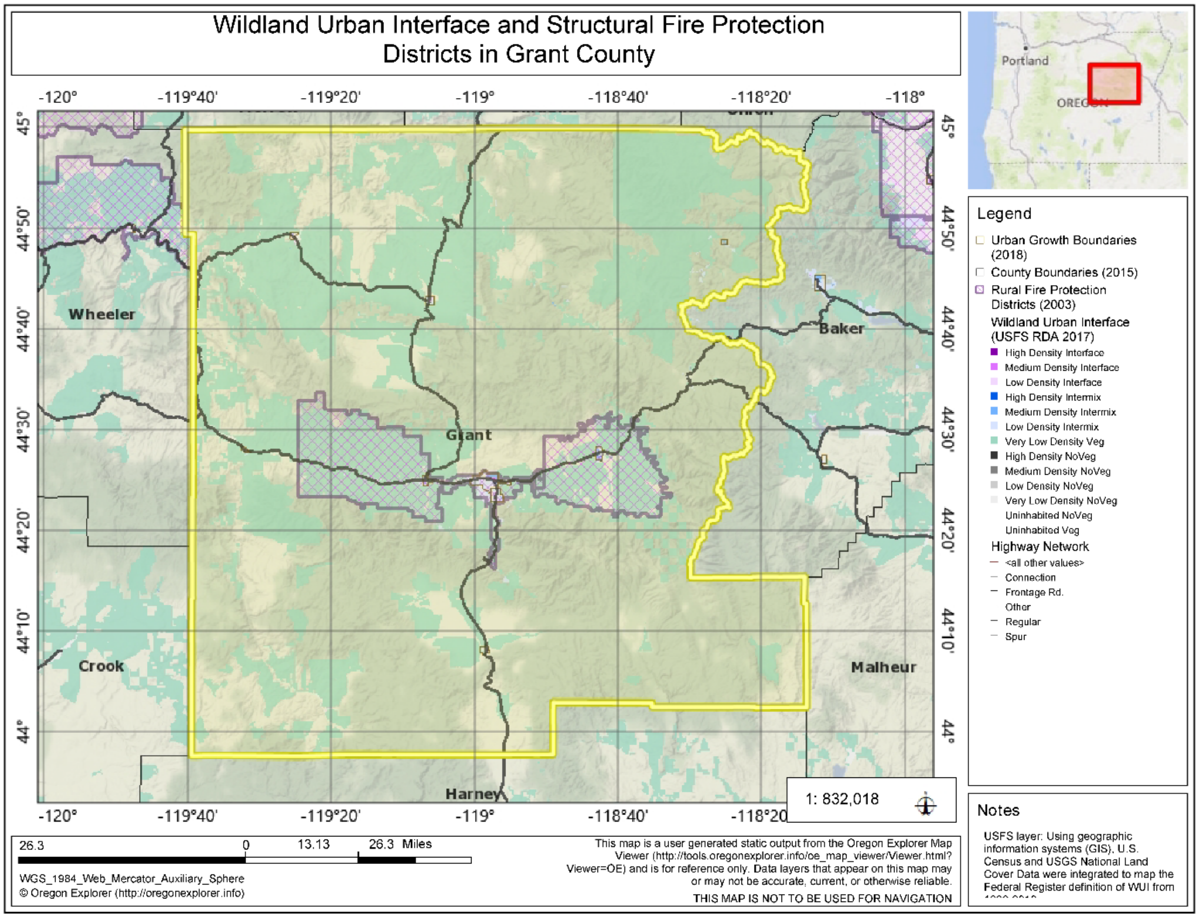
Wildfires threaten the limited but valued and valuable forest resources, agricultural land, rangelands, and individual home sites. State and federal wildland firefighters protect state and federal lands. While they fight to protect structures, they do not fight fires once they become structural and equipment fires.

[1]Fire Ecology, Pacific Biodiversity Institute http://www.pacificbio.org/initiatives/fire/fire_ecology.html and Evaluating the ecological benefits of wildfire by integrating fire and ecosystem simulation models, USDA, Treesearch, https://www.fs.usda.gov/treesearch/pubs/34994

[2] Oregon Wildfire Risk Explorer, December 2019.

Notably, once a fire has started, homes and development in wildland and WUI settings complicate firefighting activities and stretch available human and equipment resources.

Figure 1. WUI areas and Structural Protection Districts in Grant County



Source: Oregon Explorer, State of Oregon, DLCD Katherine Daniel, April 2020

State and federal wildland firefighters can provide wildfire suppression service on non-state and non-federal areas through formal agreements. Currently, fire suppression authorities include the rural/city fire protection districts/departments for John Day, Mt. Vernon, Prairie City, Canyon City, Dayville, Long Creek, Granite, and Monument; the Oregon Department of Forestry (ODF) Central Oregon Forest Protection District; the USFS; and the BLM. Mutual Aid Agreements exist among the fire authorities for mutual aid and support in the event of a wildfire incident; however, each fire authority operates under regulations that dictate their area of responsibility and specify limitations.

To reduce the impact of wildfire, Grant County adopted the *Grant County Community Fire Protection Plan* in 2005. This plan provided the means to identify wildfire risk, prioritize mitigation projects, improve public awareness, and improve fire authority coordination to better manage wildfire. The most recent revision to that plan is the 2013 *Grant County Community Wildfire Protection Plan*. An update to that version is poised to get underway at this writing.

The references to wildfire risk and mitigation in the *2020 Grant County NHMP* are based on the 2013 *Grant County CWPP* as the primary source of wildfire information and mitigation actions for the county. The 2020 Grant County NHMP also draws on the Oregon State NHMP and the ongoing update for statewide analysis of wildfire risk and mitigation strategies.

The 2013 *Grant County CWPP* provides detailed information on the vulnerability and history of wildfire in the County, and provides mitigation actions the County can implement to reduce the impact of wildfire. The focus of the 2013 *Grant County CWPP* is on a sub-watershed basis with emphasis on "zones" defined by watersheds and centered around the communities of Long Creek and Monument, Ritter and Dale, Granite, the Upper Middle Fork of the John Day River, Prairie City, John Day and Canyon City, Mt. Vernon, Dayville, and the Seneca area including the Lower Middle Fork area

The impact on communities from wildfire can be huge. Reporting by the Oregonian stated that in 2017, more than 1.1 million acres were scorched by wildfire in Oregon and Washington. 2018 was even worse, with 1.3 million acres of forest and fields going up in flame. That's an area close to the size of Delaware up in smoke each year. Fighting wildfires cost Oregon and Washington more than a $1 billion in 2017 and 2018 combined, according to the Northwest Interagency Coordination Center.

The fire season in 2019 was a much different story: Just over 200,000 acres were scorched across both states, a nearly 84 percent drop from the two previous years. In 2019, both states spent less than $100 million, a 92 percent drop in costs. Much of the quiet season can be attributed to weather. The relatively cool temperatures kept fuels in forests and grasslands from drying into the tinderboxes they were in recent years. [3]

The History of Wildfires in Grant County section in this Wildfire Hazard Annex includes a description of documented wildfires as reported in the 2020 Oregon State NHMP; it is likely that not all the wildfires that have occurred are included on this list.

Wildfire can be divided into four categories: interface fires, wildland fires, firestorms, and prescribed fires.[4] These descriptions are provided for a brief but comprehensive understanding of wildfire.

Interface Fires

An interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel. The wildland/urban interface (sometimes abbreviated to WUI or called rural interface in small communities or outlying areas) can be divided into categories.

- The **classic wildland-urban interface** exists where well-defined urban and suburban development presses up against open expanses of wildland areas.

[3]Portland Oregonian, Oregonlive.com https://www.oregonlive.com/environment/2019/10/summer-2019-the-oregon-wildfire-season-that-wasnt.html

[4] Federal Emergency Management Agency, *Multi-hazard, Identification and Risk Assessment Report*, 1997, Washington, D.C., https://www.fema.gov/media-library/assets/documents/7251.

- The **mixed wildland-urban interface** is more typical of the problems in areas of exurban or rural development: isolated homes, subdivisions, resorts and small communities situated in predominantly in wildland settings.

- The **occluded wildland-urban interface** where islands of wildland vegetation exist within a largely urbanized area.[5]

Wildland Fires

A wildland fire's main fuel source is natural vegetation. Often referred to as forest or rangeland fires, these fires occur in national forests and parks, private timberland, and on public and private rangeland. A wildland fire can become an interface fire if it encroaches on developed areas.

Firestorms and Mega-Fires

A firestorm is a very intense and destructive fire usually accompanied by high winds; it may be a large fire that is difficult to impossible to control. [6] Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms often occur during dry, windy weather and generally burn until conditions change or the available fuel is consumed.

In 1987, widespread dry lightning in late August ignited fires throughout northern California and southwest Oregon. Two of these were over 10,000 acres, and according to the Oregon Department of Forestry, this series of events fits the definition of a firestorm. Resources were brought in from other states and Canada to fight them.[7] Another term used is mega-fire which is a fire that is more than 100,000 acres in size. Only the 2015 Canyon Creek complex fire rises to that level in Grant County.

Prescribed Fires

Prescribed fires are intentionally set or are select natural fires that are allowed to burn for beneficial purposes. Before humans suppressed forest fires, small, low intensity fires cleaned the underbrush and fallen plant material from the forest floor while allowing the larger plants and trees to live through the blaze. These fires were only a few inches to two feet tall and burned slowly. Forest managers now realize that a hundred years of prevention has contributed to the unnatural buildup of plant material that can flare up into tall, fast moving wildfires. These can be impossible to control and can leave a homeowner little time to react.

Conditions Contributing to Wildfires

Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, recreational activities, equipment, or an industrial accident. Once started, four main conditions affect the fire's behavior: fuel, topography, weather and development.

[5] Ibid.

[6] Definition of firestorm, Merriam-Webster Dictionary, https://www.merriam-webster.com/dictionary/firestorm and Cambridge Dictionary, https://dictionary.cambridge.org/us/dictionary/english/firestorm.

[7] Wolf, Jim, ODF, personal communication, May 8, 2001.

Fuel

Fuel is the material that feeds a fire. Fuel is classified by volume and type. Forested lands provide a larger fuel source to wildfires than other vegetated lands due to the presence of large amounts of timber and other dense vegetation in these areas. Grassland are included in the rangeland areas Grasslands, which naturally cover much of the region, are highly susceptible to wildfire. According to BLM staff, there is an increasing amount of invasive grasses in the grasslands; these invasive grasses are more susceptible to burn. The variability of the fire likelihood is great, as the factors of soil moisture, soil temperature, and amount of and nature of grass there varies. Vegetation such as agricultural lands and rangelands also provides fuel for wildfires.

Topography

Topography influences the movement of air and directs a fire's course. Slope and hillsides are key factors in fire behavior. Hillsides with steep topographic characteristics are often also desirable areas for residential development.

In this region, much of the topography is hilly or mountainous which can exacerbate wildfire hazards. These areas can cause a wildfire to spread rapidly and burn larger areas in a shorter period of time, especially, if the fire starts at the bottom of a slope and migrates uphill as it burns. Wildfires tend to burn more slowly on flatter lying areas, but this does not mean these areas are exempt from a rapidly spreading fire. Hazards that can affect these areas after the fire has been extinguished include landslides (debris flows), floods, and erosion.

Weather

Weather is the most variable factor affecting wildfire behavior. High-risk areas in Oregon share a hot, dry season in late summer and early fall with high temperatures and low humidity.

The natural ignition of wildfires is largely a function of weather and fuel; human caused fires add another dimension to the probability. Lightning strikes in areas of forest or rangeland combined with any type of vegetative fuel source will always remain as a source for wildfire. Thousands of lightning strikes occur each year throughout much of the region. Fortunately, not every lightning strike causes a wildfire, though they are a major contributor.

Future Climate Projections

Oregon's Department of Land Conservation and Development (DLCD) contracted with the Oregon Climate Change Research Institute (OCCRI) of Oregon State University to perform and provide analysis of the influence of climate change on natural hazards for Grant County. The report referenced here presents future climate projections for Grant County relevant to specific natural hazards for the 2020s (2010–2039 average) and 2050s (2040–2069 average) as compared to the 1971–2000 average historical baseline. [8]

Over the last several decades, warmer and drier conditions during the summer months have contributed to an increase in fuel aridity and enabled more frequent large fires, an increase in the total area burned, and a longer fire season across the western United States, particularly in forested ecosystems. The

[8] Future Climate Projections Grant County (Dalton, February 2020)

lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt. As a proxy for wildfire risk, the OCCRI report considers a fire danger index called 100---hour fuel moisture (FM100), which is a measure of the amount of moisture in dead vegetation in the 1–3 inch diameter class available to a fire. It is expressed as a percent of the dry weight of that specific fuel. The OCCRI report defines a "very high" fire danger day to be a day in which FM100 is lower (i.e., drier) than the historical baseline 10th percentile value. By definition, the historical baseline has 36.5 very high fire danger days annually. The future change in wildfire risk is expressed as the average annual number of additional "very high" fire danger days for two future periods under two emissions scenarios compared with the historical baseline.

The key conclusions of the analysis by OCCRI are as follows:

- Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change in Grant County.
- In Grant County, the frequency of very high fire danger days per year is projected to increase on average by about 14 days (with a range of ---4 to +36 days) by the 2050s under the higher emissions scenario compared to the historical baseline.
- In Grant County, the frequency of very high fire danger days per year is projected to increase on average by about 39% (with a range of ---10 to +98%) by the 2050s under the higher emissions scenario compared to the historical baseline.

Development

The increase in residential development in interface areas has resulted in greater wildfire risk. Fire has historically been a natural wildland element and can sweep through vegetation that is adjacent to a combustible home. New residents in remote locations are often surprised to learn that in moving away from urban areas, they have left behind readily available fire services providing structural protection. Rural locations may be more difficult to access and or simply take more time for fire protection services to get there.

History of Wildfire in Grant County

Southeastern Oregon contains large tracts of ponderosa pine forests, primarily in the northern part of Harney County. These areas are highly vulnerable to wildfire because of natural aridity and the frequency of lightning strikes. Grasslands, which naturally cover much of the region, also are problematic. The ecosystems of most forest and wildlands depend upon fire to maintain functions.

The effects of fire on ecosystem resources can include damages, benefits, or some combination of both. The benefits can include, depending upon location and other circumstances, reduced fuel load, disposal of slash and thinned tree stands, increased forage plant production, and improved wildlife habitats, hydrological processes, and aesthetic environments. Despite the benefits, fire has historically been suppressed for years because of its effects on rangelands, grasslands, recreation areas, agricultural operations, and the significant threat to property and human life.

Knowing the fire history of a place is important to understand the fire environment of the area. Knowing where and why fires start is one of the first steps in prevention and mitigation efforts. Understanding the burn probability, the hazard to potential structures, the fire intensity and flame length, and the sub-watershed level for context, provides comprehensive information for decision-making about wildfire prevention and mitigation.

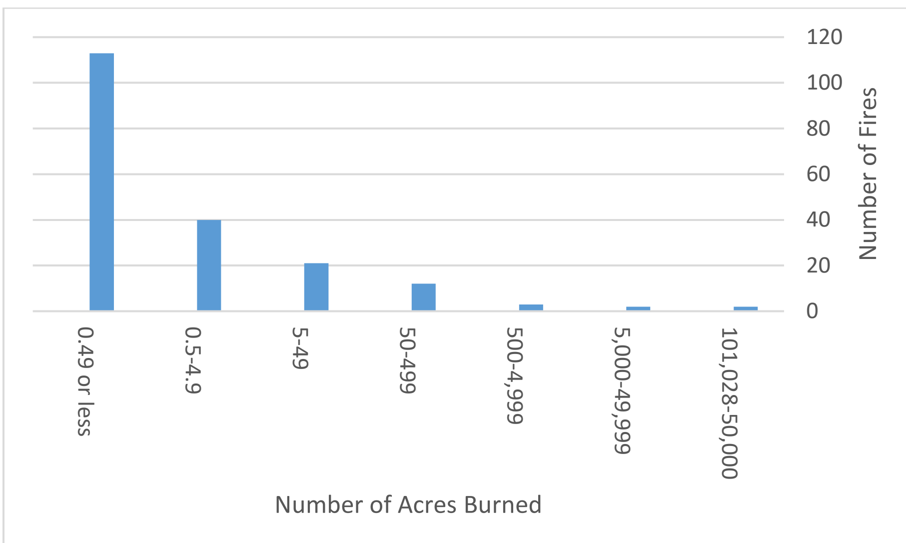
During the period from January 2014 through January 2020 a total of 193 fires were reported in Grant County. The majority of those fires consumed less than half an acre of land. The largest fires were few in number but caused the greatest amount of damage.

Table 1. Size distribution of fires in Grant County from 1/2014 through 1/2020

Number of fires	Acres burned
2	101,028-50,000
2	5,000-49,999
3	500-4,999
12	50-499
21	5-49
40	0.5-4.9
113	0.49 or less

Source: data from Oregon Department of Forestry Fire Database, consulted January 2020

Figure 2. Fire Incidents in Grant County 2014-2020



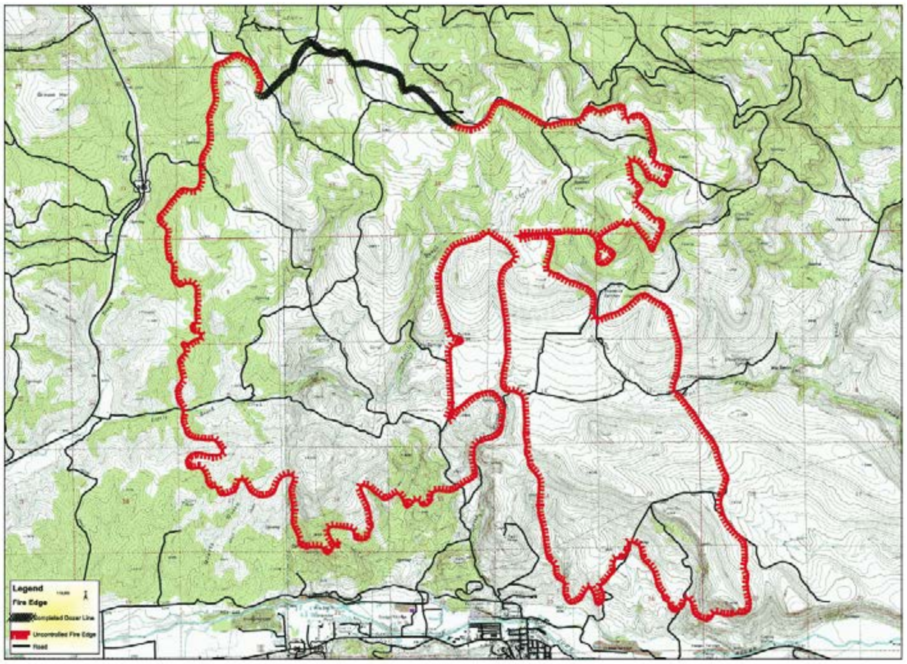
Source: data from Oregon Department of Forestry Fire Database, consulted January 2020, graphed by author

Table 2. Significant Historic Wildfires exceeding 1,000 acres in Grant County (partial list)

Fire Year	Report Date	Name of Fire	Acres Burned	Remarks
1986		Clear	6,000	Lightning caused
1988		Turner	8,000	
1996	07/26/1996	Wildcat	10,303	52 structures threatened near Pairie City; Conflagration mobilization cost: $176,107
1996	08/08/1996	Sloan's Ridge	10,556	
1996	08/20/1996	Summit Fire	37,842	Lightning caused
1996	08/26/1996	Tower Fire	50,815	Lightning caused
1999		Cummings Creek, 11 miles west of Mt. Vernon		Executive Order No. EO-00-27; 50 structures threatened, one structure lost; Conflagration costs: $52,296
2000		Carrol Creek	3,197	
2001	08/13/2001	Monument Complex	32,352	Lightning caused; Executive Order No. EO-01-21; 28 structures threatened; Conflagration mobilization costs: $229,717; federal funding: $229,717
2002	July	Malheur Complex/Flagtail	21,641	Lightning caused; Executive Order No. EO-02-09; Threatened large portions of Grant County near Austin Junction and Seneca; Two structures lost; Conflagration mobilization costs: $188,697; federal funding: $188,697
2002	07/12/2002	Roberts Creek	13,480	Lightning caused
2006	08/22/2006	Shake Table	14,453	Lightning caused
2007	07/14/2007	Monument Complex-Lovelett Ck	53,556	Lightning caused
2009	08/01/2009	North Fork Complex	14,000	Lightning caused
2013	August	GC Complex Fire (Grouse Mountain and Starvation Fires)	12,076	Threatened John Day including 400 residences and 11 structures, one structure lost; Conflagration mobilization costs (as of 9-12-13): $17,084
2014	07/14/2014	Sunflower	7,175	Lightning caused
2014	08/01/2014	Murderers Creek South	66,174	Lightning caused
2014	08/29/2014	Lost Hubcap	2,712	Equipment use
2015	08/12/2015	Berry Creek (part of Canyon Creek Complex fire)	101,028	Lightning caused Suppression costs: $31,000,000
2015	08/12/2015	Mason Spring (part of Canyon Creek Complex fire	9,211	Lightning caused

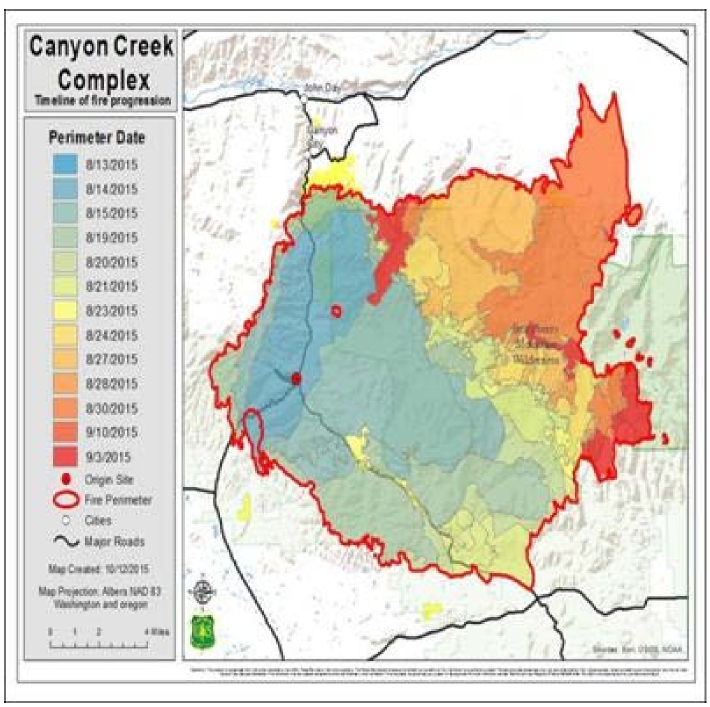
Source: 2015 Oregon State NHMP; Grant County CWPP 2013; Oregon Department of Forestry; Governor's List of Executive Orders: http://www.oregon.gov/gov/Pages/exec_orders.aspx; Oregon Governor-Declared Conflagrations http://www.oregon.gov/osp/SFM/docs/ConflagrationHistory.pdf

Figure 3. Grouse Mountain Fire Boundaries (John Day city at bottom edge of map)



Source: Inciweb: Incident Information System

Figure 4. Canyon Creek Complex, Timeline of Fire Progression



Source: US Forest Service Canyon Creek Complex, Malheur National Forest, Overview and Frequently Asked Questions https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd503421.pdf, consulted January 2020

Community Wildfire Protection Plan[9]

The Healthy Forests Restoration Act of 2003 (HFRA) provides the impetus for wildfire risk assessment and planning at the county and community level. The HFRA refers to this level of planning as Community Wildfire Protection Plans (CWPP). The minimum requirements for a CWPP as described in the HFRA are:

- Collaboration: A CWPP must be collaboratively developed by local and state government representatives, in consultation with federal agencies and other interested parties. Prioritized Fuel Reduction: A CWPP must identify and prioritize areas for hazardous fuel reduction treatments and recommend the types and methods of treatment that will protect one or more at-risk communities and essential infrastructure.
- Treatment of Structural Ignitability: A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

Grant County developed and adopted one of the earliest CWPPs completed in Oregon dated July 6, 2005. The 2013 revision included a detailed wildfire hazard assessment (*Communities At Risk* or CAR) that ranked risk using a range of factors (prior occurrence, slope, aspect, elevation, vegetation, crown fire potential, home density, infrastructure, fire response and community preparedness), a county-wide community base map prepared by Grant Soil and Water Conservation District, and a discussion of the county's wildfire suppression situation. This plan is now ready to be updated. The Community Wildfire Coordinator, Irene Jerome, will be engaging the communities of Grant County to update the plan during the course of 2020.

The CWPP allows a community to evaluate its current situation with regards to wildfire risk and plan ways to reduce risk for protection of human welfare and other important economic, social or ecological values. The CWPP may address issues such as community wildfire risk, structure flammability, hazardous fuels and non-fuels mitigation, community preparedness, and emergency procedures. The CWPP should be tailored to meet the needs of the community.

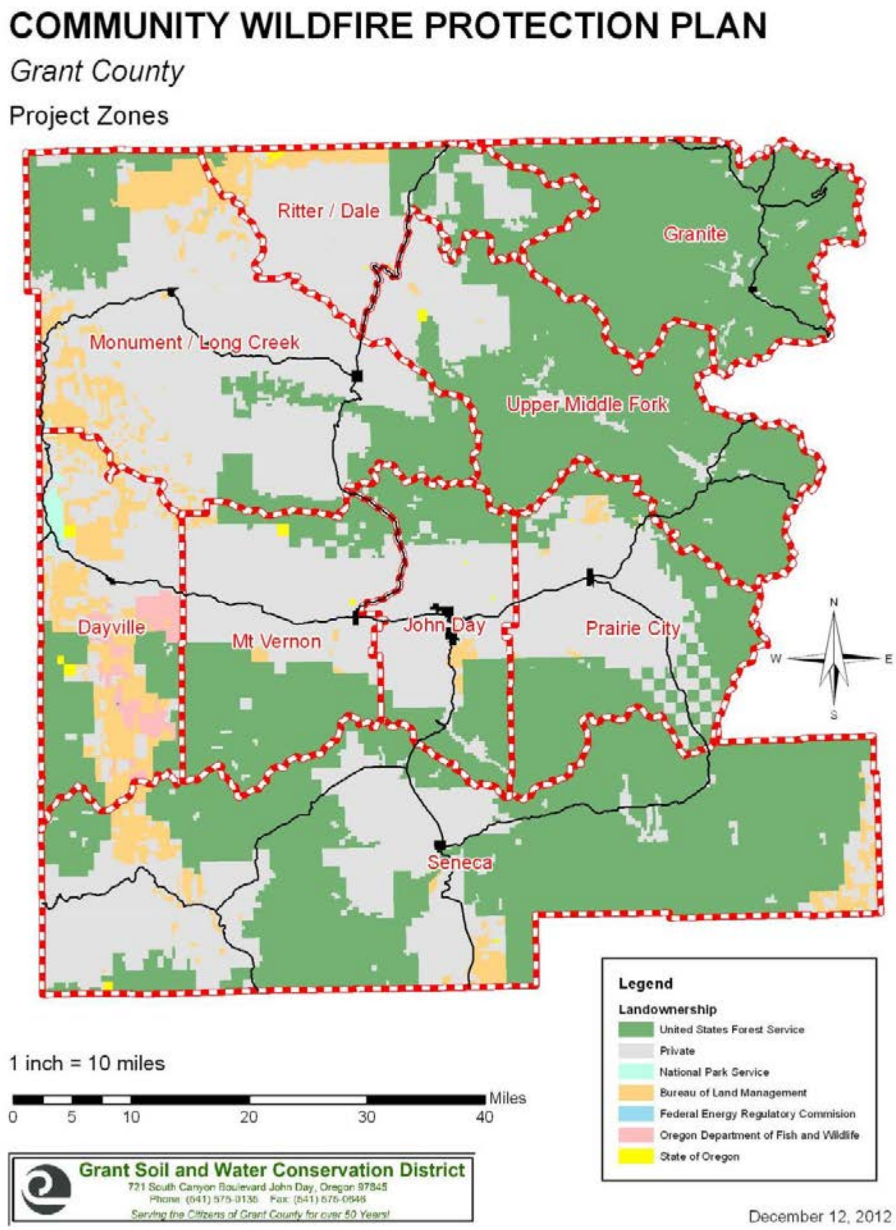
The 2013 Grant County CWPP was developed on a sub-watershed basis with emphasis on "zones" defined by watersheds and centered on the communities of Long Creek and Monument, Ritter and Dale, Granite, the Upper Middle Fork of the John Day River, Prairie City, John Day and Canyon City, Mt. Vernon, Dayville, and the Seneca area including the Lower Middle Fork area (Figure 6). The CWPP describes the broader conditions and history of the county as well as providing detail on the personnel, capabilities and equipment of each Fire District in the county. There is a thorough description of the roles and responsibilities of a range of federal, state and local agencies and departments that must work together to implement the CWPP. The CWPP describes the linkages with the County Emergency Operations Plan and the cooperative agreements with Harney County.

The CWPP contains a section devoted to the legislation, policies and programs that form the regulatory environment for wildfire mitigation. The CWPP discusses Oregon Senate Bill 360, the Oregon Forestland-Urban Interface Fire Protection Act of 1997 which was the Oregon legislature's response to several escalating wildland fire problems. As firefighting capacity may be limited SB-360 enlisted the aid of the only people who can make fuel reduction changes to residential property: the landowners themselves. It discusses the Emergency Conflagration Act, which once invoked, authorizes the Governor

[9] This section excerpts the 2013 Grant Community Wildfire Protection Plan http://www.grantcountycwpp.com/

to use the resources of any county, city, or district fire suppression organization to assist fire-fighting efforts anywhere in the state. It discusses both federal and Oregon state laws that govern fire management including the National Fire Plan, the Healthy Forest Restoration Act (HFRA), FEMA Presidential Disaster Relief Fund, the FLAME Act to fund fire suppression costs, the National Cohesive Wildland Fire Management Strategy, the Oregon Statewide Land Use Planning Goals, Fire Adapted Communities, and Firewise Communities USA, a program of the National Fire Protection Association.

Figure 5. CWPP Project Zones and Land Ownership



Source: 2013 Grant County Community Wildfire Protection Plan

The 2013 CWPP also assesses the risk of wildfire in each of the zones using a framework developed by the Oregon Department of Forestry for application statewide called *Communities at Risk (CAR).* The CAR assessment was used to develop a statewide fuels strategy and to help set large-scale priorities across geographic areas (watersheds, multi-county coordination areas, etc). The CAR methodology is applicable at a national scale and must be applied consistently statewide for relative comparisons. The 2013 Grant CWPP applied this methodology and found that all of the cities in Grant County are Moderate (Dayville, Monument) or High Risk (Canyon City, Granite, John Day, Mt. Vernon, Prairie City and Seneca). The application of the CAR methodology of wildfire risk assessment yielded the conclusion that all of the zones in Grant County are at High Risk of wildfire.

The final section of the 2013 CWPP entitled Wildfire Mitigation Strategy covers prioritization of the wildland urban interface areas of the county and the application of nine strategies. These strategies have been incorporated into the 2020 Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan as noted in Table 4 of Volume I: Basic Plan.

FLOOD HAZARD ANNEX

Flooding results when rain and snowmelt creates water flow that exceed the carrying capacity of rivers, streams, channels, ditches, and other watercourses. In Oregon, flooding is most common from October through April when storms from the Pacific Ocean bring intense rainfall. Most of Oregon's most destructive natural disasters have been floods. Flooding can be aggravated when rain is accompanied by snowmelt and frozen ground; the spring cycle of melting snow is the most common source of flood in the region.

Countywide exposure to 100-year flood:

- Number of buildings damaged: **488**
- Loss Estimate: **$20,261,000**
- Loss Ratio: **1.0%**
- Damaged critical facilities: **7**
- Potentially Displaced Population: **799**

Causes and Characteristics of Flooding

The most damaging floods have occurred during the winter months, when warm rains from tropical latitudes melt mountain snow packs. Such conditions were especially noteworthy in February 1957, February 1963, December 1964 and January 1965. Somewhat lesser flooding has been associated with ice jams, normal spring run-off, and summer thunderstorms. Heavily vegetated stream banks, low stream gradients (e.g. Grande Ronde Valley), and breeched dikes have contributed to past flooding at considerable economic cost. Northeast Oregon counties also have experienced flooding associated with low bridge clearances, over-topped irrigation ditches, and natural stream constrictions

The Oregon Climate Change Research Institute prepared an analysis of the potential future impact of changing climate on the natural hazards experienced in Grant County. With respect to flooding the report summarizes the likely effects as follows:

- The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor.
- Although the frequency of days with at least ¾" of precipitation is not projected to change substantially, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 16% (with a range of 7% to 25%) and 12% (with a range of ---3%to 24%), respectively, by the 2050s under the higher emissions scenario relative to the historical baselines. Rainfall events are expected result in more rain.
- In Grant County, the frequency of days exceeding a threshold for landslide risk, based on 3---day and 15---day precipitation accumulation, is not projected to change substantially. However, landslide risk depends on a variety of factors and this metric may not reflect all aspects of the hazard.

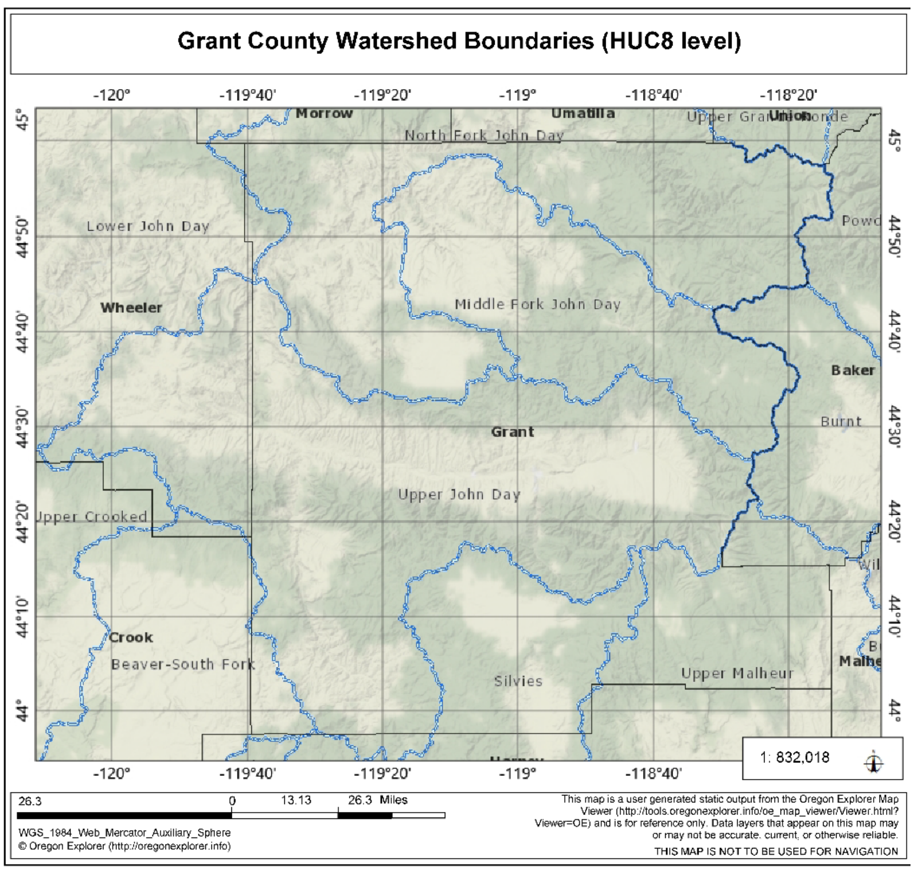
The report makes particular note of the effect of warming temperatures on low to mid-level elevations where winter precipitation may fall more frequently as rain rather than snow thereby exacerbating spring rain on snow flooding events[10].

The principal types of floods that occur in Grant County include:

Riverine Flooding

Riverine floods occur when water levels in rivers and streams overflow their banks. Most communities located along such water bodies have the potential to experience this type of flooding after spring rains, heavy thunderstorms or rapid runoff from snow melt. Riverine floods can be slow or fast-rising, but usually develop over a period of days. The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with melting of snow. Figure 6 below shows the river HUC 8 level sub-basins in Grant County that are the sources of riverine flooding.

Figure 6. Grant County Watershed Boundaries



Source: Oregon Explorer map prepared by K. Daniel, April 2020

[10] Future Climate Projections Grant County, Oregon Climate Change Research Institute, Oregon State University, February 2020

Snow-melt Flooding

Flooding throughout the region is most commonly linked to the spring cycle of melting snow. The weather pattern that produces these floods occurs during the winter months and has come to be associated with La Nina events, a three to seven year cycle of cool, wet weather. In brief, cool, moist weather conditions are followed by a system of warm, moist air from tropical latitudes. The intense warm air associated with this system quickly melts foothill and mountain snow. Above-freezing temperatures may occur well above pass levels (4,000-5,000 feet). Such conditions were especially noteworthy with low bridge clearances which have particularly damaged Northeast Oregon areas as seen in the 2010 flooding of the Grant-Union High School. The 2011 flooding in Pine Valley was also the result of snow-melt flooding.

Figure 7. Flooding near John Day/Canyon City damaged the Grant-Union High School in 2010

Source: 2014 NE OR Multi-Jurisdictional Natural Hazard Mitigation Plan

Flash Floods

Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods usually occur in the summer during thunderstorm season, appear with little or no warning and can reach full peak in a few minutes. They are most common in the arid and semi-arid central and eastern areas of the state where there is steep topography, little vegetation and intense but short duration rainfall. Flash floods can occur in both urban and rural settings, often along smaller rivers and drainage ways. In flash flood situations, waters not only rise rapidly, but also generally move at high velocities and often carry large amounts of debris. In these instances a flash flood may arrive as a fast moving wall of debris, mud, water or ice. Such material can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back in such a manner can cause flooding both up stream and then later downstream if the obstruction is removed or breaks free.

Terms related to Flooding

Floodplain

A floodplain is land adjacent to a river, stream, lake, estuary or other water body that is subject to flooding. These areas, if left undisturbed, act to store excess floodwater. The floodplain is made up of two areas: the flood fringe and the floodway:

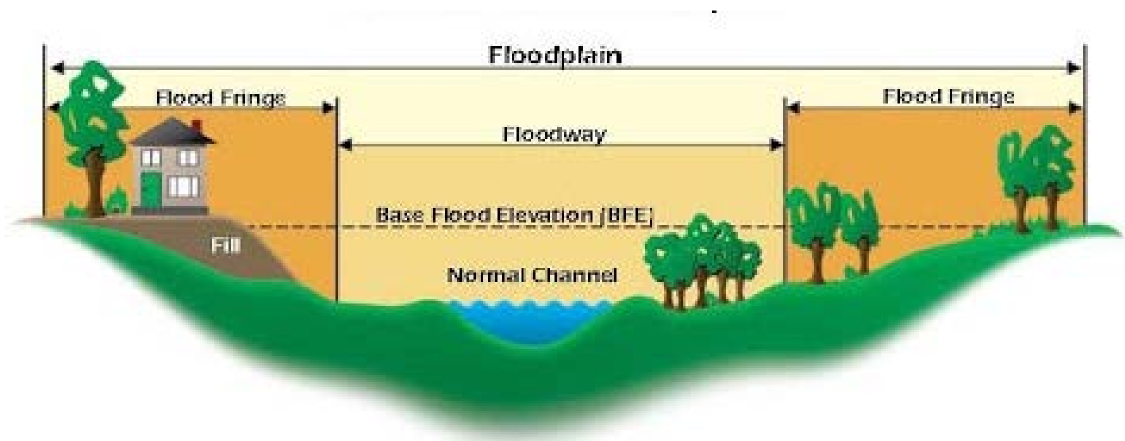
Floodway

The floodway is the portion of the floodplain that is closer to the river or stream. For National Flood Insurance Program (NFIP) and regulatory purposes, floodways are defined as the channel of a river or stream, and the over-bank areas adjacent to the channel. Unlike floodplains, floodways do not reflect a recognizable geologic feature. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures, so that flood flows are not obstructed or diverted onto other properties. The NFIP floodway definition is “the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot (See Figures FL-3 and FL-4).” Floodways are not mapped for all rivers and streams but are typically mapped in developed areas.

The Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken (See Figure FL-3).

Figure 8. Characteristics of a Floodplain



Source: Oregon Department of Geology and Mineral Industries

Base Flood Elevation

Base Flood Elevation (BFE) means the water surface elevation during the base flood in relation to a specified datum or benchmark. The Base Flood Elevation (BFE) is depicted on the FEMA Flood Insurance

Rate Map (FIRM) to the nearest foot and in the Flood Insurance Study to the nearest 0.1 foot. The Base Flood Elevation is a baseline pulled together from historic weather data, local topography, and the best science available at the time. It's a reasonable standard to insure against, but it is not a guarantee that it will flood only 1 time every 100 years.

Factors that Affect Flooding in Grant County

Precipitation

In Oregon, observed precipitation is characterized by high year--to--year variability and future precipitation trends are expected to continue to be dominated by this large natural variability. On average, summers in Oregon are projected to become drier and other seasons to become wetter resulting in a slight increase in annual precipitation by the 2050's.[11] Locations surrounded by mountains receive barely 10 inches per year, a portion of which falls as snow. This is in sharp contrast to the 37 to 50 inches normally seen in other parts of the Pacific Northwest. Low levels of precipitation are due in part by the rain shadow effect caused by the Cascade Mountains. Summer precipitation is very low, increasing the risk of wildfire and requiring irrigation for crops.

Projections for future changes in climate suggest that there is greater uncertainty in future projections of precipitation-related metrics than temperature-related metrics. Future streamflow magnitude and timing in the Pacific Northwest is projected to shift toward higher winter runoff, lower summer and fall runoff, and an earlier peak runoff, particularly in snow-dominated regions. These changes are expected to result from warmer temperatures causing precipitation to fall more as rain and less as snow, in turn causing snow to melt earlier in the spring; and in combination with increasing winter precipitation and decreasing summer precipitation.

Warming temperatures and increased winter precipitation are expected to increase flood risk for many basins in the Pacific Northwest, particularly mid--- to low---elevation mixed rain---snow basins with near freezing winter temperatures. The greatest changes in peak streamflow magnitudes are projected to occur at intermediate elevations in the Cascade Range and the Blue Mountains.[12]

Surface Permeability

In urbanized areas, increased pavement leads to an increase in volume and velocity of runoff after a rainfall event, exacerbating potential flood hazards. Storm water systems collect and concentrate rainwater and then rapidly deliver it into the local waterway. Traditional storm water systems are a benefit to urban areas, by quickly removing captured rainwater. However, they can be detrimental to areas downstream because they cause increased stream flows due to the rapid influx of captured storm water into the waterway. It is very important to evaluate storm water systems in conjunction with development in the floodplain to prevent unnecessary flooding to downstream properties. Frozen ground and burn scars are other contributors to rapid runoff in the urban and rural environment.

The principle rivers in Grant County include the North Fork, the South Fork and the Middle Fork of the John Day River, Canyon Creek and the Silvies River.

[11] Future Climate Projections Grant County, Dalton, February 2020, p. 17

[12] Ibid p. 21

Location of Development

When development is located in the floodplain, it may cause floodwaters to rise higher than before the development was located in the hazard areas. This is particularly true if the development is located within the floodway. When structures or fill are placed in the floodplain, water is displaced. Development raises the base-flood elevation by forcing the river to compensate for the flow space obstructed by the inserted structures. Over time, when structures or materials are added to the floodplain and no fill is removed to compensate, serious problems can arise.

Displacement of a few inches of water can mean the difference between no structural damage occurring in a given flood event and the inundation of many homes, businesses, and other facilities. Careful attention must be paid to development that occurs within the floodplain and floodway of a river system to ensure that structures are prepared to withstand base flood events.

How is Flooding Hazard Identified?

Flood hazard in some areas of Grant County are identified through FEMA issued Flood Insurance Rate Maps (FIRM), in conjunction with their Flood Insurance Studies (FIS). Flood records in areas without FIRMs are often not well documented, particularly in unincorporated areas because their floodplains are sparsely developed and risk to life and property are low. The Grant County's Flood Insurance Rate Maps (FIRMs), like much of eastern Oregon are not modernized. New floodplain mapping of the Silvies River and Bear Creek in Seneca and adjacent Grant County has been completed and is currently in the 90 day appeal period. Pending adjudication of any appeals these maps will become effective May 26, 2020. Additional lidar will be prepared to cover the area of the confluence of the Silvies River and Bear Creek in the future. Lidar for the Upper John Day watershed has been funded and will be carried out as a first step to updating the FEMA floodplain maps for most of the John Day River in Grant Count.

The table below shows that as of April 2020, Grant County (including the cities of Canyon City, John Day, Mount Vernon and Prairie City) has 61 National Flood Insurance Program (NFIP) policies in force, 11 total paid claims and one repetitive loss building. The repetitive flood loss claims in John Day resulted in $16,643 in payments over two losses. The tables below display the number of policies by building type and show that the majority of residential structures that have flood insurance policies are single-family homes and that there are 11 non-residential structures with flood insurance policies. The county has not received a Community Assistance Visit in the past 15 years, however, the City of John Day participated in a recent Community Assistance Visits in the April 2019. The county is not a member of the Community Rating System (CRS) and neither are any of the incorporated cities within Grant County.

The Community Repetitive Loss record for Grant County identifies one repetitive loss building and two total repetitive loss claims totaling $16,644. The repetitive loss building is located within the City of John Day. There are no other repetitive loss buildings within any other city in the county. The one identified repetitive flood loss property is a single-family residential building located in Flood Zone A03 of the existing FIRM. The property is located on NW Bridge Street, between NW 7th Avenue and NW 5th Avenue.

Repetitive flood loss properties (those which have experienced multiple flood insurance claims) have been identified as high priority hazard projects by the NFIP. Nationwide, 40% of all flood insurance claims are paid on just two-percent of insured properties. In Oregon, repetitive loss properties represent about one-percent of all insured properties, and account for about 14% of all claims paid (19% of the dollar amounts paid).[13]

Table 3. Grant County Flood Insurance Policy Detail

				Policies by Building Type			
Jurisdiction	**Current FIRM effective date**	**Policies**	**Pre-FIRM**	Single Family	2 to 4 Family	Other Residential	Non-Residential
Grant County	5/18/1982	17	11	15	-	-	2
Canyon City	9/18/1987	2	2	2	-	-	
John Day	2/23/1982, revised by LOMR effective 10/17/2019	34	24	25	-	-	9
Mount Vernon	9/18/1987	7	5	6	1	-	-
Prairie City	2/17/1988	1	1	1	-	-	-
Totals		61	43	49	1		11

Table 4. Grant County Flood Insurance Claim and Substantial Damage Detail

Jurisdiction	Insurance in Force	Total Paid Claims	Substantial Damage Claims	Repetitive Loss Buildings	Total Paid Amount	Last CAV	Last CAC
Grant County	$3,203,500	0	0	0	0	6/29/1994	5/09/2019
Canyon City	$315,000	0	0	0	0	7/1/1989	5/28/2019
John Day	$6,810,800	10	1	1	$51,094	4/26/2019	none
Mount Vernon	$879,900	1	0	0	0	6/14/1993	none
Prairie City	$175,000	0	0	0	0	7/1/1989	none
Totals	$11,384,200	11	1	1	$51,094		

Source: Information compiled by Department of Land Conservation and Development, FEMA Community Information System consulted April 2020.

[13] State Natural Hazards Mitigation Plan 3-FL-9

There are no NFIP policies in the cities of Dayville, Long Creek, Monument, or Seneca. The FIRMs for these communities each became effective on 9/24/1984.

History of Flooding in Grant County

Table 5 below shows the history of major flood events within Grant County. Staff at the Oregon Department of Land Conservation and Development (DLCD) compiled a list of all recorded floods in Oregon across 146 years of available data, as part of a 2020 update to the 2015 State NHMP table of flooding events. Data for this list had two sources: the Table 1 in the DLCD "Flood Technical Resource Guide" (Andre and others, 2001)[14] which was used to record events that occurred prior to 2000 and the NOAA Storm Event Database [15] which captured events from 2000 to the present.

There are limitations to this listing in that information from the DLCD Flood Technical Resource Guide's represents a list of 'Historic Flooding' which typically records only at most 12 events in a single region across a decade. In comparison, the NOAA database records storm-driven flooding events that result in damage, injury, loss of life or events that have unusual conditions that may generate media attention. This shows as many as 45 events occurring in one region within a decade. By compiling data from two different sources, neither of which have a quantitative metric for defining a flood, has resulted in a list that is inconsistent and likely incomplete. This table differs somewhat from the list of historic floods in the 2014 NHMP because this plan relates to only a portion of the area covered in the 2014 NHMP.

[14] https://oregonexplorer.info/data_files/OE_topic/hazards/documents/04_flood.pdf
[15] https://www.ncdc.noaa.gov/stormevents/

Table 5. History of flooding in Grant County

Date	Location	Description
June 1884	John Day	
Feb. 1907	western Oregon and John Day	
March 1932	Malheur, Grande Ronde, John Day, and Umpqua	
Dec. 1964–Jan. 1965	Pacific Northwest	rain on snow; record flood on many rivers
June 2001	Grant County	The Oregon Dept of Transportation reported flash flooding on State Highway 26
May – June 2011	Union and Grant Counties	melting heavy snowpack caused riverine and playa flooding
March 2014	Union, Umatilla, and Grant Counties	Heavy rain fell across much of the northern Blue Mountains and Wallowa County throughout the first week of March. March 9th received very heavy rain with snow levels around 6000ft. This allowed for a significant increase in runoff, which lead to a quick rise in rivers for the period
May 2018	Grant and Wallowa Counties	Heavy rain from slow moving thunderstorms caused rock slides and water on roadways within an area that includes Mount Vernon, John Day and Canyon City
April 2019	Union, Grant, Umatilla, Wallowa and Wheeler Counties Note: DR-4452 declared 7/9/19 in Grant, Umatilla and Wheeler Counties	Snow water equivalents near 200% of normal in the Blue Mountains coupled with warm temperatures and near record rainfall totals for April produced significant river flooding across eastern Oregon.

Sources: DLCD “Flood Technical Resource Guide” (Andre and others, 2001) and National Climate Data Center Storm events Database http://www.ncdc.noaa.gov/stormevents

DROUGHT HAZARD ANNEX

Risk Score: **219** of 240

Risk Level: **High**

Drought is a hazard of nature. We can't see it ignite, like a fire, or predict where it is likely to touch down, as we do a tornado. Like its natural hazard cousins, however, drought can leave a trail of destruction that may even include loss of life.

And while we might refer to a fire's crackle or the roar of a tornado, a drought hazard does not announce its arrival. In fact, those familiar with drought call it a "creeping phenomenon," because what may first appear to be merely a dry spell can only be discerned in hindsight as the early days of a drought.

Drought's stealthy reputation is also based on the way its effects vary from region to region. A week without rain might be considered a drought in a tropical climate like Bali, while a gap of only seven days between rains might be unusual in Libya, a desert area where annual rainfall is less than seven inches(180 millimeters). Drought can even co-exist with record rainfall!

In the most general sense, drought is defined as a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage. The effects of this deficiency are often called drought impacts. Natural impacts of drought can be made even worse by the demand that humans place on a water supply. [16]

Causes and Characteristics of Drought

Droughts can generally be characterized by an increased demand or decreased supply of water. Drought is commonly understood to be a period of drier than normal conditions that results in water-related problems.[17] In the most general sense, drought is defined as a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage. In the early 1980s, researchers with the National Drought Mitigation Center (NDMC) and the National Center for Atmospheric Research located more than 150 published definitions of drought. In order to simplify analysis, the NDMC now provides four different ways in which drought can be defined based on the impacts of the drought. They are as follows: meteorological, agricultural, hydrological, and socioeconomic.

Drought is a temporary condition – it is seen in an interval of time, generally months or years, when moisture is consistently below normal. It differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. [18] The Oregon Climate Change Research Institute conducted a

[16] University of Nebraska-Lincoln, National Drought Mitigation Center website https://drought.unl.edu/Education/DroughtBasics.aspx

[17] Moreland, A. USGS, *Drought. Open File Report 93-642*, 1993, https://pubs.er.usgs.gov/publication/ofr93642.

[18] National Drought Mitigation Center, *Types of Drought,* https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx, accessed April, 2020.

study of potential future climate impacts in Grant County and predicts that what has been "normal" is likely to change[19].

The National Drought Mitigation Center (NDMC) categories of drought impacts are mirrored in the Oregon's *Emergency Operations Plan (*EOP*)* in the *Incident Annex for Drought.* The 2016 Oregon EOP Incident Annex for Drought adopted these characterizations of drought except for drought that has ecological impacts. The *2015 Oregon Natural Hazards Mitigation Plan* (*2015 Oregon NHMP*) also includes all the classifications of drought identified by the NDMC except ecological drought.

Wilhite and Glantz[20] cited by NDMC categorized the definitions in terms of four basic approaches to measuring drought: *meteorological*, *hydrological*, *agricultural*, and *socioeconomic*. The first three approaches deal with ways to measure drought as a physical phenomenon. The last deals with drought in terms of supply and demand, tracking the effects of water shortfall as it ripples through socioeconomic systems.

Meteorological Droughts

Meteorological droughts are defined in terms of the departure from a normal precipitation pattern and the duration of the event. These are region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region. This drought type may relate specific precipitation departures to average amounts on a monthly, seasonal, or yearly basis.

Agricultural Droughts

Agricultural drought links various characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, and reduced groundwater or reservoir levels. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural drought accounts for the variable susceptibility of crops during different stages of crop development, from emergence to maturity.

Hydrological Droughts

Hydrological droughts refer to deficiencies in surface water and sub-surface water supplies. It is measured as stream flow, and as lake, reservoir, and ground water levels. When precipitation is reduced or deficient over an extended period of time, the shortage will be reflected in declining surface and sub-surface water levels. Hydrological droughts are usually out of phase with the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and groundwater and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors. Also, water in hydrologic storage systems (e.g., reservoirs, rivers) is often used for multiple and competing purposes (e.g., flood control, irrigation, recreation, navigation, hydropower, and wildlife habitat), further complicating the sequence and quantification of impacts. Competition for water in these storage systems escalates during drought and conflicts between water users increase significantly.

[19] Future Climate Projections Grant County, Dalton, February 2020
[20] https://www.tandfonline.com/doi/abs/10.1080/02508068508686328

Socioeconomic Droughts

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.

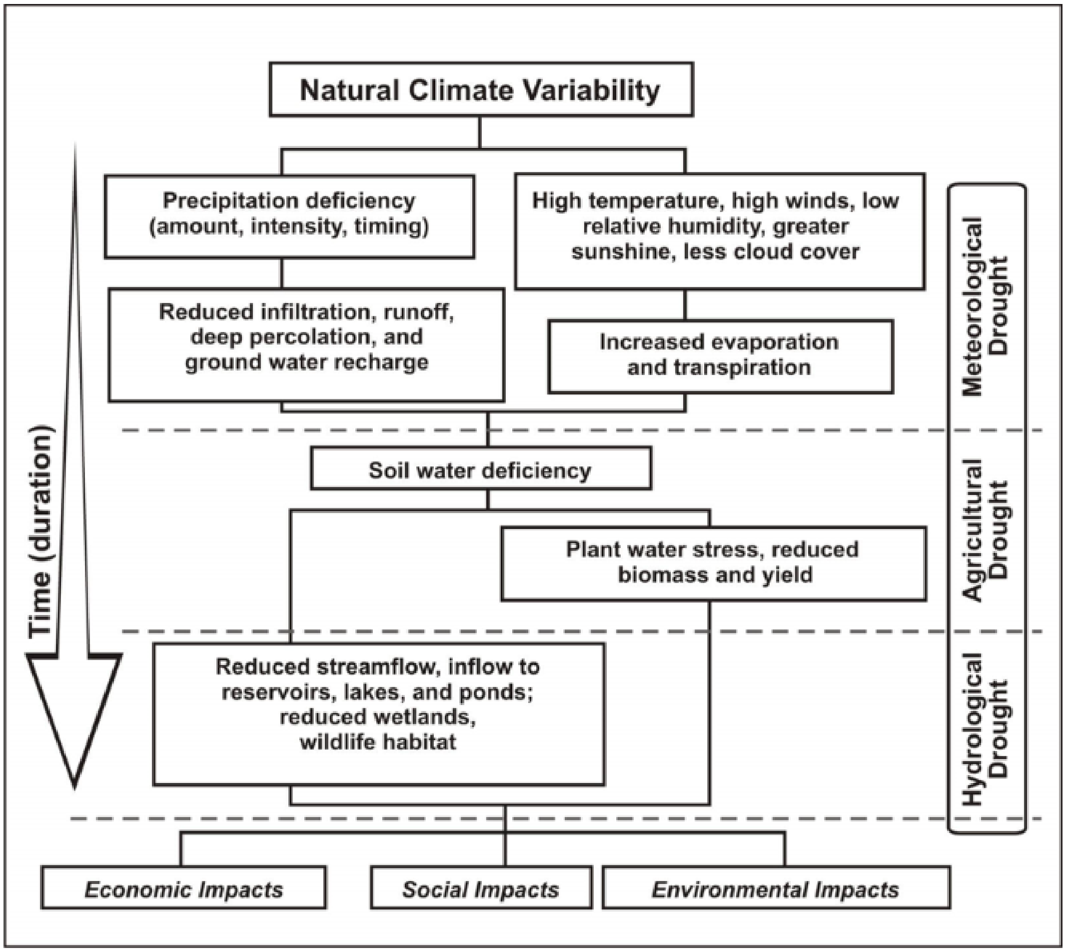
In most instances, the demand for economic goods is increasing as a result of increasing population and per capita consumption. Supply may also increase because of improved production efficiency, technology, or the construction of reservoirs that increase surface water storage capacity. If both supply and demand are increasing, the critical factor is the relative rate of change. Is demand increasing more rapidly than supply? If so, vulnerability and the incidence of drought may increase in the future as supply and demand trends converge.

Ecological Droughts

A more recent effort by conservationists focuses on defining drought in ecological terms. The Science for Nature and People Partnership (SNAPP) is a first-of-its-kind collaboration between three partners: The Nature Conservancy (TNC), the Wildlife Conservation Society (WCS), and the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California, Santa Barbara. They define ecological drought as "a prolonged and widespread deficit in naturally available water supplies — including changes in natural and managed hydrology — that create multiple stresses across ecosystems."[21]

[21] https://snappartnership.net/teams/ecological-drought/

Figure 9. Types of Drought and Impacts



Sequence of drought occurrence and impacts for commonly accepted drought types. All droughts originate from a deficiency of precipitation or meteorological drought but other types of drought and impacts cascade from this deficiency. (Source: NDMC)

Oregon's Drought Planning and Monitoring

Oregon Revised Statute (ORS) Chapter 536 identifies authorities available during a drought. "To trigger specific actions from the Water Resources Commission and the Governor, a "severe and continuing drought" must exist or be likely to exist. Oregon relies upon two inter-agency groups to evaluate water supply conditions, and to help assess and communicate potential drought-related impacts. The Water Supply Availability Committee (WSAC) is a technical committee chaired by the Water Resources Department. The other group—the Drought Readiness Council—is a coordinating body of state agencies co-chaired by the Water Resources Department and the Office of Emergency Management."[22]

[22] State of Oregon, *Emergency Operations Plan*, *Incident Annex for Drought*, April 2016, https://www.oregon.gov/oem/Documents/2015_OR_EOP_IA_01_drought.pdf.

An example of a tool used to estimate drought conditions is the Surface Water Supply Index (SWSI).[23] The SWSI is an index of current water conditions throughout a state that the Natural Resources Conservation Service (NRCS) calculates to predict the surface water available in a basin compared to historic supply. The index utilizes parameters derived from snow, precipitation, reservoir and streamflow data.

Another tool produced by NRCS is the Water Supply Outlook report[24]. The Water Supply Outlook is a report containing forecasts of runoff and snowmelt runoff. It also contains a summary of current snowpack, precipitation, river flow volumes, reservoir storage and soil moisture, and data for these is published in the Maps and Data Summaries section. Runoff from the mountains is important for the major rivers in the province where reservoirs store water supplies for irrigation, hydroelectricity and community & municipal purposes. Plains area runoff is important for replenishing soil moisture and water storage in local storage facilities.

Another drought index used by most federal agencies is the Palmer Method which incorporates precipitation, runoff, evaporation, and soil moisture. However, the Palmer Method does not incorporate snowpack as a variable. Therefore, it is does not provide a very accurate indication of drought conditions in Oregon and the Pacific Northwest, although it can be very useful because of its a long-term historical record of wet and dry conditions.

The Water Supply Availability Committee consists of state and federal agencies that meet early and often throughout the year to evaluate the potential for drought conditions. If drought development is likely, monthly meetings occur shortly after release of NRCS Water Supply Outlook reports for that year (second week of the month beginning as early as January) to assess conditions. The following are indicators used by the WSAC for evaluating drought conditions:

- Snowpack
- Precipitation
- Temperature anomalies
- Long range temperature outlook
- Long range precipitation outlook
- Current stream flows and behavior
- Spring and summer streamflow forecasts
- Ocean surface temperature anomalies (El Nino, La Nina)
- Storage in key reservoirs
- Soil and fuel moisture conditions
- NRCS Surface Water Supply Index.[25]

In the *2015 Oregon Natural Hazards Mitigation Plan* (*2015 Oregon NHMP*), it states "Oregon has not undertaken a comprehensive statewide analysis to identify which communities are most vulnerable to drought. Mitigation actions specified in this plan including developing an improved methodology for

[23] Natural Resource Conservation Service, Surface Water Supply Index
[24] Natural Resource Conservation Service, Water Supply Outlook reports https://www.wcc.nrcs.usda.gov/state_outlook_reports.htm
[25] State of Oregon, *Emergency Operations Plan*, *Incident Annex for Drought*, April 2016, https://www.oregon.gov/oem/Documents/2015_OR_EOP_IA_01_drought.pdf.

gathering data and identifying the communities most vulnerable to drought and related impacts, and implementing this methodology continue to require adequate staffing and priority for funding.

Ranching, farming, and other agricultural activities contribute significantly to Grant County's economy. Drought can have a significant impact on the agricultural community and associated businesses that rely on this industry. Besides the economy, the *2015 Oregon NHMP* also describes impacts of droughts on the environment, population, infrastructure, critical/essential facilities, and state-owned and operated facilities.

Factors that Affect Drought in Grant County

Drought is frequently an "incremental" hazard, meaning both the onset and end are often difficult to determine. Also, its effects may accumulate slowly over a considerable period of time and may linger for years after the termination of the event. Dust storms are a common occurrence during simultaneous high wind events and drought periods.

Droughts are not just a summer-time phenomenon; winter droughts can have a profound impact on agriculture. Below average snowfall in higher elevations has a far-reaching effect, especially in terms of hydro-electric power, irrigation, recreational opportunities and a variety of industrial uses.

Drought can affect all segments of a jurisdiction's population, particularly those employed in water-dependent activities such as ranching, agriculture, hydroelectric generation, and recreation. Aquifer capacity may be a notable concern under drought conditions. Domestic water-users within the cities may be subject to stringent conservation measures such as water rationing and could be faced with significant increases in electricity rates.

Grant County has been impacted numerous times by precipitation shortfalls/drought conditions. Seasonal irrigation water from mountain snow packs tails off towards the end of August. It is common to find municipal water systems imposing some type of water rationing during dry years. Location of reservoirs helps mitigate the impact of a drought -- water availability is not always correlated to the amount of precipitation.

Facilities affected by drought conditions include communications facilities, hospitals, and correctional facilities that are subject to power failures. Storage systems for potable water, sewage treatment facilities, water storage for firefighting, and hydroelectric generating plants may be vulnerable to drought. Low water also means reduced hydroelectric production especially as the habitat benefits of water compete with other beneficial uses.

There also are environmental consequences. A prolonged drought in forests promotes an increase of insect pests, which in turn, damage trees already weakened by a lack of water. A moisture-deficient forest constitutes a significant fire hazard (see the Wildfire summary). Discussions with community members during the hazard identification process indicate that while drought may limit the growth of fuel for wildfires, it does provide ideal conditions for wildfires to occur. Drought significantly increases the probability for lightning-caused wildfires to occur, and provides ideal conditions for the rapid spread of wildfire. In addition, drought and water scarcity add another dimension of stress to species listed pursuant to the Endangered Species Act (ESA) of 1973.

History of Drought in Grant County and Oregon

Quantifying drought requires an objective criterion for defining the beginning and end of a drought period. The Palmer Drought Severity Index is most effective in determining long-term drought — e.g. several months — and is not as good with short-term forecasts, e.g. a matter of weeks.

The Palmer Method or Palmer Drought Severity Index (PDSI) indicates the prolonged and abnormal moisture deficiency or excess. It indicates general conditions and not local conditions caused by isolated rain. The PSDI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged period of abnormally dry or wet weather. It can be used to delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.

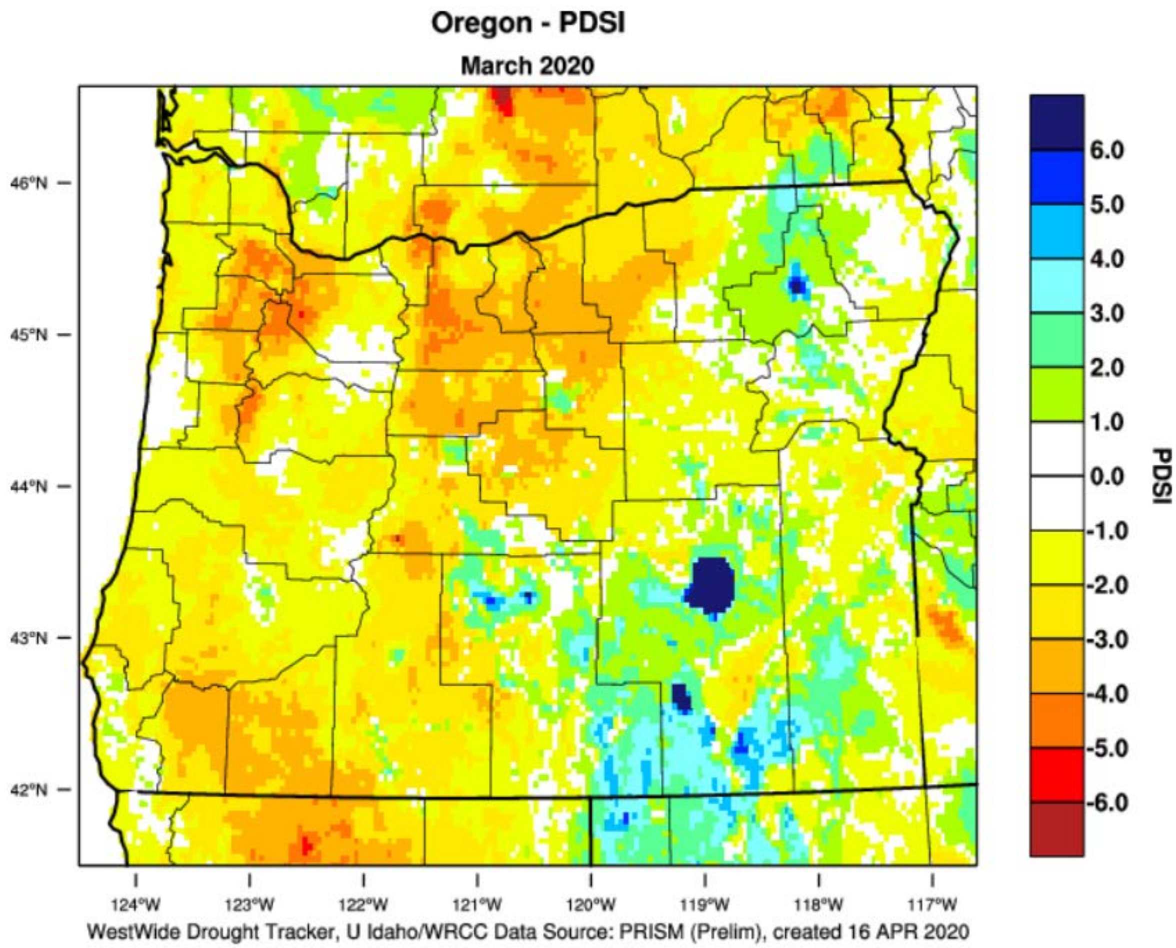
The PDSI uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that spans -10 (dry) to +10 (wet). As it uses temperature data and a physical water balance model, it can capture the basic effect of global warming on drought through changes in potential evapotranspiration. Monthly PDSI values do not capture droughts on time scales less than about 12 months. The PDSI uses a zero (0) as normal, and drought is shown in terms of negative numbers; for example, negative two (-2.00) is moderate drought, negative three (-3.00) is severe drought, and negative four (-4.00) is extreme drought.[26] See Figure 1.

Some Oregon droughts were especially significant during the period of 1928 to 1994. The period from 1928 to 1941 was a prolonged drought that caused major problems for agriculture. The only area spared was the northern coast, which received abundant rains in 1930-33. The three Tillamook burns (1933, 1939, and 1945) were the most significant results of this very dry period.

During 1959-1962 stream flows were low throughout Eastern Oregon, but areas west of the Cascades had few problems. The driest period in Western Oregon was the summer following the benchmark 1964 flood. Low stream flows prevailed in Western Oregon during the period from 1976-81, but the worst year, by far, was 1976-77, the single driest year of the century. The Portland airport received only 7.19 inches of precipitation between Oct. 1976 and Feb. 1977, only 31% of the average 23.16 inches for that period. The 1985-94 drought was not as severe as the 1976-77 drought in any single year, but the cumulative effect of ten consecutive years with mostly dry conditions caused statewide problems. The peak year of the drought was 1992, when a drought emergency was declared for all of Oregon. Forests throughout the state suffered from a lack of moisture. Fires were common and insect pests, which attacked the trees, flourished. In 2001 and 2002 Oregon experienced drought conditions.

[26] https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi

Figure 10. Oregon Counties Palmer Drought Severity Index Map for March 2020



Source: West Wide Drought Tracker, Oregon – PDSI, https://wrcc.dri.edu/wwdt/index.php?region=or

During the 2005 drought the Governor issued declarations for eight counties, all east of the Cascades, and the USDA issued three drought declarations, overlapping two of the Governor's. State declarations were made for Baker, Crook, Gilliam, Hood River, Klamath, Morrow, Sherman, and Umatilla counties. Federal declarations were made in Coos, Klamath, and Umatilla counties. Wheeler County made a county declaration. The USDA declarations provided access to emergency loans for crop losses.

Table 6. History of Drought in Grant County

Year	Location	Description
1938-1939	statewide	the 1920s and 1930s, known more commonly as the Dust Bowl, were a period of prolonged mostly drier than normal conditions across much of the state and country
1977	N & S central Oregon; eastern Oregon	a severe drought for northeast Oregon
1999	Baker, Grant, Union and Wallowa	Baker, Grant, Union and Wallowa Counties were declared disaster areas by the Department of Agriculture due to drought. Approximately one-third of the wheat crop in those areas was lost due to weather.
1994	Regions 4–8	in 1994, Governor's drought declaration covered 11 counties located within regions 4, 5, 6, 7, and 8
2002	southern and eastern Oregon	2001 drought declarations remain in effect for all counties, including Region 7's Baker, Union, and Wallowa Counties; Governor adds Grant County in 2002, along with five additional counties, bringing statewide total to 23 counties under a drought emergency.
2003	southern and eastern Oregon	Grant County 2002 declaration remains in effect through June 2003; Governor issues new declarations for Baker, Union, and Wallowa Counties, which are in effect through December 2003
2007	Regions 6–8	Grant, Baker, and Union Counties receive a Governor drought declaration; three other counties affected in neighboring regions
2014	Regions 4, 6–8	Grant and Baker County receive drought declarations, including eight other counties in other regions
2015	statewide	36 Oregon Counties across the state receive federal drought declarations, including 25 under Governor's drought declaration
2018	Regions 1, 4-8	Baker and Grant County receive Governor's drought declarations, including 9 other counties in 5 other regions

Source: 2015 Oregon State Hazard Mitigation Plan update; 2014 NE Oregon Multi-Jurisdictional NHMP

LANDSLIDE HAZARD ANNEX

Landslides are a chronic problem in our state, affecting both infrastructure and private property. Approximately 13,048 documented landslides have occurred in Oregon in the last 150 years (Burns, 20172). The combination of geology, precipitation, topography, and seismic activity makes portions of Oregon especially prone to landslides[27].

Countywide exposure:
- Number of buildings: **1,035**
- Exposure Value: **$205,629,000**
- Ratio of Exposure Value: **10%**
- Critical facilities exposed: **2** (Blue Mountain Hospital and Dayville School)
- Potentially Displaced Population: **1,080**

Landslides are a geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year.[28] In Oregon, economic losses due to landslides for a typical year are estimated to be over $10 million.[29] In years with heavy storms, such as in 1996, losses can be an order of magnitude higher and exceed $100 million.[30]

While not all landslides result in private property damage, many landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life. Increasing population in Oregon and the resultant growth in home ownership has caused the siting of more development in or near landslide areas. Often these areas are highly desirable owing to their location along the coast, rivers, and on hillsides.

Although landslides are propelled by gravity, they can be triggered by other natural geologic events or human activity. Volcanic eruptions and earthquakes can initiate earth movement on a grand scale. Although earthquakes can initiate debris flows, the major causes of landslides in the northwest are continuous rains that saturate soils.

Landslides can also be the direct consequence of human activity. Seemingly insignificant modifications of surface flow and drainage may induce landslides. In an urban setting, improper drainage is most often the factor when a landslide occurs.

Many unstable, landslide prone areas can be recognized. Tip-offs include scarps, tilted and bent ("gun-stocked") trees, wetlands and standing water, irregular and hummocky ground topography, and over

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[27] Sears, Lahav, Burns and McCarley. 2019. Preparing for Landslide Hazards: A Land Use Guide for Oregon Communities https://www.oregon.gov/lcd/Publications/Landslide_Hazards_Land_Use_Guide_2019.pdf

[28] Mileti, Dennis. 1999. Disasters by Design: A Reassessment of Natural Hazards in the United States. Washington D.C.: Joseph Henry Press.

[29] Wang, Yumei, Renee D. Summers, R. Jon Hofmeister, and Oregon Department of Geology and Mineral Industries. 2002. "Open-File Report O-02-05: Landslide Loss Estimation Pilot Project in Oregon." http://www.oregon.gov/LCD/docs/rulemaking/012308/item_1_Kehoe_att_b.pdf, accessed February 14, 2010

[30] Ibid.

steepened slopes with a thick soil cover. The technology of spotting landslides by use of aerial photography and new laser based terrain mapping called lidar is helping DOGAMI develop much more accurate and detailed maps of areas with existing landslides and they are now able to create landslide susceptibility maps, that is, maps that that show where staff geologists estimate that different types of landslides may occur in the future.[31]

All landslides can be classified into one of the following six types of movements: (1) slides, (2) flows, (3) spreads, (4) topples, (5) falls, or (6) complex. In addition, landslides may be broken down into the following two categories: (1) rapidly moving; and (2) slow moving. Rapidly moving landslides are typically "off-site" (debris flows and earth flows) and present the greatest risk to human life. Rapidly moving landslides have caused most of the recent landslide-related injuries and deaths in Oregon, including eight deaths in 1996 following La Niña storms. Slow moving landslides tend to be "on-site" (slumps, earthflows, and block slides) and can cause significant property damage, but are less likely to result in serious human injuries.

Landslides vary greatly in the volumes of rock and soil involved, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials.

In general, areas at risk to landslides have steep slopes (25 percent or greater,) or a history of nearby landslides. In otherwise gently sloped areas, landslides can occur along steep river and creek banks, and along ocean bluff faces. At natural slopes under 30 percent, most landslide hazards are related to excavation and drainage practices, or the reactivation of preexisting landslide hazards.[32]The severity or extent of landslides is typically a function of geology and the landslide triggering mechanism. Rainfall initiated landslides tend to be smaller, and earthquake induced landslides may be very large. Even small slides can cause property damage, result in injuries, or take lives. Natural conditions and human activities can both play a role in causing landslides. The incidence of landslides and their impact on people and property can be accelerated by development.[33]

Causes and Characteristics of Landslides

In simplest terms, a landslide is any detached mass of soil, rock, or debris that falls, slides or flows down a slope or a stream channel. Landslides are classified according to the type and rate of movement and the type of materials that are transported.

In understanding a landslide, two forces are at work: 1) the driving forces that cause the material to move down slope, and 2) the friction forces and strength of materials that act to retard the movement and stabilize the slope. When the driving forces exceed the resisting forces, a landslide occurs.

Landslides can be broken down into two categories: (1) rapidly moving; and (2) slow moving, in addition to "on-site" or "off-site" hazards. Rapidly moving landslides are typically "off-site" (debris flows and earth flows) and present the greatest risk to human life, and persons living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Rapidly moving landslides have

[31] Ibid

[32]Interagency Hazard Mitigation Team.2012- Oregon Natural Hazards Mitigation Plan. Salem, OR: Oregon Military Department – Office of Emergency Management

[33] DLCD, CPW, Planning for Natural Hazards: Oregon Technical Resource Guide, 1999

also caused most of the recent landslide-related injuries and deaths in Oregon. Slow moving landslides tend to be "on-site" (slumps, earthflows, and block slides) and can cause significant property damage, but are less likely to result in serious human injuries.

The staff from Oregon Department of Geology and Mineral Industries teamed up with staff from Oregon Department of Land Conservation and Development to develop an updated guide on land use issues for landslide hazards. This Landslide Guide both describes landslides and the methods used to map them more accurately using LiDAR (Light Detection and Ranging) methods, as well as the types of site specific reporting and the professionals qualified to produce them, mitigation planning topics and the implementation of mitigation actions including a guide to examples of landslide codes for local planners. This document is excerpted below and a reference to the full document is available through the following link:
https://www.oregon.gov/lcd/Publications/Landslide_Hazards_Land_Use_Guide_2019.pdf

Types of Landslides

All landslides can be classified into six types of movement: 1) falls, 2) topples, 3) slides, 4) spreads, 5) flows, and 6) complex (**Figure 2-1**). Most slope failures are complex combinations of these six distinct types, but the generalized groupings provide a useful means for framing discussion of the type of hazard and potential mitigation actions. Movement type should be combined with other landslide characteristics such as type of material, rate of movement, depth of failure, and water content to understand more fully the landslide behavior. For a more complete description of the different types of landslides, see *U.S. Transportation Research Board Special Report 247, Landslides: Investigation and Mitigation* (Turner & Schuster, 199610), which has an extensive chapter on landslide types and processes.

One type of landslide that is commonly life threatening is channelized debris flow, sometimes referred to as a *rapidly moving landslide* or RML. They are more prevalent and impactful than most people recognize. Channelized debris flows normally initiate on a steep slope, move into a steep channel (or drainage), increase in volume by incorporating channel materials, and then deposit material, usually at the mouth of the channel on existing fans. Debris flows can be mobilized by other types of landslides that occur on slopes near a channel. Debris flows can also initiate within channels from accelerated erosion during heavy rainfall or snowmelt. These debris flows move fast enough that they are difficult to outrun. Slopes that have failed in the past often remain in a weakened state, and many of these areas tend to fail repeatedly over time. For example, a channel with a debris flow fan at its mouth indicates a history of debris flows in that channel. The formation of talus slopes indicates that numerous rock falls have occurred above the slope. Talus is "[a]n outward sloping and accumulated heap or mass of rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep, rocky slope, and formed chiefly by gravitational falling, rolling, or sliding" (USGS11).

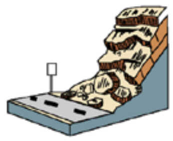
The tendency for failures to reoccur is true for all types of landslide movements and over periods much longer than human recorded history. Large landslide complexes may have moved dozens of times over thousands of years, with long periods of stability punctuated by episodes of movement. In some cases, areas that have previously failed have subtle topographic morphology now, making them difficult to identify. However, technological advances such as lidar have greatly helped in the process of identifying and mapping older landslides. Identifying and mapping both historical and ancient landslide areas –

many of which will move again – is of great importance for mitigating the risk these natural hazards pose.

Potential slope instability is not limited to past landslide sites. Areas near previous landslides and of similar geology and topography are also at higher risk for slope failure. This makes it even more important to locate previous landslides and study them: Mapping landslide locations can identify nearby or similar areas susceptible to slope instability.[34]

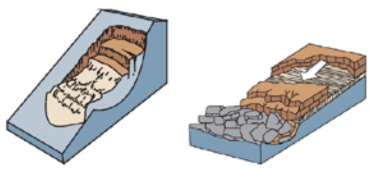
[34] Preparing for Landslide Hazards: A Land Use Guide for Oregon Communities (October 2019)

Figure 11. Types of Common Landslides in Oregon



Falls are near-vertical, rapid movements of masses of materials, such as rocks or boulders. The rock debris sometimes accumulates as talus at the base of a cliff.

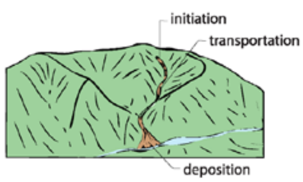
Topples are distinguished by forward rotation about some pivotal point, below or low in the mass.



Slides are downslope movement of soil or rock on a surface of rupture (failure plane or shear-zone).

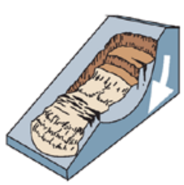
- **Rotational** slides move along a surface of rupture that is curved and concave.
- **Translational** slides displace along a planar or undulating surface of rupture, sliding out over the original ground surface.

Spreads are commonly triggered by earthquakes, which can cause liquefaction of an underlying layer and extension and subsidence of commonly cohesive materials overlying liquefied layers.



Channelized Debris Flows commonly start on a steep, concave slope as a small slide or earth flow into a channel. As this mixture of landslide debris and water flows down the channel, it pick ups more debris, water, and speed, and deposits in a fan at the outlet of the channel.

Earth Flows commonly have a characteristic "hourglass" shape. The slope material liquefies and runs out, forming a bowl or depression at the head.



Complex landslides are combinations of two or more types. A common complex landslide is a slump-earth flow, which usually exhibit slump features in the upper region and earth flow features near the toe.

Source: Preparing for Landslide Hazards: A Land Use Guide for Oregon Communities (October 2019)

Conditions Affecting Landslides

Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslides. Landslides can damage or temporarily disrupt utility services, roads and other transportation systems and critical lifeline services such as police, fire, medical, utility and communication systems, and emergency response. In addition to the immediate damage and loss of services, serious disruption of roads, infrastructure and critical facilities and services may also have longer term impacts on the economy of the community and surrounding area.

Natural conditions and human activities can both play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. Locations with steep slopes are at the greatest risk of slides. However, the incidence of landslides and their impact on people and property can be accelerated by development. Developers who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

The following are principal factors that affect or increase the likelihood of landslides:

- Natural conditions and processes including the geology of the site, rainfall, wave and water action, seismic tremors and earthquakes and volcanic activity.
- Excavation and grading on sloping ground for homes, roads and other structures. Improper excavation practices, sometimes aggravated by drainage issues, can reduce the stability of otherwise stable slopes.
- Drainage and groundwater alterations that are natural or human-caused can trigger landslides. Human activities that may cause slides include broken or leaking water or sewer lines, water retention facilities, irrigation and stream alterations, ineffective storm water management and excess runoff due to increased impervious surfaces.
- High rainfall accumulation in a short period of time increases the probability of landslide. An extreme winter storm can produce inches of rainfall in a 24 hour period; if the storm occurs well into the winter season, when the ground is already saturated, the hydraulic overload effect is heightened.
- Change or removal of vegetation on very steep slopes due to timber harvesting, land clearing and wildfire.

Allowing development on or adjacent to existing landslides or known landslide-prone areas raises the risk of future slides regardless of excavation and drainage practices. Homeowners and developers should understand that in many potential landslide settings there are no development practices that can completely assure slope stability from future slide events.

Building on fairly gentle slopes can still be subject to landslides that begin a long distance away from the development. Sites at greatest risk are those situated against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels. Home siting practices do not cause these landslides, but rather put residents and property at risk of landslide impacts. In these cases, the simplest way to avoid such potential effects is to locate development out of the impact area, or construct debris flow diversions for the structures that are at risk.

Certain forest practices can contribute to increased risk of landslides. Forest practices may alter the physical landscape and its vegetation, which can affect the stability of steep slopes. Physical alterations can include slope steepening, slope-water effects, and changes in soil strength. Of all forest management activities, roads have the greatest effects on slope stability, although changing road construction and maintenance practices are reducing the effects of forest roads on landslides.

History of Landslides in Grant County and Oregon

In recent events, particularly noteworthy landslides accompanied storms in 1964, 1982, 1966, 1996, and 2005. Most of Oregon's landslide damage has been associated with severe winter storms where landslide losses can exceed $100 million in direct damage such as the February 1996 event. More winter storm induced landslides occurred in Oregon during November 1996. Intense rainfall on recently past logged land as well as previously unlogged areas triggered over 9,500 landslides and debris flows that resulted directly or indirectly in eight fatalities Highways were closed and a number of homes were lost. The fatalities and losses resulting from the 1996 landslide events brought about the passage of Oregon Senate Bill 12, which set site development standards, authorized the mapping of areas subject to rapidly moving landslides and the development of model landslide (steep slope) ordinances.

Annual average maintenance and repair costs for landslides in Oregon are over $10 million.[35]Heavier than normal rains caused thousands of landslides throughout Oregon of which roughly 9,500 were identified and added to a database. Some of these slides were the reactivation of ancient and historically active landslides and some were new failures.

Preparing for Landslide Hazards: A Land Use Guide for Oregon

DOGAMI and DLCD prepared a comprehensive guide on landslide hazard reduction entitled *Preparing for Landslide Hazards: A Land Use Guide for Oregon* (referred to as the Landslide Guide) that addresses what landslides are and the nature of the risk that they pose to people and property along with specific details on the methodology for mapping landslide susceptibility. The Landslide Guide goes beyond the identification of the hazard and description of the risk to mitigation actions that local jurisdictions can to reduce risk from landslides. The Landslide Guide contents will be summarized here and will serve as a key reference to consult when considering mitigation of the risk of landslides in Oregon communities.

The Landslide Guide identifies planning tools and mitigation strategies to reducing landslide hazard risk. Improved mapping is the first step in better identifying areas where landslides have occurred in the past, a landslide inventory map, and susceptible to landslides. This improved mapping based on lidar (Light Detection and Ranging) technology has significantly improved DOGAMI's ability to identify and map landslide features. Lidar is a relatively new technology that allows mappers to see the earth's surface beneath vegetation and trees, as if the earth had been stripped bare. Lidar gives geologists the ability to identify and map landslide features that may have previously been unrecognized or overlooked. DOGAMI has published the landslide inventory maps in a database called SLIDO. Currently SLIDO is at release 3.4 and has been updated to contain 13,048 historic landslide points and 44,929 landslide polygons. So far, 2,986 square miles of Oregon have been mapped. Oregon is 95,988 square miles.[36]

Further analysis that combines geologic information with the landslide inventory can be used to develop landslide susceptibility maps. Once a landslide feature has been recognized and mapped using lidar, several attributes about the slide, such as type of movement and material, depth of failure, direction of

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[35] Wang and Chaker, 2004. Geological Hazards Study for the Columbia River Transportation Corridor. Oregon Department of Geology and Mineral Industries Open File Report OFR 0-4-08
[36] https://www.indexmundi.com/facts/united-states/quick-facts/oregon/land-area#map

movement, volume of material, and initial slope angle are recorded to aid in the creation of landslide susceptibility maps for the local area. The estimated depth of failure or landslide thickness is used to classify some of the landslides as shallow (less than 15 feet depth) or deep (greater than 15 feet depth). The deep and shallow susceptibility maps are produced using the landslide inventory data combined with models and highlight the relative risk of a landslide occurring at any given point within the mapped area. These susceptibility maps work in conjunction with landslide inventory maps to provide jurisdictional staff, community leaders, and residents information necessary to reduce the risk of landslides impacting people, property, and the environment.

The Landslide Guide answers questions local planners and property owners may have regarding the type of professionals who are qualified to perform engineering geologic reports or geotechnical engineering reports. Engineering geologic reports and geotechnical engineering reports refer to different but related services performed by geoprofessionals with different professional certifications. Engineering geologic reports focus on how the earth (e.g., landforms, water table, soil, and bedrock) and earth processes (e.g., landslides and earthquakes) impact structures or potential structures and describe the degree of risk, while geotechnical engineering reports focus on the design of building products (e.g., structures, retaining walls, pavements) that can withstand or mitigate for subsurface and geologic conditions.

The primary purpose of the Landslide Guide is to provide a range of tools and strategies for using the information provided by landslide inventory and susceptibility maps and the information in geotechnical engineering or engineering geologic reports.

The Landslide Guide addresses how landslide hazard can be incorporated into comprehensive plans. In Oregon the required components of a comprehensive plan are: an inventory of existing conditions (factual base); goals and objectives; plan policies; and implementation measures and ordinances. The inventory of existing conditions (factual base) provides the basis and justification for plan policies. The plan policies provide general guidance in review of land use proposals. The implementing measures and ordinances provide the specific standards and criteria against which development proposals are reviewed. The Cities of Medford, Astoria and Portland provide examples of incorporation of landslide hazard mapping into comprehensive planning.

The Landslide Guide goes further to address the implementation of comprehensive plans through zoning codes. Zoning for natural hazards is often accomplished through zoning overlays, with other related maps, and with corresponding text in the zoning code. A better understanding of the causes and characteristics of landslides, as well as recognizing the locations, types, and extents of landslides leads to more effective plans, policies, and implementing measures. Identifying hazard areas and evaluating proposed development in these areas reduces risk and better protects a community. Zoning ordinances can be a powerful tool for protecting community and private assets against landslides and other hazards.

Finally the Landslide Guide reviews the codes of thirty-four Oregon communities with respect to landslide hazard and summarizes what makes a strong regulatory framework for reducing hazards from landslide. The Landslide Guide summarizes key ways that communities can reduce risk from landslide as follows:

• **Identify the hazard** – Know what the hazard is, where it is located, what causes it, what are its characteristics, when and where has it occurred historically, and when and where might it happen again.

• **Assess the vulnerabilities** – Inventory and analyze the existing and planned property and populations exposed to a hazard, and estimate how they will be affected by the hazard.

• **Assess the level of risk** – Risk is the expression of the potential magnitude of a disaster's impact. A natural hazards risk assessment involves *Landslide Hazards Land Use Guide for Oregon Communities* characterizing the natural hazards, assessing the vulnerabilities, and describing the risk either quantitatively or qualitatively or both.

• **Avoid the hazard** – Stay away from the hazard area if possible.

• **Reduce the level of risk** - Minimize development, reduce density, and implement mitigation measures. Manage the water on the site. Coordinate land use planning efforts with other planning efforts such as emergency operations plans, transportation plans, economic development plans, stormwater management plans, and so forth.

• **Evaluate development in landslide-prone areas** – Use technical information such as maps and reports, including site specific studies as well as broader scale information.

• **Require geotechnical investigations** – When development is proposed for locations that have landslide hazards, require site specific reports by a certified engineering geologist engineer (geotechnical assessment) or a certified engineering geologist and a geotechnical engineer (geotechnical report).

• **Adopt land use policies and enact regulations** – Regulatory tools such as overlay zones, incentive zoning, grading and erosion control provisions, stormwater management, restrictions on the types of uses and development in landslide-prone areas, size and weight of structures, management of vegetation, and other means can reduce risk of landslides. Incentive zoning requires developers to exceed limitations imposed upon them by regulations, in exchange for specific concessions. For example, if the developer avoids building on a landslide-prone area of the property then they could build on another portion of the land at a higher density than is allowed by the zoning.

• **Consider non-regulatory strategies** – Sharing information, incentives, and purchasing high hazard lands to keep them as open space are examples of strategies that can reduce risk.

• **Provide public outreach and education** – Information about the landslide hazards should be available to all inhabitants of the jurisdiction. Post it on the website, have handouts, and raise awareness of the hazard with the public at large.

Volume III: Resources

Photo credits: Prairie City Cemetery by Shannon Springer; lower photo by Grant County Chamber of Commerce

Volume III: Resources

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Appendix A:
Community Profile

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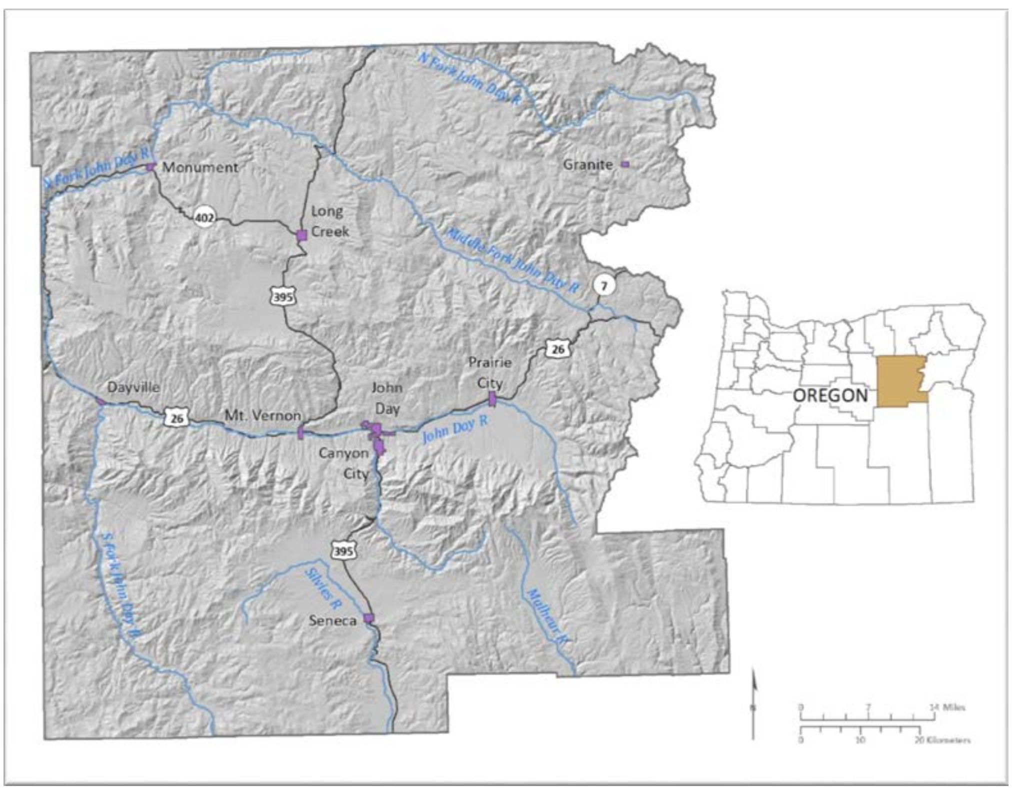
Community Profile

Grant County was established on Oct. 14, 1864, and named for General Ulysses S. Grant, commander of the Union Army during the Civil War. Early in his military career Grant was stationed at Fort Vancouver and assigned to protect the increasing number of travelers on the Oregon Trail. Grant County is located in eastern Oregon and was created out of Wasco and Umatilla Counties. At that time Grant County was the largest county in the state. Its size was later reduced by the transfer of land to Lake County and the creation of Harney and Wheeler Counties. Grant County shares boundaries with 8 counties: Morrow, Umatilla, and Union to the north; Harney to the south; Malheur and Baker to the east; and Crook and Wheeler to the west.

Prior to 1864, cases brought to court were tried in The Dalles, county seat of the vast Wasco County. The great distance from the John Day country to The Dalles made law enforcement a difficult problem and imposed a heavy burden on citizens who had a need to transact business at the courthouse. The settlers, feeling a need for a more centralized county government, successfully petitioned the Legislative Assembly.

Figure 1. Map of Grant County Oregon and its incorporated cities



Source: Department of Geology and Mineral Industries

The first county court session was convened at Canyon City, the county seat, on Nov. 7, 1864. Five officials composed the administration of the county: a judge, sheriff, clerk and two commissioners. A month later the court appointed a treasurer, surveyor, superintendent of schools and coroner. The first county election, held in June 1866, resulted in the election of a county judge, clerk and sheriff. The first courthouse was known as "Dunker's Hall," and the present courthouse was built in 1952. Grant County government consists of a county court made up of a county judge and two commissioners. The county judge retains judicial authority only over probate matters.

After gold was discovered on Whiskey Flat in 1862 the increased population created a need for county government. It is estimated that within ten days of the original discovery of gold 1,000 miners were camped along Canyon Creek. Over $20 million in gold was mined from the Canyon City and Susanville areas. Following the decline of gold and placer mining, stock raising and agriculture became the main work of residents.

Environmental, Demographic and Socio-economic Profile

Grant County contains the headwaters of the John Day River, which has more miles of wild and scenic designation than any other river in the United States. More than 60% of the county's land area is under public ownership, and the county contains parts of four national forests. Principal industries in Grant County include agriculture, livestock, forestry and recreation.

The first census was in 1870 and counted 2,251 persons. The population of Grant County in 2013 was 7,445. This represented a slight decrease from 2010.[1] The county's largest community is the City of John Day and the county seat is the City of Canyon City. Most of the residents in the county reside along the John Day River (see Figure 1 in Volume I, page 8).

Grant County encompasses an area of approximately 4,528 square miles (2,897,238 acres). Approximately 61.6% of the land area of the county is controlled by the Federal Government. Grant County contains most of the Malheur National Forest and sections of the Wallowa–Whitman, Umatilla and Ochoco National Forests, and contains more than 150,000 acres of federally designated Wilderness Areas.

The county has a total of 8,417 buildings, both residential buildings as well as agricultural structures dominate the building inventory. Of the total number of buildings in the county, 4,933 (59%) are in unincorporated areas and collectively they make up an estimated total building value of $1,169,279,000 or about 58% of the total for all buildings in the county as shown in Table 1, below. The data contained in the DOGAMI Risk Assessment also illustrates that the majority of buildings in the county are agricultural structures, but approximately 1,000 structures in unincorporated Grant County are residential in nature.

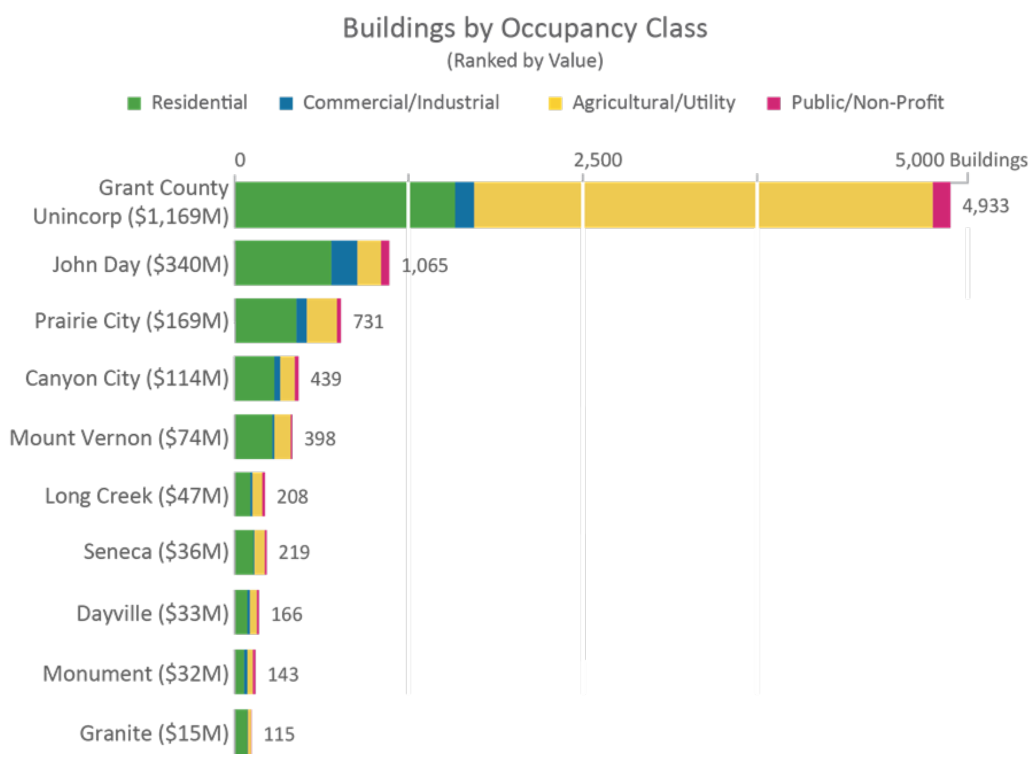
[1] Oregon Blue Book, https://sos.oregon.gov/blue-book/Pages/local/counties/grant.aspx, accessed August 22, 2019

Table 1. Study area building inventory.

Community	Total Number of Buildings	Percentage of Total Buildings	Estimated Total Building Value ($)	Percentage of Total Building Value
Unincorporated County	4,933	59%	1,169,279,000	58%
Canyon City	439	5.2%	114,298,000	5.6%
Dayville	166	2.0%	33,364,000	1.6%
Granite	115	1.4%	15,264,000	0.8%
John Day	1,065	13%	339,542,000	17%
Long Creek	208	2.5%	46,914,000	2.3%
Monument	143	1.7%	32,015,000	1.6%
Mount Vernon	398	4.7%	73,681,000	3.6%
Prairie City	731	8.7%	169,267,000	8.3%
Seneca	219	2.6%	35,692,000	1.8%
Total Grant County	8,417	100%	2,029,317,000	100%

Source: Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Williams, Anthony & O'Brien, DOGAMI, 2019

Figure 2. Community building value in Grant County by occupancy class



Source: Natural Hazard Risk Report For Grant County, Oregon: Final Report to the Oregon Department of Land Conservation and Development, Williams, Anthony & O'Brien, DOGAMI, 2019

Natural Environment

Natural environment capacity is recognized as the geography, climate, and land cover of the area such as, urban, water and forested lands that maintain clean water, air and a stable climate.[2] Natural resources such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. However, natural systems are often impacted or depleted by human activities adversely affecting community resilience.

Geography

The Northeast Region encompasses approximately 12,808 square miles.[3]The region is bordered by the Snake River to east and the Columbia River to the north. Columbia River Basalt lava flows formed the high plateaus of the region; the two major mountain ranges are the Blue and Wallowa Ranges. Major rivers include the John Day, Grande Ronde, the Powder, and the Snake.[4]

Blue Mountains

The Blue Mountains extend from the northeast corner of the state into the John Day Valley. It extends east to the Snake River Canyon, northwest to the Columbia Plateau and south to the High Lava Plains and Owyhee Plateau.[5] The range forms sub-ranges including the Elkhorn Mountains in western Baker and northeastern Grant counties; and the Strawberry Mountains in central Grant County.[6] The Blue Mountains drain into the Grande Ronde, Imnaha, Wallowa, and John Day Rivers.[7]

The Blue Mountains are not a single cohesive range, but rather a complex of ranges and inter-mountain basins and valleys that extend from southeast Washington into central Oregon, ending near Prineville.

Aldrich Mountains

The Aldrich Mountains are an east–west range rising south of the John Day River valley, the mountains are bounded on the west by the South Fork John Day River, on the south by Murderers Creek and the Bear Valley, and on the east by Canyon Creek.[8] Most of the Aldrich Mountains and the mountainous terrain south of them are contained within the Malheur National Forest. The highest point in the range is Fields Peak at 7,362 feet (2,244 m), and the nearest human settlement is Mount Vernon, located in the John Day River valley.[9] Across the South Fork John Day River to the west are the Ochoco Mountains, while across Canyon Creek to the east is the Strawberry Range.

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[2]Mayunga, J. 2007. Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer Academy for Social Vulnerability and Resilience Building.

[3] Oregon Blue Book, County Government, http://bluebook.state.or.us/local/counties/counties.htm; *Baker 3,089 sq. mi., Grant 4,528 sq. mi., Union 2,038 sq. mi., 3,153 sq. mi;* Accessed May 2013

[4] Loy, W.G., ed. 2001. *Atlas of Oregon*, 2nd Edition. Eugene: University of Oregon Press.

[5] Idaho Power Boardman to Hemingway Transmission Line Project; Exhibit H

[6] Oregon State University "Blue Mountain Ecological Province" http://oregonstate.edu/dept/range/sites/default/files/EcologicalProvincesOfOregon/blue_mountain.htm Accessed May 2013

[7] Idaho Power Boardman to Hemingway Transmission Line Project; Exhibit H

[8] Oregon Road & Recreation Atlas (Map) (Third ed.). Medford, Oregon: Benchmark Maps. 2006. pp. 65–66. ISBN 0-929591-88-7.

[9] "Field's Peak Trail #212". U.S. Forest Service. Retrieved July 27, 2018.

Ochoco Mountains

The Ochoco Mountains in central Oregon form the western end of the Blue Mountains province. The Ochoco portion of the province is part of a wide uplifted plateau made of rocks from the Permian, Triassic, and Jurassic periods (300 to 200 million years old) that were transported by the Pacific Plate and accreted in the late Mesozoic era (about 100 million years ago) as part of a vast shallow sea, then slowly uplifted by volcanic eruptions during the Eocene epoch (50 to 37 million years ago) to form the Clarno Formation. From 37 to 17 million years ago, eruptions in the western Cascade Range spread ash across eastern Oregon, forming the John Day Formation. From 17 to 14 million years ago, major volcanic eruptions covered much of the province with basalt flows, creating the Columbia River Basalt Group. Since then, continued faulting and uplift has resulted in a deeply eroded landscape. Steins Pillar is an excellent example of this erosion.[10]

During the Eocene epoch, central Oregon volcanoes deposited layers of lava and ash up to 1,000 feet (300 m) thick over the area that is now the Ochoco Mountains. Large mudflows called lahars were also common during that period. These mudflows often covered and preserved the plants and animals, resulting in fossil beds. Today, fossils of prehistoric trees, fruits, nuts, and flowers can be found in the Ochoco Mountains along with fossilized animals including horses, camels, rhinoceros, and hippopotami.[11]

Surface Water Resources

Grant County is situated at the headwaters of three principle watersheds, the John Day River, the Silvies River and the Malheur River.

Most of Grant County is drained by the four forks of the John Day River, all of which have their headwaters in the county. The John Day River system drains some 7,900 square miles. It is the third longest free-flowing river in the lower 48 states and has more miles of federal ‘Wild and Scenic River’ designation than any other river in the United States.

The river system in Grant County includes the upper 100 miles of the Main Stem, all of the 112 miles of the North Fork, all 75 miles of the Middle Fork, and all 60 miles of the South Fork of the John Day River. From Grant County, the lower John Day River flows another 184 miles to its confluence with the Columbia River. The southeastern corner of the county includes the headwaters of the Malheur and Little Malheur rivers, which find their way to the Snake River. The southern part of Grant County includes the northern-most reaches of the Great Basin, including the Silvies River watershed, which flows south into Harney Lake in the High Desert of Eastern Oregon. A small area in the southwestern corner of Grant County is in the Crooked River and Dechutes River watersheds

Grant County has several natural lakes. Their name, township and range location and ownership are listed below:

- Magone Lake T12S R32 E Section 6, 7 US Forest Service

[10] "Blue Mountains Province", Deschutes and Ochoco National Forests, United States Forest Service, United States Department of Agriculture, Bend, Oregon. Archived from the original on 3 September 2005.

[11] "Additional Points of Interest - Geology of Central Oregon", Prineville Crook County Chamber of Commerce, Prineville, Oregon. Archived from the original on 6 October 2011

• Strawberry Lake	T14S R34E Section 31	US Forest Service
• Slide Lake	T15S R34E Section 8	US Forest Service
• Bull Prairie	T6N R26E Section 7	US Forest Service
• Unnamed Lake	T18S R32E Section 6	Private Ownership
• Olive Lake	T9S R34E Section 15	US Forest Service
• Lost Lake	T9S R34E Section 8	US Forest Service
• Upper Reservoir	T9S R34E Section 22	US Forest Service Wilderness Area
• Buddy Lake	T8S R36E Section 21, 28	US Forest Service
• Crawfish Lake	T7S R36E Section 23	US Forest Service
• Unnamed Lake	T15S R30E Section 31	Private Ownership
• Unnamed Lake	T15S R30E Section 33	Private Ownership
• Unnamed Lake	T13S R30E Section 33	Private Ownership

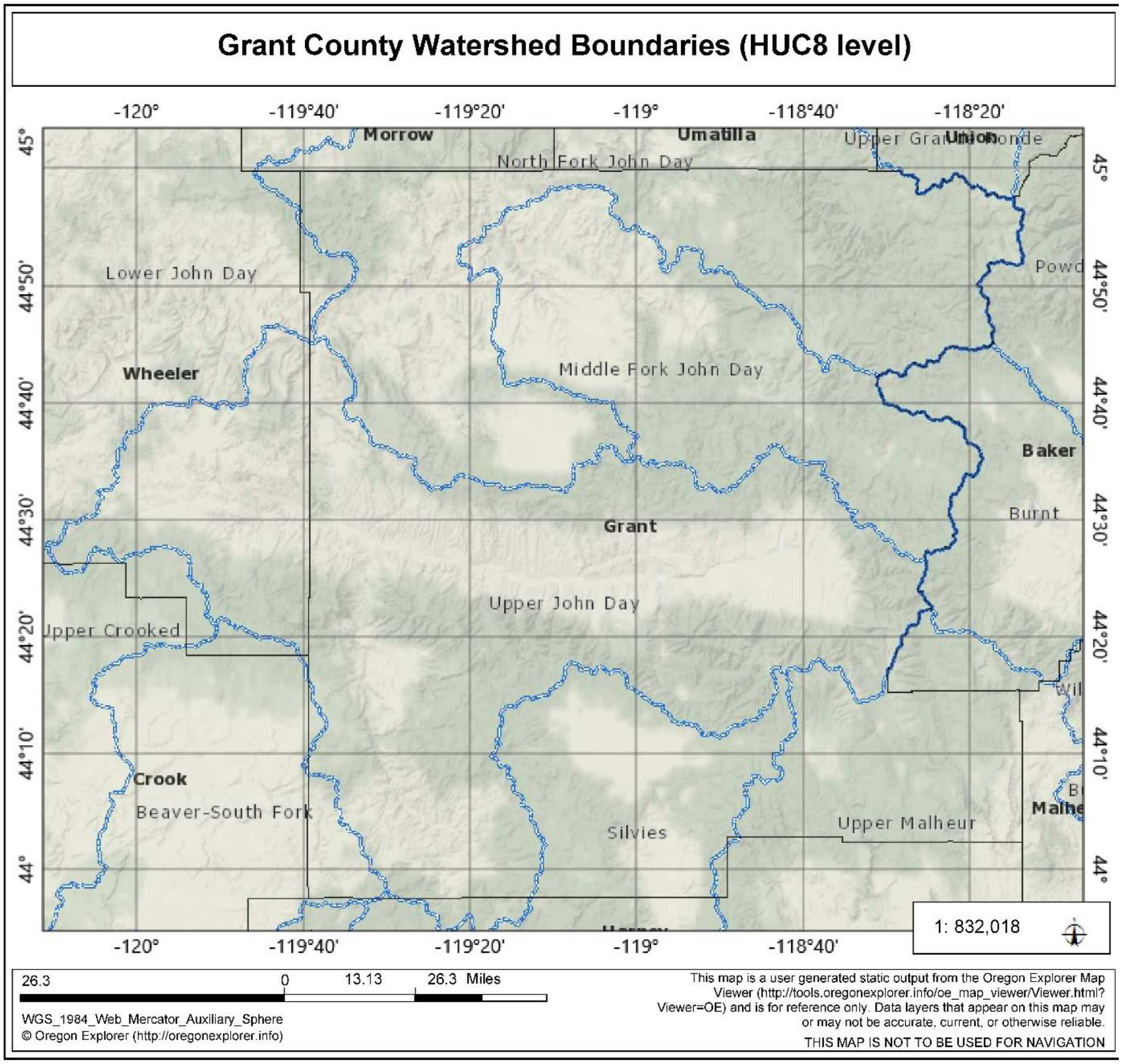
Grant County also has one man-made water storage reservoir at Bates State Park,T11S R35E Section 28.

The Oregon Water Resources Department (OWRD) supports the Water Resources Commission which determines the policies and procedures for the use and control of the state's water resources. The OWRD recently developed a new Strategic plan. One of the key objectives is to continue to improve its work in addressing instream and out-of-stream water supply needs now and into the future.[12] The Program includes funding opportunities and other resources through three program components: Planning Grants, Feasibility Study Grants, and Water Project Grants and Loans. In 2019, the Grant Soil and Water Conservation District applied for funding to perform an aquifer management feasibility study and in 2018 The Freshwater Trust applied to conduct an irrigation efficiency and conveyance upgrade project in the Upper John Day River basin.[13] The Blue Mountain Eagle reported that five John Day River restoration projects will receive $489,100 in funding from the Oregon Watershed Enhancement Board. The North Fork and South Fork watershed councils will use the funding to enhance fish and wildlife habitat for chinook salmon, steelhead and bull trout, restore clean water, increase water quality and reduce fire risk.[14]

The figure below illustrates the location the sub-basins of the John Day watershed.

[12] OWRD Strategic Plan 2019-2024, https://www.oregon.gov/owrd/wrdreports/OWRD_2019-2024_Strategic_Plan_Final.pdf
[13] Oregon Water Resources Department, https://www.oregon.gov/owrd/Pages/index.aspx
[14] Blue Mountain Eagle, July 30, 2019, https://www.bluemountaineagle.com/news/state-funding-will-support-five-river-projects/article_9950782e-8ee6-11e9-96cf-87e322974b9e.html

Figure 3. John Day Watershed sub-basins



Source: Oregon Explorer

John Day River

The John Day River is a tributary of the Columbia River and drains from the Blue Mountains before entering the Columbia River Gorge. The John Day River is the longest free flowing river in the United States. The John Day River system represents the watershed for most of Grant County, primarily the northern half, drained by the four forks of the John Day River.[15]

[15] Grant County CWPP 2013 "2.2 Existing Conditions"

Silvies River

The Silvies River extends through the southern portion of Grant County into Harney County and drains approximately 1,275 square miles of the northern Harney Basin. The headwaters are near the flank of the Aldrich Mountains and the river runs roughly south where it empties into Malheur Lake, near Burns, Oregon.

Malheur River

The Malheur River is a 190-mile-long tributary of the Snake River in eastern Oregon in the United States. It drains a high desert area, between the Harney Basin and the Blue Mountains.

Watershed Councils

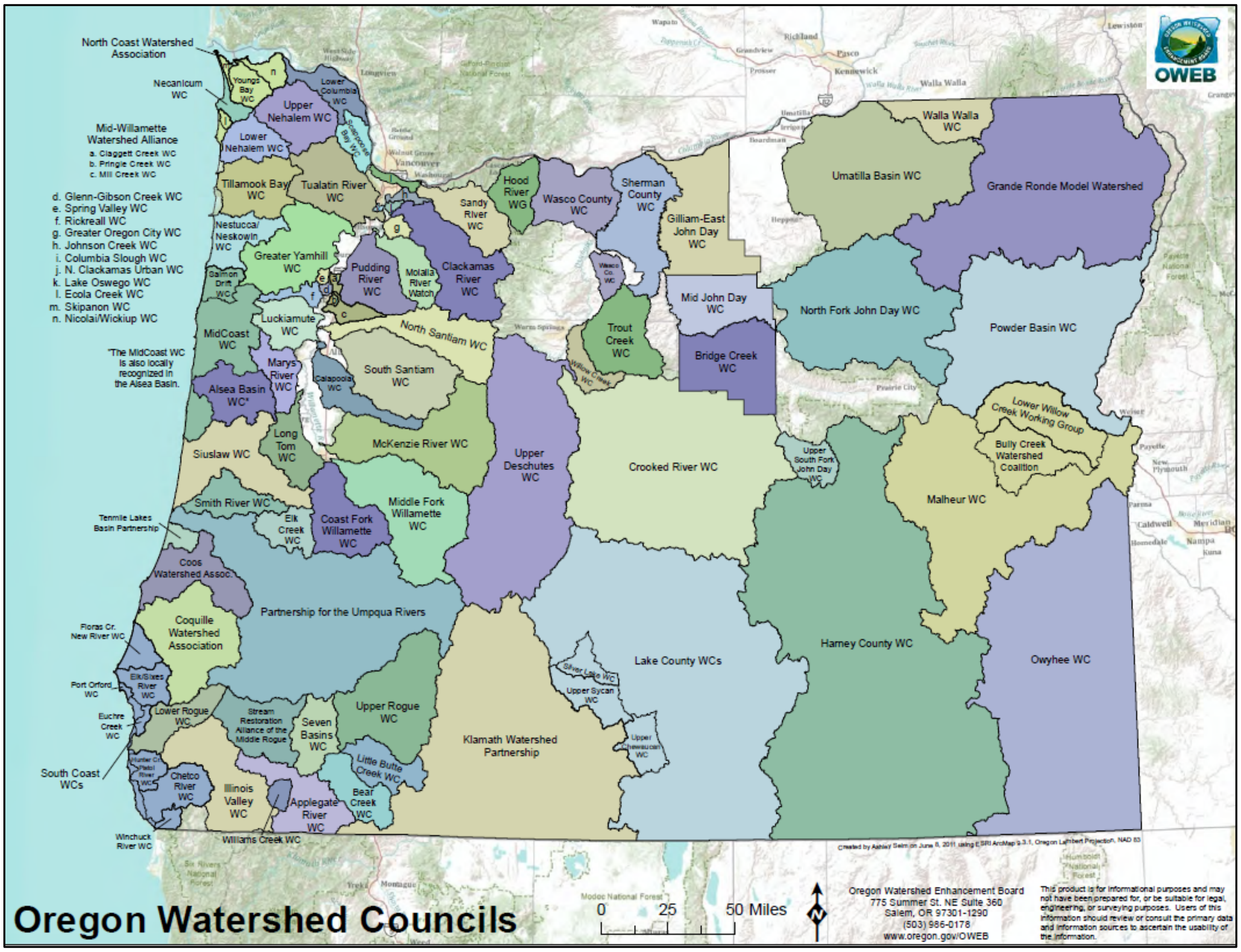
A watershed council is a community-based, voluntary, non-regulatory group that meets regularly in their local communities to assess conditions in a given watershed (usually a river or creek and the lands that drain into them) and to conduct projects to restore or enhance the waters and lands for fish and native plants in their areas. Oregon is one of the few states to have this community-based model – supported by the state and recognized by local governments – to focus on restoring land and water from "ridgetop to ridgetop." Four Watershed Councils represent portions of Grant County: North Fork John Day WC, South Fork John Day River WC, Malheur WC and Harney County WC. Grant County is situated at the headwaters of three principle watersheds, the John Day River, the Silvies River and the Malheur River.

Table 2. Area Watershed Council Contact Information

WC Name	Contact Person	Address	Phone number	Email address	Website
North Fork John Day WC	Valeen Madden	PO Box 444, Long Creek, OR 97856	(541) 421-3018	valeen@nfjdwc.org	http://nfjdwc.org/
South Fork John Day River WC	Amy Stiner	PO Box 522, Mt. Vernon, OR 97865	(541) 792-0435	astiner@outlook.com	http://www.southforkjohnday.com
Harney County WC	Karen Moon	PO Box 1289 Hines, OR 97738	(541) 573-2000	HCwatershedcouncil@gmail.com	http://hcwatershedcouncil.com/
Malheur WC	Ken Diebel	710 SW 5th Ave., Ontario, OR 97914	(541) 910-4034	diebelk12@gmail.com	http://malheurwatershed.org/
Mid John Day Bridge Creek WC	Debra Bunch	40535 Hwy 19, Fossil OR 97830	(541) 468-2990	debrabunch@gmail.com	

Source: https://www.oregon.gov/oweb/resources/Pages/Watershed-Councils.aspx

Figure 4. Location of Oregon Watershed Councils



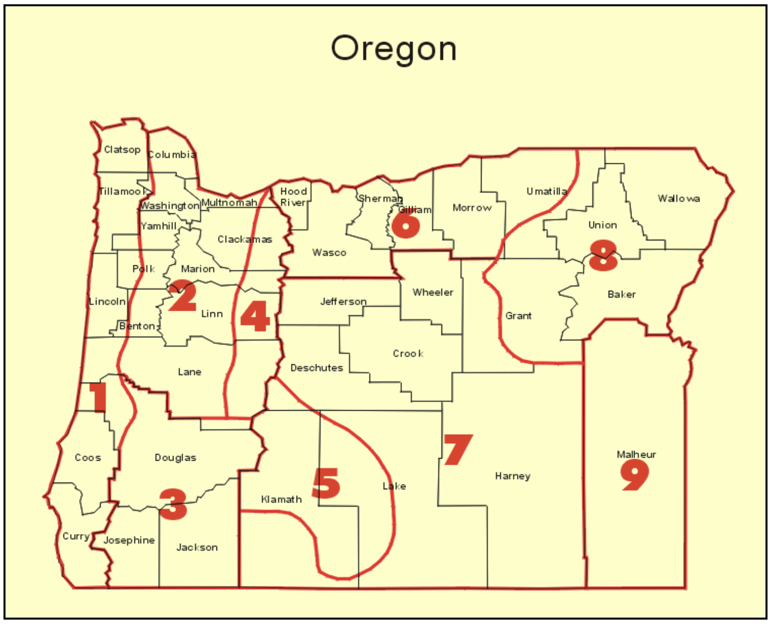
Source: Oregon Watershed Enhancement Board "Watershed Councils in Oregon"
https://www.oregon.gov/oweb/resources/Pages/Watershed-Councils.aspx

Climate

The eastern half of Grant County is within NOAA's Climate Division 8 and the western third is in Climate Division 7 as shown in Figure 3 below. The region is generally dry and there are large seasonal variations in temperature ranging from high temperatures of 80 to 90 degrees F from June to September to average highs of low teens in the winter months. In most winters, there are frequent and severe winter storms characterized by temperature, wind velocity, ground saturation, and snow pack. Winter storms can slow or halt traffic, damage power lines, and kill livestock.[16]

[16] Climate divisions are created by the National Oceanic Oregon and Atmospheric Administration to separate regions that have similar climates.

Figure 5. Map of Climatic Divisions



Source: National Oceanic and Atmospheric Administration, National Weather Service “Climate Divisions within Counties”

Precipitation: Rainfall and Snowfall

The average annual precipitation is mostly uniform at the different NOAA stations throughout the county. See Figure 5 below for precipitation (inches) for different NOAA Stations across the county. The highest and lowest levels are within 10 inches of one another. Average annual precipitation ranges from just over 11 inches of rain at Dayville 8 NW NOAA Station to just over 21 inches of rain at the Austin 3 S NOAA Station. Annual precipitation for the four counties is almost always below 20 inches. Areas of higher elevation generally have larger annual rainfall and areas of lower elevation have lower annual rainfall.

Precipitation tends to spike in spring and again in the late fall. Monthly distribution compared to the rest of Oregon is mostly uniform throughout the year, and well distributed across the months.

Snowfall similarly varies by elevation, ranging from approximately seven (7) inches at the Dayville station to nearly 88 inches at the Austin station.

Temperature and Climate Change Variability

Grant County usually experiences freezing winters and hot dry summer days. Seneca, located in the Blue Mountains at 4,690 feet elevation holds the record for the coldest temperature in Oregon at -54°F. The county also sees blistering summers when maximum daytime high temperatures can exceed 100°F. Figure 7 below shows monthly average temperatures averaged over a 30 year period from 1981 to 2010.

Figure 6. 30 Year Temperature Averages in Grant County (1981-2010 averages)

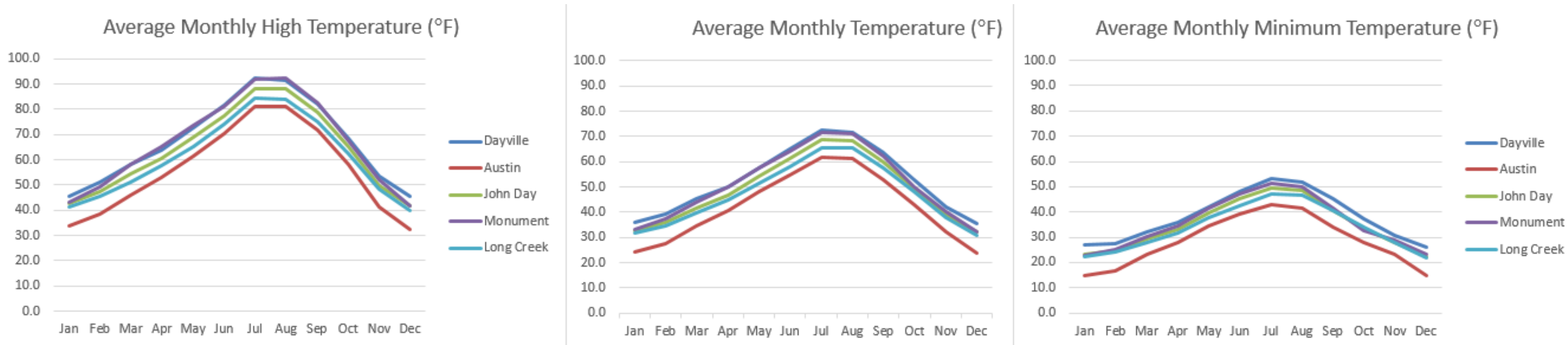
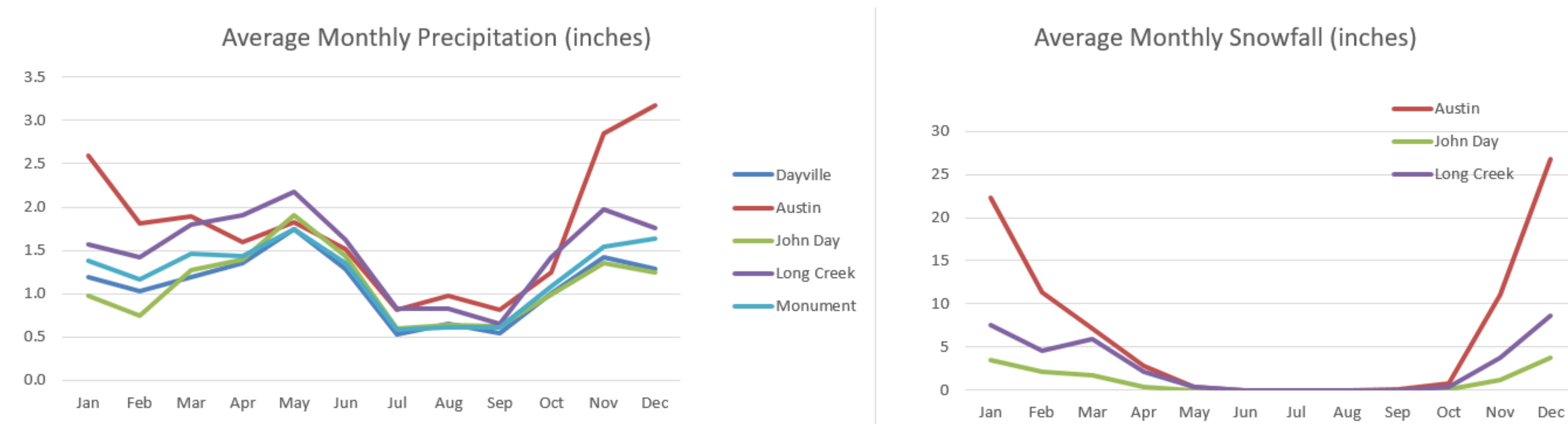


Figure 7. 30 Year Average Monthly Precipitation and Snowfall in Grant County (1981-2010 averages)



Source: NOAA National Centers for Environmental Information 1981-2010 Normals, https://www.ncdc.noaa.gov/cdo-web/datatools/normals data for the following NOAA stations: Dayville 8 NW, Austin 3 S, John Day, Long Creek, and Monument

Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures. [17]

In Grant County, the frequency of hot days per year with temperatures at or above 90°F is projected to increase on average by 27 days (ranging from 10 to 38 days), by the 2050s under the higher emissions scenario relative to the historical baselines. This average increase represents a more than tripling of hot days relative to the average historical baseline.[18]

In Grant County, the temperature of the hottest day of the year is projected to increase on average by nearly 8°F, (ranging from 3 to 11°F), by the 2050s under the higher emissions scenario relative to the historical baselines. Temperature increases will occur throughout all seasons, with the greatest differences in summer months.[19]

Increasing temperatures affects hydrology. Spring snowpack has substantially decreased throughout the Western part of the United States, particularly in areas with milder winter temperatures, such as the Cascade Mountains. In other areas of the West, such as east of the Cascades Mountains, snowfall is affected less by the increasing temperature because the temperatures are already cold and more by precipitation patterns. Spring flooding could be affected by warming climate. Mid- to low-elevation areas in Grant County's Blue Mountains that are near the freezing level in winter, receiving a mix of rain and snow, are projected to experience an increase in winter flood risk due to warmer winter temperatures causing precipitation to fall more as rain and less as snow. [20]

Demographics

Grant County Residents

With 7,176 residents in 2018, Grant County had the 5th lowest population among Oregon counties. About 60% of all residents are concentrated in five cities along the Highway 26 corridor that runs east-west through the County. These include the cities of Prairie City (2018 pop. 878), John Day (2018 pop. 1,665), Canyon City (2018 pop. 668), Mt. Vernon (2018 pop. 512) and Dayville (2018 pop. 144). Outside of this corridor are the towns of Seneca (2018 pop. 207) to the south, and Monument (2018 pop. 124), Long Creek (2018 pop. 189), and Granite (2018 pop. 37) to the north. The remainder of county residents are scattered in other small hamlets and unincorporated areas across a large, remote and rugged farm and forest land interspersed by wild river valleys and robust canyon lands.

Between the years 2010 and 2018, the total population of Grant County decreased by 3.6%. However, Eastern Oregon's[21] population as a whole increased by 8,048 people during this eight year time period. Natural increase (+4,508) combined with net in migration (+3,540) pushed the total number of residents in the region to 190,180 people.

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[17] Future Climate Projection Grant County, OCCRI, February 2020

[18] Ibid.

[19] Ibid

[20] Ibid.

[21] Eastern Oregon is comprised of the following counties: Wallowa, Umatilla, Union, Morrow, Grant, Baker, Harney and Malheur.

However, even with the increases, population growth rate in Eastern Oregon (4.4%) was less than half the overall growth rate in the State of Oregon (9.5%) for the period. While natural increase (births minus deaths) and net migration (in-migrants minus out-migrants) were both positive for the region, the two components varied among individual counties, creating notable differences in population shifts over time. According to Oregon Employment Department and Portland State University Population Research Center Grant and Harney Counties were the only ones in Eastern Oregon to experience a loss in population for the eight-year period.

Table 3. Grant County – Incorporated Cities Population 2000 & 2018.

Community	Population 2010	Population 2018	Change in population	Percent change
Canyon City	703	668	-35	-5.0%
Dayville	149	144	-5	-3.4%
Granite	38	37	-1	-2.6%
John Day	1744	1665	-79	-4.5%
Long Creek	197	189	-8	-4.1%
Monument	128	124	-4	-3.1%
Mt. Vernon	527	512	-15	-2.8%
Prairie City	909	878	-31	-3.4%
Seneca	199	207	8	4.0%
Sub-total of Cities	4594	4424	-170	-3.7%
Unicorporated Grant County	2851	2752	-99	-3.5%
Total	7445	7176	-269	-3.6%

Source: US Census Population and Housing Unit Estimates, consulted May 2020

Vulnerable Population Groups

People of certain population groups may be more vulnerable to natural hazards by virtue of age, both the youngest and the oldest; language, non-native English speakers, for example; educational background and household characteristics. Combinations of these factors may further exacerbate vulnerability. Elderly residents living alone are among the most vulnerable during natural disasters.

Age

Both children and the elderly are more vulnerable than are others to the risks posed by natural hazards.

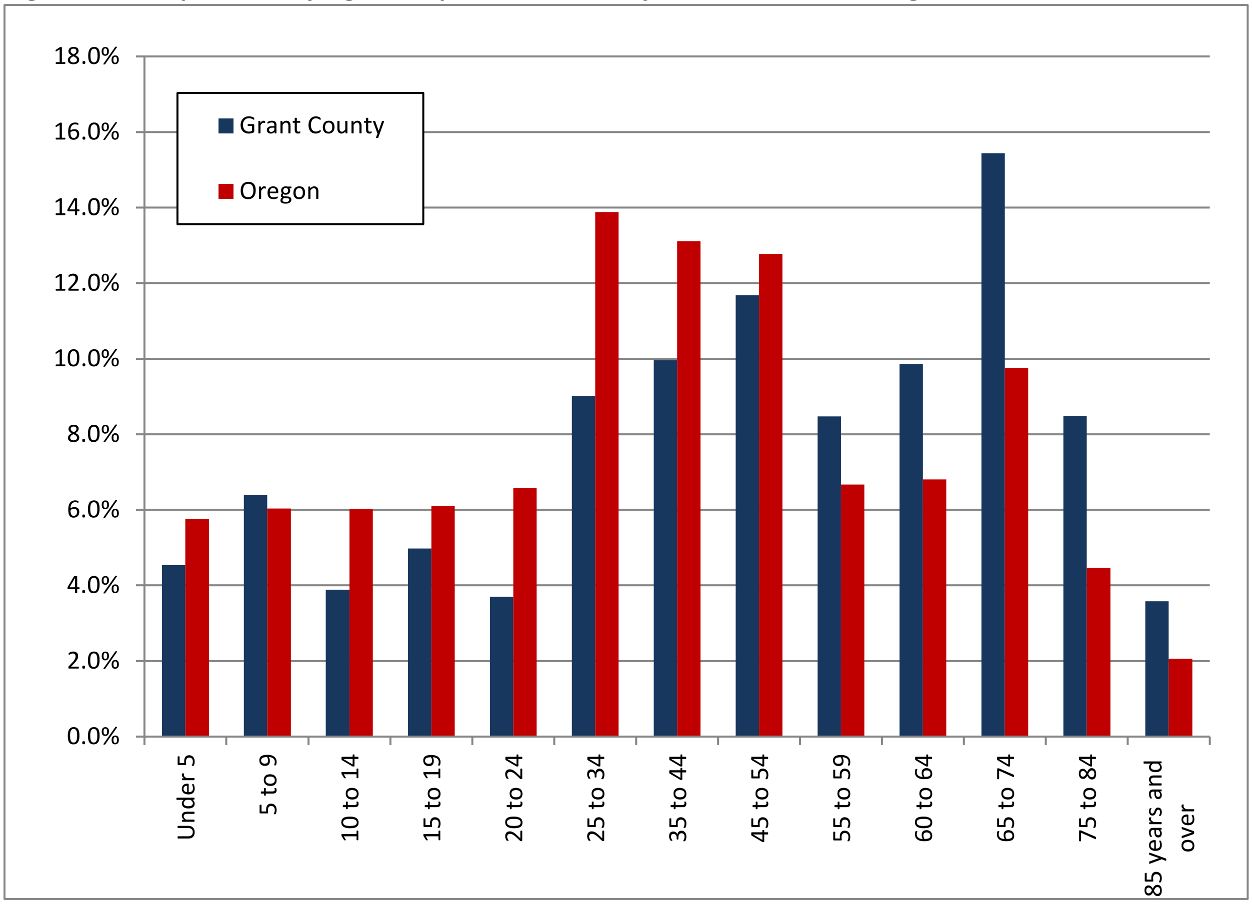
Many seniors are sensitive to heat and cold, reliant upon public transportation or other people to transport them to obtain medication and access medical facilities, and have comparatively more difficulty in making home modifications that reduce risks to hazards. In addition, seniors may be reluctant to leave home in a disaster event. This implies the need for targeted preparatory programming that includes evacuation procedures and shelter locations accessible to seniors.[22] Seniors living alone may have more challenges knowing about and responding to a disaster than those living with other people.

[22] Oregon NHMP: Oregon Department of Land Conservation and Development, 2015

Young children are also more vulnerable to heat and cold, have fewer transportation options, and require assistance to obtain medication and access medical facilities. In addition, parents may lose time and money when childcare facilities and schools are impacted by disasters. Therefore, special consideration should also be afforded young children, schools, and parents during the natural hazards mitigation process.[23]

Figure 6 below shows Grant County's population by age group. Like many rural areas, the percentage of the population over 55 is relatively high for Grant County, especially compared to the State of Oregon as a whole.

Figure 8. Population by Age Group in Grant County and the State of Oregon



Source: U.S. Census Bureau, 2013---2017 American Community Survey.

Language

Special consideration should be given to populations who do not speak English as their primary language. Language barriers can be a challenge when disseminating hazard planning and mitigation resources to the general public, and it is less likely they will be prepared if special attention is not given to language and culturally appropriate outreach techniques. A small proportion of Grant County's population speaks a language other than English at home. While the vast majority of residents speak

[23] Ibid.

only English at home (95%), there are over 300 county residents who languages other than English at home. Spanish speakers comprise the majority of those.

Education

Educational attainment of community residents is also identified as an influencing factor in socio-demographic capacity. Educational attainment often reflects higher income and, therefore, higher self-reliance. Widespread educational attainment is also beneficial for the regional economy and employment sectors supporting potential employment in the professional, governmental and service sectors. An oversaturation of either highly educated residents or low educational attainment can have negative effects on the resiliency of the community.

According to the U.S. Census, 33.3% of the Grant County population over 25 years of age has graduated from high school or received a high school equivalency, with approximately 10.7% going on to earn a Bachelor's Degree.[24] In 2017-2018, the county's largest school - Grant Union High School - had an on time graduation rate of 86%. 97% of students earned their high school diploma or GED within five years. The county's 2nd largest school, Prairie City School, showed similar attainment.

Living Arrangements

As described in Volume I as part of the Vulnerability Assessment the 2020 Grant County NHMP Steering Committee identified people living in poverty as a vulnerable population. The American Fact Finder data for 2017 estimates that there were a total of 3,176 households (family and non-family households) in Grant County. Among the most vulnerable people are people living below the poverty line whether they live in families or not. Of all families in Grant County, 8.6% or 172 families of the total 2,002 families in Grant County are families whose income in the preceding 12 months was below the poverty level. Of families headed by a female householder with children under 5 years old in Grant County, 38% or 71 of these 187 single female parent families were living in poverty. Of people living alone, 335 single person households or others not living in families are living below the poverty line in Grant County. [25]

Seniors living alone may have more challenges knowing about and responding to a disaster than those living with other people. Based on the US Census American Fact Finder data for 2017 out of the 3,176 households in Grant County, 973 households were 1-person households. Of these 1-person households, 50.3% or 490 households are people over 65 years old living alone in Grant County.[26]

Home Ownership

Housing occupancy data may relate to factors that influence resilience to natural hazards, both positively and negatively. On the positive side, length of occupancy in the same residence may reflect how strongly people are tied to their community. Strong community ties may support community resilience in the face of a flood or fire. In addition, those who own their homes may be more likely to prepare their homes to be more resistant to natural hazards, such as maintenance of defensible space to combat the threat of wildfires.

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[24] US Census, 2018 American Community Survey (Educational Attainment), consulted May 2020
[25] US Census, consulted May 2020
[26] Ibid.

In Grant County, there are 3,176 housing units, of which 2,323 (73.1%) are owner occupied. This is well above the Oregon statewide average of 61%.[27] Of the owner occupied housing in Grant County, a high percentage – 54.5% - is not burdened by a mortgage.[28] Requirements may be place on owners by mortgage lenders, such as obligatory flood insurance purchase for structures located in the FEMA floodplain. However, those home owners who do not hold mortgages, may drop flood insurance policies after the mortgage is paid off, particularly if household income is limited.

Economics

Income and Poverty

Household income and poverty rates are indicators of the stability of the local economy and broader community resilience to natural hazards. People living in poverty suffer a disproportionate burden from disasters. They are more likely to be isolated and less likely to have the assets to withstand economic setback. When a disaster interrupts work, the ability to provide housing, food, and basic necessities becomes increasingly difficult. In addition, low-income populations are hit especially hard as public transportation, public food assistance, public housing, and other public programs upon which they rely for day-to-day activities are often impacted in the aftermath of the disaster. [29]

Median household income across Grant County in 2018 was $45,357. Between 2010 and 2018 median income rose significantly in some cities within Grant County. Table 2 below shows the change in median household income for the state, the county and the cities in Grant County from 2010 to 2018, as well as the household poverty rate for those jurisdictions.

[27] Ibid.
[28] Ibid.
[29] FEMA Local Mitigation Planning Handbook, 2013

Table 3. Median Household Income and Households below the Poverty Level

Community	Median Household Income 2010	Median Household Income 2018	% Change	2010 % of Families in Poverty	2018 % of Families in Poverty
Oregon	$46,560	$63,426	36.2%	15.8%	12.6%
Grant County	$35,974	$45,357	26.1%	11.4%	7.6%
Canyon City	$47,917	$50,781	6.0%	11.4%	5.3%
Dayville	$27,321	$38,750	41.8%	0%	0%
John Day	$31,833	$40,192	26.3%	12.7%	11.4%
Long Creek	$20,833	$36,667	76.0%	17.7%	22.0%
Mt, Vernon	$34,180	$37,500	9.7%	10.6%	8.3%
Prairie City	$37,731	$48,646	28.9%	14.3%	10.2%
Seneca	$32,500	$39,659	22.0%	10.1%	1.5%

Source: US Census Bureau (https://www.census.gov/), Tables S1901 and S1702 consulted May 2020.

Within the wider region of Eastern Oregon, in 2017 the combined personal income of the residents of Baker, Grant, Harney, Malheur, Morrow, Umatilla, Union, and Wallowa counties) totaled about $6.8 billion in 2017, up from $5.1 billion in 2008, a growth rate of 33 percent. Baker County had the highest rate of personal income growth in the area (41%), followed by Grant (39%), Harney (34%), Wallowa (34%), Umatilla (33%), Morrow (32%), Malheur (30%), and Union (29%). Eastern Oregon's rate of growth was well below Oregon's statewide growth of 43%.

These data would suggest that those communities with higher poverty rates bear a disproportionate burden from disasters; those families in poverty are more likely to be isolated and when work is interrupted by a disaster, the ability to provide housing, food, and basic necessities becomes increasingly difficult for them.

Employment and Wages

According to the Oregon Employment Department and shown in Table 3 below, unemployment declined from 2009 to 2018 reflecting recovery from the Great Recession of 2008. However, unemployment in northeastern Oregon, remains higher than the State unemployment rate.

The understanding of the impact on unemployment by the COVID-19 pandemic in 2020 remains incomplete at the time of this writing. An April 21, 2020 Press Release from the Oregon Employment Department reported that statewide the department received 53,800 initial claims for unemployment benefits from April 5-11. That's in addition to a revised total of 243,000 initial claims filed during the prior three weeks, March 15 to April 4. In comparison, the Employment Department received just

14,820 initial claims during the comparable four-week period in 2019 (March 17 to April 13). This surge in claims is unprecedented.[30]

In Eastern Oregon, initial claims had surged as well, with 2,473 processed initial unemployment insurance claims for the four-week period, March 15 to April 11. This represents a significant increase over the 379 claims during the comparable four-week period in 2019. All Eastern Oregon counties have seen a relatively large upswing in unemployment insurance claims. The majority of claims have come from four industries: accommodation and food services, health care and social assistance, manufacturing, and retail trade. [31]

Table 4. Unemployment Rates in Northeast Oregon (Region 7)

Community	Employment 2009	Employment 2018	Unemployment Rate 2009 (%)	Unemployment Rate 2018 (%)	% Change in Unempl. Rate
Oregon	1,608,760	1,920,804	11.3%	4.2%	-62.8%
Grant County	2,319	2,482	13.7%	7.3%	-46.7%
Baker County	5,286	5,544	10.4%	5.5%	-47.1%
Union County	9,447	10,173	11.6%	5.4%	-53.4%
Wallowa County	2,362	2,572	12.0%	6.1%	-49.1%

Source: Oregon Employment Department, Local Area Unemployment Statistics, accessed August 29, 2019.

NHMP Plan Holders - Jurisdictions and Institutions

Grant County

Grant County is located in the northeastern portion of the state and is bordered by Morrow, Umatilla, and Union Counties on the north, Baker and Malheur Counties on the east. Harney County on the south and Crook and Wheeler Counties on the east. The total area of Grant County is 4,528 square miles (2,897,238 acres). A significant portion of the county (61.6%) is federally or state owned with about 54.5% of the area of the county comprised of the Malheur National Forest (1,128,931 acres) and sections of the Wallowa–Whitman (82,834 acres), Umatilla (309,144 acres) and Ochoco (57,805 acres) National Forests of which more than 150,000 acres are federally designated Wilderness Areas.[32]

The geography of Grant County consists of the rugged Blue Mountain range, which is a part of the Columbia River Plateau. Grant County features river canyons and high plateaus, which are interspersed with wide grasslands. The headwaters of the John Day, Malheur, North Fork John Day, and Silvies Rivers all originate within Grant County.

[30] Oregon Employment Department, April 21, 2020 Press Release
[31] Ibid.
[32] Grant County Community Wildfire Protection Plan (2013)

The economy of Grant County historically has been mainly forest products, livestock, hunting, and recreation. Since 2005, there has been a significant decline in the forest products infrastructure in the county due primarily to the lack of consistent and stable supply of suitable raw materials. Agriculturally, the county is primarily livestock country with vast spring, summer and fall temperature ranges. In addition to beef cattle, which are the dominant livestock interest, there is also some raising of horses. Field crops grown on commercial basis include alfalfa, grass hay, with very small acreages in wheat, oats, and rye.

City of John Day

The City of John Day sits at the intersection of State Highways 26 and 395 and in 2018 had a population of 1,665 people, making it the largest city in the county.[33] It was named for the John Day River which runs east to west through the city. The County seat of Canyon City is adjacent to John Day to the south. The city is at an elevation of 3,087 feet and is surrounded by the Strawberry Range to the south other ranges of the Blue Mountains to the east and west.

Historically, industrial and agricultural businesses like gold mining, sheep and cattle ranching, timber harvesting, and lumber milling have been the economic mainstays of the community. Today, the economy of John Day is dominated by four industries: educational services, health care and social assistance, agriculture and government services.[34]

However, three decades of steady population decline has left the City of John Day struggling to find sufficient revenue to fund basic public services. The disruption to the natural resource-based economy in the 1990s and the subsequent loss of family-wage jobs created a vacuum filled largely by the unemployed, marginally employed and by retired residents living on fixed incomes.

The City has multiple initiatives focused on recovering financially and stemming the tide of population decline. It embraces being globally interconnected to digital economy of the Information Age. The strategy for growth views residents as customers who have a choice about where they live and where they spend their money. Today, the City is losing market share because its customers are leaving, and those customers are leaving because the City is not providing the amenities that will keep them here. A new strategy is being developed that clearly aligns spending priorities, investment options and decision-making with the growth they need to revitalize their community.[35] Resilience to natural hazards can be part of that strategy. A community that has a strong, well rounded economy can more easily mitigation for natural hazards, but recover from them when they do occur.

Grant County Education Services District

The mission of Grant County Education Service District (ESD) is to assist school districts and the State of Oregon in providing excellent and equitable educational opportunities and successful learning environments for all Grant County students. Grant ESD is dedicated to providing leadership in helping to achieve Oregon's education goals and working in partnership with schools and the community to enhance the healthy development of children and their families.

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[33] US Census American Fact Finder 2018 Population Estimates
[34] Ibid
[35] A Strategy for Growth, John Day City Manager, January 24th, 2017

Grant ESD meets the challenge of its mission by providing services to its constituent districts that serve over 800 students in a 4,500 square-mile area. Schools and school districts within the Grant County ESD include: Grant School District which is comprised of Grant Union Junior and Senior High School, Humboldt Elementary, and Seneca Elementary; Dayville School District, Long Creek School District, Monument School District and Prairie City School District.

Grant School District

Grant School District is developing a long-range plan to address millions of dollars of needed repairs to its three schools and the district offices. In January 2020, the district received an estimate for the cost of major repairs at Humbolt Elementary, Grant Union Junior-Senior High School, Seneca Elementary and the District Office and is weighing the costs and benefits of repairs or replacement.[36]

The Grant School District, headquartered in Canyon City, OR and is made up of the three schools described below.

Grant Union Junior and Senior High School

Grant Union Junior and Senior High School is a public school located in the City of John Day. It serves grades 7 through 12. Enrollment in 2017-18 was 261 students. The south end of the building was seismically retrofitted with $1,234,950 in funding from Business Oregon. The principal risk posed by natural hazards is flooding. The impact of ground water seepage exacerbates the risk of riverine flooding.

Humbolt Elementary

Humboldt Elementary School is a public school located in the City of John Day. It serves grades K through 6. Enrollment in the 2017-18 school year was 309 students. The lower building was retrofitted to resist seismic damage with a $942,300 award from Business Oregon. Heating and cooling upgrades in seven of fourteen classrooms were completed recently. The electrical system dates from the 1960s and poses a fire hazard.[37] These repairs are a priority for the school district.

Seneca Elementary

Seneca Elementary School is a public school located in Seneca, Oregon. It serves grades K through 6. Enrollment in the 2017-18 school year was 31 students.

Dayville School District

Dayville Elementary School is a public school located in Dayville, Oregon. It serves grades K through 12. Enrollment in the 2017-18 school year was 48 students. The school completed a Healthy and Safe Schools Plan in 2016. A recent bond measure was passed to support repairs and seismic retrofitting to the school buildings.[38]

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[36] Ibid.

[37] Blue Mountain Eagle, January 28, 2020, https://www.bluemountaineagle.com/news/district-developing-plans-to-repair-facilities/article_4ff62fcc-3d99-11ea-bc00-232eb6ae2b5a.html

[38] https://39dd929c-8a65-4b55-ba20-781c7e44c091.filesusr.com/ugd/05e59c_ecc0b8ee339c4bdb957af9d599d7ee44.pdf

Long Creek School District

Long Creek School is a public school located in Long Creek, Oregon. It serves grades K through 12. Enrollment in the 2017-18 school year was 36 students. The school has an International Student program.

Monument School District

Monument School is a public school located in Monument, Oregon. It serves grades K through 12. Enrollment in the 2017-18 school year was 47 students.

Prairie City School District

Prairie City School is a public school located in Prairie City, Oregon. It serves grades K through 12. Enrollment in the 2017-18 school year was 144 students. Prairie City School District was awarded a $2,496,990 grant to seismically retrofit the gym and cafeteria. [39]

Grant County Soil and Water District (Grant SWCD)

Soil and Water Conservation Districts (SWCDs) are local units of government that manage natural resource programs at the local level. Districts work in urban and rural settings with landowners and other units of government to carry out programs for the conservation and enhancement of soil, water and other natural resources.

The Grant SWCD was officially organized under Oregon Soil and Water District Law, with the issuance of a Certificate of Organization by the Secretary of State on July 30, 1956. The need for this District and determination of its boundaries were completed at a public hearing held March 8, 1956, at the Courthouse in Canyon City.

The original intent of organizing the Grant SWCD was to obtain technical assistance for landowners in working out their problems in range management, erosion control of streams, irrigation development, and other conservation work. Early objectives of the District included development of full and lasting use of water, land, and other resources. This was to be pursued by entering into cooperative agreements and working with individuals and groups of ranchers and farmers, and enlisting the help of all existing organizations and agencies.

Today, the Grant SWCD is committed to sustainable conservation through leadership, education, planning and implementation of environmentally sound projects to ensure the long term productivity and responsible management of Grant County's natural resources.

Built Environment

Settlement Patterns

Balancing growth with hazard mitigation is key to planning resilient communities. Therefore, understanding where development occurs and the vulnerabilities of the region's building stock is

[39] Business Oregon website, https://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/ consulted May 2020.

integral to developing mitigation efforts that move people and property out of harm's way. Eliminating or limiting development in hazard prone areas can reduce exposure to hazards, and potential losses and damages.

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of Oregon's program is the 19 Statewide Land Use Planning Goals that "help communities and citizens plan for, protect and improve the built and natural systems." These goals are achieved through local comprehensive planning. The intent of Goal 7, Areas Subject to Natural Hazards, is to protect people and property from natural hazards.[40]

Grant County, John Day and the incorporated cities have an acknowledged comprehensive plan and implementing ordinances. Each city in the county also has identified an urban growth boundary intended to identify lands needed to accommodate population and employment growth for a 20-year period.

Most of the developed land in Grant County is within the Hwy 26 corridor between Dayville and Prairie City with a significant amount of this in John Day. Approximately 57% of the population lives in this area. Figure 1 in Volume I depicts the population density of Grant County.

While almost 6 out 10 residents live in the Highway 26 corridor, a significant amount of the building inventory for the county is located outside of this area. There are 8,417 buildings in Grant County. Of these, 59% or 4,933 are located in unincorporated areas (Figure 5). These structures account for 58% of the estimated total building value in the county. Much of the value of the structures in the unincorporated area is in agriculture facilities, whereas in the incorporated areas, the majority of the building stock is devoted to residential use.

[40] Department of Land Conservation and Development, http://www.oregon.gov/LCD/docs/goals/ goal7.pdf

Table 5. Building Inventory in Grant County

Community	Total # of Buildings	% of Total Buildings	Est. Total Building Value ($)	% of Total Building Value
Canyon City	439	5.2	114,298,000	5.6
Dayville	166	2.0	33,364,000	1.6
Granite	115	1.4	15,264,000	0.8
John Day	1,065	13.0	339,542,000	17.0
Long Creek	208	2.5	46,914,000	2.3
Monument	143	1.7	32,015,000	1.6
Mount Vernon	398	4.7	73,681,000	3.6
Prairie City	731	8.7	169,267,000	8.3
Seneca	219	2.6	35,692,000	1.8
Unincorporated County	4,933	59.0	1,169,279,000	58.0
Total Grant County	8,417	100.0	2,029,317,000	100.0

Source: Source: Natural Hazard Risk Report for Grant County, 2019. Oregon Department of Geology and Mineral Industries.

Critical or Essential Facilities

Critical facilities are structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery. When identifying vulnerabilities, consider both the structural integrity and content value of critical facilities and the effects of interrupting their services to the community.[41]

DOGAMI, in their risk assessment for Grant County, identified a number of critical facilities with data that came from the DOGAMI Statewide Seismic Needs Assessment.[42] GAMI updated the SSNA data by reviewing Google Maps™ data. The critical facilities GAMI attributed include hospitals, schools, fire stations, police stations, emergency operations, and military facilities. In addition to these standard building types, GAMI considered other building types based on local input or special considerations that are specific to Grant County that would be essential during a natural hazard event, such as public works and water treatment facilities. Critical facilities are important to note because these facilities play a crucial role in emergency response efforts. Communities that have critical facilities that can function during and immediately after a natural disaster are more resilient than those with critical facilities that are inoperable after a disaster.

Table 6. Critical Facilities by Community

Critical Facilities by Community		Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Wildfire High Hazard

[41] FEMA Local Mitigation Planning Handbook, 2013
[42] Statewide Seismic Needs Assessment; Lewis, 2007

		Exposed	>50% Prob.	Exposed	Exposed
Dayville Sewage Treatment	County				X
Grant County Road Department	County	X			
Canyon City City Hall	Canyon City				
Canyon City VFD	Canyon City				
Grant County Courthouse	Canyon City				
Grant County Sheriff Dept	Canyon City				
Grant Union High School*	Canyon City	X			X
Humbolt Elementary School*	Canyon City				
Oregon Dept of Transportation	Canyon City	X	X		
Dayville Fire Department	Dayville				X
Dayville School	Dayville		X	X	X
Blue Mountain Hospital	John Day			X	
Grant County Elks Club	John Day				
Grant County Health Dept.	John Day				
Grant County Regional Airport	John Day				
John Day Fire Dept.	John Day				
John Day Fire Dept. (old)	John Day				
John Day Police Dept and City Hall	John Day				
John Day Radio Station KJDY	John Day	X			
John Day Sewage Treatment Plant	John Day				
Oregon Dept of Forestry	John Day	X			
Oregon State Police	John Day				
Oregon Trail Electric Co-op	John Day	X			
USFS Malheur District Office	John Day	X			
Long Creek City Hall	Long Creek				
Long Creek Fire Dept.	Long Creek				
Long Creek School	Long Creek				
Monument City Hall	Monument				
Monument School	Monument		X		
Mount Vernon City Hall	Mount Vernon				
Mount Vernon Fire Dept	Mount Vernon		X		
Mount Vernon Public Works	Mount Vernon		X		
Mount Vernon Sewage Treatment	Mount Vernon				
Oregon Telephone Corporation	Mount Vernon		X		
Prairie City Fire Dept. and City Hall	Prairie City				
Prairie City School	Prairie City		X		
Prairie City Sewage Treatment	Prairie City				X
Seneca Elementary School	Seneca				
Seneca Fire Dept and City Hall	Seneca				

Source: Grant County Natural Hazard Risk Assessment, DOGAMI, 2019

Blue Mountain Hospital District (BMHD)

Blue Mountain Hospital District (BMHD) is a non-profit organization directed by a local Board of Directors. The District consists of a 25-bed hospital located in John Day and a 40-bed care center in

Prairie City. John Day currently has a general surgeon as well as several family practice providers, including physicians and nurse practitioners. They participate in the Oregon Health Sciences University Family Practice Residency program, which rotates residents and interns through the community on a regular basis.

Blue Mountain Hospital is well staffed, with most nurses ACLS and trauma-certified. There are three monitored ICU/CCU beds, two modern birthing suites, and two surgery suites that provide both inpatient and outpatient same-day surgeries. Blue Mountain Hospital is a level IV trauma hospital in the Oregon State Trauma System with 24-hour emergency department coverage, and medical evacuation to tertiary care centers by Air Link of Oregon and Life Flight. Blue Mountain Hospital has a helipad on site to offer rapid transport under critical circumstances. In addition, the hospital has an ambulance service that is staffed by volunteer EMTs and staff paramedics.

The hospital houses a Surgery Clinic and a Rural Health family practice clinic. The Surgery Clinic is staffed by a Board-Certified General Surgeon. The family practice clinic, Strawberry Wilderness Community Clinic (SWCC), has several providers including family physicians and nurse practitioners. They have two outreach primary care clinics in neighboring communities for those who have difficulty traveling the distance to the hospital. The hospital also offers monthly specialty clinics with physicians specializing in urology, ophthalmology, cardiology and podiatry.

Blue Mountain Care Center is an intermediate care facility that has skilled staff to provide care to the elderly and others who are unable to live independently. In addition to full-time care, the care center is licensed to provide adult day care when families need regular or occasional daytime relief from caring for their elderly family members.

Cultural and Historic Resources

Cultural and historic resources provide information about our past, insight into our present, and frame our local character and identity. Grant County has 10 sites on the National Register of Historic Places.

Grant County was established in 1864, a couple of years after gold was discovered in Whiskey Flat near present day Canyon City. This led to a spike in population in the Canyon City / John Day area. Along with this was an influx of Chinese immigrants. The Kam Wah Chung State Heritage Site in John Day explores the legacy of the Chinese workforce in Oregon. The site is based in a rustic building that was constructed as a trading post along The Dalles Military Road in the mid-1800s.[43] This tiny, unassuming building became home to two Chinese immigrants, Ing "Doc" Hay and Lung On in 1888. Both became locally famous: Lung On as a general store proprietor and businessman, and "Doc" Hay as a practitioner of herbal medicine. For over 60-some years the building was a social, medical, and religious center for Oregon's Chinese community.[44]

The Kam Wah Chung Heritage Site is located along Canyon Creek, but outside the FEMA designated floodplain.

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[43] Oregon Blue Book https://sos.oregon.gov/blue-book/Pages/facts/history/state-chinese.aspx
[44] Oregon Parks web page on Kam Wah Chung, https://oregonstateparks.org/index.cfm?do=parkPage.dsp_parkPage&parkId=5

Figure 6: Kam Wah Chung Heritage Site, John Day, Oregon

Source: Oregon State Parks.

The John Day Fossil Beds National Monument is a U.S. National Monument in Wheeler and Grant counties. Located within the John Day River basin and managed by the National Park Service, the park is known for its well-preserved layers of fossil plants and mammals that lived in the region between the late Eocene, about 45 million years ago, and the late Miocene, about 5 million years ago. The monument consists of three geographically separate units: Sheep Rock, Painted Hills, and Clarno. The Sheep Rock Unit is the only one of the three located in Grant County.

The units cover a total of 13,944 acres (5,643 ha) of semi-desert shrublands, riparian zones, and colorful badlands. About 210,000 people visited the park in 2016 to engage in outdoor recreation or to visit the Thomas Condon Paleontology Center or the James Cant Ranch Historic District.

Before the arrival of Euro-Americans in the 19th century, the John Day basin was frequented by Sahaptin people who hunted, fished, and gathered roots and berries in the region. After road-building made the valley more accessible, settlers established farms, ranches, and a few small towns along the river and its tributaries. Paleontologists have been unearthing and studying the fossils in the region since 1864, when Thomas Condon, a missionary and amateur geologist, recognized their importance and made them known globally. Parts of the basin became a National Monument in 1975.

Averaging about 2,200 feet (670 m) in elevation, the monument has a dry climate with temperatures that vary from summer highs of about 90 °F (32 °C) to winter lows below freezing. The monument has more than 80 soil types that support a wide variety of flora, ranging from willow trees near the river to grasses on alluvial fans to cactus among rocks at higher elevations. Fauna include more than 50 species of resident and migratory birds. Large mammals like elk and smaller animals such as raccoons, coyotes, and voles frequent these units, which are also populated by a wide variety of reptiles, fish, butterflies, and other creatures adapted to particular niches of a mountainous semi-desert terrain (Wikipedia).

The park headquarters and main visitor center are both in the Sheep Rock Unit.

Figure 7: John Day Fossil Bed National Monument, Sheep Rock Unit

Source: John Day Fossil Beds National Monument, Wikipedia, 2019.

The other prominent historic sites in Grant County include the Advent Christian Church in John Day, the James Cant Ranch Historic District, the St. Thomas Episcopal Church in Canyon City and the Sumpter Valley Railway and Historic District that extends from Prairie City to Baker City.

Infrastructure

Roads & Bridges

Surface transportation in Grant County is handled mainly by two US highways: Highway 26 and Highway 395. These highways are used predominantly by through traffic traveling across the state. Local traffic volumes are higher in the urban areas of cities. Highway 26 moves traffic east and west through the center of the county, providing access to the larger cities of Prineville, Madras, and Bend to the west and the cities of Baker City (via Highway 7) and Ontario to the east. Highway 395 is oriented in a north-south direction also through the center of the county, providing access to Pendleton to the north and Burns and Hines to the south. These two highways intersect each other, tying together the cities of Dayville, Mt. Vernon, John Day, Prairie City, Dale, Long Creek, Fox, Canyon City, and Seneca. On a local level, these highways serve as the principal corridors along which each of these cities is situated.

The Kimberly-Long Creek Highway (Highway 402) is a relatively short highway that begins and ends in Grant County. This highway connects the town of Kimberly with the cities of Monument, Hamilton, and Long Creek. It runs between Highways 19 and 395.

Portions of two other state highways are also present in Grant County. A section of Highway 19, roughly 19 miles in length, is located along the western border of the county line, which provides access to the town of Kimberly, Highway 207 to the northwest (Spray to Heppner), and Highway 26 to the south. Highway 7 is another highway which deviates from Highway 26 in a northeast direction toward Baker City in the eastern part of the county, providing the shortest connection to I-84.

In addition to the state highways, a network of county roads runs throughout the study area. County roads serve many purposes. They provide access to residences in rural areas around the incorporated cities. They also serve other smaller rural communities. County roads often connect to agricultural areas, recreational areas, and national forests.

Many of the county roads connect with the state highway system while others connect with city streets. Connections to the highways are generally located in the rural areas, although some direct connections are made within the city urban areas. The county roads in the John Day River valley are relatively short roads while longer and more extensive county roads serve other parts of the county.

Some county roads provide alternate routes to state highways, allowing shorter, and more direct travel between some communities. County Road #63 from Highway 395 west to Highway 380 provides a parallel route to both Highway 26 and 20.

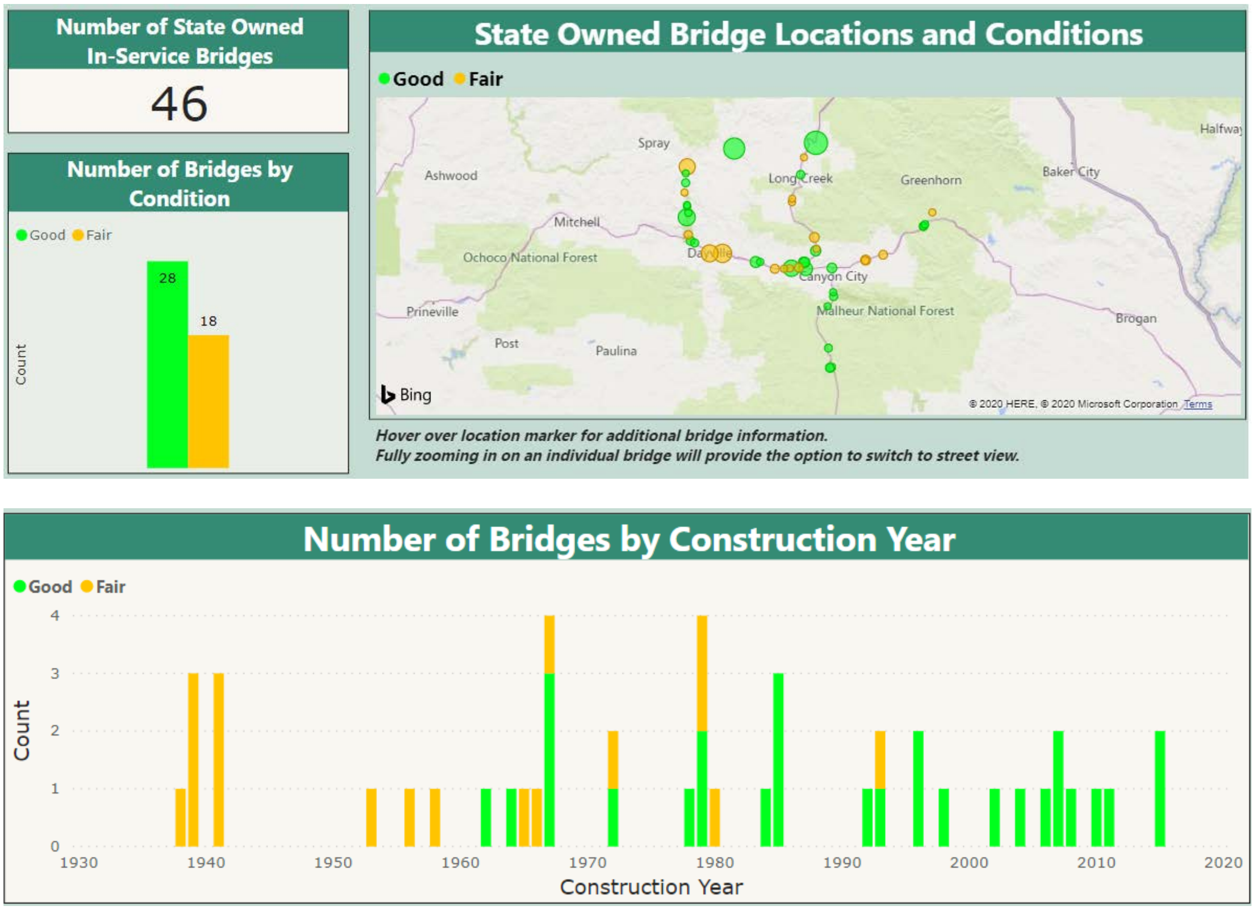
Public usage roads and USFS roads also play a role in Grant County. They generally provide access to the Malheur, Umatilla, and Ochoco National Forests and other public lands.[45]

The Oregon Department of Transportation (ODOT) inventories and assesses the condition of bridges in Oregon. According to the 2019 Interactive Bridge Condition Report[46] provided by ODOT, no bridges in Grant County are in Poor or Very Poor Condition. All bridges on OR 26 along the John Day River are in Good or Fair Condition. The same goes for the bridge across the North Fork of the John Day River along Route 402 near Monument.

[45] Grant County Comprehensive Plan 1997

[46] 2019 ODOT Bridge Condition Report, https://www.oregon.gov/ODOT/Bridge/Pages/BCR.aspx, consulted May 2020

Figure 9. Report on Grant County bridge conditions from Oregon Department of Transportation



Source: Oregon Department of Transportation 2019 Interactive Bridge Conditions Report

There are numerous private bridges in Grant County, some of which are made of wood. These wood bridges were problematic during the Canyon Creek Complex fire. These wooden bridges can make evacuation and access for emergency services difficult or impossible. The picture on the cover of Volume II: Hazard Annexes includes a photo of a wooden bridge that burned during that fire in 2015.[47]

Public Transportation

The Grant County Transportation District operates a regional bus service known as The People Mover. In 2018, it transported 37,450 total passengers. The People Mover has a paid staff of 1.5 dispatchers, 10 drivers and a district manager.

Service includes the Red Line, a deviated fixed route that circulates through John Day and Canyon City every hour from 7am to 6pm. Another deviated fixed route runs between Prairie City and Mt. Vernon four times a day. Both of these routes are free. The People Mover offers free medical transportation to

[47] Personal communication with Irene Jerome, Community Wildfire Coordinator, May 2020

eligible Grant County veterans and non-emergent medical transportation through a contract with Greater Oregon Behavioral Health Inc.

It also provides transportation for the Long Creek, Monument and Kimberly areas to John Day, Bend, Burns and Walla Walla with reservations. On demand service is available from 8 a.m. to 6 p.m. Mondays through Fridays and from 9 a.m. to 4 p.m. Saturdays.

The People Mover staff has applied for grants to add the following:

- a 25-passenger ADA-compliant bus,
- a bus shelter at Grant Union high school, in coordination with Oregon Department of Transportation and Safe Routes to School,
- a weekly bus route from John Day to Ontario,
- and vehicle hardware and software that would allow real-time communication and tracking of vehicles as well as automated stop announcements and other features.[48]

Railroads

No passenger or freight rail lines currently pass through Grant County. The nearest operating service is the Class I Union Pacific line that runs from Portland, through the Columbia Gorge, Pendleton, La Grande, and Baker City. Amtrak passenger service operates between Portland, OR and Spokane, WA on the Washington State side of the Columbia River. The nearest Amtrak stops to Grant County are in Wishram, WA (181 miles from John Day) and Pasco, WA (193 miles from John Day).

Airports & Emergency Rotary Landing Zones

Grant County has two public use airports, the Grant County Regional Airport and the Monument Municipal Airport. The Grant County Regional Airport (GCRA), also known as Ogilvie Field, is a 335 acre county-owned, public use airport with two runways.

The Grant County Regional Airport serves as a lifeline to this isolated part of the state and it is also a base for fighting wildfires. Access to the airport is good with a location on a high plateau just above the county's largest urban center of John Day/Canyon City. The Risk Assessment contained in Volume I: Basic Plan shows that this area is located in an area of Very High Landslide Susceptibility. Until updated landslide hazard mapping is completed, the risk of landslide should be considered when planning the additional runway and other improvements contemplated in the Grant County Regional Airport Master Plan.

The GCRA is also the helibase and training center for the United States Forest Service (USFS) Malheur Rappel Crew of firefighters. The Malheur Rappel Crew (MRC) is a Type One 29 person crew that specializes in initial attack and helicopter operations.[49] GCRA has become the national training center for all USFS rappel crews. To facilitate crew training, the USFS have a rappel training tower located near the Terminal building.[50] It is staffed year around with peak operations generally occurring from May through October.

[48] Blue Mountain Eagle, June 27, 2019, https://www.bluemountaineagle.com/specialsections/progress/progress-the-people-mover-expands-with-free-routes/article_5aad6902-8d5f-11e9-9e25-bb6436b87bb2.html
[49] https://www.fs.usda.gov/detail/malheur/landmanagement/resourcemanagement/?cid=fsbdev3_033854
[50] Grant County Regional Airport Master Plan, December 2018

The US Forest Services and the Oregon Department of Forestry (ODF) use part of the Terminal Building for firefighting operations. They use approximately 39 percent of the building for offices, operation room, crew quarters, and hangar space. They also use an old apron adjacent to the Terminal for vehicle parking. The USFS owns two storage buildings south of the Terminal (chainsaw shop and helicopter rigging shop).

In addition, a Single Engine Air Tanker (SEAT) base is located at the northeast corner of the corporate apron as shown on Figure 2-8. It is used and maintained by the USFS and ODF for SEAT operations, including fire retardant refilling and parking. The current area has a single loading pit, one 10,000 retardant tank, one 6,000 water tank as well as one temporary trailer office and multiple storage sheds. The current space allows for two SEAT tie-down locations. The USFS and ODF use the airport helipads described in Section 2.4.4 for helicopter parking. Throughout the season, 2 to 9 additional landing areas are used for helicopters.

The Monument Municipal Airport (12S) is owned by the City of Monument and consists of a single 2,104 x 29 ft. asphalt runway.

The County also has three private airstrips which could be used in a natural disaster. The Cerny Airport (710R) 10 miles northwest of Seneca has a 1500 x 25 ft. turf runway, the Silvies Valley Ranch Airport (OG14) 7 miles south of Seneca has a 5,000' x 50 ft. asphalt runway, and the Longview Ranch Airport (OG39) 7 miles south of Kimberly has a 5,335 x 75 ft. asphalt runway[51] (www.airnav.com). The Grant County Emergency Manager reported that there are eight emergency landing zones for helicopters in Grant County as listed in Table 8 below.

Table 8. Emergency Rotary Landing Zones in Grant County

Location	Latitude/Longitude	Nearby Hazard
East Baseball Field, North of John Day River, John Day, OR	44.422190N / 118.945895W	Power lines near field
Prairie High School Football Field, Prairie City, OR	44.454823 / 118.709282W	Goal posts
Marked Helipad in Seneca, OR. Pad is immediately south of N. Bridge Rd. near intersection with John Day-Burns Hwy. NW of town.	44.140283N / 118.975109W	Large building just east of the landing zone
Dayville High School football Field, Dayville, OR.	44.462297N / 119.530166W	Goal posts
Monument High School Football Field, Monument, OR	44.821567N / 119.419852W	Goal posts

[51] www.airnav.com consulted November 2019

Mt. Vernon Old School - helipad, Mt. Vernon, OR	44.418879N / 119.116613W	Large building SW of landing zone
Long Creek School – open field east of the school and football field, Long Creek, OR	44.712977N / 119.097086W	Wire fence, Keen Forks Rd just north of landing zone
Granite Helipad (Jupiter Rd), Granite, OR	44.808764N / 118.423455W	Power lines, pine trees nearby. Use only in winter

Source: Grant County Department of Emergency Management, October 16, 2019.

Utilities

Electricity is provided to Grant County from three separate cooperatives which are described below:

Oregon Trail Electric Cooperative

Oregon Trail Electric Cooperative (OTEC) is one of Oregon's largest distribution cooperatives. Headquartered in Baker City, Oregon, with district offices in La Grande, John Day, and Burns, OTEC serves approximately 31,000 customers in Baker, Grant, Harney and Union counties with a network of overhead and underground lines over 3,000 miles long. OTEC's distribution system represents an investment of more than $153 million[52] (Oregon Trail Cooperative website).

Central Electric Cooperative

The Central Electric Cooperative (CEC) is another of Oregon's 18 member-owned cooperative electric utilities. CEC is a transmission and distribution cooperative. Its source of wholesale electricity is the federal power marketing agency, the Bonneville Power Administration. Central Electric Cooperative obtains this supply through Portland, Oregon based PNGC Power, a generation and transmission cooperative owned by 14 Northwest electric distribution cooperative utilities, including CEC. CEC provides electric service to portions of Deschutes, Crook, Jefferson, Grant, Linn, Wasco and Lake Counties, in central and eastern Oregon. In Grant County CECs service area is restricted to the southwestern section of the county. [53]

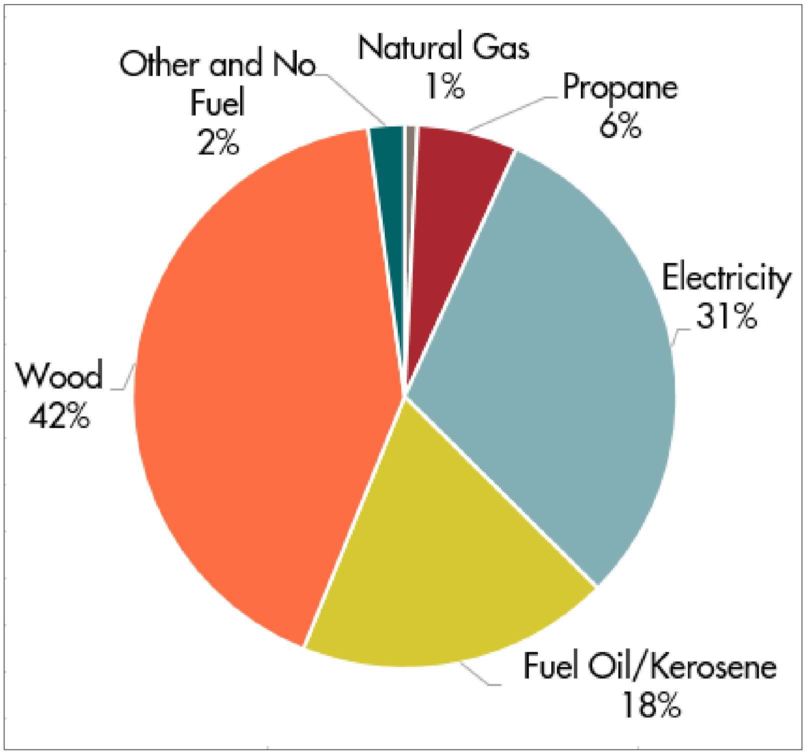
Columbia Power Cooperative Association

Columbia Power Cooperative Association is located in Monument, Oregon. This organization has been in operation for 70 years in the electric power distribution industry.

Although just over thirty percent of Grant County residents use electricity to heat their homes, wood is the source of heat for forty-two percent of Grant County residents followed by fuel oil.

Figure 10: Home Heating Fuel Use in Grant County.

[52] Oregon Trail Electric Cooperative, https://otec.coop/
[53] Central Electric Cooperative, https://www.cec.coop/



Source: Oregon Department of Energy, 2018 Biennial Energy Report.

Communications

Cellular service in Grant County is provided by Verizon Wireless and AT&T. There are 11 cellular towers in Grant County. There locations are as follows:

- 2 towers are located one mile north of John Day, at 44.4342N / -118.9589W
- 2 towers are located north of Hwy 26 at township and range address: T18S R30E Section 22.
- 2 towers are located in Prairie City.
- 1 tower is located 7.5 kilometers south/southeast of the town of Ritter, Oregon.
- 1 tower is located in Dayville, Oregon.
- 1 tower is located on Aldrich Mtn. approximately 8 miles SE of Dayville at 44.3772N / 119.4508W
- 1 tower is located near Indian School Rd.
- 1 tower is located on Eagles Peak.

The internet provider in Grant County is Century Link and the phone provider is Oregon Telephone Corporation.

Water and Waste Water Systems

John Day: John Day has emergency power to its # 3 well and portable emergency power to all other wells and to its water treatment plant. Reservoir capacity will serve up to four days of normal use. John Day and Canyon City water lines are tied together and can supply water to each other. The water distribution system includes three deep wells and a natural spring. The three wells are located on the north side of the John Day River while Long Gulch Spring is located on the south side of the John Day River along the east side of Highway 395 between John Day and Canyon City.

Canyon City: Canyon City has two systems; a high level system that feeds the upper level residents and a low level gravity system to the lower residents. There is currently no backup power for the water treatment plant which services Canyon City.

Seneca: Most of Seneca's water is power dependent with no emergency backup, however it does have a gravity fed system that can supply water for a few days. Water reservoir capacity is approximately 100,000 gallons.

Prairie City: Nearly 98 % of Prairie City's water is supplied by gravity fed springs. Wells are only used during summer and when there are shortages. The City currently has 2 active wells. The city's water and sewage treatment plants have backup emergency power. Water reservoir capacity is approximately 1,000,000 gals, approximately 2- 3 days of normal use. When tank capacity is reduced to 20 ft. Level firefighting capability may be compromised. Upper tank has approximately 82,000 gals of potable water.

Mount Vernon: Emergency power for the water supply is a diesel generator. The water reservoir can supply approximately 2 days of normal use. The water treatment plant has emergency power.

Dayville: Dayville water is supplied by 4 springs and a well that was drilled in 2008. The springs provide 14-18 gallons of water per minute and are supplemented by the well when necessary. Storage consists of a 124,000 gallon steel reservoir. There is a control building that has Chlorination room and a control and telemetry monitoring room. The water distribution line is total gravity fed. Estimated 2-4 days water of normal use.

Monument: The city of Monument does not have emergency power backup. Water reservoir capacity is approximately 3 days.

Granite: The town of Granite has no emergency power back-up. Has 1 well and 1 water storage tank. Unknown capacity

Appendix B:
Planning and Public Process

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Planning and Public Process

Purpose

This Appendix describes the process of updating the plan, how the plan was prepared, who was involved and specific changes made to the *2014 Northeast Oregon Multi-jurisdictional Natural Hazards Mitigation Plan (2014 NHMP)* during the plan update process.

Background

The Disaster Mitigation Act of 2000 requires communities to update their mitigation plans every five years to remain eligible for Pre-Disaster Mitigation (PDM) program funding, Flood Mitigation Assistance (FMA) program funding, and Hazard Grant Mitigation Program (HMGP) funding. Grant County was a participant in the *2014 NHMP* that expired during the update process. In 2018 the Department of Land Conservation and Development was awarded an HMGP grant by FEMA to assist Grant County with its NHMP update. Grant County partnered with the Oregon Department of Land Conservation and Development (DLCD staff over the next year and a half to update the *NHMP* producing this document, the *2020 Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan.*

DLCD staff worked with Grant County's Emergency Manager, Ted Williams, to form the Grant County 2020 NHMP Steering Committee (Steering Committee) representative of the whole community. Initially the DLCD Natural Hazard Planner, Jason Gately, managed the project and met with members of the SC four times and conducted individual phone conversations and email conversation to guide SC work on the plan update. From late July through mid-September, FEMA was concurrently conducting a Risk MAP process that involved risk assessment and mitigation strategy development. These meetings are included in the NHMP update process. In January 2020 Katherine Daniel took up the project management and writing of the NHMP update and met with the Steering Committee an addition three times.

The Steering Committee includes representatives from Grant County and from the Cities of John Day, and Canyon City, the Grant Education Service District, the Grant School District #3, the Grant Soil and Water Conservation District, and Blue Mountain Hospital. Meetings were attended by a number of individuals representing other small cities in the county and representatives of private non-profits as well as citizens at large. Below is a list of the Steering Committee members and other participants who signed in at meetings.

2020 NHMP Public Participation Process

Grant County is dedicated to directly involving the public in the review and update of the natural hazard mitigation plan. Although members of the 2020 NHMP Steering Committee represent the public to some extent, the residents of Grant County, the Cities of John Day, Canyon City, Monument, Granite, Dayville, Prairie City, and Seneca were notified about opportunities to provide feedback about the NHMP through personal communication, public notices, Facebook posts and meetings. As described in Volume I: Section 4 - Plan Implementation and Maintenance, the NHMP will undergo formal review once per year.

Grant County Emergency Manager posted notification of steering committee meetings on the Grant County website and the Emergency Management Facebook page along with posted flyers in prominent locations. The project manager prepared a press release on March 19, 2019 to advertise the kickoff meeting. Later in the process, Grant County, the City of John Day, Grant ESD and Grant SWCD made the completed draft *2020 Grant County MJ NHMP* available via their websites prior to the final meeting for public comment on March 19, 2019. The Blue Mountain Eagle published two articles about the public process of updating the NHMP during the course of the project.

Public Involvement Summary

Keeping in mind the importance of representing the whole community, the 2020 Grant County NHMP Steering Committee (the Steering Committee) was assembled by Ted Williams, Grant County Emergency Manager, and Jason Gately, DLCD Natural Hazard Planner. A broad range of jurisdictions and agencies were solicited for potential participation. Opportunity to participate as a member of the steering committee was extended to representatives of all the incorporated cities in the county, local and regional agencies involved in hazard mitigation and agencies that have the authority to regulate development. Emails soliciting participation were sent to representatives from the county and cities, such as the County Judge, City Mayors, City Recorders, Planning Directors, Public Works Department Directors; Soil and Water Conservation and the Blue Mountain Hospital Special District Managers, School District Superintendents; representatives of US and Oregon agencies, such as the Oregon Department of Forestry, Oregon Water Resource Department, the Army Corps of Engineers, the Bureau of Land Management; owners of local businesses; local non-profits and involved citizen leaders.

The members of the Steering Committee volunteered their time to provided edits and updates to the NHMP during publicly advertised meetings and on an individual basis such comments being vetted in a public forum before inclusion in the document. Opportunities for the public to comment were provided at each meeting and through the Emergency Management Facebook page.

Not all those who were invited were able to participate in the NHMP Steering Committee, however, the FEMA Risk MAP webinar meeting and the Discovery meeting were well attended.

Project Steering Committee:

Dept. of Land Conservation & Development Project Managers:

Jason Gately and Katherine Daniel, Natural Hazards Planners

Representatives from the following organizations served as Steering Committee members for the Grant County Natural Hazards Mitigation Plan update process.

Grant County

Convener, Ted Williams	Grant County, Emergency Management
Scott Myers	Grant County Judge
Hilary McNary	Grant County, Planning
Shannon Springer	Grant County, Planning
Haley Walker	Grant County Municipal Airport, Manager

City of John Day

Nicholas Green	City of John Day, City Manager/Lead Planner
Daisy Goebel	City of John Day, Planner

Grant Soil and Water Conservation District

Jason Kehrberg	Grant Soil and Water District
Kyle Sullivan	Grant Soil and Water District

Grant Education Service District

Robert Waltenburg	Grant Education Service District, Superintendent
Bret Uptmor	Grant School District #3, Superintendent

Blue Mountain Hospital

Rebekah Rand	BMH, Emergency Medical Services Director
Krista Qual	Blue Mountain Hospice aide

Other Participants

Irene Jerome	Community Wildfire Coordinator
Don Mooney	Canyon City Council
Jana Peterson	Oregon Department of Forestry
Mark Webb	Blue Mountain Forest Partners
Barbara Dole	Citizen
Frances Preston	Citizen

The following pages include copies of meeting agendas and sign-in sheets from NHMP Steering Committee meetings, website screenshots, flyers, and other information that demonstrates the outreach that has been done during this NHMP update process.

The Risk MAP Discovery meeting was attended by a number of jurisdiction and agency representatives who did not attend other NHMP Steering Committee meetings. They included the City Manager of the City of Seneca, the City Recorder of the City of Monument, the City Recorder of the City of Long Creek, the Director of Public Works for the City of Dayville, the Director of Public Works and the Fire Chief for the City of Prairie City, the Office Manager for Long Creek Schools and the Outreach Coordinator for the North Fork John Day Watershed Council.

Summary of Outreach

Table 1. Grant County NHMP Outreach Efforts

Date	Description of Event/Activity
February 5, 2019	Ted Williams, Grant County Emergency Manager, convened the NHMP Committee to discuss the composition and role of members of the 2020 Grant County NHMP Steering Committee.
February 21, 2019	Flyer distributed around the county in post offices, the County Health Department, and the Courthouse promoting a survey mounted by the Project Manager and the Steering Committee.
March 14, 2019	Ted Williams convenes the first Steering Committee meeting. The responsibilities of all parties are reconfirmed. The Steering Committee members accept the lead on public engagement during the NHMP update process.
Spring, 2019	The Percolator, a local business and industry newsletter, profiles Ted Williams and in a separate article highlighted the Firewise Community program providing Irene Jerome's contact information and providing examples of Firewise program activities in Pine Creek, Middle Fork, Ritter and Upper Laycock Creek Road.
May 23, 2019	Ted Williams convenes the second Steering Committee meeting to consider the Risk Assessment phase of the NHMP update and to complete a Hazard Vulnerability Analysis. This meeting was advertised to the public with flyers posted in post offices, and the County Courthouse.
July 18, 2019	Ted Williams convenes the third Steering Committee meeting to begin discussing the Mitigation Strategy. This meeting was advertised to the public with flyers posted in post offices, and the County Courthouse.

July 26 – August 01, 2019	FEMA Risk MAP project initiates Discovery process through Community Information Exchange webinars with communities in Grant County.
August 21, 2019	Flyer distributed around the county in post offices, the County Health Department, and the County Courthouse advertising the results of the risk assessment exercise conducted at the second Steering Committee meeting.
August 22, 2019	Blue Mountain Eagle ran an article entitled “Natural hazards plan update underway” by Richard Hanners that highlighted the process of updating the NHMP and the benefits of doing so.
September 4-26, 2019	Intergovernmental Agreements signed establishing the relationship between DLCD and the plan holders and the expectations of each party.
September 9, 2019	Ted Williams convenes fourth Steering Committee meeting to complete the Mitigation Strategy analysis. This meeting was advertised to the public with flyers posted in post offices, and the County Courthouse.
January 2020	DLCD Project Manager position is filled by Katherine Daniel.
February 14, 2019	Ted Williams convenes fifth Steering Committee meeting to allow K. Daniel to confirm with the Steering Committee the work completed to date with DLCD staff member Jason Gately, who resigned his position in December 2019 including work as Grant County NHMP Project Manager.
March 2020	Emergency Manager Williams resigns his position.
April 10, 2020	Katherine Daniel convenes the sixth Steering Committee meeting.
May 2020	Grant County, the City of John Day, Grant Education Service District, and Grant Soil and Water Conservation District post the draft NHMP on their websites along with information about how to attend the seventh and final Steering Committee meeting.
May 6, 2020	Blue Mountain Eagle publishes an article about the NHMP process and the final Steering Committee meeting.
May 12, 2020	Katherine Daniel convenes the seventh and final Steering Committee meeting.

Steering Committee Meeting Agendas and Sign-in Sheets

Figure 1. February 5, 2019 Steering Committee meeting agenda

Grant County NHMP Update
County/DLCD Coordination Meeting

February 5th, 2019	Grant County Emergency Management Offices
10:00 – 12:00 PM	530 E. Main St., John Day, OR

A. Discuss the Intergovernmental Agreement. 10 min

B. Discuss the Scope of Work and revise as necessary or appropriate. 20 min

C. Discuss the current MJNHMP's strengths and opportunities for improvement; 10 min

D. Discuss the Draft Project Schedule and revise as necessary or appropriate; 10 min

E. Discuss Table 1: Allocation of Basic Responsibilities and Tasks and revise as necessary or appropriate. These basic responsibilities and tasks will be performed throughout the duration of the project in addition to other others described and deliverables assigned in Tasks 1 through 16. 20 min

F. Determine the method for and roles of DLCD and the COUNTY in inviting cities and special districts to participate in the planning process and designate SC members and alternates. SC members and alternates must have or have been delegated authority to make decisions and act on behalf of their jurisdictions for the purposes of this project. 10 min

G. Discuss the project initiation letter from DLCD to Grant County. 5 min

H. Draft a list of stakeholders, technical advisors, and other interested parties including at a minimum representatives of FEMA's six "whole community" sectors: 10 min

I. Prepare a draft Public Engagement Program for SC discussion and finalization. 20 min

J. Develop a Communication Protocol. 10 min

Grant County / DLCD Organizational Mtg. Page 1

Figure 2. February 5, 2019 meeting sign-in sheet

Grant County Natural Hazards Mitigation Plan
Project Coordination Meeting
February 5th, 10am-12pm

530E. Main St.

PLEASE SIGN IN (Sign your name or add to the list)

Full Signature	Name	Title	Representing
	Jason Kehrberg	District Manager Grant SWCD	Grant SWCD
	TED WILLIAMS	GC Emergency Management	Grant Co.
	Shannon Springer	Assistant Planner	Grant Co Planning
	Scott W. Myers	County Judge	Grant Co.
	JASON GATELY	DLCD PLANNER	DLCD

Figure 3. March 14, 2019 Steering Committee meeting agenda

Grant County Natural Hazard Mitigation Plan Update
1st Steering Committee Meeting

Thursday, March 14, 2019, 10:00 to 12:00 PM
Oregon Department of Forestry - John Day Unit Office
415 Patterson Bridge Rd, John Day, OR 97845

OREGON
Department of Land Conservation & Development

AGENDA

Introduction and Background	**10:00 – 10:10**
▪ Introductions ▪ Meeting Goals and Objectives ▪ Process Overview · Why are We Here?	
Natural Hazards Mitigation Planning Overview	**10:10 - 10:20**
▪ What is Natural Hazards Mitigation Planning? · Plan Elements · Guiding Principles · Funding Overview – Grants & Other Sources	
Review and Discuss the Intergovernmental Agreement (IGA)	**10:20 - 10:30**
▪ Comments or Questions?	
Review and Discuss the Scope of Work and Schedule (SOW)	**10:30 – 11:15**
▪ Go through each task, deliverable and roles and responsibilities ▪ Comments or Questions?	
Review and Discuss Public Engagement Program	**11:15 -11:30**
▪ The Grant County Steering Committee is the lead for public engagement ▪ Venues and formats? Online Survey? ▪ Comments or Questions?	
Review and Discuss Communication Protocol	**11:30 -11:45**
▪ Comments or Questions?	

Natural Hazard / Community Assets Worksheet	**11:45 -12:00**
▪ Homework! Email completed form to: Jason.gately@state.or.us	
Next Steps / Adjourn	**12:00**
▪ Steering Committee Mtg. #2: Risk Assessment – need a date and location. ▪ Action Items	

FEMA Local Mitigation Planning Handbook:
https://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf

Free Hazard Mitigation Planning Tutorials:
http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/mitigationplanning/SitePages/2017_Coffee_Break.aspx

Figure 4. March 14, 2019 meeting sign-in sheet

Grant County Natural Hazards Mitigation Plan

1st Steering Committee meeting Oregon Dept. of Forestry March 14, 2019 10am-12pm

Please sign in

Signature	Name	Title	Representing	Contact No
TED [illegible]	TED WILLIAMS	EMERGENCY MANAGER	Grant County	Cell 541-620-1074
Barbara Dole	Barbara Dole		Public	cell 208-201-1109
Krista Qual	[illegible]	EP Quality HO BMHD	Public	541 620 8127
[illegible]	Jason Kehrberg	District Manager	Grant SWCD	541-575-0135
[illegible]	Robert Waltenburg	Supt	Grant ESD	541-575-1349
Jason Gately	Jason Gately	Planner	DLCD (State)	360-521-1167
[illegible]	Bret A Uptmor	Supt	Grant SD	541 575-1288

Figure 5. May 23, 2019 Steering Committee meeting Agenda

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #2

Risk Assessment

May 23rd, 2019
10:00 to 12:00 PM
Oregon Department of Forestry - John Day Unit Office
415 Patterson Bridge Rd, John Day, OR 97845

AGENDA

Introduction and Background	**10:00 – 10:10**
▪ Introductions ▪ Meeting Goals and Objectives · Review what we are doing and the role of the Steering Committee · Conduct a Risk Assessment for Grant Co.	
Review Planning Process, Schedule, Cost Share and Goals	**10:10 - 10:25**
▪ Schedule Review ▪ IGA & Cost Share ▪ Plan Goals and Mission Statement	
Hazard Vulnerability Analysis (HVA)	**10:25 - 11:40**
▪ Hazard History Review ▪ Community Assets & Vulnerability Review ▪ Hazard Vulnerability Worksheet	
Public Engagement	**11:40 – 11:50**
▪ Opinion Survey ▪ Other Outreach Opportunities? Internet, festivals, senior centers, radio, newspaper, other? ▪ Photos of people and places.	
Next Steps	**11:50 -12:00**
▪ Next Steering Committee Meeting ▪ Action Items	

Figure 6. May 23, 2019 meeting sign-in sheet

Grant County Natural Hazards Mitigation Plan

2st Steering Committee meeting Oregon Dept. of Forestry May 23, 2019 10am-12pm
RISK ASSESSMENT –

Please sign in

Signature	Name	Title	Representing	Contact No
[illegible]	Theodore Williams	Grant Co Emergency Manager	Grant Co	541-575-1024
[illegible]	Rebekah Rand	EMS & HEPP	BMHD	541-575-4159
[illegible]	Don Mooney	Canyon City Council	Canyon City	541-792-9214
[illegible]	Jason Kehrberg	Grant SWCD District Manager	Grant SWCD	541-575-0135
[illegible]	Robert Waltenburg	Superintendent	Grant ESD	541-575-1349
[illegible]	Haley Walker	GC Regional Airport Manager	GCRA	541-575-1151
[illegible]	Bret A Uptmor	superintendent	Grant SD	541-575-1280
[illegible]	Krista Qual	Quality, EP	BMHD - HH/HO	541-575-1648
[illegible]	Nick Green	John Day City Mgr	John Day	541 575 0028
Scott W. Myers	Scott W. Myers	Grant County Judge	Grant County	(541) 575-005
[illegible]	Jana Peterson	Unit Forester	ODF	541-575-1139
[illegible]	Shannon Springer	Asst Planner	Grant Co	541-575-1519

Figure 7. July 18, 2019 Steering Committee meeting agenda

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #3

Mitigation Strategy

July 18, 2019
9:00 to 11:00 PM
Oregon Department of Forestry - John Day Unit Office
415 Patterson Bridge Rd, John Day, OR 97845

AGENDA

Introduction and Background	**9:00 – 9:10**
▪ Introductions ▪ Meeting Goals and Objectives · Review and Assess Past Mitigation Actions · Develop and Assess New Mitigation Actions at Next Meeting	
Updates	**9:10 - 9:20**
▪ Schedule Review ▪ Public Outreach / Survey / Flyer ▪ Cost Share	
Mitigation Strategy	**9:20 - 10:50**
▪ Review Risk Assessment Findings ▪ Review Plan Goals & Mission Statement ▪ Review and Assess Past Mitigation Actions	
Next Steps	**10:50 – 11:00**
▪ Action Items ▪ Fill Out and Turn In Cost Share Form.	

Figure 8. July 18, 2019 Sign-in Sheet

2020 Grant County Natural Hazards Mitigation Plan Update
Steering Committee Mtg. #3
07/18/19
415 Patterson Bridge Rd, John Day, OR 97845
Sign-in Sheet

Signature	Steering Committee Member	Organization	Email
	Ted Williams	County Emergency Manager	williamst@grantcounty-or.gov
	Scott Myers	County Judge	myerss@grantcounty-or.gov
	Hilary McNary	County Planning	mcnaryh@grantcounty-or.gov
	Shannon Springer	County Planning	gcplan@grantcounty-or.gov
	Haley Walker	Grant County Regional Airport	walkerh@grantcounty-or.gov
	Steve Fisher	Canyon City Mayor	fischers@grantcounty-or.gov
	Bret Uptmor	Grant County Education Service District	uptmorb@grantesd.k12.or.us
	Robert Wallenberg	Grant County Education Service District	waltenburgr@grantesd.k12.or.us
	Barbara Dole	Citizen-at-large	sagebrusharts@yahoo.com
	Krista Qual	BHM Quality Assistance Hospice	kqual@bluemountainhospital.org
	Rebekah Rand	Blue Mountain Hospital District	rrand@bluemountainhospital.org
Mark Webb	Mark Webb	Blue Mtns Forest Partners	bwfp06@gmail.com

2020 Grant County Natural Hazards Mitigation Plan Update
Steering Committee Mtg. #3
07/18/19
415 Patterson Bridge Rd, John Day, OR 97845
Sign-in Sheet

Signature	Steering Committee Member	Organization	Email
	Jason Kehrberg	Grant SWCD	jkehrberg@ortelco.net
	Nick Green	City of John Day	greenn@grantcounty-or.gov
	Marvin Rynearson	Prairie City Fire Dept.	
	City Manager	City of Dayville	dville@ortelco.net
	Zach Mobley	Under Sheriff	mobleyz@grantcounty-or.gov
	Alan Hickerson	Grant County Roads	hickersona@grantcounty-or.gov
	Ron Smith	John Day Fire Dept.	Ronsmith5201@yahoo.com
	Ryan Miller	Oregon Department of Forestry	Ryan.miller@regon.gov
	Brian Vogt	Monument SWCD	mswcd@centurytel.net
	Eric Julsrud	Oregon Water Resources Dept.	Eric.W.JULSRUD@wrd.state.or.us
	Kenny Delano Mayor	City of Mt. Vernon	kennyfse@ortelco.net

Figure 9. September 9, 2019 Steering Committee meeting agenda

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #4

Mitigation Strategy

September 9, 2019
9:00 to 11:00 PM
Oregon Department of Forestry - John Day Unit Office
415 Patterson Bridge Rd, John Day, OR 97845

AGENDA

Introduction and Background	**9:00 – 9:10**
▪ Introductions ▪ Meeting Goals and Objectives · Review and Assess Updated Mitigation Actions List	
Updates	**9:10 - 9:40**
▪ DOGAMI Risk Assessment - Matt Williams, Geohazards Analyst (971-940-4908) ▪ Schedule Review ▪ Public Outreach / Survey / Flyer ▪ Cost Share ▪ IGA ▪ Risk MAP Discovery	
Mitigation Strategy	**9:40 - 10:30**
▪ Review and Assess Updated Mitigation Actions List	
Next Steps	**10:30 – End of Mtg.**
▪ Action Items ▪ Fill Out and Turn In Cost Share Form.	

Figure 10. September 9, 2019 Sign-in Sheet

2020 Grant County Natural Hazards Mitigation Plan Update
Steering Committee Mtg. #4
09/09/19
415 Patterson Bridge Rd, John Day, OR 97845
Sign-in Sheet

Signature	Steering Committee Member	Organization	Email
[illegible]	Ted Williams	County Emergency Manager	williamst@grantcounty-or.gov
Scott W. Myers	Scott Myers	County Judge	myerss@grantcounty-or.gov
	Hilary McNary	County Planning	mcnaryh@grantcounty-or.gov
[illegible]	Shannon Springer	County Planning	gcplan@grantcounty-or.gov
[illegible]	Haley Walker	Grant County Regional Airport	walkerh@grantcounty-or.gov
	Steve Fisher	Canyon City Mayor	fischers@grantcounty-or.gov
	Bret Uptmor	Grant County Education Service District	uptmorb@grantesd.k12.or.us
	Robert Wallenberg	Grant County Education Service District	waltenburgr@grantesd.k12.or.us
	Barbara Dole	Citizen-at-large	sagebrusharts@yahoo.com
	Krista Qual	BHM Quality Assistance Hospice	kqual@bluemountainhospital.org
[illegible]	Rebekah Rand	Blue Mountain Hospital District	rrand@bluemountainhospital.org

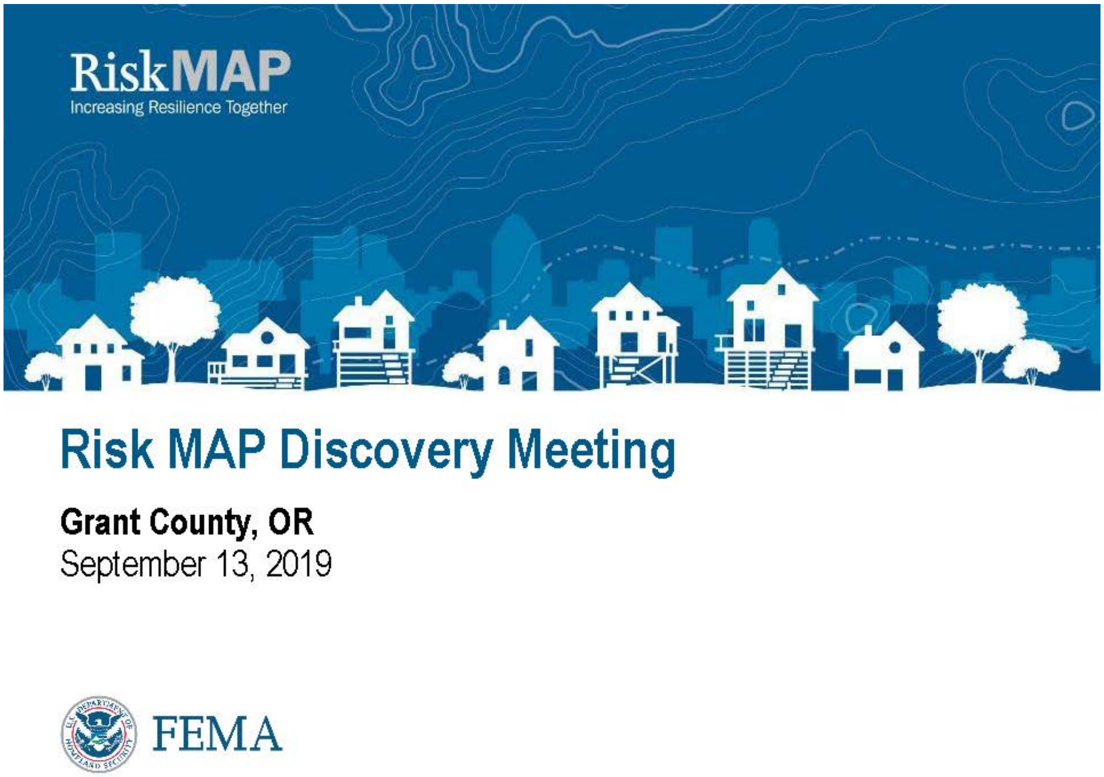
2020 Grant County Natural Hazards Mitigation Plan Update
Steering Committee Mtg. #4
09/09/19
415 Patterson Bridge Rd, John Day, OR 97845
Sign-in Sheet

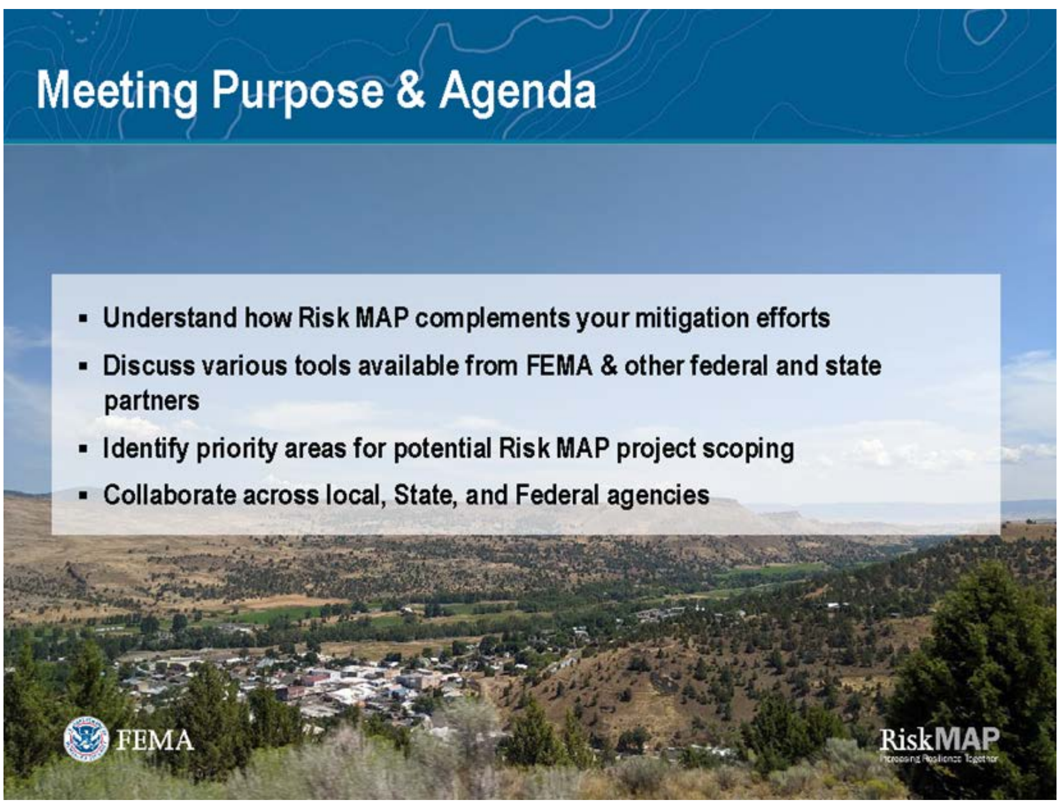
Signature	Steering Committee Member	Organization	Email
[illegible]	Kyle Sullivan	Grant SWCD	sullivank@ortelco.net
	Nick Green	City of John Day	greenn@grantcounty-or.gov
	Marvin Rynearson	Prairie City Fire Dept.	
	City Manager	City of Dayville	dville@ortelco.net
	Zach Mobley	Under Sheriff	mobleyz@grantcounty-or.gov
	Alan Hickerson	Grant County Roads	hickersona@grantcounty-or.gov
	Ron Smith	John Day Fire Dept.	Ronsmith5201@yahoo.com
	Ryan Miller	Oregon Department of Forestry	Ryan.miller@regon.gov
	Brian Vogt	Monument SWCD	mswcd@centurytel.net
	Eric Julsrud	Oregon Water Resources Dept.	Eric.W.JULSRUD@wrd.state.or.us
	Kenny Delano Mayor	City of Mt. Vernon	kennyfse@ortelco.net

2020 Grant County Natural Hazards Mitigation Plan Update
Steering Committee Mtg. #4
09/09/19
415 Patterson Bridge Rd, John Day, OR 97845
Sign-in Sheet

Signature	Steering Committee Member	Organization	Email
	Raamin Burrell City Manager	City of Seneca	admin@senecaoregon.com
	Bobbie Brown	City of Prairie City	pchall@ortelco.net
Mark Webb		Blue Mtns Forest Partners	bmfp06@gmail.com
Frances Preston		citizen	fnpreston1@gmail.com

Figure 11. September 13, 2019 FEMA Risk MAP notification





GRANT COUNTY & COMMUNITIES

DISCOVERY MEETING SIGN-IN | September 13, 2019

NAME	TITLE	COMMUNITY (COUNTY/CITY/AGENCY)	EMAIL
Hilary McNary	Planning Director	Grant County	mcnaryh@grantcounty-or.gov
Shannon Springer	Planning Assistant	Grant Co	gcplan@grantcounty-or.gov
Marsie Watson	City Recorder	Long Creek	citylc@centurytel.net
Jason Gately	Natural Hazard Planner	State of Oregon	jason.gately@state.or.us
Raamin Burrell	City Manager	City of Seneca	admin@senecaoregon.com
Bret Uptmor	Superintendent	Grant School District #3	Uptmorb@GrantESD.K12.OR.US
Nick Green	City Manager	John Day	greenn@grantcounty-or.gov
Joseph Murray	Planner	OMD-Office of Emergency Mngt.	joseph.murray@mil.state.or.us
Ted Williams	Grant Co Emergency Management	Grant County	williamst@grantcounty-or.gov
Vali Hettinga	Dayville		vhettinga@msn.com

GRANT COUNTY & COMMUNITIES

DISCOVERY MEETING SIGN-IN | September 13, 2019

NAME	TITLE	COMMUNITY (COUNTY/CITY/AGENCY)	EMAIL
David Hand	City of Dayville Public Works Maintenance	Grant / Dayville	handdavid1@yahoo.com
Chris Camarena	Director of Public Works	City of Prairie City	pworks@ortelco.net
Marvin Rynearson	Fire Chief Prairie City	City of Prairie City	pcsdmarvin@gmail.com
Kristian Thornton	Outreach Coordinator	City of Long Creek	kris@nfjdwc.org
Jennifer Garinger	Office Manager LC School EMS/Fire Long Creek	Long Creek	garingerj@grantesd.k12.or.us
Mark Webb	ED Blue Mountains Forest Partners	county-wide	bmfp06@gmail.com

GRANT COUNTY & COMMUNITIES

DISCOVERY MEETING SIGN-IN | September 13, 2019

NAME	TITLE	COMMUNITY (COUNTY/CITY/AGENCY)	EMAIL
Doug Jordan	City Recorder	City of Monument	cityofmonument@centurytel.net

Figure 12. February 14, 2020 Steering Committee meeting agenda

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #5

Risk Assessment Draft Review

February 14, 2020
10:00 to 12:00 PM
Oregon Department of Forestry - John Day Unit Office
415 Patterson Bridge Rd, John Day, OR 97845

AGENDA

Introduction and Background	**10:00 – 10:10**
▪ Introductions ▪ Meeting Goals and Objectives · Review and revise draft Risk Assessment chapter	
Updates	**10:10 - 10:30**
▪ Schedule Review ▪ Public Outreach ▪ Cost Share	
Risk Assessment Chapter review	**10:30 - 11:30**
▪ Review and Revise Risk Assessment Chapter	
Next Steps	**11:30 – End of Mtg.**
▪ Review Mitigation Actions ▪ Draft Mitigation Chapter ▪ Set meeting for review of Mitigation Chapter ▪ Public Outreach on Risk Assessment and Mitigation Actions ▪ Public Comment	

Figure 13. February 14, 2020 Minutes in lieu of Sign-in sheet

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #5

Risk Assessment Draft Review

February 14, 2020
10:00 to 12:00 PM
530 E. Main Street, Suite F, John Day, OR 97845
And via Zoom https://zoom.us/j/801564108
Meeting ID: 801 564 108

Minutes

Attending: Ted Williams, Bret Uptmor, Robert Waltenburg, Shannon Springer, Daisy Goebel, Haley Walker, Katherine Daniel

Introductions: The meeting began at 10:02 am with brief introductions and review of the objective of the meeting, review and revision of the draft Risk Assessment chapter. The meeting was advertised through a flyer prepared by Ted Williams posted in post offices around the county, in the county courthouse, county health department and through emails to steering committee members, invited attendees and any member of the public who had attended any previous meetings.

Schedule: The schedule was reviewed briefly noting that there would be two more public meetings to complete the NHMP. The next meeting is anticipated in the last half of March to review mitigation actions. The Steering Committee anticipates that this March meeting will be advertised in the weekly Blue Mountain Eagle. Ted Williams indicated that he will provide that notice to the newspaper.

Public Outreach: Other methods for making public outreach were discussed. A booth and/or flyers at the grocery store and a booth at the Health Fair in April were discussed. Ted Williams indicated that he could include information on the NHMP process at the Health Fair.

Cost Share: Katherine Daniel briefly discussed the value of each Steering Committee members' time during the update of the NHMP. Documentation of this time spent (cost share) in activities related to the development of the NHMP (meetings, time preparing for meetings, presentations or staffing public outreach events) is important, however, she was not yet clear on how to do that most efficiently and will be in touch with meeting participants via email in the near future on that.

Review of Risk Assessment Chapter:

Daisy noted the need to focus on the vulnerability of John Day's waste water treatment facility to flooding. The city intends to relocate the facility, but it is not yet completed. In this way the location of the facility is both a continuing vulnerability and a potential success story.

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Shannon commented that drought may not be as much a factor in wildfire incidence as the condition of the forest is. There was discussion of the Community Wildfire Protection Plan. Ted indicated that he uses it regularly and that the individual who is charged with implementing this plan, Irene Jerome, is active in implementing the CWPP and would be a useful contact for Katherine and the Steering Committee as they evaluate mitigation actions for the plan. The group agreed that updating the CWPP might be a useful mitigation action for the threat of wildfire.

The group agreed that wind storms and landslides might be more likely hazards than volcanic events. There was discussion of the vulnerability of the Blue Mountain Hospital to landslide hazard and its critical role in recovery from disasters. Other areas that are vulnerable to landslide include portions of Canyon City where fuel tanks sit adjacent to hillside areas prone to rock fall protected only by block walls.

Windstorms tend to be intense for a short period of time, but can cause significant damage. Ted gave the example of the water supply system in Prairie City that was sustained damage to its electrical components and some mechanical components. The city was able to secure some grant funding to repair the system, but this repair is still on going. The public works director for Prairie City was able to work together with the City of John Day to ensure that sufficient water was on hand for firefighting during the time that the water system was out of commission. This is a powerful example of resilience in Grant County and should be included in the NHMP.

Other vulnerabilities for isolated communities include limited access. Landslide could further isolate or even cut off access to communities like Granite.

Seismic retrofitting of Grant Union High School is partially complete and the Education Service District intends to make another push at application for retrofitting the remainder of Humboldt Elementary and other schools in the district. Robert asked about leveraging funds obligated through bonds for seismic retrofitting as were raised in Dayville to match future funding for seismic retrofitting. He indicated that other public structures such as John Day City Hall could be retrofitted with leveraged funding.

The vulnerability of Grant Union High School to flooding and to intrusion of groundwater makes this location potentially unusable as a shelter. There was discussion about means for mitigating this hazard including constructing flood walls, elevating the building and constructing levees.

The Risk Assessment chapter will be edited with these comments and provided to the Steering Committee before Friday, February 21.

The next meeting will be held in the latter half of March to discuss mitigation actions.

The meeting concluded at 11:45 am.

Figure 14. April 10, 2020 Steering Committee agenda

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #6

Mitigation Strategy Draft Review

April 10, 2020
10:00 to 12:00 AM
Via Zoom only
Meeting URL: https://zoom.us/j/739176304 or
by phone dial 888 683 5191 or 855 880 1246 or 877 853 5257
Meeting ID: 739 176 304

AGENDA

Introductions and Objectives	**10:00 – 10:10**

- Introductions
- Meeting Objectives
  - Review and revise draft Mitigation Strategy chapter
  - Discuss plan implementation framework for next 5 years

Consideration of integration of Risk MAP report outcomes into Mitigation Strategy	**10:10 - 11:00**

Please review the attached Risk MAP report which would have been emailed to many of you in January. I will be prepared to propose specific revisions and additions to the Mitigation Actions table in the chapter emailed a week ago and also attached.

Please note that the Risk MAP report is broken down with tables for each city and for the county. Please focus on the pages that relate especially to the jurisdiction you represent.

Plan Implementation framework discussion - How will we implement the plan?	**11:00 - 11:30**

- How will we provide updates to elected officials?
- How will we monitor and evaluate progress on action items?
- What will be the schedule for updating the mitigation plan within a 5-year cycle?
- How will we continue to encourage public participation among our communities during the plan maintenance process?

Public Comment and Next Steps	**11:30 – End of Mtg.**

- More reading…both the Introduction and the Plan Implementation chapter will be sent to you soon for your review and comments.
- How to solicit public comment on completed plan?
- Last meeting

Figure 15. April 10, 2020 Steering Committee Minutes

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #6

Mitigation Strategy Draft Review

April 10, 2020
10:00 to 12:00 AM
Via Zoom only
Meeting URL: https://zoom.us/j/739176304 or
by phone dial 888 683 5191 or 855 880 1246 or 877 853 5257
Meeting ID: 739 176 304

Minutes

Attending Steering Committee members: Daisy Goebel, Grant County Planner; Kyle Sullivan, Grant Soil and Water Conservation District; Katherine Daniel, DLCD project manager

Attending stakeholders and members of the public: Raamin Burrel, Seneca City Manager; Irene Jerome, Community Wildfire Coordinator; Tamra Mabbott, DLCD Regional Representative; Rudy Diaz, Blue Mountain Eagle reporter;

Introductions: The meeting began at 10:04 am with brief introductions and a review of the objective of the meeting.

Review of Mitigation Strategy: Each action item was reviewed. Additions, clarifications or corrections were made to the draft Mitigation Actions table during the meeting with the guidance of the steering committee members.

Plan Implementation: The steering committee members agreed that the plan would be maintained and implemented through annual meetings of an implementation committee. This committee was established as the full participation of the steering committee and a new Emergency Manager would be crucial to the formation of that body. The Implementation Committee would be chaired by the Emergency Manager and comprised of representatives from each of the incorporated cities and special districts in the county along with other Grant County staff.

Public Comment: A staff writer for the Blue Mountain Eagle attended the meeting, but did not have any specific comments or questions at this time.

Next Steps and Outreach: The project manager indicated that the remainder of the plan could be written within two weeks. It was agreed that she would send a link to the document to the steering committee members and they would plan to convene for the final steering committee meeting on May 8th. At that time the means for soliciting public review of the completed NHMP would be discussed. The steering committee suggested that notification to the public would be accomplished through radio and newspaper as well as through the members' internal networks.

The meeting adjourned at 12:02 pm.

Figure 16. May 12, 2020 Steering Committee Agenda

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #7

2020 Grant County NHMP final draft review

OREGON
Department of Land Conservation & Development

May 12, 2020
11:00 AM to 1:00 PM
Via Zoom only
Meeting URL:
https://us02web.zoom.us/j/99172788386?pwd=UHk5MWNFWG9EZ2Jpb3E4aE82alhiZz09
or
by phone dial 888 683 5191 or 855 880 1246 or 877 853 5257
Meeting ID: 991 7278 8386; Password: 433574

AGENDA

Introductions and Objectives **11:00 – 11:10**

- Introductions
- Meeting Objectives
  - Review and provide final comments on NHMP final draft
  - Discuss plan approval and adoption process

Minor revisions to Risk Assessment and Mitigation Strategy **11:10 - 11:20**

- High Priority, Short term mitigation actions
- Minor revisions include update to Prairie City School seismic retrofit project. Observations from Steering Committee members and the public.

Remaining sections of Volume I: Basic Plan **11:20 - 11:40**

- Introduction section
- Plan Implementation section, Implementation Committee formation and first meeting

Volume II: Hazard Annexes and OCCRI report **11:40 – 12:00**

Comments and revisions to Volume II; implications of OCCRI report

Volume III: Resources **12:00 – 12:15**

Comments and revisions to Volume III

Plan approval and adoption process **12:15 – 12:30**

Public comment **12:30 – 12:50**

Meeting wrap-up and thank you's **12:50 – 1:00**

May 12 minutes

Figure 17. May 12, 2020 Steering Committee Minutes

Grant County Natural Hazard Mitigation Plan Update
Steering Committee Meeting #7

2020 Grant County NHMP final draft review

May 12, 2020
11:00 AM to 1:00 PM
Via Zoom only
Meeting URL:
https://us02web.zoom.us/j/99172788386?pwd=UHk5MWNFWG9EZ2Jpb3E4aE82alhiZz09
or
by phone dial 888 683 5191 or 855 880 1246 or 877 853 5257
Meeting ID: 991 7278 8386; Password: 433574

Minutes

Attending Steering Committee members: Nick Green, Daisy Goebel, Kyle Sullivan, Shannon Springer, Bret Uptmor, Robert Waltenburg, and Katherine Daniel

Attending stakeholders and members of the public: Tamra Mabbott, Irene Jerome

Introductions: The meeting began at 11:02 am with brief introductions and a review of the objective of the meeting. A recording of the Zoom meeting was saved by K. Daniel for additional evidence of attendance for grant documentation purposes.

Minor revisions to Risk Assessment and Mitigation Strategy: The High Priority, Short Term mitigation actions were selected from the full slate of actions as those that warrant a summary Action Item Sheet for inclusion in Appendix C: Mitigation Action Sheets. The group reviewed and approved the development of a select number of Action Item sheets as fodder for project development and implementation resource development by the Implementation Committee.

Additional information for the Mitigation Action table included the following:

- 2020 status of action EQ 4 (Prairie City School seismic retrofit) was updated to reflect project funding and local permitting has been completed;
- 2020 status of action EQ 6 (Humbolt School seismic retrofit) was updated to reflect the application by Grant School District this year for funding from Business Oregon;
- 2020 status of FL 1.1 (John Day wastewater treatment plant relocation) was updated to reflect that the design funding has been secured and construction funding is being sought.

Discussion of action item DR 2.1 concluded in retaining this action item for development of a summary Action Item Sheet.

Remainder of the Plan: Volume II and Volume III were retained as drafted.

Plan approval and adoption process: K. Daniel described the process that will follow the finalization of the NHMP document. She described the process of completing the FEMA Review Tool for inclusion with the final document and submission to the Oregon Office of Emergency Management and subsequently to FEMA Region X for comments. Comments provided by OEM and FEMA will be

Grant County Outreach Materials and Media

A public engagement strategy was developed early in the process as illustrated in the 2020 Grant County Public Engagement Strategy document below. Flyers were prepared and utilized to educate Steering Committee members to promote public engagement. These flyers were posted in public locations until March 2020, when public engagement was restricted to notices posted online. Press releases stimulated interest in the NHMP process by reports at the local newspaper, the Blue Mountain Eagle. Two articles were published by the Blue Mountain Eagle over the course of the project. In the final months of the process, the plan holding jurisdictions and special districts posted the draft NHMP on their websites and steering committee meetings were held via video conference. The links to these video conference meetings were included in flyers and agendas posted regarding these meetings.

Figure 18. Public Engagement Strategy

2020 Grant County NHMP Public Engagement Strategy

Public engagement is a cornerstone of the NHMP Update. It may include such things as: scheduling, preparing for and staffing public outreach events, posting documents online and gathering comments, organizing mailers, meeting one on one with key stakeholders, or delivering a presentation to stakeholders. Public engagement for the update of the Grant County NHMP will consist of engaging three tiers (groups) of people at various times during the planning process. Grant County will be the lead for this task.

Public Engagement Objectives

Provide an opportunity for all citizens – the whole community - of Grant County to be involved in the planning process, to educate the citizens of Grant County on the risks of natural hazards in their community, to give the planning team a solid understanding of community concerns and values so that they can be reflected in the plan, and to ensure that the whole community clearly understands that their thoughts and concerns will be listened and responded to.

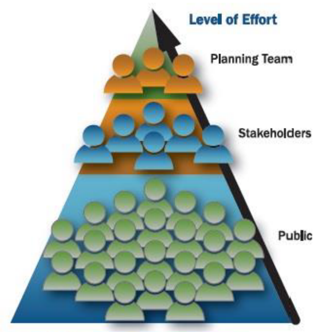

Figure 3.1: Outreach strategy framework

Tier One: The Planning Team

The Planning Team consists of the Grant County Project Conveyor, the Steering Committee and the DLCD Project Manager.

When to provide information and seek input

- At Steering Committee Meetings;
- When a draft of the Risk Assessment has been completed;
- When a draft of the Mitigation Strategy has been completed; and
- When a draft plan and a final have been completed.

How to provide information and seek input

- See the Communication Protocol for the Steering Committee (attached).

Tier Two: Stakeholders

Stakeholders, as defined by FEMA, are individuals or groups that can affect or can be affected by a mitigation action or policy. This may include: elected officials, business leaders, government agencies, cultural institutions, non-profit organizations, neighborhood groups, and academic institutions.

When to provide information and seek input

- At the beginning of the project to let people know what is happening and why;
- When a draft of the Risk Assessment has been completed;
- When a draft of the Mitigation Strategy has been completed; and
- When a draft plan has been completed.

How to provide information and seek input

- Via an internet based county wide opinion survey;
- Through presentations to specific groups;
- In one on one briefings and interviews;

2020 Grant County NHMP Update 1
Public Engagement Strategy

- At well attended county events (fairs, rodeos, etc.);
- Through the news media (television, radio, online and print);
- On relevant social media sites, including jurisdiction web pages, Facebook and Twitter.

Tier Three: General Public

The general public is of all other citizens in Grant County.

When to seek input

- At the beginning of the project to let people know what is happening and why;
- When a draft of the Risk Assessment has been completed;
- When a draft of the Mitigation Strategy has been completed; and
- When a draft plan has been completed.

How to provide information and seek input

- Via an internet based county wide opinion survey;
- Through presentations to business and civic groups;
- In one on one briefings and interviews;
- At key county events (fairs, rodeos, etc.);
- Through the news media (television, radio, online and print); and
- On relevant social media sites, including jurisdiction web pages, Facebook and Twitter.

Other Things to Consider

Develop clear and consistent messages that align with community values

- Consider the overarching goals and values of the community and how they align with reducing the impacts of future hazards and disasters. Then, personalize talking points for discussions with different audiences and develop messages that appeal to them. For example, if a gold-medal trout stream or historic downtown is important to a community's identity and economy, then frame mitigation messages to emphasize these assets and the need for their long-term protection.

Evaluate and incorporate feedback from outreach activities

- The feedback you receive through outreach activities, such as completed questionnaires and surveys, comments at meetings, and comments on plan drafts, should be evaluated and incorporated into the planning team's decision making process and the final plan. Clearly communicate to stakeholders and the public how the planning team uses their feedback to inform the plan. Develop a process for organizing and evaluating the comments received, as well as documenting them in the final plan.

Document the Public Engagement Process

- The plan must document how the public was given the opportunity to be involved in the planning process and how their feedback was incorporated into the plan. The opportunity for participation must occur during the plan's development, which is prior to the comment period on the final plan and prior to plan adoption and approval.

Figure 19. Initial NHMP Public Engagement flyer

2020 Grant County
Natural Hazards Mitigation Plan Update

Wildfires, Floods, Drought, Winter Storms
What Concerns You?

Grant County is collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update the counties plan for natural hazards. A Steering Committee, chaired by the Emergency Manager, is meeting now. The NHMP is targeted for completion by Fall 2020.

Please see the back of this flyer for how to get involved.

Project Contact:
Jason Gately, Project Manager | DLCD
#503-934-0043
Email: Jason.Gately@state.or.us

Grant county
JOURNEY
THROUGH TIME

Why engage in natural hazard mitigation planning?

To avoid disasters by reducing or eliminating long-term risk to people, property, and the environment from natural hazards.

To maintain eligibility for federal disaster related funding.

To increase safety and resiliency by integrating hazard mitigation into the plans, programs, and policies

Grant County's Natural Hazards

Hazard	Risk Score	Risk Level (H-M-L)
Wildfire	240	High
Winter Storms	229	High
Floods	224	High
Droughts	216	High
Volcanic Events	158	Medium
Wind Storms	123	Medium
Landslides	120	Medium
Earthquake	84	Medium

How to Get Involved:

Check the Grant County Website and Facebook page for meeting dates and times, documents to review and an Online survey to complete; and

Call or Email the Project Manager for more information at 503-934-0043 or Jason.Gately@state.or.us

Figure 20. Second Public Engagement flyer, back page only

Why engage in natural hazard mitigation planning?

To avoid disasters by reducing or eliminating long-term risk to people, property, and the environment from natural hazards.

To maintain eligibility for federal disaster related funding.

To increase safety and resiliency by integrating hazard mitigation into the plans, programs, and policies

Grant County's Natural Hazards

Hazard	Risk Score	Risk Level (H-M-L)
Wildfire	240	High
Winter Storms	229	High
Floods	224	High
Droughts	216	High
Volcanic Events	158	Medium
Wind Storms	123	Medium
Landslides	120	Medium
Earthquake	84	Medium

How to Get Involved:

Check the Grant County Website and Facebook page for meeting dates and times and documents to review.

Take the Natural Hazards Survey!
Copy and paste into your browser
https://forms.gle/qkMsiNnaa1e94XVd7

A press release was prepared and sent to the local media. As a result, an article appeared in the Blue Mountain Eagle, the principle local hard copy and online newspaper.

Figure 21. Blue Mountain Eagle article published August 22, 2019

Natural hazards plan update underway

By Richard Hanners Blue Mountain Eagle Aug 22, 2019 0

The public is being asked to provide input for an update to a Natural Hazards Mitigation Plan for Grant County.

The revised plan will not only include updated information for emergency planning but will focus on Grant County rather than be regional in scope, Grant County Emergency Management Coordinator Ted Williams told the Eagle.

The goals of natural hazard mitigation planning are to avoid disasters by reducing or eliminating long-term risk to people, property and the environment; to maintain eligibility for federal disaster-related funding; and to increase safety and resiliency by integrating hazard mitigation into plans, programs and policies.

Eight natural hazards have been broadly identified. At the top in priority are wildfires, severe winter storms, floods and drought, followed by volcanic activity, wind storms, landslides and earthquakes.

Work on the plan update is being funded with an Oregon Department of Land Conservation and Development grant, Williams said. A steering committee to work on the update currently has 24 members, including state and county officials, city representatives, school officials, local fire chiefs and first-responders.

Based on the results of the steering committee's analysis, mitigation actions will be developed to help make Grant County more resilient to these natural hazards. Mitigation actions can include local plans and regulations, structure and infrastructure projects, natural systems protections, education programs and awareness programs.

Some of these mitigation activities may be eligible for future Federal Emergency Management Administration funding, such as localized flood reduction measures, property acquisition and relocation, infrastructure retrofits, creating defensible space around homes and businesses for wildfires and even weatherizing homes to help make homes more resilient to climate fluctuations, such as hotter summers and colder winters.

The steering committee will meet from 9-11 a.m. Monday, Sept. 9, at the Oregon Department of Forestry building in John Day. The meeting is open to the public.

Residents and interested parties can also provide input through a public opinion survey online at https://forms.gle/XGt2ewvYLhieAKzs8. Williams can be contacted at 541-575-0990 or williamst@grantcounty-or.gov.

In separate but parallel work, a FEMA Risk MAP meeting will be held in Grant County on Sept. 13, with some of the same steering committee members in attendance. The meeting is not open to the public.

"It is what they call a discovery meeting," Grant County Planning Director Hilary McNary told the Eagle. "Essentially they are in the process of understanding (discovering) what risks face our community and how they can help."

McNary said her primary interest is updating flood maps for the county that will be accurate and reflect the actual risk of a flood event for a specific property. The FEMA meeting will also cover wildfires, landslides and other hazards.

Tags: Ted Williams | Management | Computer Science | Emergency | Plan | Public | Natural | Hazard | Williams | Steering Committee | Politics | Company | Social Services | Update | Fire Chief | Official | First Responder | Grant County | Mitigation | Program | Work | Risk | Welfare | Planning | Hilary Mcnary | Building Industry

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Richard Hanners
Reporter
Richard Hanners is a reporter for the Blue Mountain Eagle. He can be contacted at rick@bmeagle.com or 541-575-0710.

Figure 22. Second article published by the Blue Mountain Eagle May 5, 2020

Final planning session for Grant County Natural Hazard Mitigation Plan

By Rudy Diaz Blue Mountain Eagle May 5, 2020 Updated 15 hrs ago 0

1 of 3

Planning for the updated Grant County Natural Hazard Mitigation Plan comes to an end in May as the committee moves on to the final conference call for planning.

On May 12, there will be a virtual meeting from 11 a.m. to 1 p.m., and this will likely be the final steering committee meeting prior to future meetings to adopt the plan. The link for the meeting is https://us02web.zoom.us/j/99172788386pwd=UHk5MWNFWG9EZ2Jpb3E4aE82alhiZz(

The meeting ID is 991 7278 8386. The password is 433574.

This plan is created from an assessment from the community and their perceptions of the risks faced from a range of natural hazards, according to Katherine Daniel from the Oregon Department of Land Conservation and Development.

MOST POPULAR

Articles

- Governor's office proposes guidelines for reopening Oregon businesses
- Deputy on paid leave for more than a year pleads guilty to DUII
- New draft guidelines posted for reopening Oregon salons, restaurants
- Man dies Saturday in crash near Mt. Vernon
- Former deputy pleads not guilty to attempted rape, other charges
- Eastern Oregon counties developing plans to reopen economy
- 9th Circuit rejects lawsuit against Malheur National Forest grazing authorizations
- Unanimous jury verdicts now required in Oregon; Albany defense attorney celebrates Supreme Court decision
- Teamsters: Labor Dispute Looming at Hood River Distillers!
- Grant County economic reopening plan call scheduled at 4 p.m. Tuesday

Another benefit is the opportunity to work with the Oregon Department of Geology and Mineral Industries, which provides an analysis of the structures and people at risk from floods, fires or other hazards.

"The goal of this is to reduce the damage to property and the risk to lives," Daniel said.

The mitigation plan focuses on eight hazards in the county, which are wildfires, severe winter storms, floods and drought, followed by volcanic activity, wind storms, landslides and earthquakes.

Daniel said that this plan is an update to an existing plan from 2014 that focused on the northeastern part of Oregon and included four counties. The current work is updating the plan with a focus on Grant County.

The Federal Emergency Management Agency sets the planning process and provides grant money for the DLCD to participate in writing a plan. FEMA also sets expectations for the county to be as involved as possible. After the planning process concludes, the plan will be submitted to the Oregon Emergency Management for review, and then FEMA will look at the plan for approval and comments before the next phase.

"I want to emphasize that one of the big benefits of having a mitigation plan that's been approved by FEMA is that it opens the door to FEMA mitigation grant funding, so the community doesn't have to support the whole bill, but they have to be supportive of the plan as a whole so their elected officials have the authority to go forward and seek grants that'll be necessary for some of the mitigation plans," Daniel said.

She said the average homeowner can provide a unique perspective and may also be aware of hazards they are subject to and assist in providing a full picture of what the community will support when the process of adoption begins.

"In the end, community resources may be required to put forth some of these mitigation actions," Daniel said.

Ted Williams, the former Grant County emergency management coordinator, was central to planning as he helped build the steering committee with Jason Gatley from the DLCD, prior to Daniel. Williams had the responsibility to make people aware of the meetings and what the content would be, according to Daniel.

The steering committee is formed from people from the state and county officials, city representatives, school officials, local fire chiefs and first responders.

Even with the resignation of Williams from his position, the steering committee continues to plan and work, but the open position will need to be addressed for the next phase.

"I think Ted laid a really great groundwork and did a great job at putting together a cohesive group that would show up and participate," Daniel said.

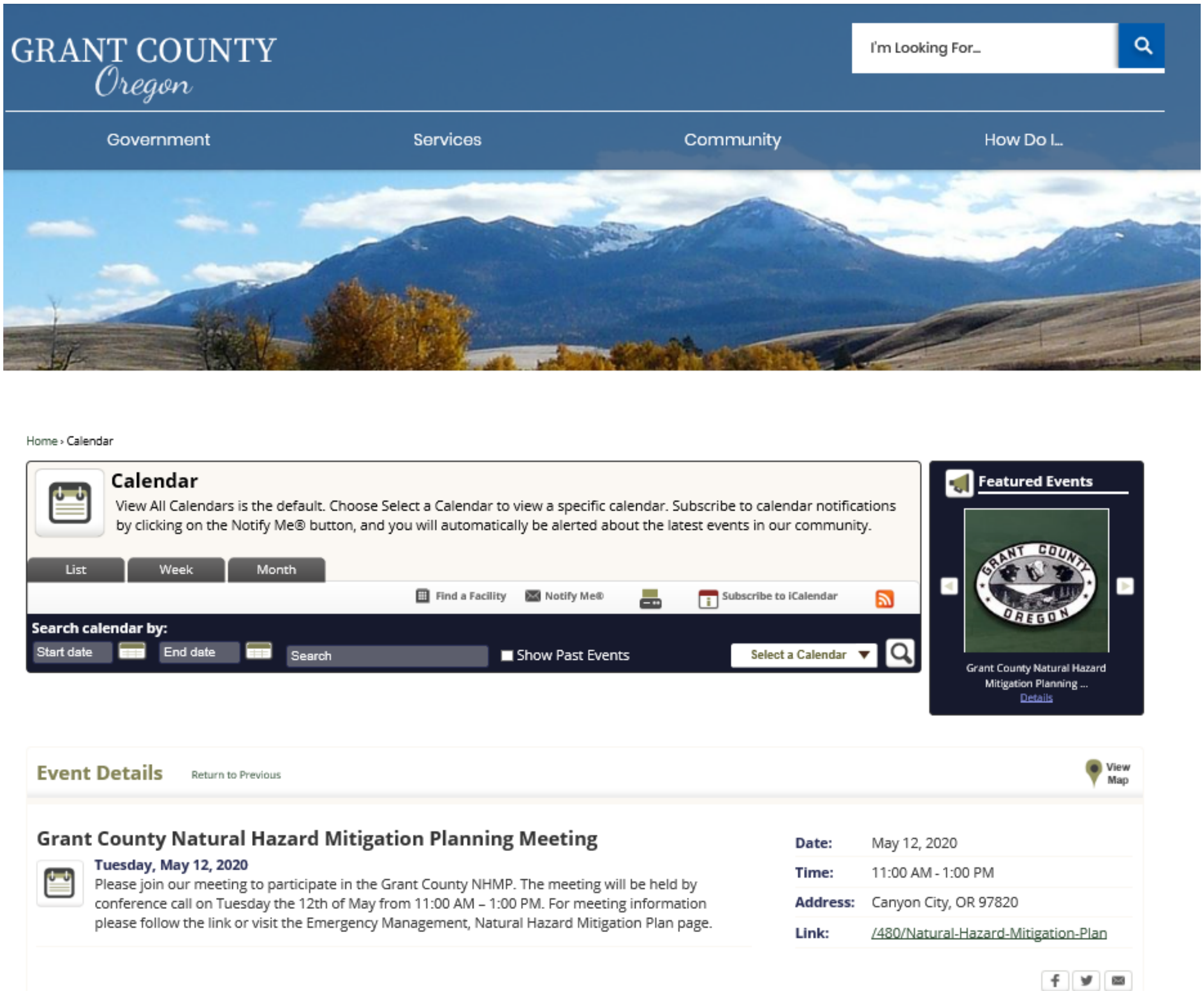
As the committee concludes the plan, which will be effective for five years, the next phase is to implement the mitigation actions. Daniel said the individual who would build the implementation committee would be the emergency manager.

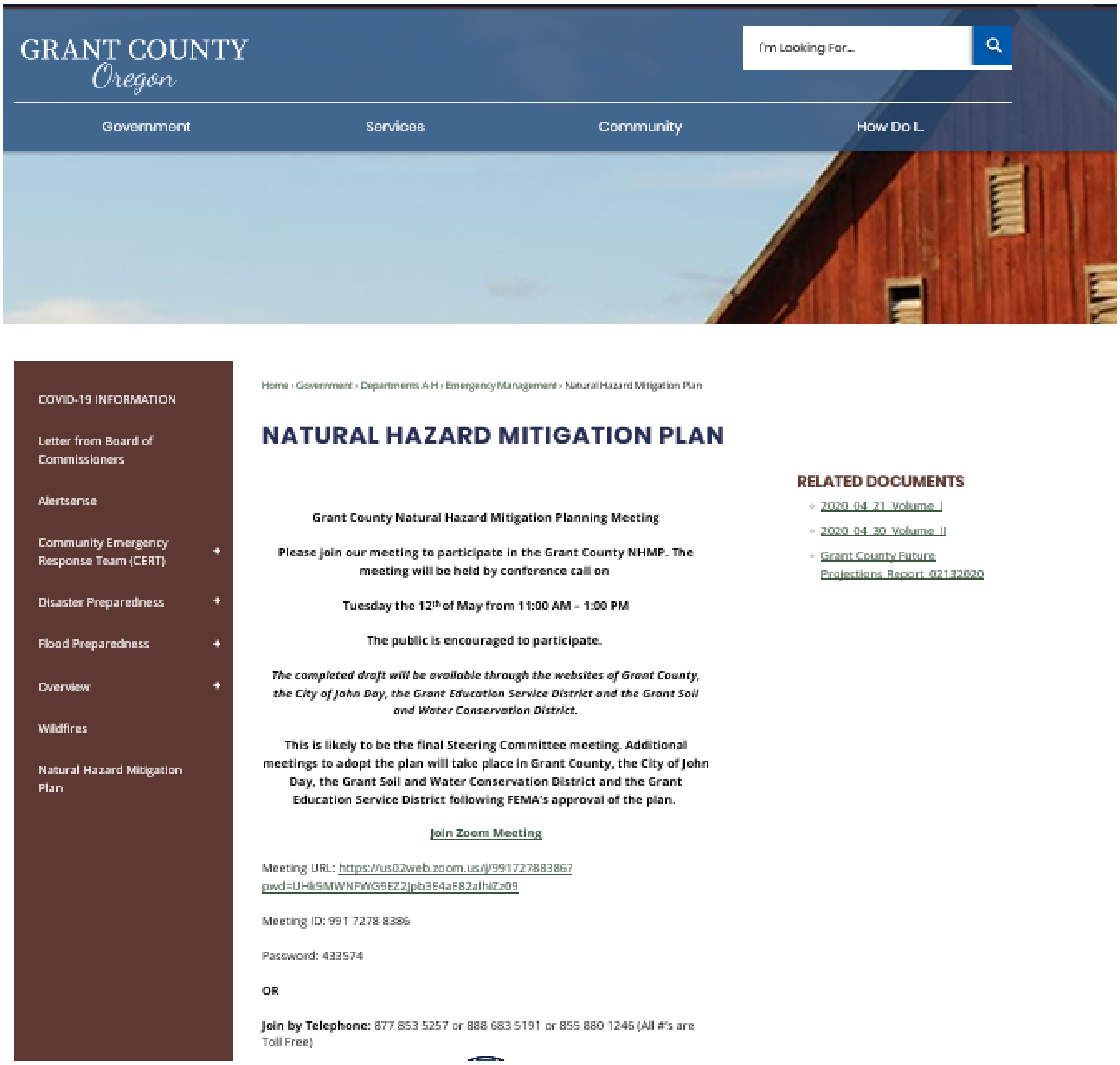
"The steering committee made the decision at the last meeting that the implementation committee should meet every year," Daniel said. "They also decided that the emergency manager, when in place, would be the convener of that committee," Daniel said.

Currently, the temporary emergency manager is Dave Dobler until the COVID-19 pandemic subsides, according to Grant County Judge Scott Myers.

"The writing of the plan may be nearly done, but being involved in educating yourselves or your neighbors about how Grant County residents can avoid the devastation from floods or wildfires is important," Daniel said. "It's important to be engaged with your government and be aware that the county has a whole separate plan that relates only to wildfire."

Figure 23. Grant County Webpage May 2020





GRANT COUNTY Oregon

I'm Looking For...

Government | Services | Community | How Do I...

COVID-19 INFORMATION
Letter from Board of Commissioners
Alertsense
Community Emergency Response Team (CERT)
Disaster Preparedness
Flood Preparedness
Overview
Wildfires
Natural Hazard Mitigation Plan

Home › Government › Departments A-H › Emergency Management › Natural Hazard Mitigation Plan

NATURAL HAZARD MITIGATION PLAN

Grant County Natural Hazard Mitigation Planning Meeting

Please join our meeting to participate in the Grant County NHMP. The meeting will be held by conference call on

Tuesday the 12th of May from 11:00 AM – 1:00 PM

The public is encouraged to participate.

The completed draft will be available through the websites of Grant County, the City of John Day, the Grant Education Service District and the Grant Soil and Water Conservation District.

This is likely to be the final Steering Committee meeting. Additional meetings to adopt the plan will take place in Grant County, the City of John Day, the Grant Soil and Water Conservation District and the Grant Education Service District following FEMA's approval of the plan.

Join Zoom Meeting

Meeting URL: https://us02web.zoom.us/j/99172788386?pwd=UHlkSMWNFWG9EZ2Jpb3E4aE82alhiZz09

Meeting ID: 991 7278 8386

Password: 433574

OR

Join by Telephone: 877 853 5257 or 888 683 5191 or 855 880 1246 (All #'s are Toll Free)

RELATED DOCUMENTS

- 2020_04_21_Volume_I
- 2020_04_30_Volume_II
- Grant County Future Projections Report_02132020

Figure 24. John Day Facebook Page

Figure 25. John Day website posting May 2020

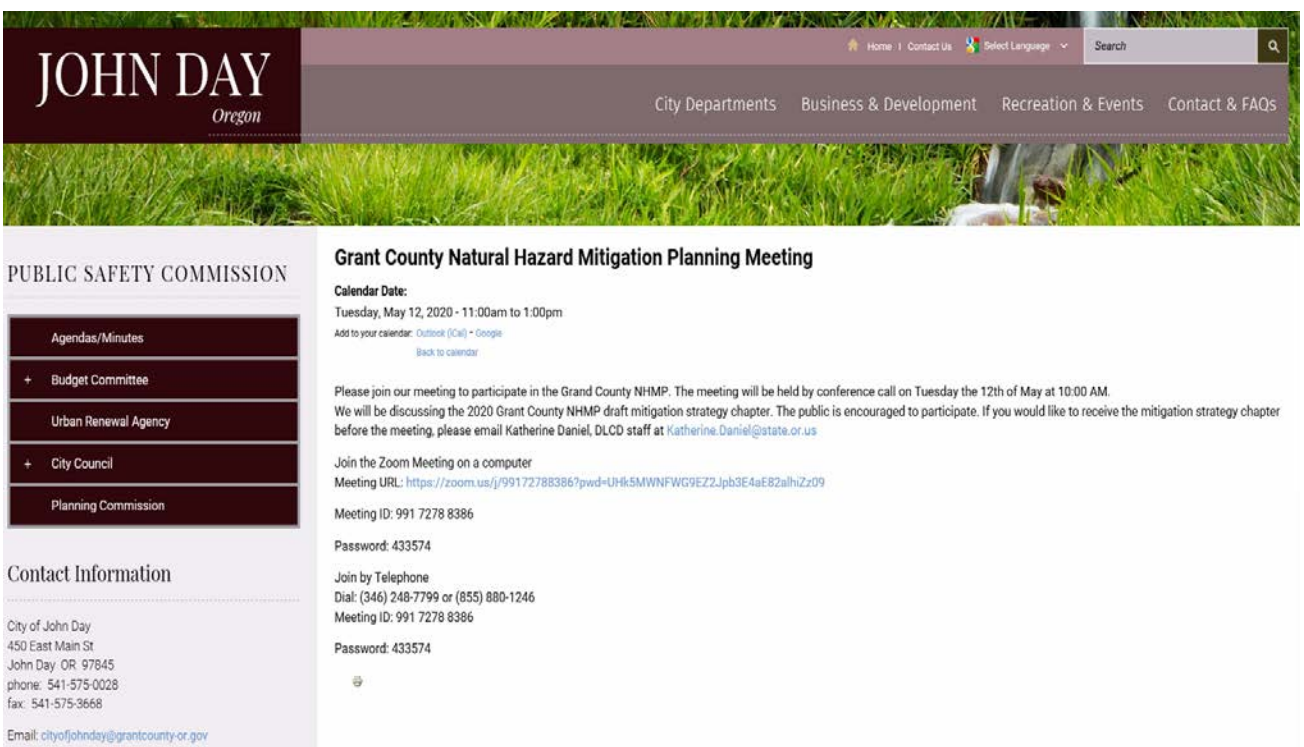
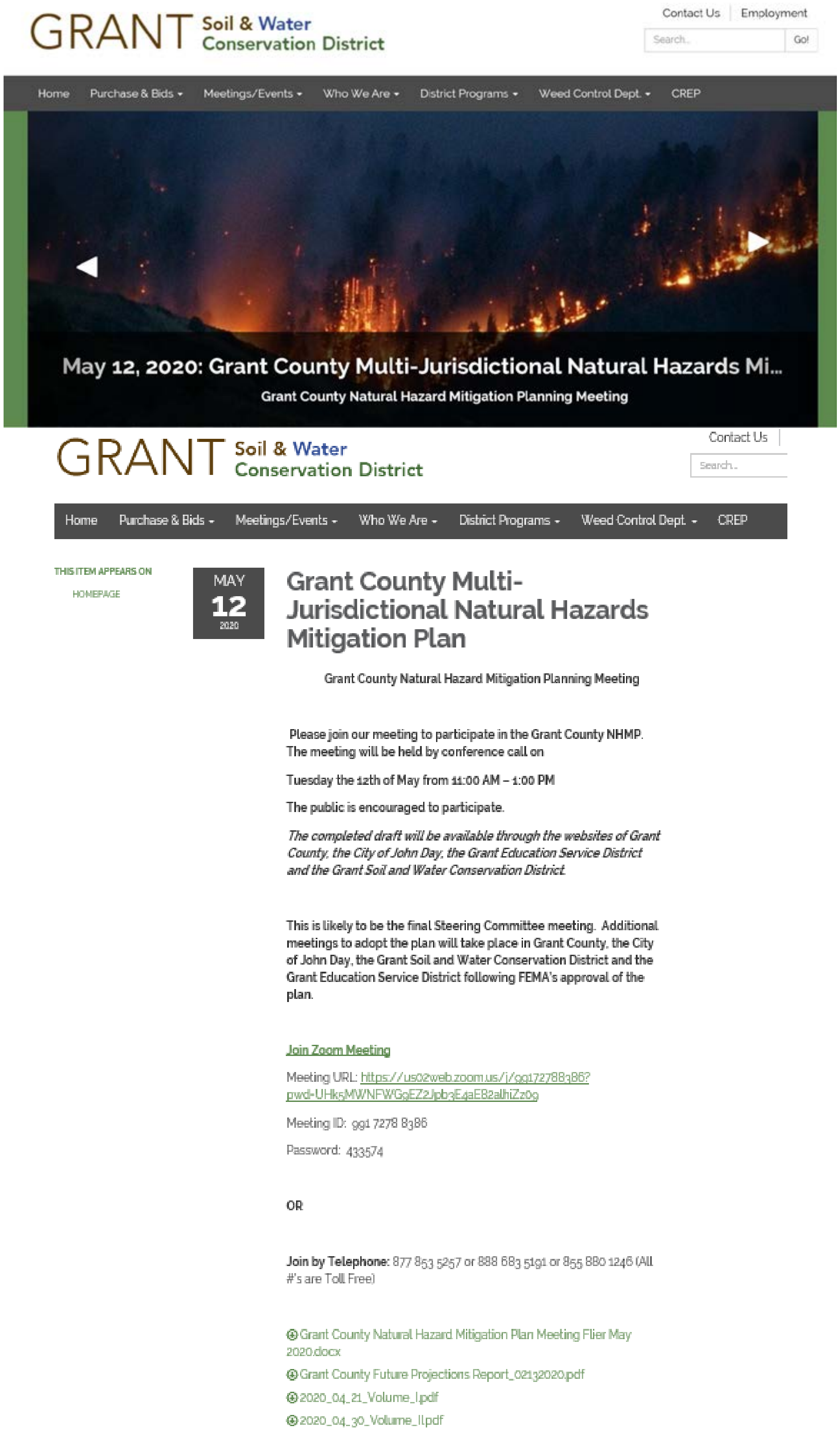


Figure 26. Grant Soil and Water Conservation District Webpage posting May 2020



2020 Plan Update Changes

The entire *2014 Northeast Oregon Multi-Jurisdictional NHMP* has been revised and updated. While the basic format of the existing NHMP was retained, substantial changes have been. Generally, the *2020 Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan* provides updated statistics and attempts to make the document more readable by removing repetition and focusing on the most salient aspects of hazard identification, risk assessment and mitigation actions. The document style has been revised to match other NHMPs prepared by DLCD beginning with the Tillamook County NHMP so as to make this work recognizable as such.

Cover and Front Pages

The cover and the front pages orient the reader of the NHMP to what the NHMP contains.

- A new NHMP cover was created in the style noted above. The photos for the cover were taken by Grant County and DLCD staff. Photos were also added to the Volume I,II, and III covers.
- The FEMA Approval Pending Adoption (APA) and final approval letter as well as the County and Cities resolutions of adoption are included in the final document (when available).
- The Acknowledgements have been updated to include the 2019-2020 Steering Committee members.

Volume I: Basic Plan

Volume I includes the cover, approval letters, jurisdictional resolutions, the Table of Contents, and the Executive Summary. It provides the overall plan framework for the *2020 Grant County NHMP*. It also contains Section 1: Introduction; Section 2: Risk Assessment; Section 3: Mitigation Strategy; and Section 4: Plan Implementation and Maintenance.

Section 1: Introduction

Section 1 introduces the concept of natural hazards mitigation planning and answers the question, “Why develop a mitigation plan?” Additionally, Section 1 summarizes the 2020 plan update process, and provides an overview of how the plan is organized.

The principle change to this section, as with the entire NHMP, is that information from the focus on Grant County alone has allowed the plan to drill down to focus on the incorporated cities in Grant County allowing a more granular view of hazard mitigation in the county. Rather than having separate addenda for the Cities, the Cities are included in the main body of the NHMP. Where applicable, the Cities are specifically called out for their unique situations.

Section 2: Risk Assessment

Section 2, Risk Assessment, consists of three phases: natural hazard identification, vulnerability assessment, and risk analysis. Hazard identification involves the identification of hazard geographic extent, its intensity, and probability of occurrence. The second phase combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, then attempts to predict how different types of property and population groups will be affected by the hazard. The third phase involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time.

Changes to Section 2 include:

- Format changes to the document to match the style referenced above.
- The incorporation of the information from the cities along with the information concerning Grant County to create a cohesive Risk Assessment section.
- Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. Discussion of the community Hazard Vulnerability Analysis was moved up to Volume I: Section 2 – Risk Assessment. More detailed information about each hazard was moved back to Volume II: Hazard Annexes
- NFIP information was updated.
- The Grant County NHMP Steering Committee performed a new Hazard Vulnerability Analysis/Assessment (HVA), resulting in new scores for the identified hazards of drought, earthquake, flood, landslide, winter storms, wind storms, volcanic events, and wildfire.

Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the NHMP. Changes to Section 3 include the following:

- The NHMP Steering Committee opted to prioritize mitigation actions as described in the section above, using the HVA risk levels. All the multi-hazard mitigation actions were identified as high priority while hazard specific mitigation actions are high, high-medium, medium, and low.
- The mission statement and the goals were reviewed and re-confirmed by the 2020 Steering Committee without any changes.
- The mitigation actions from the *2014 Northeast Oregon Multi-Jurisdictional NHMP* were reviewed. Actions were deleted, retained as is, or retained in a modified fashion. New mitigation actions were established.

Section 4: Plan Implementation and Maintenance

The Grant County NHMP convener is the Emergency Manager; this person will form and facilitate an Implementation Committee for maintaining, updating, and implementing the NHMP. The Implementation Committee will be composed of members of the NHMP Steering Committee and other members of the community. The Implementation Committee plans to meet formally at least once per year based on the framework set out in Section 4 Plan Implementation and Maintenance to implement the Mitigation Strategy contained in Section 3 of the Basic Plan.

Volume II: Hazard Annexes

All hazard specific annexes were reformatted and updated to include new history, data, maps, vulnerability information, and resources as available. Cross references to other information in the NHMP has been updated. Information about climate change has been integrated into the hazard specific annexes and added as Appendix D: Future Climate Projections Reports.

Volume III: Mitigation Resources

All of the appendices have been revised and updated to focus uniquely on Grant County and its incorporated cities. The appendices have been reorganized slightly placing the Community Profile in

Appendix A and the Action Items in Appendix C to follow a more logical progression. Data contained in the Community Profile has been updated with the most recent census information. Appendix D now contains the Future Climate Projection Grant County report prepared by OCCRI while the Appendix previously titled Economic Analysis of Natural Hazards has been located in Appendix E and renamed to better reflect its contents, that being a method of evaluating mitigation actions based on benefit/cost analysis. The remaining appendix includes resources for hazard mitigation grants and program resources. The appendix containing the Regional Household Preparedness Survey was deleted because it was no longer relevant.

Appendix C: Mitigation Action Worksheets

Mitigation Actions from the *2014 NE Oregon Multi-Jurisdictional Natural Hazard Mitigation Plan* were carried over into the 2020 Grant County *Multi-Jurisdictional Natural Hazard Mitigation Plan* as illustrated below in Table 1. This table also tracks the jurisdictions within Grant County to which the mitigation actions apply.

Of the thirty-two actions that were carried over from the 2014 Plan, four of those actions were removed and four actions were completed. Thirty-three new actions were added. These new actions were refinements or more specific actions based on existing action descriptions many of which were identified through the Risk MAP Discovery process conducted by FEMA during the course of the plan update process.

This plan identifies 57 mitigation actions. These actions are prioritized into High Priority (33 actions), Medium Priority (16 actions) and Low Priority (8 actions). Within each priority ranking, the actions are further divided primarily into Long Term, Medium Term and Short Term time frames for action. Some actions are in progress and this is also noted under the Timeline column.

Table 1. Relationship between 2014 NHMP actions and 2020 actions; 2020 timeline, status and jurisdictions concerned

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
MH #1	**MH 1**	**Completed**	Complete Continuity of Operations Plan (COOP) for Grant County.	Short Term	Completed								
MH #2	**MH 2**	**High**	Incorporate the Natural Hazards Mitigation Plan into the Comprehensive Plan (State Planning Goal 7)	Medium Term	Deferred	x	x	x	x	x	x	x	x
MH #3	**MH 3**	**High**	Inform public officials about mitigation awareness and the Natural Hazards Mitigation Plan as part of plan maintenance and implementation.	Routine	Routine	x	x	x	x	x	x	x	x
MH #4	**MH 4**	**High**	Develop and implement education and outreach programs to increase public awareness of the risk associated with natural hazards. Specifically target vulnerable populations	Routine	Routine	x	x	x	x	x	x	x	x
	MH 4.1	**Medium**	Training on how to use HAZ-VU and the Department of Geology and Mineral Industries (DOGAMI) Landslide Mapping Guide to educate property owners. Education is needed for plan review and building permits in high landslide risk zones.	Short Term	New Action	x							

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	MH 4.2	**Medium**	Improve disaster-related public notifications, including: • Flood awareness recommendations outside of reverse 911. • Installing a reader board near City Hall to inform residents and others driving through the city. • Maintain communication during extended power outages. • Leverage evacuation plans.	Medium Term	New Action	x			x				
	MH 4.3	**Medium**	<u>Planning and Training:</u> Requesting training to support disaster preparedness and response to identify roles and responsibilities for staff and volunteers. <u>Outreach and Training</u>: Training for city staff to improve risk communications.	Routine	New Action					x		x	
MH #5		**Removed; perceived inability to implement**	Increase resilience of small businesses to natural hazards.										
MH #6	**MH 5**	**High**	Enhance communication and response coordination among all of the incorporated areas in Grant County.	Routine	Mechanism in place with the NE Oregon fire chiefs. John Day, OR is the defacto hub for group.	x	x	x	x	x	x	x	x
MH #7		**Removed; no longer relevant to new NHMP**	Develop a Memorandum of Understanding to establish a regional committee responsible for oversight and implementation of the regional plan, and to oversee reviewing and updating of the NE Natural Hazards.										

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
MH #8	**MH 6**	**High**	Create a position for a Countywide Hazards Mitigation Project Coordinator	Long Term	Revised to extend action countywide; Deferred due to lack of funding	x							
MH #9	**MH 7**	**High**	Develop a warning and emergency evacuation protocol for vulnerable populations	Short Term	In progress	x							
	MH 7.1	**Medium**	Improve the county website and outreach process specific to: • Identifying how all hazards align with evacuation routes. • Identifying and adding shelter information for all hazards in each community to the website, especially as they relate to evacuation routes.	Short Term	New Action	x							
	MH 7.2	**Medium**	Explore the reverse 911 program and other real-time communication for hard to reach and low-lying areas for people who have minimal technology and communication methods. This would supplement the existing Alert Sense program already implemented in the county to push out alerts to mobile devices for those who sign up for them.	Short Term	New Action	x							
MH #10	**MH 8**	**High**	Ensure that critical airport services are available in the event of an emergency. Critical elements include: adequate fuel systems, appropriate lighting, functioning weather services, ground-access to the airport, and safe runways/taxiway infrastructure	Routine	Routine	x							

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	MH 9	**High**	Expand the existing geographical information system (GIS) for the county and secure funding for expansion of the GIS system.	Short Term	New Action	x	x	x	x	x	x	x	x
MH #11 - MH #17		**Do not apply to Grant County**											
	MH 10	**High**	Complete a road hazard assessment to address existing road situations which could result in problems for evacuation of residents and limit fire apparatus response during a wildfire situation.	Short Term	New Action	x	x	x	x	x	x	x	x
	MH 11	**Medium**	Explore emergency food storage options for county communities for periods when transportation coorridors and delivery logistics are compromised for extended periods of time.	Medium Term	New Action	x	x	x	x	x	x	x	x
	MH 11.1	**Low**	Provide for a stock of supplies and backup generators for each local shelter location.	Medium Term	New Action	x		x	x			x	

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	MH 12	**Medium**	Collect new LiDAR data for both flood hazard and landslide hazard mapping in the listed locations as outlined in the Risk MAP Discovery report particularly in the southwest and northeast areas of Grant County and near the following: • Silvies Watershed to complete the confluence area of Bear Creek and the Silvies River, •Monument and John Day, • North, Middle, and South Forks of the John Day River.	Short Term	New Action	x							
DR #1	**DR 1**	**Medium**	Identify incentive programs to increase water efficiency among agricultural water users	Routine	Routine	x							
DR #2	**DR 2**	**Medium**	Identify incentive programs to Increase water efficiency among municipal water users	Routine	Routine	x	x	x	x	x	x	x	x

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	DR 2.1	**High**	Requesting an irrigation ditch assessment, with consideration of the following details: • The goal is to increase the resilience of the irrigation ditch - improving the ditch so that it is no longer a flood hazard and can be utilized during a wildfire. • Background: The ditch is primarily used for agriculture and irrigation and is funded by the local ditch association. There have been several blowouts. The ditch was damaged in recent floods. Previous funding was provided through residential fee increases. • The city would like to develop a plan for improvement and determine project funding opportunities. The city would like to collaborate with the Oregon Water Resources and Fish & Wildlife departments.	Short Term	New Action				x				
	DR 2.2	**High**	The city has obtained funding and is completing the improvement of the city's well fields to provide more water for both consumption and wildfire protection.	In progress	New Action			x					
DR #3	**DR 3**	**High**	Develop community drought emergency plans and policies	Routine	Routine	x	x	x	x	x	x	x	x
DR #4 & DR #5		**Do not apply to Grant County**											

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
EQ #1	**EQ 1**	**Low**	Perform an earthquake risk evaluation on all critical buildings not listed in the DOGAMI RVS report. Specifically including the Fire Station and City Hall buildings in Prairie City and downtown stone masonry buildings.	Long Term	Modified to fit Grant County needs	x	x	x	x	x	x	x	x
EQ #2 - EQ #8		**Do not apply to Grant County**											
EQ #9	**EQ 2**	**Completed**	Seismically retrofit the John Day Fire Department to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options		Completed - building rebuilt.								
EQ #10	**EQ 3**	**Completed**	Seismically retrofit Mount Vernon Middle School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options		Removed - School closed and sold.								
EQ #11	**EQ 4**	**High**	Seismically retrofit Prairie City School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Short Term	In progress			x					
EQ #12	**EQ 5**	**Completed**	Seismically retrofit Grant Union High School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options		Completed								

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
EQ #13	**EQ 6**	**High**	Seismically retrofit Humbolt Elementary School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Short Term	In progress								x
EQ #14	**EQ 7**	**High**	Seismically retrofit Seneca Elementary School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Short Term	In progress					x			
EQ #15	**EQ 8**	**High**	Seismically retrofit Monument School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options	Short Term	Retain						x		
EQ #16 - EQ #28		**Do not apply to Grant County**											
FL #1	**FL 1**	**Medium**	Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Short Term	Deferred	x	x	x	x	x	x	x	x
	FL 1.1	**High**	Move the waste water treatment plant out of the SFHA. This $12-14 million project is planned to be completed in 2020-21.	Short Term	New Action		x						
	FL 1.2	**Medium**	Create a transportation route that connects the bridges in John Day. There are two bridges that are not connected by streets. Both bridges are small and failing.	Short Term	New Action		x						

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	FL 1.3	**High**	Re-engineer, re-construct, and deepen the USACE river channel that is causing a contamination problem and reduce flooding. The goal is to create a community greenway.	Medium Term	New Action		x						
	FL 1.4	**Medium**	Update and replace Bridge Street and Patterson Bridge. Bridge scouring is occurring along Dixie Creek and Canyon Creek. There is a need to add another bridge to service residential areas and provide improved evacuation routes. The city has questions about how, where, and who can help support and fund these mitigation projects.	Medium Term	New Action		x						
	FL 1.5	**Medium**	Explore opportunities to mitigate flood risk to homes from the Canyon Creek floodplain.	Medium Term	New Action	x	x						x
	FL 1.6	**Low**	Explore opportunites to mitigate flood risk to schools near flood hazard areas near Canyon City, including the high school.	Long Term	New Action		x						
	FL 1.7	**High**	Conduct river restoration and flood mitigation projects to protect vital transportation infrastructure at risk, including bridge access to critical resources.	Long Term	New Action	x		x		x	x		

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	FL 1.8	**High**	Implement best practices for post-wildfire stream stabilization efforts in Dixie Creek and other streams adjacent to recent burn areas. For example, previous efforts to slow stream flow by placing unanchored woody debris in stream beds (Oliver Creek is an example) has resulted in further damage to streams and their fisheries during intense summer storms that can cause mudflows from burned areas.	Medium Term	New Action	x		x					
	FL 1.9	**High**	Address erosion around footings, aprons and and abutments of the Main Street and Bridge Street bridges across the John Day River.	Long Term	New Action			x					
FL #2	**FL 2**	**High**	Explore the costs and benefits for participation in the NFIP's Community Rating System	Short Term	Deferred	x	x	x	x	x	x	x	x
FL #3	**FL 3**	**High**	Increase awareness concerning the NFIP program.	Short Term	Deferred	x	x	x	x	x	x	x	x
FL #4	**FL 4**	**High**	Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	Short Term	In progress	x	x	x	x	x	x	x	x

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	FL 4.1	**High**	New flood analysis is requested with the following details: • all areas of development within or near flood hazard areas, • along Highway 26 and Zone D areas, • expand mapping extent along the North, Middle, and South Forks for the John Day River, • expand mapping extent in the unmapped areas south of Canyon City, • extend mapping to better tie into the Silvies flood map above Seneca and Bear Creek, • re-map the area where the Canyon Meadows Dam once was, and • re-map floodway in populated areas.	Short Term	New Action	x							
	FL 4.2	**Low**	Requesting updated flood studies that will be leveraged during the upcoming Comprehensive Plan update. Specifics include: • Map undeveloped areas as they are being considered for future development. • Flooding in John Day impacts Dayville. • Most flooding occurs in areas with little population.	Medium Term	New Action				x				

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	FL 4.3	**High**	Funding is needed for river gauges for the Silvies River and Bear Creek where flooding commonly occurs at the confluence at the north end of the city. Data on flow and river gauges for the Silvies River and Bear Creek would support mitigation efforts to reduce debris flow and flooding that strands residents.	Medium Term	New Action					x			
	FL 4.4	**Medium**	Requesting an update to the flood maps that would improve existing gaps in the SFHA and increase the understanding of flood risk in the north end of town at the confluence of Bear Creek and Silvies River.	Short Term	New Action	x				x			
FL #5	**FL 5**	**High**	Explore mitigation opportunities for the Canyon City bridge (bridge # 7)	Medium Term	In progress								x
FL #6 & FL #7		**Do not apply to Grant County**											
LS #1	**LS 1**	**Low**	Identify, obtain, and evaluate detailed risk assessments in landslide prone areas and develop mitigation strategies to reduce the likelihood of a potential hazardous event.	Long Term	Deferred	x	x	x	x	x	x	x	x
	LS 1.1	**Low**	Create updated and more detailed hazard maps incorporating the most recent LiDAR data into the current geohazard overlay.	Short Term	New Action	x	x						

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	LS 1.2	**Medium**	Landslide risk assessments to address the concern of being located within a valley.	Short Term	New Action						x		
SW #1	**SW #1**	**Low**	Participate in the NOAA Storm Ready Program	Long Term	Deferred	x							
SW #2	**SW #2**	**Medium**	Shorten spans and anchor poles on utility lines in high wind or heavy icing areas	Routine	Routine	x							
SW #3		**Removed; budgetary constraints**	Bury overhead power lines in winter storm and windstorm prone areas.										
	WS #1	**Removed** due to reticence to exceed existing requirements of state building codes	Adopt additional regulations governing residential construction to prevent wind damage. Currently in compliance with State of Oregon regulations.										
WF #1	**WF 1**	**High**	Advocate for the implementation of the actions identified in the Community Wildfire Protection Plan.	Routine	Routine	x	x	x	x	x	x	x	x

Action number in 2014 NE Oregon NHMP	Action number in 2020 Grant County NHMP	Priority	Description	Timeline	Status	Grant Co	John Day	Prairie City	Dayville	Seneca	Monument	Long Creek	Canyon City
	WF 2	**High**	Implement CWPP's at the zone level. Grant County has been divided into nine separate "zones" for the purposes of the revised CWPP. This methodology was devised to better recognize differences in topography, vegetation, and fire prevention resources within communities throughout the county. Each zone within the county will be encouraged to develop a local CWPP reflecting specific needs and hazards for that area. Each zone will have the opportunity to implement the Firewise Communities USA program.	Medium Term	New Action in progress	x	x	x	x	x	x	x	x
	WF 3	**High**	Evaluate and update the county emergency management system county wide.	Routine	New Action	x	x	x	x	x	x	x	x
	WF 4	**High**	Assist Rural Fire Districts in attratcing volunteer firefighters, upgrading their firefighting equipment, facilities, and training needs.	Routine	New Action	x	x	x	x	x	x	x	x
	WF 5	**High**	Encourage and support collaborative efforts between the USFS, BLM, and communities at risk from wildfires. Help identify needed hazard fuel reduction work on federal lands within the WUI.	Routine	New Action	x	x	x	x	x	x	x	x
	WF 6	**High**	Continue county-wide wildfire education and prevention efforts as described in the 2012 CWPP.	Routine	New Action	x	x	x	x	x	x	x	x

Action number in 2014 NE Oregon NHMP	**Action number in 2020 Grant County NHMP**	**Priority**	**Description**	**Timeline**	**Status**	**Grant Co**	**John Day**	**Prairie City**	**Dayville**	**Seneca**	**Monument**	**Long Creek**	**Canyon City**
	VE 1	**Low**	Continue to support ongoing study of probability of volcanic eruption and potential impact.	Routine	New Action	x	x	x	x	x	x	x	x

High Priority, Short Term Mitigation Actions

In order to focus on the most important and shortest term mitigation actions for further elaboration, the subset of actions which were both High Priority and Short Term were selected. This selection of ten mitigation actions were fleshed out in Mitigation Action Worksheets. The purpose of these worksheets is to provide a jump start for Grant County and the incorporated cities to use in developing funding proposals to implement these most important actions.

The High Priority, Short Term Mitigation Actions are as follows:

MH 7: Develop a warning and emergency evacuation protocol for vulnerable populations

MH 9: Expand the existing geographical information system (GIS) for the county and secure funding for expansion of the GIS system.

MH 10: Complete a road hazard assessment to address existing road situations which could result in problems for evacuation of residents and limit fire apparatus response during a wildfire situation.

DR 2.1: Requesting an irrigation ditch assessment to increase the resilience of the irrigation ditch - improving the ditch so that it is no longer a flood hazard and can be utilized during a wildfire.

EQ 4: Seismically retrofit Prairie City School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.

EQ 7: Seismically retrofit Seneca Elementary School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options

EQ 8: Seismically retrofit Monument School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.

FL 1.1: Move the John Day waste water treatment plant out of the Special Flood Hazard Area.

FL 4: Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.

FL 4.1: New flood analysis is requested with the following details:
- all areas of development within or near flood hazard areas,
- along Highway 26 and Zone D areas,
- expand mapping extent along the North, Middle, and South Forks for the John Day River,
- expand mapping extent in the unmapped areas south of Canyon City,
- extend mapping to better tie into the Silvies flood map above Seneca and Bear Creek,
- re-map the area where the Canyon Meadows Dam once was, and
- re-map floodway in populated areas.

Mitigation Action Title

Each mitigation action item includes a title and a brief description of the proposed action.

Alignment with Plan Goals

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

Affected Jurisdiction

Many of the mitigation actions within this plan apply to all of the participating Cities and Grant County; however, some actions are specific. The list of affected jurisdictions is provided on the right side of the matrix. The action item form in Appendix A provides more detailed information.

Alignment with Existing Plans / Policies

Identify any existing community plans and policies where the mitigation action can be incorporated. Incorporating the mitigation action into existing plans and policies, such as comprehensive plans, will increase the likelihood that it will be implemented.

Rationale or Key Issues Addressed

Mitigation actions should be fact-based and tied directly to issues or needs identified throughout the planning process. Mitigation actions can be developed at any time during the planning process and can come from a number of sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed mitigation actions is based on the information documented in Section 2 Risk Assessment and Volume II Hazard Annexes.

Implementation through Existing Programs

For each mitigation action, the Mitigation Action Item form asks for some ideas for implementation, which serve as the starting point for taking action. This information offers a transition from theory to practice. Ideas for implementation could include: (1) collaboration with relevant organizations, (2) alignment with the community priority areas, and (3) applications to new grant programs.

The ideas for implementation offer a transition from theory to practice and serve as a starting point for this plan. This component of the mitigation action is dynamic, since some ideas may prove to not be feasible, and new ideas may be added during the plan maintenance process. Ideas for implementation include such things as: collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and physical manipulation of buildings and infrastructure. When an action is implemented, more work may be needed to determine the exact course of action.

The *2020 Grant County NHMP* includes a range of mitigation actions that, when implemented, will reduce loss from hazard events in the County. Within the NHMP, FEMA requires the identification of existing programs that might be used to implement these action items. Grant County and the participating cities currently address statewide planning goals and legislative requirements through their comprehensive land use plans, capital improvements plans, mandated standards and building codes. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land use, comprehensive, and strategic plans are updated regularly, and can adapt easily to changing conditions and needs.[1] Implementing the NHMP's action items through such plans and

[1] Ibid

policies increases their likelihood of being supported and implemented. The jurisdictions will work to incorporate the mitigation actions into existing programs and procedures.

Coordinating Organization

The coordinating organization is the public agency with the regulatory responsibility to address natural hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring and evaluation.

The Coordinating Organization and main contact for the Grant County NHMP is the Grant County Emergency Manager, a position that is vacant at the time of this writing. The Implementation Committee for the *2020 Grant County NHMP* has not yet been formed.

Internal and External Partners

The internal and external partner organizations listed in the Mitigation Actions Table and in the Action Item Worksheets are potential partners recommended by the Steering Committee but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the County or other participating jurisdiction that may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization.

External partner organizations can assist the coordinating organization in implementing the action items in various functions and may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations.

Potential Funding Sources

Where possible, identify potential funding sources for the mitigation action. Example funding sources can include: the federal Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) Programs; state funding sources such as the Oregon Seismic Rehabilitation Grant Program; or local funding sources such as capital improvement or general funds. A mitigation action may have multiple funding sources. The funding sources are identified general as short- or long-term (see below) and includes an element of funding capacity of the jurisdiction for that action. Appendix A Action Item Forms includes the more detailed description of each mitigation action; funding sources are included there. See Appendix E Grant Programs and Resources for additional information on funding opportunities.

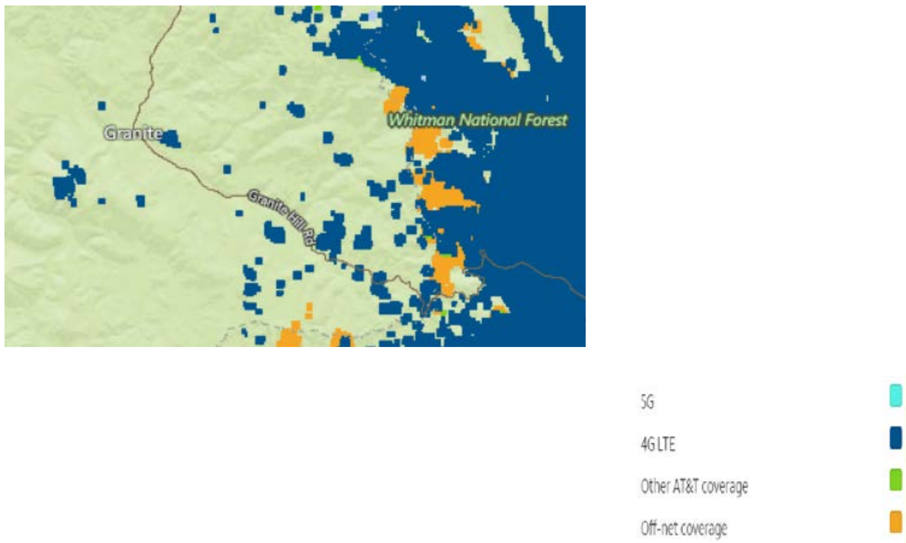
Sample maps or examples

Where possible, examples of the issue to be resolved by the mitigation action or maps of the area of concern are included.

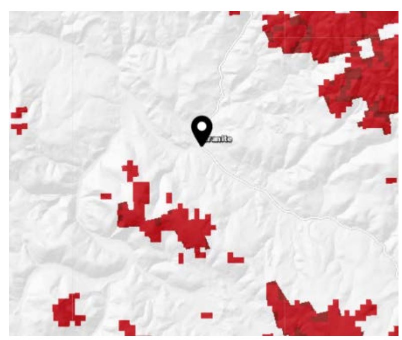
<table>
<tr><th colspan="2">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th>High Priority Action Item?</th></tr>
<tr><td colspan="2">MH 7: Develop a warning and emergency evacuation protocol for vulnerable populations.
MH 7.2: Explore the reverse 911 program and other real-time communication for hard to reach and low-lying areas for people who have minimal technology and communication methods. This would supplement the existing Alert Sense program already implemented in the county to push out alerts to mobile devices for those who sign up for them.</td><td>Goals 1 and 4</td><td>☒ High Priority
☒ Medium Priority</td></tr>
<tr><th colspan="4">Affected Jurisdictions:</th></tr>
<tr><td>☒ Grant County</td><td>☒ John Day</td><td>☒ Canyon City</td><td>☒ Dayville</td></tr>
<tr><td>☒ Mt. Vernon</td><td>☒ Prairie City</td><td>☒ Seneca</td><td>☒ Monument</td></tr>
<tr><td>☒ Granite</td><td></td><td></td><td></td></tr>
<tr><th colspan="4">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="4">Emergency Operations Plan; Community Wildfire Protection Plan</td></tr>
<tr><th colspan="4">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="4">The Emergency Manager is charged with developing inventory lists that identify agencies serving vulnerable populations and the provisions of specialized vehicles and trained drivers to evacuate vulnerable populations and to provide trained support personnel at shelters designated for vulnerable populations.
Many areas of Grant County are remote and isolated. Some persons living in these areas may be house-bound with long-term or chronic health conditions that require periodic visits by health care professionals and suppliers. Other physical disabilities such as age, mobility problems, or combinations of several issues, may cause a life-threatening situation for those stranded due to weather.
The County has implemented a warning system called Alert Sense, however the ability to ensure notification of citizens who do not utilize cell phones is a challenge for those in remote locations.</td></tr>
<tr><th colspan="4">Ideas for Implementation:</th></tr>
<tr><td colspan="4">• Expand existing system to include reverse 911 notifications to all land lines. Reverse 911 was successfully implemented in Baker County and helped with the water disease crypto outbreak
• Expand registration for Alert Sense and maximize that system’s capacity to send alerts to land lines.
• Create a voluntary registration for vulnerable populations (i.e., senior citizens, persons with wheelchairs or oxygen tanks, etc.) who may need emergency assistance in evacuating.</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="3">Grant County Emergency Management, County Road M</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="2">External Partners:</th></tr>
<tr><td colspan="2">Emergency Management Department</td><td colspan="2">Oregon Office of Emergency Management; People Mover, Assisted living facilities, Elks lodge, National Organization on Disability, American Red Cross</td></tr>
</table>

Potential Funding Sources:	Estimated cost:	Timeline:
		Short term (0-3 years)

Form Submitted by:	2008 NHMP Steering Committees; revised and confirmed in 2013; revised and confirmed by 2020 NHMP Steering Committee
Action Item Status:	Actions in progress and New Action
Sample locations with limited road access	

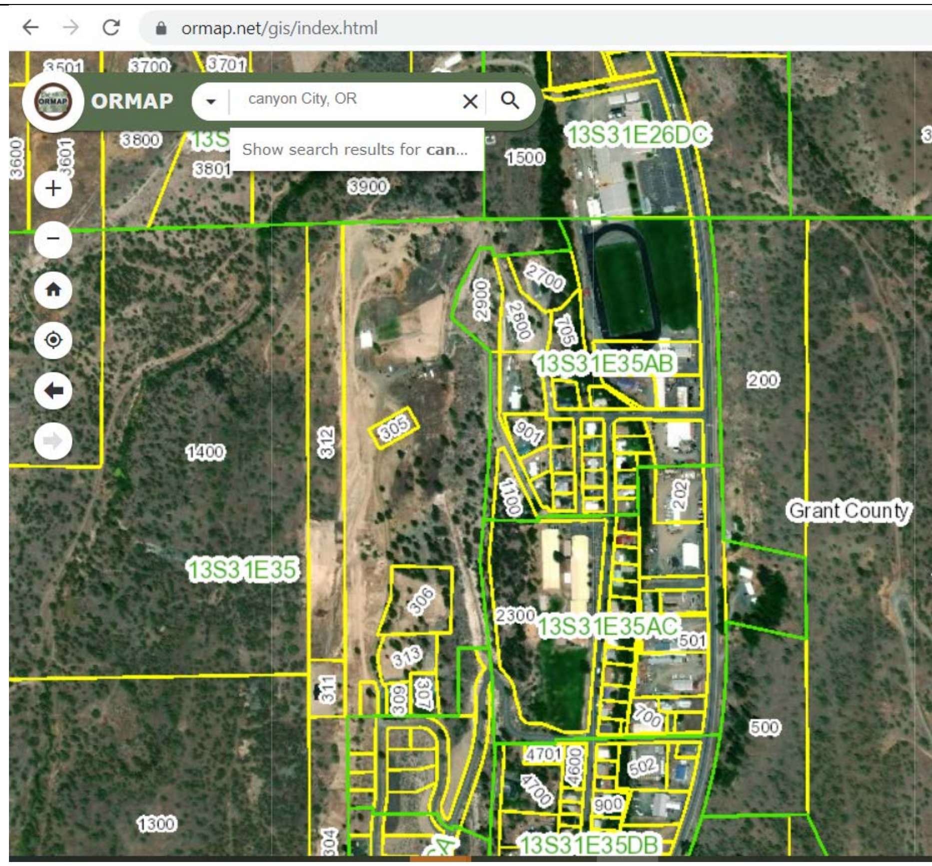


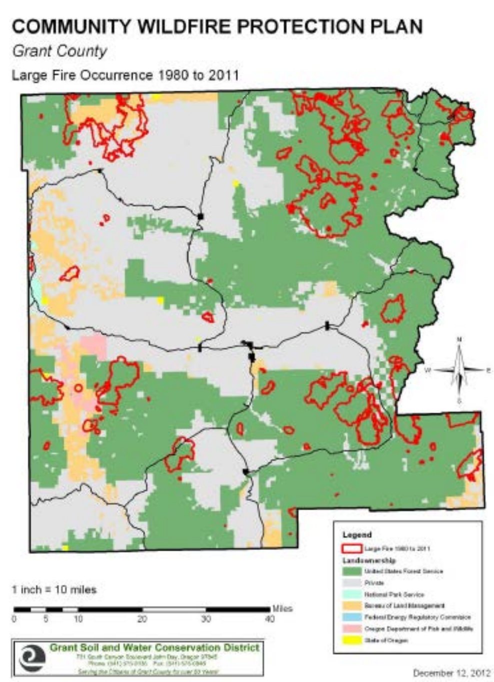
verizon



<table>
<tr><th colspan="2">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th>High Priority Action Item?</th></tr>
<tr><td colspan="2">MH 9 – Expand the existing geographical information system (GIS) for the county and secure funding for expansion of the GIS system.</td><td>Goals 1 and 4</td><td>☒ High Priority</td></tr>
<tr><th colspan="4">Affected Jurisdictions:</th></tr>
<tr><td>☒ Grant County</td><td>☒ John Day</td><td>☒ Canyon City</td><td>☒ Dayville</td></tr>
<tr><td>☒ Mt. Vernon</td><td>☒ Prairie City</td><td>☒ Seneca</td><td>☒ Monument</td></tr>
<tr><td>☒ Granite</td><td></td><td></td><td></td></tr>
<tr><th colspan="4">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="4">Community Wildfire Protection Plan</td></tr>
<tr><th colspan="4">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="4">Grant County does not have a robust GIS system for use in natural hazard mitigation.
Grant County utilizes The Oregon Map, a Geographic Information System map focused on tax assessment.
Grant Soil and Water Conservation District developed a GIS system for use in developing the Community Wildfire Protection Plan. The system was useful in tracking the response to the Canyon Creek Complex wildfire in 2015. The staff of the Grant SWCD has the knowledge and skill to develop a more robust system, but does not have the funding to allow Grant SWCD staff to allocate the time required to accomplish this.
While such a system might be developed by Grant SWCD, collaboration with Grant County Assessor's office would be important to ensure a widely useful product resulted.</td></tr>
<tr><th colspan="4">Ideas for Implementation:</th></tr>
<tr><td colspan="4">Seek funding to permit staff to allocate time to expand the existing GIS and to provide access to the system online.</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="3">Grant County Soil and Water Conservation District and Grant County Wildfire Coordinator</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="2">External Partners:</th></tr>
<tr><td colspan="2">Grant County Planning Department, Emergency Management Department</td><td colspan="2">Oregon Department of Land Conservation and Development, Oregon Office of Emergency Management, Oregon Geospatial Enterprise Office</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th>Estimated cost:</th><th>Timeline:</th></tr>
<tr><td colspan="2"></td><td></td><td>Short term (0-3 years)</td></tr>
<tr><th>Form Submitted by:</th><td colspan="3">New Action submitted by 2020 NHMP Steering Committees</td></tr>
<tr><th>Action Item Status:</th><td colspan="3">Action Item from CWPP</td></tr>
</table>

Screen Shots of current Grant SWCD GIS and of Grant County Tax Assessor's ORMAP.





Proposed Action Item:	Alignment with Plan Goals:	High Priority Action Item?
MH 10 – Complete a road hazard assessment to address existing road situations which could result in problems for evacuation of residents and limit fire apparatus response during a wildfire situation.	Goals 1, 2 and 4	☒ High Priority

Affected Jurisdictions:			
☒ Grant County	☒ John Day	☒ Canyon City	☒ Dayville
☒ Mt. Vernon	☒ Prairie City	☒ Seneca	☒ Monument
☒ Granite			

Alignment with Existing Plans/Policies:

Emergency Operations Plan, Community Wildfire Protection Plan

Rationale for Proposed Action Item:

During times of severe winter weather, several areas within Grant County may experience weather that is unusual for them. This includes both areas that are, and are not, accustomed to snow fall, ice, drifting snow. These areas may require extra measures to provide access for the protection of lives and prevention of injury.

The Grant Community Wildfire Protection Plan identifies access within the county as a key issue.

Priority areas include:
1. Areas covered by Mt. Vernon rural fire department
2. Areas covered by John Day rural fire department
3. Areas covered by Prairie City rural fire department
4. Areas covered by Monument rural fire department

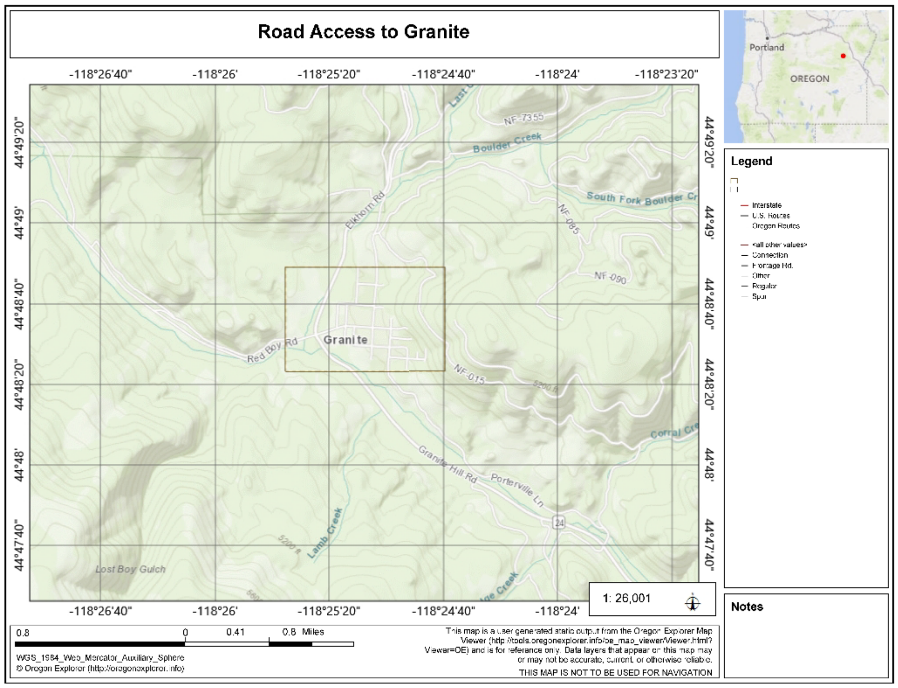
The Ritter/Dale Zone rated out as a "high" hazard for wildfire risk. This zone is extremely vulnerable to wildfire due to the location, the vegetation type, the topography, the communications structure, and the complete absence of structural fire protection in the area. Further the area is remote, especially west of Highway 395 around Ritter. The county road east to Highway 395 provides the only evacuation route since the road to the west has been locked by a private landowner.

The Granite Zone encompasses the northeast corner of the county and the city of Granite located at an elevation of 4660 feet. This area is somewhat isolated from the rest of the county with the major access road traveling from Highway 7 through the city of Sumpter in Baker County. The topography of this area is rugged and winters can be severe with deep snow accumulations.

Ideas for Implementation:

Secure funding to allow the county to contract for the execution of a road hazard assessment based on the CWPP findings and conclusions.

Coordinating Organization:	Grant County Road Department

<table>
<tr><th colspan="2">Internal Partners:</th><th colspan="2">External Partners:</th></tr>
<tr><td colspan="2">Rural Fire Districts, Grant County Sheriff's Office, ODF</td><td colspan="2">County Court, Emergency Management, County Wildfire Coordinator, USFS</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th>Estimated cost:</th><th>Timeline:</th></tr>
<tr><td colspan="2"></td><td></td><td>Short term (0-3 years)</td></tr>
<tr><th>Form Submitted by:</th><td colspan="3">New Action submitted by 2020 NHMP Steering Committees</td></tr>
<tr><th>Action Item Status:</th><td colspan="3">Action Item from CWPP</td></tr>
<tr><th>Limited access to Granite.</th><td colspan="3"></td></tr>
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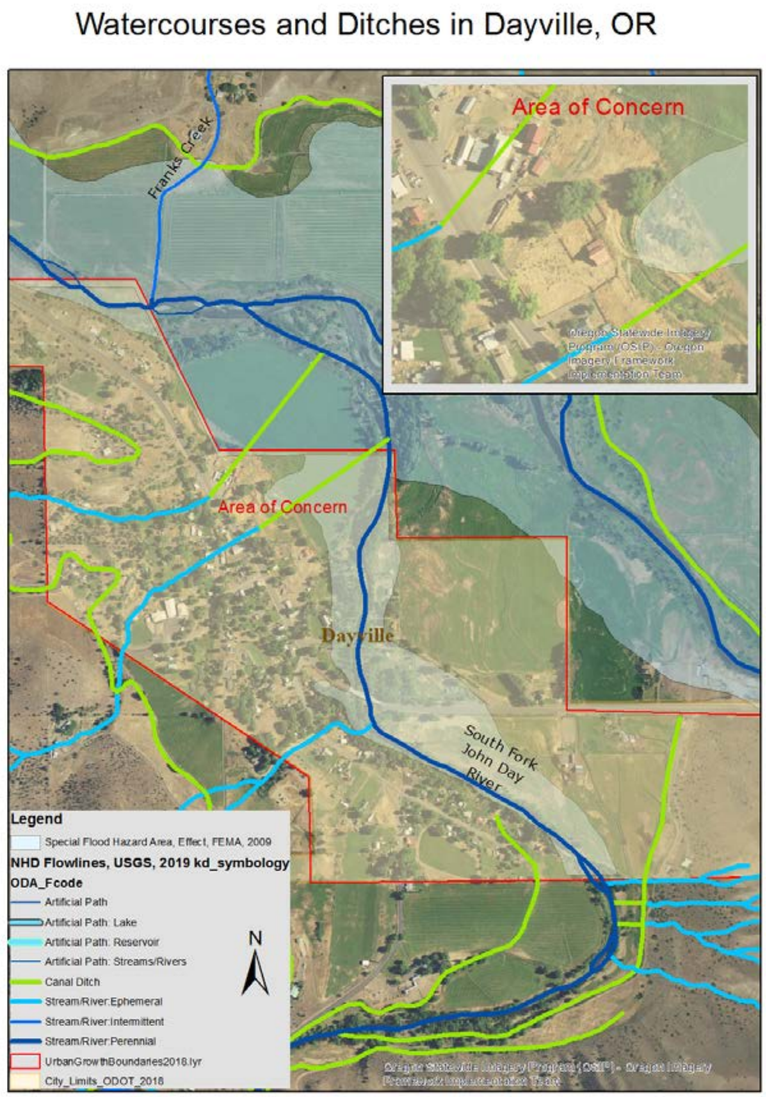
<table>
<tr><th colspan="2">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th>High Priority Action Item?</th></tr>
<tr><td colspan="2">DR 2.1: Requesting an irrigation ditch assessment to increase the resilience of the irrigation ditch and improvement to the ditch so that it is no longer a flood hazard and can be utilized during a wildfire.</td><td>Goals 1 and 4</td><td>☒ High Priority</td></tr>
<tr><th colspan="4">Affected Jurisdictions:</th></tr>
<tr><td>☐ Grant County</td><td>☐ John Day</td><td>☐ Canyon City</td><td>☒ Dayville</td></tr>
<tr><td>☐ Mt. Vernon</td><td>☐ Prairie City</td><td>☐ Seneca</td><td>☐ Monument</td></tr>
<tr><td>☐ Granite</td><td></td><td></td><td></td></tr>
<tr><th colspan="4">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="4"></td></tr>
<tr><th colspan="4">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="4">The ditch is primarily used for agriculture and irrigation and is funded by the local ditch association. There have been several blowouts. The ditch was damaged in recent floods. The city would like to develop a plan for improvement and determine project funding opportunities.</td></tr>
<tr><th colspan="4">Ideas for Implementation:</th></tr>
<tr><td colspan="4">Seek funding to develop options to mitigate flooding.</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="3">City of Dayville</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="2">External Partners:</th></tr>
<tr><td colspan="2">Grant SWCD</td><td colspan="2">OR Water Resources Dept. and OR Dept. of Fish and Wildlife, DLCD, OEM</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th>Estimated cost:</th><th>Timeline:</th></tr>
<tr><td colspan="2"></td><td></td><td>Short Term</td></tr>
<tr><th>Form Submitted by:</th><td colspan="3">2020 Grant County NHMP Steering Committee</td></tr>
<tr><th>Action Item Status:</th><td colspan="3">New Action</td></tr>
</table>

Map of ditch location and impacted areas of Dayville	

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">EQ 8: Seismically retrofit Monument School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.</td><td>Goal 1</td><td colspan="2">☒ High Priority</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☐ Grant County</td><td colspan="2">☐ John Day</td><td>☐ Canyon City</td><td colspan="2">☐ Dayville</td></tr>
<tr><td>☐ Mt. Vernon</td><td colspan="2">☐ Prairie City</td><td>☐ Seneca</td><td colspan="2">☒ Monument</td></tr>
<tr><td>☐ Granite</td><td colspan="2"></td><td></td><td colspan="2"></td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">School District Maintenance Plan</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">
• Monument School was built in 1929 and has buildings constructed of concrete sheer walls
• Monument School has been identified as a critical facility by the Steering Committee
• Oregon Senate Bill 2 (2005) directed DOGAMI to develop a statewide seismic needs assessment that includes a FEMA 154 Rapid Visual Screening survey of specific critical facilities, including schools; this assessment determined that the Monument School has buildings with a very high collapse potential.
• Retrofitting of vital infrastructure, such as schools and community buildings, provides important improvements that reduce hazard exposure and the cost and time associated with recovery (Source: American Planning Advisory Service Report Number 483/484)
• Grant County has moderate vulnerability for seismic hazards. Retrofitting Monument School will significantly reduce the school's vulnerability to seismic hazards and improve the safety of students, teachers, and community members that use the school
The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6 (c)(3)(ii)]. Seismically retrofitting the Monument School will reduce its vulnerability and ensure the viability of this critical facility.
</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">
• Conduct a detailed structural evaluation that outlines recommendations for building deficiencies, and provides a cost estimate, incorporate DOGAMI's seismic assessment data to assist in retrofitting Monument School
• Apply for grant funding through the Oregon Seismic Rehabilitation Grant Program
• Apply for FEMA project grant funding
• Conduct structural evaluation and make recommendations (structural and non-structural) for fix
</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="5">Monument SD 8</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="2">Emergency Management, County Public Works Departments, City of Seneca</td><td colspan="4">Business Oregon, Department of Geology and Mineral Industries, Federal Emergency Management Agency, Oregon Department of Education, Oregon Office of Emergency Management</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="3">Estimated cost:</th><th>Timeline:</th></tr>
<tr><td colspan="2">Business Oregon Seismic Rehabilitation Grant Program</td><td colspan="3"></td><td>Short Term</td></tr>
</table>

Form Submitted by:	2013 Grant County NHMP Steering Committee, and 2020 Grant County NHMP Steering Committee
Action Item Status:	Retained
Rapid Visual Screening	Rapid Visual Screening for Monument School https://www.oregongeology.org/rvs/reports/Gran_sch08.pdf

Monument School
Monument SD 8

Gran_sch08A

Building Type	County
School	Grant
Street	
127 North St	
City	State / Zip
Monument	OR / 97864
Latitude	Longitude
44.82064	119.41935
Tracking Code	Inspection Date
RVS in 2006	7/28/2006

Seismicity Zone: Moderate

FEMA 154 Rapid Visual Screening Score Card

	Type	Basic Score	Vert Irreg	Plan Irreg	Pre-Code	Post-Bench	Soil C	Soil D	Soil E	RVS Score
Primary	URM	3.4	-1.5	-0.5	-0.4	0	-0.4	0	0	0.6
Secondary		0	0	0	0	0	0	0	0	0
Tertiary		0	0	0	0	0	0	0	0	0

Monument School

Final RVS Score

Final Type	Final Score
URM	0.6

FEMA-154 Collapse Potential

High (>10%)

Building Type	County
School	Grant
Street	
127 North St	
City	State / Zip
Monument	OR / 97864
Latitude	Longitude
44.82073	119.41982
Tracking Code	Inspection Date
RVS in 2006	7/28/2006

Seismicity Zone: Moderate

FEMA 154 Rapid Visual Screening Score Card

	Type	Basic Score	Vert Irreg	Plan Irreg	Pre-Code	Post-Bench	Soil C	Soil D	Soil E	RVS Score
Primary	C2	3.6	-2	-0.5	-0.4	0	-0.8	0	0	-0.1
Secondary	RM1	3.6	-2	-0.5	-0.4	0	-0.8	0	0	-0.1
Tertiary		0	0	0	0	0	0	0	0	0

Monument School

Final RVS Score

Final Type	Final Score
C2	-0.1

FEMA-154 Collapse Potential

Very High (100%)

Building Type	County
School	Grant
Street	
127 North St	
City	State / Zip
Monument	OR / 97864
Latitude	Longitude
44.82094	119.42028
Tracking Code	Inspection Date
RVS in 2006	7/28/2006

Seismicity Zone: Moderate

FEMA 154 Rapid Visual Screening Score Card

	Type	Basic Score	Vert Irreg	Plan Irreg	Pre-Code	Post-Bench	Soil C	Soil D	Soil E	RVS Score
Primary	W2	4.8	-3	0	0	0	-0.8	0	0	1
Secondary		0	0	0	0	0	0	0	0	0
Tertiary		0	0	0	0	0	0	0	0	0

Monument School

Final RVS Score

Final Type	Final Score
W2	1

FEMA-154 Collapse Potential

High (>10%)

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">EQ 7: Seismically retrofit Seneca Elementary School to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options</td><td>Goal 1</td><td colspan="2">☒ High Priority</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☐ Grant County</td><td colspan="2">☐ John Day</td><td colspan="2">☐ Canyon City</td><td>☐ Dayville</td></tr>
<tr><td>☐ Mt. Vernon</td><td colspan="2">☐ Prairie City</td><td colspan="2">☒ Seneca</td><td>☐ Monument</td></tr>
<tr><td>☐ Granite</td><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">School District Maintenance Plan</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">• Seneca Elementary School was built in 1932 and has buildings constructed of a concrete shear wall
• Seneca Elementary School has been identified as a critical facility by the Grant County Steering Committee
• Oregon Senate Bill 2 (2005) directed DOGAMI to develop a statewide seismic needs assessment that includes a FEMA 154 Rapid Visual Screening survey of specific critical facilities, including schools; this assessment determined that the Seneca Elementary School has buildings with a very high collapse potential.
• Retrofitting of vital infrastructure, such as schools and community buildings, provides important improvements that reduce hazard exposure and the cost and time associated with recovery (Source: American Planning Advisory Service Report Number 483/484)
• Grant County has moderate vulnerability for seismic hazards. Retrofitting Seneca Elementary School will significantly reduce the school's vulnerability to seismic hazards and improve the safety of students, teachers, and community members that use the school
• The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6 (c)(3)(ii)]. Seismically retrofitting the Seneca Elementary School will reduce its vulnerability and ensure the viability of this critical facility.</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">• Conduct a detailed structural evaluation that outlines recommendations for building deficiencies, and provides a cost estimate, incorporate DOGAMI's seismic assessment data to assist in retrofitting Seneca Elementary School
• Apply for grant funding through the Oregon Seismic Rehabilitation Grant Program
• Apply for FEMA project grant funding
• Conduct structural evaluation and make recommendations (structural and non-structural) for fix
• Align project with School District Maintenance Plan</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="5">John Day SD 3</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="2">Emergency Management, County Public Works Departments, City of Seneca</td><td colspan="4">Business Oregon, DOGAMI, FEMA, OR Dept. of Education, OR OEM</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="3">Estimated cost:</th><th>Timeline:</th></tr>
<tr><td colspan="2">Business Oregon Seismic Rehabilitation Grant Program</td><td colspan="3"></td><td>Short Term</td></tr>
</table>

Form Submitted by:	2013 Grant County NHMP Steering Committee, and 2020 Grant County NHMP Steering Committee
Action Item Status:	Retained

Rapid Visual Screening for Seneca Elementary
https://www.oregongeology.org/rvs/reports/Gran_sch07.pdf

Seneca Elementary School — Gran_sch07A
John Day SD 3

Building Type	County
School	Grant
Street	
101 Park Ave	
City	State / Zip
Seneca	OR 97873
Latitude	Longitude
44.13643	118.97195
Tracking Code	Inspection Date
RVS in 2006	7/27/2006

Seismicity Zone: Moderate

FEMA 154 Rapid Visual Screening Score Card

	Type	Basic Score	Vert Irreg	Plan Irreg	Pre-Code	Post-Bench	Soil C	Soil D	Soil E	RVS Score
Primary	C2	3.6	-2	-0.5	-0.4	0	0	-1.2	0	-0.5
Secondary	URM	3.4	-1.5	-0.5	-0.4	0	0	-0.8	0	0.2
Tertiary		0	0	0	0	0	0	0	0	0

Seneca Elementary School

Final RVS Score

Final Type	Final Score
C2	-0.5

FEMA-154 Collapse Potential: Very High (100%)

Building Type	County
School	Grant
Street	
101 Park Ave	
City	State / Zip
Seneca	OR 97873
Latitude	Longitude
44.13663	118.97201
Tracking Code	Inspection Date
RVS in 2006	7/27/2006

Seismicity Zone: Moderate

FEMA 154 Rapid Visual Screening Score Card

	Type	Basic Score	Vert Irreg	Plan Irreg	Pre-Code	Post-Bench	Soil C	Soil D	Soil E	RVS Score
Primary	C2	3.6	-2	0	-0.4	0	0	-1.2	0	0
Secondary	RM1	3.6	-2	0	-0.4	0	0	-1.2	0	0
Tertiary		0	0	0	0	0	0	0	0	0

Seneca Elementary School

Final RVS Score

Final Type	Final Score
C2	0

FEMA-154 Collapse Potential: Very High (100%)

Building Type	County
School	Grant
Street	
101 Park Ave	
City	State / Zip
Seneca	OR 97873
Latitude	Longitude
44.13664	118.97187
Tracking Code	Inspection Date
RVS in 2006	7/27/2006

Seismicity Zone: Moderate

FEMA 154 Rapid Visual Screening Score Card

	Type	Basic Score	Vert Irreg	Plan Irreg	Pre-Code	Post-Bench	Soil C	Soil D	Soil E	RVS Score
Primary	S3	3.8	0	-0.5	0	0	0	-1	0	2.3
Secondary	W2	4.8	-3	-0.5	0	0	0	-1.2	0	0.1
Tertiary		0	0	0	0	0	0	0	0	0

Seneca Elementary School

Final RVS Score

Final Type	Final Score
W2	0.1

FEMA-154 Collapse Potential: High (>10%)

Proposed Action Item:	Alignment with Plan Goals:	High Priority Action Item?
FL 1.1: Move the John Day waste water treatment plant out of the Special Flood Hazard Area.	Goals 1 and 2	☒ High Priority

Affected Jurisdictions:			
☐ Grant County	☒ John Day	☐ Canyon City	☐ Dayville
☐ Mt. Vernon	☐ Prairie City	☐ Seneca	☐ Monument
☐ Granite			

Alignment with Existing Plans/Policies:

Innovation Gateway Area Plan, Wastewater Treatment Plant Plan

Rationale for Proposed Action Item:

Construction of the City's original wastewater collection system began in 1949. Major additions were completed in 1970 and 1978. Since 1978 the system has been expanded several times to support the City's needs and to keep the facility in operating condition.

The current wastewater treatment facility was covered under an industrial Water Pollution Control Facilities (WPCF) permit from the State of Oregon that expired in 2007. The facility is currently under Administrative Review by the Oregon Department of Environment Quality (DEQ). Although the current WWTF is effecting sufficient treatment now to meet permit limits, the facility is approaching the end of its useful life; and due to the proximity of the percolation ponds to the John Day River, continued coverage under a WPCF for the existing facility may not be possible.

In 2018 the City Council reviewed three options for the new plant:

- A facility that uses hydroponics technology to treat and reclaim wastewater for beneficial re-use
- A land application and irrigation option
- A traditional mechanical plant

These three options were the basis for a feasibility study that was conducted in 2017-18 by Anderson Perry & Associates (La Grande, OR) and Sustainable Water (Glen Allen, VA). The goal of the study was to determine the option that will create the highest economic benefit for the taxpayers.

At the June 26, 2018 city council meeting, the council approved the hydroponics facility as the option that provides our community with the best long-term value.

The new wastewater treatment plant is part of a comprehensive, integrated, multi-faceted development plan that includes transportation, recreation and community services features as well as the environmental and hazard mitigation aspects that relocating the wastewater treatment plant would provide.

The 2018 Wastewater Treatment Plant Plan Update proposes an innovative new strategy of constructing a membrane bioreactor with aerobic digestion and anticipated supply of treated effluent to new parks, gardens and most importantly, greenhouses. This treated water will be piped to the 6,200 sf pilot-scale greenhouse, located on the Oregon Pine mill site. Harvests have already occurred and this greenhouse should generate roughly 1,200 pounds of fresh produce per week. Local restaurants and grocers intend to purchase produce from the City at wholesale prices. Revenue from the greenhouse will accrue to the Sewer Fund to offset its operating expenditures and ultimately the cost of wastewater treatment. The

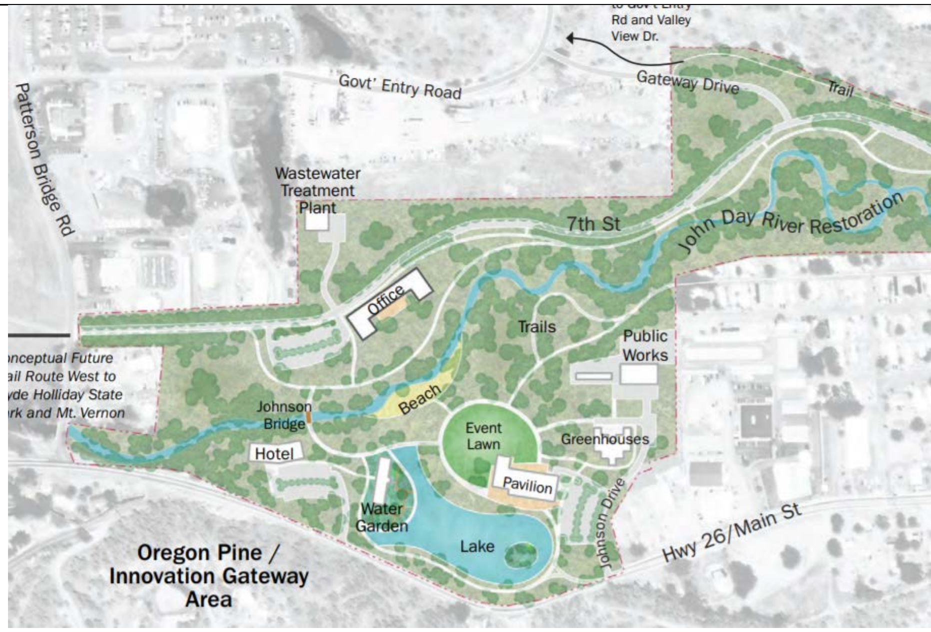
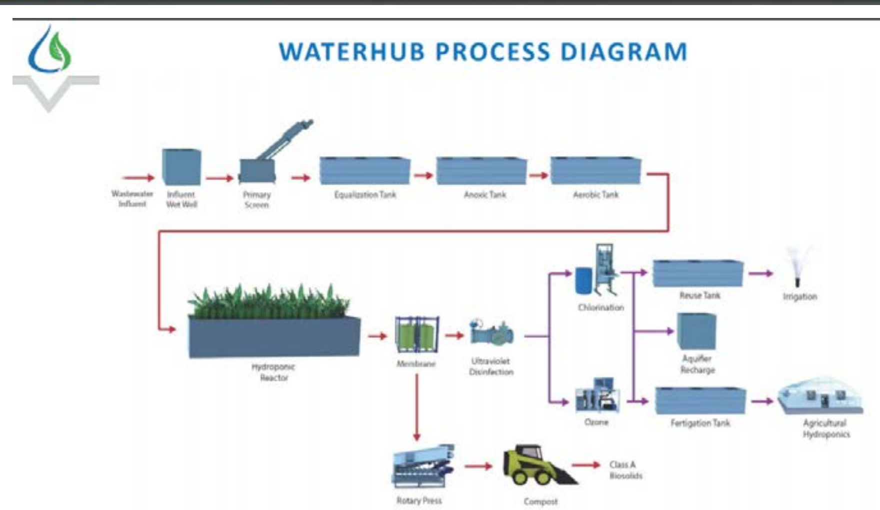
innovative project will also become a tourist attraction in its own right, while portraying evidence of an entrepreneurial public sector for companies potentially interested in investing in John Day. The existing wastewater treatment plant will be decommissioned. The land it occupies will provide space for riverbank renaturalization and new trails, including connections to the new Davis Creek Park trails. On the actual site of the current plant, a new campground is proposed, similar in design quality and experience to Clyde Holliday State Park, providing additional sites for visitors in peak season. South of this facility, a new pedestrian bridge provides access to the future Hill Family City Park and a new trail south along Canyon Creek to Kam Wah Chung. The design phase of this project is funded. The city is seeking construction funding.
Ideas for Implementation:
The City has severely limited financial resources, so has initiated a project funding and implementation approach that relies on strong partnerships with sponsors and partners at the local, regional, and national level. The City recognizes that the successful implementation of the Plan will require a community effort and ongoing collaboration with partners. Strong partnerships already exist, and the City is working to create new partnerships and recruit project sponsors. However, not all partners will play the same role. Some partners will be expected to contribute funding, while others are primarily partners in implementation, and others may play multiple roles. Business Oregon's Infrastructure Finance Program through the federal Community Development Block Grant Program awarded the City of John Day $196,500 in grant funds for design and engineering.

Coordinating Organization:	City of John Day

Internal Partners:	**External Partners:**
City of John Day Public Works	OR Dept. of Environmental Quality

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
• Water/Wastewater Financing Program • Special Public Works Fund (SPWF) • Clean Water State Revolving Fund Loan Program • USDA Rural Development loans • Oregon Water Resources Department loans and grants • U.S. Economic Development Administration (EDA) loans and grants • New Market Tax Credit	$12-14 million	Short Term

Form Submitted by:	2020 Grant County NHMP Steering Committee
Action Item Status:	New Action

Portion of Innovation Gateway Area Plan, conceptual design for new wastewater treatment plant and waterhub, and waterhub process design	  

Proposed Action Item:	Alignment with Plan Goals:	High Priority Action Item?
FL 4: Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps. FL 4.1: New flood analysis is requested with the following details: • all areas of development within or near flood hazard areas, • along Highway 26 and Zone D areas, • expand mapping extent along the North, Middle, and South Forks for the John Day River, • expand mapping extent in the unmapped areas south of Canyon City, • extend mapping to better tie into the Silvies flood map above Seneca and Bear Creek, • re-map the area where the Canyon Meadows Dam once was, and • re-map floodway in populated areas.	Goals 1, 2 and 4	☒ High Priority

Affected Jurisdictions:			
☒ Grant County	☒ John Day	☒ Canyon City	☒ Dayville
☒ Mt. Vernon	☐ Prairie City	☐ Seneca	☐ Monument
☐ Granite			

Alignment with Existing Plans/Policies:

Flood Hazard Regulations

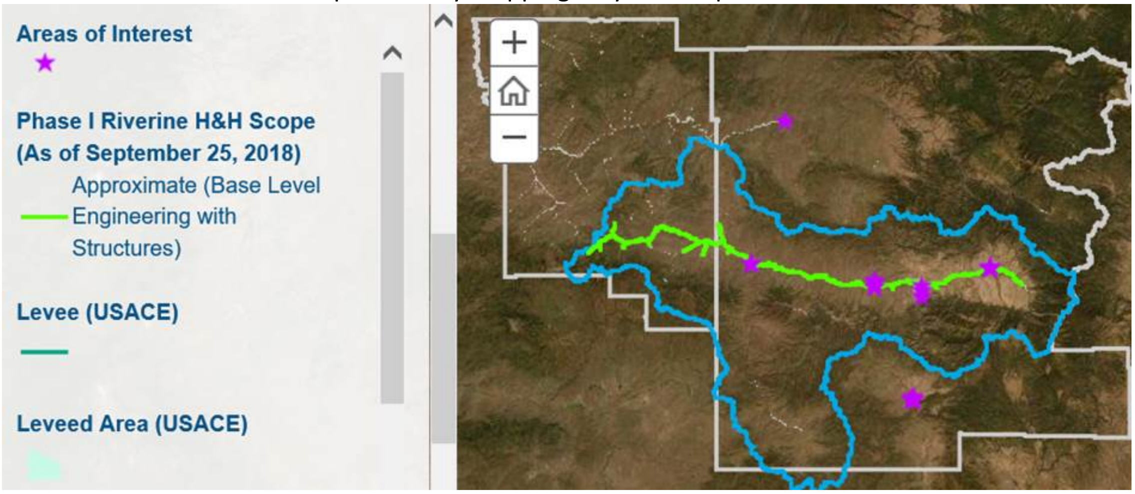
Rationale for Proposed Action Item:

The City of John Day, Grant County and Canyon City are coordinating with the Army Corps of Engineers and the Federal Emergency Management Agency (FEMA) to update our region's floodplain maps. The John Day River and Canyon Creek floodplain maps were developed in 1981. These maps were based on studies of the John Day River and Canyon Creek watershed that were conducted in the late 1970's. The maps produced from these studies were hand-drawn as opposed to digital maps. Over time, the watershed's course and flow rates have altered. The Army Corps of Engineers also has better technology at its disposal to map the real risk of flooding to our community.

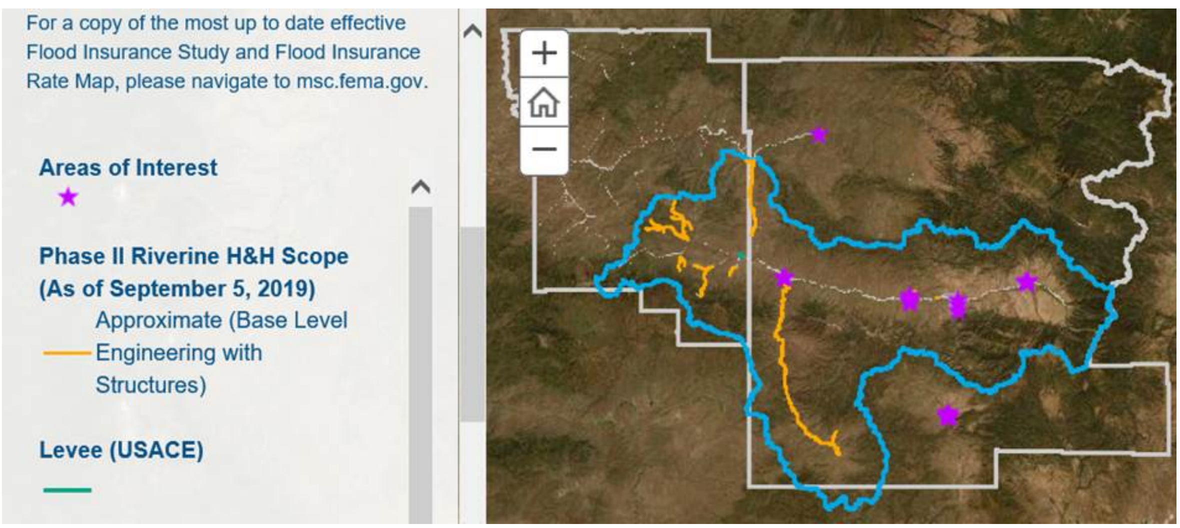
The Army Corps of Engineers prepared a Flood Study for the reaches of Canyon Creek and portions of the John Day River in and near the City of John Day. This work resulted in a Letter of Map Revision for reaches of Canyon Creek through Canyon City. The remainder of the work will be the basis for two phase update of floodplain mapping along the John Day River and several of its tributaries.

Updated mapping of the Silvies River near Seneca has been partially completed and new maps have become effective. The confluence of Bear Creek and the Silvies River still requires updated lidar in order to accurately depict the floodplain in this area.

Phase I of the FEMA Risk MAP project for the Upper John Day watershed will produce Base Level Engineering for the watershed. The Base Level Engineering production approach combines high-resolution ground elevation data, and modeling technology advancements to create engineering models and flood hazard data. The high-resolution ground elevation data has been collected using lidar (Light Detection and Ranging), an image of the topography of an area collected while flying over the area and imaging the surface of the earth. Phase I preliminary mapping may be completed soon.



Phase II of the BLE analysis is dependent on additional lidar data. This data is due to be collected by flights planned for late 2020 or early 2021. That scope is shown below in orange.

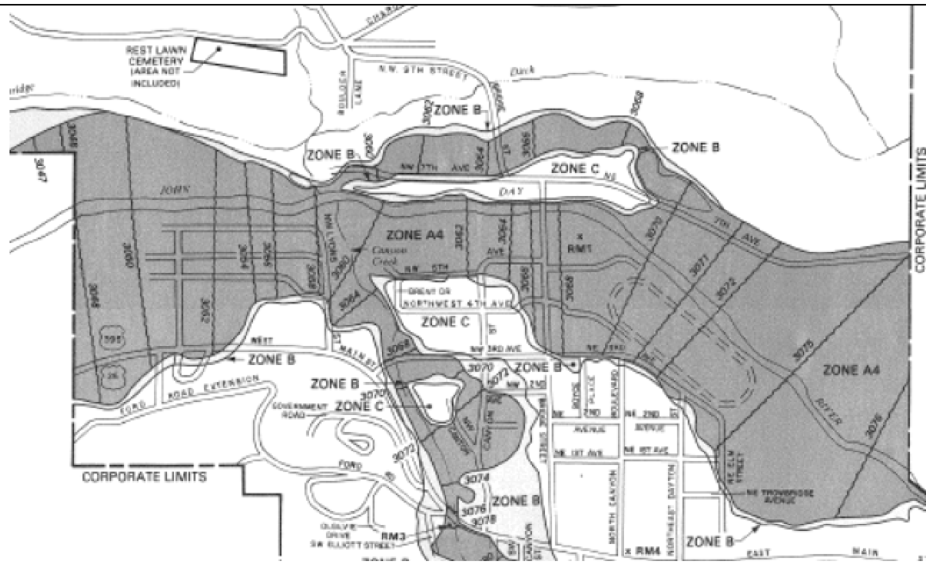


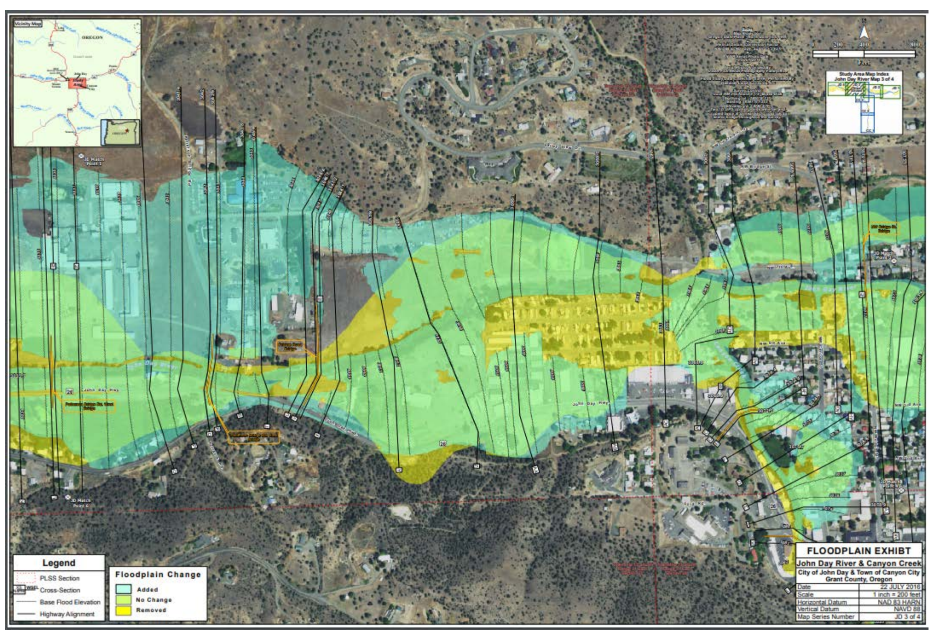
While the data collection and mapping are projects that are underway, the jurisdictions to which these new maps will apply must review and agree to the products before they become effective.

The City of John Day website describes the process and the associated timelines for review and adoption. The project envisioned here relates to the public outreach and education of the public regarding the impact of the new mapping.

Ideas for Implementation:

Floodplain managers may be the best local source of public information about flood mapping and the impact of flooding on home and business owners. Developing a robust floodplain information and outreach project may assist in preparing the community for the future review and adoption of the new maps.

<table>
<tr><td>Coordinating Organization:</td><td colspan="3">Grant County Planning</td></tr>
<tr><td colspan="2">Internal Partners:</td><td colspan="2">External Partners:</td></tr>
<tr><td colspan="2">Floodplain managers in John Day, Canyon City, Dayville, Mount Vernon, and Grant County</td><td colspan="2">Oregon NFIP Coordinator, US Army Corps of Engineers, FEMA Region X</td></tr>
<tr><td colspan="2">Potential Funding Sources:</td><td>Estimated cost:</td><td>Timeline:</td></tr>
<tr><td colspan="2">Cooperating Technical Partners grant from FEMA for outreach and education</td><td></td><td>Short Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="3">2020 Grant County NHMP Steering Committee</td></tr>
<tr><td>Action Item Status:</td><td colspan="3">In progress</td></tr>
<tr><td>Examples of current and future mapping of the John Day River floodplain.</td><td colspan="3">


</td></tr>
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Appendix D:
Future Climate Projection, Grant County

Future Climate Projections
Grant County

February 2020

A Report to the Oregon Department of Land Conservation and Development

Prepared by
The Oregon Climate Change Research Institute

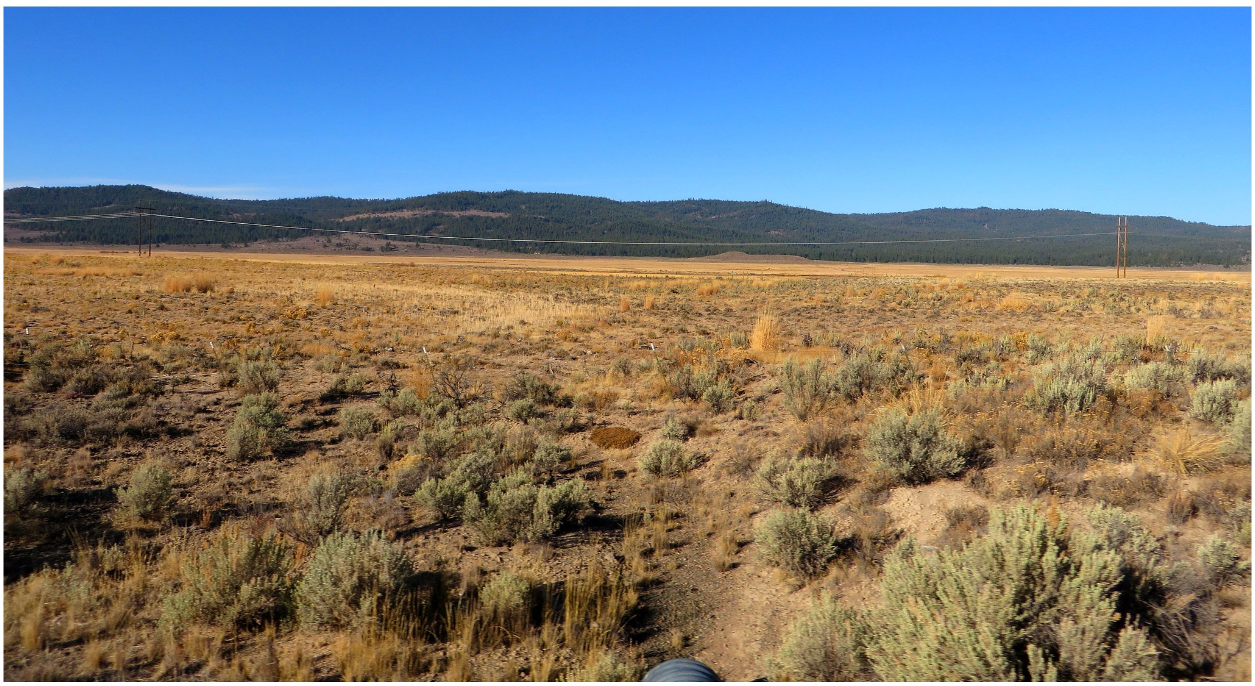

Photo credit: Grant County, U.S. Highway 395 North of Burns, Oregon by Ken Lund, https://flic.kr/p/zn1ZaQ, Creative Commons License (CC BY-SA 2.0)

OCCRI DLCD

Future Climate Projections: Grant County

A report to the Oregon Department of Land Conservation and Development

Prepared by:
Meghan Dalton
Oregon Climate Change Research Institute
College of Earth, Ocean, and Atmospheric Sciences
104 CEOAS Admin Building
Oregon State University
Corvallis, OR 97331

Guidance and review provided by:
Marian Lahav, Oregon Department of Land Conservation and Development

February 2020

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Executive Summary

Climate change is expected to increase the occurrence of most climate-related risks considered in this report. The risks of heat waves are projected to increase with very high confidence due to strong evidence in published literature, model consensus, and robust theoretical principles for continued increasing temperatures. The majority of risks expected to increase with climate change have high or medium confidence due to moderate to strong evidence and consensus yet they are influenced by multiple secondary factors in addition to increasing temperatures. Risks with low confidence, while important, show relatively little to no changes due to climate change or the level of evidence is limited. The projected direction of change along with the level of confidence in the direction of change for each climate change-related risk is summarized in Table 1.

Table 1 Summary of projected direction of change along with the level of confidence in climate change-related risk of natural hazard occurrence. Very high confidence means all models agree on the direction of change and there is strong evidence in the published literature. High confidence means most models agree on the direction of change and there is strong to medium evidence in the published literature. Medium confidence means that there is medium evidence and consensus on the direction of change with some caveats. Low confidence means the direction of change is small compared to the range of model responses or there is limited evidence in the published literature.

	Low Confidence	Medium Confidence	High Confidence	Very High Confidence
Risk Increasing ↑	Poor Air Quality	Drought Increased Invasive Species Risk	Heavy Rains Flooding Wildfire Loss of Wetland Ecosystems	Heat Waves
Risk Unchanging =	Windstorms			
Risk Decreasing ↓	Dust Storms			Cold Waves

This report presents future climate projections for Grant County relevant to specific natural hazards for the 2020s (2010–2039 average) and 2050s (2040–2069 average) relative to the 1971–2000 average historical baseline. The projections were analyzed for a lower greenhouse gas emissions scenario as well as a higher greenhouse gas emissions scenario, using multiple global climate models. This summary lists only the projections for the 2050s under the higher emissions scenario. Projections for both time periods and both emissions scenarios can be found within relevant sections of the main report.

Heat Waves

Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures.

In Grant County, the frequency of hot days per year with temperatures at or above 90°F is projected to increase on average by 27 days, with a range of about 10 to 38 days, by the 2050s under the higher emissions scenario relative to the historical baselines. This average increase represents a more than tripling of hot days relative to the average historical baseline.

In Grant County, the temperature of the hottest day of the year is projected to increase on average by nearly 8°F, with a range of about 3 to 11°F, by the 2050s under the higher emissions scenario relative to the historical baselines.

Cold Waves

Cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms.

In Grant County, the frequency of cold days per year at or below freezing is projected to decrease on average by 16 days, with a range of about 9 to 23 days, by the 2050s under the higher emissions scenario relative to the historical baselines. This average decrease represents a future about a third of the cold days per year relative to the average historical baseline.

In Grant County, the temperature of the coldest night of the year is projected to increase on average by 9°F, with a range of about 1 to 16°F, by the 2050s under the higher emissions scenario relative to the historical baselines.

Heavy Rains

The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor.

In Grant County, the frequency of days with at least ¾" of precipitation is not projected to change substantially. However, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 16% (with a range of 7% to 25%) and 12% (with a range of -3% to 24%), respectively, by the 2050s under the higher emissions scenario relative to the historical baselines.

In Grant County, the frequency of days exceeding a threshold for landslide risk, based on 3-day and 15-day precipitation accumulation, is not projected to change substantially. However, landslide risk depends on a variety of factors and this metric may not reflect all aspects of the hazard.

River Flooding

Mid- to low-elevation areas in Grant County's Blue Mountains that are near the freezing level in winter, receiving a mix of rain and snow, are projected to experience an increase in winter flood risk due to warmer winter temperatures causing precipitation to fall more as rain and less as snow.

Drought

Drought conditions, as represented by low summer soil moisture, low spring snowpack, low summer runoff, and low summer precipitation are projected to become more frequent in Grant County by the 2050s relative to the historical baseline.

By the end of the 21st century, summer low flows are projected to decrease in the Blue Mountains region putting some sub-basins at high risk for summer water shortage associated with low streamflow.

Wildfire

Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change. In Grant County, the frequency of very high fire danger days per year is projected to increase on average by about 39% (with a range of -10 to +98%) by the 2050s under the higher emissions scenario compared to the historical baseline.

Air Quality

Under future climate change, the risk of wildfire smoke exposure is projected to increase in Grant County. The number of "smoke wave" days—days with high concentrations of wildfire-specific particulate matter—is projected to increase by 39% and the intensity of "smoke waves" is projected to increase by 105% by 2046–2051 under a medium emissions scenario compared with 2004–2009.

Windstorms

Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

Dust Storms

Limited research suggests that the risk of dust storms in summer would decrease in eastern Oregon under climate change in areas that experience an increase in vegetation cover from the carbon dioxide fertilization effect.

Increased Invasive Species Risk

Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

Loss of Wetland Ecosystems

Freshwater wetland ecosystems are sensitive to warming temperatures and altered hydrological patterns, such as changes in precipitation seasonality and reduction of snowpack.

Introduction

Industrialization has given rise to increasing amounts of greenhouse gas emissions worldwide, which is causing the Earth's climate to warm (IPCC, 2013). The effects of which are already apparent here in Oregon (Dalton *et al.*, 2017; Mote *et al.*, 2019). Climate change is expected to influence the likelihood of occurrence of existing natural hazard events such as heavy rains, river flooding, drought, heat waves, cold waves, wildfire, air quality, and coastal erosion and flooding.

Oregon's Department of Land Conservation and Development (DLCD) contracted with the Oregon Climate Change Research Institute (OCCRI) to perform and provide analysis of the influence of climate change on natural hazards. The scope of this analysis is limited to the geographic area encompassed by the four Oregon counties that are part of the Pre-Disaster Mitigation (PDM) 17 grants DLCD received from FEMA. Those counties include: Lincoln, Clatsop, Baker, and Grant. Outcomes of this analysis include county-specific data, graphics, and text summarizing climate change projections for climate metrics related to each of the natural hazards listed in Table 2. This information will be integrated into the Natural Hazards Mitigation Plan (NHMP) updates for the four counties, and can be used in other county plans, policies, and programs. In addition to the county reports, sharing of data, and other technical assistance will be provided to the counties. This report covers climate change projections related to natural hazards relevant to Grant County.

Table 2 Natural hazards and related climate metrics evaluated in this project.

Heavy Rains Wettest Day ◆Wettest Five Days Landslide Threshold Exceedance	**Heat Waves** Hottest Day ◆ Warmest Night "Hot" Days ◆ "Warm" Nights
River Flooding Annual maximum daily flows Atmospheric Rivers Rain-on-Snow Events	**Cold Waves** Coldest Day ◆ Coldest Night "Cold" Days ◆ "Cold" Nights
Drought Summer Flow ◆ Spring Snow Summer Soil Moisture Summer Precipitation	**Air Quality** Unhealthy Smoke Days
Wildfire Fire Danger Days	**Dust Storms**
Windstorms	**Loss of Wetland Ecosystems**
Increased Invasive Species Risk	

Future Climate Projections Background

Introduction

The county-specific future climate projections prepared by OCCRI are derived from 10–20 global climate models (GCM) and two scenarios of future global greenhouse gas emissions. Future climate projections have been "downscaled"—that is, made locally relevant—and summaries of projected changes in the climate metrics in Table 2 are presented for an early 21st century period and a mid 21st century period relative to a historical baseline. (Read more about the data sources in the Appendix.)

Global Climate Models

Global climate models are sophisticated computer models of the Earth's atmosphere, water, and land and how these components interact over time and space according to the fundamental laws of physics (Figure 1). GCMs are the most sophisticated tools for understanding the climate system, but while highly complex and built on solid physical principles, they are still simplifications of the actual climate system. There are several ways to implement such simplifications into a GCM, which results in each one giving a slightly different answer. As such, it is best practice to use at least ten GCMs and look at the average and range of projections across all of them. (Read more about GCMs and uncertainty in the Appendix.)

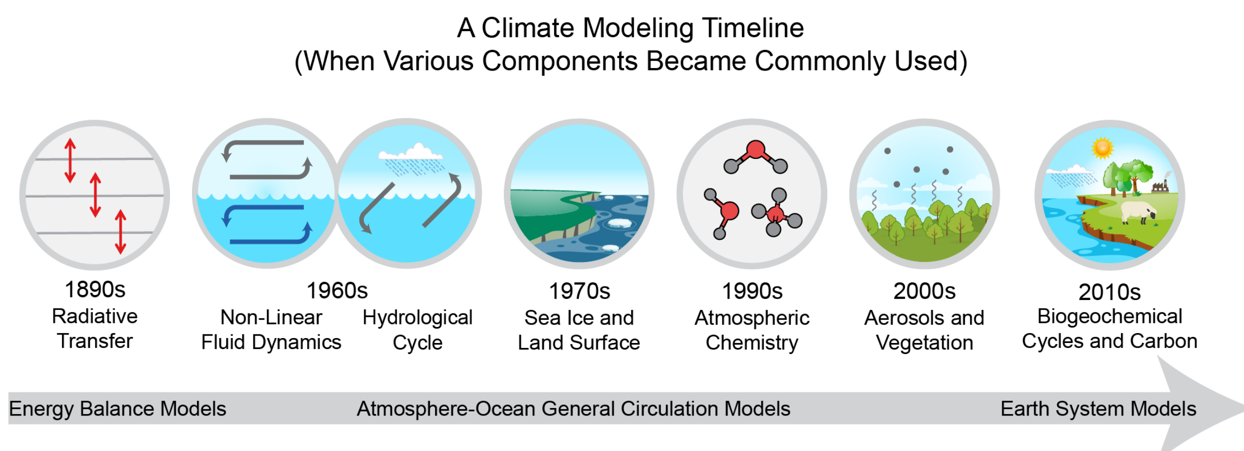

Figure 1 As scientific understanding of climate has evolved over the last 120 years, increasing amounts of physics, chemistry, and biology have been incorporated into calculations and, eventually, models. This figure shows when various processes and components of the climate system became regularly included in scientific understanding of global climate calculations and, over the second half of the century as computing resources became available, formalized in global climate models. (Source: science2017.globalchange.gov)

Greenhouse Gas Emissions

When used to project future climate, scientists give the GCMs information about the quantity of greenhouse gases that the world would emit, then the GCMs run simulations of what would happen to the air, water, and land over the next century. Since the precise amount of greenhouse gases the world will emit over the next century is unknown, scientists use several scenarios of different amounts of greenhouse gas emissions based on plausible societal trajectories. The future climate projections prepared by OCCRI uses emissions pathways called Representative Concentration Pathways (RCPs). There are several RCPs and the higher global emissions are, the greater the expected increase in global temperature (Figure 2). OCCRI considers a lower emissions scenario (RCP 4.5) and a higher emissions scenario (RCP 8.5) because they are the most commonly used scenarios in published literature and the downscaled data is available for these scenarios. (Read more about emissions scenarios in the Appendix.)

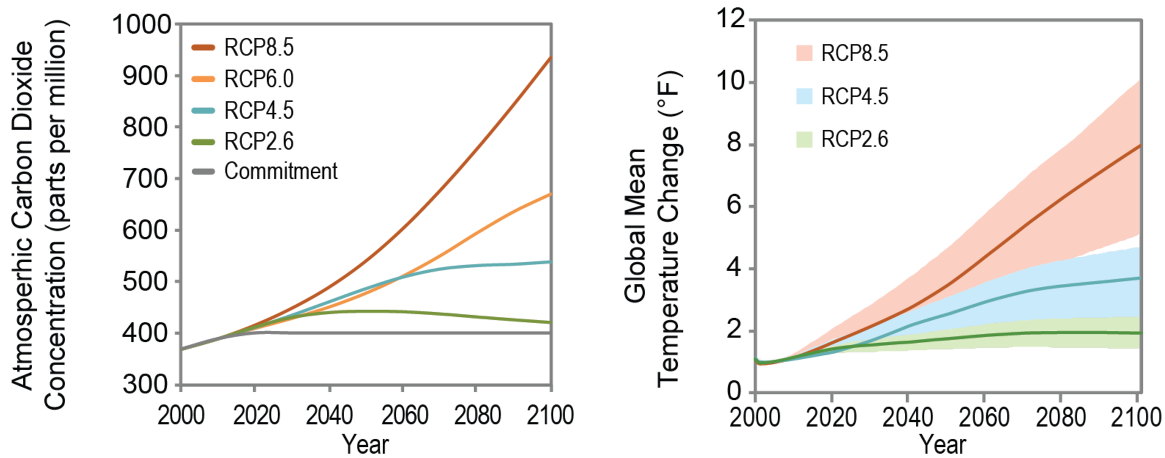

Figure 2 Future scenarios of atmospheric carbon dioxide concentrations (left) and global temperature change (right) resulting from several different emissions pathways, called Representative Concentration Pathways (RCPs), which are considered in the fourth and most recent National Climate Assessment. (Source: science2017.globalchange.gov)

Downscaling

Global climate models simulate the climate across adjacent grid boxes the size of about 60 by 60 miles. To make this coarse resolution information locally relevant, GCM outputs have been combined with historical observations to translate large-scale patterns into high-resolution projections. This process is called statistical downscaling. The future climate projections produced by OCCRI were statistically downscaled to a resolution with grid boxes the size of about 2.5 by 2.5 miles (Abatzoglou and Brown, 2012). (Read more about downscaling in the Appendix.)

Future Time Periods

When analyzing global climate model projections of future climate, it is best practice to compare the average across at least a 30-year period in the future simulations to an average across at least a 30-year period in the historical simulations. The average over a 30-year period in the historical simulations is called the *historical baseline*. For the future climate projections in this report, two 30-year future periods are analyzed in comparison with a 30-year historical baseline (Table 3).

Each of the twenty global climate models simulates historical and future climate slightly differently. Thus, each global climate model has a different historical baseline from which future projections are compared. Because each climate model's historical baseline is slightly different, this report presents the average and range of projected *changes* in the variables relative to each model's own historical baseline (rather than the average and range of future projected absolute values). The average of the twenty historical baselines, called the *average historical baseline*, is also presented to aid in understanding the relative magnitude of projected changes. The average historical baseline can be combined with the average projected future change to infer the average projected future absolute value of a given variable. However, the average historical baseline cannot be combined with the range of projected future changes to infer the range of projected future absolute values.

Table 3 Historical and future time periods for presentation of future climate projections

Historical Baseline	Early 21st Century "2020s"	Mid 21st Century "2050s"
1971–2000	2010–2039	2040–2069

How to Use the Information in this Report

Given the changing climate, anticipating future outcomes by considering only past trends may become increasingly unreliable. Future projections from GCMs provide an opportunity to explore a range of plausible outcomes taking into consideration the climate system's complex response to increasing concentrations of greenhouse gases. It is important to be aware that GCM projections should not be thought of as predictions of what the weather will be like at some specified date in the future, but rather viewed as projections of the long-term statistical aggregate of weather, in other words, "climate", if greenhouse gas concentrations follow some specified trajectory.[1]

The projections of climate variables in this report, both in the direction and magnitude of change, are best used in reference to the historical climate conditions under which a particular asset or system is designed to operate. For this reason, considering the projected changes between the historical and future periods allows one to envision how current systems of interest would respond to climate conditions that are different from what they have been. In some cases, the projected change may be small enough to be accommodated within the existing system. In other cases, the projected change may be large enough to require adjustments, or adaptations, to the existing system. However, engineering or design projects would require a more detailed analysis than what is available in this report.

The information in this report can be used to:

- Explore a range of plausible future outcomes taking into considering the climate system's complex response to increasing greenhouse gases
- Envision how current systems may respond under climate conditions different from those the systems were designed to operate under
- Evaluate potential mitigation actions to accommodate future conditions
- Influence the risk assessment in terms of the likelihood of a particular climate-related hazard occurring.

[1] Read more: https://nca2014.globalchange.gov/report/appendices/faqs#narrative-page-38784

Average Temperature

Oregon's average temperature warmed at a rate of 2.2°F per century during 1895–2015. Average temperature is expected to continue warming during the 21st century under scenarios of continued global greenhouse gas emissions; the rate of warming depends on the particular emissions scenario (Dalton *et al.*, 2017). By the 2050s (2040–2069) relative to the 1970–1999 historical baseline, Oregon's average temperature is projected to increase by 3.6 °F with a range of 1.8°–5.4°F under a lower emissions scenario (RCP 4.5) and by 5.0°F with a range of 2.9°F–6.9°F under a higher emissions scenario (RCP 8.5) (Dalton *et al.*, 2017). Furthermore, summers are projected to warm more than other seasons (Dalton *et al.*, 2017).

Average temperature in Grant County is projected to warm during the 21st century at a similar rate to Oregon as a whole (Figure 3). Projected increases in average temperature in Grant County relative to each global climate model's 1971–2000 historical baseline range from 1.1–3.9°F by the 2020s (2010–2039) and 1.9–7.6°F by the 2050s (2040–2069), depending on emissions scenario and climate model (Table 4).

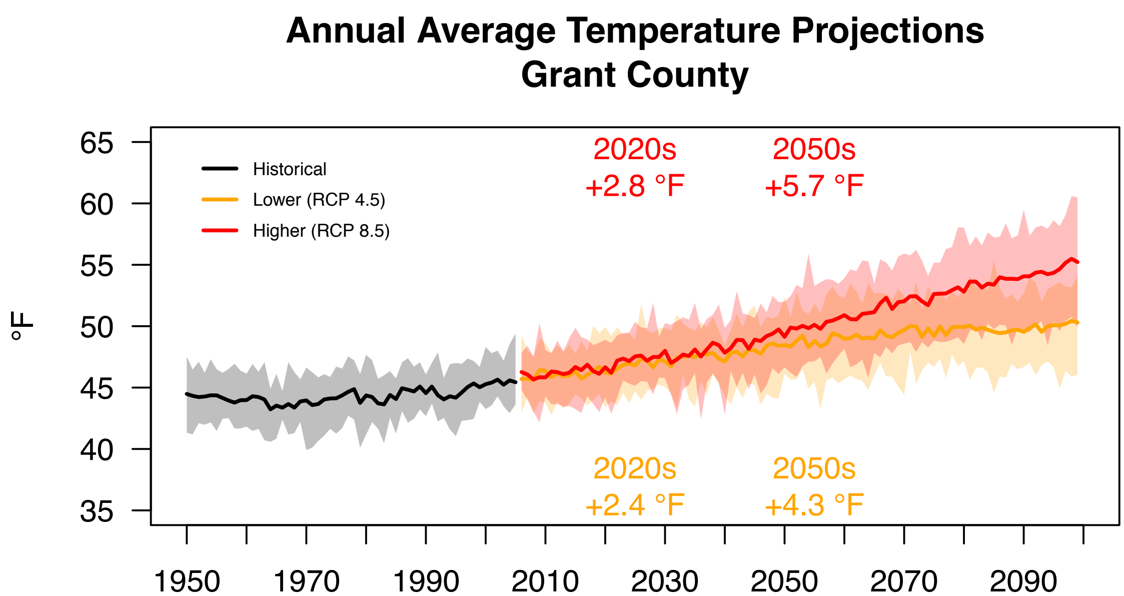

Figure 3 Annual average temperature projections for Grant County as simulated by 20 downscaled global climate models under a lower (RCP 4.5) and a higher (RCP 8.5) greenhouse gas emissions scenario. Solid line and shading depicts the 20-model mean and range, respectively. The multi-model mean differences for the 2020s (2010–2039 average) and the 2050s (2040–2069 average) relative to the average historical baseline (1971–2000 average) are shown.

Table 4 Average and range of projected future changes in Grant County's average temperature relative to each global climate model's (GCM) historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 GCMs.

	Change by Early 21st Century "2020s"	Change by Mid 21st Century "2050s"
Higher (RCP 8.5)	+2.8°F (1.6 to 3.9)	+5.7°F (3.0 to 7.6)
Lower (RCP 4.5)	+2.4°F (1.1 to 3.9)	+4.3°F (1.9 to 6.1)

Heat Waves

Extreme heat events are expected to increase in frequency, duration, and intensity in Oregon due to continued warming temperatures. In fact, the hottest days in summer are projected to warm more than the change in mean temperature over the Pacific Northwest (Dalton *et al.*, 2017). This report presents projected changes for three metrics of heat extremes for both daytime (maximum temperature) and nighttime (minimum temperature) (Table 5).

Table 5 Heat extreme metrics and definitions

Metric	Definition
Hot Days	Number of days per year maximum temperature is greater than or equal to 90°F
Warm Nights	Number of days per year minimum temperature is greater than or equal to 65°F
Hottest Day	Annual maximum of maximum temperature
Warmest Night	Annual maximum of minimum temperature
Daytime Heat Waves	Number of events per year with at least 3 consecutive days with maximum temperature greater than or equal to 90°F
Nighttime Heat Waves	Number of events per year with at least 3 consecutive days with minimum temperature greater than or equal to 65°F

In Grant County, all the extreme heat metrics in Table 5 are projected to increase by the 2020s (2010–2039) and 2050s (2040–2069) under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 6). For example, for the 2050s under the higher emissions scenario climate models project that the number of hot days greater than or equal to 90°F per year, relative to each model's 1971–2000 historical baseline, would increase by as little as 10 days to as much as 38 days. The average projected increase in the number of hot days per year is 27 days above the average historical baseline of about 10 days. This represents a projected more than tripling in the frequency of hot days by the 2050s under the higher emissions scenario.

Likewise, the temperature of the hottest day of the year is projected to increase by as little as 3.1°F to as much as 10.5°F by the 2050s under the higher emissions scenario relative to the models' historical baselines. The average projected increase is 7.8°F above the average historical baseline of 93.6°F. The frequency of daytime heat waves is projected to increase by nearly three events per year on average relative to the average historical baseline of one event. In other words, hot days are projected to become more frequent and the hottest days are projected to become even hotter.

Projected changes in the frequency of extreme heat days (i.e., Hot Days and Warm Nights) are shown in Figure 4. Projected changes in the magnitude of heat records (i.e., Hottest Day and Warmest Night) are shown in Figure 5. Projected changes in the frequency of extreme heat events (i.e., Daytime Heat Waves and Nighttime Heat Waves) are shown in Figure 6.

Table 6 Mean and range of projected future changes in extreme heat metrics for Grant County relative to each global climate model's (GCM) historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 GCMs. The average historical baseline across the 20 GCMs is also presented and can be combined with the average projected future change to infer the average projected future absolute value of a given variable. However, the average historical baseline cannot be combined with the range of projected future changes to infer the range of projected future absolute values.

		Change by Early 21st Century "2020s"		Change by Mid 21st Century "2050s"	
	Average Historical Baseline	**Lower**	**Higher**	**Lower**	**Higher**
Hot Days	9.7 days	+9.1 days (2.9–14.0)	+11.1 days (4.3–15.6)	+18.7 days (6.6–27.1)	+27.4 days (9.8–38.3)
Warm Nights	0.2 days	+0.5 days (0.0–1.2)	+0.6 days (0.2–1.2)	+1.7 days (0.1–4.0)	+4.2 days (1.0–9.6)
Hottest Day	93.6°F	+3.2°F (1.2–5.1)	+3.8°F (1.8–5.2)	+5.8°F (2.5–8.2)	+7.8°F (3.1–10.5)
Warmest Night	59.7°F	+2.6°F (1.0–4.2)	+2.9°F (1.5–4.2)	+4.5°F (1.3–7.3)	+6.5°F (3.6–9.6)
Daytime Heat Waves	1.4 events	+1.2 events (0.6–1.9)	+1.5 events (0.8–2.0)	+2.2 events (1.1–3.6)	+2.9 events (1.5–4.2)
Nighttime Heat Waves	0.0 events	+0.1 events (0.0–0.2)	+0.1 events (0.0–0.2)	+0.2 events (-0.0–0.5)	+0.5 events (0.1–1.1)

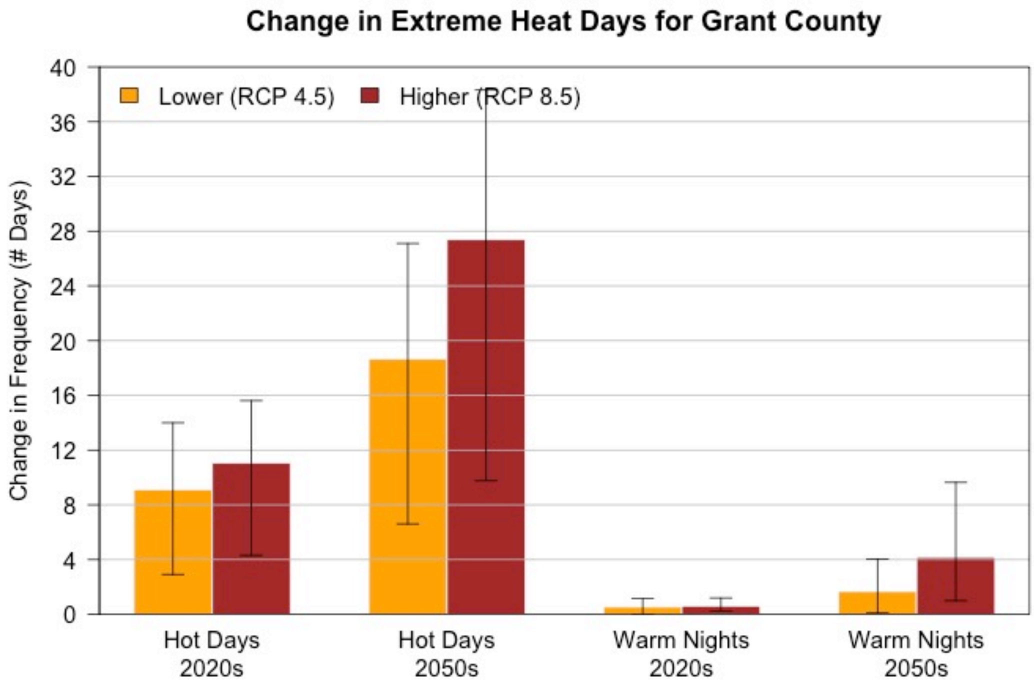

Figure 4 Projected future changes in the number of hot days (left two sets of bars) and number of warm nights (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline. Hot days are defined as days with maximum temperature of at least 90°F; warm nights are defined as days with minimum temperature of at least 65°F.

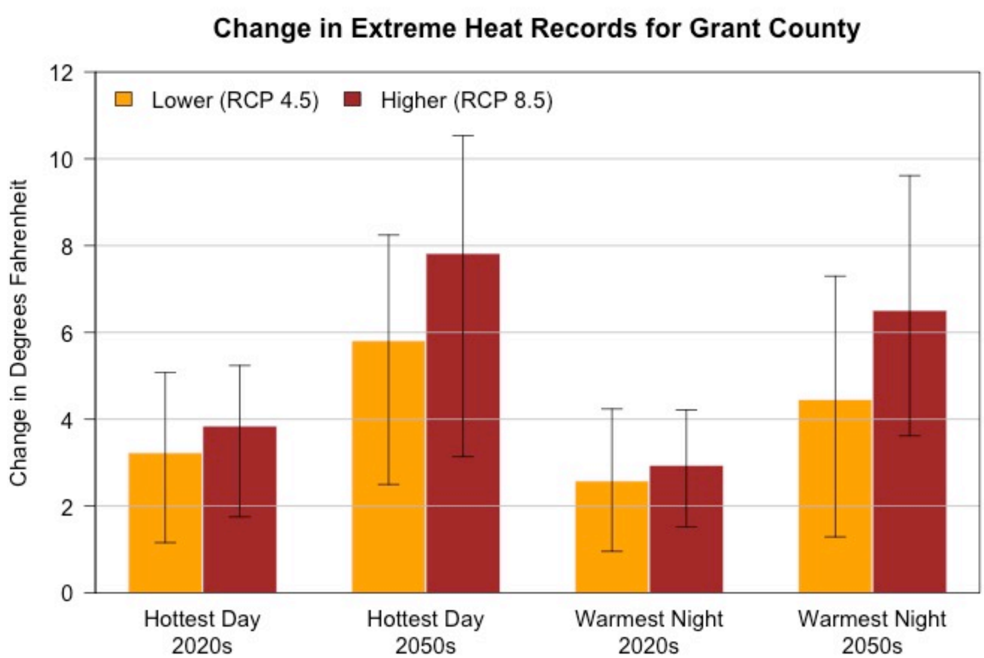

Figure 5 Projected future changes in the hottest day of the year (left two sets of bars) and warmest night of the year (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline.

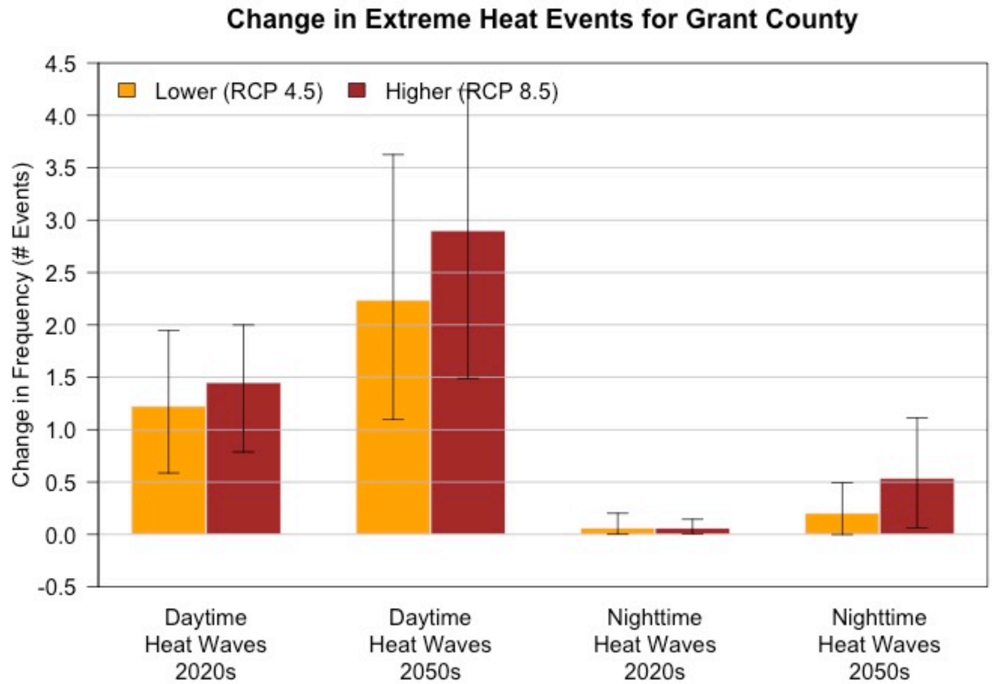

Figure 6 Projected future changes in the number of daytime heat waves (left two sets of bars) and number of nighttime heat waves (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline. Daytime heat waves are defined as events with three or more consecutive days with maximum temperature of at least 90°F; nighttime heat waves are defined as events with three or more consecutive days with minimum temperature of at least 65°F.

Key Messages:

⇒ Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures.

⇒ In Grant County, all the extreme heat metrics in Table 5 are projected to increase by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 6).

⇒ In Grant County, the frequency of hot days per year with temperatures at or above 90°F is projected to increase on average by 27 days, with a range of about 10 to 38 days, by the 2050s under the higher emissions scenario relative to the historical baselines. This average increase represents a more than tripling of hot days relative to the average historical baseline.

⇒ In Grant County, the temperature of the hottest day of the year is projected to increase on average by nearly 8°F, with a range of about 3 to 11°F, by the 2050s under the higher emissions scenario relative to the historical baselines.

Cold Waves

Over the past century, cold extremes have become less frequent and severe in the Northwest; this trend is expected to continue under future global warming of the climate system (Vose *et al.*, 2017). This report presents projected changes for three metrics of cold extremes for both daytime (maximum temperature) and nighttime (minimum temperature) (Table 7).

Table 7 Cold extreme metrics and definitions

Metric	Definition
Cold Days	Number of days per year maximum temperature is less than or equal to 32°F
Cold Nights	Number of days per year minimum temperature is less than or equal to 0°F
Coldest Day	Annual minimum of maximum temperature
Coldest Night	Annual minimum of minimum temperature
Daytime Cold Waves	Number of events per year with at least 3 consecutive days with maximum temperature less than or equal to 32°F
Nighttime Cold Waves	Number of events per year with at least 3 consecutive days with minimum temperature less than or equal to 0°F

In Grant County, the extreme cold metrics in Table 7 are projected to become less frequent or less cold by the 2020s (2010–2039) and 2050s (2040–2069) under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 8). For example, for the 2050s under the higher emissions scenario climate models project that the number of cold days less than or equal to 32°F per year, relative to each model's 1971–2000 historical baseline, would decrease by at least 9 to as much as 23 days. The average projected decrease in the number of cold days per year is 16 days relative to the average historical baseline of 25 days. This represents a future with about a third of the cold days as before by the 2050s under the higher emissions scenario.

Likewise, the temperature of the coldest night of the year is projected to increase by at least 0.5°F to at most 15.9°F relative to the models' historical baselines. The average projected increase is 9.0°F above the average historical baseline of -2.7°F. The frequency of daytime cold waves is projected to decrease by two events per year on average relative to the average historical baseline of about three events. In other words, cold days are projected to become less frequent and the coldest nights are projected to become warmer.

Projected changes in the frequency of extreme cold days (i.e., Cold Days and Cold Nights) are shown in Figure 7. Projected changes in the magnitude of cold records (i.e., Coldest Day and Coldest Night) are shown in Figure 8. Projected changes in the frequency of extreme cold events (i.e., Daytime Cold Waves and Nighttime Cold Waves) are shown in Figure 9.

Table 8 Mean and range of projected future changes in extreme cold metrics for Grant County relative to each global climate model's (GCM) historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 GCMs. The average historical baseline across the 20 GCMs is also presented and can be combined with the average projected future change to infer the average projected future absolute value of a given variable. However, the average historical baseline cannot be combined with the range of projected future changes to infer the range of projected future absolute values.

		Change by Early 21st Century "2020s"		Change by Mid 21st Century "2050s"	
	Average Historical Baseline	**Lower**	**Higher**	**Lower**	**Higher**
Cold Days	24.8 days	-7.9 days (-15.1 to -0.4)	-9.6 days (-15.2 to -2.2)	-13.3 days (-18.1 to -5.3)	-15.6 days (-22.8 to -8.5)
Cold Nights	2.5 days	-0.9 days (-2.3 to 0.3)	-1.2 days (-2.3 to -0.3)	-1.7 days (-2.9 to -0.3)	-1.8 days (-2.6 to -0.4)
Coldest Day	18.5°F	+1.9°F (-2.3 to 5.1)	+3.3°F (-0.2 to 7.1)	+5.0°F (0.7 to 8.4)	+6.3°F (1.0 to 11.2)
Coldest Night	-2.7°F	+3.0°F (-1.9 to 10.1)	+4.8°F (0.2 to 11.4)	+7.2°F (0.7 to 12.6)	+9.0°F (0.5 to 15.9)
Daytime Cold Waves	3.2 events	-1.0 events (-1.9 to 0.1)	-1.2 events (-2.0 to -0.3)	-1.7 events (-2.3 to -0.7)	-2.0 events (-2.9 to -0.9)
Nighttime Cold Waves	0.3 events	-0.1 events (-0.3 to 0.1)	-0.1 events (-0.3 to 0.1)	-0.2 events (-0.4 to 0.0)	-0.2 events (-0.4 to -0.0)

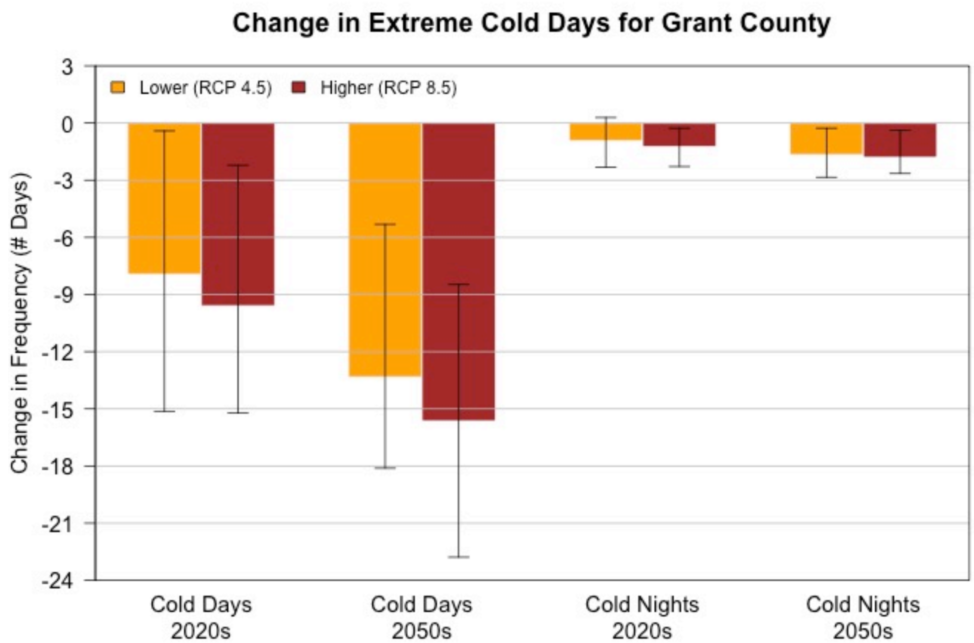

Figure 7 Projected future changes in the number of cold days (left two sets of bars) and number of cold nights (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline. Cold days are defined as days with maximum temperature at or below 32°F; cold nights are defined as days with minimum temperature at or below 0°F.

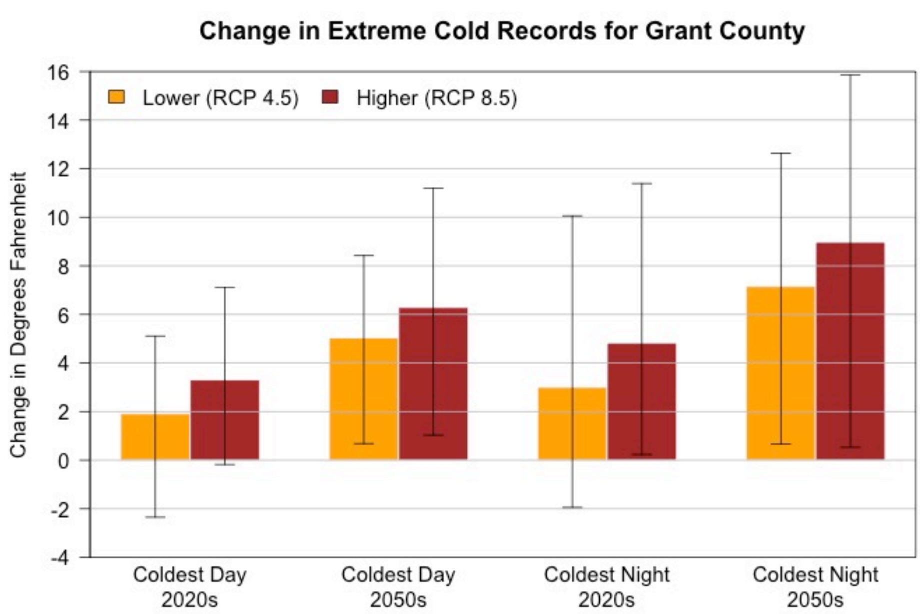

Figure 8 Projected future changes in the coldest day of the year (left two sets of bars) and coldest night of the year (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline.

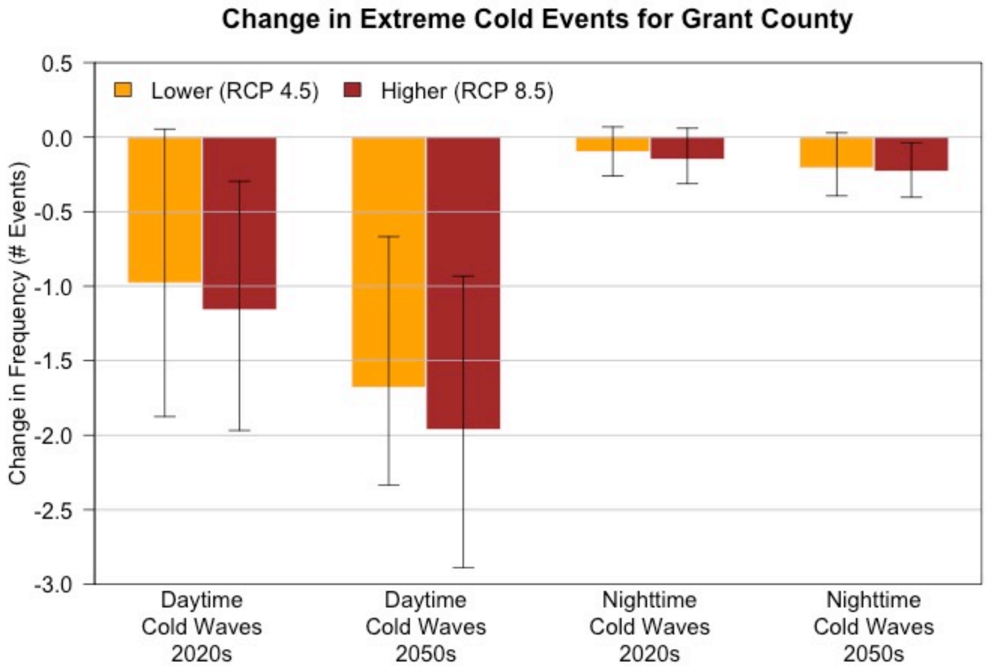

Figure 9 Projected future changes in the number of daytime cold waves (left two sets of bars) and number of nighttime cold waves (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline. Daytime cold waves are defined as events with three or more consecutive days with maximum temperature at or below 32°F; nighttime cold waves are defined as events with three or more consecutive days with minimum temperature at or below 0°F.

Key Messages:

⇒ Cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms.

⇒ In Grant County, the extreme cold metrics in Table 7 are projected to become less frequent or less cold by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 8).

⇒ In Grant County, the frequency of cold days per year at or below freezing is projected to decrease on average by 16 days, with a range of about 9 to 23 days, by the 2050s under the higher emissions scenario relative to the historical baselines. This average decrease represents a future about a third of the cold days per year relative to the average historical baseline.

⇒ In Grant County, the temperature of the coldest night of the year is projected to increase on average by 9°F, with a range of about 1 to 16°F, by the 2050s under the higher emissions scenario relative to the historical baselines.

Heavy Rains

There is greater uncertainty in future projections of precipitation-related metrics than temperature-related metrics. This is because of the large natural variability in precipitation patterns and the fact that the atmospheric patterns that influence precipitation are manifested differently across GCMs. From a global perspective, mean precipitation is likely to decrease in many dry regions in the sub-tropics and mid-latitudes and increase in many mid-latitude wet regions (IPCC, 2013). That boundary between mid-latitude increases and decreases in precipitation is positioned a little differently for each GCM, which results in some models projecting increases and others decreases in Oregon (Mote *et al.*, 2013).

In Oregon, observed precipitation is characterized by high year-to-year variability and future precipitation trends are expected to continue to be dominated by this large natural variability. On average, summers in Oregon are projected to become drier and other seasons to become wetter resulting in a slight increase in annual precipitation by the 2050s. However, some models project increases and others decreases in each season (Dalton *et al.*, 2017).

Extreme precipitation events in the Pacific Northwest are governed both by atmospheric circulation and by how it interacts with complex topography (Parker and Abatzoglou, 2016). Atmospheric rivers—long, narrow swaths of warm, moist air that carry large amounts of water vapor from the tropics to mid-latitudes—generally result in coherent extreme precipitation events west of the Cascade Range, while closed low pressure systems often lead to isolated precipitation extremes east of the Cascade Range (Parker and Abatzoglou, 2016).[2]

Observed trends in the frequency of extreme precipitation events across Oregon have depended on the location, time frame, and metric considered, but overall the frequency has not changed substantially. As the atmosphere warms, it is able to hold more water vapor that is available for precipitation. As a result, the frequency and intensity of extreme precipitation events are expected to increase in the future (Dalton *et al.*, 2017), including atmospheric river events (Kossin *et al.*, 2017). In addition, regional climate modeling results suggest a weakened rain shadow effect in winter projecting relatively larger increases in precipitation east of the Cascades and smaller increases west of the Cascades in terms of both seasonal precipitation totals and precipitation extremes (Mote *et al.*, 2019).

This report presents projected changes for four metrics of precipitation extremes (Table 9).

[2] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

Table 9 Precipitation extreme metrics and definitions

Metric	Definition
Wettest Day	Annual maximum 1-day precipitation per water year
Wettest Five-Days	Annual maximum 5-day precipitation total per water year
Wet Days	Number of days per year with precipitation greater than 0.75 inches
Landslide Risk Days	Number of days per water year exceeding the USGS landslide threshold[3]: https://pubs.er.usgs.gov/publication/ofr20061064 o P3/(3.5-.67*P15)>1, where: ▪ P3 = Previous 3-day precipitation accumulation ▪ P15 = 15-day precipitation accumulation prior to P3

In Grant County, the magnitude of precipitation on the wettest day and wettest consecutive five days is projected to increase on average by the 2020s (2010–2039) and 2050s (2040–2069) under both the lower and higher emissions scenarios (Table 10). However, some models project decreases in some of these metrics for certain time periods and scenarios.

For the 2050s under the higher emissions scenario, climate models project that the magnitude, or amount, of precipitation on the wettest day of the year, relative to each model's 1971–2000 historical baseline, would increase by as little as 7.4% to as much as 25.3%. The average projected percent increase in the amount of precipitation on the wettest day of the year is 16.4% above the average historical baseline of 0.85 inches.

For the magnitude of precipitation on the wettest consecutive five days of the year, some models project decreases by as much as -3.2% while other models project increases by as much as 23.6% for the 2050s under the higher emissions scenario. The average projected percent change in the amount of precipitation on the wettest consecutive five days is an increase of 11.7% above the average historical baseline of nearly two inches.

The average number of days per year with precipitation greater than ¾" is not projected to change substantially given that such days are rare in Grant County with an average historical baseline of only one day per year.

Landslides are often triggered by rainfall when the soil becomes saturated. This report analyzes a cumulative rainfall threshold based on the previous 3-day and 15-day precipitation accumulation as a surrogate for landslide risk. For Grant County, the average number of days per year exceeding the landslide risk threshold is not projected to change substantially given that such days are rare in Grant County with an average historical baseline of only one day per year. Landslide risk depends on a variety of site-specific factors and this metric may not reflect all aspects of the hazard. It is important to note that this particular landslide threshold was developed for Seattle, Washington and may or may not have similar applicability to other locations.

[3] This threshold was developed for Seattle, Washington and may or may not have similar applicability to other locations.

Projected changes in the magnitude of extreme precipitation events (i.e., Wettest Day and Wettest Five-Days) are shown in Figure 10. Projected changes in the frequency of extreme precipitation events (i.e., Wet Days and Landslide Risk Days) are shown in Figure 11.

Table 10 Mean and range of projected future changes in extreme precipitation metrics for Grant County relative to each global climate model's (GCM) historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 GCMs. The average historical baseline across the 20 GCMs is also presented and can be combined with the average projected future change to infer the average projected future absolute value of a given variable. However, the average historical baseline cannot be combined with the range of projected future changes to infer the range of projected future absolute values.

		Change by Early 21st Century "2020s"		Change by Mid 21st Century "2050s"	
	Average Historical Baseline	Lower	Higher	Lower	Higher
Wettest Day	0.85 inches	+12.9% (-0.3 to 32.6)	+10.1% (-4.8 to 25.2)	+13.3% (2.1 to 25.2)	+16.4% (7.4 to 25.3)
Wettest Five-Days	1.98 inches	+7.5% (-2.8 to 26.1)	+6.3% (-15.4 to 23.9)	+7.8% (-3.2 to 15.7)	+11.7% (-3.2 to 23.6)
Wet Days	1.4 days	+0.3 days (-0.1 to 0.7)	+0.3 days (-0.1 to 1.0)	+0.5 days (0.2 to 0.9)	+0.6 days (0.1 to 1.0)
Landslide Risk Days	1.6 days	+0.4 days (-0.1 to 1.0)	+0.3 days (-0.8 to 1.1)	+0.5 days (-0.2 to 1.2)	+0.7 days (-0.3 to 1.6)

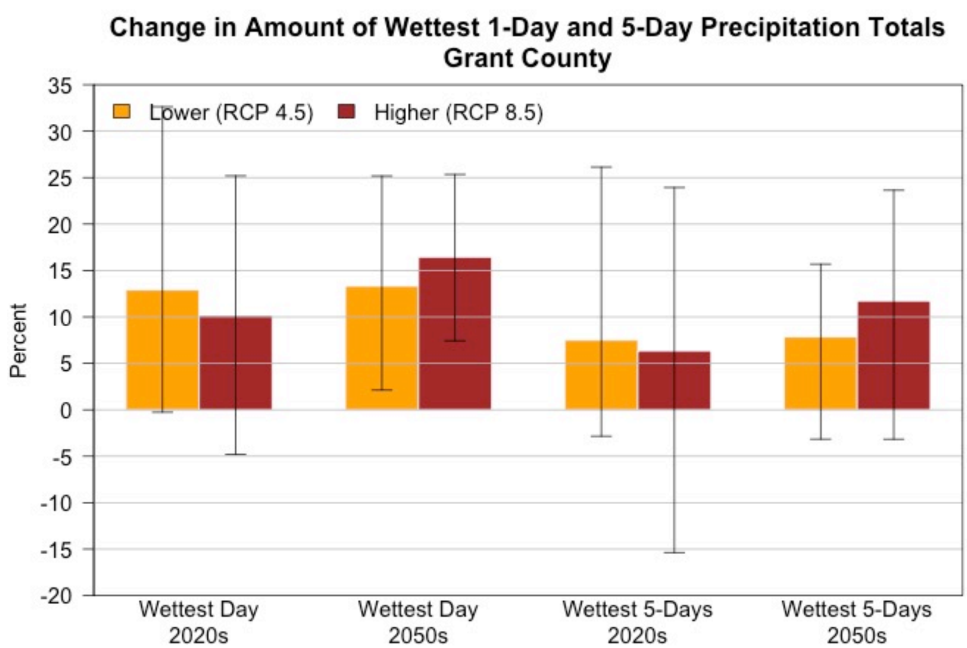

Figure 10 Projected future changes in the wettest day of the year (left two sets of bars) and wettest consecutive five days of the year (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline.

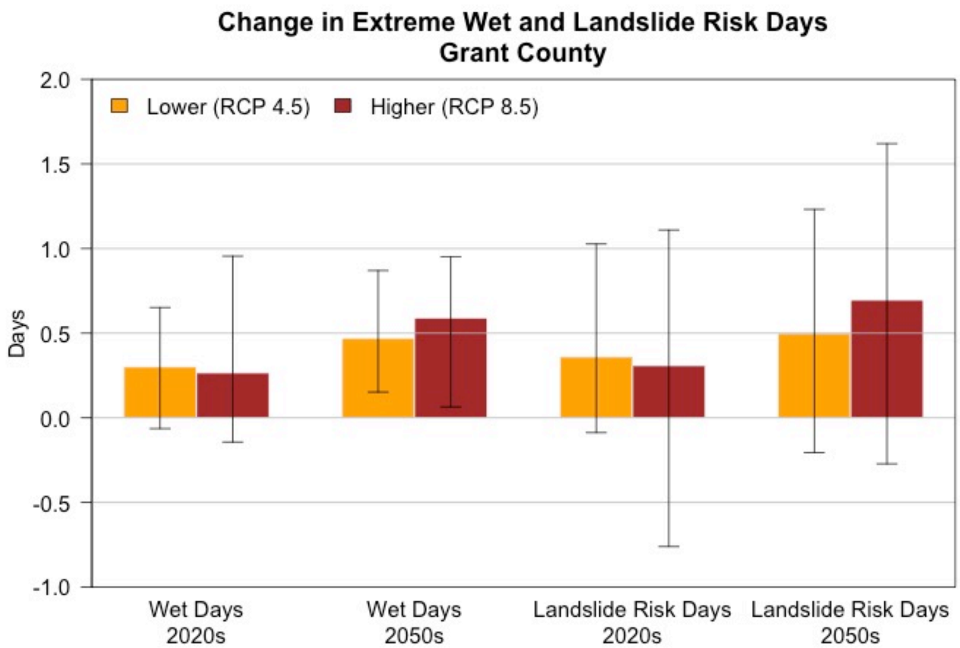

Figure 11 Projected future changes in the frequency of wet days (left two sets of bars) and landslide risk days (right two sets of bars) for Grant County relative to the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models (GCMs). The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs relative to each GCM's historical baseline.

Key Messages:

⇒ The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor.

⇒ In Grant County, the frequency of days with at least ¾" of precipitation is not projected to change substantially. However, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 16% (with a range of 7% to 25%) and 12% (with a range of -3% to 24%), respectively, by the 2050s under the higher emissions scenario relative to the historical baselines.

⇒ In Grant County, the frequency of days exceeding a threshold for landslide risk, based on 3-day and 15-day precipitation accumulation, is not projected to change substantially. However, landslide risk depends on a variety of factors and this metric may not reflect all aspects of the hazard.

River Flooding

Future streamflow magnitude and timing in the Pacific Northwest is projected to shift toward higher winter runoff, lower summer and fall runoff, and an earlier peak runoff, particularly in snow-dominated regions (Raymondi *et al.*, 2013; Naz *et al.*, 2016).[4] These changes are expected to result from warmer temperatures causing precipitation to fall more as rain and less as snow, in turn causing snow to melt earlier in the spring; and in combination with increasing winter precipitation and decreasing summer precipitation (Dalton *et al.*, 2017; Mote *et al.*, 2019).

Warming temperatures and increased winter precipitation are expected to increase flood risk for many basins in the Pacific Northwest, particularly mid- to low-elevation mixed rain-snow basins with near freezing winter temperatures (Tohver *et al.*, 2014). The greatest changes in peak streamflow magnitudes are projected to occur at intermediate elevations in the Cascade Range and the Blue Mountains (Safeeq *et al.*, 2015). Recent advances in regional hydro-climate modeling support this expectation, projecting increases in extreme high flows for most of the Pacific Northwest, especially west of the Cascade Crest (Salathé *et al.*, 2014; Najafi and Moradkhani, 2015; Naz *et al.*, 2016). One study, using a single climate model, projects flood risk to increase in the fall due to earlier, more extreme storms, including atmospheric river events, and to a shift of precipitation from snow to rain (Salathé *et al.*, 2014).[5] Across the western US, the 100-year and 25-year peak flow magnitudes—major flooding events—are projected to increase at a majority of streamflow sites by the 2070–2099 period compared to the 1971–2000 historical baseline under the higher emissions scenario (RCP 8.5) (Maurer *et al.*, 2018).

In parts of the Blue Mountains (the Wallowa Mountains, Hells Canyon Wilderness Area, and northeast Wallowa-Whitman National Forest), flood magnitude for the 1.5-year return period event is expected to increase by the end of the 21st century under a medium emission scenario (SRES-A1B)[6], particularly in mid-elevation areas, as precipitation falls more as rain and less as snow (Clifton *et al.*, 2018) (Figure 12). The 1.5-year return period event has a 67% probability of occurrence in a given year and is indicative of flooding levels that can begin to cause damage to roads. An increase in flood magnitude for a specified flood frequency implies an increase in flood frequency for a given flood magnitude. Figure 12 shows projections of flood magnitude change for the 1.5-year return period event for the 2080s compared to a historical baseline. Unfortunately, quantitative information about flood risk in Grant County is not available for the 2020s and 2050s.

Some of the Pacific Northwest's largest floods occur when copious warm rainfall from atmospheric rivers combine with a strong snowpack, resulting in rain-on-snow flooding events (Safeeq *et al.*, 2015).[7] The frequency and intensity—amount of transported moisture—of atmospheric river events is projected to increase along the West Coast in response to rising atmospheric temperatures (Kossin *et al.*, 2017). This larger moisture transport of atmospheric rivers would lead to greater likelihoods of flooding along the

[4] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[5] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[6] The medium emissions pathway (SRES-A1B) is from an earlier generation of emissions scenarios and it is most similar to RCP 6.0 from Figure 2.

[7] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

West Coast (Konrad and Dettinger, 2017).

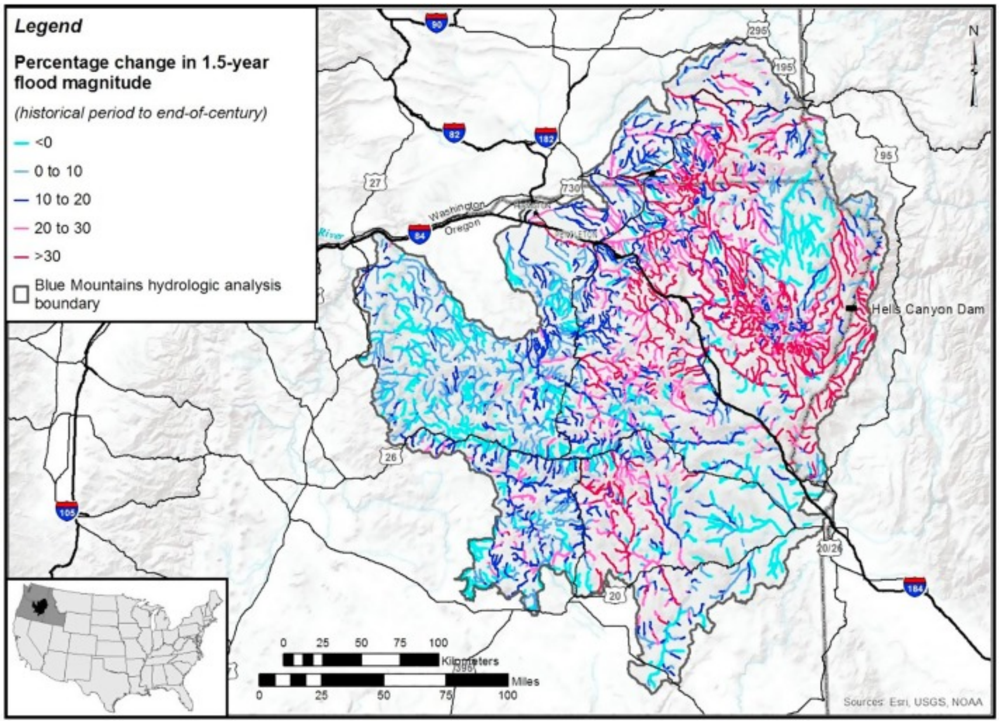

Figure 12 Projected change in the 1.5-year return interval daily flow magnitude between the historical period (1970–1999) and the 2080s (2070–2099) under a medium emissions scenario (SRES-A1B)[8] for the Blue Mountains region. (Source: Clifton et al., 2018)

Future changes in rain-on-snow events as a result of climate warming depend on elevation. At lower elevations, the frequency of rain-on-snow events is projected to decrease due to decreasing snowpack, whereas at high elevations the frequency of rain-on-snow events is projected to increase due to the shift from snowy to rainy days (Surfleet and Tullos, 2013; Safeeq *et al.*, 2015; Musselman *et al.*, 2018). How such changes in rain-on-snow frequency would affect high streamflow events is varied. For example, projections for the Santiam River, OR, show an increase in annual peak daily flows with moderate return intervals (<10 years) but a decrease at higher (> 10-year) return intervals (Surfleet and Tullos, 2013). In the John Day River Basin in northeast Oregon, the total volume and intensity of the top ten rain-on-snow events is projected to increase in the future due to precipitation falling more as rain and less as snow (Musselman *et al.*, 2018).

Key Messages:

⇒ Mid- to low-elevation areas in Grant County's Blue Mountains that are near the freezing level in winter, receiving a mix of rain and snow, are projected to experience an increase in winter flood risk due to warmer winter temperatures causing precipitation to fall more as rain and less as snow.

[8] The medium emissions pathway (SRES-A1B) is from an earlier generation of emissions scenarios and it is most similar to RCP 6.0 from Figure 2.

Drought

Across the western US, mountain snowpack is projected to decline leading to reduced summer soil moisture in mountainous environments (Gergel *et al.*, 2017). Climate change is expected to result in lower summer streamflows in historically snow-dominated basins across the Pacific Northwest as snowpack melts off earlier due to warmer temperatures and summer precipitation decreases (Dalton *et al.*, 2017; Mote *et al.*, 2019).

This report presents future changes in five variables indicative of drought conditions—low spring snowpack, low summer soil moisture[9], low summer runoff, low summer precipitation, and high summer evaporation—in terms of a change in the frequency of the historical baseline 1-in-5 year event (that is, an event having a 20% chance of occurrence in any given year). The future projections, displayed in the orange and brown bars of Figure 13, are the frequency in the future period of the magnitude of the event that has a 20% frequency in the historical period.

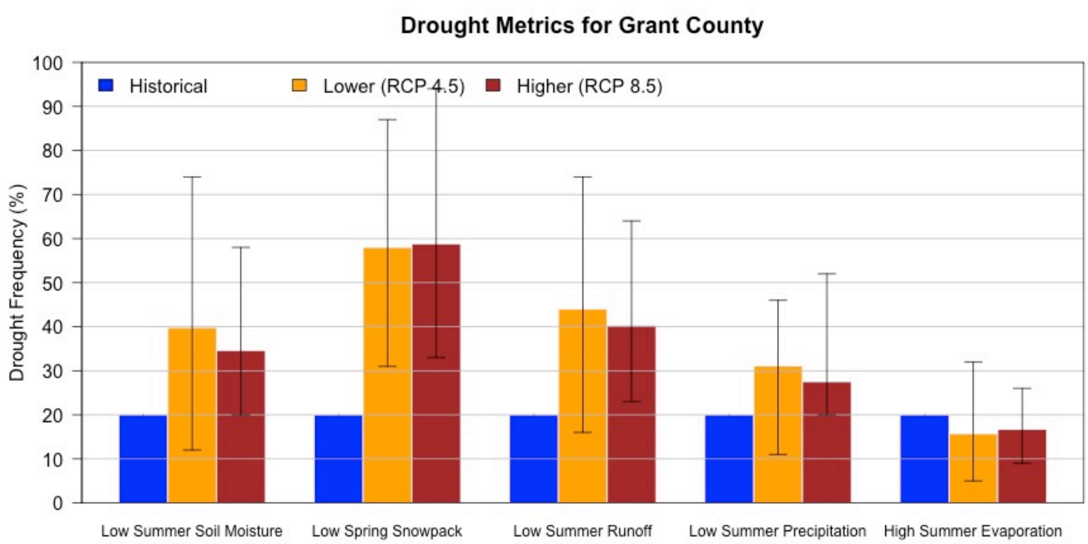

Figure 13 Frequency of the historical baseline (1971–2000) 1-in-5 year event (by definition 20% frequency) of low summer soil moisture (average of June-July-August), low spring snowpack (April 1 snow water equivalent), low summer runoff (total of June-July-August), low summer precipitation (total for June-July-August), high summer evaporation (total for June-July-August) for the future period 2040–2069 for lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios. The bar and whiskers depict the mean and range across ten global climate models. (Data Source: Integrated Scenarios of the Future Northwest Environment, https://climate.northwestknowledge.net/IntegratedScenarios/)

In Grant County, spring snowpack (that is, the snow water equivalent on April 1), summer runoff, summer soil moisture, and summer precipitation are projected to decline under both lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios by the 2050s (2040–2069). This leads to the magnitude of low summer soil moisture, low spring snow pack, low summer runoff, and low summer precipitation expected with a 20% chance in any given year of the historical period being projected to occur more frequently by the 2050s under both emissions scenarios (Figure 13). Of the five metrics, climate change shows the strongest impact on spring snowpack and summer runoff in Grant County. By the 2050s

[9] Soil moisture projections are for the total moisture in the soil column from the surface to 140 cm below the surface.

under the higher emissions scenario the 1-in-5 year events for low spring snowpack and low summer runoff are projected to become roughly a 1-in-1.7 year event and 1-in-2.5 year event, respectively. The projected changes in the 1-in-5 year events for the other variables are smaller and less certain given that some models project an increase and others a decrease. The 2020s (2010–2039) were not evaluated in this drought analysis due to data limitations, but can be expected to be similar but of smaller magnitude to the changes for the 2050s.

Some areas in northeast Oregon are more sensitive to changes in spring snowpack and summer streamflow than others. A recent climate vulnerability analysis for the Blue Mountains region indicates that declines in spring snowpack are projected to be largest in low to mid-elevation locations, but even some locally higher elevation ranges, such as the Strawberry Mountains and Monument Rock Wilderness, and mid-elevations in the North Fork John Day, and Hells Canyon Wilderness would have relatively high sensitivity to snow losses (Clifton *et al.*, 2018). Summer streamflow in about half of the perennial streams in the Blue Mountains are projected to decrease by less than 10%, while areas more sensitive to changing low flows, such as the Wallowa Mountains and Elkhorn Mountains, are projected to see decreases in summer streamflow of more than 30% by the late 21st century (Clifton *et al.*, 2018) (Figure 14). Sub-basins with high risk for summer water shortage associated with low streamflow include the Burnt, Powder, Upper Grande Ronde, Silver, Silvies, Upper John Day, Wallowa, and Willow sub-basins (Clifton *et al.*, 2018).

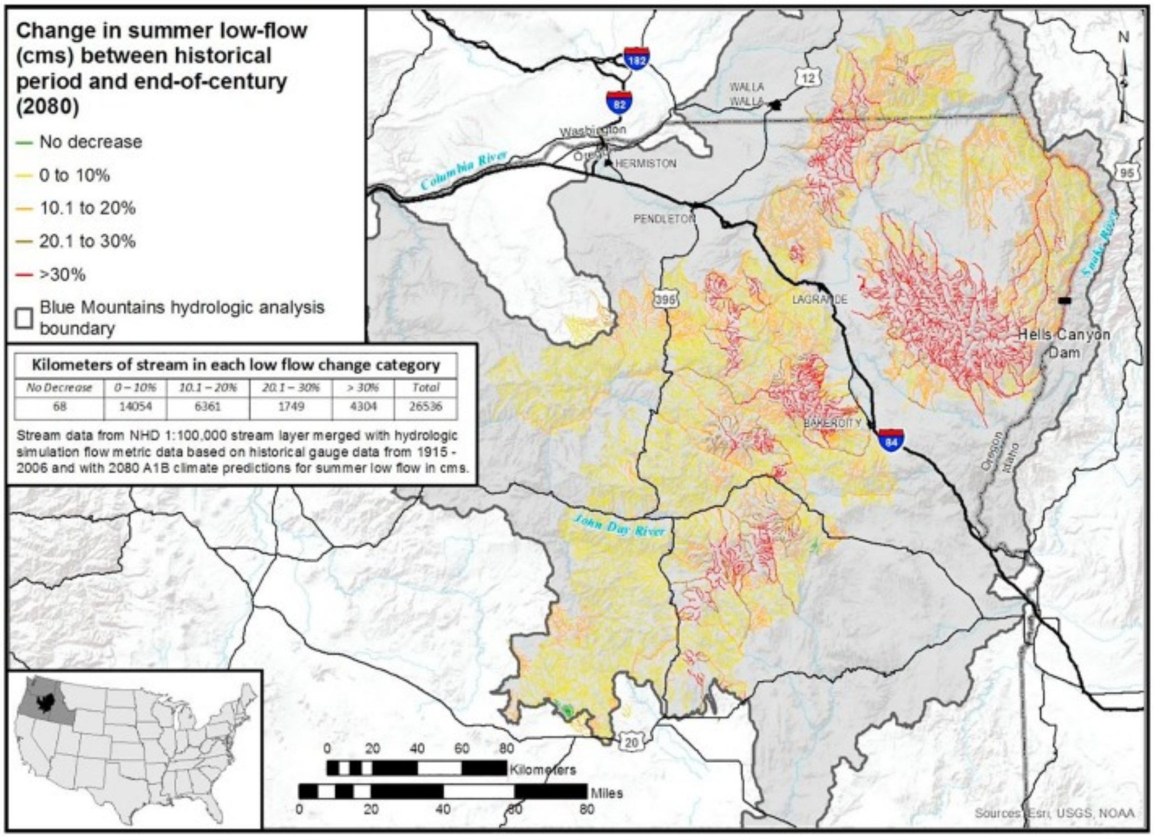

Figure 14 Projected change in mean summer streamflow from the historic time period (1970–1999) to the 2080s (2070–2099) under a medium emissions scenario[10] for streams in the Blue Mountains region. Note, the 0 to 10%, 10.1 to 20%, etc. all indicate decreases in flow. (Source: Clifton et al., 2018)

Key Messages:

⇒ Drought conditions, as represented by low summer soil moisture, low spring snowpack, low summer runoff, and low summer precipitation are projected to become more frequent in Grant County by the 2050s relative to the historical baseline.

⇒ By the end of the 21st century, summer low flows are projected to decrease in the Blue Mountains region putting some sub-basins at high risk for summer water shortage associated with low streamflow.

[10] The medium emissions pathway (SRES-A1B) is from an earlier generation of emissions scenarios and it is most similar to RCP 6.0 from Figure 2.

Wildfire

Over the last several decades, warmer and drier conditions during the summer months have contributed to an increase in fuel aridity and enabled more frequent large fires, an increase in the total area burned, and a longer fire season across the western United States, particularly in forested ecosystems (Dennison *et al.*, 2014; Jolly *et al.*, 2015; Westerling, 2016; Williams and Abatzoglou, 2016). The lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt (Westerling, 2016). Recent wildfire activity in forested ecosystems is partially attributed to human-caused climate change: during the period 1984–2015, about half of the observed increase in fuel aridity and 4.2 million hectares (or more than 16,000 square miles) of burned area in the western United States were due to human-caused climate change (Abatzoglou and Williams, 2016). Under future climate change, wildfire frequency and area burned are expected to continue increasing in the Pacific Northwest (Barbero *et al.*, 2015; Sheehan *et al.*, 2015).[11]

As a proxy for wildfire risk, this report considers a fire danger index called 100-hour fuel moisture (FM100), which is a measure of the amount of moisture in dead vegetation in the 1–3 inch diameter class available to a fire. It is expressed as a percent of the dry weight of that specific fuel. FM100 is a common index used by the Northwest Interagency Coordination Center to predict fire danger. A majority of climate models project that FM100 would decline across Oregon by the 2050s (2040–2069) under the higher (RCP 8.5) emissions scenario (Gergel *et al.*, 2017). This drying of vegetation would lead to greater wildfire risk, especially when coupled with projected decreases in summer soil moisture. This report defines a "very high" fire danger day to be a day in which FM100 is lower (i.e., drier) than the historical baseline 10th percentile value. By definition, the historical baseline has 36.5 very high fire danger days annually. The future change in wildfire risk is expressed as the average annual number of additional "very high" fire danger days for two future periods under two emissions scenarios compared with the historical baseline (Figure 15). The impacts of wildfire on air quality are discussed in the following section on Air Quality.

[11] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

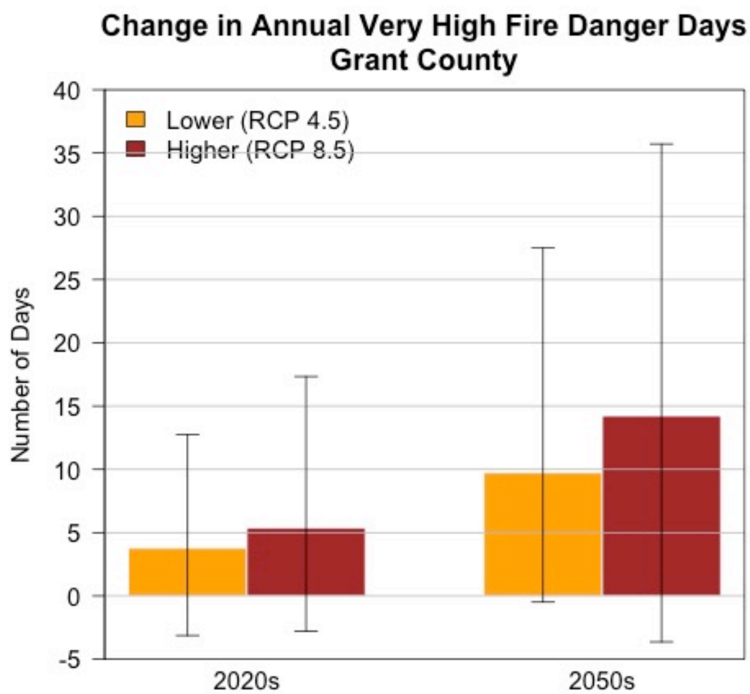

Figure 15 Projected future changes in the frequency of very high fire danger days for Grant County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 18 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 18 GCMs. (Data Source: Northwest Climate Toolbox, climatetoolbox.org/tool/Climate-Mapper)

Key Messages:

⇒ Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change in Grant County.

⇒ In Grant County, the frequency of very high fire danger days per year is projected to increase on average by about 14 days (with a range of -4 to +36 days) by the 2050s under the higher emissions scenario compared to the historical baseline.

⇒ In Grant County, the frequency of very high fire danger days per year is projected to increase on average by about 39% (with a range of -10 to +98%) by the 2050s under the higher emissions scenario compared to the historical baseline.

Air Quality

Climate change is expected to worsen outdoor air quality. Warmer temperatures may increase ground level ozone pollution, more wildfires may increase smoke and particulate matter, and longer, more potent pollen seasons may increase aeroallergens. Such poor air quality is expected to exacerbate allergy and asthma conditions and increase respiratory and cardiovascular illnesses and death (Fann *et al.*, 2016).[12] In addition to increasing health risks, wildfire smoke impairs visibility and disrupts outdoor recreational activities (Nolte *et al.*, 2018). This report presents quantitative projections of future air quality measures related to fine particulate matter (PM2.5) from wildfire smoke.

Climate change is expected to result in a longer wildfire season with more frequent wildfires and greater area burned (Sheehan *et al.*, 2015). Wildfires are primarily responsible for days when air quality standards for PM2.5 are exceeded in western Oregon and parts of eastern Oregon (Liu *et al.*, 2016), although woodstove smoke and diesel emissions are also main contributors (Oregon DEQ, 2016). Across the western United States, PM2.5 levels from wildfires are projected to increase 160% by mid-century under a medium emissions pathway[11] (SRES A1B) (Liu *et al.*, 2016). This translates to a greater risk of wildfire smoke exposure through increasing frequency, length, and intensity of “smoke waves”—that is, two or more consecutive days with high levels of PM2.5 from wildfires (Liu *et al.*, 2016).[13]

The change in risk of poor air quality due to wildfire-specific PM2.5 is expressed as the number of “smoke wave” days within a six-year period and the average intensity—concentration of particulate matter—of smoke wave days in the present (2004–2009) and mid-century (2046–2051) under a medium emissions pathway[14] (Figure 16). See Appendix for description of methodology and access to the Smoke Wave data. In Grant County the frequency and intensity of “smoke wave” days is expected to increase.

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[12] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[13] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[14] The medium emissions pathway used is from an earlier generation of emissions scenarios. Liu et al. (2016) used SRES-A1B, which is most similar to RCP 6.0 from Figure 2.

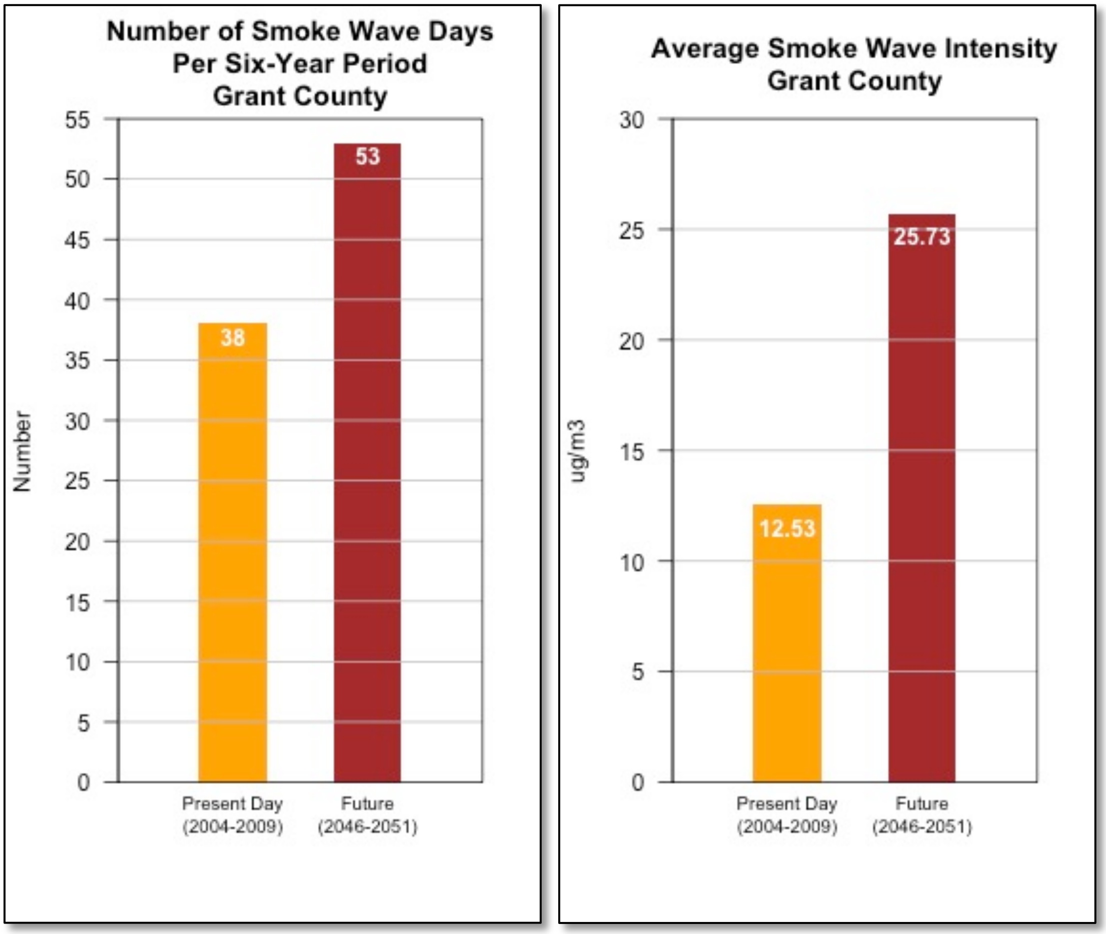

Figure 16 Simulated present day (2004–2009) and future (2046–2051) frequency (left) and intensity (right) of "smoke wave" days for Grant County under a medium emissions scenario[11]. The bars display the mean across 15 GCMs. (Data source: Liu et al. 2016, https://khanotations.github.io/smoke-map/)

Key Messages:

⇒ Under future climate change, the risk of wildfire smoke exposure is projected to increase in Grant County.

⇒ In Grant County, the number of "smoke wave" days is projected to increase by 39% and the intensity of "smoke waves" is projected to increase by 105% by 2046–2051 under a medium emissions scenario compared with 2004–2009.

Windstorms

Climate change has the potential to alter surface winds through changes in the large-scale free atmospheric circulation and storm systems, and through changes in the connection between the free atmosphere and the surface. West of the Cascade Mountains in the Pacific Northwest, changes in surface wind speeds tend to follow changes in upper atmosphere winds associated with extratropical cyclones (Salathé *et al.*, 2015). East of the Cascades, cool air pooling is common which can impede the transport of wind energy from the free atmosphere to the surface. Changes in this factor are likely important for understanding future changes in windstorms (Salathé *et al.*, 2015). However, this is not yet well studied.

Winter extratropical storm frequency in the northeast Pacific exhibited a positive, though statistically not significant, trend since 1950 (Vose *et al.*, 2014). However, there is a high degree of uncertainty in future projections of extratropical cyclone frequency (IPCC, 2013). Future projections indicate a slight northward shift in the jet stream and extratropical cyclone activity, but there is as yet no consensus on whether or not extratropical storms (Vose *et al.*, 2014; Seiler and Zwiers, 2016; Chang, 2018) and associated extreme winds (Kumar *et al.*, 2015) will intensify or become more frequent along the Northwest coast under a warmer climate. Therefore, no descriptions of future changing conditions are included in this report.

Key Messages:

⇒ Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

Dust Storms

Climate, through precipitation and winds, and vegetation coverage can influence the frequency and magnitude of dust events, or dust storms, which primarily concern parts of eastern Oregon. Periods of low precipitation can dry out the soils increasing the amount of soil particulate matter available to be entrained in high winds. In addition, the amount of vegetation cover can influence the amount of soil susceptible to high winds.

One study found that in eastern Oregon, precipitation is the dominant factor affecting dust event frequency in the spring whereas vegetation cover is the dominant factor in the summer (Pu and Ginoux, 2017). The same study projected that in the summertime in eastern Oregon, dust event frequency would decrease largely due to a decrease in bareness (or an increase in vegetation cover) (Pu and Ginoux, 2017). There were no clear projected changes in other seasons or locations in Oregon. These projections compare the 2051–2100 average under a higher emissions scenario (RCP 8.5) with the 1861–2005 average.

Another study found that wind erosion in Columbia Plateau agricultural areas is projected to decrease by mid-century under a lower emissions scenario (RCP 4.5) largely due to increases in biomass production, which retain the soil (Sharratt *et al.*, 2015). The increase in vegetation cover in both studies is likely due to the fertilization effect of increased amounts of carbon dioxide in the atmosphere and warmer temperatures. Tillage practices may also influence the amount of soil available to winds. Therefore, no descriptions of future changing conditions are included in this report.

Key Messages:

⇒ Limited research suggests that the risk of dust storms in summer would decrease in eastern Oregon under climate change in areas that experience an increase in vegetation cover from the carbon dioxide fertilization effect.

Increased Invasive Species Risk

Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

Warming and more frequent drought will likely lead to a greater susceptibility among trees to insects and pathogens, a greater risk of exotic species establishment, more frequent and severe forest insect outbreaks (Halofsky and Peterson, 2016), and increased damage by a number of forest pathogens (Vose *et al.*, 2016). In Oregon and Washington, mountain pine beetle (*Dendroctonus ponderosae*) and western spruce budworm (*Choristoneura freemani*) are the most common native forest insect pests, and both have caused substantial tree mortality and defoliation over the past several decades (Meigs *et al.*, 2015).[15]

Climatic warming has facilitated the expansion and survival of mountain pine beetles, particularly in areas that have historically been too cold for the insect (Littell *et al.*, 2013). Across the western United States, the time between generations among different populations of mountain pine beetles is similar; however, the amount of thermal units required to complete a generation cycle was significantly less for beetles at cooler sites (Bentz *et al.*, 2014). Winter survival and faster generation cycles could be favored under future projections of decreases in the number of freeze days (Rawlins *et al.*, 2016).[16]

Western spruce budworm is a destructive defoliator that sporadically breaks out in interior Oregon Douglas-fir (*Pseudotsuga menziesii*) forests (Flower *et al.*, 2014). An analysis of three hundred years of tree ring data reveals that outbreaks tended to occur near the end of a drought, when trees' physiological thresholds had likely been reached. This analysis suggests that such outbreaks would likely intensify under the more frequent drought conditions that are projected for the future (Flower *et al.*, 2014), unless increasing atmospheric carbon dioxide, which may enhance water use efficiency, mitigates drought stress.[17]

More frequent rangeland droughts could facilitate invasion of non-native weeds as native vegetation succumbs to drought or wildfire cycles, leaving bare ground (Vose *et al.*, 2016). Cheatgrass (*Bromus tectorum L.*), a lower nutritional quality forage grass, facilitates more frequent fires, which reduces the capacity of shrub steppe ecosystem to provide livestock forage and critical wildlife habitat (Boyte *et al.*, 2016). Cheatgrass is a highly invasive species in the rangelands in the West that is projected to expand northward (Creighton *et al.*, 2015) and remain stable or increase in cover in most parts of the Great Basin (Boyte *et al.*, 2016) under climate change.[18]

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[15] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 49

[16] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 49

[17] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 49–50

[18] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 70

Crop pests and pathogens may continue to migrate poleward under global warming as has been observed globally for several types since the 1960s (Bebber *et al.*, 2013). Much remains to be learned about which pests and pathogens are most likely to affect certain crops as the climate changes, and about which management strategies will be most effective.[19]

Key Messages:

⇒ Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

[19] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 67

Loss of Wetland Ecosystems

Wetlands play key roles in major ecological processes and provide a number of essential ecosystem services: flood reduction, groundwater recharge, pollution control, recreational opportunities, and fish and wildlife habitat, including for endangered species.[20] Climate change stands to affect freshwater wetlands Oregon through changes in the duration, frequency, and seasonality of precipitation and runoff; decreased groundwater recharge; and higher rates of evapotranspiration (Raymondi *et al.*, 2013).

Reduced snowpack and altered runoff timing may contribute to the drying of many ponds and wetland habitats across the Northwest.[21] The absence of water or declining water levels in permanent or ephemeral wetlands would affect resident and migratory birds, amphibians, and other animals that rely on the wetlands (Dello and Mote, 2010). However, potential future increases in winter precipitation may lead to the expansion of some wetland systems, such as wetland prairies.[22]

In Oregon's western Great Basin, changes in climate would alter the water chemistry of fresh and saline wetlands affecting the migratory water birds that depend on them. Hotter summer temperatures would cause freshwater sites to become more saline making them less useful to raise young birds that haven't yet developed the ability to process salt. At the same time, increased precipitation would cause saline sites to become fresher thereby decreasing the abundance of invertebrate food supply for adult water birds (Dello and Mote, 2010).

Key Messages:

⇒ Freshwater wetland ecosystems are sensitive to warming temperatures and altered hydrological patterns, such as changes in precipitation seasonality and reduction of snowpack.

[20] Verbatim from the Oregon Climate Change Adaptation Framework, p. 62

[21] Verbatim from the Climate Change in the Northwest (Dalton *et al.*, 2013), p. 53

[22] Verbatim from the Climate Change in the Northwest (Dalton *et al.*, 2013), p. 53

Appendix

Future Climate Projections Background

Read more about emissions scenarios, global climate models, and uncertainty in the Climate Science Special Report, Volume 1 of the Fourth National Climate Assessment (https://science2017.globalchange.gov).

Emissions Scenarios: https://science2017.globalchange.gov/chapter/4#section-2

Global Climate Models & Downscaling:
https://science2017.globalchange.gov/chapter/4#section-3

Uncertainty: https://science2017.globalchange.gov/chapter/4#section-4

Climate & Hydrological Data

Statistically downscaled GCM output from the Fifth phase of the Coupled Model Intercomparison Project (CMIP5) served as the basis for future projections of temperature, precipitation, and hydrology variables. The coarse resolution of GCMs output (100–300 km) was downscaled to a resolution of about 6 km using the Multivariate Adaptive Constructed Analogs (MACA) method, which has demonstrated skill in complex topographic terrain (Abatzoglou and Brown, 2012). The MACA approach utilizes a gridded training observation dataset to accomplish the downscaling by applying bias-corrections and spatial pattern matching of observed large-scale to small-scale statistical relationships. (For a detailed description of the MACA method see: https://climate.northwestknowledge.net/MACA/MACAmethod.php.)

This downscaled gridded meteorological data (i.e., MACA data) is used as the climate inputs to an integrated climate-hydrology-vegetation modeling project called Integrated Scenarios of the Future Northwest Environment (https://climate.northwestknowledge.net/IntegratedScenarios/). Snow dynamics were simulated using the Variable Infiltration Capacity hydrological model (VIC version 4.1.2.l; (Liang *et al.*, 1994) and updates) run on a 1/16th x 1/16th (6 km) grid.
Simulations of historical and future climate for the variables maximum temperature (*tasmax*), minimum temperature (*tasmin*), and precipitation (*pr*) are available at the daily time step from 1950 to 2099 for 20 GCMs and 2 RCPs (i.e., RCP4.5 and RCP8.5). Hydrological simulations of snow water equivalent (*SWE*) are only available for the 10 GCMs used as input to VIC. Table 11 lists all 20 CMIP5 GCMs and indicates the subset of 10 used for hydrological simulations. Data for all the models available was obtained for each variable from the Integrated Scenarios data archives in order to get the best uncertainty estimates.

Table 11 The 20 CMIP5 GCMs used in this project. The subset of 10 CMIP5 GCMs used in the Integrated Scenarios: Hydrology dataset are noted with asterisks.

Model Name	Modeling Center
BCC-CSM1-1 BCC-CSM1-1-M*	Beijing Climate Center, China Meteorological Administration
BNU-ESM	College of Global Change and Earth System Science, Beijing Normal University, China
CanESM2*	Canadian Centre for Climate Modeling and Analysis
CCSM4*	National Center for Atmospheric Research, USA
CNRM-CM5*	National Centre of Meteorological Research, France
CSIRO-Mk3-6-0*	Commonwealth Scientific and Industrial Research Organization/Queensland Climate Change Centre of Excellence, Australia
GFDL-ESM2G GFDL-ESM2M	NOAA Geophysical Fluid Dynamics Laboratory, USA
HadGEM2-CC* HadGEM2-ES*	Met Office Hadley Center, UK
INMCM4	Institute for Numerical Mathematics, Russia
IPSL-CM5A-LR IPSL-CM5A-MR* IPSL-CM5B-LR	Institut Pierre Simon Laplace, France
MIROC5* MIROC-ESM MIROC-ESM-CHEM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MRI-CGCM3	Meteorological Research Institute, Japan
NorESM1-M*	Norwegian Climate Center, Norway

All simulated climate data and the streamflow data have been bias-corrected using quantile-mapping techniques. Only SWE is presented without bias correction. Quantile mapping adjusts simulated values by creating a one-to-one mapping between the cumulative probability distribution of simulated values and the cumulative probability distribution of observed values. In practice, both the simulated and observed values of a variable (e.g., daily streamflow) over the some historical time period are separately sorted and ranked and the values are assigned their respective probabilities of exceedence. The bias corrected value of a given simulated value is assigned the observed value that has the same probability of exceedence as the simulated value. The historical bias in the simulations is assumed to stay constant into the future; therefore the same mapping relationship developed from the historical period was applied to the future scenarios. For MACA, a separate quantile mapping relationship was made for each non-overlapping 15-day window in the calendar year. For streamflow, a separate quantile mapping relationship was made for each calendar month.

Hydrology was simulated using the Variable Infiltration Capacity hydrological model (VIC; Liang et al. 1994) run on a $1/16^{th}$ x $1/16^{th}$ (6 km) grid. To generate daily streamflow estimates, runoff from VIC grid cells was then routed to selected locations along the stream network using a daily-time-step routing model. Where records of naturalized flow were available, the daily streamflow estimates were then bias-corrected so that their statistical distributions matched those of the naturalized streamflows.

The wildfire danger day metric was computed using the same MACA climate variables to compute the 100-hour fuel moisture content according to the equations in the National Fire Danger Rating System.

Smoke Wave Data

Abstract from Liu et al. (2016):
Wildfire can impose a direct impact on human health under climate change. While the potential impacts of climate change on wildfires and resulting air pollution have been studied, it is not known who will be most affected by the growing threat of wildfires. Identifying communities that will be most affected will inform development of fire management strategies and disaster preparedness programs. We estimate levels of fine particulate matter ($PM_{2.5}$) directly attributable to wildfires in 561 western US counties during fire seasons for the present-day (2004–2009) and future (2046–2051), using a fire prediction model and GEOS-Chem, a 3-D global chemical transport model. Future estimates are obtained under a scenario of moderately increasing greenhouse gases by mid-century. We create a new term “Smoke Wave,” defined as ≥2 consecutive days with high wildfire-specific $PM_{2.5}$, to describe episodes of high air pollution from wildfires. We develop an interactive map to demonstrate the counties likely to suffer from future high wildfire pollution events. For 2004–2009, on days exceeding regulatory $PM_{2.5}$ standards, wildfires contributed an average of 71.3 % of total $PM_{2.5}$. Under future climate change, we estimate that more than 82 million individuals will experience a 57 % and 31 % increase in the frequency and intensity, respectively, of Smoke Waves. Northern California, Western Oregon and the Great Plains are likely to suffer the highest exposure to wildfire smoke in the future. Results point to the potential health impacts of increasing wildfire activity on large numbers of people in a warming climate and the need to establish or modify US wildfire management and evacuation programs in high-risk regions. The study also adds to the growing literature arguing that extreme events in a changing climate could have significant consequences for human health.

Data can be accessed here: https://khanotations.github.io/smoke-map/
For the DLCD project, we looked at the variables “Total # of SW days in 6 yrs” and “Average SW Intensity”. The first variable tallies all the days within each time period in which the fine particulate matter exceeded the threshold defined as the 98^{th} quantile of the

distribution of daily wildfire-specific $PM_{2.5}$ values in the modeled present-day years, on average across the study area. The second variable computes the average concentration of fine particulate matter across identified "smoke wave" days within each time period. Liu et al. (2016) used 15 GCMs from the Third Phase of the Coupled Model Intercomparison Project (CMIP3) under a medium emissions scenario (SRES-A1B). The data site only offers the multi-model mean value (not the range), which should be understood as the aggregate direction of projected change rather than the actual number expected.

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Appendix E: Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center. It has been reviewed and accepted by the Federal Emergency Management Agency as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon Military Department – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation*. This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred. Evaluating possible natural hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

What are some Economic Analysis Approaches for Evaluating Mitigation Strategies?

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the three methods is outlined below:

Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by the state Oregon Military Department – Office of Emergency Management (OEM), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e., the net benefits will exceed the net costs) to be eligible for FEMA funding.

Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in Public Sector Mitigation Activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions which involve a diverse set of beneficiaries and non-market benefits.

Investing in Private Sector Mitigation Activities

Private sector mitigation projects may occur on the basis of one or two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies;
2. Dispose of the building or land either by sale or demolition;
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchases. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

STAPLE/E Approach

Considering detailed benefit/cost or cost-effectiveness analysis for every possible mitigation activity could be very time consuming and may not be practical. There are some alternate approaches for conducting a quick evaluation of the proposed mitigation activities which could be used to identify those mitigation activities that merit more detailed assessment. One of those methods is the STAPLE/E approach.

Using STAPLE/E criteria, mitigation activities can be evaluated quickly by steering committees in a synthetic fashion. This set of criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation item in your community. The second chapter in FEMA's How-To Guide "Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies" as well as the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process" outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E approach from the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process."

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical: The city or county public works staff, and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?

- Is it the most useful action in light of other community goals?

Administrative: Elected officials or the city or county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political: Consult the mayor, city council or city board of commissioners, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

Legal: Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

Economic: Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private?)
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

Environmental: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

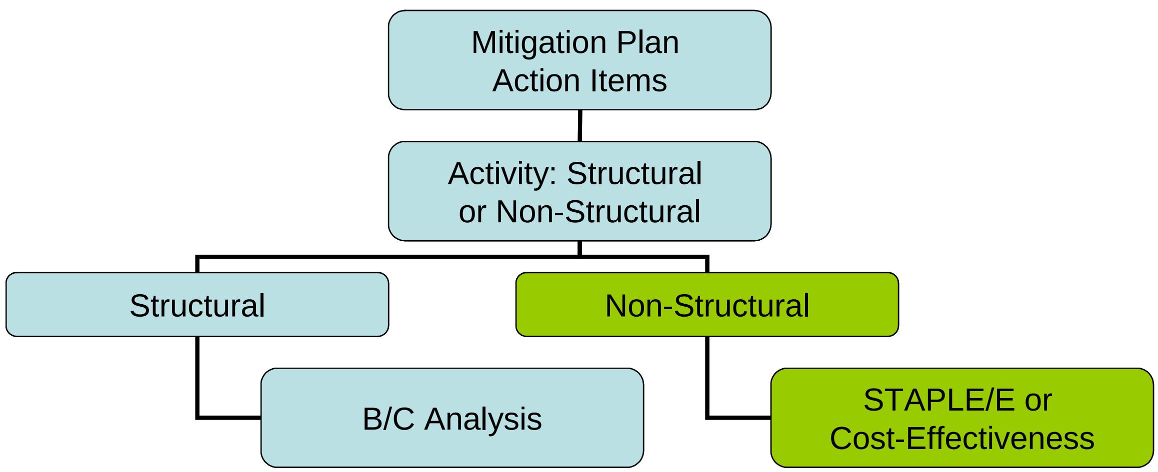
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed benefit/cost analyses.

When to use the various approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

Figure C.1: Economic Analysis Flowchart



Source: Oregon Partnership for Disaster Resilience. 2005.

Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating mitigation activities is outlined below. This framework should be used in further analyzing the feasibility of prioritized mitigation activities.

1. Identify the Activities

Activities for reducing risk from natural hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation projects can assist in minimizing risk to natural hazards, but do so at varying economic costs.

2. Calculate the Costs and Benefits

Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate activities. Potential economic criteria to evaluate alternatives include:

- ***Determine the project cost***. This may include initial project development costs, and repair and operating costs of maintaining projects over time.
- ***Estimate the benefits***. Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.
- ***Consider costs and benefits to society and the environment***. These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- ***Determine the correct discount rate***. Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Activities

Once costs and benefits have been quantified, economic analysis tools can rank the possible mitigation activities. Two methods for determining the best activities given varying costs and benefits include net present value and internal rate of return.

- ***Net present value***. Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today's dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.

- ***Internal rate of return***. Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or land owners as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided
- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor's income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources

CUREe Kajima Project, *Methodologies for Evaluating the Socio-Economic Consequences of Large Earthquakes*, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates, Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation* Projects, Riverine Flood, Version 1.05, Hazard Mitigation Economics, Inc., 1996

Federal Emergency Management Agency, *Report on the Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

Goettel & Horner Inc., *Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in the City of Portland*, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects* Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, Ocbober 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures*, Robert Olsen Associates, Prepared for Oregon Military Department – Office of Emergency Management, July 1999.

Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon State Police – Office of Emergency Management, 2000.)

Risk Management Solutions, Inc., *Development of a Standardized Earthquake Loss Estimation Methodology*, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., *A Benefit/Cost Model for the Seismic Rehabilitation of Buildings*, Volumes 1 & 2, Federal Emergency management Agency, FEMA Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects*, 1993.

VSP Associates, Inc., *Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model*, Volume 1, Federal Emergency Management Agency, FEMA Publication Number 255, 1994.

Appendix F: Grant Programs and Resources

Post-Disaster Federal Programs

Hazard Mitigation Grant Program

- The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
  http://www.fema.gov/hazard-mitigation-grant-program

Physical Disaster Loan Program

- When physical disaster loans are made to homeowners and businesses following disaster declarations by the U.S. Small Business Administration (SBA), up to 20% of the loan amount can go towards specific measures taken to protect against recurring damage in similar future disasters.
  http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans

Pre-Disaster Federal Programs

Pre-Disaster Mitigation Grant Program

- The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.
  http://www.fema.gov/pre-disaster-mitigation-grant-program

Flood Mitigation Assistance Program

- The overall goal of the Flood Mitigation Assistance (FMA) Program is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other National Flood Insurance Program (NFIP) insurable structures. This specifically includes:
  - Reducing the number of repetitively or substantially damaged structures and the associated flood insurance claims;
  - Encouraging long-term, comprehensive hazard mitigation planning;
  - Responding to the needs of communities participating in the NFIP to expand their mitigation activities beyond floodplain development activities; and

- Complementing other federal and state mitigation programs with similar, long-term mitigation goals.
http://www.fema.gov/flood-mitigation-assistance-program

Detailed program and application information for federal post-disaster and pre-disaster programs available at : https://www.fema.gov/library/viewRecord.do?id=4225

For Oregon Military Department – Office of Emergency Management grant guidance on Federal Hazard Mitigation Assistance, visit:
http://www.oregon.gov/OMD/OEM/pages/all_grants.aspx - Hazard_Mitigation_Grants

OEM contact: Amie Bashant, amie.bashant@state.or.us

State Programs

Community Development Block Grant Program

- Promotes viable communities by providing: 1) decent housing; 2) quality living environments; and 3) economic opportunities, especially for low and moderate income persons. Eligible Activities Most Relevant to Hazard Mitigation include: acquisition of property for public purposes; construction/reconstruction of public infrastructure; community planning activities. Under special circumstances, CDBG funds also can be used to meet urgent community development needs arising in the last 18 months which pose immediate threats to health and welfare.
https://www.hudexchange.info/programs/cdbg/

Oregon Watershed Enhancement Board

- While OWEB's primary responsibilities are implementing projects addressing coastal salmon restoration and improving water quality statewide, these projects can sometimes also benefit efforts to reduce flood and landslide hazards. In addition, OWEB conducts watershed workshops for landowners, watershed councils, educators, and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees, and other sources. OWEB awards approximately $20 million in funding annually.
http://www.oregon.gov/OWEB/Pages/index.aspx

Federal Mitigation Programs, Activities & Initiatives

Basic & Applied Research/Development

- National Earthquake Hazard Reduction Program (NEHRP), National Science Foundation. Through broad based participation, the NEHRP attempts to mitigate the effects of earthquakes. Member agencies in NEHRP are the US Geological Survey (USGS), the National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute for Standards and Technology (NIST). The agencies focus on research and development in areas such as the science of earthquakes, earthquake performance of buildings and other structures, societal impacts, and emergency response and recovery.
http://www.nehrp.gov/

- Decision, Risk, and Management Science Program, National Science Foundation. Supports scientific research directed at increasing the understanding and effectiveness of decision making by individuals, groups, organizations, and society. Disciplinary and interdisciplinary research, doctoral dissertation research, and workshops are funded in the areas of judgment and decision making; decision analysis and decision aids; risk analysis, perception, and communication; societal and public policy decision making; management science and organizational design. The program also supports small grants for exploratory research of a time-critical or high-risk, potentially transformative nature. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423

Hazard ID and Mapping

- National Flood Insurance Program: Flood Mapping; FEMA. Flood insurance rate maps and flood plain management maps for all NFIP communities. http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping
- National Digital Orthophoto Program, DOI – USGS. Develops topographic quadrangles for use in mapping of flood and other hazards. http://www.ndop.gov/
- Mapping Standards Support, DOI-USGS. Expertise in mapping and digital data standards to support the National Flood Insurance Program. http://ncgmp.usgs.gov/standards.html
- Soil Survey, USDA-NRCS. Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes. http://soils.usda.gov/survey/printed_surveys/

Project Support

- Coastal Zone Management Program, NOAA. Provides grants for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration https://coast.noaa.gov/czm/
- Community Development Block Grant Entitlement Communities Program, HUD. Provides grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate- income persons. https://www.hudexchange.info/programs/cdbg-entitlement/
- National Fire Plan (DOI – USDA) Provides technical, financial, and resource guidance and support for wildland fire management across the United States. Addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability. http://www.forestsandrangelands.gov/
- Assistance to Firefighters Grant Program, FEMA. Grants are awarded to fire departments to enhance their ability to protect the public and fire service personnel from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER). http://www.fema.gov/welcome-assistance-firefighters-grant-program
- Emergency Watershed Protection Program, USDA-NRCS. Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp

- Rural Development Assistance – Utilities, USDA. Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs. https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service
- Rural Development Assistance – Housing, USDA. Grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary. https://www.usda.gov/topics/rural/housing-assistance
- Public Assistance Grant Program, FEMA. The objective of the Federal Emergency Management Agency's (FEMA) Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President. http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit
- National Flood Insurance Program, FEMA. Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements. http://www.fema.gov/national-flood-insurance-program
- HOME Investments Partnerships Program, HUD. Grants to states, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons. https://www.hud.gov/hudprograms/home-program
- Disaster Recovery Initiative, HUD. Grants to fund gaps in available recovery assistance after disasters (including mitigation). https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs/dri
- Emergency Management Performance Grants, FEMA. Helps state and local governments to sustain and enhance their all-hazards emergency management programs and to fund some hazard mitigation work. https://www.fema.gov/emergency-management-performance-grant-program
- Partners for Fish and Wildlife, DOI – FWS. Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats. http://www.fws.gov/partners/
- North American Wetland Conservation Fund, DOI-FWS. Cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats. https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php
- Federal Land Transfer / Federal Land to Parks Program, DOI-NPS. Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space. http://www.nps.gov/ncrc/programs/flp/index.htm
- Wetlands Reserve program, USDA-NCRS. Financial and technical assistance to protect and restore wetlands through easements and restoration agreements. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=STELPRDB1049327
- Secure Rural Schools and Community Self-Determination Act of 2000, US Forest Service. Reauthorized for FY2012, it was originally enacted in 2000 to provide five years of

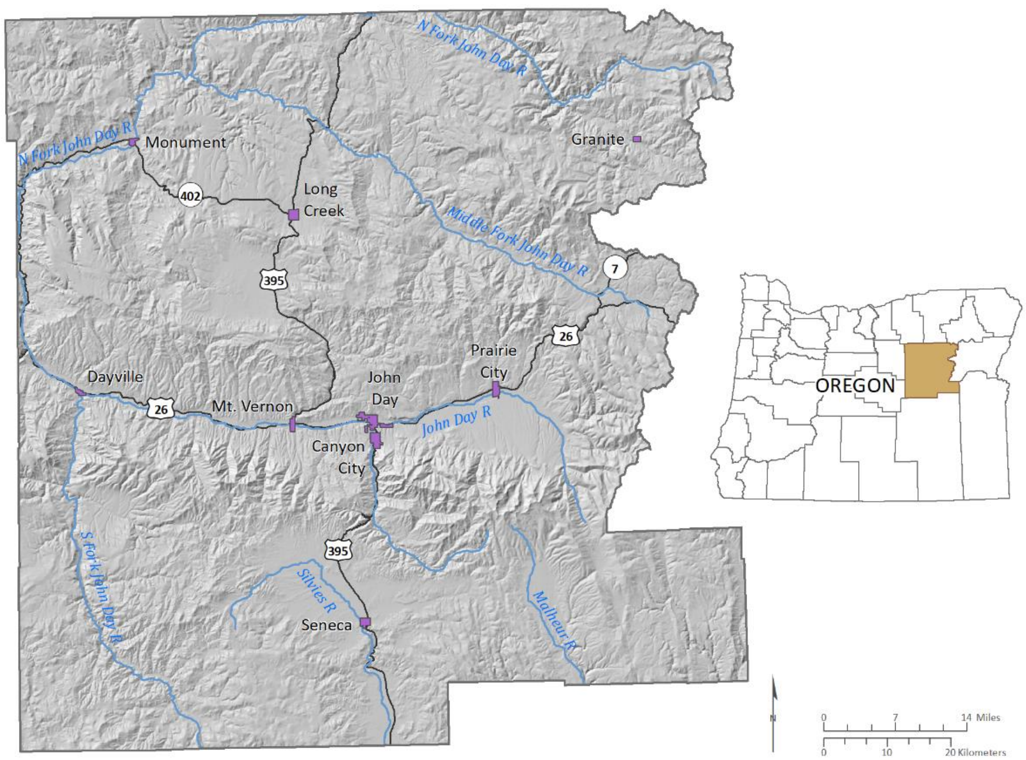
transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. Funds have been used for improvements to public schools, roads, and stewardship projects. Money is also available for maintaining infrastructure, improving the health of watersheds and ecosystems, protecting communities, and strengthening local economies. http://www.fs.usda.gov/pts/

Appendix G:
Natural Hazard Risk Report for Grant County, Oregon

State of Oregon
Oregon Department of Geology and Mineral Industries
Brad Avy, State Geologist

NATURAL HAZARD RISK REPORT FOR GRANT COUNTY, OREGON: FINAL REPORT TO THE OREGON DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT

INCLUDING THE CITIES OF CANYON CITY, DAYVILLE, GRANITE, JOHN DAY, LONG CREEK, MONUMENT, MOUNT VERNON, PRAIRIE CITY, AND SENECA



by Matt C. Williams, Lowell H. Anthony, and Fletcher O'Brien

DRAFT

2019

DISCLAIMER

This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication.

Cover image: Study area of the Grant County Risk Report. Map depicts Grant County, Oregon and incorporated communities included in this report.

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Oregon Department of Geology and Mineral Industries DRAFT

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http://oregon.gov/DOGAMI/

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EXECUTIVE SUMMARY

This report describes the methods and results of the natural hazard risk assessments performed in 2019 by the Oregon Department of Geology and Mineral Industries (DOGAMI) for the communities of Grant County. The purpose of this project is to provide communities within Grant County a detailed risk assessment of the natural hazards that affect them to enable them to compare hazards and act to reduce their risk. The risk assessments contained in this project quantify the impacts of natural hazards to these communities and enhance the decision-making process in planning for disaster.

The primary findings and conclusions of this project are:

1. **Hazus-MH earthquake analysis show a moderate amount of damage and losses for the study area**—The results indicate that Grant County would incur a moderate amount of damage (3.6%) from an earthquake similar to the one simulated in this report. Areas of landslide and liquefaction have some influence on the damage results. This is evidenced by low loss estimates throughout the county, but with higher loss estimates occurring in areas with high or very high landslide or liquefaction susceptibility. Dayville, which is exposed to very high landslide hazard, could see 4.7% in losses in the 2500-year probabilistic earthquake scenario.
2. **Flooding is a recurrent problem for some communities in Grant County**—Most of the development in Grant County is located within or adjacent to the floodplain of the John Day River and its tributaries. Many buildings in the study area, primarily within this floodplain, are vulnerable to flooding. We estimate a moderate amount of damage from flooding overall due mainly to the flooding along the John Day River and Canyon Creek. For only the buildings within the area of 100-year inundation, an average of 9% loss was calculated. During a 100-year flood event, most of the communities of Grant County are expected to sustain losses under 1% of total building value. The City of Canyon City and John Day being the exception to this with approximately 2% of estimated loss to total building value.
3. **Elevating structures in the flood zone reduces vulnerability**—Flood exposure analysis was used in addition to Hazus-MH loss estimation to identify buildings that were not damaged but were within the area expected to experience a 100-year flood. By using both analyses in this way, the number of elevated structures within the flood zone could be quantified. This showed possible mitigation needs in flood loss prevention and the effectiveness of past activities. John Day, Mount Vernon, and Prairie City were identified as communities with a large number of buildings in the floodplain elevated above the estimated flood height.
4. **New landslide mapping would increase the accuracy of future risk assessments**—Exposure analysis was used to assess the threat from landslide hazard. Landslide is a widespread hazard for much of the undeveloped portions of the county. Most of the very high and high landslide risk occurs along the steep portions of the John Day River valley within the Cities of John Day and Dayville. The landslide hazard data used in this risk assessment was created before modern mapping technology and future risk assessments using lidar derived landslide hazard data would provide more accurate results. Earthquake analysis would also benefit from better landslide mapping since Hazus-MH analysis uses landslide probability as an input dataset.
5. **Wildfire is a natural hazard threat for many areas in Grant County**—Exposure analysis shows that buildings throughout the study area are at high risk to wildfire hazard. The communities within the county have a minimum of 30% of exposure to at least moderate wildfire hazard and some communities are at much greater risk. The communities of Granite, Dayville, and Monument

are particularly at risk to high wildfire hazard. Additionally, wildfire risk is high throughout the unincorporated county.

6. **Several of Grant County's critical facilities are at risk to flood hazard**—Critical facilities were identified and were specifically examined within this report. We have estimated that 18% of Grant County's 39 critical facilities at risk to be non-functioning due to a 100-year flood. DOGAMI has also found that 5 critical facilities are exposed to high wildfire hazard. For comparative purposes, almost zero of Grant County's critical facilities are at risk to landslides or earthquake.
7. **Biggest displacement to population was wildfire**—Displacement of permanent residents from natural hazards was quantified within this report. We estimate that of the 7,445 total residents in Grant County 19% of the population or 1,446 residents could be potentially displaced due to wildfire. Landslide hazard is a potential threat to 15% (1,080) of permanent residents, and flood hazard makes 11% (799) vulnerable to displacement.
8. **Community needs can be prioritized**—Each community within Grant County was assessed for natural hazard exposure and loss. This allowed for comparison of risk between communities and impacts from each natural hazard. In using Hazus-MH and exposure analysis, these results can assist in developing plans that address the concerns for those individual communities.

We arrived at these findings and conclusions by completing three main tasks: compiling an asset database, identifying and using best available hazard data, and performing natural hazard risk assessment.

In the first task, we created a comprehensive asset database for the entire study area by synthesizing assessor data, U.S. Census information, Hazus-MH general building stock information, and building footprint data. This work resulted in a single dataset of building points and their associated building characteristics. With these data we were able to conduct highly accurate hazard analysis on a building-by-building basis.

The second task was to identify and use the most current and appropriate hazard datasets for Grant County. Most of the hazard datasets used in this report were created by DOGAMI and some were produced by using high-resolution lidar topographic data. Each hazard dataset for Grant County were the best available at the time of writing.

In the third task, we performed risk assessments using Esri® ArcGIS Desktop® software. We used two risk assessment approaches: (1) estimated loss (in dollars) to buildings from flood and earthquake scenarios using FEMA Hazus®-MH methodology, and (2) calculated number of buildings, their value, and associated populations that are exposed to earthquake and flood inundation scenarios, or susceptible to varying levels of hazard from landslides and wildfire.

Results were broken out for the following geographic areas:

- Unincorporated Grant County
- City of Dayville
- City of John Day
- City of Monument
- City of Prairie City
- City of Canyon City
- City of Granite
- City of Long Creek
- City of Mount Vernon
- City of Seneca

Selected Countywide Results Total buildings: 8,417 Total estimated building value: $2 billion	
2500-year Probabilistic Magnitude 6.7 Earthquake Red-tagged buildings[a]: 76 Yellow-tagged buildings[b]: 328 Loss estimate: $73 million	**Landslide Exposure (High and Very High-Susceptibility)** Number of buildings exposed: 1,035 Exposed building value: $206 million
100-year Flood Scenario Number of buildings damaged: 488 Loss estimate: $20 million	**Wildfire Exposure (High Hazard)** Number of buildings exposed: 2,692 Exposed building value: $588 million

[a]Red-tagged buildings are considered uninhabitable due to complete damage
[b]Yellow-tagged buildings are considered limited habitability due to extensive

1.0 INTRODUCTION

A natural hazard risk assessment analyzes how a hazard could affect the built environment, population, and local economy and identifies potential risk. In natural hazard mitigation planning, risk assessments are the basis for developing mitigation strategies and actions. A risk assessment enhances the decision-making process, so that steps can be taken to prepare for a potential hazard event.

This is the first multi-hazard risk assessment analyzing individual buildings and residents in Grant County and therefore is the most detailed and comprehensive analysis to date of natural hazard risk and provides a comparative perspective never before available. In this report, we describe our assessment results, which quantify the various levels of risk that each hazard presents to Grant County's communities.

Grant County is subject to several significant natural hazards, including: riverine flooding, earthquake, landslides, and wildfire. This region of the state is lightly developed, with most of the development occurring in the county's largest city, John Day. Natural hazards that pose a potential threat to development results in risk. The primary goal of the risk assessment is to inform communities of their vulnerability to and risk from natural hazards and to be a resource for risk reduction actions.

1.1 Purpose

The purpose of this project is to help communities in Grant County better understand their risk and increase resilience to natural hazards that may threaten their community. This is accomplished by providing the best available information about these hazards and by measuring the number of people and buildings at risk. In some cases, the best available information may contain inaccuracies or be incomplete in some respect. This is particularly true for seismic and landslide hazards in Grant County. As a result, the results of this study should be used carefully, and on the assumption that the risks could be significantly greater than what is presented here.

The main objectives of this study are to:

- compile and/or create a database of critical facilities, tax lot data, buildings, and population distribution data,
- incorporate and use existing data from previous geologic, hydrologic, and wildfire hazard studies,
- perform exposure and Hazus–based risk analysis, and
- share this report widely so that all interested parties have access to its information and data.

The body of this report describes the methods and results for these objectives. Two primary methods (Hazus-MH or exposure), depending on the type of hazard, were used to assess risk. We describe the methods for creating the building and population information used in this project. Results for each hazard type are reported on a study area basis within each hazard section, and community based results are reported in detail in **0:**

Community Risk Profiles

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1.2 Study Area

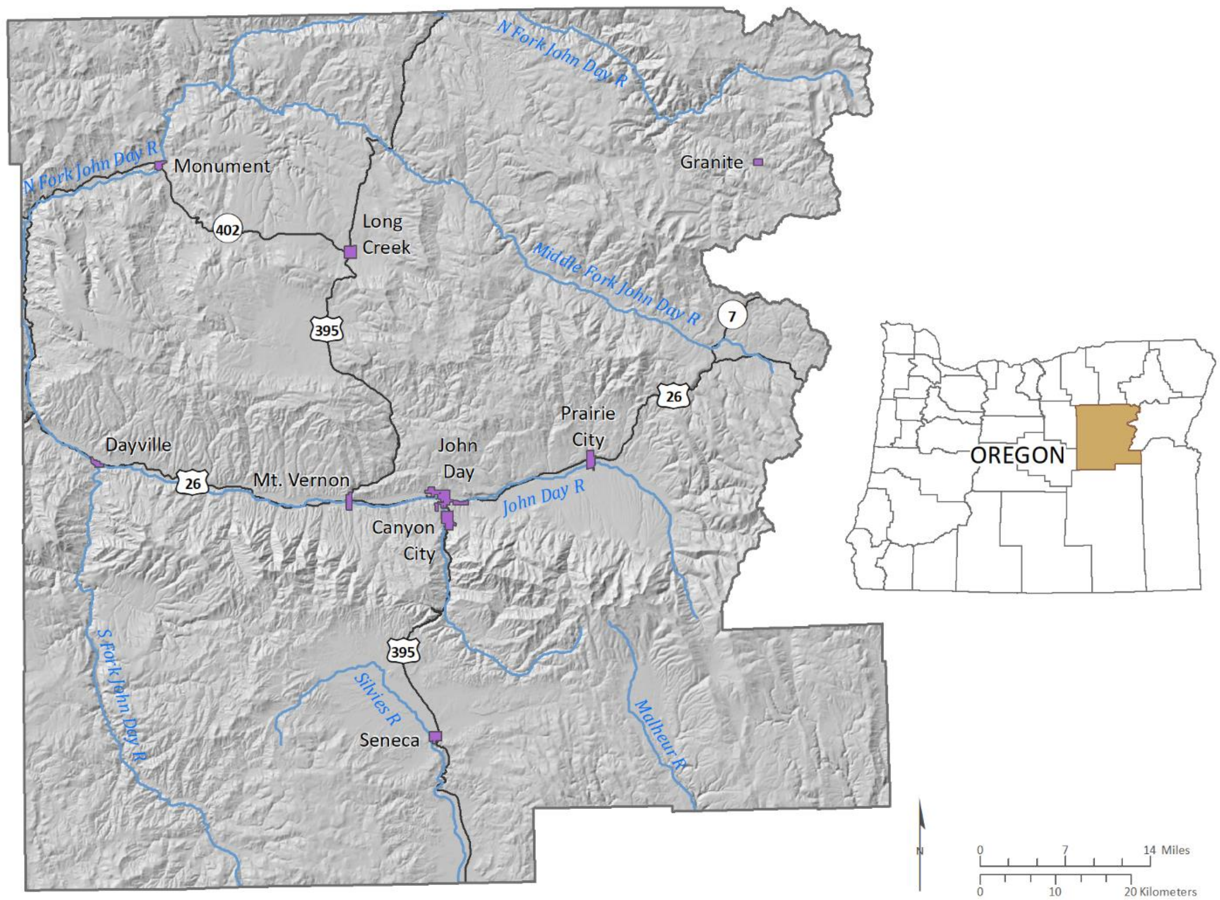
Grant County for this project is the entirety of Grant County, Oregon. Grant County is located in the northeastern portion of the state and is bordered by Morrow, Umatilla, and Union Counties on the north, Baker and Malheur Counties on the east. Harney County on the south and Crook and Wheeler Counties on the east. The total area of Grant County is 4,528 square miles (11,727 square km). A significant portion of the county (70%) is federally or state owned with about 50% being part of the Ochoco or Malheur National Forests.

The geography of Grant County consists of the rugged Blue Mountain range, which is a part of the Columbia River Plateau. Grant County features river canyons and high plateaus, which are interspersed with wide grasslands. The headwaters of the John Day, Malheur, North Fork John Day, and Silvies Rivers all originate within Grant County.

The population of Grant County is 7,445 according to the 2010 U.S. Census (2010a). The county's largest community is the City of John Day and the county seat is the City of Canyon City. Most of the residents in the county reside along the John Day River (Error! Reference source not found.).

No unincorporated communities within Grant County were selected as separate communities from the unincorporated county. DOGAMI considers a community's population size and density to determine if it should be distinct from the overall unincorporated county. We use census block and building count information to make these determinations.

Figure 1-1. Study area: Grant County with communities identified.



1.3 Project Scope

For this risk assessment, we took a quantitative approach and applied it to buildings and population. The decision to limit the project scope to buildings and population was driven by data availability, strengths and limitations of the risk assessment methodology, and funding availability. We did not analyze impacts to the local economy. Depending on the natural hazard, we used one of two methodologies: loss estimation or exposure. Loss estimation was modeled using methodology from Hazus®-MH (Hazards U.S., Multi-Hazard), a tool developed by FEMA for calculating damage to buildings from flood and earthquake. Exposure is a simpler methodology, where buildings are categorized based on their location relative to various hazard zones. To account for impacts on population (permanent residents only), 2010 U.S. census data (U.S. Census Bureau, 2010a) were associated with residential buildings.

A critical component of this risk assessment is a countywide building inventory developed from building footprint data and Grant County tax lot data. The other key component is a suite of datasets that represent the currently best available science for a variety of natural hazards. The geologic hazard scenarios were selected by DOGAMI staff based on their expert knowledge of the datasets; most datasets are DOGAMI publications. In addition to geologic hazards, we included wildfire hazard in this risk assessment. The following is a list of the natural hazards and the risk assessment methodologies that were applied. See **Table 1-1** for data sources.

Earthquake Risk Assessment

- Hazus-MH loss estimation from a 2500-year probabilistic magnitude 6.7 scenario

Flood Risk Assessment

- Hazus-MH loss estimation to four recurrence intervals (10%, 2%, 1%, 0.2% annual chance)
- Exposure to 1% annual chance recurrence interval

Landslide Risk Assessment

- Exposure based on landslide susceptibility (low to very high)

Wildfire Risk Assessment

- Exposure based on fire risk index (low to high)

Table 1-1. Hazard data sources in Grant County.

Hazard	Scenario or Classes	Scale/Level of Detail	Data Source
Earthquake	2500-year probabilistic M6.7	National	USGS (Peterson and others, 2014)
Flood	Depth Grids: 10% (10-yr) 2% (50-yr) 1% (100-yr) 0.2% (500-yr)	Countywide	DOGAMI – derived from FEMA (1987 and 1988) and from pending FEMA (2019a, b, c) data
Landslide*	Susceptibility (Low, Moderate, High, Very High)	Statewide	DOGAMI (Burns and others, 2016)
Wildfire	Risk (Low, Moderate, High)	Regional (Pacific Northwest, US)	ODF (Pyrologix, LCC, 2018)

*Landslide data comprise a composite dataset where the level of detail varies greatly from place to place within the state. Please refer to Section 3.4.1 or the report by Burns and others (2016) for further information.

1.4 Previous Studies

One previous risk assessment has been conducted that included Grant County by DOGAMI. Wang and Clark (1999: DOGAMI Special Paper 29) ran two general level Hazus-MH earthquake analyses, a magnitude 8.5 CSZ earthquake and a 500-year probabilistic earthquake scenario, for the entire state of Oregon. In those analyses Grant County had a very low loss ratio relative to most counties in the state.

We did not compare the results of this project with the results of the previous study since very different methodologies were used.

2.0 METHODS

2.1 HAZUS-MH Loss Estimation

"Hazus provides nationally applicable, standardized methodologies for estimating potential wind, flood, and earthquake losses on a regional basis. Hazus can be used to conduct loss estimation for floods and earthquakes [...]. The multi-hazard Hazus is intended for use by local, state, regional officials, and consultants to assist mitigation planning and emergency response and recovery preparedness" (FEMA, 2012a, p. 1-1).

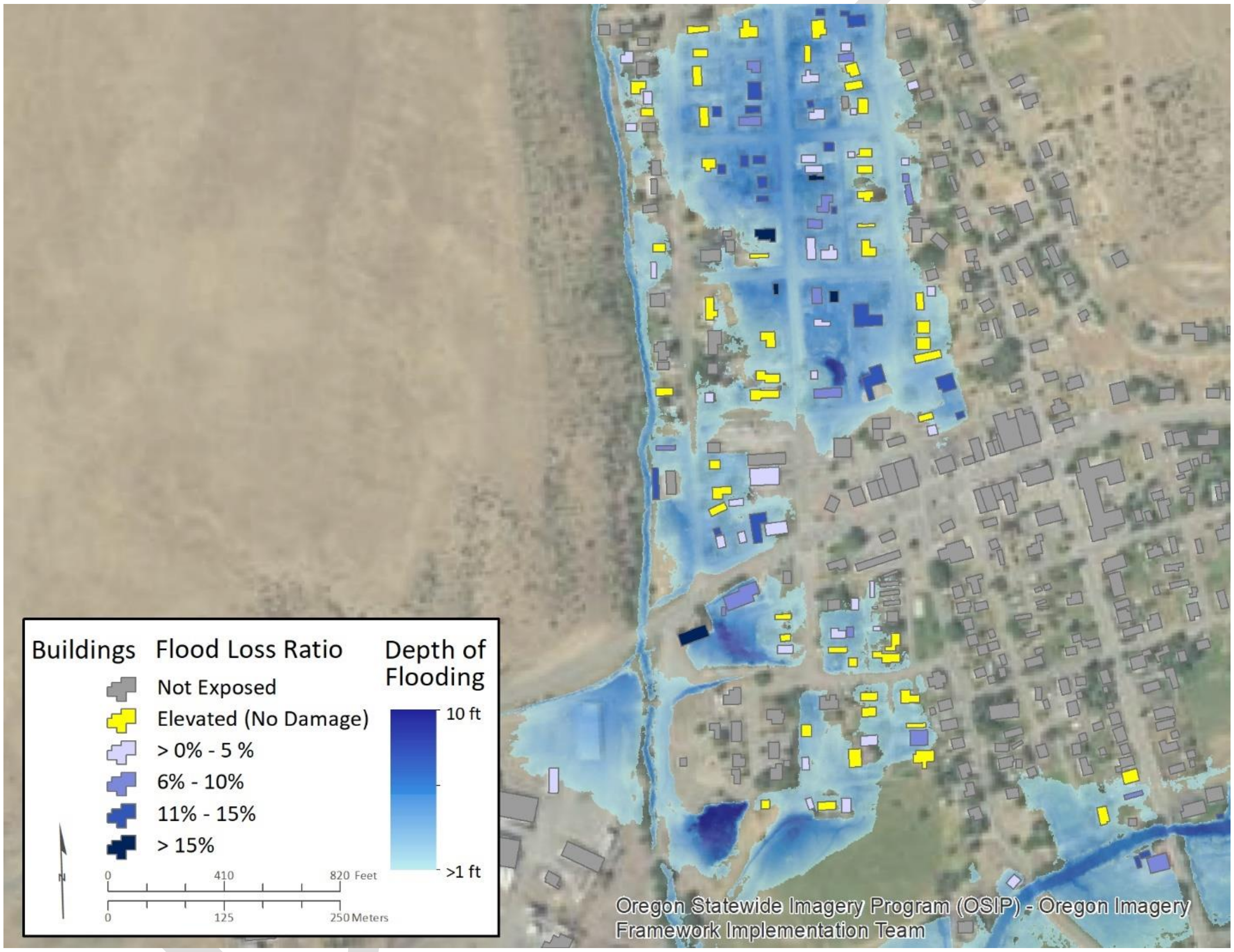
> ***Key Terms:***
> - *Loss estimation:* Damage that occurs to a building in an earthquake or flood scenario, as modeled with Hazus-MH methodology.
> - *Loss ratio:* Percentage of estimated loss relative to the total value.

Hazus-MH can be used in different modes depending on the level of detail required. Given the high spatial precision of the building inventory data and quality of the natural hazard data, DOGAMI chose the user-defined facility (UDF) mode. This mode makes loss estimations for individual buildings relative to their "cost," which DOGAMI then aggregates to the community level to report loss ratios. DOGAMI derives cost from the estimated building replacement cost. Replacement cost is based on a method called RSMeans valuation (The Gordian Group, 2017) and is calculated by multiplying the building square footage by a standard cost per square foot. These standard rates per square foot are in tables within the default Hazus-MH database.

Damage functions are at the core of Hazus-MH. The damage functions stored within the Hazus-MH data model were developed and calibrated from the observed results of past disasters. Estimates of loss are made by intersecting building locations with natural hazard layers and applying damage functions based on the hazard severity and building characteristics. **Figure 2-1** illustrates the range of building loss estimates from Hazus-MH flood analysis.

DOGAMI used Hazus-MH version 3.0 (FEMA, 2015), which was the latest version available when we began this risk assessment.

Figure 2-1. 100-year flood zone and building loss estimates example in the City of Prairie City.



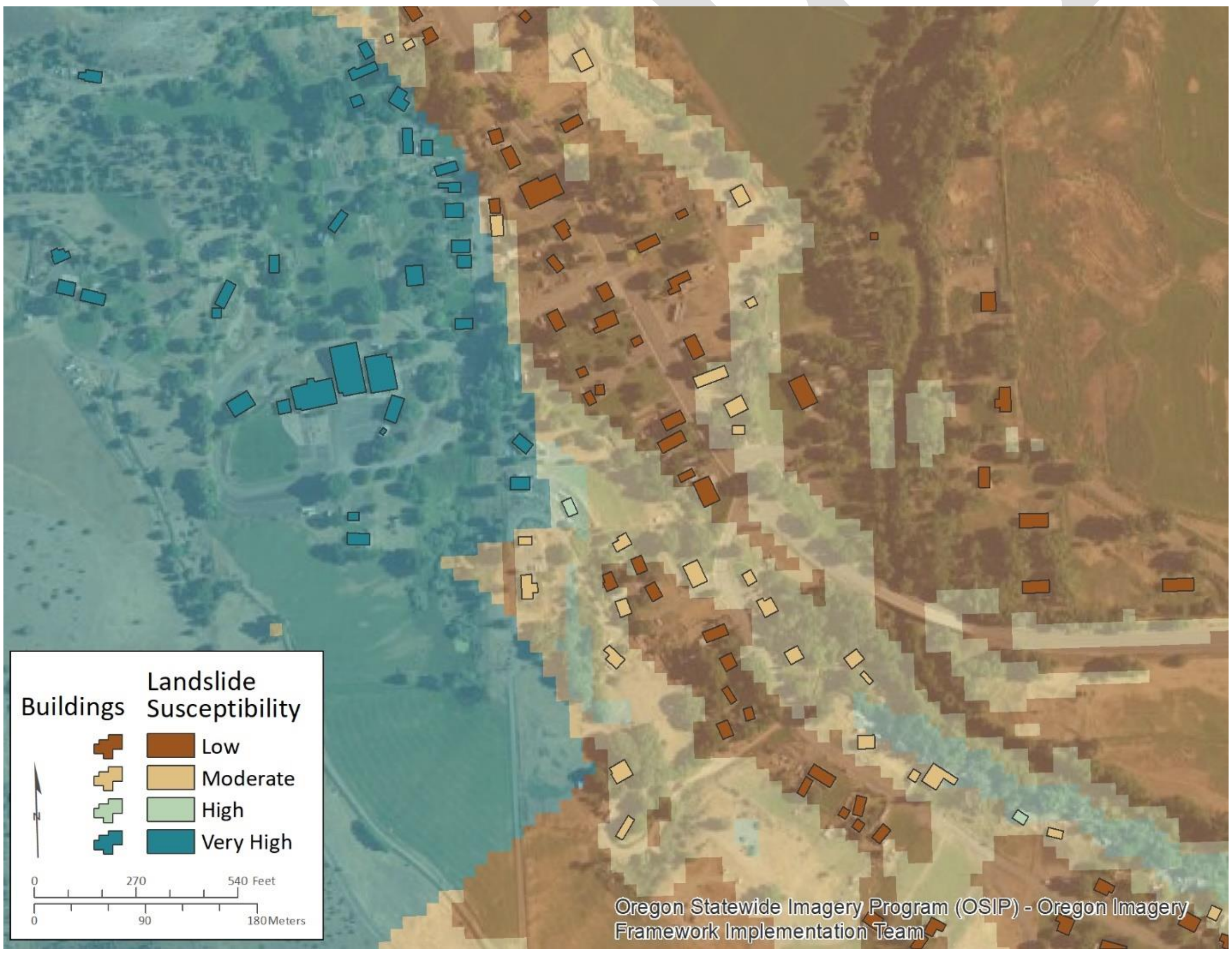
2.2 Exposure

> ***Key Terms:***
> - *Exposure:* Determination of whether a building is within or outside of a hazard zone. No loss estimation is modeled.
> - *Building value:* Total monetary value of a building. This term is used in the context of exposure.

Exposure methodology is calculating the buildings and population that are within a natural hazard zone. This is an alternative for natural hazards that do not have readily available damage functions and, therefore, loss estimation is not possible. It provides a way to easily quantify what is and what is not threatened. Exposure results are communicated in terms of total building value exposed, rather than loss estimate because the loss ratio is unknown. For example, **Figure 2-2** shows buildings that are exposed to different landslide susceptibility areas.

Exposure is used for landslide and wildfire. For comparison with loss estimates, exposure is also used for the 1% annual chance flood.

Figure 2-2. Landslide susceptibility areas and building exposure example in the City of Dayville.



2.3 Building Inventory

A key piece of the risk assessment is the building inventory for the entire study area. This inventory consists of all buildings larger than 400 square feet (37 square meters), as determined from existing building footprints or tax lot data. **Figure 2-3** shows an example of building inventory occupancy types used in the Hazus-MH and exposure analyses in Grant County. See also Appendix F, **Plate 1** and **Plate 2**.

To use the building inventory within the Hazus-MH methodology, building footprints were converted to points and migrated them into a UDF database with standardized field names and attribute domains. The UDF database formatting allows for the correct damage function to be applied to each building. Hazus-MH version 2.1 technical manuals (FEMA, 2012b, c) provide references for acceptable field names, field types, and attributes. The fields and attributes used in the UDF database (including building seismic codes) are discussed in more detail in Appendix **C.2.2**.

Figure 2-3. Building occupancy types in the City of John Day.

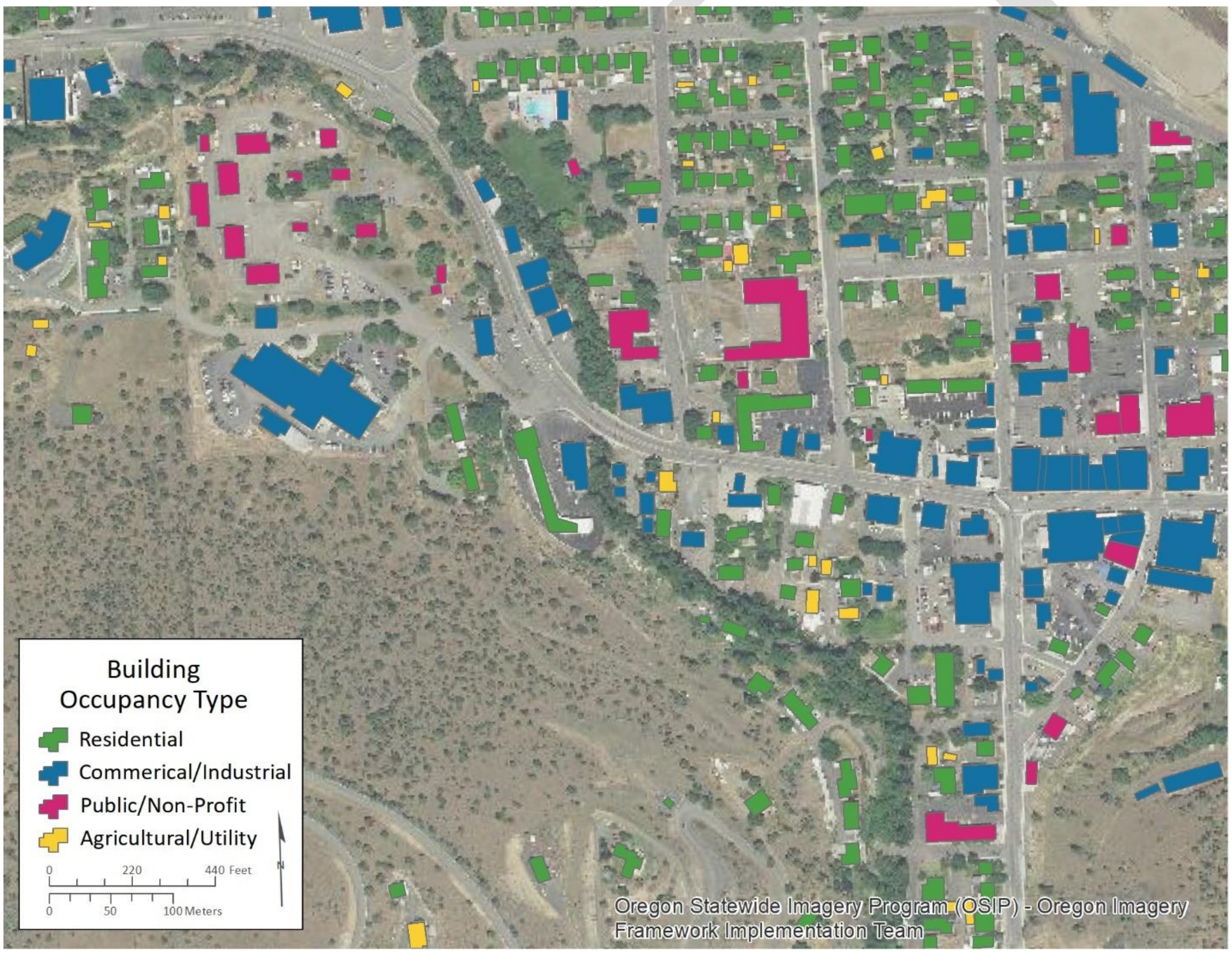


Table 2-1 shows the distribution of building count and value within the UDF database for Grant County. A table detailing the occupancy class distribution by community is included in **Appendix B: Detailed Risk Assessment Tables**.

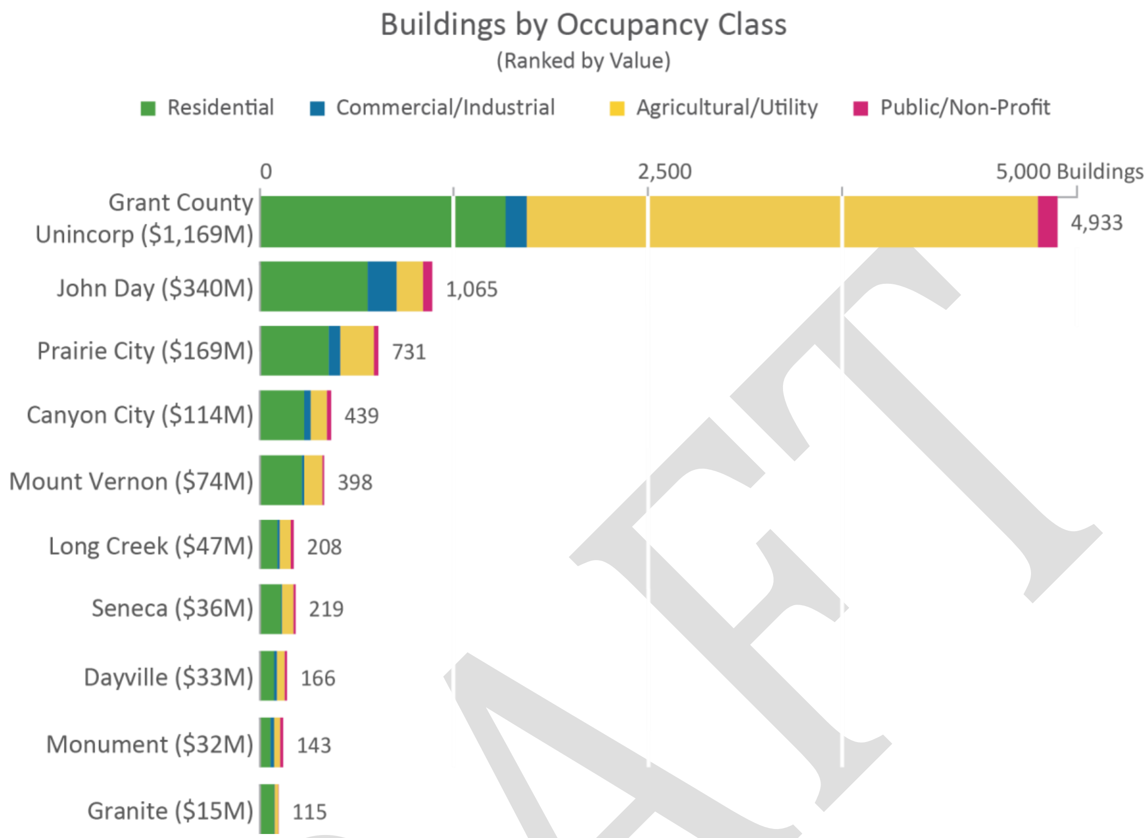
Table 2-1. Study area building inventory.

Community	Total Number of Buildings	Percentage of Total Buildings	Estimated Total Building Value ($)	Percentage of Total Building Value
Unincorporated County	4,933	59%	1,169,279,000	58%
Canyon City	439	5.2%	114,298,000	5.6%
Dayville	166	2.0%	33,364,000	1.6%
Granite	115	1.4%	15,264,000	0.8%
John Day	1,065	13%	339,542,000	17%
Long Creek	208	2.5%	46,914,000	2.3%
Monument	143	1.7%	32,015,000	1.6%
Mount Vernon	398	4.7%	73,681,000	3.6%
Prairie City	731	8.7%	169,267,000	8.3%
Seneca	219	2.6%	35,692,000	1.8%
Total Grant County	8,417	100%	2,029,317,000	100%

The building inventory was developed from several data sources and was refined for use in loss estimation and exposure analyses. A database of building footprints for the entirety of Grant County was already available from an open source database created by Microsoft (Bing Maps, 2018). Building footprints in the database were developed using artificial intelligence and collected from the best available aerial imagery; see (https://github.com/Microsoft/USBuildingFootprints). The building footprints provide a spatial location and 2D representation of a structure.

Grant County supplied tax lot data that we formatted for use in the risk assessment. Tax lot data, which contains property boundaries and other information regarding the property, was obtained from the county assessor and was used to link with the buildings. The linkage between the two datasets resulted in a database of UDF points that contain attributes for each building. These points are used in the risk assessments for both loss estimation and exposure analysis. **Figure 2-4** illustrates the variation of building value and occupancy across the communities of Grant County.

Figure 2-4. Community building value in Grant County by occupancy class.



We attributed critical facilities in the UDF database so that they could be highlighted in the results. Critical facilities data came from the DOGAMI Statewide Seismic Needs Assessment (SSNA; Lewis, 2007). We updated the SSNA data by reviewing Google Maps™ data. The critical facilities we attributed include hospitals, schools, fire stations, police stations, emergency operations, and military facilities. In addition to these standard building types, we considered other building types based on local input or special considerations that are specific to Grant County that would be essential during a natural hazard event, such as public works and water treatment facilities. Critical facilities are important to note because these facilities play a crucial role in emergency response efforts. Communities that have critical facilities that can function during and immediately after a natural disaster are more resilient than those with critical facilities that are inoperable after a disaster. **Table 2-2** shows the critical facilities on a community basis. Critical facilities are listed for each community (see

Community Risk Profiles
).

Table 2-2. Study area critical facilities inventory.

Community	Hospital & Clinic		School		Police/Fire		Emergency Services		Military		Other*		Total	
	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)	Count	Value ($)
(all dollar amounts in thousands)														
Unincorp. County	0	0	0	17,868	0	0	0	0	0	0	2	14,362	2	32,231
Canyon City	0	0	2	15,078	2	4,033	1	585	0	0	2	3,236	7	22,932
Dayville	0	0	1	6,153	1	412	0	0	0	0	0	0	2	6,564
Granite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
John Day	2	17,632	0	0	4	6,352	0	0	0	0	7	14,456	13	38,441
Long Creek	0	0	1	10,620	1	684	1	683	0	0	0	0	3	11,987
Monument	0	0	1	7,850	0	0	1	570	0	0	0	0	2	8,420
Mount Vernon	0	0	0	0	1	413	1	176	0	0	3	1,700	5	2,289
Prairie City	0	0	1	20,132	1	1,996	0	0	0	0	1	154	3	22,282
Seneca	0	0	1	2,671	1	899	0	0	0	0	0	0	2	3,570
Total Grant County	2	17,632	7	80,371	11	14,791	4	2,014	0	0	15	33,908	39	148,716

Note: Facilities with multiple buildings were consolidated into one individual building.

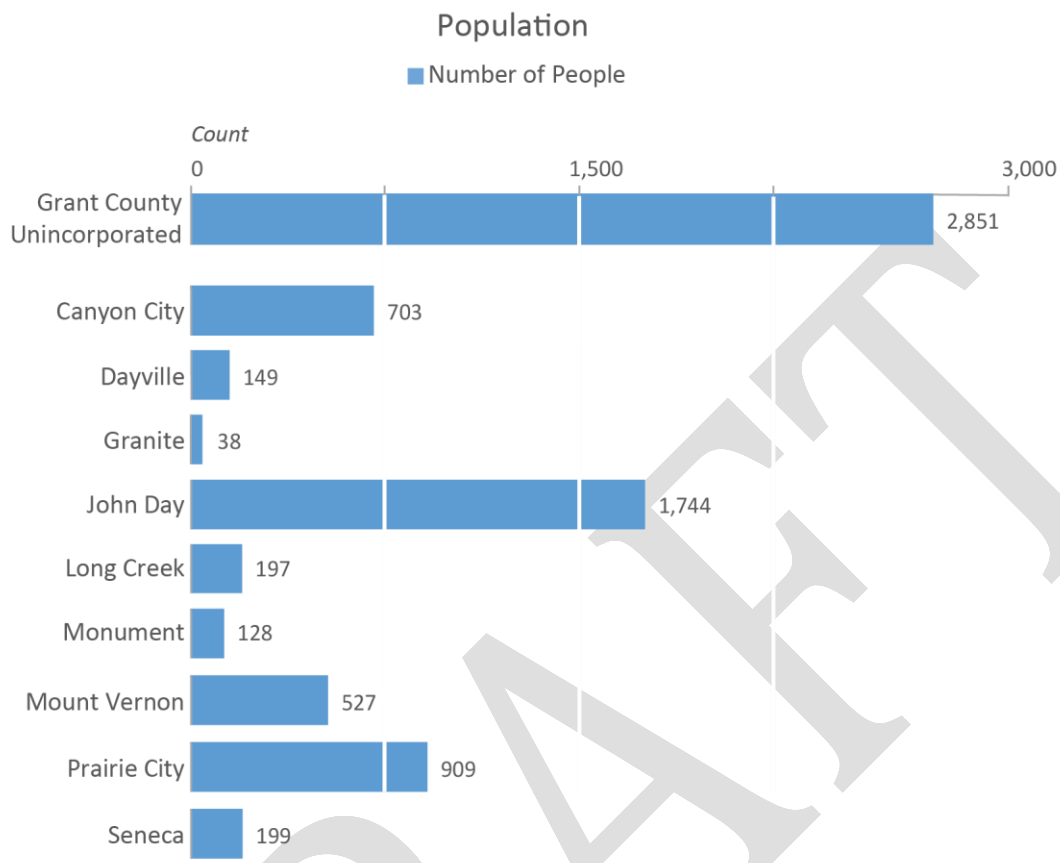
*Category includes buildings that are not traditional (emergency response) critical facilities but considered critical during an emergency based on input from local stakeholders (e.g. water treatment facilities or airports).

2.4 Population

Within the UDF database, the population of permanent residents reported per census block was distributed among residential buildings and pro-rated based on square footage (**Figure 2-5**). We did not examine for this report the impacts from natural hazards to non-permanent populations (e.g., tourists), whose total numbers fluctuate seasonally. Due to lack of information within the tax lot and census databases, the distribution includes vacation homes. From information reported in the 2010 U.S. Census, American FactFinder regarding vacation rentals within the county and Grant County's communities, it is estimated that 12% of residential buildings are vacation rentals (United States Census Bureau, 2010b).

Using this population distribution, DOGAMI estimated the number of permanent residents who could be affected by a natural hazard scenario. For each natural hazard, with the exception of the 2500-year probabilistic 6.7 earthquake scenario, a simple exposure analysis was used to find the number of potentially displaced residents within a hazard zone. For the earthquake scenario the potentially displaced residents were based on residents in buildings estimated to be significantly damaged by the earthquake.

Figure 2-5. Total population by community.



3.0 ASSESSMENT OVERVIEW AND RESULTS

This risk assessment considers four natural hazards (earthquake, flood, landslide, and wildfire) that pose a risk to Grant County. The assessment describes both localized vulnerabilities and the widespread challenges that impact all communities. The loss estimation and exposure results, as well as the rich dataset included with this report, can lead to greater understanding of the potential impact of disasters. Communities can use the results to update plans as part of the work toward becoming more resilient to future disasters.

3.1 Hazards and Study Area Results

In this section, results are presented for Grant County. Grant County includes all unincorporated areas, unincorporated communities, and cities within Grant County. Individual community results are in **0:**

Community Risk Profiles

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3.2 Earthquake

An earthquake is a sudden movement of material on each side of a fault in the earth's crust that abruptly releases strain accumulated over a long period of time. The movement along the fault produces waves of strong shaking that spread in all directions. Oregon is underlain by a large and complex system of faults that can produce damaging earthquakes. Although smaller faults produce smaller earthquakes, they are often close to populated areas, and damage can be extensive to nearby buildings (Madin and Burns, 2013).

Two potential earthquake-induced hazards are liquefaction and landslides. Liquefaction occurs when loose, saturated soils substantially lose bearing capacity due to ground shaking, causing the soil to behave like a liquid; this action can be a source of tremendous damage. If an earthquake causes strong shaking in populated areas, it may result in causalities, economic disruption, and extensive property damage.

3.2.1 Data sources

The earthquake scenario used in this analysis was the 2500-year (2% in 50 years) probabilistic, which is based on a national map of seismic hazard created by the USGS and is used within the Hazus-MH earthquake model (Petersen et al, 2014). Based on results from a few initial Hazus-MH earthquake analyses and available seismic data (historical events, fault locations, etc.) from DOGAMI and USGS, the earthquake scenario used in this report was deemed the most appropriate for communicating earthquake risk for Grant County. It is important to note that there is a large amount of uncertainty in the probabilistic ground shaking maps for Baker County. The historical seismicity and active fault data on which the probabilistic maps are based are known to be very incomplete for Baker County. For example, using lidar topographic data, DOGAMI has identified a significant active fault in the county which is not considered in the probabilistic model and would likely increase the expected shaking.

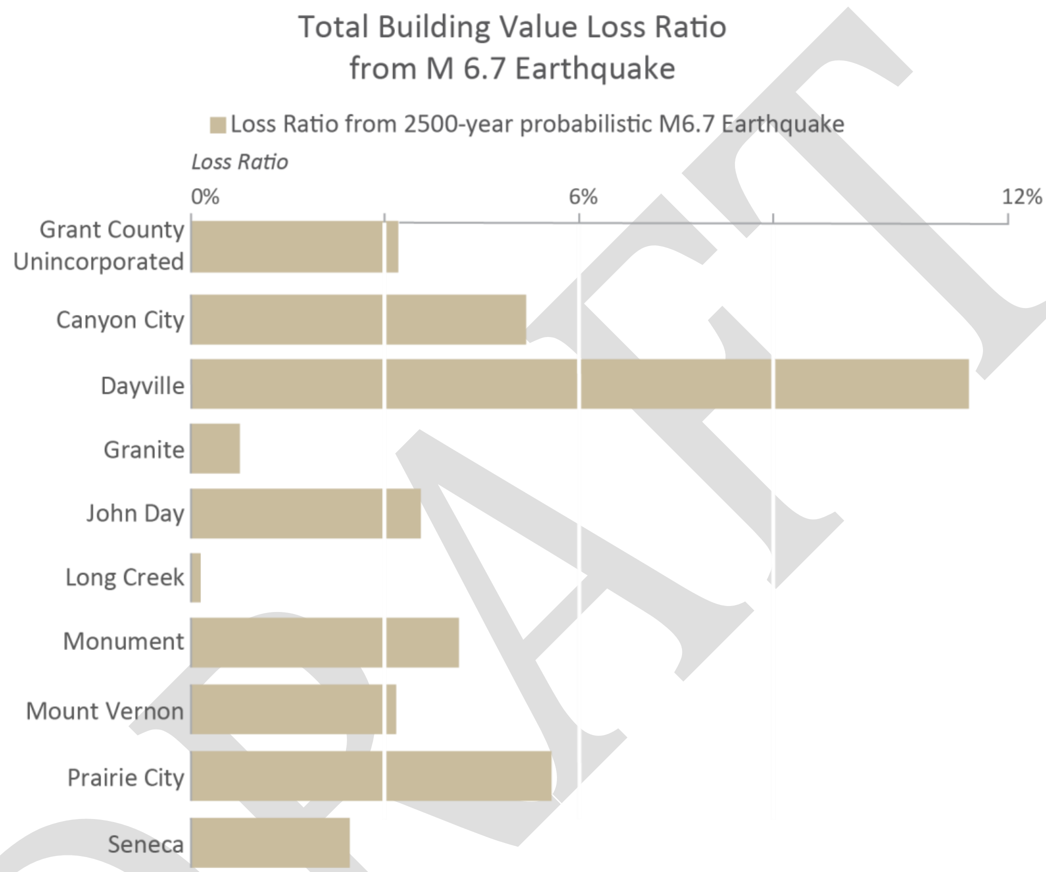
Hazus-MH offers two scenario methods for estimating loss from earthquake, probabilistic and deterministic (FEMA Hazus-MH, 2012b). A probabilistic scenario uses U.S. Geological Survey (USGS) National Seismic Hazard Maps which are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions as a result of all possible earthquake sources (USGS, 2017). A deterministic scenario is based on a specific seismic event, such as a Cascadia Subduction Zone magnitude 9.0 event. We selected the probabilistic scenario method because there is no clearly defined dominant seismic source for the area and it best suited estimating the level of seismic risk. This method was used along with the UDF database so that loss estimates could be calculated on a building-by-building basis.

The USGS 2500-year probabilistic map (Petersen et al, 2014) provides the Hazus-MH earthquake model with ground shaking parameters (peak ground acceleration [PGA], peak ground velocity [PGV], spectral acceleration at 1.0 second period and 0.3 second period [SA10 and SA03]) that have been integrated together. We set the magnitude to 6.7 within Hazus-MH for the scenario used in this report. Additional seismic inputs utilized in the earthquake scenario were liquefaction susceptibility and NEHRP site classification derived from the Oregon Resilience Plan (ORP) (Madin and Burns, 2013) and landslide susceptibility from Burns and others (2016).

3.2.2 Countywide results

Because an earthquake can affect a wide area, it is unlike other hazards in this report—every building in Grant County, to some degree, would be affected by it. Hazus-MH loss estimates (see **Table B-2**) for each building are based on a formula where coefficients are multiplied by each of the five damage state percentages (none, low, moderate, extensive, and complete). These damage states are correlated to loss ratios that are then multiplied by the building dollar value to obtain a loss estimate (FEMA, 2012b). Error! Reference source not found. shows the loss estimates by community for Grant County from a 2500-year probabilistic magnitude 6.7 event.

Figure 3-1. Earthquake loss ratio by community.



In keeping with earthquake damage reporting conventions, we used the ATC-20 post-earthquake building safety evaluation color-tagging system to represent damage states (Applied Technology Council, 2015). Red-tagged buildings correspond to a Hazus-MH damage state of "complete," which means the building is uninhabitable. Yellow-tagged buildings are in the "extensive" damage state, indicating limited habitability. The number of buildings in each damage state is based on an aggregation of probabilities per community and does not represent individual buildings (FEMA, 2012b).

Critical facilities were considered non-functioning if the Hazus-MH earthquake analysis showed that a building or complex of buildings had a greater than 50-percent chance of being at least moderately damaged (FEMA, 2012b).

The number of potentially displaced residents from the scenario earthquake is based on the number of red-tagged and a percentage of yellow-tagged residences that were determined in the Hazus-MH earthquake analysis results.

Grant County 2500-year probabilistic M6.7 earthquake results:

- Number of red-tagged buildings: 76
- Number of yellow-tagged buildings: 328
- Loss estimate: $72,885,000
- Loss ratio: 3.6%
- Non-functioning critical facilities: 7
- Potentially displaced population: 78

The results indicate that Grant County would incur a moderate amount of damage from an earthquake similar to the one simulated in this report. These results were heavily influenced by earthquake-induced landslides and liquefaction. This is evidenced by low loss estimates throughout the county, but with higher loss estimates occurring in areas with high or very high landslide or liquefaction susceptibility.

Risk assessments conducted by DOGAMI typically include analysis of scenarios that show if buildings could be seismically upgraded to moderate or high code, the impact of the earthquake event would be reduced. While these upgrades can decrease earthquake vulnerability, the benefits are minimized in landslide and liquefaction areas, where buildings would need additional geotechnical mitigation to have an effect on losses. This simulation was not done for Grant County because assessor information was limited on the construction date of buildings which informs the design level, a key attribute necessary for this simulation. While this simulation was not done, seismic retrofits can greatly reduce vulnerability to earthquake hazards. Special considerations may be applied to critical facilities with regards to seismic retrofits.

Key Terms:

- *Seismic retrofit:* Structural modification to a building that improves its resilience to earthquake.
- *Design level:* Hazus-MH terminology referring to the quality of a building's seismic building code (i. e. pre, low, moderate, and high).

3.2.3 Areas of vulnerability or risk

We identified locations within Grant County that are comparatively more vulnerable or at greater risk to the 2500-year probabilistic M6.7 earthquake hazard:

- Portions of Dayville that are within very high landslide hazard, show elevated potential of damage from earthquake. The damages calculated in Hazus-MH are primarily from earthquake-induced landslides.
- A high percentage of inhabited areas of Grant County are along the John Day River and Canyon Creek, which generally correspond to liquefiable soils.

Key Terms:

- *Vulnerability:* Characteristics that make people or assets more susceptible to a natural hazard.
- *Risk:* Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of a natural hazard.

3.3 Flooding

In its most basic form, a flood is an accumulation of water over normally dry areas. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Floods are a frequently occurring natural hazard in Grant County and have the potential to create public health hazards, public safety concerns, close and damage major highways, destroy railways, damage structures, and cause major economic disruption. A typical method for determining flood risk is to identify the probability of flooding and the impacts of flooding. The probabilities calculated for flood hazard used in this report are 10%, 2%, 1%, and 0.2%, henceforth referred to by their equivalent return periods as 10-year, 50-year, 100-year, and 500-year, respectively.

The primary river for Grant County is the John Day River. The additional major streams within Grant County are Canyon Creek, Malheur River, Middle Fork John Day River, North Fork John Day River, South Fork John Day River, and Silvies River. All the listed streams are subject to flooding and causing damage to buildings within the floodplain.

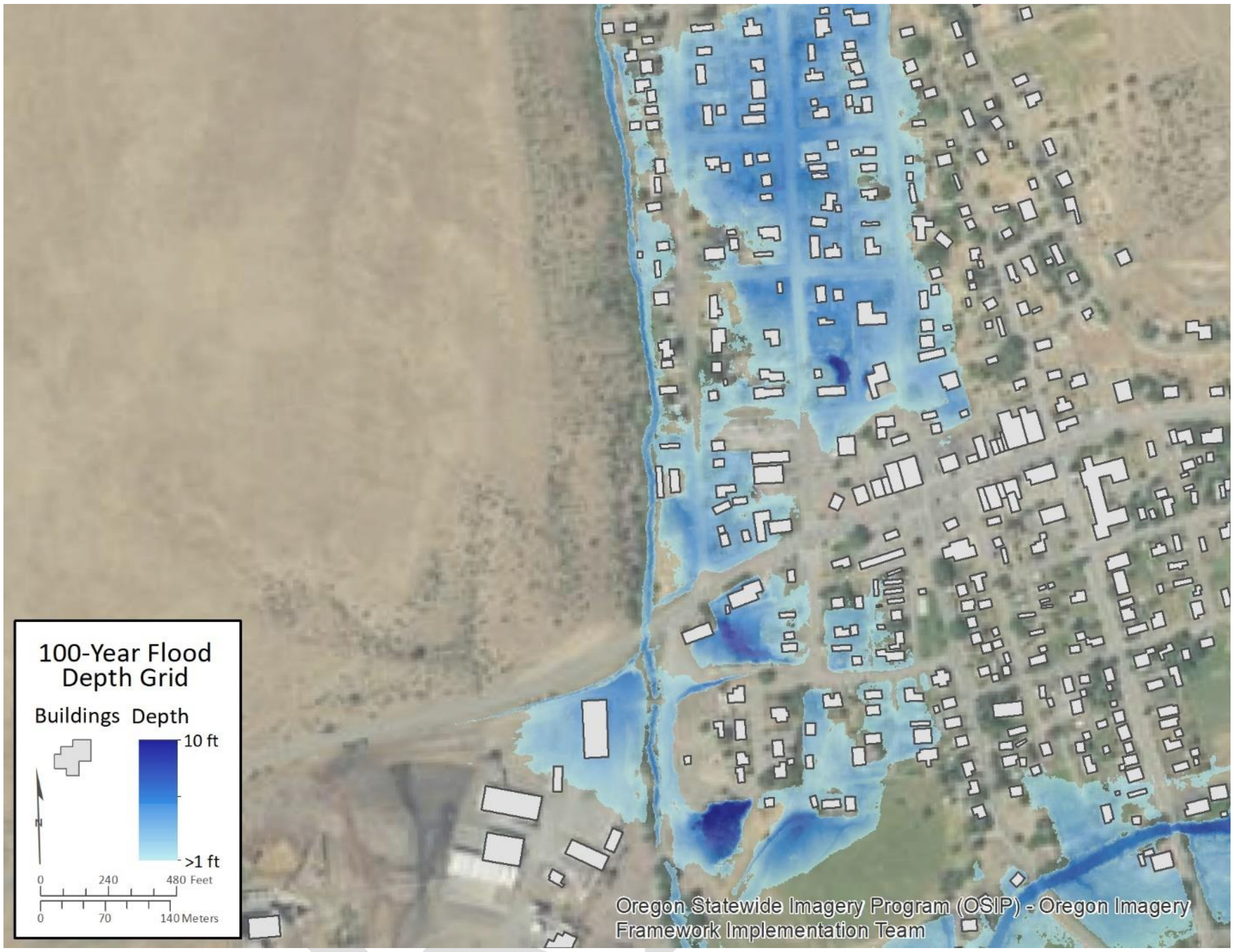
The ability to assess the probability of a flood, and the level of accuracy of that assessment, is influenced by modeling methodology advancements, better knowledge, and longer periods of record for the stream or water body in question. The impacts of flooding are determined by adverse effects to human activities within the area and the natural and built environment. A common mitigating activity is by elevating structures above the expected level of flooding or by removing the structure through FEMA's property acquisition ("buyout") program.

3.3.1 Data sources

The Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) for Grant County were made effective in the 1980's, with some areas updated and, at the time of writing, still pending in 2019 for local adoption (FEMA, 1987; 1988; and 2019a, b, c); these were the primary data sources for the flood risk assessment. Further information regarding NFIP related statistics can be found at FEMA's website: https://www.fema.gov/policy-claim-statistics-flood-insurance. This was the only flood data source that DOGAMI used in the analysis, but flooding does occur in areas outside of the detail mapped areas. Flood issues like flash flooding, ice jams, post-wildfire floods, and dam safety were not looked at in this report.

Depth grids, developed by DOGAMI in 2019 and based on the effective and pending map data, were used in this risk assessment to determine the level to which buildings are impacted by flooding. Depth grids are raster GIS datasets where each digital pixel value represents the depth of flooding at that location within the flood zone **(Figure 3-2)**. Though considered draft at the time of this analysis, the depth grid data are the best available flood hazard data. Depth grids for four flooding scenarios (10-, 50-, 100-, and 500-year) were used for loss estimations and, for comparative purposes, exposure analysis.

Figure 3-2. Flood depth grid example, portion of the City of Prairie City.



Building loss estimates are determined by Hazus-MH by overlaying building data over a depth grid. Hazus-MH uses individual building information, specifically the first floor height above ground and the presence of a basement, to calculate the loss ratio from a particular depth of flood.

For the Grant County, occupancy type attributes were derived from the tax lot database for most buildings. Where individual building information was not available from assessor data, we used oblique imagery and street level imagery to estimate these important building attributes. Only buildings in a flood zone or within 500 feet (152 meters) of a flood zone were examined closely to attribute buildings with more accurate information for first-floor height and basement presence. Because our analysis accounted for building first-floor height, buildings that have been properly elevated above the flood level were not given a loss estimate—but we counted residents in those structures as displaced. We did not look at the duration that residents would be displaced from their homes due to flooding. For information about structures exposed to flooding but not damaged, please see the **Exposure analysis** section below.

3.3.2 Countywide results

Since there are not vast floodplains within Grant County, there are only a few areas where buildings are vulnerable to flooding. However, in areas where flooding does occur it is a recurrent issue. For this risk assessment, we imported Grant County UDF data and depth grids into Hazus-MH and a ran a flood analysis for the four flood scenarios (10-, 50-, 100-, and 500-year). We used the 100-year flood as the primary scenario for reporting the flood results (also see Appendix F. **Plate 5)**. The 100-year flood has traditionally been used as a reference level for flooding and is the standard probability that FEMA uses for regulatory purposes (FEMA, 2013). See **Table B-4** for multi-scenario cumulative results.

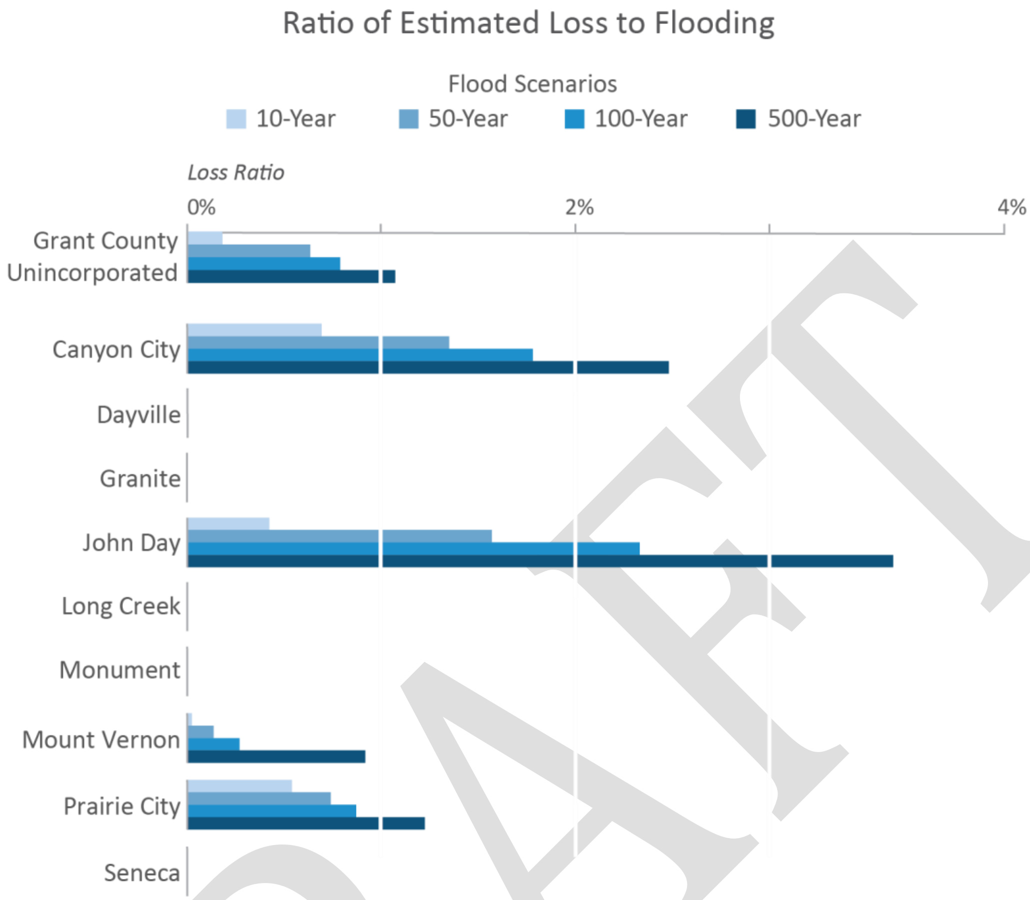
Grant Countywide 100-year flood loss:

- Number of buildings damaged: 488
- Loss Estimate: $20,261,000
- Loss Ratio: 1.0%
- Damaged critical facilities: 7
- Potentially Displaced Population: 799

3.3.3 Hazus-MH analysis

The Hazus-MH loss estimate of the 100-year flood scenario for Grant County is approximately $20 million. While the overall loss ratio for flood damage in Grant County is only 1%, 100-year flooding has a major impact to Grant County where development exists near streams that are prone to flooding. (**Figure 3-3**). In situations with communities where most residents are not within flood designated zones, the loss ratio may not be as helpful as the actual replacement cost and number of residents displaced to assess the level of risk from flooding. The Hazus-MH analysis also provides useful flood data on individual communities so that planners can identify problems and consider which mitigating activities will provide the greatest resilience to flooding.

Figure 3-3. Flood loss estimates by community.



3.3.4 Exposure analysis

Separate from the Hazus-MH flood analysis, we did an exposure analysis by overlaying building locations on the 100-year flood extent. A large number (703 buildings) of Grant County's buildings were found to be within designated flood zones. By comparing the number of non-damaged buildings from Hazus-MH with exposed buildings in the flood zone, we estimated the number of buildings that could be elevated above the level of flooding. Of the 703 buildings that are exposed to flooding, we estimate that 215 are above the height of the 100-year flood. This evaluation can also shed some light on the number of residents that might have mobility or access issues due to surrounding water. See appendix **Table B-5** for community-based results of flood exposure.

3.3.5 Areas of vulnerability or risk

We identified locations within Grant County that are comparatively more vulnerable or at greater risk to flood hazard:

- Flooding along Canyon Creek for many buildings in Canyon City and John Day is a frequent problem.
- Flooding is a persistent problem for buildings along the John Day River within the City of John Day and further downstream west of John Day.
- Several buildings in Prairie City are impacted by flooding from Dixie Creek upstream from the Highway 26 bridge.

3.4 Landslide susceptibility

Landslides are downhill movements of rock, debris, or soil. There are many different types of landslides in Oregon. In Grant County, the most common are debris flow, shallow-, and deep-seated landslides. Landslides can occur in many sizes, at different depths, and with varying rates of movement. Generally, they are large, deep, and slow moving or small, shallow, and rapid. Some factors that influence landslide type are hillside slope, water content, and geology. Many triggers can cause a landslide: intense rainfall, earthquakes, or human-induced factors like excavation along a landslide toe or loading at the top. Landslides can cause severe damage to buildings and infrastructure. Fast-moving landslides may pose life safety risks and can occur throughout Oregon (Burns and others, 2016).

3.4.1 Data sources

The Statewide Landslide Information Layer for Oregon [SLIDO], release 3.2 [Burns and Watzig, 2014]) is an inventory of mapped landslides in the state of Oregon. SLIDO is a compilation of past studies; some studies were completed very recently using new technologies, like lidar-derived topography, and some studies were performed more than 50 years ago. Consequently, SLIDO data vary greatly in scale, scope, and focus and thus in accuracy and resolution across the state. Landslide inventory mapping for Grant County was done before lidar was available for high-accuracy mapping.

Burns and others (2016) used SLIDO inventory data along with maps of generalized geology and slope to create a landslide susceptibility overview map of Oregon that shows zones of relative susceptibility: Very High, High, Moderate, and Low. SLIDO data directly define the Very High landslide susceptibility zone, while SLIDO data coupled with statistical results from generalized geology and slope maps define the other relative susceptibility zones (Burns and others, 2016). Statewide landslide susceptibility map data have the inherent limitations of SLIDO and of the generalized geology and slope maps used to create the map. Therefore, the statewide landslide susceptibility map varies significantly in quality across the state, depending on the quality of the input datasets. Another limitation is that susceptibility mapping does not include some aspects of landslide hazard, such as runout, where the momentum of the landslide can carry debris beyond the zone deemed to be a high hazard area.

We used the data from the statewide landslide susceptibility map (Burns and others, 2016) in this report to identify the general level of susceptibility of given area to landslide hazards, primarily shallow and deep landslides. We overlaid building and critical facilities data on landslide susceptibility zones to assess the exposure for each community (see **Table B-6**). The total dollar value of exposed buildings was summed for Grant County and is reported below. We also estimated the number of people threatened by landslides. Land value losses due to landslides were not examined for this report, in addition to potentially hazardous unmapped areas that may pose real risk to communities.

3.4.2 Countywide results

Many communities in Grant County have some exposure to landslide risk. Communities that developed in terrain with moderate to steep slopes or at the base of steep hillsides may be at risk to landslides. While these areas are highly prone to landslides, a large percentage of the populated areas are not within these zones as they are currently mapped. The percentage of building value exposed to very high and high landslide susceptibility is approximately 10% for the entire study area, but the threat is elevated for buildings in these hazard zones.

We combined high and very high susceptibility zones as the primary scenarios to provide a general sense of community risk for planning purposes (see Appendix F, **Plate 6**). It was useful to combine exposure for both susceptibility zones to accurately depict the level of landslide risk to communities.

These susceptibility zones represent areas most prone to landslides with the highest impact to the community.

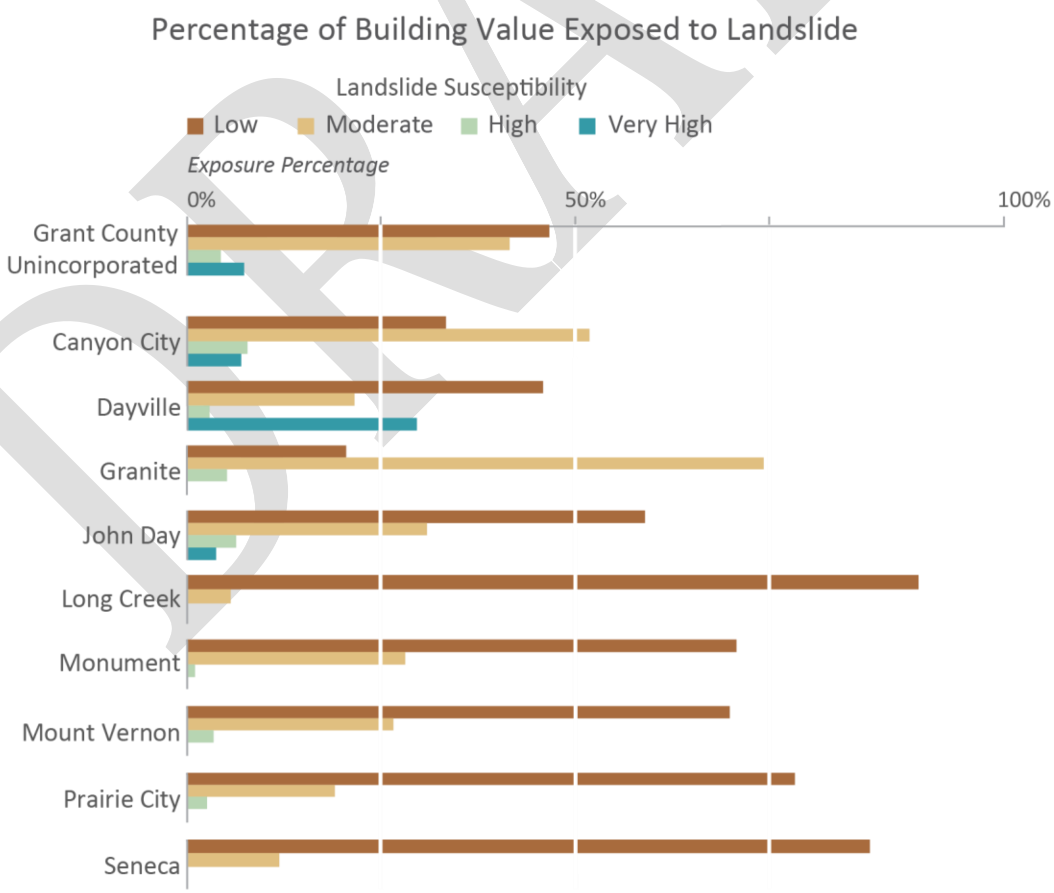
For this risk assessment we compared building locations to geographic extents of the landslide susceptibility zones (**Figure 3-4**). The exposure results shown below are for the high and very high susceptibility zones. See **Appendix B: Detailed Risk Assessment Tables** for multi-scenario analysis results.

Grant Countywide landslide exposure (High and Very High susceptibility):

- Number of buildings: 1,035
- Exposure Value: $205,629,000
- Ratio of Exposure Value: 10%
- Critical facilities exposed: 2
- Potentially Displaced Population: 1,080

The majority of developed land in Grant County corresponds to low and moderate susceptibility landslide zones. Landslide hazard is ubiquitous in a large percentage of undeveloped land and may present challenges for planning and mitigation efforts. Awareness of nearby areas of landslide hazard is beneficial to reducing risk for every community and rural area of Grant County. Lidar based landslide mapping would provide a more accurate picture of the landslide hazard within Grant County.

Figure 3-4. Landslide susceptibility exposure by study area community.



3.4.3 Areas of vulnerability or risk

We identified locations within Grant County that are comparatively more vulnerable or at greater risk to landslide hazard:

- The western portion of the City of Dayville is at greater risk to landslide hazard than other communities in Grant County.
- Buildings in and near the City of John Day are exposed to very high landslide hazard in the steep areas north of the John Day airport.
- A cluster of residential buildings east of the downtown portion of Canyon City are exposed to very high landslide hazard.
- Some communities in Grant County may be at higher or lower risk than what the data show, lidar-based landslide mapping would provide a better understanding of the risk.

3.5 Wildfire

Wildfires are a natural part of the ecosystem in Oregon. However, wildfires can present a substantial hazard to life and property in growing communities, because often development occurs in the wildland-urban interface (WUI). The most common wildfire hazard factors include: hot, dry, and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, its behavior is influenced by numerous conditions, including fuel, topography, weather, drought, and development (Pyrologix, LCC., 2018). Post-wildfire geologic hazards can also present risk. These usually include flood, debris flows, and landslides. Post-wildfire geologic hazards were not evaluated in this project.

There is potential for losses due to WUI fires in Grant County. Fire prone areas cover a large portion of the county and are present in developed areas in the county. The Grant County Community Wildfire Protection Plan (Jerome, 2013), recommends several steps that homeowners can take to reduce their risk to wildfire. Some risk reduction examples are maintaining defensible space around structures, reducing fuels, and using non-flammable materials in construction (Jerome, 2013).

3.5.1 Data sources

The Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results (PNRA; Pyrologix LCC, 2018) is a comprehensive report that includes a database developed by the United States Forest Service (USFS) for the states of Oregon and Washington. The steward of this database in Oregon is the Oregon Department of Forestry (ODF). The database was created to assess the level of risk residents and structures have to wildfire. For this project, the Burn Probability dataset, a dataset included in the PNRA database, was used to measure the risk to communities in Grant County.

Using guidance from ODF, we categorized the Burn Probability dataset into low, moderate, and high-hazard zones for the wildfire exposure analysis. Probability ranges of the Burn Probability dataset from the PNRA were grouped into 3 categories of wildfire hazard. Burn probability is derived from simulations using many elements, such as, weather, ignition frequency, ignition density, and fire modeling landscape (Pyrologix LCC, 2018).

Burn probabilities were grouped into 3 hazard categories:

- Low wildfire hazard (0.0001 – 0.0002 or 1/10,000 – 1/5,000)

- Moderate wildfire hazard (0.0002 – 0.002 or 1/5,000 – 1/500)
- High wildfire hazard (0.002 – 0.04 or 1/500 – 1/25)

We overlaid the buildings layer and critical facilities on each of the wildfire hazard zones to determine exposure. In certain areas no wildfire data is present which indicates areas that have minimal risk to wildfire hazard (see Error! Reference source not found.). The total dollar value of exposed buildings Grant County is reported below. We also estimated the number of people threatened by wildfire. Land value losses due to wildfire were not examined for this project.

3.5.2 Countywide results

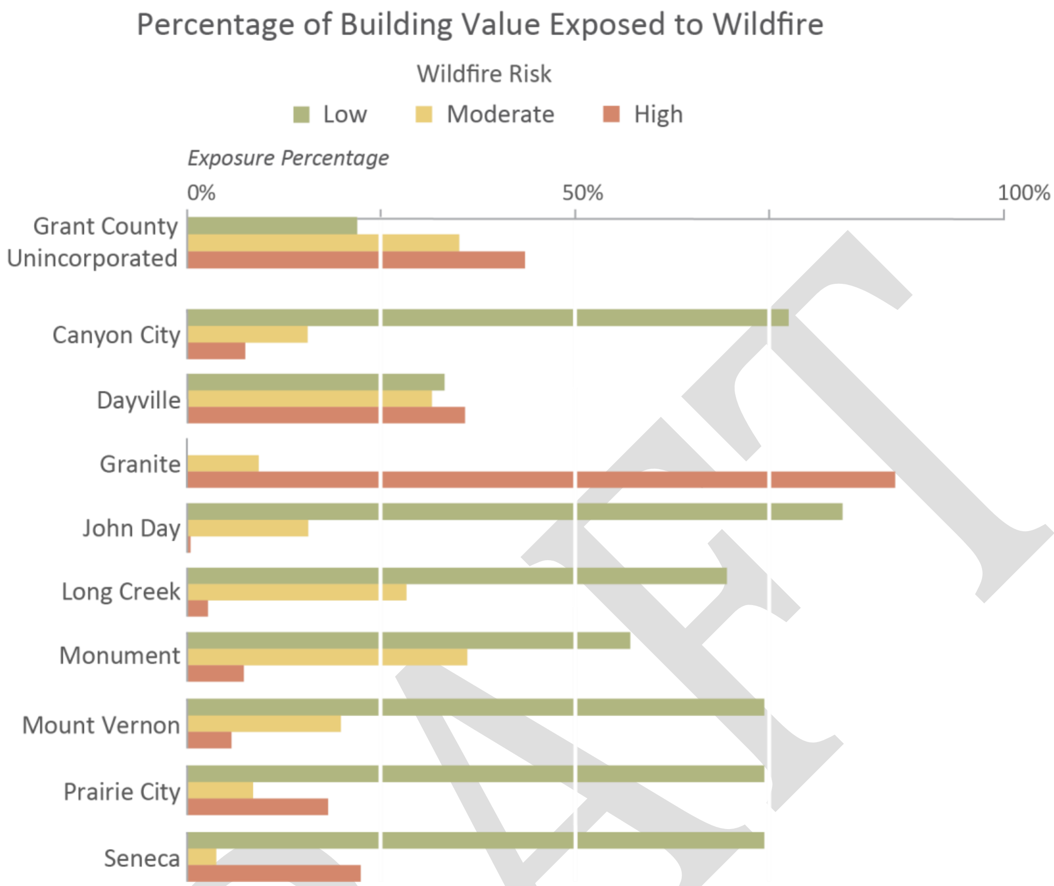
We chose the high hazard category as the primary scenario for this report because it represents the areas that have the highest potential for losses. However, a large amount of loss would occur if the moderate hazard areas were to burn, as some communities have ~20–30% of exposure to moderate wildfire hazard. Other communities have even higher exposure to wildfire hazard. Still, the focus of this section is on high hazard areas within Grant County to emphasize the areas where lives and property are most threatened.

Grant Countywide wildfire exposure (High risk):

- Number of buildings: 2,692
- Exposure Value: $588,264,000
- Ratio of Exposure Value: 29%
- Critical facilities exposed: 5
- Potentially Displaced Population: 1,446

For this risk assessment, the building locations were compared to the geographic extent of the wildfire hazard categories. Several communities in Grant County have a high percentage of buildings and residents exposed to high wildfire hazard. The primary areas of exposure to this hazard are in the forested unincorporated areas of the county that have not already experienced recent burns (see Appendix F, Error! Reference source not found.**)**. Wildfire hazard is based on conditions that can change on an annual basis, so local knowledge and understanding of wildfire risk may need to be considered when determining mitigation actions. The communities of Dayville, Granite, and the unincorporated county have the highest percentage of exposure to high wildfire hazard within Grant County. **Figure 3-5** illustrates the distribution of exposure to wildfire with the different communities of Grant County. See **Appendix B: Detailed Risk Assessment Tables** for multi-scenario analysis results.

Figure 3-5. Wildfire hazard exposure by community.



3.5.3 Areas of vulnerability or risk

We identified locations within Grant County that are comparatively more vulnerable or at greater risk to wildfire hazard:

- Wildfire risk is high for many of homes in the forested area south the John Day airport.
- The communities of Dayville, Granite, and the unincorporated county are most at risk to high wildfire hazard compared to other Grant County communities.
- Prairie City and Seneca have a considerable amount of exposure to high wildfire hazard.

4.0 CONCLUSIONS

The purpose of this study is to provide a better understanding of potential impacts from multiple natural hazards at the community scale. We accomplish this by using the latest natural hazard mapping and loss estimation tools to quantify expected damage to buildings and potential displacement of permanent residents. The comprehensive and fine-grained approach to the analysis provides new context for the county's risk reduction efforts. Based on the results of this study we note several important findings:

1. **Hazus-MH earthquake analysis show a moderate amount of damage and losses for the study area**—The results indicate that Grant County would incur a moderate amount of damage (3.6%) from an earthquake similar to the one simulated in this report. Areas of landslide and liquefaction have some influence on the damage results. This is evidenced by low loss estimates

throughout the county, but with higher loss estimates occurring in areas with high or very high landslide or liquefaction susceptibility. Dayville, which is exposed to very high landslide hazard, could see 4.7% in losses in the 2500-year probabilistic earthquake scenario.

2. **Flooding is a recurrent problem for some communities in Grant County**—Most of the development in Grant County is located within or adjacent to the floodplain of the John Day River and its tributaries. Many buildings in the study area, primarily within this floodplain, are vulnerable to flooding. We estimate a moderate amount of damage from flooding overall due mainly to the flooding along the John Day River and Canyon Creek. For only the buildings within the area of 100-year inundation, an average of 9% loss was calculated. During a 100-year flood event, most of the communities of Grant County are expected to sustain losses under 1% of total building value. The City of Canyon City and John Day being the exception to this with approximately 2% of estimated loss to total building value.
3. **Elevating structures in the flood zone reduces vulnerability**—Flood exposure analysis was used in addition to Hazus-MH loss estimation to identify buildings that were not damaged but were within the area expected to experience a 100-year flood. By using both analyses in this way, the number of elevated structures within the flood zone could be quantified. This showed possible mitigation needs in flood loss prevention and the effectiveness of past activities. John Day, Mount Vernon, and Prairie City were identified as communities with a large number of buildings in the floodplain elevated above the estimated flood height.
4. **New landslide mapping would increase the accuracy of future risk assessments**—Exposure analysis was used to assess the threat from landslide hazard. Landslide is a widespread hazard for much of the undeveloped portions of the county. Most of the very high and high landslide risk occurs along the steep portions of the John Day River valley within the Cities of John Day and Dayville. The landslide hazard data used in this risk assessment was created before modern mapping technology and future risk assessments using lidar derived landslide hazard data would provide more accurate results. Earthquake analysis would also benefit from better landslide mapping since Hazus-MH analysis uses landslide probability as an input dataset.
5. **Wildfire is a natural hazard threat for many areas in Grant County**—Exposure analysis shows that buildings throughout the study area are at high risk to wildfire hazard. The communities within the county have a minimum of 30% of exposure to at least moderate wildfire hazard and some communities are at much greater risk. The communities of Granite, Dayville, and Monument are particularly at risk to high wildfire hazard. Additionally, wildfire risk is high throughout the unincorporated county.
6. **Several of Grant County's critical facilities are at risk to flood hazard**—Critical facilities were identified and were specifically examined within this report. We have estimated that 18% of Grant County's 39 critical facilities at risk to be non-functioning due to a 100-year flood. DOGAMI has also found that 5 critical facilities are exposed to high wildfire hazard. For comparative purposes, almost zero of Grant County's critical facilities are at risk to landslides or earthquake.
7. **Biggest displacement to population was wildfire**—Displacement of permanent residents from natural hazards was quantified within this report. We estimate that of the 7,445 total residents in Grant County 19% of the population or 1,446 residents could be potentially displaced due to wildfire. Landslide hazard is a potential threat to 15% (1,080) of permanent residents, and flood hazard makes 11% (799) vulnerable to displacement.
8. **Community needs can be prioritized**—Each community within Grant County was assessed for natural hazard exposure and loss. This allowed for comparison of risk between communities and

impacts from each natural hazard. In using Hazus-MH and exposure analysis, these results can assist in developing plans that address the concerns for those individual communities.

5.0 LIMITATIONS

There are several limitations to keep in mind when interpreting the results of this risk assessment.

- **Spatial and temporal variability of natural hazard occurrence** – Flood, landslide, and wildfire are extremely unlikely to occur across the fully mapped extent of the hazard zones. For example, areas mapped in the 1% annual chance flood zone will be prone to flooding on occasion in certain portions of Grant County during specific events, but not all at once throughout the entire study area or even the entire community. While we report the overall impacts of a given hazard scenario, the losses from a single hazard event probably will not be as severe and widespread. An exception to this is earthquake ground-shaking, which is expected to impact the entire study area, and loss estimates for this hazard are based on a single event.
- **Loss estimation for individual buildings** – Hazus-MH is a model, not reality, which is an important factor when considering the loss ratio of an individual building. Hazus-MH does not provide a site-specific analysis. On-the-ground mitigation, such as elevation of buildings to avoid flood loss, has been only minimally captured. Also, due to a lack of building material information, assumptions were made about the distribution of wood, steel, and un-reinforced masonry buildings. Loss estimation is most insightful when individual building results are aggregated to the community level, smoothing out the noise.
- **Loss estimation versus exposure** – We recommend careful interpretation of exposure results. This is due to the spatial and temporal variability of natural hazards (described above) and the inability to perform loss estimations due to the lack of Hazus-MH damage functions. Exposure is reported in terms of total building value, which could imply a total loss of the buildings in a particular hazard zone, but this is not the case. Exposure is simply a calculation of the number of buildings and their value and does not make estimates about the level to which an individual building could be damaged.
- **Population variability** – Some of the communities in Grant County are considered vacation destinations, particularly during the summer. Our estimates of potentially displaced people rely on permanent populations published in the 2010 U.S. Census (United States Census Bureau, 2010b). As a result, we are slightly underestimating the number of people that may be in harm's way on a summer weekend.
- **Data accuracy and completeness** – Some datasets in our risk assessments had incomplete coverage or no high-resolution data within Grant County. We used lower resolution data to fill gaps where there was incomplete coverage or where high resolution was not available. Assumptions to amend areas of incomplete data coverage were made based on reasonable methods described within this report. However, we are aware that some uncertainty has been introduced from these data amendments at an individual building scale. At community-wide scales the effects of the uncertainties are slight. Data layers in which assumptions were made to fill gaps are: building footprints, population, some attributes derived from the assessor database, and landslide susceptibility. Many of the datasets included known or suspected artifacts, omissions and errors, identifying or repairing these problems was beyond the scope of the project.

6.0 RECOMMENDATIONS

We recommend the following items for future work to reduce risk to natural hazards. These recommendations, while not comprehensive, touch on all phases of risk management. The recommendations focus on awareness, planning, regulation, emergency response, mitigation funding opportunities, and hazard-specific risk reduction activities.

6.1 Awareness and Preparation

Awareness is crucial to lowering risk and lessening the impacts of natural hazards. When community members understand their risk and know the role that they play in preparedness, the community in general is a much safer place to live. Awareness and preparation not only reduce the initial impact from natural hazards, they also reduce the amount of recovery time for a community to bounce back from a disaster—this ability is commonly referred to as "resilience."

This report is intended to provide local officials a comprehensive and authoritative profile of natural hazard risk to underpin their public outreach efforts. We encourage local officials to design outreach campaigns that target elected officials, businesses, utility managers, civic groups, developers, students, and homeowners.

Messaging can be tailored to stakeholder groups. For example, outreach to homeowners could focus on actions they can take to reduce risk to their property. The DOGAMI Homeowners Guide to Landslides (http://www.oregongeology.org/sub/Landslide/ger_homeowners_guide_landslides.pdf) provides a variety of risk reduction options for homeowners who live in high landslide susceptibility areas. This guide is one of many existing resources; we recommend local officials coordinate with DOGAMI and Oregon Department of Land Conservation and Development (DLCD) to discover other resources.

6.2 Planning

Incorporating the information presented here into local plans can help guide community development away from risky areas. The primary framework for accomplishing this is through the comprehensive planning process. The comprehensive plan sets the long-term trajectory of capital improvements, zoning, and urban growth boundary expansion, all of which are planning tools that can be used to reduce natural hazard risk.

Another framework is the natural hazard mitigation plan (NHMP) process. NHMP plans focus on characterizing natural hazard risk and identifying actions to reduce risk. The recommendations in this report can be considered when reviewing and updating mitigation actions. Additionally, the information presented here serves as the basis for the vulnerability assessment section of the NHMP plan. In fact, the study results have been organized for easy incorporation into the plan.

While there are many similarities between this report and an NHMP, the hazards or critical facilities in the two reports can vary. Differences between the reports may be due to data availability or limited methodologies for specific hazards. The critical facilities considered in this report may not be identical to those listed in a typical NHMP due to the lack of damage functions in Hazus-MH for non-building structures and to different considerations about emergency response during and after a disaster.

6.3 Regulation

One effective way to encourage risk reduction is the adoption and enforcement of regulations and ordinances. Having these in place will ensure new development complies with hazard-reducing construction methods and development standards.

Local officials working with DOGAMI can determine which natural hazard maps provide sufficient detail to support their regulatory goals. DLCD can also be engaged for technical assistance in developing ordinance language.

Existing regulatory programs can incentivize safer development or discourage building in known hazardous areas. Some jurisdictions in Grant County are already engaged in these regulatory programs, but wider implementation is recommended. The NFIP is one federal program that provides a framework for flood risk reduction through regulation. Communities can improve their standing in the NFIP by exceeding minimum requirements and earning points in the Community Rating System (CRS). Another regulatory program is the State of Oregon Structural Specialty Code (OSSC) and Fire and Life Safety Code, which define building codes for seismic safety that reduce the risk to earthquake. Local officials working with DLCD, DOGAMI, and the Oregon Building Codes Division can ensure they comply with existing programs or explore enhanced regulations.

6.4 Emergency response

Critical facilities will play a major role during and immediately after a natural disaster. This study can help emergency managers identify vulnerable critical facilities and develop contingencies in their response plans. Additionally, detailed mapping of potentially displaced residents can be used to re-evaluate evacuation routes and identify vulnerable populations to target for early warning.

The building database that accompanies this report presents many opportunities for future pre-disaster mitigation, emergency response, and community resilience improvements. Vulnerable areas can be identified and targeted for awareness campaigns. These campaigns can be aimed at pre-disaster mitigation through, for example, improvements of the structural connection of the frame to the foundation. Emergency response entities can benefit from the use of the building dataset through identification of potential hazards and populated buildings before and during a disaster. Both reduction of the magnitude of the disaster and increase in the response time contribute to a community's overall resilience.

6.5 Mitigation funding opportunities

Several funding options are available to communities that are susceptible to natural hazards and have specific mitigation projects they wish to accomplish. State and federal funds are available for projects that demonstrate cost effective natural hazard risk reduction. The Oregon Office of Emergency Management (OEM) State Hazard Mitigation Officer (SHMO) can provide communities assistance in determining eligibility, finding mitigation grants, and navigating the mitigation grant application process.

FEMA has two programs that assist with mitigation funding for natural hazards: the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) Grant Program. FEMA also has a grant program specifically for flooding called Flood Mitigation Assistance (FMA). The SHMO can help with finding further opportunities for earthquake assistance and funding.

- OEM Grants webpage (includes links to HMGP, PDM, and FMA information): http://www.oregon.gov/oem/emresources/Grants/Pages/HMA.aspx

Before applying for a mitigation grant the county must have an approved NHMP that includes the specific mitigation project need. The project also must meet eligibility requirements. Some grants require in-kind local funding for as high as 25% of the project cost. We advise working closely with the SHMO on exploring the various options available.

Other funding sources include:

- State of Oregon Seismic Rehabilitation Grant Program, including hospitals: www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/
- Oregon Health Authority Public Health: https://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/SRF/Pages/sipp.aspx
- Oregon Business Development Department (OBDD) Infrastructure Authority (IFA) Special Public Works Fund: http://www.orinfrastructure.org/Infrastructure-Programs/SPWF/
-

6.6 Hazard-specific risk reduction actions

6.6.1 Earthquake

- Evaluate critical facilities for seismic preparedness by identifying structural deficiencies and vulnerabilities to dependent systems (e.g. water, fuel, power).
- Address vulnerabilities of critical facilities.
- Conduct awareness campaigns to encourage home and business owners to perform seismic retrofits. Seismic upgrades can significantly reduce losses to buildings.
- Ensure seismic building codes are strictly adhered to, especially for manufactured homes.
- Consider implementing regulations in highly liquefiable soil zone areas or using planning to reduce risk.

6.6.2 Flood

- For communities that participate in the NFIP, enforce minimum requirements and explore enhanced measures to achieve standing in CRS.
- Find opportunities to increase flood water storage areas. One possibility is to incentivize farm landowners to convert portions of their land to wetlands.
- Relocate or elevate vulnerable structures above the estimated base flood elevation. In some cases, communities can use FEMA's property acquisition or "buyout" program to remove structures that have repeatedly flooded in the past. https://www.fema.gov/media-library-data/20130726-1507-20490-4551/fema_317.pdf
- Create more permeable surfaces within urban areas, especially large parking lots.

6.6.3 Landslide

- Create modern landslide inventory and susceptibility maps and use in planning and regulations for future development.
- Control storm water in landslide-prone areas.
- Monitor ground movement in high susceptible areas.
- Implement grading codes, especially in areas of high landslide susceptibility.

6.6.4 Wildfire

- Maintain building buffer areas from forestland, especially in the fire-prone wildland-urban interface.
- Reduce fuel loads in buffer areas that can act as firebreaks.
- Evaluate post-wildfire geologic hazards include flood, debris flows, and landslides.

7.0 ACKNOWLEDGMENTS

This natural hazard risk assessment was conducted by the Oregon Department of Geology and Mineral Industries (DOGAMI) in 2019. It was funded by Federal Emergency Management Agency (FEMA) Region 10 through its Risk Mapping, Assessment, and Planning (Risk MAP) program (Cooperative Agreement EMS-2018-PC-0003). DOGAMI worked closely with the Oregon Department of Land Conservation and Development (DLCD) to complete the risk assessment and produce this report. Several communities of Northeast Oregon participated in the Northeast Oregon Multi-Jurisdictional Natural Hazard Mitigation Plan (NEONHMP), last updated in 2013 (NEONHMP, 2013). DLCD is coordinating with communities in Grant County on a countywide Natural Hazard Mitigation Plan (NHMP) update, which will incorporate the findings from this risk assessment.

Many people contributed to this report at different points during the analysis phase and during the writing phase and at various levels. We are grateful to everyone who contributed, especially the following from DOGAMI: Christina Appleby and Deb Schueller.

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9.0 APPENDICES

APPENDIX A. COMMUNITY RISK PROFILES

A hazard analysis summary for each community is provided in this section to encourage ideas for natural hazard risk reduction. Increasing disaster preparedness, public hazards communication and education, ensuring functionality of emergency services, and access to evacuation routes are actions that every community can take to reduce their risk. This appendix contains community specific data to provide an overview of the community and the level of risk from each natural hazard analyzed. In addition, for each community a list of critical facilities and assumed impact from individual hazards is provided.

A.1 Unincorporated Grant County

Table A-1. Unincorporated Grant County hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Unincorporated Grant County		2,851	4,933		2	1,169,279,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	74	2.6%	123	1	8,954,000	0.8%
Earthquake	2500-year Probabilistic	32	1.1%	223	0	37,365,000	3.2%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	552	19%	716	0	136,181,000	12%
Wildfire	High Hazard	999	35%	2,204	1	506,634,000	43%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-2. Unincorporated Grant County critical facilities.

	Flood 1% Annual Chance	**Earthquake Moderate to Complete Damage**	**Landslide High and Very High Susceptibility**	**Wildfire High Hazard**
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Dayville Sewage Treatment				X
Grant County Road Department	X			

A.2 City of Canyon City

Table A-3. City of Canyon City hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Canyon City	703	439	7	114,298,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	99	14%	54	2	1,980,000	1.7%
Earthquake	2500-year Probabilistic	15	2.2%	34	1	5,719,000	5.0%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	170	24%	109	0	16,806,000	15%
Wildfire	High Hazard	68	9.7%	41	1	8,478,000	7.4%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with “First floor height” above the level of flooding (base flood elevation).

Table A-4. City of Canyon City critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed
Canyon City City Hall				
Canyon City VFD				
Grant County Courthouse				
Grant County Sheriff Dept				
Grant Union High School*	X			X
Humbolt Elementary School*				
Oregon Dept of Transportation	X	X		

*Seismic retrofits completed for building(s).

A.3 City of Dayville

Table A-5. City of Dayville hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]		Total Building Value ($)
Dayville		149	166		2		33,364,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake	2500-year Probabilistic	3	1.9%	21	1	3,906,000	12%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	39	26%	40	1	10,837,000	33%
Wildfire	High Hazard	70	47%	72	2	11,883,000	36%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-6. City of Dayville critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Wildfire High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Dayville Fire Department				X
Dayville School		X	X	X

A.4 City of Granite

Table A-7. City of Granite hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Granite	38	115	0	15,264,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake	2500-year Probabilistic	0	0.0%	1	0	171,000	1.1%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	3	8.5%	7	0	779,000	5.1%
Wildfire	High Hazard	33	86%	102	0	13,870,000	91%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

A.5 City of John Day

Table A-8. City of John Day hazard profile.

Community Overview

Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
John Day	1,744	1,065	13	339,542,000

Hazus-MH Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	359	21%	192	4	7,703,000	2.3%
Earthquake*	2500-year Probabilistic	14	0.8%	53	0	11,660,000	3.4%

Exposure Analysis Summary

Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	262	15%	127	1	33,941,000	10%
Wildfire	High Hazard	9	0.5%	10	0	1,335,000	0.4%

[1] Facilities with multiple buildings were consolidated into one building complex.

[2] No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-9. City of John Day critical facilities.

	Flood 1% Annual Chance	**Earthquake Moderate to Complete Damage**	**Landslide High and Very High Susceptibility**	**Wildfire High Hazard**
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Blue Mountain Hospital			X	
Grant County Elks Club				
Grant County Health Dept.				
Grant County Regional Airport				
John Day Fire Dept.				
John Day Fire Dept. (old)				
John Day Police Dept and City Hall				
John Day Radio Station KJDY	X			
John Day Sewage Treatment Plant				
Oregon Dept of Forestry	X			
Oregon State Police				
Oregon Trail Electric Co-op	X			
USFS Malheur District Office	X			

A.6 City of Long Creek

Table A-10. City of Long Creek hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]		Total Building Value ($)
Long Creek		197	208		3		46,914,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	2500-year Probabilistic	0	0%	0	0	69,000	0.1%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0%	0	0	0	0%
Wildfire	High Hazard	4	2.2%	10	0	1,232,000	2.6%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-11. City of Long Creek critical facilities.

	Flood 1% Annual Chance	**Earthquake Moderate to Complete Damage**	**Landslide High and Very High Susceptibility**	**Wildfire High Hazard**
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Long Creek City Hall				
Long Creek Fire Dept.				
Long Creek School				

A.7 City of Monument

Table A-12. City of Monument hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Monument	128	143	2	32,015,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0%	0	0	0	0%
Earthquake*	2500-year Probabilistic	1	0.5%	5	1	1,317,000	4.1%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	2	0	312,000	1.0%
Wildfire	High Hazard	19	15%	15	0	2,313,000	7.2%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-13. City of Monument critical facilities.

	Flood 1% Annual Chance	**Earthquake Moderate to Complete Damage**	**Landslide High and Very High Susceptibility**	**Wildfire High Hazard**
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Monument City Hall				
Monument School		X		

A.8 City of Mount Vernon

Table A-14. City of Mount Vernon hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Mount Vernon	527	398	5	73,681,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	97	18%	30	0	192,000	0.3%
Earthquake*	2500-year Probabilistic	2	0.4%	12	3	2,290,000	3.1%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	27	5.1%	16	0	2,496,000	3.4%
Wildfire	High Hazard	42	7.9%	29	0	4,189,000	5.7%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with “First floor height” above the level of flooding (base flood elevation).

Table A-15. City of Mount Vernon critical facilities.

	Flood 1% Annual Chance	**Earthquake Moderate to Complete Damage**	**Landslide High and Very High Susceptibility**	**Wildfire High Hazard**
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Mount Vernon City Hall				
Mount Vernon Fire Dept		X		
Mount Vernon Public Works		X		
Mount Vernon Sewage Treatment				
Oregon Telephone Corporation		X		

A.9 City of Prairie City

Table A-16. City of Prairie City hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]	Total Building Value ($)	
Prairie City		909	731		3	169,267,000	
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	170	19%	89	0	1,432,000	0.8%
Earthquake*	2500-year Probabilistic	11	1.2%	47	1	9,459,000	5.6%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	27	3.0%	18	0	4,276,000	2.5%
Wildfire	High Hazard	181	20%	160	1	30,393,000	18%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-17. City of Prairie City critical facilities.

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Landslide High and Very High Susceptibility	Wildfire High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Prairie City Fire Dept. and City Hall				
Prairie City School		X		
Prairie City Sewage Treatment				X

A.10 City of Seneca

Table A-18. City of Seneca hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Seneca	199	219	2	35,692,000	

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	0	0	0	0.0%
Earthquake*	2500-year Probabilistic	1	0.5%	7	0	930,000	2.6%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Exposure Ratio
Landslide	High and Very High Susceptibility	0	0.0%	0	0	0	0.0%
Wildfire	High Hazard	22	11%	49	0	7,938,000	22%

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table A-19. City of Seneca critical facilities.

	Flood 1% Annual Chance	**Earthquake Moderate to Complete Damage**	**Landslide High and Very High Susceptibility**	**Wildfire High Hazard**
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**
Seneca Elementary School				
Seneca Fire Dept and City Hall				

APPENDIX B. DETAILED RISK ASSESSMENT TABLES

Table B-1. Study area building inventory.

(all dollar amounts in thousands)

	Residential			Commercial and Industrial			Agricultural			Public and Non-Profit			All Buildings			
Community	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Number of Buildings per County Total	Building Value ($)	Value of Buildings per County Total
Unincorp. Grant County	1,518	293,242	25%	131	77,593	6.6%	3,159	756,292	65%	121	42,152	3.6%	4,933	59%	1,169,279	58%
Canyon City	274	57,142	50%	39	15,120	13%	100	13,308	12%	26	28,729	25%	439	5.2%	114,298	5.6%
Dayville	87	15,186	46%	18	3,893	12%	48	5,541	17%	13	8,745	26%	166	2.0%	33,364	1.6%
Granite	87	11,214	73%	3	991	6.5%	24	2,621	17%	1	438	2.9%	115	1.4%	15,264	0.8%
John Day	666	153,808	45%	179	107,712	32%	163	22,498	6.6%	56	55,524	16%	1,065	13%	339,542	17%
Long Creek	108	18,398	39%	13	2,437	5.2%	69	10,171	22%	18	15,908	34%	208	2.5%	46,914	2.3%
Monument	65	9,802	31%	22	5,547	17%	38	5,590	17%	18	11,075	35%	143	1.7%	32,015	1.6%
Mount Vernon	259	41,073	56%	15	5,092	6.9%	111	15,012	20%	11	12,504	17%	398	4.7%	73,681	3.6%
Prairie City	426	89,366	53%	70	17,771	11%	208	30,578	18%	26	31,552	19%	731	8.7%	169,267	8.3%
Seneca	129	20,568	58%	7	1,972	5.5%	71	7,050	20%	12	6,101	17%	219	2.6%	35,692	1.8%
Total Study Area	3,619	709,799	35%	497	238,129	12%	3,991	868,660	43%	302	212,729	10%	8,417	100%	2,029,317	100%

Table B-2. Earthquake loss estimates.

			(all dollar amounts in thousands)			
			Buildings Damaged from Earthquake			
	Total Number of Buildings	**Total Estimated Building Value ($)**	**Yellow-Tagged Buildings**	**Red-Tagged Buildings**	**Sum of Economic Loss**	**Loss Ratio**
Unincorp. Grant County	4,933	1,169,279	179	44	37,365	3.2%
Canyon City	439	114,298	28	6	5,719	5.0%
Dayville	166	33,364	17	4	3,906	12%
Granite	115	15,264	1	0	171	1.1%
John Day	1,065	339,542	44	9	11,660	3.4%
Long Creek	208	46,914	0	0	69	0.1%
Monument	143	32,015	5	1	1,317	4.1%
Mount Vernon	398	73,681	10	2	2,290	3.1%
Prairie City	731	169,267	39	8	9,459	5.6%
Seneca	219	35,692	6	1	7,938	2.6%
Total Study Area	8,417	2,029,317	328	76	72,885	3.6%

Table B-3. Flood loss estimates.

			(all dollar amounts in thousands)											
			10% (10-yr)			2% (50-yr)			1% (100-yr)			0.2% (500-yr)		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**	**Number of Buildings**	**Loss Estimate**	**Loss Ratio**
Unincorp. Grant County	4,933	1,169,279	56	2,047	0.2%	106	7,204	0.6%	123	8,954	0.8%	150	12,185	1.0%
Canyon City	439	114,298	29	769	0.7%	43	1,500	1.3%	54	1,980	1.7%	71	2,760	2.4%
Dayville	166	33,364	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Granite	115	15,264	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
John Day	1,065	339,542	56	1,395	0.4%	132	5,185	1.5%	192	7,703	2.3%	276	12,016	3.5%
Long Creek	208	46,914	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Monument	143	32,015	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Mount Vernon	398	73,681	5	16	0.0%	21	97	0.1%	30	192	0.3%	67	657	0.9%
Prairie City	731	169,267	49	887	0.5%	77	1,217	0.7%	89	1,432	0.8%	126	2,015	1.2%
Seneca	219	35,692	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Total Study Area	8,417	2,029,317	195	5,115	0.3%	379	15,203	0.7%	488	20,261	1.0%	690	29,634	1.5%

Table B-4. Flood exposure.

Community	Total Number of Buildings	Total Population	1% (100-yr)				
			Potentially Displaced Residents from Flood Exposure	% Potentially Displaced Residents from flood Exposure	Number of Flood Exposed Buildings	% of Flood Exposed Buildings	Number of Flood Exposed Buildings Without Damage
Unincorp. Grant County	4,933	2,851	74	2.6%	137	2.8%	14
Canyon City	439	703	99	14%	64	15%	10
Dayville	166	149	0	0%	0	0%	0
Granite	115	38	0	0%	0	0%	0
John Day	1,065	1,744	359	21%	282	27%	90
Long Creek	208	197	0	0%	0	0%	0
Monument	143	128	0	0%	0	0%	0
Mount Vernon	398	527	97	18%	71	18%	41
Prairie City	731	909	170	19%	149	20%	60
Seneca	219	199	0	0%	0	0%	0
Total Study Area	8,417	7,445	799	11%	703	8.4%	215

Table B-5. Landslide exposure.

			(all dollar amounts in thousands)								
			Very High Susceptibility			**High Susceptibility**			**Moderate Susceptibility**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Unincorp. Grant County	4,933	1,169,279	440	85,759	7.3%	276	50,422	4.3%	2,280	486,715	42%
Canyon City	439	114,298	48	7,949	7.0%	61	8,857	7.7%	245	59,327	52%
Dayville	166	33,364	33	9,882	30%	7	955	2.9%	44	7,201	22%
Granite	115	15,264	0	0	0%	7	779	5.1%	77	11,357	74%
John Day	1,065	339,542	57	12,540	3.7%	70	21,401	6.3%	302	104,985	31%
Long Creek	208	46,914	0	0	0%	0	0	0%	17	2,629	5.6%
Monument	143	32,015	0	0	0%	2	312	1.0%	46	9,009	28%
Mount Vernon	398	73,681	0	0	0%	16	2,496	3.4%	115	19,592	27%
Prairie City	731	169,267	0	0	0%	18	4,276	2.5%	129	32,215	19%
Seneca	219	35,692	0	0	0%	0	0	0%	31	4,238	12%
Total Study Area	8,417	2,029,317	578	116,131	5.7%	457	89,498	4.4%	3,286	737,269	36%

Table B-6. Wildfire exposure.

			(all dollar amounts in thousands)					
			High Hazard			**Moderate Hazard**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Unincorp. Grant County	4,933	1,169,279	2,204	506,634	43%	1,889	407,764	35%
Canyon City	439	114,298	41	8,478	7.4%	93	17,614	15%
Dayville	166	33,364	72	11,883	36%	37	10,469	31%
Granite	115	15,264	102	13,870	91%	13	1,394	9.1%
John Day	1,065	339,542	10	1,335	0.4%	197	52,616	16%
Long Creek	208	46,914	10	1,232	2.6%	78	13,194	28%
Monument	143	32,015	15	2,313	7.2%	54	11,502	36%
Mount Vernon	398	73,681	29	4,189	5.7%	99	14,601	20%
Prairie City	731	169,267	160	30,393	18%	72	14,167	8.4%
Seneca	219	35,692	49	7,938	22%	14	1,321	3.7%
Total Study Area	8,417	2,029,317	2,692	588,264	29%	2,546	544,641	27%

APPENDIX C. HAZUS-MH METHODOLOGY

C.1 Software

We performed all loss estimations using Hazus®-MH 3.0 and ArcGIS® Desktop® 10.2.2.

C.2 User-Defined Facilities (UDF) Database

We compiled a UDF database for all buildings in Grant County for use in both the flood and earthquake modules of Hazus-MH. We used the Grant County tax lot database (acquired in 2019) to determine which tax lots had improvements (i.e., buildings).

C.2.1 Locating buildings points

DOGAMI used a dataset of building footprints produced from the work of Microsoft to digitize every building in the United States of America. The buildings used in this report were extracted and revised from this open source dataset (Bing Maps, 2018). Extra effort was spent to make edits and corrections, especially along the 1% and 0.2% annual chance inundation fringe. For buildings partially within the inundation zone, we moved the building point to the centroid of the portion of the building within the inundation zone. We used an iterative approach to further refine locations of building points for the flood module by generating results, reviewing the highest value buildings, and moving the building point over a representative elevation on the lidar digital elevation model to ensure an accurate first-floor height.

C.2.2 Attributing building points

Populating the required attributes for Hazus-MH was achieved through a variety of approaches. We used the Grant County tax lot dataset or Google Street View™ whenever possible, but in many cases this data or application did not provide the necessary information. The following is list of attributes and their sources:

- **Longitude and Latitude** – Location information that provides Hazus-MH the x and y-position of the UDF point. This allows for an overlay to occur between the UDF point and the flood or earthquake input data layers. The hazard model uses this spatial overlay to determine the correct hazard risk level that will be applied to the UDF point. The format of the attribute must be in decimal degrees. A simple geometric calculation using GIS software is done on the point to derive this value.
- **Occupancy class** – An alphanumeric attribute that indicates the use of the UDF (e.g. 'RES1' is a single family dwelling). The alphanumeric code is composed of seven broad occupancy types (RES = residential, COM = commercial, IND = industrial, AGR = agricultural, GOV = public, REL = non-profit/religious, EDU = education) and various suffixes that indicate more specific types. This code determines the damage function to be used for flood analysis. It is also used to attribute the Building Type field, discussed below, for the earthquake analysis. The code was interpreted from the Grant County tax lot dataset. When data was not available, the default value of RES1 was applied throughout.
- **Cost** – The replacement cost of an individual UDF. Loss ratio is derived from this value. Replacement cost is based on a method called RSMeans valuation (The Gordian Group, 2017) and

is calculated by multiplying the building square footage by a standard cost per square foot. These standard rates per square foot are in tables within the default Hazus database.

- **Year built** – The year of construction that is used to attribute the Building Design Level field for the earthquake analysis. The year of "1900" was applied as a default value.
- **Square feet** – The size of the UDF is used to pro-rate the total improvement value for tax lots with multiple UDFs. The value distribution method will ensure that UDFs with the highest square footage will be the most expensive on a given tax lot. This value is also used to pro-rate the Number of People field for Residential UDFs within a census block. The value was obtained from Bing Map's building footprints.
- **Number of stories** – The number of stories for an individual UDF, along with Occupancy Class, determines the applied damage function for flood analysis. Due to lack of information the default values of 1 story was used throughout. For UDFs without assessor information for number of stories that are within the flood zone, closer inspection using Google Street View™ or available oblique imagery was used for attribution.
- **Foundation type** – The UDF foundation type correlates with First Floor Height values in feet (see Table 3.11 in the Hazus-MH Technical Manual for the Flood Model [FEMA Hazus-MH, 2012a]). It also functions within the flood model by indicating if a basement exists or not. UDFs with a basement have a different damage function from UDFs that do not have one. For UDFs without adequate information for basements that are within the flood zone, closer inspection using Google Street View™ or available oblique imagery was used to ascertain if one exists or not.
- **First floor height** – The height in feet above grade for the lowest habitable floor. The height is factored during the depth of flooding analysis. The value is used directly by Hazus-MH, where Hazus-MH overlays a UDF location on a depth grid and using the first floor height determines the level of flooding occurring to a building. It is derived from the Foundation Type attribute or observation via oblique imagery or Google Street View™.
- **Building type** – This attribute determines the construction material and structural integrity of an individual UDF. It is used by Hazus-MH for estimating earthquake losses by determining which damage function will be applied. This information was derived from a statistical distribution based on Occupancy Class.
- **Building design level** – This attribute determines the seismic building code for an individual UDF. It is used by Hazus-MH for estimating earthquake losses by determining which damage function will be applied. This information is derived from the Year Built attribute state/regional Seismic Building Code benchmark years.
- **Number of people** – The estimated number of permanent residents living within an individual residential structure. It is used in the post-analysis phase to determine the amount of people affected by a given hazard. This attribute is derived from default Hazus database (United States Census Bureau, 2010a) of population per census block and distributed across residential UDFs.
- **Community** – The community that a UDF is within. These areas are used in the post-analysis for reporting results. The communities were based on incorporated boundaries and for unincorporated areas, based on building density.

C.3 Flood Hazard Data

DOGAMI developed flood hazard data in 2019 for a revision of the Grant County FEMA Flood Insurance Study. The hazard data was based on some previous flood studies and new riverine hydrologic and hydraulic analyses. For riverine areas, the flood elevations for the 100-year event for each stream cross-section were used to develop depth of flooding raster dataset or a "depth grid."

A countywide, 2-meter, lidar-based depth grid was developed for each of the 10-, 50-, 100-, and 500-year annual chance flood events. The depth grids were imported into Hazus-MH for determining the depth of flooding for areas within the FEMA flood zones.

Once the UDF database was developed into a Hazus-compliant format, the Hazus-MH methodology was applied using a Python (programming language) script developed by DOGAMI. The analysis was then run for a given flood event, and the script cross-referenced a UDF location with the depth grid to find the depth of flooding. The script then applied a specific damage function, based on a UDF's Occupancy Class [OccCls], which was used to determine the loss ratio for a given amount of flood depth, relative to the UDF's first-floor height.

C.4 Earthquake Hazard Data

The primary data layer used for the probabilistic analysis conducted for this report was the USGS 2500-year (2% in 50 years) seismic hazard map for the conterminous United States for 2014. This data layer does not represent a single event, rather it is a probability for intensities of PGA, PGV, SA03, and SA10 for a given location (Petersen et al, 2014). Hazus has integrated this data layer into its standard probabilistic source, so there is no need to import from a USGS source.

Liquefaction susceptibility and NEHRP site classification data came directly from the ORP (Madin and Burns, 2013). The landslide susceptibility data from the ORP was replaced with newer and more accurate data from DOGAMI's 2016 Landslide Susceptibility Dataset (Burns and others, 2016). We used a magnitude of 6.7 in Hazus along with the previously mentioned data layers to derive our loss estimates.

During the Hazus earthquake analysis, each UDF is analyzed given its site-specific parameters (ground motion and ground deformation) and are evaluated for its loss, expressed as a probability of a damage state. Specific damage functions based on Building Type and Design Level are used to calculate the damage states given the site-specific parameters for each UDF. The output provides probabilities of the five damage states (None, Slight, Moderate, Extensive, Complete) from which losses in dollar amount is derived.

C.5 Post-Analysis Quality Control

Ensuring the quality of the results from Hazus-MH flood and earthquake modules is an essential part of the process. A primary characteristic of the process is that it is iterative. A UDF database without errors is highly unlikely, so this part of the process is intended to limit and reduce the influence these errors have on the final outcome. Before applying the Hazus-MH methodology, closely examining the top 10 largest area UDFs and the top 10 most expensive UDFs is advisable. Special consideration can also be given to critical facilities due to their importance to communities.

Identifying, verifying, and correcting (if needed) the outliers in the results is the most efficient way to improve the UDF database. This can be done by sorting the results based on the loss estimates and closely scrutinizing the top 10 to 15 records. If corrections are made, then subsequent iterations are necessary. We continued checking the "loss leaders" until no more corrections were needed.

Finding anomalies and investigating possible sources of error are crucial in making corrections to the data. A wide range of corrections might be required to produce a better outcome. For example, floating homes may need to have a first-floor height adjustment or a UDF point position might need to be moved due to issues with the depth grid. Incorrect basement or occupancy type attribution could be the cause of a problem. Commonly, inconsistencies between assessor data and tax lot geometry can be the source of an error. These are just a few of the many types of problems addressed in the quality control process.

APPENDIX D. ACRONYMS AND DEFINITIONS

D.1 Acronyms

CRS	Community Rating System
CSZ	Cascadia subduction zone
DLCD	Oregon Department of Land Conservation and Development
DOGAMI	Department of Geology and Mineral Industries (State of Oregon)
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FRI	Fire risk index
GIS	Geographic Information System
NFIP	National Flood Insurance Program
NHMP	Natural hazard mitigation plan
NOAA	National Oceanic and Atmospheric Administration
ODF	Oregon Department of Forestry
OEM	Oregon Emergency Management
OFR	Open-File Report
OPDR	Oregon Partnership for Disaster Resilience
PGA	Peak ground acceleration
PGD	Permanent ground deformation
PGV	Peak ground velocity
Risk MAP	Risk Mapping, Assessment, and Planning
SHMO	State Hazard Mitigation Officer
SLIDO	State Landslide Information Layer for Oregon
UDF	User Defined Facilities
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WUI	Wildland-urban interface

D.2 Definitions

1-% annual chance flood – The flood elevation that has a 1-percent chance of being equaled or exceeded each year. Sometimes referred to as the 100-year flood.

0.2% annual chance flood – The flood elevation that has a 0.2-percent chance of being equaled or exceeded each year. Sometimes referred to as the 500-year flood.

Base flood elevation (BFE) – Elevation of the 1-percent-annual-chance flood. This elevation is the basis of the insurance and floodplain management requirements of the NFIP.

Critical facilities – Facilities that, if damaged, would present an immediate threat to life, public health, and safety. As categorized in HAZUS-MH, critical facilities include hospitals, emergency operations centers, police stations, fire stations and schools.

Exposure – Determination of whether a building is within or outside of a hazard zone. No loss estimation is modeled.

Flood Insurance Rate Map (FIRM) – An official map of a community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – Contains an examination, evaluation, and determination of the flood hazards of a community and, if appropriate, the corresponding water-surface elevations.

Hazus-MH – A GIS-based risk assessment methodology and software application created by FEMA and the National Institute of Building Sciences for analyzing potential losses from floods, hurricane winds, and earthquakes.

Lidar – A remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. Lidar is popularly used as a technology to make high-resolution maps.

Liquefaction – Describes a phenomenon whereby a saturated soil substantially loses strength and stiffness in response to an applied stress, usually an earthquake, causing it to behave like liquid.

Loss Ratio – The expression of loss as a fraction of the value of the local inventory (total value/loss).

Magnitude – A scale used by seismologists to measure the size of earthquakes in terms of energy released.

Risk – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of a natural hazard. Sometimes referred to as vulnerability.

Risk MAP – The vision of this FEMA strategy is to work collaboratively with State, local, and tribal entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property.

Riverine – Of or produced by a river. Riverine floodplains have readily identifiable channels.

Susceptibility – Degree of proneness to natural hazards that is determined based on physical characteristics that are present.

Vulnerability – Characteristics that make people or assets more susceptible to a natural hazard.

APPENDIX E. MAP PLATES

See appendix folder for individual map PDFs.

Building Distribution Map of Grant County, Oregon

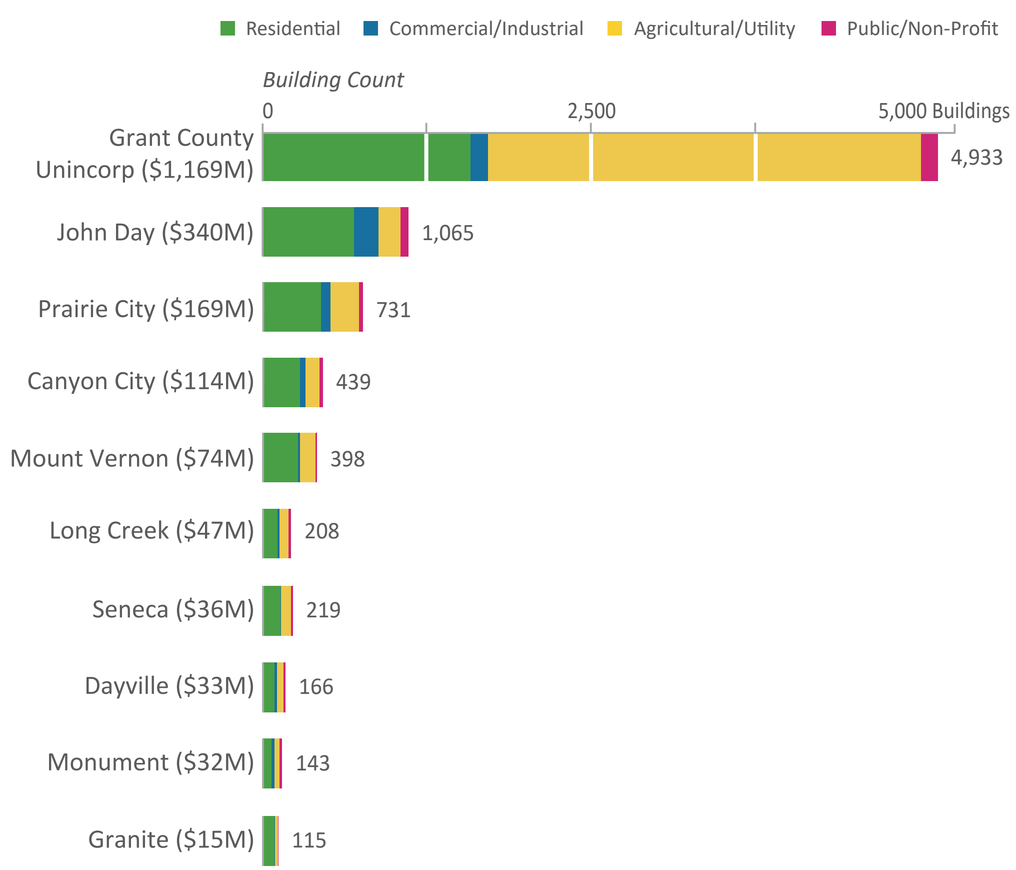
PLATE 1

Building Occupancy

- Agricultural / Utility
- Commercial / Industrial
- Public / Non-Profit
- Residential

Buildings by Occupancy Class

(Ranked by Value)



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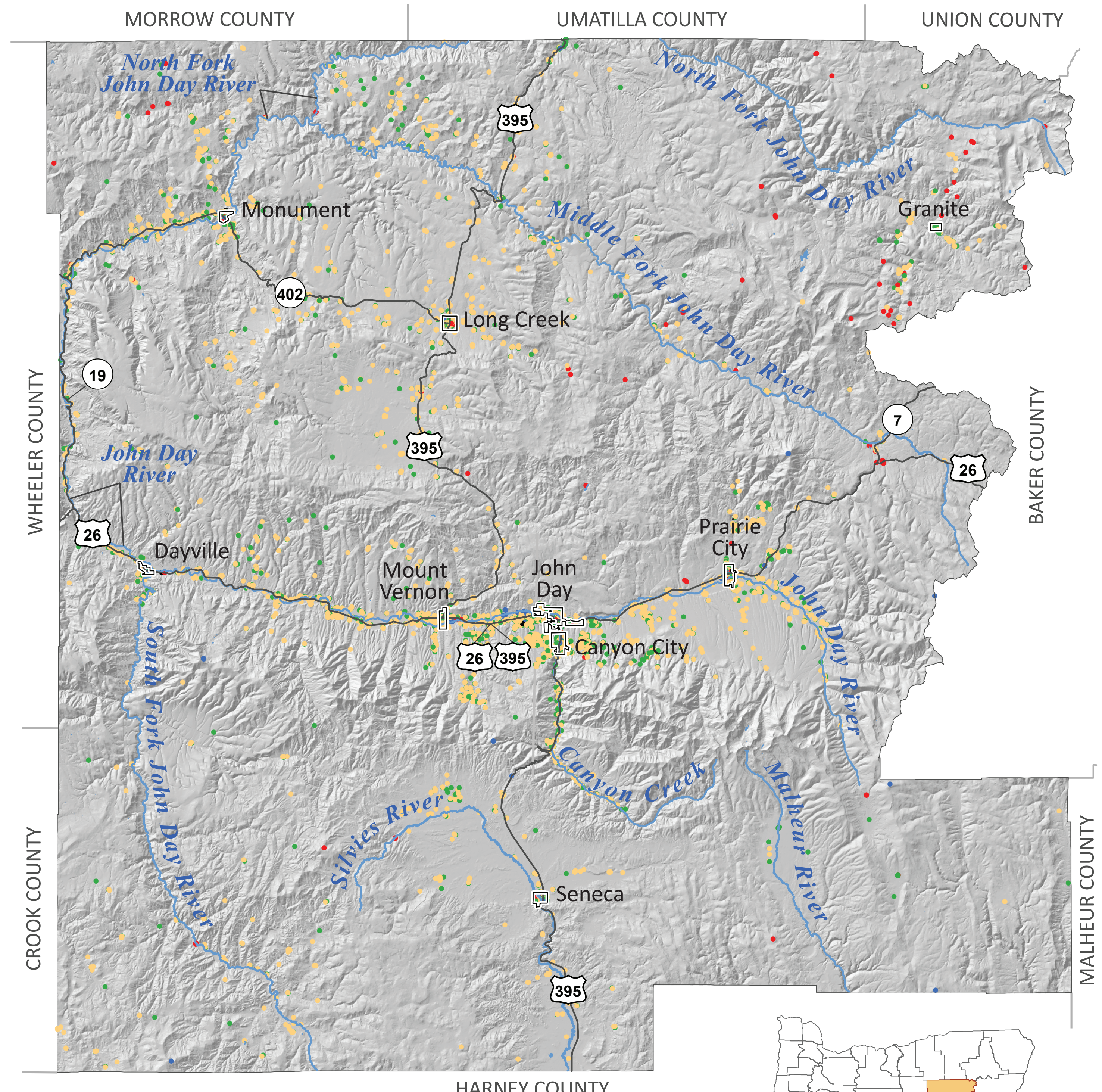


Study Location Map

This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Grant County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Data Sources:
Building footprints: Microsoft Bing US Building Footprints (2018)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

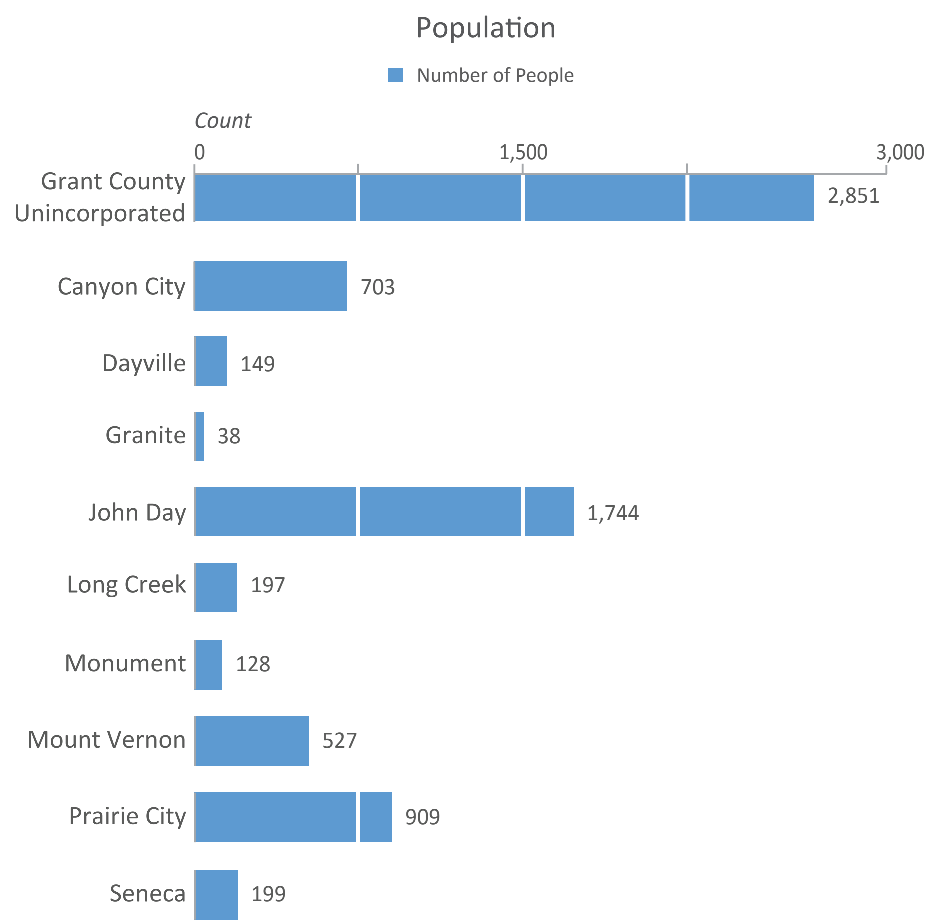
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

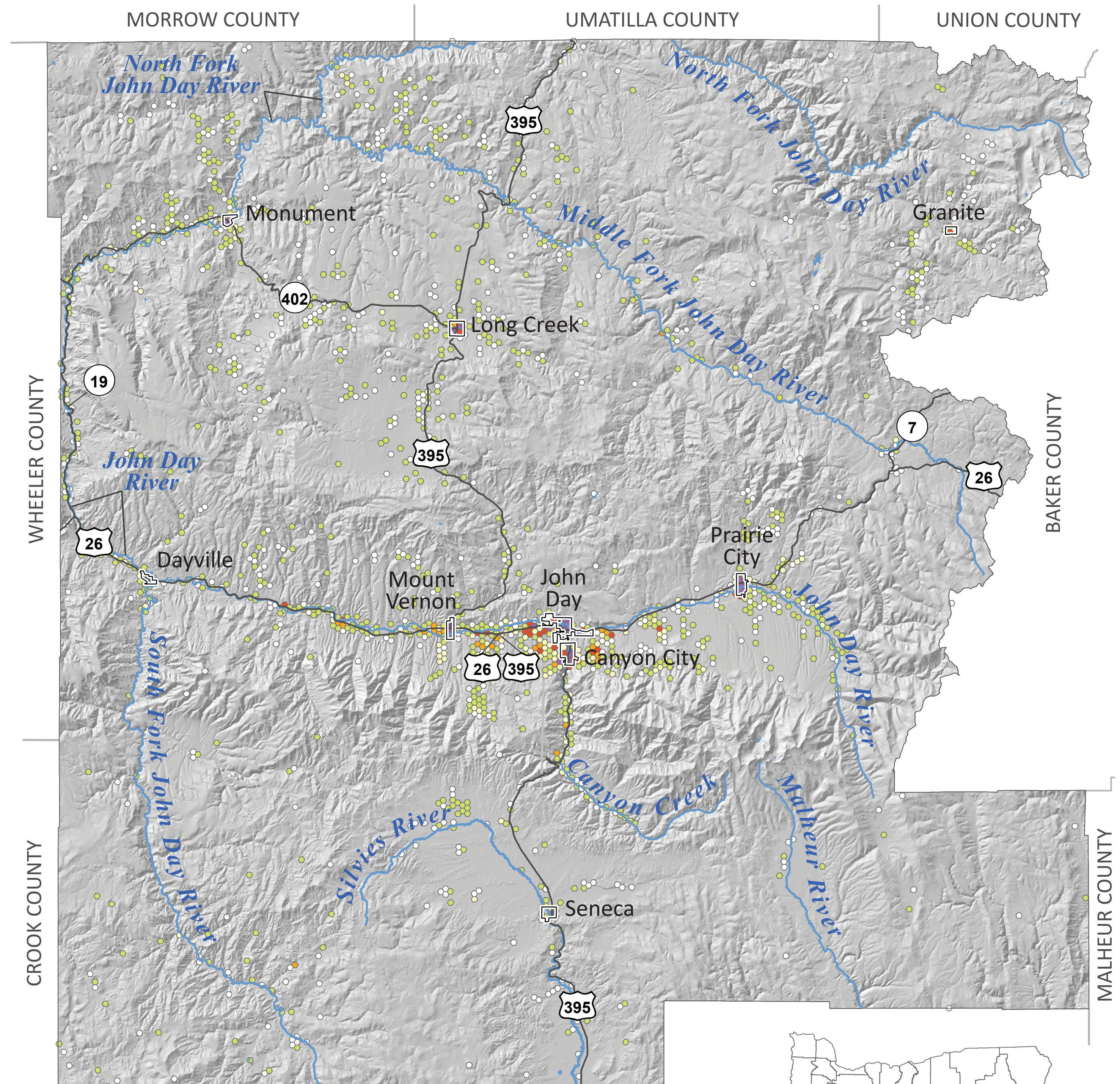
Cartography by: Lowell H. Anthony, 2019

Population Density Map of Grant County, Oregon

People per 80 acres

- Building(s) present no permanent residents
- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 30
- 31 +





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N

0 10 20 Miles

0 10 20 Kilometers

Study Location Map

Data Sources:
Population data: U.S. Census (2010)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

Cartography by: Lowell H. Anthony, 2019

2500-year Probabilistic Earthquake Shaking Map of Grant County, Oregon

PLATE 3

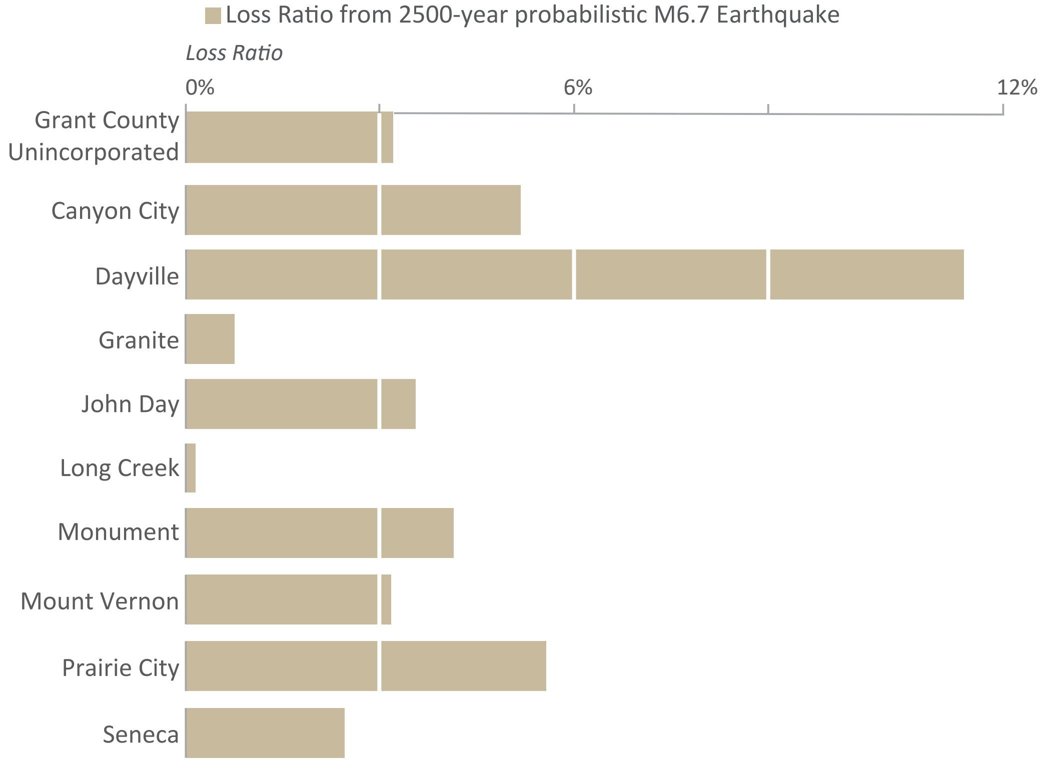
Earthquake Peak Ground Acceleration

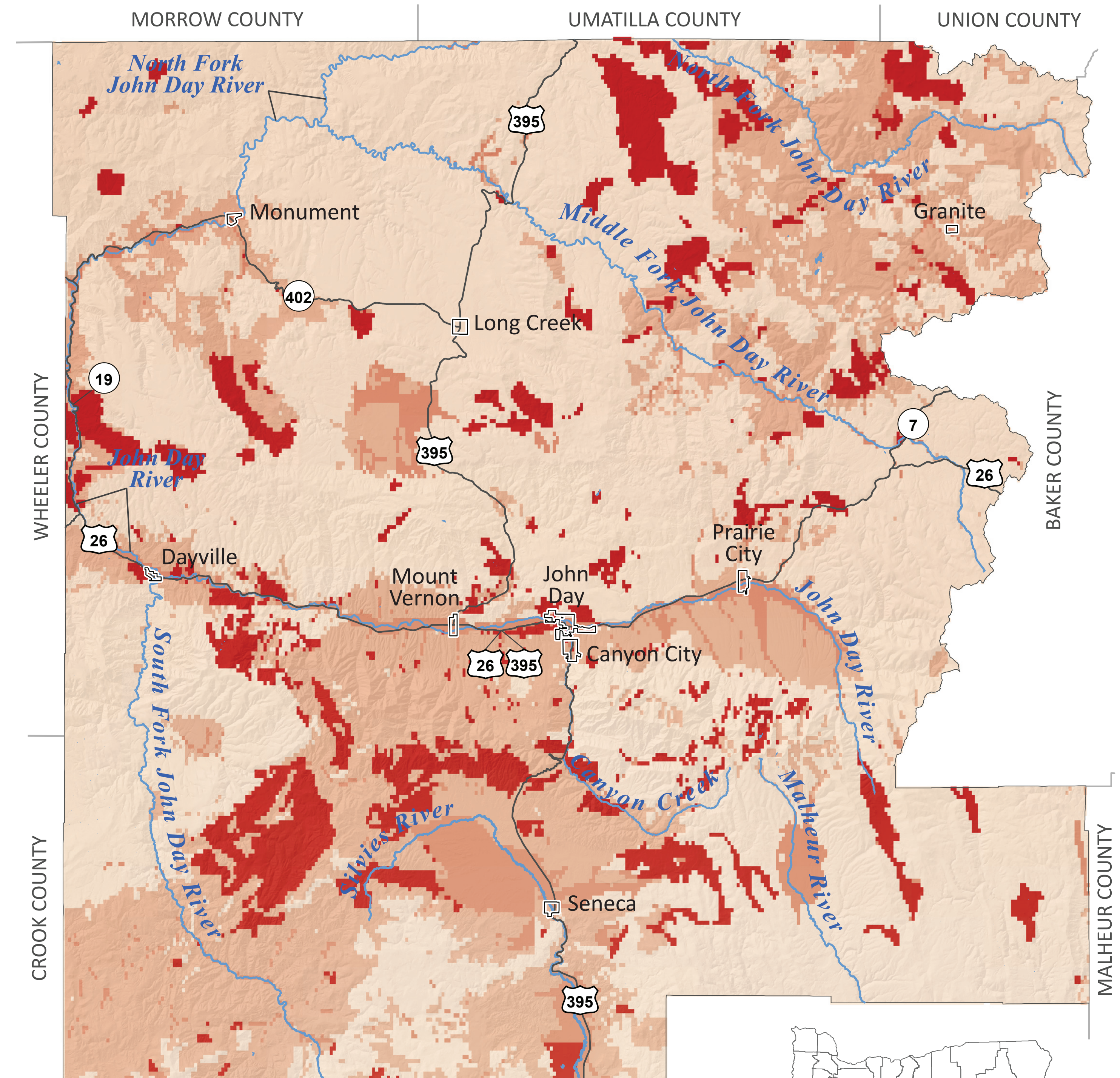
(Modified Mercalli Intensity Scale)

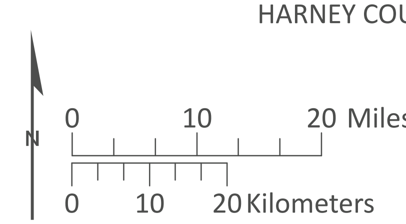
Strong — Very Strong

Peak Ground Acceleration (PGA) is the maximum acceleration in a given location or rather how hard the ground is shaking during an earthquake. It is one measurement of ground motion, which is closely associated with the level of damage that occurs from an earthquake.

Total Building Value Loss Ratio from M 6.7 Earthquake







Study Location Map

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This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Grant County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Data Sources:
Earthquake peak ground acceleration: Oregon Department of Geology and Mineral Industries (2019)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

Cartography by: Lowell H. Anthony, 2019

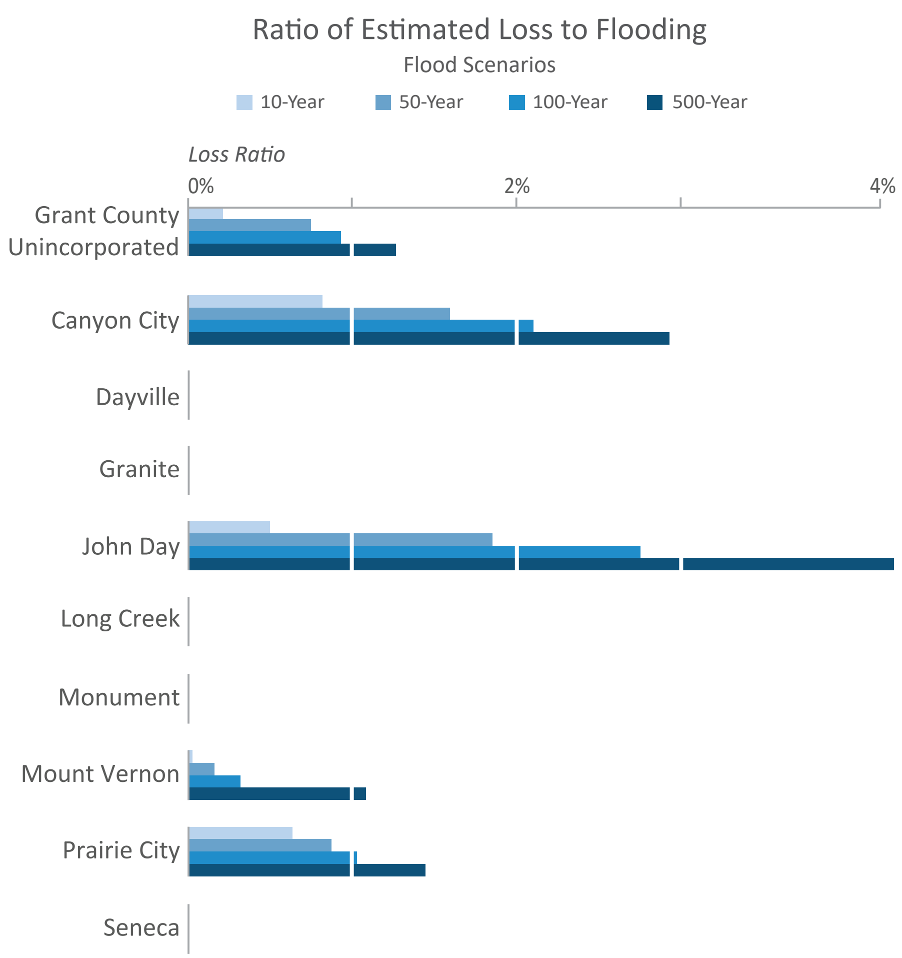
Flood Hazard Map of Grant County, Oregon

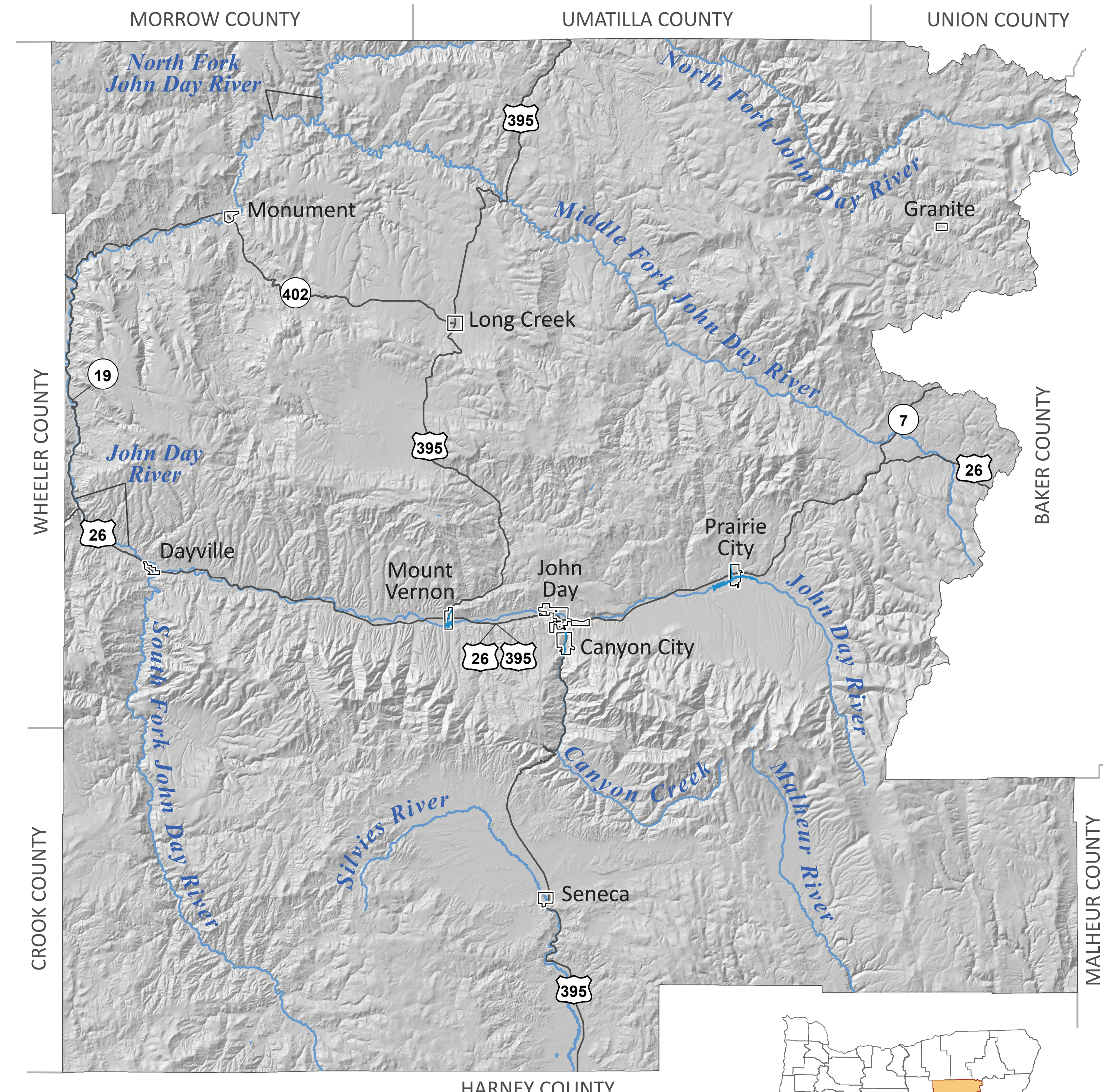
PLATE 4

Flood Hazard Zone

100-Year Flood (1% annual chance)

The flood hazard data show areas expected to be inundated during a 100-year flood event. Flooding sources include riverine. Areas are consistent with the regulatory flood zones depicted in Grant County's Digital Flood Insurance Rate Maps.





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N

0 10 20 Miles

0 10 20 Kilometers

Study Location Map

Data Sources:
Flood hazard zone (100-year): Grant County Flood Insurance Rate Map (1982, 1987, 1988, and 2019)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

Cartography by: Lowell H. Anthony, 2019

This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Grant County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Landslide Susceptibility Map of Grant County, Oregon

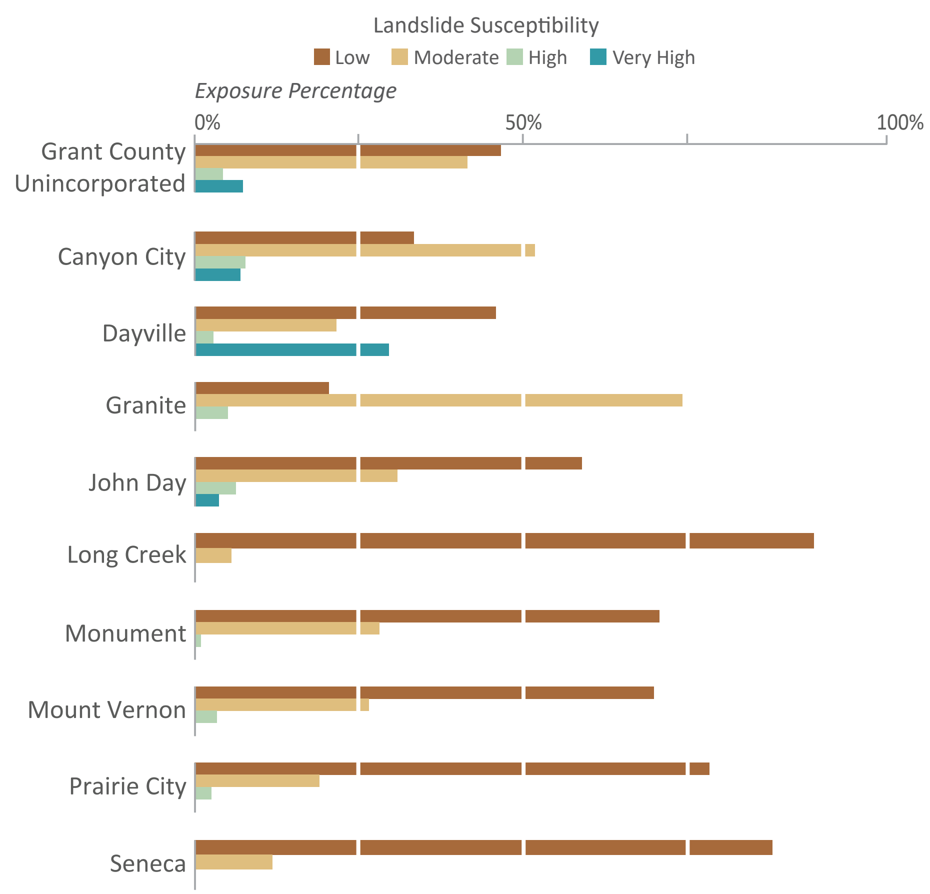
PLATE 5

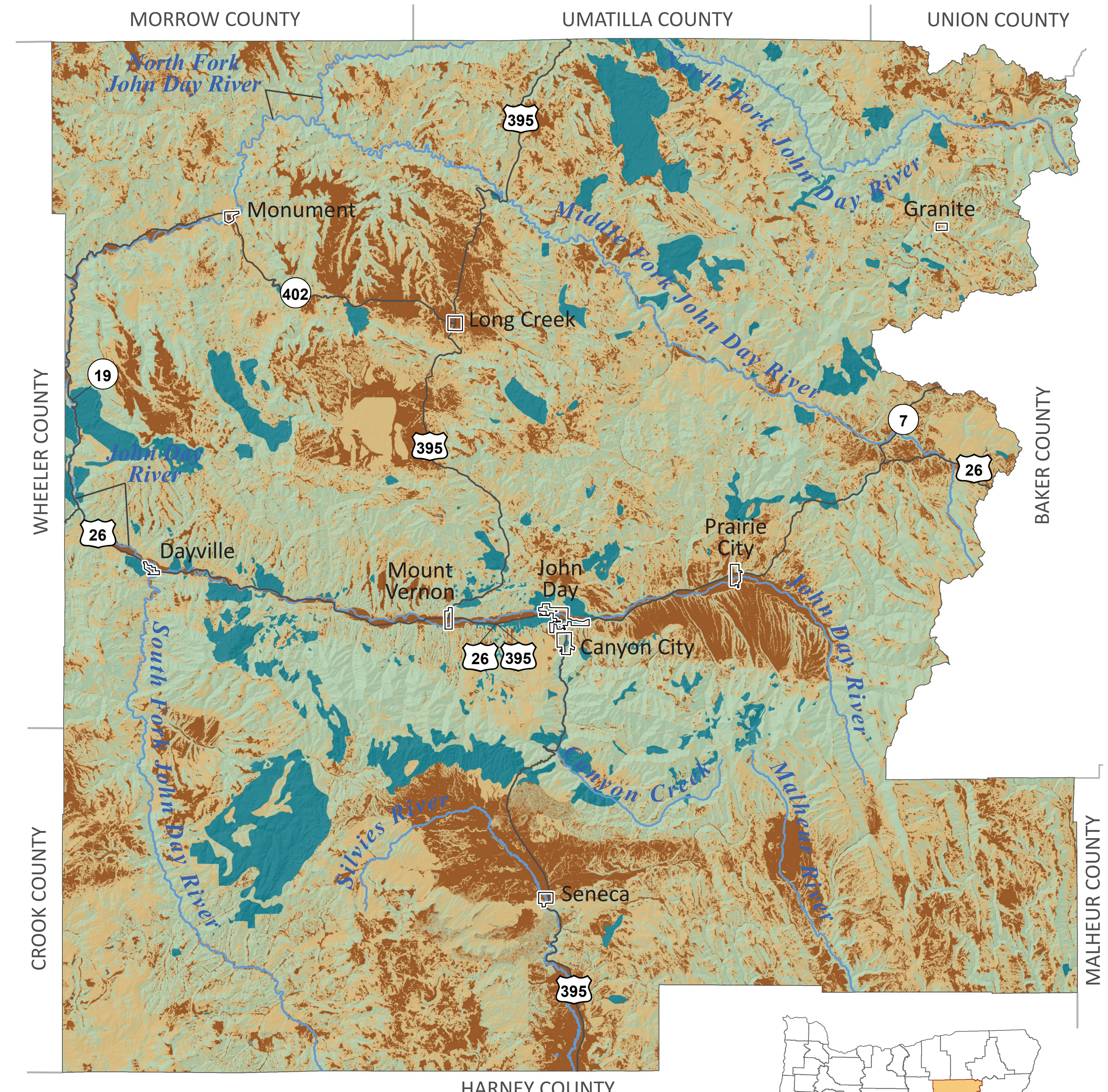
Landslide Susceptibility

- Low
- Moderate
- High
- Very High

Landslide susceptibility is categorized as Low, Moderate, High, and Very High which describes the general level of susceptibility to landslide hazard. The dataset is an aggregation of three primary sources: landslide inventory (SLIDO), generalized geology, and slope.

Percentage of Building Value Exposed to Landslide





Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication. See the accompanying text report for more details on the limitations of the methods and data used to prepare this publication.

N

0 10 20 Miles

0 10 20 Kilometers

Study Location Map

This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Grant County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Data Sources:
Landslide susceptibility: Oregon Department of Geology, Burns and others (2016)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

Cartography by: Lowell H. Anthony, 2019

Burn Probability Map of Grant County, Oregon

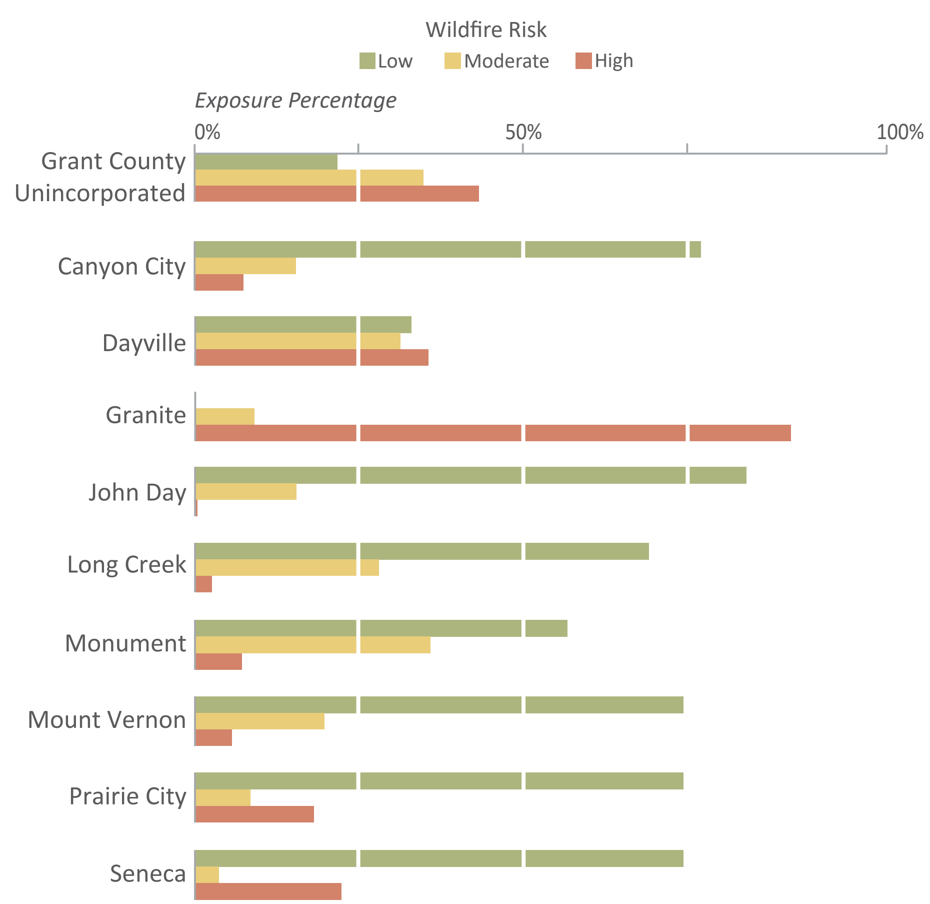
PLATE 6

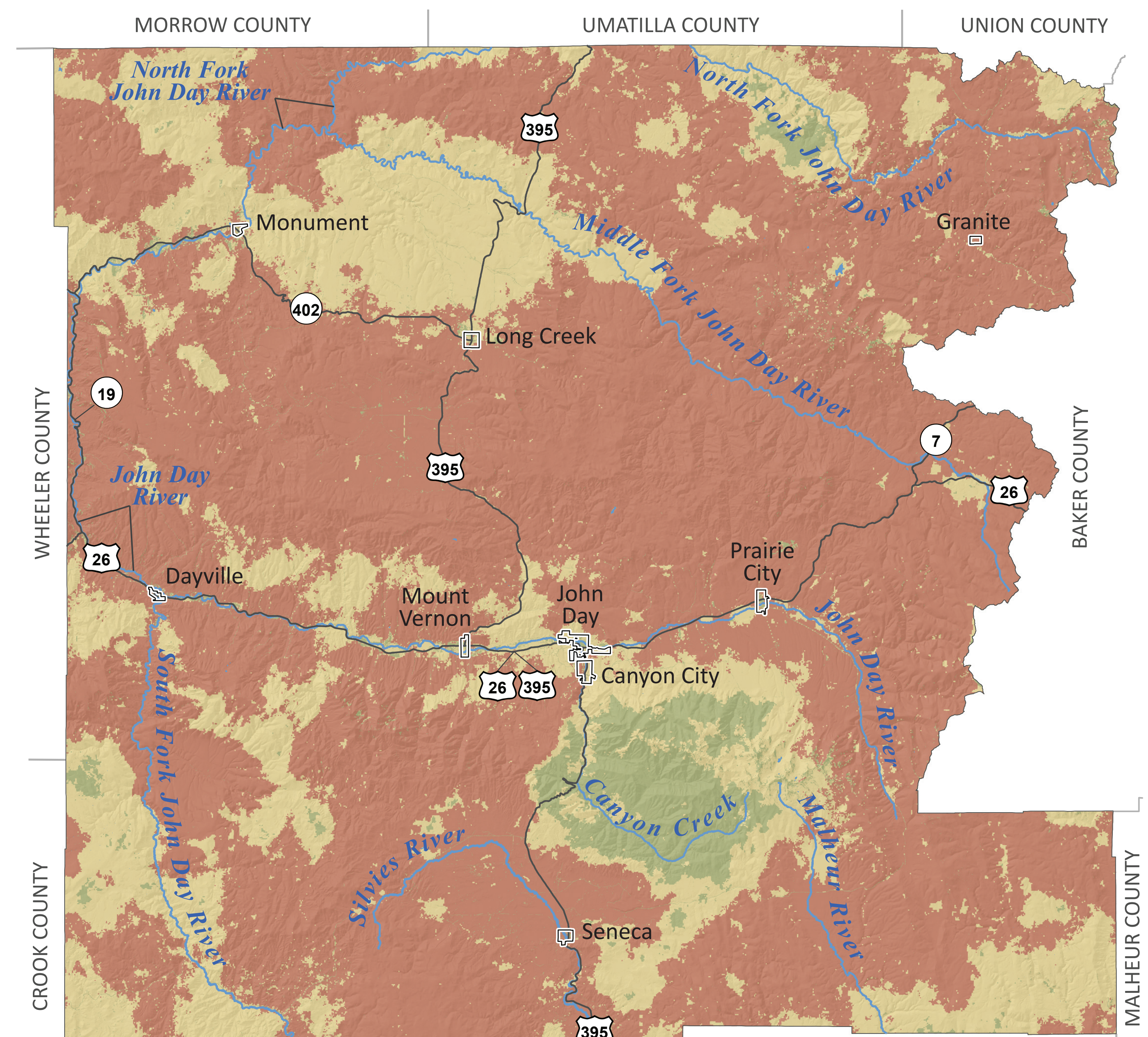
Burn Probability

- Low
- Moderate
- High

Wildfire Burn Probability is categorized as Low, Moderate, and High and indicates the probability a location has to wildfire hazard. Probability ranges of the Burn Probability dataset from the PNRA were grouped into 3 categories of wildfire hazard. Burn probability is derived from simulations using many elements, such as, weather, ignition frequency.

Percentage of Building Value Exposed to Wildfire





Study Location Map

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This map is an overview map and not intended to provide details at the community scale. The GIS data that is published with the Grant County Natural Hazard Risk Assessment can be used to inform regarding queries at the community scale.

Data Sources:
Burn probability data: Oregon Department of Forestry, Pyrologix, LCC. (2018)
Roads: Oregon Department of Transportation Signed Routes (2013)
Place names: U.S. Geological Survey Geographic Names Information System (2015)
City limits: Oregon Department of Transportation (2014)
Basemap: Oregon Lidar Consortium (2017)
Hydrography: U.S. Geological Survey National Hydrography Dataset (2017)

Projection: WGS 1984 Web Mercator Auxiliary Sphere
Software: Esri® ArcMap 10, Adobe® Illustrator CC

Cartography by: Lowell H. Anthony, 2019

Appendix H:
FEMA Risk MAP Discovery Report
Grant County, Oregon

FEMA

REGION X DISCOVERY REPORT

GRANT COUNTY | OREGON

WEBINARS: 7/25/2019 - 8/1/2019

MEETING: 9/13/2019

REPORT: 1/15/2020

RiskMAP
Increasing Resilience Together

GRANT COUNTY | OREGON

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GRANT COUNTY | OREGON

EXECUTIVE SUMMARY

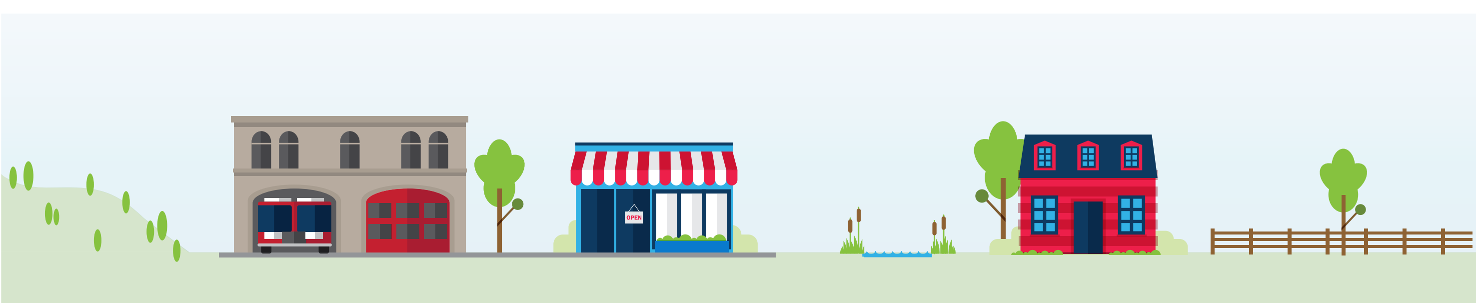
The Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) process begins with Discovery. The Discovery phase is twofold: (1) Pre-Discovery Information Exchange webinars held with each participating community, and (2) an in-person Discovery Meeting to build upon the discussions held via the webinars. The Grant County Discovery Report provides users with an understanding of historical and current natural hazard risks, and identified, current, and completed mitigation activities within the county.

The goals of Discovery are to (1) determine what natural hazard information already exists, (2) learn what natural hazard information is still needed to make mitigation decisions, and (3) identify what critical infrastructure and resources could potentially be affected during a natural hazard event. This report discusses the risks and needs identified during the Discovery process. The information gathered during Discovery can be used to inform discussions regarding community resilience and to identify or support mitigation projects.

Discussions with Grant County led to the request for a variety of Risk MAP products and services that can improve community resilience. These are listed on the right.

COMMUNITY-REQUESTED RISK MAP PRODUCTS AND SERVICES:

- Multi-hazard outreach materials
- Expanded LiDAR (Light Detection and Ranging) throughout the county
- Updated flood maps with new topography developed from LiDAR
- Flood studies and redelineation for areas of concern
- Countywide wildfire mapping
- Hazard Risk Assessments for landslide and earthquake – all to be strengthened by LiDAR
- Trainings for real estate agents, title companies, and contractors who work within the Special Flood Hazard Area
- Information on the Cooperating Technical Partners (CTP) Program and additional funding opportunities.
- Non-regulatory mapping for ice jams.
- Scenario-based mapping related to post-wildfire flooding.



GRANT COUNTY | OREGON

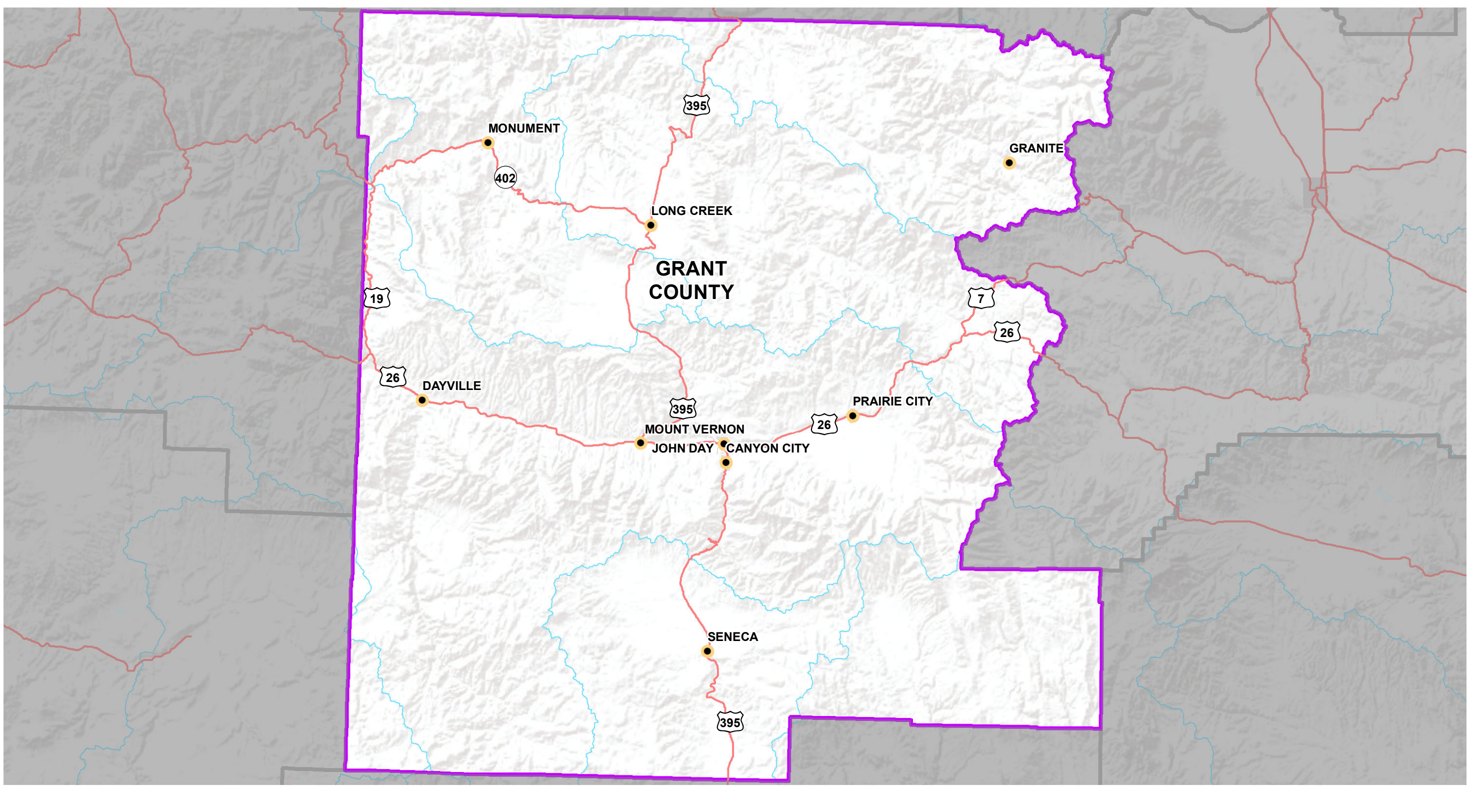
PROJECT OVERVIEW

Discovery Meeting maps were developed for Grant County and incorporated jurisdictions to visually display areas of concern identified during Pre-Discovery with the communities. Additional information included in these maps came from the best available data from local, State, and Federal data sources. Below, you will find the Grant County Project Area Map. Additional maps for the project area can be found at: http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/OR_Grant_Discovery/Forms/AllItems.aspx.

RiskMAP DISCOVERY

Map Contains:
PROJECT AREA MAP
GRANT COUNTY, OREGON
DATE November 2019
This is a non-regulatory product and is provided for information gathering and sharing purposes only.

FEMA



BASEMAP LAYERS

JURISDICTION
STATE
COUNTY
MAJOR ROAD

COMMUNITIES & POPULATION

GRANT, COUNTY OF	7,190
CANYON CITY, TOWN OF	669
DAYVILLE, TOWN OF	145
GRANITE, CITY OF	36
JOHN DAY, CITY OF	1,669
LONG CREEK, CITY OF	190
MONUMENT, CITY OF	125
MOUNT VERNON, CITY OF	511
PRAIRIE CITY, CITY OF	880
SENECA, CITY OF	207

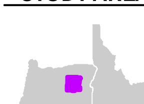
REFERENCE

1 inch = 13.8 miles 1:875,000

N

Service Layer Credits: Sources: Esri, USGS, NOAA

STUDY AREA



GRANT COUNTY | OREGON

DISCOVERY MEETING OUTCOMES

At the Discovery Meeting, local community attendees were asked to participate in two main workshop activities: (1) to identify areas on a map where participants might want more information, either on the structure or location itself, or for data relating to hazards in that location; and (2) to discuss each identified area in more detail during breakout groups. During this second activity, mitigation actions were addressed along with ways Risk MAP data could support each risk reduction effort. Attendees also discussed how this information could be used to inform the hazard mitigation plan update process. Each community ranked its mitigation actions for each timeframe (short term: 1 to 3 years, mid-term: 3 to 7 years, and long term: 7+ years) after all mitigation projects were identified and discussed. To organize the information further, each risk reduction effort was grouped within a category: planning, project, hazard mapping, risk assessment, outreach, training, and technical assistance, which are described below. The outcomes of the discussion from this workshop activity are described on the next pages for each jurisdiction that attended the Discovery Meeting.

COMMUNITY NEED	RISK MAP SUPPORT EXAMPLES
PLANNING	• Hazard Mitigation Plan development • Developing mitigation strategies • Assistance with recovery and emergency response planning • Land use planning • Plan integration • Plan maintenance
PROJECT	• Mapping and hazard assessments to support planning efforts • Hazard data and assistance to strengthen grant applications
HAZARD MAPPING	• Flood Studies, both approximate and detailed • LiDAR collection
RISK ASSESSMENT	• Multi-hazard risk assessments analyzing hazard extent and structural loss estimates using hazard scenarios and local parcel data • Hazards can include earthquake, wildfire, drought, flood, severe storm, landslide, dam failure, avalanche, ice jam, and volcano
OUTREACH	• Development of handouts, flyers, brochures, posters, etc. focused on hazard information, preparedness, response, and recovery • Assistance with developing effective community outreach through messaging and public events
TRAINING	• Training provided to local staff, such as NFIP training and technical support, risk assessment training and technical support, and hazard mitigation planning support
TECHNICAL ASSISTANCE	• Support for ideas in public engagement • Best practices for mitigation strategies • Presenting or advocating hazard and response-related plans to elected officials • Linking hazard mitigation to other local planning efforts

GRANT COUNTY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
HAZARD MAPPING	New flood analysis is requested with the following details: • All areas of development within or near flood hazard areas. • Along Highway 26 and Zone D areas. • Expand LIDAR and mapping extents along the North, Middle, and South Forks for the John Day River. • Extend mapping to the unmapped areas south of Canyon City. • Extend mapping to better tie into the Silvies flood map above Seneca and Bear Creek. • Re-map the area where the Canyon Meadows Dam once was. • Re-map floodway in populated areas.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	FIRM and FIS report and hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to flooding, which can improve communication, outreach, and support for mitigation and planning efforts.	●	#1
HAZARD MAPPING	Extend LIDAR to southwest and northeast county to areas of or near the following: • Monument and John Day • Silvies Watershed to complete the confluence area of Bear Creek and the Silvies River.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	LiDAR data provided through Risk MAP will improve flood and multi-hazard mapping in populated areas and areas with projected population growth.	●	#2
TRAINING	Training on how to use HAZ-VU and the Department of Geology and Mineral Industries (DOGAMI) Landslide Mapping Guide to educate property owners. Education is needed for plan review and building permits in high landslide risk zones.	Action Item: MH #4 - Develop and implement education and outreach programs to increase public awareness of the risk associated with natural hazards. Specifically target vulnerable populations.	Risk MAP supports inter-agency conversations with many State partners and mitigation planning techincal experts. Tailored trainings, resources, and technical assitance can be provided, upon request.		

● SHORT TERM (1-3 YEARS) ● MID-TERM (3-7 YEARS) ● LONG TERM (7+ YEARS)

GRANT COUNTY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
OUTREACH	Improve the county website and outreach process specific to: • Identify how all hazards align with evacuation routes. • Identify and add shelter information for all hazards in each community to the website, especially as they relate to evacuation routes. • Explore the reverse 911 program and other real-time communication for hard to reach and low-lying areas for people who have minimal technology and communication methods.	Action Item: MH #9 - Develop a warning and emergency evacuation protocol for vulnerable populations.	Hazard risk and exposure assessments, provided thorough Risk MAP, can identify areas prone to hazard risk, which can improve communication, support and prioritize planning efforts, and determine evacuation routes.; Through Risk MAP, tailored communication and outreach materials can be developed leveraging available earthquake data and localized risk assessments. Existing outreach materials can be shared.	Short term	#2 CONTINUED
RISK ASSESSMENTS	Wildfire: Conduct wildfire risk assessments and create probability maps for the entire county.	Goal 1: Protect human welfare, property, and natural resources	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to wildfire risk, which can improve communication, and support and prioritize wildfire mitigation efforts.	Mid-term	#1
PROJECT	Leverage wildfire risk assessment to identify mitigation opportunities to reduce risk in non-populated areas that would then reduce the risk in populated areas.	Goal 1: Protect human welfare, property, and natural resources	Through the Risk MAP program, FEMA and their State partners can support risk assessment data development related to wildfire risk, grants management (CTP or other funding opportunities), and technical support for identified mitigation projects.	Mid-term	#2

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

DAYVILLE CITY| OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT, PLANNING, AND TECHNICAL ASSISTANCE	Requesting an irrigation ditch assessment, with consideration of the following details: · The goal is to increase the resilience of the irrigation ditch - improving the ditch so that it is no longer a flood hazard and can be utilized during a wildfire. · The ditch is primarily used for agriculture and irrigation and is funded by the local ditch association. · There have been several blowouts. · The ditch was damaged in recent floods. · The city would like to develop a plan for improvement and determine project funding opportunities. · Previous funding was provided through residential fee increases. · The city would like to collaborate with the Oregon Water Resources and Fish & Wildlife departments.	Action Item: DR #2 - Increase water efficiency among municipal water users.	Flood and wildfire risk/exposure assessment (risk database and risk report), recommended resiliency strategies, and grant/technical assistance support.; Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to flood risk, which can improve communication and outreach efforts.		#1
PROJECT	Adding a generator to the Community Hall to formally make it an emergency shelter.	Goal 3: Motivate mitigation activity against the effects of natural hazards through education, outreach, and awareness.	Through the Risk MAP program, FEMA and their State partners can support grants management (CTP or other funding opportunities) and technical support for identified mitigation projects.		#2
PROJECT AND OUTREACH	Participate in Firewise (a program that provides a number of wildland/urban interface resources for firefighter safety, community planning, landscaping, construction, and maintenance) to support the city's efforts to address wildfire concerns.	Goal 3: Motivate mitigation activity against the effects of natural hazards through education, outreach, and awareness.	Wildfire exposure assessments, provided through Risk MAP, can identify areas prone to wildfire risk. This information can support the process for gaining Firewise interest and can identify communities at highest risk to target outreach towards.		

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

DAYVILLE CITY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
FUNDING AND TECHNICAL ASSISTANCE	Acquire funding for water improvement projects, including: · Increasing the number of fire hydrants within the city north of U.S. Route 26. · Adding and improving existing hydrants to stretch to the north side of the highway.	Goal 1: Protect human welfare, property, and natural resources.	Drought and wildfire risk assessments, provided through Risk MAP, can support mitigation project proritization and provide data to enhance grant applications.		#1
OUTREACH	Improve disaster-related public notifications, including: · Flood awareness recommendations outside of reverse 911. · Installing a reader board near City Hall to inform residents and others driving through the city. · Maintain communication during extended power outages. · Leverage evacuation plans.	Action Item: MH #4 - Develop and implement education and outreach programs to increase public awareness of the risk associated with natural hazards. Specifically target vulnerable populations.	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to natural hazard risk, which can improve communication and outreach efforts.; Existing outreach materials and recommended outreach strategies can be shared.		#2
RISK ASSESSMENT	Requesting updated flood studies that will be leveraged during the upcoming Comprehensive Plan update. Specifics include: · Map undeveloped areas as they are being considered for future development. · Flooding in John Day impacts Dayville. · Most flooding occurs in areas with little population.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	FIRM and FIS report and hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to flooding, which can improve communication, outreach, and support for mitigation and planning efforts.		#3
PROJECT	Build a levee system in low-lying areas on the west side of the city to increase buildable areas. This area has the largest flood concern, but a lower population. The city is looking for a site to develop an industrial park and building a levee could help mitigate flood risk in available sites.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	LiDAR data provided through Risk MAP will improve flood mapping in populated areas and areas with projected population growth. Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to flooding, which can improve communication, and support and prioritize mitigation efforts such as the construction of flood control structures.		#1

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

JOHN DAY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Move the waste water treatment plant out of the SFHA. This $12-14 million project is planned to be completed in 2020-21.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Hazard risk and exposures assessments, provided through Risk MAP, can identify areas prone to flooding and other natural hazards, which can identify mitigation project priorities, inform relocation sites, and support funding applications.		#1
PROJECT	Create a transportation route that connects the bridges in John Day. There are two bridges that are not connected by streets. Both bridges are small and failing.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Hazard risk and exposures assessments, provided through Risk MAP, can identify areas prone to flooding, which can identify mitigation project priorities and funding applications for bridge and road upgrades.		#2
HAZARD MAPPING	Create an updated and usable file incorporating the most recent LiDAR data into the current geohazard overlay.	Action Item: LS #1: Identify, obtain, and evaluate landslide prone areas and develop mitigation strategies to reduce the likelihood of a potential event.	Grants management (CTP or other funding opportunities) and technical support for identified projects. Through the Risk MAP program, FEMA and their State partners can support grants management (CTP or other funding opportunities) and technical support for hazard mapping needs.		#3
PROJECT	Re-engineer, re-construct, and deepen the USACE river channel that is causing a contamination problem and reduce flooding. The goal is to create a community greenway.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Grants management (CTP or other funding opportunities) and technical support for identified projects. Through the Risk MAP program, FEMA and their State partners can support grants management (CTP or other funding opportunities) and technical support for identified mitigation and restoration projects.		#1
PROJECT	Update and replace Bridge Street and Patterson Bridge. Bridge scouring is occurring along Dixie Creek and Canyon Creek. There is a need to add another bridge to service residential areas and provide improved evacuation routes. The city has questions about how, where, and who can help support and fund these mitigation projects.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Hazard risk and exposures assessments, provided through Risk MAP, can identify areas prone to flooding, which can identify mitigation project priorities and funding applications for bridge and road upgrades.		#2

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

JOHN DAY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Remove homes from the Canyon Creek floodplain.	Action Item: FL # 4 – Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	Through Risk MAP, flood risk assessments can inform and support residential buy-out priorities. Furthermore, floodplain restoration projects can be funded through State and Federal grant programs.	Mid-term	#3
PROJECT	Restore the natural function of the river by restructuring the dredge-mined areas by widening a 2-mile stretch, which has a negative impact on habitat and flooding. The goal is to make this public land so that it can be converted to a more natural area.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Through the Risk MAP program, FEMA and their State partners can support grants management (CTP or other funding opportunities) and technical support for identified mitigation and restoration projects.	Long term	#1
PROJECT	Relocate schools near flood hazard areas near Canyon City, including the high school.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Through the Risk MAP program, FEMA and their State partners can support grants management (CTP or other funding opportunities) and technical support for identified mitigation projects. Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to flooding and other natural hazards, which can identify mitigation project priorities and inform relocation sites.	Long term	#2

SHORT TERM (1-3 YEARS)   MID-TERM (3-7 YEARS)   LONG TERM (7+ YEARS)

LONG CREEK | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Obtain broadband to improve cellular service and communication technologies. Improving communication will reduce the risk of isolation during outages.	Goal 4: Strengthen organizational and community capacity.	Through Risk MAP, hazard risk and exposure assessments can be provided and may inform discussions about building out telecommunication capacities.		#1
PLANNING AND TRAINING	Requesting training to support disaster preparedness and response to identify roles and responsibilities for staff and volunteers.	Goal 4: Strengthen organizational and community capacity	Through Risk MAP, tailored FEMA-supported trainings can be delivered, as needed. State trainings may also be available and coordinated through FEMA-supported partnerships.		#2
RISK ASSESSMENTS	Wildfire and Earthquakes: Requesting risk assessments.	Goal 1: Protect human welfare, property, and natural resources	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to wildfire and earthquakes, which can improve communication, and support and prioritize mitigation efforts.		#3
OUTREACH AND TRAINING	Training for city staff to improve risk communications.	Action Item: MH #4 - Develop and implement education and outreach programs to increase public awareness of the risk associated with natural hazards. Specifically target vulnerable populations.	Through Risk MAP, tailored FEMA-supported trainings can be delivered, as needed. State trainings may also be available and coordinated through FEMA-supported partnerships.		#1
PLANNING	Improve coordination and networking between municipalities, non-profits, and stakeholders at all levels of government.	Goal 4: Strengthen organizational and community capacity.	Through Risk MAP, local, State, and Federal partnerships are encouraged and strengthened. FEMA can participate in conversations, as needed, to ensure that cross-agency coordination is achieved.		#2

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

LONG CREEK | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Stock supplies for the local shelter.	Goal 3: Motivate mitigation activity against the effects of natural hazards through education, outreach, and awareness.	Multi-hazard exposure assessments, provided through Risk MAP, can identify areas prone to natural hazard risks. This information can support grant applications and other needs assessments.	●	#3
PROJECT	Update and upgrade EMS and fire supplies for both daily routine activities and disaster events.	Goal 4: Strengthen organizational and community capacity.	Wildfire exposure assessments, provided through Risk MAP, can identify areas prone to wildfire risk. This information can support grant applications and other needs assessments.	●	#2
PROJECT	Upgrade emergency response equipment and retrofit emergency structures.	Goal 4: Strengthen organizational and community capacity.	Multi-hazard exposure assessments, provided through Risk MAP, can identify areas prone to natural hazard risks. This information can support grant applications and other needs assessments.	●	#1

● SHORT TERM (1-3 YEARS) ● MID-TERM (3-7 YEARS) ● LONG TERM (7+ YEARS)

MONUMENT | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Obtain broadband to improve cellular service and communication technologies. Improving communication will reduce the risk of isolation during outages.	Goal 4: Strengthen organizational and community capacity.	Through Risk MAP, hazard risk and exposure assessments can be provided and may inform discussions about building out telecommunication capacities.	Short term	#1
RISK ASSESSMENTS	Landslide: Requesting landslide risk assessments to address the concern of being located within a valley.	Action Item: LS #1 - Identify, obtain, and evaluate detailed risk assessments in landslide prone areas and develop mitigation strategies to reduce the likelihood of a potential hazardous event.	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to landslides, which can improve communication, and support and prioritize mitigation efforts.	Short term	#2
RISK ASSESSMENTS	Multi-Hazard: Requesting multi-hazard risk assessments specific to local infrastructure. Wildfire and flooding hazards were elevated. · One side of town has a fireline (river), but the other is covered in invasive juniper. · Flooding occurs on the North Fork John Day River at the intersection southeast of town. · Floodwaters have occurred within the current mapped SFHA, including flooding near properties on the east side of town. · There is significant seepage. · Ice jams get caught at the bridge to the southeast of town at North Fork John Day River. · The waste water treatment plant and city well are inches from the mapped floodplain.	Goal 1: Protect human welfare, property, and natural resources.	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to wildfire, flooding, landslides, and other hazards, which can improve communication, and support and prioritize mitigation efforts.	Mid-term	#1

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

MONUMENT | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Conduct river restoration and flood mitigation projects to protect vital infrastructure at risk, including the bridge on Highway 402.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Through Risk MAP, hazard risk and exposure assessments can be provided and may inform discussions about building out telecommunication capacities.	Long term	#1
PROJECT	Thin juniper as part of a fuels reduction project.	Goal 1: Protect human welfare, property, and natural resources.	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to wildfire risk, which can improve communication, and support and prioritize wildfire mitigation planning efforts.	Long term	#2

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

PRAIRIE CITY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	The city is obtaining funding to build and expand the wells within the city to provide more water for both consumption and wildfire protection.	Action Item: DR #2 - Increase water efficiency among municipal water users.	Drought exposure assessments, provided through Risk MAP, can identify areas of historic droughts and identify gaps in hazard data. Leveraging the Cooperating Technical Partner (CTP) grants, State, Federal, and Regional partnerships, and other funding/resource opportunities, drought information can be coordinated.		#1
OUTREACH	Requesting outreach support for fuels reduction. Improved efforts are needed to thin juniper and grasses, especially on managed land adjacent to homes. Uninformed residents are not aware of fire fuel properties, and reoccurring fires are misunderstood.	Goal 3: Motivate mitigation activity against the effects of natural hazards through education, outreach, and awareness.	Through Risk MAP, hazard risk and exposure assessments can be provided and can identify areas prone to wildfire risk, which can improve communication and outreach efforts. Existing outreach materials and recommended outreach strategies can be shared.		#2
FUNDING AND PROJECT	New fire trucks are needed to fight wildfires without relying on support from other departments or neighboring communities.	Goal 1: Protect human welfare, property, and natural resources.	Wildfire exposure assessments, provided through Risk MAP, can identify areas prone to wildfire risk. This information can support grant applications and other needs assessments.		#3
PROJECT	All schools in the city need seismic retrofitting. Many still need assessment and project prioritization.	Action Item: EQ #1 - Perform an earthquake risk evaluation in critical buildings not listed in the DOGAMI RVS report.	Through the Risk MAP program, FEMA and their State partners can support grants management (CTP or other funding opportunities) and technical support for identified mitigation projects.		#1
HAZARD MAPPING	Requesting updated flood maps and post-wildfire debris flow analysis, with the following details: • The Oliver Creek basin is burdened by trees and debris. During flash floods, the debris gathers at bridges and culverts. This can also lead to mudflows. • The city would benefit from learning best practices for post-wildfire recovery efforts.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	FIRM and FIS Report; LiDAR data provided through Risk MAP will improve flood mapping in populated areas and areas with projected population growth. Mitigation and technical support can be provided to discuss risk reduction best practices for post-wildfire flooding and debris flow.		#2

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

PRAIRIE CITY | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
PROJECT	Improved vegetation (trees and brush) anchoring and engineering is needed along water ways.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Hazard risk and exposures assessments, provided through Risk MAP, can identify areas prone to flooding, which can identify mitigation project priorities and funding applications.		#3
PROJECT	Upgrade and/or replace the Main Street and Bridge Street bridges on Dixie Creek and the John Day River.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Hazard risk and exposures assessments, provided through Risk MAP, can identify areas prone to flooding, which can identify mitigation project priorities and funding applications for bridge and road upgrades.		#1
PROJECT	Tree thinning is needed in coordination with the Department of Environmental Quality.	Action Item: FL #1 - Explore flood mitigation opportunities for homes and critical facilities subject to flooding.	Hazard risk and exposures assessments, provided through Risk MAP, can identify areas prone to flooding, which can identify mitigation project priorities and funding applications.		#2

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

SENECA | OREGON

COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
FUNDING ASSISTANCE	Funding is needed for river gauges for the Silvies River and Bear Creek where flooding commonly occurs at the confluence at the north end of the city.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	Through Risk MAP, technical support can be provided to support data collection and assessment. Leveraging the Cooperating Technical Partner (CTP) grants, State, Federal, and Regional partnerships, and other funding/resource opportunities and data collection efforts can be coordinated.		#1
HAZARD PLANNING	Requesting an update to the flood maps that would improve existing gaps in the SFHA and increase the understanding of flood risk.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	FIRM and FIS Report; LiDAR data provided through Risk MAP will improve flood mapping in populated areas and areas with projected population growth.		#2
HAZARD MAPPING	Extend LIDAR to cover gaps in Seneca to improve the flood study.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	LiDAR data provided through Risk MAP will improve flood and multi-hazard mapping in populated areas and areas with projected population growth.		
OUTREACH	Improve wildfire outreach to encourage residents to participate in the Firewise program. The city is requesting existing outreach materials.	Goal 3: Motivate mitigation activity against the effects of natural hazards through education, outreach, and awareness.	Through Risk MAP, hazard risk and exposure assessments can be provided and can identify areas prone to wildfire risk, which can improve communication and outreach efforts. Existing outreach materials and recommended outreach strategies can be shared.		#1
TECHNICAL ASSISTANCE	Data on flow and river gauges for the Silvies River and Bear Creek would support mitigation efforts to reduce debris flow and flooding that strands residents.	Action Item: FL # 4 –Update the County and City FEMA Flood Insurance Rate Maps and digitize the updated maps.	Through Risk MAP, technical support can be provided to support data collection and assessment.		#2

SHORT TERM (1-3 YEARS)   MID-TERM (3-7 YEARS)   LONG TERM (7+ YEARS)

SENECA | OREGON

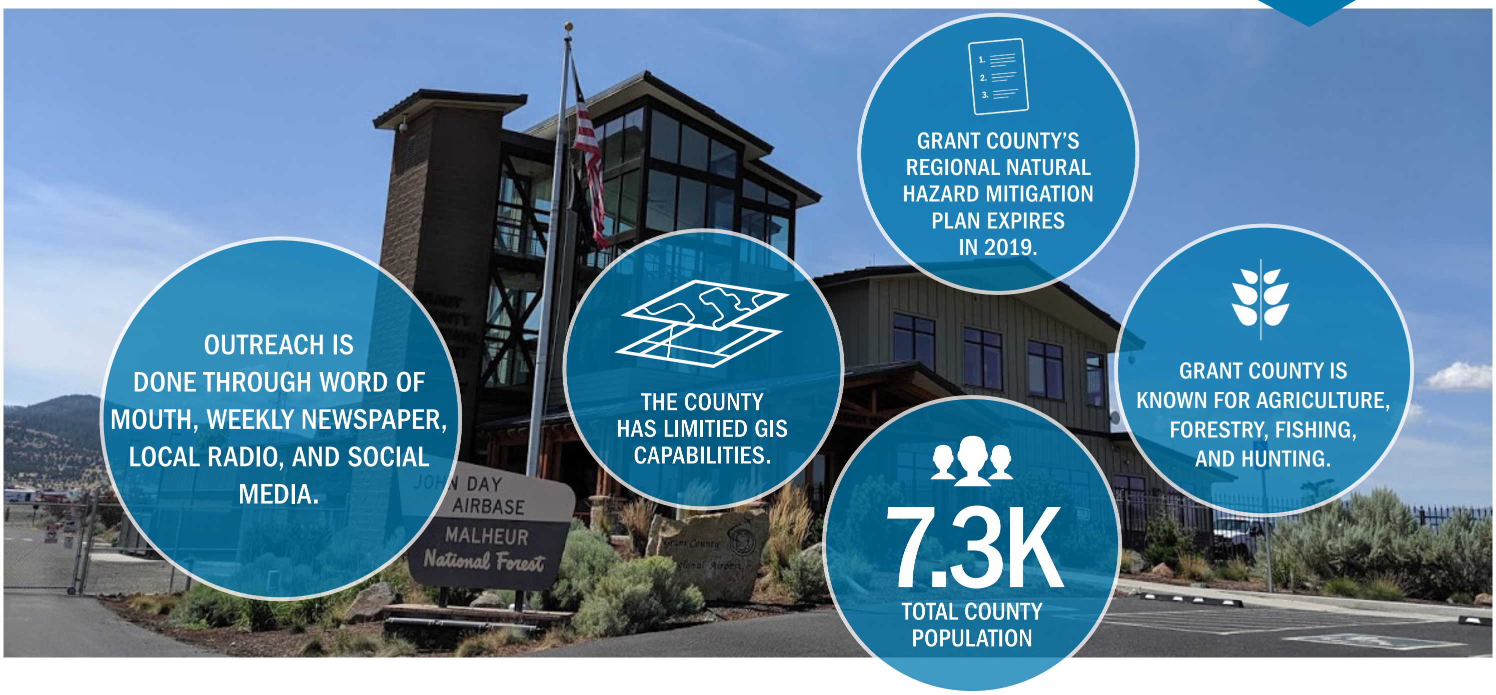
COMMUNITY NEED	RISK REDUCTION INTEREST	2014 NATURAL HAZARD MITIGATION PLAN LINKAGE	RISK MAP SUPPORT	TIMELINE	PRIORITY
RISK ASSESSMENTS	Post-Wildfire Flood: Requesting scenario-based mapping related to post-wildfire flooding.	The 2014 NHMP does not provide mitigation projects for post-wildfire flooding.	Hazard risk and exposure assessments, provided through Risk MAP, can identify areas prone to post-wildfire flooding and debris flows, which can improve communication, and support and prioritize mitigation efforts. Leveraging the Cooperating Technical Partner (CTP) grants, State, Federal, and Regional partnerships, and other funding/resource opportunities, post-wildfire burn information can be coordinated.	Long term	#1

SHORT TERM (1-3 YEARS) MID-TERM (3-7 YEARS) LONG TERM (7+ YEARS)

GRANT COUNTY: COMMUNITY PROFILE

COMMUNITY CHARACTERISTICS

The Grant County community characteristics information was developed to inform the Discovery Meeting and will continue to be used to inform what technical assistance and tools, through Risk MAP, can support the community.



GRANT COUNTY COMMUNITY CHARACTERISTICS

Located in eastern Oregon, Grant County boarders eight other counties and has more than 150,000 acres of federally designated Wilderness Areas. Grant County contains most of the Malheur National Forest and sections of the Wallowa–Whitman, Umatilla, and Ochoco National Forests. The county's public lands play an important role in local job creation, both for the government workers who manage the resources and the private-sector employees who work with forest products and other natural resources. More than 25 percent of the county's workforce is employed by some level of government or public services.

Grant County and the Cities of Canyon City, Dayville, John Day, Long Creek, Monument, Mt. Vernon, Prairie City, and Seneca all participate in the National Flood Insurance Program (NFIP); the Town of Granite does not participate in the NFIP.

The county has minimal GIS capabilities, which limits the amount of hazard risk analysis they can carry out in-house, but the county partners with the Grant County Soil & Water Conservation District. Through this partnership, the county is finalizing a long process of gathering building footprints from site visits, aerial photos, and county building assessor data to map out all county structures.

DATE OF LAST EFFECTIVE FIRM:

1982, REVISED

FEMA & COUNTY TOUCH POINTS

COUNTY CAV: 6/29/1994

COUNTY CAV: N/A

CRS PARTICIPATION AND RATING:

NOT PARTICIPATING

POLICIES IN FORCE (# OF PAID LOSSES):

63 (7)

$51,094 PAID LOSSES

Information gathered from 2017 American Community Survey, April 2019 Community Information System, the 2014 Northeast Oregon Regional Natural Hazards Mitigation Plan, the Greater Eastern Oregon Development Corporation- Comprehensive Economic Development Strategy, and information exchange webinars.

NE OREGON | PAST DISASTERS
(1964 - CURRENT)

2011 WINTER WINDSTORM & TWO FLOODING EVENTS

2009 WILDFIRE

2007 DROUGHT & WILDFIRE

2006 TWO WILDFIRES

2004 DR-1510
SEVERE WINTER STORM(S)

2002 FS-2448
FLAGTAIL WILDFIRE

2002 WILDFIRE & DROUGHT

2001 WILDFIRE

1999 WILDFIRE & DROUGHT

1997 DR-1160
SEVERE WINTER STORM(S), LAND AND MUDSLIDES, FLOODING

1996 FOUR WILDFIRES

1977 EM-3039
DROUGHT

1965
M4.4
EARTHQUAKE

1964 DR-184
HEAVY RAINS AND FLOODING

Landslides have accompanied storms in 1964, 1966, 1982, 1996, and 2005. The fatalities and losses resulting from the 1996 landslide events brought about the passage of Oregon Senate Bill 12, which set site development standards, authorized the mapping of areas subject to rapidly moving landslides, and developed model landslide ordinances (2014 Northeast Oregon Regional HMP).

Although there have been no recent volcanic events in the Northeast Oregon region, the area is active and susceptible to eruptive events, since it is near the volcanic Cascades Range. Volcanoes were considered as a Hazard in the 2014 Northeast Oregon Regional HMP.

= Federally Declared Disaster

= Local emergency declarations, specific to Grant County and Jurisdictions, from the *2014 Northeast Oregon Regional Hazards Mitigation Plan Update**.

*For a complete list of regional hazard events, please reference this document.

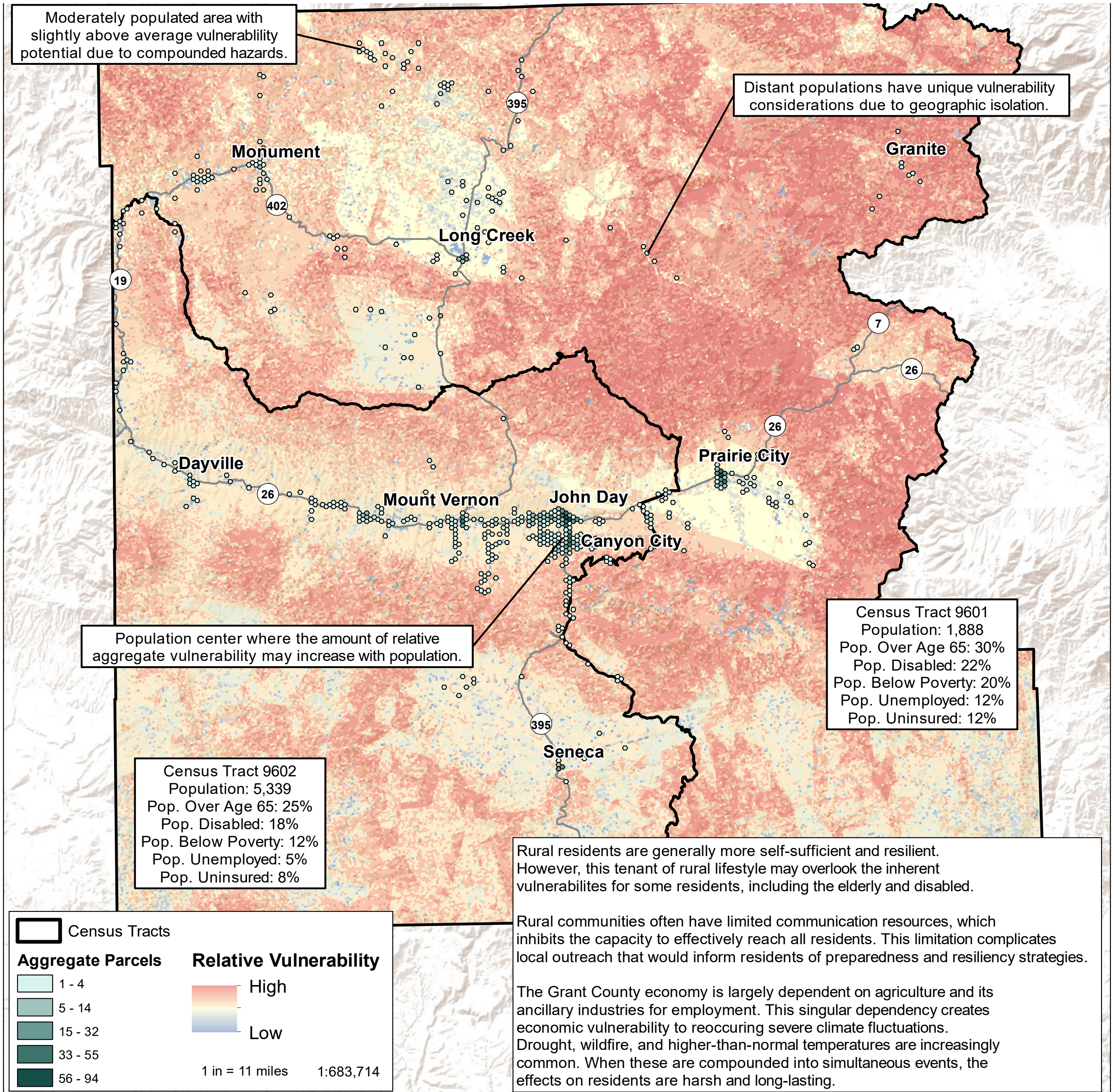
GRANT COUNTY | COMMUNITY DATA

COMMUNITY	POPULATION	FIRM DATES AND STATUS	NFIP	NFIP POLICIES	CRS	FEMA & COMMUNITY FLOOD MAP TOUCH POINTS
CANYON CITY	832	**1987** ORIGINAL	YES	3	NO	**CAV:** 7/1/1989 **CAC:** N/A
DAYVILLE	124	**1984** ALL ZONE A, C, AND X - NO ELEVATION DETERMINED	YES	NONE	NO	N/A
GRANITE	9	NEVER MAPPED	NO	N/A	NO	N/A
JOHN DAY	2,071	**1982** REVISED	YES	36	NO	**CAV:** 6/14/1993 **CAC:** N/A
LONG CREEK	163	**1984** ALL ZONE A, C, AND X - NO ELEVATION DETERMINED	YES	NONE	NO	N/A
MONUMENT	75	**1984** ALL ZONE A, C, AND X - NO ELEVATION DETERMINED	YES	NONE	NO	N/A
MT. VERNON	490	**1987** ORIGINAL	YES	6	NO	**CAV:** 6/14/1993 **CAC:** N/A
PRAIRIE CITY	741	**1988** ORIGINAL	YES	1	NO	**CAV:** 7/1/1989 **CAC:** N/A
SENECA	222	**1984** ALL ZONE A, C, AND X - NO ELEVATION DETERMINED	YES	NONE	NO	N/A
GRANT COUNTY (UNINCORPORATED)	2,482	**1982** REVISED	YES	20	NO	**CAV:** 6/29/1994 **CAC:** N/A

NOTE: Information gathered from 2017 American Community Survey and April 2019 Community Information System. CRS= Community Rating System, CAV=Community Assistance Visits, CAC=Community Assistance Contacts. FEMA uses the CAV and CAC process to stay connected with communities about their flood maps.

GRANT COUNTY SOCIOECONOMIC

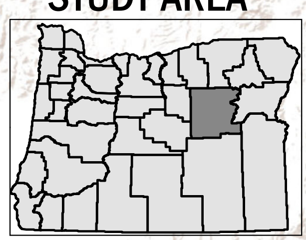
Socioeconomic factors can significantly affect the community's susceptibility to loss. Understanding these influences can help communities allocate resources effectively and equitably to their more vulnerable populations.



This map depicts human vulnerability to natural hazards including: wildfire, flood, and earthquake. The socioeconomic variables used here consist of 15 unique US Census-derived metrics. Hazard and socioeconomic numeric risk variables are combined to return location-specific sensitivity to natural hazards. Human sensitivity to hazards is based on pre-hazard socioeconomic conditions that are exacerbated during and after an event.

Sources: CDC, BLM, NOAA, USACE, USGS, USFS

STUDY AREA



GRANT COUNTY | COMMUNITY CONCERNS

INFORMATION EXCHANGE OUTCOMES

In July and early August 2019, Grant County and the Cities of Dayville, John Day, Long Creek, Mount Vernon, Monument, Prairie City, and Seneca participated in Pre-Discovery Information Exchange Webinars. During the sessions, each community was asked to discuss its hazard concerns and identify top-priority hazards. Below is a summary of that discussion. Hazards that were referenced overlap with those identified in the community's Natural Hazard Mitigation Plan (NHMP). These hazards will remain the focus of future Risk MAP projects.

GRANT COUNTY'S TOP HAZARDS AND DISCUSSION NOTES

WILDFIRE

- The Canyon Creek Complex Fire in 2015 had a major impact throughout Grant County.
- Communities are acutely aware of the risk; many maintain defensible space, encourage metal roofs, and participate in Firewise.
- 70 percent of lands in the county are federally owned, which limits development and the county's ability to mitigate wildfire risk.
- The county is currently updating and revising their Community Wildfire Protection Plan.
- Air quality is a major concern for some aging communities.

FLOOD

- The county believes that updates to the flood maps are needed – updated maps would capture changes resulting from stream-hardening projects, updated bridges, and on-going mitigation efforts.
- Each community is at the confluence of the John Day River and a different creek – every city experiences flooding.
- Communities are interested in investment in mitigation to reduce the risk up-front, as opposed to paying for it later.
- Flooding is accompanied by debris flow and blockages; debris collection at bridges is a major concern for many communities.
- The cities of Seneca, John Day, and Canyon City have seen recent impacts from floods; flooding occurs frequently between the city of John Day and Canyon City.

SEVERE WEATHER

- Cold weather and winter storms are a way of life; residents are generally prepared for extreme weather.
- Tourism brings people unfamiliar with the extreme environmental conditions to the county, and many people get stuck or lost on remote access roads.
- Cities have the potential to become isolated during winter storm events.

DROUGHT

- Droughts heavily affects agricultural production throughout the county.
- Many communities have installed an extra storage reservoirs or wells to mitigate the impacts of drought.

EARTHQUAKE

- There is no concern about direct impacts, but the communities would like to be better prepared for the aftermath of a Cascadia event and influx of people.
- Mount Vernon would like additional data regarding a fault on Birch Creek and Strawberry Mountain.

GRANT COUNTY | LOCAL OUTREACH

INFORMATION EXCHANGE OUTCOMES

During the discussion of the community's top-priority hazards, ongoing and completed outreach efforts were highlighted. Each outreach effort below supports the continued focus on increasing the public's awareness of hazard risk. Additionally, through conversations, the community expressed interest in Risk MAP products and services.

COMMUNITY OUTREACH EFFORTS

Communication about hazard mitigation and personal preparedness is largely driven by word of mouth, throughout Grant County and its cities. Phone trees and localized phone lists are utilized often throughout the region; this is especially true following local hazard events. In the area, there is a high expectation for self-preparedness and self-sufficiency due to the rural nature of the communities.

Locals receive information most often from the weekly newspaper, local radio, and social media. However, access to the internet can be limited in rural areas of the county. Utility mailers, community fliers, newsletters, townhall meeting, and local bulletin boards are also used by local staff. Grant County operates a reverse-911 system and manages a website with relevant resources; the City of Seneca operates a website; both Prairie City and Mount Vernon are in the process of developing online sites.

Most communities shared that they would be interested in improving outreach to residents, especially to address long-term residents who are hesitant to adapt to changing risk. Most communities also shared that locals tend to be more reactive than proactive when it comes to mitigating risk.

GRANT COUNTY | MITIGATION PLANNING

BENEFITS OF RISK MAP THAT SUPPORT HAZARD MITIGATION PLANNING

Mitigation is most effective when it is based on a comprehensive, long-term plan that is developed before a disaster occurs. A FEMA-approved NHMP is a requirement for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects such as infrastructure retrofits, purchasing generators, property buy-outs, and the development of NHMPs and other planning mechanisms that integrate hazard mitigation information.

Trainings and technical assistance are available through Risk MAP and can support your planning efforts. These resources are intended to help build risk awareness and increase a community's ability to communicate risk.

HAZARD MITIGATION PLAN DETAILS

PLAN STATUS:
The current Northeast Oregon Regional NHMP expired June 5, 2019.

PARTICIPATING JURISDICTIONS:
The 2014 plan included Grant County, the cities of John Day, Prairie City and Canyon City, along with Baker, Union, and Wallowa counties.

LOCAL PLANNING TEAM:
The planning committee included the Grant County Judge; Grant County Community Wildfire Protection Plan Coordinator; Grant County Regional Airport; Grant County Road Department; Grant County Planning Department; representatives from Canyon City; John Day, and Prairie City; and State and Federal partners.

MITIGATION OBJECTIVES | FOUND IN THE HAZARD MITIGATION PLAN, UNLESS OTHERWISE NOTED

- Advocate for the implementation of the actions identified in each county's Community Wildfire Protection Plan (Grant County).
- Complete a road hazard assessment to address existing road situations which could result in problems for evacuating residents and limit fire apparatus response during a wildfire (Canyon City, 2017 Addendum).

- Explore the costs and benefits for participation in the NFIP's Community Rating System (Grant County).
- Explore mitigation opportunities for the Canyon City Bridge (Grant County).
- Pursue Inland Avenue property acquisition (Canyon City, 2017 Addendum).

- Develop community drought emergency plans and policies (John Day).

- Seismically retrofit the John Day Fire Department to reduce the building's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options (John Day).
- Perform an earthquake risk evaluation in critical buildings not listed in the DOGAMI RVS report (Grant County).

COMPLETED MITIGATION ACTIONS

- Prairie City removed debris from bridges along the John Day River to reduce the risk of flooding.
- Seneca maintains a bulldozed fire line around town to increase defensible space and reduce the risk of wildfire.
- Long Creek Fire Department is rewriting their Standard Operating Procedures to focus on embers related to wildfires.
- John Day is in the process of moving the local Wastewater Treatment Plant out of the SFHA – to be completed in 2020-2021.
- Pine Creek, Middle Fork, Ritter, and Upper Laycock Creek Road are all participating in ongoing Firsewise projects.

GRANT COUNTY | RISK MAP PROCESS

Discovery Meeting: September 13, 2019

Discovery provides an opportunity for communities to share their local risk knowledge with FEMA and identify opportunities for future work. This could include public outreach support, trainings, technical assistance, grant assistance, and hazard mapping.

If the data and research collected during the Discovery phase supports the need for a flood map update and regulatory products, a recommended scope of work is developed for stream reaches requiring studies. The following timeline shows the steps of that process.

RISK MAP PHASE	WHAT TO EXPECT
Data Development	If a flood mapping update project is initiated, FEMA and its partners move forward with preparing the data, maps, and Flood Risk Products. Tasks included in the data development process include gathering information required for hydraulic and hydrologic modeling, ground truthing, and conducting engineering studies.
Data Communication: Flood Risk Review	FEMA, State, and local officials meet to validate mapping data and supporting research, which helps identify areas prone to flooding and provides spatial orientation to project planners.
Issue Preliminary Map	FEMA issues preliminary maps and Flood Insurance Study (FIS) reports for community officials to review.
Data Communication: Consultation Coordination Officer Meeting (CCO)	Preliminary maps are reviewed with community officials at the CCO Meeting. The comment and appeal process is also explained.
Facilitate Public Comment and Appeal Period	Preliminary maps and the comments and appeals process are shared with community residents and business owners during a FEMA-supported Public Meeting or Open House. Communities have 90 days to submit comments and/or appeals. Comments and/or appeals are reviewed, and flood maps may be updated appropriately.
Issue Letter of Final Determination	Once a flood map is finalized, it is adopted by the community. A 6-month adoption period begins to allow communities time to adopt adequate floodplain management ordinances based on the new flood map.
Issue Flood Map	Community leaders monitor and track local developments. Letters of Map Revision (LOMRs) are required within 6 months of project completion for projects that change the flood hazards in a specific area.

Separate from regulatory flood products, FEMA can also support and provide multi-hazard risk products, detailed on the next page. The data and resources provided can support the identification of areas most vulnerable to hazards and inform safer and more resilient development. Throughout the Risk MAP process, communities can be connected to funding opportunities and partnerships that can support mitigation and risk reduction projects. This information often is shared during in-person Resilience Workshops that bring together local, State, and Federal partners.

GRANT COUNTY | RISK MAP PRODUCTS

FEMA and their partners can also develop a suite of multi-hazard products to help your community identify and assess risk from other types of natural hazards to support your local mitigation efforts and future land-use planning decisions.

RISK MAP PRODUCT	WHAT IS IT?	HOW IS IT USED?
MULTI-HAZARD RISK DATABASE AND MAP PACKAGE	The ArcGIS multi-hazard risk database and map package contain spatial data, including outputs from the risk assessment and the various hazard datasets used for the assessment.	By compiling available natural hazard data and quantifying the risk to those natural hazards using community assessor data, this dataset can identify local risk to hazards for each structure in a community. This information can be used for grant applications, local planning and emergency management efforts, identifying vulnerable populations, and communicating risk to various audiences.
MULTI-HAZARD RISK REPORT	Provides a written summary and analysis of the multi-hazard risk database and map package. The report includes recommended mitigation planning strategies and highlights potential areas for mitigation projects and/or risk reduction actions.	The information provided in the risk report can identify vulnerable areas, enhance planning efforts, and improve risk communication and outreach to the public.
MULTI-HAZARD STORY MAP	Leveraging the multi-hazard risk analysis, this product shows where communities are vulnerable to hazards using online interactive maps and shares helpful mitigation planning strategies or other risk reduction recommendations. Links to the risk database, risk report, and other helpful resources are also included.	This product is intended for an audience that is less familiar with GIS analysis and can be easily shared with a wide range of audiences. Officials can use the story map to identify vulnerable areas, enhance planning efforts, and improve risk communication and outreach to the public.
FLOOD DEPTH AND ANALYSIS GRID	Communicates detailed information about the depth and velocity of floodwaters, as well as the probability of an area being flooded over time.	Officials can use depth grids to show individuals the depth of flooding structures might experience at different flood frequencies.
CHANGES SINCE LAST FIRM	Highlights how the new or updated FIRMs differ from the previous maps to help communities understand the changes and prepare for adoption of new maps.	Communities can use this to engage residents and businesses about their changing risk and the implications for flood insurance.
FLOOD & EARTHQUAKE HAZUS RISK ASSESSMENT	Focuses on damage that results from various flood and earthquake scenarios. Communicates the densities of social and structural vulnerabilities as well as economic risks.	Communities can use this information to identify and support mitigation strategies and understand how to position resources and messaging to vulnerable populations, in advance of a disaster.
EXPOSURE RISK ASSESSMENT	Identifies areas and structures that would be affected by natural hazards. Applicable to all natural hazards.	Provides an opportunity for officials to prioritize mitigation actions in areas exposed to natural hazards.

GRANT COUNTY | OREGON

COMMUNITY REQUESTS AND NEXT STEPS

Summarized below are the requests that were captured during both the Information Exchanges and Discovery Meeting that can be supported through Risk MAP.

COMMUNITY REQUESTS

- **MULTI-HAZARD OUTREACH MATERIALS:** Multi-hazard outreach materials can be provided through Risk MAP and tailored to specific communities and needs.
- **LIDAR COLLECTION:** LiDAR is planned to be flown throughout the Grant County project area. LiDAR data can support and enhance flood mapping, multi-hazard risk assessments, grant applications, project prioritization, and multiple local planning efforts.
  For more information, visit: https://www.oregongeology.org/lidar/
- **TECHNICAL ASSISTANCE AND PLANNING:** The Risk MAP program can provide support for hazard mitigation efforts. This can include, but is not limited to, support for public engagement, sharing best practices, advocating hazard and response-related plans to elected officials, and linking hazard mitigation to other local planning efforts.
- **TRAININGS:** Through Risk MAP, inter-agency relationships are strengthened. As a participating community, trainings can be provided through Federal and State agencies for local staff and elected officials.

CONCLUSION

We are all passionate about helping communities understand their risks and develop plans to mitigate those risks. Whether flood, earthquake, wildfire, or other natural hazards, these risks can have a significant impact on the people, property, and resources in our communities. So far, the Information Exchanges and Discovery Meeting have captured your effective, completed, and ongoing efforts to reduce risk to natural hazards. By participating in the Risk MAP process, you are accessing additional tools and resources to support these existing efforts and prioritized mitigation actions.

NEXT STEPS

- LiDAR collection is planned to be completed in 2020.
- FEMA will reach out to you to discuss next steps and scoping efforts as this project moves forward.
- Keep an eye out for quarterly reports that will be emailed as updates become available.

QUESTIONS

If you have any questions, please contact the FEMA Region X Oregon State Engineer, David Ratte.
David.Ratte@fema.dhs.gov | (425) 487-4657

GRANT COUNTY | OREGON

LOCAL PARTICIPATION

The Grant County Information Exchange webinars were held in July and August 2019 with Grant County and the cities of Dayville, John Day, Long Creek, Monument, Mount Vernon, Prairie City, and Seneca.

Staff from Grant County and the cities of Dayville, John Day, Long Creek, Monument, Prairie City, and Seneca attended the in-person Grant County Discovery Meeting on September 13, 2019.

DISCOVERY MEETING LOCATION: Grant County Airport, John Day, OR

COMMUNITY	NAME	TITLE	INFORMATION EXCHANGE WEBINAR	IN-PERSON DISCOVERY MEETING
GRANT COUNTY	DAVE DOBLER	SAR Coordinator	X	
	IRENE JEROME	CWPP Planning Director	X	
	HILLARY MCNARY	Planning Department Director	X	X
	SHANNON SPRINGER	Planning Dept. Assistant Director	X	X
	KYLE SULLIVAN	Soil and Water Conservation District Manager	X	
	BRET UPTMOR	Grant School District Superintendent		X
	TED WILLIAMS	Emergency Manager		X
	HAYLEY WALKER	Airport Manager	X	
	MARK WEBB	Blue Mountains Forest Partners Executive Director		X
DAYVILLE	DAVID HAND	Maintenance Lead	X	X
	VALLI HETTINGA	City Councilor	X	X
JOHN DAY	NICK GREEN	City Manager	X	X
	MONTE LEGG	Public Works Director	X	
LONG CREEK	JENNIFER GARINGER	School Administrator	X	X
	KRISTIAN THORNTON	North Fork John Day Watershed Council	X	X
	MARSIE WATSON	City Recorder	X	X

GRANT COUNTY | OREGON

LOCAL PARTICIPATION

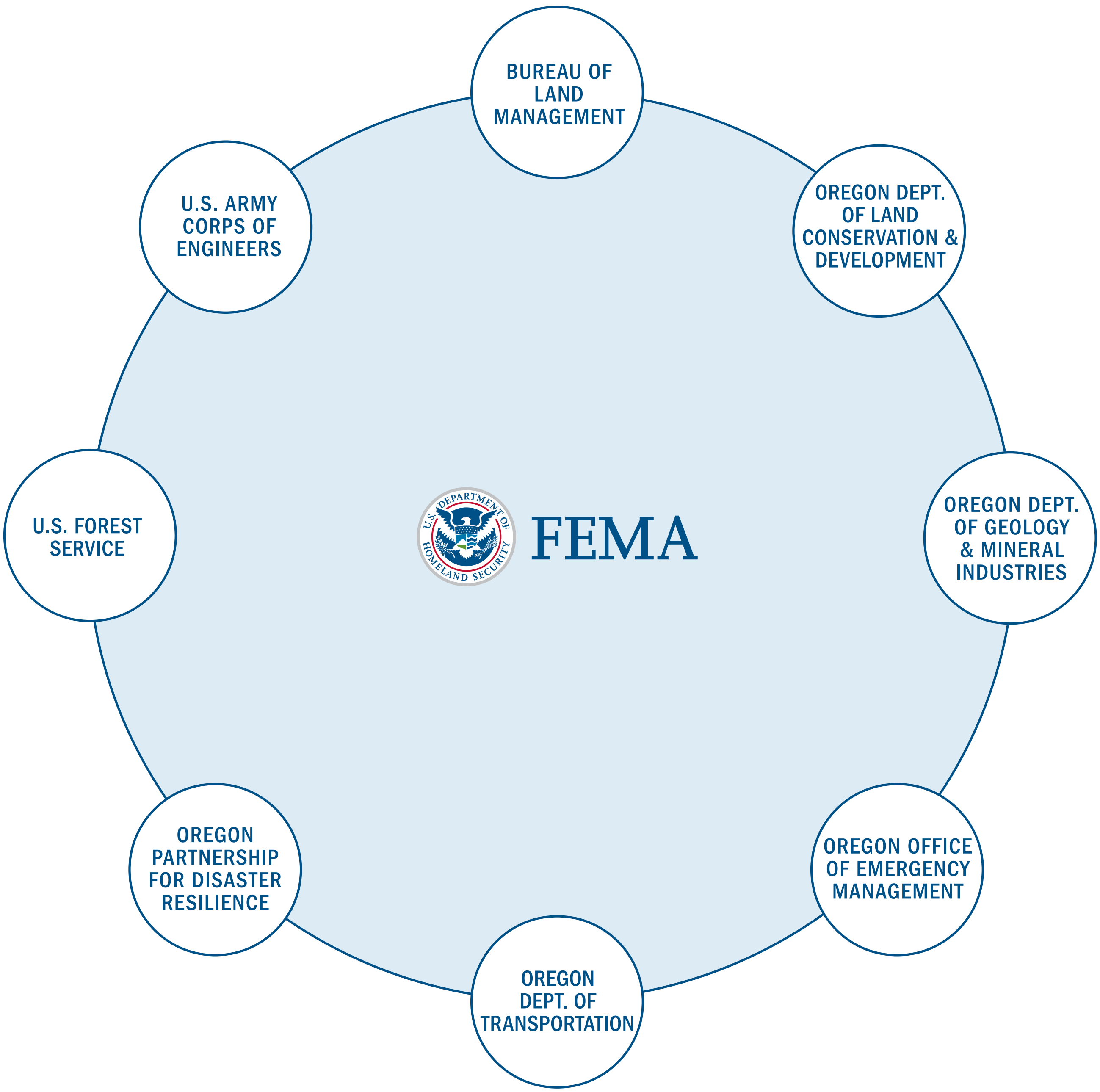
COMMUNITY	NAME	TITLE	INFORMATION EXCHANGE WEBINAR	IN-PERSON DISCOVERY MEETING
MONUMENT	DORTHY JORDAN	City Recorder	X	X
MOUNT VERNON	KENNY DELANO	Mayor	X	
	TAMI KOWING	City Recorder	X	
PRAIRIE CITY	CHRIS CAMARENA	Public Works Director	X	X
	BOBBIE BROWN	City Recorder	X	
	JIM HAMSHER	Mayor	X	
	MARVIN RYEARSON	Fire Chief		X
SENECA	RAAMIN BURRELL	City Manager	X	X

FEDERAL AND STATE PARTNERS

FEDERAL AND STATE CONTACTS

FEMA's Risk MAP effort is supported by multiple State and Federal agencies that are available as data and assistance resources throughout this process. These partnerships exist to better develop hazard planning and technical assistance support and to strengthen the quality and accuracy of any FEMA developed product. The current Grant County project partners are listed below.

PARTNERS



FEDERAL AND STATE PARTNERS

FEDERAL AND STATE CONTACT INFORMATION

YOUR PRIMARY RISK MAP CONTACT	DAVID RATTE FEMA Region X	Engineer Lead	David.Ratte@fema.dhs.gov

AGENCY	NAME	TITLE	EMAIL
FEMA	JAKE GRABOWSKY	Hazard Mitigation Community Planner	James.Grabowsky@fema.dhs.gov
	RYNN LAMB	Risk Analyst	Rynn,Lamb@fema.dhs.gov
	ROXANNE PILKENTON	Floodplain Management Specialist	Roxanne.Reale-Pilkenton@fema.dhs.gov
	WENDY SHAW	Regional Engineer	Wendy.Shaw@fema.dhs.gov
DOGAMI	CHRISTINA APPLEBY	GIS & Remote Sensing	Christina.Appleby@oregon.gov
	MATT WILLIAMS	Geohazards Analyst	Matt.Williams@oregon.gov
DLCD	CELINDA ADAIR	State NFIP Coordinator	Cadair@dlcd.state.or.us
OEM	AMIE BASHANT	State Hazard Mitigation Officer	Amie.E.Bashant@mil.state.or.us
STRATEGIC ALLIANCE FOR RISK REDUCTION II	KATIE DOPIERALA	Project Manager	Katie.Dopierala@atkinsglobal.com
RESILIENCE ACTION PARTNERS	CHELSEA KAHN	Community Engagement and Risk Communication	Chelsea.Kahn@mbakerintl.com

Appendix I: FEMA Approval Letter, Review Tool and Local Resolutions of Adoption

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021-8627

FEMA

October 6, 2020

The Honorable Scott W. Meyers
County Judge, Grant County, OR
201 S. Humbolt Street
Suite 280
Canyon City, Oregon 97820

Dear Judge Meyers:

On September 3, 2020, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Grant County Multi-Jurisdictional Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through September 2, 2025, through your state.

Grant County	Grant County Education Service District
City of John Day	Grant Soil and Water Conservation District

The updated list of approved jurisdictions includes the Grant Soil and Water Conservation District and Grant County Education Service District that recently adopted the Grant County Multi-Jurisdictional Hazard Mitigation Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval, please contact Joseph Murray, State Hazard Mitigation Planner with the Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities. If you have questions regarding FEMA's mitigation grant programs, please contact Amie Bashant, State Hazard Mitigation Officer with the Oregon Military Department, Office of Emergency Management, at 503-378-4660.

Sincerely,

Kristen Meyers, Director
Mitigation Division

cc: Amie Bashant, Oregon Office of Emergency Management

Enclosure

JS:vl/cf

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Grant County, Oregon	**Title of Plan:** Grant County, Oregon Multi-Jurisdictional Natural Hazards Mitigation Plan	**Date of Plan:** May 2020

Local Point of Contact: Katherine Daniel	**Address:** 635 Capitol Street NE, Suite 150 Salem, OR 97301-2540
Title: Hazard Mitigation Planner	
Agency: Oregon Department of Land Conservation and Development	
Phone Number: 503-934-0010	**E-Mail:** Katherine.daniel@state.or.us

State Reviewer:	**Title:**	**Date:**

FEMA Reviewer:	**Title:**	**Date:**
Claire Fetters Josh Vidmar John Schelling John.Schelling@fema.dhs.gov	CERC Planner CERC Planner Hazard Mitigation Planning Manager	06/05/2020 06/24/2020 06/30/2020
Date Received in FEMA Region ***(insert #)***	06/01/2020	
Plan Not Approved		
Plan Approvable Pending Adoption	06/30/2020	
Plan Approved	09/03/2020	

SECTION 1:
MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

MULTI-JURISDICTION SUMMARY SHEET													
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)						
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
1	Grant County	County	Ted Williams				Y	Y	Y	Y		
2	John Day	City	Nicholas Green				Y	Y	Y	Y		
3	Grant Soil and Water Conservation District	Special District	Jason Kehrberg				Y	Y	Y	Y		
4	Grant County Education Service District	Special District	Robert Waltenburg				Y	Y	Y	Y		

SECTION 2:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section I, pp. 3-5; App. B, pp. 2-27; App. H, pp. 4-34	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section I, p. 4; App. B, pp. 3-26	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section I, p. 4; App. B, p. 3, 27-42	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section I, pp. 4-5	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section IV, pp. 84-85	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section IV, pp. 81-86	X	
<u>**ELEMENT A: REQUIRED REVISIONS**</u>			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)	**Met**	**Not Met**
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section II, pp. 13-58; Volume II, pp. 3-41; App. G, pp. 6-71	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section II, pp. 13-58; Volume II, pp. 3-41; App. D, pp. 5-42; App. G, pp. 6-71	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section II, pp. 15-58; Volume II, pp. 3-41; App. D, pp. 5-42 App. G, pp. 6-71	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section II, p. 42 Volume II, p. 6	X	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section III, pp. 73-78; Section IV, pp. 80-81	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section II, p. 42; Section III, pp. 67-69	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section III, p. 59	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section III, pp. 63-72; App. C, pp. 1-37	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section III, pp. 61-62, 79; App. E, pp. 1-8; App. F, pp. 1-5	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section III, p. 73; Section IV, p. 83	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)	**Met**	**Not Met**
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section II, pp. 43-44; App. A, pp. 13-19, 22-24	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section III, p. 61; App. B, p. 44; App. C, pp. 1-16	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	App. B, pp. 43-45	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))		X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))		X	
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 3:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths

- The worksheet created to evaluate the plan is an extremely well-thought out tool.
- There was a thorough presentation of the efforts made to alert and involve public and private stakeholders as well as the public.

Opportunities for Improvement

- The amount of information found in the appendices for the planning process should be included in the basic plan. Be sure to continue to place sign-in sheets, newspaper articles, etc. in the appendix, but all relevant information should be in found in the basic plan.

Element B: Hazard Identification and Risk Assessment

Plan Strengths

- Utilizing information, data, and maps from other plans and reports to support vulnerability analyses and hazard profiles was a best-practice method.
- The clear identification of hazards that have occurred since the previous plan was uniform throughout each hazard profile.

Opportunities for Improvement

- The separation of the more in-depth hazard risk assessments from the basic plan was unnecessary. Include the wildfire, flood, drought, and landslide annexes in the plan.
- While the hazards that did not have as critical assessments completed were not deemed as big of threat, they were included in the mitigation plan. Provide the same high-level analysis for all hazards included in the plan.
- The RiskMAP report could have been incorporated into the plan as it is an extremely strong document to reference and incorporate into the flooding hazard profile.

Element C: Mitigation Strategy

Plan Strengths

- All high-priority mitigation actions had dedicated worksheets that provided further information.
- The mitigation plan identified the planning area's regulatory, technical, financial, and administrative capabilities.

Opportunities for Improvement

- Identify funding sources and estimated costs for each mitigation action.
- Although there were actions that seek to integrate the plan into other planning mechanisms, be sure to clearly identify what aspects of the mitigation plan will be referenced in each planning tool.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths

- A thorough discussion of land development and future trends was presented in the plan.
- It was clear how the steering committee suggested changes to be made and how the mitigation efforts have been completed since the previous plan.

Opportunities for Improvement

- Consider permitting the public to submit comments regarding the plan electronically even if the plan is not in the process of being updated.

B. Resources for Implementing Your Approved Plan

FEMA **Mitigation Planning and the Community Rating System** Key Topics Bulletin supports communities who participate in the National Flood Insurance Program's CRS Program, or who would like to, and updating a Natural Hazard Mitigation Plan. You can reach this information at https://www.fema.gov/media-library/assets/documents/171290.

The **Region 10 Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it in the FEMA Library at http://www.fema.gov/media-library/assets/documents/89725.

The **Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials** resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns. It includes recommended steps and tools to assist with local integration efforts, along with ideas for overcoming possible impediments, and presents a series of case studies to demonstrate successful integration in practice. You can find it in the FEMA Library at http://www.fema.gov/library/viewRecord.do?id=7130.

The **Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. You can find it in the FEMA Library at http://www.fema.gov/library/viewRecord.do?id=6938.

The **Local Mitigation Planning Handbook** provides guidance to local governments on developing or updating hazard mitigation plans to meet and go above the requirements. You can find it in the FEMA Library at http://www.fema.gov/library/viewRecord.do?id=7209.

The **Integration Hazard Mitigation and Climate Adaptation Planning: Case Studies and Lessons Learned** resource is a 2014 ICLEI publication for San Diego with a clear methodology that could assist in next steps for integration impacts of climate change throughout mitigation actions. http://icleiusa.org/wp-content/uploads/2015/08/Integrating-Hazard-Mitigation-and-Climate-Adaptation-Planning.pdf

The **Local Mitigation Plan Review Guide and Tool** resource is available through FEMA's Library and should be referred to for the next plan update. http://www.fema.gov/library/viewRecord.do?id=4859

The **Tribal Multi-Hazard Mitigation Planning Guidance:** This resource is specific to tribal governments developing or updating tribal mitigation plans. It covers all aspects of tribal planning requirements and the steps to developing tribal mitigation plans. You can find the document in the FEMA Library at http://www.fema.gov/media-library/assets/documents/18355

Volcanic Eruption Mitigation Measures: For information on Mitigation Actions for Volcanic Eruptions that would satisfy the C4 requirement, please visit: http://earthzine.org/2011/03/21/volcanic-crisis-management-and-mitigation-strategies-a-multi-risk-framework-case-study/ and http://www.gvess.org/publ.html.

The FEMA Region 10 **Risk Mapping, Analysis, and Planning program (Risk MAP)** releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region. Past newsletters can be viewed at http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/Pages/default.aspx. If you would like to receive future newsletters, email rxnewsletter@starr-team.com and ask to be included.

The mitigation strategy may include eligible projects to be funded through FEMA's hazard mitigation grant programs (Pre-Disaster Mitigation, Hazard Mitigation Grant Program, and Flood Mitigation Assistance). Contact your State Hazard Mitigation Officer, Amie Bashant at amie.bashant@mil.state.or.us, for more information.

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RECEIVED AND FILE

AUG 04 2020

BRENDA PERCY COUNTY CLEF
By [signature]

IN THE COUNTY COURT OF THE STATE OF OREGON

IN AND FOR THE COUNTY OF GRANT

IN THE MATTER OF ADOPTING GRANT COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN) RESOLUTION NO. 20-23

THIS BEING THE 22nd day of July, 2020, and a day set aside for a regular meeting of the Grant County Court and there being present Scott W. Myers, County Judge, Jim Hamsher, County Commissioner, and Sam Palmer, County Commissioner,

A Resolution Adopting the Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS Grant County recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

WHEARAS undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

WHEARAS an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEARAS Grant County has fully participated in the FEMA prescribed mitigation planning process to prepare the *Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan*, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEARAS Grant County has identified natural hazard risks and prioritized several proposed actions and programs needed to mitigate the vulnerabilities of Grant County to the impacts of future disasters within the *Grant County Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

WHEARAS these proposed projects and programs have been incorporated into the *Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan* that has been prepared and promulgated for consideration and implementation by Grant County.

WHEARAS the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Grant County, Multi-Jurisdictional Natural Hazards Mitigation Plan* and pre-approved it (dated: June 30, 2020) contingent upon this official adoption of the participating governments and entities;

WHEARAS me II – Hazard Annexes, Volume III – Resources; and

WHEARAS the NHMP is in an on-going cycle of development and revision to improve its effectiveness; and

WHEARAS Grant County adopts the NHMP and directs the Grant County Emergency Management to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

NOW THEREFORE BE IT RESOLVED Grant County Court adopts *the Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

BE IT FURTHER RESOLVED the Grant County Court will submit this Adoption Resolution to the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

Adopted this 22nd day of July, 2020

DONE AND DATED THIS 22nd day of July, 2020.

Scott W. Myers

Scott W. Myers, County Judge

RESOLUTION NO. 20-841-14

A RESOLUTION ADOPTING THE 2020 GRANT COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

WHEREAS, natural hazards threaten life, businesses, property, and environmental systems in the City of John Day and throughout Grant County.

WHEREAS, an understanding of the nature, extent, and potential impacts of natural hazards is the foundation for developing strategies to reduce or eliminate those impacts.

WHEREAS, it is in the interest of Grant County and the cities and special districts located therein to undertake natural hazards mitigation planning and implementation together as coordinated planning strengthens communities and better serves all.

WHEREAS, the City of John Day has fully participated in the FEMA prescribed mitigation planning process to prepare the Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEREAS, the NHMP has identified natural hazard risks and prioritized several proposed actions and programs needed to mitigate the vulnerabilities of the City of John Day to the impacts of future disasters.

WHEREAS, having a natural hazards mitigation plan developed in accordance with the Disaster Mitigation Act of 2000 and approved by FEMA is a prerequisite for local government eligibility for certain federal pre- and post-disaster mitigation funds.

WHEREAS, as a result of coordinated planning, the 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan is an integrated plan, without an individual addendum for each participating jurisdiction but with the necessary information for each.

WHEREAS, the NHMP is in an on-going cycle of development and revision to improve its effectiveness; and

WHEREAS, adoption of the updated 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan demonstrates the City of John Day's commitment to reducing or eliminating the potential impacts of natural hazards and to achieving the Plan's goals.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY OF JOHN DAY:

Section 1. The City of John Day City Council hereby adopts the recitals above in support of this resolution.

Section 2. The City of John Day City Council hereby adopts the Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan.

DATED this 28th day of July, 2020.

Ron Lundbom, Mayor

ATTEST:

Nicholas Green, City Manager

RESOLUTION

A RESOLUTION ADOPTING THE 2020 GRANT COUNTY MUTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

WHEREAS, natural hazards threaten life, businesses, property, and environmental systems throughout Grant County.

WHEREAS, an understanding of the nature, extent, and potential impacts of natural hazards is the foundation for developing strategies to reduce or eliminate those impacts.

WHEREAS, it is in the interest of Grant County and the cities and special districts located therein to undertake natural hazards mitigation planning and implementation together as coordinated planning strengthens communities and better serves all.

WHEREAS, Grant Soil and Water Conservation District has participated in the FEMA prescribed mitigation planning process to prepare the 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan.

WHEREAS, as a result of coordinated planning, the 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan is an integrated plan, without an individual addendum for each participating jurisdiction but with the necessary information for each.

WHEREAS, adoption is required for FEMA approval of the 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan and subsequent eligibility for certain federal pre- and post-disaster mitigation funds.

WHEREAS, adoption of the 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan demonstrates Grant Soil and Water Conservation District's commitment to reducing or eliminating the potential impacts of natural hazards and to achieving the Plan's goals.

NOW, THEREFORE, BE IT RESOLVED BY THE GRANT SOIL AND WATER CONSERVATION DISTRICT:

Section 1. The Grant Soil and Water Conservation District Board of Directors hereby adopts the recitals above in support of this resolution.

Section 2. The Grant Soil and Water Conservation District Board of Directors hereby adopts the 2020 Grant County Multi-Jurisdictional Natural Hazards Mitigation Plan.

DATED this 3rd day of September, 2020.

Patrick Voigt

Patrick Voigt, Board Chairman

ATTEST:

Kyle S. Sullivan

Kyle S. Sullivan, District Manager

GRANT COUNTY EDUCATION SERVICE DISTRICT

835 S. Canyon Blvd., John Day, OR 97845 Phone: (541) 575-1349 Fax: (541) 575-3601

Robert Waltenburg-Superintendent
waltenburgr@grantesd.k12.or.us

Stacie Holmstrom – Deputy Clerk
holmstroms@grantesd.k12.or.us

Pursuant to a news release to Blue Mountain Eagle and the Directors of the Grant County Education Service District, a Regular Board meeting was Septeber22, 2020 at 5:15 pm.

Board Members Present:	Megan Brandsma, Chair	Shilo Fretwell, Vice-Chair
	Bob Cockrell	Katy Nelson
	John Stearns	

Board Members Absent: Becky Tatum

Supt./Clerk: Robert Waltenburg
Deputy Clerk: Stacie Holmstrom

MINUTES

1. CALL TO ORDER – Megan called the meeting to order at 5:20.

2. CONSENT AGENDA
   2.1. Approval of Minutes – July 28, 2020: Bob moved that the consent agenda be approved, Shilo seconded. Unanimous.

3. REPORTS
   3.1. Superintendent Report
      3.1.1. COVID Update: Robert handed out the data that is being used to determine if the schools will be kept open or have to close. It is based on per week data, looking back three weeks. He shared that Representative Mark Owens has been a real champion for the small Eastern Oregon rural counties at helping us get different metrics for the small areas.
      3.1.2. Reopening: Robert shared that all schools had reopened in the County except Long Creek who was providing Comprehensive Distance Learning. All of the schools (except LC) are offering in class and online options to all of their students. He met with the superintendents today and they estimated that about 10% of their students were doing school online.
      3.1.3. QPR (Question/Persuade/Defer) – a suicide awareness and prevention training was recently held. Robert attended as well as Debi Hueckman. Robert thought it was a good training and can now provide the training to others.
      3.1.4. Preschool Funds: We have been receiving funds from the Grant County Road Department for many years for the county's preschools. The funds were allocated many years ago and have not been re-allocated for probably 15 years. Prairie City and Long Creek schools have recently received Preschool Promise money and Robert would like to see about re-allocating the $50,250 that we receive differently due to the large influx of funds that Prairie ($188,000) and Long Creek are receiving. He spoke to the superintendents today in the meeting and Casey agreed. He is unsure who to talk to in Long Creek as they don't currently have anyone in charge. He will also be speaking to Alan Hickerson the Grant County Roadmaster to make sure that he is okay with us determining a formula based on the number of students in the preschools. After he has visited with everyone we will allocate and send out the funds. Board agreed with a nod.
      3.1.5. October In-service: We are still planning on hosting Emily Gibson regarding her Culture of Hope program. Tracey Blood wrote a grant to the Meyer Memorial Foundation for $5,000 to help with the costs for the October In-service and to provide both sets of books to the staff in the

county to go along with the training. We are hoping to be able to do it in person but aren't expecting it. It may end up being an online setup.

3.2. Technology Report

3.2.1. GB Connection: Robert shared that we needed to increase our bandwidth and Frontier Telenet was unable to give us what we needed so we have now switched to OrTelCo. We were supposed to be getting 1 gigabit of data availability, we are currently using about 25%.

3.2.2. He shared that we currently have 2.0 FTE in the tech department working on approximately 1200 total devices on the network. There has been quite a bit of extra work for the people who are attempting to work from home. They have updated the filter to extend out into the world – so anyone reaching into our network or using computers that may be re-attached to our network are covered.

4. UNFINISHED BUSINESS

4.1. First Reading of Policies: GBEB, BGN-JBA, JBA-GBN, JHCC

4.2. Natural Hazard Mitigation Plan: Robert shared that he had sent this out in the spring and again now for the board to review. In a nutshell, he was part of a group that was working to make sure that there were plans in place to mitigate any problems from any of the natural hazards that may damage Grant County. This plan being approved allows the schools to be eligible for FEMA funds if any of the natural disasters identified (Fire, Drought, Earthquake, Flood) occur and cause damage. Katie moved that the plan be approved. Shilo seconded. Unanimous.

5. NEW BUSINESS

5.1. New VISA Account: Stacie shared that we have recently had problems with the Old West Federal Credit Union Visa not allowing purchases if they are international purchases (which are many of the tech purchases). We are asking to have a new VISA account opened at Bank of Eastern Oregon with a maximum of $25,000 split among four cards. Katy moved that we be allowed to open a new account at Bank of Eastern Oregon and close our account at Old West. Bob seconded. Unanimous.

5.2. OAESD Taskforce on Equity and Racial Injustice: Robert shared that OAESD was creating a new committee regarding Equity and he needed someone to be on the taskforce. Katy volunteered. Board consensus.

5.3. OAESD Professional Learning Activities: The OAESD meeting that is generally held prior to the OSBA meeting in November will not be held this year. OAESD is asking if the board would like to participate in any online learning. Robert asked that board and was given a list of "IF this, then yes" that he will be passing on to OAESD.

6. NEXT MEETING

6.1. Next meeting will be October 27, 2020 at 5:15.

7. ADJOURNMENT

7.1. Meeting adjourned at 6:20 pm.

Respectfully Submitted:

____

Deputy Clerk/Board Secretary