
2022

YAKIMA COUNTY

Multi-Jurisdictional Hazard Mitigation Plan

Prepared For:
Yakima Valley Office of
Emergency Management



TABLE OF CONTENTS

EXECUTIVE SUMMARY	8
SECTION 1. INTRODUCTION	12
1.1. Structure of the Plan.....	13
1.2. Planning Process	17
Plan Update Approach and Timeline	19
HMP Committee and Stakeholder Involvement.....	20
Public Involvement.....	22
Plan Updates and Revisions.....	24
SECTION 2. COMMUNITY PROFILE	25
2.1. Location.....	25
2.2. Climate	26
2.3. Land Use and Future Development	26
2.4. Demographics	27
2.5. Local Economy	29
Agriculture.....	29
Health Services.....	29
Government	30
Retail Trade	30
Manufacturing	30
2.6. Government.....	31
2.7. Transportation	32
2.8. Utilities.....	34
SECTION 3. HAZARD IDENTIFICATION AND RISK ASSESSMENT	35
3.1. Risk Assessment Methodology	36
3.2. Hazard Identification.....	38
3.3. Critical Facilities Exposure	43
3.4. Risk Assessment Results.....	45
3.5. Agricultural Disease Outbreak.....	46
Strength/Magnitude	47
Strength	Error! Bookmark not defined.
Past Occurrences	47
Future Probability.....	48
Yakima County Vulnerabilities	48

Overall Risk Ranking	49
3.6. Avalanche.....	50
Strength/Magnitude	50
Location	51
Past Occurrences	52
Future Probability.....	52
Yakima County Vulnerabilities	52
Overall Risk Ranking	53
3.7. Drought.....	54
Strength/Magnitude	54
Location	55
Past Occurrences	57
Future Probability.....	57
Yakima County Vulnerabilities	58
Overall Risk Ranking	60
3.8. Earthquake	61
Strength/Magnitude	61
Location	62
Past Occurrences	65
Future Probability.....	65
Yakima County Vulnerabilities	66
Overall Risk Ranking	67
3.9. Extreme Temperatures.....	68
Strength/Magnitude	68
Location	69
Past Occurrences	69
Future Probability.....	70
Yakima County Vulnerabilities	71
Overall Risk Ranking	73
3.10. Flooding.....	74
Strength/Magnitude	75
Location	76
Past Occurrences	80
Future Probability.....	85

Yakima County Vulnerabilities	86
Overall Risk Ranking	90
3.11. Landslides and Other Geologic Hazards	91
Strength/Magnitude	91
Location	92
Past Occurrences	93
Future Probability	93
Yakima County Vulnerabilities	94
Overall Risk Ranking	96
3.12. Public Health Emergency	97
Communicable Disease	97
Environmental Health	98
Strength/Magnitude	99
Location	100
Past Occurrences	100
Future Probability	102
Yakima County Vulnerabilities	102
Overall Risk Ranking	104
3.13. Severe Weather	105
Strength/Magnitude	105
Location	108
Past Occurrences	108
Future Probability	112
Yakima County Vulnerabilities	113
Overall Risk Ranking	114
3.14. Severe Winter Weather	115
Strength/Magnitude	116
Location	116
Past Occurrences	116
Future Probability	120
Yakima County Vulnerabilities	121
Overall Risk Ranking	122
3.15. Volcanic Eruption	123
Strength/Magnitude	123

Location	124
Past Occurrences	125
Future Probability.....	125
Yakima County Vulnerabilities	125
Overall Risk Ranking	127
3.16. Wildfire	128
Strength/Magnitude	128
Location	129
Past Occurrences	131
Future Probability.....	133
Yakima County Vulnerabilities	134
Overall Risk Ranking	136
3.17. Cyber Threat/Attack	137
Strength/Magnitude	137
Past Occurrences	138
Future Probability.....	140
Yakima County Vulnerabilities	140
Overall Risk Ranking	142
3.18. Dam and Levee Failure	143
Strength/Magnitude	144
Location	145
Past Occurrences	152
Future Probability.....	152
Yakima County Vulnerabilities	152
Overall Risk Ranking	154
3.19. Hazardous Materials Release	155
Strength/Magnitude	156
Location	157
Past Occurrences	158
Future Probability.....	159
Yakima County Vulnerabilities	159
Overall Risk Ranking	162
3.20. Nuclear Release/Radiological Incident.....	163
Strength/Magnitude	163

Location	163
Past Occurrences	164
Future Probability	164
Yakima County Vulnerabilities	164
Overall Risk Ranking	165
3.21. Terrorism	166
Strength/Magnitude	167
Location	167
Past Occurrences	167
Future Probability	167
Yakima County Vulnerabilities	168
Overall Risk Ranking	169
SECTION 4. MITIGATION STRATEGY	170
4.1. Mission	170
4.2. Mitigation Goals	170
4.3. Action Plan Matrix	172
Coordinating Organization	172
Participating Jurisdictions and Supporting Agencies	172
Relevant Plan Goals	172
Timeline	173
Funding	173
Priority	173
4.4. Review of 2015 Action Plan	189
4.5. Analysis and Prioritization	196
Benefit/Cost Analysis	196
Prioritization	198
SECTION 5. MITIGATION STRATEGY IMPLEMENTATION AND PLAN INTEGRATION	199
5.1. Existing Policies and Programs	199
Yakima Valley Emergency Management	201
Yakima Countywide Flood Control Zone District	201
Yakima County Planning Division	201
Yakima County Building and Fire Safety Division	201
5.2. Plan Integration	202
5.3. Funding	205

Federal Emergency Management Agency Grant Programs	205
National Flood Insurance Act Grant Programs	205
Other Federal Grant Programs	207
SECTION 6. PLAN MAINTENANCE, MONITORING, AND EVALUATION.....	209
6.1. Plan Adoption	209
6.2. Plan Maintenance.....	210
Yakima County HMP Committee	210
Cities and Towns	210
Special Districts	211
Plan Revisions	211
6.3. Continued Public Involvement.....	212
6.4. Five Year Formal Review Process	213
6.5. Procedures for Additional Jurisdictions to the HMP	215
APPENDIX A. ACRONYMS	
APPENDIX B. PLANNING PROCESS AND PUBLIC INVOLVEMENT	
APPENDIX C. COMMUNITY SURVEY RESULTS	
APPENDIX D. COMPLETE HAZARD HISTORY FOR YAKIMA COUNTY	
APPENDIX E. DETAILED MITIGATION STRATEGY	
APPENDIX F. HAZARD MAPS	
JURISDICTION ANNEXES	
Annex 1. City of Grandview	
Annex 2. City of Granger	
Annex 3. City of Moxee	
Annex 4. City of Selah	
Annex 5. City of Sunnyside	
Annex 6. City of Tieton	
Annex 7. City of Toppenish	
Annex 8. City of Union Gap	
Annex 9. City of Yakima	
Appendix 9.1. 2016 and 2017 Flooding – An Historic Perspective	
Annex 10. Town of Harrah	
Annex 11. Town of Naches	
Annex 12. Yakima County Fire Districts	
Annex 13. Yakima County-wide Flood Control Zone District	

EXECUTIVE SUMMARY

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), 42 U.S.C. 5165, as amended by the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390), provides for States, Tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning. The National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 et seq, reinforced the need and requirement for mitigation plans, linking flood mitigation assistance programs to State, Tribal and Local Mitigation Plans.

After a presidential major disaster declaration, mitigation funding becomes available. The amount is based on a percentage of the total federal grants awarded under the Public Assistance and Individuals and Households Programs for the entire disaster. Projects are funded with a combination of federal, state, and local funds.

Section 322 of the amended Stafford Act essentially states that as a condition of receiving a disaster loan or grant:

“The state and local government(s) shall agree that natural hazards in the areas affected shall be evaluated and appropriate action taken to mitigate such hazards, including safe land-use and construction practices. For disasters declared after November 1, 2004, all potential applicants (sub-grantees) must have either their own, or be included in a regional, locally adopted and FEMA approved all hazard mitigation plan to be eligible to apply for mitigation grant funds.”

The regulations governing the mitigation planning requirements for local mitigation plans are published under 44 CFR §201.6. Under 44 CFR §201.6, local governments must have a FEMA-approved Local Mitigation Plan to apply for and/or receive certain project grants under various FEMA hazard mitigation assistance programs.

About the Plan Update

The 2022 Yakima County Multi-Jurisdiction Hazard Mitigation Plan (HMP) is an update to the 2015 Yakima County and 2020 City of Yakima plans. This plan update included a thorough review of each required element, as well as the addition of 11 municipalities, one county-wide special district, and five Yakima County fire districts. The plan update was led by Yakima Valley Emergency Management (YVEM) in coordination with a Planning Committee representing county departments involved in hazard mitigation and participating municipalities and special districts. The Planning Committee met monthly between April – September 2022 to inform the plan update with contract support from Integrated Solutions Consulting. Municipalities and special districts not participating in the 2022 MJHMP update can work with YVEM to annex into the plan in the future, and a full update to the plan will be completed by 2027.

Hazard Identification and Risk Assessment

Hazard events happen somewhere in the world every day. Whether such events become a disaster depends on whether there are injuries, deaths, or significant property, natural resource, or cultural damage. Conducting a risk assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment. At the most fundamental level, both the U.S. Department of Homeland Security and FEMA recognize that:

Risk = Frequency of a Hazard X Consequence from that Hazard

To reach a certain level of **risk**, there must be a probability or likelihood for that event to occur (**frequency**). Likewise, if the event does happen, but there is no **impact or consequence**, the level of risk is negated or substantially reduced. To determine the risk for each hazard, this assessment considers frequency of the hazard based on historic occurrence and future climate conditions, as well as potential consequences.

The 2022 HMP includes 17 hazards of concern, including 12 natural hazards and 5 technological and human-caused hazards. The Planning Committee analyzed and scored each of the 17 hazards using a risk assessment methodology which considered probability, frequency, and six impact criteria, including: Human Health, Property Damage, Economic Disruption, Environmental Resource Damages/Degradation, Emergency Services Burden, and Critical Facilities Exposure. Total risk scores for each hazard were further refined into three categories to better illustrate which hazards present the greatest threat to Yakima County.

Table ES.1 provides a summary of the risk assessment results, as well as a comparison to the 2015 HMP risk assessment. It is important to note that the methodology has changed between the 2015 and 2022 HMPs, so a direct comparison of scores is not applicable.

Table ES.1. Risk Assessment Summary		
Natural Hazards	2022 Risk Ranking and Score	2015 Risk Ranking
Wildfire	25 - High	Medium
Flooding	24 - High	High
Public Health Emergency	24 - High	N/A
Severe Winter Weather	24 - High	Medium
Drought	22 - Medium	Not Ranked
Agriculture Disease Outbreak	21 - Medium	N/A
Landslide and Geologic Hazards	20 - Medium	Medium
Severe Weather	20 - Medium	Medium-Low
Extreme Temperatures	19 - Medium	Not Ranked
Earthquake	18 - Medium	Medium-Low
Avalanche	14 - Low	Not Ranked
Volcanic Eruption	12 - Low	Low
Technological and Human-caused Hazards	2022 Risk Ranking and Score	2015 Risk Ranking
Dam/Levee Failure	24 - High	Medium
Hazardous Materials Incident	23 - High	Medium-Low
Cyber Incident	18 - Medium	N/A
Nuclear/Radiological Incident	16 - Low	N/A
Terrorism	16 - Low	N/A

Hazard Mitigation Strategy

The mitigation strategy is made up of three parts: **Mission**, **Goals**, and **Action Items**.

The **mission** of the Yakima County HMP is to promote sound public policy designed to protect community members, critical facilities, infrastructure, private property, and the environment from natural, technological, and human-caused hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

The plan **goals** describe the overall direction that Yakima County agencies, jurisdictions, and community members can take to minimize the impacts of hazards. The goals are stepping-stones between the broad direction of the mission and the specific action items.

Protect Life, Property and Public Welfare

- Implement sustainable activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resilient to natural and technological hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for encouraging higher standards for safer development in areas vulnerable to natural and technological hazards.

Public Awareness

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural and technological hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Natural Systems

- Balance watershed planning, natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, re-establish, and enhance natural systems to serve natural hazard mitigation functions.

Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, community members, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within the public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

Emergency Services

- Prioritize mitigation projects for critical facilities, services, and infrastructure.
- Improve understanding of hazard risks through monitoring and assessment projects.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate natural and technological hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

Action items are activities which county agencies, participating jurisdictions, special districts, and other stakeholders can implement to reduce risk. There are **70** total action items that represent a range of investments and projects to mitigate risk for the 17 identified hazards. For each action item, the following information is included: Coordinating Organization, Participating Jurisdictions and Supporting Agencies, Relevant Mitigation Goals, Timeline, Estimated Cost, Funding, and Potential Benefit. This information was used to complete a prioritization process based on a simple benefit-cost analysis, as well as support effective implementation by participating agencies.

Mitigation Strategy Implementation and Plan Integration

Successful implementation of the mitigation strategy depends on the capability of Yakima County and participating jurisdictions. The essential components for successful implementation are funding, resource allocation, and organizational capacity. The multi-jurisdictional mitigation strategy identifies the principal Yakima County and municipal agencies and departments that are responsible for implementing each identified action item. The strategy also considers other jurisdictions and state or federal partner agencies for collaboration.

FEMA requires the evaluation of existing hazard management policies, programs, and capabilities that exist and could be used to implement the mitigation strategy. Many Yakima County departments, programs, and collaborative groups can help reduce losses from emergencies and disasters. The capability of participating jurisdictions to implement mitigation activities is described briefly in each [Jurisdiction Annex](#).

Plan Maintenance, Monitoring, and Evaluation

YVEM will lead a formal process to ensure that the HMP remains an active and relevant document. The process includes a schedule for monitoring and evaluating the HMP annually and producing a plan revision every five years.

YVEM will be responsible for facilitating the adoption of the HMP in coordination with participating jurisdictions. The Yakima County Board of County Commissioners (BOCC) will be responsible for adopting for the county, city councils for the cities/towns, and governing bodies for the special districts. These governing bodies have the authority to promote sound public policy regarding natural, technological, and human-caused hazards. Once the plan has been reviewed and approved by the HMP Committee, YVEM will be responsible for submitting it to the Mitigation Officer at WaEMD. WaEMD will then submit the plan to FEMA for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201. FEMA will designate the HMP as "Approved Pending Adoption", giving each governing body up to 12 months to formally adopt the plan. Upon local adoption, Yakima County and the participating jurisdictions will gain eligibility for Hazard Mitigation Grant Program funds. YVEM and each participating jurisdiction will maintain documentation of local plan adoption.

The HMP will be reviewed on an annual basis to determine the effectiveness of programs, and to reflect changes in land development or mitigation priorities. YVEM will convene meetings of the HMP Committee for the annual review. Plan implementation and evaluation will be a shared responsibility among the jurisdictions, but YVEM is responsible for plan maintenance. Jurisdictions will be responsible for monitoring and evaluating the progress of the mitigation strategies in the HMP based upon their area of expertise. Annual review of the plan allows for "mid-course" corrections to the plan and consider additional funding opportunities.

SECTION 1. INTRODUCTION

Throughout history, the residents of Yakima County have dealt with various natural, technological, and human-caused hazards affecting the area. The county is subject to 54 hazards. Table 1.1 lists the 17 hazards of concern identified for this mitigation plan, including 12 natural hazards and 5 technological and human-caused hazards.

Natural Hazards	Technological and Human-caused Hazards
Agricultural Disease Outbreak	Cyber Attack/Threat
Avalanche	Dam/Levee Failure
Drought	Hazardous Materials Incident
Earthquake	Nuclear Release/Radiological Incident
Extreme Temperatures	Terrorism
Flood	
Landslides and other Geologic Hazards	
Public Health Emergency	
Severe Weather	
Severe Winter Storm	
Volcanic Eruption	
Wildfire	

It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the county. However, with careful planning and collaboration within the community, it is possible to minimize the losses that can result from disasters.

Yakima County is located in the south-central portion of Washington State. It is the second largest county in Washington State with a total land area of 4,273 square miles. The county's western boundary generally follows the crest of the Cascade Mountain range. The widest portion of the county measures approximately 80 miles from north to south. The most eastern boundary measures 48 miles from north to south and runs along the Columbia River for approximately 9 miles. From east to west the county measures approximately 75 miles.

The terrain of Yakima County varies from areas of irregular, densely timbered, mountainous terrain in the west to broad valleys and arid sagebrush-covered foothills in the east. The arable lands within the county are made up of basin lands, bottom lands, terraces, and lower uplands tributary to the Yakima River and are collectively called the Yakima Valley. The area north of Ahtanum and Rattlesnake Ridges is generally referred to as the Upper Yakima Valley while the area south of them is often referred to as the Lower Yakima Valley. The Upper Valley is more heavily populated while the Lower Valley is characterized by smaller towns and contains more productive farmland.

Much of the recent development in Washington State occurs in or near floodplains. This development increases the likelihood of flood damage in two ways. First, new developments near a floodplain add structures and people in flood areas. Secondly, new construction alters surface water flows by diverting water to new courses or increases the amount of water that runs off impermeable pavement and roof surfaces. This second effect diverts waters to places previously safe from flooding.

1.1. Structure of the Plan

Each section of the mitigation plan provides information and resources to assist people in understanding the county and the hazard-related issues facing residents, critical facilities and operations, businesses and the local economy, and natural and cultural resources. Combined, the sections of the plan work together to create a document that guides the mission to reduce risk and prevent loss from future hazard events.

The structure of the plan enables people to use a section of interest to them. It also allows county jurisdictions to review and update sections when new data becomes available. The ability to update individual sections of the mitigation plan places less of a staffing burden on jurisdictions. Decision-makers can allocate staff resources to selected pieces in need of review, thereby avoiding a full update, which can be time-consuming. New data can be easily incorporated, resulting in a hazards mitigation plan that remains current and relevant to Yakima County jurisdictions

The mitigation plan is organized in six sections, as described below.

Section 1: Introduction

The *Introduction* describes the background and purpose of developing the mitigation plan for Yakima County. This section also describes the process for engaging local stakeholders and the public in plan development and review.

This section addresses the following aspects of FEMA's Local Mitigation Plan requirements under 44 CFR §201.6:

- 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))
- 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))
- A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))
- D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

Section 2: Community Profile

Community Profile presents the history, geography, demographics, and socioeconomics of Yakima County and its jurisdictions. It serves as a tool to provide an historical perspective of hazards in the county.

This section addresses the following aspects of FEMA's Local Mitigation Plan requirements under 44 CFR §201.6:

- D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

Section 3: Hazard Identification and Risk Assessment

Hazard Identification and Risk Assessment provides information on hazard identification, describes the methodology and results of the risk assessment, and summarizes the frequency, location, extent, and expected vulnerabilities or impacts from the 17 hazards identified in the HMP Update.

This section addresses the following aspects of FEMA's Local Mitigation Plan requirements under 44 CFR §201.6 for the entirety of Yakima County. Each [Jurisdiction Annex](#) addresses these aspects at the local level.

- 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))
- 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))
- 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))
- 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 4: Mitigation Strategy

Mitigation Strategy provides information on the process used to develop goals and action items that cut across the 17 hazards addressed in the mitigation plan. The plan action items are included in this section, and address both multi-hazard and hazard-specific activities that can be implemented to reduce risk and prevent loss from future hazard events.

This section also describes FEMA's requirements for benefit-cost analysis in hazard mitigation, as well as approach for conducting an analysis and prioritization for the proposed mitigation activities.

This section addresses the following aspects of FEMA's Local Mitigation Plan requirements under 44 CFR §201.6 for the entirety of Yakima County. Each [Jurisdiction Annex](#) addresses these aspects at the local level.

- 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))
- C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))
- 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))
- 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))
- D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))

Section 5: Mitigation Strategy Implementation & Plan Integration

Mitigation Strategy Implementation & Plan Integration describes Yakima County's capacity and capability to implement the mitigation strategy, including other plans that have been integrated in the HMP, or where the HMP can be integrated in the future.

This section addresses the following aspects of FEMA's Local Mitigation Plan requirements under 44 CFR §201.6 for the entirety of Yakima County. Each [Jurisdiction Annex](#) addresses these aspects at the local level.

- A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))
- 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))
- 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 6: Plan Maintenance

Plan Maintenance provides information on plan implementation, monitoring, and evaluation.

This section addresses the following aspects of FEMA's Local Mitigation Plan requirements under 44 CFR §201.6:

- A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))
- 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)(1))

Appendices

The HMP Appendices provide additional detail and resources on various aspects of the HMP.

- **Appendix A: Acronyms:** This appendix provides a list of acronyms for county, regional, state, and federal agencies and organizations, as well as industry terms that may be referred to within the HMP.
- **Appendix B: Planning Process and Public Involvement Documentation:** This appendix provides detailed documentation of stakeholder engagement in the planning process, as well as outreach efforts to involve the public throughout the planning period.
- **Appendix C: Community Survey Results:** This appendix includes the complete results of a Community Survey distributed as one strategy for public involvement.
- **Appendix D: Complete Hazard History for Yakima County:** This appendix includes a complete hazard history for Yakima County as recorded by in the NOAA Storm Events Database. This database is the most comprehensive public source for hazard history but does not include some natural hazards (such as wildfire) or technological or human-caused hazards. All hazard events during the HMP analysis period (2015-2021) are included in Section 3 of the base plan.

- **Appendix E: Detailed Mitigation Strategy with Revisions Notes:** This appendix provides the complete detail of the mitigation strategy. Given the amount of detail in the complete mitigation action matrix, a summarized version is included in Section 4 of the base plan for clarity and readability.
- **Appendix F: Hazard Maps:** This appendix includes full-size versions of hazard maps provided throughout the plan.

Participating Jurisdiction Annexes

Each jurisdiction participating in the 2022 HMP Update has an individual annex to be adopted by their respective governing bodies. Each annex details the unique hazard risks, vulnerabilities, capabilities, and mitigation strategy for the jurisdiction. Please note that the Yakima County Fire Districts are included together in one annex. Jurisdiction annexes include the following:

- **City of Granger Annex**
- **City of Grandview Annex**
- **City of Moxee Annex**
- **City of Selah Annex**
- **City of Sunnyside Annex**
- **City of Tieton Annex**
- **City of Toppenish Annex**
- **City of Union Gap Annex**
- **City of Yakima Annex**
- **Town of Harrah Annex**
- **Town of Naches Annex**
- **Yakima County Fire Districts Annex**
- **Yakima County-wide Flood Control Zone District Annex**

2022 Yakima County Community Wildfire Protection Plan Annex

In tandem with the 2022 HMP Update, a Planning Committee, made up of Yakima Valley Office of Emergency Management, Yakima Fire Department, Senator Murray's Office, Yakima County Fire Marshal's Office, Yakima County Commissioners, Washington Department of Natural Resources, and other agencies updated the Community Wildfire Protection Plan (CWPP) for Yakima County. The 2022 CWPP will be adopted by the Yakima County Commissioners as an Annex to the HMP. The CWPP identifies and prioritizes wildland-urban interface (WUI) areas within Yakima County (including state, county, federal and other lands) for hazardous fuels reduction treatments and recommends methods for achieving hazardous fuels reduction.

1.2. Planning Process

The 2022 Yakima County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) follows FEMA's Local Mitigation Plan requirements under 44 CFR §201.6 which specifically identify criteria that allow for multi-jurisdictional mitigation plans. Many issues are better resolved by evaluating hazards more comprehensively by coordinating at the county, regional, or watershed level. Although economy-of-scale efforts are apparent and encouraged with multi-jurisdictional plans, FEMA requires that all participating jurisdictions meet the requirements for mitigation plans identified in 44 CFR §201.6. While certain elements are common to all participating jurisdictions (e.g., planning process, hazards, goals, and maintenance), there are some elements that are unique to each participating jurisdiction, including:

- Risks – where they differ from the general planning area
- Mitigation Actions – actions must be identified for each jurisdiction
- Participation in the planning process
- Adoption – each jurisdiction must formally adopt the plan

The Yakima Valley Office of Emergency Management (YVEM) identified organizations consistent with federal guidance as to those which should be included in the mitigation process. YVEM recruited the following types of agencies to participate:

- **Local Government:** Section 201.2 of 44 CFR defines Local Government as any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government.
- **Public College or University:** Under 44 CFR 201, a public college or university may be an active participant in a FEMA approved State, Tribal or Local Mitigation Plan, or have an approved plan of their own that meets the requirements of 44 CFR §201.6 to be eligible for mitigation project grants.
- **Private Institutions:** Private institutions may opt to participate in local or regional multi-jurisdictional plans, or they may develop plans of their own. Either way, the key to success is to ensure that all of the requirements established by regulation are met. This includes coordinating the planning activities of each campus with those of the surrounding community and, in the case of a multi-institution plan, ensuring that each institution's unique risks are addressed in addition to those risks affecting the entire university system.
- **School Districts:** School districts or independent school districts, or other special districts are defined as local governments at 44 CFR Part 201.2, and are therefore required to have a FEMA-approved local mitigation plan to be eligible for project grants under FEMA hazard mitigation assistance programs. A school district may also demonstrate their participation as a separate government entity in another local government's approved mitigation plan to be eligible for project grants under FEMA hazard mitigation assistance programs.

The 2022 HMP Update focused primarily on local government agencies, but YVEM intends to prioritize adding other entities to the HMP over future iterations.

Table 1.2 lists those local government agencies targeted for 2022 MJHMP inclusion. **Table 1.3** represents the jurisdictions that are included in the 2022 MJHMP Update, tracking their participation in the planning process. [Section 6.5](#) outlines the procedures to add jurisdictions to the HMP that did not participate in 2022.

Table 1.2. Yakima County Local Government Agencies	
Cities and Towns	
City of Grandview City of Granger Town of Harrah City of Mabton City of Moxee Town of Naches City of Selah	City of Sunnyside City of Tieton City of Toppenish City of Union Gap City of Wapato City of Yakima City of Zillah Yakima County (unincorporated areas)
Fire Protection Districts	
Fire District #1 (Highland) Fire District #2 (Selah) Fire District #3 (Naches) Fire District #4 (East Valley) Fire District #5 (Lower Valley)	Fire District #6 (Gleed) Fire District #7 (Glade) Fire District #9 (Naches Heights) Fire District #12 (West Valley) Fire District #14 (Nile)
School Districts	
East Valley School District No. 90 Grandview School District No. 200 Granger School District No. 204 Highland School District No. 203 Mabton School District No. 120 Mt. Adams School District No. 209 Naches Valley School District Jt 3 Selah School District No. 119	Sunnyside School District No. 201 Toppenish School District No. 202 Union Gap School District No. 2 Wapato School District No. 207 West Valley School District No. 208 Yakima School District No. 7 Zillah School District No. 205 Education Service District 105
Irrigation Districts	
Ahtanum Irrigation District #11 Buena Irrigation District #20 Grandview Irrigation District #30 Granger Irrigation District #40 Selah-Moxee Irrigation District Home Irrigation District #50 Naches Union Irrigation District #180 Naches-Selah Irrigation District #60 Outlook Irrigation District #70 Roza Irrigation District #98 Selah-Moxee Irrigation District #90	Snipes Mountain Irrigation District #100 Sunnyside Valley Irrigation District South Naches Irrigation District #190 Terrace Heights Irrigation District #120 Union Gap Irrigation District #130 Wenas Irrigation District #140 Zillah Irrigation District #170 Yakima-Tieton Irrigation District Yakima Valley Canal Company—Congdon Canal Fruitvale Canal (City of Yakima)

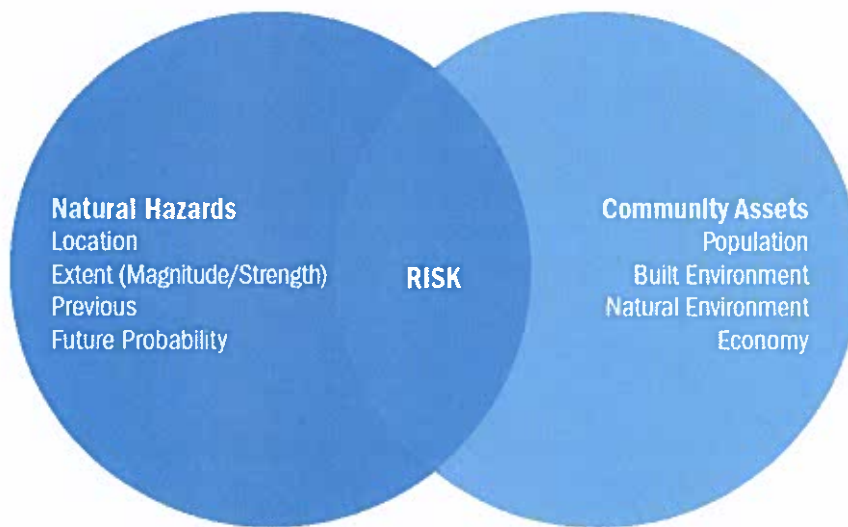
Plan Update Approach and Timeline

The 2022 Yakima County HMP update was organized into three distinct project phases, as described below. Detailed documentation of the planning process is available as [Appendix B](#).

Phase 1: Risk Analysis (April – June 2022)

The 2022 HMP Committee engaged residents, government officials, and subject matter experts to understand the unique assets in the community that should be protected, the type of hazards they face, and the risks that posed impacts on the most vulnerable assets and community members. This process is illustrated in **Figure 1.1**, developed by the U.S. Geological Survey and Oregon Partnership for Disaster Resilience.

Figure 1.1. Risk Analysis



Phase 2: Mitigation Strategy (June – September 2022)

The HMP Committee developed a strategy that advances shared mitigation goals identified through public involvement efforts. The strategy leveraged the community’s existing plans, policies, and programs, and addressed the top priority hazards and identified risks from Phase 1. This strategy included a clear action plan that prioritized the different projects, plans, and policies that mitigate property damage and loss of life from a disaster. Each action was evaluated based on cost benefit, time frame, existing partnerships, and more.

Phase 3: Implementation & Monitoring (October 2022 through 2027)

With an action plan in hand, the HMP Committee will work to identify local, state, and federal programs that can help advance priority actions. The plan will be submitted to WaEMD and FEMA for approval, and then adopted by the Yakima County Board of County Commissioners and the City Councils or other governing bodies of each participating jurisdiction. Every year, the HMP Committee will meet to monitor and report on progress on identified mitigation actions. In 2027, the plan will be completely updated and submitted to FEMA for approval, continuing on a five-year cycle. Continued implementation of mitigation actions will help with steadily reducing the risks posed by hazards to the community.

HMP Committee and Stakeholder Involvement

During the planning period (April – September 2022), the HMP Committee met monthly to assess plan development progress and provide feedback on key components. Two of these meetings served as “Mitigation Strategy Workshops” where additional stakeholders were invited to inform development of the mitigation strategy and action items. The goal of the virtual meetings was to find a clear action plan that prioritizes the different projects to mitigate property damage and loss of life from a disaster. **Table 1.3** represents the jurisdictions that are included in the 2022 HMP Update, tracking their participation in the planning process.

Table 1.3. 2022 HMP Update Committee Meeting Participation

Name	Organization	Mtg. #1 3/15/22	Mtg. #2 4/20/22	Mtg. #3 5/18/22	Mtg. #4 6/22/22	Mtg. #5 7/20/22	Mtg. #6 8/18/22	Mtg. #7 9/21/22
Jose Trevino	City of Granger	X	X					
Kimberly Grimm	City of Granger					X		
Jeff Burkett	City of Moxee		X					
Joe Henne	City of Selah	X	X					
Rocky Wallace	City of Selah			X			X	X
Mickey Gillie	City of Selah			X				
Ken Anderson	City of Sunnyside	X	X		X	X		X
Albert Escalera	City of Sunnyside							
Elizabeth Alba	City of Sunnyside			X		X		
Frank Brewer	City of Tieton		X		X	X		X
Holly Davis	City of Tieton						X	
Tim Smith	City of Toppenish		X	X		X		
Gregory Cobb	City of Union Gap	X	X			X	X	X
David Brown	City of Yakima	X		X	X		X	X
Randy Tabert	City of Yakima							X
Janice Deccio	City of Yakima	X				X	X	
John Simmons	City of Zillah	X	X					
Dale Hillie	East Valley Fire Department	X	X			X	X	X
Jim Johnston	Fire District #12 West Valley Fire						X	X

Table 1.3. 2022 HMP Update Committee Meeting Participation

Name	Organization	Mtg. #1 3/15/22	Mtg. #2 4/20/22	Mtg. #3 5/18/22	Mtg. #4 6/22/22	Mtg. #5 7/20/22	Mtg. #6 8/18/22	Mtg. #7 9/21/22
Nate Craig	Fire District #12 West Valley Fire				X	X		
Ken Frazier	Gleed Fire District #6			X	X	X	X	X
Pat Mason	Grandview Fire Department (City of Grandview)	X	X	X	X	X		X
Deborah LaCombe	HLA Civil Engineering (City of Naches, City of Granger)	X	X	X	X	X		
Jim Lange	Selah Fire Department	X			X	X	X	X
Sarah Hovis	Town of Harrah	X	X	X		X	X	X
Barbara Harrer	Town of Harrah	X	X	X		X	X	X
Jeff Ranger	Town of Naches		X					
Michael Martian	Yakima County - GIS					X		
David Haws	Yakima County Environmental Services Division	X	X	X	X	X		
Chris Pedersen	Yakima County Fire Marshal's Office					X	X	X
Joel Freudenthal	Yakima County Flood Control Zone District	X	X		X	X	X	X
Troy Havens	Yakima County Flood Control Zone District	X	X	X		X	X	
Thomas Carroll	Yakima County Planning Division					X	X	
Aaron Markham	Yakima Fire Department	X			X			X
Andrew Bigelow	Yakima Valley Emergency Mgmt					X		X
Antone Miller	Yakima Valley Emergency Mgmt	X	X	X	X	X	X	X
Mike McMullen	Yakima Valley Emergency Mgmt		X	X				X
Nicole Parpart	Yakima Valley Emergency Mgmt	X	X	X	X	X	X	

Public Involvement

Public participation is a key component to strategic planning processes. Public participation offers residents the chance to voice their ideas, interests, and opinions. Washington State’s land use planning goals (RCW 36.70A.020) address the need for public input. Goal 11 - Citizen Participation and Coordination “encourages the involvement of citizens in the planning process and ensures coordination between communities and jurisdictions to reconcile conflicts.” FEMA also requires public input during the development of mitigation plans.

Through public involvement, the mitigation plan reflects community issues, concerns, and new ideas and perspectives on mitigation opportunities and plan action items.

Residents were regularly engaged in the hazard mitigation planning process. Key roles for members of the public included:

- Shaping the mitigation goals that guide the focus of the entire plan
- Informing priority community assets and vulnerable groups
- Prioritizing mitigation actions for the community to implement over the life of the plan

Neighboring communities and other community stakeholders were offered the opportunity for involvement and comment on the HMP. The HMP Committee invited representatives of Kittitas and Benton counties, as well as Yakama Nation to guide the development of the HMP and identify coordination efforts on the mitigation strategy. All stakeholders were also invited to a public meeting where the final HMP was presented. Table 1.4 summarizes efforts to involve neighboring jurisdictions and key stakeholders.

Name	Organization	Participated	Participation Details	Contact Dates
Deanna Davis	Benton County Emergency Services	No	N/A	Invite to public meeting and update on plan review period (Email 9/9 and 9/19)
John Carney	City of Yakima Information Technology	Yes	Participated in an interview about cyber threats for the city	August 22 Meeting
Bill Preston	City of Yakima Engineer	Yes	Participated in final plan review	Contacted by Committee Member during plan review period (9/15 – 10/5)
Joan Davenport	City of Yakima Planning	Yes	Participated in final plan review	Contacted by Committee Member during plan review period (9/15 – 10/5)
Darren Higashiyama	Kittitas County Sheriff’s Office	No	N/A	Invite to public meeting and update on plan review period (Email 9/9 and 9/19)
John Sinclair	Kittitas Valley Fire & Rescue	No	N/A	Invite to public meeting and update on plan review period (Email 9/9 and 9/19)

Table 1.4. Additional Stakeholders and Neighboring Jurisdictions				
Name	Organization	Participated	Participation Details	Contact Dates
Elizabeth Sanchez	Yakama Nation	No	N/A	Invite to public meeting and update on plan review period (Email 9/16 and 9/19)
Dale Panattoni	Yakima County Information Technology	Yes	Participated in an interview about cyber threats for the county	August 22 Meeting
Nathan Johnson	Yakima County Health District	Yes	Participated in final plan review	Contacted by Committee Member during plan review period (9/15 – 10/5)
	Yakima Valley Memorial Hospital	Yes	Participated in final plan review	Contacted by Committee Member during plan review period (9/15 – 10/5)

Public Meetings

The HMP Committee hosted two public meetings throughout the planning process. The goal of these hybrid virtual/in-person meetings was to establish public priorities and offer opportunities to inform plan development. The focus of the first public meeting included the planning process, priority hazards, and mitigation goals. The final public meeting goal is to review the draft version of the plan and provide feedback on the mitigation strategy, specifically the priority action items. As the COVID-19 global pandemic was ongoing at the time of plan development, all meetings and public engagement were available for both virtual and in-person participation.

- Public Meeting #1 – Monday, April 11 from 6:00 – 8:30pm
- Public Meeting #2 – Wednesday, October 5 from 4:00 – 5:00pm

Community Preparedness Survey

In addition to public meetings, members of the public completed the Community Preparedness Survey. This survey helped to understand risk, vulnerability, and preparedness of community members. This survey was made available on Monday, April 11 through August 31, 2022. The survey was posted on the YVEM, Yakima County, and City of Yakima websites and Facebook pages, shared online and in the Yakima Herald and YakTri newspapers, and via email through the Yakima County Commissioners newsletter and listserv. The survey was made available in both English and Spanish. A total of 287 people completed the online survey. A complete summary of results is available as [Appendix C](#).

YVEM Hazard Mitigation Plan (HMP) Webpage

The YVEM website was used to advertise HMP progress and allow for public and stakeholder participation and feedback to be shared. The “County Emergency Plans” page hosted regular updates on the planning process and public meetings.

Plan Updates and Revisions

The 2022 HMP is an update to the 2015 HMP for Yakima County, and prior to that, a 2010 version. While the 2015 HMP Update maintained the structure and approach of the 2010 plan, the 2022 HMP Update includes major revisions and organization changes. A summary of the most pertinent changes between 2015 and 2022 is provided in **Table 1.5**.

Table 1.5. Summary of Changes	
Section	2022 HMP Update Changes
Executive Summary	The 2022 HMP retains the same structure and integrity as the 2015 HMP.
Section 1. Introduction	The 2022 HMP combines 2015 HMP Sections 1 (Introduction) and 7 (Public Involvement) to provide a more holistic summary of the planning process. Other additions and refinements include: <ul style="list-style-type: none"> • Summary of planning process/phases • Alignment of FEMA HMP requirements by plan section • Condensed and clarified approach to recruiting stakeholder participation
Section 2. Community Profile	The 2022 HMP retains the same structure and integrity as the 2015 HMP. Additions and refinements include: <ul style="list-style-type: none"> • Updated Census/American Community Survey data for 2020 • Expanded description of land use and development trends and integration with the updated County Comprehensive Plan • Added assessment of critical transportation routes by sector in the county
Section 3. Hazard Identification and Risk Assessment	The 2022 HMP combines the hazard identification section from the 2015 HMP with the separate hazard profiles (including hazard history). Additions and refinements include: <ul style="list-style-type: none"> • Revisited the hazard identification to include 5 technological/human-caused hazards (two were previously included) • Revisited the hazard identification to update the natural hazards in alignment with the 2018 Washington State HMP • Added a more comprehensive description of hazard impacts and history • Refined the risk assessment methodology to full evaluate each hazard based on frequency/probability and impact criteria
Section 4. Mitigation Strategy	The 2022 HMP retains the same structure and integrity as the 2015 HMP. Mitigation actions were reviewed and updated, with new actions added and some actions noted as completed or removed. The 2022 HMP combines Section 6 from the 2015 HMP which described the process for evaluating and prioritizing mitigation actions.
Section 5. Mitigation Strategy Implementation & Plan Integration	This section is new to the 2022 HMP. A summary of implementation mechanisms, capability assessment, and plan integration strategy was included within the Mitigation Strategy in the 2015 HMP.
Section 6. Plan Maintenance	The 2022 HMP retains the same structure as the 2015 HMP.

SECTION 2. COMMUNITY PROFILE

Natural, human-caused, and technological hazards and threats impact community members, property, the environment, and the economy of Yakima County. These hazards have exposed Yakima County residents and businesses to the financial and emotional costs of recovering after disasters. The risk associated with hazards increases as more people move to areas affected by these incidents. The inevitability of natural and human-caused hazards, and the growing population and activity within the county create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future hazard events. Identifying risks posed by hazards and developing strategies to reduce the impact of a hazard event can assist in protecting life and property of people and communities. Residents and businesses can work together with the county to create a hazard mitigation plan that addresses the potential impacts of hazard events.

This Community Profile uses data tables provided as a part of the 2022 Yakima County Profile developed by the Washington State Employment Security Department.¹

2.1. Location

Yakima County is located in south central Washington state. It is bounded to the north by Kittitas County, to the south by Klickitat County, on the west by Thurston, Lewis, and Skamania counties, and the east by Benton and Grant counties. The geography varies from densely timbered, mountainous terrain at the crest of the Cascade Mountain Range in the west to rolling foothills, broad valleys, and arid sagebrush covered regions to the east, to fertile valleys in the central and southern parts of the county that has made agriculture the staple of the economy over the last 100 years. The highest point in the county is Mount Adams at 12,277 feet (3,742 meters) above sea level. The city of Yakima sits at 1,068 feet. Yakima County is 4,296 square miles, or approximately 2.75 million acres, making it the second largest county in Washington.

Three entities own over 1.7 million of the total acres of Yakima County, or 63.4% of the total county area, including:

- Yakama Nation (1,074,174 acres)
- U.S. Forest Service (503,726 acres)
- Yakima Training Center (165,787 acres)

The city of Yakima, the tenth largest city in the state, contains over 37% of the county population. 90% of the state's population is within a 3-hour drive from Yakima. The County derives its names from the regional Yakama Indian tribes. There are several theories on the meaning of "Yakima," including a native legend about a Chief's daughter from Moxee who fled from her home after breaking tribal rules. The word Yakima in this legend means "runaway." Others believe "runaway" refers to the rivers that surround the valley. Yakima has also been interpreted to mean "well fed people."

¹ The complete profile is available here: <https://media.esd.wa.gov/esdwa/Default/ESDWAGOV/labor-market-info/Libraries/Regional-reports/County-Profiles/Yakima-county-profile-2022-rev.pdf>

2.2. Climate

Yakima has four distinct seasons. Sunshine is the norm in Yakima County at nearly 300 days per year. Average precipitation is 8 inches a year, of which 24 inches occurs as snowfall in the months of November, December, and January. The average temperature in the winter is 37, spring 63, summer 88, and fall 64. This favorable weather makes Yakima a leader in agricultural products (including hops, fruit, dairy, and many others), wine growing, outdoor recreation, and tourism.

2.3. Land Use and Future Development

Yakima County's development was shaped largely by the Northern Pacific Railroad and the Yakima River. Most of the county's population is concentrated along this river, largely because irrigation was critical to the success of the communities and the farmers who settled in this area.

The arable lands within the county are made up of basin lands, bottom lands, terraces, and lower uplands tributary to the Yakima River. Collectively, these lands are called the Yakima Valley. The area north of Ahtanum and Rattlesnake Ridges is generally referred to as the Upper Yakima Valley while the area south of them is known as the Lower Yakima Valley. The Upper Valley is more heavily populated while the Lower Valley is characterized by smaller cities and contains more productive farmland.

Land use and development priorities and policies are outlined in Horizon 2040, the Yakima County Comprehensive Plan adopted in 2017. Land use is organized into three categories identified in the Washington State Growth Management Act – 1) urban, 2) rural, and 3) resource. These categories are defined as:

- **Urban** lands are those included within the Urban Growth Area (UGA) of one of Yakima County's fourteen incorporated cities. They are typified by growth patterns that have made or will make an intensive use of land for buildings, structures, and impermeable surfaces. As a result, other uses, such as the production of food, become incompatible.
- **Rural** lands are those areas outside of both the UGA and the resource lands. Rural areas allow low to moderate densities that can be supported and sustained without urban services -- primarily water and sewer service. By state law, development in rural areas cannot occur if it is urban in nature.
- **Economic Resource** lands are those lands important and necessary for their ability to sustain the long-term commercial production of agricultural goods, forest products and mineral commodities.

While areas within UGAs are considered urban, many Yakima County communities are more traditionally considered rural areas. The U.S. Census Bureau defines urban as either: 1) Urbanized Areas (UAs) of 50,000 people or more; or 2) Urban Clusters (UCs) of 2,500-49,999 people. Most Yakima County cities fall into the UC category, while several including Harrah, Mabton, Naches, and Tieton, fall below this threshold. Additionally, many Yakima County UGAs are very small in area, surrounded by widespread rural and agricultural resource lands, giving the county a predominantly rural character.

The Yakima County Horizon 2040 Comprehensive Plan includes a Natural Hazards element that ensures that "when planning for natural hazards, the county must balance public safety with the protection of individual property rights." The plan element specifically addresses mitigation

capabilities in the county, and addresses flooding, wildfire, and drought as hazards of concern that may be directly influenced by land use and development patterns. Yakima County’s existing Critical Area Ordinance and the Shoreline Master Plan protect streams, wetlands, and vegetative buffers from development.

The Horizon 2040 Comprehensive Plan also includes many policies that reduce or restrict development in hazard prone areas, including wildfire risk reduction strategies, restriction of subdivisions in flooding areas, designated areas where development is not allowed due to landslide or other geological hazards, ensuring adequate stormwater infrastructure, and locating critical infrastructure outside of high hazard risk areas, among others.

2.4. Demographics

Yakima is the largest city in the county. In addition to its permanent resident base, the county has a large seasonal population related to the agricultural industry. This temporary population has been estimated at up to 50,000 during peak activity.

Table 2.1 below provides a summary of the area population, including the entire county, unincorporated areas, and each town in Yakima County. The county population has grown by 0.9% over the last thirty years and is projected to grow at the same rate over the next 10 years. This growth rate is slightly lower than that of Washington State (1.5% over the last 30 years).

Table 2.1. Area Population by Jurisdiction in Yakima County²			
Jurisdiction	2010 Actual	2015 Actual	2022 Estimated
Yakima County	243,231	249,314	259,950
Unincorporated	83,755	85,618	88,955
Incorporated	159,476	163,696	170,995
Grandview	10,862	11,108	11,020
Granger	3,246	3,377	3,740
Harrah	630	603	580
Mabton	2,286	2,120	1,975
Moxee	3,308	3,830	4,665
Naches	795	927	1,125
Selah	7,147	7,638	8,365
Sunnyside	15,858	15,856	16,500
Tieton	1,191	1,295	1,505
Toppenish	8,949	8,814	8,870
Union Gap	6,047	6,254	6,640
Wapato	4,997	4,811	4,615
Yakima	91,196	93,927	98,200

² Estimates from Washington Office of Financial Management and U.S. Bureau of Economic Analysis as summarized by the Employment Security Department

Table 2.2 below shows the race and ethnicity of the Yakima County population compared to Washington State for 2010, while **Table 2.3** illustrates the same data for 2021. The percentage of the Yakima County population that is Hispanic or Latino has grown since 2010, now constituting 51% of the population, compared to just 14% for Washington as a whole.

Table 2.2. Race and Ethnicity in Yakima County (2010)

Jurisdiction	Non-Hispanic Population by Race						Hispanic or Latino
	White alone	Black or African American alone	American Indian and Alaska Native alone	Asian alone	Native Hawaiian and Other Pacific Islander alone	Two or More Races	
Washington	4,888,788	231,472	89,149	479,752	39,321	240,268	755,790
Yakima County	116,419	1,756	9,120	2,386	144	3,936	109,470
Washington	72.7%	3.4%	1.3%	7.1%	0.6%	3.6%	11.2%
Yakima County	47.9%	0.7%	3.7%	1.0%	0.1%	1.6%	45.0%

Table 2.3. Race and Ethnicity in Yakima County (2021)

Jurisdiction	Non-Hispanic Population by Race						Hispanic or Latino
	White alone	Black or African American alone	American Indian and Alaska Native alone	Asian alone	Native Hawaiian and Other Pacific Islander alone	Two or More Races	
Washington	4,943,852	304,625	91,991	748,230	64,664	509,296	1,085,366
Yakima County	103,322	1,758	9,399	2,884	228	7,916	132,593
Washington	63.7%	3.9%	1.2%	9.6%	0.8%	6.6%	14.0%
Yakima County	40.0%	0.7%	3.6%	1.1%	0.1%	3.1%	51.4%

Yakima County has a generally younger population than Washington state, with 49.5% of residents under 18 years old, and 14% over 65 years old in 2021. Additionally, Yakima County has slightly lower educational attainment than Washington state. Less than 75% of the county population 25 years and older has a high school diploma, and 17.6% of adults have a bachelor's degree or higher.

2.5. Local Economy

Agriculture is the bedrock of the Yakima County economy. The industry is the number one employment sector, followed by health services and local government. In 2020, agricultural employers provided over 30,000 jobs in Yakima County (about 28% of total employment). Health services provided 16,500 jobs (15%) and local government provided 13,000 jobs (12%). Together, these industries provide over 54% of total covered employment in the county.

Table 2.4 below summarizes the top five Yakima County industry sectors in 2020 in terms of employment.

Sector	Number of Jobs	Share of Employment
Agriculture, forestry, and fishing	30,767	27.8%
Health services	16,543	14.9%
Local government	13,079	11.8%
Retail trade	10,623	9.6%
Manufacturing	8,010	7.2%
All other industries	31,778	28.7%
Total covered employment	110,800	100%

Agriculture

Yakima County has 558,000 irrigated acres of private land used for agriculture. The Yakima Project, operated by the U.S. Bureau of Reclamation, supplies irrigation water to approximately 464,000 acres across the Yakima Basin. Five reservoirs, the Keechelus, Kachess, Cle Elum, Rimrock, and Bumping lakes, serve as storage for water that is then released to supply irrigation diversions through the Basin.³ As the state's leading agricultural county, Yakima has a large and highly varied farm base, complemented by diverse non-agricultural sectors. Yakima County is Washington State's number one producer of apples, hops, corn, spearmint, peppermint, and grapes and one of the top producers of sweet cherries. In 2015 and 2016, the Yakima Valley produced more hops than any other agricultural area in the world, edging out Germany, which had long held the title. Each year, about 75% of the nation's hop crop comes from the Yakima Valley. Yakima's wine industry has gained national awareness, producing award winning varieties of Cabernet Sauvignon, Chardonnay, Riesling, Merlot, and Syrah wines. Yakima produces 29% of the nation's cherries, 42% of the nation's pears, and 38% of the nation's concord grapes. Yakima County is one of the leaders in the state for its inventory of bee colonies, cattle, and sheep. Yakima County ranks eighth in the nation for milk production.

Health Services

This industry expanded by 27% between 2010 and 2020, adding more than 3,000 jobs in Yakima County. Health services moved from the third to the second largest sector in that same time. Jobs in the health services industry are relatively "good paying" compared to agriculture, making up 16% of total wage income in the county.

³ Yakima Basin Fish & Wildlife Recovery Board. Yakima Basin Overview. Accessed from <https://ybfwrp.org/yakima-basin-overview/>

Government

Of the three levels of government (federal, state, and local) the largest numbers of employees are in the local level, specifically in the elementary and secondary school system. The Joint Base Lewis-McChord Yakima Training Center, located seven miles north of Yakima, is the Army's premier maneuver training area in the Northwest and has 325 permanent military/civilian personnel. The government sector also includes jobs and wages at tribal organizations.

Retail Trade

Retail trade added the fourth-largest number of jobs across Yakima County between 2010 and 2020, with 50% of the growth in building material and garden supply stores. This sector provides a smaller percentage of total wage income compared to total employment in the county, as a higher percentage of jobs are part time.

Manufacturing

Closely tied with Washington's agricultural tradition is value added manufacturing processes with specific focus on food processing. These activities include milling, blending, packaging, canning, freezing, processing, manufacturing, and refining end products for industrial, business and consumer production. Food processing represents about 41% of the manufacturing sector in Yakima County. A significant share of manufacturing employment stems from the agricultural sector but lumber and wood products, non-electrical machinery, paper and allied products, transportation equipment, metals, plastics, and fabricated metal products all have a significant impact. Biofuel is an emergent industry with a bright future in Yakima County, and includes bio-diesel, bio-gas, and ethanol products.

2.6. Government

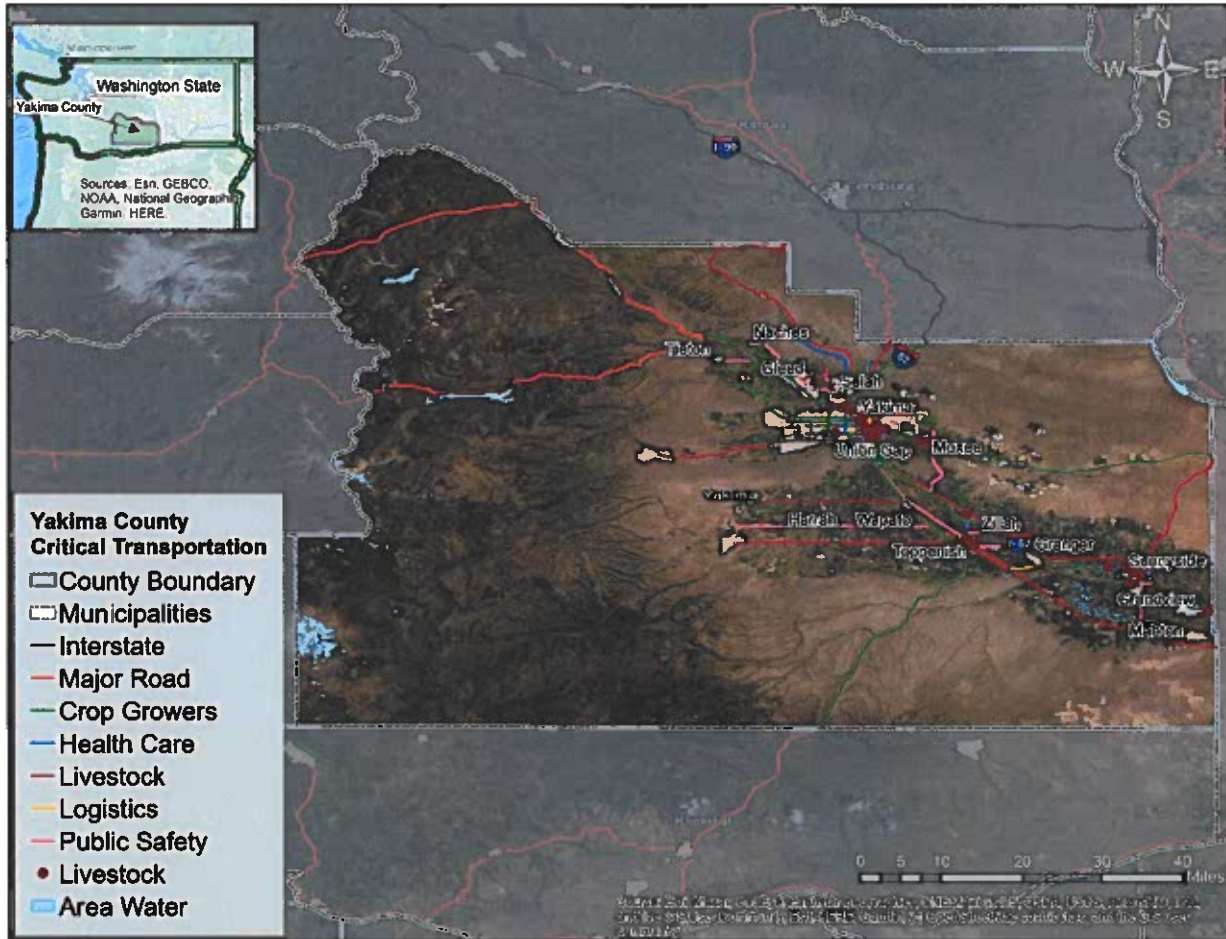
Yakima County has a County Commission with three elected commissioners. The city of Yakima has a City Manager, a seven-member City Council and serves as the county seat. There are 14 incorporated towns within the county that are governed by city/town councils. Yakima County maintains 1,655 miles of roads, a large majority of which are oiled or gravel. There are 9 County Fire Districts that operate outside the Valley's major towns or cities. Approximately 600 paid and volunteer firefighters help run these rural fire stations. Yakima County maintains a jail facility with an average daily inmate population of 326.

Washington State uses sales and use taxes, business and occupation (B&O) taxes, gas taxes and property taxes to generate a predominate share of overall state revenue. The state's tax structure is relatively stable when tracked against changes in personal income. Washington State has no corporate income, unitary, or inventory tax. There is also no tax on interest, dividends, or capital gains. The business and occupation tax is based on gross receipts generated within the state. Local governments work within the state tax collection system. A portion of local property taxes and sales taxes is also retained by Yakima County.

2.7. Transportation

Figure 2.1 illustrates the critical transportation corridors in Yakima County based on several primary functions, including crop growers, healthcare, livestock, logistics, and public safety.

Figure 2.1. Critical Transportation in Yakima County



- Major Highways:** Interstate 82 runs through the heart of Yakima County. The modern freeway links with Interstate 90 at Ellensburg, just 30 miles north of Yakima and Interstate 84 to the south. I-90 connects Seattle with New York City. Major highways include US Routes 12 and 97, and State Routes 22, 24, 241, and 410.
- Transit:** Yakima Transit buses connect Yakima, Selah, and Union Gap with all downtown services. Buses run every 20 minutes. Greyhound Bus Lines serve daily routes from Grandview, Sunnyside, Granger, Toppenish, Wapato, and Yakima to Seattle, Pasco, and Portland.
- Airport:** General aviation service is available at Yakima Air Terminal, Sunnyside Airport, and Buena Field. Yakima is served by Alaska Airlines with three flights daily to Seattle. There are two full service fixed base operators on the airfield. Airfreight service is available from Federal Express and UPS.

- **Motor Freight Carriers:** Within Yakima County there are 10 trucking firms for heavy hauling, one for liquid or dry bulk, two for local cartage, and 38 for motor freight.
- **Railroads:** Rail shipment to and from Yakima County is available via Burlington Northern Santa Fe and Central Washington railroad lines with 292 active spurs throughout the county.
- **Ports:** Puget Sound is three hours from Yakima County and provides major international ports on the Pacific Ocean. Inland ports are available within two hours on the Columbia River.

2.8. Utilities

- **Electric:** Hydroelectric dams on the Columbia and Snake Rivers provide Washington State with the lowest rates in the nation. Yakima County is served by three electric utilities, Pacific Power, an investor-owned utility, Yakama Power, owned by Yakama Nation, and the Benton County Rural Electric Association.
- **Natural Gas:** Cascade Natural Gas Corporation distributes natural gas throughout Yakima County with service available for all types of installations.
- **Solid Waste Disposal:** Solid waste collection service is available throughout the county either by municipal systems or private companies. There are three solid waste landfills and two transfer stations within Yakima County. The area has recycling centers for some items.
- **Water:** The Utilities Division of Yakima County operates 27 water systems throughout the county. Most cities in the county also operate their own water systems, typically sourced from groundwater. Many homes in Yakima County use private domestic wells, and as documented in the Lower Valley Groundwater Management Area reports, are subject to higher concentrations of nitrates that exceed drinking water standards.
- **Wastewater:** Each city operates its own wastewater collection system, while Yakima County operates three wastewater systems. The Port of Sunnyside operates a system dedicated to the treatment of industrial waste. The regional treatment plant operated by the City of Yakima has a delegated industrial pretreatment monitoring program in place.
- **Telecommunications:** Advanced telecommunication services are available in most major communities in Yakima County. Competition between local providers has helped improve telecommunications infrastructure dramatically. Extensive fiber optic cables are in place in most of the major communities in the region, including Yakima.

SECTION 3. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Hazard events happen somewhere in the world every day. Whether such events become a disaster depends on whether there are injuries, deaths, or significant property, natural resource, or cultural damage. Conducting a risk assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment. At the most fundamental level, both DHS and FEMA recognize that:

Risk = Frequency of a Hazard X Consequence from that Hazard

To reach a certain level of **risk**, there must be a probability or likelihood for that event to occur (**frequency**). Likewise, if the event does happen, but there is no **impact or consequence**, the level of risk is negated or substantially reduced. To determine the risk for each hazard, this assessment considers frequency of the hazard based on historic occurrence and future climate conditions, as well as potential consequences. The risk assessment includes three elements:

- **Hazard Identification** selects 17 hazards that consistently affect this geographic area. These hazards were identified based on input from the HMP Committee as well as review of the 2018 Washington State HMP. A summary of the identified hazards is available as [Section 3.2](#).
- **Hazard Profiles** describes its geographic impact area, extent or intensity of the hazard, probability of its occurrence, causes and characteristics of each hazard, how it has affected Yakima County in the past, and how Yakima County's population, critical facilities, built infrastructure, economy, emergency and critical operations, and natural and cultural resources might be vulnerable. Using the best available data, the HMP estimates potential losses from the hazards. For each hazard where data was available, quantitative estimates for potential losses are included in the hazard assessment. Hazard profiles are available as [Section 3.5 – 3.21](#).
- **Critical Facilities Exposure** combines hazard identification with an inventory of the existing critical facilities that may be exposed to a hazard. Critical facilities are of particular concern because these entities provide essential services to the public that are necessary to preserve the welfare and quality of life in the county and fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities have been identified, plotted in GIS, and overlaid with hazard mapping. The summary of critical facilities is available as [Section 3.3](#).

3.1. Risk Assessment Methodology

Some hazards can be expected in Yakima County given regular climate and weather conditions. These types of hazards are “chronic” hazards as they occur with some regularity and can sometimes be predicted through historic evidence and scientific methods. Other disasters are “catastrophic” as they do not occur with the frequency of chronic hazards and can have devastating impacts on life, property, and the environment when they do occur.

The HMP Risk Assessment used the criteria in **Table 3.1** to evaluate the future probability and historic frequency of hazard events.

Table 3.1. Risk Assessment Methodology – Frequency and Probability					
	Very Unlikely	Unlikely	Somewhat Likely	Likely	Very Likely
Historical Occurrence (Frequency)	Extremely Rare or No Documented History	51-100 years	11-50 years	5-10 years	1-4 years
Future Probability	100+ years	51-100 years	11-50 years	5-10 years	1-4 years
Score	1	2	3	4	5

Anticipated consequences or impacts to Yakima County communities from various hazards are determined using the impact criteria described in **Table 3.2**. By using these criteria, a comparison of each hazard can be made to determine which pose the greatest risk. The determination of which hazards present the greatest risk is based on the combined score of impacts.

The impact score is then combined with the frequency score to generate a risk level of **High**, **Medium**, or **Low** for each hazard. A summary of hazard risk rankings is included in [Section 3.4](#) and in detail within each hazard profile.

Table 3.2. Risk Assessment Methodology – Impact Criteria

	Very Low	Low	Medium	High	Very High
Human Health	0-1 death	2-3 deaths	4-5 deaths	6-9 deaths	10+ deaths
	0-3 injuries	4-7 injuries	8-10 injuries	11-19 injuries	20+ injuries
Property Damage	Minimal	Localized repairable	Widespread repairable; OR localized substantial	Widespread substantial damages	Widespread non-repairable
Economic Disruption	Minimal	Localized temporary	Widespread temporary	Up to 6 months	Long-term disruption
Environmental Resource Damages/Degradation*	Minimal	Localized minor	Widespread minor	Localized severe	Widespread severe and/or long-term
Emergency Services Burden	Minimal	Localized and temporary burden	Widespread and temporary burden; OR localized and medium-term	Widespread and medium-term burden (<14 days)	Widespread and long-term burden (>14 days)
Critical Facilities Exposure	<10% exposed	10-20% exposed	20-30% exposed	30-50% exposed	>50% exposed
Score	1	2	3	4	5

**Environmental Resource Damages/Degradation includes impacts to agriculture such as livestock deaths, crop damages, and soil degradation.*

3.2. Hazard Identification

Yakima County is vulnerable to approximately 54 threats and hazards, listed in Table 3.3. They range from natural to technological or human-caused events. The HMP Committee reviewed the list of threats and hazards, the hazards included in the 2015 Yakima County HMP, and the 2018 Washington State HMP to determine the hazards to include in the 2022 plan update.

Natural Hazards	Technological and Human-caused Hazards
Avalanche	Air Pollution
Cold, Extreme	Attack, Conventional
Cold, Freeze	Building/Structure Collapse
Dam/Levee Failure	Business Interruption
Drought	Chemical Stockpiles
Epidemic/Pandemic, Animal	Civil Unrest
Epidemic/Pandemic, Human	Ecological Terrorism
Fire, Brush	Economic Emergency
Fire, Forest	Energy Emergency
Fire, Range	Financial Collapse
Fire, Rural/Urban	Fire/Explosion
Flood, Flash	Fuel Shortage
Flood, Riverine/Stream	Hazardous Materials Incident, Fixed Facility
Flood, Urban	Hazardous Materials Incident, Transportation
Heat, Extreme	Hostage Situation
Landshift, Earthquake	Power Outage
Landshift, Earthslide/Rock Slide	Radiological, CGS or DOE
Landshift, Erosion	Radiological, Transportation
Landslide	Riot/Demonstrations/Violent Protest/Illegal Assembly
Storm, Blizzard	Sabotage
Storm, Dust/Sand	Strike
Storm, Ice/Hail	Transportation Accident, Aircraft
Storm, Lightning	Transportation Accident, Railroad
Storm, Snow	Water Shortage
Storm, Windstorm	Weapons of Mass Destruction: biological, chemical, explosive, incendiary, nuclear incidents
Tornado	Workplace Violence: business/industry and schools
Volcano	

Table 3.4 describes the identified hazards included in the 2022 HMP Update, as well a description of changes from the 2015 HMP.

Table 3.4. Hazard Identification Summary		
Hazard Type	Changes from 2015	Explanation
<i>Natural Hazards</i>		
Agricultural Disease Outbreak	New hazard in 2022.	Agricultural disease is included in the 2018 Washington State HMP. As a predominantly agricultural community, Yakima County is reliant on healthy and consistent crop returns. Yakima County has been impacted by agricultural diseases including Mad Cow disease, avian influenza, cherry disease, and invasive pests including stinkbugs, apple maggots, and the Japanese Beetle.
Avalanche	Avalanche was included as a hazard in 2015.	Based on the location of key transportation routes and recreational areas threatened by avalanche, parts of Yakima County would be vulnerable. Yakima County Planning Division uses policies and ordinances to mitigate for avalanches and other geologic hazards through the Critical Areas Ordinance, as described in Section 5.1 , which has also been adopted by most municipalities.
Drought	Drought was included as a hazard in 2015.	From the State Hazard Mitigation Plan, a county is most vulnerable to drought if it meets at least five of seven criteria. Yakima County meets those criteria. Yakima County Comprehensive Plan was updated in 2017 to include a Hazard Mitigation element addressing drought among other natural hazards.
Earthquake	Earthquake was included as a hazard in 2015.	Factors including the size of potentially vulnerable populations, the age of the housing stock, and building materials such as unreinforced masonry, play a part in determining which counties are most vulnerable. Yakima County is at risk to both a localized earthquake as well as the impacts of a Cascadia Subduction Zone earthquake impacting Seattle and the greater Pacific Northwest. Yakima County Planning Division uses policies and ordinances to mitigate for earthquakes and other geologic hazards through the Critical Areas Ordinance, as described in Section 5.1 , which has also been adopted by most municipalities.
Erosion	Erosion was combined with Landslides and other geologic hazards in the 2022 HMP.	Long-term erosion is a result of multi-year impacts such as repetitive flooding. Death and injury are not typically associated with erosion; however, it can destroy buildings and infrastructure.
Extreme Temperatures	Extreme Temperatures was included as a hazard in 2015.	Extreme heat is typically recognized as the condition where temperatures consistently stay ten degrees or more above a region's average high temperature for an extended period. Fatalities can result from extreme temperatures, as they can push the human body beyond its limits (hyperthermia and hypothermia).
Flood	Flooding was included as a hazard in 2015.	Yakima County regularly experiences flooding events that damage homes, property, and critical infrastructure, as well as disrupting critical operations and the local economy.

Table 3.4. Hazard Identification Summary		
Hazard Type	Changes from 2015	Explanation
		<p>Since the 2015 HMP, several communities in the county experienced damaging flood events in 2016 and 2017.</p> <p>Yakima County Planning Division uses policies and ordinances to mitigate flooding impacts. Yakima County Critical Areas Ordinance (Titles 16A and 16C) and Yakima County Shoreline Master Program (Title 16D) implement policies that restrict development in the floodplain and floodway and protect hydrologically related critical areas. These critical areas include flood hazard areas and wetlands, which provide flood flow attenuation and other flood mitigation functions. Most municipalities in Yakima County have adopted the Critical Areas Ordinance and Shoreline Master Program.</p> <p>Yakima County Comprehensive Plan was updated in 2017 to include a Hazard Mitigation element addressing flooding among other natural hazards.</p>
Hail	Hail was combined with other severe weather events for the 2022 HMP.	Hailstorms frequently accompany thunderstorms, so their locations and spatial extents overlap. Hail can cause substantial damage to vehicles, roofs, landscaping, and other areas of the built environment. U.S. agriculture is typically the area most affected by hail storms, which cause severe crop damage even during minor events.
Landslide	Landslide was included as a hazard in 2015. This hazard now includes Erosion.	On October 11, 2009, a landslide occurred at approximately RM 22.3 (T 15N, R15E, Sec. 2) on the Naches River in Yakima County. The landslide was a rotational slump, approximately 16 million cubic yards in size. State Route 410 was obliterated in the slide area for a quarter mile, and the Naches River was completely blocked by landslide debris on the western side of the slide. Yakima County Planning Division uses policies and ordinances to mitigate for Landslides and other geologic hazards.
Lightning	Lightning was combined with other severe weather events for the 2022 HMP.	Lightning can strike communications equipment (e.g., radio or cell towers, antennae, satellite dishes, etc.) and hamper communication and emergency response. Lightning strikes can also cause significant damage to buildings, critical facilities, and infrastructure, largely by igniting a fire. Lightning can also ignite a wildfire.
Public Health Emergency (Communicable Disease)	New hazard in 2022.	Yakima County, along with the rest of the world, was heavily impacted by COVID-19 in 2020-2022. The global pandemic interrupted daily life, critical operations, global and local supply chains, and led to the death of over 800 people in Yakima County. Other communicable diseases, including vector-borne, are an annual concern.
Severe Wind Storm	Wind Storm was combined with other severe weather events for the 2022 HMP.	All areas of Washington State are vulnerable to severe weather. Typically, a severe storm can cause major impacts to transportation, infrastructure and services, and loss of utilities. Most storms move into Washington from the

Table 3.4. Hazard Identification Summary		
Hazard Type	Changes from 2015	Explanation
		Pacific Ocean. A severe storm is defined as an atmospheric disturbance that results in one or more of the following phenomena: high winds, large hail, thunderstorms, lightning, or tornadoes.
Severe Winter Storm	Severe Winter Storms was included as a hazard in 2015.	All areas of Washington State are vulnerable to severe weather. Typically, a severe storm can cause major impacts to transportation, infrastructure and services, and loss of utilities. Most storms move into Washington from the Pacific Ocean. Severe winter storm is profiled separately from other severe weather, given the impacts of heavy snow, ice, and long duration power outages.
Tornado	Tornado was combined with other severe weather events for the 2022 HMP.	All areas of Washington State are vulnerable to severe weather. Typically, a severe storm can cause major impacts to transportation, infrastructure and services, and loss of utilities. Most storms move into Washington from the Pacific Ocean. A severe storm is defined as an atmospheric disturbance that results in one or more of the following phenomena: high winds, large hail, thunderstorms, lightning, or tornadoes.
Volcanic Eruption	Volcanic Eruption was included as a hazard in 2015.	<p>Scientists define a volcano as active if it has erupted in historic time or is seismically or geothermally active. By this definition Mount Rainier, Mount Baker, and Mount St. Helens are active volcanoes. Mount Adams is also capable of renewed activity.</p> <p>On May 18, 1980, at 8:32 a.m., Mount St. Helens erupted killing 57 people. After a 5.1 magnitude earthquake, the volcano's summit slid away in a huge landslide, the largest in earth's recorded history, at that time. The landslide depressurized the volcano's magma system, triggering a powerful explosion that ripped through the sliding debris. Rock, ash, volcanic gas, and steam were blasted upwards and outward to the north. Over the course of the day, prevailing winds blew 520 million tons of ash eastward across the United States and caused complete darkness in across Yakima County. The ash fall required millions of dollars in clean-up and ash removal, and impacted local businesses and agriculture for several years.</p> <p>Yakima County Planning Division uses policies and ordinances to mitigate for Volcanic Eruptions and other geologic hazards, which have been adopted by most municipalities in the county.</p>
Wildfire	Wildland Fire was included as a hazard in 2015. This hazard is slightly modified to reflect concern for	Residents of Yakima County have experienced repeated cycles of wildland fires. A series of major wildfires between the 2010 Cowiche Mill Fire and the 2021 Schneider Springs Fire have prompted residents, government officials, a local recreation nonprofit land owner, and local

Table 3.4. Hazard Identification Summary		
Hazard Type	Changes from 2015	Explanation
	WUI as well as wildland fires.	<p>fire district leaders to come together and act to reduce the future risk of damaging wildfires.</p> <p>Yakima County Comprehensive Plan was updated in 2017 to include a Hazard Mitigation element addressing wildfire among other natural hazards. The Yakima County Community Wildfire Protection plan was updated in 2022 and adopted as an annex to the 2022 HMP.</p>
Technological and Human-caused Hazards		
Cyber Threat/Attack	New hazard in 2022.	Cyber attacks are considered the fastest growing threat to communities. Cyber threats are rapidly increasing in frequency and expanding in size, scope, and style. Local governments are considered very underprepared for cyber threats, and many communities within Washington have been impacted in recent years.
Dam/Levee Failure	Dam/Levee failure was partially included in 2015 as an aspect of Flooding. It is included as a distinct hazard in 2022.	Nearly every Yakima County community is located in a dam inundation area. There are at least six High Hazard Potential Dams in the area that require monitoring and maintenance, as well as public education to understand the potential threat and protective actions. Levee failure, while potentially less severe, may be more likely to occur given the extensive system throughout Yakima County resulting in more levee miles than dam miles. Levee failure results in dynamic erosive forces, and different stage and volume characteristics of flood events.
Hazardous Materials	Hazardous Materials Incident was included as a hazard in the 2015 HMP.	There are three types of hazardous materials threats in Yakima County – fixed facilities, transport, and pipelines. Interstate 82 runs through the heart of Yakima County. The modern freeway links with Interstate 90 at Ellensburg, just 35 miles north of Yakima and Interstate 84 to the south. I-90 connects Seattle with New York City. Major highways include US Routes 12 and 97, and State Routes 22, 24, 241 and 410. Rail shipment to and from Yakima County is available via Burlington Northern Santa Fe railroad with 292 active spurs throughout the county. Yakima County has over 2,350 fixed facilities subject to Tier II Extremely Hazardous Substances reporting, as defined by the Environmental Protection Agency.
Nuclear Release/Radiological Incident	New hazard in 2022.	Yakima County is within the 50-mile radius of Hanford Site in southeastern Washington. While a well-regulated site, there is some risk that a spill or release could impact the wider region, including embargoes on Yakima Valley agricultural products. A radiological incident is included in the 2018 Washington State HMP.
Terrorism	New hazard in 2022.	Terrorism is included in the 2018 Washington State HMP. While there is no recent history of terrorism in Yakima County, domestic violent extremism is of growing concern in many communities.

3.3. Critical Facilities Exposure

After determining which hazard events can impact Yakima County, the HMP Committee considered the critical facilities that are vulnerable to the identified hazards. Location data for 1,277 assets were collected using Yakima County GIS, City of Yakima GIS, national and state GIS databases, and through the collection of physical addresses. Each facility was then plotted within a GIS shapefile and overlaid with available hazard geographic layers. The assessment only includes point data (location data) rather than line data such as roads and railways.

The result of this overlay serves as an exposure analysis of critical facilities to certain hazards. Hazards that impact the entirety of Yakima County, such as winter storms, are not included in the exposure analysis. It is assumed that all critical facilities are at risk of these more chronic hazards, and their vulnerability is more related to building age and maintenance needs than location.

The following hazards were included in the critical facilities exposure analysis:

- **Flood:** Facilities located in the 100-year floodplain (Special Flood Hazard Area)
- **Landslide:** Facilities with a medium landslide risk or higher
- **Wildfire:** Facilities with high or extreme wildfire risk
- **Dam/Levee Failure:** Facilities located in a mapped dam or levee inundation area
- **Hazardous Materials:** Facilities located within a one-mile buffer zone of major transportation routes

Table 3.5 identifies the categories of critical facilities identified for the exposure analysis. In addition to the critical assets included in the Risk Assessment, each hazard profile includes expected impacts to critical assets.

Table 3.5. Yakima County Critical Facilities Exposure

Facility Type	Landslide	Flood	Wildfire	Dam/Levee Failure	HazMat	Total by Facility Type
Communications (Cell and Radio Towers)	3	0	6	7	14	30
Education (Childcare and Schools)	2	11	2	63	122	200
Emergency Services (Fire Stations, Police Stations, EMS, and Emergency Management)	4	5	4	18	40	71
Hospitals	0	0	0	1	0	1
Mass Care (Food Distribution, Emergency Shelters)	0	6	0	26	43	75
Transportation (Air, Bridges, Rail Stations, Public Transit Stations, EV Charging Stations)	32	137	25	147	233	574
Utilities (Dams, Levees, Irrigation Districts, Water and Wastewater, Power)	3	4	7	30	37	81
Total Facilities Exposed by Hazard Percent Exposed	44 3.4%	163 12.8%	44 3.4%	292 22.9%	489 38.3%	1032

3.4. Risk Assessment Results

The Planning Committee analyzed each of the hazards using the Probability/Frequency and Impact Criteria described in [Section 3.1](#). The total scores for each hazard event were further refined into three categories to better illustrate which hazards present the greatest threat to Yakima County. The three categories are as follows:

- **High = more than 22 points**
- **Medium = 18-22 points**
- **Low = less than 18 points**

Table 3.6 provides a summary of the risk assessment results, as well as a comparison to the 2015 HMP risk assessment. It is important to note that the methodology has changed between the 2015 and 2022 HMPs, so a direct comparison of scores is not applicable. Each hazard profile provides more detailed scoring using the previously described Probability/Frequency and Impact Criteria. Major changes between 2015 and 2022 include:

- **Complete Rankings:** Some hazards, including Drought, Extreme Temperatures, and Avalanche did not receive a complete ranking in the 2015 HMP.
- **Risk Increases:** Many hazards have a higher risk ranking than in the 2015 HMP, including Wildfire, Severe Winter Weather, Dam/Levee Failure, and Hazardous Materials. Only Earthquake has a slightly lower hazard ranking.

Natural Hazards	2022 Risk Ranking and Score	2015 Risk Ranking
Wildfire	25 - High	Medium
Flooding	24 - High	High
Public Health Emergency	24 - High	N/A
Severe Winter Weather	24 - High	Medium
Drought	22 - Medium	Not Ranked
Agriculture Disease Outbreak	21 - Medium	N/A
Landslide and Geologic Hazards	20 - Medium	Medium
Severe Weather	20 - Medium	Medium-Low
Extreme Temperatures	19 - Medium	Not Ranked
Earthquake	18 - Medium	Medium-Low
Avalanche	14 - Low	Not Ranked
Volcanic Eruption	12 - Low	Low
Technological and Human-caused Hazards	2022 Risk Ranking and Score	2015 Risk Ranking
Dam/Levee Failure	24 - High	Medium
Hazardous Materials Incident	23 - High	Medium-Low
Cyber Incident	18 - Medium	N/A
Nuclear/Radiological Incident	16 - Low	N/A
Terrorism	16 - Low	N/A

3.5. Agricultural Disease Outbreak

The agriculture sector in Yakima County is significant – the 12th largest agricultural producing county in the nation, according to the Yakima County Development Association. The area grows various consumable products and manages one of the largest concentrations of farm animals in the Pacific Northwest.⁴ In 2020, agriculture, forestry, and fishing accounted for 27.8% of employment.⁵ According to the University of Washington, the annual value for animal agriculture is approximately \$600 million and irrigated land including 140,000 acres and a total of acres managed being 2.2 million acres.⁶ The health of a county's agriculture sector can be negatively affected by disease. The introduction of invasive pests and agricultural disease to plants and animals in Yakima County may impact the population, built environment, critical infrastructure, government and emergency operations, economy, and natural resources.

Livestock, including birds, cattle, equine, rabbits, sheep, goats, and swine, as well as crops and plants are all susceptible to disease. Tree fruit crops, vegetable crop, fruit & berry crop, and nut crops are cultivated in Yakima County can be affected.⁷

Some of the agricultural diseases and invasive pests of note in Yakima County include:

- **Mad Cow Disease** or Bovine Spongiform Encephalopathy is a neurological disease of cows that damages the cow's central nervous system and progressively becomes worse over time.⁸
- **Avian influenza** or bird flu is a disease caused by infection with avian influenza Type A viruses. These viruses naturally spread among wild birds worldwide and can infect domestic poultry and other animal species.⁹
- **Cherry Diseases** include Brown Rot, Black Knot, and Cherry Leaf Spot.¹⁰ Proper ventilation, direct sunlight, and proper maintenance of leaf debris is needed to ward off these diseases.
- **Invasive Pests** are intrusive non-native pest species that severely impact both natural and managed lands.¹¹ A common pest is the brown marmorated stink bug that feeds successfully on numerous fruit, vegetable, and field crops including apples, apricots, Asian pears, cherries, corn, grapes, lima beans, nectarines and peaches, peppers, tomatoes, and soybeans.¹²

⁴ Yakima Development Association. Food Processing. Accessed from: <https://chooseyakimavalley.com/key-industries/food-processing/>

⁵ Employment Security Department. Yakima County profile. Accessed from: <https://esd.wa.gov/labormarketinfo/county-profiles/yakima>

⁶ Washington State University. Irrigated pastures and grazed forages. Accessed from: <https://extension.wsu.edu/yakima/agriculture/irrigated-pastures-and-grazed-forages/>

⁷ Washington State University. Crop Production. Accessed from: <https://extension.wsu.edu/yakima/crop-production/>

⁸ U.S. Food & Drug Administration. All About BSE (Mad Cow Disease). Accessed from: <https://www.fda.gov/animal-veterinary/animal-health-literacy/all-about-bse-mad-cow-disease>

⁹ Center for Disease Control and Prevention. Information on Bird Flu. Accessed from: <https://www.cdc.gov/flu/avianflu/index.htm>

¹⁰ Ohio State University. Diseases of Cherries. Accessed from: <https://u.osu.edu/cfaescapstone/tree-fruits/cherries/diseases/>

¹¹ United States Department of Agriculture. Invasive Pests and Diseases. Accessed from: <https://www.nifa.usda.gov/topics/invasive-pests-diseases>

¹² United States Environmental Protection Agency. Brown Marmorated Stink Bug. Accessed from: <https://www.epa.gov/safepestcontrol/brown-marmorated-stink-bug>

Strength/Magnitude

An agricultural disease and pest outbreak may have severe impact on the county's food supply; causing production loss, starvation, environmental degradation, and financial ramifications. Agricultural disease can affect not only plants and animals but may even cause health issues to humans. Agricultural diseases have the potential to impact the local economy, through lost revenue or loss of real property through crop failure, livestock death, or lowered production.

Location

An agricultural disease can occur anywhere in Yakima County where crops and livestock are cultivated and managed. According to the 2018 Washington State HMP, central and eastern counties in the state are at higher risk to a disease due to the large numbers of farmlands and larger feedlots. In Yakima County alone there were 2,952 farms operating on about 1,781,463 acres.¹³

Past Occurrences

Yakima County has a historic record of facing agricultural diseases and pests. The county was the first to experience mad cow disease in 2003 in a dairy herd in Mabton, a small dairy farm in southeast Yakima County.¹⁴ At the time, multiple businesses reliant on beef consumption and sale were hit heavily with their stocks falling about 5 to 7%.¹⁵ 1,000 slaughterhouses and meat-packing employees lost their jobs and \$319 million was lost in revenue per month.¹⁶ Humans may become infected by eating infected animal parts.

During the HMP analysis period (2015-2021), Washington has experienced numerous agricultural diseases, some of which have affected Yakima County. In 2015 and 2016, the state killed hundreds of poultry birds to prevent the spread of the contagious avian influenza which was introduced by wild birds. According to the Washington State Department of Agriculture, Yakima County continues to discover cases of avian influenza in backyard flocks.¹⁷ This is of concern, since bird flu outbreaks can cause insurance burdens to farmers and property owners.

Specifically looking at plants, from 2015 to 2020, the prevalent Cherry Disease and X-Disease has affected the county's orchards, reaching approximately 238,856 trees.¹⁸

Pests such as stink bugs have also been prevalent in Yakima County; affecting crops and plants even today.¹⁹ Invasive pests such as the Spotted Winged Drosophila, Apple Maggots, and Coddling Moths have a history in Yakima County and continue to wreak havoc on Yakima County's crops and fruit yields. As a result of outbreak of Apple Maggots, the county

¹³ United States Department of Agriculture. Yakima County Washington, 2017. Accessed from: www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Washington/cp53077.pdf

¹⁴ HistoryLink. First U.S. case of mad cow disease is reported in a Mabton Dairy cow on December 23, 2003.

¹⁵ The Seattle Times. Mad-cow disease hits state; feds say beef absolutely safe. Accessed from: <https://archive.seattletimes.com/archive/>

¹⁶ Seattle Met. Washington's Mad Cow Scare, 10 years Later. Accessed from: <https://www.seattletimes.com/news-and-city-life/2014/01/washington-s-mad-cow-scare-10-years-later-december-2013>

¹⁷ Washington State Department of Agriculture. 2022 Washington bird flu detections. Accessed from: <https://agr.wa.gov/departments/animals-livestock-and-pets/avian-health/avian-influenza/bird-flu-2022>

¹⁸ Yakima Herald-Republic. Little cherry disease, pests, record heat battered Yakima Valley growers in 2021. Accessed from: <https://www.yakimaherald.com/news/local/little-cherry-disease-pests-record-heat-battered-yakima-valley-growers-in-2021/article>

¹⁹ Inlander. Invasion! Washington state under siege from the stink bug menace! Accessed from: <https://www.inlander.com/Bloglander/archives/2018/04/23/invasion-washington-state-under-siege-from-the-stinkbug-menace>

implemented quarantine actions in 2021.²⁰ At the time of plan development, Grandview was in quarantine for the Japanese Beetle.

Future Probability

The future probability of a pest, plant, and crop disease in Yakima County is **Very Likely** (expected to occur every 1-4 years), given the number of farming operations and acres of land in the county.

Climate Change Impacts

Climate change has a clear connection to agricultural disease. As a result of climate change, researchers estimate the frequency of damaging agricultural diseases to increase, potentially undermining the growth of crop yields.²¹ Colder locations will be able to sustain crops but will also be more conducive to pathogens.²² The Yakama Nation Climate Adaptation Plan notes that longer or shorter seasons for pest reproduction could impact forests and other plant species, as well as leave them more vulnerable to insect attacks and plant diseases.

Yakima County Vulnerabilities

The local economy and businesses linked to farming and agriculture are most vulnerable to agricultural disease and pest infestations. While this hazard poses little risk to the built environment or property, a significant outbreak could lead to major economic losses, business and food supply chain disruption, and impacts on natural resources.

Loss Estimates

Calculating losses from an agricultural disease is difficult and rare. Pests and pathogens are reported to cost global agriculture approximately \$540 billion a year.²³ Locally, agriculture contributes \$1.2 billion dollars to the local economy.²⁴

Impacts on the Yakima County Population and Vulnerable Populations

An agricultural disease can have a significant impact on the population in Yakima County. Plant disease is known to reduce the food available to humans by interfering with crop yields. As a leading employment sector in the county, many families operate and manage farms, and livelihoods are linked to farming through equipment and supply sales or labor. Invasive pests and disease can negatively hurt families and workers that depend on this industry.

Impacts on Built Environment and Critical Infrastructure

There is no significant impact to the built environment or critical infrastructure from an agricultural disease.

²⁰ Yakima Herald-Republic. County pest board seeks public's help to contain apple maggots. Accessed from:

<https://www.yakimaherald.com/news/local/county-pest-board-seeks-publics-help-to-contain-apple-maggots/article>

²¹ Smithsonian Magazine. New study shows climate change may increase the spread of plant pathogens. Accessed from: <https://www.smithsonianmag.com/science-nature/new-study-shows-climate-change-may-increase-spread-plant-pathogens-180978377/>

²² Smithsonian Magazine. New study shows climate change may increase the spread of plant pathogens. Accessed from: <https://www.smithsonianmag.com/science-nature/new-study-shows-climate-change-may-increase-spread-plant-pathogens-180978377/>

²³ Reuters. Pests and pathogens could cost agriculture billions: report. Accessed from:

<https://www.reuters.com/article/us-environment-plants-idUSKCN18E005>

²⁴ Washington State University. Agriculture. Accessed from: <https://extension.wsu.edu/yakima/agriculture/>

Impacts on Government and Emergency Operations

There is no significant impact to government and emergency operations from an agricultural disease. However, the government may need to intervene to provide safety and inspection services, and alleviate and stabilize costs and prices, and policies.

Impacts on the Economy and Businesses

An outbreak of a plant and animal disease can be costly and have a serious impact on Yakima County’s economy and businesses. The agricultural sector is one of the largest employment sectors in Yakima County. In 2020 alone, employers in the agricultural sector provided approximately 30,767 jobs, or 27.8% percent of the total employment in the county.²⁵ Agricultural disease has the potential to result in production losses, a decline in local markets, increased unemployment, and disruption of regional and local supply chains. A small outbreak of an animal disease can influence trading partners to impose heavy embargoes on imports of products that could be infected with the disease.

Impacts on Natural and Cultural Resources

An outbreak of an agricultural disease and introduction of invasive pests can severely impact the surrounding natural resources. All species of plants, both wild and domesticated, are susceptible to disease. An outbreak can affect approximately 10-20% of a species or habitat. Plant pathogens and diseases can lead to plant and crop mortality, loss of animal ecosystem, and lower the health of the host population. Invasive pests can similarly ruin the environment eliminating yields and potentially harming humans.

Overall Risk Ranking

Yakima County has a **Medium Risk** to agricultural disease. While agricultural disease is included in the 2018 Washington State HMP, no hazard ranking is available for comparison. FEMA does not include agricultural disease in the National Risk Index. **Table 3.7** below summarizes the risk assessment results for the agricultural disease hazard for Yakima County.

Criteria	Score	Description
Human Health	1	Minimal
Property Damage	1	Minimal
Economic Disruption	3	Medium; widespread, temporary
Environmental Resource Damages/Degradation	4	High; localized, severe
Emergency Services Burden	1	Minimal
Critical Facilities Exposure	1	Minimal
Probability Score	5	Very High; expected to occur every 1-4 years
Frequency Score	5	Very High; has occurred every 1-4 years
Total Impact Score	19	Medium Risk

²⁵ Employment Security Department. Yakima County profile. Accessed from: <https://esd.wa.gov/labormarketinfo/county-profiles/yakima>

3.6. Avalanche

An avalanche is an often-rapid downhill motion of the snowpack or portion of the snowpack. This motion may be natural or artificially induced, and controlled or uncontrolled in terms of time, place, and severity. The amount of damage that occurs is dependent on the type of material moving with the snow, which could include soil, rock, and trees. When there are slabs of snow that dislodge from a mountainside, it gathers more snow on its way down and grows wider and larger. The more dangerous slab avalanche occurs when a cohesive mass of snow breaks free and moves downward, either as a single unit or breaking into smaller pieces traveling together. Velocity, the force of the flow, the path of the avalanche, and its pressure are other variables that influence the damage. Most avalanches occur on slopes between 30 and 40 degrees, but they can occur on slopes averaging between 25 to 50 degrees. Triggers include natural seismic or climatic factors such as earthquakes, thermal changes, blizzards, or human activities. Most avalanches occur in the backcountry.

Avalanches are comprised of three zones – the release zone where the mass breaks free and accelerates, the track where the mass travels downward at a relatively constant speed (often approaching 80 mph), and the runout zone where the mass slows and comes to rest. Although the exact moment of an avalanche cannot be predicted, avalanche conditions are readily recognizable, and avalanches tend to recur in the same areas.

Strength/Magnitude

The North American Avalanche Danger Scale, illustrated in Figure 3.1, is a tool used by avalanche forecasters to communicate the potential for avalanches that may cause harm or injury to backcountry travelers. The higher the level on the danger scale, the stronger the magnitude of the avalanche.

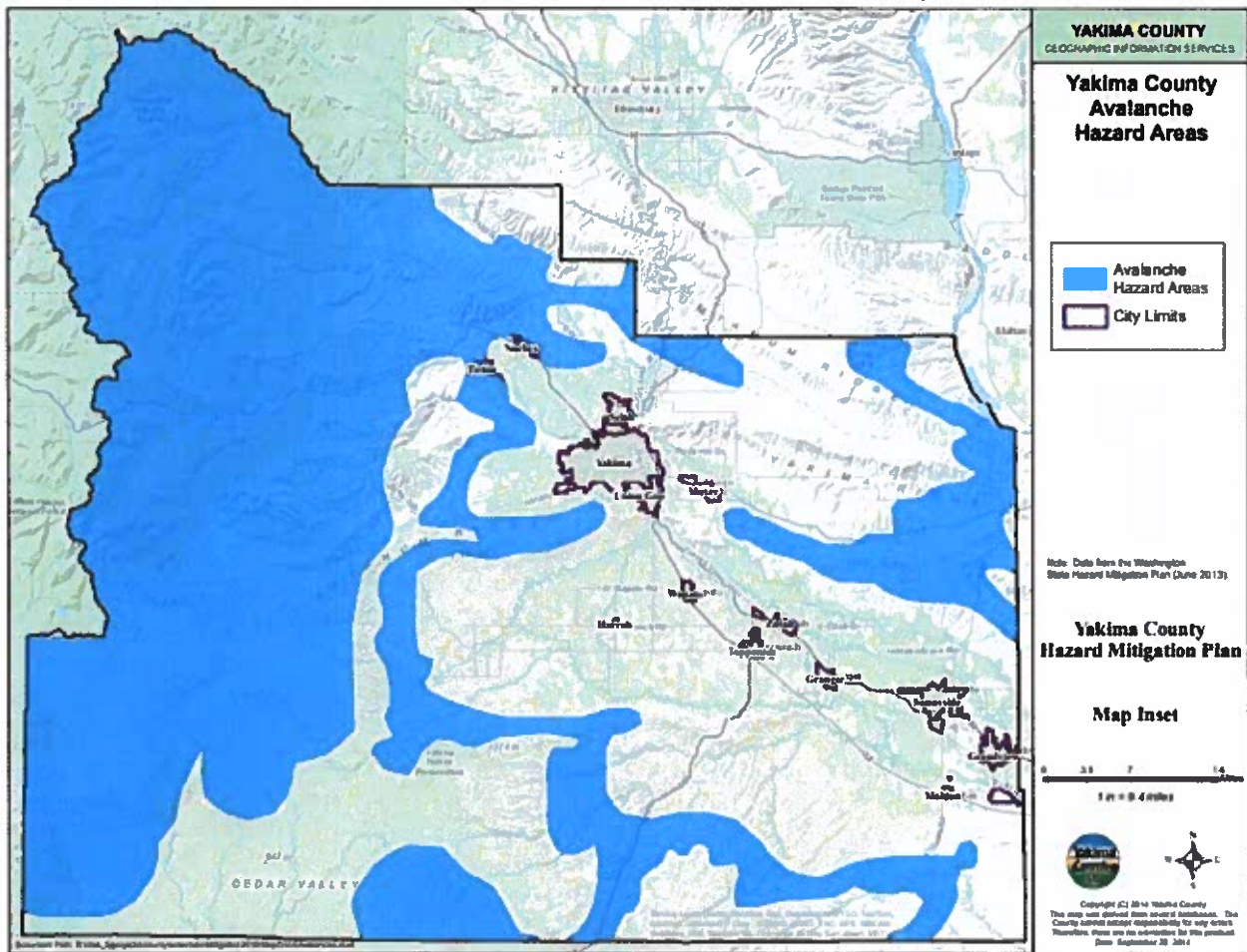
Figure 3.1. North American Avalanche Danger Scale

North American Public Avalanche Danger Scale Avalanche danger is determined by the likelihood, size and distribution of avalanches.		
Danger Level		Travel Advice
5 Extreme		Avoid all avalanche terrain.
4 High		Very dangerous avalanche conditions. Travel in avalanche terrain not recommended.
3 Considerable		Dangerous avalanche conditions. Careful snowpack evaluation, cautious route-finding and conservative decision-making essential.
2 Moderate		Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern.
1 Low		Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.
No Rating		Watch for signs of unstable snow such as recent avalanches, cracking in the snow, and audible collapsing. Avoid traveling on or under similar slopes.
Safe backcountry travel requires training and experience. You control your own risk by choosing where, when and how you travel.		

Location

Figure 3.2 illustrates where avalanches are most likely to occur in Yakima County. According to the 2018 Washington State HMP, approximately 50% of Yakima County land area is exposed to avalanches, but the vast majority of that is in unpopulated areas of the eastern slope of the Cascades. Avalanche hazard areas are typically outside city limits, however, the rural areas of the county near the Ahtanum Ridge (to the west) and Yakima Ridge (to the east) could experience avalanches. The greatest areas of concern for avalanche hazards are along critical transportation routes through rural and mountainous terrain, including along US-12 and US-97 through the Yakama Reservation. Intermittent winter avalanche control is used by Washington Dept. of Transportation (WSDOT) along US-12 at White Pass, on the very western edge of Yakima County, when conditions warrant, but a formal avalanche control program does not currently exist for this area.²⁶

Figure 3.2. Avalanche Hazard Areas in Washington



²⁶ Washington Emergency Management Division. 2018 Washington State Enhanced Hazard Mitigation Plan. Accessed from: <https://mil.wa.gov/asset/5f233441409d0>

Past Occurrences

On average, avalanches kill one to two people each year in Washington. The worst recorded avalanche in the state occurred in 1910 when massive avalanches hit two trains stopped on the west side of Stevens Pass; at least 96 people were killed. According to the 2018 Washington State HMP, there have been two avalanches in Yakima County since 1960, incurring \$575,512.96 in property damages. There have been no reported injuries or fatalities from avalanches in Yakima County.

Future Probability

Historically, Yakima County has experienced a major avalanche every 31 years since 1960, with no recorded events during the HMP analysis period (2015-2021). The future probability of a major avalanche is **Somewhat Likely** (expected to occur every 11-50 years).

Climate Change Impacts

In the short-term, mountain and terrain roughness is expected to rise and snow cover to become thinner, which will likely increase blunt trauma and secondary injuries. The survival rate of avalanches is expected to decline because wetter and warmer snow climate makes it more difficult to find someone buried.²⁷ In the distant future, avalanches will become less frequent as there will be less snowpack at lower elevations.

Yakima County Vulnerabilities

Yakima County is located between mountain ranges, increasing the chances of an avalanche. Mountainous parts of the county have a very low concentration of people or critical infrastructure, but the majority of the Yakama Reservation is in a vulnerable area. The hazard exposure for people and property is low, therefore the risk of damage is low.

Loss Estimates

Table 3.8 summarizes the 2022 Expected Annual Loss for avalanches in Yakima County, as provided by the FEMA National Risk Index. Expected annual loss is a likelihood and consequence component of risk that measures the expected loss of building value, population, and agricultural value each year.

Table 3.8. 2022 Expected Annual Loss - Avalanche²⁸

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	\$110,802	\$500	\$110,302	0.01	n/a

Based on the recorded hazard history, each of the past two occurrences averaged \$287,756.48 in property damage. That is an average of \$9,282.47 in expected losses each year.

Impacts on the Yakima County Population and Vulnerable Populations

Avalanches are more common in the backcountry away from populated areas. As a result, there is a low impact on the population. According to the 2018 Washington State HMP, less than 1%

²⁷ Frontiers. Effects of climate change on avalanche accidents and survival. <https://www.frontiersin.org/articles/10.3389/fphys.2021.639433/full>

²⁸ FEMA. National Risk Index for Natural Hazards. Accessed from <https://www.fema.gov/flood-maps/products-tools/national-risk-index>

of the population in Yakima County is vulnerable to avalanches. The most vulnerable groups to avalanches are recreationalists.

Impacts on Built Environment and Critical Infrastructure

There is no significant impact on Yakima County's built environment and critical infrastructure from avalanches. The 2018 Washington State HMP assessment indicated there were 601 critical infrastructure facilities in the County, 60 of which are in avalanche exposure areas. Similarly, the assessment found that less than 1% of the building stock is in an avalanche risk area. Avalanche risk areas are not included in the 2022 HMP critical facilities exposure analysis.

Impacts on Government and Emergency Operations

Emergency operations and traffic operations could be affected by debris from an avalanche. Depending on volume, an avalanche could block roadways, with closures lasting anywhere from a couple of hours to days. These roadblocks can affect emergency access and prolong response times. Avalanches could also lead to power outages that impact communications, transportation, and other daily operations for government and first responders.

Impacts on the Economy and Businesses

There is no significant impact on the Yakima County economy or businesses from avalanches. Avalanches mostly occur in the backcountry. When avalanches do occur, they restrict normal traffic movement and can reduce access to ski resorts or other recreational areas.

Impacts on Natural and Cultural Resources

As a naturally occurring phenomenon in mountainous areas, avalanches do not cause significant environmental damage. Avalanches may down trees and spread debris along their spillways. Historic and cultural resources in very mountainous areas may be at risk to avalanches, including those within the Yakama Reservation. There are no historic or cultural properties of note in the Yakima County avalanche risk area.

Overall Risk Ranking

Yakima County has a **Low Risk** to avalanches. FEMA has rated Yakima County **Relatively Low Risk** to avalanches, with a risk score is 25.44. According to the 2018 Washington State HMP, Yakima County has a **Medium-Low Risk** to avalanches. **Table 3.9** below summarizes the risk assessment results for the avalanche hazard for Yakima County.

Criteria	Score	Description
Human Health	1	Very Low; 0-1 deaths and few injuries expected
Property Damage	1	Minimal
Economic Disruption	1	Minimal
Environmental Resource Damages/Degradation	2	Localized, minor
Emergency Services Burden	2	Low; localized and temporary
Critical Facilities Exposure	1	Very Low; less than 10% of critical facilities exposed
Probability Score	3	Medium; expected every 11-50 years
Frequency Score	3	Medium; experienced every 31 years
Total Impact Score	14	Low Risk

3.7. Drought

According to the National Integrated Drought Information System, drought “originates from a deficiency of precipitation over an extended period, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector.”²⁹ It can be difficult to identify a drought and may take weeks or even months to determine and can be ongoing for several years. The statutory definition of drought in Washington (RCW 43.83B.400) is when the water supply for the area is below 75% of normal. Water uses and users in the area will likely incur undue hardships because of the water shortage.

There have been more than 150 definitions of drought that reflect the differences in region, needs, and disciplinary approach. The four basic approaches include:

- **Meteorological Drought** is dependent on the region because it is defined by the degree of dryness and the duration of the dry period.
- **Agricultural Drought** is the drought phase after meteorological drought and before hydrological drought. It occurs when there is not enough moisture in the soil to meet the needs of the crops.
- **Hydrological Drought** is defined as deficiencies in water surfaces and sub-surfaces.
- **Socioeconomic Drought** is the economic relationship between supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. Goods such as water, forage, food grains, fish, and hydroelectric power depend on weather. When the demand for the goods exceeds the supply, a socioeconomic drought occurs.

Strength/Magnitude

The severity of a drought depends on many factors, including the moisture deficiency, duration of drought, and the size of the affected area. The United States Drought Monitor (USDM) classifies drought by intensity, with D1 as the least intense level, and D4 the most intense. **Table 3.10** below illustrates the Palmer Drought Severity Index, including the key indicators behind these classifications.

Alert	Criteria	Palmer Drought Index
D0 Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1 Moderate Drought	Some damage to crops, pastures, streams, reservoirs, or wells low, some water shortages developing or imminent, and voluntary water-use restrictions requested.	-2.0 to -2.9
D2 Severe Drought	Crop or pasture losses are likely, water shortages common and water restrictions imposed.	-3.0 to -3.9
D3 Extreme Drought	Major crop and pasture losses with widespread water shortages or restrictions.	-4.0 to -4.9

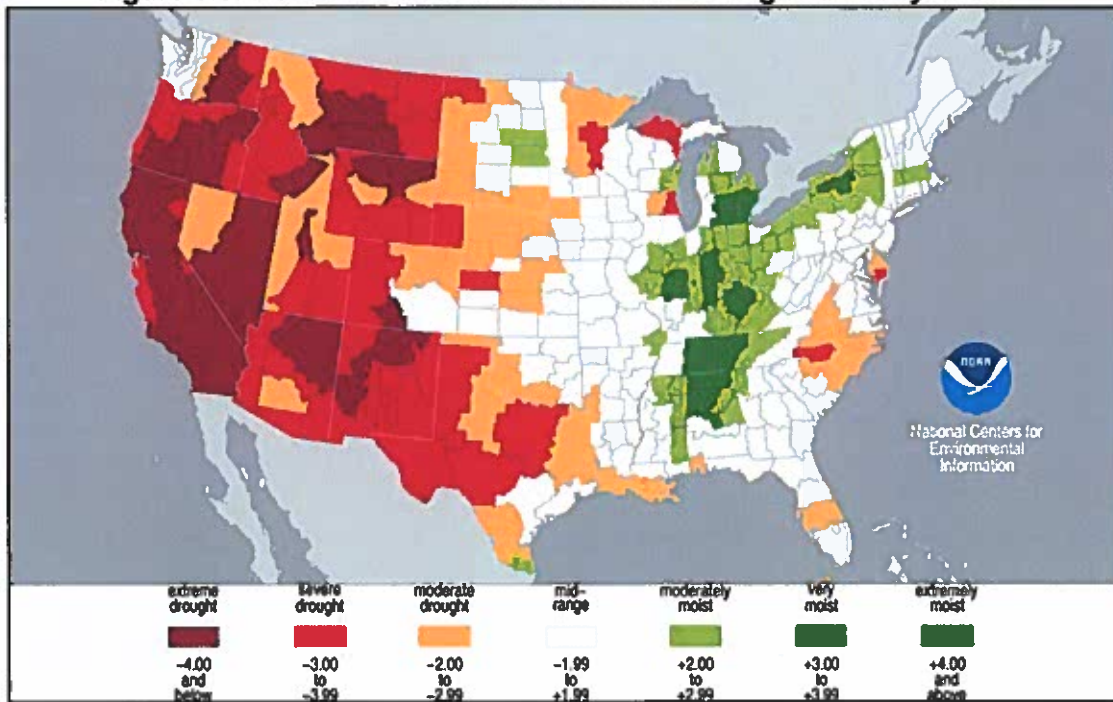
²⁹ National Integrated Drought Information System. Drought Basics. <https://www.drought.gov/what-is-drought/drought-basics>

Table 3.10. Palmer Drought Severity Index		
Alert	Criteria	Palmer Drought Index
D4 Exceptional Drought	Exceptional and widespread crop and pasture loss, shortages of water in reservoirs, streams, and wells creating water emergencies.	-5.0 or less

Location

Figure 3.3 illustrates drought severity throughout the United States as of March 2022 as characterized by the Palmer Severity Drought Index. As is evident, most of the West has been impacted by prolonged drought conditions.

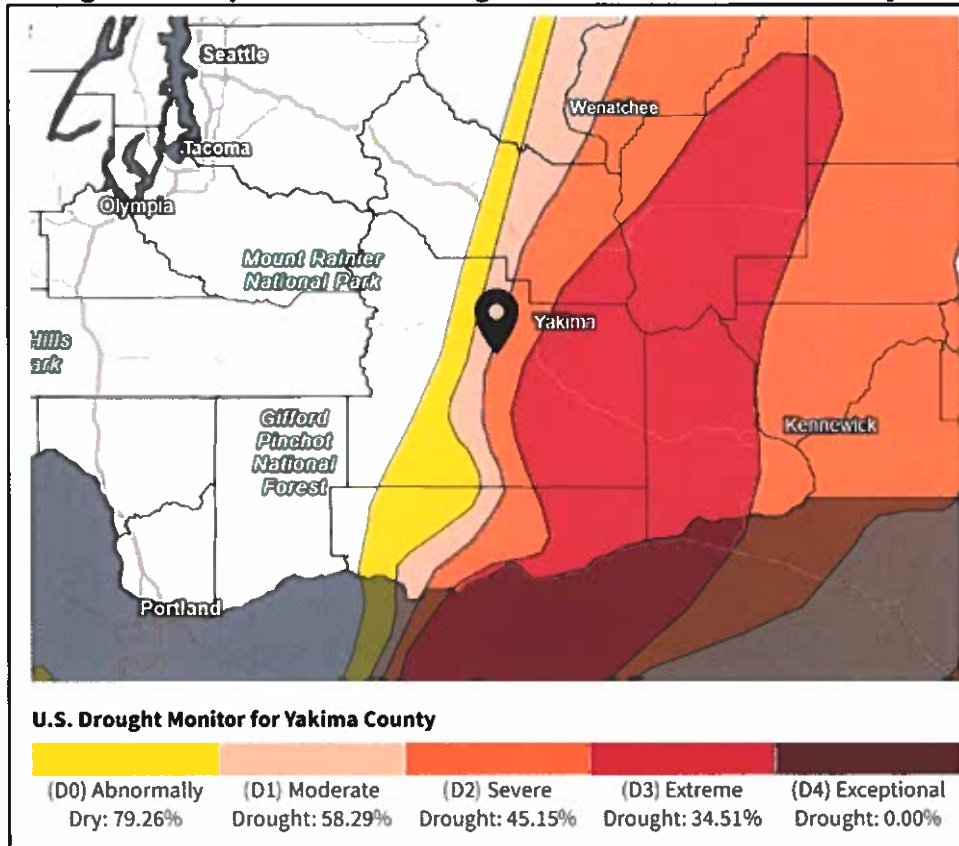
Figure 3.3. March 2022 Nationwide Palmer Drought Severity Index³⁰



³⁰ United States Drought Monitor, accessed from <https://droughtmonitor.unl.edu/>

Figure 3.4 is a drought map of Yakima County showing USDM drought alert levels. This map represents a snapshot in time. All of Yakima County and the West Coast can and do experience severe to extreme drought. In Yakima County, areas within the Yakima Valley River Basin, east of the Cascades, experience the most severe and recurring drought conditions.

Figure 3.4. April 2022 US Drought Monitor for Yakima County³¹

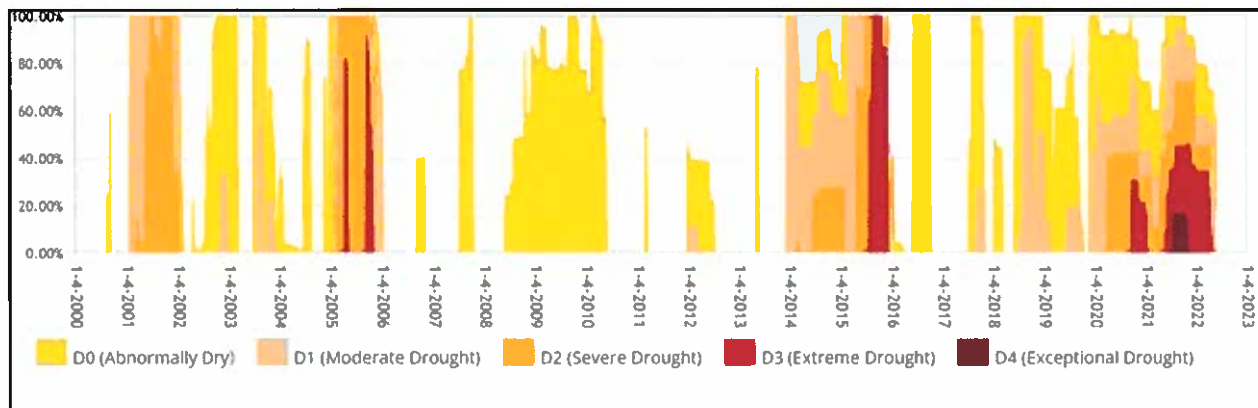


³¹ U.S. Drought Monitor, accessed from <https://droughtmonitor.unl.edu/>

Past Occurrences

Washington experienced 19 droughts between 1900 and 2015. In March 2001 and March 2005, there were statewide emergency declarations for drought; in both cases, water levels were less than 75% of the normal water supply and expected to cause undue hardship. In July 2021, Washington declared an emergency drought declaration again, covering 96% of the state. The drought declaration was lifted in July 2022. Figure 3.5 illustrates drought occurrences between 2000-2022 in Yakima County using the Palmer Severity Drought Index. Yakima County reached D2 (Severe Drought) four times in that period, including in 2001, 2005, 2014-2015, and 2020-2022.

Figure 3.5. Yakima County Drought History³²



Future Probability

Historically, Yakima County has experienced severe to exceptional droughts approximately every five years, including two prolonged periods during the HMP analysis period (2015-2021). Given the warming climate in the Pacific Northwest due to human-caused climate change, more droughts and extreme heat is expected in the future. The future probability of a significant drought in Yakima County is **Very Likely** (expected to occur every 1-4 years).

Climate Change Impacts

Climate change is increasing the occurrence of drought. Warmer temperatures enhance evaporation, which dries out soils and vegetation. Warmer winter temperatures reduce the amount of snowfall and decreased snowpack is a critical issue. Water management systems and ecosystems rely on the melted snow. According to the Washington Climate Change Impacts Assessment, the Yakima River Basin will likely be less able to supply water to all users, especially those with junior water rights, given significant decreases in snowpack and shifts in snowmelt over the spring.

³² United States Drought Monitor. Accessed from: <https://droughtmonitor.unl.edu/>

Yakima County Vulnerabilities

All of Yakima County is vulnerable to prolonged and severe drought as is an especially critical hazard for agricultural producers. Drought poses minimal impacts to critical facilities and built infrastructure, but can create significant economic distress for Yakima County, which is highly dependent on various agricultural industries. Expected annual losses stem from the loss of agricultural values. Drought can also influence other, more damaging hazards, including wildfire.

Loss Estimates

Table 3.11 summarizes the 2022 Expected Annual Loss for drought in Yakima County, as provided by the FEMA National Risk Index. Expected annual loss is a likelihood and consequence component of risk that measures the expected loss of building value, population, and agricultural value each year. The expected agricultural losses from a drought are significant across the county, reaching nearly \$2 million.

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Drought	\$1,984,854	n/a	n/a	n/a	\$1,984,854

In 2015, during the “extreme” drought, the Washington Department of Agriculture estimated statewide economic damage at approximately \$639 million to \$780 million.³⁴ The figure is not comprehensive and does not include agriculture producers, secondary, or indirect impacts, therefore alluding to the grave impact of droughts.

Impacts on the Yakima County Population and Vulnerable Populations

Given that drought can impact the entire county, all Yakima County residents, workers, and visitors can be vulnerable. According to the 2018 Washington State HMP, “almost 50% of the population with medium or higher drought exposure is also ranked medium or higher on social vulnerability.”³⁵ This number fluctuates depending on the severity of drought in the County. The greatest impacts from drought on Yakima County residents are reduced community water supplies and the potential for required water conservation measures during an extreme drought. While the region employs careful irrigation systems, groundwater supplies may suffer during extreme drought in some communities.

Impacts on Built Environment and Critical Infrastructure

Yakima County is a transportation hub that connects suppliers to key markets. Less than three hours away, goods travel overseas through Port Pasco. Port Pasco is located on the Columbia River and during drought lower water levels could reduce the number of available routes and cargo-carrying capacity.

In addition to water transportation, ground transportation can be impacted as well. High temperatures and drought can cause roads and airport runways to crack, requiring increased

³³ FEMA. National Risk Index for Natural Hazards. Accessed from <https://www.fema.gov/flood-maps/products-tools/national-risk-index>

³⁴ Yakima Basin Water Enhancement Project Workgroup. Water security for the Yakima River basin’s economy, communities, and watersheds. Accessed from: <https://apps.ecology.wa.gov/publications/SummaryPages/1712009.html>

³⁵ Washington Emergency Management Division. Washington State Enhanced Hazard Mitigation Plan. Accessed from: <https://mil.wa.gov/asset/5d1626c2229c8>

maintenance. Additionally, secondary hazards related to drought can pose a risk to Yakima County infrastructure, including wildfires and sinkholes. All the infrastructure in Yakima County could be impacted as groundwater and water supplies are depleted during a drought.

Impacts on Government and Emergency Operations

Government and emergency operations are not expected to be significantly impacted during a drought, apart from water utilities that may need to identify water conservation methods and tap into back-up water supplies to support critical facilities.

Impacts on the Economy and Businesses

The Yakima Basin extends 214 miles, making it the longest river in Washington, and is home to a diversity of plants and wildlife. Of its 6,100 square miles, 40% of the Basin is forested, 40% is rangeland, and 15% is cropland.³⁶ The region produces apples, cherries and pears, wine and juice grapes, hay, beef cattle and dairies, and 75% of the nation's hops. Reduced snowpack due to drought could lead to reduced irrigation supply, requiring increased spending on irrigation and wells. Additionally, drought conditions may reduce crop and livestock returns, impacting a significant economic sector within the county and state.

For the community, region, and states that rely on crops from Yakima County, food prices can increase during a drought, which may last for several years. A consequence of rising food prices is a reduction in discretionary spending which can cause a crippling effect on many businesses, especially those that provide entertainment. The Yakama Nation Climate Adaptation plan notes that drought can exacerbate existing irrigation water shortages and irrigation distribution inequalities. These problems were apparent during the 2015 drought, when the Wapato Irrigation Project had just 70% of its water supply.

Impacts on Natural and Cultural Resources

Drought has an adverse effect on natural and cultural resources. Some impacts include loss of plant life, an increase in wildfires, and a reduction in the population of local species. Surface and groundwater declines can directly impact fisheries, the aquatic environment, economic development, and long-term rural and urban economic security.

³⁶ Yakima Basin Fish & Wildlife Recovery Board. Yakima Basin Overview. Accessed from <https://ybfwrp.org/yakima-basin-overview/>

Overall Risk Ranking

Yakima County has a **High Risk** to drought. FEMA has rated Yakima County **Relatively High Risk** for drought, with a risk score of 26.71. According to the 2018 Washington State HMP, Yakima County has a **High Risk** to drought. **Table 3.12** below summarizes the risk assessment results for the drought hazard for Yakima County.

Table 3.12. Risk Assessment Results – Drought		
Criteria	Score	Description
Human Health	1	Very Low; 0-1 deaths and few injuries expected
Property Damage	1	Minimal
Economic Disruption	4	High; up to 6 months
Environmental Resource Damages/Degradation	5	High; Widespread, severe
Emergency Services Burden	1	Minimal
Critical Facilities Exposure	1	Very Low; less than 10% of critical facilities exposed
Probability Score	5	Very High; expected every 1-4 years
Frequency Score	4	High; has occurred every 5-10 years
Total Impact Score	22	Medium Risk

3.8. Earthquake

An earthquake is the result of a sudden release of stored energy in the Earth's crust. The U.S. Geological Survey (USGS) defines an earthquake as "ground shaking caused by the sudden release of accumulated strain by an abrupt shift of rock along a fracture in the Earth or by volcanic or magmatic activity, or other sudden stress changes in the Earth."³⁷ Earthquakes cause both vertical and horizontal ground shaking which varies both in amplitude (the amount of displacement of the seismic waves) and frequency (the number of seismic waves per unit time), usually lasting less than thirty seconds.

Strength/Magnitude

There are several ways to measure the severity of an earthquake, including magnitude, energy release, and shaking intensity.

Magnitude (M) is the physical size of an earthquake, and is expressed on a logarithmic scale, meaning each number increase in magnitude is a tenfold increase (i.e., an M 6.3 earthquake has a 10x greater magnitude than an M 5.3 earthquake). The Richter Scale is a commonly referenced scale for measuring magnitude but is not actually used by seismologists today.

Energy Release is the amount of energy radiated by an earthquake and creating potential damage to buildings and structures, averaged over the entire event.

Intensity is the measurement of shaking from an earthquake event at a particular geographic location. The intensity is dependent on the distance from the fault rupture area, as well as geologic factors of the ground beneath you. Intensity is generally measured using the Modified Mercalli Intensity (MMI) Scale in the United States. The MMI Scale, included as **Table 3.13**, assigns a numerical value for intensity based on observed effects on people, objects, and buildings from historical occurrences.

Table 3.13. Modified Mercalli Intensity (MMI) Scale³⁸

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations like the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

³⁷ USGS Thesaurus. Earthquakes. Accessed from: <https://www.vocabularyserver.com/usgs/index.php?tema=456&/earthquakes>.

³⁸ USGS. The modified Mercalli Intensity (MMI) Scale assigns intensities as... Accessed from: <https://www.usgs.gov/media/images/modified-mercalli-intensity-mmi-scale-assigns-intensities>

Table 3.13. Modified Mercalli Intensity (MMI) Scale³⁸

Intensity	Shaking	Description/Damage
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Location

The severity of an earthquake is based on site-specific factors, including distance from the epicenter, soil type, and more. Buildings in low probability earthquake regions are often not designed to withstand a moderate or significant earthquake event. There are many fault lines that exist in Yakima County, leading to a higher risk of liquefaction and shaking during an earthquake. The cities of Toppenish and Union Gap have active faults crossing through or near the city, increasing local seismic risk. According to the 2018 Washington State HMP, about 10% of Yakima County’s land area has a Medium or Medium-High exposure to earthquakes, mostly concentrated along the fault lines.

Figure 3.6 is a map illustrating the peak ground acceleration, which is measured in percentage of gravity (%g), showing the acceleration of gravity both horizontally and vertically. This acceleration assesses the intensity and frequency of seismic events. All of Yakima County has a consistent and relatively high seismic hazard rating.

Figure 3.6. Yakima County Seismic Risk Map

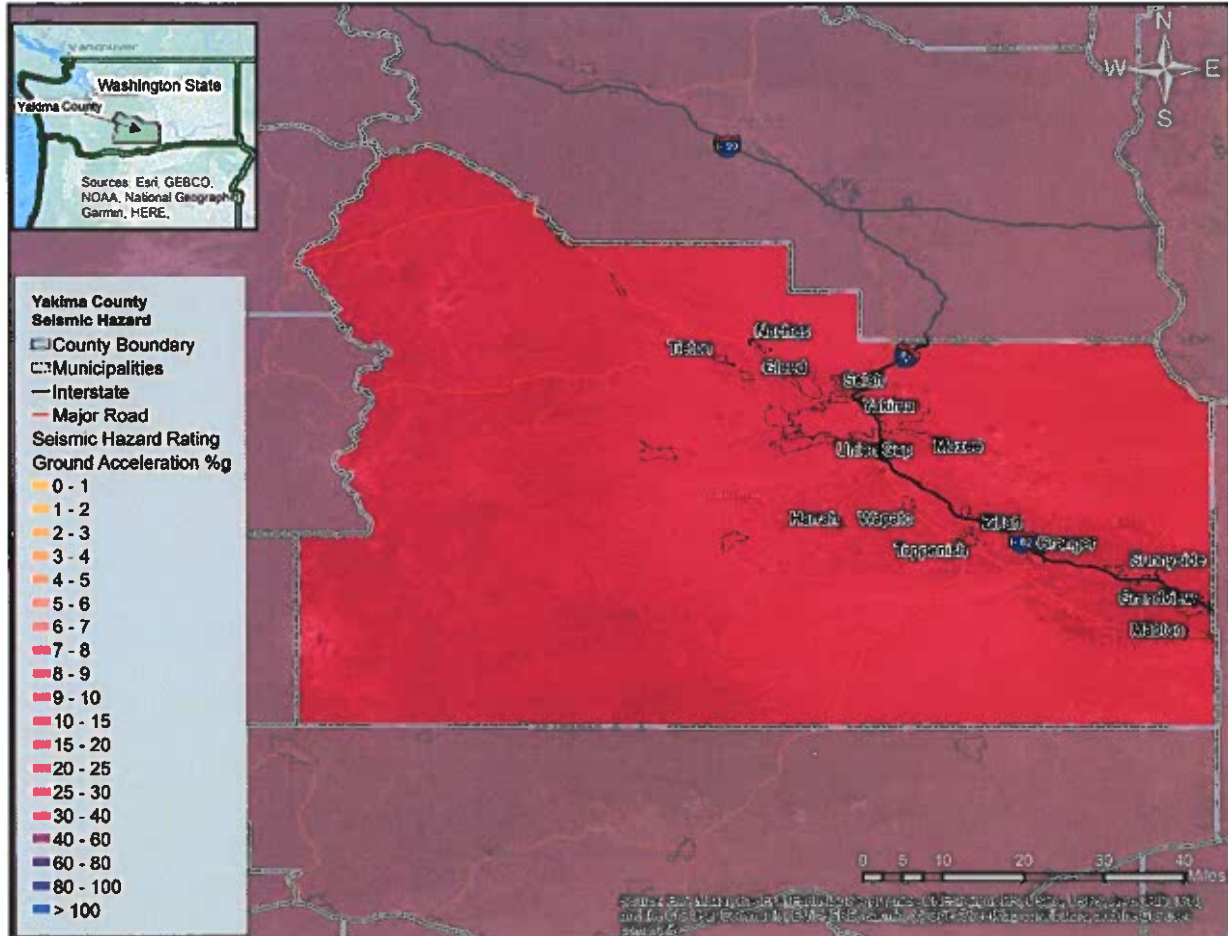
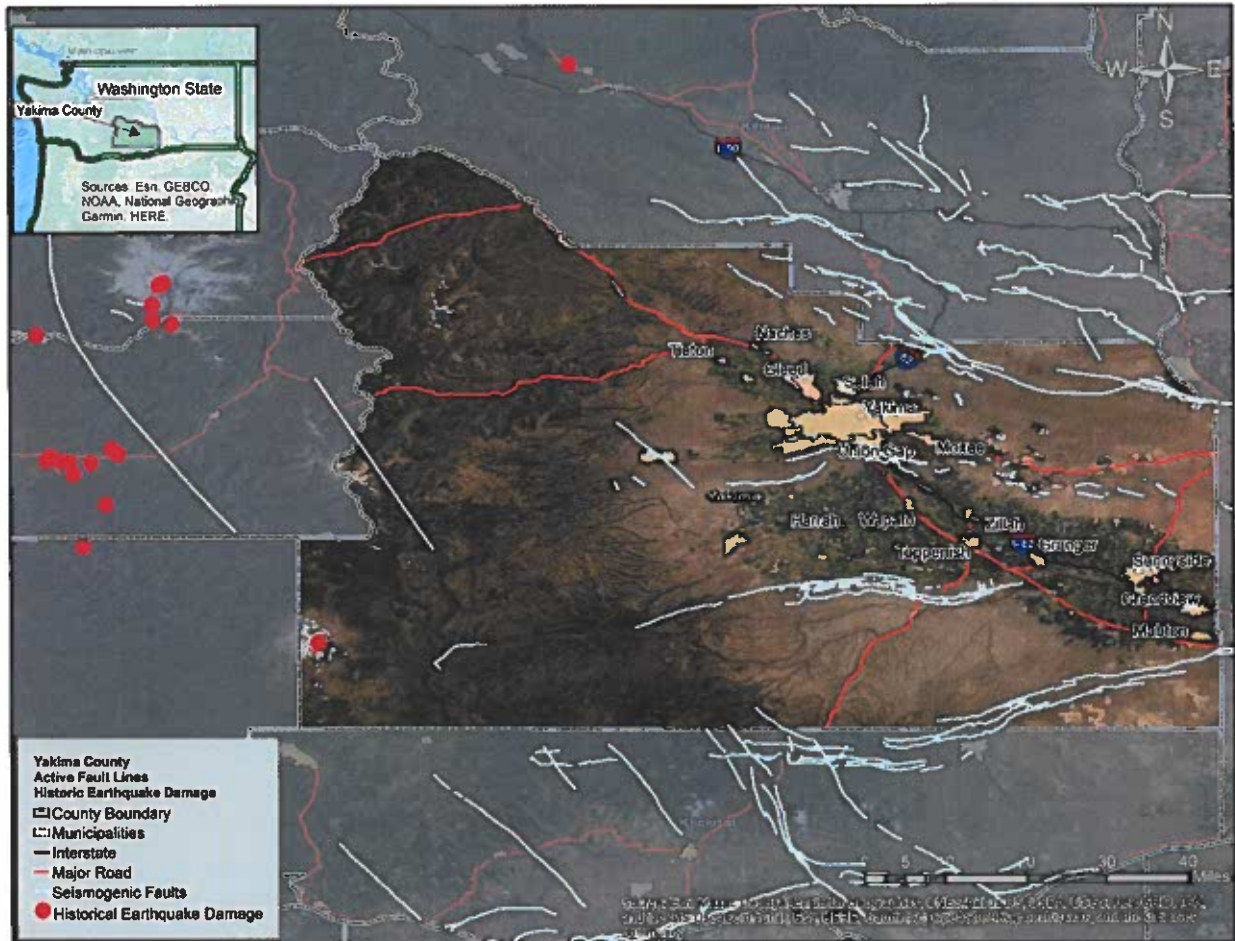


Figure 3.7 is a map of the known fault lines in and around Yakima County, as well as reported damage from Washington’s three largest historical earthquakes (above M 6.0). There are several fault lines making up the Toppenish Ridge, south of Toppenish and crossing US-97. Additionally, active fault lines are present along the Ahtanum Ridge and Rattlesnake Hills, south of the more densely populated communities along US-24 and crossing I-82. There are also many active faults in the areas surrounding Yakima County.

Figure 3.7. Yakima County Active Fault Lines and Historical Earthquake Damage³⁹



³⁹ Data illustrated is from Washington State Department of Natural Resources

Past Occurrences

Earthquakes occur regularly in Yakima County, given the presence of many small faults. Table 3.14 includes a list of earthquakes in Washington over M 5.0 since 1900, according to the 2018 Washington State HMP. The 2001 Nisqually earthquake created the most damage, leading to one fatality, many injuries, and an estimated \$1-4 billion in property damages across the state. Unreinforced masonry (URM) buildings were most impacted by the Nisqually earthquake. Most earthquakes over M 5.0 have occurred west of the Cascades, but smaller earthquakes that cannot be felt frequently occur in the region. Since 2001, no earthquakes have caused extensive damage or injuries in Yakima County.

Table 3.14. Earthquake History (M5.0+) in Washington (1900 - 2022)

Year	Magnitude	Nearest City
2001	5.0	Satsop, Washington
2001	6.8	Longbranch, Washington
1999	5.8	Elma, Washington
1996	5.4	Puget Sound Region, Washington
1995	5.0	Tacoma, Washington
1981	5.5	Morton, Washington
1980	5.7	Mt. St. Helens, Washington
1965	6.7	Tacoma, Washington
1949	6.8	North Yelm, Washington
1946	5.8	Olympia, Washington
1945	5.7	North Bend, Washington
1939	6.2	Bremerton, Washington
1936	6.1	Walla Walla, Washington
1932	5.7	Granite Falls, Washington
1909	6.0	Friday Harbor, Washington

Future Probability

Given several active fault lines that run through Yakima County and a history of regular, small earthquakes, it is highly likely an earthquake will occur. One earthquake has caused damage in Yakima County since 1900, and a large earthquake can be expected in Washington once every 8 years, given the hazard history. According to the 2018 Washington State HMP, the annual likelihood of a major earthquake event is 17%. The Pacific Northwest Seismic Network found that, there's a 10-20% chance of a Cascadia Subduction Zone (CSZ) earthquake in the next 50 years, although areas east of the Cascades will experience far fewer immediate impacts. The future probability of a significant earthquake causing damage in Yakima County is **Unlikely** (expected to occur every 51-100 years).

Climate Change Impacts

Climate change is not known to impact the frequency or intensity of earthquakes.

Yakima County Vulnerabilities

The Saddle Mountain Fault is located on the northeastern side of the Yakima County border with neighboring Kittitas County. The area experiences smaller earthquakes regularly that do not lead to noticeable shaking or damage. However, a strong earthquake will impact people, property, critical infrastructure, and natural resources.

Loss Estimates

Table 3.15 below summarizes the 2022 Expected Annual Loss for earthquakes in Yakima County, as provided by the FEMA National Risk Index. Expected annual loss is a likelihood and consequence component of risk that measures the expected loss of building value, population, and agricultural value each year. The FEMA National Risk Index assumes that 21% of the county population would be impacted during a significant earthquake.

Table 3.15. 2020 Expected Annual Loss – Earthquake ⁴⁰					
Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Earthquake	\$6,687,506	\$5,106,688	\$1,580,818	0.21	n/a

WaEMD conducted modeling of an M7.4 scenario shallow or crustal earthquake for the Saddle Mountain fault zone. The modeling results included dozens of injuries in Yakima County, as well as at least 250 people impacted.

Impacts on the Yakima County Population and Vulnerable Populations

Earthquakes can threaten the health and safety of residents, as well as create enormous economic and social losses. Injuries and fatalities may result from collapsed buildings and falling objects. Yakima County would experience minimal ground shaking from a CSZ event, but there would be significant impacts on the state and region, including in-migration of western Washington and disruptions in the local, regional, and national supply chain.

Impacts on Built Environment and Critical Infrastructure

Violent earthquakes may cause full or partial collapse of buildings, bridges, overpasses, and other critical infrastructure. The level of impact is dependent on the strength of the earthquake. Historic buildings, specifically URM buildings, are the most vulnerable in the built environment. The 2018 Washington State HMP found that Yakima County does not have a significant amount of general building stock situated in areas at medium or higher exposure from earthquakes.

Impacts on Government and Emergency Operations

Communications system disruptions may limit or delay emergency response capabilities. A major earthquake event, even one west of the Cascades, could lead to a disruption in emergency response services. A severe statewide event would place significant stress on state and regional emergency operations, requiring most police, fire, and emergency medical personnel, overwhelming or potentially disabling disaster services.

Impacts on the Economy and Businesses

Depending on the magnitude, there may be no impact to the economy, catastrophic impact, or somewhere in the middle. In the worst-case scenario, including a CSZ event, the economy and businesses could be impacted for several months or even years. Yakima County could

⁴⁰ FEMA. National Risk Index for Natural Hazards. Accessed from <https://www.fema.gov/flood-maps/products-tools/national-risk-index>

experience loss of revenues if people move away and there is a cost to rebuild and return to a new normal. A major earthquake in Washington could lead to supply chain disruptions, critical supply shortages, and rippling economic impacts. Damage to shipping channels and facilities along the Columbia River could contribute to long-term supply chain impacts in the region.

Impacts on Natural and Cultural Resources

The Yakima River Basin and other water sources can be indirectly impacted by an earthquake if objects fall in and cause contamination. Landslides and debris flows associated with ground shaking from an earthquake could block rivers and shifts in channelization. Most environmental impacts would stem from secondary hazards such as hazardous materials spills or broken utility lines. Major earthquakes can cause significant land and vegetation deformation, but a mild earthquake will cause minimal environmental damage. Historic buildings and cultural resources are very vulnerable to earthquake events and damage due to shaking.

Overall Risk Ranking

Yakima County has a **Medium Risk** to earthquakes. FEMA has rated Yakima County **Relatively Moderate Risk** for earthquakes, with a risk score is 18.36. According to the 2018 Washington State HMP, Yakima County has a **Medium Risk** to earthquakes. **Table 3.16** below summarizes the risk assessment results for the earthquake hazard for Yakima County.

Criteria	Score	Description
Human Health	1	Very Low; 0-1 deaths and few injuries expected
Property Damage	3	Medium; widespread, repairable
Economic Disruption	3	Widespread, temporary
Environmental Resource Damages/Degradation	1	Minimal
Emergency Services Burden	3	Widespread, temporary
Critical Facilities Exposure	3	Medium; 20-30% of critical facilities exposed
Probability Score	2	Unlikely; expected to occur every 51-100 years
Frequency Score	2	Unlikely; has occurred every 51-100 years
Total Impact Score	18	Medium Risk

3.9. Extreme Temperatures

Extreme temperatures are associated with extreme heat and extreme cold weather events. Extreme heat events occur when temperatures remain at least ten degrees or more above the region's average temperature for that period. Extreme cold events are associated with freezing temperatures that are below normal cold temperatures for the region. Both types of extreme temperatures can result in serious injuries or death given the human body cannot regulate outside normal weather temperatures. Common serious health conditions related to extreme temperatures include hyperthermia when a body is exposed to temperatures too hot and hypothermia with temperatures are too cold for a body to withstand.

Strength/Magnitude

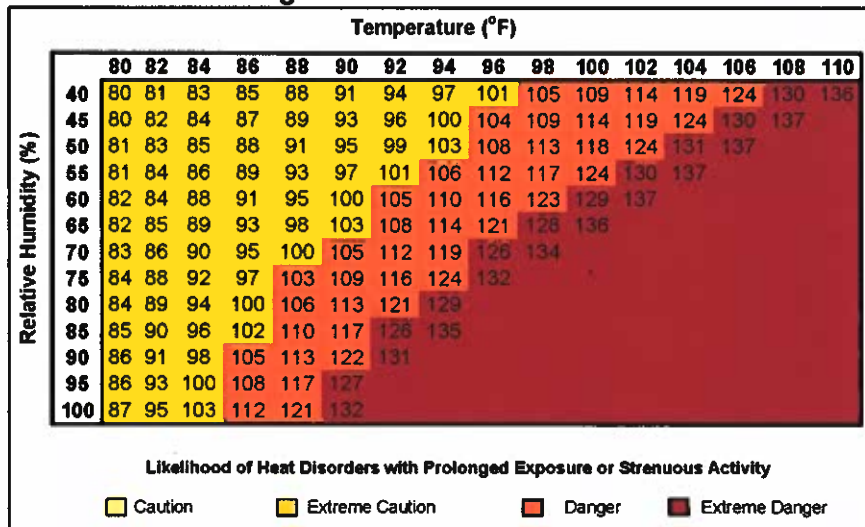
The National Weather Service (NWS) Heat Index, included as Table 3.17, can be used to determine the health risks associated with different heat classifications.

Table 3.17. NWS Heat Index⁴¹

Classification	Heat Index	Effects on the Human Body
Caution	80 - 90°F	Persistent exposure or physical activity resulting in fatigue
Extreme Caution	90-103°F	Possible heat stroke, heat cramps or heat exhaustion after persistent exposure or physical activity.
Danger	103-124°F	Possible heat cramps or exhaustion likely to cause heat stroke after persistent exposure or physical activity
Extreme Danger	125°F or above	Most likely to cause heat stroke

The Heat Index provides a threshold to measure the subjective experience of how hot it feels to the human body by combining temperature and relative humidity. Eastern Washington does not often experience very high temperatures in combination with high humidity, resulting in very infrequent extreme heat conditions.

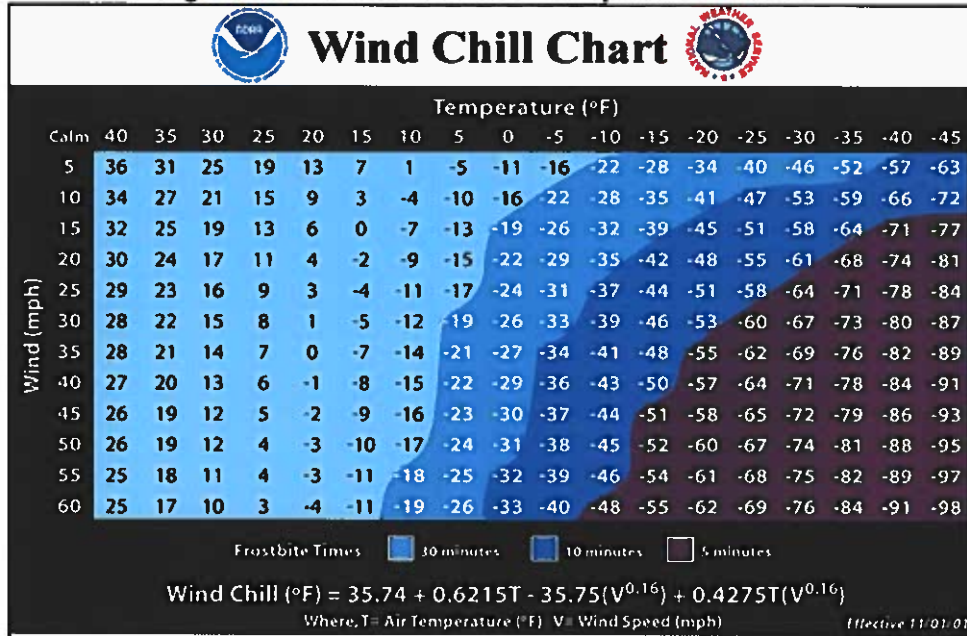
Figure 3.8. NWS Heat Index



⁴¹ National Weather Service. Accessed from: <https://www.weather.gov/ama/heatindex>

The NWS Wind Chill Temperature Index calculates the dangers to the human body through frost bites caused by winter winds and freezing temperatures.

Figure 3.9. NWS Wind Chill Temperature Index⁴²



Location

Extreme temperatures can impact the entire county simultaneously. Mountainous areas are more likely to experience extreme cold temperatures, but the landscape and built environment is more ready for these events. Similarly, valley areas of the county are more susceptible to extreme heat events. When either trend is switched – the valley experiencing extreme, unseasonable cold, or the mountain region experiencing extreme heat – the associated impacts are expected to be greater.

Past Occurrences

Yakima County experiences 300 days of sunshine each year and receives approximately 8 inches of precipitation annually. The lowest temperatures tend to occur between November and January. This period is also when the region experiences the most precipitation as snowfall. The average annual high temperature for Yakima County is 63°F, while the average annual low is 36°F, although the average by month ranges from 39°F (January) to 88°F (July).⁴³

⁴² National Weather Service. Wind Chill Chart. Accessed from: <https://www.weather.gov/safety/cold-wind-chill-chart>

⁴³ U.S. Climate Data. Climate Yakima - Washington. Accessed from: <https://www.usclimatedata.com/climate/yakima/washington/united-states/uswa0502>

Table 3.18 details extreme temperature events reported in the NOAA Storm Events Database for Yakima County during the HMP analysis period (2015-2021). Appendix D contains a list of historical extreme temperature events reported prior to 2015, as well as a more detailed description of each occurrence.

Date	Event Type	Property Damage	Fatalities/ Injuries	Narrative
6/26 – 7/1/21	Excessive Heat	0	4	A strong upper-level ridge of high pressure and a surface thermal trough brought several days of record high temperatures across the Pacific NW, with many locations in the lower and higher elevations experiencing extreme heat risk during this event. Calculated heat risk values recorded consecutive days between June 26 through July 1 of temperatures that met or exceeded excessive heat warning criteria. The Yakima County Coroner's Office reported 4 fatalities that heat was a contributing factor to during the heat wave, however, no additional details were provided regarding age, sex, actual date, or location.

Future Probability

During the HMP analysis period (2015-2021), there was one heat-related extreme temperature event. However, extreme heat events are expected to increase in the future for the entire state. Given much of the land area is susceptible to extreme temperatures, a high frequency of occurrences in recent years, and the impact of the changing climate, extreme temperature events are considered **Likely** (occurs every 5-10 years) for Yakima County. Extreme temperatures are not included in the 2018 Washington HMP for comparison.

Climate Change Impacts

The Pacific Northwest is predicted to see increased temperatures year-round, resulting in more warm days in the summer time.⁴⁴ According to the Washington Climate Change Impacts Assessment, this increase will average .5°F per decade. A consistent increase in temperatures due to the changing climate will likely result in more extreme heat events across Yakima County and eastern Washington.

⁴⁴ University of Washington. How is pacific northwest climate projected to change? Accessed from: <https://ciq.uw.edu/wp-content/uploads/sites/2/2020/12/snoveretalsok2013sec5.pdf>

Yakima County Vulnerabilities

Yakima County may experience a variety of negative impacts due to the expected increase in occurrences of extreme temperatures. Annual economic losses are expected in the millions dollars, specifically from extreme cold temperatures. Extreme weather can also impact the most vulnerable community members, degrade natural resources, and disrupt normal operations.

Loss Estimates

Extreme temperature events have the potential to create major economic losses in Yakima County. Most of these losses will stem from impacts to agricultural production in the region, such as the loss of livestock and damaged crops.

Drawing from the EPA, heatwaves are likely to increase because of climate change and directly affect livestock causing billions in dollars. In 2011, exposure to high temperature events caused over \$1 billion in heat-related losses to agricultural producers.⁴⁵ Exposure to extreme temperatures can also severely impact crops and fisheries. Weeds, fungi, and other pests thrive during extreme temperatures, therefore the cost of weed prevention may increase. Currently, the cost of fighting weeds is \$11 billion annually.⁴⁶ As of 2012, fisheries contribute more than \$1.55 billion to the economy annually, thus impact to fisheries from extreme temperatures can be costly.⁴⁷

Table 3.19 below summarizes the 2022 Expected Annual Loss for extreme cold in Yakima County, as provided by the FEMA National Risk Index. There is no expected annual loss from extreme heat or heat wave events reported by the FEMA National Risk Index. This is due to the difficulty calculating and quantifying how global temperature increases will affect economies. Expected annual loss is a likelihood and consequence component of risk that measures the expected loss of building value, population, and agricultural value each year.

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Cold Wave	\$3,626,183	\$1,294	\$1,064,746	0.14	\$2,560,143

Impacts on the Yakima County Population and Vulnerable Populations

As hotter days ranging over 100 degrees Fahrenheit increase in the future, there is an expected increase of heat related illness. Yakima County’s agricultural workers and anyone who works or lives outside are especially vulnerable to this threat, given their high exposure to the sun. Heat exposure can lead to heat exhaustion or heat stroke, characterized by dizziness, fatigue, headache, nausea, and lightheadedness. Dehydration is common particularly where extreme heat and high humidity combine. Small increases in temperatures can lead to heat-related deaths, especially for vulnerable community members with underlying medical conditions.

⁴⁵ U.S. Environmental Protection Agency. Climates impacts on agriculture and food supply. Accessed from: <https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-agriculture-and-food-supply.html#livestock>

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ FEMA. National Risk Index for Natural Hazards. Accessed from <https://www.fema.gov/flood-maps/products-tools/national-risk-index>

Change in temperature can promote outbreaks of disease from environmental pathogens that are influenced by the weather patterns or climate. This phenomenon includes early activity of rodents, insects such as mosquitos or ticks, and other animals that can increase human and livestock exposure to vector borne diseases. These diseases include deadly viruses such as West Nile virus, Zika, Lyme disease, and Hantavirus, which all have the potential to create a public health emergency or disease outbreak among livestock.

Impacts on Built Environment and Critical Infrastructure

Extreme temperatures, whether high or low, can be highly disruptive to critical infrastructure, including an increase in electric cooling demand which may reduce or compromise energy supply grid reliability. Extreme heat can also damage road systems by causing road buckling, while frequent freezing and thawing cycles on pavement cause cracking and potholes.

Impacts on Government and Emergency Operations

Yakima County recognizes that extreme temperatures disrupt local health and medical facilities' operations, as well as emergency response services. This disruption may cause a delay in urgent medical care and make it difficult to ensure hospital readiness.

Impacts on the Economy and Businesses

Rising temperatures will have a direct impact on dairy production in Washington State, specifically in Yakima River Basin where it is predicted by the year 2075, milk farming will significantly decrease in production. Higher temperatures increase the rate of evaporation in agricultural soil, which decreases plant production during the growing season. Crop and agricultural productions account for most exports from the Yakima River Basin. Given insects thrive in warmer temperatures, their populations can increase to a point that become a greater problem for agricultural economies.

Impacts on Natural and Cultural Resources

Prolonged warm temperatures and extreme heat can increase tree mortality and deteriorating forest conditions, leading to fire danger in forest and grassland areas. More intense summer heat will also contribute to warmer water temperatures, affecting aquatic systems and fish populations.

Overall Risk Ranking

Yakima County has a **Medium Risk** to extreme temperature events. FEMA has rated Yakima County as **Very High Risk** for extreme cold, with a risk score of 100. There is no data available for extreme heat events, and the 2018 Washington State HMP does not include extreme temperatures as a hazard. **Table 3.20** below summarizes the risk assessment results for the extreme temperatures hazard for Yakima County.

Table 3.20. Risk Assessment Results – Extreme Temperatures		
Criteria	Score	Description
Human Health	3	Moderate; 4-5 deaths and several injuries expected
Property Damage	1	Minimal
Economic Disruption	3	Widespread, temporary
Environmental Resource Damages/Degradation	3	Widespread, minor
Emergency Services Burden	1	Minimal
Critical Facilities Exposure	1	Very Low; less than 10% of critical facilities exposed
Probability Score	4	Likely; expected to occur every 5-10 years
Frequency Score	3	Somewhat Likely; has occurred every 11-50 years
Total Impact Score	19	Medium Risk

3.10. Flooding

Flooding is the inundation of normally dry areas from any form of surface water or accumulation of water. Floods are the most common natural hazard occurrence in Washington. In a natural setting, floods tend to follow heavy precipitation events such as heavy rainfall, snow melt, winter storms, or major thunderstorms. Several types of flooding events can impact Yakima County and are considered in this plan:

- **Riverine or Stream Flooding:** Riverine flooding occurs when a channel receives more water than it can hold, and the excess water flows over its banks and inundates low-lying areas, causing a flood. Riverine flooding can occur due to rapid snowmelt or prolonged or heavy rainfall, which is also a cause of flash flooding.
- **Flash Flooding:** Flash floods result from a large amount of rain in a short period of time, typically within six hours of an event. This type of event is particularly hazardous in mountainous areas or other places with restricted floodplain storage. More urbanized areas may see flash flooding due to a lack of permeable surfaces.
- **Ice Jam Flooding:** Flooding caused by ice jams is similar to flash flooding. Ice jam formation causes a rapid rise of water at the jam and extends upstream. Failure or release of the jam causes sudden flooding downstream. The formation of ice jams depends on the weather and physical conditions in river channels. Ice jams are most likely to occur where the channel slope naturally decreases, where culverts freeze solid, at headwaters of reservoirs, at natural channel constrictions such as bends and bridges, and along shallows where channels may freeze solid.

Flooding may also occur because of other hazard events, including earthquakes, volcanoes, wildfires, and landslides. Flooding can be natural, human-caused, or a combination of both. Human-caused flooding includes dam failure, levee failure, and activities that increase the rate and amount of runoff, such as paving, reducing ground cover, and clearing forested areas. The amount of damage caused by a flood is influenced by the speed and volume of the water flow, the length of time the impacted area is inundated, the amount of sediment and debris carried and deposited, and the amount of erosion that may take place.

Although floods can happen at any time during the year, there are typical seasonal patterns for flooding in Washington. In Eastern Washington, floods generally occur in the foothills of the Cascade Range during spring snowmelt. Winter floods, which are more frequent and of larger magnitude, occur when rain or unseasonably warm weather melts accumulations of snow. Flash flooding may also occur as a result of severe storms in the summer.

Flood Terminology

Several flood-related terms are frequently used in this plan and are defined below.

- **Flood Insurance Rate Map (FIRM):** FIRMs are the official maps on which the Federal Insurance Administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.
- **Floodplain:** A floodplain is an area adjacent to a lake, river, stream, estuary, or another water body that is subject to flooding. If left undisturbed, the floodplain serves to store and discharge excess floodwater. In riverine systems, the floodplain includes the floodway.

- **Regulatory Floodway:** a Regulatory Floodway is a FEMA prescribed term which means the channel of a river or other watercourse and the adjacent areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. Communities must regulate development in floodways to ensure that there are no increases in upstream flood elevations. For streams and other watercourses where FEMA has provided Base Flood Elevations (BFEs), but no floodway has been designated, the community must review floodplain development on a case-by-case basis to ensure that increases in water surface elevations do not occur or identify the need to adopt a floodway if adequate information is available.

Strength/Magnitude

Under the National Flood Insurance Program (NFIP), the Federal standard for floodplain management is the **100-year floodplain**. This area is chosen using historical data such that in any given year, there is a 1% chance of a Base Flood (also known as 100-year Flood, 1% annual flood, Special Flood Hazard Area, or Regulatory Flood). A 100-year flood has a 26% chance of occurring in a thirty-year period.

A **500-year floodplain** has a 0.2% of being equaled each year. The nomenclature can be confusing and does not mean this flood will only happen every 500 years. This type of flood has at least a 6% chance of occurring in a 30-year time period with the 100-year flood.

FIRMs identify flood zones through hydrologic and hydraulic studies. These zones represent the areas susceptible to the 1% annual chance flood, or 100-year flood. Where possible, FEMA also determines a Base Flood Elevation (BFE) for the 100-year floodplain, which is the calculated elevation of flooding during this event and a commonly used standard for determining flood risk and managing potential floodplain development. These maps provide a more definitive representation of the highest flood risks in the communities.

Since the 100-year flood level is statistically computed using existing data, as more data is available the flows, heights, and extent of the 100-year flood may change. As more data are collected, or when a river basin is altered in a way that affects the flow of water in the floodplain, re-evaluation is needed (and sometimes required) to keep the maps as representative of current conditions as possible. Alterations can include dams and urban development, and other human-made changes in a basin that affect floods.

The extensive system of reservoirs/dams in Washington and Yakima County has generally reduced the crest heights of floods and lengthened their duration. Longer duration flows at sediment transport level wear away at revetments, levee armor, natural bank, bridge abutments, and other flood control infrastructure over a longer period above sediment transport thresholds. Some flooding events can have a higher volume of flow and lower crest over time. Some can have high peak and low volume. Both can be hazardous in their own ways. Longer duration floods require longer monitoring and patrol as erosion continues over time.

The NWS Advanced Hydrologic Prediction Service publishes forecast hydrographs when flooding is expected based on river and stream gauge data. Table 3.21 details the terminology used to describe flooding based on this data.

Term	Description
Action Stage	The stage which, when reached by a rising stream, lake, or reservoir represents the level where the NWS or a partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity.
Minor Flooding	Minimal or no property damage, but possibly some public threat
Moderate Flooding	Some inundation of structures and roads near stream. Some evacuations of people and/or transfer of property to higher elevations.
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
Record Flooding	Flooding which equals or exceeds the highest stage or discharge at a given site during the period of record keeping.

Location

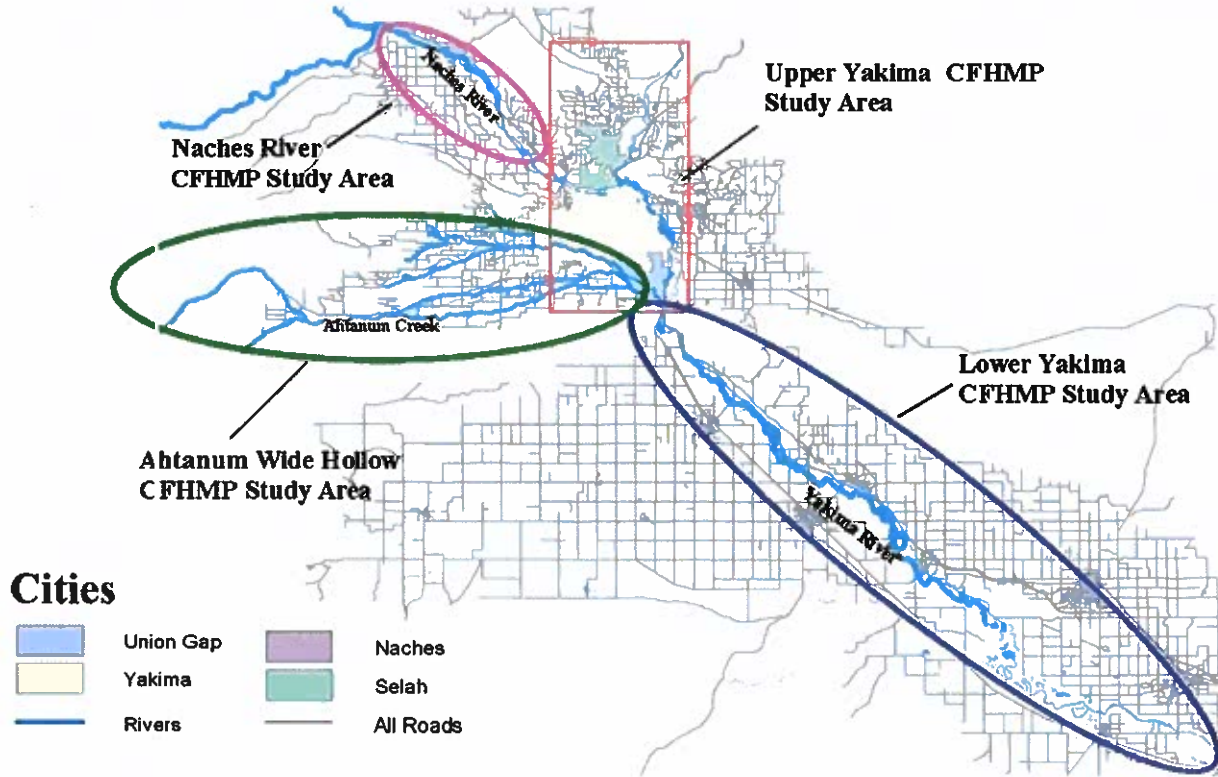
The Yakima County Flood Control Zone District (FCZD) is responsible for flood hazard management across the county. FCZD divides Yakima County into four distinct study areas that experience flooding, each of which includes various municipalities. The study areas include:

- **Naches River:** Covers the Naches River from the confluence of the Naches and Tieton Rivers to the Twin Bridges northwest of Yakima. Agriculture makes up 41% of the current land use in the study area, there are also residential and commercial developments in the floodplain that have been subject to repeated flood damage. Includes the municipalities of Naches, Tieton, and Gleed.
- **Lower Yakima:** Yakima River south of Union Gap along the boundary with Yakama Nation. Includes the municipalities of Granger, Grandview, Toppenish, Sunnyside, Zillah
- **Upper Yakima:** Yakima River from the Yakima County northern boundary to Union Gap and along the Naches River from Twin Bridges on State Route 12 to its mouth. Includes the municipalities of Yakima, Union Gap, and Selah.
- **Ahtanum-Wide Hollow:** The Ahtanum and Wide Hollow watersheds extend east from the Cascade Mountains to include the cities of Yakima and Union Gap, ending where the creeks flow into the Yakima River. The northern boundary for the two adjoining basins is formed by Cowiche Mountain, and the southern boundary by Ahtanum Ridge.

⁴⁹ National Weather Service Advanced Hydrologic Prediction Service. Hydrograph Terminology. Accessed from https://water.weather.gov/ahps2/pdf/hydrograph_terminology.pdf

Figure 3.10 illustrates the four CHFMP study areas as determined by FCZD.

Figure 3.10. Yakima County CFHMP Study Areas



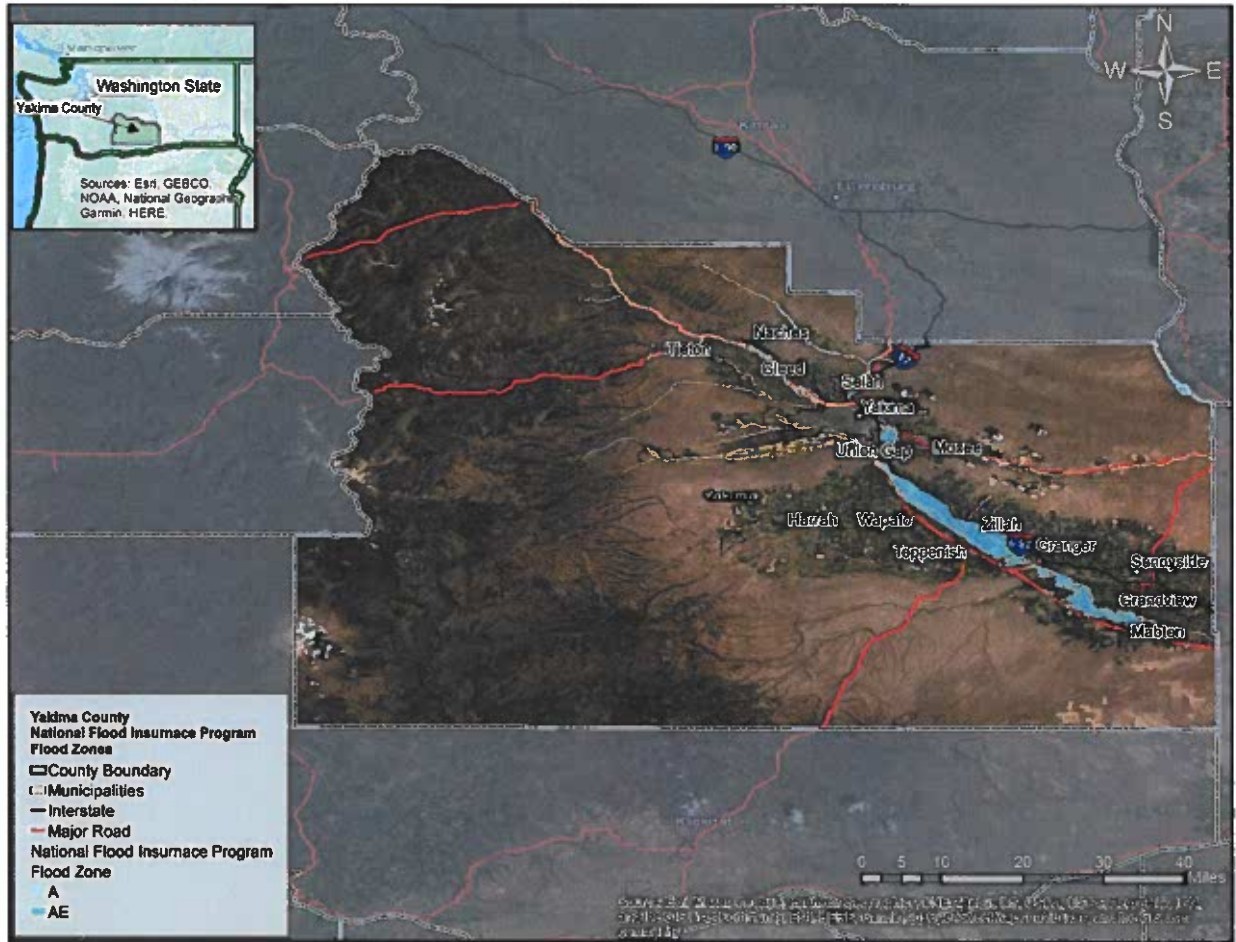
Much of the recent infrastructure development in Washington State has occurred in or near floodplains which leads to a high susceptibility to flooding. This type of development also changes the course of natural water flows, increasing runoff from pavement and roof surfaces. Diverting waters to new surface areas results in places previously safe from flooding become susceptible to the damages of flooding.

Figure 3.11 illustrates the NFIP Special Flood Hazard Area, or 100-year floodplain, which has a 1% annual chance of flooding. As depicted, many communities along the Lower Yakima River are within the 100-year floodplain. According to the 2018 Washington State HMP, approximately 2% of Yakima County's land area is susceptible to 100-year flood conditions.

The following participating communities have land within the floodplain, described in more detail in each Jurisdiction Annex.

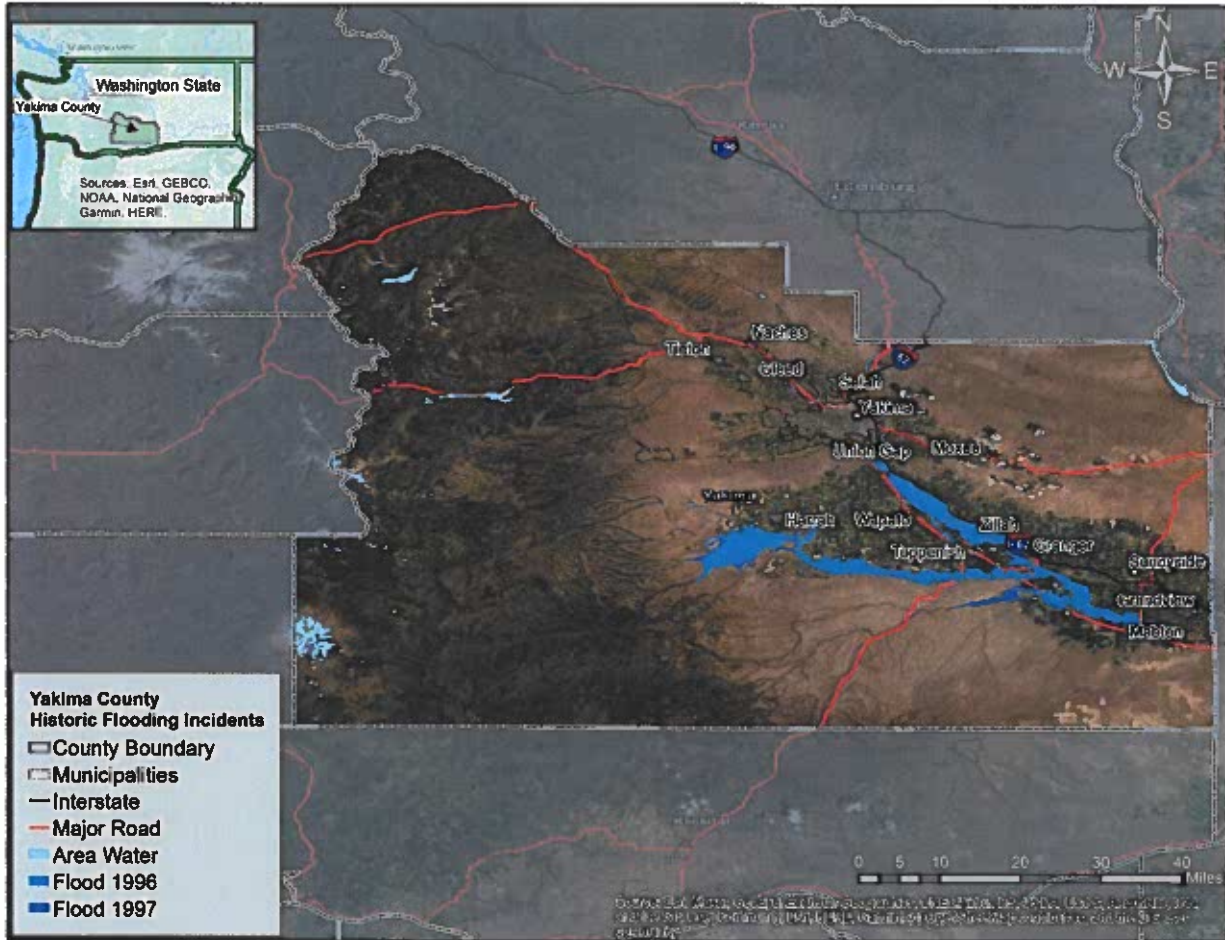
- City of Granger
- City of Selah
- City of Tieton
- City of Toppenish
- City of Union Gap
- City of Wapato
- City of Yakima
- City of Zillah
- Town of Naches
- Unincorporated Yakima County

Figure 3.12. NFIP Flood Zone (100-year floodplain), Yakima County



Additionally, Yakima County has tracked the incidence of historic flooding outside of the 100-year floodplain. Major flooding in 1996 and 1997 exceeded the mapped floodplain, as illustrated in Figure 3.13. As depicted, flooding reached far outside of the 100-year floodplain, west past the Town of Harrah along the established levee system.

Figure 3.13. Historic Flooding Incidents, Yakima County



Past Occurrences

The most significant flood, in terms of property damage, on the Yakima River in Yakima County occurred on February 9, 1996, with damage amounting to over \$17.7 million in Yakima County. During the 1996 flood, the following communities experienced significant damage: Selah, Wapato, and Toppenish on the Yakima River; Rock Creek, The Nile, Town of Naches, Glead, and Ramblers Park on the Naches River; Wiley City, Ahtanum, and Emma Lane on Ahtanum Creek, and White Swan on Toppenish Creek within Yakama Nation. Flood damages are not well represented in Yakima County by insurance claims due to the relative absence of flood insurance for older flood prone homes. Of the above locations, Rock Creek, the Town of Naches, and Ramblers Park were behind PL84-99 levees that were overcome and resulted in more significant damage. These three levees were reinforced following 1996 and subsequent flood events. The Ramblers Park levee has been fully setback, and the Town of Naches levee has been partially setback to reduce future damages and allow for more flood conveyance. In addition, bridges severely damaged on the mainstem during the 1996 flood have been replaced with structures with opening widths that are multiples of the original; at SR-24 and Donald-Wapato highway on the Yakima River and Powerhouse Road on the Naches River.

Including the 1996 event, Yakima County has experienced 9 declared disasters for flooding since 1953, including the following:

- **DR-185:** 1964, Heavy Rains and Flooding
- **DR-300:** 1971, Heavy Rains, Melting Snow, and Flooding
- **DR-414:** 1974, Severe Storms, Snowmelt, and Flooding
- **DR-482:** 1975, Severe Storms and Flooding
- **DR-545:** 1977, Severe Storms, Mudslides, and Flooding
- **DR-883:** 1990, Severe Storms and Flooding
- **DR-1100:** 1996, High Winds, Severe Storms, and Flooding
- **DR-1079:** 1996, Severe Storms, High Wind, and Flooding
- **DR-1159:** 1997, Severe Winter Storms, Land and Mud Slides, and Flooding
- **DR-1817:** 2009, Severe Winter Storms, Landslides, Mudslides, and Flooding

FCZD has produced CFHMPs for the Upper Yakima River, Cowiche Creek, Naches River, and Ahtanum-Wide Hollow, and plans to develop a CFHMP for the Lower Yakima River. Each CFHMP details the flood and damage history in the distinct study areas.

There have been no declared disasters for flooding during the HMP analysis period. **Table 3.22** outlines 8 flood events reported on the NOAA Storm Events Database in Yakima County during the HMP analysis period (2015-2021). [Appendix D](#) contains a list of all flood events prior to 2015, as well as a more detailed description of each occurrence.

Location	Date	Event Type	Property Damages	Narrative
Rimrock, Selah	5/21/2015	Flash Flood	None reported	Debris flow just east of Rimrock Lake, reported by the Yakima Herald. Flooding in streets, 911 had some people evacuate buildings in fear of roof collapse. Police set up barricades to help divert drivers from flooded roadways,

Table 3.22. Past Flood Occurrences, Yakima County (2015-2021)

Location	Date	Event Type	Property Damages	Narrative
				flooding in some homes. A few places lost power.
Harwood	3/6/2016	Flood	\$300,000	Heavy Rain and snowmelt resulted in higher waters along some of the rivers, which also resulted in minor flooding along some river banks.
Tampico	2/10/2017	Flood	None reported	After a brief warm up, an ice jam formed and broke loose on the North Fork of the Ahtanum Creek in central Yakima County. The ice moved downstream damaging five homes with water and structural damage. One family was displaced.
Yakima	3/10/2017	Flood	\$20,000	Substantial snow pack remained in the foothills and lower elevations of the Washington Cascades at the beginning of March. Temperatures started to moderate during the first week of the month with several nights of temperatures above freezing occurring on the 8th and 9th. Flooding was reported along Wide Hollow and Cottonwood creeks from about 9 miles west of Yakima through the city of Yakima as rapid snow melt was occurring in the foothills west of Yakima. Water flowed through the Meadowbrook Mobile Home Park, and there were numerous reports of damaged driveways as culverts were overwhelmed with mud and other debris. Along Ahtanum Creek, there was standing water in fields, with water from roadside ditches spilling over the road in places.
Tieton, Brace	3/14-16/2017	Flood	None reported	More flooding was reported along Wide Hollow and Cottonwood creeks, as well as Cowiche and Ahtanum creeks, through the city of Yakima, then southeast into the lower Yakima Valley. Rapid snow melt occurred in the foothills west of Yakima. Water from roadside ditches spilled over various road in places. Along Toppenish and Satus Creeks, in the lower valley, water over

Table 3.22. Past Flood Occurrences, Yakima County (2015-2021)

Location	Date	Event Type	Property Damages	Narrative
				<p>roads and field flooding were reported along the main branches of the creeks as well as the numerous tributaries to these creeks. A few roads remained closed due to high water through the rest of March.</p> <p>On March 15, high flows on Cowiche Creek caused a section of a levee that had previously been damaged to breach, opening a 20-foot-wide gap. The water followed along Highway 12 with the bulk of the water flowing into an irrigation canal. On March 16, water inundated the intersection of North 40th and Fruitvale Boulevard, flooding a few businesses and parking lots and the Riverview Mobile Home Park. Public Works tried to divert the water into Myron Lake, with a channel expected to take the water back from the lake to the Naches River. Instead, the water overflowed from Myron Lake into Willow Lake and then Aspen Lake, where it overflowed into neighborhoods surrounding the lakes.</p>
Naches	5/5/2017	Flood	None reported	Increased snow melt resulted in minor flooding of the Naches River near Naches. On May 5th the river crested at 18.25 feet, flood stage is 17.8 feet.
Naches	5/30/2017	Flood	None reported	On May 30th, warm temperatures lead to increased snow melt with the Naches River rising briefly to the flood stage of 17.8 feet.
Naches	2/7/2020	Flood	None reported	<p>Naches near Naches – Flood stage is 17.8 feet. The river rose above flood stage on February 7, 4 am, crested at 18.6 feet on February 7th at 130 pm, then fell below flood stage on February 8th at 430 am. Minor flooding was observed in low areas along river.</p> <p>Naches near Clifdell – Flood stage is 31.0 feet. The river rose above flood stage on February 7 at 4am, crested at</p>

Table 3.22. Past Flood Occurrences, Yakima County (2015-2021)

Location	Date	Event Type	Property Damages	Narrative
				<p>31.4 feet on by 1145am, then fell below flood stage on by 1130pm. Minor flooding was observed in low areas along river.</p> <p>Yakima near Parker – Flood stage is 10.0 feet. The river rose above flood stage on February 7th, 8 pm, crested at 10.4 feet on February 8th, 245 am, then fell below flood stage on February 8th, 6pm. Minor flooding was observed in low areas along river.</p>

In addition to recorded damages, Yakima County also monitors streamflow values measured at stream gauges along the Yakima River, Ahtanum River, and Naches River. **Tables 3.23 – 3.26** below summarize the historic crests on the Yakima River at Umtanum and Parker, as well as on the Naches River at Naches and Cliffdell. Stream gauges on the Ahtanum, Cowiche, and Toppenish do not include records of historic crests, but are used for active flood monitoring.

As summarized in **Table 3.23**, flood stage on the Yakima River at Umtanum is 35.5 feet which has been exceeded 11 times, with two occurrences in the HMP analysis period (2015-2021).

Table 3.23. Historic Crests on the Yakima River at Umtanum

Flood Categories	Historic Crest Height (feet)	Date
Major Flood Stage (39 feet)	41.10	11/15/1906
Moderate Flood Stage (38 feet)	38.98	05/29/1948
	38.77	02/09/1996
Flood Stage (35.5 feet)	37.93	11/25/1990
	37.84	01/08/2009
	37.63	12/03/1977
	37.08	11/23/1959
	36.69	01/17/2011
	36.50	05/16/2011
	35.70	12/10/2015
Action Stage (33.5 feet)	35.67	02/16/2016
	35.22	01/31/1965
	34.44	2/30/1999

As summarized in **Table 3.24**, flood stage on the Yakima River at Parker is 10 feet which has been exceeded 25 times, with three occurrences in the HMP analysis period (2015-2021).

Table 3.24. Historic Crests on the Yakima River at Parker		
Flood Categories	Historic Crest Height (feet)	Date
Major Flood Stage (14 feet)	16.21	02/09/1996
	15.00	12/23/1933
	14.61	11/30/1995
	14.50	11/26/1990
Moderate Flood Stage (12 feet)	13.97	12/03/1977
	13.44	12/27/1980
	13.35	01/16/1974
	13.20	05/16/2011
	13.14	12/04/1975
	13.03 (P)	01/09/2009 (P)
	12.20	01/18/2011
12.15	12/10/2015	
Flood Stage (10 feet)	11.65	01/31/1965
	11.65	03/14/1972
	11.61	02/21/1982
	11.41	01/25/1984
	11.30	04/01/2011
	11.28	02/21/1995
	10.93	02/16/2016
	10.75	02/01/1995
	10.61	02/19/1981
	10.40	02/08/2020
	10.22	02/26/1986
	10.19	04/25/2012
	10.11	03/10/1983

As summarized in Table 3.25, flood stage on the Naches River at Naches is 17.8 feet which has been exceeded 14 times, with two occurrences in the HMP analysis period (2015-2021).

Table 3.25. Historic Crests on the Naches River at Naches		
Flood Categories	Historic Crest Height (feet)	Date
Major Flood Stage (21 feet)	22.90	12/23/1933
	22.36	02/08/1996
Moderate Flood Stage (19 feet)	20.40	05/16/2011
	20.19	12/09/2015
	20.07	12/02/1977
	19.00	11/30/1995
	19.00	(05/16/2011)
Flood Stage (17.8 feet)	18.60	02/07/2020
	18.40	12/04/1975
	18.27	04/25/2012
	18.25	05/18/2008
	18.02	12/27/1980
17.95	06/17/1974	

Table 3.25. Historic Crests on the Naches River at Naches

Flood Categories	Historic Crest Height (feet)	Date
	17.81	05/18/2006
Action Stage (16 feet)	17.60	11/25/1990
	17.50	05/26/1999
	17.38	06/08/2011
	17.11	06/10/1972
	16.82	05/12/2013
	16.05	05/24/1969

As summarized in Table 3.26, flood stage on the Naches River at Cliffdell is 31 feet which has been exceeded 6 times, with two occurrences in the HMP analysis period (2015-2021).

Table 3.26. Historic Crests on the Naches River at Cliffdell

Flood Categories	Historic Crest Height (feet)	Date
Flood Stage (31 feet)	32.97	02/09/1996
	32.20	05/15/2011
	32.17	11/30/1995
	31.47	11/25/1990
	31.47	12/10/2015
	31.40	02/04/2020

Future Probability

Yakima County has experienced flood and flash flood events at least 42 times since 1950, including 8 recorded events during the HMP analysis period (2015-2021) and 9 declared disasters. According to the 2018 Washington State HMP, the Yakima River is expected to flood once every 2-5 years, and based on the historical record, the county will experience flooding at least once every other year. Given the consistent history of flooding impacting community members, property, and infrastructure in the county, the future probability of a significant flooding events is **Very Likely** (expected to occur every 1-4 years).

Climate Change Impacts

Climate change will influence seasonal patterns. Cascade drainage systems will soon be rain dominate rather than both snow and rain dominate. This change will result in drainages that carry reduced annual flows of water and distribute them over winter months instead of the usual two-week period. Furthermore, summer storage of water will be reduced greatly as summer flows will be reduced due to rain precipitation becoming the dominate source of water.⁵⁰ Changes in precipitation and streamflow may lead to flood of roads and increased erosion, as well as more winter flooding given changes to snowpack accumulation and melt rates. Flooding

⁵⁰ Climate Impacts Group. 2009. The Washington Climate Change Impacts Assessment. M. McGuire Elsner, J. Littell, and L. Whitely Binder (eds). Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Oceans, University of Washington, Seattle, Washington. <https://doi.org/10.6069/GWSP-MB82>

may occur more frequently over the winter and spring, resulting in two distinct peaks that impact already degraded aquatic habitats and destabilize channels.⁵¹

Yakima County Vulnerabilities

In 2016, the Washington Department of Ecology completed flood risk ranking for every watershed, including the Yakima River Basin. The risk assessment considered population density (weighted 60%), NFIP policies and claims (30%), and the floodplain area (10%). Based on this ranking, the Lower Yakima is the 7th highest risk watershed, mostly driven by floodplain area (4th in the state). The Upper Yakima ranks 19th in the state.⁵²

Flooding can threaten life, safety, and health and often results in substantial damage to homes, vehicles, land, crops, or livestock. Annual economic losses from flooding are expected in the thousands of dollars for the region, as well as impacts on vulnerable community members, potential destruction of critical infrastructure and the built environment, disruption of normal operations, and the potential loss of natural and cultural resources.

Loss Estimates

Flooding can lead to devastating property damages to homes in and near the floodplain. Additionally, flooding can lead to other economic losses, such as closures of critical transportation routes due to inundation, damage to agricultural resources due to heavy rainfall, and the potential to cause fatalities and injuries. According to the FEMA National Risk Index, Yakima County is expected to lose \$1,598,546 in 2022 from riverine flooding. According to the 2018 Washington State HMP, between 1960 and 2017, flooding in Yakima County has led to \$106,597,198 in property damages.

Table 3.27 summarizes the 2022 Expected Annual Loss for riverine flooding in Yakima County, as provided by the FEMA National Risk Index. Expected annual loss is a likelihood and consequence component of risk that measures the expected loss of building value, population, and agricultural value each year.

Table 3.27. 2022 Expected Annual Loss – Flooding⁵³					
Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Riverine Flooding	\$1,598,546	\$94,977	\$1,281,301	0.17	\$222,267

Yakima County participates in the National Flood Insurance Program (CID #530217D) and the last FIRM for the area was issued on 10/21/2021. Yakima County also participates in the Community Rating System (CRS) program and is in Class 10.

Only about 25 to 35 percent of homes in floodplains have insurance for flood losses. Uninsured homeowners face greater financial liability than they realize. Yakima County had 235 NFIP claim counts between 1978-2018, amounting to \$1,748,992.97.

⁵¹ Yakama Nation. Climate Adaptation Plan for the Territories of the Yakama Nation. Accessed from <https://ciq.uw.edu/projects/yakama-nation-climate-adaptation-plan/>

⁵² 2018 Washington State Enhanced Hazard Mitigation Plan, Hazard Inventory and Vulnerability Assessment. Top 20 At-Risk Watershed in Washington State. Accessed from <https://mil.wa.gov/enhanced-hazard-mitigation-plan>

⁵³ FEMA. National Risk Index for Natural Hazards. Accessed from <https://www.fema.gov/flood-maps/products-tools/national-risk-index>

As a part of the NFIP, FEMA identifies Repetitive Loss and Severe Repetitive Loss properties, as classified below.

Repetitive Loss Properties: A repetitive loss property is one for which two or more losses of at least \$1,000 each have been paid by the National Flood Insurance Program (NFIP) over a rolling 10-year period.

Severe Repetitive Loss Properties: A Severe Repetitive Loss property is a residential property that is covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or,
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.
- For both points above, at least two of the referenced claims must have occurred within any 10-year period and must be greater than 10 days apart.

Based on data provided by the Washington State Emergency Management Department as of September 2021, there are 27 Repetitive Loss properties in Yakima County, including four Severe Repetitive Loss Properties (both NFIP and Flood Mitigation Assistance programs). Of those 27, 12 are NFIP insured. These properties are summarized in Table 3.28, with **SRL properties in bold**.

Table 3.28. Repetitive Loss/Severe Repetitive Loss Properties in Yakima County					
Community Name	Mitigated	NFIP Insured	Address City	Most Recent Date of Loss	Occupancy
SELAH, CITY OF	NO	NO	Selah	11/28/1995 2/7/1996	Single Family
YAKIMA COUNTY *	NO	NO	Yakima	1/31/2003	Single Family
YAKIMA COUNTY *	YES	NO	Yakima	1/8/1983	Single Family
SELAH, CITY OF	NO	NO	Selah	2/7/1996	Other Non-residential
YAKIMA COUNTY *	NO	YES	Yakima	2/7/1996	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	1/2/1997	Single Family
YAKIMA COUNTY *	NO	NO	Wapato	2/9/1996	Single Family
SELAH, CITY OF	NO	NO	Selah	2/7/1996	Other Non-residential
YAKIMA COUNTY *	NO	NO	Yakima	2/9/1996	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	2/9/1996	Single Family
YAKIMA COUNTY *	NO	NO	Yakima	1/2/1997	Single Family
YAKIMA COUNTY *	NO	NO	Naches	7/1/1999	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	1/31/2003	Single Family
YAKIMA COUNTY *	NO	YES	Selah	1/9/2009	Single Family
SELAH, CITY OF	NO	YES	Selah	5/15/2011	Business
YAKIMA COUNTY *	NO	NO	Tieton	3/31/2011	Single Family

Table 3.28. Repetitive Loss/Severe Repetitive Loss Properties in Yakima County

Community Name	Mitigated	NFIP Insured	Address City	Most Recent Date of Loss	Occupancy
YAKIMA COUNTY *	NO	NO	Naches	5/14/2011	Single Family
YAKIMA COUNTY *	NO	NO	Naches	5/22/2011	Single Family
YAKIMA COUNTY *	NO	YES	Naches	5/15/2011	Single Family
YAKIMA COUNTY *	NO	NO	Yakima	3/14/2017	Single Family
YAKIMA COUNTY *	NO	NO	Yakima	3/16/2017	Single Family
YAKIMA, CITY OF	NO	YES	Yakima	3/10/2017	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	3/10/2017	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	4/12/2017	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	1/8/2009	Single Family
YAKIMA COUNTY *	NO	YES	Yakima	3/11/2017	Single Family
YAKIMA COUNTY *	NO	NO	Naches	5/15/2011	Single Family

Impacts on the Yakima County Population and Vulnerable Populations

Just over 15% of Yakima County's total population is exposed to a 100-year flood event, and approximately 2.7% are exposed to a 500-year flood event. However, more than 5% of the county's most vulnerable population (based on a social vulnerability index) resides in the 100-year floodplain, the highest percentage in the state, according to the 2018 Washington State HMP. Flooding sometimes leads to deaths if floodwaters become deep and swift enough to sweep away people or vehicles. It is possible that the sick, disabled, or elderly may not be mobile enough to escape rising floodwaters and may become trapped in their houses. During flooding events, residents may also be at an increased risk of waterborne diseases. For many, the psychological impact of major floods can be intense. Loss of loved ones, homes, and livelihoods can obviously create intense psychological and social disruption. Flooding in Yakima County has caused two reported injuries since 1960.

Impacts on Built Environment and Critical Infrastructure

According to the 2018 Washington State HMP, roughly 15.5% of Yakima County's total built environment is exposed in areas with 1% annual risk of flooding, expanding to almost 3% exposed to areas with 0.2% annual risk of flooding. Likewise, 6.3% of Yakima County's critical infrastructure is exposed to areas with 1% annual risk of flooding. Flooding poses a risk to the county's transportation infrastructure, as well as health and medical facilities and utility services. Bank erosion and channel migration are also of concern. In 2022, a municipal water line was exposed and required repair due to erosion in the City of Yakima.

The 2022 exposure analysis considered critical facilities in Yakima County located in the 100-year floodplain (Special Flood Hazard Area). The results are summarized in **Table 3.29**. Facilities of note include five fire stations (Toppenish Station 9, Glead Sheriff's Office/Fire Department, West Valley Station 2, and Nile/Cliffdell Station 11), 11 childcare facilities and school buildings, and 6 mass care sites (American Red Cross shelters and food banks).

Table 3.29. Yakima County Critical Facilities Exposure to Flooding	
Facility Type	Number of Exposed Facilities
Communications	0
Education	11
Emergency Services	5
Hospitals	0
Mass Care	6
Transportation	137
Utilities	4
Total Facilities Exposed by Hazard	163

Impacts on Government and Emergency Operations

Flooding may lead to a disruption of Yakima County's emergency response services, such as police, fire, and ambulance services, including delayed response due to blocked roads and an increase in calls for assistance. The local government also experiences long-term burdens on operational and emergency funds as resources are directed to response, repair, and mitigation projects. The 1996 flood resulted in an extended impact on Yakima County's general fund as staff worked to document losses and claim reimbursement from FEMA.

Impacts on the Economy and Businesses

Flooding events have significant impact on the economy. Yakima County is one of the many counties ranked as medium on the state flood risk index that is accredited for 83% of the entire state's Gross Domestic Product value. The local agricultural community is reliant on surface water diversions for irrigation, which are typically located in the floodway/floodplain or directly connected to a river or stream. These diversions are highly vulnerable to damage during flood events.

Impacts on Natural and Cultural Resources

There are limited impacts that directly affect the environment due to flooding events. Flooding provides ecological enrichment to floodplains by ensuring continued biological productivity and diversity. However, pollution from flooding may disrupt aquatic habitats. Additionally, improvements and repairs to levees and flood control structures generally require in-water work which stresses fish and other aquatic species. It is essential that mitigation strategies consider levee or flood control structure setbacks where feasible to reduce stress caused by nuisance in-water work and future repairs.

Overall Risk Ranking

Yakima County has a **High Risk** to flooding. FEMA has rated Yakima County **Relatively High Risk** for riverine flooding, with a risk score is 18.69. According to the 2018 Washington State HMP, Yakima County has a **Medium Risk** to flooding. **Table 3.30** below summarizes the risk assessment results for flooding for Yakima County.

Table 3.30. Risk Assessment Results – Flooding		
Criteria	Score	Description
Human Health	1	Very Low; 0-1 deaths and few injuries expected
Property Damage	4	High; widespread and substantial
Economic Disruption	3	Medium; widespread and temporary
Environmental Resource Damages/Degradation	3	Medium; widespread and minor
Emergency Services Burden	2	Low; widespread and temporary burden
Critical Facilities Exposure	2	Low; 10-20% of critical facilities exposed
Probability Score	5	Very Likely; expected every 1-4 years
Frequency Score	4	Likely; major events have occurred every 5-10 years
Total Impact Score	24	High Risk

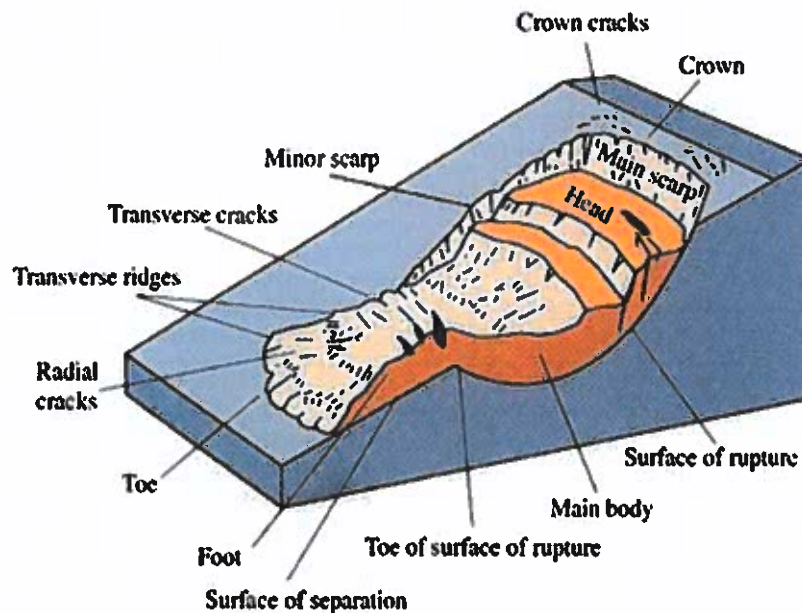
3.11. Landslides and Other Geologic Hazards

Yakima County is vulnerable to several types of geologic hazards, including landslides, mudslides, debris flows, rockfalls, and erosion. This hazard profile includes consideration of all these hazards but recognizes that landslides pose the most significant risk.

Landslides are generally defined as the unprovoked downhill movement of rocks, soil, and anything constructed. Fall, topple, slide, spread, or flow are movements by which landslides could be identified. The cause of the movement is a disturbance in the natural stability of the slope. Earthquakes, heavy rains, volcanic eruptions, and erosion are events that can initiate landslides. Landslides, mudslides, and other debris flows are also a significant secondary hazard in wildfire burn areas.

The characteristics of a landslide are depicted in the following diagram from USGS:

Figure 3.14. USGS Typical Landslide Diagram⁵⁴



Erosion is the process of the earth being worn away by natural elements such as wind and water. Water erosion is the exposure of rock to rain or other movements of water which breaks down the solid structure of rock or loosens the soil making it easier for it to crumble and increasing slippery conditions. Glacial erosion is the friction between the ice and the ground which causes abrasion. Wind erosion the turbulent flow of sand particles that sandblast land forms, this is more common in deserts, but is a documented issue along ridgelines in Yakima County.

Strength/Magnitude

Soil type, steepness, and previous disturbance or movement of the earth in a specific area are factors that influence landslides. Soil type is a key indicator for landslide potential and is used by

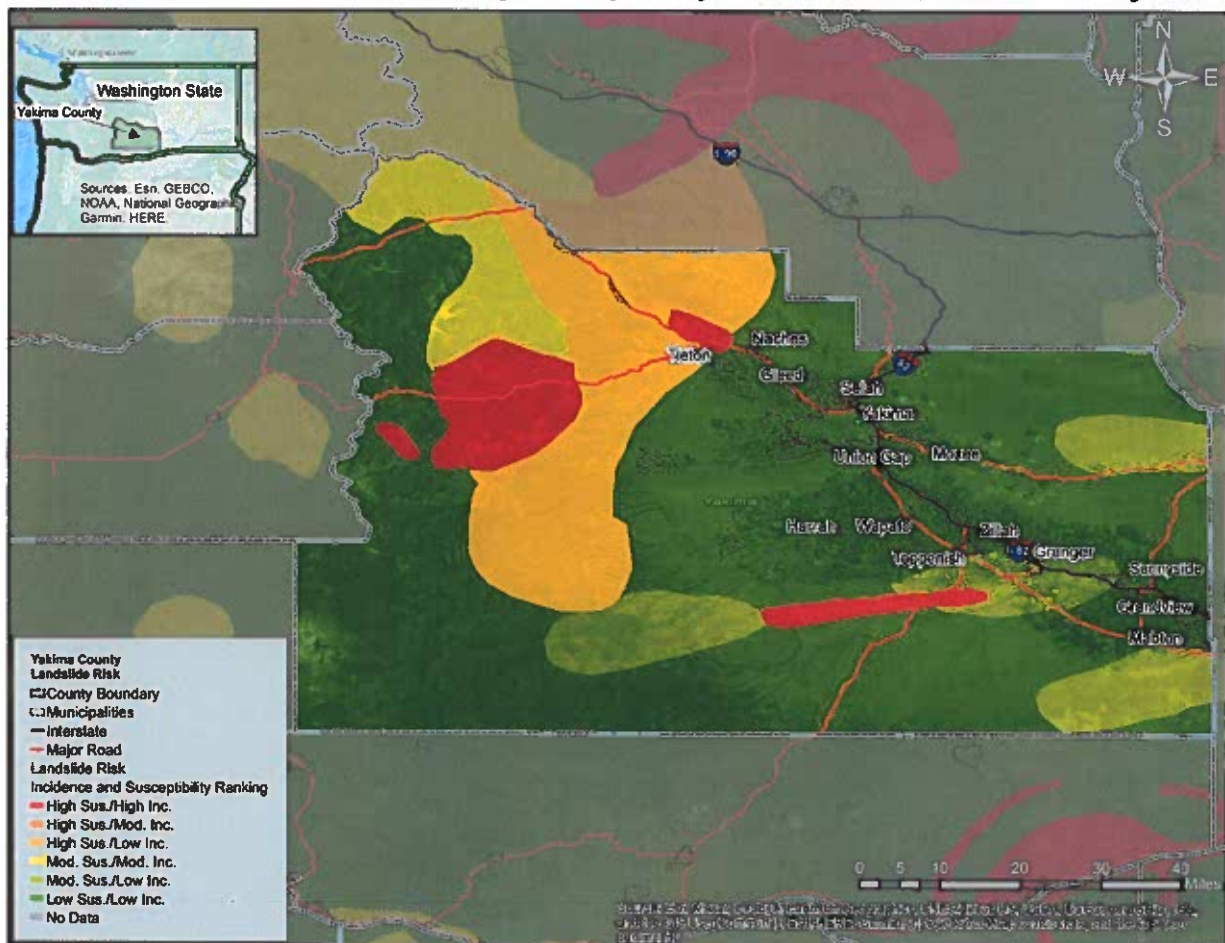
⁵⁴ U.S. Dept. of Interior, USGS. Fact Sheet 2004-3072. Accessed from: <https://pubs.usgs.gov/fs/2004/3072/>

geologists and geotechnical engineers to determine soil stability for construction standards. Landslide susceptibility maps, like the one illustrated in **Figure 3.15**, describe the relative likelihood of future landsliding based on the properties of the site, including prior failure, rock or soil strength, and steepness of slope. The extent of a landslide ultimately depends on the depth of the landslide and how far it might travel downslope over a given distance. Landslides can be shallow and slow-moving or very fast-moving, depending on these many factors.

Location

Landslides are common on steep slopes (20 degrees or greater) and areas where erosion has occurred. Yakima County is located between mountain ranges and has several rivers that flow throughout. As illustrated in **Figure 3.15**, landslide risk is greatest in the western section of the county in the areas surrounding US-12 and SR-410, as well as along the Toppenish Ridge. The communities of Nile, Toppenish, Naches, and Tieton are situated closest to these hazard areas. According to the 2018 Washington State HMP, nearly 50% of the Yakima County land area is exposed to landslide hazards.

Figure 3.15. Landslide Risk by Susceptibility and Incidence, Yakima County



Past Occurrences

Yakima County has experienced seven significant landslide incidents since 1960. These events collectively led to over \$14 million in property damages, but no reported injuries or fatalities. No significant events have occurred during the HMP analysis period (2015-2021).

Of note is an ongoing, slow-moving landslide in the Rattlesnake Hills. This landslide is about 20 acres in size, located near Union Gap, WA. Geologists and engineers expect the landslide to slowly move south, running into a nearby quarry. A bypass road to I-82, Thorp Road, has been closed since 2018 as a precautionary measure. There is a low probability scenario where the landslide could accelerate and reach I-82, nearby homes, or the Yakima River, and irrigation conveyance and other utilities are currently at risk. The Washington Department of Natural Resources and other agencies continue to monitor the landslide. Local agencies, including YVEM and Yakama Nation, are working to plan for various scenarios, including evacuations, detour routes, damming of the river, and subsequent flooding.⁵⁵

In 2009, the Nile Valley landslide moved over 40 million cubic yards of earth, rock, and debris across about 110 acres. This incident buried one house and severely damaged four others. In addition to this immediate property damage, the landslide blocked the Naches River and flooded the valley, causing additional flood damage to approximately 20 homes. The landslide destroyed a section of SR-410, illustrated in **Figure 3.16**, and led to about \$22 million in direct costs. It also required constructing a detour route, re-channelizing the river, and reconstructing the highway. This cost is not captured in the property damage estimates above. The landslide also led to evacuations for 60 residents and a nearby residential program and resort, as well as precautionary power shutoffs for about 800 customers.⁵⁶



Figure 3.16. Nile Valley Landslide on SR-410
Source: Washington Dept. of Transportation

The incident resulted in a State of Emergency declaration by the Governor and an emergency proclamation by Yakima County, but Yakima County did not qualify for FEMA Individual Assistance. There have been two Presidential Disaster Declarations for Yakima County related to mudslides and landslides resulting from severe storms and flooding, including in 1997 (DR-1159) and 2009 (DR-1817).

Future Probability

Yakima County has experienced a significant landslide event approximately once every 9 years since 1960. Damaging landslides are expected to increase in the future, given the intensity of rain events and rapid snowmelt, an increase in wildfires and forest vulnerability, and increasing development in landslide and wildfire prone areas. It is **Likely** (expected to occur every 5-10 years) that a significant landslide will occur in Yakima County.

⁵⁵ Washington State Department of Natural Resources. Rattlesnake hills landslide. Accessed from: <https://www.dnr.wa.gov/rattlesnake-hills-landslide#:~:text=>

⁵⁶ History Link. Massive landslide in the Nile Valley (Yakima County) blocks State Route 410 and redirects the flow of the Naches River on October 11, 2009. Accessed from: <https://www.historylink.org/File/9224>

Climate Change Impacts

Landslide events can be expected to increase in frequency in the future as a result of warmer, wetter winters and hotter, dryer summers. These conditions stress forested areas throughout the Cascades, increasing wildland fire risk and associated soil mobilization and landslides. Additionally, heavy rain events are the primary cause of landslides and are expected to happen with more frequency and intensity due to human-caused climate change.

Yakima County Vulnerabilities

The most vulnerable areas are those downhill of a steep slope where there is high susceptibility to landslides, including recent occurrences. Landslides can damage property and critical facilities, as well as blocking and damaging critical transportation infrastructure. Large slides can also block or divert waterways, leading to necessary improvements to maintain irrigation and flood control infrastructure.

Loss Estimates

Table 3.31 summarizes the 2022 Expected Annual Loss for landslides in Yakima County, as provided by the FEMA National Risk Index. Expected annual loss is a likelihood and consequence component of risk that measures the expected loss of building value, population, and agricultural value each year.

Table 3.31. 2022 Expected Annual Loss – Landslide and Erosion⁵⁷

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Landslide	\$148,780	\$85,237	\$63,543	0.01	n/a

Impacts on the Yakima County Population and Vulnerable Populations

According to the 2018 Washington State HMP, 5% of the Yakima County population is directly exposed to landslides. Very few homes are in areas that may experience landslides, rockslides, or mudflows. That said, many community members may experience the indirect impacts of landslides, including damage to agricultural lands, contaminated water sources, disrupted transportation routes, or subsequent flooding from dammed rivers.

Built Environment and Critical Infrastructure

In Yakima County, most of the built environment is not located in higher risk landslide areas. Roadways are most likely to be impacted by landslides, requiring alternate transportation routes. According to the 2018 Washington State HMP, about 5% of the general building stock in Yakima County is exposed to landslides. Conversely, a significant portion of Yakima County’s critical facilities are exposed to landslide hazards – up to 40% as estimated by the 2018 Washington State HMP. This is similar to the statewide average exposure.

⁵⁷ FEMA. National Risk Index for Natural Hazards. Accessed from <https://www.fema.gov/flood-maps/products-tools/national-risk-index>

The 2022 exposure analysis considered critical facilities in Yakima County with a medium or higher landslide risk. The results are summarized in **Table 3.32**. Facilities of note include four fire stations in the Nile-Cliffdell Fire District, the Tieton Dam Hydro Electric Project, two small airports, and Naches Valley High School and Hope Academy, both in Naches.

Facility Type	Number of Exposed Facilities
Communications	3
Education	2
Emergency Services	4
Hospitals	0
Mass Care	0
Transportation	32
Utilities	3
Total Facilities Exposed by Hazard	44

Impacts on Government and Emergency Operations

A landslide could damage communications and power lines that are in its track and block roads once it has reached flat land. As in the 2009 Nile Valley landslide, a significant incident could disrupt power and communications, as well as limit access to certain areas. A landslide blocking any critical transportation corridor could slow or limit emergency response until a detour is established.

Impacts on the Economy and Businesses

Impacts to the economy and businesses are minimal from a landslide, as most businesses are located outside of landslide risk areas. Businesses could be impacted indirectly if a landslide were to disrupt communications or power or block critical transportation routes.

Impacts on Natural and Cultural Resources

Landslides can impact agricultural lands by damaging crops and livestock. In addition, landslides can impact irrigation systems, requiring expensive improvements or replacements. Landslides and erosion are also likely to impact river basins and drainage areas, potentially impacting water quality and fisheries, or causing changes to channels and river flow. Landslides in forested areas could also damage timber stands.

Overall Risk Ranking

Yakima County has a **Medium Risk** to landslides and other geologic events. FEMA has rated Yakima County **Relatively High Risk** for landslides, with a risk score is 25.67. According to the 2018 Washington State HMP, Yakima County has a **Medium-Low Risk** to landslides. **Table 3.33** below summarizes the risk assessment results for the landslide hazard for Yakima County.

Table 3.33. Risk Assessment Results – Landslide		
Criteria	Score	Description
Human Health	1	Very Low; 0-1 deaths and few injuries expected
Property Damage	3	Medium; localized, substantial
Economic Disruption	2	Low; localized, temporary
Environmental Resource Damages/Degradation	2	Low; localized, minor
Emergency Services Burden	3	Medium; localized, temporary
Critical Facilities Exposure	1	Very Low; less than 10% exposed
Probability Score	4	Likely; expected to occur every 5-10 years
Frequency Score	4	Likely; has occurred every 5-10 years
Total Impact Score	20	Medium Risk

3.12. Public Health Emergency

This hazard profile primarily considers outbreaks of a communicable disease as a potential public health emergency facing Yakima County. Additional consideration is given to public health emergencies related to environmental health.

Communicable Disease

A large outbreak within a population may constitute a public health emergency. A communicable disease spreads between people and animals through contact with bodily fluids, direct skin contact, airborne droplets, aerosolized particles, or insect/animal bites. A widespread communicable disease can cause a public health emergency as either a more localized epidemic or as a larger global pandemic. An epidemic is essentially the spread of a specified disease within a community over a period of time. A pandemic is the spread of a communicable disease that spreads throughout other parts of the country or world. Epidemics and pandemics result in short term and long term economic, social, and health impacts on the community.

Depending on the cause and virulent strength, outbreaks can occur frequently. The spread of a communicable disease may occur as a result of a natural disaster, the release of a chemical agent, interactions with an infected animal or insect, unsafe food handling practices, or improper hygiene practices.

New and emerging diseases can cause an outbreak amongst individuals who are immunocompromised. Historically, the United States has been introduced to many new diseases such as new strains of influenza (flu), HIV/AIDS, Tuberculosis, H1N1 (variant influenza), Ebola, MERS, and SARS. New diseases may cause fear amongst residents as little is known and they may result in an epidemic or a pandemic. The United States has recently experienced the following diseases:

Pandemic Influenza

Pandemic influenza is a new and widely spread influenza virus that is different from a seasonal influenza.⁵⁸ A pandemic influenza may mirror typical symptoms of seasonal influenza such as fever, cough, sore throat, chills, and muscle and joint soreness; however, the infection and mortality rate is higher and can result in hospitalization and death. Vaccinations may not be readily available for a new strain of influenza.

COVID-19

Corona Virus 2019 or COVID-19 is an infectious disease caused by severe acute respiratory syndrome (SARS-CoV-2 virus).⁵⁹ In 2019, COVID-19 was traced to an open animal market in Wuhan, Hubei, China. Globally as of 2022, the World Health Organization (WHO) has confirmed approximately 588 million cases of COVID-19 and 6 million deaths.⁶⁰ In the United States alone, there has been nearly 91 million cases reported and one million deaths as of 2022.⁶¹

⁵⁸ Centers for Disease Control and Prevention. Pandemic Basics. Accessed from: <https://www.cdc.gov/flu/pandemic-resources/basics/index.html>

⁵⁹ World Health Organization. Coronavirus disease (COVID-19). Accessed from: https://www.who.int/health-topics/coronavirus#tab=tab_1

⁶⁰ World Health Organization. WHO Coronavirus (COVID-19) Dashboard. Accessed <https://covid19.who.int/>

⁶¹ World Health Organization. United States of America: WHO Coronavirus disease (COVID-19) dashboard. Accessed from: <https://covid19.who.int/region/amro/country/us>

COVID-19 spreads during close contact between individuals through respiratory droplets from sneezing, talking, coughing, or breathing. Public health professionals recommend that individuals take proper precautions such as wearing a mask in public, social distancing, and isolating when infected.

Additional outbreaks include:

- **Severe Acute Respiratory Syndrome (SARS)** is a respiratory illness caused by coronavirus, called SARS-associated Coronavirus (SARS-CoV). This illness was first documented in Asia and quickly spread causing a global outbreak in 2003. During the outbreak a total of 8,098 cases were documented and 774 died. Only eight individuals tested positive for SARS in the United States.⁶²
- **Middle East Respiratory Syndrome (MERS)** is also a respiratory illness caused by coronavirus (MERS-CoV) and is essentially new to humans. MERS was first recorded in Saudi Arabia in 2012 and quickly spread to other countries. According to the CDC MERS presents a low risk to the public in the United States.⁶³
- **Human Immunodeficiency Virus (HIV)** is a virus that attacks the body immune system and if not treated can lead to AIDS, Acquired Immunodeficiency Syndrome. HIV was first seen in Central Africa and has jumped to other countries globally. The virus has existed in the United States since the mid to late 1970s.⁶⁴ In the 1980s the United States experienced a rapid increase in the 1980s, labeling it the AIDS epidemic.
- **Tuberculosis (TB)** presents itself as a respiratory illness caused primarily by bacteria called Mycobacterium tuberculosis. The bacteria can affect any part of the body including the kidney, spine, and brain. The bacteria that cause TB can be spread through air from one person to another.⁶⁵

Environmental Health

Community members may also be at risk of health hazards related to their environment, typically a substance that can cause an adverse health event, including animal and insect diseases, drinking water quality, food safety, septic systems, solid waste disposal, and more. Environmental health hazards can be the result of a natural disaster, such as a wildfire, human error, or development/land use decisions that locate industrial, agricultural, or other contaminating activities near residential areas or sensitive resource areas. Common examples of environmental hazards include air contaminants, toxic waste, radiation, disease-causing microorganisms and plants, pesticides, heavy metals, and chemicals in consumer products.⁶⁶

Environmental health hazards of concern in Yakima County include:

- **Water Quality:** Both groundwater and surface water are subject to contamination from runoff, agricultural uses, industrial uses, and other sources in Yakima County. Lower

⁶² Centers for Disease Control and Prevention. SARS Basic Fact Sheet. Accessed from: <https://www.cdc.gov/sars/about/fs-sars.html>

⁶³ Centers for Disease Control and Prevention. Middle East Respiratory Syndrome (MERS). Accessed from: <https://www.cdc.gov/coronavirus/mers/index.html>

⁶⁴ Centers for Disease Control and Prevention. HIV Basics: About HIV. Accessed from: <https://www.cdc.gov/hiv/basics/whatishiv.html>

⁶⁵ Centers for Disease Control and Prevention. Basic TB Facts. Accessed from: <https://www.cdc.gov/tb/topic/basics/default.htm>

⁶⁶ Centers for Disease Control and Prevention. Introduction to Environmental Public Health Tracking. Accessed from: <https://www.cdc.gov/nceh/tracking/tracking-intro.html>

valley communities in Yakima County are working to reduce nitrate contamination concentrations in groundwater below state drinking water standards. The affected water quality is primarily the result of human activities at the surface that degrade groundwater quality in private domestic wells. According to the CDC, about 1 in 8 Americans get their drinking water from a private well, and 1 in 5 sampled private wells were found to be contaminated at levels that could affect health.⁶⁷ Disease outbreaks connected to private well sources continue to increase. Contaminants with links to possible health effects include radiological, chemical, and microbiological sources.

- **Vector-borne Diseases:** According to the WHO, vector-borne diseases are human illnesses caused by parasites, viruses, and bacteria that are transmitted by vectors.⁶⁸ Vectors are organisms that can transmit infectious pathogens between humans and animals. Common vectors include mosquitoes, fleas, ticks, blackflies, lice, etc. These vectors such as mosquitoes transmit can transmit Dengue, Yellow Fever, Rift Valley Fever, Zika, Lyme. Ticks can transmit Lyme disease, tick-borne encephalitis, Tularemia, etc. Lice may cause Typhus and Louse-borne relapsing fever and fleas may cause Plague and Tungiasis.⁶⁹ West Nile Virus, Western equine encephalitis, and St. Louis Encephalitis are present in Washington. Washington does not have mosquitos that carry dengue, Zika, or yellow fever. Around 25-50 travel-related malaria cases are diagnosed in Washington each year.

Safeguarding environmental health is also of primary concern during disaster response and recovery. Communities must safeguard drinking water, control disease-carrying vectors, ensure proper food safety, and maintain healthy environments that may be impacted by various sources of contamination during the disaster or as a consequence of response activities.

Strength/Magnitude

A pandemic occurs in waves and has the potential to last weeks to months and in some circumstances years. Once a communicable disease reaches the point of human-to-human transmission, the strength of the disease is likely to increase and easily cross geographical boundaries. A strong strain of a disease has the potential to reach even remote and isolated locations. When examining COVID-19, research has shown an overall pattern as a series of waves with surges and declines. The large spikes of COVID-19 cases occurred over the winter months.⁷⁰ The winter months have greater occurrences of travel and social gatherings.

Environmental health concerns range widely in severity and magnitude. A small source of contamination that is not mitigated may create more severe consequences over a long period of time. A short-term but severe source of contamination could leave water sources or other environmental resources degraded and dangerous for years after initial response.

⁶⁷ Centers for Disease Control. Environmental Health Services: Private Wells. Accessed from: <https://www.cdc.gov/nceh/ehs/water/private-wells/index.html>

⁶⁸ World Health Organization. Vector-borne diseases. Accessed from: <https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases>

⁶⁹ Ibid.

⁷⁰ Johns Hopkins Medicine. Coronavirus second wave, third wave and beyond: What causes a COVID surge. Accessed from: <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/first-and-second-waves-of-coronavirus>

Location

Cities with the largest populations in Yakima County are more susceptible to a communicable disease outbreak due to the number of residents living near each other. The county seat, the City of Yakima, has the largest population in the area with 96,000 residents. That said, additional factors influence the spread of disease. During COVID-19 in Yakima County, the lower valley saw higher rates of transmission based on social factors, including multigenerational housing, limited personal transportation access, limited access to healthcare, and more. Other factors influencing disease spread include areas with high contact with animals, high international travel and trade, and access to healthcare. That said, communicable diseases can affect all Yakima County residents, and their spread does not respect city or county boundaries.

Environmental health hazards can impact residents across Yakima County. People living in close proximity to contaminant sources, including industrial areas, high-density urban areas, and transportation corridors (major highways and railroads) are likely to experience higher exposure to hazards.

Past Occurrences

During the 20th and 21st centuries, the globe has seen multiple pandemics. Pandemics have been seen during 1918, 1957, 1968, 2009, and 2020 – almost every 30 years. These pandemics include:

- **1918 (Spanish Flu):** The pandemic that occurred during the 1918-1919 was seen as the most severe in history. Approximately 500 million people, about one-third of the world's population, became infected. In the United States alone, the number of deaths reached at least 50 million with about 675,000 occurred in the United States.⁷¹ Mortality ranged between age, however children younger than 5 years of age, 20-40 years old, and 65 years and older had a high rate.⁷²
- **1957 (Asian Pandemic Flu-H2N2):** During 1957 a new virus emerged in East Asia with the first case reported in Singapore and followed to Hong Kong, and the United States in Summer of 1957. There were approximately 1.1 million deaths worldwide with 116,000 in the United States.⁷³
- **1968 (Hong Kong Flu-H3N2):** In the 1968 a new pandemic emerged worldwide. The pandemic was first documented in the United States. Deaths rose to 1 million worldwide and approximately 100,000 in the United States. The virus continues to circulate worldwide as a seasonal influenza.⁷⁴
- **2009 (Swine Flu-H1N1):** During the spring of 2009, a novel virus emerged globally. The first case of the H1N1 virus was detected in the United States and spread quickly around

⁷¹ Centers for Disease Control and Prevention. 1918 Pandemic (H1N1 virus). Accessed from: <https://www.cdc.gov/flu/pandemic-resources/1918-pandemic-h1n1.html>

⁷² Ibid.

⁷³ Centers for Disease Control and Prevention. 1957-1958 pandemic (H2N2 virus). Accessed from: <https://www.cdc.gov/flu/pandemic-resources/1957-1958-pandemic.html>

⁷⁴ Centers for Disease Control and Prevention. 1963 pandemic (H3N2 virus). Accessed from: <https://www.cdc.gov/flu/pandemic-resources/1968-pandemic.html>