KITTITAS COUNTY

HAZARD MITIGATION PLAN





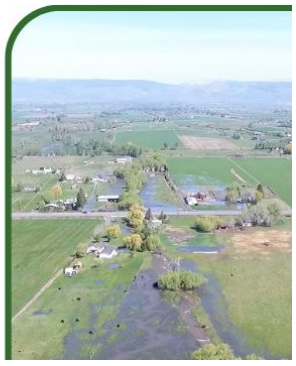
Volume I:
Countywide Planning Elements













Kittitas County
Public Works Department

TABLE OF CONTENTS

Executive Summary **1**
Chapter 1. Introduction **5**
1.1. Purpose of the Plan 5
1.2. Hazard Mitigation Program 5
1.3. Planning Area 6
1.4. Participating Jurisdictions 6
1.5. Plan Participation 7
1.5.1. Core Planning Team *7*
1.5.2. Steering Committee *7*
1.5.3. Local Planning Teams and Community Representatives *9*
1.5.4. Supporting Organizations *9*
1.6. Plan Approval and Adoption 9
Chapter 2. Planning Process **11**
2.1. Review of Existing Programs and Plans 13
2.2. Equity Consideration for Underserved Population 13
Chapter 3. Community Profile **16**
3.1. Kittitas County History 17
3.2. Topography 18
3.2.1. Geology *18*
3.2.2. Soils *19*
3.2.3. Slope Stability *21*
3.2.4. Seismic Features *21*
3.3. Climate 22
3.4. Land Use 24
3.5. Changes in Development 28
3.6. Demographics 29
3.6.1. Underserved Population *34*
3.7. Economy 35
3.8. Critical Facilities and Infrastructure 37
3.9. Capability Assessment 39
3.9.1. Planning and Regulatory Capabilities *39*
3.9.2. Administrative and Technical Capabilities *44*
3.9.3. Financial Capabilities *45*
3.9.4. Education and Outreach Capabilities *46*
3.9.5. Recommended Expanded or Improved Capabilities *46*

3.10. Hazard Mitigation Integration 47
3.10.1. Existing Plan Integration 47
3.10.2. Potential Future Integration 48
3.11. National Flood Insurance Program 49
3.11.1. Floodplain Managers 50
3.11.2. Participation Activities 50
Chapter 4. Hazard Identification and Risk Assessment 54
4.1. Identified Hazards 54
4.2. Presidential Disaster and Emergency Declarations 55
4.3. Risk Assessment Methodology 56
4.3.1. Probability of Occurrence 58
4.3.2. Extent Factors 58
4.3.3. Vulnerability Factors 59
4.3.4. Impact Factors 60
4.4. FEMA National Risk Index Scores 64
4.4.1. Expected Annual Loss 64
4.4.2. Social Vulnerability 65
4.4.3. Community Resilience 65
4.5. Total Risk Scores 66
4.6. Hazard Profiles 69
4.6.1. Avalanche 69
4.6.2. Dam and Levee Failure 80
4.6.3. Drought 96
4.6.4. Earthquake 107
4.6.5. Flood 123
4.6.6. Landslide 142
4.6.7. Severe Weather 149
4.6.8. Volcanic Activity 174
4.6.9. Wildfire 185
4.6.10. Winter Weather 197
4.6.11. Other Hazards of Concern 211
Chapter 5. Mitigation Strategy 217
5.1. Mitigation Goals 217
5.2. Review of Possible Mitigation Activities 218
5.2.1. Prevention 218
5.2.2. Property Protection 219

5.2.3. Natural Resource Protection *220*
5.2.4. Emergency Services *220*
5.2.5. Structural Projects *221*
5.2.6. Public Information *222*
5.3. Mitigation Strategies and Actions 222
5.3.1. Mitigation Action Plan *223*
5.4. Changes in Priority 227
Chapter 6. Plan Maintenance 229
6.1. Plan Update 229
6.1.1. Monitoring, Evaluation *229*
Appendix A. Mitigation Actions 234
Appendix B. Stakeholder Engagement 285
Appendix C. Public Engagement 306
Appendix D. Plan Adoption 388

LIST OF TABLES

Table 1-1. Participating Jurisdictions 7
Table 1-2. Core Planning Team Members 7
Table 1-3. Hazard Mitigation Steering Committee Members 8
Table 3-1. Kittitas County Monthly Climate Summary (1893 – 2023) 23
Table 3-2. Land Use Designation and Corresponding Zoning Classification 24
Table 3-3. Population Estimates 29
Table 3-4. Kittitas County Projected Population (2020 – 2050) 30
Table 3-5. 2037 County Population Growth and Allocations 31
Table 3-6. Poverty Thresholds for 2022 by Size of Family 31
Table 3-7. Age Distribution (2022) 32
Table 3-8. Racial and Ethnic Distribution (2022) 32
Table 3-9. Disability Characteristics (2022) 33
Table 3-10. Social Vulnerability Index (2020) 35
Table 3-11. Employment by Industry (2022) 35
Table 3-12. Employment Status (2022) 36
Table 3-13. Occupation (2022) 36
Table 3-14. Income and Benefits (2022) 37
Table 3-15. Critical Facilities in Kittitas County 38
Table 3-16. Critical Facilities in Kittitas County 39
Table 3-17. State and Local Existing Planning Initiatives 40
Table 3-18. Legal and Regulatory Capability 42
Table 3-19. Administrative and Technical Capabilities 45
Table 3-20. Financial Resources 45
Table 3-21. Education and Public Outreach Capabilities 46
Table 3-22. Current Plan Integration 47
Table 3-23. Potential Future Integration 49
Table 3-24. NFIP Participation Information 50
Table 3-25. Floodplain Managers 50

Table 4-1. Kittitas County Hazards 55
Table 4-2. State and Federal Disaster Declarations for Kittitas County 56
Table 4-3. Probability of Occurrence 58
Table 4-4. Extent/Intensity Factor 58
Table 4-5. Catastrophic Factor 59
Table 4-6. Population Exposure Factor 59
Table 4-7. Property Exposed Factor 59
Table 4-8. Changes in Development Factor 60
Table 4-9. Population and Life Safety Factor 60
Table 4-10. Underserved/Equity Factor 61
Table 4-11. Property Damage Factor 61
Table 4-12. Economic Factor 62
Table 4-13. Environmental Factor 62
Table 4-14. Essential Operations Factor 62
Table 4-15. Future Development Factor 63
Table 4-16. Climate Change Factor 63
Table 4-17. Risk Index Score for Kittitas County (FEMA National Risk Index) 64
Table 4-18. Expected Annual Loss for Kittitas County (FEMA National Risk Index) 65
Table 4-19. Social Vulnerability for Kittitas County (FEMA National Risk Index) 65
Table 4-20. Community Resilience for Kittitas County (FEMA National Risk Index) 66
Table 4-21. 2025 Hazard Risk Score for Kittitas County 67
Table 4-22. Avalanche Types 70
Table 4-23. North American Public Avalanche Danger Scale 72
Table 4-24. Northwest Avalanche Center Avalanche Advisories 73
Table 4-25. Avalanche Annualized Frequency (FEMA National Risk Index) 73
Table 4-26. Avalanche Past Events 74
Table 4-27. Avalanche Expected Annual Loss (FEMA National Risk Index) 78
Table 4-28. Avalanche Risk Index (FEMA National Risk Index) 78
Table 4-29. Avalanche Total Risk Score 79
Table 4-30. Dam Failure Types80F 80
Table 4-31. High Hazard Dams in Kittitas County 82
Table 4-32. Additional Dams in Kittitas County 82
Table 4-33. Kittitas County High Hazard Dams with DSO Hazard Classification and Population at Risk 83
Table 4-34. Levees in Kittitas County 87
Table 4-35. USACE Dam Hazard Categories 89
Table 4-36. USACE Levee Safety Action Classification (LSAC)91F 90
Table 4-37. 25-Year Precipitation Projections for Kittitas County 93
Table 4-38. Future Climate Indicators for Kittitas County 94
Table 4-39. Dam and Levee Failure Total Risk Score 95
Table 4-40. Types of Drought 96
Table 4-41. Palmer Drought Severity Index 97
Table 4-42. U.S. Drought Monitor Classification 99
Table 4-43. Drought Annualized Frequency for Kittitas County (FEMA National Risk Index) 101
Table 4-44. Drought Past Events 102
Table 4-45. 25-Year Climate Projections for Kittitas County 104
Table 4-46. Future Climate Indicators for Kittitas County 105
Table 4-47. Drought Expected Annual Loss (FEMA National Risk Index) 105
Table 4-48. Drought Risk Index (FEMA National Risk Index) 106
Table 4-49. Drought Total Risk Score 106

Table 4-50. Modified Mercalli Scale vs. Richter Scale 110
Table 4-51. ShakeAlert Earthquake Early Warning System Alerting Thresholds 113
Table 4-52. Earthquake Annualized Frequency (FEMA National Risk Index) 114
Table 4-53. Earthquake Past Events 115
Table 4-54. Hazus Earthquake Expected Building Damage by Occupancy 118
Table 4-55. Hazus Earthquake Expected Building Damage by Building Type 118
Table 4-56. Hazus Earthquake Expected Damage to Essential Facilities 119
Table 4-57. Hazus Earthquake Building Related Economic Loss Estimates (Millions of Dollars) 119
Table 4-58. Hazus Earthquake Expected Damage to Transportation Systems 120
Table 4-59. Hazus Earthquake Transportation System Economic Losses (Millions of Dollars) 120
Table 4-60. Earthquake Expected Annual Loss (FEMA National Risk Index) 121
Table 4-61. Earthquake Risk Index (FEMA National Risk Index) 122
Table 4-62. Earthquake Total Risk Score 122
Table 4-63. Flood Types147F 123
Table 4-64. Kittitas County Peak Discharges 127
Table 4-65. NWS Flood Advisories 129
Table 4-66. NWS Flash Flood Impact Based Warnings 129
Table 4-67. NWS River Flood Severity Categories 130
Table 4-68. Recurrence Intervals and Probabilities of Occurrences 130
Table 4-69. Riverine Flooding Annualized Frequency (FEMA National Risk Index) 131
Table 4-70. Kittitas County Repetitive Loss and Severe Repetitive Loss Properties 132
Table 4-71. Kittitas County NFIP Policies 132
Table 4-72. Flood Events (1997 – 2023) 133
Table 4-73. 25-Year Climate Projections for Kittitas County 135
Table 4-74. Future Climate Indicators for Kittitas County 136
Table 4-75. Hazus 100-Year Flood Expected Building Damage by Occupancy 137
Table 4-76. Hazus 100-Year Flood Expected Building Damage by Building Type 137
Table 4-77. Hazus 100-Year Flood Expected Damage to Essential Facilities 137
Table 4-78. Hazus 100-Year Flood Building Related Economic Loss Estimates (Millions of Dollars) 138
Table 4-79. Hazus 500-Year Flood Expected Building Damage by Occupancy 138
Table 4-80. Hazus 100-Year Flood Expected Building Damage by Building Type 139
Table 4-81. Hazus 500-Year Flood Expected Damage to Essential Facilities 139
Table 4-82. Hazus 500-Year Flood Building Related Economic Loss Estimates (Millions of Dollars) 140
Table 4-83. Riverine Flooding Expected Annual Loss (FEMA National Risk Index) 140
Table 4-84. Riverine Flooding Risk Index (FEMA National Risk Index) 141
Table 4-85. Flood Total Risk Score 141
Table 4-86. Types of Slope Movement 142
Table 4-87. USGS Landslide Advisories 145
Table 4-88. Landslide Annualized Frequency (FEMA National Risk Index) 146
Table 4-89. Landslide Expected Annual Loss (FEMA National Risk Index) 148
Table 4-90. Landslide Risk Index (FEMA National Risk Index) 148
Table 4-91. Landslide Total Risk Score 148
Table 4-92. Stages of a Thunderstorm 149
Table 4-93. Types of Thunderstorms 150
Table 4-94. Hail Speed Estimates 151
Table 4-95. Types of Tornadoes 151
Table 4-96. Types of Strong Winds 152
Table 4-97. Converting Traditional Hail Size Descriptions 158

Table 4-98. Beaufort Wind Scale 159
Table 4-99. Enhanced Fujita Scale 160
Table 4-100. NWS HeatRisk Categories 160
Table 4-101. NWS Severe Weather Advisories 161
Table 4-102. NWS Excessive Heat Advisories 162
Table 4-103. NWS Cold Weather Advisories 162
Table 4-104. Hail Annualized Frequency (FEMA National Risk Index) 163
Table 4-105. Strong Wind Annualized Frequency (FEMA National Risk Index) 163
Table 4-106. Tornado Annualized Frequency (FEMA National Risk Index) 163
Table 4-107. Heat Wave Annualized Frequency (FEMA National Risk Index) 163
Table 4-108. Cold Wave Annualized Frequency (FEMA National Risk Index) 164
Table 4-109. Heavy Rainfall Events (1950 – 2023) 164
Table 4-110. Hail Events (1950 – 2023) 164
Table 4-111. Strong Wind/Damaging Wind Events (1950 – 2023) 165
Table 4-112. Heat Wave/Excessive Heat Events (1950 – 2023) 165
Table 4-113. Cold Wave/Extreme Cold Events (1950 – 2023) 166
Table 4-114. 25-Year Climate Projections for Kittitas County 169
Table 4-115. Hail Expected Annual Loss (FEMA National Risk Index) 169
Table 4-116. Strong Wind Expected Annual Loss (FEMA National Risk Index) 170
Table 4-117. Tornado Expected Annual Loss (FEMA National Risk Index) 170
Table 4-118. Heat Wave Expected Annual Loss (FEMA National Risk Index) 170
Table 4-119. Cold Wave Expected Annual Loss (FEMA National Risk Index) 171
Table 4-120. Hail Risk Index (FEMA National Risk Index) 171
Table 4-121. Strong Wind Risk Index (FEMA National Risk Index) 171
Table 4-122. Tornado Wind Risk Index (FEMA National Risk Index) 171
Table 4-123. Heat Wave Risk Index (FEMA National Risk Index) 172
Table 4-124. Cold Wave Risk Index (FEMA National Risk Index) 172
Table 4-125. Severe Weather Total Risk Score 173
Table 4-126. Volcano Types 174
Table 4-127. Volcanic Eruption Types 175
Table 4-128. Volcano Related Hazards 175
Table 4-129. Volcanoes Within 1,000 Miles of Kittitas County 177
Table 4-130. Volcanic Explosivity Index 179
Table 4-131. United States Geological Survey Volcano Alert Levels 179
Table 4-132. United States Geological Survey Aviation Color Code 180
Table 4-133. Volcano Activity Annualized Frequency (FEMA National Risk Index) 181
Table 4-134. Past Volcano Eruptions 181
Table 4-135. Volcanic Activity Expected Annual Loss (FEMA National Risk Index) 184
Table 4-136. Volcanic Activity Risk Index (FEMA National Risk Index) 184
Table 4-137. Volcanic Activity Total Risk Score 184
Table 4-138. Types of Wildfires 185
Table 4-139. Wildland Urban Interface Planning Area Fire Coverage 186
Table 4-140. Air Quality Index for Ozone and Particulate Pollution 189
Table 4-141. NWS Fire Advisories 190
Table 4-142. Wildfire Annualized Frequency (FEMA National Risk Index) 191
Table 4-143. Wildfire Events (1950 – 2023) 191
Table 4-144. 25-Year Climate Projections for Kittitas County 194
Table 4-145. Future Climate Indicators for Kittitas County 195
Table 4-146. Wildfire Expected Annual Loss (FEMA National Risk Index) 196
Table 4-147. Wildfire Risk Index (FEMA National Risk Index) 196

Table 4-148. Wildfire Total Risk Score 196
Table 4-149. Winter Precipitation Types 197
Table 4-150. Ice Related Hazard 198
Table 4-151. NWS Winter Weather Advisories 199
Table 4-152. NWS Winter Storm Severity Index 199
Table 4-153. Sperry-Piltz Ice Accumulation Index 200
Table 4-154. Winter Weather Annualized Frequency (FEMA National Risk Index) 201
Table 4-155. Ice Storm Annualized Frequency (FEMA National Risk Index) 201
Table 4-156. Ice Storm Events (1950 – 2023) 201
Table 4-157. Heavy Snow Events (1950 – 2023) 202
Table 4-158. Blizzard Events (1950 – 2023) 206
Table 4-159. Winter Storm Events (1950 – 2023) 206
Table 4-160. Winter Weather Events (1950 – 2023) 207
Table 4-161. Winter Weather Expected Annual Loss (FEMA National Risk Index) 209
Table 4-162. Ice Storm Expected Annual Loss (FEMA National Risk Index) 209
Table 4-163. Winter Weather Risk Index (FEMA National Risk Index) 210
Table 4-164. Ice Storm Risk Index (FEMA National Risk Index) 210
Table 4-165. Winter Weather Total Risk Score 210
Table 4-166. Communicable Disease/Pandemic Events 212
Table 4-167. Communicable Disease/Pandemic Total Risk Score 216
Table 5-1. Kittitas County Mitigation Goals and Objectives 217
Table 5-2. Suitability of Mitigation Activities for the Highest Ranked Hazards 222
Table 5-3. Kittitas County Mitigation Actions Summary 223
Table 5-4. Mitigation Action Estimated Cost Parameters 224
Table 5-5. Mitigation Action Benefits Parameters 224
Table 5-6. Mitigation Action Project Duration Parameters 224
Table 5-7. STAPLEE+E Method 225
Table 5-8. New Mitigation Action Implementation Priority Parameters 227
Table 6-1. Five-Year Action Plan 231

LIST OF FIGURES

Figure 3-1. Map of Kittitas County 17
Figure 3-2. USDA Soil Map of Kittitas County 20
Figure 3-3. Kittitas County Topographical Map 22
Figure 3-4. Kittitas County Land Use Designation Map 27
Figure 3-5. Kittitas County Zoning and Future Land Use 28
Figure 3-6. Kittitas County Population and Projected Growth (1980 – 2050) 30
Figure 4-1. Areas Vulnerable to Avalanches 71
Figure 4-2. High Hazard Dams in Kittitas County 83
Figure 4-3. Cle Elum Dam Inundation Map 85
Figure 4-4. Easton Dam Inundation Map 86
Figure 4-5. Keechelus and Kachess Dam Inundation Areas 87
Figure 4-6. Levees in Kittitas County 89
Figure 4-7. Palmer Drought Severity Index Map (June 2024) 98
Figure 4-8. Washington U.S. Drought Monitor (August 27, 2024) 100
Figure 4-9. U.S. Drought Monitor Time Series for Kittitas County 101
Figure 4-10. Fault Systems Located Within Kittitas County 108
Figure 4-11. Earthquake History in Kittitas County Area 109
Figure 4-12. National Earthquake Hazards Reduction Program Soil Type Map 111

Figure 4-13. Liquefaction Susceptibility for Kittitas County 112
Figure 4-14. USGS National Seismic Hazard Map 114
Figure 4-15. Kittitas County Special Flood Hazard Area 126
Figure 4-16. Landslide Hazard Areas in Kittitas County 144
Figure 4-17. NWS Heat Index Chart 154
Figure 4-18. NWS Wind Chill Chart 155
Figure 4-19. Kittitas County Hail History (1950 – 2023) 156
Figure 4-20. Kittitas County Strong Winds History (1950 – 2023) 157
Figure 4-21. SPC Severe Thunderstorm Outlook Categories 158
Figure 4-22. Volcanoes Within 100 Miles of Kittitas County 178
Figure 4-23. Kittitas County Wildfire Likelihood 188
Figure 4-24. Kittitas County Wildfire Risk to Homes 189

EXECUTIVE SUMMARY

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. Kittitas County and a coalition of 15 plan participants prepared and updated the 2025 Kittitas County Hazard Mitigation Plan in order to identify the risks posed by hazards and find ways to reduce their impacts. The Plan identifies potential hazards that could negatively impact County operations and assesses the risk and vulnerability of life safety and County assets for each hazard. Furthermore, this Plan establishes strategies and priorities to mitigate risk from natural and human-caused/technological hazards, identifies specific mitigation projects to pursue for each identified hazard, guides the County in associated risk management activities, and establishes eligibility for future mitigation program funds. The development of this Plan was a collaborative effort among the Kittitas County Core Planning Team and Steering Committee with support from Integrated Solutions Consulting (ISC).

Kittitas County is located in central Washington State on the eastern slopes of the Cascade Mountains, between the Cascade Crest and the Columbia River in the Columbia River basin. In 2023, the County had an estimated population of 47,300. In terms of area, Kittitas County is the eighth largest County in the State, covering approximately 2,297 square miles. The surrounding counties are Chelan and Douglas to the north, King to the west, Yakima to the south, and Grant to the east. Kittitas County contains five (5) municipalities; more than half of the County's population lives in the incorporated areas.

The responsibility for hazard mitigation lies with many, including private property owners, business and industry, and local, state, and the federal government. Through multi-jurisdictional partnerships, local jurisdictions within an area that has uniform risk exposure can pool resources and eliminate redundant planning activities. Kittitas County opened this planning effort to all municipalities and special districts within the County. The list of participating jurisdictions that were part of the entire planning process and are covered under this Plan is below.

Cities, Towns, and Unincorporated Kittitas County		
Kittitas County	City of Ellensburg	Town of South Cle Elum
City of Cle Elum	City of Roslyn	
Special Districts		
Kittitas School District #403	Kittitas Valley Fire Rescue (Kittitas County Fire District #2)	Snoqualmie Pass Utility District
Cle Elum/Roslyn School District #404	Kittitas County Fire District #6	Kittitas Public Utility District
Kittitas County Conservation District	Kittitas County Fire District #7	Central Washington University
Kittitas County Fire District #1	Snoqualmie Pass Fire & Rescue (Kittitas County Fire District #51)	

The five (5) goals for this Plan, identified by the Kittitas County Steering Committee, are listed below. The goals represent the County's long term and strategic vision to accomplish and achieve successful mitigation efforts. Additionally, the Steering Committee identified 13 objectives which are specific strategies and steps identified to assist the communities in attaining the listed goals.

Goals	
1	Protect life, property, and the environment.
2	Continuously build and support local capacity to enable the public to mitigate, prepare for, respond to, and recover from the impact of hazards and disasters.
3	Establish a hazard and disaster resilient economy.
4	Promote public awareness, engage public participation, and enhance partnerships through education and outreach.
5	Encourage the development and implementation of long-term, cost-effective mitigation projects.

There are a number of hazards that pose a threat to human life, health, and well-being, and this Plan is not meant to compile an exhaustive list. Kittitas County identified 10 natural hazards and one (1) human-caused/technological hazard for this Plan. Although FEMA only requires and reviews natural hazards in hazard mitigation plans, Kittitas County decided to rank and mitigate against a comprehensive list of hazard events that could impact the County. Due to the nature of non-natural hazards and the discretionary status regarding their inclusion, the following hazards of interest have been briefly and qualitatively assessed for the sake of public education and informing their inclusion within the hazard ranking and mitigation process. Hazards that have been identified as significant in Kittitas County and that will be considered in this Plan are listed below.

Natural Hazards
Avalanche
Dam and Levee Failure
Drought
Earthquake
Flood
Landslide
Severe Weather *(Thunderstorms, Hail, Tornado, Strong Winds/Damaging Winds, Heat Wave/Extreme Heat, and Cold Wave/Extreme Cold)*
Winter Weather *(Ice Storm, Heavy Snow/Blizzard)*
Volcanic Activity
Wildfire *(Wildfire Smoke)*
Human-Caused/Technological Hazards
Communicable Diseases/Pandemic

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel and first responders to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- **Hazard Identification:** Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- **Vulnerability Identification:** Determine the impact of natural hazard events on the population, environment, economy, and lands of the region.

- **Cost Evaluation:** Estimate the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the Federal Disaster Mitigation Act of 2000 (44 CFR, Section 201.6(c)(2)).

Risk rankings were performed by each planning partner to compare the probable impacts of the hazards of concern. For each community, the rankings assessed the probability of each hazard's occurrence as well as its likely impact on people, property, and the economy. The hazard ranking for each plan participant can be found in their respective annexes. The results of the countywide ranking, which were used in establishing mitigation action and priorities, are summarized below.

Note: *The sub hazards for severe weather (i.e., thunderstorms, hail, tornado, strong winds/damaging winds, heat wave/extreme heat, and cold wave/extreme cold) and wildfire (i.e., wildfire smoke) were individually ranked in the hazard risk ranking; however, severe weather and wildfire are each considered as the main hazard throughout this Plan.*

Hazard Ranking			
High	Wildfire	**Medium**	Avalanche
High	Winter Weather *(i.e., Blizzard/Heavy Snow, Ice Storm)*	**Medium**	Heat Wave/Extreme Heat ***(Severe Weather)***
High	Earthquake	**Medium**	Landslide
High	Flood	**Medium**	Drought
High	Strong Winds/Damaging Winds ***(Severe Weather)***	**Low**	Hail ***(Severe Weather)***
High	Wildfire Smoke ***(Wildfire)***	**Low**	Tornado ***(Severe Weather)***
Medium	Thunderstorms ***(Severe Weather)***	**Low**	Dam and Levee Failure
Medium	Communicable Diseases/Pandemic	**Low**	Volcano Activity
Medium	Cold Wave/Extreme Cold ***(Severe Weather)***		

The heart of a hazard mitigation plan is the mitigation strategy, which serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy describes how Kittitas County and the participating jurisdictions will accomplish the overall purpose, or mission, of the planning process. As part of the update process, mitigation goals and objectives were reevaluated; and mitigation actions/projects were updated/amended, identified, evaluated, and prioritized. Over 100 mitigation projects were identified and updated by the County and participating jurisdictions. Mitigation actions and status for each plan participant can be found in their respective annexes.

The 2025 Kittitas County Hazard Mitigation Plan was submitted for review and approval to the Washington Emergency Management Division (WEMD) and FEMA in February 2025. The 2025 update of the Kittitas County Hazard Mitigation Plan was approved by WEMD and FEMA in July, 2025 and has been officially adopted by the Kittitas County Board of Commissioners (Kittitas County Resolution 2025-

143). Each participating jurisdictions must officially adopt the Plan through resolution within one (1) year to be officially recognized by FEMA as being part of the Kittitas County Hazard Mitigation Plan.

The following key elements are included in the 2025 Kittitas County Hazard Mitigation Plan.

- **Planning Process:** The Core Planning Team, Steering Committee, and planning process are described and documented.
- **Community Profile:** Demographics (including underserved population), social, and economic data, as well as existing and future land use descriptions, are updated to reflect the status of Kittitas County and its jurisdictions.
- **Hazard Risk Assessment:** Outlines the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. In this section, the process focuses on the following elements – hazard identification, vulnerability identification, and cost evaluation.
- **Mitigation Strategy:** The mitigation strategy describes how the community will accomplish the overall purpose of the planning process. In this section, mitigation goals and objectives were reevaluated and updated; and mitigation actions were updated, identified, evaluated, and prioritized.
- **Plan Maintenance:** The Hazard Mitigation Plan requires monitoring, evaluation, and updating every five (5) years. This section includes a schedule for annual monitoring and evaluation of the programmatic outcomes established in the Plan and for producing a formal Plan revision every five (5) years.
- **Appendices:** Includes the Kittitas County's mitigation actions, stakeholder and public engagement details and supporting documentation, and the plan adoption.
- **Annexes:** This Plan includes 15 plan participants – four (4) municipalities and 11 special districts – and each jurisdiction developed its own annex. All jurisdiction specific information and supporting documentation (e.g., hazard vulnerability and impacts, mitigation actions, stakeholder and public engagement) can be found in the respective annexes.

In 2026, in response to feedback from the Washington State Department of Ecology and Washington State Washington Emergency Management Division, Kittitas County and Fire District 7 updated the plan to incorporate additional information and mitigation actions associated with Yakima River flood hazards and potential impactions to Fire Station 73. This minor plan update was officially adopted by the Kittitas County Board of Commissioners and Fire District 7 as shown in the 2026 adoption resolutions included in Appendix D.

CHAPTER 1. INTRODUCTION

The Kittitas County Hazard Mitigation Plan (Plan) was developed to guide the County in a risk-based approach to become more resilient to the impacts of natural hazards through mitigation planning. The Plan documents historical disasters, assesses probabilistic disasters through Hazus-MH and Geographic Information System (GIS) analysis, and addresses specific strategies to mitigate the potential impacts of these disasters.

This five (5) year update was a collaborative effort among the Kittitas County Core Planning Team and Steering Committee. The Plan accomplishes the following:

- Identifies areas of risk and assesses the probability, extent, vulnerability, and impacts for each natural hazard.
- Establishes strategies and priorities to mitigate risk from natural hazards.
- Identifies specific mitigation projects to pursue for each identified natural hazard.
- Guides the communities in their risk management activities and minimizes conflicts among agencies.
- Establishes eligibility for future mitigation program funds.

1.1. PURPOSE OF THE PLAN

The Plan identifies activities that can be undertaken by both the public and private sectors to reduce risk to natural hazards, property damage, and economic disruption caused by these hazards. This Plan reviews mitigation activities and selects those that will be most beneficial for Kittitas County.

The Federal Disaster Mitigation Act of 2000 requires jurisdictions to develop and maintain a Hazard Mitigation Plan to remain eligible for certain Federal disaster assistance and hazard mitigation funding programs (e.g., Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities). Renewal of the Plan every five (5) years is required to encourage continual awareness of mitigation strategies. Additionally, communities that participate in the Federal Emergency Management Agency (FEMA) Community Rating System (CRS), a voluntary program that reduces National Flood Insurance Program (NFIP) premiums and are designated as a Category C repetitive loss community, must prepare a Floodplain Management Plan (FMP) or a Repetitive Loss Area Analysis (RLAA). However, the CRS Program allows multi-hazard, and multi-jurisdictional mitigation plans to fulfill this requirement.

This Plan fulfills the federal requirements for mitigation funding outlined in 44 Code of Federal Regulations (CFR), section 201.6 (44 CFR § 201.6) and United States Code (USC) 42, section 5165 (42 USC § 5165), the CRS Program and provides the jurisdiction with a blueprint for reducing the impacts of natural hazards.

1.2. HAZARD MITIGATION PROGRAM

Hazard mitigation is defined as any sustainable action taken to reduce or eliminate long-term risk to people, property, and the environment from future disasters. Mitigation planning breaks the cycle of disaster damage, reconstruction, and repeated damage. Hazard mitigation includes long-term solutions that reduce the impact of disasters in the future.

- Keep the hazards away from people, property, and structures.
- Keep people, property, or structures away from the hazard.
- Reduce the impact of the hazards on victims (e.g., insurance).

1.3. PLANNING AREA

The planning area was defined to consist of the unincorporated county, four (4) incorporated jurisdictions (i.e., cities and towns), and 11 special districts (i.e., school districts, fire districts, public utility districts, higher education) within the geographical boundary of Kittitas County. All partners to this Plan have jurisdictional authority within this planning area.

All incorporated jurisdictions were invited to participate in the planning process; however, the City of Kittitas opted to not participate in this Hazard Mitigation Plan. Therefore, the City of Kittitas is not included as a participating jurisdiction in this Plan. However, for Countywide interest and statistical purposes, some of the City of Kittitas demographics and hazard-related data are included in this Plan. The intent of this inclusion is to create a more informative plan regarding the hazards, risks, and vulnerabilities across all of Kittitas County.

1.4. PARTICIPATING JURISDICTIONS

The participating jurisdictions (i.e., cities, towns, and special districts) listed in **Table 1-1** were represented by one (1) or more representatives. Responsibilities for each of the participating jurisdiction's representatives included the following:

- Assist with gathering the appropriate data and historical information.
- Complete the community preparedness survey.
- Participate in their jurisdiction's hazard analysis.
- Update existing mitigation actions.
- Identify new mitigation actions.
- Participate in workshops, hazard mitigation meetings, and webinars.
- Review draft documents, as necessary.

Contact information for each of the representatives and documentation of participation in the Plan update are available in **Appendix B**. The County also invited key organizations to assist and review the Plan update process; supporting documentation is available in **Appendix C**.

Table 1-1. Participating Jurisdictions

Cities, Towns, and Unincorporated Kittitas County		
Kittitas County	City of Ellensburg	Town of South Cle Elum
City of Cle Elum	City of Roslyn	
Special Districts		
Kittitas School District	Kittitas Valley Fire Rescue	Snoqualmie Pass Utility District
Cle Elum/Roslyn School District	Kittitas County Fire District #6	Kittitas Public Utility District
Kittitas County Conservation District	Kittitas County Fire District #7	Central Washington University
Kittitas County Fire District #1	Snoqualmie Pass Fire & Rescue (Kittitas County Fire District #51)	

1.5. PLAN PARTICIPATION

Updating this Plan involved assistance in identifying and evaluating hazards and mitigation actions from five (5) main groups – Core Planning Team, Steering Committee, representatives from the participating jurisdictions, members of the public, and other stakeholders.

1.5.1. Core Planning Team

The Core Planning Team consisted of key members from Kittitas County Public Works, Kittitas County Public Health, Kittitas County Sheriff's Office (Emergency Management), and staff from Integrated Solutions Consulting (ISC). The Core Planning Team also served on the Steering Committee and helped guide the planning process. **Table 1-2** lists the Core Planning Team members from Kittitas County.

Table 1-2. Core Planning Team Members

Name	Title	Jurisdiction/Organization
Arden Thomas	Water Resource Program Manager	Kittitas County Public Works
Samantha Cox	Water Resources Specialist	Kittitas County Public Works
Kelly Bacon	Local Emergency Response Coordinator	Kittitas County Public Health
Darren Higashiyama	Emergency Management Coordinator	Kittitas County Sheriff's Office (Emergency Management)
Kyra Garnich	Emergency Management Specialist	Kittitas County Sheriff's Office (Emergency Management)

1.5.2. Steering Committee

Hazard mitigation planning enhances collaboration and support among diverse parties whose interest can be affected by hazard losses. A Hazard Mitigation Steering Committee (the Steering Committee) was formed to oversee all phases of the planning process.

Throughout this Plan update, the Steering Committee agreed to meet as often as needed throughout the planning process. The Core Planning Team facilitated each meeting, which addressed a set of objectives based on the work plan established. All members of the Steering Committee were actively involved in attending meetings and responsible for the following:

- Identifying and prioritizing natural hazards that impact Kittitas County.
- Defining and identifying critical facilities.
- Identifying the Plan's goals and objectives.
- The planning area's capability assessment and consideration of mitigation alternatives.
- Identifying and prioritizing mitigation actions and projects.
- Coordinating and conducting outreach with key stakeholders, planning partners, and the public.

The Steering Committee was headed by Kittitas County Public Works. Other members included representatives from various county departments, cities, towns, and other key hazard mitigation partners. The Steering Committee members are listed on **Table 1-3** and the Steering Committee Meetings sign-in sheets are available in **Appendix B**.

Table 1-3. Hazard Mitigation Steering Committee Members

Name	Title	Jurisdiction/Organization
Arden Thomas	Water Resource Manager	Kittitas County Public Works
Anna Lael	District Manager	Kittitas County Conservation District
Bryan Nash	Maintenance Transportation Director	Kittitas School District #403
Cameron Classen	Captain	Ellensburg Police Department
Christa Stream	City Administrator	City of Kittitas
Christopher Horner	Deputy Prosecuting Attorney	Kittitas County Prosecutor's Office
Daiko Abe	Director of Operations	Integrated Solutions Consulting
Darren Higashiyama	Chief Deputy/Emergency Management Coordinator	Kittitas County Sheriff's Office
Deja Blanchard	Disability Specialist	Central Washington Disabilities Resource
Edwin Mills	Fire Chief	City of Cle Elum
Geoff Scherer	Operations Manager	Upper Kittitas County Medic One
Heidi Behrends Cerniwey	City Manager	City of Ellensburg
Jay Wiseman	Fire Chief	Snoqualmie Pass Fire Rescue
Jesse Cox	Environmental Health Supervisor	Kittitas County Public Health
Kasey Knutson	Special Programs Coordinator	Kittitas County Public Health
Keiko Walsh	Senior Transportation Manager	HopeSource
Kelee Hodges	Environmental Transportation Planner	Kittitas County Public Works
Kelly Bacon	Local Emergency Response Coordinator	Kittitas County Public Health
Kelsey Smith	Disaster Program Manager	American Red Cross
Kyra Garnich	Kittitas County Emergency Management Specialist	Kittitas County Sheriff's Office

Name	Title	Jurisdiction/Organization
Mark Larson	Health Officer	Kittitas County Public Health
Matthew Boast	General Manager	Kittitas Public Utility District
Michelle Geiger	Planner/Building Official	City of Roslyn
Mitchell Rhodes	Grant Writer	Kittitas Valley Healthcare
Neil Musser	Director of Security & Safety	Ellensburg School District
Nick Moeur	Project Manager	Puget Sound Energy
Patti Stacey	Facilities & Waste Operations Director	Kittitas County Solid Waste
Peggy Morache	Chief Executive Director	Fish Food Bank, Food Pantries, Open Table Meal Service
Rhonda Holden	Chief Ancillary Officer	Kittitas Valley Healthcare
Robert Cepeda	Emergency Manager	Central Washington University
Ryan Risdon	Emergency Management and Special Operations Coordinator	Kittitas County Fire District #6
Jamey Ayling	Planning Manager	Kittitas County Community Development Services
Mark Cook	Public Works Director and Interim Community Development Services Director	Kittitas County Public Works / Community Development Services
Samantha Cox	Water Resources Specialist	Kittitas County Public Works
Troy Jackson	Fire Chief	Kittitas County Fire District #6
Yahiritza D. Álvarez	Senior Consultant	Integrated Solutions Consulting

1.5.3. Local Planning Teams and Community Representatives

Each of the participating jurisdictions identified representatives to serve on their Local Planning Teams. The Local Planning Teams were instrumental in identifying community-specific risks/hazards and identifying and prioritizing mitigation actions that would reduce the costs of disaster response and recovery, protect people and infrastructure, and minimize overall disruption to their respective communities in the event of a disaster. The Local Planning Team members for each participating jurisdiction can be found in their respective annexes.

1.5.4. Supporting Organizations

Throughout the planning process, key stakeholders, departments, and community organizations, including local community organizations that provide support to underserved communities, engaged in providing key input, data, disseminating information about the Plan, survey, meetings, and reviewing the draft of the Plan (i.e., public comment period). Details regarding stakeholder engagement throughout the planning process and a list of stakeholders can be found in **Appendix B**.

1.6. PLAN APPROVAL AND ADOPTION

The Plan presents a comprehensive description of Kittitas County's commitment to significantly reduce or eliminate the potential impacts of disasters through planning and mitigation. Adoption by the local

governing body within the State of Washington legitimizes the Plan and authorizes Kittitas County and its jurisdictions to implement mitigation responsibilities and activities.

A hazard mitigation plan must document that it has been formally adopted by the governing bodies of the jurisdictions requesting federal approval of the Plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, such as this, each jurisdiction requesting approval must formally adopt the Plan. This Plan will be submitted for a pre-adoption review to the Washington State Emergency Management Division and FEMA Region 10 prior to adoption. Once pre-adoption approval has been provided, all participating jurisdictions will formally adopt the Plan. Federal Disaster Mitigation Act of 2000 compliance and its benefits cannot be achieved until the Plan is adopted. Copies of the resolution adopting Volume I can be found in **Appendix D** and resolutions for each plan participant can be found under each annex.

CHAPTER 2. PLANNING PROCESS

The Kittitas County Hazard Mitigation Plan was developed to provide a basis for identifying and managing natural hazards, and to meet federal, state, and local requirements for hazard mitigation and FEMA mitigation grant funding.

Updating this Plan began with an initial kick-off meeting with Kittitas County Public Works on September 21, 2023. Following this meeting, a Steering Committee Meeting was held on December 11, 2024, to outline the planning process, discuss the role of the Steering Committee, identify the hazards that should be addressed in the 2025 Plan update, and approve the mitigation goals and priorities. Furthermore, the planning process involved the following:

- Review of the existing Plan.
- Updating Kittitas County's hazard history.
- Gathering information on local hazards from individual communities.
- Gathering input on hazard priorities.
- Identifying specific vulnerabilities and desired mitigation strategies.
- Evaluating the previous Plan goals, objectives, and mitigation strategies.
- Determining the status of previous mitigation strategies and action plans.
- Identifying Repetitive Loss and Severe Repetitive Loss properties.
- Facilitating the activities of the Steering Committee.
- Conducting multiple public meetings and outreach activities (e.g., public survey, public comment period).

Information regarding Kittitas County's hazards and applicable mitigation strategies was obtained through two (2) Stakeholder's Workshops held in the Public Works Upper County Shop and the Kittitas County Event Center Armory Main Hall on February 21, 2024, and February 22, 2024, respectively. Additionally, a comprehensive public survey that reached 158 residents and resulted in 108 completed responses.

The 2025 Kittitas County Hazard Mitigation Questionnaire (i.e., Public Survey) was available in English and Spanish. The English and Spanish survey opened on September 1, 2023. As part of this Survey, Steering Committee members, community representatives, and members of the public were asked to rate each of the hazards in terms of perceived risk. Furthermore, they were asked to rate "mitigation importance" for each of the identified hazards in the Plan. The information gathered from this Survey was used to inform the hazard risk prioritization process, and to ensure the Plan adequately addressed the public's concerns and priorities. Two (2) Public Meetings were held throughout the County on February 21 and 22, 2024. These meetings were advertised for residents to have an opportunity to provide input into the Plan. Additionally, a draft of the Plan was made available on the Kittitas County Public Works website for public review and comment between October 7, 2024, through November 7, 2024.

The purpose of the two (2) Stakeholder Workshops was to ensure local jurisdictions had the opportunity to identify their community's risks and identify/update their mitigation strategies and priorities. These Workshops included local planning team members from each city, town, and special district. Participants validated the County's risk assessment findings, described specific hazard risks and concerns for their

communities, updated existing mitigation actions/strategies from the 2019 Plan, and worked with their Local Planning Team to identify new mitigation actions. Through a combination of ranking exercises, worksheets, and discussions, workshop participants evaluated hazard risk results, action plans, and rankings; and selected options for mitigating specific hazards to be included in the 2025 Plan update.

In summary, the planning process consisted of the following key tasks:

Task 1: Organize Resources
Kittitas County Public Works created a Core Planning Team to attend meetings, gather data and historical information, review drafts, and participate in mitigation brainstorming sessions. Additionally, a Steering Committee was formed to provide overall guidance and direction throughout the mitigation planning process. A series of Steering Committee meetings were held throughout the Plan update process. Participating jurisdictions were invited to form Local Planning Teams to ensure their jurisdiction's mitigation needs and priorities were addressed. *Refer to the Plan Participation section under Chapter 1 (Introduction) for a list of Core Planning Team and Steering Committee members.*

Task 2: Risk Assessment
The Core Planning Team identified the hazards to include in this Plan, as well as hazard profiles to address the probability, extent, vulnerabilities, and impacts associated with each hazard. Furthermore, the Team used local resources to inventory Kittitas County's assets and estimated losses. The Core Planning Team and Steering Committee provided input and subject matter expertise throughout this process.

Task 3: Public Engagement
The public was given an opportunity to be involved throughout the planning process via a public survey, in-person public meetings, and public engagement activities to review the Plan draft. The public was invited to attend one (1) of two (2) Public Meetings to review the risk assessment results and discuss mitigation strategies. The Public Meetings were advertised locally in advance. A comprehensive Public Survey that reached 158 residents and resulted in 108 complete responses, up until March 15, 2024, was also conducted. The Survey results were used to inform the hazard risk prioritization process and to ensure the Plan adequately addresses the public's concerns and priorities. The complete survey and a summary of its findings can be found in **Appendix C**. Once the draft Plan was completed, the public was given an opportunity to review and provide comments on Volume 1 (Countywide Planning Elements) and each of the jurisdiction annexes. The public comment period began on October 7, 2024. The Plan was posted on the Kittitas County Hazard Mitigation Plan website, and the public was invited to review and provide feedback via a County press release and advertising through social media (i.e., Facebook). Kittitas County and plan participants advertised the various opportunities for public involvement via Facebook and the County's website. Further details on public engagement and participation along with supporting documentation can be found in **Appendix C**.

To further facilitate continued public involvement in the planning process, the public will have an opportunity to provide continual feedback and input. As future needs and concerns arise, or if the public would like to provide feedback regarding the latest version of the Kittitas County Hazard Mitigation Plan, the public is invited to use the form provided on the County's Hazard Mitigation Plan website to provide comments.

Task 4: Develop Mitigation Strategies
The Core Planning Team met with representatives from each community (i.e., Local Planning Team) to develop and prioritize mitigation strategies and action items that would reduce the costs of disaster response and recovery, protect people and infrastructure, and minimize overall disruption to the County

in the event of a disaster. The County's mitigation action list can be found in **Appendix A**. A list of mitigation actions for each plan participant can be found in their respective annexes.

Task 5: Complete the Plan
The Core Planning Team compiled all the relevant sections of the Plan to produce a draft Plan for review. Kittitas County stakeholders, which include members of the public, had multiple opportunities to review and revise the Plan before submitting it to the Washington State Emergency Management Division and FEMA for review.

Task 6: Plan Adoption
Kittitas County Public Works coordinated the effort to ensure the Approvable Pending Adoption (APA) was formally adopted by each participating jurisdiction (i.e., city, town, and special district) and that at least one (1) jurisdiction adopted the Plan within one (1) year of the APA notification from FEMA.

2.1. REVIEW OF EXISTING PROGRAMS AND PLANS

Since a Hazard Mitigation Plan is only a part of the emergency planning, mitigation, preparedness, response, and recover process, a second objective of the planning process was to coordinate Plan preparation with existing Kittitas County emergency plans, programs, procedures, and organizations. The following programs can impact mitigation within the planning area:

- Washington State Fire Code
- Washington Wildland Urban Interface Code
- Washington State Building Code
- 2023 Washington State Enhanced Hazard Mitigation Plan
- 2021 Kittitas County Comprehensive Plan
- 2018 Kittitas County Community Wildfire Protection Plan, with 2022 Amendment
- Kittitas County Comprehensive Flood Hazard Management Plan
- Kittitas Shoreline Master Program
- Local Capital Improvement Programs
- Local Emergency Operations Plans
- Local Zoning Ordinances
- Region 7 Healthcare Alliance Wildfire Smoke Response Plan

An assessment for each jurisdiction's capabilities that can contribute to the reduction of long-term vulnerabilities to hazards are addressed in their respective annexes. It should be noted that this Plan does not replace any existing plans or programs but is intended to provide a reference on hazard mitigation to be used in planning and program development.

2.2. EQUITY CONSIDERATION FOR UNDERSERVED POPULATION

Some disasters occur on larger scales and are more impacted by built environments and are most likely to continually impact those most at risk because of existing health conditions, lack of resources, being underserved by past mitigation planning work, facing historical disinvestment in their communities, or

other factors. In this case, people in widely different locations can be the most harmed by repeating disaster cycles, so mitigation strategies should also work to break cycles of loss caused by social and economic disparities. Hazard mitigation strategies can reduce existing risk by, for example, relocating a building out of an area that frequently floods. In each case, an attempt has been made to lessen the harm of a future flood before the event happens. Strategies may also seek to make future development less vulnerable to hazards at the time it is built. Examples would be requiring new structures to be elevated above predicted flood levels or building structures to better withstand future hazards. Hazard mitigation plans are designed to involve the input of stakeholders from different perspectives to ensure plans use the best available data, are aligned with the needs of the entire community, and are in alignment with other plans (e.g., general plans, capital improvement plans, and climate action plans).

The Kittitas County Hazard Mitigation Plan recognizes that all members of the community are not impacted in the same way by natural, human-caused, and technological disasters. Some community members are at more risk, for a number of possible reasons. A mitigation strategy that uses a *one size fits all* approach and does not recognize different levels of risk will not adequately or efficiently support historically underserved populations and can actually make inequalities worse after a disaster.

This Plan highlights equity as a key component of the Plan's overall vision and seeks to continue to develop a shared understanding among participants of how hazard mitigation can be made more inclusive and be proactive in creating strategies that reduce existing disparities in risk and hazard recovery. Addressing the whole community requires an understanding that while a single solution for all seems fair, it does not address historical inequalities and current differences in age, financial resources, housing stability, neighborhood investment, health or ability, and access to government services. In mitigation planning, this means that successfully reducing risk in the most meaningful and efficient way requires understanding how the distribution of resources will actually reduce risk and for whom.

Equitable mitigation success should be measured by assessing who was most impacted in loss of life or financial harm by past and future disasters, quantifiable reductions of vulnerability to those most at risk, and increasing engagement with historically underserved populations and community organizations to better understand how plans and processes and natural hazard events are affecting different communities. The following highlights how this Plan addresses this priority.

Chapter 3 (Community Profile): This section describes different demographic and economic factors in Kittitas County. Additionally, the section includes data from the Centers for Disease Control and Protection (CDC) Social Vulnerability Index (SVI).

Chapter 4 (Hazard Identification and Risk Assessment): This section includes FEMA's National Risk Index scores for the County for social vulnerability and community resilience. *Social vulnerability* is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.[1] *Community resilience* is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.[2] Additionally, it includes a hazard ranking methodology that specifically assessed the impact of the hazard on underserved populations. Furthermore, each hazard profile includes a narrative of the vulnerability and impacts for the underserved and at risk population, FEMA's Expected Annual Loss analysis, and the National Risk Index score for the County.

[1] Federal Emergency Management Agency. (2023). Social Vulnerability. Retrieved from https://hazards.fema.gov/nri/social-vulnerability.
[2] Federal Emergency Management Agency. (2023). Community Resilience. Retrieved from https://hazards.fema.gov/nri/community-resilience.

The Risk Index score is based on the following components – Social Vulnerability, Community Resilience, and Estimate Annual Loss (based on Exposure, Annualized Frequency, and Historic Loss Ratio (HLR) factors, for a total of five (5) risk factors).[3]

Mitigation goals were updated to encourage greater participation and engagement from underserved populations and groups and aligns with the Kittitas County Public Health Department Strategic Plan and Community Health Assessment. During Stakeholder Workshops, in which new and ongoing mitigation strategies were discussed, jurisdictional representatives were encouraged to consider how the mitigation actions directly and/or indirectly resulted in equitable outcomes.

During this Plan update process, a comprehensive community preparedness questionnaire was developed and disseminated. The questionnaire was developed with a specific focus to better understand the challenges and concerns related to access and functional needs, access to information, ability to recover, and services needed, especially for those who may be underserved or lack access to key resources. The survey was available in English and Spanish. Additionally, Spanish translation assistance was provided during all Public Meetings that were held, which is a key demographic in Kittitas County.

The County and participating jurisdictions have a responsibility to ensure equitable outcomes in the implementation of this Plan and to ensure that action is taken to reduce vulnerabilities to disasters experienced disproportionately by marginalized populations.

When conducting community engagement related to implementation of or update to this Plan, Kittitas County will ensure that the whole community has an opportunity to participate in the process and discussion. FEMA defines the *whole community* as the groups and organizations that should share the responsibility for emergency preparedness and mitigation, to include:[4]

- Individuals
- Families
- Businesses
- Faith-based and community organizations
- Non-profit groups
- Schools and academia
- Media
- Local and state government
- Artists and arts organizations
- Tribal government and associations
- Territories
- Other federal agencies

[3] Federal Emergency Management Agency. (2023). Determining Risk. Retrieved from https://hazards.fema.gov/nri/determining-risk.
[4] Federal Emergency Management Agency. (n.d.). Guide to Expanding Mitigation. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_mitigation-guide_whole-community.pdf.

CHAPTER 3. COMMUNITY PROFILE

Kittitas County is located at the geographic center of Washington State, 100 miles east of Seattle across the Cascade Mountain range. The County covers 2,315 square miles (1,481,814 acres) of highly varied terrain.[5] It is the 24th most populous county in the State[6] and the eighth largest in area.[7] Kittitas County is bounded to the north by Chelan and Douglas counties, to the south by Yakima County, to the east by Grant County, and to the west by King and Pierce counties. The Pacific Crest Trail in the Cascade Range forms its western boundary, and the Columbia River forms its eastern boundary.

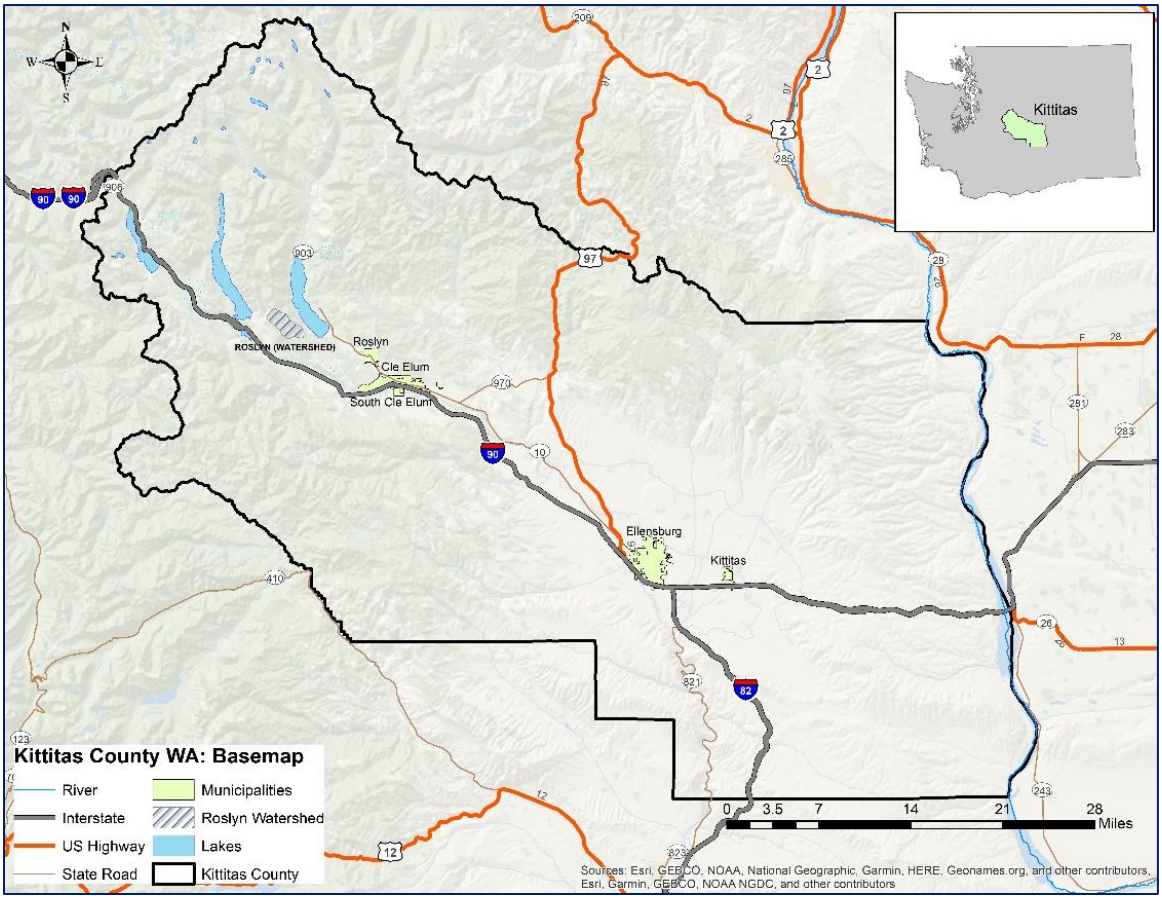
The County is a geographically diverse area which offers a number of recreational opportunities (e.g., biking, birdwatching, camping, fishing, golf, hiking, horseback riding, rockhounding, snow activities, and swimming). Additionally, the City of Ellensburg is home to Central Washington University (CWU) and the Ellensburg Rodeo.

The City of Ellensburg, located in the southeast part of the County, is the Kittitas County seat. Kittitas County contains 10 United States Census recognized communities, five (5) of which are incorporated jurisdictions – Cle Elum, Ellensburg, Kittitas, Roslyn, and South Cle Elum. The other areas include the towns of Easton, Ronald, Snoqualmie Pass, Thorp, and Vantage.[8]

Like most locations in the United States, Kittitas County is vulnerable to natural hazards that threaten life safety, public health, business, economy, and its critical infrastructure. **Figure 3-1** illustrates the Kittitas County planning area.

[5] Kittitas County. (2021). Kittitas County Comprehensive Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/cds/comp-plan/2021/2021%20Comprehensive%20Plan.pdf.
[6] Washington Demographics. (n.d.). Washington Counties by Population. Retrieved from https://www.washington-demographics.com/counties_by_population.
[7] Washington Land Area County Rank. http://www.usa.com/rank/washington-state--land-area--county-rank.htm.
[8] HomeTownLocator. (n.d.). Kittitas County WA Cities, Towns, & Neighborhoods. Retrieved from https://washington.hometownlocator.com/counties/cities,cfips,037,c,kittitas.cfm.

Figure 3-1. Map of Kittitas County



3.1. KITTITAS COUNTY HISTORY

Kittitas County was part of the land ceded by the Yakama Tribe in 1855. Briefly part of Ferguson County (now defunct), then Yakima County, Kittitas County was established on November 24, 1883. The Kittitas Valley became a stopping place for cowboys driving herds north to mining camps in Canada and northwest to Seattle/Tacoma. By the late 1860s, cattle ranchers established land claims and cattle became the area's foremost industry. Significant points in the County's history included the completion of a wagon road over Snoqualmie Pass in 1867, the arrival of the Northern Pacific Railroad in 1887, the discovery of gold in Swauk Creek in 1873 and coal near Cle Elum in 1883, and the 1932 completion of the Kittitas (irrigation) Project. Today, the main industries are agriculture (i.e., timothy hay to feed racehorses), manufacturing (e.g., food processing, lumber, and wood products), and government (i.e., employment at CWU).

Interpretations of the meaning of the word Kittitas vary, but the name probably refers to the region's soil composition. If this is the case, Kittitas could mean shale rock, white chalk, or white clay. Another interpretation is that the bread made from the root kous (grown in the Kittitas Valley) was called kit-tit while "Tash" is generally accepted to mean "place of existence."

The first inhabitants of the Kittitas Valley were the Psch-wan-wap-pams (stony ground people), also known as the Kittitas band of the Yakama or Upper Yakama. Although the Kittitas were distinct from the Yakima (later renamed Yakama) Tribe, settlers and the Federal government (for treaty purposes)

grouped the Kittitas with the larger Yakama Tribe. The Kittitas Valley was one of the few places in Washington where both camas (sweet onion) and kous (a root used to make bread) grew. These were staples that could be dried, made into cakes, and saved for winter consumption. Yakama, Cayous, Nez Perce, and other tribes gathered in the valley to harvest these foods, fish, hold council talks, settle disputes, socialize, trade goods, racehorses, and play games. The west side of the Columbia River, at what would eventually become the eastern border of Kittitas County, was home to some dozen Wanapum villages.

Fur trader Alexander Ross was one of the earliest non-Native Americans to describe the Kittitas Valley. Along with a clerk, two (2) French Canadian trappers, and the trappers' wives, Ross entered the Kittitas Valley in 1814 to trade for horses.

The abundant bunchgrass and clear streams of the Kittitas Valley gave rise to a prosperous cattle industry. Much of this success was foretold by local Indians who, before the advent of white settlement, grazed horses in the Valley and sold them to neighboring tribes and white explorers and traders who passed through. As early as 1861, white ranchers from the Yakima Valley grazed their cattle in the Kittitas Valley before continuing on to mine districts in the north central region and British Columbia. The mining towns eventually began raising their own cattle, but Puget Sound demand filled the vacuum; the cattle were herded to the Sound through Snoqualmie or Naches Pass.

By the late 1860s, cattle ranchers established land claims in Kittitas itself. Over the next 10 years, especially in the late 1870s, new ranches flourished, and large herds of cattle grazed everywhere. The resulting overproduction led to declining beef prices. Prices, however, rose to earlier levels after the severe winter of 1880-81 killed more than half the herds. Although the number of cattle eventually returned to early levels, overgrazing was beginning to take its toll on the range. As a result, the Federal government began to regulate grazing in 1897. This led to a gradual shift from open grazing to fenced pastures and hay feeding.

Better rail transportation around the turn of the century and irrigation projects in the 1930s helped expand the County's cattle industry. The railroads provided more effective transport of cattle to the nation's eastern markets. Irrigation projects enhanced the quality of pastures and spurred the growth of row crops, whose byproducts were converted into inexpensive cattle feed. By the 1960s, the number of Kittitas County cattle had more than doubled, to approximately 70,000. However, price controls and rising feed costs in the early 1970s prompted many ranchers to change from cattle to hay and grain production.[9]

3.2. TOPOGRAPHY

3.2.1. Geology

Kittitas County possesses a diverse topography that is dominated by the Cascade and Wenatchee Mountains. From the high Cascades, the land slopes generally downward to the east and south to the Columbia River. The eastern part of the County consists of low, rolling to moderately steep glacial terraces and long, narrow valleys. The southeast section of the County is characterized by moderately steep to steep glacial terraces and steep, rough, broken mountain foothills.

The major geological features of Kittitas County are the Cascade and Wenatchee Mountains on the west and north portions, the south central Yakima River Valley, and the Boylston and Saddle Mountains at the

[9] Ochran, J. (n.d.). About the County. Retrieved from https://www.co.kittitas.wa.us/about/history.aspx.

southeastern edge along the Columbia River. Within these elevations, slope, geologic, and soil conditions vary dramatically (i.e., steep mountain peaks, foothills, broad rich valleys, and near-desert areas).

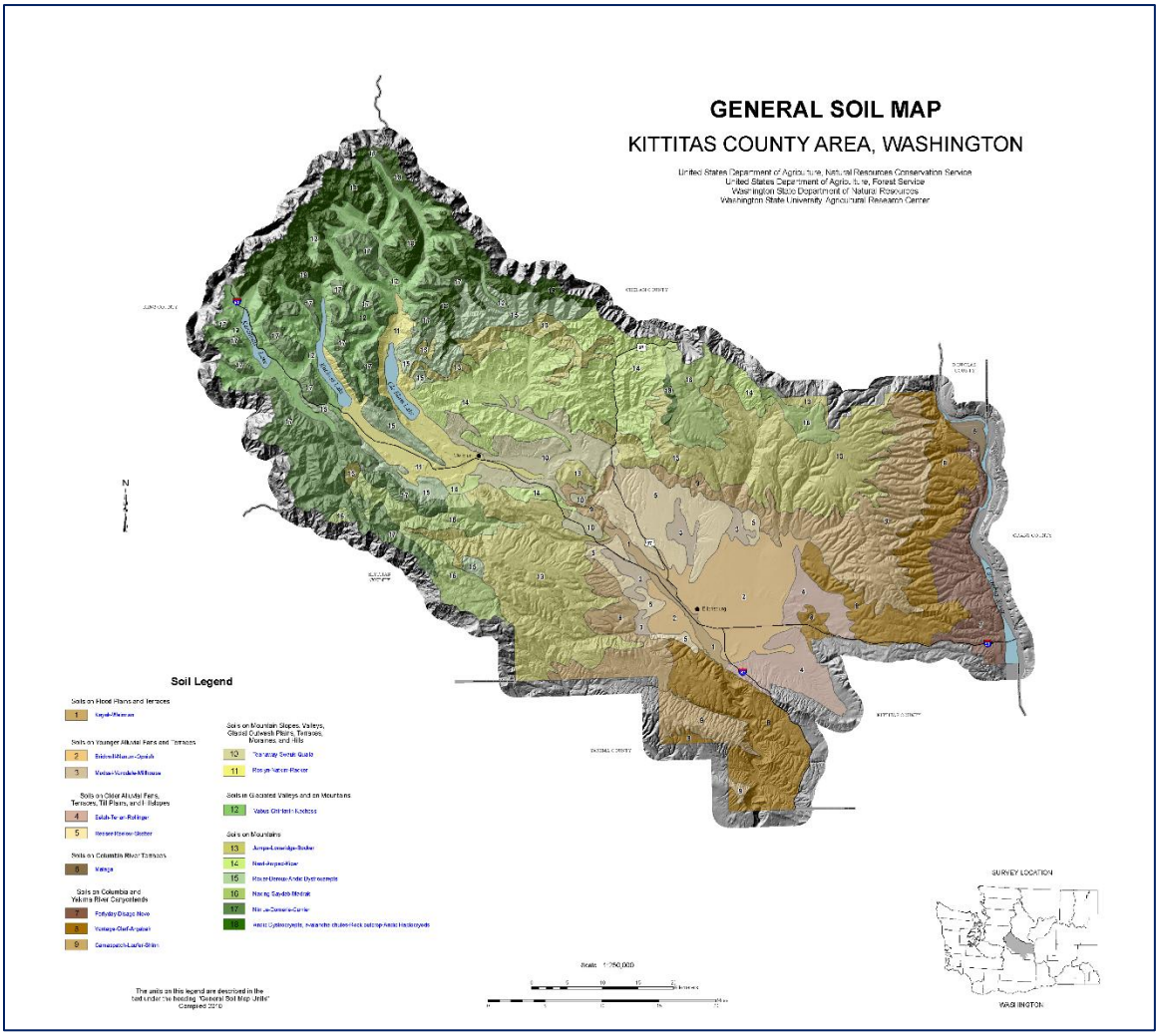
Alpine and continental glaciers moved through this region shaping the mountains and depositing materials to create the geology and soils of the region. The primary types of glacial deposits in the County are outwash and till. Outwash consists of unconsolidated sand, gravel and rocks and results from runoff of melting glaciers, and it is usually loose and highly permeable. Glacial till (i.e., hardpan), consists of unsorted clay, sand, gravel, or rock that has been compacted by the weight of the glacial ice into a highly impervious, concrete-like material.[10]

3.2.2. Soils

Kittitas County soils were formed by the forces of water, heat, time, vegetation and animal life, acting on the geologic parent material. The principal parent material consists of sand and gravels associated with glacial till and outwash. Highly organic soils were developed in a moist climate under a rich covering of vegetation. **Figure 3-2** shows the County soil map that is available through the United States Department of Agriculture (USDA). Soil maps are useful for determining general limitations and character of soils.

[10] Kittitas County. (n.d.). Comprehensive Flood Hazard Management Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/public-works/flood/documents/1996%20Kittitas%20County%20Comprehensive%20Flood%20Hazard%20Management%20Plan.pdf.

Figure 3-2. USDA Soil Map of Kittitas County



The load bearing capacity of soil, its hydric properties, erosion potential, and other characteristics all play a significant role in the development of land. Hydric properties in soil indicate the existence of wetlands and signal the potential for other environmental concerns. Soil suitability for structural support and stability is also important in determining the potential for development. Area soil types vary considerably:[11]

- Soil in the western mountainous portion of the County is more suited for growing forest products than food crop farming. These soils are strongly acidic, gravelly, or rocky, saturated most of the year, and occur in steep areas at high elevations.
- Soil in the foothill areas with streams is ideal for growing native trees.
- Soil in the Yakima River Valley is more suited to agriculture and those on the south slopes of the Valley are used for extensive fruit growing.
- Other areas have been designated as critical areas due to erosion and landslide potential.

[11] Ibid.

3.2.3. Slope Stability

Slope stability refers to the potential of land slippage due to factors such as steepness, composition of materials, and water content within soils. Slopes that have been landscaped and altered from their natural vegetated state or saturated by septic tanks are also subject to sliding. Slumping can also occur when water infiltrates the soil and comes in contact with an impermeable layer. Although the upper layers of soil may not become saturated, water perches on the impermeable layer and causes a slippery interface resulting in the downward and outward movement of weak rock or unconsolidated material. Much of the western and northern portions of Kittitas County contain slopes of 15% or greater. Slopes less than 15% are generally found in the river basins in the eastern portions of the County.[12] *Refer to the Landslide section (Chapter 4) of this Plan for further details on the hazard.*

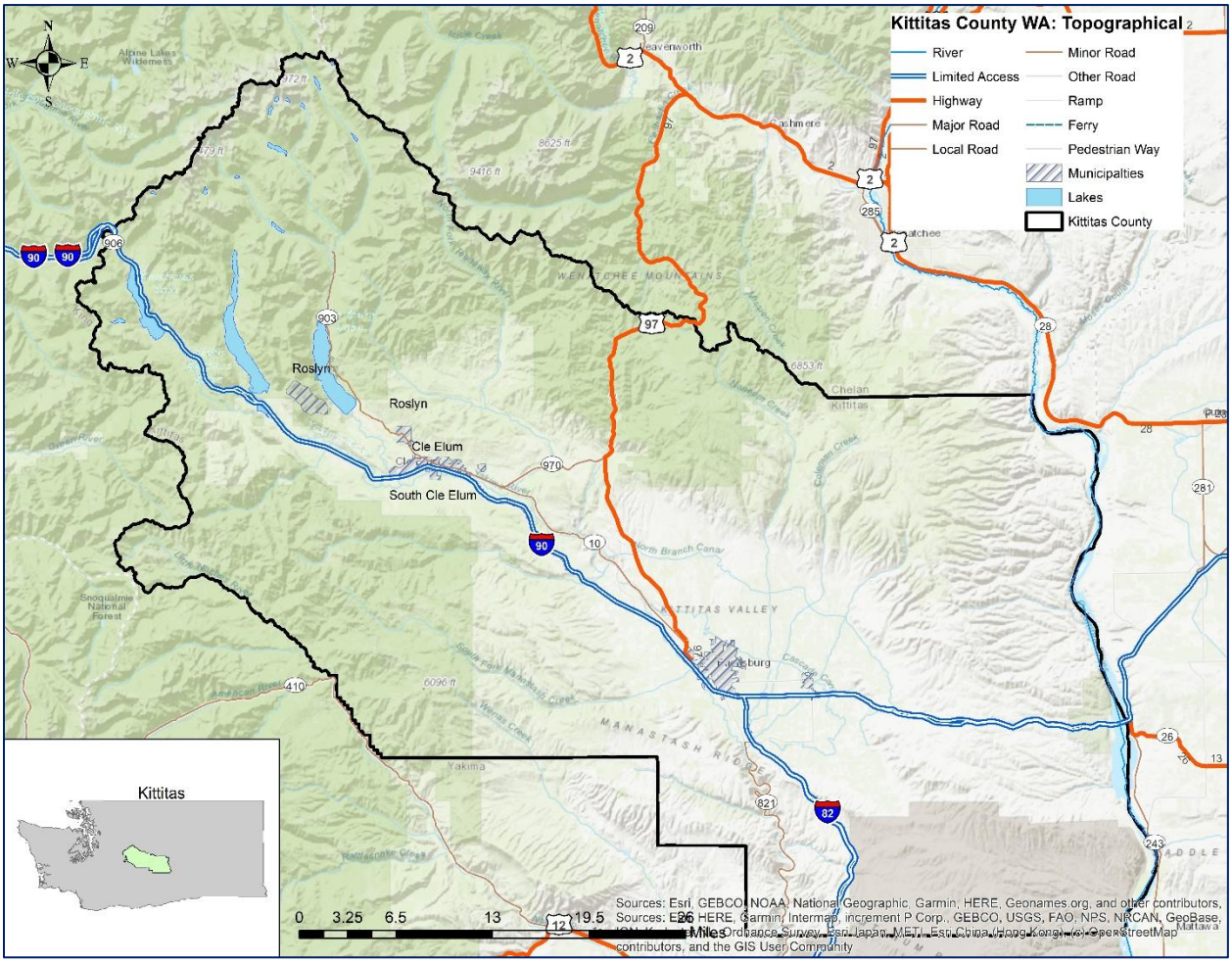
3.2.4. Seismic Features

Seismic events could pose limited landslides and liquefaction hazards in areas where steep or exposed slopes occur. Landslides occur when the structural integrity of a geological formation is damaged. There are known areas of landslide activity, which may or may not have resulted from seismic events, along the Yakima River. Soil liquefaction occurs when soil loses its strength and bearing capacity during an earthquake. This is most likely to occur on non-cohesive soils with high moisture content. These types of soils are poorly compacted and combined with moist conditions, are subject to liquefying during an earthquake. Structures built on liquefiable soil are subject to greater shaking and damage during an earthquake, but this damage can be minimized by engineering and construction methods. Kittitas County has little potential for seismic events other than secondary effects from activity occurring west of the Cascades.[13] *Refer to the Earthquake section (Chapter 4) of this Plan for further details on the hazard.*

Figure 3-3 illustrates the topographical map for Kittitas County.

[12] Ibid.
[13] Ibid.

Figure 3-3. Kittitas County Topographical Map



3.3. CLIMATE

Eastern Washington climate is a function of maritime and continental influences. The Yakima River basin's location is just east of the Cascade crest places it in a rain shadow, with hotter summers, colder winters, a shorter growing season, and less precipitation than areas of similar latitude west of the Cascades. Temperatures generally increase and precipitation generally decreases from northwest to southeast and from high to low elevation.[14]

Because of the variation in elevation, temperatures greatly vary in the Yakima River basin. In the Kittitas Valley, summers tend to be hot, with wide divergent fluctuations, and mild to severe winters. Data is scarce for higher elevations; however, those areas are generally characterized by cool summers and cold winters. For example, in the Subalpine Fir forest zone, which extends from approximately 2,000 feet to the timberline, average July temperatures in the range of 55ºF to 65ºF can be expected.

As is typical of areas in the lee of large coastal mountain ranges, the Yakima River basin is generally arid. Precipitation varies with elevation and distance from the Cascades, from 150 inches annually at the Cascade crest to 10 inches at the Columbia River. Runoff rates are affected by disparities in precipitation

[14] Ibid.

rates from one area to another, as well as the character of rivers in different drainages, which influence flooding and land use potential.

Approximately 66% of the County's precipitation, mostly in the form of snow, occurs between October and April. In the winter, considerable snow accumulates in higher elevations. In the Kittitas Valley, the snow season generally ranges from November through February, with significant variation from one season to the next. Summers in Kittitas County tend to be dry.[15] The monthly climate summary, based on the Ellensburg, WA weather station, is listed in **Table 3-1**.

Table 3-1. Kittitas County Monthly Climate Summary (1893 – 2023)
Ellensburg, WA Station

Average Daily Temperature[16] *(° F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
26.7	32.2	40.5	47.7	55.6	62.1	68.7	67.6	58.9	48.0	36.3	28.2	47.4
Average Maximum Temperature[17] *(° F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
34.4	41.6	52.7	61.4	69.3	75.9	84.1	83.6	74.5	62.0	45.7	35.5	59.7
Average Minimum Temperature[18] *(° F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
18.9	22.8	28.4	34.0	41.9	48.4	53.2	51.7	43.2	34.0	26.9	20.8	35.1
Average Total Precipitation[19] *(inches)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.04	0.05	0.77
Average Total Snowfall[20] *(inches)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
0.3	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.3	0.9

[15] Kittitas County. (2018). Community Wildfire Protection Plan. Retrieved from https://www.dnr.wa.gov/publications/rp_burn_cwpp_kittitasco.pdf.
[16] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Mean Average Temperature for Ellensburg, WA). Retrieved from https://www.weather.gov/wrh/climate?wfo=pdt.
[17] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Mean Max Temperature for Ellensburg, WA). Retrieved from https://www.weather.gov/wrh/climate?wfo=pdt.
[18] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Mean Min Temperature for Ellensburg, WA). Retrieved from https://www.weather.gov/wrh/climate?wfo=pdt.
[19] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Sum Precipitation for Ellensburg, WA). Retrieved from https://www.weather.gov/wrh/climate?wfo=pdt.
[20] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Sum Precipitation for Ellensburg, WA). Retrieved from https://www.weather.gov/wrh/climate?wfo=pdt.

3.4. LAND USE

Kittitas County is located midway between the heavily populated Puget Sound region and the eastern farming areas centered around Moses Lake. Over 50% of the County is covered by coniferous forests, 30% is in pasture or unimproved grazing land, and less than 2% is in urban development. The County has a highly varied terrain which begins in the high Cascades where the land slopes generally to the east and south to the Columbia River.

Land use in Kittitas County ranges from residential uses to resource-based activities. In the Snoqualmie Pass area, resource allocation in the form of timber harvesting is the predominant land use with additional areas used for recreation. Resource lands still predominate the mid-elevations, though residential development increases in these areas. In the lower elevations, agricultural activities are the main land use, with residential development intermixed in the area. The Yakima Training Center, owned by the United States Department of Defense, is located in the southeastern portion of the County and makes up approximately 164,132 acres within the lower Kittitas Valley.[21]

More than 70% of the County is publicly owned. Approximately, two thirds of the land is managed by the United States Forest Service (USFS) and the United States Army (Yakima Training Center) and the remaining one third is owned by the Washington Department of Natural Resources (DNR) and the Washington Department of Fish and Wildlife. Privately owned land is a mixture of rural development, agriculture, and commercial forestry.[22]

Table 3-2 lists the land use designations assigned in the 2021 Kittitas County Comprehensive Plan, along with the corresponding zone classifications present in each land use designation and total area in acres occupied.[23]

Table 3-2. Land Use Designation and Corresponding Zoning Classification

Land Use	Use Intensity	Description	Acres	Zoning Classification	Acres
Resource					
Commercial Agriculture	Resource Lands	Agricultural lands of long-term commercial significance.	289,515.8	Commercial Agriculture	289,515.8
Commercial Forest	Resource Lands	Forest lands of long-term commercial significance.	800,275.0	Commercial Forest	800,275.0
Mineral Lands *(includes lands zoned Commercial Agriculture, Commercial Forest, Agriculture 20, or Forest & Range)*	Resource Lands	Mineral lands of long-term commercial significance	5,690.7	Zoning Classification Varies	5,690.7
				Resource Land Use Total (acres)	***1,095,481.5***

[21] Kittitas County. (2021). Kittitas County Comprehensive Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/cds/comp-plan/2021/2021%20Comprehensive%20Plan.pdf.
[22] Kittitas County. (2018). Community Wildfire Protection Plan. Retrieved from https://www.dnr.wa.gov/publications/rp_burn_cwpp_kittitasco.pdf.
[23] Kittitas County. (2021). Kittitas County Comprehensive Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/cds/comp-plan/2021/2021%20Comprehensive%20Plan.pdf.

Land Use	Use Intensity	Description	Acres	Zoning Classification	Acres
Rural					
Rural Working	Low	Supports agriculture, timber and mineral uses not in resource lands.	328,754.3	Agriculture 20	111,226.4
				Forest and Range	217,527.9
Rural Residential	Moderate	Residential opportunities with rural character outside of Urban Growth Areas (UGAs) and Limited Areas of More Intensive Development (LAMIRD).	29,900.9	Agriculture 5	11,921.6
				Rural 5	17,936.5
				General Commercial	0.7
				Planned Unit Development	42.1
Rural Recreation	Moderate	Activities to support and enhance recreational opportunities.	10,462.0	General Commercial	22.0
				Master Planned Resort	6,444.5
				Planned Unit Development	363.8
				Rural Recreation	3,631.7
Limited Areas of More Intensive Development (LAMIRD)	More Intense	Non-incorporated urban like development.	1,210.4	Agriculture 20	28.3
				Agriculture 3	42.4
				Forest and Range	77.6
				General Commercial	195.2
				General Industrial	4.7
				Highway Commercial	45.2
				Light Industrial	36.3
				Limited Commercial	13.6
				Planned Unit Development	218.0
				Residential	412.3
				Residential 2	40.8
				Rural 3	42.4
				Rural 5	53.6
				Rural Land Use Total (acres)	***370,327.6***

Land Use	Use Intensity	Description	Acres	Zoning Classification	Acres
Urban					
Urban	Intense	Incorporated Cities and their Urban Growth Areas (UGAs).	16,041.11	Agriculture 3	80.2
				Forest and Range	606.8
				General Commercial	244.7
				General Industrial	592.5
				Highway Commercial	83.4
				Historic Trailer Court	24.2
				Incorporated City	10,137.1
				Light Industrial	1,631.0
				Limited Commercial	3.8
				Planned Unit Development	88.7
				Residential	140.4
				Rural 3	423.6
				Rural 5	10.1
				Urban Residential	1,974.61
				Urban Land Use Total (acres)	***16,041.11***
				County Total (acres)	***1,481,850.21***
The acreages are approximate. The totals in this table are subject to change based on improved accuracy of GIS shapefiles and assessor's information.					

Figure 3-4 illustrates the land use designation within Kittitas County and **Figure 3-5** illustrates the zoning and future land use within Kittitas County.

Figure 3-4. Kittitas County Land Use Designation Map

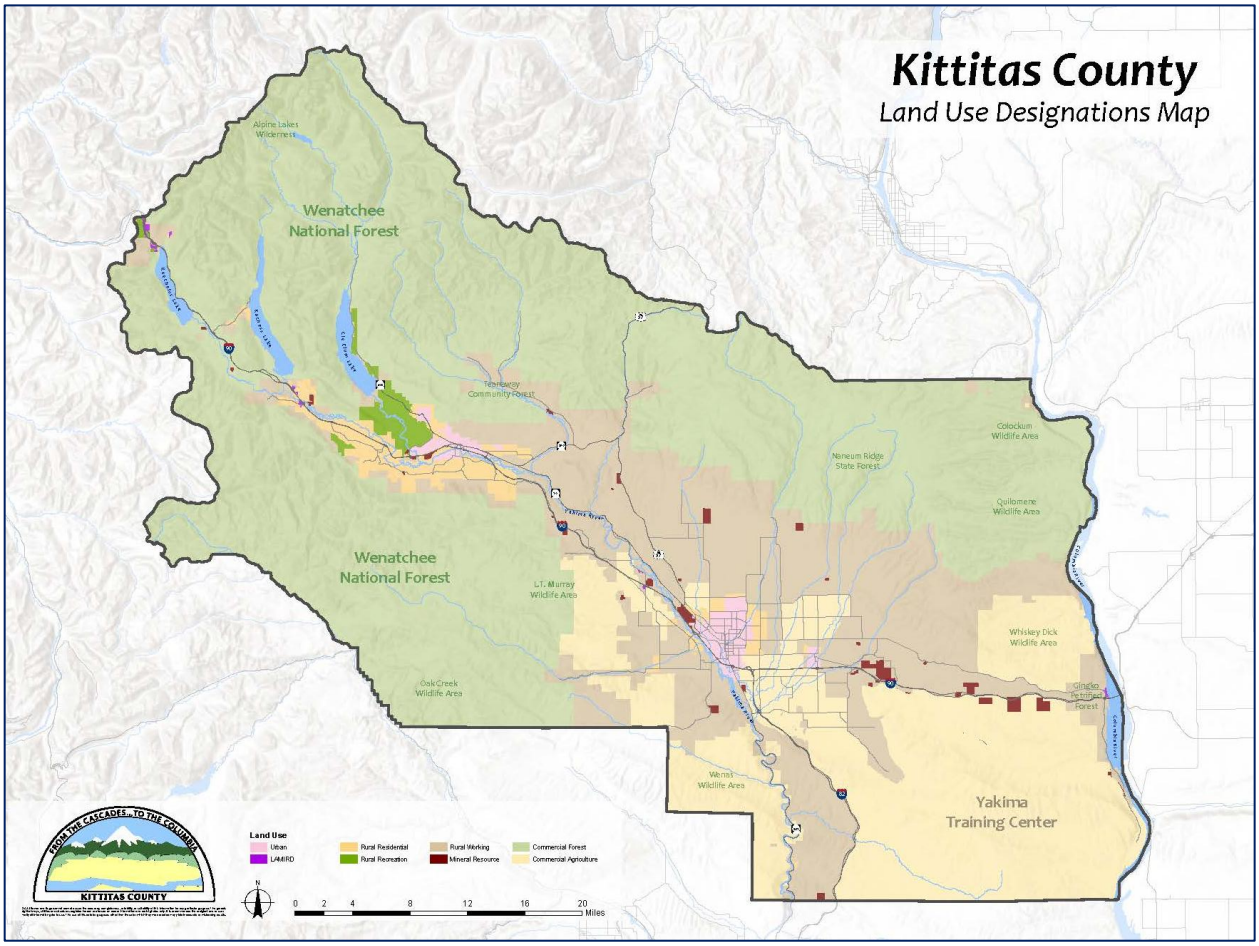
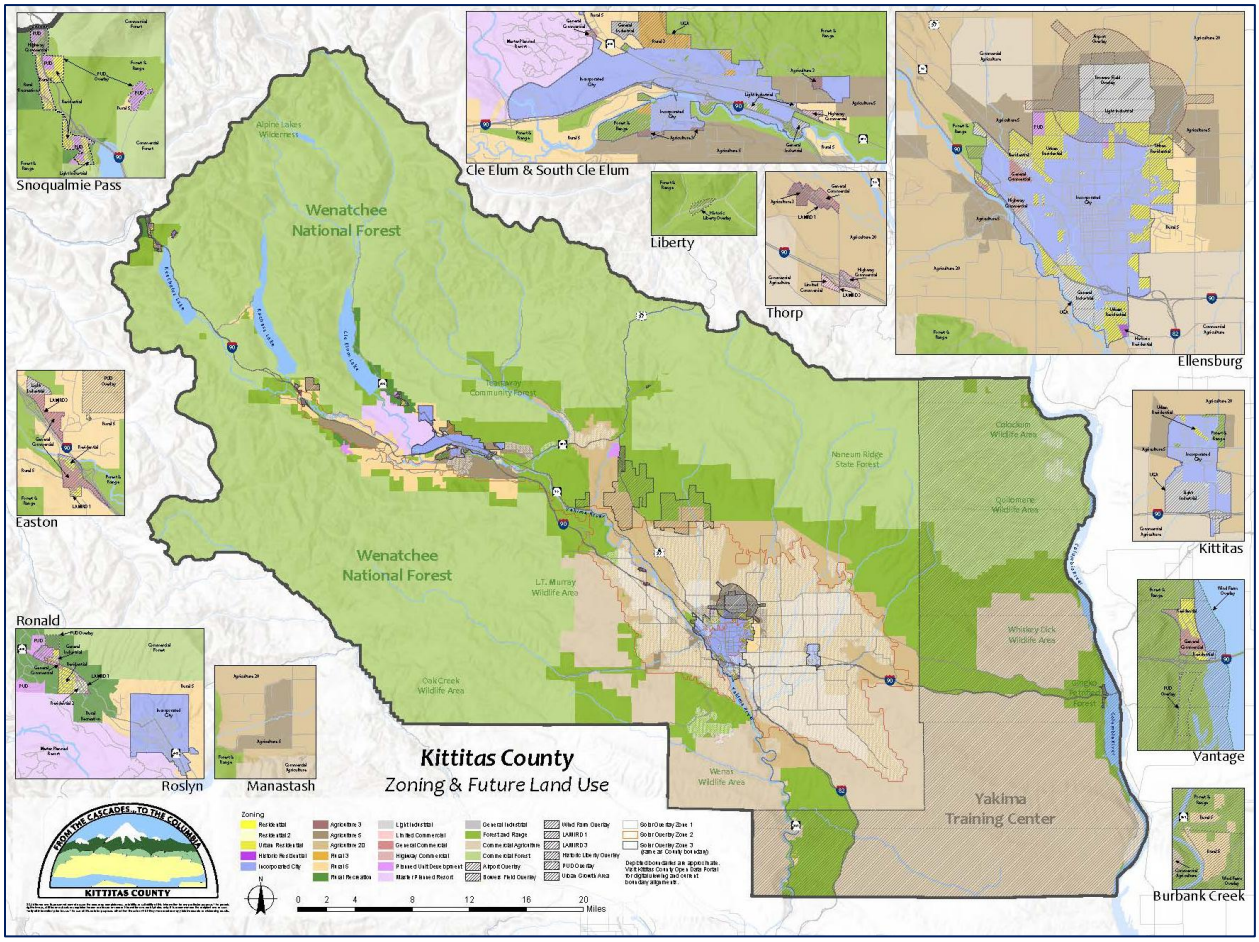


Figure 3-5. Kittitas County Zoning and Future Land Use



3.5. CHANGES IN DEVELOPMENT

Kittitas County addresses future growth challenges through the County's Comprehensive Plan. The Comprehensive Plan is adopted by the County in compliance with the Washington State Growth Management Act (RCW 36.70A) and under authority of the Planning Commission Act (RCW 35.63). The Plan is based on a framework of community goals and objectives which are adopted by the County with the help of other subarea groups and citizens as a final expression of public policy.

The Comprehensive Plan includes eight (8) elements – land use, housing, capital facilities plan, utilities, rural, transportation, economic, and park and recreation. Amendments to the RCW 36.70A Code in 2023 added a ninth mandatory element, Climate Change and Resiliency, which will be included in the next iteration of the Kittitas County Comprehensive Plan. The most current Kittitas County Comprehensive Plan can be accessed via the following link https://www.co.kittitas.wa.us/cds/comp-plan/default.aspx.

This Hazard Mitigation Plan will work together with these programs to support future comprehensive land use by providing vital information on the risks associated with natural hazards in Kittitas County. All municipal planning partners will seek to incorporate by referencing the Kittitas County Hazard Mitigation Plan in their comprehensive plans. This will ensure that all future development trends can be established with the benefits of the information on risk and vulnerability to the natural hazards identified in this Plan.

3.6. DEMOGRAPHICS

Population and Population Density: Kittitas County had a population of 47,300 in 2023 and approximately 45% of the population lives in Unincorporated Kittitas County. Between 2010 and 2020, the population increased by approximately 13.5% and by 1.8% between 2020 and 2023.[24] **Table 3-3** shows Kittitas County's population distribution by jurisdiction between 2010 and 2023 based on the Washington State Office of Financial Management (OFM) data.

Table 3-3. Population Estimates

Jurisdiction	2010[25]	2020[26]	2023[27]	Population Change *(2010 – 2023)*
Kittitas County	40,915	46,468	47,300	15.6%
City of Cle Elum	1,872	2,157	2,255	20.5%
City of Ellensburg	18,174	20,797	20,900	15.0%
City of Kittitas	1,381	1,438	1,440	4.3%
City of Roslyn	893	950	960	7.5%
Town of South Cle Elum	532	559	565	6.2%
Unincorporated Kittitas County	18,063	20,567	21,180	17.3%

Population Projections: In 2022, OFM released three (3) separate population growth projections for Kittitas County – Low, Medium, and High. **Figure 3-6** shows Kittitas County population between 1980 and 2050 along with OFM's High, Medium, and Low growth projections.[28] OFM's high projection assumes an average annual growth rate of 2.13% between 2017 and 2037 while the medium projection assumes a growth rate of 1.08%. According to this analysis, projections suggest that Kittitas County may see large increases in population due to an emergence as a retirement destination, increased student enrollment at CWU, and transportation improvements allowing easier passage to King County. However, it is also noted that this positive growth trend may be countered by negative trends (e.g., lack of job growth, water right restrictions and an increase in climate change related events).

[24] United States Census Bureau. (2022). Quick Facts: Kittitas County, Washington. Retrieved from https://www.census.gov/quickfacts/kittitascountywashington.
[25] Washington State Office of Financial Management. (n.d.). Decennial Census Counts of Population for the State, Counties, Cities and Towns. Retrieved from https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/historical-estimates-april-1-population-and-housing-state-counties-and-cities.
[26] Ibid.
[27] Washington State Office of Financial Management. (n.d.). April 1, 2024 Population of Cities, Towns, and Counties Used for Allocation of Selected State Revenues. Retrieved from https://ofm.wa.gov/sites/default/files/public/dataresearch/pop/april1/ofm_april1_population_final.pdf.
[28] Washington State Office of Financial Management. (2022). Growth Management Act Population Projections for Counties: 2020 to 2050. Retrieved from https://ofm.wa.gov/sites/default/files/public/dataresearch/pop/GMA/projections2022/gma_2022_high_low_charts.pdf.

Figure 3-6. Kittitas County Population and Projected Growth (1980 – 2050)

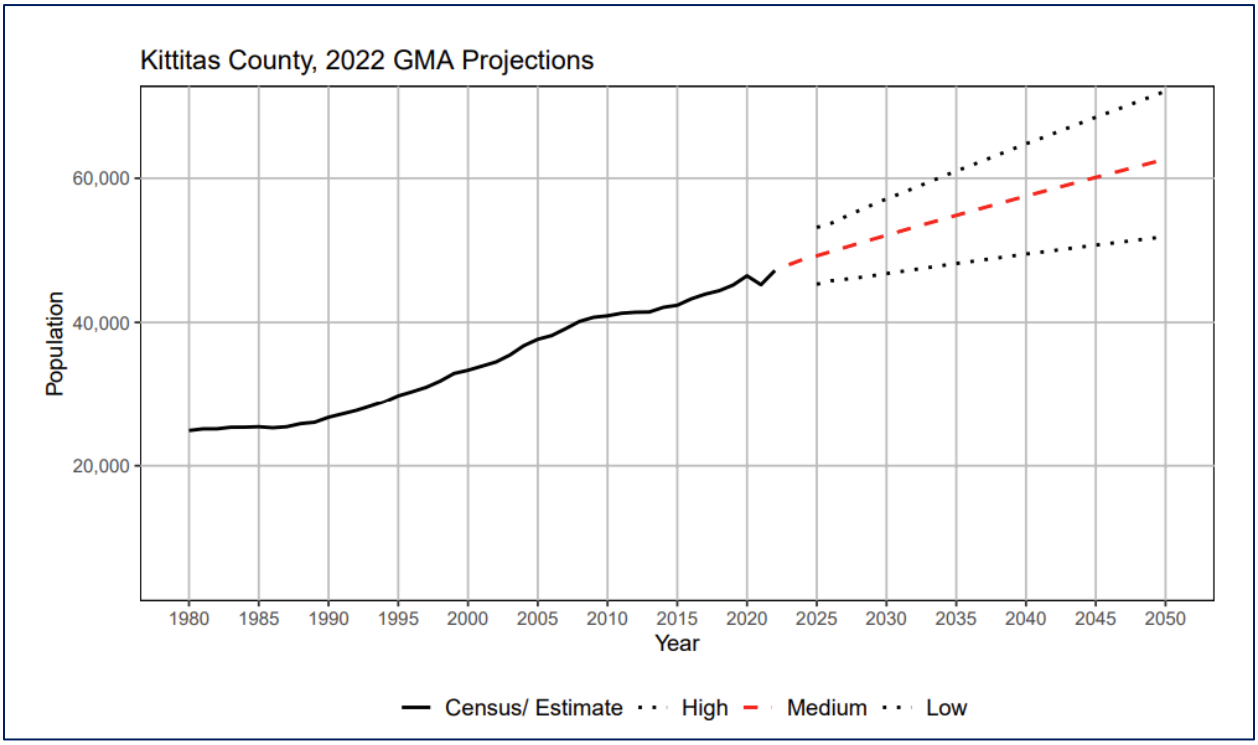


Table 3-4 shows the projected rates of average annual population growth according to the OFM projections.[29]

Table 3-4. Kittitas County Projected Population (2020 – 2050)

Projection Series	2020	2025	2030	2035	2040	2045	2050
Low	46,468	45,295	46,779	48,172	49,484	50,723	51,907
Medium	46,468	49,234	52,091	54,850	57,521	60,112	62,643
High	46,468	53,173	57,143	61,008	64,778	68,461	72,079

The medium projection is OFM's actual estimate, and it is assumed that it is the most accurate while the high and low projections are provided as a margin of safety. However, Kittitas County has a reason to believe that these projections are not a good representation of the local conditions. As a result, Kittitas decided to use 2% as the projection for the growth rate which falls between the medium and high OFM projections. Through County Resolution 2017-068, Kittitas County adopted the countywide growth and allocation, listed in **Table 3-5**, using OFM projections.[30]

[29] Washington State Office of Financial Management. (2022). Growth Management Act Population Projections for Counties: 2020 to 2050. Retrieved from
[30] Kittitas County. (2021). Kittitas County Comprehensive Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/cds/comp-plan/2021/2021%20Comprehensive%20Plan.pdf.

Table 3-5. 2037 County Population Growth and Allocations

Jurisdiction	2017	2037 Population Growth	2037 Population
City of Cle Elum	1,875	1,808	2,250
City of Ellensburg	20,783	11,757	32,540
City of Kittitas	1,481	807	2,288
City of Roslyn	896	307	1,203
Town of South Cle Elum	595	464	1,059
Unincorporated Kittitas County	17,043	8,154	25,197
Kittitas County	46,670	23,297	65,967

Income and Socioeconomic Status: In 2022, the median household income in Kittitas County was $66,800. About 11% of the households in Kittitas County are below the poverty level.[31] **Table 3-6** outlines the poverty thresholds for 2022 by size of family.[32]

Table 3-6. Poverty Thresholds for 2022 by Size of Family

Size of Family Unit	Weighted Average Threshold
One (1) Person	$14,880
Two (2) People	$18,900
Three (3) People	$23,280
Four (4) People	$29,950
Five (5) People	$35,510
The source of the weighted average thresholds is the 2023 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).	

Sex and Age Distribution: 19% of Kittitas County's population is 65 years old and over, compared to the State average of 17.1%.[33] It is also estimated that 17.4% of the County's population is 18 years old or younger, compared to the State average of 21.1%. Females make up 49.4% while males make up 50.6% of the Kittitas County population.[34] The age group with the highest percentage is the 20 to 24 age group, with the 15 to 19 age group the second highest. The overall age distribution for Kittitas County is outlined in **Table 3-7**.[35]

[31] United States Census Bureau. (2022). Quick Facts: Kittitas County, Washington. Retrieved from https://www.census.gov/quickfacts/kittitascountywashington.
[32] United States Census Bureau. (2022). Poverty Threshold (By Size of Family and Number of Children). Retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html.
[33] United States Census Bureau. (2022). Quick Facts: Kittitas County, Washington. Retrieved from https://www.census.gov/quickfacts/kittitascountywashington.
[34] United States Census Bureau. (2022). Quick Facts: Kittitas County, Washington, and Washington State. Retrieved from https://www.census.gov/quickfacts/fact/table/WA,kittitascountywashington/PST045222.
[35] United States Census Bureau. (2022). S0101: Age and Sex (2022: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2022.S0101?g=050XX00US53037.

Table 3-7. Age Distribution (2022)

Age Group	Estimate	Percent
Under 5 Years	1,901	4.3%
5 to 9 Years	2,229	5.0%
10 to 14 Years	2,313	5.2%
15 to 19 Years	4,388	9.9%
20 to 24 Years	5,287	11.9%
25 to 29 Years	2,893	6.5%
30 to 34 Years	2,564	5.8%
35 to 39 Years	2,484	5.6%
40 to 44 Years	2,320	5.2%
45 to 49 Years	2,260	5.1%
50 to 54 Years	2,390	5.4%
55 to 59 Years	2,665	6.0%
60 to 64 Years	3,266	7.4%
65 to 69 Years	2,641	5.9%
70 to 74 Years	1,985	4.5%
75 to 79 Years	1,479	3.3%
80 to 84 Years	845	1.9%
85 Years and Over	514	1.2%

Race and Ethnic Distribution: The majority of the population in Kittitas County is White (83.6%), with the next highest percent being Hispanic or Latino (9.6%). **Table 3-8** outlines the racial and ethnic distribution in Kittitas County.[36]

Table 3-8. Racial and Ethnic Distribution (2022)

Race and Ethnicity	Estimate	Percent
White (not Hispanic or Latino)	37,139	83.6%
Black or African American	402	0.9%
American Indian and Alaska Native	220	0.5%
Asian	611	1.4%
Native Hawaiian and Other Pacific Islander	152	0.3%
Two (2) or More Races	3,791	8.5%

[36] United States Census Bureau. (2022). DP05: ACS Demographic and Housing Estimates (2022:ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2022.DP05?g=050XX00US53037.

Race and Ethnicity	Estimate	Percent
Some Other Race Alone	2,109	4.7%
Hispanic or Latino	4,258	9.6%

3.4% of the population in Kittitas County is foreign born.[37] Other than English, the most commonly spoken language in Kittitas County is Spanish (4.6%). The United States Census Bureau estimates that 1.2% of the County's residents speak English "less than very well."[38]

Disabled Population: Approximately, 22.4% of Kittitas County population has a disability type (i.e., hearing, vision, cognitive, or ambulatory, self-care, and independent living difficulty). People with disabilities are more likely to require assistance when responding to a hazard event and more likely to require assistance during the 72 hours after a hazard event, which is the period generally reserved for self-help. Furthermore, individuals with disabilities are likely to be compounded with other vulnerabilities, (e.g., age, economic disadvantage, race, and ethnicity). **Table 3-9** summarizes the estimates for the disabled population by disability type, age, race, and ethnicity within Kittitas County.[39]

Table 3-9. Disability Characteristics (2022)

Disability Type	Estimate	Percent
Hearing Difficulty	2,112	4.8%
Vision Difficulty	1,059	2.4%
Cognitive Difficulty	2,358	5.6%
Ambulatory Difficulty	2,013	4.8%
Self-Care Difficulty	760	1.8%
Independent Living Difficulty	1,913	5.2%
Age	**Estimate**	**Percent**
Under 5 years	14	0.7%
5 to 17 years	241	4.1%
18 to 34 years	1,074	7.8%
35 to 64 years	2,058	13.5%
65 to 74 years	771	16.7%
75 years and over	1,567	55.9%

[37] United States Census Bureau. (2022). DP03: Selected Social Characteristics in the United States (2022: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSDP5Y2022.DP02?g=050XX00US53037.
[38] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2022.S1601?g=050XX00US53037.
[39] United States Census Bureau. (2022). S1810: Disability Characteristics (2022: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2022.S1810?g=050XX00US53037.

Race and Ethnicity	Estimate	Percent
White (not Hispanic or Latino)	4,930	13.3%
Black or African American	59	14.9%
American Indian and Alaska Native	45	20.9%
Asian	52	8.6%
Native Hawaiian and Other Pacific Islander	14	9.6%
Two (2) or More Races	380	10.1%
Some Other Race Alone	245	11.8%
Hispanic or Latino	180	4.3%

3.6.1. Underserved Population

FEMA defines underserved populations as groups that have limited or no access to resources or that are otherwise disenfranchised. These groups may include, but are not limited to, people who are socioeconomically disadvantaged, people with limited English proficiency, geographically isolated or educationally disenfranchised people, people of color as well as those of ethnic and national origin minorities, women and children, individuals with disabilities and other access and functional needs, and seniors.[40]

The CDC's SVI is considered an appropriate and authoritative dataset to identify areas where efforts can be prioritized to ensure equitable outcomes from mitigation planning and actions. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of natural, human-caused, and technological disasters. CDC's SVI combines 16 census-derived social factors, within four (4) themes (i.e., socioeconomic status, household characteristics, racial and ethnic minority status, and housing type and transportation) that summarizes the extent to which an area is socially vulnerable to disasters. The overall SVI combines all variables to provide a comprehensive assessment, and the possible scores range from zero (0) (lowest vulnerability) to one (1) (highest vulnerability).[41]

The overall SVI score for Kittitas County is 0.3008 which indicates a low to medium level vulnerability. **Table 3-10** outlines the SVI information for each social factor for Kittitas County.[42]

[40] Federal Emergency Management Agency. (n.d.). Glossary: Underserved Population/Communities. Retrieved from https://www.fema.gov/about/glossary.
[41] Centers for Disease Control and Prevention. (2022). CDC/ATSDR SVI 2020 Documentation. Retrieved from https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/pdf/SVI2020Documentation_08.05.22.pdf.
[42] Centers for Disease Control and Prevention. (2020). CDC/ATSDR Social Vulnerability Index (SVI). Retrieved from https://www.atsdr.cdc.gov/placeandhealth/svi/interactive_map.html.

Table 3-10. Social Vulnerability Index (2020)

Theme	Social Factors	Population	Percent
Socioeconomic Status	People below 150% poverty estimate	10,890	24.6%
	Unemployed *(Civilian 16 years old and older)*	1,507	3.4%
	Housing Cost Burden	5,875	13.3%
	No High School Diploma	2,356	5.3%
	No Health Insurance	2,132	4.8%
Household Characteristics	65 years old and older	7,533	17.0%
	17 years and younger	7,970	18.0%
	Civilian with a Disability	6,261	14.1%
	Single-Parent Household	658	1.5%
	English Language Proficiency	180	0.4%
Racial and Ethnic Minority Status	• Hispanic or Latino (of any race) • Black or African American • Asian • American Indian or Alaska Native • Native Hawaiian or Pacific Islander • Two or More Races • Other Races	8,424	19.0%
Housing Type and Transportation	Multi-Unit Structures	2,570	5.8%
	Mobile Homes	1,779	4.0%
	Crowding	295	0.7%
	No Vehicle	775	1.7%
	Group Quarters	2,596	5.9%

3.7. ECONOMY

62.5% of the 16 years old and over population was in the labor force. Of the 23,480 civilian employed population, 68.1% were employed in the private sector. Kittitas County is currently experiencing an average unemployment rate of 5.9%. Educational services, health care, and social assistance represent the largest sector, employing over 25.2% of the workforce. **Tables 3-11** through **3-14** provide a breakdown of the economic characteristics of Kittitas County.[43]

Table 3-11. Employment by Industry (2022)

Industrial Sector	Estimate	Percent
Agriculture, forestry, fishing, hunting, and mining	1,089	4.9%
Construction	1,684	7.6%

[43] United States Census Bureau. (2022). DP03: Selected Economic Characteristics (2022: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table?q=DP03:+Selected+Economic+Characteristics&g=050XX00US53037.

Industrial Sector	Estimate	Percent
Manufacturing	916	4.1%
Wholesale funds	582	2.6%
Retail trade	2,221	10.1%
Transportation, warehousing, and utilities	1,085	4.9%
Information	348	1.6%
Finance and insurance, real estate, and leasing	1,072	4.9%
Professional, scientific, management, and administrative	1,882	8.5%
Educational services, health care, and social assistance	5,563	25.2%
Arts, entertainment, recreation, accommodation, and food	3,373	15.3%
Other services (except public administration)	967	4.4%
Public administration	1,307	5.9%
Civilian Employed Population 16 Years and Over	**22,089**	

Table 3-12. Employment Status (2022)

Industrial Sector	Estimate	Percent
In Labor Force	23,515	62.5%
Civilian Labor Force	23,480	62.4%
Employed	22,089	58.7%
Unemployed	1,391	3.7%
Armed Forces	35	0.1%
Not in Labor Force	14,119	37.5%
Total Employed Population 16 and Over	**37,634**	

Table 3-13. Occupation (2022)

Occupation	Estimate	Percent
Management, business, science, and arts occupation	8,300	37.6%
Service occupations	5,013	22.7%
Sales and office occupations	4,416	20.0%
Natural resources, construction, and maintenance occupations	2,146	9.7%
Production, transportation, and material moving occupations.	2,214	10.0%
Civilian Employed Population 16 Years Old and Over	**22,089**	

The median household income in Kittitas County estimated in 2022 was $66,800, while 10.4% of households had an annual income of less than $15,000. **Table 3-14** outlines the breakdown of income and benefits in Kittitas County.[44]

Table 3-14. Income and Benefits (2022)

Income	Number of Households *(Estimate)*	Percent
Less than $10,000	1,088	5.7%
$10,000 to $14,999	910	4.7%
$15,000 to $24,999	1,318	6.8%
$25,000 to $34,999	1,555	8.1%
$35,000 to $49,999	2,593	13.5%
$50,000 to $74,999	2,979	15.5%
$75,000 to $99,999	2,118	11.0%
$100,000 to $149,999	3,442	17.9%
$150,000 to $199,999	1,540	8.0%
$200,000 or more	1,707	8.9%
Median Household Income	**$66,800**	
Total Households	**19,250**	

3.8. CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities are structures or other improvements that, because of its function, size, service area, or uniqueness, have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if it is destroyed or damaged, or if its functionality is impaired. These include police and fire stations, utilities, government facilities, and hazardous materials facilities.[45] Critical infrastructure is comprised of assets, systems, and networks, whether physical or virtual, which are so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof.[46]

For the purposes of this Plan, a critical facility is a local (non-state or federal) facility or infrastructure in either the public or private sector that provides essential products and services to the public, such as preserving the quality of life in Kittitas County fulfilling important public safety, emergency response, and disaster recovery functions. The loss of a critical facility would result in a severe economic or catastrophic impact and would affect the County's ability to provide essential services that protect life and property.

[44] Ibid.
[45] Federal Emergency Management Agency. (2017). National Flood Insurance Program, Community Rating System Coordinator's Manual. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf.
[46] Cybersecurity & Infrastructure Security Agency. (n.d.). Critical Infrastructure Sectors. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors.

- Government facilities (i.e., department, agencies, administrative offices)
- Emergency response facilities (i.e., police, fire, and emergency operations centers)
- Educational facilities (i.e., higher education and K-12)
- Medical and healthcare facilities (i.e., hospitals, nursing homes, continuing care retirement facilities, and housing for residents with access and functional needs)
- Community gathering places (i.e., parks, museums, libraries, senior centers)
- Public and private utilities and infrastructure are vital to maintaining or restoring normal services to areas damaged by an emergency or disaster
- Hazardous materials facilities (i.e., structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials)

Figure 3-15 shows locations of many critical facilities within Kittitas County. **Table 3-16** provides a summary of fire stations, hospital, emergency facility, and school critical facilities in each municipality and unincorporated County areas. Due to the sensitivity of this information, a detailed list of facilities is not provided as part of this Plan. The list is on file with each jurisdiction.

Table 3-15. Critical Facilities in Kittitas County

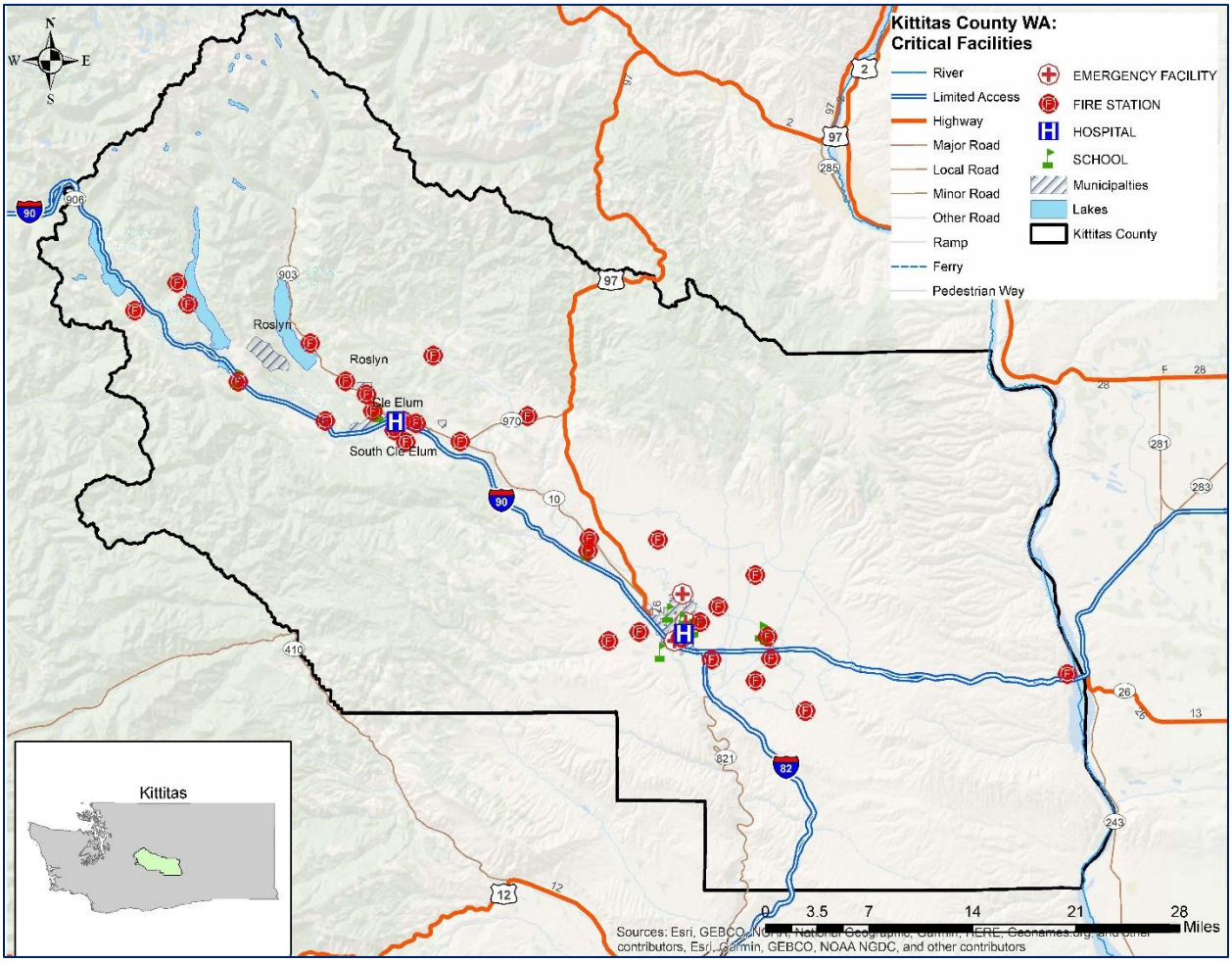


Table 3-16. Critical Facilities in Kittitas County

Jurisdiction	Fire Station	Hospital	Emergency Facility	School	Total
City of Cle Elum	2	2	0	0	4
City of Ellensburg	2	2	3	6	13
City of Kittitas	1	0	0	3	4
City of Roslyn	1	0	0	0	1
Town of South Cle Elum	1	0	0	0	1
Unincorporated Kittitas County	24	0	1	8	33
Total	**31**	**4**	**4**	**17**	**56**

3.9. CAPABILITY ASSESSMENT

Federal regulations require hazard mitigation plans to identify goals for reducing long-term vulnerabilities for the identified hazards in the planning area (Section 201.6(c)(3)(i)). A critical step in the development of specific hazard mitigation actions and projects is assessing existing authorities, policies, programs, and resources and capabilities to use or modify local tools to reduce losses and vulnerability from profiled hazards.

A capability assessment was conducted for Kittitas County and participating jurisdictions' authorities, policies, programs, and resources. Goals and mitigation actions were developed using input from this assessment. *Capability assessments for each participating jurisdiction can be found in their respective annexes.* Section 3.11 of this Plan includes information regarding the County's implementation of and continued participation in the National Flood Insurance Program (NFIP).

The Core Planning Team assessed Kittitas County's capabilities that can contribute to the reduction of long-term vulnerabilities to hazards. The capabilities include the following categories:

- Planning and Regulatory Capabilities
- Administrative and Technical Capabilities
- Financial Capabilities
- Education and Outreach Capabilities

Additionally, ways to expand on and improve these existing policies and programs to integrate hazard mitigation into the day-to-day activities and programs of the County were considered.

3.9.1. Planning and Regulatory Capabilities

These include local ordinances, policies, and laws to manage growth and development (e.g., land use plans, capital improvement plans, transportation plans, emergency preparedness and response plans, building codes, and zoning ordinances). **Table 3-17** and **Table 3-18** contain a list of State and local planning and regulatory capabilities.

Table 3-17. State and Local Existing Planning Initiatives

Washington State Enhanced Hazard Mitigation Plan (2023)	
The Washington State Enhanced Hazard Mitigation (SEHMP) Plan, a multi-agency statewide document, profiles hazards, identifies risks and vulnerabilities, and proposes strategies and actions to reduce risks to people, property, the economy, the environment, infrastructure and first responders. It incorporates best practices, programs and knowledge from multiple state agencies, and tracks progress in achieving mitigation goals through state and local programs and strategies. Furthermore, it communicates progress among agency partners and elected leadership. By meeting federal requirements for an enhanced state plan (44 CFR parts 201.4 and 201.5), the SEHMP allows the State to seek significantly higher funding from the Hazard Mitigation Grant Program following presidential declared disasters. The SEHMP provided guidance for the Kittitas County Hazard Mitigation Plan update process.	
Lead Department	Washington Emergency Management Division
Washington State's Integrated Climate Response Strategy (2012)	
This Strategy was developed as directed by the Legislature under the Integrated Climate Change Response Strategy (Chapter 70A.05 RCW) to enable state and local agencies, public and private businesses, nongovernmental organizations, and individuals to prepare for, address, and adapt to impacts of climate change. Additionally, the Strategy offers recommendations on how existing state policies and programs can better prepare the State to respond to the impacts of climate change. Furthermore, it urges state agencies to make adaptation a standard part of agency planning and ensure that scientific information about climate change impacts accessible to public and private sector decisions makers. It also recommends that state agencies strengthen existing efforts to help local and tribal governments, private and public organizations, and individuals reduce their vulnerability to climate change. During this Hazard Mitigation Plan update, the State was in the process of updating the current Strategy document by September 30, 2024.	
Lead Department	State of Washington Department of Ecology
Washington State Infrastructure Protection Plan (2008)	
The Washington State Infrastructure Protection Plan brings together the voluntary efforts of all levels of government, private sector, and non-governmental organizations. Together they provide the mechanism for identifying critical assets, systems, networks and functions; understanding threats; assessing vulnerabilities and consequences; prioritizing protection initiatives; and enhancing information sharing efforts and applying protective measures within and across sectors.	
Lead Department	Washington State Military Department
Yakima River Basin Integrated Plan (2012)	
The Yakima River Basin Integrated Plan was developed as a comprehensive approach to address a variety of water resource and ecosystem problems affecting fish passage and habitat and agricultural, municipal, and domestic water supplies in the Yakima River Basin. Currently, water resources infrastructure, programs, and policies in the Yakima River Basin have not been capable of consistently meeting aquatic resource demands for fish and wildlife habitat, dry-year irrigation demands, and municipal water supply demands. The Integrated Plan was developed by the United States Bureau of Reclamation and the Washington Department of Ecology, in partnership with the Yakima River Basin Water Enhancement Project (YRBWEP) Workgroup (composed of representatives of the Yakama Nation, Federal, State, county, and city governments, environmental organizations, and irrigation districts, including the Kittitas Reclamation District).	
Lead Department	State of Washington Department of Ecology

Resilient Washington State: A Framework for Minimizing Loss and Improving Statewide Recovery After an Earthquake (2012)	
The report provides a general assessment of the recovery capacity of the state's major systems and infrastructure, including estimates of the time it is likely to take for each component to recover following a serious earthquake, a target timeframe for each component recovery, and the top 10 recommendations for improving statewide resilience.	
Lead Department	Washington State Department of Natural Resources

Kittitas County Countywide Planning Policies (2016)	
The Countywide Planning Policies are to be used solely to establish a framework from which the comprehensive plans of the County and cities within the county are developed and adopted, pursuant to the Revised Code of Washington (RCW) 36.70A, The Growth Management Act. These policies are adopted to ensure consistency and coordination among the comprehensive plans of the County and the cities throughout the State.	
Lead Department	Kittitas County Conference of Governments

Kittitas County Comprehensive Plan (2021)	
The Comprehensive Plan affects all unincorporated lands of Kittitas County, and it is intended to conserve lands by protecting them from conflicting land uses, providing sufficient services and ensuring adequate facilities. This Plan is adopted by the County in compliance with the Washington State Growth Management Act, RCW 36.70A and under authority of the Planning Commission Act, RCW 35.63. The goals and objectives outlined in the Comprehensive Plan for land use and development, conservation, housing and infrastructure, and economic development were considered in the hazard mitigation planning process.	
Lead Department	Kittitas County Community Development Services

Kittitas County Comprehensive Emergency Management Plan (2016)	
The Comprehensive Emergency Management Plan (CEMP) supports the government in its responsibility to preserve lives, protect property and the environment, and ensure public health in times of natural, human-caused, and technological disasters. Through the implementation of the CEMP, the resources and capabilities of the public, private, and nonprofit sectors can be more efficiently utilized to minimize the loss of life and property and to protect the environmental and economic health of the County.	
Lead Department	Kittitas County Emergency Management Department of the Kittitas County Sheriff's Office

Kittitas County Shoreline Master Program (2021)	
The Washington State Shoreline Management Act (RCW 90.58) and its associated rules (WAC 173-26) require local governments to adopt shoreline master programs (SMPs) with policies and regulations that apply to development near shorelines. The Shoreline Master Program Plan outlines goals for conservation, use, and development of shoreline areas. In Kittitas County, shoreline jurisdiction includes all shorelines of the State, upland areas within 200 feet of the ordinary high water mark of those waters, associated wetlands and river deltas, and floodways and contiguous floodplain areas landward 200 feet from such floodways. These regulations have particular implications for the flooding section of the Risk Assessment section of this Hazard Mitigation Plan.	
Lead Department	Kittitas County Community Development Services

Kittitas County Wildfire Protection Plan (2018/2022)	
The County Wildfire Protection Plan (CWPP) identifies wildfire response capability, educates homeowners to reduce the ignitability of structures, and evaluates critical infrastructure throughout the County. The CWPP identifies prioritized areas for hazardous fuel reduction treatments on Federal, State, and private land, and builds on existing efforts to restore healthy forest conditions within the County. This Plan was considered during discussion of the Wildfire section of this Hazard Mitigation Plan.	
Lead Department	The Kittitas Fire Adapted Communities Coalition and Kittitas County Public Works

Capital Improvement Plan (2022 – 2027)	
The Capital Improvement Plan (CIP) provides broad direction for development of County facilities and infrastructure. It describes a strategy to maintain adequate support for the County's communities and commerce. Additionally, it addresses transportation, greenhouse gases, stormwater, and other environmental factors.	
Lead Department	Kittitas County Community Development Services

Table 3-18. Legal and Regulatory Capability

Capability Category	Local Authority	Other Jurisdictional Authority	State Mandated	Comments
Codes, Ordinances, and Requirements				
Building Code	Yes	No	Yes	KCC Title 14.04 (Building Code) RCW 19.27
Zoning Code	Yes	No	Yes	KCC Title 17
Subdivisions Code	Yes	No	Yes	KCC Title 16
Floodplain Ordinance	Yes	Yes	Yes	KCC Title 14.08
Stormwater Management	Yes	No	No	KCC Title 12.04
Post Disaster Recovery	No	No	No	
Real Estate Disclosure	No	No	Yes	RCW 64.06.020
Growth Management	Yes	No	Yes	The Washington State Growth Management Act (RCW Chapter 36.70A) directs growth management and comprehensive planning for cities and counties. Kittitas County Comprehensive Plan was adopted in 2021.
Site Plan Review	Yes	No	No	KCC Title 14.04 Site plans are reviewed for compliance with codes and development regulations.
Public Health and Safety	Yes	Yes	Yes	KCC Title 8 and 13
Climate Change Adaptation	Yes	No	No	
Shoreline Management	Yes	No	Yes	RCW 90.58 Shoreline Master Plan and KCC Title 17B
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire, etc.)	Yes	No	Yes	KCC Titles: 12.04, 17A.06, and 20.10
Environmental Protection	No	Yes	Yes	KCC Title 15, 17A, and 17B

Capability Category	Local Authority	Other Jurisdictional Authority	State Mandated	Comments
Special Purpose (flood management, critical areas)	Yes	Yes	Yes	KCC Title 14.08 (Flood Damage Protection) and 17A (Frequently Flooded Areas) Kittitas County Flood Control Zone District
Critical Areas	Yes	Yes	Yes	KCC Title 17A
Fire and Life Safety	Yes	No	No	KCC Title 20
Planning Documents				
Comprehensive Plan	Yes	No	Yes	Washington State Growth Management Act, RCW 36.70A, under authority of the Planning Commission Act, RCW 35.63. Updated annually.
Floodplain or Basin Plan	Yes	No	No	RCW 86.16, implemented through WAC 173-158. Kittitas County Flood Control Zone District
Stormwater Plan	No	No	No	Eastern Washington Stormwater Management Plan
Capital Improvement Plan	No	No	No	The Capital Facilities Plan is adopted as part of the 2021 Comprehensive Plan.
Habitat Conservation Plan	No	No	No	
Shoreline Management Plan	Yes	No	Yes	Shoreline Master Program, updated in 2016
Community Wildfire Protection Plan	Yes	No	No	Kittitas County Community Wildfire Protection Plan was updated in 2018 and amended in 2022. An update is planned for 2024/2025 with USFS Community Wildfire Defense Grant (CWDG) Program grant through the Kittitas Fire Adapted Communities Coalition.
Transportation Plan	Yes	No	Yes	Transportation Element is part of the Comprehensive Plan.
Comprehensive Emergency Management Plan	Yes	No	Yes	RCW 38.52 Last update of the CEMP was 2016. At the time of this Hazard Mitigation Plan update, the CEMP update was in process.

Capability Category	Local Authority	Other Jurisdictional Authority	State Mandated	Comments
Threat and Hazard Identification and Risk Assessment	No	No	No	Kittitas County Hazard Inventory Vulnerability Analysis (2018) In 2024, the State of Washington is in the process of replacing THIRA/SPR with a new program called the County Emergency Preparedness Assessment (CEPA). Kittitas County will officially participate in this assessment with the State beginning February 2025.
Terrorism Plan	No	No	No	
Post-Disaster Recovery Plan	No	No	No	Debris Removal Plan (approved by FEMA in 2016, updated in 2018, but not approved).
Continuity of Operations Plan	No	No	No	Included in the CEMP (Appendix 1).
Public Health Plans	Yes	No	No	Kittitas County Public Health Department (KCPHD) 2020 – 2024 Strategic Plan Kittitas County Community Health Improvement Plan KCPHD Emergency Operations Plans
Economic Development Plan	Yes	No	No	The Economic Development Plan is a part of the Comprehensive Plan, and the Economic Development Strategic Plan prepared by the Economic Development Group of Kittitas County has been adopted by reference into the 2016 Kittitas County Comprehensive Plan. Kittitas County and the City of Ellensburg adopted an updated Kittitas County Economic Development Strategic Plan in 2023.

3.9.2. Administrative and Technical Capabilities

The administrative and technical capabilities include community (i.e., public and private) staff and their skills and tools, which can be used for mitigation planning and implementation. This capability includes engineers, planners, emergency managers, GIS analysts, building inspectors, grant writers, and floodplain managers. Small communities may rely on other government entities, such as counties or special districts, for resources. These capabilities may be used to support mitigation activities. **Table 3-19** lists administrative and technical capabilities.

Table 3-19. Administrative and Technical Capabilities

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	**Kittitas County Public Works:** Director, County Engineer, Planner **Kittitas County Community Development Services:** Planners
Engineers or professionals trained in building or infrastructure construction practices	Yes	**Kittitas County Public Works:** County Engineer, Construction Manager, Director **Kittitas County Community Development Services:** Building Official, Plans Examiner, Building Inspector
Planners or engineers with an understanding of natural hazards	Yes	**Kittitas County Public Works:** Director, County Engineer, Planner, Hydrology and Hydraulic Engineer in Training **Kittitas County Community Development Services:** Planners
Staff with training in benefit/cost analysis	No	N/A
Floodplain manager	Yes	**Kittitas County Public Works:** Water Resource Manager, Water Resources Specialist
Surveyors	Yes	**Kittitas County Public Works:** Kittitas County Surveyor, Engineering Techs
Personnel skilled or trained in GIS applications	Yes	**Kittitas County Public Works:** Planners, Floodplain Managers, Engineering Techs **Kittitas County Community Development Services:** Planners **Kittitas County Information Services:** GIS Analyst **Kittitas County Assessor:** Cadastral Technician Various other county departments have employees with GIS experience.
Scientist familiar with natural hazards in local area	Yes	By contract: Central Washington University, Washington State Department of Transportation, National Oceanic and Atmospheric Administration, Washington State Department of Fish and Wildlife, Washington State Department of Ecology, Washington State Department of Natural Resources
Emergency manager	Yes	**Kittitas County Sheriff's Office:** Emergency Management Operations Commander, Kittitas County Search and Rescue
Grant writers	Yes	Numerous Kittitas County employees with grant writing experience.

3.9.3. Financial Capabilities

Table 3-20 contains a list of financial capabilities available to the County. These financial resources may be used to support mitigation activities based on procedures for each resource.

Table 3-20. Financial Resources

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	No
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Yes

Financial Resources	Accessible or Eligible to Use?
Withhold Public Expenditures in Hazard-Prone Areas	No
State Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Eligible: Yes Accessible: No

3.9.4. Education and Outreach Capabilities

Table 3-21 lists the County's education and public outreach capabilities. These capabilities include fire safety programs, hazard awareness campaigns, public information, and communications offices. Education and outreach capabilities can be used to inform the public about current and potential mitigation activities.

Table 3-21. Education and Public Outreach Capabilities

County Emergency/Disaster Readiness Website *https://www.co.kittitas.wa.us/sheriff/emergency.aspx*
The County Sheriff's website has educational material on numerous programs, including making an emergency plan, stocking supplies, staying informed, and getting involved in community preparedness programs.
Kittitas County Emergency Response Information *https://www.co.kittitas.wa.us/response/default.aspx*
Provides resources and links for public safety and emergency information in Kittitas County.
County Community Emergency Response Team (CERT)
The Community Emergency Response Team (CERT) Program is a 20-hour all risk, all hazard training offered by the Kittitas County Sheriff's Office through Kittitas County Search and Rescue. This valuable course is designed to help you protect yourself, your family, your neighbors, and your neighborhood in an emergency.
Ellensburg Community Television (ECTV)
The Ellensburg Community Television (ECTV) is the flagship channel of Kittitas County's cable television programming, bringing special events, government meetings, and produced shows. ECTV broadcasts on channel 191 or online via ectv2.com.
Kittitas County Emergency Management Alerts
The Kittitas County Emergency Management Alerts can alert residents with critical information quickly in a variety of situations, such as severe weather, wildfires, unexpected road closures, missing persons and evacuations of buildings or neighborhoods. Residents will receive time-sensitive messages wherever they specify, such as your home, mobile or business phones, email address, text messages and more.

3.9.5. Recommended Expanded or Improved Capabilities

Kittitas County identified existing authorities, policies, programs, funding, and/or resources that could be expanded and/or improved to support the implementation of the hazard mitigation initiatives identified in this Plan (e.g., mitigation actions).

- Several Kittitas County staff are proficient utilizing GIS, but an expansion of GIS capabilities for spatial data creation, dataset management, and spatial data analysis would help advance hazard mitigation initiatives. Efforts to expand capabilities should be informed by an understanding of the current roles and responsibilities within and across County departments, and of state and federally managed datasets.

- The Kittitas County Conference of Governments (COG) is a regional planning agency with the purpose of developing and promoting communication, understanding, and cooperation among the COG member jurisdictions. The COG has supported a Standard of Cover Assessment as part of their work program. The Standard of Cover Assessment will help identify overlaps or gaps in emergency service areas as well as how to coordinate efforts more efficiently. Efforts through the COG to enhance coordination and cooperation among jurisdictions, emergency services, and fire districts may help support hazard mitigation initiatives.

3.10. HAZARD MITIGATION INTEGRATION

The information on hazards, risk, vulnerability, and mitigation contained in this Hazard Mitigation Plan is based on the best available data at the time of the Plan update. Plan integration consists of the incorporation of hazard mitigation into other relevant planning mechanisms (e.g., general planning and capital improvement planning). It includes the integration of natural hazard information and mitigation policies, principles, and actions into local planning mechanisms and vice versa. Additionally, plan integration is achieved through the involvement of key staff and community officials in collaborative hazard mitigation planning.

3.10.1. Existing Plan Integration

In the performance period since the adoption of the previous Hazard Mitigation Plan, Kittitas County made progress on integrating components of the hazard mitigation strategy (e.g., goals, objectives, and actions) into the planning initiatives listed in **Table 3-22**.

Table 3-22. Current Plan Integration

Planning Initiative	Description
Kittitas County Comprehensive Plan	The Comprehensive Plan is based on a framework of community goals and objectives adopted by the County with assistance from various subarea groups and other citizens as a final expression of public policy. The development and adoption of the Comprehensive Plan is in compliance with the Washington State Growth Management Act (RCW) 36.70A and under authority of the Planning Commission Act, RCW 35.63. Plan Participants used their comprehensive plans and this Hazard Mitigation Plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of Kittitas County. Future updates to a Comprehensive Plan may trigger an update to the Hazard Mitigation Plan.
Capital Improvement Plan	The Capital Improvement Plan (CIP) includes projects that can help mitigate potential hazards. The County will strive to ensure consistency between the Hazard Mitigation Plan and the current and future Capital Improvement Plan. The Hazard Mitigation Plan may identify new possible funding sources for capital improvement projects and may result in modifications to proposed projects based on results of the risk assessment.
Countywide Planning Policies	The Countywide Planning Policies are used to establish a framework from which the comprehensive plans of the County, cities, and towns are developed and adopted, pursuant to the Growth Management Act (RCW 36.70A).
Kittitas County Code	Portions of the County Code (e.g., building, zoning, subdivisions) will be reviewed based on developing trends in identified hazards and mitigation measures that can make them more effective at preventing losses.

Planning Initiative	Description
Flood Control Zone District Capital Improvement Planning	Each year the Flood Control Zone District updates its 6-year Capital Improvement Plan (CIP). This Plan is then incorporated into the County (CIP). Mitigation measures in the Hazard Mitigation Plan for flood and levee related hazards inform this CIP.
Comprehensive Flood Hazard Management Planning	Kittitas County fully integrates Comprehensive Flood Hazard Management Planning into the County's Hazard Mitigation Plan. Washington State Flood Control Account Assistance Program (FCAAP) funding was available for technical studies and planning efforts to update Flood Hazard Plans. Kittitas County conducted a technical assessment of the Yakima River Easton Reach, addressing flood risks for several floodplain communities and advancing several mitigation measures identified in the 2019 Hazard Mitigation Plan. Additionally, the City of Ellensburg is currently implementing an FCAAP funded project to conduct an in-depth analysis of urban flooding caused by Whiskey and Mercer creeks within the Ellensburg Urban Growth Area and city limits.
Community Rating System	Kittitas County participation in the Community Rating System (CRS) helps determine the Flood Control Zone District Work Program. The District's Work Program includes annual progress reporting on Hazard Mitigation Plan implementation and outreach projects regarding flood hazards. CRS is a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the NFIP.
Community Wildlife Protection Plan	This Plan was considered during discussion of the Wildfire portion of the Risk Assessment section of this Hazard Mitigation Plan and helped inform identified mitigation strategies to address wildfire risk.
Washington State Wildland Fire Protection 10 – Year Strategic Plan	The State's Wildland Fire Protection Strategic Plan is a blueprint for effective wildland fire protection in Washington and inform associated policy and resource decisions. The Plan is also anchored in the National Cohesive Wildland Fire Management Strategy and shares its focus on resilient landscapes, fire-adapted communities, and safe, effective wildfire response. The Wildland Fire Protection Strategic Plan focuses on wildfire prevention, reducing human-caused ignitions, and post-fire recovery and informed the CWPP.
Washington State Eastern Washington 20 – Year Forest Health Strategic Plan:	The 20-Year Forest Health Strategic Plan was developed by the DNR to treat areas of state forest land that have been identified as being in poor health. The plan sets a vision, guiding principles, and process for moving forward, and takes an all-lands approach that is science-based for treating 1.25 million forested acres in Eastern Washington. This Strategic Plan helped inform the CWPP.

3.10.2. Potential Future Integration

As the Hazard Mitigation Plan is implemented, Kittitas County will use information from the Plan as the best available science and data on hazards. The capability assessment presented in Section 3.9 of this Plan identifies codes, plans, and programs that provide opportunities for integration. The countywide and local action plans developed for this Plan are related to plan integration. The capability assessment identified plans and programs, listed in **Table 3-23**, that do not currently integrate goals and recommendations of this Plan but provide opportunities to do so in the future.

Table 3-23. Potential Future Integration

Planning Initiative	Description
County Comprehensive Plan	The next Comprehensive Plan periodic update is due by 2026. A ninth element – Climate Change and Resiliency – must be added as part of this update. This new element is designed to reduce overall greenhouse gas emissions and to enhance resiliency to and avoid the adverse impacts of climate change. Furthermore, the Plan must include efforts to reduce localized greenhouse gas emissions and avoid creating or worsening localized climate impacts to vulnerable populations and overburdened communities. This Hazard Mitigation Plan will be reviewed for eligibility to be incorporated, by reference, in the 2026 Comprehensive Plan to address the climate resilience sub-element.
Community Wildfire Protection Plan	The Hazard Mitigation Plan and CWPP should be aligned and mitigation actions in the Hazard Mitigation Plan should support the goals of the CWPP. Analysis of the wildfire hazard in this Hazard Mitigation Plan can inform updates and revisions to the CWPP. In addition to the Washington State Wildland Fire Protection 10-Year Strategic Plan and the Washington State Eastern Washington 20-Year Forest Health Strategic Plan, updates to the CWPP will be informed by the Washington Shrubsteppe Restoration and Resiliency Initiative, the USFS wildfire crisis strategy (i.e., Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests), and policy recommendations developed by the Wildland Fire Mitigation and Management Commission (i.e., On Fire: The Report of the Wildland Fire Mitigation and Management Commission).
Capital Improvement Plan	The CIP should include mitigation measures that will be funded by the County such as improvements to stormwater collection systems, elevation of roadways at risk for flooding and strengthening of structures. Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization.
Community Rating System	CRS planning activities should be aligned with risks and mitigation actions in the Hazard Mitigation Plan.
Yakima River Basin Integrated Water Resource Management Plan	The Yakima River Basin Integrated Water Resource Management Plan directly identifies strategies and projects needed to address drought-related water shortages under current conditions, and climate change and resiliency needs.

The County's Local Planning Team will identify all relevant planning initiatives that are scheduled to be updated in the next year and during the annual update process of the Hazard Mitigation Plan. Additionally, opportunities to integrate key elements of the Hazard Mitigation Plan, specifically any relevant strategies, into the planning initiatives will be identified by the Local Planning Team. Mitigation actions were identified to promote plan integration in future revisions of this Plan.

3.11. NATIONAL FLOOD INSURANCE PROGRAM

As of July 2023, six (6) jurisdictions within Kittitas County are members of the National Flood Insurance Program (NFIP). Only unincorporated Kittitas County participates in the Community Rating System (CRS) which is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions, meeting the three (3) goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance ratings.

- Promote flood insurance awareness.

Table 3-24 identifies each community and the date each participant joined the NFIP and CRS.[47]

Table 3-24. NFIP Participation Information

CID	Community Name	NFIP Participation Date	Current Effective FIRM Date	CRS Entry Date	CRS Current Effective Date	CRS Class
530095	Unincorporated Kittitas	5/5/1981	9/24/2021	5/1/2015	5/1/2015	6
530096	City of Cle Elum	5/5/1981	9/24/2021	n/a	n/a	n/a
530234	City of Ellensburg	5/5/1981	9/24/2021	n/a	n/a	n/a
530098	City of Kittitas	4/15/1982	9/24/2021	n/a	n/a	n/a
530299	City of Roslyn	6/5/1985	9/24/2021	n/a	n/a	n/a
530263	Town of South Cle Elum	5/5/1981	9/24/2021	n/a	n/a	n/a

3.11.1. Floodplain Managers

All NFIP participating jurisdictions have a designated Floodplain Manager that is charged with enforcing floodplain regulations, routinely monitoring the floodplains, and providing community assistance such as encouraging owners to maintain flood insurance. A list of Kittitas County floodplain managers (County and cities) can be found in **Table 3-25**.

Table 3-25. Floodplain Managers

Jurisdiction	Department	Name	Title	Phone Number
Unincorporated Kittitas	Kittitas County Public Works	Josh Fredrickson	Public Works Director	(509) 962-7523
City of Cle Elum	Mayor's Office	Matthew Lundh	Mayor	(509) 674-2262
City of Ellensburg	Community Development	Dan Carlson	Community Development Director	(509) 925-8653
City of Kittitas	City Administration	Richard Hink	Mayor	(509) 968-0220
City of Roslyn	Planning/Building Department	Michelle Geiger	Planning and Building Official	(509) 649-3105
Town of South Cle Elum	Mayor's Office	Jim DeVere	Mayor	(509) 674-4322

3.11.2. Participation Activities

Kittitas County NFIP participation activities over the last five (5) years include the following activities that could prevent or reduce the severity of flooding within Kittitas County. *Refer to the Flood hazard profile in Section 4.6.5 for details on the flood hazard assessment.*

[47] Federal Emergency Management Agency. (2023). Community Status Book Report. Retrieved from https://www.fema.gov/cis/WA.pdf.

- Provides the following services – permit review, GIS, inspections, and engineering capability.
- The County educates private owners and other stakeholders about the importance of flood insurance through public outreach events, workshops, and/or seminars.
- The County conducts site visits and informs private owners about potential retrofit options.
- The County participates in the CRS, a voluntary, incentive-based program that encourages floodplain management practices that exceed NFIP minimum standards.
- The County provides flood map information for all properties within the County.
- Enforces local floodplain regulations and monitors compliance in Unincorporated County.
- Floodplain management regulations meet or exceed FEMA or State minimum requirements.

NFIP participation activities for each plan participant can be found in their respective annex.

3.11.2.1. Substantial Damage

Substantial damage means damage of any origin sustained by a structure by which the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred. *(County Code Title 14, Chapter 14.08 – Flood Damage Prevention)*

3.11.2.2. Substantial Improvement

Substantial improvement means any reconstruction, rehabilitation, addition or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred *substantial damage*, regardless of the actual repair work performed. However, the term does not include:

- Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official, and which are the minimum necessary to assure safe living conditions.
- Any alteration of a historic structure provided that the alteration will not preclude the structure's continued designation as a "historic structure." *(County Code Title 14, Chapter 14.08 – Flood Damage Prevention)*

3.11.2.3. Issues

The Core Planning Team identified flood related issues relevant to Kittitas County.

- The extent of flood protection provided by flood control facilities (e.g., dams, dikes and levees) is not known due to the lack of an established national policy on flood protection standards.
- The risk associated with the flood hazard overlaps the risk associated with other hazards (e.g., earthquake and landslide losses). This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce the risk for multiple hazards.
- There is no consistency of land use practices within the planning area or the scope of regulatory floodplain management beyond the minimum requirements of the NFIP.
- Climate change could alter flood conditions throughout Kittitas County.

- More information is needed on flood risk to support the concept of a risk based analysis for capital projects.
- There needs to be a sustained effort to gather historical damage data (e.g., high water marks on structures and damage reports) to measure the cost-effectiveness of future mitigation projects.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by the flood hazard in the County.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods.
- The concept of residual risk should be considered in the design of future capital flood control projects and should be communicated with residents living within the floodplain.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.
- Existing floodplain compatible uses (e.g., agricultural and open space) need to be maintained. There is constant pressure to convert these existing uses to more intense uses within the planning area during times of moderate to high growth.
- The economy affects a jurisdiction's ability to manage its floodplains. Budget cuts and personnel losses can strain resources needed to support floodplain management.
- A buildable-lands analysis that looks at vacant lands and their designated land use would be a valuable tool in helping decision makers make informed decisions about future development.
- The risk associated with flooding due to canal failure is unknown at this time. Data on this risk needs to be gathered to better support communities' preparedness and response efforts.
- Federally regulated dams have an adequate level of oversight and sophistication in the development of Emergency Action Plans for public notification in the unlikely event of failure. However, the protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping for federally regulated dams is already required and available; however, mapping for non-federal regulated dams that estimates inundation depths is needed to better assess the risk associated with dam failure from these facilities.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst case scenario, it is generally the event with the lowest probability of occurrence. For non-federal-regulated dams, mapping of dam failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.
- Dam and levee failure could result in loss of homes, businesses, and infrastructure (e.g., transportation corridors and irrigation facilities), thus lowering the overall tax base for the

affected area. Businesses could take long periods of time to recover, and the economy could be significantly impacted.

CHAPTER 4. HAZARD IDENTIFICATION AND RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel and first responders to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements.

- **Hazard Identification:** Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- **Vulnerability Identification:** Determine the impact of natural hazard events on the population, environment, economy, and lands of the region.
- **Cost Evaluation:** Estimate the cost of potential damage or cost that can be avoided by mitigation.

This Plan is designated to comply with requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities and 44 CFR Part 201 (44 CFR § 201.6), which states that local governments must have an approved Hazard Mitigation Plan in place for eligibility of pre-disaster and/or post-disaster mitigation grant funds. Additionally, this Plan is designed to comply with the FEMA and the Washington State Emergency Management Division guidance documents (particularly the Local Mitigation Planning Policy Guide, effective April 19, 2023) and other applicable federal, state, and local regulations. This was accomplished by evaluating the impacts of known natural hazards, prioritizing mitigation alternatives, and coordinating hazard mitigation with other Kittitas County programs and policies.

4.1. IDENTIFIED HAZARDS

There are a number of hazards that pose a threat to human life, health, and well-being, and this Plan is not meant to compile an exhaustive list. Those addressed in disaster planning are generally categorized as natural, human-caused, or technological. Some hazards are a threat to all geographic areas (e.g., drought) while others (e.g., flooding) are more limited in their extent.

The Kittitas County hazards were identified, and their frequency of occurrence was evaluated through a historical analysis using a number of resources, including:

- 2019 Kittitas County Hazard Mitigation Plan
- 2023 Washington State Enhanced Hazard Mitigation Plan
- Hazard planning documents developed by state, federal, and private agencies
- National Centers for Environmental Information
- Northwest Avalanche Center
- United States Drought Monitor
- National Weather Service
- United States Geological Survey

Although FEMA only requires and reviews natural hazards in hazard mitigation plans, Kittitas County decided to rank and mitigate against communicable diseases/pandemic. Due to the nature of non-natural hazards and the discretionary status regarding their inclusion, communicable disease/pandemic has been briefly and qualitatively assessed for the sake of public education and informing its inclusion within the hazard ranking and mitigation process. Hazards that have been identified as significant in Kittitas County and will be considered in this Plan are listed in **Table 4-1**.

Table 4-1. Kittitas County Hazards

Natural Hazards
Avalanche
Dam and Levee Failure
Drought
Earthquake
Flood
Landslide
Severe Weather *(Thunderstorms, Hail, Tornado, Strong Winds/Damaging Winds, Heat Wave/Extreme Heat, and Cold Wave/Extreme Cold)*
Winter Weather *(Ice Storm, Heavy Snow/Blizzard)*
Volcanic Activity
Wildfire *(Wildfire Smoke)*
Human-Caused/Technological Hazards
Communicable Diseases/Pandemic

Per FEMA's requirement to consider all natural hazards, the following natural hazards were not included because these hazards are not considered significant for Kittitas County due to its geographic location and lack of significant historical occurrences.

- Coastal Flooding
- Hurricane
- Lightning
- Tsunami

4.2. PRESIDENTIAL DISASTER AND EMERGENCY DECLARATIONS

Kittitas County has had 16 Major Disaster Declarations (DR), two (2) Emergency Declarations (EM), and eight (8) Fire Disaster Declarations (FR) between 1964 and 2023, listed in **Table 4-2**, according to FEMA.[48] This lists shows the foundation for identifying what hazards pose the most significant risk within the County.

[48] Federal Emergency Management Agency. (2023). Disaster Declaration for States and Counties. Retrieved from https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Table 4-2. State and Federal Disaster Declarations for Kittitas County

Event	Declaration Date	FEMA Disaster Number
Washington Wildfires and Straight-line Winds	February 4, 2021	DR-4584
Washington COVID-19 Pandemic	March 22, 2020	DR-4481
Washington COVID-19	March 13, 2020	EM-3427
Washington Ryegrass Coulee Fire	July 10, 2018	FM-5253
Washington Jolly Mountain Fire	September 2, 2017	FM-5200
Severe Storms, Straight-line Winds, Flooding, Landslides, and Mudslides in Washington	January 15, 2016	DR-4249
Wildfires	August 11, 2014	DR-4188
Washington Snag Canyon Fire	August 3, 2014	FM-5071
Washington Saddle Mountain Fire	July 19, 2014	FM-5064
Washington Colockum Tarps Fire	July 30, 2013	FM-5038
Washington Table Mountain Fire	September 20, 2012	FM-5020
Washington Taylor Bridge Fire	August 14, 2012	FM-5005
Severe Winter Storm, Flooding, Landslides, and Mudslides in Washington	March 25, 2011	DR-1963
Severe Winter Storm and Record and Near Record Snow in Washington	March 2, 2009	DR-1825
Severe Winter Storm, Landslides, Mudslides, and Flooding	January 30, 2009	DR-1817
Washington Elk Heights Fire	July 30, 2004	FM-2538
Washington Earthquake	March 1, 2001	DR-1361
Washington Severe Winter Storms/Flooding	January 17, 1997	DR-1159
Washington Severe Storms/Flooding	February 9, 1996	DR-1100
Washington Storms/High Winds/Floods	January 3, 1996	DR-1079
Washington Flooding, Severe Storm	November 26, 1990	DR-883
Washington Volcanic Eruption, Mt. St. Helens	May 21, 1980	DR-623
Washington Severe Storms, Mudslides, Flooding	December 10, 1977	DR-545
Washington Drought	March 13, 1977	EM-3037
Washington Severe Storms, Flooding	December 13, 1975	DR-492
Washington Heavy Rains & Flooding	December 29, 1964	DR-185

4.3. RISK ASSESSMENT METHODOLOGY

As part of Kittitas County Public Works, the risk assessment identifies the natural hazards that have potential impacts on all or portions of the County. Hazard identification, historical occurrences, and risk modeling (where applicable and available for specific hazards) information was collected from multiple sources including, but not limited to:

- Environmental Systems Research Institute (Esri)
- Federal Emergency Management Agency
- National Centers for Environmental Information
- National Weather Service
- United States Geological Survey
- United States Drought Monitor
- Hazus (for Earthquake and Flood)
- Northwest Avalanche Center
- Local repositories

This information was analyzed to assess the risk and vulnerability of people, property, the environment, and the jurisdiction's essential operations from these hazards. Furthermore, a risk ranking was performed for the hazards of concern described in this Plan. The risk ranking is an important step in developing an action plan, as it allows jurisdictions to compare the risk factors from one hazard to another. That comparison provides critical information to use in selecting hazard mitigation actions and their priorities. This process is not only intended to help focus actions on the hazards with the highest ranking, but also to ensure that jurisdictions are aware of the hazards that ranked low yet still pose significant risk.

In order to provide an informed and comprehensive ranking of the hazards addressed in this Plan, a number of categories of factors were considered – probability, extent, vulnerability, and impact. The sum of all the weighted factors for the extent, vulnerability, and impact categories were combined into a final consequence score. Probability multiplied by consequence resulted in a total risk score for each hazard.

Extent + Vulnerability + Impact = Consequence

Consequence x Probability = Total Risk Score

These results were determined by following a data driven quantitative assessment, reviewing, and ranking local knowledge from local subject matter experts, and developing other risk elements by the Core Planning Team based on the data collected. These elements were then aggregated to inform the analysis.

At the fundamental level, consequence is an assessment of the potential impact(s) if the hazard incident actually occurs. In this assessment, the consequence of an event (or the impact) will be interdependent on the following factors:

- Vulnerabilities (i.e., social, physical, and community conditions)
- Capabilities and capacities
- Mitigation
- Characteristics of the hazard event (i.e., magnitude, scale)

The frequency/probability of the hazard is not included in assessing the consequence because without the event, there is no consequence or impact.

4.3.1. Probability of Occurrence

The probability of occurrence of a hazard is indicated by a probability factor based on the likelihood of annual occurrence. Numerical probability factors were assigned as follows.

Table 4-3 outlines the probability of occurrence factors used in the risk assessment calculations for this Plan. A significant hazard event is defined as any hazard occurrence that directly or indirectly damages structures or infrastructure, impedes normal business operations, and/or is likely to cause serious or fatal injuries.

Table 4-3. Probability of Occurrence

Probability	Description	Probability Factor
High	Significant hazard event is likely to occur annually.	3
Medium	Significant hazard event is likely to occur within 25 years.	2
Low	Significant hazard event is likely to occur within 100 years.	1
Unlikely	There is little to no probability of significant occurrence, or the recurrence interval is greater than every 100 years.	0

The assessment of hazard frequency is generally based on past hazard events in the area and professional judgment of local subject matter experts.

4.3.2. Extent Factors

Extent was assessed in two (2) categories – extent/intensity potential and catastrophic probability of the hazard. **Table 4-4** and **Table 4-5** outline the numerical extent factors used in the risk assessment calculation for this Plan.

4.3.2.1. Extent/Intensity Factor

Extent is defined as the range of anticipated intensities of the identified hazards. This category is most commonly expressed using various scientific scales (e.g., Saffir-Simpson, Enhanced Fujita, Modified Mercalli). Extent/Intensity Factors are hazard-specific and are detailed in each hazard profile. **Table 4-4** outlines the extent/intensity factors used in the risk assessment calculations for this Plan.

Table 4-4. Extent/Intensity Factor

Probability	Description	Extent Factor
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1
Unlikely	Historical and/or probabilistic models/studies for this hazard indicate the possibility of little to no intensity.	0

4.3.2.2. Catastrophic Factor

The probability that a hazard could be catastrophic. Catastrophes are defined as significant incidents that cause sudden and great harm or destruction. **Table 4-5** outlines the catastrophic factors used in the risk assessment calculations for this Plan.

Table 4-5. Catastrophic Factor

Probability	Description	Extent Factor
High	High potential that this hazard could be catastrophic.	3
Medium	Medium potential that this hazard could be catastrophic.	2
Low	Low potential that this hazard could be catastrophic.	1
No Impact	Virtually no probability that this hazard could be catastrophic.	0

Each category was assigned a weighting factor to reflect its significance, consistent with this typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for *Extent/Intensity* and its potential for *Catastrophe*.

4.3.3. Vulnerability Factors

Vulnerabilities were assessed in three (3) categories – population exposure, property exposure, and exposure based on changes in development. Numerical vulnerability factors were assigned as follows.

4.3.3.1. Population Exposure Factor

Population exposure values were assigned based on the percentage of the total population exposed to the hazard event. **Table 4-6** outlines the population exposure factors used in the risk assessment calculation of this Plan.

Table 4-6. Population Exposure Factor

Probability	Description	Vulnerability Factor
High	30% or more of the population is exposed to the hazard.	3
Medium	15% to 29% of the population is exposed to the hazard.	2
Low	14% or less of the population is exposed to the hazard.	1
No Vulnerability	None of the population is exposed to the hazard.	0

4.3.3.2. Property Exposure Factor

Property exposure values were assigned based on the percentage of the total property value exposed to the hazard event. **Table 4-7** outlines the property exposure factors used in the risk assessment calculation of this Plan.

Table 4-7. Property Exposed Factor

Probability	Description	Vulnerability Factor
High	25% or more of the total assessed property value is exposed to the hazard.	3

Probability	Description	Vulnerability Factor
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2
Low	9% or less of the total assessed property value is exposed to a hazard.	1
No Vulnerability	None of the total assessed property value is exposed to a hazard.	0

4.3.3.3. Changes in Development

Changes in development in the past five (5) years have increased or decreased the community's vulnerability/exposure to the hazard. **Table 4-8** outlines the changes in development factors used in the risk assessment calculation of this Plan.

Table 4-8. Changes in Development Factor

Probability	Description	Vulnerability Factor
High	Changes in development have increased the vulnerability/exposure of the community to the hazard by 10% or more.	3
Medium	Changes in development have increased the vulnerability/exposure of the community to the hazard between 5% and 9%.	2
Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1
No Vulnerability	Changes in development had no effect and/or have decreased the vulnerability/exposure of the community to the hazard.	0

Each category was assigned a weighting factor to reflect the significance, consistent with those typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for *Population Exposure*, and a weighting factor of one (1) was assigned for *Property Exposed* and *Changes in Development*.

4.3.4. Impact Factors

Hazard impacts were assessed in eight (8) categories – population and life/safety, underserved/equity, property damages, economic, environmental, essential operations, future development, and climate change. Numerical impact factors were assigned as follows.

4.3.4.1. Population and Life Safety Factor

Population and life safety values were assigned based on the best available data (historical and probabilistic) for people vulnerable to the hazard event and whether the affected population is likely to experience adverse impacts from the hazard incident. **Table 4-9** outlines the population and life safety factors used in the risk assessment calculation of this Plan.

Table 4-9. Population and Life Safety Factor

Probability	Description	Impact Factor
High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2

Probability	Description	Impact Factor
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1
No Impact	Populations exposed to this hazard are not likely to experience significant adverse impacts.	0

4.3.4.2. Underserved/Equity Factor

Underserved/equity values were assigned based on the best available data for underserved populations vulnerable to the hazard event and whether the affected population is likely to experience adverse/disproportionate impacts from the hazard incident resulting in greater disparity in equity. **Table 4-10** outlines the underserved/equity factors used in the risk assessment calculation of this Plan.

Table 4-10. Underserved/Equity Factor

Probability	Description	Impact Factor
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1
No Impact	Underserved populations exposed to the hazard are not likely to experience significant adverse/disproportionate impacts.	0

4.3.4.3. Property Damage Factor

Property damage values were assigned based on the expected total property damage incurred from a hazard incident. It is important to note that values represent estimates of the loss from a major incident based on historical data or probabilistic models/studies. **Table 4-11** outlines the property damage factors used in the risk assessment calculation of this Plan.

Table 4-11. Property Damage Factor

Probability	Description	Impact Factor
High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3
Medium	More than $500,000 but less than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2
Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1
No Impact	Little to no property damage is expected from a single major hazard event.	0

4.3.4.4. Economic Factor

An estimation of the impact, expressed in terms of dollars, on the local economy is based on a loss of business revenue, crops, worker wages, and local tax revenues or on the impact on the local gross domestic product (GDP). **Table 4-12** outlines the economic factors used in the risk assessment calculation of this Plan.

Table 4-12. Economic Factor

Probability	Description	Impact Factor
High	Where the total economic impact is likely to be greater than $10 Million.	3
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 Million.	2
Low	Total economic impact is not likely to be greater than $100,000.	1
No Impact	Virtually no significant economic impact.	0

4.3.4.5. Environmental Factor

An estimate of the environmental impact from a major hazard event requiring outside resources and support; and/or repair, clean-up, restoration, and/or preservation work. **Table 4-13** outlines the environmental factors used in the risk assessment calculation of this Plan.

Table 4-13. Environmental Factor

Probability	Description	Impact Factor
High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.	3
Medium	Environmental impact from a single major hazard event is likely to be localized, requiring some outside resources and support; and/or repair, clean-up, restoration, or preservation work.	2
Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1
No Impact	No environmental impacts from a single major hazard event are likely.	0

4.3.4.6. Essential Operations Factors

The essential operations factor is the impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community after a single major hazard event. **Table 4-14** outlines the essential operations factors used in the risk assessment calculation of this Plan.

Table 4-14. Essential Operations Factor

Probability	Description	Impact Factor
High	Impact greater than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	3

Probability	Description	Impact Factor
Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2
Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1
No Impact	No impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	0

4.3.4.7. Future Development Factor

The future development factor is the potential that future development will have on increasing or decreasing the impact/consequence of the hazard. **Table 4-15** outlines the future development factors used in the risk assessment calculation of this Plan.

Table 4-15. Future Development Factor

Probability	Description	Impact Factor
High	Future development trends will increase the impact/consequence of the hazard by 10% or more.	3
Medium	Future development trends will increase the impact/consequence of the hazard between 5% and 9%.	2
Low	Future development trends will increase the impact/consequence of the hazard by 4% or less.	1
No Impact	Future development trends will not increase the impact/consequence of the hazard, and/or may even decrease the impact/consequence of this hazard.	0

4.3.4.8. Climate Change Factor

The potential that climate change will increase the risk of the hazard (i.e., type, location, and range of anticipated intensities of the hazard and impacts). **Table 4-16** outlines the climate change factors used in the risk assessment calculation of this Plan.

Table 4-16. Climate Change Factor

Probability	Description	Impact Factor
High	Climate change trends will significantly increase the risk of this hazard and its impacts.	3
Medium	Climate change trends will increase the risk of this hazard and its impacts, but not significantly.	2
Low	Climate change trends will minimally increase the risk of this hazard and its impacts.	1
No Impact	Climate change trends will not increase the risk of this hazard and its impacts.	0

Each category was assigned a weighting factor to reflect its significance, consistent with those typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for *Population and Life Safety*, and *Underserved/Equity*, and a weighting factor of two (2) was assigned

for *Property Damage*. A weighting factor of one (1) was assigned for *Economic*, *Environmental*, *Essential Operations, Future Development*, and *Climate Change*.

4.4. FEMA NATIONAL RISK INDEX SCORES

The National Risk Index (NRI) is a dataset and online tool to help illustrate the United States communities most at risk communities for 18 natural hazards. These include:

- Avalanche
- Coastal Flooding
- Cold Wave
- Drought
- Earthquake
- Hail
- Heat Wave
- Hurricane
- Ice Storm
- Landslide
- Lightning
- Riverine Flooding
- Strong Wind
- Tornado
- Tsunami
- Volcanic Activity
- Wildfire
- Winter Weather

All the hazards on this list are not applicable to Kittitas County; therefore, only those hazards with a defined risk to the County will be included in this Plan. The NRI's goal is to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

In the NRI, risk is defined as the potential for negative impacts as a result of a natural hazard. The Risk Index is based on three (3) components – a natural hazards component (Expected Annual Loss), a consequence enhancing component (Social Vulnerability), and a consequence reduction component (Community Resilience). Using these components, the composite and hazard type Risk Index values are calculated for each community (county and Census Tract). Risk Index values form an absolute basis for measuring Risk within the NRI and are used to generate Risk Index percentiles and ratings across communities.[49]

Table 4-17 illustrates the Risk Index rating and score for Kittitas County.

Table 4-17. Risk Index Score for Kittitas County (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	84.4
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

4.4.1. Expected Annual Loss

The Expected Annual Loss (EAL), the natural hazards component of the NRI, represents the average economic loss in dollars resulting from natural hazards each year. It is calculated for each hazard type and quantified loss for relevant consequence types such as, buildings, people, and agriculture. The EAL score and rating represents a community's relative level of expected losses each year when compared

[49] Federal Emergency Management Agency. (2023). Determining Risk. Retrieved from https://hazards.fema.gov/nri/determining-risk.

to other communities at the same level. Since the score is associated to a community's risk; the higher EAL score results in a higher Risk Index score.[50]

Table 4-18 illustrates the EAL rating and score for Kittitas County.

Table 4-18. Expected Annual Loss for Kittitas County (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	85.9
Expected Annual Loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).		

An EAL score and rating is calculated independently for each consequence type (i.e., buildings, population, and agriculture) for each county and Census Tract. The population EAL is measured in fatalities and injuries while the building and agriculture values are measured in dollars. However, for consistency in the unit of measurement, the population EAL was monetized into population equivalence using a value of statistical life (VSL) approach where each fatality or 10 injuries is treated as $11.6 Million of economic loss.

4.4.2. Social Vulnerability

Social vulnerability, the consequence enhancing risk component of the NRI, measures the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. The Social Vulnerability score and rating represent the relative level of a community's social vulnerability compared to all other communities at the same level. A higher Social Vulnerability score results in a higher Risk Index score.[51]

Table 4-19 illustrates the Social Vulnerability rating and score for Kittitas County.

Table 4-19. Social Vulnerability for Kittitas County (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively Low	30.1
Social Vulnerability is measured using the Social Vulnerability Index (SoVI) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).		

4.4.3. Community Resilience

Community resilience, the consequence reduction risk component, measures the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The Community Resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. Since the score is inversely proportional to a community's risk; the higher Community Resilience score results in a lower Risk Index score.[52]

[50] Federal Emergency Management Agency. (2023). Expected Annual Loss. Retrieved from https://hazards.fema.gov/nri/expected-annual-loss.
[51] Federal Emergency Management Agency. (2023). Social Vulnerability. Retrieved from https://hazards.fema.gov/nri/social-vulnerability.
[52] Federal Emergency Management Agency. (2023). Community Resilience. Retrieved from https://hazards.fema.gov/nri/community-resilience.

Table 4-20 illustrates the Community Resilience rating and score for Kittitas County

Table 4-20. Community Resilience for Kittitas County (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively High	61.4
Community Resilience is measured using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).		

4.5. TOTAL RISK SCORES

Table 4-21 represents the overall risk scores for Kittitas County, based on the Risk Assessment Methodology defined at the beginning of this section. Following a data driven quantitative assessment, reviewing, and ranking local knowledge from local subject matter experts, and developing other risk elements by the Core Planning Team based on data collected. These elements were aggregated to inform the analysis. The hazards are ranked from highest to lowest based on the Total Risk Score. However, if the Risk Score is the same, then it is ranked by the Probability Factor. If the Probability Factor is the same, then it is ranked by the sum of the Impact Factor. If the Impact Factor is the same, then it is ranked by the sum of the Vulnerability Factor.

It is important to note that the sub hazards for severe weather (i.e., strong winds/damaging winds, thunderstorms, cold wave/extreme cold, heat wave/extreme heat, hail, and tornado) and wildfire (i.e., wildfire smoke) were individually ranked in the hazard risk ranking; however, wildfire and severe weather are each considered as the main hazard throughout this Plan.

Table 4-21. 2025 Hazard Risk Score for Kittitas County

Hazard Event	Probability	Consequence (Sum of weighted factors)				Total Risk
	Probability Factor	Extent (sum of the weighted Extent factors)	Vulnerability (sum of the weighted Vulnerability factors)	Impact (sum of the weighted Impact factors)	Consequence Score	Total Risk Score (Probability x Consequence)
Wildfire	3	18	11	30	59	81
Winter Weather *(Blizzard/Heavy Snow, Ice Storm)*	3	15	16	24	55	77
Earthquake	2	12	16	33	61	59
Flood	2	18	11	31	60	59
Strong Winds/Damaging Winds *(Severe Weather)*	3	9	16	15	40	59
Wildfire Smoke *(Wildfire)*	3	9	10	20	39	57
Thunderstorms *(Severe Weather)*	2	6	16	26	48	48
Communicable Diseases / Pandemic	2	18	10	20	48	48
Cold Wave / Extreme Cold *(Severe Weather)*	2	12	12	20	44	45
Avalanche	3	9	6	13	28	43
Heat Wave / Extreme Heat *(Severe Weather)*	2	12	12	17	41	42
Landslide	2	12	12	13	37	39
Drought	2	9	6	16	31	33
Hail *(Severe Weather)*	1	6	16	16	38	22
Tornado *(Severe Weather)*	1	6	16	16	38	22
Dam and Levee Failure	1	9	11	17	37	22

Hazard Event	Probability	Consequence (Sum of weighted factors)				Total Risk
	Probability Factor	Extent (sum of the weighted Extent factors)	Vulnerability (sum of the weighted Vulnerability factors)	Impact (sum of the weighted Impact factors)	Consequence Score	Total Risk Score (Probability x Consequence)
Volcanic Activity	1	12	6	15	33	20

Total Risk Score Legend						
Classification	Probability Factor	Extent (sum if the weighted Extent factors)	Vulnerability (sum if the weighted Vulnerability factors)	Impact (sum if the weighted Impact factors)	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6. HAZARD PROFILES

4.6.1. Avalanche

4.6.1.1. Description

Avalanches are a rapid flow of snow down a hill or mountainside. Avalanches can occur whenever a sufficient depth of snow is deposited on slopes steeper than about 20 degrees, with the most dangerous coming from slopes between 35 and 40 degrees. Areas prone to avalanches can be identified with some accuracy because they typically follow the same paths year after year (i.e., scarring paths). However, unusual weather conditions can produce new paths or cause avalanches to extend beyond their normal paths.[53]

An avalanche begins when an unstable mass of snow breaks away from a slope. Subsequently, snow picks up speed as it moves downhill, producing a river of snow and a cloud of icy particles. As the snow mass moves down the slope it picks up more snow. A large, fully developed avalanche can weigh as much as a million tons and travel faster than 200 miles per hour (mph).[54]

A snowpack is layers of snow, each one from a different snowfall, which becomes compacted under the weight of subsequent layers that lie on the top. It remains on the ground until warmer temperatures cause it to melt (i.e., snowmelt) in the spring. Snowmelt is an important source of water for many areas, such as Kittitas County.[55] Bonds between the layers in a snowpack can be weak when snow refreezes in between snowfalls. When snow refreezes, it causes a slick coating of ice to form on the surface and when new snow falls it may not stick and slide off. As temperatures warm up during the spring melted snow can seep through a snowpack making the lower layer slippery. Subsequently, adding weight or vibration (e.g., skier) to these conditions can create an avalanche.[56]

Factors that influence the occurrence of an avalanche are weather, temperature, wind, slope steepness, terrain, vegetation, and general snowpack conditions. Avalanches are most likely to occur when fresh snowfall adds to a new layer to a snowpack and if the new snow piles during the storm, the snowpack may become overloaded setting off a slide. Earthquakes can set off avalanches as well.[57]

In the high alpine regions of the Cascade Mountains, avalanches are a year-round event. However, the typical avalanche season usually begins in November and continues into early summer.[58]

Avalanches are categorized based on physical, objective, and observable characteristics (e.g., hard or soft, wet or dry). Sometimes an avalanche can be classified as two (2) different types. For example, a

[53] Peninsula Emergency Management Coalition. (n.d.). Avalanches. Retrieved from https://www.pep-c.org/uploads/1/2/4/0/124049041/avalanches.pdf.
[54] National Geographic. (n.d.). Avalanche. Retrieved from https://education.nationalgeographic.org/resource/avalanche/.
[55] National Geographic. (n.d.). Snowpack. Retrieved from https://education.nationalgeographic.org/resource/snowpack/.
[56] National Geographic. (n.d.). Avalanche. Retrieved from https://education.nationalgeographic.org/resource/avalanche/.
[57] Ibid.
[58] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.

dry snow avalanche may turn into a wet snow avalanche as it moves down the mountain where the snow conditions change. The different types of avalanches are explained in **Table 4-22**..[59]

Table 4-22. Avalanche Types

Type	Description
Dry	An avalanche that breaks in dry snow. Dry snow can be found when the temperature is below freezing, and it is characterized by frozen ice crystals lacking moisture. Dry avalanches can be either dry loose avalanches or dry slabs. Dry snow fails when additional stress overcomes the strength of the snowpack, either from new snow loading, wind loading, falling cornices, or human triggers. Dry avalanches are characterized by relatively fast flow, often with a powder cloud. They are the most common type of avalanche encountered during typical mid-winter conditions and account for the majority of avalanche fatalities.
Wet	An avalanche that breaks in or entrains wet snow. Wet snow is at its melting point, characterized by some amount of liquid water existing between snow grains. In certain situations, increased liquid water content causes the snowpack to lose strength and avalanche. These wet avalanches can be released from a single point (wet loose) or as a cohesive slab (wet slab) and can occur from rain on snow, strong solar input, or warm temperatures. Although wet snow avalanches are typically slower than dry snow avalanches, they can move very quickly in steep and constrained terrain, and they produce very dense and destructive debris. They are commonly recognized by the presence of striations on the bed surface, debris leaves along the track, and snowballs in the debris. Wet avalanches account for fewer fatalities than dry snow avalanches. Accidents are often attributed to misjudging the timing of natural avalanches or underestimating the danger of getting caught in slow-moving wet snow debris.
Hard Slab	A slab avalanche of relatively dense, compacted snow. These slabs are hard and dense enough that it is difficult to push a single finger into them and are often characterized by hard, blocky debris. Hard slabs can be thin, formed from heavily wind compacted snow, or much thicker, formed as snow hardens under the weight of several storm events. Hard slabs are difficult to manage because stiffer slabs tend to give less feedback and are more likely to fail far above you. Hard slabs are notorious for unpredictable failures. You are most likely to trigger one from a thinner or softer part of the slab (e.g., near rock outcrops or near the edge of a slope).
Soft Slab	A slab avalanche of relatively soft, low density snow. These slabs are soft and low density enough that you can push a gloved hand or fingers into them. They are often characterized by soft, powdery debris. Soft slabs can vary in thickness, and most often form in the upper snowpack from recent storm events. Although soft slabs tend to give more feedback than hard slabs, they can still be triggered remotely or from below the fracture line, depending on conditions.
Loose Snow	An avalanche that releases from a single point and entrains cohesionless snow as it fans downhill. Loose snow avalanches (i.e., sluffs or point releases) vary in size, depending on how much snow is entrained and on the size of the terrain feature where they occur. Loose snow avalanches release immediately below their trigger point and are typically smaller and more predictable than slab avalanches. As a result, they cause fewer avalanche fatalities. Accidents involving loose snow avalanches often result from victims getting dragged into terrain traps (e.g., gullies, cliffs, couloirs, or trees). Wet loose avalanches can pack a heavier punch and grow to very destructive sizes.

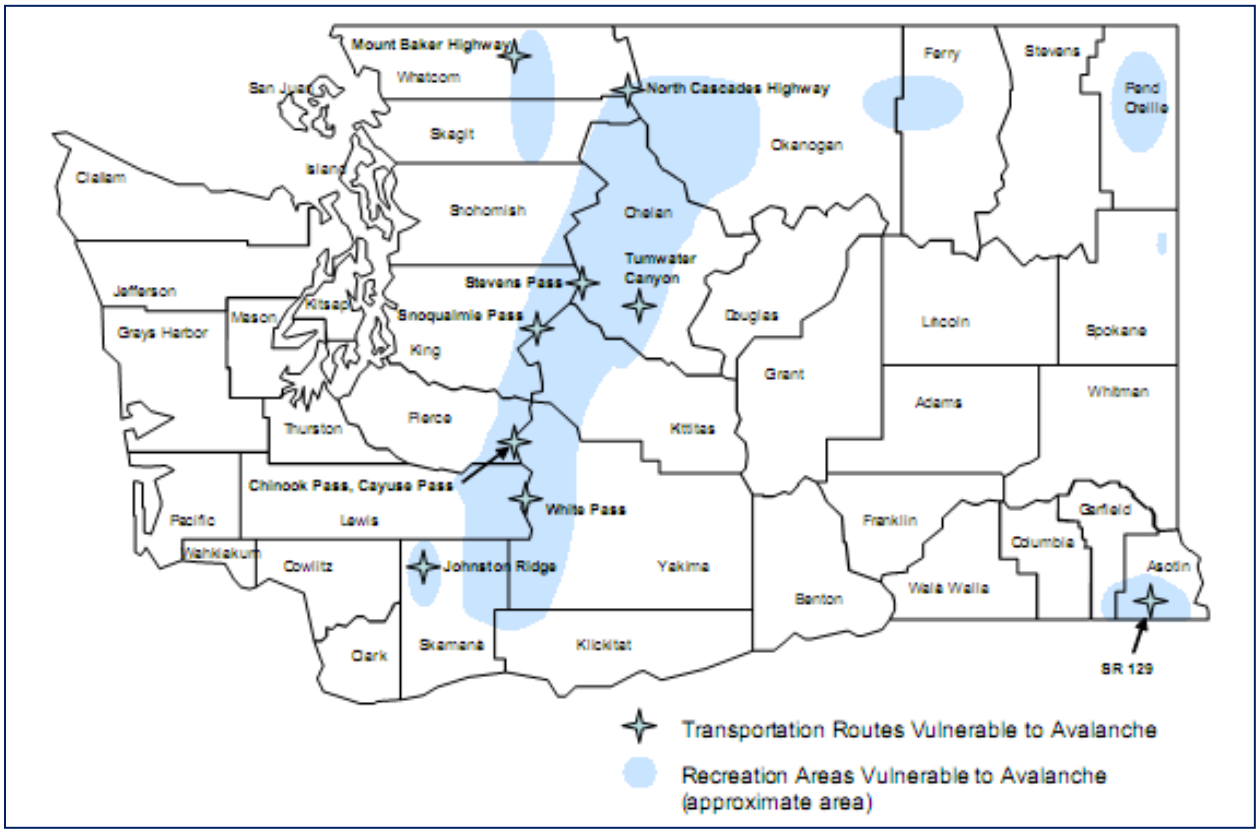
[59] Avalanche.org. (n.d.) Avalanche Encyclopedia: Avalanche Types. Retrieved from https://avalanche.org/avalanche-encyclopedia/#avalanche-type.

Type	Description
Cornice Fall	An overhanging mass of wind-deposited snow that breaks off of a ridgeline and tumbles down the slope. Cornices typically form on the leeward side of a sharp, wind-exposed terrain break (e.g., a ridge crest or summit). Cornice falls can trigger additional slab avalanches on the slope below, or they can simply consist of the cornice and any additional snow entrained by the cornice blocks. Accidents typically involve cornices breaking unexpectedly below ridgeline travelers, or occasionally from natural cornice falls that overtake travelers on slopes below.

4.6.1.2. Hazard Location

The Cascade Range in the western half of Kittitas County receives extensive precipitation due to its size and orientation to the flow of Pacific marine air. In the local maritime climate, it is common for air temperatures to rise above freezing and for precipitation to change from snow to rain during mid-winter storm cycles. Temperatures can change several degrees within minutes, causing abrupt changes in precipitation type. These conditions frequently cause the release of avalanches. **Figure 4-1** shows the areas vulnerable to avalanches in Washington State, including the westernmost portion of Kittitas County, which includes the Snoqualmie Pass. The majority of this area is included in Unincorporated Kittitas County. The cities of Roslyn and Cle Elum, and the Town of South Cle Elum are located on the edge of this hazard area. Due to their location on the periphery and mitigation efforts, these jurisdictions have very low levels of risk from avalanche.

Figure 4-1. Areas Vulnerable to Avalanches



4.6.1.3. Hazard Extent/Intensity

The Northwest Avalanche Center (NWAC) produces daily avalanche forecasts for 10 zones across the State of Washington and northern Oregon during the winter season. Field-based avalanche forecasters

and meteorologists analyze snow observations from across the area and weather forecast guidance to create a forecast specific to each zone.

On a daily basis, avalanche and snowpack information comes in from NWAC forecasters and professional observers, avalanche professionals, backcountry travelers, and remote weather stations from around the region. Professional ski patrols, highway avalanche control programs, national park and forest rangers, ski guides, and other professionals share information with NWAC throughout the winter season in order to ensure that the best and most pertinent information becomes incorporated into the forecasts.[60]

The North American Public Avalanche Danger Scale (NAPADS) is a system that rates avalanche danger and provides general travel advice based on the likelihood, size, and distribution of expected avalanches. It consists of five (5) levels, from least to highest amount of danger – low (1), moderate (2), considerable (3), high (4), extreme (5). Danger ratings are typically provided for three (3) distinct elevation bands. Although the danger ratings are assigned in numerical levels, the danger increases exponentially between levels. In other words, the hazard rises more dramatically as it ascends toward higher levels on the scale. **Table 4-23** lists and describes the five (5) levels of the NWAC Danger Scale.[61]

Table 4-23. North American Public Avalanche Danger Scale

Scale	Travel Advice	Likelihood	Size and Distribution
Low (1)	**Generally safe avalanche conditions.** Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.
Moderate (2)	**Heightened avalanche conditions on specific terrain features.** Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
Considerable (3)	**Dangerous avalanche conditions.** Careful snowpack evaluation, cautious route-finding and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
High (4)	**Very dangerous avalanche conditions.** Travel in avalanche terrain not recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
Extreme (5)	**Extraordinarily dangerous avalanche conditions.** Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Very large avalanches in many areas.

NWAC partners with the National Weather Service (NWS) to help disseminate avalanche advisories to the general public. **Table 4-24** lists and describes the different types of NWAC avalanche advisories.[62]

[60] Northwest Avalanche Center. (n.d.). About Forecasts. Retrieved from https://nwac.us/about-the-forecasts-2/.
[61] Northwest Avalanche Center. (n.d.). North American Public Avalanche Danger Scale. Retrieved from https://avalanche.org/avalanche-encyclopedia/human/resources/north-american-public-avalanche-danger-scale/.
[62] Northwest Avalanche Center. (n.d.). About Forecasts. Retrieved from https://nwac.us/about-the-forecasts-2/.

Table 4-24. Northwest Avalanche Center Avalanche Advisories

Type	Definition
Special Avalanche Bulletin	Issued when significant public use is expected and dangerous avalanche conditions exist, but the avalanche conditions do not meet the level necessary to issue an Avalanche Warning. This is an impact-based product.
Avalanche Watch	Issued when there is high confidence that warning conditions will develop within 24 and 48 hours of the forecast issuance. An Avalanche Watch will likely be upgraded to a warning closer to the anticipated event.
Avalanche Warning	Issued when High avalanche danger is expected within 24 hours of the forecast issuance for many areas. Many areas can mean very large geographic areas or several aspects and/or elevations in a specific geographic area. Avalanche Warnings are not issued when the danger is high in specific or isolated areas. Furthermore, warnings can be issued when non-recreationalists or people who would not otherwise access the avalanche forecast are expected to be adversely impacted. NWAC will always issue an avalanche warning when the danger is at least *High* or *Extreme* (per the NAPADS) in all three (3) elevation bands – below treeline, near treeline and above treeline.

4.6.1.4. Probability and Frequency

The probability of occurrence for an avalanche occurring in Kittitas County is high because avalanche events occur annually. According to the 2023 Washington State Enhanced Hazard Mitigation Plan, the probability of a future avalanche related disaster declarations each year is less than 1% in the State. Avalanches occur regularly every year in mountain areas. Many weather and terrain factors determine avalanche danger. At lower elevations of the Cascades, the avalanche season begins in November and continues until the last remnants of snow have melted in early summer. In the high alpine regions, the hazard continues year round. Hundreds of thousands of avalanches are thought to occur each year in the Cascades. While the probability of avalanches occurring each year is very high, there is a very low impact on the planning area due to the remote locations of events and mitigation efforts along developed areas. Avalanches along two (2) main mountain highway passes are limited due to ongoing mitigation to control slides during the winter months.

The avalanche annualized frequency value represents the average number of recorded avalanche hazard occurrences, in event days, per year over the period of record. **Table 4-25** outlines the annualized frequency for avalanches, based on FEMA NRI data, for Kittitas County.

Table 4-25. Avalanche Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(1960 – 2019)*	Annualized Frequency
Kittitas County	7	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.1.5. Past Events

Avalanches occur frequently each year and kill, on average, one (1) to two (2) people annually in Washington and about 28 people annually in the United States.[63,64] Avalanches have killed more people in Washington than any other hazard during the past century. In 90% of avalanche fatalities, the weight

[63] Washington Emergency Management Division. (n.d.). Avalanche. Retrieved from https://mil.wa.gov/avalanche.
[64] Federal Emergency Management Agency. (n.d.). Avalanche: Impact. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Avalanche-Impact.

of the victim or someone in the victim's party triggers the slide. According to the NWAC, avalanches have killed approximately 63 people in Washington since 1997.[65] The deadliest avalanche in United States history occurred in 1910 in Wellington, Washington resulting in 96 fatalities.[66] NWAC has reported 32 avalanche events in Kittitas County, listed in **Table 4-26**, that have resulted in injuries and/or fatalities between 1997 and 2023.[67]

Table 4-26. Avalanche Past Events

Date	Description
February 6, 2021	A group of four (4) snowmobilers access terrain for back country snowboarding starting from the Easton Reload Sno-Park (off of Interstate 9). On a northwest aspect, estimated at 5,800 feet they triggered a very large avalanche which fully buried one (1) snowboarder. The group quickly located and uncovered the victim within three (3) minutes uninjured and able to return to the trail head without assistance.
January 31, 2021	Two (2) skiers were caught and carried by a slab avalanche in Bryant Peak, Snoqualmie Pass. One (1) skier sustained a knee injury. The crown depth varied from four (4) to 20 inches. The group ended up traversing above cliffs between Great Scott Bowl and the Bryant Peak Couloir in low visibility conditions. After descending 200 to 300 vertical feet, the skiers realized that they had cliffed out. The skiers ascended back uphill, first following their ski tracks on skis and then by boot when they triggered an area of wind affected snow. The avalanche swept both skiers 300 vertical feet through trees and over small cliff features, narrowly missing larger cliff bands. The slide occurred on a northeast aspect around 5,200 feet. Alpental Patrol responded to help extricate the injured skier while the other skier was able to self-rescue.
February 8, 2021	Two (2) snow bike riders left the French Cabin Creek Snopark near Salmon la Sac (near Cle Elum Lake) to go riding in the Knox Creek area and triggered an avalanche from somewhere in the lower start zone. The two (2) bikers were caught – one (1) was partially buried while the other was buried and killed.
March 3, 2018	Four (4) snowmobilers were involved in a slab avalanche accident just south of Longs Pass near Esmerelda Peak. All four (4) snowmobilers were caught and carried by the avalanche and with two (2) were killed. The avalanche was approximately 450 to 500 feet wide, 2.5 to three (3) feet deep, and traveled 1,500 vertical feet.
February 25, 2018	Two (2) teenagers were killed by a slab avalanche that released on a south aspect at 4,250 feet in Source Lake-Snow Lake Divide, Alpental Valley (Snoqualmie Pass area). The avalanche was estimated at 350 feet wide and ran 500 vertical feet into mature timber with crown depths up to 36 inches.
February 25, 2018	One (1) snowmobiler was caught, carried, and killed by a slab avalanche that released above Cottonwood Lake, Snoqualmie Pass. The avalanche debris was up to 6 feet deep. There were another four (4) snowmobilers in the group who suffered minor injuries and were partially buried with one partial critical burial.
February 18, 2018	A snowboarder triggered a slab avalanche adjacent to the Alpental Ski Area on a northeast aspect. The snowboarder was caught, carried, and partially buried. The avalanche extended from the normal path and ran into the resort in an area known as Powder Bowl. The avalanche hit a ski patroller and his avalanche dog conducting training. The dog was caught and carried, though neither the patroller nor dog were injured or buried. The snowboarder was rescued by Alpental Ski Patrol and sustained injuries needing additional treatment.

[65] Northwest Avalanche Center. (2024). Northwest Avalanche Accident Summaries. Retrieved from https://nwac.us/accident-reports/.
[66] Lesatele, E. (2023). The Deadliest Avalanche in American History. Retrieved from https://medium.com/@ella.lesatele/the-deadliest-avalanche-in-american-history-71b00138925.
[67] Northwest Avalanche Center. (2024). Northwest Avalanche Accident Summaries. Retrieved from https://nwac.us/accident-reports/.

Date	Description
April 11, 2017	The body of a male skier was recovered on the southwest side of Red Mountain, Commonwealth Basin by local search and rescue team. The skier was traveling alone with skis on a pack when caught by an avalanche. The skier was recovered on a treed slope and died of blunt force trauma.
March 4, 2017	A skier in a group of three (3) triggered a slab avalanche near the summit of Avalanche Mountain (Snow Lake area) on a 38 to 40 degree west facing aspect near 5,200 feet. The first skier made a few turns and was able to move out of the way. The second skier was carried approximately 300 vertical feet down slope until he hit a tree, breaking his femur.
March 4, 2017	Two (2) snowmobilers were caught and carried in an avalanche in a southeast facing bowl on Hawkins Mountain, Central Cascades after one (1) of the snowmobilers high-marked near the top of the bowl and triggered the avalanche. A separate group of two (2) snowmobilers resting in the run further below were able to escape on foot but their sleds were caught and buried. The two (2) snowmobilers that were caught, one (1) was partially buried with only his hand sticking out (enabling rescue) and the other was completely buried and killed.
December 31, 2015	A snowshoer was caught by a small wind slab avalanche in Granite Mountain, Snoqualmie Pass. The snowshoer was carried into the trees and died of trauma injuries.
December 19, 2015	There was one (1) probable avalanche fatality. The terrain in which the victim was found, body position, information from the coroner's report, and documented human and natural avalanches in the immediate and surrounding terrain all support the likelihood of an avalanche fatality in Alpental Valley, Commonwealth Basin (Snoqualmie Pass area).
December 17, 2015	Two (2) skiers were caught in two (2) separate human triggered soft slab avalanches in Alpental Valley, Snoqualmie Pass area. One (1) skier was fully buried, and the other was partially buried, and both were able to self-rescue.
April 27, 2014	Two (2) skiers triggered and were caught in an avalanche in Slot Couloir, Snoqualmie Mountain. One (1) skier was seriously injured.
March 22, 2014	Two (2) skiers triggered and were caught in an avalanche in Granite Mountain, near Snoqualmie Pass. One (1) skier was killed.
February 22, 2014	Three (3) skiers were caught by a deep slab avalanche in Chair Peak, near Snoqualmie Pass. All skiers were partially buried and able to self-rescue with no injuries.
January 4, 2014	A climber triggered and was caught in an avalanche in Chair Peak, near Snoqualmie Pass. The climber was partially buried and was able to self-rescue.
April 13, 2013	Three (3) climbers were caught in an avalanche in Granite Mountain, near Snoqualmie Pass. One (1) climber was killed..
April 13, 2013	Multiple snowshoers were caught in an avalanche in Red Mountain, near Snoqualmie Pass. One (1) snowshoer was killed.
January 15, 2013	Two (2) climbers caught in an avalanche in Chair Peak, Snoqualmie Pass. One (1 climber was injured.
February 19, 2012	Two (2) snowboarders were caught in an avalanche in Alpental, Snoqualmie Pass. One (1) snowboarder was killed.
January 21, 2012	Three (3) skiers were caught and partially buried in an avalanche in Alpental, Snoqualmie Pass. All victims were able to self-rescue with no injuries.
April 6, 2011	A group of five (5) skiers triggered a soft slab avalanche in Mount Snoqualmie. Three (3) were caught in the avalanche, and two (2) were seriously injured and one (1) had minor injuries.
April 9, 2010	Two (2) skiers were caught and partially buried in Kendall Peak, Snoqualmie Pass. One (1) was slightly injured while the other was critically injured.
December 2, 2007	Three (3) hikers caught were caught in an avalanche in Snow/Source Lake Trail, Snoqualmie Pass. One (1) hiker was partially buried, injured, and self-rescued. Two (2) hikers were completely buried and killed.
January 12, 2005	Two (2) skiers were caught in an avalanche in Alpental, Snoqualmie Pass. One (1) skier was partially buried and was able to self-recue. One (1) was completely buried and killed.

Date	Description
December 13, 2003	One (1) snowshoer was caught, buried, and killed by an avalanche in Snoqualmie Pass. The victim was found on December 20, 2023.
March 29, 2003	One (1) skier was caught and partly buried after an avalanche in Granite Mountain, Snoqualmie Pass. The skier was seriously injured.
March 10, 2002	One (1) skier was caught and buried after an avalanche in Granite Mountain, Snoqualmie Pass. The skier was rescued by the partner.
January 27, 2002	One (1) snowshoer was caught and buried in an avalanche in Gold Creek, Snoqualmie Pass. The snowshoer was rescued by own dog.
January 24, 2002	Two (2) overnight campers were caught in an avalanche while in a tent in Source Lake, Snoqualmie Pass. Both self-rescued without major injuries.
January 18, 1998	One (1) snowmobiler was caught, buried, and killed while high marking in Lion Rock near Blewett Pass, central Washington Cascades.

4.6.1.6. Vulnerability and Impacts

Life Safety and Health: Avalanches pose a significant threat to life safety and health in Kittitas County, as a result of the region's geographical features, climatic conditions, and human activities. Avalanches can cause serious injury and loss of life which occur, on average, annually within the County. Individuals that get caught in an avalanche sustain serious injuries such as fractures, head trauma, hypothermia, and suffocation as a result of being buried in snow.[68] Although avalanches tend to occur in remote locations, Kittitas County is a popular destination for winter sports (e.g., skiing, snowboarding, snowmobiling) which exposes these individuals to avalanche prone areas. Although those that ski within the ski result boundaries, which have ski maintenance protocols, have a low vulnerability if they go outside these boundaries they become more vulnerable. Additionally, those working in mountains (e.g., miners and loggers), recreational users (e.g., hikers and cross country skiers) remain vulnerable.

Property Damage and Critical Infrastructure: Most of the avalanche hazard areas in Kittitas County are uninhabited or has minimal development. Therefore, damage to property remains low. The ski resorts that are located throughout the County have a low vulnerability to avalanches because of ski maintenance protocols in place within the resort boundary.

Snoqualmie Pass (Interstate 90) is a critical transportation corridor connecting the large population and business centers of the Puget Sound with the agricultural industries and recreational activities of eastern Washington through the Cascade Mountains.[69] Daily traffic through Snoqualmie Pass averages about 31,000 vehicles (approximately 23,000 passenger vehicles and 8,000 freight vehicles) and volumes can increase to more than 58,000 on weekends and holidays.[70] According to the Washington State Department of Transportation (WSDOT), in 2009, travel across the Pass is increasing at a rate of 2.1% annually and the number of vehicles to use Interstate 90 are expected to increase to 52,000 daily by 2028.[71] In the last couple of years, WSDOT implements avalanche mitigation (i.e., avalanche control) along Interstate 90. Mitigation activities include intentionally triggering avalanches on slopes above the

[68] Federal Emergency Management Agency. (n.d.). Avalanche: Impact. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Avalanche-Impact.
[69] Washington State Department of Transportation. (n.d.). I-90 – Snoqualmie Pass East Project. Retrieved from https://wsdot.wa.gov/construction-planning/major-projects/i-90-snoqualmie-pass-east-project.
[70] AASHTO. (2020). I-90 Snoqualmie Pass East Keeps the Economy Moving, People and Wildlife Safe. Retrieved from https://benefits.transportation.org/i-90-snoqualmie-pass-east-keeps-the-economy-moving-people-and-wildlife-safe/.
[71] United States Department of Transportation, Federal Highway Administration. (2009). Reconstructing Snoqualmie Pass. Retrieved from https://highways.dot.gov/public-roads/julaug-2009/reconstructing-snoqualmie-pass.

roadways in a controlled environment to minimize traffic disruption, passive avalanche control by building elevated roadways so avalanches can pass under highways, snow sheds so that avalanches flow over highways, catchment basins to stop avalanche flow, and diversion dams and berms to keep snow off highways.[72]

Economy: Avalanches cause direct and indirect economic losses to the public and private sector by disrupting recreational facilities, blocking transportation routes, occasionally destroying property, and through expensive rescue efforts of stranded victims.[73] Kittitas County's economy heavily relies on winter tourism (e.g., skiing, snowboarding, snowmobiling) and a severe avalanche event that can prolong impacts to recreational areas can deter tourists resulting in reduced revenue for tourism and local businesses. Furthermore, closures to Snoqualmie Pass (Interstate 90) can have significant implications for the County and State economy because it can impact freight transport, local businesses' ability to received inventory, tourism, and public services. For example, WSDOT estimates that a two (2) hour closure of Snoqualmie Pass can cost the State's economy over $1 Million.[74] In 2008, a four (4) day closure of Interstate 90 at Snoqualmie Pass cost the State 170 jobs (for one (1) year after the closure), $27.9 Million in total losses in the economic output, $1.42 Million losses in the State tax revenue, and $8.6 Million reduction in personal income.[75]

Changes in Development and Impact of Future Development: Most avalanche prone areas in Kittitas County remain uninhabited or with minimal development. Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to avalanches. Future development may minimally increase (4% or less) the impact of avalanches within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population face unique vulnerabilities and impacts as a result of avalanches. These groups include, but are not limited to, low-income families, elderly, individuals with disabilities, those with limited English proficiency, and those without adequate access to emergency resources. These groups may not have access to the appropriate avalanche equipment and education on avalanche risk. Furthermore, these groups may not have access to accurate and timely information due to limited internet access, language barriers, and living in isolated areas. Therefore, critical avalanche warnings may not reach these groups in a timely manner which results in higher injury and mortality rates within these communities. Additionally, individuals living in isolated areas with limited access (e.g., one (1) road in and one (1) road out) are vulnerable to being cut off from community lifelines if an avalanche were to block access to the area for an extended period of time.

Effects of Climate Change in Severity of Impacts: The main driver of avalanches is weather, not climate. Snow avalanches are mainly ruled by temperature fluctuations, heavy precipitation, and wind patterns. Studies show that climate change can affect extreme weather events (e.g., heavier snowfall

[72] Washington State Department of Transportation. (n.d.). Avalanche Control. Retrieved from https://wsdot.wa.gov/travel/operations-services/avalanche-control.
[73] Spencer, J. (2011). Avalanche Fatalities in the Wester United States: A Comparison of Three Databases. Retrieved from https://www.researchgate.net/publication/225993162_Avalanche_fatalities_in_the_western_United_States_A_comparison_of_three_databases.
[74] United States Senate Energy and Natural Resources Committee. (2004). Federal Land Recreational Visitor Protection Act: Senate Report. Retrieved from https://www.congress.gov/congressional-report/108th-congress/senate-report/320/1.
[75] Washinton State Department of Transportation. (2008). Storm-Related Closures of I-5 and I-90: Freight Transportation Economic Impact Assessment Report. Retrieved from https://leg.wa.gov/JTC/Meetings/Documents/WSDOT_I5_90ClosuresFinalReport._061808pdf.pdf.

events); however, these types of events have a short term impact on avalanche conditions, but the sequence, intensity, and duration of weather events will be more important.[76] According to the 2019 Intergovernmental Panel on Climate Change Report, avalanches are projected to decline in number and runout distance at lower elevations while avalanches involving wet snow, even in the winter, may occur more frequently due to surface melt or rain-on-snow.[77]

4.6.1.7. FEMA NRI Expected Annual Loss Estimates

An avalanche NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to avalanches when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-27** outlines the avalanche EAL for Kittitas County.

Table 4-27. Avalanche Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$588,314	$868	n/a	$589,181	83.7	Very High
Expected Annual Loss is calculated utilizing an equation that includes exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.1.8. Avalanche Risk Index Scores

The FEMA avalanche Risk Index score and rating represent a community's relative risk for avalanches when compared to the rest of the United States. **Table 4-28** illustrates the avalanche Risk Index rating and score for Kittitas County.

Table 4-28. Avalanche Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	80.8
Expected Annual Loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).		

[76] Horton, S. (2023). Layers of Complexity: Climate Change and the Future of Avalanches. Retrieved from https://www.protectourwinters.ca/layers_of_complexity.
[77] Intergovernmental Panel on Climate Change. (2019). Special Report on the Ocean and Cryosphere in a Changing Climate: High Mountain Areas (Chapter 2). Retrieved from https://www.ipcc.ch/srocc/chapter/chapter-2/.

Table 4-29 represents the avalanche Total Risk Score for Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-29. Avalanche Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Avalanche	3	9	6	13	28	43

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.2. Dam and Levee Failure

4.6.2.1. Description

Dams are a critical and vital part of the nation's infrastructure as they provide a range of benefits, such as irrigation, electrical generation, flood control, renewable/clean energy, water storage, sediment/hazardous materials control, navigation, fisheries, and recreation.[78] Dams are artificial/human-made structures built across a watercourse for the purpose of retaining water.[79] A levee is a human-made structure, usually an earthen embankment or concrete floodwall, designed and constructed to contain, control, or divert the flow of water to provide reasonable assurance of excluding temporary flooding from the levee area.[80]

Dam Failure

The sudden rapid and uncontrolled release of impounded water or liquid-borne solids characterizes a failure. The term "dam failure" encompasses a wide variety of circumstances. Situations that would constitute a dam failure vary widely, from developing problems to a partial or catastrophic collapse of the entire dam. There are numerous potential causes of a dam failure and can be attributed to deficiencies in the original design of the dam, the quality of construction, the maintenance of the dam, operation of the appurtenances and acts of nature including precipitation in excess of the design, flood, and damage from earthquakes. Dam failures are most likely to happen for one (1) of five (5) reasons listed in **Table 4-30**.

Table 4-30. Dam Failure Types[81]

Failure Type	Description
Overtopping	Caused by water spilling over the top of a dam. Overtopping of a dam is often a precursor of dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for approximately 34% of all dam failures in the United States.
Foundation Defects	Include settlement and slope instability, cause about 30% of all dam failures.
Cracking	Caused by movements like the natural settling of a dam.
Inadequate Maintenance and Upkeep	Inadequate Maintenance and Upkeep
Piping	When seepage through a dam is not properly filtered and soil particles continue to progress, and form sink holes in the dam. Another 20% of United States dam failures have been caused by piping (internal erosion caused by seepage). Seepage often occurs around hydraulic structures (e.g., pipes and spillways), through animal burrows, around roots of woody vegetation, and through cracks in dams, dam appurtenances, and dam foundations.

Dam failure is potentially extremely dangerous if it occurs catastrophically with little or no warning. Dam inundation areas may contain large populations and significant critical infrastructure. During a catastrophic failure, the water flow may be dozens of feet high and move at high velocity. For large dams, evacuation procedures may not be adequate to prevent large loss of life and property damage.

[78] FEMA. (2020). The National Dam Safety Program: 25 Years of Excellence. Retrieved from https://www.fema.gov/sites/default/files/2020-08/national-dam-safety-25-years.pdf.
[79] Merriam-Webster. (n.d.). Dam. Retrieved from https://www.merriam-webster.com/dictionary/dam.
[80] United States Army Corps of Engineers. (n.d.). Levees and Flood Risk Management. Retrieved from https://www.nwp.usace.army.mil/Missions/Flood-Risk-Management/Levees/.
[81] Association of State Dam Safety Officials. (n.d.). Understanding Dam Failures. Retrieved from https://damsafety.org/dam-failures.

The State of Washington Department of Ecology Dam Safety Office (DSO) is responsible for overall dam safety within the State. As of December 2023, DSO's inventory of dams includes a total of 1,242 regulated dams in the State of Washington. These dams are defined as structures that can impound 10 acre-feet or more of watery material at the dam crest elevation. Approximately, 51% of the dams in the State are privately-owned and 21% are owned by local government.[82]

Levee Failure

A levee failure can occur when flood waters exceed the height of a levee and flow over its crown (i.e., overtopping); or when breaching occurs. A levee breach can occur gradually or suddenly when part of the levee gives way, resulting in an opening through which floodwater may pass. The most dangerous breaches happen quickly during periods of high water. The resulting stream of water can quickly flood a large area behind the failed levee with little to no warning.[83]

Earthen levees can be damaged in several ways and if severe enough these scenarios can lead to a zone of weakness that could cause a levee breach.

- Strong river currents and waves can erode the surface.
- Trees growing on a levee can blow over, leaving a hole where the root ball and soil used to be.
- Burrowing animals can create holes that enable water to pass through a levee.
- In seismically active areas like Kittitas County, earthquakes and ground shaking can cause a loss of soil strength, weakening the levee potentially resulting in a levee failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.[84]

The United States Army Corps of Engineers (USACE) operates, maintains, and evaluates flood protection levees to determine if they meet accreditation requirements. Most levees are owned by local communities and flood control districts that must ensure proper operation and maintenance of the levee system as well.

4.6.2.2. Hazard Location

The National Inventory of Dams (NID) consists of dams meeting at least one (1) of the following criteria:

- High hazard potential classification – loss of human life is likely if the dam fails.
- Significant hazard potential classification – no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
- Equal or exceed 25 feet in height and exceed 15 acre-feet in storage.
- Equal or exceed 50 acre-feet storage and exceed six (6) feet in height.

Although the goal of the NID is to include all dams in the United States that meet these criteria, in reality, this inventory is limited to information that can be gathered and properly interpreted. In most cases, dams within the NID criteria are regulated (e.g., construction permit, inspection, and/or enforcement) by federal or state agencies, who have basic information on the dams within their jurisdiction. All high hazard dams have Emergency Action Plans (EAP) in place, however due to data privacy and protected information,

[82] State of Washington Department of Ecology. (2023). Inventory of Dams Report. Retrieved from https://apps.ecology.wa.gov/publications/documents/94016.pdf.
[83] American Society of Civil Engineers. (2010). So, You Live Behind a Levee! Retrieved from https://www.spl.usace.army.mil/Portals/17/SoYouLiveBehindLevee.pdf.
[84] Ibid.

this information is not included in this Plan. Existing EAPs include inundation data for all listed High Hazard dams. According to the NID, most High Hazard dams do not include a USACE risk assessment as outlined via the NID tool's risk tab.

According to the NID, there are seven (7) high hazard dams within Kittitas County. **Table 4-31** lists the high hazard dams within Kittitas County and **Table 4-32** lists additional dams within the County classified as low hazard potential.[85] **Figure 4-2** displays the high hazard dams within five (5) miles of Kittitas County.

Table 4-31. High Hazard Dams in Kittitas County

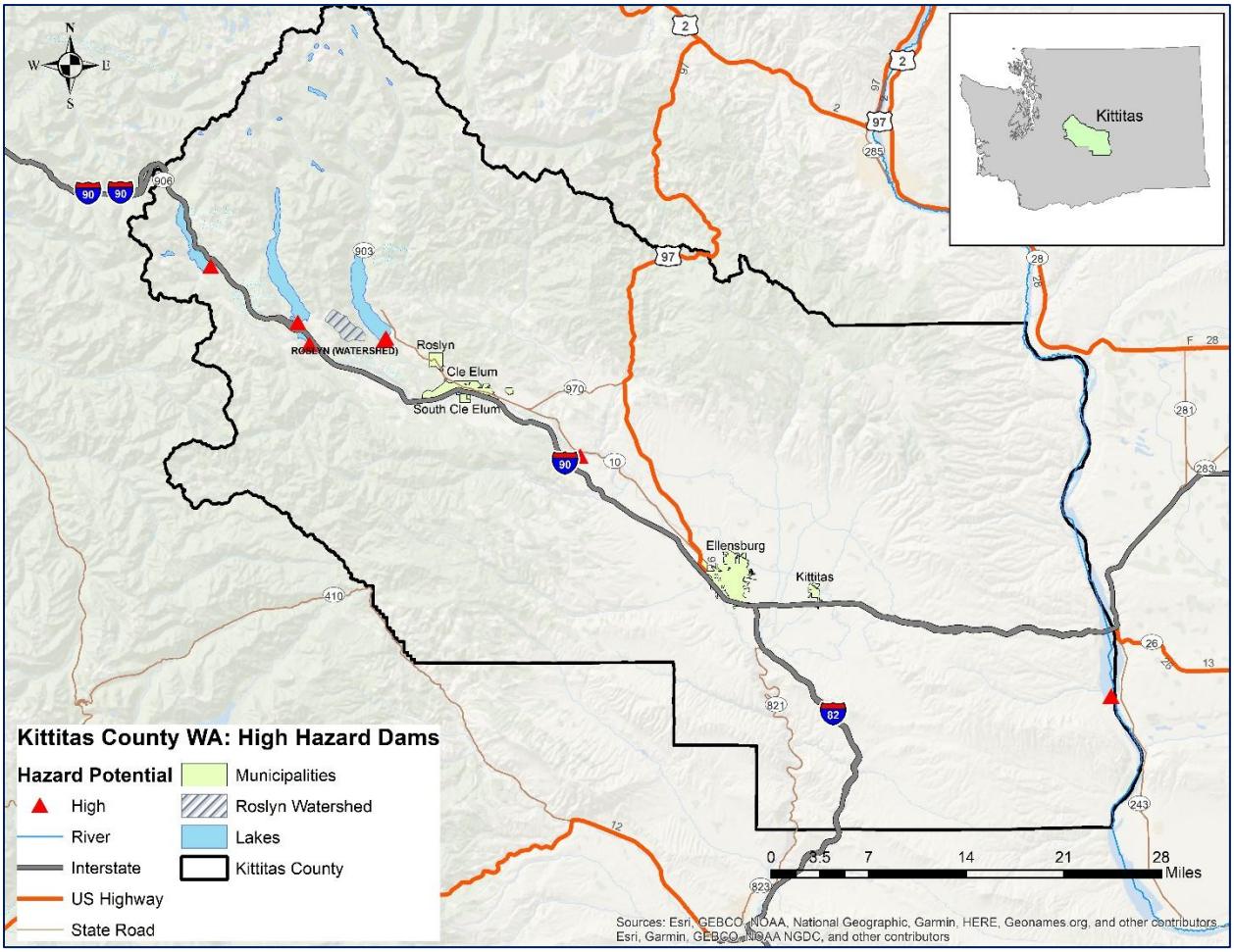
Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	EAP
Cle Elum	WA00274	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	165	437,000	40,000	Yes
Cle Elum Main Dike	WA00274 S001	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	40	437,000	--	Yes
Easton Diversion	WA00276	Kittitas, WA	Federal Bureau of Reclamation	Concrete, Gravity	N/A	N/A	66	4,000	15,000	Yes
Kachess	WA00260	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	115	239,000	5,516	Yes
Keechelus	WA00265	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	128	158,000	11,800	Yes
Upper Sunlight Lake Dam	WA00666	Kittitas, WA	Sunlight Waters Country Club	Earth	Satisfactory	6/24/2020	22	39	3	Yes
Wanapum	WA00085	Kittitas, WA	Grant County Public Utility District	Gravity, Concrete, Rockfill	Fair	4/11/2023	205.5	590,000	1,400,000	Yes

Table 4-32. Additional Dams in Kittitas County

Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*
Cle Elum Dike 1	WA00274 S002	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	13	437,000	--
Cle Elum Dike 2	WA00274 S003	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	13	437,000	--
Cle Elum Dike 3	WA00274 S004	Kittitas, WA	Federal Bureau of Reclamation	Earth	N/A	N/A	13	437,000	--
Roslyn Wastewater Lagoon No 3	WA01652	Kittitas, WA	City of Roslyn	Earth	N/A	N/A	10	50	1
Roza Diversion	WA00275	Kittitas, WA	Federal Bureau of Reclamation	Concrete	N/A	N/A	67	100	50,000
Snoqualmie Pass PUD Sewage Lagoon No 1	WA00472	Kittitas, WA	Snoqualmie Pass Utility District	Earth	N/A	N/A	23	22	6

[85] United States Army Corps of Engineers. (n.d.). National Inventory Dams. Retrieved from https://nid.sec.usace.army.mil/#/.

Figure 4-2. High Hazard Dams in Kittitas County



DSO classifies dams slightly differently than NID. The DSO classification is initially determined using the quantitative evaluation of the population at risk. Additionally, in some cases, a qualitative evaluation includes severity of each deficiency at an individual dam, potential economic and environmental losses, age of the dam, the adequacy warning systems, and the best professional judgement of the DSO engineer assigned to the dam. *Refer to the Hazard Extent/Intensity section for further details on DSO's classification.* **Table 4-33** lists the dams in Kittitas County with the DSO classification, as of May 2023. There are six (6) dams that are considered high hazard dams, per the DSO's classification.[86]

Table 4-33. Kittitas County High Hazard Dams with DSO Hazard Classification and Population at Risk

Name	National ID	State ID	Location	Owner	Type	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	Hazard Category
Brown Boys Effluent Pond	WA01836	KT39-1836	Yakima River (Offstream)	Brown Brothers	Earth Fill	10	31	2	3

[86] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.

Name	National ID	State ID	Location	Owner	Type	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	Hazard Category
Childress Winegar Dam	WA01011	KT39-1011	Tributary-Morrison Creek	David & Roberta Israel	Earth Fill	9	5	0	3
Cle Elum Dam	WA00274	KT39-274	Cle Elum River	U.S. Bureau of Reclamation – Pacific Northwest Region	Earth Fill	165	437,000	40,000	1A
Easton Diversion Dam	WA00276	KT39-276	Yakima River	U.S. Bureau of Reclamation – Pacific Northwest Region	Concrete Gravity	66	4,000	13,000	1B
Kachess Dam	WA00260	KT39-260	Kachess River	U.S. Bureau of Reclamation – Pacific Northwest Region	Earth Fill	115	239,000	5,516	1A
Keechelus Dam	WA00265	KT39-265	Yakima River	U.S. Bureau of Reclamation – Pacific Northwest Region	Earth Fill	128	158,000	11,800	1A
Knudson Dam	WA01015	KT39-1015	Tributary-Yakima River	WA DFW	Earth Fill	10	7	0	3
Lower Sunlight Lake Dam	WA01805	KT39-1805	Yakima River	Sunlight Waters Country Club	Earth Fill	12	10	3	3
Milk Pond Dam	WA00392	KT38-392	Tributary-Milk Creek	USFS – Snoqualmie National Forest	Earth Fill	18	93	133	3
Nelson Siding Community Club Dam	WA01996	KT39-1996	Unnamed Tributary-Yakima River	Nelson Siding Community Club	Earth Fill	7	10	5	3
Porky Pig Farm Dam	WA01618	KT39-1618	Tributary-Yakima River (Offstream)	Larry M. Howard	Earth Fill	16	25	300	3
Reecer Creek Ranch Dam	WA01617	KT39-1617	Currier Creek	Dick E Van De Graaf	Earth Fill	6	25	90	3
Reimer Pond Dam	WA01083	KT39-1083	Tributary-Yakima River (Offstream)	James Etux P Roan	Earth Fill	19	15	55	3
Roslyn Wastewater Lagoon No. 3	WA01652	KT39-1652	Crystal Creek (Offstream)	Roslyn City	Earth Fill	10	50	1	3
Roza Diversion Dam	WA00275	KT39-275	Yakima River	U.S. Bureau of Reclamation – Pacific Northwest Region	Concrete Gravity	67	100	50,000	3
Snoqualmie Pass Public Utility District Sewage Lagoon No. 1	WA00472	KT39-472	Tributary-Lake Keechelus (Offstream)	Snoqualmie Pass Utility District	Earth Fill	23	22	6	3
Tjossem Pond	WA01228	KT39-1228	Wilson Creek (Offstream)	Morris P. Sorensen	Earth Fill	12	15	0	3
Twardoski Dam	WA01991	KT39-1991	Unnamed Tributary-Yakima River	Cindy & Bryan Thomson	Earth Fill	13	20	150	3
Upper Sunlight Lake Dam	WA00666	KT39-666	Yakima River	Sunlight Waters Country Club	Earth Fill	22	39	3	1C
Wanapum Dam	WA00085	KT40-85	Columbia River	Grant County Public Utility District No. 1	Concrete Gravity, Earth Fill	213	673,500	1,400,000	1A

The DSO has prepared dam failure inundation mapping for the Hazard Category 1A and 1B dams. Individual mapping was created for the Cle Elum Dam (Category 1A) (**Figure 4-3**) and Easton Diversion Dam (Category 1B) (**Figure 4-4**). The DSO prepared a single inundation area map for failure of the Kachess and Keechelus dams (Category 1A) (**Figure 4-5**).

The inundation areas for the Cle Elum Dam, and the Kachees and Keechelus dams would impact the cities of Cle Elum and Ellensburg, and the Town of South Cle Elem. The Easton Diversion Dam inundation area would impact the City of Cle Elum and the Town of South Cle Elum. All inundation areas impact portions of Unincorporated Kittitas County. The Kachees and Keechelus dams are estimated to have the largest impact on the planning area.

Figure 4-3. Cle Elum Dam Inundation Map

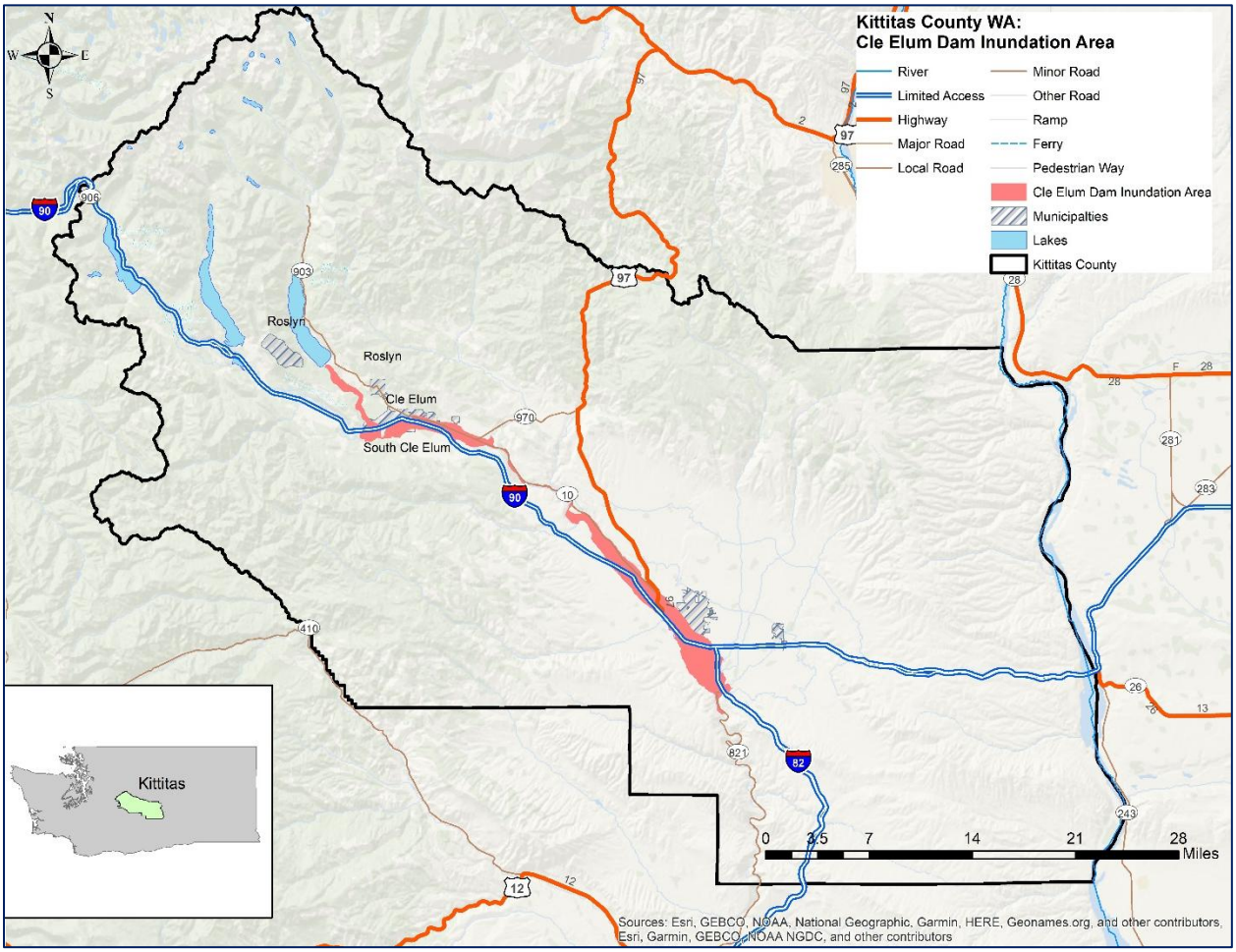


Figure 4-4. Easton Dam Inundation Map

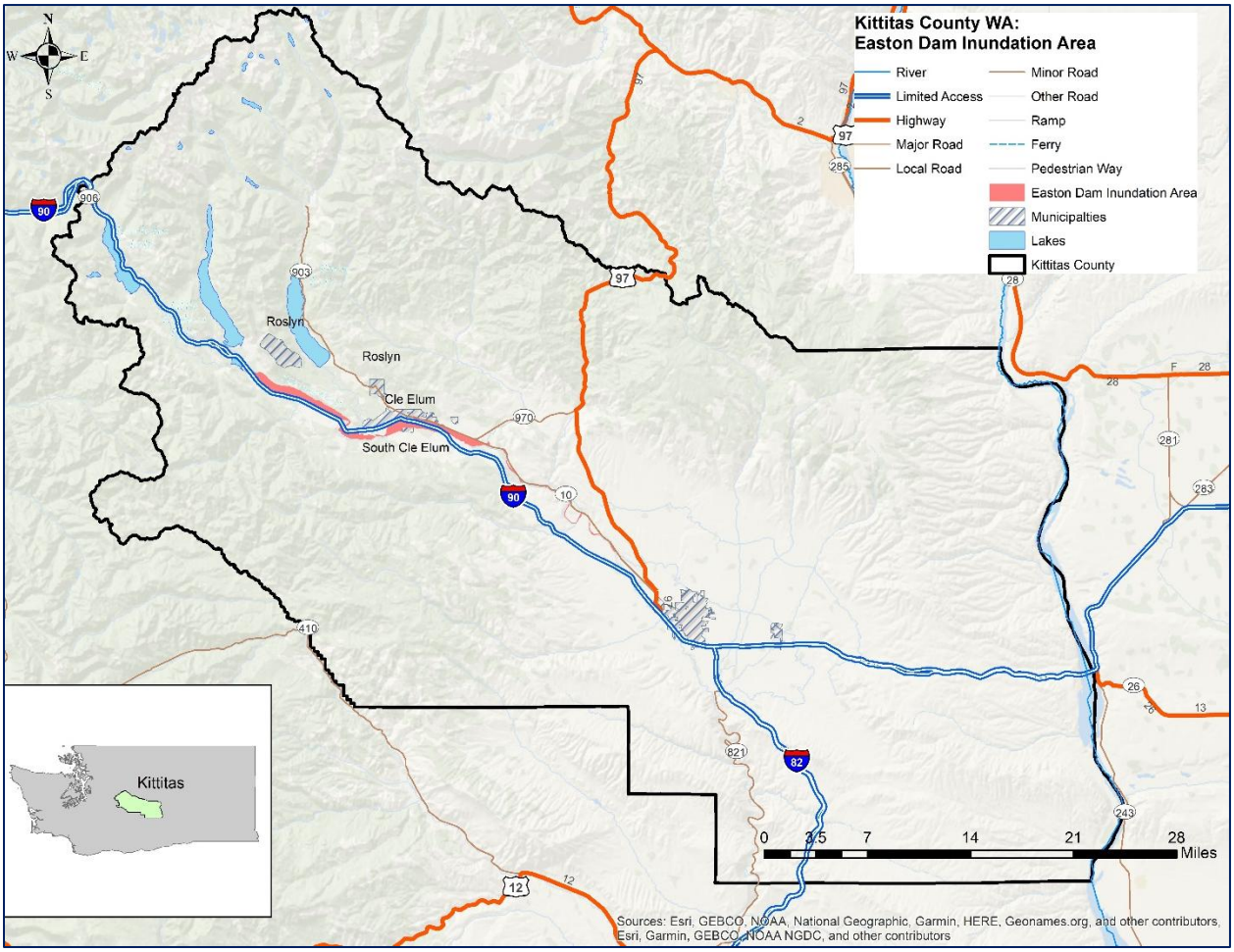
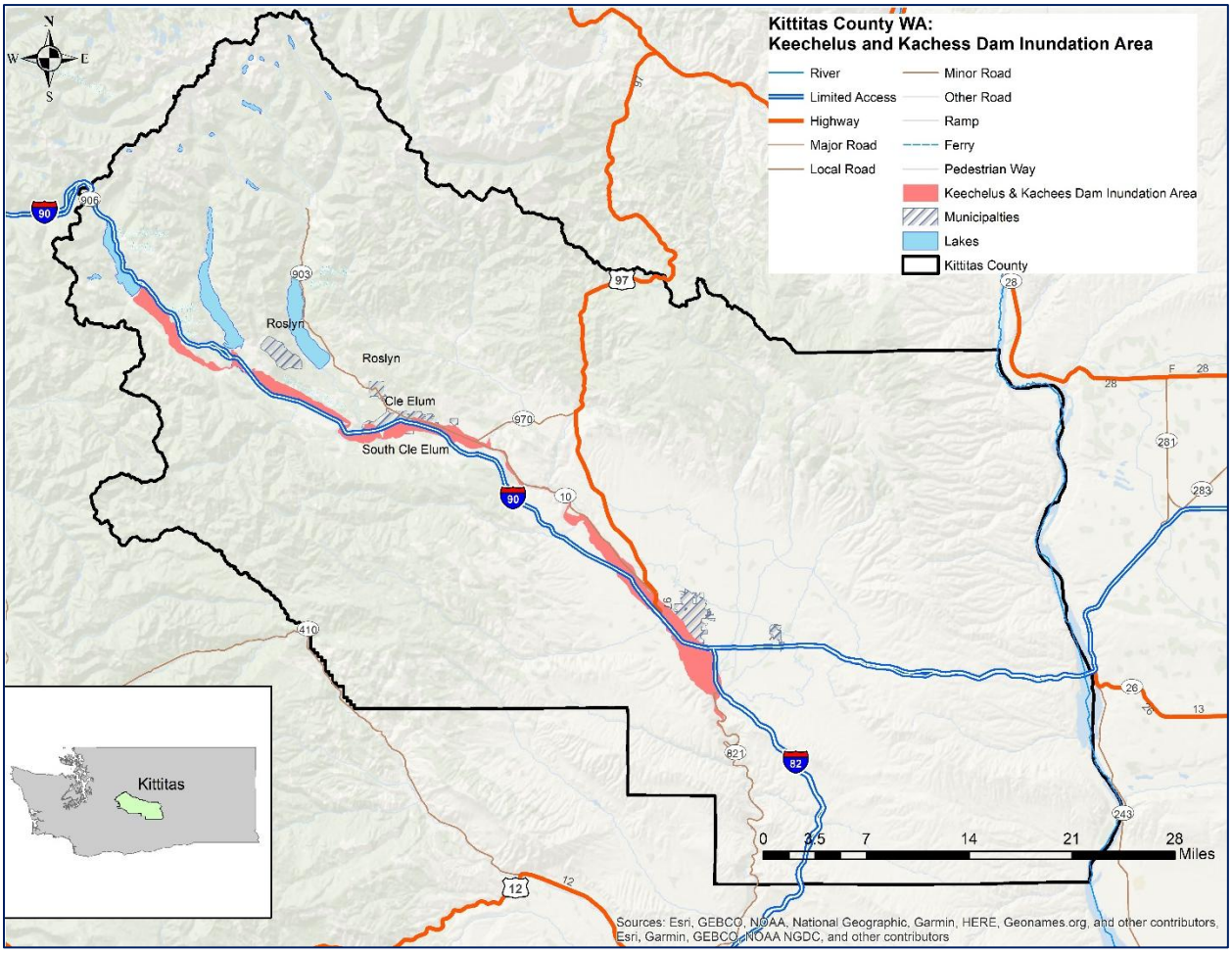


Figure 4-5. Keechelus and Kachess Dam Inundation Areas



According to the National Levee Database, there are 11 levees in the County which are included in the USACE Levee Program, listed in **Table 4-34**.[87] **Figure 4-6** displays the levee systems within Kittitas County.

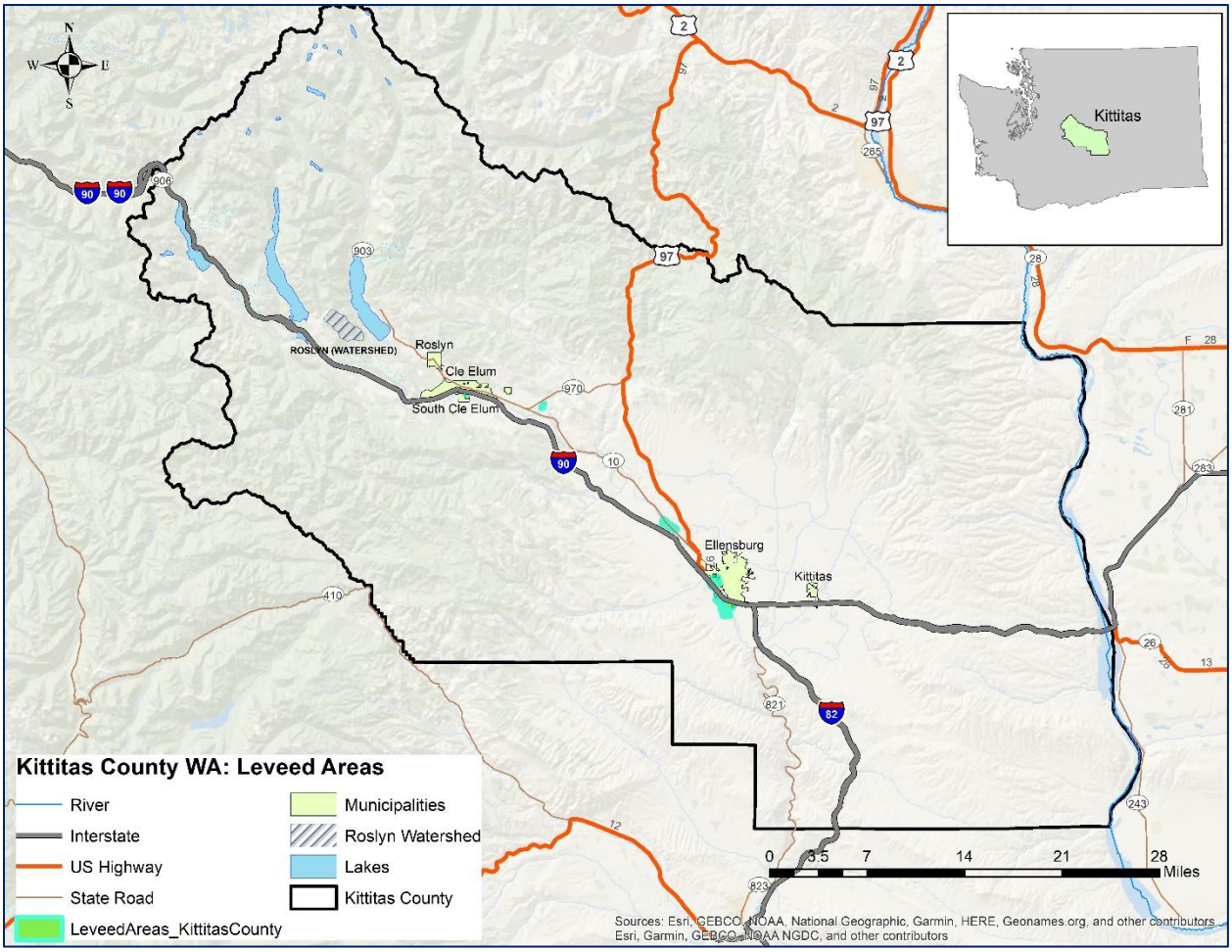
Table 4-34. Levees in Kittitas County

Levee Name	System ID	Operation / Maintenance Organization	Location	Flooding Source	Behind Levee
Charter Road	5505000321	Kittitas County	City of Cle Elum	Yakima River	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Fireman Park	5505000322	Kittitas County	City of Cle Elum	Yakima River	**24** Buildings **36** People **$8 M** Property Value **0** Critical Structures

[87] United States Army Corps of Engineers. (n.d.). National Levee Database. Retrieved from https://levees.sec.usace.army.mil/.

Levee Name	System ID	Operation / Maintenance Organization	Location	Flooding Source	Behind Levee
Jeffries	5505000128	Kittitas County	City of Ellensburg	Upper Yakima River	**9** Buildings **14** People **$2 M** Property Value **0** Critical Structures
Jensen	5505000129	Kittitas County	City of Ellensburg	Yakima River	**6** Buildings **9** People **$2 M** Property Value **0** Critical Structures
Klocke / City Well	5505000063	Kittitas County	Thorp	Yakima River	**26** Buildings **41** People **$4 M** Property Value **0** Critical Structures
Park	5505000206	City of Ellensburg	City of Ellensburg	Yakima River	**4** Buildings **0** People **$270,000** Property Value **0** Critical Structures
Reecer	5505000234	Kittitas County	City of Ellensburg	Yakima River	**4** Buildings **2** People **$300,000** Property Value **0** Critical Structures
Reecer Creek	5505000235	City of Ellensburg	City of Ellensburg	Yakima River	**49** Buildings **57** People **$10 M** Property Value **1** Critical Structures
Schaake	5505000255	Kittitas County	City of Ellensburg	Yakima River	**12** Buildings **11** People **$20 M** Property Value **0** Critical Structures
Teanaway	5505000279	Kittitas County	City of Cle Elum	Teanaway River	**12** Buildings **14** People **$5 M** Property Value **0** Critical Structures
Town Ditch	5505000285	Kittitas County	Thorp	Yakima River	**0** Buildings **0** People **$70,000** Property Value **0** Critical Structures

Figure 4-6. Levees in Kittitas County



4.6.2.3. Hazard Extent/Intensity

Federal guidelines provide for a three (3) level classification system that defines low, significant, and high-hazard potential classifications depending on the potential for loss of life, economic loss, and environmental damage resulting from a hypothetical dam failure. The USACE dam hazard categories are listed in **Table 4-35**.

Table 4-35. USACE Dam Hazard Categories

Hazard Category	Direct Loss of Life	Lifeline Losses	Property Losses	Environmental Losses
Low	None *(rural location, no permanent structures for human habitation).*	No disruption of services *(cosmetic or rapidly repairable damage).*	Private agricultural lands, equipment, and isolated buildings.	Minimal incremental damage.
Significant	Rural location, only transient or day-use facilities.	Disruption of essential facilities and access.	Major public and private facilities.	Major mitigation required.

Hazard Category	Direct Loss of Life	Lifeline Losses	Property Losses	Environmental Losses
High	Certain (one or more) extensive residential, commercial, or industrial development.	Disruption of essential facilities and access.	Extensive public and private facilities.	Extensive mitigation cost or impossible to mitigate.

The USACE Levee Safety Program key activities include levee inspections, risk assessments, and sharing levee information.[88] To better inform stakeholders and residents of the residual risk within their communities, USACE utilizes the Levee Safety Action Classification (LSAC) tool.[89] **Table 4-36** outlines the LSAC risk levels, actions, and risk characteristics for each level. The LSAC is not a levee rating or grade, but a classification system designed to consider the following:

- Probability of the levee being loaded (hazard).
- Existing condition of the levee.
- The current and future maintenance of the levee (performance).
- The consequences if the levee were to fail or be overwhelmed.

For example, a levee that reduces risk for a dense population will have a different classification from an equally constructed levee with a smaller population because the consequences associated with failure are greater.[90]

Table 4-36. USACE Levee Safety Action Classification (LSAC)[91]

Risk	Actions for Levee Systems and Leveed Areas in this Class *(Adapt actions to specific levee system conditions)*	Risk Characteristics of this Class
Very High (1)	Based on risk drivers, take immediate action to implement interim risk reduction measures. Increase frequency of levee monitoring, communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning systems and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as very high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences result in very high risk.
High (2)	Based on risk drivers, implement interim risk reduction measures. Increase frequency of levee monitoring; communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in high risk.

[88] United States Army Corps of Engineers. (n.d.). Levee Safety Program. Retrieved from https://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/.
[89] United States Army Corps of Engineers. (n.d.). Levee Safety Action Classification (LSAC). Retrieved from https://www.mvn.usace.army.mil/LSAC/.
[90] Ibid.
[91] United States Army Corps of Engineers. (n.d.). Levee Safety Action Classification (LSAC). Retrieved from https://www.mvn.usace.army.mil/Portals/56/docs/PAO/LSACs/LSAC%20Table.pdf.

Risk	Actions for Levee Systems and Leveed Areas in this Class *(Adapt actions to specific levee system conditions)*	Risk Characteristics of this Class
Moderate (3)	Based on risk drivers, implement interim risk reduction measures as appropriate. Verify risk information is current and implement routine monitoring program; assure O&M is up to date; communicate risk characteristics to the community in a timely manner; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as a priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in moderate risk.
Low (4)	Verify risk information is current and implement routine monitoring program and interim risk reduction measures if appropriate; assure O&M is up to date; communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions to further reduce risk to as low as practicable.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk.
Very Low (5)	Continue to implement routine levee monitoring program, including operation and maintenance, inspections, and monitoring of risk. Communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very low risk.
No Verdict	Not enough information is available to assign an LSAC.	

**Levee risk is the risk that exists due to the presence of the levee system, and this is the risk used to inform the decision on the LSAC assignment.*

The information presented in this table does not reflect the overtopping without breach risk associated with the presence or operation of the levee system.

Dam and levee failure may occur with little or no warning time. For a dam failure, warning time varies depending on the cause of the failure. For example, in the event of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. On the other hand, in the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Earthen dams tend to not fail completely or instantaneously, the time of breach formation ranges from a few minutes to a few hours. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted, or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water.

Kittitas County and its planning partners have established protocols for flood warning and response to imminent dam failure in the flood warning portion of adopted emergency operations plans. These protocols are tied to EAPs created by the dam owners. Not all dams have EAPs; only those rated as high hazard are mandated to do so by state and federal regulations.

Warning time for levee failures also depends on the cause of the failure. A levee failure caused by structural failure can be sudden and occur with little to no warning. If heavy rains are impacting a levee system, communities located in the immediate danger zone can be evacuated before a failure occurs. If the levee failure is caused by overtopping, the community may or may not be able to recognize the impending failure and evacuate. If a levee failure occurs suddenly, evacuation may not be possible.

4.6.2.4. Probability and Frequency

Dam failure has a low probability of occurrence (a significant occurrence of this hazard is likely to occur within 100 years) and usually coincides with events that cause them (e.g., earthquakes, landslides, excessive rain, and snowmelt). Between 1950 and 2023, there have been three (3) Federal disaster declarations due to dam failure in the United States, none of which have occurred in the State of Washington.[92] However, dam safety incidents, which are less severe than dam failures, have occurred.

Like dams, levee failures have a low probability of occurrence (a significant occurrence of this hazard is likely to occur within 100 years) and usually coincide with events that cause them (e.g., earthquakes and heavy rainfall). Between 1950 and 2023, there has been one (1) Federal disaster declarations due to a levee failure in the United States.[93]

4.6.2.5. Past Events

According to DSO records, 19 notable dam failure events occurred in the State of Washington between 1918 and 2023. None of these occurred within or impacted Kittitas County and to date, Kittitas County has not had a Presidentially Declared Disaster caused by dam or levee failure.[94]

4.6.2.6. Vulnerability and Impacts

Life Safety and Health: Dam and levee failures can lead to loss of life or injury to individuals in the immediate downstream area, property damage, and disruption of essential services (e.g., power, water supply, transportation). The potential for loss of life is affected by the capacity and number of evacuation routes available to those living in potential inundation areas. The vulnerable populations include everyone who is downstream from dam and levee failures.

Property Damage and Critical Infrastructure: Vulnerable properties are those closest to the dam and levee inundation areas. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam and levee waters would accumulate. Transportation routes (e.g., roads, bridges, railroads) are vulnerable and have the potential to be destroyed, creating isolation issues within the community. Transportation infrastructure most vulnerable to dam and levee failure are those that are already in poor condition and would not be able to withstand a large water surge. Additionally, overhead power lines, cable and phone lines could be vulnerable, and loss of these utilities could create additional isolation issues for the inundation areas.

Economy: Kittitas County's economy can be affected by a dam failure due to loss of homes, businesses, and infrastructure (e.g., transportation infrastructure, irrigation facilities). A dam or levee failure that is significant enough to impact Kittitas County may cause high impact (greater than $10 Million) on the local economy based on loss of business revenue, crops, worker wages, and local tax revenues or in the impact on local GDP.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to dam and levee failures. Future development may minimally increase (4% or less) the impact of dam and levee failures within Kittitas County.

[92] Federal Emergency Management Agency. (n.d.). Declared Disasters. Retrieved from https://www.fema.gov/disaster/declarations.
[93] Ibid.
[94] State of Washington Department of Ecology. (2019). Washington State Notable Dam Failures and Incidents. Retrieved from https://appswr.ecology.wa.gov/docs/WaterRights/wrwebpdf/damfailure-ws.pdf.

Underserved and At Risk Population: The underserved and at risk population are exposed to higher vulnerabilities and impacts during dam and levee failure events. During a dam and levee failure event, the underserved and at risk population includes those that are potentially unable to evacuate on their own such as the elderly, children, individuals with disabilities, and low-income families who may not have the appropriate resources to evacuate. Additionally, individuals with limited English proficiency may not have access to information in the appropriate language and limited internet access may prohibit to obtain the emergency information in a timely manner.

Effects of Climate Change in Severity of Impacts: Although climate change does not have a direct impact on dam and levee failures, flood frequency and magnitude are expected to increase as a result of climate change. Subsequently increasing the probability of dam and levee failures. *Refer to the Flood section of this Plan.* **Table 4-37** indicated the 25-year precipitation projections in Kittitas County.[95] **Table 4-38** outlines the flood associated climate indicators for Kittitas County projected through the end of the century..[96]

Table 4-37. 25-Year Precipitation Projections for Kittitas County

Higher Emissions (RCP8.5)
Kittitas County is expected to experience a 12% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience 0.8 more days of heavy precipitation per year (from 6.9 days to 7.8 days per year).
Lower Emissions (RCP4.5)
Kittitas County is expected to experience a 5% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience 0.3 more days of heavy precipitation per year (from 7.2 days to 7.5 days per year).

[95] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[96] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-38. Future Climate Indicators for Kittitas County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Annual average total precipitation	**37 inches**	**38 inches**	**38 inches**	**39 inches**	**40 inches**	**40 inches**	**41 inches**
	35 – 38	36 – 58	35 – 55	35 – 63	36 – 56	35 – 62	35 – 60
Days per year with precipitation *(Wet Days)*	**156 days**	**155 days**	**154 days**	**153 days**	**153 days**	**152 days**	**148 days**
	152 – 160	145 – 172	142 – 170	137 – 176	140 – 170	137 – 173	128 – 167
Maximum period of consecutive wet days	**17 days**	**17 days**	**17 days**	**17 days**	**17 days**	**17 days**	**17 days**
	16 – 18	15 – 21	15 – 21	14 – 20	15 – 21	15 – 19	13 – 22
Annual Days with							
Annual days with total precipitation greater than 1 inch	**6 days**	**7 days**	**7 days**	**7 days**	**7 days**	**8 days**	**8 days**
	7 – 9	10 – 19	10 – 21	12 – 28	13 – 35	13 – 38	22 – 61
Annual days with total precipitation greater than 2 inches	**1 day**	**1 day**	**1 day**	**1 day**	**1 day**	**1 day**	**2 days**
	1 – 1	1 – 3	1 – 3	1 – 4	1 – 3	1 – 4	1 – 4
Annual days with total precipitation greater than 3 inches	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1
Annual days that exceed 99th percentile precipitation	**5 days**	**6 days**	**6 days**	**7 days**	**7 days**	**7 days**	**8 days**
	1 – 13	2 – 15	2 – 15	2 – 16	2 – 17	2 – 18	2 – 20
Days with maximum temperature below 32°F	**52 days**	**43 days**	**40 days**	**36 days**	**33 days**	**32 days**	**21 days**
	50 – 55	36 – 48	32 – 47	26 – 46	19 – 43	18 – 43	9 – 36

4.6.2.7. FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess dam and levee failure events.

4.6.2.8. Dam and Levee Failure Risk Index Score

The FEMA NRI does not assess dam and levee failure events. **Table 4-39** represents the dam and levee failure Total Risk Score for Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-39. Dam and Levee Failure Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Dam and Levee Failure	1	9	11	17	37	22

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.3. Drought

4.6.3.1. Description

Drought can be difficult to define. Some definitions are an idea or concept which can be important in establishing drought policy, and others can be operational. Operational drought definitions describe how drought functions or operates in a way that can be measured. Per Washington State Statue 43.83B, drought conditions mean that the water supply for a geographic area, or for a significant portion of a geographic area, is below 75% of normal and the water shortage is likely to create undue hardships for water users and/or the environment.[97] The National Integrated Drought Information System (NIDIS) defines drought as the deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage.[98] The NWS defines drought as a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area.[99]

Drought is part of the climate cycle, and it is an underestimated slow-moving hazard that can cause as much damage as other faster-moving hazards (e.g., hurricanes, flooding). Drought can impact agriculture, public health, transportation, ecosystems, wildfire, and water quality. In order to assist with drought classification and monitoring, scientists have defined five (5) types of droughts, listed on **Table 4-40**.[100]

Table 4-40. Types of Drought

Type	Description
Meteorological	Occurs when dry weather patterns dominate the area.
Hydrological	Occurs when low water supply becomes evident in the water system
Agricultural	Occurs when crops become affected by drought.
Socioeconomic	Occurs when the supply and demand of various commodities is affected by drought.
Ecological	Occurs when natural ecosystems are affected by drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. Drought differs from other natural hazards in three (3) ways.

- The onset and end of a drought are difficult to determine due to the slow accumulation and lingering effects of an event after its apparent end.
- The lack of an exact and universally accepted definition adds to the confusion about its existence and severity.

[97] Washington State Legislature. (n.d.). Revised Code of Washington, Title 43, Chapter 43.83B. Retrieved from https://app.leg.wa.gov/rcw/default.aspx?cite=43.83B.
[98] National Integrated Drought Information System. (2023). What is a Drought? Drought Basics. Retrieved from https://www.drought.gov/what-is-drought/drought-basics.
[99] National Oceanic and Atmospheric Administration, National Weather Service. (2009). National Weather Service Glossary. Retrieved from https://w1.weather.gov/glossary/.
[100] National Integrated Drought Information System. (2023). What is a Drought? Drought Basics. Retrieved from https://www.drought.gov/what-is-drought/drought-basics.

- In contrast with other natural hazards, the impact of drought is less obvious and may spread over a larger geographic area. These characteristics have hindered many governments' preparation of drought contingency or mitigation plans.

Snowpack is critical to Washington's water supply. Approximately three (3) quarters of the runoff from the Cascades originates as snowpack. This snowpack acts as a natural reservoir, and a weak snowpack during the winter months or a shift in the timing of snowmelt can impact water supply in the spring and summer. Some basins located in the lower elevations are more rain dominant, and spring precipitation is important for filling up soil moisture before the summer dry period develops.[101]

4.6.3.2. Hazard Location

A drought can occur anywhere in the Kittitas County region and affect the entire planning area.

4.6.3.3. Hazard Extent/Intensity

Many drought indices have been developed; however, the Palmer Drought Severity Index (PDSI) is the most prominent index of meteorological drought utilized in the United States for drought monitoring. PDSI uses readily available temperature and precipitation data to estimate relative dryness to indicate the prolonged and abnormal moisture deficiency or excess. As an important climatological tool, the PDSI assists in evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. Furthermore, it can be utilized to identify disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water and potential intensity of wildfires.[102, 103]

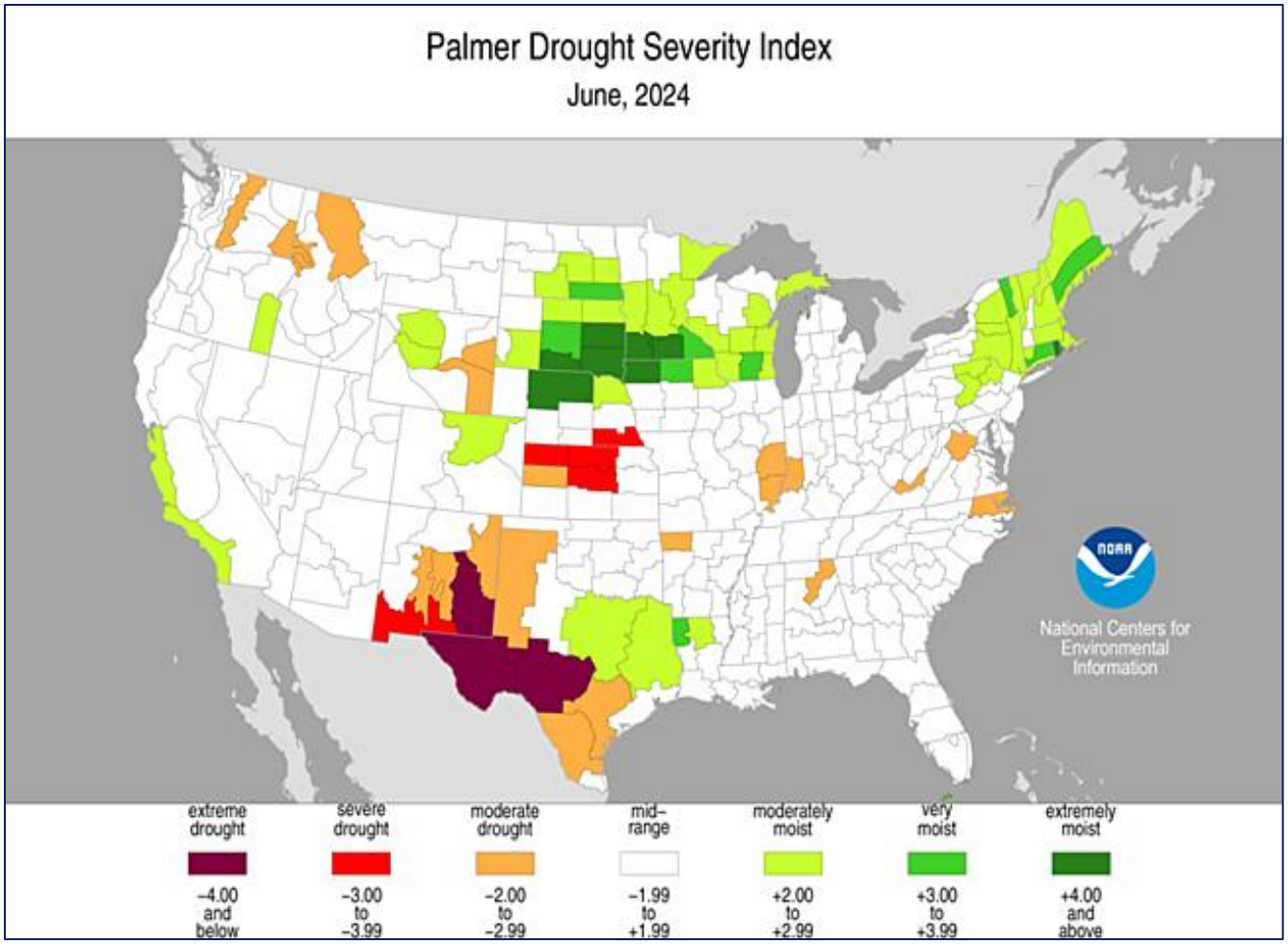
The PDSI is a standardized measure that compares moisture deficiency and excess on a numerical scale that usually ranges from positive five (5) to a negative five (5). Positive values mean there is an excess in moisture supplies and conversely, negative values indicate moisture demands in excess of supplies. **Table 4-41** displays the PDSI categories and **Figure 4-7** illustrates the drought conditions in the contiguous United States as measured by the PDSI for the month of June 2023.[104]

Table 4-41. Palmer Drought Severity Index

Palmer Drought Severity Index	Category
- 4.00 and below	Extreme Drought
- 3.00 to - 3.99	Severe Drought
- 2.00 to - 2.99	Moderate Drought
- 1.99 to + 1.99	Mid-Range
+ 2.00 to + 2.99	Moderately Moist
+ 3.00 to + 3.99	Very Moist
+ 4.00 and above	Extremely Moist

[101] National Integrated Drought Information System. (n.d.). Drought.gov: Washington. Retrieved from https://www.drought.gov/states/washington.
[102] National Weather Service, Climate Prediction Center. (2005). Drought Indices: Explanation. Retrieved from https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/wpdanote.shtml.
[103] National Center for Atmospheric Research. (n.d.). Climate Data Guide: Palmer Drought Severity Index (PDSI). Retrieved from https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi.
[104] National Centers for Environmental Information. (2023). Historical Palmer Drought Indices: Maps. Retrieved from https://www.ncei.noaa.gov/access/monitoring/historical-palmers/maps/psi/202312.

Figure 4-7. Palmer Drought Severity Index Map (June 2024)



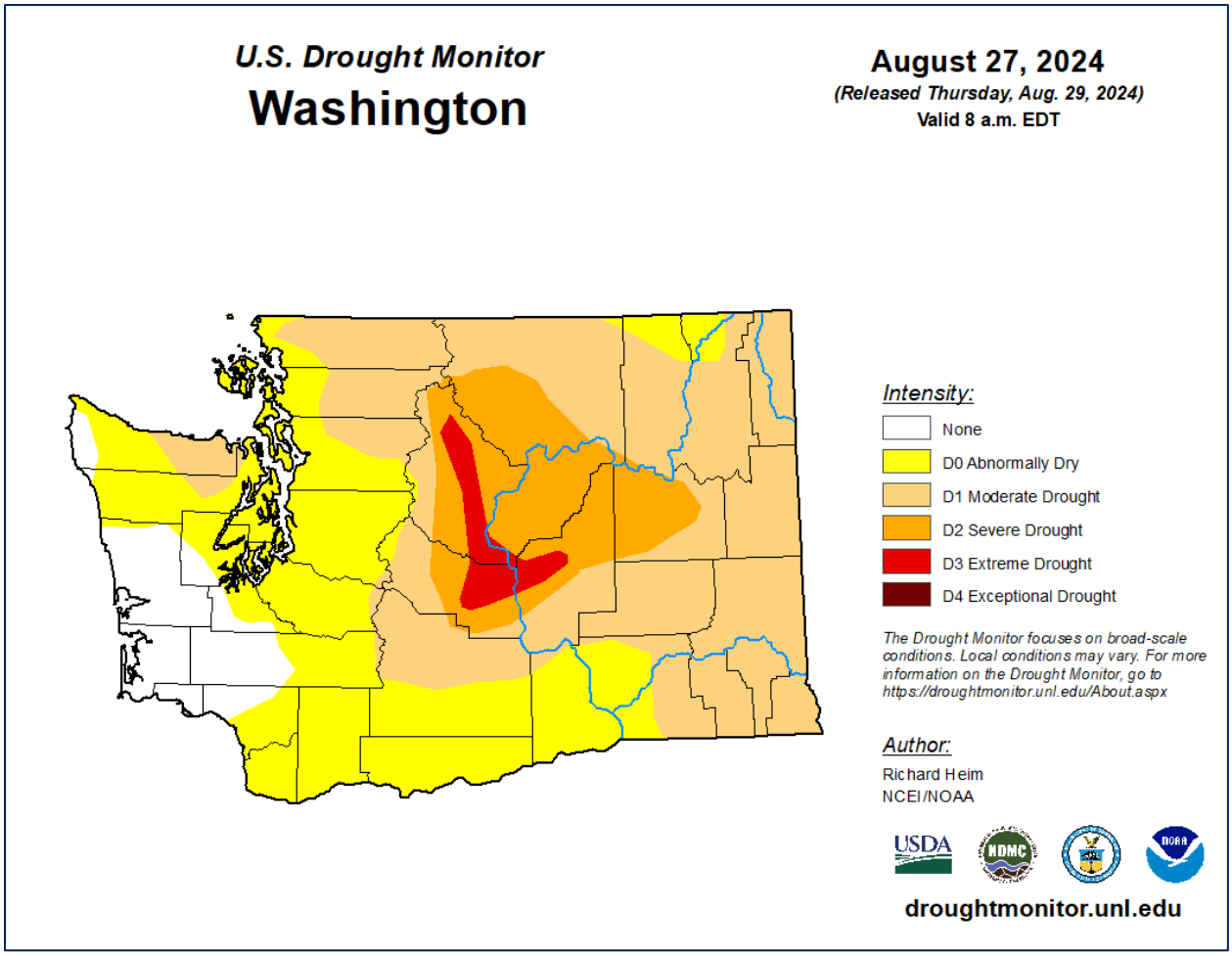
The U.S. Drought Monitor (USDM) is a collaboration between the National Drought Mitigation Center (NDMC), USDA, and National Oceanic and Atmospheric Administration (NOAA). They also rate drought nationwide by intensity utilizing a D0 (Abnormally Dry) to D4 (Exceptional Drought) scale, shown in **Table 4-42**.[105] The map updates weekly to show the location and intensity of drought across the country.[106] **Figure 4-8** illustrates the USDM map for the State of Washington which shows where drought conditions are occurring and its severity.[107]

[105] National Drought Mitigation Center. (n.d.). What is USDM. Retrieved from https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx.
[106] National Integrated Drought Information System. (2023). U.S. Drought Monitor (USDM). Retrieved from https://www.drought.gov/data-maps-tools/us-drought-monitor.
[107] U.S. Drought Monitor. (2023). Washington. Retrieved from https://droughtmonitor.unl.edu/Maps/MapArchive.aspx.

Table 4-42. U.S. Drought Monitor Classification

Category	Description	Possible Impacts	PDSI Range
D0	Abnormally Dry	Used for areas showing dryness, but not yet in drought, or for areas recovering from drought. ***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 and pastures. • Streams, reservoirs, or wells are low, and some water shortages are developing or imminent. • Voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	• Crop or pasture losses are likely. • Water shortages are common. • Water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	• Major crop/pasture losses. • Widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses. • Shortages of water in reservoirs, streams, and wells are creating water emergencies.	-5.0 or less

Figure 4-8. Washington U.S. Drought Monitor (August 27, 2024)



Generally, drought cannot be predicted for more than a few weeks into the future. Drought patterns throughout the nation are related to large-scale climate patterns in the Pacific and Atlantic oceans, such as the El Niño–Southern Oscillation (ENSO) in the Pacific and the Atlantic Multidecadal Oscillation in the Atlantic. As these large scale ocean climate patterns vary in relation to each other, drought conditions in the United States shift from region to region. The intensity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts.

4.6.3.4. Probability and Frequency

The probability of occurrence for drought in Kittitas County is medium because significant occurrences of this hazard have occasionally impacted the County and will likely occur again within 25 years. Meteorological drought can begin and end rapidly while hydrological drought develops a lot slower and takes longer to recover. Due to the significant differences in the types of droughts, different indices have been developed to measure and monitor droughts in the various sectors. The USDM depicts drought integrated across all time scales and differentiates between agricultural and hydrological impacts.[108] Meanwhile, NOAA utilizes the PDSI to measure drought conditions (**Table 4-41**).

[108] National Oceanic and Atmospheric Administration. (n.d.). Did You Know? Index (Definition of Drought). Retrieved from https://www.ncei.noaa.gov/access/monitoring/dyk/drought-definition.

Estimating drought probability and frequency continues to be difficult, regardless of the improvements in science and technology. According to the 2023 Washington State Enhanced Hazard Mitigation Plan, the probability of future drought related disaster declarations each year will increase by 24% in the State.[109]

The drought annualized frequency value represents the average number of recorded drought hazard occurrences, in event days, per year over the period of record (22 years). **Table 4-43** outlines the annualized frequency for drought, based on FEMA NRI data, for Kittitas County.

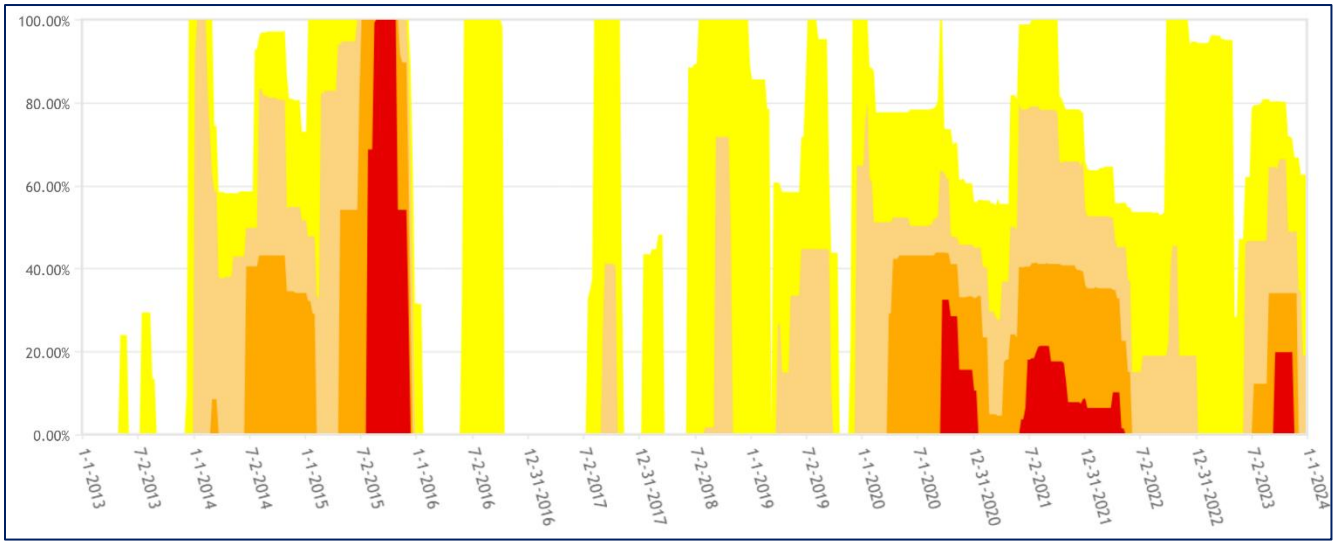
Table 4-43. Drought Annualized Frequency for Kittitas County (FEMA National Risk Index)

Location	Events on Record *(2000 – 2021)*	Annualized Frequency
Kittitas County	546	14.8 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.3.5. Past Events

Droughts reoccur every few years. Unlike other hazards (e.g., floods and earthquakes), droughts are not easily defined as "events". Kittitas County has experience multiple droughts between 2013 and 2023, as illustrated in **Figure 4-9**.[110] One (1) drought Emergency Declaration has been issued for Kittitas County between 1964 and 2023.

Figure 4-9. U.S. Drought Monitor Time Series for Kittitas County



[109] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.
[110] U.S Drought Monitor. (n.d.). Time Series (Kittitas County, WA). Retrieved from https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx.

There have been three (3) notable droughts in Kittitas County between 2013 and 2023, listed in **Table 4-44**.

Table 4-44. Drought Past Events

Date	Description
2023	The State of Washington ranked as the fourth warmest and 11th driest period since 1895 between May and June; the State received 49% of the usual rainfall. Early snowmelt, a lack of spring rain, and low stream flows prompted the Washington State Department of Ecology to declare a drought emergency in 12 counties, including Kittitas County, on June 5, 2023.[111]
2021	On July 14, 2021, the State of Washington Department of Ecology declared a drought emergency for most of the State, including Kittitas County, after a historically dry spring and summer, followed by a record-breaking heat wave, affected water supplies.[112]
2015	This drought was a result of the "snowpack drought", unlike classic droughts that are characterized by extended precipitation deficits. Between October and March, the average statewide temperatures were 4.7°F above the 20th century long-term average, ranking as the warmest October through March on record. The State experienced record low snowpack because mountain precipitation fell as rain, instead of snow. In early spring and into the summer, the snowpack deficit was exacerbated as precipitation amounts remained at below normal levels. A combination of record spring and summer temperatures and little to no precipitation, the snowpack drought turned into a traditional precipitation drought. On March 13, 2015, a drought emergency was declared for some regions including Kittitas County; however, the declaration was extended statewide on May 15, 2015. The USDA reported over $336 Million in agricultural impacts statewide.[113]

4.6.3.6. Vulnerability and Impacts

Life Safety and Health: The entire population of Kittitas County is vulnerable to drought events. Increased temperatures that are expected in drought conditions pose a threat to health and life safety. Heat stress, a recurrent health problem for vulnerable residents, has been the leading weather-related cause of death in the United States since 1986. Furthermore, disruptions to electricity and water supplies will exacerbate these health problems. Residential and commercial heating, ventilation, and air conditioning (HVAC) systems can malfunction from water shortages that result from drought, exposing vulnerable populations to extreme heat.[114] Other possible impacts include recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and hygiene; compromised food and nutrition; and increased incidence of illness and disease.[115] Droughts can also lead to reduced local firefighting capabilities.

Property Damage and Critical Infrastructure: Property will not be directly affected by drought conditions. However, some structures may become vulnerable to wildfires, which are more prevalent

[111] State of Washington Department of Ecology. (2023). Ecology Declares Drought Emergency for 12 Counties. Retrieved from https://ecology.wa.gov/about-us/who-we-are/news/2023/july-24-ecology-declares-drought-emergency-in-12-counties.
[112] State of Washington Department of Ecology. (2021). Ecology Declares Drought Emergency. Retrieved from https://ecology.wa.gov/about-us/who-we-are/news/2021/2021-drought-declaration.
[113] State of Washington Department of Ecology. (2016). 2015 Drought Response Summary Report. Retrieved from https://apps.ecology.wa.gov/publications/documents/1611001.pdf.
[114] Cybersecurity and Infrastructure Security Agency. (2021). Drought and Infrastructure: A Planning Guide. Retrieved from https://www.cisa.gov/sites/default/files/publications/Drought_and_Infrastructure_A_Planning_Guide_508c.pdf.
[115] National Integrated Drought Information System. (n.d.). Drought.gov, By Sector: Public Health. Retrieved from https://www.drought.gov/sectors/public-health.

following years of drought. *Refer to the Wildfire section of this Plan for further details on wildfires.* Critical infrastructure such as water and wastewater, and energy can be impacted by drought conditions.

- Water and wastewater: Changing factors (e.g., climate, population and land use) influence water supply and demand. Population growth and an increase in land use will increase water demands resulting in increased competition for water which in turn can impact the County's economy (e.g., agriculture, energy, tourism).
- Energy: Reduced water supply can reduce energy production because water is used to produce energy. Additionally, higher temperatures that occur during drought conditions can affect electricity lines. Water and wastewater services are highly dependent on electricity.[116] Disruptions to electricity and water supplies will exacerbate health problems.

Economy: The primary direct economic impact of drought in the agricultural sector, an important contributor to the economy of Kittitas County and the United States, is crop failure and pasture losses. Water availability in soils and increasing costs to access water for crop or forage irrigation and watering livestock causes a significant decline in crops and livestock productivity. Additionally, drought conditions can increase the probability of wildfires and insect outbreaks which can also have severe impacts to the agriculture sector. As a result, reduced agricultural productivity can lead to higher food prices and economic instability for farming communities.[117] Drought has a number of indirect effects in the economy; however, impacts to recreational activities have a significant impact in Kittitas County. In particular, those activities that are dependent on water or snow (e.g., skiing) can experience economic losses, particularly for small business owners.[118] Among environmental hazards associated with billion-dollar weather disasters since 1980, drought ranks third behind tropical cyclones and severe storms. Drought events average over $9 Billion per year.[119]

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to drought. Future development may minimally increase (4% or less) the impact of drought within Kittitas County.

Underserved and At Risk Population: Droughts have a profound impact on underserved and at risk populations, exacerbating existing vulnerabilities and creating new challenges. The people most vulnerable to the health impacts of droughts are those with chronic medical conditions (e.g., cardiovascular disease, respiratory conditions, mental illness), lower income, infants and children, and the elderly.[120] During droughts, air quality can decrease as a result of wildfires and dust which produce air particulates that irritate the lungs and bronchial passages exacerbating chronic respiratory conditions.

[116] Cybersecurity and Infrastructure Security Agency. (2021). Drought and Infrastructure: A Planning Guide. Retrieved from https://www.cisa.gov/sites/default/files/publications/Drought_and_Infrastructure_A_Planning_Guide_508c.pdf.
[117] National Integrated Drought Information System. (n.d.). Drought.gov, By Sector: Agriculture. Retrieved from https://www.drought.gov/sectors/agriculture.
[118] National Integrated Drought Information System. (n.d.). Drought.gov, By Sector: Recreation and Tourism. Retrieved from https://www.drought.gov/sectors/recreation-and-tourism.
[119] National Integrated Drought Information System. (n.d.). Drought.gov, By Sector: Agriculture. Retrieved from https://www.drought.gov/sectors/agriculture.
[120] Centers for Disease Control and Prevention. (n.d.). Populations Impacted by Drought. Retrieved from https://www.cdc.gov/drought-health/toolkit/vulnerable-populations.html.

Additionally, drought conditions can also increase the incidence of illness and disease (e.g., mosquito-borne diseases, anxiety, depression, and other adverse mental health outcomes).[121]

Effects of Climate Change in Severity of Impacts: Climate change has led to more frequent and intense drought periods in central Washington, including Kittitas County. As average temperatures in the Pacific Northwest continue to increase, high elevation areas are expected to warm faster than lower elevations. This results in increased evaporation rates and reduced snowpack, which is imperative in order to maintain the water supply during the dry summer months. Additionally, it is expected that more precipitation will occur as rain instead of snow. The reduced snowpack leads to lower stream flows and diminished water availability for agriculture, ecosystems, and human consumption. Higher temperatures and longer periods between precipitation events are expected to lead to more frequent and severe droughts.[122] **Table 4-45** indicates the 25-year heat and precipitation projections for Kittitas County.[123] **Table 4-46** outlines the drought associated climate indicators for Kittitas County projected through the end of the century.[124]

Table 4-45. 25-Year Climate Projections for Kittitas County

Higher Emissions (RCP8.5)
Kittitas County is expected to experience an 88% increase in extremely hot days and a 12% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience five (5) more days that reach above 95°F (from six (6) days to 11 days per year).
By 2049, Kittitas County is expected to have a 2°F increase (from 45°F to 47°F) in average annual temperatures.
By 2049, Kittitas County is expected to experience 0.8 more days of heavy precipitation per year (from 6.9 days to 7.8 days per year).
By 2049, Kittitas County is expected to have a two (2) inch increase (from 39″ to 41″) in average annual precipitation.
Lower Emissions (RCP4.5)
Kittitas County is expected to experience a 65% increase in extremely hot days and a 5% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience three (3) more days that reach above 95°F (from five (5) days to nine (9) days per year).
By 2049, Kittitas County is expected to have a 2°F increase (from 44°F to 46°F) in average annual temperatures.
By 2049, Kittitas County is expected to experience 0.3 more days of heavy precipitation per year (from 7.2 days to 7.5 days per year).
By 2049, Kittitas County is expected to have a 0.3 inch increase (from 40″ to 40.2″) in average annual precipitation.

[121] National Integrated Drought Information System. (n.d.). Drought.gov, By Sector: Public Health. Retrieved from https://www.drought.gov/sectors/public-health.
[122] United States Department of Agriculture. (n.d.). Climate Change Impacts in the Northwest. Retrieved from https://www.climatehubs.usda.gov/hubs/northwest/topic/climate-change-impacts-northwest.
[123] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[124] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-46. Future Climate Indicators for Kittitas County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Average annual total precipitation	**37 inches**	**38 inches**	**38 inches**	**39 inches**	**40 inches**	**40 inches**	**41 inches**
	35 – 38	36 – 58	35 – 55	35 – 63	36 – 56	35 – 62	35 – 60
Days per year with precipitation *(Wet Days)*	**156 days**	**155 days**	**154 days**	**153 days**	**153 days**	**152 days**	**148 days**
	152 – 160	145 – 172	142 – 170	137 – 176	140 – 170	137 – 173	128 - 167
Days per year no precipitation *(Dry Days)*	**209 days**	**210 days**	**211 days**	**212 days**	**212 days**	**213 days**	**217 days**
	205 – 213	193 – 220	195 – 223	189 – 228	195 – 225	192 – 228	198 – 237
Maximum number of consecutive dry days	**31 days**	**33 days**	**33 days**	**34 days**	**35 days**	**35 days**	**39 days**
	25 – 36	26 – 41	26 – 44	26 – 48	27 – 48	28 – 48	30 – 52
Temperature Thresholds							
Annual days with maximum temperature greater than 90°F	**7 days**	**15 days**	**16 days**	**19 days**	**23 days**	**25 days**	**42 days**
	7 – 9	10 – 19	10 – 21	12 – 28	13 – 35	13 – 38	22 – 61
Annual days with maximum temperature greater than 100°F	**0 days**	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**	**13 days**
	0 – 0	0 – 2	0 – 4	1 – 5	1 – 10	1 – 5	4 – 26

4.6.3.7. FEMA NRI Expected Annual Loss Estimates

A drought NRI EAL score, and rating represent a community's relative level of expected agriculture loss each year due to droughts when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-47** outlines the drought EAL for Kittitas County.

Table 4-47. Drought Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	n/a	n/a	$14,625	$14,625	45.9	Relatively Moderate
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.3.8. Drought Risk Index Score

The FEMA drought Risk Index score and rating represent a community's relative risk for droughts when compared to the rest of the United States. **Table 4-48** illustrates the drought Risk Index rating and score for Kittitas County.

Table 4-48. Drought Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively Moderate	43.9
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-49 represents the drought Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-49. Drought Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Drought	2	9	6	16	31	33

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.4. Earthquake

4.6.4.1. Description

Earthquakes are rapid shaking of the earth caused by the release of energy stored in rocks. The United States Geological Survey (USGS) defines an earthquake as the sudden slip on a fault and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Ground shaking is a term utilized to describe the vibration of the ground during an earthquake. Other than the initial ground shaking, additional earthquake hazards include building collapses, displacement or cracking of the earth's surface, landslides, liquefaction, tsunamis, seiches, flooding as a result of damage to dams or levees, and fires from ruptured gas lines, downed power lines and other sources.[125] *Landslides and flooding will be addressed separately in this Plan.* 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 30 seconds.[126]

Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers or homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

The Pacific Northwest's geography (Washington, Oregon, and northern California) is shaped by the Cascadia Subduction Zone (CSZ), the largest active fault. The CSZ "megathrust" fault is approximately 621 miles long and it stretches from Northern Vancouver Island to Cape Mendocino, California and it separates the Juan de Fuca and North American plates.[127] This fault produces some of the largest and most damaging earthquakes in the world. Most of the Pacific Northwest deep earthquakes are a result of the rupture faults within the subducting Juan de Fuca plate (beneath Puget Sound at depths from 19 to 44 miles).[128] In the Pacific Northwest, depending on where the earthquake occurs, seismologists characterize the Cascadia region earthquakes into four (4) different types – Cascadia megathrust, deep intraplate, crustal faulting, and volcanic earthquakes. Volcanic earthquakes are generally too small and remote to cause direct damage, but they provide evidence about potential volcanic eruptions.[129]

Geologists classify faults by their relative hazards and determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. The Washington Geological Survey identifies a fault active when there is evidence for movement within the Holocene time period (since about 12,000 years ago). It usually also means that there are earthquakes (even small

[125] U.S Geological Survey. (n.d.). Earthquake Hazards Program Glossary. Retrieved from https://www.usgs.gov/glossary/earthquake-hazards-program.
[126] U.S Geological Survey. (n.d.). What are the Effects of Earthquakes. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.
[127] Pacific Northwest Seismic Network. (n.d.). Cascadia Subduction Zone. Retrieved from https://pnsn.org/outreach/earthquakesources/csz.
[128] Pacific Northwest Seismic Network. (n.d.). Deep Earthquakes. Retrieved from https://pnsn.org/outreach/earthquakesources/deepearthquakes.
[129] Pacific Northwest Seismic Network. (n.d.). PNW Earthquake Sources Overview. Retrieved from https://pnsn.org/outreach/earthquakesources.

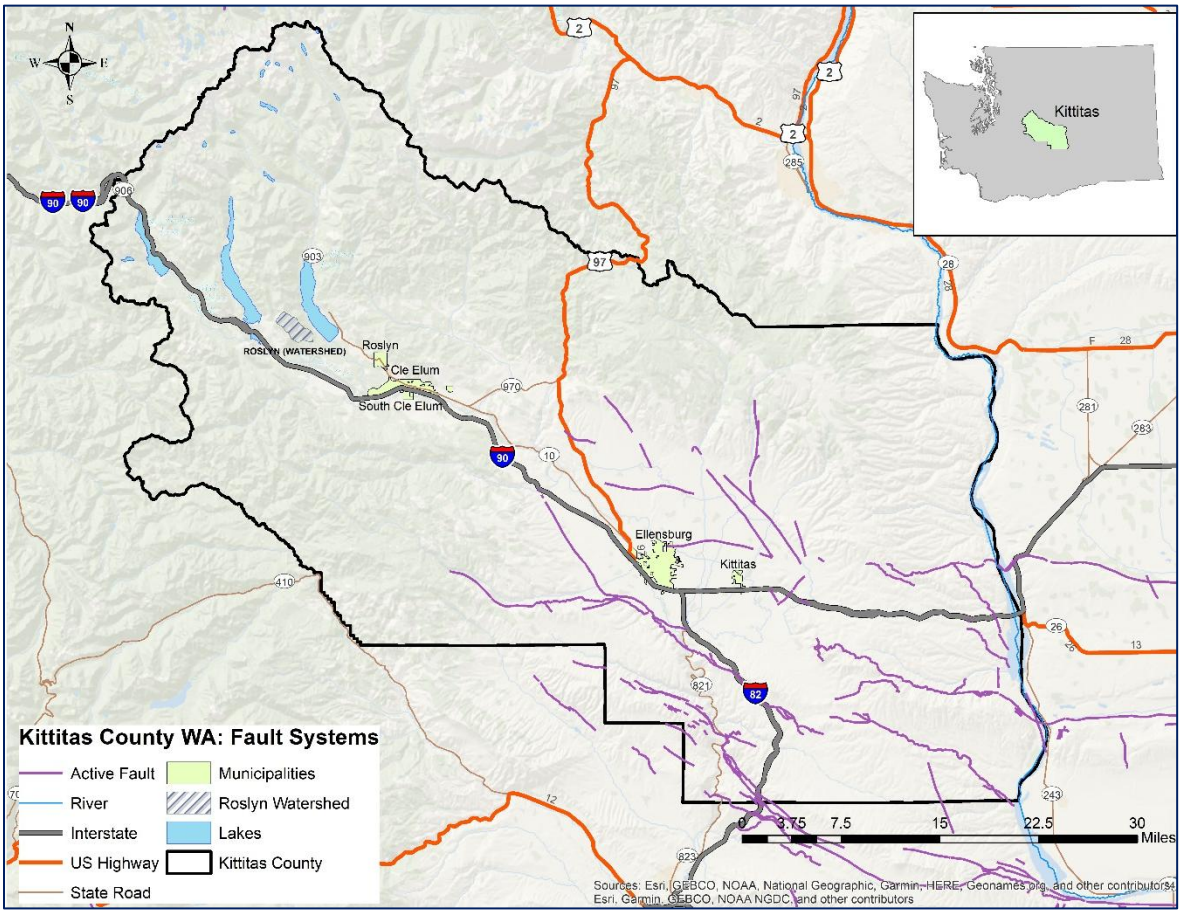
ones) on the fault.[130] A quaternary fault (i.e., potentially active faults) are those that have moved in the past 1.6 million years).[131]

4.6.4.2. Hazard Location

Kittitas County is located in an area with high seismic activity with numerous local faults. The State of Washington has dozens of active faults and fault zones, some of which are in remote areas. However, some faults such as the Seattle faults and the southern Whidbey Island fault zone are under major cities and pose a significant hazard. The largest active fault that will affect the State and the entire Pacific Northwest is the CSZ. The CSZ is capable of producing some of the largest and most damaging earthquakes in the world. Although larger faults produce larger earthquakes, other faults regardless of their size can cause significant damage if they rupture.[132]

There are a series of active fault systems within Kittitas County, most of which are located in the eastern portion of the County. **Figure 4-10** illustrates the fault systems located within Kittitas County.

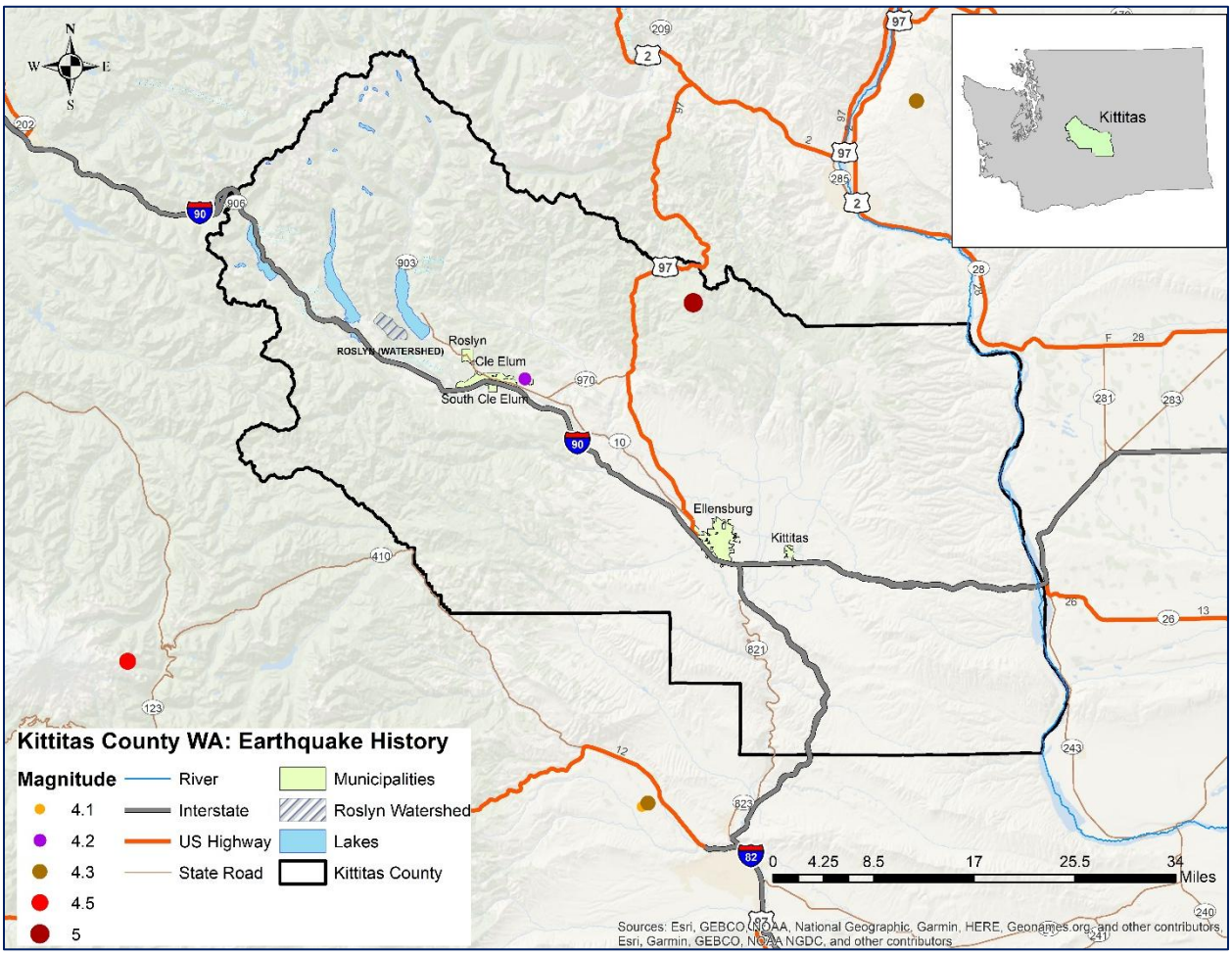
Figure 4-10. Fault Systems Located Within Kittitas County



[130] Washington State Department of Natural Resources. (n.d.). Earthquakes and Faults. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/earthquakes-and-faults#active-faults-and-future-earthquakes.
[131] U.S. Geological Survey. (n.d.) What is a "Quaternary" fault? Retrieved from https://www.usgs.gov/faqs/what-quaternary-fault.
[132] Washington State Department of Natural Resources. (n.d.). Earthquakes and Faults. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/earthquakes-and-faults.

Figure 4-11 illustrates earthquake events greater than Magnitude 4.1 within 20 miles of Kittitas County.

Figure 4-11. Earthquake History in Kittitas County Area



4.6.4.3. Hazard Extent/Intensity

Earthquakes are measured both in terms of their inherent magnitude and in terms of their local intensity. There are several standard measures of earthquakes, including the Richter Scale and the Modified Mercalli Intensity (MMI) scale. The Richter Scale measures the magnitude or amount of energy an earthquake releases. Magnitude is measured by seismographs. The MMI scale is an observed measurement of the earthquake's intensity felt at the earth's surface and it varies depending on the observer's location at the earthquake's epicenter. The MMI Scale is comprised of 12 increasing levels, designated by Roman numerals, which range from imperceptible shaking to catastrophic destruction. Furthermore, the MMI can be used to map earthquake impacts.[133]

Table 4-50 correlates the MMI Scale with the Richter Scale and effects of ground shaking.

[133] Pacific Northwest Seismic Network. (n.d.). Magnitude/Intensity. Retrieved from https://pnsn.org/outreach/about-earthquakes/magnitude-intensity.

Table 4-50. Modified Mercalli Scale vs. Richter Scale

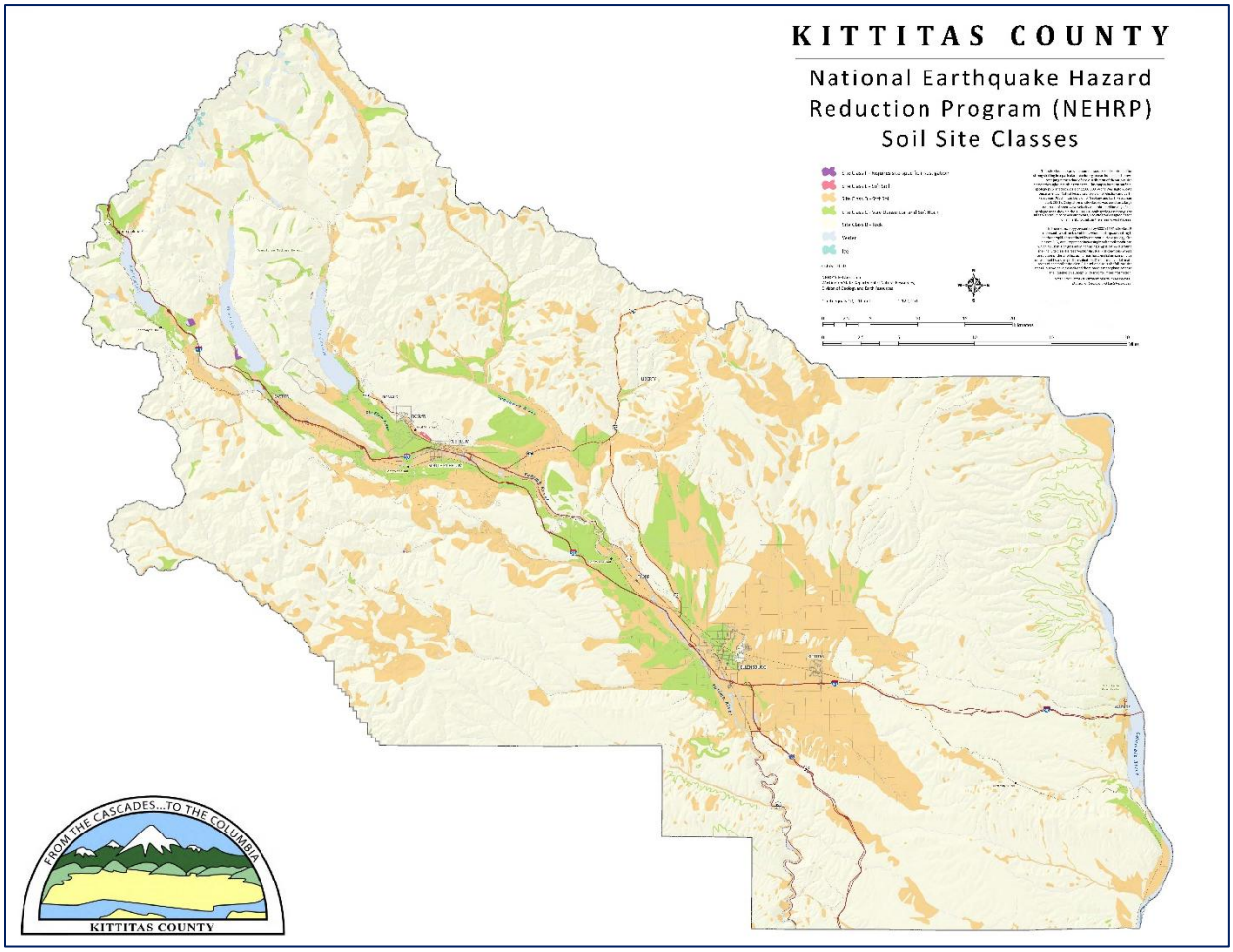
Intensity	Effects	Richter Scale *(approximate)*
I. Instrumental	Not felt.	1 – 2
II. Just Perceptible	Felt by only a few people, especially on upper floors of tall buildings.	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings.	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle.	4
V. Rather Strong	Generally felt by everyone; sleeping people may be awakened.	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling object.	5
VII. Very Strong	General alarm; walls and plaster crack.	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged.	6
IX. Ruinous	Some houses collapse; pipes break.	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides.	7
XI. Very Disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad; severe landslides).	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered.	8

Earthquakes can trigger other types of ground failures, which could contribute to the damage. These include flow failures, landslides, and liquefaction. Liquefaction is not a type of ground failure; however, it is a physical process that occurs when shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a problem in floodplains where the water table is relatively high, and the soil is more susceptible to liquefaction.[134]

The National Earthquake Hazards Reduction Program (NEHRP) defined six (6) different site classifications, based on the type of soil and rock in the area, and their shear-wave velocity. NEHRP soil type A (hard rock), B (rock), and C (very dense soil and soft rock) typically can sustain low magnitude ground shaking without much effect. On the other hand, NEHRP soil types D (stiff soil), E (soft clay soil), and F (could contain different types of soils, requiring site-specific evaluations) are most affected by ground shaking making these areas more susceptible to liquefaction.[135] **Figure 4-12** shows the NEHRP soil classifications present in Kittitas County.

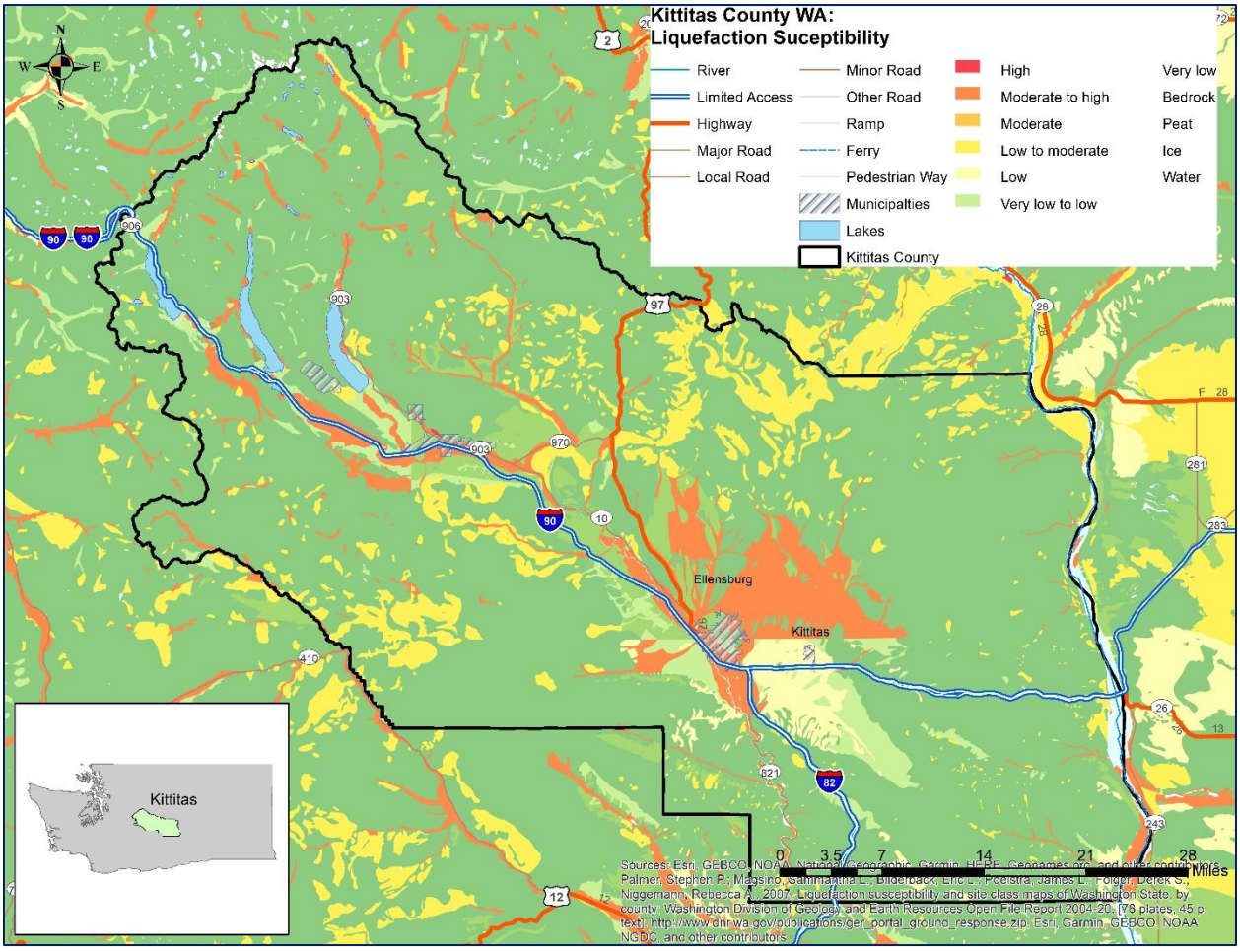
[134] United States Geological Survey. (n.d.). What are the Effects of Earthquakes? Retrieved from: https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.
[135] Nolan, J. (2022). The Effects of Soil Type on Earthquake Damage. Retrieved from https://www1.wsrb.com/blog/the-effects-of-soil-type-on-earthquake-damage.

Figure 4-12. National Earthquake Hazards Reduction Program Soil Type Map



Soil liquefaction maps are useful tools to assess potential damage from earthquakes. **Figure 4-13** shows the liquefaction susceptibility in Kittitas County.

Figure 4-13. Liquefaction Susceptibility for Kittitas County



Earthquakes occur with little to no warning. Scientists cannot predict or forecast earthquakes. An earthquake early warning system uses earthquake science and technology of monitoring systems to alert devices and people when shaking waves generated by an earthquake are expected to arrive at a location. Although it may not sound like a lot of time (compared to other natural hazards), seconds to tens of seconds of advance warning can allow people and systems to take action and protect life and property from destructive shaking.[136]

A partnership between the University of California Berkeley, USGS ShakeAlert, and California Office of Emergency Services developed the Earthquake Early Warning system (i.e., ShakeAlert). The State of California first used the App, but it is now available for the State of Washington and Oregon. The system uses ground-motion sensors to detect earthquakes that have already started and estimate their size, location, and impact. Once it detects a significant magnitude, the MyShake App (registration is required), Wireless Emergency Alerts, or Android Alerts sends a warning to mobile phone users when shaking is about to occur in the user's area. The speed of the alert varies depending on the individual's distance from the origin of the earthquake. Therefore, if the individual is closer to the earthquake's epicenter the

[136] United States Geological Survey. (n.d.). What is the difference between earthquake early warning, earthquake forecasts, earthquake probabilities, and earthquake prediction? Retrieved from https://www.usgs.gov/faqs/what-difference-between-earthquake-early-warning-earthquake-forecasts-earthquake-probabilities.

warning will arrive faster than someone that is further away. **Table 4-51** outlines the alerting thresholds for the ShakeAlert Earthquake Early Warning system.[137, 138]

Table 4-51. ShakeAlert Earthquake Early Warning System Alerting Thresholds

Warning System	Threshold
Wireless Emergency Alerts	The Wireless Emergency Alerts are used in response to magnitude 5.0 or greater earthquakes and will alert people who will experience a shaking level of MMI IV (light) or greater.
MyShake App	The MyShake App is used in response to magnitude 4.5 or greater earthquakes and will alert people who will experience a shaking level of MMI III (weak) or greater.
Android Alerts	The Android Alerts are used in response to magnitude 4.5 or greater earthquakes and will alert people who will experience a shaking level of MMI III (weak) or greater.

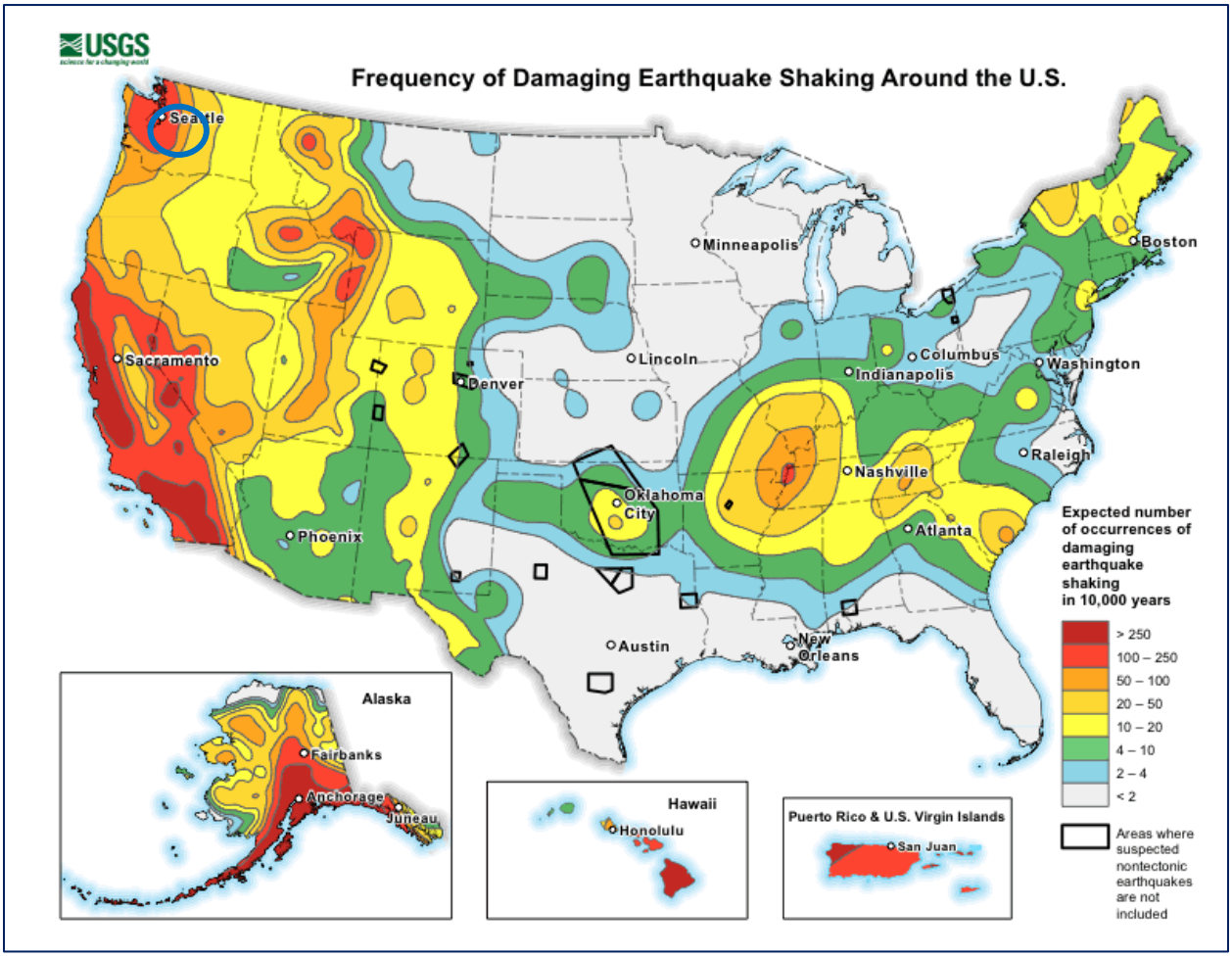
4.6.4.4. Probability and Frequency

The probability of occurrence for an earthquake in Kittitas County is medium because significant occurrences of this hazard have impacted the County and will likely occur again within 25 years. Due to Washington's location at the boundary of two (2) major tectonic plates, the State is particularly vulnerable to earthquakes. USGS estimates that there is an 84% chance of a magnitude 6.5 or greater deep earthquake occurring over the next 50 years in the Pacific Northwest.[139] According to the 2023 Washington State Enhanced Hazard Mitigation Plan, the probability of future earthquake related disaster declarations each year is 2.5% in the State.[140]

The USGS National Seismic Hazard Maps reflect the best and most current understanding of earthquake hazard in an area, the distribution of damaging earthquake shaking across the United States, and compares earthquake shaking hazard areas with other areas across the United States. **Figure 4-14** illustrates the most recent USGS National Seismic Hazard Map which represents the expected number of occurrences of damaging earthquake shaking in 10,000 years. A "damaging earthquake shaking" in this map is that of MMI level VI or higher.[141]

[137] California Governor's Office of Emergency Services. (n.d.). Earthquake Warning California: Types of Alerts. Retrieved from https://earthquake.ca.gov/get-alerts/.
[138] Washington Emergency Management Division. (n.d.). Alert & Warning Notifications. Retrieved from https://mil.wa.gov/alerts.
[139] Pacific Northwest Seismic Network. (n.d.). Deep Earthquakes. Retrieved from https://pnsn.org/outreach/earthquakesources/deepearthquakes.
[140] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.
[141] United States Geological Survey, Earthquake Hazards Program. (2022). Introduction to the National Seismic Hazard Maps. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science/introduction-national-seismic-hazard-maps.

Figure 4-14. USGS National Seismic Hazard Map



The earthquake annualized frequency value represents the modeled frequency of an earthquake hazard occurrence per year. A higher annualized frequency value results in higher EAL and Risk Index scores. **Table 4-52** outlines the annualized frequency for earthquakes, based on FEMA NRI data, for Kittitas County.

Table 4-52. Earthquake Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(2021 Dataset)*	Annualized Frequency
Kittitas County	N/A	0.287% chance per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.4.5. Past Events

Washington, especially the Puget Sound basin, has a history of frequent earthquakes. According to the DNR, earthquakes occur almost every day throughout the State. However, most are too small to be felt or cause damage. Larger magnitude earthquakes, which result in damage, occur less frequently.[142] More

[142] Washington State Department of Natural Resources. (n.d.). Earthquakes and Faults. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/earthquakes-and-faults.

than 1,000 earthquakes occur in the state each year. A dozen or more are strong enough that people feel ground shaking. The State has experienced at least 20 damaging events in the last 125 years.[143]

There have been three (3) earthquakes in the last 100 years that have caused damage in Washington. These occurred in April 1949, April 1965, and February 2001. Although most of the damage occurred west of the Cascade Range, reports of intensity MMI VI were received from the City of Roslyn during the Puget Sound April 1965 earthquake. Reports included cracked and collapsed chimneys, falling of small objects and furnishing, vases, small objects, and furniture were overturned, rapid strong shaking that lasted 45 seconds.[144]

The Pacific Northwest Seismic Network has reported 55 earthquakes magnitude 3.0 or greater between 1971 and 2023. **Table 4-53** lists past seismic events that have impacted Kittitas County with a magnitude of 3.0 or greater since 1971.

Table 4-53. Earthquake Past Events

Date	Magnitude	Distance From	Depth *(miles)*
2/26/2017	3.2	22.2 miles WNW from Ellensburg, WA	2.5
1/22/2017	3.1	9.3 miles WNW from Hyak, WA	2.2
10/10/2016	3.1	7.4 miles SSE from Ellensburg, WA	4.8
2/18/2015	4.0	20.0 miles NNW from Ellensburg, WA	2.2
10/29/2013	3.1	26.2 miles NW from Entiat, WA	4.6
6/26/2013	4.2	24.4 miles NW from Entiat, WA	4.6
9/13/2012	3.1	15.0 miles ESE from Wenatchee, WA	5.7
3/29/2010	3.7	19.7 miles WNW from Ellensburg, WA	0.8
7/24/2006	3.1	1.9 miles SSE from Entiat, WA	3.3
6/29/2005	3.5	6.3 miles NW from Yakima, WA	5.7
1/14/2003	3.2	1.7 miles from Yakima, WA	6.3
6/6/2002	3.4	5.0 miles NNW from Entiat, WA	3.6
12/25/1999	3.0	2.1 miles SSE from Entiat, WA	3.6
9/3/1997	3.3	3.0 miles NNW from Entiat, WA	-0.3
1/1/1997	3.7	12.8 miles NNE from Yakima, WA	-0.3
12/17/1995	3.1	4.6 miles S from Entiat, WA	6.9
6/30/1995	3.0	7.5 miles NNE from Ellensburg, WA	6.4
3/08/1995	3.0	23.6 miles NW from Ellensburg, WA	0.7
1/13/1995	3.2	9.5 miles W from Yakima, WA	7.6

[143] Washington Emergency Management Division. (n.d.). Earthquake. Retrieved from https://mil.wa.gov/earthquake.
[144] Washington State Department of Natural Resources. (1986). The Puget Lowland Earthquakes of 1949 and 1965. Retrieved from https://www.dnr.wa.gov/publications/ger_ic81_pugetlowland_eq_1949-65.pdf.

Date	Magnitude	Distance From	Depth *(miles)*
6/18/1994	4.3	7.3 miles SSE from Skykomish, WA	-0.5
1/7/1993	3.4	10.5 miles SW from Skykomish, WA	8.4
10/25/1992	3.5	13.6 miles SW from Ellensburg, WA	-0.5
11/24/1991	3.2	4.03 miles SSW from Entiat, WA	3.7
7/6/1991	3.4	10.42 miles SE from Ellensburg, WA	2.1
7/6/1991	3.3	10.6 miles SE from Ellensburg, WA	3.2
3/27/1991	3.3	5.02 miles WNW from Entiat, WA	-0.3
2/22/1991	3.2	10.23 miles SW from Ellensburg, WA	7.6
2/1/1991	3.4	12.8 miles SSW from Ellensburg, WA	3.6
2/28/1990	3.1	19.5 miles E from Skykomish, WA	-0.2
5/4/1988	3.3	4.7 miles W from Entiat, WA	3.4
12/2/1987	4.3	9.6 miles NW from Yakima, WA	10.4
12/1/1987	4.1	9.8 miles NW from Yakima, WA	10.7
6/11/1987	3.0	15.3 miles NNW from Yakima, WA	10.0
6/17/1985	3.0	8.2 miles NNW from Vantage, WA	-0.2
4/19/1985	3.2	14.0 miles SE from Ellensburg, WA	2.8
1/30/1985	3.3	8.4 miles NNW from Vantage, WA	-0.2
1/8/1985	3.3	9.0 miles NNW from Vantage, WA	-0.2
8/23/1984	3.0	19.4 miles ESE from Skykomish, WA	-0.03
4/1/1984	4.3	8.9 miles S from Entiat, WA	4.4
12/4/1983	3.2	9.2 mile WSW from Ellensburg, WA	6.8
11/14/1983	3.8	5.8 miles NNW from Yakima, WA	4.4
8/11/1983	3.1	6.3 miles ESE from North Bend, WA	7.3
9/26/1982	3.4	25.6 miles W from Ellensburg, WA	1.4
2/17/1981	4.2	21.5 miles NW from Ellensburg, WA	1.5

4.6.4.6. Vulnerability and Impacts

Life Safety and Health: The entire population in Kittitas County is vulnerable to direct and indirect impacts of a major earthquake in or around the planning area. The degree of exposure is dependent on several factors (e.g., age and construction type of the structures people live in, the soil type the homes are constructed on, their proximity to fault location). Whether directly or indirectly impacted, the entire population will be vulnerable to the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and utility failures could impact health and life safety of the population that suffered no direct damage from the actual event.

Property Damage and Critical Infrastructure: Earthquakes are capable of producing significant damage to property and critical infrastructure, especially in built environments. Minor earthquakes can

cause damage to household goods, fallen objects, merchandise, and other building content. However, major earthquakes can cause full or partial collapses of buildings, bridges, overpasses, and other critical infrastructure (e.g., Interstate 90, hospitals, and schools). Broken gas lines and downed power lines can cause damaging fires, and hazardous materials may be released following an earthquake. Additionally, critical facilities involved in the production, transport, or storing fuel and/or supporting the electrical grid are extremely vulnerable and can be severely impacted by an earthquake. Earthquakes can also trigger landslides and avalanches in areas with steep terrain and loose soil which can result in blocked roads, property and critical infrastructure damage, and utility disruption all of which can affect emergency response. *Please refer to the avalanche and landslide sections of this Plan for further details on the vulnerability and impacts for each.*

Economy: Economic losses due to earthquakes arise from the destruction of structures and infrastructure, interruption of business activity, and a multitude of other reasons. Earthquakes have significant economic impacts that manifest in both short-term and long-term consequences. In the short term, earthquakes typically result in the destruction of businesses, industries, and critical infrastructure (e.g., Interstate 90, hospitals, and schools). This immediate damage can lead to issues such as looting and disruption of transportation networks, complicating business operations and economic relations. Long-term economic impacts include the extensive costs and time required for reconstruction of infrastructure, transportation systems, and homes. This rebuilding process demands substantial investment, diverting resources away from economic development, and leading to income losses. According to research by the Centre for Research on the Epidemiology of Disasters (CRED), between 1998 and 2017, the economic loss directly attributed to earthquakes was at least $661 Billion in the United States..[145] There is no impact to one (1) specific industry, but the local and regional economy can be severely impacted if individuals are unable to work or spend due to the severity of the incident.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to earthquakes. Future development may minimally increase (4% or less) the impact of earthquakes within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population face unique vulnerabilities and impacts as a result of earthquakes. These groups include, but are not limited to, low-income households, the population over 65 years old and under 16 years old, and individuals with access and functional needs. The low-income population do not have the financial resources to enhance their homes to prevent and mitigate earthquake damage, and are less likely to have insurance to help compensate for the losses of earthquake damage. The elderly and younger population may have more difficulty in taking the appropriate precautions during and after an earthquake without additional assistance. Additionally, the elderly and individuals with access and functional needs may be more socially isolated and are more likely to need special medical attention which may not be available in the event of isolation caused by an earthquake.

Effects of Climate Change in Severity of Impacts: The exact nature and extent of this impact still needs to be studied and fully understood as it pertains to climate change. However, climate change can increase the risk of earthquake cascading hazards (e.g., landslides, flooding, avalanche). *The impacts of climate change for landslides, flooding, and avalanche are addressed separately in this Plan.*

[145] Quantectum: Earthquake Forecasting Center. (n.d.). Earthquakes' Impact on Society. Retrieved from https://quantectum.com/blog/the-impact-earthquakes-have-on-society/.

Hazus

Probabilistic Magnitude

The total economic loss estimated for the earthquake is $97.7 Million, which includes building and lifeline related losses based on the region's available inventory. Hazus estimates that about 295 buildings will be at least moderately damaged. This is over 1.0% of the buildings in the region. There is an estimated one (1) building that will be damaged beyond repair. **Table 4-54** and **Table 4-55** summarize the expected damage by general occupancy and by building type, respectively, for the buildings in Kittitas County.

Table 4-54. Hazus Earthquake Expected Building Damage by Occupancy

Damage Level	None		Slight		Moderate		Extensive		Complete	
Occupancy	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Agriculture	90.4	0.5	3.4	0.4	1.1	0.4	0.2	0.5	0.0	0.5
Commercial	1,629.3	6.8	109.1	11.2	49.4	18.5	8.6	31.5	0.6	33.8
Education	29.8	0.1	2.6	0.3	1.4	0.5	0.3	1.1	0.0	1.4
Government	1,072.9	4.5	59.2	6.1	28.8	10.8	4.0	14.6	0.2	10.0
Industrial	369.0	1.6	17.9	1.8	7.9	3.0	1.3	4.7	0.0	1.6
Other Residential	4,260.4	17.9	304.6	31.4	118.8	44.5	7.0	25.6	0.2	9.2
Religion	51.1	0.2	3.4	0.4	1.3	0.5	0.2	0.7	0.0	0.8
Single Family	16,308.0	68.5	471.2	48.5	58.3	21.8	5.8	21.2	0.7	42.8
TOTAL	**23,811**		**971**		**267**		**27**		**2**	

Table 4-55. Hazus Earthquake Expected Building Damage by Building Type

Damage Level	None		Slight		Moderate		Extensive		Complete	
Building Type	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Wood	17,684.3	74.3	526.3	54.2	41.0	15.3	0.4	1.5	0.0	0.0
Steel	643.4	2.7	43.4	4.5	24.5	9.2	3.4	12.5	0.2	10.9
Concrete	714.5	3.0	51.3	5.3	20.6	7.7	2.4	8.7	0.0	1.3
Precast	314.0	1.3	19.5	2.0	13.6	5.1	2.9	10.6	0.0	2.5
Reinforced Masonry	1,228.1	5.2	41.8	4.3	23.6	8.9	3.3	12.0	0.0	0.2
Unreinforced Masonry	400.0	1.7	65.0	6.7	37.3	14.0	9.00	33.0	1.4	82.0
Manufactured Housing	2,826.7	11.9	224.0	23.1	106.4	39.9	5.9	21.8	0.1	3.2
TOTAL	**23,811**		**971**		**267**		**27**		**2**	

Table 4-56 summarizes the expected damage to essential facilities in Kittitas County.

Table 4-56. Hazus Earthquake Expected Damage to Essential Facilities

Facility	Total	At Least Moderate *(Greater than 50% damage)*	Complete *(Greater than 50% damage)*	With Functionality *(Greater than 50% on day 1)*
Hospitals	1	0	0	1
Schools	22	0	0	22
Emergency Operations Center	2	0	0	2
Police Stations	6	0	0	6
Fire Stations	20	0	0	20

The total building related losses were $65.7 Million. 27.0% of the estimated losses were related to the business interruption in Kittitas County. The largest loss was sustained by the residential occupancies, which made up over 22.0% of the total loss. **Table 4-57** provides a summary of the losses associated with the building damage in Millions of dollars.

Table 4-57. Hazus Earthquake Building Related Economic Loss Estimates (Millions of Dollars)

	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses	Wage	0.00	0.15	2.85	0.07	1.67	4.74
	Capital-Related	0.00	0.06	3.00	0.04	0.22	3.33
	Rental	0.16	0.40	1.16	0.06	0.98	2.75
	Relocation	0.50	0.44	1.58	0.20	3.89	6.61
	TOTAL	**0.66**	**1.06**	**8.59**	**0.36**	**6.76**	**17.43**
Capital Stock Losses	Structural	1.36	1.06	2.56	0.54	3.02	8.54
	Non-Structural	4.93	3.89	5.53	1.35	12.43	28.11
	Content	1.10	0.70	2.35	0.84	5.97	10.96
	Inventory	0.00	0.0	0.46	0.15	0.02	0.63
	TOTAL	**7.38**	**5.64**	**10.90**	**2.89**	**21.44**	**48.25**
SUBTOTAL		**8.04**	**6.70**	**19.49**	**3.25**	**28.20**	**65.67**

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake incident. Hazus also estimates the number of displaced individuals that will require accommodations in temporary public shelters. The model estimates eight (8) households will be displaced due to the earthquake. Of these, four (4) people (out of a total population of 44,337) will seek temporary shelter in public shelters.

For the transportation systems, Hazus computes the direct repair cost for each component only. **Table 4-58** provides damage estimate for the transportation systems.

Table 4-58. Hazus Earthquake Expected Damage to Transportation Systems

System	Component	Number of Locations				
		Locations / Segments	*With at Least Moderate Damage*	*With Complete Damage*	*With Functionality Greater than 50%*	
					After Day 1	*After Day 7*
Highway	Segments	58	0	0	58	58
	Bridges	316	0	0	316	316
	Tunnels	2	0	0	2	2
Railways	Segments	7	0	0	7	7
	Bridges	45	0	0	45	45
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	3	0	0	3	3
	Runways	5	0	0	5	5

Table 4-59 provides a detailed breakdown in transportation system economic losses in Millions of dollars.

Table 4-59. Hazus Earthquake Transportation System Economic Losses (Millions of Dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,992.2	0.0	0.0
	Bridges	657.8	0.1	0.0
	Tunnels	4.6	0.0	0.0
	TOTAL	**2,654.5**	**0.1**	
Railways	Segments	175.1	0.0	0.0
	Bridges	225.2	0.0	0.0
	Tunnels	0.0	0.0	0.0
	Facilities	0.0	0.0	0.0
	TOTAL	**400.4**	**0.0**	

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Light Rail	Segments	0.0	0.0	0.0
	Bridges	0.0	0.0	0.0
	Tunnels	0.0	0.0	0.0
	Facilities	0.0	0.0	0.0
	TOTAL	**0.0**	**0.0**	
Bus	Facilities	2.0	0.0	1.8
	TOTAL	**2.0**	**0.0**	
Ferry	Facilities	0.0	0.0	0.0
	TOTAL	**0.0**	**0.0**	
Port	Facilities	0.0	0.0	0.0
	TOTAL	**0.0**	**0.0**	
Airport	Facilities	15.9	0.5	3.2
	Runways	26.7	0.0	0.0
	TOTAL	**42.6**	**0.5**	
SUBTOTAL		**3,099.4**	**0.7**	

4.6.4.7. FEMA NRI Expected Annual Loss Estimates

An earthquake NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to earthquakes when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-60** outlines the earthquake EAL for Kittitas County.

Table 4-60. Earthquake Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$1.3 Million	$3.9 Million	N/A	$5.2 Million	92.4	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.4.8. Earthquake Risk Index Score

The FEMA earthquake Risk Index score and rating represent a community's relative risk for earthquakes when compared to the rest of the United States. **Table 4-61** illustrates the earthquake Risk Index rating and score for Kittitas County.

Table 4-61. Earthquake Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	93.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-62 represents the earthquake Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-62. Earthquake Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Earthquake	2	12	16	33	61	59

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.5. Flood

4.6.5.1. Description

Floods are the most common and widespread of all weather-related natural disasters and result in more deaths each year than tornadoes, hurricanes, and lightning. A flood is defined as an overflowing of water onto dry land which occurs when the existing channel of a stream, river, canyon, or other watercourses cannot contain excess runoff from rainfall or snowmelt. **Table 4-63** lists and describes the different types of flood. Flooding can be damaging, and it can happen with only a few inches of water or covering a house up to the rooftop. Additionally, floods can occur within a few minutes or over a long period of time, and last days, weeks, or longer.[146]

Table 4-63. Flood Types[147]

Type	Description
River Flood	Occurs when water levels rise over the top of riverbanks due to excessive rain from tropical systems making landfall, persistent thunderstorms over the same area for extended periods of time, combined rainfall and snowmelt, or an ice jam.
Inland Flooding	Occurs when moderate precipitation accumulates over several days, intense precipitation falls over a short period, or a river overflow because of an ice or debris jam or dam or levee failure.
Flash Flood	Occurs during heavy or excessive rainfall in a short period of time, generally less than six (6) hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.
Coastal Floods	Caused by higher than average high tide and worsened by heavy rainfall and onshore winds (i.e., wind blowing landward from the ocean); the inundation of land areas along the coast.
Storm Surge	An abnormal rise in water level in coastal areas, over and above the regular astronomical tide, caused by forces generated from a severe storm's wind, waves, and low atmospheric pressure.

Floodplains

Floodplain is synonymous with the 100-year floodplain and means that the land area is susceptible to inundation with a 1% chance of being equaled or exceeded in any given year. The limit of this area shall be based upon flood ordinance regulation maps or a reasonable method which meets the objectives of the act.[148]

Floodplains are a part of a system that has evolved to accommodate changing water levels during the course of each year. In a natural landscape, floodplains temporarily store floodwater during spring runoff, reducing flood levels and slowing the river's flow. Those functions of floodplains can be impaired when a river is restricted by riprap or a bulkhead, or when the floodplain's natural characteristics are changed by development or by removal of native vegetation.

[146] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Flood Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/.
[147] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Floods. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/types/.
[148] Kittitas County. (2016). Shoreline Master Program. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/cds/smp/20160307-Kittitas-County-Shoreline-Master-Program.pdf.

When a river is restricted by development and confined to a single channel, the velocity of the water increases, and flood elevations increase. As the velocity increases, the water gains power and can erode its banks, scour the riverbed, and damage structures.

Floodplain characteristics also affect the river's behavior during a flood event. Native vegetation helps slow flood waters, allowing it to soak into the ground or move gradually back into the stream channel. Established root systems of riparian vegetation help to control erosion by binding the soil. On the other hand, when vegetation is removed, water runs off more quickly, often taking valuable topsoil with it. The overall effect of removing native vegetation can be an increase in debris, bank erosion, and bed load moved by a stream or river. Lawns and other non-native plantings do a better job than paved surfaces or bare soil, but they are not as effective as natural riparian and wetland vegetation.

Furthermore, floodplains also help maintain water quality by filtering surface water runoff before it reaches a stream or river. Natural floodplains help keep ground water recharged, and summer low flows are often higher in streams with functioning floodplains because ground water recharge is higher. More water soaks into the ground because plant roots and soil-dwelling animals keep the soil porous.[149]

Geomorphology refers to the relationship between the shape and other physical characteristics of a river and the rocks and sediments of the valley in which it flows. The river creates its channel, which reflects the force of the flowing water and the material of which the bed and banks are made. Changes in watershed conditions can affect the amount of runoff and the amount and size of sediment that enters the river. Changes in runoff and sediment loading affect the river's behavior, including flood characteristics.[150]

4.6.5.2. Hazard Location

In Kittitas County, the Yakima River is the principle hydraulic feature. Its basin covers 1,594 square miles of the County. The major Yakima River tributaries include the Cle Elum and Teanaway Rivers (all forks) and many creeks including, but not limited to, Cabin, Cole, Gold, Silver, Manastash, Taneum, Naneum, Wilson, Reecer, Mercer, Big, and Little. The hydrology of an area is largely affected by climate, topography, geology, and glacial history. Understanding the hydrology of the basin helps planners to estimate the frequency and magnitude of flooding.[151]

Additionally, temperatures and precipitation shape the flood hazard potential in Kittitas County. The amount of snowfall and snowmelt runoff rates are critical in determining flood potential. Most flooding in the Yakima and Teanaway river basins follow periods in which large amounts of wet snow accumulate and are associated with rain on snow events during which runoff cannot percolate into the soil because the soil has been saturated or because the ground is frozen.

The Yakima River's character changes in response to local geology as it flows downstream. Much of the river is braided, with interlaced channels and gravel bars and an active channel area; however, there are areas where basalt geology constricts the lateral movement of the river. All forks of the Teanaway River generally are constrained in their upper reaches. Moving downstream to the Teanaway River valley, the river is fairly channelized but has free lateral movement.

[149] Kittitas County. (1996). Comprehensive Flood Hazard Management Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/public-works/flood/documents/1996%20Kittitas%20County%20Comprehensive%20Flood%20Hazard%20Management%20Plan.pdf.
[150] Ibid.
[151] Ibid.

There are many flood problem areas throughout Kittitas County; however, the principal flood sources are riverine flooding, urban flooding, and irrigation facilities.

Riverine Flooding

Large scale developments with urban densities adjacent to the Yakima and Teanaway rivers (i.e., Elk Meadows, Elk Meadows Park, Pine Glen, Sun Island, Sun Country, Teanaway Acres, and the Teanaway Wagon Wheel) have experienced substantial flood damage. The County also has numerous streams with large and unpredictable floodplains and flood capacities. These include, but are not limited to, Cabin, Cole, Big, Little, Silver, Gold, Manastash, Taneum, Wilson and Reecer creeks.

Floods on the Yakima, Teanaway, and Cle Elum rivers occur as the result of snowmelt in spring and early summer and occur after heavy rainfall in November and December. Ice and debris can have an impact on flood stages when culverts and bridges are obstructed. The spring/summer snowmelt floods are characterized by slow rise and long duration of high flow; river stages may be increased by ice and debris jams. The fall/winter flood crests are reduced because flood storage is available after the irrigation season in Kachess, Keechelus, and Cle Elum lakes. However, these reservoirs control only a small part of the runoff, and storage may not be available if two (2) winter flood events occur in short succession. The three (3) reservoirs have a combined storage capacity of 833,700 acre feet (157,800 acre feet in Keechelus Lake; 239,000 acre feet in Kachess Lake, and 436,900 acre feet in Cle Elum Lake). These reservoirs were constructed for irrigation purposes but are also operated for flood control on the basis of runoff forecasts.

Urban Flooding

Kittitas County has experienced rapid change due to urban development in rural areas where drainage systems are comprised of a series of pipes, roadside ditches, and channels. Urban flooding occurs when drainage systems lack the capacity to convey rainfall runoff to nearby creeks, streams, and rivers. When the drainage systems in place become overwhelmed, roads and transportation corridors become the conveyance.

The main contributors to urban flooding are rainfall intensity and duration; however, topography, soil conditions, urbanization and groundcover also play an important role. Urban floods can be a great disturbance to daily life as roads can become impassable, and people may be unable to go to work or school. Economic damage can be high, but casualties are usually limited because of the nature of the flooding.

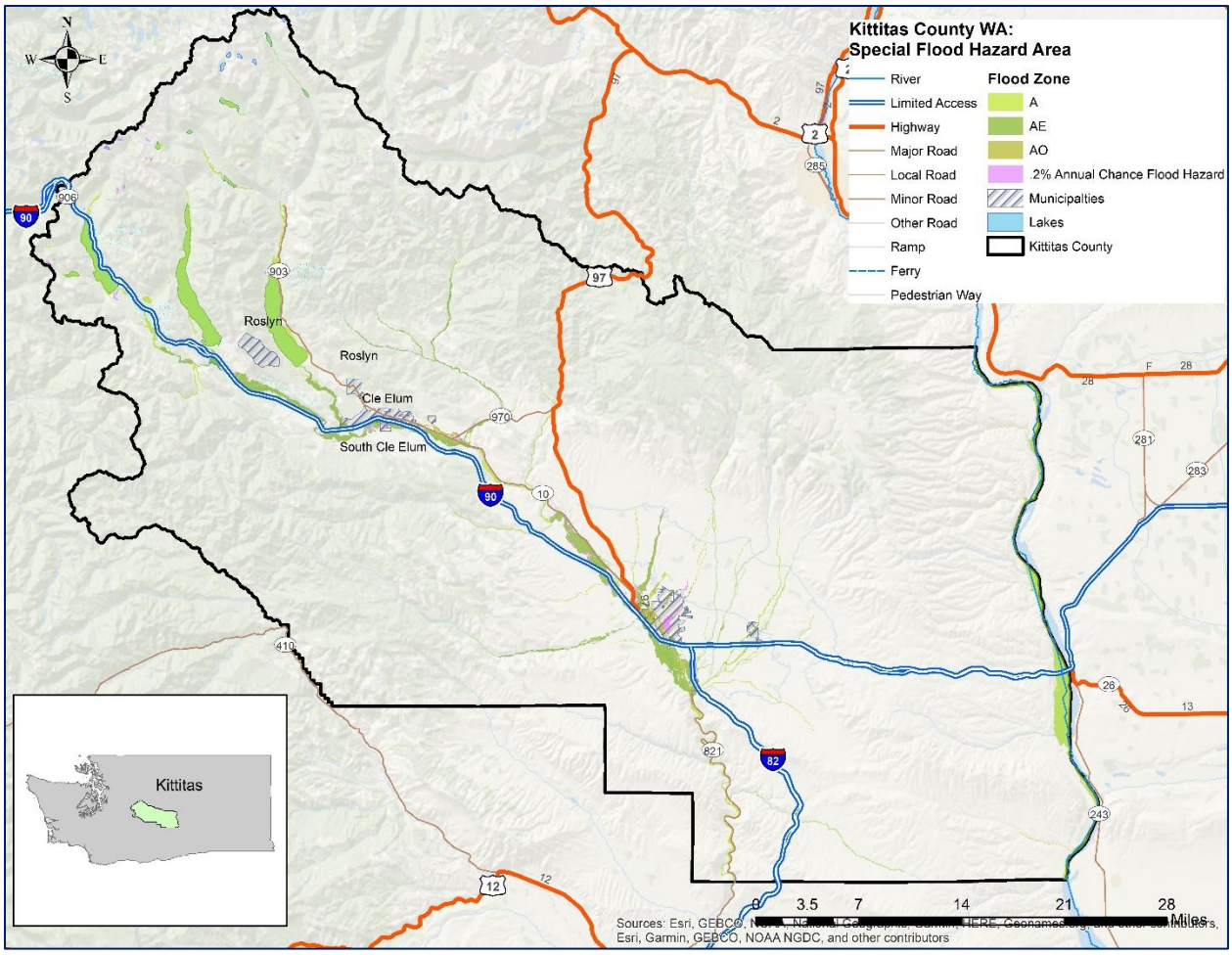
Irrigation Facilities

The cities of Ellensburg and Kittitas are surrounded by complex irrigation systems consisting of the Kittitas Reclamation District North Branch Canal and Whipple Wasteway, and the Ellensburg Water Company and Cascade Irrigation District canals. These systems, which cover 330 miles, distribute water for irrigation and may at times provide incidental flood control. However, the system has a decreasing capacity downstream and can become overwhelmed when used to route floodwaters. Significant floods have occurred in the past when this system diverted floodwater from one basin to another. Additionally, potential irrigation district infrastructure failure could create a flood hazard.

The Flood Insurance Rate Maps (FIRMs) show the flood zones, floodplain boundaries, and Base Flood Elevation (BFE) and are used for floodplain management, flood insurance ratings, and to determine flood insurance requirements. These maps show areas with a 1% chance of flooding each year, commonly known as the 100-year floodplains, and are shown as the Special Flood Hazard Areas (SFHA) in the

FIRM maps.[152] The 500-year floodplains show areas with a 0.2% chance of flooding each year. The Kittitas County FIRMs initially became effective on May 5, 1981, and the current FIRMs became effective on September 24, 2021. **Figure 4-15** illustrates the Kittitas County SFHA, including each Flood Zone, and the 500-year floodplain

Figure 4-15. Kittitas County Special Flood Hazard Area



4.6.5.3. Hazard Extent/Intensity

Flood depth and velocity are the primary factors affecting flood extent/intensity. The deeper and faster floods flow the more damage they can cause. However, shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood extent/intensity is often evaluated by examining peak discharges. **Table 4-64** lists the peak flows utilized by FEMA to map Kittitas County's floodplains.[153]

[152] Ibid.
[153] Kittitas County. (1996). Comprehensive Flood Hazard Management Plan. Retrieved from https://www.co.kittitas.wa.us/uploads/documents/public-works/flood/documents/1996%20Kittitas%20County%20Comprehensive%20Flood%20Hazard%20Management%20Plan.pdf.

Table 4-64. Kittitas County Peak Discharges

Flooding Source and Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Year	50-Year	100-Year	500-Year
Yakima River					
Downstream Study Limit	1,594	20,000	29,300	33,900	45,400
Wilson Creek (Upstream)	1,190	19,000	28,000	32,300	43,600
Confluence with Manastash Creek	1,177	18,900	27,700	32,000	43,200
Confluence with Dry Creek	1,037	18,500	27,100	31,400	42,400
Confluence with Teanaway River	740	17,100	25,100	29,100	39,600
Confluence with Teanaway River (Upstream)	533	14,700	21,700	25,200	34,300
Confluence with Crystal Creek (Upstream)	495	14,500	21,400	24,700	33,800
Confluence with Cle Elum River	485	14,200	21,000	24,300	33,200
Confluence with Cle Elum River (Upstream)	263	7,990	11,700	13,500	18,400
Confluence with Big Creek (Upstream)	229	7,220	10,600	12,200	16,600
At Easton	188	6,580	9,660	11,200	15,200
Confluence with Cabin Creek and Kachees River (Upstream)	122	4,900	7,180	8,290	11,300
Confluence with Cabin Creek (Upstream)	82.1	3,740	5,480	6,300	8,600
Upstream	74.8	3,460	5,060	5,840	7,900
Kachees River					
Kachees River at Mouth	64.0	2,300	3,360	3,860	5,180
Silver Creek					
Silver Creek at Mouth	6.1	260	370	425	560
Cle Elum River					
Cle Elum River at Mouth	222	8,020	11,800	13,600	18,600
Upstream	203	7,540	11,100	12,800	17,400
Manastash Creek					
Downstream	87	1,400	2,000	2,010	2,700
Confluence of Manastash and North Fork Manastash Creeks	69.7	1,240	1,780	2,040	2,670
Upstream	42.8	967	1,400	1,590	2,100

Flooding Source and Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Year	50-Year	100-Year	500-Year
Crystal Creek					
Crystal Creek at Mouth	7.7	150	220	250	320
Naneum Creek					
Naneum Creek at Mouth	--	920	1,310	1,480	1,890
Wilson Creek					
Wilson Creek at Mouth[a]	396	3,100	4,250	4,750	5,900
Confluence with Cherry Creek (Upstream)	--	2,050	2,750	3,000	3,700
Confluence with Naneum Creek (Upstream)[a]	--	1,550	2,170	2,360	2,950
Upstream[a]	--	475	680	770	986
Reecer Creek					
Downstream	40	280	400	450	560
Currier Creek					
Downstream[b]	40	280	400	450	560
Dry Creek Connection Road	26.6	180	255	290	360
Whiskey Creek					
5th Street	--	75	105	175[c]	275[c]
Upstream	10.3	75	105	118	147
Mercer Creek					
Mercer Creek at Mouth	15.6	110	150	220[a]	310[a]
Railroad Avenue	--	110	150	170	210
Caribou Creek					
Downstream	36.7	294	417	471	595
Teanaway River					
Teanaway River at Mouth	207	5,300	6,700	7,350	8,700
Confluence with North Fork Teanaway River (Upstream)	69	2,400	3,000	3,300	3,900
North Fork Teanaway River					
North Fork Teanaway River at Mouth	95	2,900	3,700	4,000	4,750
Middle Fork Teanaway River					
Middle Fork Teanaway River at Mouth	30	1,250	1,570	1,700	2,020

Flooding Source and Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Year	50-Year	100-Year	500-Year
West Fork Teanaway River					
West Fork Teanaway River at Mouth	39.3	1,300	1,640	1,780	2,080
Upstream	19.2	790	1,000	1,080	1,260

[a] *Includes overflow from Yakima River, and Reecer, and Currier creeks.*
[b] *Combined values Reecer and Currier creeks.*
[c] *Includes overflow from Reecer Creek.*

Flooding can be unexpected and leave a small window of time for evacuation, if it is required. The NWS Pendleton, Oregon Forecast Office is responsible for issuing flood advisories in Kittitas County. **Table 4-65** outlines the flood advisories issued by the NWS as conditions warrant.

Table 4-65. NWS Flood Advisories

Type	Definition
Flood Advisory	Issued when a flood event warrants notification but is less urgent than a warning Advisories are issued for conditions that could cause a significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.
Flood Watch	Issued to indicate current or developing conditions that are favorable for flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flooding. In situations where a river or stream is expected to be the main source of the flooding, forecast confidence may allow for a Flood Watch to be issued several days in advance.
Flood Warning	Issued to inform the public of flooding that poses a serious threat to life and/or property. A Flood Warning may be issued hours to days in advance of the onset of flooding based on forecast conditions. Floods occurring along a river usually contain river stage (level) forecasts.
Flash Flood Watch	Issued to indicate current or developing conditions that are favorable for flash flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flash flooding.
Flash Flood Warning	Issued to inform the public, emergency management and other cooperating agencies that flash flooding is in progress, imminent, or highly likely. Flash Flood Warnings are urgent messages as dangerous flooding can develop very rapidly, with a serious threat to life and/or property. Flash Flood Warnings are usually issued minutes to hours in advance of the onset of flooding.

NWS issues Flash Flood Warnings Impact-Based Warnings for events that occur within approximately six (6) hours of heavy rainfall. The flash flood impact-based warnings fall into the three (3) categories listed in **Table 4-66**.[154]

Table 4-66. NWS Flash Flood Impact Based Warnings

Type	Definition
Base	Used most of the time when flash flood impact is possible.

[154] National Weather Service. (2019). Impact-Based Flash Flood Warning. Retrieved from https://www.weather.gov/media/wrn/FFW-IBW-factsheet.pdf.

Type	Definition
Considerable	Used rarely, when there are indications flash flooding capable of unusual severity or impact is imminent or ongoing and urgent action is needed to protect lives and property. Will trigger the Wireless Emergency Alert system.
Catastrophic	Used exceedingly rarely, when a flash flood threat to life and catastrophic damage is occurring or is imminent, and floodwaters have risen or will rise to levels rarely if ever seen. Will trigger the Wireless Emergency Alert system.

When a river reaches flood stage, NWS River Forecast Centers convey the magnitude of observed forecast flooding using flood severity categories based on property damage and public threat. The three (3) flood severity categories are listed in **Table 4-67**.[155]

Table 4-67. NWS River Flood Severity Categories

Type	Definition
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience.
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

4.6.5.4. Probability and Frequency

The probability of occurrence for flooding in Kittitas County is medium because significant occurrences of this hazard have occasionally impacted the County and will likely occur again within 25 years. Kittitas County experiences episodes of riverine flooding almost every winter and significant floods that can cause property damage typically to occur every three (3) to seven (7) years. However, nuisance flooding (i.e., urban flooding) related to drainage issues is experienced annually in urban portions of the County.

Isolated and lower-impact events occur with recurrent regularity. The number of years between floods of any given severity significantly varies due to a naturally changing climate. According to USGS, the reoccurrence interval is based on the probability that the given event will be equaled or exceeded in any given year based on past occurrences. The concept of reoccurrence intervals and probabilities is outlined in **Table 4-68**.[156]

Table 4-68. Recurrence Intervals and Probabilities of Occurrences

Recurrence Interval *(years)*	Probability of Occurrence In any Given Year	Percent Chance of Occurrence in Any Given Year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20

[155] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Frequently Asked Questions About Floods. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/faq/.
[156] United States Geological Surve, New Jersey Water Science Center. (n.d.). Floods: Recurrence Intervals and 100-Year Floods. Retrieved from https://www.usgs.gov/centers/new-jersey-water-science-center/floods-recurrence-intervals-and-100-year-floods#data.

Recurrence Interval *(years)*	Probability of Occurrence In any Given Year	Percent Chance of Occurrence in Any Given Year
2	1 in 2	50

The FEMA NRI analyses flooding data as riverine flooding – when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land.[157] The riverine flooding annualized frequency value represents the average number of recorded riverine flooding hazard occurrences, in event days, per year over the period of record (24 years). **Table 4-69** outlines the annualized frequency for riverine flooding, based on FEMA NRI data, for Kittitas County.

Table 4-69. Riverine Flooding Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(1996 – 2019)*	Annualized Frequency
Kittitas County	17	0.7 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

Repetitive Loss and Severe Repetitive Loss Properties

FEMA defines a Repetitive Loss property as an NFIP-insured property meeting at least one (1) of the following paid loss criteria since 1978, regardless of any changes in ownership:

- Four (4) or more separate claims payments greater than $5,000 each (including building and contents payment).
- Two (2) or more separate flood insurance claims payments (building payments only), where the total of the payments is greater than the property's current value.

Additionally, to receive a designation, at least two (2) of the claim payments must occur within 10 years of one another.[158]

A Severe Repetitive Loss property is defined by FEMA as any NFIP-insured single-family or multi-family residential building meeting at least one (1) of the following paid loss criteria since 1978 or from building constructed after 1978, regardless of any changes in ownership:

- That has incurred flood-related damage for which four (4) or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000.
- For which at least two (2) separate claims payments (building payments only) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the building.[159]

[157] Federal Emergency Management Agency. (n.d.). FEMA National Risk Index: Riverine Flooding. Retrieved from https://hazards.fema.gov/nri/riverine-flooding.
[158] Federal Emergency Management Agency, National Flood Insurance Program. (2023). A Policyholder's Guide to Severe Repetitive Loss. Retrieved from https://agents.floodsmart.gov/sites/default/files/fema_nfip-policyholders-guide-severe-repetitive-loss_brochure_07-2023.pdf.
[159] Federal Emergency Management Agency, National Flood Insurance Program. (2021). National Flood Insurance Program: Flood Insurance Manual. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_nfip-all-flood-insurance-manual-apr-2021.pdf.

Additionally, to receive designation, at least (2) of the claims must be within 10 years of each other. Claims within 10 days of each other will be counted as one (1) claim.

Refer to Section 3.11 of this Plan for a list of Kittitas County jurisdiction participating in the NFIP and CRS.

Table 4-70 summarizes FEMA Repetitive Loss and Severe Repetitive Loss properties in Kittitas County and its municipalities.

Table 4-70. Kittitas County Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	Repetitive Loss Properties	Severe Repetitive Loss Properties
Kittitas County	15	1
City of Cle Elum	1	0
City of Ellensburg	0	0
City of Kittitas	1	0
City of Roslyn	0	0
Town of South Cle Elum	0	0

Table 4-71 summarizes the NFIP active policies and coverage in force data for Kittitas County and its municipalities.

Table 4-71. Kittitas County NFIP Policies

Jurisdiction	Community ID	NFIP Policies	Insurance in Force	Total Claims Paid	Sum of Claims Paid
Kittitas County	530095	297	$79.207 Million	205	$2.330 Million
City of Cle Elum	530096	19	$5.337 Million	12	$162,832
City of Ellensburg	530234	75	$21.583 Million	31	$206,669
City of Kittitas	530098	19	$3.596 Million	13	$9,808
City of Roslyn	530299	3	$1.153 Million	0	$0
Town of South Cle Elum	530263	8	$1.874 Million	1	$8,374

4.6.5.5. Past Events

The National Centers for Environmental Information (NCEI) has reported 21 flood events between 1997 and 2023 in Kittitas County. Notably on January 7, 2009, heavy rainfall on deep snowpack caused excessive runoff and moderate flooding on the Yakima River with damage reported in the cities of Cle Elum, Roslyn, and the west portion of Ellensburg. This resulted in flooded roads that buckled in some areas and property damage totaling $10 Million. Additionally, on May 16, 2011, an upper level low pressure system over the Pacific Northwest produced heavy rainfall and combined with a significant amount of spring snowpack significant flooding occurred. Property damage totaled $4 Million.

Table 4-72 lists flood events that occurred in Kittitas County between 1997 and 2023.

Table 4-72. Flood Events (1997 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
ELLENSBURG	Kittitas County	WA	3/13/2017	10:15	Flood	0	0	0.00K	0.00K
HORLICK	Kittitas County	WA	8/14/2014	15:45	Flash Flood	0	0	0.00K	0.00K
NELSON	Kittitas County	WA	5/9/2013	14:36	Flood	0	0	0.00K	0.00K
LIBERTY	Kittitas County	WA	5/15/2011	0:00	Flood	0	0	4.00M	0.00K
HOLMES	Kittitas County	WA	4/1/2011	0:00	Flash Flood	0	0	0.00K	0.00K
TEANAWAY	Kittitas County	WA	4/1/2011	0:00	Flood	0	0	0.00K	0.00K
MARTIN	Kittitas County	WA	4/1/2011	0:00	Flood	0	0	0.00K	0.00K
MARTIN	Kittitas County	WA	3/31/2011	10:30	Flood	0	0	0.00K	0.00K
UMTANUM	Kittitas County	WA	3/31/2011	13:00	Flood	0	0	0.00K	0.00K
CLE ELUM ARPT	Kittitas County	WA	3/31/2011	15:00	Flood	0	0	0.00K	0.00K
EASTON	Kittitas County	WA	1/15/2011	6:00	Flood	0	0	2.15M	0.00K
EASTON	Kittitas County	WA	1/7/2009	0:00	Flood	0	0	10.00M	0.00K
CLE ELUM	Kittitas County	WA	3/12/2007	0:00	Flood	0	0	0.00K	0.00K
CLE ELUM	Kittitas County	WA	11/6/2006	0:00	Flood	0	0	0.00K	0.00K
VANTAGE	Kittitas County	WA	5/4/2005	14:40	Flash Flood	0	0	90.00K	0.00K
ROZA	Kittitas County	WA	5/20/2004	15:30	Flash Flood	0	0	2.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	2/1/2003	0:00	Flood	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/31/2003	13:45	Flood	0	0	3.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/28/1998	11:00	Flood	0	0	0.00K	0.00K
ELLENSBURG	Kittitas County	WA	7/3/1998	13:30	Flash Flood	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/17/1997	18:00	Flood	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**16.25M**	**0.00K**

4.6.5.6. Vulnerability and Impacts

Life Safety and Health: Most deaths during a flood occur when vehicles are driven into hazardous floodwater. Vehicles trying to drive through flooded areas or standing water can be swept away and potentially drown. Additionally, a number of hazards can be hidden below floodwater which is why it is imperative to avoid floodwater. Floodwater and standing water can make you vulnerable to infectious diseases, chemical hazards, and injuries.[160]

Property Damage and Critical Facilities: Floods pose a direct threat to private property and critical infrastructure, especially those within the floodplain. Flooding can block or damage roads or railroads which can isolate residents and can prevent access throughout the County, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges that are washed out or blocked by floods or debris also can cause isolation. There are six (6) major roads within the County that are within the 100-year floodplain; therefore, exposed to flooding – Interstate 82, Interstate 90 State Route 10, State Route 821, State Route 970, and US Route 97. Although some of these roads

[160] Centers for Disease Control and Prevention. (2022). Flood Waters or Standing Waters. Retrieved from https://www.cdc.gov/healthywater/emergency/extreme-weather/floods-standingwater.html.

are built above flood level and/or have infrastructure in place to prevent flooding (e.g., levees), in the event of severe flooding these roads can be blocked or damaged. Furthermore, underground utilities can be damaged and levees in rivers, streams, and creeks can fail and inundate the land that they protect. Water and sewer infrastructure is extremely vulnerable to flooding. Floodwaters are capable of backing up drainage systems and culverts can be blocked by debris from the flood event resulting in localized flooding. Additionally, drinking water can be contaminated when floodwater enters the drinking water supplies, and sewer systems can be backed up causing wastewater to spill into homes, neighborhoods, rivers, and streams causing significant public health concerns.

Economy: Flooding events could have a significant impact on the Kittitas County economy. Businesses could be flooded and be unable to reopen until necessary repairs are completed. Studies show that 40% of businesses do not reopen after a disaster, another 25% will close one (1) year after the hazard event, and 90% of companies fail within two (2) years of being impacted by a disaster.[161] Flooding frequently results in roads and bridges becoming impassable, impacting employee's ability to reach their place of work and the supply chain. With 27% of the population employed in local and state government, there could be major impacts on the basic functioning of the government. Other industries that will be particularly impacted will be Accommodation and Food Service with 14.8% of Kittitas County employees, Retail Trade with 12.5%, and Health Services with 8.1%.[162]

Locations that are directly flooded experience the greatest economic impact. In these areas, renovations of commercial buildings may be necessary, disrupting associated services. Significant damage may occur in agricultural areas, with the destruction of crops and other agricultural products. The tourism industry may be affected by major flood events, as popular vacation areas tend to overlap flood hazard zones. Finally, flooding can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur; and drinking water and wastewater treatment facilities may be temporarily out of operation.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to floods. Future development may slightly increase (between 5% and 9%) the impact of floods within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population face unique vulnerabilities and impacts as a result of flooding. These groups include, but are not limited to, race and ethnic minorities, low-income population, people with limited English proficiency, the elderly population, individuals with no high school diploma, and those with access and functional needs. The low income population and minority population are more likely to reside in high flood prone areas. Additionally, low income populations have been shown to be less likely to evacuate in response to warning systems. Minorities and individuals with limited English proficiency may have limited access to information and resources designed to prevent or mitigate flooding risk due to language or cultural differences. Individuals with no high school diploma are more likely to receive lower hourly wages and have less wealth; therefore, they may be forced to live in less desirable areas (e.g., highly flood prone areas). The elderly and individuals with access and functional needs may require additional assistance to evacuate and take the appropriate precautions before, during, and after a flooding incident.[163]

[161] Access. (2020). Study: 40% of Businesses Fail to Reopen After a Disaster. Retrieved from https://www.accesscorp.com/press-coverage/study-40-percent-businesses-fail-reopen-disaster/.
[162] Washington State Employment Security Department. (2022). Kittitas County Profile. Retrieved from https://esd.wa.gov/labormarketinfo/county-profiles/kittitas.
[163] Environmental Protection Agency. (n.d.). Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. Retrieved from https://www.epa.gov/cira/social-vulnerability-report.

Effects of Climate Change in Severity of Impacts: As global average temperatures increase, evaporation increases adding moisture to the atmosphere, which results in more precipitation.[164] Heavy precipitation events are expected to increase as much as three (3) times the historical average by the end of the century. Although heavy precipitation does not necessarily result in flooding, the potential increases and in some location moderate amounts of precipitation can lead to serious damage.[165] **Table 4-73** indicates the 25-year precipitation projections for Kittitas County. **Table 4-74** outlines the flood associated climate indicators for Kittitas County projected through the end of the century.[166]

Table 4-73. 25-Year Climate Projections for Kittitas County

Higher Emissions (RCP8.5)
Kittitas County is expected to experience a 12% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience 0.8 more days of heavy precipitation per year (from 6.9 days to 7.8 days per year).
Lower Emissions (RCP4.5)
Kittitas County is expected to experience a 5% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience 0.3 more days of heavy precipitation per year (from 7.2 days to 7.5 days per year).

[164] Environmental Protection Agency. (n.d.). Climate Change Indicators: U.S. and Global Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation.
[165] Denchak, M. (2019). Flooding and Climate Change: Everything You Need to Know. Retrieved from https://www.nrdc.org/stories/flooding-and-climate-change-everything-you-need-know.
[166] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-74. Future Climate Indicators for Kittitas County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Annual average total precipitation	**37 inches**	**38 inches**	**38 inches**	**39 inches**	**40 inches**	**40 inches**	**41 inches**
	35 – 38	36 – 58	35 – 55	35 – 63	36 – 56	35 – 62	35 – 60
Days per year with precipitation *(Wet Days)*	**156 days**	**155 days**	**154 days**	**153 days**	**153 days**	**152 days**	**148 days**
	152 – 160	145 – 172	142 – 170	137 – 176	140 – 170	137 – 173	128 – 167
Maximum period of consecutive wet days	**17 days**	**17 days**	**17 days**	**17 days**	**17 days**	**17 days**	**17 days**
	16 – 18	15 – 21	15 – 21	14 – 20	15 – 21	15 – 19	13 – 22
Annual Days with							
Annual days with total precipitation greater than 1 inch	**6 days**	**7 days**	**7 days**	**7 days**	**7 days**	**8 days**	**8 days**
	7 – 9	10 – 19	10 – 21	12 – 28	13 – 35	13 – 38	22 – 61
Annual days with total precipitation greater than 2 inches	**1 day**	**1 day**	**1 day**	**1 day**	**1 day**	**1 day**	**2 days**
	1 – 1	1 – 3	1 – 3	1 – 4	1 – 3	1 – 4	1 – 4
Annual days with total precipitation greater than 3 inches	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1
Annual days that exceed 99th percentile precipitation	**5 days**	**6 days**	**6 days**	**7 days**	**7 days**	**7 days**	**8 days**
	1 – 13	2 – 15	2 – 15	2 – 16	2 – 17	2 – 18	2 – 20
Days with maximum temperature below 32°F	**52 days**	**43 days**	**40 days**	**36 days**	**33 days**	**32 days**	**21 days**
	50 – 55	36 – 48	32 – 47	26 – 46	19 – 43	18 – 43	9 – 36

Hazus

A Hazus analysis was conducted for a 100-year and 500-year flood to examine the exposure and damages of buildings to flooding.

100-Year Flood Analysis

The total economic loss estimated for the flood is $1,005.6 Million, representing 23.3% of the total replacement value of the scenario buildings. Hazus estimates that about 338 buildings will be at least moderately damaged. This is over 56.0% of the total number of buildings in the scenario. There are an estimated 21 buildings that will be completely destroyed. **Table 4-75** and **Table 4-76** summarize the expected damage by general occupancy and by building type, respectively, for the buildings in Kittitas County.

Table 4-75. Hazus 100-Year Flood Expected Building Damage by Occupancy

Damage Level	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
Occupancy	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial	27.0	45.0	33.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Education	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government	18.0	62.0	11.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	7.0	64.0	4.0	36.0	0.0	0.0	0.0	0.0	0.0	0.0
Religion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	111.0	28.0	166.0	42.0	48.0	12.0	33.0	8.0	15.0	4.0	21.0	5.0
TOTAL	**156.0**		**217.0**		**52.0**		**33.0**		**15.0**		**21.0**	

Table 4-76. Hazus 100-Year Flood Expected Building Damage by Building Type

Damage Level	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
Building Type	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Concrete	17.0	47.0	18.0	50.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufactured Housing	7.0	18.0	6.0	15.0	5.0	13.0	0.0	0.0	5.0	13.0	17.0	43.0
Masonry	10.0	48.0	11.0	52.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Steel	3.0	43.0	4.0	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood	107.0	29.0	171.0	46.0	43.0	12.0	33.0	9.0	10.0	3.0	4.0	1.0

Table 4-77 summarizes the expected damage to essential facilities in Kittitas County.

Table 4-77. Hazus 100-Year Flood Expected Damage to Essential Facilities

Facility	Total	At Least Moderate	At Least Substantial	Loss of Use
Hospitals	1	0	0	0
Schools	22	0	0	0
Emergency Operations Center	2	1	0	1
Police Stations	6	0	0	0
Fire Stations	20	2	0	2

The total building related losses were $334.3 Million. 67% of the estimated losses were related to the business interruption in Kittitas County. The residential occupancies made up 12.2% of the total loss. **Table 4-78** provides a summary of the losses associated with the building damage in Millions of dollars.

Table 4-78. Hazus 100-Year Flood Building Related Economic Loss Estimates (Millions of Dollars)

	Area	Residential	Commercial	Industrial	Others	Total
Building Loss	Building	56.84	16.23	17.38	13.98	104.44
	Content	29.85	62.53	44.28	75.67	212.33
	Inventory	0.00	9.05	6.96	1.55	17.56
	TOTAL	**86.69**	**87.81**	**68.62**	**91.20**	**334.32**
Business Interruptions	Income	0.51	58.09	1.34	16.79	76.73
	Relocation	26.96	15.68	1.56	23.80	66.00
	Rental Income	9.32	10.66	0.47	9.19	29.63
	Wage	1.23	60.74	2.29	434.62	498.87
	TOTAL	**36.01**	**145.17**	**5.66**	**484.40**	**671.24**
SUBTOTAL		**122.70**	**232.98**	**74.28**	**575.60**	**1,005.56**

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood incident and associated potential evacuation. Hazus also estimates the number of displaced individuals that will require accommodations in temporary public shelters. The model estimates 910 households (2,730 people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 148 people (out of a total population of 44,271) will seek temporary shelter in public shelters.

500-Year Flood Analysis

The total economic loss estimated for the flood is $1,420.9 Million, representing 33.0% of the total replacement value of the scenario buildings. Hazus estimates that about 503 buildings will be at least moderately damaged. This is over 56% of the total number of buildings in the scenario. There are an estimated 57 buildings that will be completely destroyed. **Table 4-79** and **Table 4-80** summarize the expected damage by general occupancy and by building type, respectively, for the buildings in Kittitas County.

Table 4-79. Hazus 500-Year Flood Expected Building Damage by Occupancy

Damage Level	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
Occupancy	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial	33.0	39.0	49.0	58.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Education	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government	24.0	59.0	17.0	41.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	1.0	8.0	5.0	42.0	3.0	25.0	3.0	25.0	0.0	0.0	0.0	0.0
Religion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Damage Level	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
Occupancy	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Residential	120.0	22.0	209.0	38.0	73.0	13.0	54.0	10.0	31.0	6.0	57.0	10.0
TOTAL	**178.0**		**280.0**		**78.0**		**57.0**		**31.0**		**57.0**	

Table 4-80. Hazus 100-Year Flood Expected Building Damage by Building Type

Damage Level	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
Building Type	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Concrete	22.0	49.0	21.0	47.0	2.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufactured Housing	11.0	17.0	11.0	17.0	8.0	13.0	0.0	0.0	5.0	8.0	28.0	44.0
Masonry	12.0	32.0	23.0	61.0	2.0	5.0	0.0	0.0	0.0	0.0	1.0	3.0
Steel	7.0	54.0	6.0	46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood	111.0	22.0	210.0	43.0	65.0	13.0	54.0	11.0	26.0	5.0	28.0	6.0

Table 4-81 summarizes the expected damage to essential facilities in Kittitas County.

Table 4-81. Hazus 500-Year Flood Expected Damage to Essential Facilities

Facility	Total	At Least Moderate	At Least Substantial	Loss of Use
Hospitals	1	0	0	0
Schools	22	0	0	0
Emergency Operations Center	2	1	0	1
Police Stations	6	0	0	0
Fire Stations	20	5	0	4

The total building related losses were $502.7 Million. 65% of the estimated losses were related to the business interruption in Kittitas County. The residential occupancies made up 13.4% of the total loss. **Table 4-82** provides a summary of the losses associated with the building damage in Millions of dollars.

Table 4-82. Hazus 500-Year Flood Building Related Economic Loss Estimates (Millions of Dollars)

	Area	Residential	Commercial	Industrial	Others	Total
Building Loss	Building	89.49	25.54	24.53	22.37	161.91
	Content	47.25	97.06	63.14	106.32	313.76
	Inventory	0.00	15.02	9.65	2.31	26.98
	TOTAL	**136.73**	**137.63**	**97.31**	**130.99**	**502.66**
Business Interruptions	Income	1.85	82.14	1.70	22.44	108.13
	Relocation	33.53	22.22	1.91	31.97	89.64
	Rental Income	14.15	15.34	0.57	12.44	42.51
	Wage	4.37	87.99	2.87	582.70	677.92
	TOTAL	**53.90**	**207.70**	**7.05**	**649.55**	**918.20**
SUBTOTAL		**190.63**	**345.33**	**104.36**	**780.54**	**1,420.85**

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood incident and associated potential evacuation. Hazus also estimates the number of displaced individuals that will require accommodations in temporary public shelters. The model estimates 1,195 households (3,584 people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 178 people (out of a total population of 44,271) will seek temporary shelter in public shelters.

4.6.5.7. FEMA NRI Expected Annual Loss Estimates

A riverine flooding NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to riverine flooding when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-83** outlines the riverine flooding EAL for Kittitas County.

Table 4-83. Riverine Flooding Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$186,606	$2.2 Million	$8,521	$2.4 Million	86.2	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.5.8. Flooding Risk Index Scores

The FEMA riverine flooding Risk Index score and rating represent a community's relative risk for riverine flooding when compared to the rest of the United States. **Table 4-84** illustrates the riverine flooding Risk Index rating and score for Kittitas County.

Table 4-84. Riverine Flooding Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	84.44
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-85 represents the Flood Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-85. Flood Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Flood	2	18	11	31	60	59

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.6. Landslide

4.6.6.1. Description

A landslide is the downslope movement of a mass of rock, debris, or earth at rates that range from inches per year to tens of miles per hour. Landslides are a type of "mass wasting," which denotes any downslope movement of soil and rock under the direct influence of gravity. The landslide term is comprised of five (5) types of slope movement – falls, topples, slides, spreads, and flows – which are further subdivided by the type of geologic material (i.e., bedrock, debris, or earth).[167] A major difference between the types of landslides is their depth and the amount of water they contain. Slope movement occurs when forces acting downslope exceed the strength of the earth's material that composes the slope. The modes of slope movement are listed in **Table 4-86**.[168]

Landslides are an important natural process because they shape the Earth's landscape and contribute to the overall environmental quality of a region. However, when landslides impact people, property, or infrastructure it is considered a natural hazard.

Table 4-86. Types of Slope Movement

Type	Description
Falls and Topples	Usually rapid, downward movement of large pieces of rock or debris. Sometimes this is enough rock to cover a road or block a stream or river. Rockfalls and topples are common in Washington's mountain highways.
Slides	Downslope movements of soil or rock along a discrete or narrow failure surface and can be deep-seated or shallow. The initiation of slides, like flows or rockfalls, is sensitive to steep slopes, the additional weight of water or other loads, and friction along their base. • **Translational Slides:** Usually fail along geologic discontinuities such as faults, joints, bedding surfaces, or the contact between two rock types. They move out or down along a planar surface with little tilting and can travel great distances. Translational slides can contain loose sediments or large slabs of bedrock. • **Block Slides:** A type of translational slide that occurs when large and relatively intact slabs of rock or earth are rapidly transported downslope. These type of landslides can be large and damaging and occur where alternating layers of strong and weak rock slope downhill. • **Rotational Slides (Slumps):** occur along a curved or spoon-shaped surface. Back-tilting may occur near the scarp of the landslide and there is often a toe of displaced material. Rotational slides often occur because the internal strength of the material is overcome by its own weight. They are usually composed of relatively loose or unconsolidated material.

[167] United States Geological Survey. (n.d.). What is a Landslide and What Causes One? Retrieved from https://www.usgs.gov/faqs/what-landslide-and-what-causes-one.
[168] Washington State Department of Natural Resources. (n.d.). Landslides. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/landslides.

Type	Description
Flows	It is generally a slurry mixture of water, soil, rock and (or) debris that moves rapidly downslope. Flows may or may not be confined to a channel. • **Earthflows:** Have a characteristic 'hourglass' shape. The slope material loses strength and runs out, often forming a bowl or depression at the head. Flows usually occur in fine-grained material on moderate, water-saturated slopes. • **Debris Flows:** Usually occur in steep gullies, move very rapidly, and can travel for many miles. They may contain more coarse material than mudflow when channelized. Slopes where vegetation has been removed by fire or humans are at greater risk for debris flows and many other types of landslides. • **Debris Avalanches:** Unchanneled debris flows that move very rapidly. They typically do not mobilize far and sometimes move like a snow avalanche. • **Lahars:** debris flows that originate on volcanoes. A volcanic eruption can rapidly melt snow and ice, causing a deluge of rock, soil, ash, and water that accelerates down the slopes of a volcano, devastating anything in its path. They can travel great distances and damage structures in flat areas far from their source. • **Lateral Spreads:** occur on very low-angle slopes toward a free face such as a cliff or embankment. Movement is accompanied by cracking of the ground. Failure is often caused by liquefaction (when soil is transformed from a solid to a liquid), usually because of an earthquake. • **Soil Creep:** is the very slow (inches/year), steady, downward movement of soil or rock. Creep is indicated by curved tree trunks, bent fences or retaining walls, tilted poles or fences, and small soil ripples or ridges.
Complex	Occurs when more than one (1) type of movement occurs sequentially during a failure.
Composite	Occurs when more than one (1) type of movement does not occur sequentially during a failure.

4.6.6.2. Hazard Location

The best available predictor of where movement of slides and earth flows might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles and many show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges.

The recognition of ancient dormant mass movement sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding. Some areas are more likely to experience landslides, such as: [169]

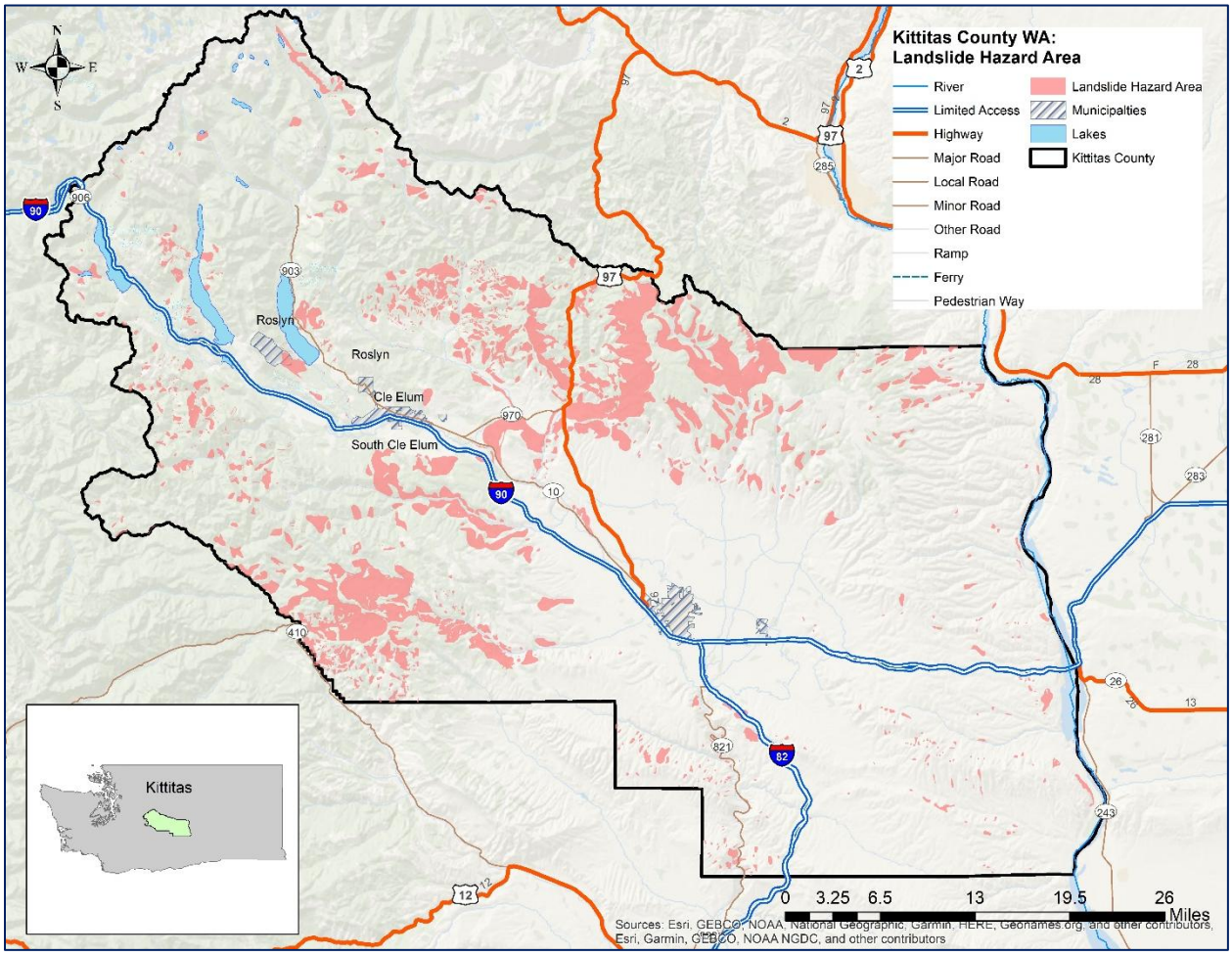
- Areas where wildfires or human modification of the land have destroyed vegetation.

[169] Centers for Disease Control and Prevention. (2024). Landslides and Mudslides and Your Safety. Retrieved from https://www.cdc.gov/landslides-and-mudslides/about/index.html.

- Areas where landslides have occurred before.
- Steep slopes and areas at the bottom of slopes or canyons.
- Slopes that have been altered for construction of buildings and roads.
- Channels along a stream or river.
- Areas where surface runoff is directed.

Landslide susceptibility maps describe the relative likelihood of future land sliding based solely on the intrinsic properties of a location or site. There are three (3) site factors that most determine susceptibility – prior failure, rock or soil strength, and steepness of slope. **Figure 4-16** illustrates landslide hazard areas in Kittitas County.

Figure 4-16. Landslide Hazard Areas in Kittitas County



4.6.6.3. Hazard Extent/Intensity

In the United States, landslides cause billions of dollars in damages and kill between 25 and 50 people annually. Casualties are primarily caused by rockfalls, rockslides, and debris flows. Worldwide, landslides cause thousands of casualties and billions of dollars in damages.[170]

Landslides can occur suddenly or slowly. The velocity of mass movement depends on slope angle, material, and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to determine what areas are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides.

USGS provides a system of notification for potential landslides, listed in **Table 4-87**. Watches and warnings may be issued for discrete areas and include advice about contacting the area's local emergency management. Additionally, rainfall induced debris flows watches and warning are weather dependent and will closely track NWS advisories for flash flooding.[171]

Table 4-87. USGS Landslide Advisories

Type	Description
Landslide Advisory	A general statement about the potential of landslide activity in a given region relative to developing rainfall predictions. An advisory may include general statements about rainfall conditions that can lead to debris flow activity, and list precautions to be taken in the event of heavy rainfall.
Landslide Watch	Means that landslide activity will be possible but is not imminent. People in, or planning to travel through, a watch area should know landslide preparedness and stay informed about developing weather patterns.
Landslide Warning	Indicate that landslide activity is presently occurring, and extreme caution should be taken.

4.6.6.4. Probability and Frequency

The probability of occurrence for landslides in Kittitas County is medium because significant occurrences of this hazard have occasionally impacted the County and will likely occur again within 25 years. According to the 2023 Washington State Enhanced Hazard Mitigation Plan, the probability of future landslide related disaster declarations each year is 44% in the State.

Landslides are often triggered by other natural hazards such as earthquakes, heavy rainfall, floods, or wildfires; as a result, landslide frequency is often related to the frequency of these other hazards. In Kittitas County, landslides typically occur during and/or after heavy rainfall events, so the potential for landslides largely coincides with the potential for consecutive heavy rainfall events that saturate steep, vulnerable soils. However, the ground must be saturated prior to the onset of a heavy rainfall event for significant land sliding to occur. Most local landslides occur in January when the water table is higher after the wetter months of November and December. Water is involved in nearly all cases and human influence has been identified in more than 80% of reported landslides. Furthermore, as a result of climate

[170] United States Geological Survey. (2004). Landslide Types and Processes. Retrieved from https://pubs.usgs.gov/fs/2004/3072/pdf/fs2004-3072.pdf.
[171] United States Geological Survey. (n.d.). What is the Difference Between a Landslide Advisory, a Landslide Watch, and a Landslide Warning? Retrieved from https://www.usgs.gov/faqs/what-difference-between-landslide-advisory-landslide-watch-and-landslide-warning.

change, the frequency of landslides in areas at risk is expected to increase due to the impacts of extreme precipitation and wildfires (post-wildfire debris flows).[172]

The landslide annualized frequency value represents the average number of recorded landslide hazard occurrences in event days, per year over the period of record (11.8 years). **Table 4-88** outlines the annualized frequency for landslides, based on FEMA NRI data, for Kittitas County.

Table 4-88. Landslide Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(2010 – 2021)*	Annualized Frequency
Kittitas County	4	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.6.5. Past Events

There is little recorded information regarding landslides in Kittitas County. Between 1960 and 2023, there have been nine (9) significant landslide events in Kittitas County most of which have coincided with presidential disaster declarations for severe storms and flooding. The recorded events occurred on January 26, 1965; December 18, 1972; January 17, 1997; January 9, 2009; October 11, 2009; January 11, 2011; November 12, 2015; June 1, 2018; and February 2020.[173] Although there are no recorded fatalities in the County attributed to landslides, deaths have occurred across the west coast. The Oso Landslide of 2014 in Snohomish County, Washington provides context for the worst case scenario. This event caused 43 fatalities, destroyed 40 homes, and buried approximately one (1) mile of State Route 530. The landslide moved about 18 million tons of sand, till, and clay at an average speed of 40 miles per hour.

4.6.6.6. Vulnerability and Impacts

Life Safety and Health: In the United States, landslides result in 25 to 50 deaths each year. Landslides can cause injuries and fatalities to anyone that gets trapped in a vehicle or structure during a landslide, either in transit or if they happen to be standing in the area when the landslide occurs. Buildings, roads, and other structures built on landslide prone slopes can collapse trapping people causing injury or death during a landslide incident. Additionally, landslides can block roads and pathways impacting access to emergency services potentially hindering evacuation efforts.[174] In general, all of the population exposed to the higher risk landslide areas are considered to be vulnerable. As the population increases and many homes are built on property above or below bluffs and on steep slopes subject to mass movement, increases the number of lives endangered by this hazard.

Property Damage and Critical Facilities: Landslides can severely damage or destroy homes, rendering them uninhabitable. Additionally, property value may decrease in landslide prone areas and the cost of repairs can be significant. Roads, bridges, and utility lines (e.g., power, communication, water, irrigation, and gas) are vulnerable and can be impacted by a landslide incident. Access to major roads is crucial to life safety and response operations after a disaster event and recovery operations. Landslides can block egress and ingress on roads, causing neighborhoods to become isolated, traffic problems, and delays

[172] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.
[173] Events prior to 2018 were obtained from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) for the 2019 update of the Hazard Mitigation Plan. However, SHELDUS was not utilized the 2024 update and events that on or after 2018 were provided by the Kittitas County Public Works Department.
[174] Centers for Disease Control and Prevention. (2024). Landslides and Mudslides and Your Safety. Retrieved from https://www.cdc.gov/landslides-and-mudslides/about/index.html.

for public and private transportation. Furthermore, landslides can impact bridges when abutments are destroyed or compromised resulting in closure. Utility lines can be damaged by landslides leading to service interruptions. Landslides could impact the conveyance of irrigation water during the growing season resulting in severe indirect economic impacts. Other critical facilities potentially vulnerable to landslides include hospitals, healthcare facilities, emergency services, and schools.

Economy: Direct economic impacts due to landslides include the repair of roads and properties, road cleanup, and loss of life. Indirect economic impacts include the loss of property value and tax revenue, and environmental impacts (e.g., water quality degradation).[175] Businesses that heavily rely on the transportation infrastructure (e.g., movement of inventory) can be disrupted in the event that a landslide impacts or damages transportation lifelines. Kittitas County has a significant agricultural sector and the loss of the ability to deliver irrigation water would create direct economic impacts.

Changes in Development and Impact of Future Development: Changes in development have slightly increased (between 5% and 9%) the vulnerability of Kittitas County to landslides. Future development may minimally increase (4% or less) the impact of landslides within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population face unique vulnerabilities and impacts as a result of landslides. These groups include, but are not limited to, low-income families, elderly, individuals with disabilities, those with limited English proficiency, and those without adequate access to emergency resources. These groups may not have access to the appropriate education on landslide risk. Furthermore, these groups may not have access to accurate and timely information due to limited internet access, language barriers, and living in isolated areas. Therefore, critical landslide warnings may not reach these groups in a timely manner which results in higher injury and mortality rates within these communities. Additionally, those individuals living in isolated areas with limited access (e.g., one (1) road in and one (1) road out) are vulnerable to being cut off from community lifelines if a landslide were to block access to the area for an extended period of time.

Effects of Climate Change in Severity of Impacts: As global average temperatures increase; evaporation increases adding moisture into the atmosphere which results in more precipitation.[176] The frequency and intensity of heavy precipitation events are projected to increase over the 21st century.[177] Although heavy precipitation does not necessarily result in landslides, landslides are predominantly a result of saturated soils, it is possible that increased intensity of rain events will result in a greater number of landslides annually and an increase in the severity of impacts. Additionally, increases in temperatures will reduce snowpack and spring snowmelt, which may reduce the likelihood of spring landslides due to snowmelt.[178] Increasing temperatures are expected to increase the occurrence and duration of droughts and the probability of wildfire, reducing the vegetation that helps to support steep slopes. Overall, the impacts of climate change on various hazards will result in an increased probability for landslide occurrences.

[175] Washington State Department of Natural Resources. (n.d.). Landslides. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/landslides.
[176] Environmental Protection Agency. (n.d.). Climate Change Indicators: U.S. and Global Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation.
[177] U.S. Global Change Research Program. (2017). Climate Science Special Report: Fourth National Climate Assessment, Volume I (Chapter 7: Precipitation Change in the United States). Retrieved from https://science2017.globalchange.gov/chapter/7/.
[178] United States Department of Agriculture. (n.d.). Climate Change Impacts in the Northwest. Retrieved from https://www.climatehubs.usda.gov/hubs/northwest/topic/climate-change-impacts-northwest.

4.6.6.7. FEMA NRI Expected Annual Loss Estimates

A landslide NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to landslides when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-89** outlines the landslide EAL for Kittitas County.

Table 4-89. Landslide Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$61,729	$19,713	n/a	$81,441	78.2	Relatively High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.6.8. Landslide Risk Index Scores

The FEMA landslide Risk Index score and rating represent a community's relative risk for landslide when compared to the rest of the United States. **Table 4-90** illustrates the landslide Risk Index rating and score for Kittitas County.

Table 4-90. Landslide Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively High	76.9
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-91 represents the landslide Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-91. Landslide Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Landslide	2	12	12	13	37	39

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.7. Severe Weather

4.6.7.1. Description

For the purposes of this Plan, severe weather includes thunderstorms (i.e., heavy rainfall), hail, strong winds, tornadoes, and extreme temperatures (i.e., extreme heat and cold).

Thunderstorms

A thunderstorm is a rain shower with thunder and lightning. However, a thunderstorm is classified as *severe* when it contains one (1) or more of the following – hail of one (1) inch or greater, winds gusting in excess of 58 mph, and/or a tornado. For a thunderstorm to form, it needs three (3) basic ingredients – moisture, unstable rising air, and a lifting mechanism.[179] Thunderstorms form in three (3) stages – the developing stage, the mature stage, and the dissipating stage. The life cycle of a thunderstorm is outlined in **Table 4-92**.[180]

Table 4-92. Stages of a Thunderstorm

Stage		Description
1	Developing	Cumulus clouds form when warm moist air rises into cold air, and as it rises the moisture in the air condenses into water droplets. As long as warm air from below continues to rise, the clouds will continue to grow. An updraft of warm moist air can form when air is forced up the side of a mountain or when air is forced upward at weather fronts, where warm and cool air masses collide. However, updrafts often form simply because warm air rises, without a mountain or front to guide them. Air near the ground heats up during the day as energy from the Sun heats the ground, which subsequently heats the air. The warm air rises higher in the atmosphere because warm air has less mass than cool air.
2	Mature	As the cumulus cloud continues to grow, the tiny water droplets within the cloud grow larger as more water from the rising air is added to the droplets. The cloud starts to look dark and gray as more water is added, and the growing droplets that make up the cloud become heavy. Once the rising air cannot hold the raindrops, they begin to fall through the clouds. Meanwhile, cool dry air flows downward in the cloud (i.e., downdraft), resulting in rain. With an updraft, downdraft, and rain, the cloud is now called a cumulonimbus cloud, and the cycling of air up and down is called a thunderstorm cell. The moving air within the cloud builds up electric charges as it slides past other air allowing lightning to form, and as a result thunder when lightning strikes. Thunder often happens after you see the bolt of lightning because sound travels slower than light.
3	Dissipating	Once the downdrafts in the cloud become stronger than the updrafts, the storm begins to weaken. Since warm moist air can no longer rise, cloud droplets can no longer form. The storm dissipates with light rain as the cloud disappears from the bottom to the top. For an ordinary storm, the whole process takes about one (1) hour. However, for severe thunderstorms, which are much larger (e.g., supercells and squall lines) and powerful, tend to last several hours.

Thunderstorms can consist of one (1) or multiple convective cells, or one (1) extremely large and powerful convective cell. There are three (3) types of thunderstorms which are described in **Table 4-93**.[181]

[179] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Thunderstorm Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/.
[180] University Corporation for Atmospheric Research. (n.d.). How Thunderstorms Form. Retrieved from https://scied.ucar.edu/learning-zone/storms/how-thunderstorms-form.
[181] University Corporation for Atmospheric Research. (n.d.). Thunderstorms. Retrieved from https://scied.ucar.edu/learning-zone/storms/thunderstorms.

Table 4-93. Types of Thunderstorms

Type	Description
Single-Cell Thunderstorm	Thunderstorms created by just one (1) convection cell in the atmosphere. Most of these are small, lasting only about an hour, and are also called ordinary thunderstorms. These storms often form during summer and include towering cumulonimbus clouds that can grow 7.5 miles high in the atmosphere. Rain and lightning are common. Sometimes hail falls.
Multi-Cell Thunderstorms	Thunderstorms that are made from many convection cells that move as a single unit. Often the convection cells are arranged as a cluster, with each cell at a different stage of the thunderstorm cycle. Multi-cell storms along a cold or warm front, where warm air is pushed high into the atmosphere above cold air, often form a line, called a squall line. The squall line can be up to 600 miles long. Strong wind gusts can often be found just ahead of the storm.
Supercell Thunderstorms	Thunderstorms with deep, rotating updraft winds (i.e., supercells) are very large and last for hours releasing significant amounts of rain and sometimes even baseball-sized hail. They include fast moving convection – air zooming upward at as much as 175 mph. Rotation in supercells sometimes forms violent tornadoes, the largest and most damaging type, because the storms are so long-lived. Several tornadoes can be produced from one (1) supercell thunderstorm. Supercell clouds grow up to 11 miles high in the atmosphere. Although the least common types of thunderstorms, supercell thunderstorms are the most destructive.

Heavy Rainfall

There is no single definition for heavy (or extreme) rainfall. However, meteorologists consider instances where the amount of precipitation (rain or snow) experienced in a location substantially exceeds normal amounts. The amount of precipitation needed to qualify as heavy rainfall varies with location and season. Rainfall events share characteristics such as high moisture and an atmospheric disturbance (e.g., winter storm, atmospheric river) and when these conditions persist over an area, the more rainfall an area will receive.[182] Heavy rainfall is most frequently measured by tracking the frequency of events, analyzing the mean return period, and measuring the amount of precipitation in a certain period (most typically inches of rain within a 24-hour period)[183]. *Refer to the flood section of this Plan for further details on flooding as a result of heavy rainfall.*

Hail

Hail is a form of precipitation that consists of solid ice that forms inside thunderstorm updrafts. During a thunderstorm, hail forms when raindrops are carried upward by the thunderstorm's updrafts into extremely cold air and freeze. As the hailstones continue to be carried upward, they continue to collide with liquid water drops that freeze into the surface of the hailstone. Once the thunderstorm's updraft can no longer hold the weight of the hailstone, which occurs when the updraft weakens or the hailstone is too heavy, then the hail falls. When a hailstone encounters different liquid water content conditions and temperatures within the thunderstorms, it causes hailstone to have layers of clear and cloudy ice. The speed at which hail falls primarily depends on four (4) characteristics – hail size, friction between the hailstone and surrounding air, local wind conditions (horizontal and vertical), and degree of melting of the

[182] National Oceanic and Atmospheric Administration. (2018). Ask the Scientist: Extreme Rainfall, Why it Happens and How We Predict It. Retrieved from https://www.noaa.gov/stories/ask-scientist-extreme-rainfall-why-it-happens-and-how-we-predict-it.
[183] United States Environmental Protection Agency. (2023). Climate Change Indicators: Heavy Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation.

hailstone. There is much uncertainty in the average speed hail falls; however, NOAA developed the estimates shown on **Table 4-94**.[184]

Table 4-94. Hail Speed Estimates

Hail Size (inches)	Fall Speed (mph)
Less than 1	9 – 25
1 – 1.75	20 – 40
2 – 4	44 – 72
4 or greater	Over 100

Tornado

A tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground. A tornado is hard to see unless it forms a condensation funnel made up of water droplets, dust, and debris. Tornadoes are among the most violent phenomena of all atmospheric storms and atmospheric scientists continue to conduct research to better understand how tornadoes form. Tornadoes come from mainly two (2) types of thunderstorms – supercell and non-supercell.[185] **Table 4-95** outlines the types of tornadoes.[186]

Table 4-95. Types of Tornadoes

Type	Description
Supercell	The most common and destructive tornadoes occur from supercells. A supercell is a rotating thunderstorm with a well-defined radar circulation called a mesocyclone. *Supercells can also produce damaging hail, severe non-tornadic winds, frequent lightning, and flash floods.* The rotating updraft from a supercell is the key development for a tornado. One way a column of air can begin to rotate is from wind shear when winds at two (2) different levels above the ground blow at different speeds or in different directions. Once the updraft is rotating and fed with warm moist air flowing in the ground level, a tornado can form.
Non-Supercell	Nearly 20% of all tornadoes are associated with lines of strong thunderstorms called quasi-linear convective systems (QLCS). QLCS tornadoes frequently occur during the late night and early morning hours. These tornadoes, however, tend to be weaker and shorter-lived on average than those associated with supercell thunderstorms. NOAA's National Severe Storms Laboratory (NSSL) researchers are looking for ways to detect QLCS tornadoes more effectively.
Another type of non-supercell tornado is a landspout. A landspout is a tornado with a narrow, rope-like condensation funnel that forms while the thunderstorm cloud is still growing and there is no rotating updraft - the spinning motion originates near the ground.	

Strong Winds/Damaging Winds

Strong winds/damaging winds are classified as those exceeding 58 mph and are often called "straight-line" winds to differentiate the damage they cause from tornado damage. Damage from strong winds/damaging winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from a tornado. These types of winds can reach up to 100 mph and produce a

[184] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.
[185] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Tornado Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/.
[186] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Tornadoes. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/types/.

damage path extending hundreds of miles.[187] **Table 4-96** outlines the different types of strong winds.[188] Strong winds in the State of Washington are often associated with atmospheric river events. Atmospheric rivers are long, concentrated regions in the atmosphere that transport moist air from the tropics to higher latitudes. The combination of moist air and high wind speeds produces heavy precipitation upon landfall, especially over mountainous terrain. As atmospheric rivers move over land, conditions can be similar to a tropical cyclone leading to flash flooding, landslides, cyclone force winds, increased wave heights, and catastrophic damage to life and property.[189] *Refer to the flood and landslide sections of this Plan for further details on these hazards.* Over the last 20 years, studies show that globally half of the most extreme mid-latitude windstorms were associated with atmospheric rivers, causing billions of dollars in damages.[190]

Table 4-96. Types of Strong Winds

Type	Description
Straight-line Wind	Term is used to define any thunderstorm wind that is not associated with a rotation and is used mainly to differentiate from tornadic winds.
Downdraft	A small-scale column of air that rapidly winds towards the ground.
Macroburst	An outward burst of strong winds at or near the surface with horizontal dimensions larger than 2.5 miles and occurs when a strong downdraft reaches the surface. Macroburst winds may begin over a smaller area and then spread out over a wider area, sometimes producing damage similar to a tornado. Although usually associated with thunderstorms, macrobursts can occur with showers too weak to produce thunder.
Microburst	A small, concentrated downburst that produces an outward burst of strong winds at or near the surface. Microbursts are small (less than 2.5 miles across) and short-lived (five (5) to 10 minutes) with maximum windspeeds sometimes exceeding 100 mph. There are two (2) kinds of microbursts – wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
Gust Front	The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
Derecho	A widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous downbursts and downburst clusters. By definition, if the wind damage swath extends more than 240 miles and includes wind gusts of at least 58 mph or greater along most of its length, then the event may be classified as a derecho.
Haboob	A wall of dust that is pushed out along the ground from a thunderstorm downdraft at high speeds.
A **downburst is the general term used to broadly describe macro and microbursts.*	

[187] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Damaging Winds Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/wind/.
[188] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Damaging Winds. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/wind/types/.
[189] National Oceanic and Atmospheric Administration. (2023). Atmospheric Rivers: What are They and How Does NOAA Study Them? Retrieved from https://research.noaa.gov/2023/01/11/atmospheric-rivers-what-are-they-and-how-does-noaa-study-them/.
[190] Buis, A. (2017). In Atmospheric River Storms, Wind Is a Risk, Too. Retrieved from https://www.jpl.nasa.gov/news/in-atmospheric-river-storms-wind-is-a-risk-too.

Strong winds not associated with thunderstorms are often referred to as gradient winds and are usually a result of tight pressure gradients between strong areas of low pressure and high pressure. These strong winds can be just as strong as thunderstorm wind gusts, but cover a much larger area, and can result in widespread damage.[191]

In coastal regions a strong wind is called a gale. Gale winds are sustained surface winds between 34 and 47 knots (39 to 54 mph).

Extreme Temperatures

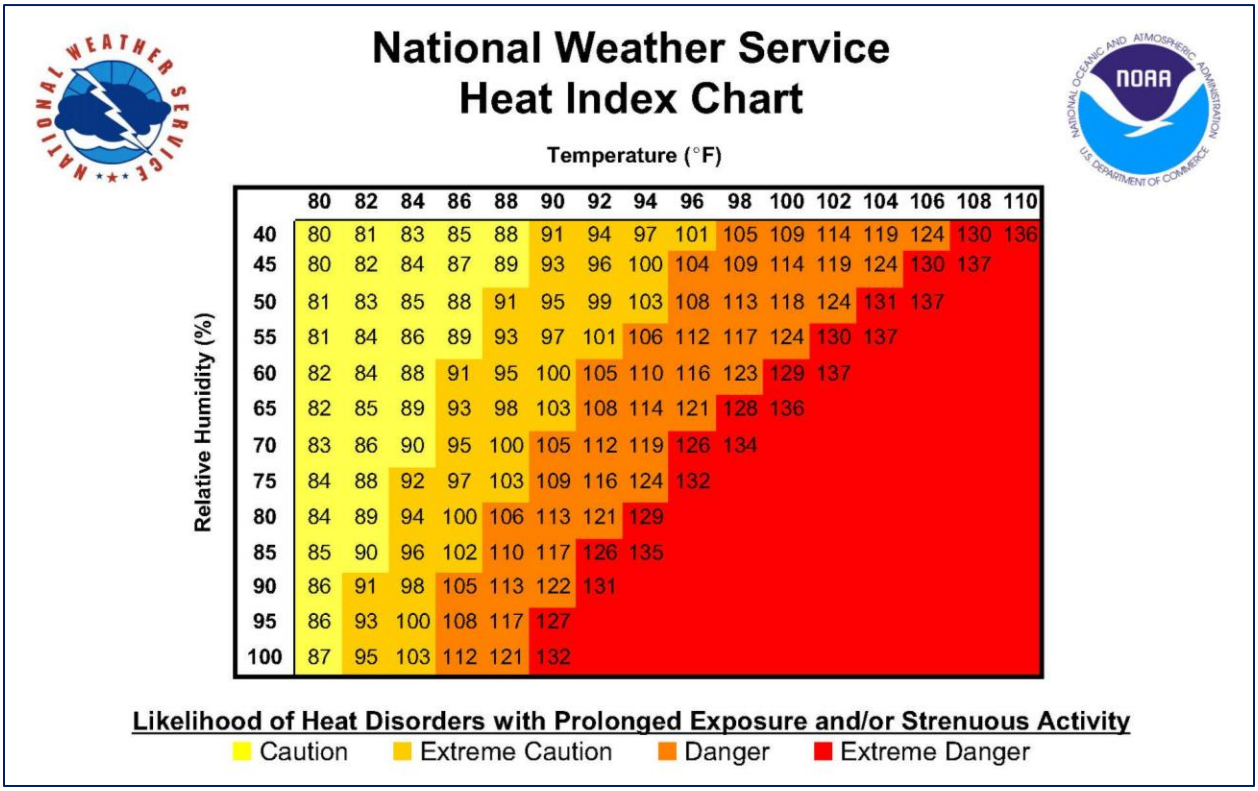
Heat Wave/Excessive Heat

The definition of a heat wave varies based on different factors, such as location, weather conditions (e.g., temperature, humidity, cloud cover) and the time of year.[192] However, excessive/extreme heat can be defined as a prolonged period of excessively hot weather, with temperatures above the average high.[193] Heat alone does not make high temperatures a threat; both humidity and heat combined is what makes high temperatures a dangerous.[194] The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature (i.e., ambient temperature).

Figure 4-17 illustrates NWS's Heat Index Chart. The NWS primarily uses Heat Index values to determine excessive heat events and issue the appropriate advisories.[195]

[191] National Weather Service. (n.d.). Non Thunderstorm Wind Hazards. Retrieved from https://www.weather.gov/mhx/NonThunderstormWindHazards.
[192] U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.
[193] Federal Emergency Management Agency. (n.d.). Extreme Heat | What. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Extreme-Heat-What.
[194] National Oceanic and Atmospheric Administration. (2022). Heat Index. Retrieve from https://www.noaa.gov/jetstream/global/heat-index#.
[195] National Weather Service. (n.d.). Heat Forecast Tools. Retrieved from https://www.weather.gov/safety/heat-index.

Figure 4-17. NWS Heat Index Chart



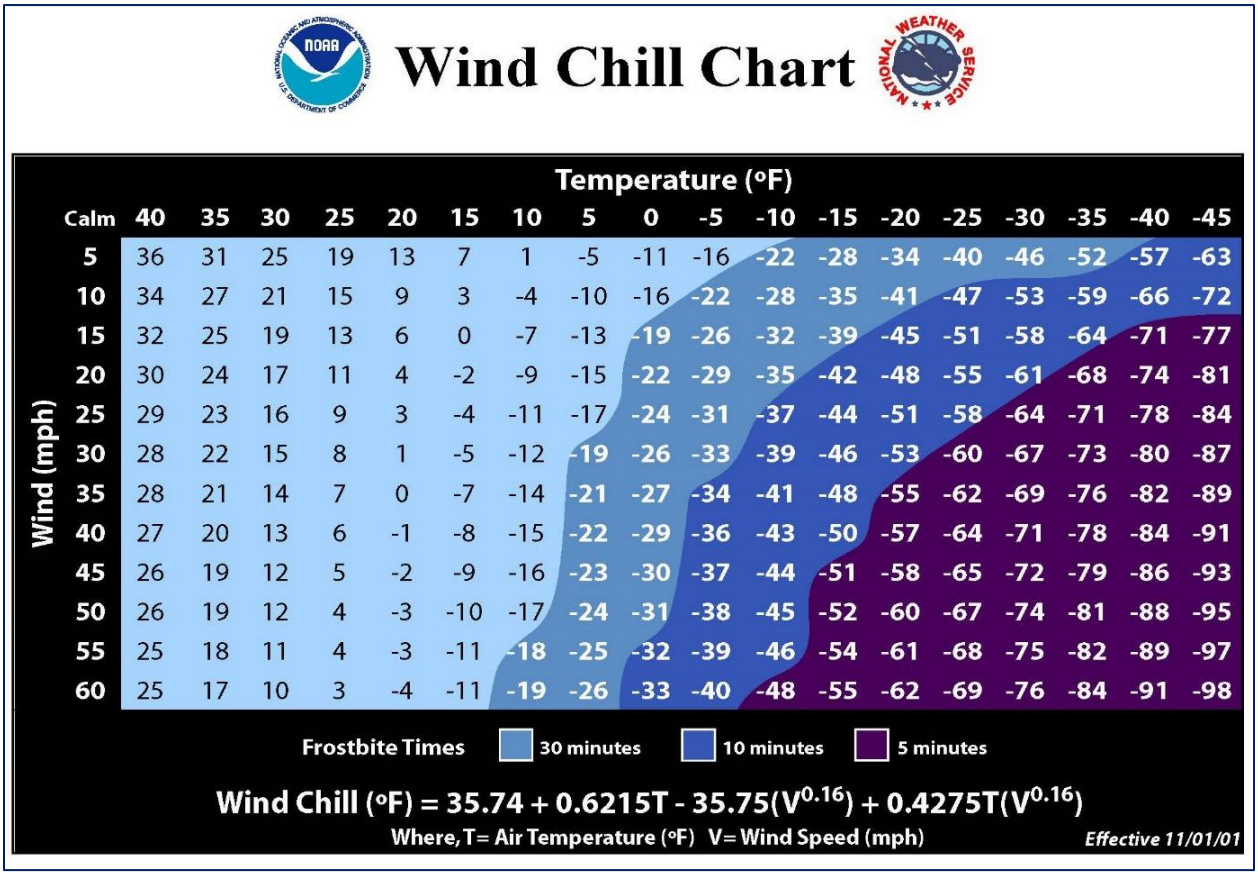
Cold Wave/Extreme Cold

Cold waves are a rapid temperature drop within 24 hours and/or when extreme low temperatures are expected for an extended period of time. The temperatures classified as a cold wave are dependent on the location and defined by the local NWS Forecast Office.[196] The Wind Chill Index is a measure of how cold it really feels when there is wind and low temperatures. It considers the human body's heat loss due to its surroundings during cold and windy weather.[197]

The wind chill index helps determine when dangerous conditions develop that could lead to frostbite and hypothermia.[198] **Figure 4-18** illustrates the NWS Wind Chill Chart.

[196] Federal Emergency Management Agency. (2023). Cold Wave. Retrieved from https://hazards.fema.gov/nri/winter-weather.
[197] National Weather Service. (n.d.). Wind Chill Chart. Retrieved from https://www.weather.gov/safety/cold-wind-chill-chart.
[198] Ibid.

Figure 4-18. NWS Wind Chill Chart



4.6.7.2. Hazard Location

Thunderstorms, hail, tornadoes, strong winds/damaging winds, and extreme temperatures (i.e., extreme heat and cold) can occur anywhere in Kittitas County.

Figure 4-19 illustrates hail (one (1) inch or greater) events within five (5) miles of Kittitas County that occurred between 1950 and 2023.

Figure 4-19. Kittitas County Hail History (1950 – 2023)

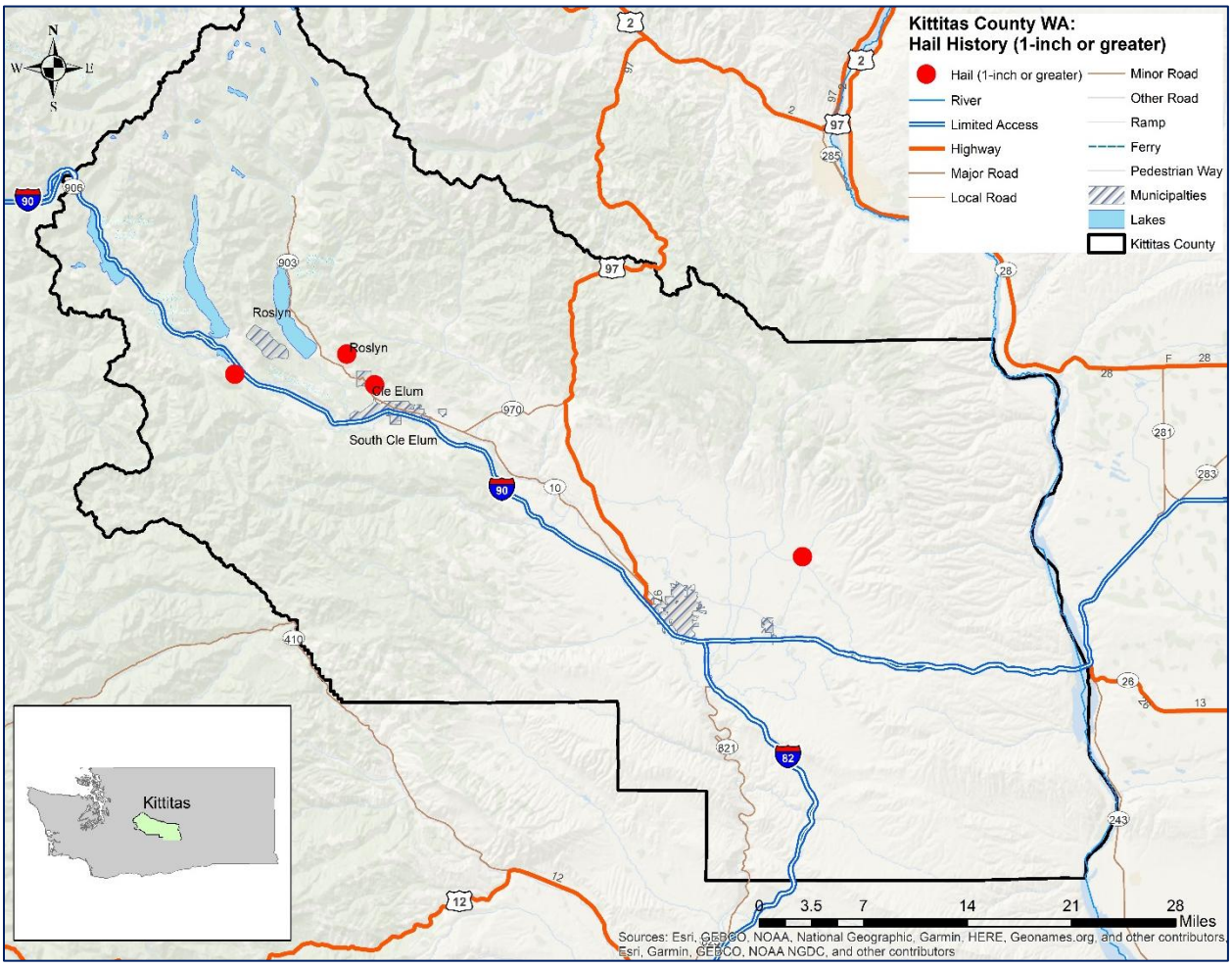
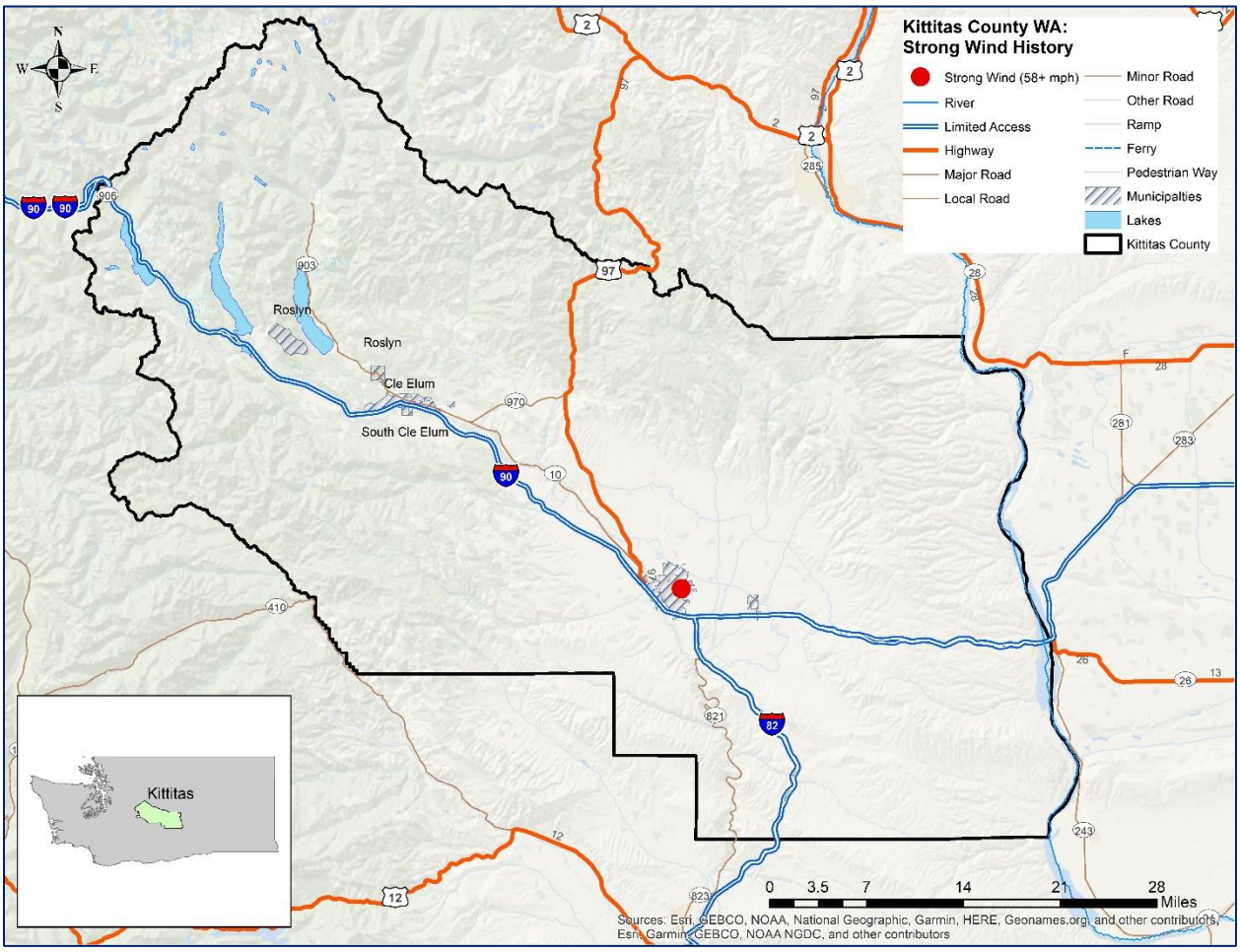


Figure 4-20 illustrates strong winds events within five (5) miles of Kittitas County that occurred between 1950 and 2023.

Figure 4-20. Kittitas County Strong Winds History (1950 – 2023)



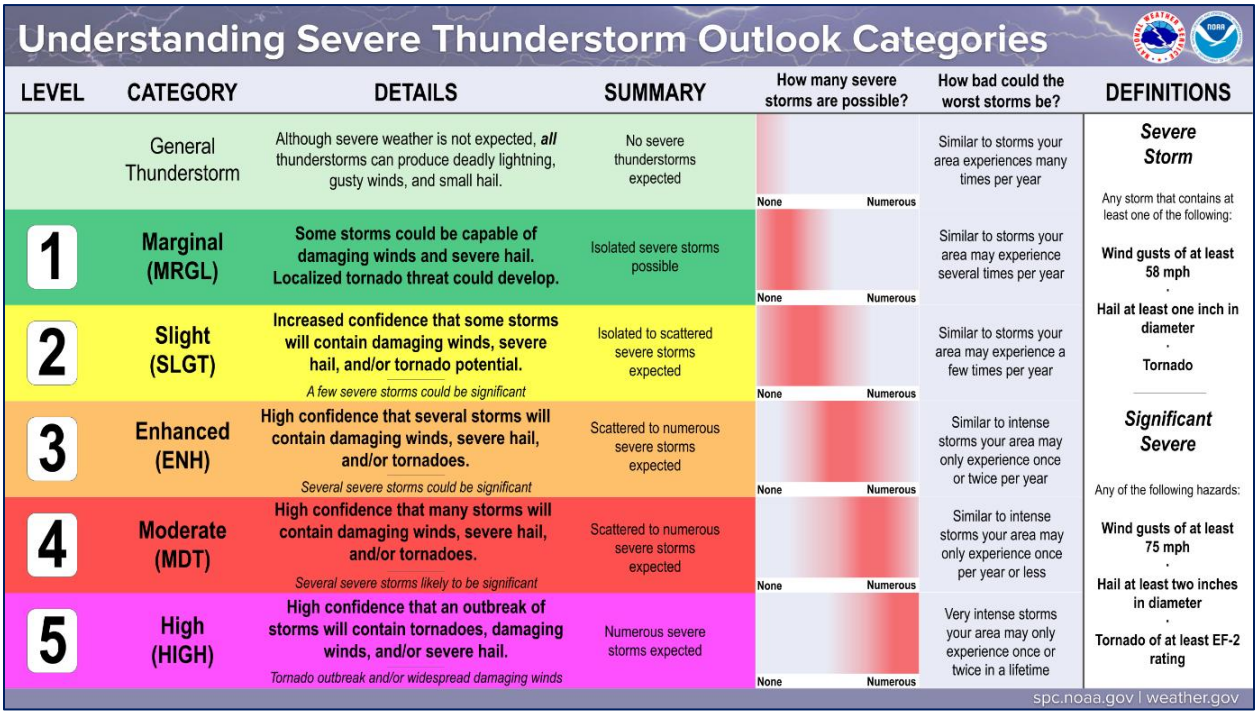
4.6.7.3. Hazard Extent/Intensity

Severe weather can be life threatening and can cause substantial damage to infrastructure and property. The extent of damage caused by severe weather depends on the type of severe weather, strength, and location. However, the west coast of the United States does not experience as many severe thunderstorms as other areas in the United States because of the cool water temperatures that are offshore in the Pacific Ocean. This impacts the air temperature that moves inland which makes it generally more stable and less convective, which hinders severe thunderstorm formation.[199]

Figure 4-21 illustrates the severe thunderstorm outlook categories used by the NWS Storm Prediction Center (SPC) when issuing Severe Thunderstorm Outlooks.

[199] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Frequently Asked Questions About Thunderstorms. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/faq/.

Figure 4-21. SPC Severe Thunderstorm Outlook Categories



Hail can vary in shapes and sizes, and only the very large hailstones pose a serious risk to life safety. NWS reports hail size by comparing the hailstone with traditional object to size conversion for assessment and translation of severe hail reports. **Table 4-97** lists the traditional conversion of hail size descriptions.[200]

Table 4-97. Converting Traditional Hail Size Descriptions

Hail Size *(inches)*	Object Analog Reported
0.25	Pea
0.50	Mothball
0.75	Penny
0.88	Nickel
1.00	Quarter
1.50	Walnut, ping pong
1.75	Golf ball
2.50	Tennis ball
2.75	Baseball
3.00	Teacup
4.00	Softball

[200] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.

Hail Size *(inches)*	Object Analog Reported
4.50	Grapefruit

The Beaufort Wind Scale was developed to estimate and report wind speeds when a measuring apparatus is not available (e.g, open sea). It was invented in the 1805 by Sir Francis Beaufort of the British Navy as a way to interpret wind conditions at sea. Since then, the scale has been modified to include the effects on land. **Table 4-98** outlines the 13 force classification that comprise the Beaufort Wind Scale.[201]

Table 4-98. Beaufort Wind Scale

Force	Wind *(knots)*	Classification	Appearance of Wind Effects	
			On the Water	On Land
0	< 1	Calm	Sea surface smooth and mirror-like.	Calm, smoke rises vertically.
1	1 – 3	Light Air	Scaly ripples and no foam crests.	Smoke drift indicates wind direction and still wind vanes.
2	4 – 6	Light Breeze	Small wavelets, crests glassy, and no breaking.	Wind felt on face, leaves rustle, and vanes begin to move.
3	7 – 10	Gentle Breeze	Large wavelets, crests begin to break, and scattered whitecaps.	Leaves and small twigs constantly moving, and light flags extended.
4	11 – 16	Moderate Breeze	Small waves of one (1) to four (4) feet becoming longer with numerous whitecaps.	Dust, leaves, and loose paper lifted, and small tree branches move.
5	17 – 21	Fresh Breeze	Moderate waves of four (4) to eight (8) feet taking longer form, many whitecaps, and some spray.	Small trees and leaves begin to sway.
6	22 – 27	Strong Breeze	Larger waves of eight (8) to 13 feet, whitecaps are common, and more spray.	Larger tree branches moving and whistling in wires.
7	28 – 33	Near Gale	Sea heaps up, waves are 13 to 19 feet, white foam streaks off breakers.	Whole trees moving and resistance felt walking against wind.
8	34 – 40	Gale	Moderately high waves (18 to 25 feet) of greater length, edges of crests begin to break into spindrift, and foam blown in streaks.	Twigs breaking off trees and generally impedes progress.
9	41 – 47	Strong Gale	High waves (23 to 32 feet), sea begins to roll, dense streaks of foam, and spray may reduce visibility.	Slight structural damage occurs, and slate blows off roofs.
10	48 – 55	Storm	Very high waves (29 to 41 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, and lowered visibility.	Seldom experienced on land, trees broken or uprooted, and considerable structural damage.
11	56 – 63	Violent Storm	Exceptionally high waves (37 to 52 feet), foam patches cover sea, and visibility more reduced.	--

[201] National Weather Service. (n.d.). Beaufort Wind Scale. Retrieved from https://www.spc.noaa.gov/faq/tornado/beaufort.html.

Force	Wind (knots)	Classification	Appearance of Wind Effects	
			On the Water	On Land
12	> 63	Hurricane	Air filled with foam, waves over 45 feet, sea completely white with driving spray, and visibility greatly reduced.	See Saffir-Simpson Hurricane Wind Scale.

Tornado rating, based on the Enhance Fujita Scale (EF Scale), is assigned after tornado-related damage is surveyed. The EF Scale is based on the estimated wind speeds and related damage. **Table 4-99** outlines the EF Scale. When tornado damages are surveyed, they are compared to a list of Damage Indicators and Degrees of Damage which help to better estimate the range of wind speeds the tornado likely produced. The EF Scale was revised from the original Fujita Scale and became operational in February 2007.[202]

Table 4-99. Enhanced Fujita Scale

EF Rating	3 Second Gust (mph)
0	65 – 85
1	86 – 110
2	111 – 135
3	136 – 165
4	166 – 200
5	Over 200

The NWS HeatRisk Tool Prototype is a color numeric-based index that provides a forecast of the potential level of risk for heat-related impacts to occur in a 24-hour period. This serves as a supplementary tool for official NWS heat products and is meant to provide risk guidance for decision-makers and heat-vulnerable populations who require certain actions at levels that may be below the NWS heat product thresholds. **Table 4-100** outlines the NWS HeatRisk categories and risk of heat-related impacts.[203]

Table 4-100. NWS HeatRisk Categories

Category		Risk of Heat-Related Impacts
0	Green	Little to no risk from expected heat.
1	Yellow	**Minor:** This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
2	Orange	**Moderate**: This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
3	Red	**Major**: This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries, and infrastructure.

[202] National Weather Service. (n.d.). The Enhance Fujita Scale (EF Scale). Retrieved from https://www.weather.gov/oun/efscale.
[203] National Weather Service. (n.d.). NWS HeatRisk Prototype. Retrieved from https://www.wrh.noaa.gov/wrh/heatrisk/.

Category		Risk of Heat-Related Impacts
4	Magenta	**Extreme**: This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries, and infrastructure.
The HeatRisk takes into consideration the following – how unusual the heat is for the time of the year, the duration of the heat including both daytime and nighttime temperatures, and those temperatures that pose an elevated risk of heat-related impacts based on data from the CDC.		

The NWS SPC is responsible for issuing severe thunderstorms and tornado advisories, as conditions warrant. **Table 4-101** outlines the severe thunderstorms and tornado advisories.[204]

Table 4-101. NWS Severe Weather Advisories

Type	Description
Severe Thunderstorm Watch	Issued by the NOAA SPC when conditions are favorable for the development of severe thunderstorms in and close to the watch area. The size of the watch can vary depending on the weather situation. Severe thunderstorm watches are usually issued for a duration of four (4) to eight (8) hours. They are normally issued well in advance of the actual occurrence of severe weather.
Severe Thunderstorm Warning	Issued by the local NWS Forecast Office when either a severe thunderstorm is indicated by radar, or a spotter reports a thunderstorm producing hail one (1) inch or larger in diameter and/or winds equal or exceed 58 mph. Severe thunderstorm warnings are usually issued for a duration of one (1) hour. They can be issued without a Severe Thunderstorm Watch already in effect. Severe thunderstorms can produce tornadoes with little or no advance warning.
Tornado Watch	Issued by the SPC when conditions are favorable for the development of tornadoes in and close to the watch area. The size of the watch can vary depending on the weather situation. Tornado watches are usually issued for a duration of four (4) to eight (8) hours. They are normally issued well in advance of the actual occurrence of tornadoes.
Tornado Warning	Issued by the local NWS Forecast Office when either a tornado is indicated by radar or sighted by spotters. Tornado warnings are usually issued for a duration of around 30 minutes. They can be issued without a Tornado Watch being already in effect.
Gale Watch	Issued by the local NWS Forecast Office for locations along the water when one (1) or both of the following conditions is possible to begin within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) **or** frequent gusts (duration of two (2) or more hours) between 34 to 47 knots (39 to 55 mph).
Gale Warning	Issued by the local NWS Forecast Office for locations along the water when one (1) or both of the following conditions is expected to begin within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) **or** frequent gusts (duration of two (2) or more hours) between 34 to 47 knots (39 to 55 mph). At this point, vessels need to be secure at port.

During an excessive heat event, the NWS Pendleton, Oregon Area Forecast Office issues excessive heat advisories, watches, and warnings. **Table 4-102** outlines the heat-related products issued by the local NWS Forecast Office. NWS' local offices collaborate with local agencies (e.g., emergency managers, public health professionals) to determine when an alert should be issued for the local area by establishing heat index thresholds for each advisory.

[204] National Weather Service. (n.d.). National Weather Service Glossary. Retrieved from https://w1.weather.gov/glossary/.

Table 4-102. NWS Excessive Heat Advisories

Type	Definition
Excessive Heat Outlook	Issued when the potential exists for an excessive heat event in the next three (3) to seven (7) days. An Outlook provides information to those who need considerable lead time to prepare for the event.
Heat Advisory	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, an advisory is issued when the heat index values are expected to reach 100°F or higher for at least two (2) days, and nighttime air temperatures will not drop below 75°F.
Excessive Heat Watch	Issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. Generally, a watch is issued when the risk of a heat wave has increased, but its occurrence and timing is still uncertain
Excessive Heat Warning	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, a warning is issued when the heat index values are expected to reach 105°F or higher for at least two (2) days and nighttime air temperatures will not drop below 75°F.

A cold wave is likely to accompany winter weather events. However, extreme cold temperatures can occur due to varying atmospheric conditions and may not always coincide with obvious cold weather events (e.g., winter storms, ice storms). When significant cold temperatures are expected, the NWS Pendleton, Oregon Area Forecast Office issues wind chill, freeze and frost advisories, watches, and warnings. **Table 4-103** outlines the cold weather products issued by the local NWS Forecast Office. [205]

Table 4-103. NWS Cold Weather Advisories

Type	Definition
Wind Chill Advisory	Issued when low wind chill index values are expected but will not reach local warning criteria. Extremely cold air and strong winds will combine to generate low wind chill readings.
Wind Chill Watch	Issued when there is the potential for a combination of extremely cold air and strong winds to create dangerously low wind chill index values.
Wind Chill Warning	Issued for a combination of very cold air and strong winds that will create dangerously low wind chill index values. This level of wind chill will result in frostbite and lead to hypothermia if precautions are not taken.
Frost Advisory	Issued when areas of frost are expected or occurring, posing a threat to sensitive vegetation.
Freeze Watch	Issued when there is a potential for significant, widespread freezing temperatures within the next 24 and 36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.
Freeze Warning	Issued when temperatures are forecasted to go below 32°F for an extended period of time. This temperature threshold kills some types of commercial crops and residential plants.
Hard Freeze Warning	Issued when temperatures are expected to be below 28°F for an extended period of time, killing most types of commercial crops and residential plants.

4.6.7.4. Probability and Frequency

The probability of occurrence for severe weather occurring in Kittitas County is dependent on the type of severe weather. For example, severe weather events in Kittitas County are often related to strong winds associated with winter storms and thunderstorms. Each hazard probability of occurrence is listed below.

[205] National Weather Service. (n.d.). Wind Chill Warning vs. Watch. Retrieved from https://www.weather.gov/safety/cold-wind-chill-warning.

- The probability of occurrence for strong winds/damaging winds in Kittitas County is high because significant occurrences of this hazard occur annually throughout the County.
- The probability of occurrence for thunderstorms, cold wave/extreme cold, and heat wave/extreme heat is medium because significant occurrences of these hazards have occasionally impacted the County and will likely occur again within 25 years.
- The probability of occurrence for hail and tornadoes is low because a significant occurrence of these hazards is likely to occur within 100 years.

The hail annualized frequency value represents the average number of recorded hail hazard occurrences, in event days, per year over the period of record (34 years). **Table 4-104** outlines the annualized frequency for hail, based on FEMA NRI data, for Kittitas County.

Table 4-104. Hail Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(1986 – 2021)*	Annualized Frequency
Kittitas County	3	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The strong wind annualized frequency value represents the average number of recorded strong wind hazard occurrences, in event days, per year over the period of record (34 years). **Table 4-105** outlines the annualized frequency for strong winds, based on FEMA NRI data, for Kittitas County.

Table 4-105. Strong Wind Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(1986 – 2021)*	Annualized Frequency
Kittitas County	3	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The tornado annualized frequency value represents the average number of recorded tornado hazard occurrences, in event days, per year over the period of record (72 years). **Table 4-106** outlines the annualized frequency for tornadoes, based on FEMA NRI data, for Kittitas County.

Table 4-106. Tornado Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(1950 – 2021)*	Annualized Frequency
Kittitas County	0	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The heat wave annualized frequency value represents the average number of recorded heat wave hazard occurrences in event days, per year over the period of record (16 years). **Table 4-107** outlines the annualized frequency for heat waves, based on FEMA NRI data, for Kittitas County.

Table 4-107. Heat Wave Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(2005 – 2021)*	Annualized Frequency
Kittitas County	15	0.9 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The cold wave annualized frequency value represents the average number of recorded cold wave hazard occurrences in event days, per year over the period of record (16.9 years). **Table 4-108** outlines the annualized frequency for cold waves, based on FEMA NRI data, for Kittitas County.

Table 4-108. Cold Wave Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(2005 – 2021)*	Annualized Frequency
Kittitas County	2	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.7.5. Past Events

NCEI has reported six (6) heavy rainfall events, four (4) hail events of one (1) inch or greater, 12 strong wind/damaging wind events, zero (0) tornado events, 10 heat wave/excessive heat events, and 11 cold wave/extreme cold events between 1950 and 2023. There have not been any notable severe weather events in Kittitas County.

Table 4-109 lists the heavy rain events that have been recorded in Kittitas County between 1950 and 2023.

Table 4-109. Heavy Rainfall Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
ELLENSBURG	Kittitas County	WA	7/17/2012	18:10	Heavy Rain	0	0	0.00K	0.00K
ELLENSBURG	Kittitas County	WA	6/13/2009	14:40	Heavy Rain	0	0	0.00K	0.00K
CLE ELUM	Kittitas County	WA	6/13/2009	14:25	Heavy Rain	0	0	0.00K	0.00K
EASTON	Kittitas County	WA	11/6/2006	08:00	Heavy Rain	0	0	0.00K	0.00K
W KING/X SE KITSAP (ZONE)	W King/X SE Kitsap (Zone)	WA	2/28/2001	11:00	Heavy Rain	0	0	200.0K	0.00K
CLE ELUM ARPT	Kittitas County	WA	6/6/1998	17:05	Heavy Rain	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**200.00K**	**0.00K**

Table 4-110 lists the hail events (hail one (1) inch or greater) that have been recorded in Kittitas County between 1950 and 2023.

Table 4-110. Hail Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EASTON	Kittitas County	WA	8/10/2013	16:21	Hail	0	0	0.00K	0.00K
KITTITAS	Kittitas County	WA	6/29/2013	12:45	Hail	0	0	0.00K	0.00K
CLE ELUM	Kittitas County	WA	7/5/2006	14:50	Hail	0	0	0.00K	0.00K
ROSLYN	Kittitas County	WA	7/5/2006	14:40	Hail	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

Table 4-111 lists the strong wind/damaging winds events (wind gusts in excess of 58 mph) that have been recorded in Kittitas County between 1950 and 2023.

Table 4-111. Strong Wind/Damaging Wind Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	5/1/2021	13:00	High Wind	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	10/25/2019	16:05	High Wind	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/17/2015	16:00	High Wind	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/13/2014	06:00	High Wind	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/11/2014	05:50	High Wind	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/10/2014	05:30	High Wind	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/14/2011	11:40	High Wind	0	0	1.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/15/2010	22:00	High Wind	0	0	100.0K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/29/2007	16:00	High Wind	0	0	7.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/19/2004	14:00	High Wind	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	11/19/2003	04:20	High Wind	0	0	0.00K	0.00K
KITTITAS CO.	Kittitas County	WA	5/12/1988	23:30	Thunderstorm Wind	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**108.00K**	**0.00K**

Table 4-112 lists the heat wave/excessive heat events that have been recorded in Kittitas County between 1950 and 2023.

Table 4-112. Heat Wave/Excessive Heat Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	8/19/2022	00:00	Excessive Heat	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	7/25/2022	00:00	Excessive Heat	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/1/2021	00:00	Excessive Heat	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	6/27/2021	00:00	Excessive Heat	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	6/26/2021	00:00	Excessive Heat	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	7/28/2020	11:00	Heat	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	8/15/2008	12:00	Excessive Heat	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	6/29/2008	12:00	Excessive Heat	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	7/21/2006	12:00	Heat	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/10/2002	00:00	Heat	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

Table 4-113 lists the cold wave/extreme cold events that have been recorded in Kittitas County between 1950 and 2023.

Table 4-113. Cold Wave/Extreme Cold Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	10/27/2023	18:31	Frost/Freeze	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	4/20/2023	00:00	Frost/Freeze	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	4/19/2023	00:00	Frost/Freeze	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	4/18/2023	00:00	Frost/Freeze	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	4/17/2023	00:00	Frost/Freeze	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/21/2022	16:00	Extreme Cold/Wind Chill	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	11/2/2022	02:00	Frost/Freeze	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	11/23/2010	18:00	Extreme Cold/Wind Chill	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/4/2004	20:00	Cold/Wind Chill	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	11/1/2002	00:00	Extreme Cold/Wind Chill	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	10/30/2002	00:00	Extreme Cold/Wind Chill	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

4.6.7.6. Vulnerability and Impacts

Life Safety and Health: Severe weather impacts to life safety and health depend on the type of severe weather. Nonetheless, the impacts can be life-threatening. In 2023, the number of weather events in the United States increased by 11% between 2019 and 2023. Subsequently, weather related deaths were up by 20% and injuries (indirect and direct) were up by 124%. The largest number of reported injuries in

2023 resulted from extreme heat (1,862), tornadoes (955), and winter weather (230). The largest number of reported deaths resulted from extreme heat (294), wildfires (105), and tornadoes (91).[206] Under the right conditions, rainfall from thunderstorms are capable of causing flash flooding, killing more people each year than hurricanes, tornadoes, or lightning. Additionally, large hail (e.g., size of a softball) can fall at speeds of over 100 mph and cause significant damage to an individual, property, and livestock.[207] Strong winds/damaging winds can impact structures and infrastructure, result in large areas with power and communication outages as it can knock down power and communication lines, roads can become impassible because of debris, and signs, roofing material, and loose objects left outside can become airborne causing injuries or serious accidents to people.

Property Damage and Critical Facilities: All properties and critical facilities within Kittitas County are vulnerable to sever weather. However, properties that are structurally compromised or in particular vulnerable locations are more vulnerable to the impacts of severe weather. For example, those in higher elevations and on ridges may be more susceptible to wind damage. Since 1980, severe storms have caused over $455 Billion in total damage, with events only increasing in severity and frequency as temperatures continue to rise.[208] Strong winds and tornadoes can directly and indirectly damage property and infrastructure due to falling trees, flying debris, and blown windows. Fallen trees can block roadways incapacitating transportation which disrupts ingress, egress and the shipment of goods and other commerce, and uprooted trees can tear down power lines. Incapacity and loss of roads are the primary transportation failures resulting from severe weather, mostly associated with secondary hazards. For example, landslides caused by heavy prolonged rainfall events can block roads. *Refer to the Landslide section of this Plan for further details on the vulnerability and impact.*

Extreme temperatures events (i.e., cold and heat waves) stress current infrastructure due to increased electrical loads. This may lead to an unstable grid and power loss during extreme heat waves. Cold waves can also severely impact critical infrastructure and property by damaging and destroying buildings and equipment. These damages due to extreme cold temperatures include frozen electrical equipment, cracked water pipes, dangerous/damaged roads, damaged bridges, and damaged aircraft systems.[209]

Economy: The number and cost of weather and climate disasters are increasing in the United States; therefore, are causing a larger financial impact.[210] Severe weather accounts for nearly 50% of all billion-dollar weather disasters in the United States since 1980.[211] Transportation systems can be severely impacted by severe weather. Disruption from debris blocking transportations routes, physical damage to transportation resources and critical infrastructure due to hail, strong winds, and/or tornadoes, can cause major disruptions to the County's economy.

[206] National Safety Council, Injury Facts. (n.d.). Most Dangerous Weather Event Types in 2022. Retrieved from https://injuryfacts.nsc.org/home-and-community/safety-topics/weather-related-deaths-and-injuries/.
[207] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Thunderstorm Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/.
[208] Cybersecurity & Infrastructure Security Agency. (n.d.). Severe Storms. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/severe-storms.
[209] Cybersecurity & Infrastructure Security Agency. (n.d.). Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/extreme-cold.
[210] Smith, A. B. (2024). 2023: A Historic Year of U.S. Billion-Dollar Weather and Climate Disasters. Retrieved from https://www.climate.gov/news-features/blogs/beyond-data/2023-historic-year-us-billion-dollar-weather-and-climate-disasters.
[211] Climate Central. (2022). Changing Thunderstorm Potential. Retrieved from https://www.climatecentral.org/climate-matters/changing-thunderstorm-potential.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to all the severe weather types outlined in this Plan. Future development may minimally increase (4% or less) the impact of all the severe weather types outlined in this Plan within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population face unique vulnerabilities and impacts as a result of severe weather. These groups include, but are not limited to, low-income families, elderly, individuals with disabilities, those with limited English proficiency, and those without adequate access to emergency resources. These groups may not have access to accurate and timely information due to limited internet access, language barriers, and living in isolated areas. Therefore, critical severe weather advisories may not reach these groups in a timely manner which results in higher injury and mortality rates within these communities. Additionally, those individuals living in isolated areas with limited access (e.g., one (1) road in and one (1) road out) are vulnerable to being cut off from community lifelines if a landslide due to heavy rainfall or debris from strong winds were to block access to the area for an extended period of time. Additionally, power outages can be life threatening to those dependent on electricity for life support and during extreme temperatures (i.e., extreme cold and heat) individuals will be unable to remain warm or cool. The isolation of this population during severe weather events (e.g., strong winds, heavy rainfall) is a significant concern because they could significantly suffer from the secondary effects of severe weather.

Effects of Climate Change in Severity of Impacts: Atmospheric rivers are part of the water cycle in the Northwest often occurring in the fall and winter, and when beneficial they result in much needed rain to the region. For example, between 1950 and 2010, about 60% to 74% of the persistent drought ended when atmospheric rivers made landfall in the area. However, when these systems produce too much water at once it can result in a significant amount of damage. As global temperatures continue to increase, the amount and severity of atmospheric rivers are projected to increase. Warmer air and oceans serve as fuel for these systems to become larger and stronger, and the atmosphere is capable of holding more moisture. Some research shows that atmospheric rivers are expected to be 25% longer and wider resulting in heavy rainfall and extreme winds over an area for a longer period of time. As rainfall increases, soil will become extremely saturated and unable to absorb additional water increasing runoff which can overwhelm rivers and result in flooding and landslides. Studies have determined that by 2090 atmospheric river events could cause up to $3.2 Billion of damage annually.[212]

As global average temperatures continue to increase, scientists expect that heat wave events will become more common, more severe, and last longer. Subsequently leading to an increase of heat-related illnesses and deaths.[213] Meanwhile, extreme and dangerous cold events continue to occur, but are becoming shorter and milder. The coldest days have warmed the most on average in the Northwest by 8.4°F.[214] **Table 4-114** indicates the 25-year heat and precipitation projections for Kittitas County.[215]

[212] United States Department of Agriculture Climate Hubs. (n.d.). Atmospheric Rivers in the Northwest. Retrieved from https://www.climatehubs.usda.gov/hubs/northwest/topic/atmospheric-rivers-northwest-0.
[213] U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.
[214] Climate Central. (2024). Coldest Days Warming Up. Retrieved from https://www.climatecentral.org/climate-matters/coldest-days-warming-up.
[215] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.

Table 4-114. 25-Year Climate Projections for Kittitas County

Higher Emissions (RCP8.5)
Kittitas County is expected to experience an 88% increase in extremely hot days and a 12% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience five (5) more days that reach above 95°F (from six (6) days to 11 days per year).
By 2049, Kittitas County is expected to have a 2°F increase (from 45°F to 47°F) in average annual temperatures.
By 2049, Kittitas County is expected to experience 0.8 more days of heavy precipitation per year (from 6.9 days to 7.8 days per year).
By 2049, Kittitas County is expected to have a two (2) inch increase (from 39″ to 41″) in average annual precipitation.
Lower Emissions (RCP4.5)
Kittitas County is expected to experience a 65% increase in extremely hot days and a 5% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience three (3) more days that reach above 95°F (from five (5) days to nine (9) days per year).
By 2049, Kittitas County is expected to have a 2°F increase (from 44°F to 46°F) in average annual temperatures.
By 2049, Kittitas County is expected to experience 0.3 more days of heavy precipitation per year (from 7.2 days to 7.5 days per year).
By 2049, Kittitas County is expected to have a 0.3 inch increase (from 40″ to 40.2″) in average annual precipitation.

4.6.7.7. FEMA NRI Expected Annual Loss Estimates

A hail NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to hail when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-115** outlines the hail EAL for Kittitas County.

Table 4-115. Hail Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$2,473	$926	$7,775	$11,174	14.8	Very Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A strong wind NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to strong winds when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-116** outlines the strong wind EAL for Kittitas County.

Table 4-116. Strong Wind Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$27,287	$2,059	$2	$29,348	11.3	Very Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A tornado NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to tornadoes when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-117** outlines the tornado EAL for Kittitas County.

Table 4-117. Tornado Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$16,482	$17,197	$80	$33,760	9.6	Very Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A heat wave NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to heat waves when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-118** outlines the heat wave EAL for Kittitas County.

Table 4-118. Heat Wave Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$22,698	$7,651	$6,762	$37,111	40.7	Relatively Moderate
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A cold wave NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to cold wave when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-119** outlines the cold wave EAL for Kittitas County.

Table 4-119. Cold Wave Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$263,143	$570	$88,146	$351,860	81.6	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.7.8. Severe Weather Risk Index Scores

The hail Risk Index score and rating represent a community's relative risk for hail when compared to the rest of the United States. **Table 4-120** illustrates the hail Risk Index rating and score for Kittitas County.

Table 4-120. Hail Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very Low	11.5
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The strong wind Risk Index score and rating represent a community's relative risk for strong winds when compared to the rest of the United States. **Table 4-121** illustrates the strong wind Risk Index rating and score for Kittitas County.

Table 4-121. Strong Wind Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very Low	8.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The tornado Risk Index score and rating represent a community's relative risk for tornadoes when compared to the rest of the United States. **Table 4-122** illustrates the tornado Risk Index rating and score for Kittitas County.

Table 4-122. Tornado Wind Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very Low	7.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The heat wave Risk Index score and rating represent a community's relative risk for heat waves when compared to the rest of the United States. **Table 4-123** illustrates the heat wave Risk Index rating and score for Kittitas County.

Table 4-123. Heat Wave Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively Low	37.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The cold wave Risk Index score and rating represent a community's relative risk for cold waves when compared to the rest of the United States. **Table 4-124** illustrates the cold wave Risk Index rating and score for Kittitas County.

Table 4-124. Cold Wave Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively High	79.5
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-125 represents the severe weather Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

It is important to note that the sub hazards for severe weather (i.e., strong winds/damaging winds, thunderstorms, cold wave/extreme cold, heat wave/extreme heat, hail, and tornado) were individually ranked in the hazard risk ranking; however, severe weather is considered as the main hazard throughout this Plan.

Table 4-125. Severe Weather Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Strong Winds/Damaging Winds	3	9	16	15	40	59
Thunderstorms	2	6	16	26	48	48
Cold Wave/Extreme Cold	2	12	12	20	44	45
Heat Wave/Excessive Heat	2	12	12	17	41	42
Hail	1	6	16	16	38	22
Tornado	1	6	16	16	38	22

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.8. Volcanic Activity

4.6.8.1. Description

Volcanoes are openings, or vents where lava, tephra (small rocks), and steam erupt onto the Earth's surface. The vent of a volcano can be visible as a small bowl shaped depression at the summit of a cone or shield-shaped mountain. Magma, molten rock beneath the surface of the Earth, is stored within and beneath the volcano. The volcano's vent is connected to one (1) or more of the magma storage areas which allows the volcano to erupt over and over again in the same location. Continuous eruptions create a slow accumulation of the erupted lava (i.e., magma that has been erupted onto the Earth's surface) which makes the volcano grow.[216] Over 80% of the Earth's surface above sea level is of volcanic origin.[217]

All volcanoes have their own unique characteristics, but most volcanoes are classified as one (1) of the three (3) classic types listed on **Table 4-126**.[218] The physical characteristics of a volcano are determined by the magma's chemistry which controls eruption dynamics and how easily lava can flow. Additionally, the volcano's explosivity is impacted by gas content and the rate of eruption.[219]

Table 4-126. Volcano Types

Type	Definition
Cinder Cone	Considered the simplest type of volcano is made of small pieces of solid lava, called cinder, which erupt from a vent. As the magma rises from within the Earth, the ground shakes before a powerful blast throws molten rocks, ash, and gas into the air. The rocks cool quickly in the air and fall to the Earth and break into small pieces of bubbly cinder that pile up around the vent. They accumulate as a small cinder cone that can be as high as 1,000 feet above the surrounding ground. Eruptions that form cinder cones also feed lava flows that spread outward from the eruptive vent. When climbing a cinder cone one can usually find the bowl-shaped crater marking the location of the vent. If eruptions of cinder and lava flows happen repeatedly from the same vent, the overlapping layers can form a composite volcano (stratovolcano).
Composite Volcano (Stratovolcano)	Some of the Earth's grandest mountains are composite volcanoes, sometimes called stratovolcanoes. They are usually tall with steep even sides and are made out of repeating layers of lava flows, volcanic ash, cinders, blocks, and volcanic bombs. Some composite volcanoes rise over 8,000 feet above their surroundings, but they reach much higher elevations when compared to sea level.
Shield Volcano	Are built almost entirely of fluid lava flows and some of the most massive volcanoes are shield volcanoes. Lava pours out of vents in all directions, either from the summit (top) or along two (2) to three (3) rift zones (fractures) that radiate out from the summit like spokes on a bicycle wheel. As lava flows overlap one another, they construct a broad, gently sloping dome shape that from a distance appears similar to a warrior's shield. Shield volcanoes build up slowly by the growth of thousands of lava flows that spread widely over great distances, and then cool as thin sheets.

[216] United States Geological Survey. (n.d.). About Volcanoes. Retrieved from https://www.usgs.gov/programs/VHP/about-volcanoes.
[217] United States Geological Survey. (n.d.). How Much of the Earth is Volcanic? Retrieved from https://www.usgs.gov/faqs/how-much-earth-volcanic.
[218] United States Geological Survey. (n.d.). About Volcanoes. Retrieved from https://www.usgs.gov/programs/VHP/about-volcanoes.
[219] National Park Service. (2022). Volcanoes, Craters, & Lava Flows: Type of Volcanoes. Retrieved from https://www.nps.gov/subjects/volcanoes/types-of-volcanoes.htm.

Volcanoes can display a range of eruptive phenomena. Some consist of quiet emissions of fluid lava flows while others have cataclysmic eruptions. **Table 4-127** lists the three (3) fundamental ways of characterizing a volcanic eruption.[220]

Table 4-127. Volcanic Eruption Types

Type	Definition
Magmatic Eruptions	Include the ejection of lava or tephra from a magma source within the earth. There is a significant range in the intensity, magnitude, explosivity, eruption rate, and amount of magma erupted. Magmatic eruptions are generally described as being effusive (dominated by passive emissions of lava) or explosive (dominated by eruption of fragmental (pyroclastic) material).
Phreatomagmatic (Hydrovolcanic) Eruption	Violent explosive eruptions driven by steam explosions produced by the interaction of hot magma with surface water or shallow groundwater. Hydrovolcanic eruptions include tephra derived from juvenile magma. These eruptions produce tephra and steam.
Phreatic Eruption	Eruptions driven by steam explosions due to the superheating of groundwater by a magmatic source. Phreatic eruptions may include volcanic ash made of shattered rock material, but incorporate no magmatic (e.g., juvenile) material. Phreatic eruptions may be precursors to magmatic eruptions.

Volcanic eruptions can last days, weeks, or years, and although they are typically focused around a single vent area, volcanoes vary significantly in explosivity. Therefore, volcanic hazards, listed on **Table 4-128**, can have extensive consequences that can affect a small area or the whole planet.[221] Furthermore, volcanic eruptions can dramatically change an area's landscape.

Table 4-128. Volcano Related Hazards

Type	Definition
Lava Flows	Moving lava and the resulting solidified deposit are referred to as lava flows. Because of the wide range in viscosity of the different lava types (i.e., basalt, andesite, dacite, and rhyolite), lava discharge during eruptions, and characteristics of the erupting vent and topography over which lava travels, lava flows come in a great variety of shapes and sizes.
Pyroclastic Flows and Surges	Pyroclastic flows are hot (greater than 1,475°F), chaotic mixture of rock fragments, gas, and ash that travels rapidly (up to 150 mph) away from a volcanic vent or collapsing flow front. Pyroclastic surges are ground-hugging clouds of ash, rock, and volcanic gas that move at hurricane velocities and have temperatures of several hundred degrees Fahrenheit.
Lahars	A mixture of water and volcanic debris that moves rapidly downstream. Consistency can range from muddy water to that of wet cement, depending on the ratio of water to debris. They form in a variety of ways, mainly as a result of the rapid melting of snow and ice due to pyroclastic flows, intense rainfall on loose volcanic rock deposits, breakout of a lake dammed by volcanic deposits, and as a consequence of debris avalanches.
Landslides	The downslope movement of rock, soil, or related debris. *Landslides are addressed separately in this Plan.*

[220] National Park Service. (2022). Volcanoes, Craters, & Lava Flows: Eruption Classifications. Retrieved from https://www.nps.gov/subjects/volcanoes/eruption-classifications.htm.
[221] United States Geological Survey. (2016). Volcano Hazards Program Glossary. Retrieved from https://volcanoes.usgs.gov/vsc/glossary/.

Type	Definition
Volcanic Gases	Magma contains dissolved gases that provide the driving force causing most volcanic eruptions. As magma rises towards the surface and pressure decreases, gases are released from the liquid portion of the magma. These gases continue to travel upward and are eventually released into the atmosphere, during and between eruptions. The majority of the gas emitted by volcanoes is water vapor (steam), derived from recent precipitation and groundwater. However, toxic gases including carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen halides, and fluorine may also be released. Depending on their concentration, toxic gases can have both short and long term effects on human and animal lives, property, agriculture, and the natural environment.
Tephra	Any type and size of rock fragment that is forcibly ejected from the volcano and travels an airborne path during an eruption (i.e., ash, bombs, and scoria).
Eruption Columns and Clouds	The ascending, vertical part of the mass of erupting debris and volcanic gas that rises directly above a volcanic vent. Higher in the atmosphere, columns usually spread laterally into plumes or umbrella clouds. A cloud of tephra and gases that forms downwind of an erupting volcano is called an eruption cloud. The vertical pillar of tephra and gases rising directly above a vent is an eruption column. Eruption clouds may drift for thousands of kilometers downwind and often become increasingly spread out over a larger area with increasing distance from an erupting vent. Large eruption clouds can encircle Earth within days.
Ashfall	Dust-sized ash particles are the byproducts of many volcanic eruptions. Ash, when blown into the air, can travel large distances causing significant problems for distal hazard zones. Areas impacted by volcanic ash largely depend upon the prevailing wind direction during eruptions. A one (1) inch layer of ash weighs an average of five (5) to 10 pounds per square foot when dry (10 to 15 pounds when wet), causing danger of structural collapse. Ash is gritty, abrasive, sometimes corrosive, and it has a sulfuric odor. Additionally, when an ash cloud combines with rain, sulfur dioxide in the cloud combines with the rainwater to form acid rain which may cause minor, but painful burns to the skin, eyes, nose, and throat.

Volcanologists classify volcanoes as active, dormant, or extinct. Active volcanoes have a recent history of eruptions (about 10,000 years ago) and are likely to erupt again. Volcanoes that have not erupted for an extended period of time but are expected to erupt in the future are classified as dormant. Extinct volcanoes are not expected to erupt in the future.[222]

4.6.8.2. Hazard Location

The Cascade Range extends more than 1,000 miles from southern British Columbia into northern California and includes 13 potentially active volcanic peaks in the United States, listed in **Table 4-129**, most of which have the potential to produce a significant eruption.[223]

[222] National Geographic. (n.d.). Volcanoes. Retrieve from https://education.nationalgeographic.org/resource/volcanoes/.
[223] United States Geological Survey. (n.d.). Cascades Volcano Observatory. Retrieved from https://www.usgs.gov/observatories/cvo.

Table 4-129. Volcanoes Within 1,000 Miles of Kittitas County

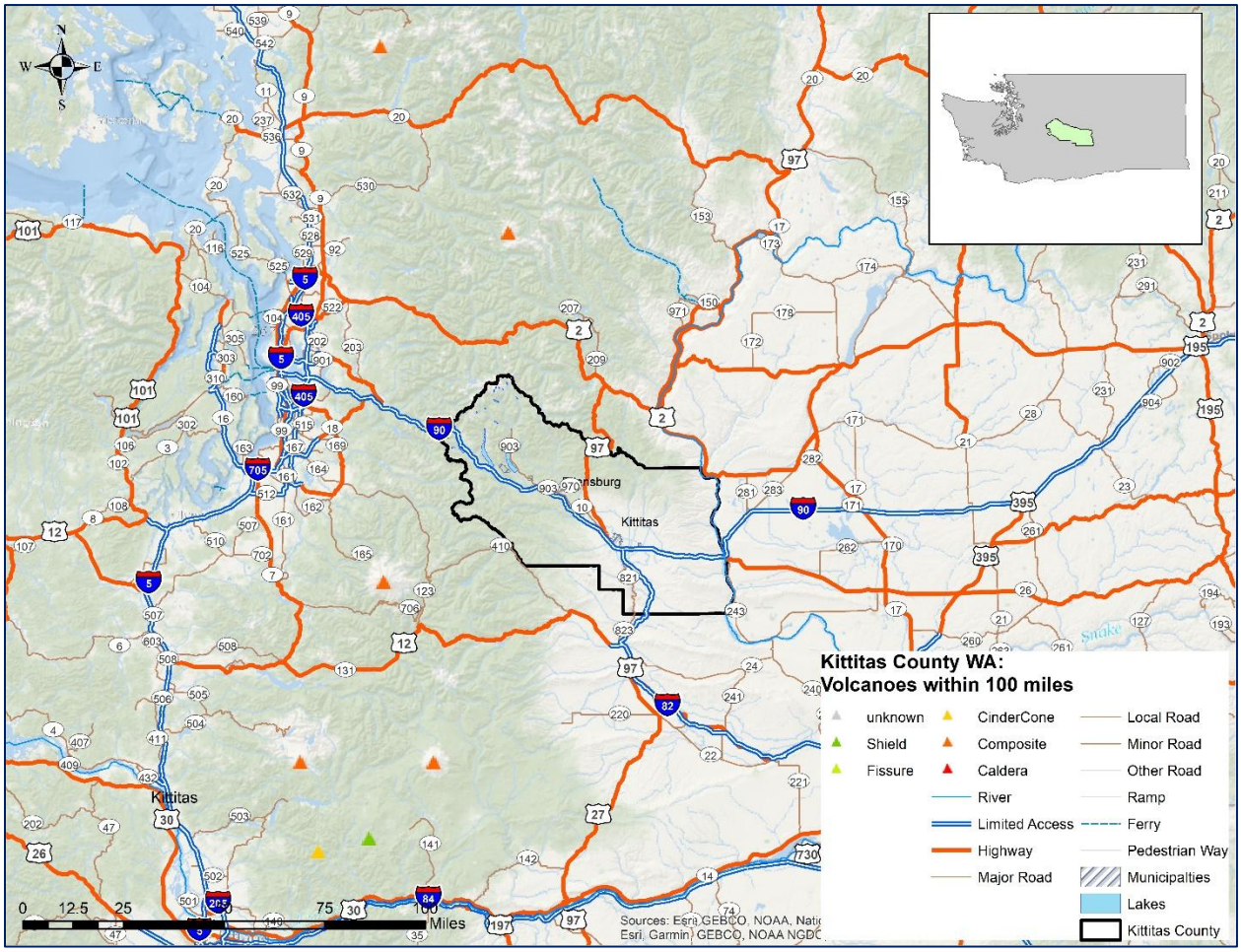
Name	Location	Elevation *(feet)*	Type	Most Recent Eruption	Threat Potential
Mount Baker	Whatcom County, Washington	10,781	Stratovolcano	6,700 years ago	Very High
Glacier Peak	Snohomish County, Washington	10,541	Stratovolcano	1,100 years ago	Very High
Mount Rainier	Pierce County, Washington	14,410	Stratovolcano	1,000 years ago	Very High
Mount St. Helens	Skamania County, Washington	8,330	Stratovolcano	1980 2004 – 2008	Very High
Mount Adams	Skamania and Yakima counties, Washington *(Yakama Nations Reserve)*	12,277	Stratovolcano	3,800 years ago	High
Mount Hood	Clackamas and Hood River counties, Oregon	11,240	Stratovolcano	1865 AD	Very High
Mount Jefferson	Jefferson, Linn, and Marion Counties, Oregon	10,495	Stratovolcano	15,000 years ago	Low/Very Low
Three Sisters	Lane County, Oregon	10,358	Complex Volcano	2,000 years ago	Very High
Newberry Volcano	Deschutes, Klamath, and Lake counties, Oregon	7,986	Shield	1,300 years ago	Very
Crater Lake	Klamath County, Oregon	8,159	Caldera	6,600 years ago	Very High
Medicine Lake Volcano	Siskiyou and Modoc counties, California	7,913	Composite	950 years ago	High
Mount Shasta	Siskiyou County, California	14,163	Stratovolcano	3,200 years ago	Very High
Lassen Peak	Shasta County, California	10,456	Dome Field, Volcanic Field	1914 – 1917	Very High

Figure 4-22 illustrates the location of volcanoes within 100 miles of Kittitas County. The four (4) major volcanoes relatively close to Kittitas County are:

- Glacier Peak (approximately 80 miles north northwest of the City of Ellensburg)
- Mount Rainier (approximately 58 miles west of the City of Ellensburg)
- Mount St Helens (approximately 95 miles southwest of the City of Ellensburg)
- Mount Adams (approximately 70 miles southwest of the City of Ellensburg)

Mount Hood constitutes a low hazard because of distance, direction of prevailing winds, and evidence that its previous ash eruptions were confined to its immediate vicinity.

Figure 4-22. Volcanoes Within 100 Miles of Kittitas County



4.6.8.3. Hazard Extent/Intensity

Volcanic eruptions can range from emissions of gases to quiet eruptions of lava flows that can be safely observed to powerful eruptions that can blow apart mountains and devastate many square miles. For example, the explosive disintegration of Mount St. Helens' north flank in 1980 vividly demonstrated the power of Cascade volcanoes. However, the 1980 eruption of Mount St. Helens, which covered over 22,000 square miles with ash is considered a relatively small volcanic eruption. Larger eruptions, such as the 1883 eruption of Krakatoa in the south Pacific, produced enough ash to slightly lower the temperature of the entire earth for several years.[224]

USGS utilizes the Volcanic Explosivity Index (VEI), outlined in **Table 4-130**, as a numeric scale that measures the relative explosivity of historic eruptions. The explosivity value is determined by the volume of products, eruption cloud height, and qualitative observations (by using terms like gentle to mega-colossal). The VEI is open-ended with the largest volcanic eruptions in history (i.e., supereruptions) given a magnitude of eight (8), and a value of zero (0) for non-explosive eruptions. The scale is logarithmic,

[224] Washington State Department of Natural Resources. (n.d.). Volcanoes and Lahars. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars.

with each interval on the scale representing a tenfold increase in observed ejecta criteria, with the exception of between VEI 0, VEI 1, and VEI 2.[225]

Table 4-130. Volcanic Explosivity Index

Volcanic Explosivity Index		Erupted Tephra Volume *(km^3) | 1 km^3 = 0.24 $miles^3$*	Examples
Non Explosive	0	0	N/A
Small	1	0.0001	Mount St. Helens (October 1, 2004)
Moderate	2	0.001	Mount St. Helens (December 7, 1989)
	3	0.01	Mount St. Helens (June 12, 1980)
Large	4	0.1	Merapi, Indonesia (2010)
Very Large	5	1	Mount St. Helens (May 18, 1980)
	6	10	Pinatubo (1991) Krakatau (1883)
	7	100	Tambora (1815) Mazama (7,700 years ago) Long Valley Caldera, CA (760,000 years ago)
	8	1,000	Yellowstone Caldera (600,000 years ago)

USGS employs a nationwide volcano alert level system for characterizing conditions (i.e., quiet, unrest, eruption) at volcanoes throughout the United States. The USGS volcano alert level system has two (2) parts – ranked terms to inform people on the ground about a volcano's status and ranked colors to inform the aviation sector about airborne ash hazards (i.e., Aviation Color Code). Volcano activity notifications for Kittitas County are issued through the USGS Cascades Volcano Observatory.[226]

Volcano Alert Levels are intended to inform people on the ground about a volcano's status and are issued in conjunction with the Aviation Color Code. Notifications are issued for both increasing and decreasing volcanic activity and are accompanied by text with details (as known) about the nature of the unrest or eruption and about potential or current hazards and likely outcomes. **Table 4-131** outlines the USGS Volcano Alert Levels.[227]

Table 4-131. United States Geological Survey Volcano Alert Levels

Type	Definition
Normal	Volcano is in a typical background, noneruptive state. **OR** After a change from a higher level, volcanic activity has ceased, and volcano has returned to noneruptive background state.

[225] United States Geological Survey. (2016). Glossary – VEI. Retrieved from https://volcanoes.usgs.gov/vsc/glossary/vei.html.
[226] United States Geological Survey. (n.d.). Volcanic Alert-Levels Characterize Conditions at U.S. Volcanoes. Retrieved from https://www.usgs.gov/programs/VHP/volcanic-alert-levels-characterize-conditions-us-volcanoes.
[227] United States Geological Survey. (2014). U.S. Geological Survey's Alert-Notification System for Volcanic Activity. Retrieved from https://pubs.usgs.gov/fs/2006/3139/fs2006-3139.pdf.

Type	Definition
Advisory	Volcano is exhibiting signs of elevated unrest above known background level. **OR** After a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
Watch	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain. **OR** Eruption is underway but poses limited hazards.
Warning	Hazardous eruption is imminent, underway, or suspected.

Color codes, which are in accordance with recommended International Civil Aviation Organization (ICAO) procedures, are intended to inform the aviation sector about a volcano's status and are issued in conjunction with a Volcano Alert Level (**Table 4-131**). Notifications are issued for both increasing and decreasing volcanic activity and are accompanied by text with details (as known) about the nature of the unrest or eruption, especially in regard to ash-plume information and likely outcomes. **Table 4-132** outlines Volcano USGS Aviation Color Code.[228]

Table 4-132. United States Geological Survey Aviation Color Code

Color	Definition
Green	Volcano is in typical background, noneruptive state. **OR** After a change from a higher level, volcanic activity has ceased, and volcano has returned to noneruptive background state.
Yellow	Volcano is exhibiting signs of elevated unrest above known background level. **OR** After a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
Orange	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain. **OR** Eruption is underway with no or minor volcanic ash emissions (ash-plume height specified, if possible).
Red	Eruption is imminent with significant emission of volcanic ash into the atmosphere likely. **OR** Eruption is underway or suspected with significant emission of volcanic ash into the atmosphere (ash-plume height specified, if possible).

4.6.8.4. Probability and Frequency

The probability of occurrence for volcano activity occurring in Kittitas County is low because a significant occurrence of this hazard is likely to occur within 100 years. Many Cascade volcanoes have erupted in the recent past and are expected to remain active in the foreseeable future. Given an average frequency of one (1) or two (2) eruptions per century during the past 12,000 years, these disasters are not part of the planning area's everyday experience. However, in the past 100 years, Lassen Peak in California and Mount St. Helens in Washington have erupted causing significant damage.

USGS classifies a volcano active when it has erupted within the Holocene (The youngest geologic time period, considered to include the past approximately 12,000 years. It is almost equivalent to postglacial

[228] Ibid.

time.) or that has the potential to erupt again in the future.[229] USGS classifies the five (5) volcanoes in the State of Washington as potentially active – Glacier Peak, Mount Adams, Mount Baker, Mount St. Helens, and Mount Rainier. Mount St. Helens is the most active volcano in the Cascades, with four (4) major eruptions in the last 500 years.

The volcano activity annualized frequency value represents the average number of recorded volcano activity hazard occurrences, in events, per year over the period of record (11,332 years). **Table 4-133** outlines the annualized frequency for volcano activity, based on FEMA NRI data, for Kittitas County. Per the FEMA NRI, volcanic activity occurs via vents that function as a conduit between the Earth's surface and inner layers, and erupt gas, molten rock, and volcanic ash when gas pressure and buoyancy drive molten rock upward and through zones of weakness in the Earth's crust.

Table 4-133. Volcano Activity Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(9310 BC – 2022)*	Annualized Frequency
Kittitas County	2	0.0 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.8.5. Past Events

Since the Mount St. Helen eruption in 2008, there has not been significant volcanic activity in the Kittitas County region. However, all five (5) of Washington's volcanoes have been active in the last 4,000 years, with Mount St. Helens (more than a dozen eruptive events) and Glacier Peak (at least six (6) eruptions) being the most active. All Washington volcanoes have had eruptions in the past 300 years that generated ash fall and/or lahars. In the past 40 years, Mount St. Helens has been the most active with dome building eruptions between 1980 and 1986, and 2004 and 2008. The most significant eruption occurred in 1980 when Mount St. Helens erupted resulting in a towering plume of ash for more than nine (9) hours, and winds carried the ash hundreds of miles away. Lahars (i.e., volcanic mudflows) carried large boulders and logs, which destroyed forests, bridges, roads, and buildings. The event resulted in 57 deaths, and it is the worst volcanic disaster in the United States recorded history.[230]

Table 4-134 outlines the eruption history for each of the volcanoes in the State of Washington.[231]

Table 4-134. Past Volcano Eruptions

Volcano	Eruption History
Mount Adams	There have been no historical eruptions in the Mount Adams volcanic field. The volcanic center first erupted between 520,000 and 500,000 years ago and continued up to about 1,000 years ago. However, there were a series of debris avalanches and lahars between approximately 600 and 300 years ago.
Mount Baker	Mount Baker is one of the youngest Cascade volcanoes and erupts infrequently. Its last major eruptive period occurred about 6,600 years ago, where large portions of the flank repeatedly collapsed generating massive lahars. There are additional reports of eruptions and lahars from the 19th century. In 1975, fumarole activity and snow melt ramped up dramatically for several years.

[229] United States Geological Survey. (2022). Active, Dormant, and Extinct: Clarifying Confusing Classifications. Retrieved from https://www.usgs.gov/observatories/yvo/news/active-dormant-and-extinct-clarifying-confusing-classifications.
[230] United States Geological Survey. (2020). Mount St. Helens' 1980 Eruption. Retrieved from https://www.usgs.gov/news/featured-story/mount-st-helens-1980-eruption-changed-future-volcanology.
[231] Washington State Department of Natural Resources. (n.d.) Volcanoes and Lahars. Retrieved from https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars.

Volcano	Eruption History
Glacier Peak	Glacier Peak erupts frequently. The eruptions are typically explosive and occasionally voluminous. Most eruptions involve tephra, but many were accompanied by far reaching lahars and dome building. Glacier Peak has erupted multiple times in the last 15,000 years. About 13,000 years ago, a series of large tephra eruptions occurred, accompanied by numerous lahars. One (1) eruption was many times the size of the Mount St. Helens 1980 eruption. Within the last 5,000 years, the volcano has produced frequent lava dome eruptions and subsequent dome collapses and lahars. The most recent eruption was approximately 300 years ago.
Mount Rainier	Mount Rainier started erupting about 500,000 years ago with intermittent eruptions and mudflows thereafter, and it still issues steam and gases from fumaroles near the summit crater. Heat from the fumaroles melts the snow and ice at the crater, as well as the summit icecap, forming caves beneath the ice.
Mount St. Helens	Mount St. Helens was formed from four (4) eruptive stages starting approximately 275,000 years ago, and intermittent eruptions currently occur. The most significant eruption occurred in 1980 after a series of earthquakes, steam explosions, and small eruptions at the summit signaled a new eruptive phase of the volcano. By mid-April 1980, a large bulge of new volcanic material had formed on the north flank of the mountain and moved outward at an average rate of five (5) feet per day. In addition to ash, pyroclastic flows and lahars traveled swiftly across the Pumice Plain and down the North Fork Toutle and Cowlitz Rivers, destroying houses and bridges along the way. Dome building eruptions occurred between 1980 and 1986, and 2004 and 2008.

4.6.8.6. Vulnerability and Impacts

According to the 2023 Washington State Enhanced Mitigation Plan, Kittitas County is not at risk of exposure to lahar or lava flow. However, ashfall can travel much further and all of Kittitas County is vulnerable to ashfall from any of the active volcanoes in the region. The following vulnerabilities and impacts will mostly focus on ashfall.

Life Safety and Health: The entire Kittitas County population is vulnerable to the hazards of volcanic activity due to its proximity to volcanoes in the Cascade Range. Life safety and health concerns after a volcanic eruption include, but are not limited to, infectious disease, respiratory illness, burns, injuries from falls, and vehicle accidents related to the slippery, hazy conditions caused by ash. Volcanic ash particles can scratch the front of the eyes; and ash particles contain crystalline silica which is a material that causes respiratory diseases such as silicosis. Ash particles can be so fine that they can be inhaled deep into the lungs and with high exposure even healthy individuals can experience respiratory issues. Although volcanic gases tend to quickly get blown away, heavy gases (e.g., carbon dioxide, hydrogen oxide) can remain stagnant in low-lying areas which can irritate the nose, eyes, and throat. At higher elevations, gases can cause rapid breathing, headache, dizziness, swelling, spasm of the throat, and suffocation. Sulfur dioxide can cause breathing problems for both healthy and people with asthma and other respiratory problems.[232]

Property Damage and Critical Facilities: The closer the property and critical facilities are to the volcano, the higher the exposure to property damage from volcanic related hazards. Impacts to property and critical facilities can range from minor to catastrophic. Volcanic ash can severely disrupt transportation systems (e.g., roads, cars, railways, and aircraft) over extremely large areas for hours to days. Heavy ashfall can affect general road conditions by reducing visibility on highways and railways. Additionally,

[232] Centers for Disease Control and Prevention. (2024). Volcanoes and Your Safety. Retrieved from https://www.cdc.gov/volcanoes/about/index.html.

roads and tracks can become slippery for cars and trains, stranding vehicles, and travelers. Electrical and communication equipment which are critical services during emergency operations, can be severely impacted by ashfall because of interference with radio waves due to atmospheric conditions, overloading of telephone systems due to increased demand, and direct damage to communication facilities. During electrical power outages the use of emergency generators may be necessary; however, generator's air intakes are vulnerable to ash. Additionally, HVAC systems can be disrupted if ash is ingested through the air intake and condenser units. Ash can accumulate in the radiator and air filters, reducing air flow potentially causing the HVAC system to stall and overheat. Infrastructure, such as drainage systems, is potentially vulnerable to the effects of ashfall because fine ash can clog pipes and culverts.[233] This may be more of a problem if an eruption occurs during winter or early spring when precipitation is highest and floods are most likely. Since Kittitas County receives significant amounts of snow every year, roofs are built to withstand snow loads; therefore, most roofs are able to withstand the potential load of ash.

Economy: Kittitas County has a significant agricultural sector, and volcanic ash can devastate crops, harm livestock, and result in long-term soil degradation. Additionally, agriculture equipment and machinery can be damaged and water sources can be contaminated. Tourism can also be impacted due to the danger and damage to natural attractions.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to volcanic activity. Future development may minimally increase (4% or less) the impact of volcanic activity within Kittitas County.

Underserved and At Risk Population: Although everyone is vulnerable to volcanic activity, children and babies, the elderly, people with chronic respiratory and cardiac conditions (e.g., asthma, emphysema, and other chronic lung diseases), and outside workers (e.g., agriculture workers) are uniquely vulnerable to volcanic gases and ash. Those with asthma can exacerbate their symptoms if exposed to volcanic gases and ash.[234] Additionally, underserved population such as low-income families, individuals with disabilities, those with limited English proficiency, and those without adequate access to emergency resources may not have access to the appropriate education on volcanic activity (e.g., ashfall protective measures) or financial resources to prepare for, respond to, and recover. Furthermore, these groups may not have access to accurate and timely information due to limited internet access, language barriers, and living in isolated areas. Therefore, critical volcanic activity information may not reach these groups in a timely manner which results in higher injury and mortality rates within these communities. Individuals with limited or no access to healthcare are highly vulnerable because treatment for respiratory and other health issues due to the gases and ashfall may be unavailable or delayed.

Effects of Climate Change in Severity of Impacts: The exact nature and extent of this impact still needs to be studied and fully understood as it pertains to climate change.

4.6.8.7. FEMA NRI Expected Annual Loss Estimates

A volcanic activity NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to volcanic activity when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-135** outlines the volcanic activity EAL for Kittitas County.

[233] United States Geological Survey. (2015). Impacts & Mitigation, Transportation. Retrieved from https://volcanoes.usgs.gov/volcanic_ash/transportation.html.
[234] Centers for Disease Control and Prevention. (2024). Health Effects of Volcanic Air Pollution. Retrieved from https://www.cdc.gov/volcanoes/risk-factors/index.html.

Table 4-135. Volcanic Activity Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$165,032	$1.8 Million	n/a	$2.0 Million	84.9	Very High

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

4.6.8.8. Volcanic Activity Risk Index Score

The volcanic activity Risk Index score and rating represent a community's relative risk for volcanic activity when compared to the rest of the United States. **Table 4-136** illustrates the volcanic activity Risk Index rating and score for Kittitas County.

Table 4-136. Volcanic Activity Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	80.9

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).

Table 4-137 represents the Volcanic Activity Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-137. Volcanic Activity Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Volcano Activity	1	12	6	15	33	20

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.9. Wildfire

4.6.9.1. Description

Wildfires are unplanned fires that occur in wildlands (e.g., forest, rangelands, or grasslands) and they are nearly impossible to prevent and difficult to control. These extreme events are common in the western United States, usually occurring during the summer and fall.[235] Free-burning fires can occur whenever combustible fuel (e.g., grasses, shrubs, trees, dead leaves) in the presence of oxygen at an extremely high temperature becomes gas (flames are the visual indicator of heated gas). Smoldering fires can occur with lower temperature heat sources and, over time, can reach ignition temperature when rapid fire growth occurs. Wildfires can be ignited by natural occurrences (e.g., lightning strike) or by human causes (e.g., unattended campfire, debris burning, or arson). In 2022, 87% of wildfires in the United States were ignited by humans; meaning that they could have been prevented.[236] However, weather conditions and topography determine the behavior of wildfire. Wind, high temperatures, and low humidity create a perfect environment for a wildfire to grow; furthermore, flames burn faster when they are moving uphill versus downhill.

Wildfires can be classified in three (3) different classes, listed in **Table 4-138**, and it is common to have all three (3) types of fire.[237]

Table 4-138. Types of Wildfires

Type	Description
Ground Fires	Mostly burn in decayed roots below ground and in the duff later which is comprised of dead plant materials (e.g., leaves, bark, needles, and twigs). Ground fires are sustained by glowing combustion (without flames) and go undetected for a long period of time because the produce little to no smoke and spread slowly.
Surface Fires	Burn loose needles, moss, lichen, herbaceous vegetation, shrubs, small trees, and saplings that are located at or near the surface of the ground, mostly by flaming combustion. Surface fires can grow in intensity to scorch or consume the forest canopy, a characteristic that is seen in crown fires depending on the following – amount of surface fuel (high), fuel moisture content (low), slope and/or wind speed (high), resultant surface flame length (high), height of the base of tree crowns (small), and density and compactness of tree crowns (tight).
Crown Fires	Usually ignited by a surface fire, crown fires burn forest canopy fuels, which include live and dead foliage/ branches, lichens in trees, and tall shrubs that lie well above the surface fuels. Crown fires can be passive (involving the burning of individual trees or small groups of trees, often called torching) or active (also referred to as running crown fires, present a solid wall of flame from the surface through the canopy fuel layers as seen in the photo below.

Wildfires are a necessary part of the natural ecosystem, but they become a hazard when they extend out of control into developed areas, resulting in loss of property, injuries, or the loss of life. The wildfire risk in the United States has increased in the last few decades with the increasing encroachment of residences and other structures into the wildland environment and the increasingly large number of people living in wildland areas.

[235] United States Department of Agriculture. (n.d.). Wildfire. Retrieved from https://www.climatehubs.usda.gov/taxonomy/term/398.
[236] United States Forest Service. (n.d.). About Wildfires. Retrieved from https://smokeybear.com/en/about-wildland-fire.
[237] Northwest Fire Science Consortium. (n.d.). What are Types of Fire? Retrieved from https://www.nwfirescience.org/sites/default/files/publications/Types%20of%20Fire.pdf.

In the State of Washington, the wildfire season usually begins in early July and ends with precipitation in late September, but wildfires have occurred in every month of the year. Drought, snowpack, and local weather conditions can affect the length of the fire season.

Wildland Urban Interface

The Kittitas County Community Wildfire Protection Plan (CWPP) defines the concept of WUI as any area where a combination of human development and vegetation has potential to result in negative impacts from wildfire in the community. As more development extends deeper into these regions, the risk of wildfire interacting with these residences increases.

The Kittitas County WUI boundary is approximately 1,018 square miles and covers 651,795 acres. **Table 4-139** outlines the County's WUI planning area fire coverage.[238]

Table 4-139. Wildland Urban Interface Planning Area Fire Coverage

Planning Are	Acres	Fire District Coverage
Eastern Kittitas County	109,854	Bureau of Land Management, Yakima Training Center, DNR, Vantage Fire Department, Kittitas Valley Fire & Rescue
Kittitas Valley Upland	150,789	DNR, Kittitas Valley Fire & Rescue, USFS
Swauk-Liberty	75,500	DNR, Kittitas County Fire District No. 7, USFS
Manastash-Taneum	113,098	DNR, Kittitas Valley Fire & Rescue, USFS
Teanaway	22,332	Kittitas County Fire District No. 7, DNR
North Lake Cle Elum	23,170	Kittitas County Fire District No. 6, DNR, USFS
Roslyn – Cle Elum	13,419	City of Roslyn FD, City of Cle Elum Fire Department, Kittitas County Fire District No. 7, DNR, USFS
Domerie Flats	11,523	Kittitas County Fire District No. 7, DNR, USFS
West Kittitas County	94,084	Kittitas County Fire District No. 51, Kittitas County Fire District No. 8, Kittitas County Fire District No. 7, DNR, USFS
South Cle Elum	58,355	City of South Cle Elum Fire Department, Kittitas County Fire District No. 7, DNR, USFS

Wildfire risk can be reduced using a number of different mitigation strategies like vegetation management and code development. In 2013, Kittitas County adopted the International Wildland Urban Interface Code (IWUIC) with amendments located in Kittitas County Code Title 20 and Appendix B: Vegetation Management Plan. This serves as a tool to mitigate wildland fire risk as vacant private land is converted to the build environment.[239]

Wildfire Smoke

A wildfire that is not within Kittitas County can impact the area with wildfire smoke, even when the wildfire is taking place thousands of miles away. Wildfire smoke is a complex mixture of particles and gases (i.e., carbon monoxide, nitrogen oxides, and volatile organic compounds), and some of the compounds in wildfire smoke are known to be carcinogenic. Particulate matter (PM) in wildfire smoke is much finer than in urban air pollution, with the bulk of wildfire smoke PM less than one (1) micrometer in diameter. Furthermore, secondary pollutants are produced in wildfire smoke. Reactions between volatile organic

[238] Kittitas County Conservation District. (2018). Community Wildfire Protection Plan. Retrieved from https://www.dnr.wa.gov/publications/rp_burn_cwpp_kittitasco.pdf.
[239] Ibid.

compounds and nitrogen oxides produce ozone which is a highly reactive gas that is harmful to breath. Wildfire smoke is highly variable in space and time. The concentration and the composition of wildfire smoke can be different from fire to fire, and the composition of a smoke plume changes as the plume ages (i.e., as it moves in the atmosphere).

Wildfire smoke poses a significant risk to the public, especially vulnerable populations (e.g., respiratory conditions or disease, cardiovascular diseases, children and adolescents, older adults, pregnant women, outdoor workers, socio-economic status). A reason that wildfire smoke may have different health effects when compared to general urban pollution is that the constituents that make up wildfire smoke may have different effects on the body. When wildfire smoke mixes with urban air pollution, the health hazard can increase. For example, in urban areas where pollutant concentrations are already elevated and considered "unhealthy", the addition of wildfire smoke can push them to hazardous levels.[240]

The CDC recognizes wildfire smoke as a public health hazard and the Washington State Enhanced Mitigation Plan acknowledges wildfire smoke as a natural hazard (under the wildfire hazard).

4.6.9.2. Hazard Location

According to the 2023 Washington State Enhanced Mitigation Plan, the region most at risk to wildfires is central Washington (east of the Cascades), which includes Kittitas County.[241] **Figure 4-23** illustrates the annual probability of wildfire burning in a specific location, also known as the wildfire likelihood. The wildfire likelihood is based on fire behavior modeling across thousands of simulations of possible fire seasons which account for contributing factors to the probability of wildfire such as weather, topography, and ignitions.[242] **Figure 4-24** illustrates the wildfire risk to homes within Kittitas County which integrates wildfire likelihood and intensity. This measures the relative consequence of wildfire to residential structures everywhere within the landscape and it includes areas where structures do not exist. This helps consider the wildfire risk in areas where new construction is proposed. As outlined in **Figure 4-24**, most of Kittitas County has a high wildfire risk; and, on average, a greater risk than 100% of the counties in the United States.[243]

Note: The Kittitas County CWPP includes more detailed mapping of wildfire risks and priority areas, which serves as a critical resource for identifying vulnerable locations and guiding mitigation efforts.

[240] Washington Region 7 Healthcare Alliance. (2024). Wildfire Smoke Response Plan (Draft).
[241] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.
[242] Wildfire Risk to Communities. (n.d.). Understand Risk. Retrieved from https://wildfirerisk.org/understand-risk/.
[243] Wildfire Risk to Communities. (n.d.). Kittitas County: Risk to Homes. Retrieved from https://wildfirerisk.org/explore/risk-to-homes/53/53037/.

Figure 4-23. Kittitas County Wildfire Likelihood

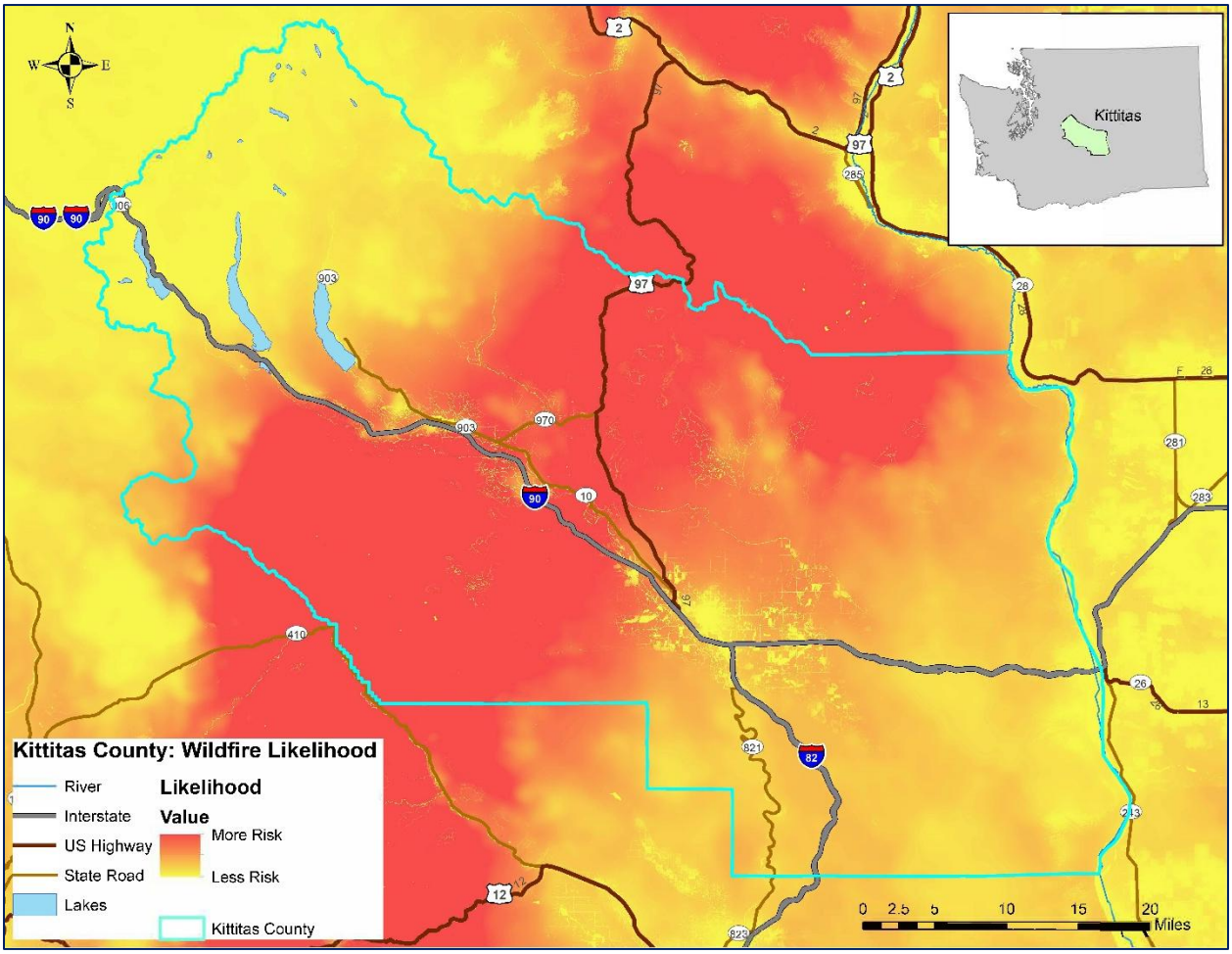
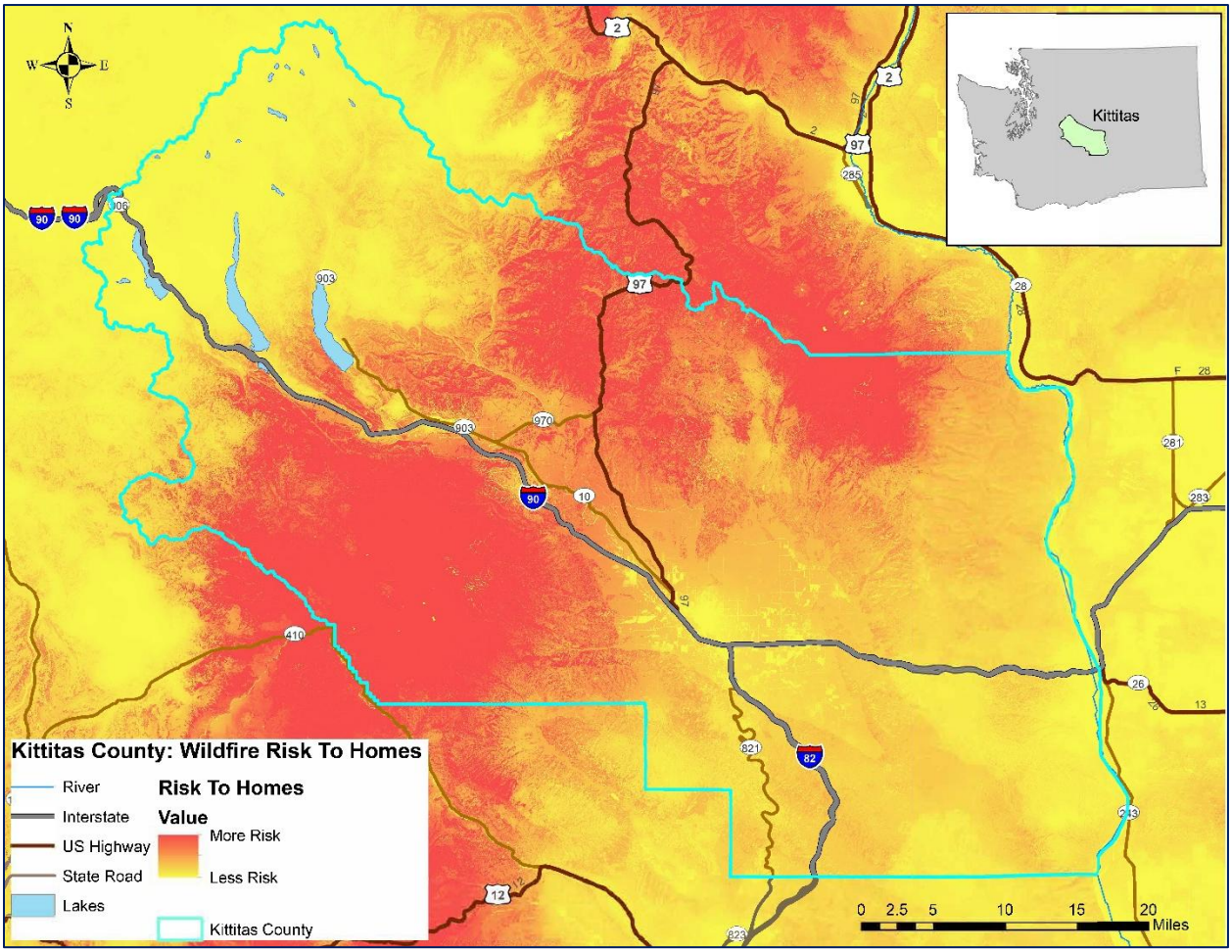


Figure 4-24. Kittitas County Wildfire Risk to Homes



4.6.9.3. Hazard Extent/Intensity

Wildfires are considered a natural and necessary component of wildland ecology. As a result, wildfires are not considered a major hazard unless their movement threatens lives, homes, communities, critical infrastructure, and natural and cultural resources.

Even if a wildfire is not occurring within Kittitas County, wildfire smoke can affect the visibility and air quality of the region. The United States Environmental Protection Agency (EPA) use the Air Quality Index (AQI) to report air quality. The AQI is divided into six (6) categories, listed in **Table 4-140**, each of which corresponds to a different level of health concern.

Table 4-140. Air Quality Index for Ozone and Particulate Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert. The risk of health effects is increased for everyone.
Maroon	Hazardous	301 or higher	Health warning of emergency conditions. Everyone is more likely to be affected.
EPA establishes an AQI for five (5) major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health - ground-level ozone, particle pollution (also known as particulate matter, including PM2.5 and PM10), carbon monoxide, sulfur dioxide, and nitrogen dioxide.			

When weather conditions are conducive to wildfire ignition, the NWS local Forecast Office issues a series of advisories. **Table 4-141** outlines the fire advisories issued by NWS as conditions warrant.[244]

Table 4-141. NWS Fire Advisories

Type	Definition
Fire Weather Watch	Issued to alert land managers and the public that upcoming weather conditions (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning) could result in extensive wildland fire occurrence or extreme fire behavior. It is issued when critical fire weather conditions are possible but not imminent or occurring.
Red Flag Warning	Issued by NWS, in conjunction with land management agencies, to alert land managers to an ongoing or imminent critical fire weather pattern (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning). It is issued when fire conditions are ongoing or expected to occur shortly.
Extreme Fire Behavior	Issued when a wildfire is likely to run out of control. It is often hard to predict because fires tend to behave erratically and sometimes dangerously. To issue this alert, one (1) or more of the following criteria must be met – moving fast (i.e., high rate of spread), prolific crowning and/or spotting, presence of fire whirls, and/or strong convection column.

4.6.9.4. Probability and Frequency

The probability of occurrence for a wildfire in Kittitas County is high because significant occurrences of this hazard occur annually throughout the County. Additionally, the probability of occurrence for wildfire smoke in Kittitas County is also high, even if the wildfire is occurring outside of the planning area. Kittitas County has, on average, a greater probability of wildfire burning in any given year than 100% of the counties in the United States. Refer to **Figure 4-23** for the wildfire likelihood within Kittitas County.[245] According to the 2023 Washington State Enhanced Hazard Mitigation Plan, the probability of future wildfire related disaster declarations each year is 70% in the State. Since 1970, the frequency of wildfires and number of acres burned has increased significantly in the State of Washington. Wildfires are expected to continue their increase in extent, intensity, and frequency for the entire State, with large fires becoming more likely in central and eastern Washington. Wildfire season is projected to increase in

[244] National Weather Service. (n.d.). Understanding Wildfire Warnings, Watches and Behavior. Retrieved from https://www.weather.gov/safety/wildfire-ww.
[245] Wildfire Risk to Communities. (n.d.). Kittitas County: Wildfire Likelihood. Retrieved from https://wildfirerisk.org/explore/wildfire-likelihood/53/53037/.

duration, putting more of the state at risk for longer periods. These changes are driven by climate change and population growth and development in the WUI.[246]

The wildfire annualized frequency value represents the modeled frequency of wildfire hazard occurrences, in event days, per year. **Table 4-142** outlines the annualized frequency for wildfire, based on FEMA NRI data, for Kittitas County.

Table 4-142. Wildfire Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(2021 Dataset)*	Annualized Frequency
Kittitas County	N/A	1.12% chance per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.9.5. Past Events

NCEI has reported 22 wildfire events, listed **Table 4-143**, between 1950 and 2023 in Kittitas County. Notably the Taylor Bridge Fire in August 2012 near the City of Cle Elum which burned a total of 23,500 acres of timber and grass. The fire was ignited by construction workers welding on the Taylor Bridge on Highway 10. The wildfire destroyed 61 homes and multiple outbuildings, and affected utility infrastructure (e.g., irrigation) and resulted in property damage totaled $8.3 Million.[247, 248]

10 fire disaster declarations have been issued for Kittitas County between 1953 and 2023.

Table 4-143. Wildfire Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	9/1/2018	00:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	8/1/2018	00:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	7/30/2018	09:00	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/19/2018	11:00	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/9/2018	22:49	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	10/1/2017	00:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	9/1/2017	00:00	Wildfire	0	0	0.00K	0.00K

[246] Washington State Emergency Management Division. (2023). Washington State Enhanced Hazard Mitigation Plan. Retrieved from https://mil.wa.gov/asset/651ec296d76a9/2023_WA_SEHMP_final_20231004.pdf.
[247] Hobbs, R. and Berglund, C. (2017). Between Two Fires: Lessons Learned in Kittitas County. Retrieved from https://fireadaptednetwork.org/between-two-fires-lessons-learned-in-kittitas-county/.
[248] National Weather Service. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=406863.

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	8/24/2017	10:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	8/11/2017	19:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	9/1/2015	00:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	8/10/2015	17:00	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	8/2/2014	16:30	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	8/1/2013	00:00	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/27/2013	07:00	Wildfire	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	8/13/2012	12:00	Wildfire	0	0	8.30M	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	8/1/2004	00:00	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/30/2004	00:00	Wildfire	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	7/1/2004	17:00	Wildfire	0	0	1.00K	0.00K
CLE ELUM	Kittitas County	WA	10/1/2003	00:00	Wildfire	0	0	0.00K	0.00K
CLE ELUM	Kittitas County	WA	9/24/2003	00:00	Wildfire	0	0	0.00K	0.00K
ROSLYN	Kittitas County	WA	9/1/2003	00:00	Wildfire	0	0	0.00K	0.00K
ROSLYN	Kittitas County	WA	8/25/2003	00:00	Wildfire	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**8.301M**	**0.00K**

4.6.9.6. Vulnerability and Impacts

Life Safety and Health: Wildfires can result in additional threats to life safety and health, such impacts to water and air quality. Wildfires can severely affect the water quality due to soil erosion, increased flooding, and the flow of debris with potential contaminants.[249] Additionally, wildfire smoke and ash can travel miles and affect communities that are not directly impacted by the wildfires and reduce air quality to unhealthy levels. The population exposed to wildfire smoke and ash can experience eyes, nose, throat, and lung irritation, and it can make it hard to breath. Additionally, these conditions can impair visibility on roads and have the potential to cause vehicle and maritime accidents.

Smoke and air pollution from wildfires that are occurring within or outside of the Country can result in severe health hazards, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (e.g., soot, tar, water vapor, and minerals), gases (e.g., carbon

[249] United States Environmental Protection Agency. (2023). Wildfires and Water Quality Research. Retrieved from https://www.epa.gov/water-research/wildfires-and-water-quality-research.

monoxide, carbon dioxide, nitrogen oxides), and toxics (e.g., formaldehyde, benzene).[250] Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Property Damage and Critical Facilities: When a wildfire is in the immediate vicinity, it can cause severe damage to all property and infrastructure along its path. The critical infrastructure sector (e.g., transportation, communications, power and gas services, and water supply) can be disrupted or damaged as a result of wildfires. Electrical systems can be destroyed or forced to shut down in order to prevent further damage. Emergency services can become severely overwhelmed during a wildfire event impacting response times and overall effectiveness. For example, law enforcement is called for traffic and evacuation assistance, paramedics are required for impacted communities and shelters, and hospitals are at risk of evacuation or could become overwhelmed due to the heightened needs of services.[251] Additionally, wildfires can create conditions that block or prevent access and can isolate residents and emergency service providers. Loss of power as a result of a wildfire poses a unique risk to the irrigation infrastructure. This includes telemetry and automated gate systems, and canal overtopping and potential breaches could occur which can result in flooding.

Economy: Wildfires can have broad economic effects on communities, including disruptions to tourism, agriculture, and other industries. Smoke can significantly impact crops and harmful composite of minerals/metals can reduce the ability to absorb sunlight, can negatively impact soil compositions, or directly damage crops. Additionally, wildfires can deposit smoke/soot along the higher elevations which result in a reduction of critical snowpack development in the next winter season. Kittitas County's economy heavily relies on winter tourism (e.g., skiing, snowboarding, snowmobiling) and a decrease in snowpack can significantly affect this part of the economy. Additionally, direct loss of irrigation infrastructure can impact operations by causing disruption of service and impacts to the economy.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to wildfire and wildfire smoke. Future development may slightly increase (between 5% and 9%) the impact of wildfire and wildfire smoke within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population face unique vulnerabilities and impacts as a result of wildfire. These groups include, but are not limited to, low-income families, elderly, individuals with disabilities, those with limited English proficiency, and those without adequate access to emergency resources or transportation. These groups may not have access to accurate and timely information due to limited internet access, language barriers, and living in isolated areas. Therefore, critical wildfire advisories may not reach these groups in a timely manner which results in higher injury and mortality rates within these communities. Additionally, in the event of an evacuation order, those without access to transportation may be unable to evacuate.

Although everyone within Kittitas County is vulnerable to wildfire smoke, the elderly, children, individuals with pre-existing respiratory and cardiovascular disease, outdoor workers, and pregnant women are uniquely vulnerable. This group is at a higher risk of the health effects attributed to wildfire smoke exposure. Short term exposure (i.e., over a few days) can cause irritation to the eyes and respiratory

[250] United States Environmental Protection Agency. (2023). Why Wildfire Smoke is a Health Concern. Retrieved from https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern.
[251] Cybersecurity & Infrastructure Security Agency. (n.d.). Critical Infrastructure Sectors. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/wildfires.

tract, respiratory symptoms (e.g., coughing, phlegm, wheezing, difficulty breathing), respiratory effects (e.g., bronchitis, reduced lung function, increased risk of asthma exacerbation and aggravation of other lung diseases, increased risk of emergency room visits and hospital admissions), cardiovascular effects (e.g., heart failure, heart attack, stroke, increased risk of emergency room visits and hospital admissions), and increased risk of premature death. Cumulative short-term exposure (i.e., over multiple days to a few weeks) can reduce lung function; and studies have not evaluated the health effects attributed to wildfire smoke exposure over multiple wildfire season (i.e., long-term exposure).[252]

Effects of Climate Change in Severity of Impacts: Changes in climate are creating warmer and drier conditions which are leading to longer and more active wildfire seasons. Studies have shown that the number of large wildfires has more than doubled in the western United States. Furthermore, projections show that a one (1) degree Fahrenheit increase in the average annual temperature could increase the average burned area per year by as much as 600% (in some types of forests) in the western United States.[253] Additionally, the incidence of illnesses and death during extreme heat events and wildfire smoke days is increasing, and climate change is stressing health systems.[254] **Table 4-144** indicates the 25-year heat and precipitation projections for Kittitas County.[255] **Table 4-145** outlines the wildfire associated climate indicators for Kittitas County projected through the end of the century.[256]

Table 4-144. 25-Year Climate Projections for Kittitas County

Higher Emissions (RCP8.5)
Kittitas County is expected to experience an 88% increase in extremely hot days and a 12% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience five (5) more days that reach above 95°F (from six (6) days to 11 days per year).
By 2049, Kittitas County is expected to have a 2°F increase (from 45°F to 47°F) in average annual temperatures.
By 2049, Kittitas County is expected to experience 0.8 more days of heavy precipitation per year (from 6.9 days to 7.8 days per year).
By 2049, Kittitas County is expected to have a two (2) inch increase (from 39″ to 41″) in average annual precipitation.

[252] United States Environmental Protection Agency. (n.d.). Wildfire Smoke and Your Patients' Health. Retrieved from https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke.
[253] National Oceanic and Atmospheric Administration. (2023). Wildfire Climate Connection. Retrieved from https://www.noaa.gov/noaa-wildfire/wildfire-climate-connection.
[254] GlobalChange.gov. (n.d.). Fifth National Climate Assessment, Chapter 27: Northwest. Retrieve from https://nca2023.globalchange.gov/chapter/27/.
[255] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[256] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Lower Emissions (RCP4.5)
Kittitas County is expected to experience a 65% increase in extremely hot days and a 5% increase in days with heavy precipitation within 25 years.
By 2049, Kittitas County is expected to experience three (3) more days that reach above 95°F (from five (5) days to nine (9) days per year).
By 2049, Kittitas County is expected to have a 2°F increase (from 44°F to 46°F) in average annual temperatures.
By 2049, Kittitas County is expected to experience 0.3 more days of heavy precipitation per year (from 7.2 days to 7.5 days per year).
By 2049, Kittitas County is expected to have a 0.3 inch increase (from 40″ to 40.2″) in average annual precipitation.

Table 4-145. Future Climate Indicators for Kittitas County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Days per year with no precipitation (*Dry Days)*	**209 days**	**210 days**	**211 days**	**212 days**	**212 days**	**213 days**	**217 days**
	205 – 213	193 – 220	195 – 223	189 – 228	195 – 225	192 – 228	198 – 237
Maximum number of consecutive dry days	**31 days**	**33 days**	**33 days**	**34 days**	**35 days**	**35 days**	**39 days**
	25 – 37	26 – 41	26 – 44	26 – 48	27 – 48	28 – 48	30 – 52
Days per year with precipitation *(Wet Days)*	**156 days**	**155 days**	**154 days**	**153 days**	**153 days**	**152 days**	**148 days**
	152 – 160	145 – 172	142 – 170	137 – 176	140 – 170	137 – 173	128 - 167
Temperature Thresholds							
Annual days with maximum temperature greater than 90°F	**8 days**	**15 days**	**16 days**	**19 days**	**23 days**	**25 days**	**42 days**
	7 – 9	10 – 19	10 – 21	12 – 28	13 – 35	13 – 38	22 – 61
Annual days with maximum temperature greater than 100°F	**0 days**	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**	**13 days**
	0 – 0	0 – 2	0 – 4	1 – 5	1 – 10	1 – 5	4 – 26

4.6.9.7. FEMA NRI Expected Annual Loss Estimates

A wildfire NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to wildfires when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-146** outlines the wildfire EAL for Kittitas County.

Table 4-146. Wildfire Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$5,275	$15.9 Million	$7,281	$15.9 Million	99.0	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.9.8. Wildfire Risk Index Scores

The wildfire Risk Index score and rating represent a community's relative risk for wildfires when compared to the rest of the United States. **Table 4-147** illustrates the wildfire Risk Index rating and score for Kittitas County.

Table 4-147. Wildfire Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very High	98.6
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-148 represents the wildfire Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

It is important to note that the sub hazards for wildfire (i.e., wildfire smoke) were individually ranked in the hazard risk ranking; however, wildfire is considered as the main hazard throughout this Plan.

Table 4-148. Wildfire Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Wildfire	3	18	11	30	59	81
Wildfire Smoke	3	9	10	20	39	57

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.10. Winter Weather

4.6.10.1. Description

For the purposes of this Plan, winter weather includes ice storms, heavy snow, and blizzards. Each hazard is examined independently, but it is recognized that these could occur simultaneously. *Refer to the severe weather section of this Plan for further details on cold wave/extreme cold.*

Winter weather consists of winter storm events in which the main type of precipitation is snow, sleet, and/or freezing rain.[257] **Table 4-149** provides a description for each of the three (3) types of winter precipitation.[258]

Table 4-149. Winter Precipitation Types

Type	Definition
Snow	Most of the precipitation that falls in the wintertime begins as snow because the top layer of the storm is usually cold enough to create snowflakes. Snowflakes are a collection of ice crystals that cling to each other as they fall towards the ground. Precipitation continues to fall as snow when the temperature remains at or below 32°F from the cloud base to the ground.
Sleet	Occurs when snowflakes only partially melt when they fall through a shallow layer of warm air. These slushy drops refreeze as they then fall through a deep layer of freezing air above the surface, and eventually reach the ground as frozen rain drops that bounce on impact.
Freezing Rain	Occurs when snowflakes descend into a warmer layer of air and melt completely. When these liquid water drops fall through another thin layer of freezing air just above the surface, they do not have enough time to refreeze before reaching the ground. Because they are “supercooled,” they instantly refreeze upon contact with anything that is at or below 32°F, creating a glaze of ice on the ground, trees, power lines, or other objects.

A winter storm requires three (3) basic ingredients – cold air, lift, and moisture. Cold air that is below freezing (less than 32°F) must be present in the clouds and near the ground to make snow and/or ice. Lift is needed to raise moist air to form the clouds and cause precipitation. For example, warm air colliding with cold air is forced to rise over the cold dome; the boundary between warm and cold air masses is called a front. Finally, moisture is needed to form clouds and precipitation. A source of moisture can be air blowing across of body of water (e.g., large lake, ocean).[259]

Ice Storm

An ice storm is a storm which results in the accumulation of at least 0.25 inches of ice on exposed surfaces (i.e., a significant accumulation of freezing rain lasting several hours or more). These storms create extremely hazardous driving and walking conditions. Additionally, the accumulation of ice on trees,

[257] Federal Emergency Management Agency. (2023). Winter Weather. Retrieved from https://hazards.fema.gov/nri/winter-weather.
[258] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Winter Weather. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/winter/types/.
[259] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Winter Weather Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/winter/.

power lines, and communication towers can bring them down causing severe damage.[260] **Table 4-150** outlines additional ice related hazards.[261]

Table 4-150. Ice Related Hazard

Type	Definition
Black Ice	It is a deadly driving hazard. Black ice are patches of ice on roadways or other transportation surfaces that are not easily seen because it is often clear with black road surfaces. It is more prevalent during the morning hours after snow melts on the roadways and freezes overnight. Black ice can also form when roadways are slick from rain and the temperature reaches freezing levels.
Ice Jams	Long cold waves can cause rivers and lakes to freeze. A rise in the water level or a thaw breaks the ice into large chunks which become jammed at human-made and natural obstructions. Ice jams can act as a dam, resulting in severe flooding. *Floods are addressed separately in this Plan.*
Frost	Frost is the formation of thin ice crystals on the ground or other surfaces in the form of scales, needles, feathers, or fans. Frost develops under conditions similar to dew, except the temperatures of the Earth's surface and earthbound objects fall below 32°F. As with the term "freeze," this condition is primarily significant during the growing agriculture season. If a frost period is sufficiently severe to end the growing season or delay its beginning, it is commonly referred to as a "killing frost." Because frost is primarily an event that occurs as the result of radiational cooling, it frequently occurs with a thermometer level temperature in the mid-30s.

Heavy Snow/Blizzards

Winter storms are a combination of heavy snow, blowing snow, and/or dangerous wind chills and they have the potential of being life-threatening. Even though heavy snowfall and severe cold often accompany blizzards, they are not required. A winter storm is classified as a blizzard when there is a combination of blowing snow and wind resulting in very low visibilities. When strong winds pick up snow that has already fallen it is called a ground blizzard.[262]

4.6.10.2. Hazard Location

Winter Weather can occur anywhere in Kittitas County. The Pacific Ocean provides an unlimited source of moisture for winter storms. If the air is cold enough, snow falls over the State of Washington. As the moisture rises into the mountains, heavy snowfall is capable of closing mountain passes and causing avalanches. *Refer to the avalanche section of this Plan for further details.* Cold air from the north has to filter through mountain canyons into the basins and valleys to the south. If the cold air is deep enough, it can spill over the mountain ridge. As the air funnels through canyons and over ridges, wind speeds can reach 100 mph and combining these winds with snow results in a blizzard.

4.6.10.3. Hazard Extent/Intensity

Often called the “deceptive killer”, winter weather can be life threatening and can cause substantial damage to infrastructure, property, and agriculture. Furthermore, many deaths are attributed to indirect causes of winter weather (e.g., icy roads lead to an increase in traffic accidents). The extent of damage caused by winter weather depends on the type of winter weather, strength, and location.

[260] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Winter Weather. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/winter/types/.
[261] National Weather Service. (n.d.). Ice Storms. Retrieved from https://www.weather.gov/safety/winter-ice-frost.
[262] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Winter Weather Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/winter/.

The NWS Pendleton, Oregon Area Forecast Office is responsible for issuing winter weather advisories, as conditions warrant. **Table 4-151** outlines the winter weather advisories.[263]

Table 4-151. NWS Winter Weather Advisories

Type	Definition
Winter Weather Advisory	Issued when snow, blowing snow, ice, sleet, or a combination of these wintry elements is expected but conditions should not be hazardous enough to meet warning criteria. Be prepared for winter driving conditions and possible travel difficulties.
Winter Storm Watch	Issued when conditions are favorable for a significant winter storm event (e.g., heavy sleet, heavy snow, ice storm, heavy snow and blowing snow, or a combination of events).
Winter Storm Warning	Issued for a significant winter weather event including snow, ice, sleet or blowing snow, or a combination of these hazards. Travel will become difficult or impossible in some situations.
Blizzard Warning	Issued for frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three (3) hours or more. A Blizzard Warning means severe winter weather conditions are expected or occurring. Falling and blowing snow with strong winds and poor visibilities are likely, leading to whiteout conditions making travel extremely difficult.
Ice Storm Warning	Usually issued for ice accumulation of around 1/4 inch or more. This amount of ice accumulation will make travel dangerous or impossible and likely lead to snapped power lines and falling tree branches.
Details on extreme cold weather advisories (i.e., wind chill, freeze and frost advisories, watches, and warnings) are available under the Severe Weather section of this Plan.	

The Winter Storm Severity Impact Index (WSSI) is a tool that assists NWS operational forecasters in maintaining situational awareness of the possible significance of weather related impacts based upon the current official forecast. Additionally, it helps enhance communication to external partners (e.g., emergency managers, public safety officials), media, and general public of the expected severity of potential societal impacts due to the expected winter weather hazards and their distribution. **Table 4-152** outlines the WSSI impact definitions.[264]

Table 4-152. NWS Winter Storm Severity Index

Index		Description
	Winter Weather Area	**Expect Winter Weather.** • Winter driving conditions. Drive Carefully.
	Minor Impacts	**Expect a few inconveniences to daily use.** • Winter driving conditions. Use caution while driving.
	Moderate Impacts	**Expect disruptions to daily life.** • Hazardous driving conditions. Use extra caution while driving. • Closures and disruptions to infrastructure may occur.
	Major Impacts	**Expect considerable disruptions to daily life.** • Dangerous or impossible driving conditions. Avoid travel if possible. • Widespread closures and disruptions to infrastructure may occur.

[263] National Weather Service. (n.d.). Winter Weather Warnings, Watches, and Advisories. Retrieved from https://www.weather.gov/safety/winter-ww.
[264] National Weather Service. (2023). Winter Storm Severity Index (WSSI): Product Description Document. Retrieved from https://www.wpc.ncep.noaa.gov/wwd/wssi/WSSI_PDD_2022-23.pdf.

Index		Description
	Extreme Impacts	**Expect substantial disruptions to daily life.** • Extremely dangerous or impossible driving conditions. Travel is not advised. • Extensive and widespread closures and disruptions to infrastructure may occur. • Life-saving actions may be needed.

The Sperry–Piltz Ice Accumulation Index (SPIA Index) is a decision support tool that estimates ice accumulation and potential ice damage from incoming ice storms. It uses an algorithm of researched parameters that, when combined with NWS forecast data, it estimates the projected footprint, total ice accumulation, and potential damage resulting from approaching ice storms. The SPIA Index categories of damage, as listed in **Table 4-153**, are based upon a combination of precipitation totals, temperatures, and wind speeds/direction.[265]

Table 4-153. Sperry-Piltz Ice Accumulation Index

Ice Damage Index	Average NWS Ice Amount *(inches)*	Wind *(mph)*	Damage and Impact Description
0	Less than 0.25	Less than 15	Minimal risk of damage to exposed utility systems. No alerts or advisories are needed for crews. Few outages.
1	0.10 – 0.25	15 – 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	Less than 15	
2	0.10 – 0.25	25 – 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulations.
	0.25 – 0.50	15 – 25	
	0.50 – 0.75	Less than 15	
3	0.10 – 0.25	Greater than or equal to 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting one (1) to five (5) days.
	0.25 – 0.50	25 – 35	
	0.50 – 0.75	15 – 25	
	0.75 – 1.00	Less than 15	
4	0.25 – 0.50	Greater than or equal to 35	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting five (5) to 10 days.
	0.50 – 0.75	25 – 35	
	0.75 – 1.00	15 – 25	
	1.00 – 1.50	Less than 15	
5	0.50 – 0.75	Greater than or equal to 35	Catastrophic damage to the entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters are needed.
	0.75 – 1.00	Greater than or equal to 25	
	1.00 – 1.50	Greater than or equal to 15	
	Greater than 1.50	Any	

[265] Sperry, S. and Piltz, S. (2011). The SPIA Index. Retrieved from https://www.weather.gov/media/ffc/iwt2014/IWT2014_Sperry.pdf.

4.6.10.4. Probability and Frequency

The probability of occurrence for winter weather in Kittitas County is high because significant occurrences of this hazard occur annually throughout the County. The planning area can expect to experience exposure to some type of winter weather event at least annually.

The winter weather annualized frequency value represents the average number of recorded winter weather hazard occurrences, in event days, per year over the period of record (16.9 years). **Table 4-154** outlines the annualized frequency for winter weather, based on FEMA NRI data, for Kittitas County.

Table 4-154. Winter Weather Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(2005 – 2021)*	Annualized Frequency
Kittitas County	124	7.7 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The ice storm annualized frequency value represents the average number of recorded ice storm hazard occurrences, in event days, per year over the period of record (67.1 years). **Table 4-155** outlines the annualized frequency for ice storms, based on FEMA NRI data, for Kittitas County.

Table 4-155. Ice Storm Annualized Frequency (FEMA National Risk Index)

Location	Events on Record *(1946– 2014)*	Annualized Frequency
Kittitas County	13	0.2 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.10.5. Past Events

NCEI has reported five (5) ice storm events, 88 heavy snowfall events, one (1) blizzards events, eight (8) winter storm events, and six (6) winter weather events between 1950 and 2023. There have not been any notable winter weather events in Kittitas County.

Table 4-156 lists the ice storm events that have been recorded in Kittitas County between 1950 and 2023.

Table 4-156. Ice Storm Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/28/2017	15:30	Ice Storm	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/17/2017	15:00	Ice Storm	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/4/2014	15:00	Ice Storm	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/17/2005	03:00	Ice Storm	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/8/2004	22:00	Ice Storm	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

Table 4-157 lists the heavy snowfall events that have been recorded in Kittitas County between 1950 and 2023.

Table 4-157. Heavy Snow Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
UPPER SLOPES OF THE EST WASHINGTON CASCADE CREST	Upper Slopes of the Est Washington Cascade Crest	WA	12/1/2023	00:00	Heavy Snow	0	0	0.00K	0.00K
UPPER SLOPES OF THE EST WASHINGTON CASCADE CREST	Upper Slopes of the Est Washington Cascade Crest	WA	4/1/2023	00:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/16/2022	22:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/9/2022	16:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/29/2022	13:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	4/11/2022	23:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	4/10/2022	22:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	4/3/2022	13:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/5/2022	13:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/2/2022	16:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/22/2021	04:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/25/2021	01:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/30/2020	06:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/16/2020	20:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/10/2020	04:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/23/2019	21:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/14/2019	08:00	Heavy Snow	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/10/2019	13:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/8/2019	23:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/4/2019	09:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/22/2018	20:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/17/2018	20:30	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/25/2018	17:30	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/23/2018	07:20	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/10/2018	10:45	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/28/2017	13:40	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	3/6/2017	21:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/8/2017	06:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/5/2017	05:10	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/2/2017	05:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/7/2017	13:08	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/26/2016	18:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/8/2016	11:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/21/2015	13:44	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/17/2015	13:45	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/4/2015	01:00	Heavy Snow	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/13/2014	04:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/16/2014	22:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/8/2014	20:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	4/14/2013	05:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/7/2013	09:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/25/2012	17:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/7/2012	08:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/12/2012	01:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	3/20/2012	07:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/28/2012	16:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/16/2012	16:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/17/2011	09:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/27/2011	19:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/11/2011	19:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/8/2011	21:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/11/2010	10:00	Heavy Snow	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/30/2010	01:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	11/21/2010	15:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/31/2009	10:20	Heavy Snow	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/14/2009	18:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/20/2008	17:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/17/2008	05:30	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/8/2008	02:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/1/2007	16:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/25/2006	23:20	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/23/2006	02:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	11/26/2006	05:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/1/2005	04:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/15/2005	13:50	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/7/2005	09:33	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/29/2004	00:53	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/25/2004	12:53	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/6/2004	05:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/1/2004	04:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/13/2003	03:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/1/2003	14:10	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	3/7/2003	00:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/22/2003	05:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/26/2002	21:45	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	11/28/2001	00:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/23/2000	08:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	11/29/2000	04:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/15/2000	22:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/22/1999	10:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/27/1998	07:00	Heavy Snow	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	12/5/1998	13:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/1/1998	00:00	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/30/1996	06:30	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/29/1996	16:30	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/28/1996	09:45	Heavy Snow	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/27/1996	15:00	Heavy Snow	0	1	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	11/19/1996	00:00	Heavy Snow	0	0	0.00K	0.00K
					TOTAL	**0**	**1**	**0.00K**	**0.00K**

Table 4-158 lists the blizzard events that have been recorded in Kittitas County between 1950 and 2023.

Table 4-158. Blizzard Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	2/9/2019	07:00	Blizzard	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

Table 4-159 lists the winter storm events that have been recorded in Kittitas County between 1950 and 2023. NCEI classifies a winter storm event that has more than one (1) significant hazard (i.e., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet and ice) and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one (1) of the precipitation elements.

Table 4-159. Winter Storm Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/22/2022	00:00	Winter Storm	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/12/2020	20:00	Winter Storm	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/18/2019	16:00	Winter Storm	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	2/8/2017	04:00	Winter Storm	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	12/19/2012	11:30	Winter Storm	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/16/2012	21:00	Winter Storm	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/14/2006	12:30	Winter Storm	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	12/25/1998	06:00	Winter Storm	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

Table 4-160 lists the winter weather events that have been recorded in Kittitas County between 1950 and 2023. NCEI classifies a winter weather event as a winter precipitation event that causes a death, injury, or a significant impact to commerce or transportation, but does not meet locally/regionally defined warning criteria. A winter weather event could result from one (1) or more winter precipitation types (i.e.,

snow, or blowing/drifting snow, or freezing rain/drizzle). The criteria can also be used to document out-of-season and other unusual or rare occurrences of snow, or blowing/drifting snow, or freezing rain/drizzle.

Table 4-160. Winter Weather Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	9/29/2019	15:00	Winter Weather	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/4/2019	04:00	Winter Weather	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	1/3/2019	06:00	Winter Weather	0	0	0.00K	0.00K
EAST SLOPES OF THE WASHINGTON CASCADES	East Slopes of the Washington Cascades	WA	11/23/2018	17:42	Winter Weather	0	0	0.00K	0.00K
KITTITAS VALLEY (ZONE)	Kittitas Valley (Zone)	WA	1/1/2005	20:44	Winter Weather	0	0	0.00K	0.00K
E KITTITAS (ZONE)	E Kittitas (Zone)	WA	1/28/2004	07:00	Winter Weather	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**0.00K**	**0.00K**

4.6.10.6. Vulnerability and Impacts

Life Safety and Health: Winter weather poses a significant threat to health and life safety, and the entire population in Kittitas County is vulnerable to winter weather events. A large number of deaths that occur due to winter weather is not directly related to the weather itself. For example, people die in traffic accidents due to ice on the roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to cold. Injuries related to ice and snow occur in automobiles (70%), people that are caught out in the storm (25%), and the majority are males over 40 years old.[266] Additionally, winter weather can create slippery and icy conditions increasing the risk of slips, falls, resulting in fractures and head trauma. Hazardous driving conditions caused by snowfall and icy roads increase the risk of vehicle accidents, which can lead to injuries and fatalities. Heavy ice and snow accumulation can weigh down trees, and communication and power lines which can result in extensive power outages. Subsequently, power outages lead to a loss of heat in residences and places of business.[267] If heat is not available for an extended period of time during a winter weather event, individuals can expose themselves to extremely cold temperatures even when indoors.

Hypothermia and frostbite are both dangerous conditions that can happen when a person is exposed to extremely cold temperatures. Hypothermia is when the body begins to lose heat faster than it is produced which leads to lower body temperatures. Those at a higher risk for hypothermia include, but are not limited to, older adults with inadequate food, clothing, or heating, babies sleeping in cold bedrooms, and

[266] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Winter Weather Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/winter/.
[267] National Weather Service. (n.d.). Ice Storms. Retrieved from https://www.weather.gov/safety/winter-ice-frost.

people who remain outdoors for extended periods of time (e.g., houseless individuals, hikers). Frostbite is a type of injury caused by freezing and it can permanently damage the body.[268]

Property Damage and Critical Facilities: Winter weather can severely impact critical infrastructure and property by damaging and destroying buildings and equipment. These damages include frozen electrical equipment, cracked water pipes, dangerous/damaged roads, damaged bridges, and damaged aircraft systems.[269] During winter weather events, electrical infrastructure may fail due to damaged or destroyed power lines and poles. If a structure is not in adequate condition, ice and snow accumulation can cause significant roof and building damage which can result in collapse. Furthermore, snow and ice can weigh down trees which can fall and damage communication and power lines, and other infrastructure. This can cause power outages and leave people without electricity and heat for an extended period of time. Severe winter weather in higher elevations can significantly impact the transportation system and the availability of public safety services. Of particular concern are roads providing access to isolated areas and the elderly. Winter weather comes with extreme cold temperatures that can stress the current infrastructure due to increased electrical loads. This may lead to an unstable grid potentially resulting in power loss, and severe impacts to critical infrastructure and property by damaging and destroying buildings and equipment.

Between 2000 and 2023, snow, ice, and freezing rain accounted for 23% of the weather related power outages in the United States. Weather related power outages have doubled in the last 10 years in the United States.[270]

Economy: Over the past 40 years, winter weather and storms have incurred more than $120 Billion in damages ranging from infrastructure damage (e.g., frozen electrical equipment) to building damage (e.g., roof collapse).[271] Severe winter weather has a direct, negative impact on the local economy in the area. In addition to direct damage, economic impacts may include reduced tourism, and delayed deliveries for local businesses due to road conditions. Additionally, transportation routes would likely be impaired during and immediately after a severe weather event due to ice and snow. Prolonged obstruction of critical routes due to snow and ice can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for Kittitas County and the entire region.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to winter weather. Future development may minimally increase (4% or less) the impact of winter weather within Kittitas County.

Underserved and At Risk Population: The underserved and at risk population within Kittitas County that are uniquely vulnerable to the impacts of severe winter weather and could suffer more secondary effects of the hazards. These groups include, but are not limited to, the elderly, low income individuals, people with limited English proficiency, those with life-threatening illnesses, and residents living in areas that are isolated from major roads. The population that lives in isolated areas is a significant concern areas because if roads become inaccessible, assistance will be delayed and if communication systems

[268] Centers for Disease Control and Prevention. (2019). Prevent Hypothermia & Frostbite. Retrieved from https://www.cdc.gov/disasters/winter/staysafe/hypothermia.html.
[269] Cybersecurity & Infrastructure Security Agency. (n.d.). Extreme Cold. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/extreme-cold.
[270] Climate Central. (2024). Weather-related Power Outages Rising. Retrieved from https://www.climatecentral.org/climate-matters/weather-related-power-outages-rising.
[271] Ibid.

are disrupted, this population will be unable to call for assistance if needed. Additionally, power outages can be life threatening to those dependent on electricity for life support.

Effects of Climate Change in Severity of Impacts: Future projections indicate that there will be an overall decrease in snow depth and snow cover duration at lower elevations, but the probability of occurrence of significant snow precipitation events is expected to remain the same.[272] According to Climate Central, the average winter temperatures in the Pacific Northwest have increased approximately 1° F since 1970.[273]

4.6.10.7. FEMA NRI Expected Annual Loss Estimates

A winter weather NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to winter weather when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-161** outlines the winter weather EAL for Kittitas County.

Table 4-161. Winter Weather Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$27,961	$3,821	$1,059	$32,842	41.3	Relatively Moderate
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

An ice storm NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to ice storms when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-162** outlines the ice storm EAL for Kittitas County.

Table 4-162. Ice Storm Expected Annual Loss (FEMA National Risk Index)

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Kittitas County	$657	$63	n/a	$720	2.5	Very Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.10.8. Winter Weather Risk Index Scores

The winter weather Risk Index score and rating represent a community's relative risk for winter weather when compared to the rest of the United States. **Table 4-163** illustrates the winter weather Risk Index rating and score for Kittitas County.

[272] Intergovernmental Panel on Climate Change. (2019). Special Report on the Ocean and Cryosphere in a Changing Climate: High Mountain Areas (Chapter 2). Retrieved from https://www.ipcc.ch/srocc/chapter/chapter-2/.
[273] Climate Change. (2019). Winter Warming. Retrieved from https://www.climatecentral.org/climate-matters/winter-warming.

Table 4-163. Winter Weather Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Relatively Low	35.7
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The ice storm Risk Index score and rating represent a community's relative risk for ice storm when compared to the rest of the United States. **Table 4-164** illustrates the ice storm Risk Index rating and score for Kittitas County.

Table 4-164. Ice Storm Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Kittitas County	Very Low	2.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-165 represents the Winter Weather Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-165. Winter Weather Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Winter Weather	3	15	16	24	55	77

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.11. Other Hazards of Concern

4.6.11.1. Communicable Diseases/Pandemic

Description

Every community has the potential to face numerous diseases and public health crises. This analysis will focus mostly on large scale epidemic and pandemic concerns rather than a temporary, isolated outbreak of a pathogen within the planning area. However, this does not suggest that other public health concerns are not a priority or a concern to Kittitas County.

The World Health Organization (WHO) defines pandemics, epidemics, and endemic diseases based on the disease's rate of spread. An epidemic is an unexpected increase in the number of disease cases in a specific geographical area and it does not have to be contagious (e.g., yellow fever, smallpox, measles, and polio). Additionally, epidemics can refer to a disease or other specific health-related behavior (e.g., smoking) where rates are above the expected occurrence in a community or region. A pandemic is declared when a disease growth rate is exponential; in other words, when the number of cases each day grows more than the prior day. During a pandemic, the virus has nothing to do with virology, population immunity, or disease severity, but it means that the virus covers a large area, affecting several countries and populations. The difference between an epidemic and a pandemic is not in the severity of the disease but the degree that it spreads. A disease is considered endemic when it is consistently present, but limited to a particular region (e.g., malaria).[274]

Health agencies closely monitor for diseases with the potential to cause an epidemic and seek to develop immunizations and eliminate vectors. While this strategy has been remarkably successful, there are many diseases of concern. For example, the human immunodeficiency virus infection/acquired immunodeficiency syndrome (HIV/AIDS) pandemic which to this day is not controlled despite more than 25 years of effort since its recognition in 1981.

Hazard Location

There is no geographic location for this hazard, beyond that outbreaks typically begin in areas with high populations. In contrast to seasonal influenza when it occurs during the late fall and early winter months, pandemic influenza can occur during any month or season. Nonetheless, at any given location, communicable diseases can be spread from person to person, from an animal to a person, or from a contaminated surface or food.

Hazard Extent/Intensity

The extent of a pandemic is highly variable. A disease able to spread worldwide (or at least across several countries) would infect a large number of people. Even if the affected individuals are not in mortal danger, they may be extremely ill and require a higher level of care, or, at the very least, need to quarantine at home to recover. A worst case scenario would involve a highly infectious pathogen (e.g., SARS-CoV-2) with a high mortality rate. Since some pathogens have an asymptomatic period, mitigation efforts may be difficult when infected individuals are not showing symptoms while spreading the disease. Kittitas County transportation services could most likely be impacted by government mitigation efforts during the outbreak of a pandemic.

[274] Columbia University Mailman School of Public Health. (2021). Epidemic, Endemic, Pandemic: What are the Differences? Retrieved from https://www.publichealth.columbia.edu/news/epidemic-endemic-pandemic-what-are-differences.

Probability and Frequency

The probability of occurrence for communicable diseases/pandemics in Kittitas County is medium because significant occurrences of this hazard have occasionally impacted the County and will likely occur again within 25 years. As per a recent study by the Duke Global Health Institute, a pandemic with an impact similar to the Coronavirus Disease 2019 (COVID-19) has about a 2% chance to occur every year. Therefore, there is a 25% chance that a similar pandemic will happen during the next decade, and 50% chance within the next 20 years.[275]

Past Events

The most notable communicable disease event in the State of Washington was COVID-19, marking the first confirmed case in the United States. On January 20, 2020, a 35 year old man who had recently returned from Wuhan, China, was diagnosed with COVID-19 in Snohomish County, Washington. The State experienced significant early impacts from the Pandemic. The first reported COVID-19 death in the United States occurred in a nursing home in Kirkland, Washington. As a result, the Governor declared a State of Emergency on February 29, 2020. Subsequently, public health measures were implemented – closure of schools, businesses, and the implementation of stay at home orders to curb the spread of the virus. Within weeks, the disease will rapidly spread in many parts of the country and worldwide. On March 11, 2020, the WHO declared COVID-19 a pandemic.[276]

Table 4-166 outlines notable pandemics that have occurred worldwide.

Table 4-166. Communicable Disease/Pandemic Events

Event	Summary
Smallpox (Eradicated in 1979)	The origin of smallpox is unknown; however, experts suggest that it has existed for at least 3,000 years. Estimated to be responsible for 300-500 million deaths during the 20th century, smallpox is one (1) of only two (2) human infectious diseases to be completely eradicated.[277] Before its eradication, up to 50 million were infected with smallpox annually.
Black Death (14th – 18th Centuries)	Estimated to have killed at least a third of Europe's population, the plague is estimated to have caused more that 25 million deaths in Europeans.[278] Between the first plague (1348) and the 18th century, more than 100 plague epidemics ravaged Europe.
Cholera Pandemics (1817 – 1970)	In 150 years, seven (7) cholera pandemics swept through various parts of the world resulting in millions of deaths.[279] In the second outbreak, the disease traveled around the Northern Hemisphere in the span of a single year.

[275] Penn, M. (2021). Statistics Say Large Pandemics Are More Likely Than We Thought. Retrieved from https://globalhealth.duke.edu/news/statistics-say-large-pandemics-are-more-likely-we-thought.
[276] Stein, A. J. (2020). First confirmed case of COVID-19 in the United States is diagnosed in Snohomish County on January 20, 2020. Retrieved from https://www.historylink.org/File/21018.
[277] Berche P. (2022). Life and Death of Smallpox. Retrieved from https://www.sciencedirect.com/science/article/pii/S0755498222000100?via%3Dihub.
[278] Glatter, K. A. and Finkelman, P. (2020). History of the Plague: An Ancient Pandemic for the Age of COVID-19. Retrieved from https://www.amjmed.com/article/S0002-9343(20)30792-0/fulltext.
[279] Hu, D., Liu, B., and Feng, L. (2016). Origins of the Current Seventh Cholera Pandemic. Retrieved from https://www.pnas.org/doi/10.1073/pnas.1608732113.

Event	Summary
The Flu Pandemic (1889 – 1890)	Also known as the "Russian Flu", is considered the first pandemic of the industrial era. It started in Turkestan and hit the Russian Empire before spreading worldwide. The disease was highly contagious with attack rates averaging 60% in urban populations, and its rapid spread in successive waves worldwide in a few months by rail and sea. Additionally, the disease tended to relapse. Despite its mortality rate being low (0.10% to 0.28%) it is estimated that one (1) million people died. It was identified that the agent responsible was *Myxovirus influenzae* which is the virus identified for all influenza pandemics since the "Spanish Flu" of 1918.[280]
1918 Flu Pandemic (1918 – 1920)	Also known as the "Spanish Flu", was the most severe pandemic in recent history. There is no consensus of where it originated, but it spread worldwide between 1918 and 1919. It was first identified in the United States in military personnel during the Spring of 1918. The disease was caused by an H1N1 virus with genes of avian origin. A unique feature of this Pandemic was the high mortality rate in healthy people, including individuals between 20 and 40 years old. It is estimated that 500 million people (one-third of the world's population) were infected with the virus and the number of deaths was estimated to be approximately 50 million worldwide; 675,000 occurring in the United States.[281]
HIV/AIDS (1981 – Present)	Although the virus likely entered the United States in the 1960s, the human immunodeficiency virus infection/acquired immunodeficiency syndrome (HIV/AIDS) rose to prominence in the early 1980s. HIV is the world's leading infectious killer and has claimed over 40 million lives as of 2023.[282] The pandemic has infection rates as high as 25% in the hardest hit countries, with 95% of new infections coming from low and middle-income countries, particularly in Sub-Saharan Africa. Although there is still no cure, antiretroviral drugs have been able to improve the quality of life for those with HIV infections, and AIDS-related deaths have been reduced by 69% since the peak in 2004.[283]
Avian Influenza (1996)	The Avian Type A viruses (bird flu viruses) do not typically infect humans, but it has occurred. The first H5N1 bird flu virus was detected in 1996 in domestic waterfowl in Southern China. In 1997, an H5N1 poultry outbreak occurred in China and Hong Kong with 18 associated human cases, including six (6) deaths. The virus caused 860 human infections with a mortality rate of 50%. Between 2003 – 2005, the virus re-emerges in China and several countries, including widespread poultry outbreaks across Asia. Wild birds spread the virus to poultry in Africa, the Middle East, and Europe in 2005. The virus continued to spread around the world and as it spreads it continued to mutate (i.e., H5N6 and H5N8).[284] The first case of the H5N1 virus in a person in the United States was reported on April 28, 2022.
Severe Acute Respiratory Syndrome Outbreak (2002 – 2004)	Severe Acute Respiratory Syndrome (SARS) is a viral respiratory illness caused by a coronavirus, SARS-associated coronavirus (SARS-CoV). The first SARS case was reported in Asia in February 2003. Over the next months, the illness began to spread to more than two (2) dozen countries in North America, South America, Europe, and Asia before the outbreak was contained. A total 8,098 people worldwide contracted the virus and 774 died. In the United States, only eight (8) tested positive for SARS-CoV and all cases were travel related. There have been no cases of SARS reported anywhere in the world since 2004.[285]

[280] Berche, P. (2022). The Enigma of the 1889 Russian flu Pandemic: A Coronavirus? Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8813723/.
[281] Centers for Disease Control and Prevention. (2018). History of 1918 Flu Pandemic. Retrieved from https://www.cdc.gov/flu/pandemic-resources/1918-commemoration/1918-pandemic-history.htm.
[282] Joint United Nations Programme on HIV/AIDS. (n.d.). Global HIV & AIDS statistics – Fact Sheet. Retrieved from https://www.unaids.org/en/resources/fact-sheet
[283] Ibid.
[284] Centers for Disease Control and Prevention. (2023). Emergence and Evolution of H5N1 Bird Flu. Retrieved from https://www.cdc.gov/flu/avianflu/communication-resources/bird-flu-origin-infographic.html.
[285] Centers for Disease Control and Prevention. (2017). SARS Basics Fact Sheet. Retrieved from https://www.cdc.gov/sars/about/fs-sars.html.

Event	Summary
H1N1 Pandemic (2009 – 2010)	In April 2009, a novel influenza A virus emerged causing the first global flu pandemic in 40 years. The first infection was detected on April 15, 2009, in California. Two (2) days later, another case was detected 130 miles from the first case, with no known connection to the previous patient. Cases continued to rise globally and on June 11, 2009, the WHO declared a pandemic. The first H1N1 vaccines were given in the United States on October 5, 2009. In late October, Influenza cases reached their highest level in reporting with 48 states reporting widespread activity. From April 12, 2009, to April 10, 2010, the CDC estimated approximately 60.8 million cases and 12,469 deaths in the United States. The WHO announced the end of the pandemic on August 11, 2010.[286] However, H1N1 virus continues to circulate as a seasonal flu virus, causing illness, hospitalizations, and deaths worldwide every year.
COVID-19 Pandemic (2019 – 2023)	The Coronavirus Disease 2019 (COVID-19) is a disease caused by infection with a coronavirus called SARS-CoV-2. On December 12, 2019, a cluster of patients in China's Hubei Province, in the city of Wuhan, began experiencing symptoms of an atypical pneumonia-like illness that was not responding to standard treatments. Cases continue to rise across Wuhan and all initial cases are connected to the Huanan Seafood Wholesale Market. The first case in the United States was confirmed on January 20, 2020, in the State of Washington. On March 11, 2020, after more than 118,000 cases in 114 countries and 4,291 deaths, the WHO declares COVID-19 a pandemic.[287] COVID-19 continued to quickly spread worldwide forcing countries to go under lockdown and impacted the availability of personal protective equipment (PPE) for medical personnel and the general public. The first COVID-19 vaccine was approved by the Food and Drug Administration (FDA) on December 18, 2020. Viruses are constantly changing. In 2021 and throughout 2022, the pandemic was ongoing as the virus continued to mutate creating new strains affecting changes in how fast the virus spreads, the severity of the illness, and effectiveness of treatments against is. On May 11, 2023, the Federal Public Health Emergency ended. On August 2, 2023, there have been 768,983,095 confirmed cases of COVID-19 (103,436,829 in the United States) and 11,740,993 deaths (1,127,152 in the United States) worldwide.[288] The COVID-19 pandemic required many communities to address the need for extensive situational awareness and coordinated planning; increased coordination across all disciplines (i.e., philanthropic, business and schools) at an unprecedented scale; public information and warning; reopening strategies; public health orders; resource support; addressing essential staff limitations/shortages across key health and medical sectors during various phases of the pandemic; limited public health laboratory testing early in the pandemic; contact tracing and investigation; fatality management; medical countermeasure dispensing and administration, specifically vaccine planning and distribution; medical surge; ongoing resupply of PPE; and community and economic recovery.

Vulnerability and Impacts

Life Safety and Health: Communicable diseases/pandemics have a significant impact on life safety and health. These emergencies often result in increased morbidity and mortality rates, posing a threat to the well-being of individuals and communities. Communicable diseases can spread rapidly causing widespread illness and potentially overwhelming healthcare systems. Public health emergencies may also disrupt routine healthcare services, delay access to necessary treatments, and hinder the

[286] Centers for Disease Control and Prevention. (2019). 2009 H1N1 Pandemic Timeline. Retrieved from https://www.cdc.gov/flu/pandemic-resources/2009-pandemic-timeline.html.
[287] Centers for Disease Control and Prevention. (n.d.). CDC Museum COVID-19 Timeline. Retrieved from https://www.cdc.gov/museum/timeline/covid19.html.
[288] World Health Organization. (n.d.). WHO Coronavirus (COVID-19) Dashboard. Retrieved from https://covid19.who.int/.

management of chronic conditions. Additionally, these emergencies can result in psychological distress, fear, and social disruption within affected populations.

Property Damage and Critical Facilities: Communicable diseases and pandemics do not directly impact property damage or critical facilities. However, during a pandemic, critical infrastructure may face unprecedented strain and reduced staff due to infection which may contribute to potential failures.[289] For example, healthcare facilities may experience increased demands and strains on resources, which can affect their capacity to provide adequate care. Additionally, transportation systems (e.g., airports and roadways) may face disruptions, impacting the movement of supplies, personnel, and patients. Communicable diseases/pandemics can also affect the functioning of utilities (e.g., water and wastewater systems, power grids, and communication networks).

Economy: Communicable diseases/pandemics can often lead to disruptions in various sectors of the economy – as seen most recently during the COVID-19 Pandemic. For instance, lockdowns, travel restrictions, and social distancing guidelines can result in business closures, reduced consumer spending, and job losses. Industries directly impacted by public health emergencies (e.g., hospitality, tourism, retail) may experience a decline in revenue and profitability. Additionally, healthcare systems and public health agencies may face increased financial burdens due to the surge in service demand and the need to invest in emergency response capabilities.

Changes in Development and Impact of Future Development: Changes in development have minimally increased (4% or less) the vulnerability of Kittitas County to communicable diseases/pandemics. Future development may minimally increase (4% or less) the impact of communicable diseases/pandemics within Kittitas County.

Underserved and At Risk Population: Underserved and at risk populations face significant vulnerabilities and impacts during a communicable disease/pandemic event. These populations include, but are not limited to, low income individuals, racial and ethnic minorities, the elderly, people with disabilities, those with preexisting health conditions. These groups may have limited access to healthcare facilities and tend to have a higher rate of uninsured or underinsured which can result in higher mortality rates due to delayed treatment. Additionally, individuals with limited English proficiency may have limited access to public health information.[290] Another at risk population during a communicable disease/pandemic event is the frontline workers (e.g., healthcare workers, grocery store and public transportation employees) because these jobs cannot be performed remotely which increases their exposure and risk.

Effects of Climate Change in Severity of Impacts: Climate Change has indirect impacts on communicable diseases and pandemics. As global average temperatures continue to increase, the reproduction rate, resilience, and distribution of vector-borne diseases (e.g., malaria, West Nile, Zika, Chikungunya) are likely to increase.

[289] John Hopkins Center for Health Security. (n.d.). Protecting Critical Infrastructure from the Next Pandemic. Retrieved from https://centerforhealthsecurity.org/our-work/research-projects/protecting-critical-infrastructure-from-the-next-pandemic.
[290] United States Centers for Disease Control and Prevention. (2022). What is Health Equity? Retrieved from https://www.cdc.gov/healthequity/whatis/index.html.

Communicable Diseases/Pandemic Total Risk Score

Table 4-167 represents the Communicable Disease/Pandemic Total Risk Score for the Kittitas County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-167. Communicable Disease/Pandemic Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Communicable Disease/ Pandemic	2	18	10	20	48	48

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 52
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	53 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

CHAPTER 5. MITIGATION STRATEGY

The heart of a Hazard Mitigation Plan is the Mitigation Strategy, which serves as the long-term blueprint for reducing the potential losses identified in the Hazard Risk Assessment. The Mitigation Strategy describes how the community will accomplish the overall purpose of the planning process. In this section, mitigation goals and objectives were reevaluated and updated; and mitigation actions were updated, identified, evaluated, and prioritized.

5.1. MITIGATION GOALS

In this section of the Plan, the Hazard Risk Assessment identified Kittitas County is prone to 11 hazards (**Table 4-1**) – 10 natural and one (1) human-caused/technological. The Steering Committee and community stakeholders understand that although hazards cannot be eliminated altogether, the many communities within Kittitas County can work together toward building disaster-resilient communities. **Table 5-1** outlines a list of five (5) goals and 13 objectives. The goals represent the County's long term and strategic vision to accomplish and achieve successful mitigation efforts. The associated objectives, which are aligned to each goal, are specific strategies and steps identified to assist the communities in attaining the listed goals.

Table 5-1. Kittitas County Mitigation Goals and Objectives

Goal 1	
Protect life, property, and the environment.	
Objectives	
1.A	Reduce natural hazard-related risks and vulnerability to populations, critical facilities, and infrastructure within the planning area.
1.B	Establish a partnership among all levels of government and the business community to improve and implement methods to protect property.
1.C	Encourage hazard mitigation measures that result in the least adverse effect on the natural environment and that use natural processes.
1.D	Identify and implement inclusive actions that reduce vulnerability for Kittitas County residents and visitors.
Goal 2	
Continuously build and support local capacity to enable the public to mitigate, prepare for, respond to, and recover from the impact of hazards and disasters.	
Objectives	
2.A	Minimize the impacts of natural hazards on current and future land uses by encouraging use of incentives for hazard mitigation (i.e., National Flood Insurance Program, Community Rating System).
2.B	Prevent or discourage new development in hazardous areas or ensure that if building occurs in high-risk areas it is done in such a way as to minimize risk.

Goal 3	
Establish a hazard and disaster resilient economy.	
Objectives	
3.A	Update the Plan annually to integrate local hazard mitigation and the results of disaster and hazard specific planning efforts.
3.B	Use the best available data, science, and technologies to improve understanding of the location and potential impacts of natural hazards, the vulnerability of building types, and community development patterns and the measures needed to protect life safety.
3.C	Review new and existing policies to determine where climate change resiliency strategies can be included.
Goal 4	
Promote public awareness, engage public participation, and enhance partnerships through education and outreach.	
Objectives	
4.A	Educate the public on the risk exposure to natural hazards and ways to increase the public's capability to prepare, respond, recover, and mitigate the impacts of these events.
4.B	Encourage home and business owners to obtain and maintain flood insurance through the NFIP or other insurance providers.
Goal 5	
Encourage the development and implementation of long-term, cost-effective mitigation projects.	
Objectives	
5.A	Integrate hazard mitigation policies into land use plans within the planning area.
5.B	Retrofit, purchase, or relocate structures in high hazard areas including those known to be repetitively damaged.

5.2. REVIEW OF POSSIBLE MITIGATION ACTIVITIES

Plan participants assessed a range of potential mitigation activities identified in the 2017 Community CRS Coordinator's Manual for floodplain management planning – prevention, property protection, natural resource protection, emergency services, structural projects, and public information. This CRS planning step is intended to provide a systematic review of planning activities to "ensure that all possible measures are explored, not just the traditional approaches of flood control, acquisition, and regulation of land use" are considered. While the CRS Coordinator's Manual is specific to flood hazard planning, the mitigation activities it identifies have a broader potential application in the mitigation actions outlined in this Plan. The review of possible mitigation activities was informed by other FEMA guidance documents, the 2019 Kittitas County Hazard Mitigation Plan, and suggestions from participating communities and their respective stakeholders during a series of workshops and public meetings held throughout the County in February 2024.

5.2.1. Prevention

Preventive measures help mitigate natural hazard related risks and prevent existing vulnerabilities from escalating. Risk associated with the use and development of high hazard areas can be addressed through planning, land acquisition, or regulation. These are usually administered by building, zoning, planning, and/or code enforcement offices. Examples include:

- Floodplain Mapping and Data
- Wildfire Severity Mapping and Data
- Wildland Urban Interface Code
- Open Space Preservation
- Floodplain Regulations
- Critical Area Regulations
- Erosion Setbacks
- Planning and Zoning
- Stormwater Management
- Drainage System Maintenance
- Building Code
- Shaded Firebreaks

Steering Committee Discussion: Prevention is a mitigation strategy incorporated in this planning document and considered for specific mitigation measures, as applicable. This Hazard Mitigation Plan identifies several regulations that address development risk in high hazard areas.

- Section 3.9.1 of this Plan identifies pertinent planning and regulatory mechanisms, and **Table 3-18** identifies legal and regulatory capabilities at the local level.
- Section 3.11 of this Plan identifies that all five (5) incorporated municipalities and Unincorporated Kittitas County participate in the NFIP and outlines details about NFIP participation activities. The NFIP, along with Critical Area Regulations provide the regulatory context for flood risk to be considered during land use decisions and set heightened building standards for areas identified as SFHA.

These regulatory tools are most effective when flood risk is well documented in the FIRMs and flood risk throughout Unincorporated Kittitas County is often not well documented in FIRMs. In many areas, flood risk was identified decades ago, utilizing approximate methods. Additionally, these flood risk maps do not effectively represent changes in risk over time (e.g., either channel migration, alluvial fan migration).

Furthermore, the Flood Control Zone District has conducted and utilized reach scale river flood assessments to inform acquisition priorities given channel migration and flood risk. Current land use planning efforts are examining critical areas and SFHA information to inform buildable land inventories.

Among the six (6) highest ranking hazards, the Steering Committee identified prevention activities, as appropriate, for the following hazards – wildfire, earthquake, and flood (**Table 5-2**).

5.2.2. Property Protection

Property protection activities are usually undertaken by property owners on a building by building or parcel basis. Examples include:

- Relocation
- Acquisition
- Building Elevation
- Retrofitting (e.g., flood, earthquakes, wildfire)
- Property Management
- Firewise Landscaping
- Sewer Backup Protection
- Insurance

Steering Committee Discussion: Relocation and retrofit of at-risk public infrastructure, strategic land acquisitions, the development of repetitive flood loss area plans, and education to inform landowners about retrofit and insurance options are actions plan participants can take. As described in Section 3.11

of this Plan, the County, through the Flood Control Zone District, educates private owners about flood insurance, building elevation, and building retrofit options for property at flood risk. The Kittitas County Conservation District offers free home risk assessments to help landowners incorporate Firewise planning into existing and developing homesites and communities. The Kittitas Fire Adapted Communities Coalition, which many of the annexes have joined, works across property ownerships to accelerate the pace and scale of restoration and for wildfire mitigation. The City of Ellensburg has identified the need to conduct a seismic retrofit of critical facilities. CWU identified specific vulnerabilities and impacts associated with seismically vulnerable buildings (Section 9 of the CWU Annex). Among the six (6) highest ranking hazards, the Steering Committee identified property protection activities, as appropriate, for the following hazards – wildfire, winter weather, earthquake, flood, and strong winds/damaging winds (**Table 5-2**).

5.2.3. Natural Resource Protection

Natural resource protection activities preserve or restore natural areas and their natural functions. For flood risks these include floodplain and watershed areas; however, vegetation cover, type, and health can also provide protection against other hazards such as wildfire and landslides. Examples include:

- Wetland Protection
- Erosion and Sediment Control
- Natural Area Restoration
- Water Quality Improvement
- Forest Health Treatments
- Environmental Corridors
- Natural Functions Protection
- Forest fire resiliency treatments

Steering Committee Discussion: Of the 25,227 acres (within Unincorporated Kittitas County) mapped within the SFHA, approximately 20% of this land is designated and managed for open space uses or is owned by state or local governmental entities. The Flood Control Zone District has conducted and utilized reach-scale river flood assessments to inform acquisition priorities given channel migration and flood risk. Management of Flood Control Zone District properties also prioritizes natural resource protection. Additionally, Critical Area and Shoreline regulations focus on the protection of wetland function, riparian health, natural riverine processes, and fish and wildlife habitat. Forest health, including factors such as drought stress, bark beetle susceptibility, and maintaining forest stand structure and composition consistent with a natural fire disturbance regime can make forests less susceptible to large-scale catastrophic fires. Forest fire resiliency treatments such as prescribed burns and mechanical thinning are important tools for preserving natural resource protection. Among the six (6) highest ranking hazards, the Steering Committee identified natural resource protection activities, as appropriate, for the following hazards – wildfire and flood (**Table 5-2**).

5.2.4. Emergency Services

Emergency services measures are taken during an emergency to minimize the impacts of the hazard. These measures are usually the responsibility of city and/or county emergency management staff, emergency response providers, and the owners or operators of major critical facilities. Examples include:

- Hazard Threat Recognition
- Hazard Warning
- Hazard Response Operations
- Health and Safety Maintenance
- Post-Disaster Mitigation Actions
- Evacuation Planning and Management

- Critical Facility Protection
- Sand Bagging for Flood Protection

Steering Committee Discussion: The Kittitas County Sheriff's Office is the lead for emergency services planning and is responsible for the maintenance of the Comprehensive Emergency Management Plan (CEMP). The CEMP is a planning effort that provides a system of emergency management programs, plans, and procedures that provide for the response and recovery of natural, human-caused, and technological disasters. The Threat and Hazard Identification and Risk Assessment (THIRA), which is developed and maintained by the State of Washington with support from the counties, helps communities identify the threats and hazards (i.e., hazard threat recognition) that can affect a community. The CEMP considers the hazards identified and described in the THIRA to develop guidance for a systematic and coordinated effort for hazard warning, hazard response operations, critical facility protection, health and safety maintenance, and evacuation planning and management. The County Emergency Preparedness Assessment (CEPA) is a standardized, repeatable process used to collect county specific data regarding overall preparedness and capabilities. It consists of an in-person meeting involving local emergency management stakeholders and subject matter experts to discuss county capabilities, concerns strengths, gaps, and among other topics.

Additionally, the Flood Control Zone District and City of Ellensburg coordinate and provide sand bagging for flood protection when conditions warrant. Evacuation planning and management are particularly important for wildfire and flood hazards. The Steering Committee identified emergency services activities, as appropriate, for all of the six (6) highest ranking natural hazards (**Table 5-2**).

5.2.5. Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the hazard itself through construction. These are usually designed by engineers and managed or maintained by Public Works staff. Examples include:

- Reservoirs
- Levees/Floodwalls
- Diversions
- Fire Hydrants/Fire Flow
- Channel Modifications
- Storm Drain/Stormwater Improvements
- Shaded Firebreaks

Steering Committee Discussion: Structural protection is utilized for floods, droughts, and fire hazards. Several flood control levees and stormwater management systems are needed in urbanized areas. To be most effective, levees/floodwalls and channel modification projects should account for natural riverine processes to better assess long term maintenance, structure feasibility, and potential environmental impacts. There are many water supply reservoirs and irrigation diversions and canals within Kittitas County. Although these facilities are able to provide incidental flood control benefits, these structures were not developed and are not operated for flood control and should not be relied upon for that purpose. Kittitas County has an extensive network of reservoirs, diversion dams, and canals that store and distribute water. Efforts to address drought risks include modernizing the canal systems, constructing additional surface and groundwater storage, and on-farm irrigation projects to more efficiently utilize available water. Structural projects to address wildfire risk include shaded firebreak treatments and the construction of water systems with adequate fire flow and fire hydrants to combat a fire in a given area.

Among the six (6) highest ranking hazards, the committee identified structural projects, as appropriate, for the following hazards – wildfire and flood (**Table 5-2**).

5.2.6. Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, such as floodplains and the wildfire hazard areas. Examples include:

- Map Information
- Outreach Projects
- Real Estate Disclosure
- Library
- Technical Assistance
- Environmental Education

Steering Committee Discussion: The committee identified that public information activities are particularly appropriate for all of the six (6) highest ranking natural hazards (**Table 5-2**). The Flood Control Zone District provides outreach for flood hazard outreach and technical assistance. Furthermore, wildfire hazard education is facilitated through the Fire Adapted Communities coalition. Additionally, burn ban signage and fire risk information on mobile boards educates visitors about wildfire risk.

Table 5-2. Suitability of Mitigation Activities for the Highest Ranked Hazards

Mitigation Activity	Wildfire	Winter Weather	Earthquake	Flood	Strong Winds/ Damaging Winds	Wildfire Smoke
Prevention	X		X	X		
Property Protection	X	X	X	X	X	
Natural Resource Protection	X			X		
Emergency Services	X	X	X	X	X	X
Structural Projects	X			X		
Public Information	X	X	X	X	X	X

5.3. MITIGATION STRATEGIES AND ACTIONS

Plan participants assessed hazard mitigation actions, including actions from FEMA guidance documents, the 2019 Kittitas County Hazard Mitigation Plan, and suggestions from participating communities and their respective stakeholders during a series of workshops and public meetings that took place throughout the County in February 2024. Supporting documentation for stakeholders and public engagement can be found in **Appendix B** and **C**, respectively. A summary of Unincorporated Kittitas County's mitigation actions status is listed in **Table 5-3** and all mitigation actions can be found in **Appendix A**.

Mitigation actions and status for each plan participant can be found in their respective annex.

Table 5-3. Kittitas County Mitigation Actions Summary

Status	Mitigation Action Total
Ongoing	28
In Progress/In Work	2
Not Started	2
Delayed/Deferred	0
New	15
TOTAL	**47**
Completed	0
Deleted/No Longer Needed	2

Mitigation Actions per Natural Hazard			
Avalanche	15	Landslide	16
Dam and Levee Failure	19	Severe Weather *(Extreme Heat, Extreme Cold, Severe Thunderstorm – Hail, Strong Winds, Tornado)*	19
Drought	17	Volcanic Activity	15
Earthquake	19	Wildfire *(Wildfire Smoke)*	20
Flood	30	Winter Weather *(Ice Storm, Heavy Snow, Blizzard)*	15
Other hazards of concern: Communicable Disease/Pandemic (2)			

The mitigation actions in **Volume 1** and each jurisdiction's annex are organized as follows:

- **New Mitigation Actions:** New actions identified during this plan development process.
- **Ongoing Mitigation Actions:** These ongoing actions were included in the previous update and have yet to be completed. These actions have no definitive end. During this Plan update, the ongoing mitigation actions were modified and/or amended, as needed, to better define the action.
- **In Progress/In Work Mitigation Actions:** These actions were included in the previous update and are underway during this Plan update. These actions have not been completed.
- **Completed Mitigation Actions:** Completed actions since the previous plan iteration.
- **Deferred/Delayed Mitigation Actions:** Actions are deferred when risk cannot be validated, or additional time is needed to validate the potential impacts and benefits of the action.
- **Deleted/No Longer Needed Mitigation Actions:** These actions are no longer relevant or applicable because other mitigation actions addressed the mitigating need, or the hazard vulnerability changed resulting in reduced risk.

5.3.1. Mitigation Action Plan

The Mitigation Action Plan helps prioritize mitigation initiatives according to a benefit cost analysis of the proposed actions and their associated cost. Additionally, the Action Plan provides the framework for how

the proposed actions and initiatives will be implemented and administered by Kittitas County and each plan participant over the next five (5) years. The parameters (i.e., estimated cost, benefits, duration, and prioritization) that will be used for the prioritization and benefit cost analysis of each mitigation action are outlined in this section.

5.3.1.1. Mitigation Action Benefit Cost Review

While the preference is to provide definitive costs (i.e., dollar figures) for each mitigation action, this is not realistic for every mitigation action without project scoping or engineering studies. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (i.e., high, medium, and low) to the costs and benefits of these projects. The estimated cost and benefits parameters are defined in **Table 5-4** and **Table 5-5**, respectively.

Table 5-4. Mitigation Action Estimated Cost Parameters

Rating	Parameter
High	Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Table 5-5. Mitigation Action Benefits Parameters

Rating	Parameter
High	Project will provide an immediate reduction of risk exposure for life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

5.3.1.2. Mitigation Action Project Duration

While the preference is to provide definitive project completion dates, this is not realistic for all mitigation actions. Therefore, the parameters for the project duration (i.e., estimated completion date) are listed in **Table 5-6**.

Table 5-6. Mitigation Action Project Duration Parameters

Rating	Parameter
Short Term	To be completed in one (1) to five (5) years.
Long Term	To be completed in more than five (5) years.
Ongoing	Currently being funded and implemented under existing programs, and/or is seeking funding and necessary approvals.

5.3.1.3. Mitigation Action Prioritization

The mitigation actions must be prioritized according to the benefit cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed actions were weighed against multiple factors as part of the project prioritization process. The benefit cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation

Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC) Program. A less formal approach was used because some actions may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time.

Mitigation actions were evaluated by each plan participant with the following STAPLEE+E method. This method utilizes eight (8) criteria for evaluating a mitigation action – Social, Technical, Administrative, Political, Legal, Economic, Environmental, and Equity and within each of those criteria are additional considerations. **Table 5-7** outlines an explanation of how each of the STAPLEE+E criteria may be applied to the evaluation of each mitigation action.

Table 5-7. STAPLEE+E Method

Criteria		Description
S	Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values. • Will the proposed action adversely affect one (1) segment of the population? • Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
T	Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts. • How effective is the action in avoiding or reducing future losses? • Will it create more problems than it solves? • Does it solve the problem or only a symptom? • Does the Mitigation strategy address continued compliance with the National Flood Insurance Program (NFIP)?
A	Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding. • Does the jurisdiction have the capability (e.g., staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? • Can the community provide the necessary maintenance? • Can it be accomplished in a timely manner?
P	Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action. • Is there political support to implement and maintain this action? • Is there a local champion willing to help see the action to completion? • Is there enough public support to ensure the success of the action? • How can the mitigation objectives be accomplished at the lowest cost to the public?

Criteria		Description
L	Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action. • Does the community have the authority to implement the proposed action? • Are the proposed laws, ordinances, and resolutions in place to implement the action? • Are there any potential legal consequences? • Is there any potential community liability? • Is the action likely to be challenged by those who may be negatively affected? • Does the mitigation strategy address continued compliance with the NFIP?
E	Economic	Budget constraints can significantly deter the implementation of mitigation actions. It is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund. • Are there currently sources of funds that can be used to implement the action? • What benefits will the action provide? • Does the cost seem reasonable for the size of the problem and the likely benefits? • What burden will be placed on the tax base or local economy to implement this action? • Does the action contribute to other community economic goals such as capital improvements or economic development? • What proposed actions should be considered but be “tabled” for implementation until outside sources of funding are available?
E	Environmental	Sustainable mitigation actions that do not have adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community’s environmental goals, have mitigation benefits while being environmentally sound. • How will this action affect the environment (i.e., land, water, endangered species)? • Will this action comply with local, state, and federal environmental laws and regulations? • Is this action consistent with community environmental goals?
E	Equity	Does not create an opportunity for unequal distribution of resources; racism; affect a particular segment of the population, including communities of color, communities that face discrimination based on sex, sexual orientation or gender identity, individuals with disabilities, individuals who identify with certain religion, individuals with Limited English Proficiency, or rural communities, etc. • Is the action consistent and systematically fair?

Implementation Priority

Priorities were assessed by requesting that every new mitigation action submitted by the plan participants be ranked by each of the eight (8) criteria factors (i.e., STAPLEE+E). Each criterion is evaluated on a scale from one (1) to five (5), with one (1) defined as strongly disagree and five (5) as strong agree. Therefore, the highest favorable score would be 40, meaning the action scored five (5) in all eight (8) categories. **Table 5-8** delineates how the STAPLEE+E prioritization score was used to prioritize the implementation of each mitigation actions.

Table 5-8. New Mitigation Action Implementation Priority Parameters

Implementation Priority	STAPLEE+E Prioritization Score
High	30 – 40 points
Medium	19 – 29 points
Low	8 – 18 points

Mitigation actions with the highest scores represent those mitigation initiatives that represent the highest priority. In addition to the STAPLEE+E Method, the Steering Committee identified those actions that represented the greatest importance and priority to Kittitas County's plan participants. It should be noted that, although the STAPLEE+E Method provides a standardized process for assigning priority/importance across all participating jurisdictions, there may be additional factors and considerations that elevate the status of a particular mitigation action. This is why input from the Steering Committee is also an important consideration in this process.

5.4. CHANGES IN PRIORITY

A community's mitigation priorities may change over time for a number of reasons. Addressing these changes allows a community to redirect actions that reflect current conditions, including financial and political realities, or changes in conditions or priorities following disaster events. Changes in the priority of a Hazard Mitigation Plan are often dynamic and reflect the evolving understanding of risk, the availability of resources, and the needs of the community. This helps ensure that the Plan remains relevant and effective in reducing vulnerability to the hazards identified in the Plan by the community. Kittitas County has identified the following changes in priorities for the 2025 Hazard Mitigation Plan:

- There were no changes to the previous mitigation goals and objectives. However, three (3) additional objectives included an objective that focuses on identifying and implementing inclusive actions that reduce vulnerability for residents and visitors within Kittitas County, including the underserved population. The new objectives are 1.D, 3.C, and 4.B, listed in **Table 5-1**.
- There are three (3) new plan participants – Kittitas Valley Fire Rescue, Kittitas County Fire District #6, and CWU.
- All mitigation actions from the previous Plan were updated, and a more concerted effort on achieving equitable outcomes for all communities, including underserved communities and socially vulnerable populations, has been implemented.
- Wildfire Smoke was added as a sub-hazard under wildfire because the County acknowledges that a wildfire that is not within Kittitas County can impact the area with wildfire smoke, even when the wildfire is taking place thousands of miles away. Furthermore, the CDC recognizes wildfire smoke as a public health hazard and the Washington State Enhanced Mitigation Plan acknowledges wildfire smoke as a natural hazard (under the wildfire hazard).

- Winter weather hazards were profiled individually. All winter weather hazards were profiled under severe weather in the previous Plan.
- There were some notable changes to the hazard risk ranking.
    - The new methodology includes 14 factors (versus four (4) in the 2019 update) which align with FEMA's risk assessment criteria. *Refer to Section 4.3 for further details on the 2025 risk assessment methodology.*
    - Severe weather hazards were ranked individually and not as a whole category. Thunderstorms, hail, tornado, strong winds/damaging winds, heat wave/extreme heat, and cold wave/extreme cold were ranked individually even though these are grouped under severe weather in the hazard profile.
    - Wildfire and wildfire smoke were ranked individually even though wildfire smoke is grouped under wildfire in the hazard profile.
    - Technological hazards and human-caused hazards were included in the hazard ranking.
    - In the 2025 ranking, wildfire is ranked as a high risk (ranked medium in the previous ranking) and drought is ranked medium (ranked low in the previous ranking).
    - Severe weather was ranked high in the previous Plan; however, winter weather was profiled under severe weather which was the main reason severe weather was ranked high. In the 2025 ranking, winter weather is ranked high.

CHAPTER 6. PLAN MAINTENANCE

The Federal Disaster Mitigation Act of 2000 requires the monitoring, evaluation and updating of the hazard mitigation plan every five (5) years. This Hazard Mitigation Plan is designed to be a "living" document and therefore will be reviewed and updated within five (5) years from its approval date. The Kittitas County Hazard Mitigation Steering Committee will provide leadership and guidance throughout the Plan's life cycle (i.e., monitoring, evaluating, and updating). Updates will allow municipal leaders and the public to provide input into the process. The public will be notified of this opportunity via legal public notices.

The Plan maintenance process includes a schedule for annual monitoring and evaluation of the programmatic outcomes established in the Plan and for producing a formal Plan revision every five (5) years.

6.1. PLAN UPDATE

The Plan may be reviewed on an annual basis by Kittitas County Public Works, and reviewed and revised every five (5) years by the Kittitas County Hazard Mitigation Steering Committee to determine the effectiveness of programs and to reflect changes that may affect mitigation priorities. The Kittitas County Water Resource Program Manager, or designee from Kittitas County Public Works, will be responsible for contacting the Steering Committee members and organizing the review. Members of the Steering Committee will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan. Additionally, the goals and actions will be reviewed by the Steering Committee to determine their relevance to changing situations in the County as well as changes in Federal policy, and to ensure they are addressing current and expected conditions. Furthermore, the Steering Committee will also review the hazard risk assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The organizations responsible for the various action items will report on the status of the projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised or removed.

The Kittitas County Water Resource Program Manager, or designee from Kittitas County Public Works, will be responsible for ensuring Plan updates and will notify all stakeholders and plan participants when changes have been made. Every five (5) years, the Plan will be updated and submitted to the Washington State Emergency Management Division and to FEMA Region 10 for review and approval.

6.1.1. Monitoring, Evaluation

To ensure the Kittitas County Hazard Mitigation Plan continues to provide an appropriate path for risk reduction throughout the County, it is necessary to regularly evaluate and update it. Kittitas County Public Works will be responsible for monitoring the status of the Plan and gathering mitigation action status reports from the appropriate parties. The Steering Committee will convene on an annual basis to determine the progress of the identified mitigation actions and will also be an active participant in the next Plan update. As this Plan matures, new stakeholders and/or plan participants will be identified and encouraged to join the existing Hazard Mitigation Steering Committee, especially those stakeholders and organizations that represent underserved population and groups within the County.

Kittitas County Public Works is responsible for contacting Steering Committee members and organizing the annual meeting. During each annual meeting, the Steering Committee will be responsible for a brief evaluation of the 2025 Hazard Mitigation Plan and to review the progress on mitigation actions. Each annual meeting must be documented, including the plan evaluation and review of mitigation actions.

Mitigation actions have been formatted to facilitate the annual review process. Additional Hazard Mitigation Steering Committee responsibilities include, but are not limited to:

- Annually reviewing each goal and objective to determine its relevance and appropriateness.
- Monitor and evaluate the mitigation strategies in this Plan to ensure the document reflects current hazard analyses, development trends, code changes, and risk analyses and perceptions.
- Ensure the appropriate implementation of annual status reports and regular maintenance of the Plan. The Steering Committee will hear progress reports from the parties responsible for the various implementation actions to monitor progress.
- Create future action plans and mitigation actions. These should be carefully assessed and prioritized utilizing the STAPLEE+E Method outlined in the Mitigation Strategy section of this Plan.
- Ensure the public is invited to comment and involved in mitigation plan updates.
- Ensure that Kittitas County complies with all applicable Federal statutes and regulations during the periods for which it receives hazard mitigation grant funding, in compliance with 44 CFR.
- Reassess the Plan in light of any major hazard event. The Steering Committee will convene within 45 days of any major event to review all applicable data and to consider the risk assessment, plan goals, objectives, and action items given the impact of the hazard event.
- Review the Plan in connection with other plans, projects, developments, and other significant initiatives.
- Coordinate with appropriate counties within Kittitas County and authorities to incorporate regional initiatives that transcend the County boundaries.
- Update the Plan every five (5) years and submit it to the Washington State Emergency Management Division and FEMA Region 10 for approval.
- Amend the Plan whenever necessary to reflect changes in state or federal laws and statutes required in 44 CFR.

6.1.1.1. Continued Public Engagement

Kittitas County Public Works and the Steering Committee are dedicated to involving the public directly in the review and updates of the Plan. The public will have the opportunity to provide input into Plan revisions and updates. Copies of the Plan will be kept by the appropriate County departments, cities, towns, and special districts.

Public meetings will be held when deemed necessary by the Steering Committee. The meetings will provide a forum where the public can express concerns, opinions, or new alternatives that can then be included in the Plan. Kittitas County Public Works, with support of the Steering Committee, will be responsible for using the appropriate resources to publicize the public meetings and maintain public involvement.

To further facilitate continued public involvement in the planning process, Kittitas County will ensure the following:

- Kittitas County Public Works will keep a copy of the Plan readily available in their office for review and comment by the public. The Plan will also be maintained on the website.

- A public meeting could be held annually to provide the public with a forum for discussing concerns, opinions, and ideas with the Steering Committee.
- Kittitas County Sherriff's Office (Emergency Management) will conduct outreach after a disaster event to remind members of the public the importance of mitigation and to solicit mitigation ideas to be included in the Plan.

6.1.1.2. Implementation and Integration through Existing Plans and Programs

Hazard mitigation practices must be incorporated within existing plans, projects, and programs. Therefore, the involvement of all departments, private non-profits, private industry, and appropriate jurisdictions is necessary in order to find mitigation opportunities within existing or planned projects and programs. To execute this, the Steering Committee will assist and coordinate resources for the mitigation actions and provide strategic outreach to implement mitigation actions that meet the goals and objectives identified in this Plan. The information on hazard, risk, vulnerability, and mitigation included in this Plan update is based on the best science and technology available at the time this Plan was completed. Plan integration consists of the incorporation of hazard mitigation into other relevant planning mechanisms (e.g., general planning and capital improvement planning).

The Hazard Mitigation Plan is essential to understanding the hazards facing Kittitas County, the resulting prioritized list of hazards is used across the suite of Kittitas County and local jurisdictions plans, and community partner organizations, thus creating a shared understanding of the hazards facing the County.

The results of this Plan will be incorporated into ongoing planning efforts throughout the County. Kittitas County, its municipalities, and special districts will update zoning plans and related ordinances, as necessary, and as part of regularly scheduled updates. Each plan participant will be responsible for updating and integrating elements of the Plan into the community's own respective community plans and ordinances.

6.1.1.3. The Five-Year Action Plan

This section outlines the implementation agenda that the Hazard Mitigation Steering Committee, led by Kittitas County Public Works, should follow five (5) years after adoption of this Plan, and then every five (5) years thereafter.

The Steering Committee will consider the following action plan for the five (5) year planning cycle. It should be noted that the schedule on **Table 6-1** can be modified as necessary and does not include any meetings and/or activities that would be necessary following a disaster event (e.g., reconvening the Hazard Mitigation Steering Committee within 45 days of a disaster or emergency to determine what mitigation projects should be prioritized during the community recovery). If an emergency meeting of the Hazard Mitigation Steering Committee occurs, this proposed schedule may be altered to fit any new needs.

Table 6-1. Five-Year Action Plan

Year 0	
2025	Update the 2019 Hazard Mitigation Plan and submit it to the Washington State Emergency Management Division and FEMA Region 10 for approval.

Year 1	
2026	• Work on mitigation actions. • Kittitas County Public Works will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts. • Reconvene the Steering Committee for an annual meeting. • Discuss opportunities for Plan integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Host public meetings to re-introduce the Plan to the community, identify additional hazards of concern that should be considered for the next update, if any, and provide update and obtain input on mitigation projects occurring within the community.
Year 2	
2027	• Work on mitigation actions. • Kittitas County Public Works will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts. • Reconvene the Steering Committee for an annual meeting. • Discuss opportunities for Plan integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Host public meetings to re-introduce the Plan to the community, identify additional hazards of concern that should be considered for the next update, if any, and provide update and obtain input on mitigation projects occurring within the community.
Year 3	
2028	• Work on mitigation actions. • Kittitas County Public Works will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts. • Apply for hazard mitigation grant funds (e.g., HMGP, BRIC) to update the next iteration of the Hazard Mitigation Plan. • Reconvene the Steering Committee for an annual meeting. • Discuss opportunities for Plan integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Host public meetings to re-introduce the Plan to the community, identify additional hazards of concern that should be considered for the next update, if any, and provide update and obtain input on mitigation projects occurring within the community.

Year 4	
2029	• Work on mitigation actions. • Kittitas County Public Works will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts. • Begin the update process for the 2025 Hazard Mitigation Plan and conduct a series of meetings with stakeholders, plan participants, and the public.
Year 5	
2030	• Update the 2025 Hazard Mitigation Plan and submit it to the Washington state Emergency Management Division and FEMA Region 10 for approval. • Repeat.

APPENDIX A. MITIGATION ACTIONS

This Appendix includes the mitigation actions that were developed to address identified risks and vulnerabilities to hazards identified in this Plan. This Plan serves only to recommend mitigation measures based on the potential for risk reduction and available funding. Implementation of mitigation actions is dependent on risk reduction priorities, feasibility, and available funding. It is also dependent on the cooperation and support of the jurisdiction and/or department responsible for each action item.

Kittitas County agreed upon **48** mitigation actions that apply to the jurisdiction's properties where they have jurisdictional responsibility and authority. **Two (2)** mitigation actions were deleted/no longer needed. A summary of the County's mitigation actions status is listed on **Table A-1**.

Table A-1. Kittitas County Mitigation Actions Summary

Status	Mitigation Action Total
Ongoing	28
In Progress/In Work	2
Not Started	2
Delayed/Deferred	0
New	16
TOTAL	**47**
Completed	0
Deleted/No Longer Needed	2

Mitigation Actions per Natural Hazard			
Avalanche	15	Landslide	16
Dam and Levee Failure	19	Severe Weather *(Extreme Heat, Extreme Cold, Severe Thunderstorm – Hail, Strong Winds, Tornado)*	19
Drought	17	Volcanic Activity	15
Earthquake	19	Wildfire *(Wildfire Smoke)*	20
Flood	31	Winter Weather *(Ice Storm, Heavy Snow, Blizzard)*	15
Other hazards of concern: Communicable Disease/Pandemic (2)			

Mitigation Action	Maintain the Kittitas County Flood Control Zone District.				
Action Number	KC-1	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	34/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Flood Control Levee Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Enhance the flood warning system on major rivers and streams within Kittitas County including strengthening the computer interface, working with irrigation districts to account for canal operations that may impact flooding. and upgrading and increasing the number of weather stations.				
Action Number	KC-2	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	32/40
Goal(s) Addressed		1, 4	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Sheriff Office, Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Department of Ecology Flood Control Account Program grants, Flood Control Zone District Levy, Other Agency Funds	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue participation and improve rating in the National Flood Insurance Program (NFIP) Community Rating System (CRS) program.				
Action Number	KC-3	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	31/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Where appropriate, support retrofitting, purchase, or relocation of structures in hazard-prone areas to protect them from future damage, with priority for properties exposed to repetitive losses. Conduct a repetitive area loss analysis to inform strategy.				
Action Number	KC-4	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	29/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Adopt appropriate regulatory standards that will reduce the risk to natural hazards through updates to existing codes affecting critical areas regulations, flood hazard regulations, shoreline regulations, and to the County's Comprehensive Plan.				
Action Number	KC-5	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	27/40
Goal(s) Addressed	1, 2, 4, 5		**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status	Ongoing		If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*	High				
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, Other		If *Other*, you **must** identify a funding source.	Department of Ecology Flood Control Account Program grants, Washington State Department of Commerce grants	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Annually disseminate a floodplain information brochure to all floodplain area or flood risk households.				
Action Number	KC-6	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	31/40
Goal(s) Addressed		1, 2, 4	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Retrofit, rehabilitate, or replace vulnerable road facilities, bridges and infrastructure throughout Kittitas County.				
Action Number	KC-7	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	32/40
Goal(s) Addressed		1, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Earthquake, Flood, Landslide, Volcanic Activity, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	County Road Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Replace undersized bridges and culverts throughout Kittitas County, to include but not limited to, Cove Road Bridge, North Fork Teanaway Road Bridge; Cooke Canyon Road Bridge, Yellowstone Culvert, and Airport Road Culvert Hungry Junction/Faust Road Culvert.				
Action Number	KC-8	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	32/40
Goal(s) Addressed		1, 5	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	County Road Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Maintain compliance and good standing under the National Flood Insurance Program (NFIP).				
Action Number	KC-9	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	32/40
Goal(s) Addressed		1, 2, 4, 5	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Community Development Services, Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Update the Kittitas County Comprehensive Flood Management Plan.				
Action Number	KC-10	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Community Development Services, Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Where feasible, seek to elevate at-risk structures within the floodplain to an adequate freeboard that is commensurate with the flood risk. The measure of feasibility will be willing participation by the property owner and the cost-effectiveness of the project.				
Action Number	KC-11	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	25/40
Goal(s) Addressed		1, 5	**Hazard(s) Mitigated**	Flood	
Project Status		Not Started	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	County Road Fund	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Upgrade or install stream gauges on rivers and streams, to include but not limited to, Reecer Creek, Wilson Creek, Naneum Creek, Whiskey Creek, Manastash River, and North Fork Teanaway River.				
Action Number	KC-12	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) Addressed		1, 3	**Hazard(s) Mitigated**	Dam and Levee Failure, Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	HMGP, Other		If *Other*, you **must** identify a funding source.	Flood Control Zone District Levee grants	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct a seismic retrofit study of all County-owned facilities to determine their vulnerability to earthquake.				
Action Number	KC-13	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	20/40
Goal(s) Addressed		1, 5	**Hazard(s) Mitigated**	Earthquake	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Maintenance		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Implement a public outreach program to educate landowners about Firewise and Fire Adapted Communities programs, defensible space around structures, non-combustible building materials, fuel reduction and other wildfire prevention tactics. Additionally, place information boards in key areas of the County.				
Action Number	KC-14	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	26/40
Goal(s) Addressed		1, 4	**Hazard(s) Mitigated**	Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Kittitas County Fire Marshal's Office		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Perform fuel reduction projects in high wildfire risk areas and areas with identified need throughout Kittitas County.				
Action Number	KC-15	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	30/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Fire Marshal's Office		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	HMGP, Other		If *Other*, you **must** identify a funding source.	Community Wildlife Defensive Grant	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Enhance the County's Subdivision Code and Building Code to include updated fire code requirements.				
Action Number	KC-16	**Year Initiated / Anticipated Year of Initiation**	2019	**Prioritization Score**	28/40
Goal(s) Addressed		1, 2, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	County Fire Marshal's Office, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to improve and preserve fire apparatus access throughout the County roads, including access through private gates.				
Action Number	KC-17	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	30/40
Goal(s) Addressed		1, 2, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Fire Marshal's Office, Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), County Road Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Identify seiche hazard areas and adopt higher regulatory standards to protect structures within the identified areas.				
Action Number	KC-18	**Year Initiated / Anticipated Year of Initiation**	2027	**Prioritization Score**	24/40
Goal(s) Addressed		1, 2, 3, 5	**Hazard(s) Mitigated**	Earthquake, Severe Weather	
Project Status		Not Started	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*	Kittitas County Comprehensive Plan		

Mitigation Action	Continue to adopt land use policies that prohibit the placement of habitable structures in high risk landslide and avalanche areas.				
Action Number	KC-19	**Year Initiated / Anticipated Year of Initiation**	2019	**Prioritization Score**	27/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Avalanche, Landslide	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*	Continue to incorporate hazard information from this Hazard Mitigation Plan in Comprehensive Planning.		

Mitigation Action	Strengthen/harden critical road facilities from the impacts of all hazards for which they have exposure and vulnerability.				
Action Number	KC-20	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) Addressed		1, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	County Road Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Proactively manage hazardous tree removal from public areas and educate private property owners about management of their own trees.				
Action Number	KC-21	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	26/40
Goal(s) Addressed		1	**Hazard(s) Mitigated**	Severe Weather, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), County Road Fund	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Use the best available data and science to continually update the County risk assessment as new information becomes available (hydrologic, geologic, topographic, etc.).				
Action Number	KC-22	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	34/40
Goal(s) Addressed		1, 2, 3	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), County Road Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Integrate this Hazard Mitigation Plan into future updates of the Kittitas County Comprehensive Plan.				
Action Number	KC-23	**Year Initiated / Anticipated Year of Initiation**	2019	**Prioritization Score**	35/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Support the implementation, monitoring, and maintenance of the Kittitas County Hazard Mitigation Plan as outlined in Volume 1.				
Action Number	KC-24	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	28/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), County Road Fund	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Integrate goals, objectives, and initiatives of the Kittitas County Hazard Mitigation Plan into existing County regulations and programs where appropriate, to include but not limited to, Critical Area regulations, heightened building standards for wildfire and flood hazards, and comprehensive planning.				
Action Number	KC-25	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	30/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Community Development Services, Kittitas County Public Works, Kittitas County Public Health		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), County Road Fund	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Maintain an ongoing public outreach strategy using available multiple media to inform the public how to personally prepare for and mitigate the hazards of concern.				
Action Number	KC-26	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	35/40
Goal(s) Addressed		1, 4	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services, Kittitas County Sheriff's Office		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct detailed ashfall studies to reduce the hazards associated with volcanic ashfall.				
Action Number	KC-27	**Year Initiated / Anticipated Year of Initiation**	2027	**Prioritization Score**	25/40
Goal(s) Addressed		1, 3	**Hazard(s) Mitigated**	Volcanic Activity	
Project Status		Not Started	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Community Development Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), County Road Fund	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Support other entities working to identify and create new impounded water sources.				
Action Number	KC-28	**Year Initiated / Anticipated Year of Initiation**	N/A	**Prioritization Score**	N/A
Goal(s) Addressed		1, 3	**Hazard(s) Mitigated**	Drought	
Project Status		Deleted/No Longer Needed	If *Deleted/No Longer Needed*, provide reason.	This mitigation action is replaced by KC-35. While the Washington State Department of Ecology and the United States Bureau of Reclamation are working on surface water storage options, this is not led by Kittitas County.	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue the public outreach program that educates the public, especially domestic well users, on drought resistance and encourage the use of water saving landscaping, irrigation, and indoor uses.				
Action Number	KC-29	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	34/40
Goal(s) Addressed		1, 2, 4,	**Hazard(s) Mitigated**	Drought	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works (Water Resource Program)		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Department of Health	
Additional Participating Jurisdictions *(If applicable)*	Kittitas County Conservation District				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, Other		If *Other*, you **must** identify a funding source.	Washington State Department of Ecology Grant	
			Please provide further detail on Potential Funding Source.	Local Water Resource Program Funding	
Implementation Priority	High	**Integration Ideas** *(Optional)*	Yakima River Basin Integrated Water Resource Management Plan		

Mitigation Action	Improve irrigation conveyance systems to reduce water loss through earthen canals and ditches.				
Action Number	KC-30	**Year Initiated / Anticipated Year of Initiation**	N/A	**Prioritization Score**	N/A
Goal(s) Addressed		1, 2, 3, 4	**Hazard(s) Mitigated**	Drought	
Project Status		Deleted/No Longer Needed	If *Deleted/No Longer Needed*, provide reason.	This mitigation action is replaced by KC-35. This is not a mitigation action that Kittitas County would directly implement.	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Kittitas County Public Works (Water Resource Program)		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	United States Bureau of Reclamation, Washington State Department of Ecology, Kittitas Reclamation District, Kittitas County Conservation District, Yakama Nation				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*	Yakima River Basin Integrated Water Resource Management Plan		

Mitigation Action	Enhance the existing dam failure early warning system.				
Action Number	KC-31	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) Addressed		1, 4	**Hazard(s) Mitigated**	Dam and Levee Failure, Flood	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works (Flood Control Zone District)		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Sherrif's Office	
Additional Participating Jurisdictions *(If applicable)*	United States Bureau of Reclamation, Washington State Department of Ecology				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Flood Control Zone District Funds	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Enhance sustained operations of critical county functions by the development and implementation of a Continuity of Operations Plan (COOP) and/or a Post-Disaster Recovery Plan.				
Action Number	KC-32	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) Addressed		1, 4	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Sheriff's Office (Emergency Management)		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Elected Officials	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP, BRIC, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to support through active participation the Countywide initiatives identified in Volume 1 of the Kittitas County Hazard Mitigation Plan.				
Action Number	KC-33	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) / Objective(s) Addressed		1, 3, 4	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Volcanic Activity, Wildfire, Winter Weather	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	All County departments	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Consider County participation in the National Weather Service "StormReady" Program.				
Action Number	KC-34	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	33/40
Goal(s) / Objective(s) Addressed		1, 3, 4	**Hazard(s) Mitigated**	Flood, Severe Weather, Winter Weather	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Sheriff's Office (Emergency Management)		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Public Works	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Support Yakima Basin partner initiatives to implement the Yakima River Basin Integrated Water Resource Management Plan, which includes but is not limited to supporting the development of surface water storage and supporting efforts to reduce irrigation conveyance system water loss.				
Action Number	KC-35	**Year Initiated / Anticipated Year of Initiation**	2027	**Prioritization Score**	32/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4	**Hazard(s) Mitigated**	Drought	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works (Water Resource Program)		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	United States Bureau of Reclamation, Washington State Department of Ecology, Kittitas Reclamation District, Kittitas County Conservation District, Yakama Nation				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	State Special Funds, HMGP, Other		If *Other*, you **must** identify a funding source.	United States Bureau of Reclamation WaterSMART Program Funds	
			Please provide further detail on Potential Funding Source.	Washington State Department of Ecology Office of Columbia River Funds	
Implementation Priority	High	**Integration Ideas** *(Optional)*	Yakima River Basin Integrated Water Resource Management Plan.		

Mitigation Action	In collaboration with Elk Meadows Homeowners Association, address current flood vulnerability associated with private McElroy Road Bridge and low-lying approaches.				
Action Number	KC-36	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	28/40
Goal(s) / Objective(s) Addressed		1, 2, 4	**Hazard(s) Mitigated**	Dam and Levee Failure, Flood	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works (Flood Control Zone District)		**Supporting Agency / Organization** *(If applicable)*	Elk Meadows Homeowners Association	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Private/Non-Profit Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Elk Meadows Homeowners Association Funds	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct a natural hazard vulnerability assessment of Group A Water systems, especially for drought and infrastructure vulnerabilities.				
Action Number	KC-37	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	Washington State Department of Ecology	
Additional Participating Jurisdictions *(If applicable)*	Group A Water System Providers				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, State Special Funds, HMGP, BRIC, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), Washington State Departments of Ecology Funds, Washington State Department of Health Funds	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Improve Channel Migration Zone mapping.				
Action Number	KC-38	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	34/40
Goal(s) / Objective(s) Addressed		1, 3, 4, 5	**Hazard(s) Mitigated**	Flood	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Works (Flood Control Zone District)		**Supporting Agency / Organization** *(If applicable)*	Washington State Department of Ecology	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	HMGP, BRIC, FMA, Other		If *Other*, you **must** identify a funding source.	Flood Control Assistance Account Program (FCAAP) Grant	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to develop, implement, and update the Flood Control Zone District 6-year Capital Facility Plan.				
Action Number	KC-39	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	35/40
Goal(s) / Objective(s) Addressed		1, 3, 4, 5	**Hazard(s) Mitigated**	Dam and Levee Failure, Flood	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works (Flood Control Zone District)		**Supporting Agency / Organization** *(If applicable)*	Washington State Department of Ecology	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	High	
Potential Funding Source	HMGP, FMA, FEMA PA, Other		If *Other*, you **must** identify a funding source.	Flood Control Assistance Account Program (FCAAP) Grant	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop a public outreach program focused on vulnerable populations and people with disabilities to prepare them for extreme heat and cold.				
Action Number	KC-40	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4	**Hazard(s) Mitigated**	Severe Weather	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Central Washington Disability Resources		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Public Health Department	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop a public outreach program focused on vulnerable populations and people with disabilities to prepare them for extreme heat and cold.				
Action Number	KC-41	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4	**Hazard(s) Mitigated**	Severe Weather	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Central Washington Disability Resources		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Public Health Department	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Identify, educate, and promote heating and cooling centers in the community for the vulnerable populations and people with disabilities.				
Action Number	KC-42	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4	**Hazard(s) Mitigated**	Severe Weather	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Sheriff's Office (Emergency Management)		**Supporting Agency / Organization** *(If applicable)*	Central Washington Disability Resources, Kittitas County Public Health Department	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Create a Functional Assessment Service Team (FAST) in Kittitas County to bridge to the gap and meet the access and functional needs members in the community during emergencies.				
Action Number	KC-43	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	35/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Winter Weather, Volcano Activity, Wildfire, Communicable Diseases/Pandemic	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Central Washington Disability Resources		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Sheriff's Office (Emergency Management), Kittitas County Public Health Department	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), Kittitas County Public Health Department Funds	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Take measures to protect public drinking water sources from contamination during flooding events. During a flood event, protecting public drinking water wells from contamination requires a multi-faceted approach which includes: • Implementing proper land use planning to prevent hazardous materials from being stored near water sources. • Constructing protective barriers around wells and implementing emergency shut-off valves can mitigate the risk of floodwater infiltration. • Regular monitoring of water quality and implementing rapid response protocols to address any contamination detected. • Educating the public on proper waste disposal practices and promoting community engagement in water protection efforts.

Action Number	KC-44	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	32/40
Goal(s) / Objective(s) Addressed		1, 2, 4, 5	**Hazard(s) Mitigated**	Flood, Communicable Diseases/Pandemic	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas County Public Health Department		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Public Works	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP, FEMA PA, Other		If *Other*, you **must** identify a funding source.	Washington State Department of Health Grant	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Implement evacuation routes in remote areas of Kittitas County.				
Action Number	KC-45	**Year Initiated / Anticipated Year of Initiation**	2029	**Prioritization Score**	32/40
Goal(s) / Objective(s) Addressed		1, 2, 4, 5	**Hazard(s) Mitigated**	Avalanche, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Severe Weather, Winter Weather, Volcano Activity, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP, HMGP-Post Fire, BRIC, Other		If *Other*, you **must** identify a funding source.	Community Wildfire Defense Grant	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Implement wildland fuels reduction projects that include reduction of fuel at ingress/egress routes, creating shaded fuel breaks, and use prescribed burns to reduce fuel loads that threaten safety and property.				
Action Number	KC-46	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	36/40
Goal(s) / Objective(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Sheriff's Office (Emergency Management)		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Conservation District	
Additional Participating Jurisdictions *(If applicable)*	Kittitas Fire Adapted Community Coalition				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Other		If *Other*, you **must** identify a funding source.	Community Wildfire Defense Grant	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct a seismic retrofit study of Kittitas Reclamation District infrastructure including, but not limited to the Easton Dam, to determine their vulnerability to earthquake.				
Action Number	KC-47	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	20/40
Goal(s) Addressed		1, 5	**Hazard(s) Mitigated**	Earthquake	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas Reclamation District		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct a natural hazard exposure and vulnerability assessment of Kittitas Reclamation District facilities, including, but not limited to the District's canal network and the Easton Dam. This assessment will allow the District to strengthen the infrastructure for future events.				
Action Number	KC-48	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Drought, Earthquake, Landslide, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Kittitas Reclamation District		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to work on actions items and proposed projects in the Kittitas County Community Wildfire Protection Plan including implementation of landscape scale restoration and partnering with stakeholders through the Kittitas Fire Adapted Communities Coalition (KFACC).				
Action Number	KC-49	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) Addressed		1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	n/a	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works, Kittitas County Sheriff's Office		**Supporting Agency / Organization** *(If applicable)*	City of Cle Elum, City of Roslyn, Kittitas County Fire District #1, Kittitas County Fire District #6, Kittitas County Fire District #7, Kittitas Valley Fire and Rescue	
Additional Participating Jurisdictions *(If applicable)*	n/a				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, HMGP Post Fire, Other		If *Other*, you **must** identify a funding source.	Washington State Conservation Commission, Washington Department of Natural Resources, Washington Department of Ecology, USDA Natural Resources Conservation Service, USDA Forest Service Community Wildfire Defense, United States Department of the Interior Bureau of Land Management grants	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Changes in Priority** *(If applicable)*			

Mitigation Action	Partner with Fire District 7 to identify and implement actions to reduce flood susceptibility and ensure continuity of services at Fire Station 73 given the flood risk to this critical facility. Planning will consider both near-term actions such as potential building retrofit for greater flood resilience and the temporary and/or permanent housing of building functions at alternative locations, as well as long-term actions such facility succession planning for when the current structure exceeds its design life.				
Action Number	KC-50	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	26/40
Goal(s) Addressed		1, 2, 3, 5	**Hazard(s) Mitigated**	Flood	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	n/a	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Kittitas County Public Works		**Supporting Agency / Organization** *(If applicable)*	Kittitas County Fire District #7	
Additional Participating Jurisdictions *(If applicable)*	n/a				
Project Duration	Short-Term		**Estimated Cost**	Medium to High	
Potential Funding Source	Local Budgeted Funds, HMGP, FMA, FEMA PA		If *Other*, you **must** identify a funding source.	n/a	
			Please provide further detail on Potential Funding Source.	Flood Control Zone District	
Implementation Priority	High	**Changes in Priority** *(If applicable)*			

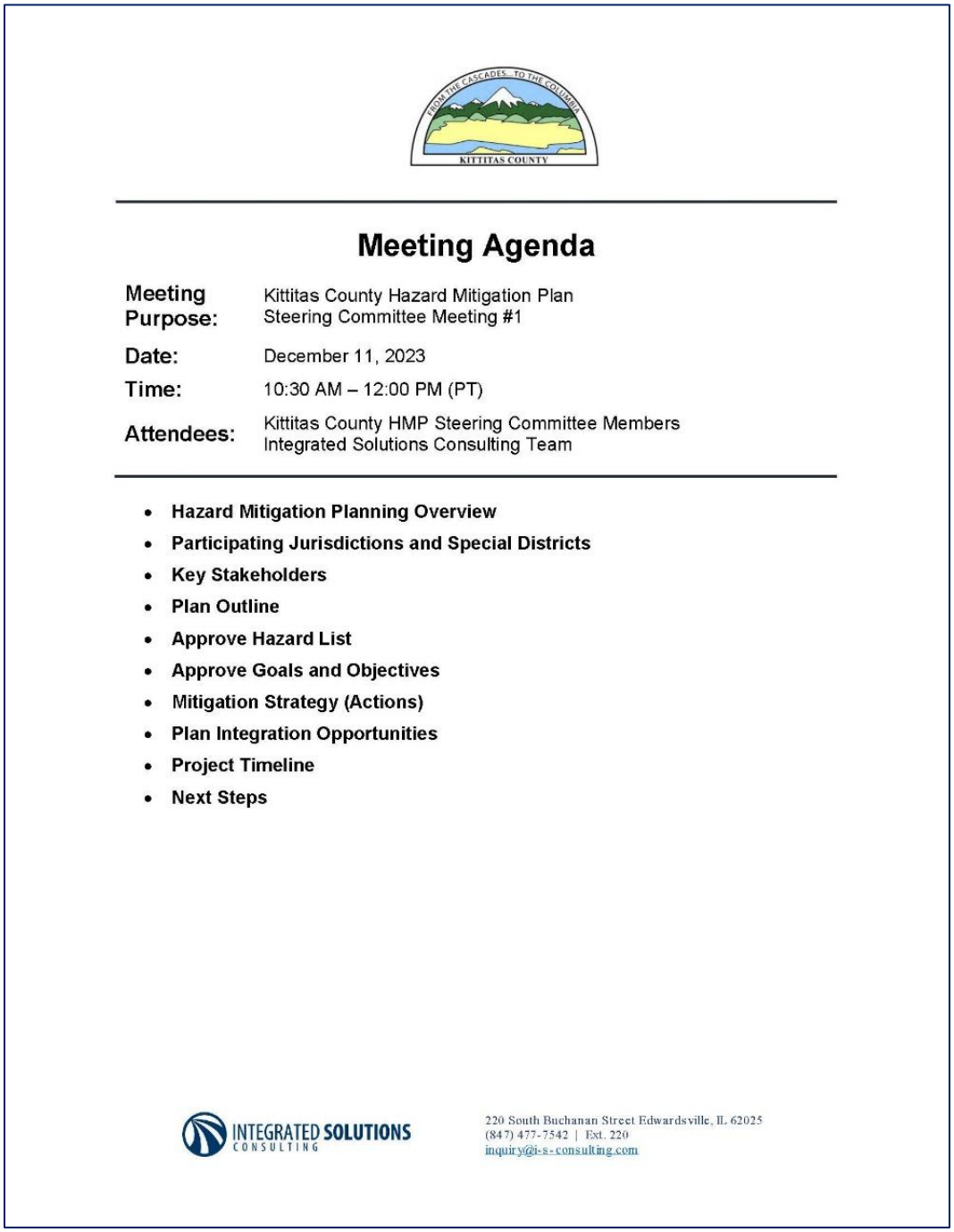
APPENDIX B. STAKEHOLDER ENGAGEMENT

Kittitas County engaged with various stakeholders on multiple occasions, to include the Steering Committee during meetings, workshops, and one on one meetings. These stakeholders assisted in identifying hazards, assessing risks and vulnerability, recording critical facilities, and develop and prioritize mitigation actions. In addition to sharing technical data, reports, and studies. Kittitas County understands the importance of stakeholder engagement and that their contribution strengthens the content and outcomes of this Hazard Mitigation Plan.

B.1. STEERING COMMITTEE MEETING #1

A total of approximately 28 steering committee members were part of the Hazard Mitigation Plan update process. **Table 1-3** in Section 1.5.2 of this Plan outlines the Steering Committee members by jurisdiction/organization, name, and position title. The first Steering Committee Meeting for the 2025 Kittitas County Hazard Mitigation Plan update was conducted on December 11, 2023, and used an agenda to guide the meeting's discussion. The meeting agenda and sign in sheets of the Steering Committee Meeting are below.

Steering Committee Meeting Agenda



KITTITAS COUNTY

Meeting Agenda

Meeting Purpose:	Kittitas County Hazard Mitigation Plan Steering Committee Meeting #1
Date:	December 11, 2023
Time:	10:30 AM – 12:00 PM (PT)
Attendees:	Kittitas County HMP Steering Committee Members Integrated Solutions Consulting Team

- **Hazard Mitigation Planning Overview**
- **Participating Jurisdictions and Special Districts**
- **Key Stakeholders**
- **Plan Outline**
- **Approve Hazard List**
- **Approve Goals and Objectives**
- **Mitigation Strategy (Actions)**
- **Plan Integration Opportunities**
- **Project Timeline**
- **Next Steps**

INTEGRATED SOLUTIONS CONSULTING

220 South Buchanan Street Edwardsville, IL 62025
(847) 477-7542 | Ext. 220
inquiry@i-s-consulting.com

Steering Committee Meeting Sign In Sheet (page 1)

2024 Kittitas County Hazard Mitigation Plan Update
Steering Committee Meeting #1

WebEx (https://kittitascounty.webex.com/kittitascounty/j.php?MTID=mb71c3121e7122db77788f96995345129)

Hazard Mitigation Steering Committee Meeting #1
Date: 12/11/2023

Name	Organization	Title	E-mail	Phone
Yahiritza D. Álvarez	Integrated Solutions Consulting	Senior Consultant	Yahiritza.Alvarez@i-s-consulting.com	(847) 737-5395 (Ext. 161)
Daiko Abe	Integrated Solutions Consulting	Director of Operations	Daiko.Abe@i-s-consulting.com	(509) 964-7920
Arden Thomas	Kittitas County Public Works	Water Resource Manager	arden.thomas@co.kittitas.wa.us	(509) 962-7690
Samantha Cox	Kittitas County Public Works	Water Resource Specialist	Samantha.cox@co.kittitas.wa.us	(509) 962-7680
Troy Jackson	Kittitas County Fire District #6	Fire Chief	tjackson@kcfpd6.com	(509) 674-8007
Kyra Garnich	Kittitas County Sheriff's Office	Kittitas County Emergency Management Specialist	kyra.garnich@co.kittitas.wa.us	(509) 859-6960
Kelly Bacon	Kittitas County Public Health	Local Emergency Response Coordinator	kelly.bacon.ph@co.kittitas.wa.us	(509) 962-7002
Peggy Morache	Fish Food Bank, Food Pantries, Open Table Meal Service	CEO	peggy@kvfish.org	(702) 449-6787
Darren Higashyama	Kittitas County Sheriff's Office	Chief Deputy / Emergency Management Coordinator	darren.higashiyama@co.kittitas.wa.us	(509) 933-8206
Robert Cepeda	Central Washington University (Police)	Emergency Manager	cepedar@cwu.edu	(509) 963-2779
Neil Musser	Ellensburg School District	Director Security/Safety	neil.musser@esd401.org	(509) 925-8308
Matthew Boast	Kittitas Public Utility District #1	General Manager	matt.boast@kittitaspud.com	(509) 607-0734
Kelsey Smith	American Red Cross	Disaster Program Manager	Kelsey.Smith@redcross.org	(509) 961-0165
Patti Stacey	Kittitas County Solid Waste	Facilities & Waste Operations Director	patti.stacey@co.kittitas.wa.us	(509) 962-7542

1

Steering Committee Meeting Sign In Sheet *(page 2)*

2024 Kittitas County Hazard Mitigation Plan Update
Steering Committee Meeting #1

Hazard Mitigation Steering Committee Meeting #1 Date: 12/11/2023				
Name	**Organization**	**Title**	**E-mail**	**Phone**
Christa Stream	City of Kittitas	City Administrator	Christa.Stream@cityofkittitas.com	(509) 859-6315
Chris Horner	Kittitas County Prosecutor's Office	Deputy Prosecuting Attorney	christopher.horner@co.kittitas.wa.us	(509) 962-7661
Rhonda Holden	Kittitas Valley Healthcare	Chief Ancillary Officer	rholden@kvhealthcare.org	(509) 962-7320
Mitchell Rhodes	Kittitas Valley Healthcare	Grant Writer	mrhodes@kvhealthcare.org	(509) 933-3910
Kelee Hodges	Kittitas County Public Works	Environmental Transportation Planner	kelee.hodges.pw@co.kittitas.wa.us	(509) 962-7051
Kasey Knutson	Kittitas County Public Health	Special Programs Coordinator	kasey.knutson@co.kittitas.wa.us	(509) 962-7090
Jay Wiseman	Snoqualmie Pass Fire Rescue	Fire Chief	jwiseman@spfire.org	(425) 761-0781
Edwin Mills	City of Cle Elum	Fire Chief	emills@cleelum.gov	(509) 656-4062
Jesse Cox	Kittitas County Public Health	Environmental Health Supervisor	Jesse.cox@co.kittitas.wa.us	(509) 962-7005
Ryan Risdon	Kittitas County Fire District #6	Emergency Management and Special Operations Coordinator	rrisdon@kcfpd6.com	(509) 656-6050
Mark Larson	Kittitas County Public Health	Health Officer	Mark.larson@co.kittitas.wa.us	(509) 899-6448
Nick Moeur	Puget Sound Energy	Project Manager	nick.moeur@pse.com	(509) 964-7920
Bryan Nash	Kittitas School District #403	Maintenance Transportation Director	bryan_nash@ksd403.org	(509) 201-3023
Michelle Geiger	City of Roslyn	Planner / Building Official	planner@ci.roslyn.wa.us	(509) 649-3105 (Ext. 2)

2

B.2. STEERING COMMITTEE MEETING #2

Another Steering Committee Meeting was held on February 13, 2025, to discuss revisions made based on comments received during the public comment period and the Community Rating System (CRS) preliminary review. The meeting also aimed at obtaining approval of the final draft of the Plan before its submission to the State and FEMA for review and approval. *Refer to Section 5.2 of this Plan for further details on the discussion.* The meeting sign in sheet is provided below.

Steering Committee Meeting Sign In Sheet (page 1)

2024 Kittitas County Hazard Mitigation Plan Update
Steering Committee Meeting #2

WebEx (https://kittitascounty.webex.com/kittitascounty/j.php?MTID=m728640603f681d21a390e48578b8fa64)

Hazard Mitigation Steering Committee Meeting #2 Date: 2/13/2025				
Name	**Organization**	**Title**	**E-mail**	**Phone**
Yahiritza D. Álvarez	Integrated Solutions Consulting	Senior Consultant	Yahiritza.Alvarez@i-s-consulting.com	(847) 737-5395 (Ext. 161)
Arden Thomas	Kittitas County Public Works	Water Resource Manager	arden.thomas@co.kittitas.wa.us	(509) 962-7690
Samantha Cox	Kittitas County Public Works	Water Resource Specialist	Samantha.cox@co.kittitas.wa.us	(509) 962-7680
Darren Higashyama	Kittitas County Sheriff's Office	Chief Deputy / Emergency Management Coordinator	darren.higashiyama@co.kittitas.wa.us	(509) 933-8206
Kelly Bacon	Kittitas County Public Health	Local Emergency Response Coordinator	kelly.bacon.ph@co.kittitas.wa.us	(509) 962-7002
Robert Cepeda	Central Washington University (Police)	Emergency Manager	cepedar@cwu.edu	
Kyra Tirey	Kittitas County Sheriff's Office	Emergency Management Specialist	kyra.garnich@co.kittitas.wa.us	(509) 859-6960
Katelyn Vandemolegraaf	Kittitas Valley Healthcare	Outreach Coordinator		
Michelle Geiger	City of Roslyn	Planner / Building Official	planner@ci.roslyn.wa.us	(509) 649-3105 (Ext. 2)
Edwin Mills	City of Cle Elum	Fire Chief	emills@cleelum.gov	(509) 656-4062
Mark Larson	Kittitas County Public Health	Health Officer	Mark.larson@co.kittitas.wa.us	(509) 899-6448
Kelly Bacon	Kittitas County Public Health	Local Emergency Response Coordinator	kelly.bacon.ph@co.kittitas.wa.us	(509) 962-7002
Cameron Clasen	City of Ellensburg Police Department	Captain	clasenc@ci.ellensburg.wa.us	(509) 962-7280
Heidi Behrends Cerniway	City of Ellensburg	City Manager	cerniweyh@ci.ellensburg.wa.us	(509) 962-7221

1

Steering Committee Meeting Sign In Sheet *(page 2)*

2024 Kittitas County Hazard Mitigation Plan Update
Steering Committee Meeting #2

Hazard Mitigation Steering Committee Meeting #2 Date: 2/13/2025				
Name	**Organization**	**Title**	**E-mail**	**Phone**
Michele Wurl	Kittitas Vally Healthcare	Chief Public Relations Officer and Emergency Preparedness Coordinator		
Jamey Ayling	Kittitas County Community Development Services	Planning Manager	Jamey.Ayling@co.kittitas.wa.us	
Kent Catlin	Puget Sound Energy	Emergency Management & Resiliency Program	kent.catlin@pse.com	
Anna Lael	Kittitas County Conservation District	District Manager	anna.lael@kccd.net	509-925-3352 (Ext. 7)
Matthew Boast	Kittitas Public Utility District	General Manager	matt.boast@kittitaspud.com	(509) 607-0734
Christa Stream	City of Kittitas	City Administrator	Christa.Stream@cityofkittitas.com	(509) 859-6315
Patti Stacey	Kittitas County Solid Waste	Facilities & Waste Operations Director	patti.stacey@co.kittitas.wa.us	(509) 962-7070
Keiko Walsh	HopeSource	Senior Transportation Manager	kwalsh@hopesource.us	(509) 925-1448
Geoff Scherer	Upper Kittitas County Medic One	Operations Manager	Geoff.scherer@ukcmedicone.org	
Deja Blanchard	Central Washington Disability Resources	Disability Specialist	disabilityspecialist@mycwdr.org	(509) 962-9620
Jeremy Johnston	Kittitas County Community Development Services	Long-Range Planner		

B.3. STAKEHOLDER WORKSHOP

Two (2) Stakeholder Workshops were held in Kittitas County on February 21, 2024, and February 22, 2024. The workshops gave each local planning team an opportunity to work with Kittitas County Public Works to identify local hazards and areas of concern, review previously identified mitigation actions, develop future mitigation projects, prioritize mitigation projects moving forward and update their jurisdiction's annex of the 2025 Kittitas County Hazard Mitigation Plan. The workshop agenda and sign in sheets are below. All participating jurisdictions were able to attend at least one (1) of the workshops.

Stakeholder Workshops Agenda

Kittitas County, Washington
2024 Hazard Mitigation Plan Update

Stakeholder Workshop

Session 1	Wednesday, February 21, 2024 1:30 PM – 4:30 PM Public Works Upper County Shop 51 No. 5 Mine Road, Cle Elum, WA 98922
Session 2	Thursday, February 22, 2024 1:30 PM – 4:30 PM Kittitas County Event Center Armory Main Hall 901 E 7th Avenue, Ellensburg, WA 98926

Agenda

- Welcome, Introductions, and Opening Remarks
- Hazard Mitigation Planning Overview
  - Overview of mitigation: Why mitigate?
  - How the mitigation plan can benefit my community/district
  - Overview of key mitigation plan elements & plan process
  - New FEMA guidance that will affect the 2024 update
- Hazard Summary Review
- Hazard Risk Assessment *(Exercise 1)*
- Mitigation Strategy and Mitigation Goals
- Public Survey Preliminary Findings
- Mitigation Funding Opportunities and Programs
- New and Existing Mitigation Actions *(Exercise 2)*
- Capability Assessment
- Plan Participation and Adoption
- Next Steps
- Closing Remarks

1

February 21, 2024 – Stakeholder Workshop (Session 1) Sign In Sheet *(page 1)*

Location: *Public Works Upper County Shop – 51 No. Mine Road, Cle Elum, WA 98922*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Public Works Upper County Shop – 51 No. 5 Mine Road, Cle Elum, WA 98922

Stakeholder Workshop
Date: Wednesday, February 21, 2024 (1:30 PM – 4:30 PM)

Name	Organization	Title	E-mail	Phone
COLLEDA MONICK	CITY OF CLE ELUM	PLANNING CONSULTANT	cmonick@hlacivil.com	509 966 7000
Arden Thomas	Kittitas County	Water Resource Manager	arden.thomas@co.kittitas.wa.us	509-962-7640
Matt MacKenzie	Town of S. Cle Elum	Public Works	southce@gmail.com	509-304-5459
Kyra Garnich	KCSO	EM Specialist	kyra.garnich@co.kittitas.waus	509-8596962
Mark Sederstrom	Cle Elum/Roslyn School Dist	Facility Director	sederstromm@cersd.org	509-674-9242
Tom Hastings	Snoq Pass Utility Dist	General Manager	thastings@snopass.org	425-434-6600
Eryn Micallef	Kittitas Co. Fire Dist 7	Chief Admin Offic	accounting@KCFD7.com	509-656-4100
Loren McFarland	Kittitas Co. Fire Dist 7	Interim Chief	LMcFarland@KCFD7.com	509-649-2789
Heidi Brands Cerniwey	Ellensburg	City Manager	cerniweyh@ellensburgwa.gov	509-899-9157
Terry Weiner	Ellensburg	City Atty	Weinert@ellensburgwa.gov	509-962-7259
Kelly Bacon	KCPH	LERC	Kelly.bacon.PH@co.Kittitas.WA.us	509-962-7002
Darren Higashiyama	KCSO/EM	Chief Deputy	darren.higashiyama@co.kittitas.wa.us	509-933-8206

1

February 21, 2024 – Stakeholder Workshop (Session 1) Sign In Sheet *(page 2)*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Public Works Upper County Shop – 51 No. 5 Mine Road, Cle Elum, WA 98922

Stakeholder Workshop
Date: Wednesday, February 21, 2024 (1:30 PM – 4:30 PM)

Name	Organization	Title	E-mail	Phone
Dan Young	Kittitas Co Fire Marshal	Fire Marshal	dan.young@co.kittitas.wa.us	509-962-7000
Ryan Risdon	KCFD #6	EM+Spec. ops coord	RRisdon@kcfpd6.com	509-656-6050
Geoff Scherer	Upper Kittitas Cnty Medic	Operation Manager	geoff.scherer@uppkittitascountymedicone.org	509 607 3161

2

Photos Stakeholder Workshops (Session 1)





February 22, 2024 – Stakeholder Workshop (Session 2) Sign In Sheet *(page 1)*

Location: *Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926

Stakeholder Workshop
Date: Thursday, February 22, 2024 (1:30 PM – 4:30 PM)

Name	Organization	Title	E-mail	Phone
Jeremy Johnston	City of Ellensburg	Planning Manager	johnstonj@ci.ellensburg.wa.us	509. 962-7232
Bryan Nash	Kittitas S.D.	maint. Transportation Director	bryan_nash@ksd403.org	509-201-3023
Mcmurray	City of Roslyn	Build Off	planner@ci.roslyn.wa.us	509.304.8337
Jon Morrow	Ellensburg	Storm Mgr.	Morrowj@ci.Ellensburg.WA.US	1) 9293844
Cepeda, R.A.	CWU	Emergency Mgr.	Robert.Cepeda@cwu.edu	509-963-2779
Derek Mayo	Ellensburg	City Engineer	mayod@ci.ellensburg.wa.us	509-929-5210
Jamey Ayling	Kittitas county	Planning Manager	Jamey.Ayling@co.kittitas.wa.us	509 -925-8605
Ed Mills	Cle Elum	Fire chief	emills@Cleelum.Gov	509 650-4067
Chuck Doan	City of Ellensburg	Building Off.	doanc@ci.ellensburg.wa.us	
Deja Blanchard	CWDK	Disability Specialist	disabilityspecialist@mycwdr.org	
Elliott Watkins	Central Wa. Disability Resource	Disability Rights Advocate	disabilityadvocate@mycwdr.org	509 962 9620
Christa Stream	City of Kittitas	City Admin	christa.stream@cityofkittitas.com	
Ryan Baker	City of Kittitas	PW Lead	Ryan.Baker@cityofkittitas.com	
Anna Lael	KCCD	District Mgr.	anna.lael@kccdnet.com	

February 22, 2024 – Stakeholder Workshop (Session 2) Sign In Sheet *(page 2)*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926

Stakeholder Workshop
Date: Thursday, February 22, 2024 (1:30 PM – 4:30 PM)

Name	Organization	Title	E-mail	Phone
Patti Stacey	Kittitas County Solid Waste	Facilities & Waste Operations Director	patti.stacey@co.kittitas.wa.us	509-962-7542
Mark Larson	Public Health	Health Officer	MARK.LARSON@CO.KITTITAS.WA.US	5095916448
Jay Wiseman	SNOQ. Pass Fire & Rescue	Fire Chief	jwiseman@SPFire.org	425-761-0781
John Sinclair	City of Ellensburg KVFR Kitt. Co Fire Dist 2	Fire Chief	sinclairj@KVFR.org	509-856-7714
Mark R Cook	Kittitas Co. PW	Director	mark.cook@co.kittitas.wa.us	509-962-7253
Brandon Schmidt	KCFD 1	Chief	kcfd1@fairpoint.net	509 964-2435
~~Ryan Drake~~	~~City of Kittitas~~	~~Public Works Director~~	~~ryan.drake@cityofkittitas.com~~	~~(509) 925-1249~~
Kelly Bacon	Kittitas Co. Public Health	LERC	Kelly.bacon.PH@co.kittitas.wa.us	509-962-7002

3

Photos Stakeholder Workshops (Session 2)





B.4. STAKEHOLDER WEBINAR – PUBLIC COMMENT PERIOD

In an effort to engage Kittitas County's stakeholders during the public comment period, two (2) webinars were hosted to provide further information on the Kittitas County Hazard Mitigation Plan 2025 update draft and guidance on the stakeholder support needed during the public comment period. This webinar was meant for Kittitas County Hazard Mitigation stakeholders – agencies, organizations, and community groups with a connection to hazard mitigation planning, implementation, and public outreach.

The webinar invite was sent to the full list of stakeholders listed in Section B.4 of this Plan. Additionally, all plan participants and Steering Committee members, listed in Section 1.5.2, were invited.

Both webinars were hosted on October 9, 2024; the first webinar was hosted during regular business hours while the second one was hosted after hours. The sign in sheets for the Stakeholder Webinars are below.

Subsequent to the webinars, an e-mail was sent to all invitees (i.e., plan participants, stakeholders, Steering Committee members) requesting plan review and feedback, and assistance in distributing information to the public, including the underserved population. Additionally, a public engagement toolkit was provided to assist with the dissemination for public comment. The toolkit included sample social media taglines, flyers, and infographics that stakeholders and plan participants could share with the community. The public comment period flyers, infographics, and website and social media post samples can be found in **Appendix C**.

Stakeholder Webinar – Public Comment Period (Session 1) Sign In Sheet

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Webinar – Public Comment Period

WebEx (https://kittitascounty.webex.com/kittitascounty/j.php?MTID=m9eab5f097033b97ac46dd96bafe57e68)

Stakeholder Webinar – Public Comment Period Date: 10/9/2024 (3:00 PM)				
Name	**Organization**	**Title**	**E-mail**	**Phone**
Yahiritza D. Álvarez	Integrated Solutions Consulting	Senior Consultant	Yahiritza.Alvarez@i-s-consulting.com	(847) 737-5395 (Ext. 161)
Arden Thomas	Kittitas County Public Works	Water Resource Manager	arden.thomas@co.kittitas.wa.us	(509) 962-7690
Samantha Cox	Kittitas County Public Works	Water Resource Specialist	Samantha.cox@co.kittitas.wa.us	(509) 962-7680
Rich Elliott	Kittitas Valley Fire and Rescue	Interim KITTCOM Director	elliottr@kvfr.org	(509) 201-6280
Tom Hastings	Snoqualmie Pass Utility District	General Manager	thastings@snopass.org	(425) 434-6600
Kasey Knutson	Kittitas County Public Health	Special Programs Coordinator	kasey.knutson@co.kittitas.wa.us	(509) 962-7090
John Marvin	Yakama Nation Fisheries	Habitat Biologist	marj@yakamafish-nsn.gov	(509) 949-2176
Keiko Walsh	HopeSource	Senior Transportation Manager	kwalsh@hopesource.us	(509) 925-1448

1

Stakeholder Webinar – Public Comment Period (Session 2) Sign In Sheet

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Webinar – Public Comment Period

WebEx (https://kittitascounty.webex.com/kittitascounty/j.php?MTID=m1b5d0bb5432ea89f284a5ac65a5fbd3e)

Stakeholder Webinar – Public Comment Period Date: 10/9/2024 (5:30 PM)				
Name	**Organization**	**Title**	**E-mail**	**Phone**
Yahiritza D. Álvarez	Integrated Solutions Consulting	Senior Consultant	Yahiritza.Alvarez@i-s-consulting.com	(847) 737-5395 (Ext. 161)
Arden Thomas	Kittitas County Public Works	Water Resource Manager	arden.thomas@co.kittitas.wa.us	(509) 962-7690
Samantha Cox	Kittitas County Public Works	Water Resource Specialist	Samantha.cox@co.kittitas.wa.us	(509) 962-7680
Sara Vickers	Kittitas Reclamation District	Lands Clerk/RRA Specialist	sara@krdistrict.org	(509) 925-6158

1

Stakeholder Webinar – Public Comment Period E-mail

From: Arden Thomas
Cc: Samantha Cox; Yahiritza Álvarez
Subject: Kittitas County Hazard Mitigation Plan Public Comment
Date: Wednesday, October 9, 2024 9:24:07 PM
Attachments: Kittitas County HMP Public Comment Flyer (English).png
Kittitas County HMP Public Comment Flyer (Spanish).png
Kittitas County HMP Public Comment Infographic (English).png
Kittitas County HMP Public Comment Infographic (Spanish).png
Stakeholder Public Comment Webinar - Kittitas County HMP.pdf
Public Comment Taglines.docx

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good Afternoon,

In an effort to make Kittitas County more resilient, the 2024 Kittitas County Hazard Mitigation Plan has been updated to provide a basis for identifying and managing natural hazards, and to meet federal, state, and local requirements for hazard mitigation and Federal Emergency Management Agency (FEMA) mitigation grant funding. The Plan identifies and assesses risks the County faces from 10 natural hazards and outlines strategies the County departments, municipalities, and special districts have identified for reducing the impact of these hazards.

Kittitas County is currently seeking stakeholder and public comment on the 2024 Kittitas County Hazard Mitigation Plan draft. The Plan is comprised of Volume 1, which includes the Countywide Planning Elements, and 15 Annexes – one (1) for each of the plan participants listed below.

Interested stakeholders and the public have until **November 7, 2024,** to review and provide feedback on the Plan and its annexes before it is submitted to the Washington Emergency Management Division and FEMA for review. The Plan is available for download via the Kittitas County Hazard Mitigation Plan website, along with instructions on how to submit comments.

We are asking our plan participants and stakeholders to assist us in distributing this information to the public. Your assistance is greatly appreciated. We have provided you with sample social media taglines, flyers, and infographics that you can share with your community. As you are sharing information about the plan and public comment period, please document your efforts! Outreach supporting documentation must be included in the Plan as a requirement by the Federal Emergency Management Agency, and it can include screenshots of social media posts, pictures at tabling events and bulletin boards, etc. We have also attached the powerpoint presentation from the stakeholder workshops held today, which has additional background information and Hazard Mitigation Planning and this update.

Cities, Towns, Unincorporated Kittitas County		
Kittitas County **(Volume 1)**	City of Ellensburg	Town of South Cle Elum

City of Cle Elum	City of Roslyn	
Special Districts		
Kittitas County Conservation District	Kittitas County Fire District #7	Kittitas Public Utility District
Kittitas Valley Fire & Rescue	Snoqualmie Pass Fire and Rescue	Snoqualmie Pass Utility District
Kittitas County Fire District #1	Cle Elum-Roslyn School District	Central Washington University
Kittitas County Fire District #6	Kittitas School District	

If you have any questions, please contact Samantha Cox with Kittitas Public Works via e-mail at samantha.cox@co.kittitas.wa.us.

Thank you,

Arden Thomas | Water Resource Program Manager
Kittitas County Public Works | 411 North Ruby, Suite 1 | Ellensburg, WA 98926
Direct: 509.962.7690

B.5. WHOLE COMMUNITY

Kittitas County provided key stakeholders an opportunity to be involved in the planning process. This included, but was not limited to, sharing information and input to inform the Plan's content; assist with targeted outreach and engagement, especially for the underserved communities; and review and provide feedback on the Plan during the plan comment period. Stakeholders are individuals or groups that a mitigation action or policy affects and involving them in the planning process helps obtain support for the Plan and identify barriers to carry out hazard mitigation.

The following stakeholder types were provided with an opportunity to be part of the planning process.

- Local and regional agencies involved in hazard mitigation activities (e.g., public works, emergency management, local floodplain administration, and GIS departments).
- Agencies that have the authority to regulate development (e.g., zoning, planning, community and economic development departments, building officials, planning, commissions, and other elected officials).
- Neighboring communities (e.g., Adjacent local governments, including special districts and tribes, that are affected by similar hazard events. They also may share a mitigation action or project that crosses jurisdictional boundaries).
- Businesses, academia, and other private interests (e.g., private utilities, chambers of commerce, dam owners, local or regional educational centers within the jurisdiction, or major employers that sustain community lifelines).
- Nonprofit organizations, including community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations (e.g., faith-based organizations, disability agencies or non-governmental organizations, rural support agencies, health and social services departments, housing agencies, and housing advocacy groups).

The stakeholders that were provided with an opportunity to participate in the planning process, including review and feedback of the draft Plan, for the Kittitas County Hazard Mitigation Plan are listed below in no particular order.

Local and Regional Agencies	
KITTCOM (Kittitas County 9-1-1)	Kittitas County Solid Waste
Kittitas County Coroner	Kittitas Public Utility District
Kittitas County Emergency Management	Kittitas Reclamation District
Kittitas County EMS Division	Roslyn Fire Department
Kittitas County Fire Marshal's Office	Upper Kittitas County Medic One
Kittitas County Public Health	Washington State Department of Transportation
Kittitas County Sheriff's Office	Yakama Nation Fisheries

Agencies that have Authority to Regulate Development	
Kittitas County Community Development Services	Kittitas County Public Works

Neighboring Communities	
Chelan County	Grant County
City of Kittitas	Yakima County

Nonprofit Organizations	
Allied People Offering Year-Round Outreach (APOYO)	Kittitas County Health Network
American Red Cross	Kittitas Conservation Trust
Central Washington Disabilities Resource	Kittitas Environmental Education Network
Elmview	Mid-Columbia Fisheries Enhancement Group
FISH Food Bank	OpenDoor Health Clinic
HopeSource	

Business, Academia, and Other Private Organizations	
American Rivers	Kittitas School District
Ellensburg School District	Kittitas Valley Healthcare
Cle Elum/Roslyn School District	Puget Sound Energy
Kittitas County Chamber of Commerce	Washington State University

APPENDIX C. PUBLIC ENGAGEMENT

The mitigation planning process promotes awareness of hazard risks and continues the conversation about the community's safety and resilience. A hazard mitigation plan generates additional community support when it accurately reflects the values and priorities of the community which will lead to successfully implementing the mitigation actions and projects identified in this Plan.

Federal regulations for mitigation plan approval require that stakeholders and the general public be given opportunities to be involved in the plan's development and update process. Input from community members can strengthen the content and outcomes of the hazard mitigation plan. Furthermore, the plan must state continued public engagement as the Plan is carried out during its lifetime.

A public outreach strategy outlines what the community intends to achieve throughout the outreach efforts. Additionally, it identifies who to involve in the process, and how and when to effectively engage the community. Kittitas County stakeholders and the public were given a number of opportunities to be involved throughout the planning process. Opportunities were provided via a public survey, in-person public meetings, and public engagement activities to review the Plan draft (i.e., public comment period).

Survey results, public meeting documentation (i.e., agendas, sign in sheets, and photos), and public comment period outreach activities are included in this section.

How Public Input was Incorporated into the Plan

Information and feedback gained through the public survey, public meetings, and public comment period provided valuable data to inform, validate, and confirm the risk assessment findings and potential mitigation strategies. Specifically, feedback from the public offered during the public meetings offered greater insights into the public's concerns regarding specific hazards and their impacts. The public also offered specific initiatives they felt would create greater resiliency for the County and its residents.

Survey results helped validate the hazards included in the Plan, the hazard ranking process, and areas where the County and jurisdictions could further improve outreach and education efforts. Open-ended responses, specifically regarding their experience with damages from past hazards, helped to validate hazard-specific impact data in Chapter 4 of this Plan. These, and related findings, helped the Core Planning Team and local planning teams determine meaningful mitigation projects.

After the public comment period ended, nine (9) feedback forms were received from the public and stakeholders. The Local Planning Team reviewed the feedback and will implement mitigation and preparedness efforts moving forward, if deemed appropriate. However, in order to keep the Plan current after it is approved, the County will ensure that the public continues to be involved in the Plan and how it is carried out. Refer to Section C.4 of this Plan for further details on continued public engagement.

C.1. PUBLIC MEETINGS

Kittitas County Public Works hosted two (2) public meetings throughout the County on February 21, 2024, and February 22, 2024. These allowed the County to introduce the Plan update, identify additional hazards of concern that should be included, if any, and to provide input for the various mitigation measures intended to eliminate or reduce the negative impact to those hazards. Language translation assistance in Spanish was available in all public meetings.

During the Public Meetings, forms were provided to each participant to identify and describe how the identified hazards for Kittitas County have impacted (or could impact) their place of residence and/or work, municipality, or organization. Additionally, participants were asked to provide mitigation actions/ideas and to identify additional hazards of concern. Although highly encouraged, these forms were voluntary and confidential.

The public meeting agendas and sign in sheets are below.

February 21, 2024 – Public Meeting #1 Agenda

Location: *Centennial Center – 719 E 3rd Street, Cle Elum, WA 98922*

Kittitas County, Washington
2024 Hazard Mitigation Plan Update
Public Meeting

Date:
Wednesday, February 21, 2024

Time:
5:00 PM – 6:15 PM

Location:
Centennial Center
719 E 3rd Street, Cle Elum, WA 98922

Agenda

Welcome, Introductions, and Opening Remarks

Hazard Mitigation Overview

Hazard Mitigation Benefits

Hazard Mitigation Planning Overview

Public Survey Results

Hazard List Summary

Hazard Risk Assessment (Exercise 1)

Hazard Assessment Form (Exercise 2)

Mitigation Goals

Mitigation Actions/Ideas (Exercise 3)

Closing Remarks

1

February 21, 2024 – Public Meeting #1 Sign in Sheet

2024 Kittitas County Hazard Mitigation Plan Update
Public Meeting

Centennial Center – 719 E 3rd Street, Cle Elum, WA 98922

Public Meeting
Date: Wednesday, February 21, 2024 (5:00 PM – 6:30 PM)

Name	Organization *(If applicable)*	Title *(If applicable)*	E-mail *(Optional)*	Phone Number *(Optional)*
Kelly	KCPH	LERC	Kelly.bacon.PhD@co.kittitas.wa.us	509-962-7092
Kyra Garnich	KCSO	EM Specialist	kyra.garnich@co.kittitas.wa.us	509-859-6960
Paula McMinn	Co Resident	Retired Teacher	mmcminn18@gmail.com	
Darren Higashiyama	KCSO			
Arden Thomas	KCPW	Water Resource Mngr	arden.thomas@co.kittitas.wa.us	509-962-7670

1

Photos Public Meeting #1





February 22, 2024 – Public Meeting #2 Agenda

Location: *Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926*

Kittitas County, Washington
2024 Hazard Mitigation Plan Update
Public Meeting

Date:
Thursday, February 22, 2024

Time:
5:00 PM – 6:15 PM

Location:
Kittitas County Event Center Armory Main Hall
901 E 7th Avenue, Ellensburg, WA 98926

Agenda

Welcome, Introductions, and Opening Remarks

Hazard Mitigation Overview

Hazard Mitigation Benefits

Hazard Mitigation Planning Overview

Public Survey Results

Hazard List Summary

Hazard Risk Assessment (Exercise 1)

Hazard Assessment Form (Exercise 2)

Mitigation Goals

Mitigation Actions/Ideas (Exercise 3)

Closing Remarks

1

February 22, 2024 – Public Meeting #2 Sign in Sheet *(page 1)*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926

Public Meeting
Date: Thursday, February 22, 2024 (5:00 PM – 6:30 PM)

Name	Organization *(If applicable)*	Title *(If applicable)*	E-mail *(Optional)*	Phone Number *(Optional)*
Dee Anderson	–	–		425-330-1079
Sarah Beauchamp	City of Ellensburg	council member		
* Cheryl Chance			cheryl chance@fairpoint.net	509. 929. 6818
Theresa Plue			trplue@gmail. com	509-962-3240
Nancy Lillquist	City of Ellensburg	Council	lillquistn@ci.ellensburg.wa.us	
Ed Harnell			rosemaryanded@gmail	925-1005
Brigit Mitchell	" "		brigitmitchell2016@gmail	509-986-0389
CARON VANORMAN			VANORMCC@GMAIL.COM	5093062883
Jan Sue Patterson			jandmelectric.mpa@gmail.com	

1

February 22, 2024 – Public Meeting #2 Sign in Sheet *(page 2)*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926

Public Meeting
Date: Thursday, February 22, 2024 (5:00 PM – 6:30 PM)

Name	Organization *(If applicable)*	Title *(If applicable)*	E-mail *(Optional)*	Phone Number *(Optional)*
Scott Heavers	N/A SAVE CRAIGS HILL	N/A	—	—
Penney Whitman	Save Craigs Hill	N/A		
Marilyn Adams	Save Craigs Hill	N/A		
MAC PRATH	SAVE CRAIGS HILL	NA		
Angie Lang	Save Craigs Hill	N/A	angsteward28@yahoo.com	[redacted]
CURT JUCSTUS	SAVE CRAIG'S HILL	NA	CURT-1946@ICLOUD.COM	
F. Leonard	SAVE CRAIG'S HILL	N/A		
Sarah Nickel	10th Generation	Educator, Counselor, Teacher	—	(509) 925-4968
[illegible]	[illegible]		[illegible]	[illegible]
Lori Harper	Save Craigs Hill	NA		
Sharon Hillmer	Save Craigs Hill	NA	—	
Tim Calke	Save Craigs Hill	N/A	—	—

3

February 22, 2024 – Public Meeting #2 Sign in Sheet *(page 3)*

2024 Kittitas County Hazard Mitigation Plan Update
Stakeholder Workshop

Kittitas County Event Center Armory Main Hall – 901 E 7th Avenue, Ellensburg, WA 98926

Public Meeting
Date: Thursday, February 22, 2024 (5:00 PM – 6:30 PM)

Name	Organization *(If applicable)*	Title *(If applicable)*	E-mail *(Optional)*	Phone Number *(Optional)*
Rhonda Griffith	Save Craigs hill		flyinggranch1@fairpoint.net	
Darrell Dyson	"			
Arlene Samuelson	Save Craigs hill			
Curt Samuelson	"			

4

Photos Public Meeting #2





Public Meeting Outreach Samples



Kittitas County Public Health Department
February 8 ·

Kittitas County Public Works wants to know how it can better prepare you for disasters. Come join us on Wednesday, February 21, 2024, from 5:00 PM to 6:15 PM at Centennial Center, located at 719 E 3rd Street, Cle Elum, WA 98922. Doors will open at 5:00 PM and the presentation will begin at 5:15 PM.

The meeting will provide the public an opportunity to review the potential hazards that could occur within Kittitas County and will request input for the various mitigation measures intended to eliminate or reduce the impact of those hazards. Spanish assistance will be provided.

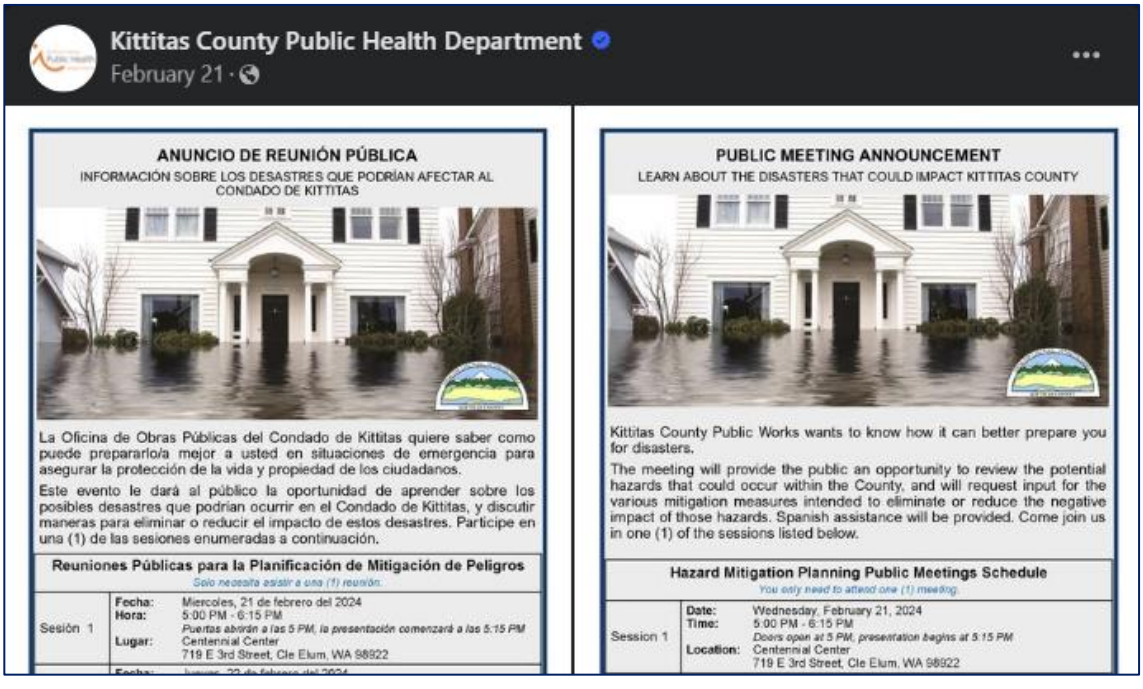
For questions, please contact the Kittitas County Public Works via phone at (509) 962-7523 or e-mail at publicworks@co.kittitas.wa.us.

La Oficina de Obras Públicas del Condado de Kittitas quiere saber como puede prepararlo/a mejor a usted en situaciones de emergencia para asegurar la protección de la vida y propiedad de los ciudadanos.

Acompáñenos el miércoles, 21 de febrero del 2024, de 5:00 PM a 6;15 PM. La reunión será en Centennial Center en 719 E 3rd Street, Cle Elum, WA 98922. Las Puertas abrirán a las 5:00 PM y la presentación comenzará a las 5:15 PM.

Este evento le dará al público la oportunidad de aprender sobre los posibles desastres que podrían ocurrir en el Condado de Kittitas, y discutir maneras para eliminar o reducir el impacto de estos desastres.

Si tiene preguntas, comuníquese con la Oficina de Obras Públicas del Condado de Kittitas por teléfono a (509) 962-7523 o correo electrónico a publicworks@co.kittitas.wa.us.



Kittitas County Public Health Department
February 21 ·

ANUNCIO DE REUNIÓN PÚBLICA
INFORMACIÓN SOBRE LOS DESASTRES QUE PODRÍAN AFECTAR AL CONDADO DE KITTITAS

La Oficina de Obras Públicas del Condado de Kittitas quiere saber como puede prepararlo/a mejor a usted en situaciones de emergencia para asegurar la protección de la vida y propiedad de los ciudadanos.

Este evento le dará al público la oportunidad de aprender sobre los posibles desastres que podrían ocurrir en el Condado de Kittitas, y discutir maneras para eliminar o reducir el impacto de estos desastres. Participe en una (1) de las sesiones enumeradas a continuación.

Reuniones Públicas para la Planificación de Mitigación de Peligros
Solo necesita asistir a una (1) reunión.

Sesión 1	Fecha:	Miercoles, 21 de febrero del 2024
	Hora:	5:00 PM - 6:15 PM *Puertas abrirán a las 5 PM, la presentación comenzará a las 5:15 PM*
	Lugar:	Centennial Center 719 E 3rd Street, Cle Elum, WA 98922

PUBLIC MEETING ANNOUNCEMENT
LEARN ABOUT THE DISASTERS THAT COULD IMPACT KITTITAS COUNTY

Kittitas County Public Works wants to know how it can better prepare you for disasters.

The meeting will provide the public an opportunity to review the potential hazards that could occur within the County, and will request input for the various mitigation measures intended to eliminate or reduce the negative impact of those hazards. Spanish assistance will be provided. Come join us in one (1) of the sessions listed below.

Hazard Mitigation Planning Public Meetings Schedule
You only need to attend one (1) meeting.

Session 1	Date:	Wednesday, February 21, 2024
	Time:	5:00 PM - 6:15 PM *Doors open at 5 PM, presentation begins at 5:15 PM*
	Location:	Centennial Center 719 E 3rd Street, Cle Elum, WA 98922

PUBLIC MEETING ANNOUNCEMENT

LEARN ABOUT THE DISASTERS THAT COULD IMPACT KITTITAS COUNTY



Kittitas County Public Works wants to know how it can better prepare you for disasters.

The meeting will provide the public an opportunity to review the potential hazards that could occur within the County, and will request input for the various mitigation measures intended to eliminate or reduce the negative impact of those hazards. Spanish assistance will be provided. Come join us in one (1) of the sessions listed below.

Hazard Mitigation Planning Public Meetings Schedule

You only need to attend one (1) meeting.

Session 1	**Date:**	Wednesday, February 21, 2024
	Time:	5:00 PM - 6:15 PM *Doors open at 5 PM, presentation begins at 5:15 PM*
	Location:	Centennial Center 719 E 3rd Street, Cle Elum, WA 98922
Session 2	**Date:**	Thursday, February 22, 2024
	Time:	5:00 PM - 6:15 PM *Doors open at 5 PM, presentation begins at 5:15 PM*
	Location:	Kittitas County Event Center Armory Main Hall 901 E 7th Avenue, Ellensburg, WA 98926

For questions, please contact the Kittitas County Public Works via phone at (509) 962-7523 or e-mail at publicworks@co.kittitas.wa.us.

ANUNCIO DE REUNIÓN PÚBLICA

INFORMACIÓN SOBRE LOS DESASTRES QUE PODRÍAN AFECTAR AL CONDADO DE KITTITAS



La Oficina de Obras Públicas del Condado de Kittitas quiere saber como puede prepararlo/a mejor a usted en situaciones de emergencia para asegurar la protección de la vida y propiedad de los ciudadanos.

Este evento le dará al público la oportunidad de aprender sobre los posibles desastres que podrían ocurrir en el Condado de Kittitas, y discutir maneras para eliminar o reducir el impacto de estos desastres. Participe en una (1) de las sesiones enumeradas a continuación.

Reuniones Públicas para la Planificación de Mitigación de Peligros

Solo necesita asistir a una (1) reunión.

Sesión 1	**Fecha:**	Miercoles, 21 de febrero del 2024
	Hora:	5:00 PM - 6:15 PM *Puertas abrirán a las 5 PM, la presentación comenzará a las 5:15 PM*
	Lugar:	Centennial Center 719 E 3rd Street, Cle Elum, WA 98922
Sesión 2	**Fecha:**	Jueves, 22 de febrero del 2024
	Hora:	5:00 PM - 6:15 PM *Puertas abrirán a las 5 PM, la presentación comenzará a las 5:15 PM*
	Lugar:	Kittitas County Event Center Armory Main Hall 901 E 7th Avenue, Ellensburg, WA 98926

Si tiene preguntas, comuníquese con la Oficina de Obras Públicas del Condado de Kittitas por teléfono a (509) 962-7523 o correo electrónico a publicworks@co.kittitas.wa.us.

C.2. PUBLIC SURVEY

The 2025 Kittitas County Hazard Mitigation Questionnaire (i.e., Public Survey) was available in English and Spanish. The Surveys opened during Labor Day Weekend 2023. The Survey was distributed and promoted through a variety of methods such as social media (e.g., Facebook, Instagram, Twitter), press releases to the County and Public Information Officers (PIOs), and county public events. Community organizations and Plan Participants were critical in connecting county and city residents with the Survey, and Kittitas County Public Works used their broad-based distribution lists of community stakeholders to disseminate the Survey to residents and employees. Ultimately, respondents for this Survey were selected from among those who volunteered to participate. No special weighting was done to reflect the demographic composition of the County.

As part of this Survey, Steering Committee members, community representatives, and members of the public were asked to rate each of the hazards in terms of perceived risk. Furthermore, they were asked to rate "mitigation importance" for each of the identified hazards in the Plan. The information gathered from this survey was used to inform the hazard risk prioritization process, and to ensure the Plan adequately addressed the public's' concerns and priorities.

The Survey had a total of 33 questions of multiple choice and open-ended questions. In total 159 respondents participated in the two (2) surveys. To ensure all data can be accurately correlated, only the survey completed (in its entirety) was used in this report. In some situations, the respondent chose not to answer one (1) or more questions which is why some discrepancies exist in the total number of responses per question. **Table C-1** provides a breakdown of the Survey responses for each language.

Table C-1. Public Survey Response Summary

Survey Status	Total	
	English	Spanish
Completed	107	1
Partial	39	5
Disqualified*	6	0
TOTAL	**152**	**6**

**A survey response is Disqualified when the respondent selects "No, I do not live or work in Kittitas County." for question 1.*

Note: After the survey was made public, minor changes to the hazards list were made. These changes include:

- Dam Failure was changed to Dam and Levee Failure.
- Extreme cold and extreme heat were added under the Severe Weather category.
- Volcano was changed to Volcano Activity.
- Wildfire smoke was added under the Wildfire category.
- Winter Storms were changed to Winter Weather which now includes ice storms, heavy snow, and blizzards.
- Communicable Diseases/Pandemic was added as a new hazard.

Public Survey Outreach Samples

This flyer was inserted in the envelope for Repetitive Loss letters that were mailed to 399 properties within the Repetitive Loss Area based on flood insurance claims on October 2, 2023.

Kittitas County Hazard Mitigation Plan

WE NEED YOU!

Kittitas County is working to update the local hazard mitigation plan. You can help by participating in our brief personal mitigation and preparedness survey. Your input will be used to inform plan development regarding natural hazards and the ways in which we can mitigate risk.
To take the survey scan the QR code, or go to: tinyurl.com/KittitasCoHMP



Kittitas County Public Health Department
February 2 ·

Are you prepared for the next disaster? Let the County know! Kittitas County residents and businesses can help the County update its emergency preparedness plans by participating in a voluntary online survey. Feedback from the confidential 10-minute survey will enable the Kittitas County Public Works to better serve residents and businesses before, during, and after an emergency or disaster.

The survey is available in English and Spanish. To complete the survey, please go to:

English Survey: https://survey.alchemer.com/.../2023-Kittitas-County...
Spanish Survey: https://survey.alchemer.com/.../2023-Condado-de-Kittitas...

For a hard copy version of the survey, please contact the Kittitas County Public Works via phone at (509) 962-7523 or e-mail at publicworks@co.kittitas.wa.us.

¿Está preparado/a para el próximo desastre? ¡Déjele saber al condado! Los residentes y negocios del Condado de Kittitas pueden ayudar al condado a actualizar sus planes de preparación para emergencias participando en una encuesta en línea voluntario. La encuesta será confidencial y deberá tomar 10 minutos para completar. Los resultados permitirán a la Oficina de Obras Públicas del Condado de Kittitas servirle mejor antes, durante y después de una emergencia o desastre.

El cuestionario está disponible en inglés y español. Para completarlo, por favor visite:

Cuestionario en Español: https://survey.alchemer.com/.../2023-Condado-de-Kittitas...
Cuestionario en Ingles: https://survey.alchemer.com/.../2023-Kittitas-County...

Para obtener una versión impresa de la encuesta, por favor contacte a la Oficina de Obras Públicas del Condado de Kittitas por teléfono a (509) 962-7523 o correo electrónico a publicworks@co.kittitas.wa.us.




Kittitas County Public Health Department
February 25 ·
What have you done to prepare for the next disaster? How can Kittitas County help? Let us know by taking this survey! https://survey.alchemer.com/.../2023-Kittitas-County...
¿Qué ha hecho usted para prepararse para el próximo desastre? ¿Cómo puede el Condado de Kittitas ayudarle? ¡Háganos saber participando en esta encuesta!
https://survey.alchemer.com/.../2023-Condado-de-Kittitas...


Kittitas County Public Health Department
February 26 ·
Kittitas County Public Works wants to know how it can better prepare you for disasters. All responses are confidential and will greatly help improve preparedness in the County. Join the conversation at https://survey.alchemer.com/.../2023-Kittitas-County....
La Oficina de Obras Públicas del Condado de Kittitas quiere saber cómo puede prepararlo/a mejor a usted para desastres. Todas las respuestas son confidenciales y contribuirán significativamente a mejorar la preparación en el condado. Únase a la conversación aquí
https://survey.alchemer.com/.../2023-Condado-de-Kittitas....
El Condado de Kittitas quiere saber cómo puede prepararlo/a mejor a usted para desastres.
Kittitas County wants to know how it can better prepare you for disasters.


Kittitas County Public Health Department
February 29 ·
Kittitas County Public Works invites you to take our disaster preparedness survey! Don't miss your opportunity to join the conversation. https://survey.alchemer.com/.../2023-Kittitas-County...
La Oficina de Obras Públicas del Condado de Kittitas le invita a participar en nuestra encuesta sobre la preparación para desastres. ¡No pierda la oportunidad para unirse a la conversación! https://survey.alchemer.com/.../2023-Condado-de-Kittitas...
¿Qué tan preparado está el Condado de Kittitas para desastres?
How prepared is Kittitas County for disasters?


How prepared is Kittitas County for disasters?
Join the conversation here:
tinyurl.com/KittitasCoHMP


¿Qué tan preparado está el Condado de Kittitas para desastres?
Únase a la conversación aquí:
tinyurl.com/KittitasCoHMP-EspanolP


Kittitas County wants to know how it can better prepare you for disasters.
Join the conversation here:
tinyurl.com/KittitasCoHMP


El Condado de Kittitas quiere saber cómo puede prepararlo/a mejor a usted para desastres.
Únase a la conversación aquí:
tinyurl.com/KittitasCoHMP-EspanolP

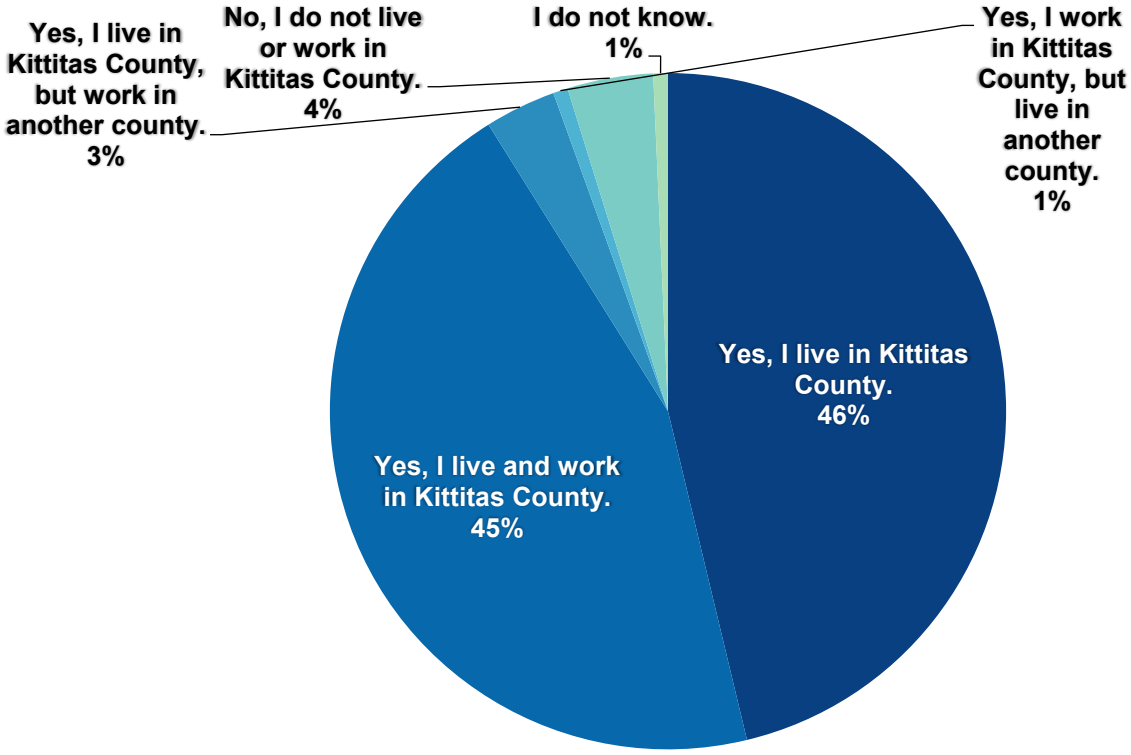

¿Está preparado para el próximo desastre?
¡Hágaselo saber al condado!
Complete la encuesta de preparación.
tinyurl.com/KittitasCoHMP-EspanolP


Are you prepared for the next disaster?
Let Kittitas County know!
Take our disaster preparedness survey.
tinyurl.com/KittitasCoHMP

Public Survey Results

NOTE: *This is the redacted version of the Survey. Open-ended responses from the public were NOT included in this version to ensure confidentiality and privacy.*

Question 1: Do you live and/or work in Kittitas County? Please select the best answer that applies to your current situation.

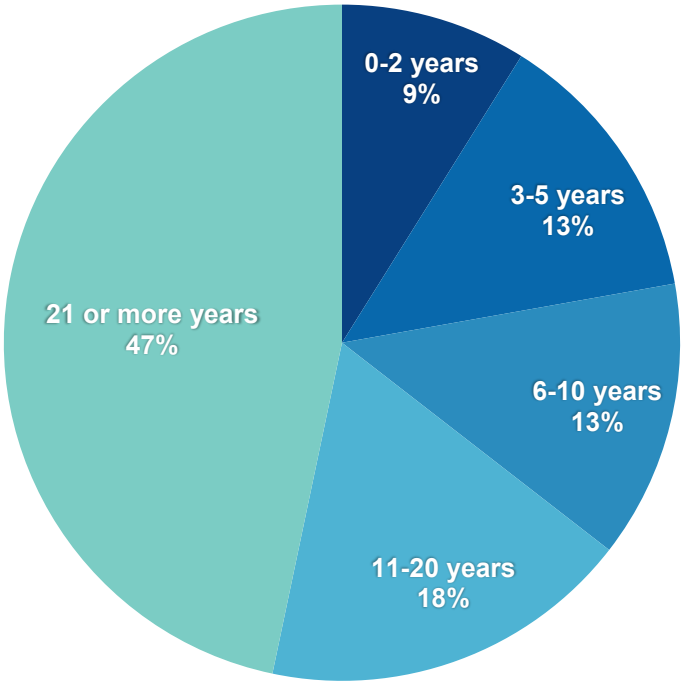


Value	Percent	Total Responses
Yes, I live in Kittitas County.	46.2%	67
Yes, I live and work in Kittitas County.	44.8%	65
Yes, I live in Kittitas County, but work in another county.	3.4%	5
Yes, I work in Kittitas County, but live in another county.	0.7%	1
No, I do not live or work in Kittitas County.	4.1%	6
I do not know.	0.7%	1
	TOTAL	**145**

Spanish Survey Results

Value	Percent	Total Responses
Yes, I live in Kittitas County.	0.0%	0
Yes, I live and work in Kittitas County.	100.0%	1
Yes, I live in Kittitas County, but work in another county.	0.0%	0
Yes, I work in Kittitas County, but live in another county.	0.0%	0
No, I do not live or work in Kittitas County.	0.0%	0
I Do Not Know.	0.0%	0
	TOTAL	**1**

Question 2: Approximately how many years have you lived in Kittitas County?

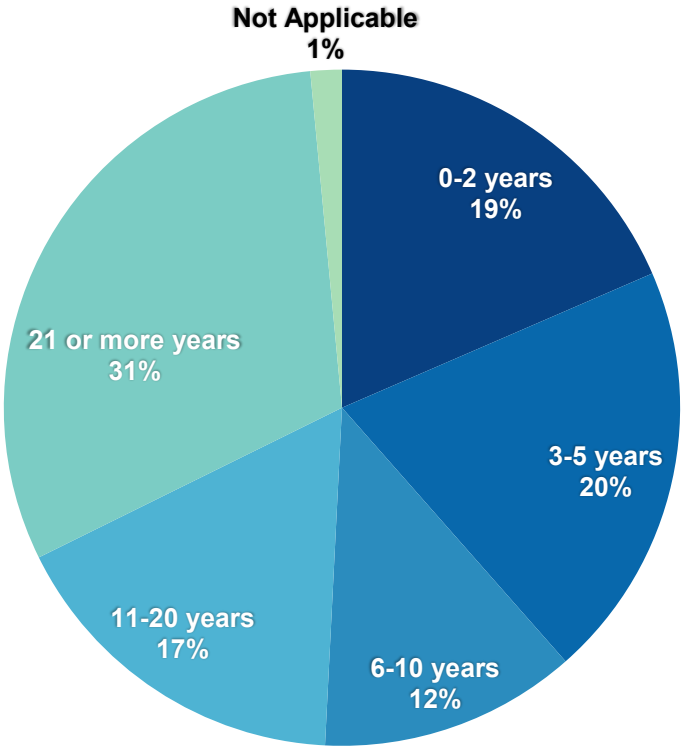


Value	Percent	Total Responses
0-2 years	8.9%	12
3-5 years	13.3%	18
6-10 years	13.3%	18
11-20 years	17.8%	24
21 or more years	46.7%	63
Not Applicable	0.0%	0
I Do Not Know	0.0%	0
	TOTAL	**135**

Spanish Survey Results

Value	Percent	Total Responses
0-2 years	0.0%	0
3-5 years	0.0%	0
6-10 years	0.0%	0
11-20 years	100.0%	1
21 or more years	0.0%	0
Not Applicable	0.0%	0
I Do Not Know	0.0%	0
TOTAL		**1**

Question 3: Approximately how many years have you worked in Kittitas County?



Value	Percent	Total Responses
0-2 years	18.5%	12
3-5 years	20.0%	13
6-10 years	12.3%	8
11-20 years	16.9%	11
21 or more years	30.8%	20
Not Applicable	1.5%	2
I Do Not Know	0.0%	0
	TOTAL	**65**

Spanish Survey Results

Value	Percent	Total Responses
0-2 years	0.0%	0
3-5 years	0.0%	0
6-10 years	0.0%	0
11-20 years	100.0%	1
21 or more years	0.0%	0
Not Applicable	0.0%	0
I Do Not Know	0.0%	0
	TOTAL	**1**

Question 4: Please indicate which community in Kittitas County you live in.

Community	Percent	Total Responses
Unincorporated County	27.6%	35
City of Cle Elum	15.0%	19
City of Ellensburg	42.5%	54
City of Kittitas	3.9%	5
City of Roslyn	3.9%	5
Town of South Cle Elum	2.4%	3
Town of Easton	1.6%	2
Town of Ronald	0.8%	1
Town of Snoqualmie Pass	2.4%	3
Town of Thorp	0.0%	0
Town of Vantage	0.0%	0
	TOTAL	**127**

Spanish Survey Results

Community	Percent	Total Responses
Unincorporated County	0.0%	0
City of Cle Elum	0.0%	0
City of Ellensburg	100.0%	1
City of Kittitas	0.0%	0
City of Roslyn	0.0%	0
Town of South Cle Elum	0.0%	0
Town of Easton	0.0%	0
Town of Ronald	0.0%	0
Town of Snoqualmie Pass	0.0%	0
Town of Thorp	0.0%	0
Town of Vantage	0.0%	0
	TOTAL	**1**

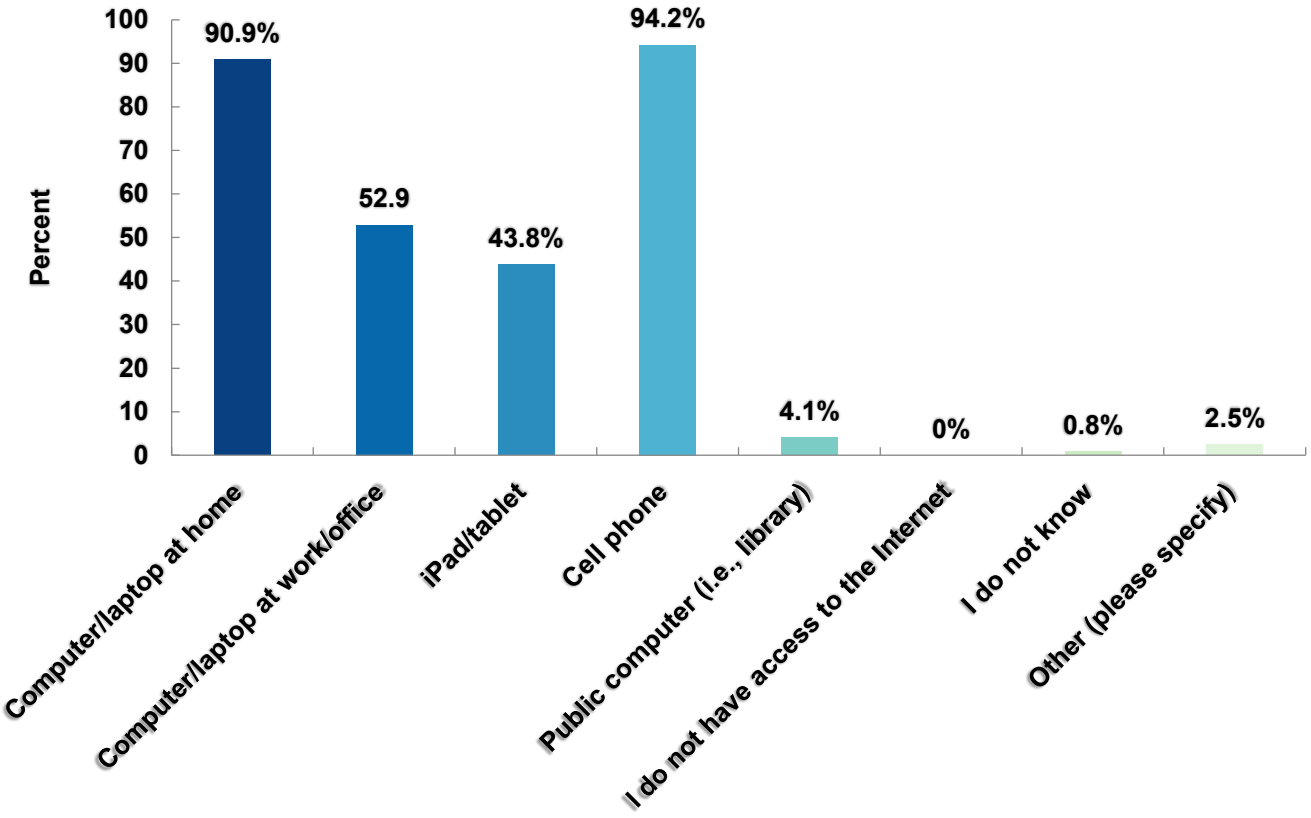
Question 5: Please indicate which community in Kittitas County you work in.

Community	Percent	Total Responses
Unincorporated County	12.3%	8
City of Cle Elum	16.9%	11
City of Ellensburg	56.9%	37
City of Kittitas	0.0%	0
City of Roslyn	4.6%	3
Town of South Cle Elum	1.5%	1
Town of Easton	1.5%	1
Town of Ronald	1.5%	1
Town of Snoqualmie Pass	4.6%	3
Town of Thorp	0.0%	0
Town of Vantage	0.0%	0
TOTAL		**65**

Spanish Survey Results

Community	Percent	Total Responses
Unincorporated County	0.0%	0
City of Cle Elum	0.0%	0
City of Ellensburg	100.0%	1
City of Kittitas	0.0%	0
City of Roslyn	0.0%	0
Town of South Cle Elum	0.0%	0
Town of Easton	0.0%	0
Town of Ronald	0.0%	0
Town of Snoqualmie Pass	0.0%	0
Town of Thorp	0.0%	0
Town of Vantage	0.0%	0
TOTAL		**1**

Question 6: Please indicate what type of device(s) you use to access the internet. Select ALL that apply.

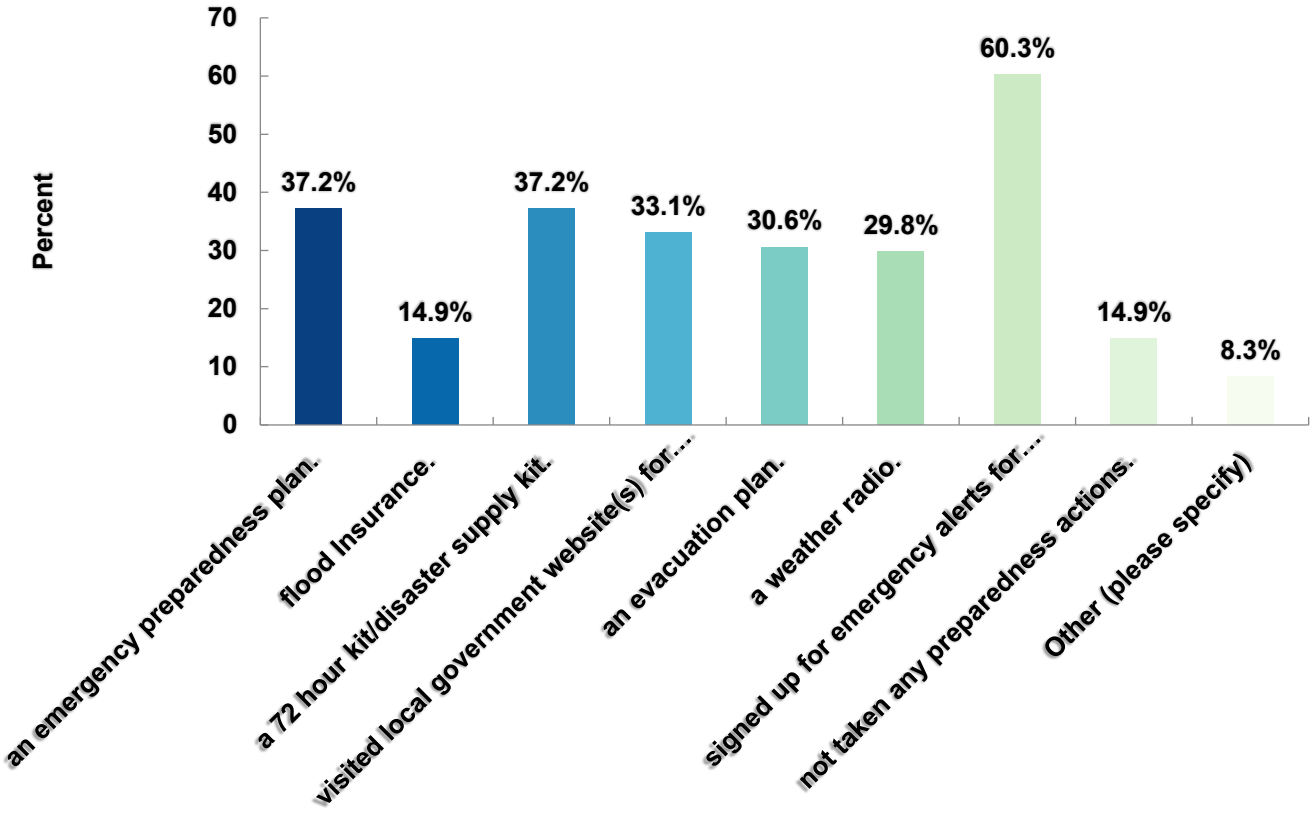


Value	Percent	Total Responses
Computer/laptop at home	90.9%	110
Computer/laptop at work/office	52.9%	64
iPad/tablet	43.8%	53
Cell phone	94.2%	114
Public computer (i.e., library)	4.1%	5
I do not have access to the Internet	0.0%	0
I Do Not Know	0.8%	1
Other (please specify)	2.5%	3

Spanish Survey Results

Value	Percent	Total Responses
Computer/laptop at home	0.0%	0
Computer/laptop at work/office	100.0%	1
iPad/tablet	0.0%	0
Cell phone	100.0%	1
Public computer (i.e., library)	0.0%	0
I do not have access to the Internet	0.0%	0
I Do Not Know	0.0%	0
Other (please specify)	0.0%	0

Question 7: Please indicate those activities you have done to prepare for emergencies and disasters. Please select ALL that apply. I have…

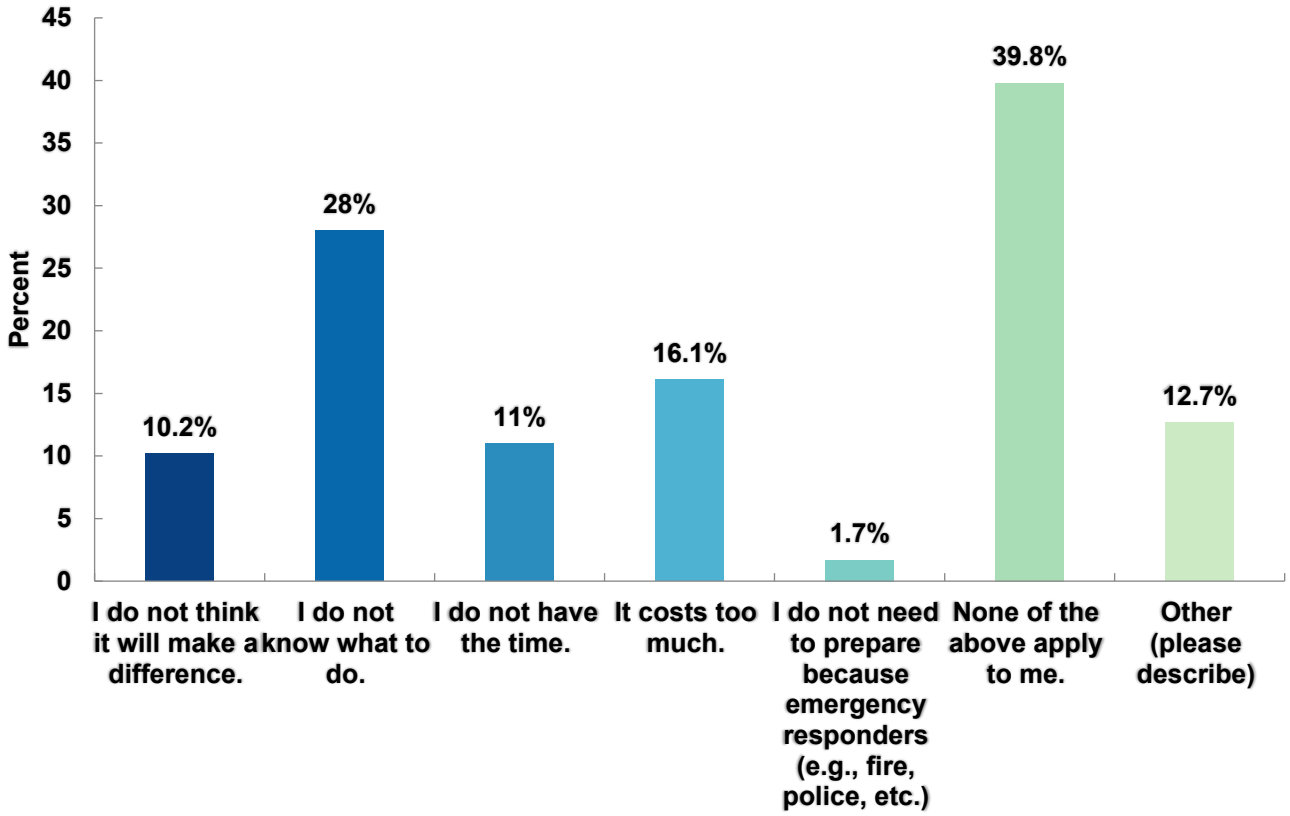


Value	Percent	Total Responses
an emergency preparedness plan.	37.2%	45
flood Insurance.	14.9%	18
a 72 hour kit/disaster supply kit.	37.2%	45
visited local government website(s) for emergency preparedness information.	33.1%	40
an evacuation plan.	30.6%	37
a weather radio.	29.8%	36
signed up for emergency alerts for Kittitas County (from any source).	60.3%	73
not taken any preparedness actions.	14.9%	18
Other (please specify)	8.3%	10

Spanish Survey Results

Value	Percent	Total Responses
an emergency preparedness plan.	100.0%	1
flood Insurance.	0.0%	0
a 72 hour kit/disaster supply kit.	100.0%	1
visited local government website(s) for emergency preparedness information.	100.0%	1
an evacuation plan.	0.0%	0
a weather radio.	0.0%	0
signed up for emergency alerts for Kittitas County (from any source).	0.0%	0
not taken any preparedness actions.	0.0%	0
Other (please specify)	0.0%	0

Question 8: Have any of the reasons below prevented you from pursuing additional preparedness activities? Please select ALL that apply.

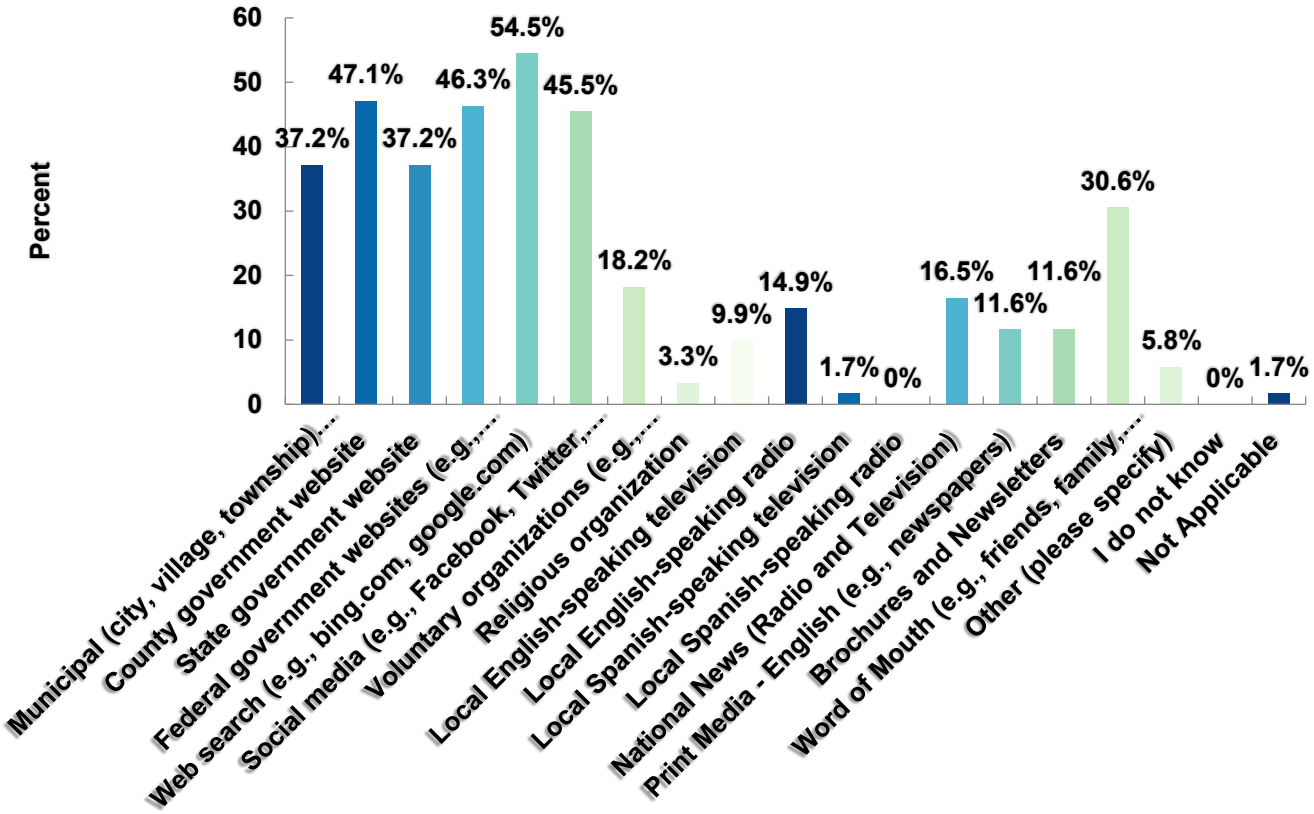


Value	Percent	Total Responses
I do not think it will make a difference.	10.2%	12
I do not know what to do.	28.0%	33
I do not have the time.	11.0%	13
It costs too much.	16.1%	19
I do not need to prepare because emergency responders (e.g., fire, police, etc.) will help me during an emergency.	1.7%	2
None of the above apply to me.	39.8%	47
Other (please describe)	12.7%	15

Spanish Survey Results

Value	Percent	Total Responses
I do not think it will make a difference.	0.0%	0
I do not know what to do.	0.0%	0
I do not have the time.	0.0%	0
It costs too much.	0.0%	0
I do not need to prepare because emergency responders (e.g., fire, police, etc.) will help me during an emergency.	0.0%	0
None of the above apply to me.	100.0%	1
Other (please describe)	0.0%	0

Question 9: Please indicate where you go to obtain emergency and disaster preparedness related information? Please select ALL that apply.



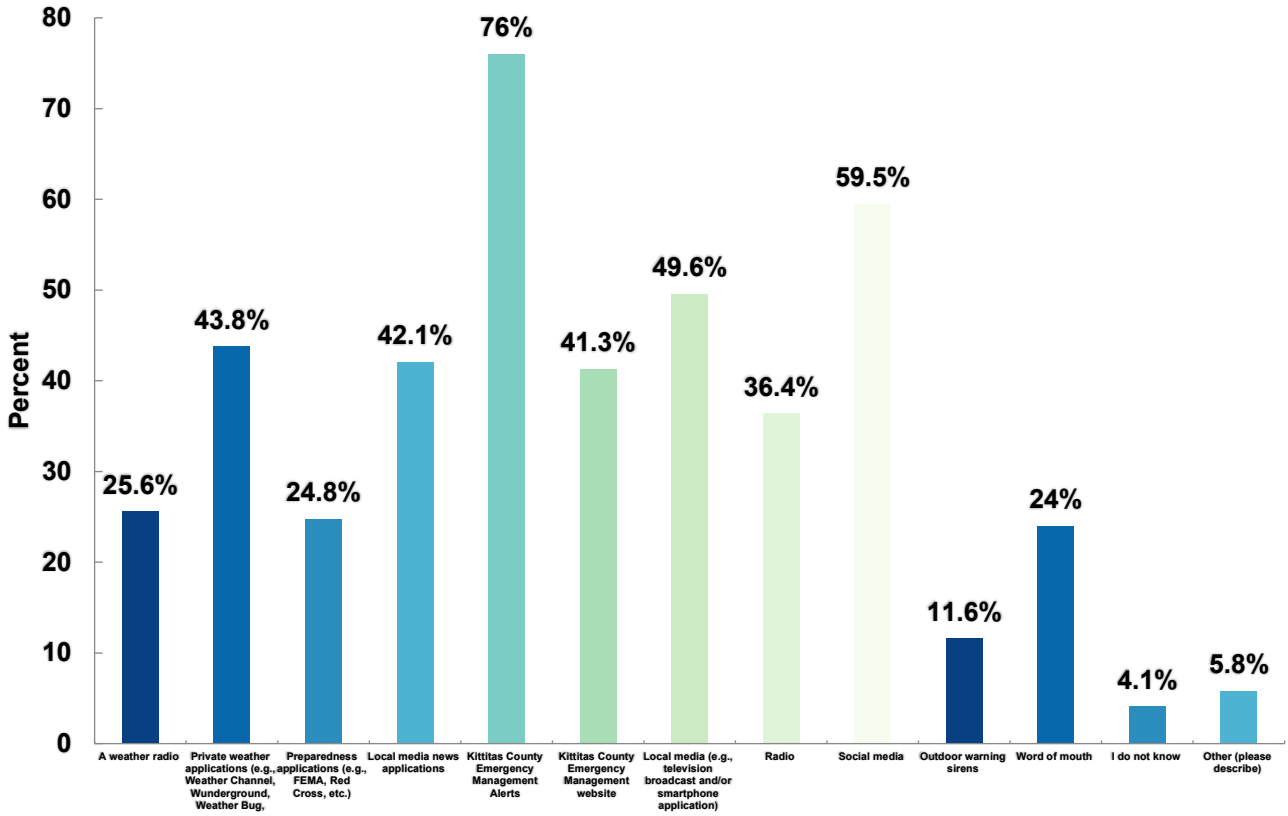
Value	Percent	Total Responses
Municipal (city, village, township) government websites	37.2%	45
County government website	47.1%	57
State government website	37.2%	45
Federal government websites (e.g., fema.gov, Ready.gov)	46.3%	56
Web search (e.g., bing.com, google.com)	54.5%	66
Social media (e.g., Facebook, Twitter, etc.)	45.5%	55
Voluntary organizations (e.g., American Red Cross, Salvation Army, etc.)	18.2%	22
Religious organization	3.3%	4
Local English-speaking television	9.9%	12
Local English-speaking radio	14.9%	18
Local Spanish-speaking television	1.7%	2

Value	Percent	Total Responses
Local Spanish-speaking radio	0.0%	0
National News (Radio and Television)	16.5%	20
Print Media - English (e.g., newspapers)	11.6%	14
Brochures and Newsletters	11.6%	14
Word of Mouth (e.g., friends, family, co-workers)	30.6%	37
Other (please specify)	5.8%	7
I Do Not Know	0.0%	0
Not Applicable	1.7%	2

Spanish Survey Results

Value	Percent	Total Responses
Municipal (city, village, township) government websites	100.0%	1
County government website	100.0%	1
State government website	0.0%	0
Federal government websites (e.g., fema.gov, Ready.gov)	0.0%	0
Web search (e.g., bing.com, google.com)	100.0%	1
Social media (e.g., Facebook, Twitter, etc.)	0.0%	0
Voluntary organizations (e.g., American Red Cross, Salvation Army, etc.)	0.0%	0
Religious organization	0.0%	0
Local English-speaking television	0.0%	0
Local English-speaking radio	0.0%	0
Local Spanish-speaking television	100.0%	1
Local Spanish-speaking radio	0.0%	0
National News (Radio and Television)	0.0%	0
Print Media - English (e.g., newspapers)	0.0%	0
Brochures and Newsletters	0.0%	0
Word of Mouth (e.g., friends, family, co-workers)	0.0%	0
Other (please specify)	0.0%	0
I Do Not Know	0.0%	0
Not Applicable	0.0%	0

Question 10: Please indicate how you expect to receive alerts and information during an emergency. Please select ALL that apply.



Value	Percent	Total Responses
A weather radio	25.6%	31
Private weather applications (e.g., Weather Channel, Wunderground, Weather Bug, AccuWeather, etc.)	43.8%	53
Preparedness applications (e.g., FEMA, Red Cross, etc.)	24.8%	30
Local media news applications	42.1%	51
Kittitas County Emergency Management Alerts	76.0%	92
Kittitas County Emergency Management website	41.3%	50
Local media (e.g., television broadcast and/or smartphone application)	49.6%	60
Radio	36.4%	44
Social media	59.5%	72
Outdoor warning sirens	11.6%	14

Value	Percent	Total Responses
Word of mouth	24.0%	29
I do not know	4.1%	5
Other (please describe)	5.8%	7

Spanish Survey Results

Value	Percent	Total Responses
A weather radio	0.0%	0
Private weather applications (e.g., Weather Channel, Wunderground, Weather Bug, AccuWeather, etc.)	100.0%	1
Preparedness applications (e.g., FEMA, Red Cross, etc.)	100.0%	1
Local media news applications	100.0%	1
Kittitas County Emergency Management Alerts	100.0%	1
Kittitas County Emergency Management website	100.0%	1
Local media (e.g., television broadcast and/or smartphone application)	100.0%	1
Radio	100.0%	1
Social media	0.0%	0
Outdoor warning sirens	0.0%	0
Word of mouth	0.0%	0
I Do Not Know	0.0%	0
Other (please describe)	0.0%	0

Question 11: Would you agree or disagree with the following statements?

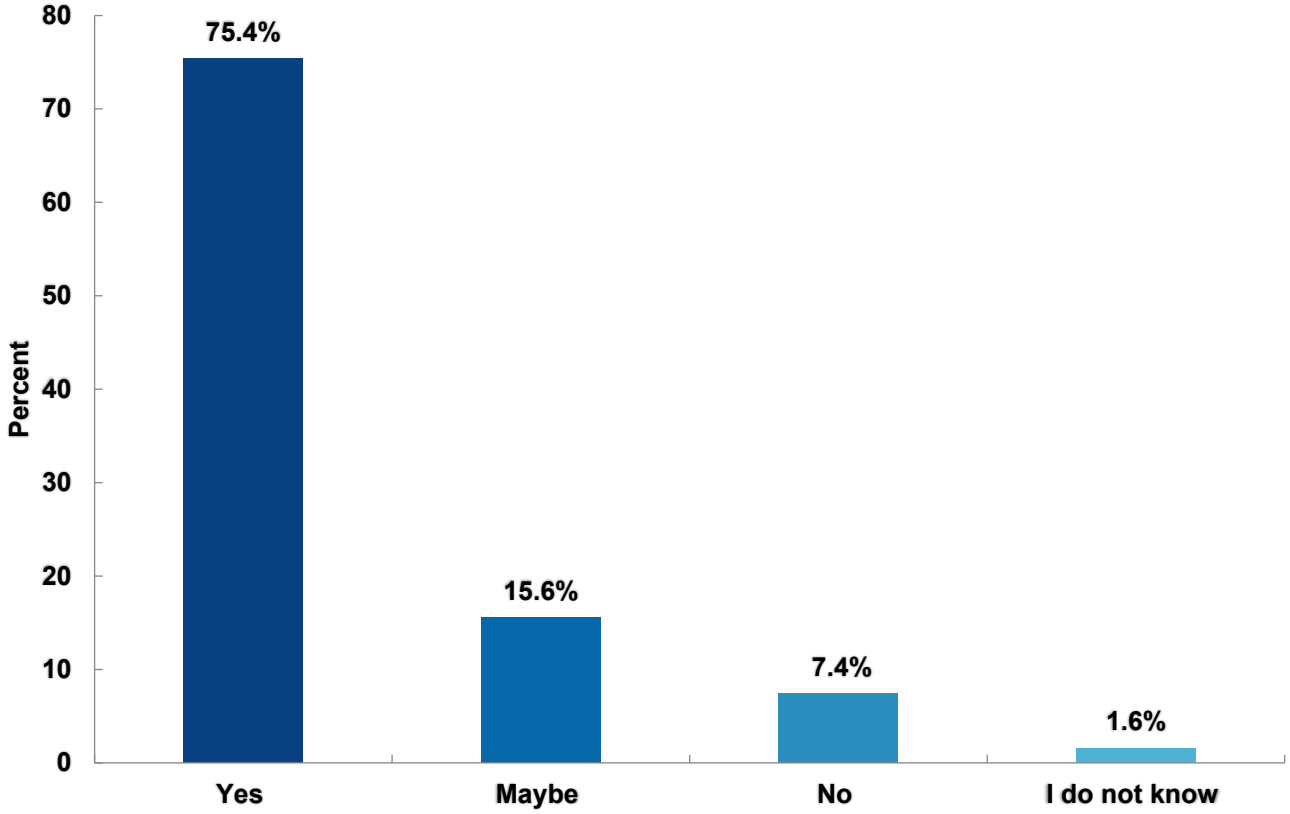
Value	Strongly Disagree		Disagree		Neither Agree or Disagree		Agree		Strongly Agree		I Do Not Know		Total Responses
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	
Kittitas County is providing the services necessary to prepare me for a disaster.	11	9.1%	8	6.6%	47	38.8%	28	23.1%	4	3.3%	23	19.0%	121
I am familiar with Kittitas County's website and can easily obtain information about emergencies and disasters.	10	8.5%	16	13.6%	33	28.0%	38	32.2%	13	11.0%	8	6.8%	118
During times of emergency, information is provided in a language or format I can understand.	4	3.4%	1	0.8%	10	8.4%	37	31.1%	55	46.2%	12	10.1%	119
I can easily obtain emergency information in times of crisis.	9	7.6%	9	7.6%	31	26.3%	45	38.1%	12	10.2%	12	10.2%	118

Spanish Survey Results

Value	Strongly Disagree		Disagree		Neither Agree or Disagree		Agree		Strongly Agree		I Do Not Know		Total Responses
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	
Kittitas County is providing the services necessary to prepare me for a disaster.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1
I am familiar with Kittitas County's website and can easily obtain information about emergencies and disasters.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1
During times of emergency, information is provided in a language or format I can understand.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1
I can easily obtain emergency information in times of crisis.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1

Question 12: Please indicate how Kittitas County can better assist you in preparing for emergencies and disasters (e.g., provide preparedness materials in my language). REDACTED

Question 13: If a disaster (i.e., snowstorm) impacted Kittitas County, knocking out electricity and running water, would your household be able to manage on its own for at least three (3) days?



Value	Percent	Total Responses
Yes	75.4%	92
Maybe	15.6%	19
No	7.4%	9
I Do Not Know	1.6%	2
	Total	**122**

Spanish Survey Results

Value	Percent	Total Responses
Yes	0.0%	0
Maybe	100.0%	1
No	0.0%	0
I Do Not Know	0.0%	0
	Total	**1**

Question 14: Do you believe that your household and/or place of business might ever be threatened by the following hazards? Please rate what hazards present the greatest risk.

Low Risk: Low impact on threat to life and property damage.
Medium Risk: Medium impact on threat to life and property damage.
High Risk: High impact on threat to life and property damage.

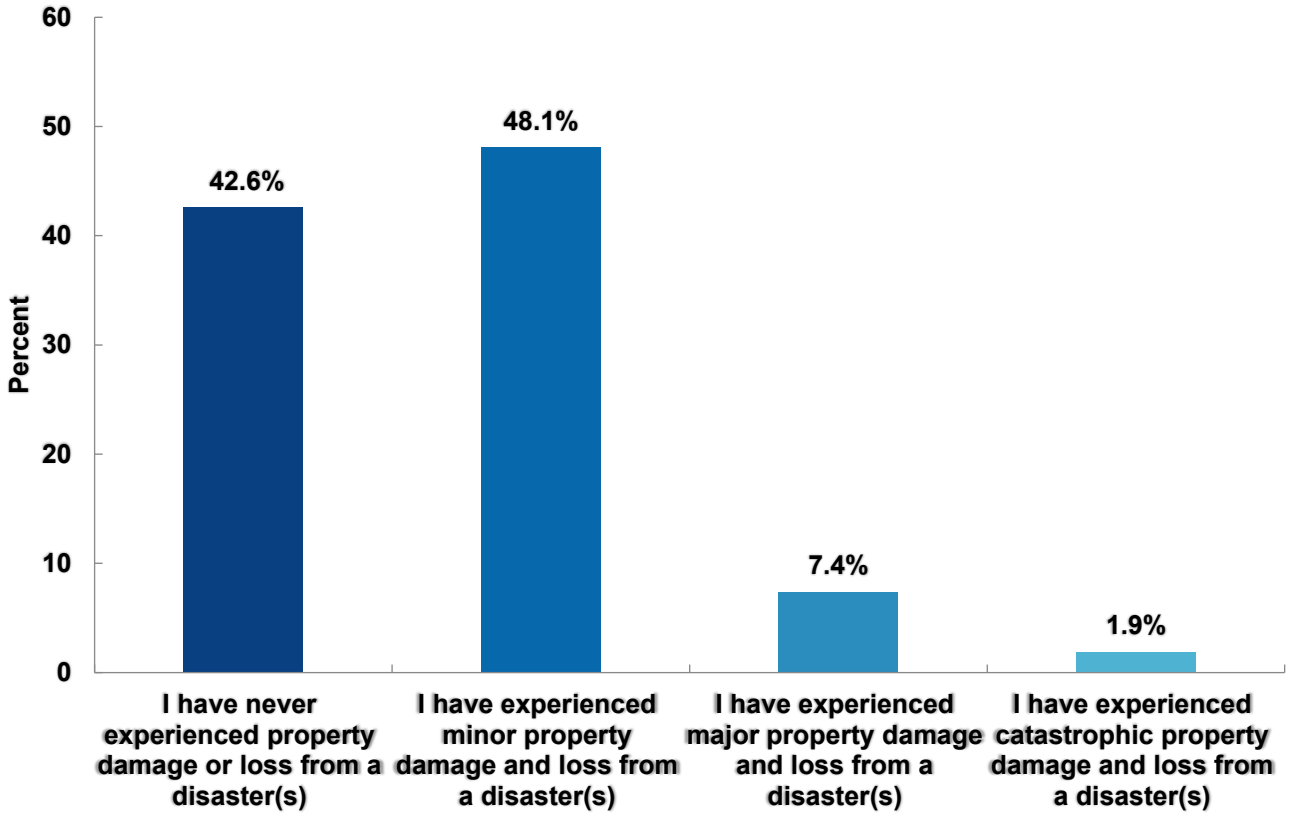
Value	Low Risk		Medium Risk		High Risk		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Avalanche	70	66.0%	5	4.7%	5	4.7%	26	24.5%	106
Dam Failure	56	52.3%	27	25.2%	9	8.4%	15	14.0%	107
Drought	23	21.5%	36	33.6%	47	43.9%	1	0.9%	107
Earthquake	24	22.4%	53	49.5%	27	25.2%	3	2.8%	107
Flood	45	41.7%	37	34.3%	22	20.4%	4	3.7%	108
Landslide	59	55.7%	19	17.9%	11	10.4%	17	16.0%	106
Severe Weather *(e.g., thunderstorms, strong winds, hail)*	9	8.5%	49	46.2%	46	43.4%	2	1.9%	106
Volcano	58	55.2%	37	35.2%	5	4.8%	5	4.8%	105
Wildfires	15	13.9%	30	27.8%	61	56.5%	2	1.9%	108
Winter Storms	8	7.5%	35	32.7%	63	58.9%	1	0.9%	107

Spanish Survey Results

Value	Low Risk		Medium Risk		High Risk		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Avalanche	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1
Dam Failure	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1
Drought	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Earthquake	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Flood	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Landslide	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1
Severe Weather *(e.g., thunderstorms, strong winds, hail)*	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1
Volcano	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Wildfires	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1
Winter Storms	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1

Question 15: If you entered additional hazard(s) on the previous question, please explain why you believe your household and/or place of business might be at risk of the listed hazard(s).
REDACTED

Question 16: Please select the answer that best describes your experience.



Value	Percent	Total Responses
I have never experienced property damage or loss from a disaster(s)	42.6%	46
I have experienced minor property damage and loss from a disaster(s)	48.1%	52
I have experienced major property damage and loss from a disaster(s)	7.4%	8
I have experienced catastrophic property damage and loss from a disaster(s)	1.9%	2
	Total	**108**

Spanish Survey Results

Value	Percent	Total Responses
I have never experienced property damage or loss from a disaster(s)	100.0%	1
I have experienced minor property damage and loss from a disaster(s)	0.0%	0
I have experienced major property damage and loss from a disaster(s)	0.0%	0
I have experienced catastrophic property damage and loss from a disaster(s)	0.0%	0
	Total	**1**

Question 17: If you have experienced any damage(s) or injury(ies) from a disaster, please list the hazard(s) that caused the damages/losses and/or injuries (e.g., flooding, wind, winter storm). REDACTED

Question 18: If you have experienced any damage(s) or injury(ies) from a disaster, please indicate where this occurred (e.g., my home, on a roadway or intersection, at work, on vacation, etc.). REDACTED

Question 19: If you have experienced any damage(s) or injury(ies) from a disaster, please describe the damages and/or injuries. (e.g., basement flooded, roof was damaged, vehicle was damaged, broken bones, lacerations, etc.). REDACTED

Question 20: Based on YOUR PERCEPTION of your jurisdiction's hazards, to what degree of emphasis would you expect your jurisdiction to mitigate the following hazards?

Definition: *Hazard mitigation is any sustainable action that reduces or eliminates long-term risk to people and property from future disasters. Hazard mitigation includes long-term solutions that reduce the impact of disasters in the future.*

No Mitigation Needed: *No mitigation on this hazard is expected or needed.*
Low Priority: *This hazard should be mitigated, but is not a high priority compared to other hazards.*
Medium Priority: *It is important to mitigate this hazard.*
High Priority: *It is a high priority to emphasize mitigation for this hazard.*

Value	No Mitigation Needed		Low Priority		Medium Priority		High Priority		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Avalanche	44	41.5%	38	35.8%	14	13.2%	10	9.4%	106
Dam Failure	23	21.5%	33	30.8%	28	26.2%	23	21.5%	107
Drought	6	5.6%	20	18.5%	36	33.3%	46	42.6%	108
Earthquake	8	7.6%	40	38.1%	41	39.0%	16	15.2%	105
Flood	7	6.4%	21	19.3%	47	43.1%	34	31.2%	109
Landslide	21	19.8%	48	45.3%	25	23.6%	12	11.3%	106
Severe Weather *(e.g., thunderstorms, strong winds, hail)*	8	7.3%	17	15.6%	45	41.3%	39	35.8%	109
Volcano	33	30.3%	48	44.0%	19	17.4%	9	8.3%	109
Wildfires	4	3.7%	3	2.8%	23	21.1%	79	72.5%	109
Winter Storm	2	1.8%	9	8.3%	42	38.5%	56	51.4%	109

Spanish Survey Results

Value	No Mitigation Needed		Low Priority		Medium Priority		High Priority		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Avalanche	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Dam Failure	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Drought	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Earthquake	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1
Flood	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Landslide	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Severe Weather *(e.g., thunderstorms, strong winds, hail)*	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Volcano	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Wildfires	0	0.0%	1	100.0%	0	0.0%	0	0.0%	1
Winter Storm	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1

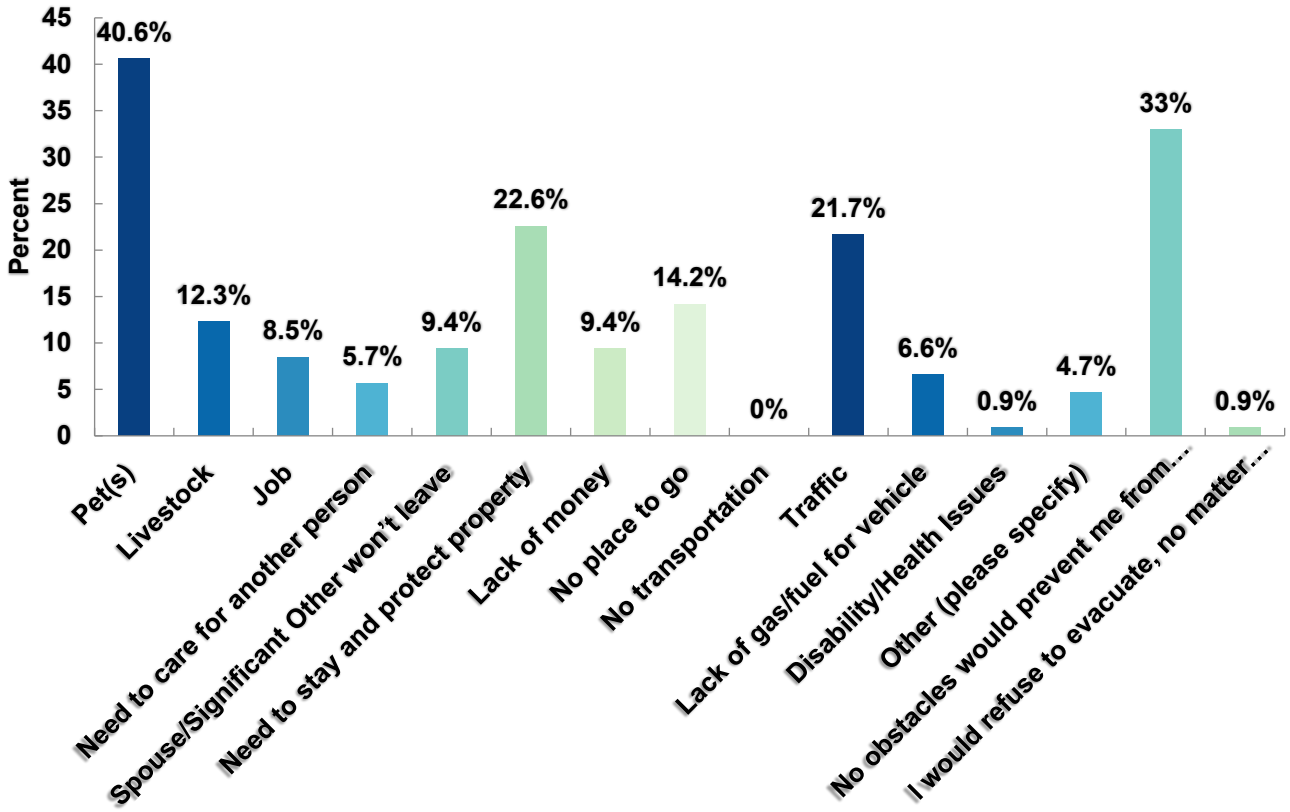
Question 21: If an evacuation was ordered for your area, please indicate how likely you would be to do the following.

Value	Very Unlikely		Unlikely		Unsure or I Do Not Know		Likely		Very Likely		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Immediately evacuate as instructed.	8	7.5%	5	4.7%	10	9.3%	25	23.4%	59	55.1%	0	0.0%	107
I would first consult with family and friends outside my household before making a decision to evacuate.	25	24.0%	23	22.1%	9	8.7%	34	32.7%	13	12.5%	0	0.0%	104
Wait and see how bad the situation is going to be before deciding to evacuate.	30	28.3%	36	34.0%	15	14.2%	17	16.0%	8	7.5%	0	0.0%	106
I refuse to evacuate, no matter what.	76	72.4%	18	17.1%	5	4.8%	4	3.8%	2	1.9%	0	0.0%	105

Spanish Survey Results

Value	Very Unlikely		Unlikely		Unsure or I Do Not Know		Likely		Very Likely		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Immediately evacuate as instructed.	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1
I would first consult with family and friends outside my household before making a decision to evacuate.	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1
Wait and see how bad the situation is going to be before deciding to evacuate.	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1
I refuse to evacuate, no matter what.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1

Question 22: What might prevent you from leaving your place of residence if there was an evacuation order? Please select ALL that apply.



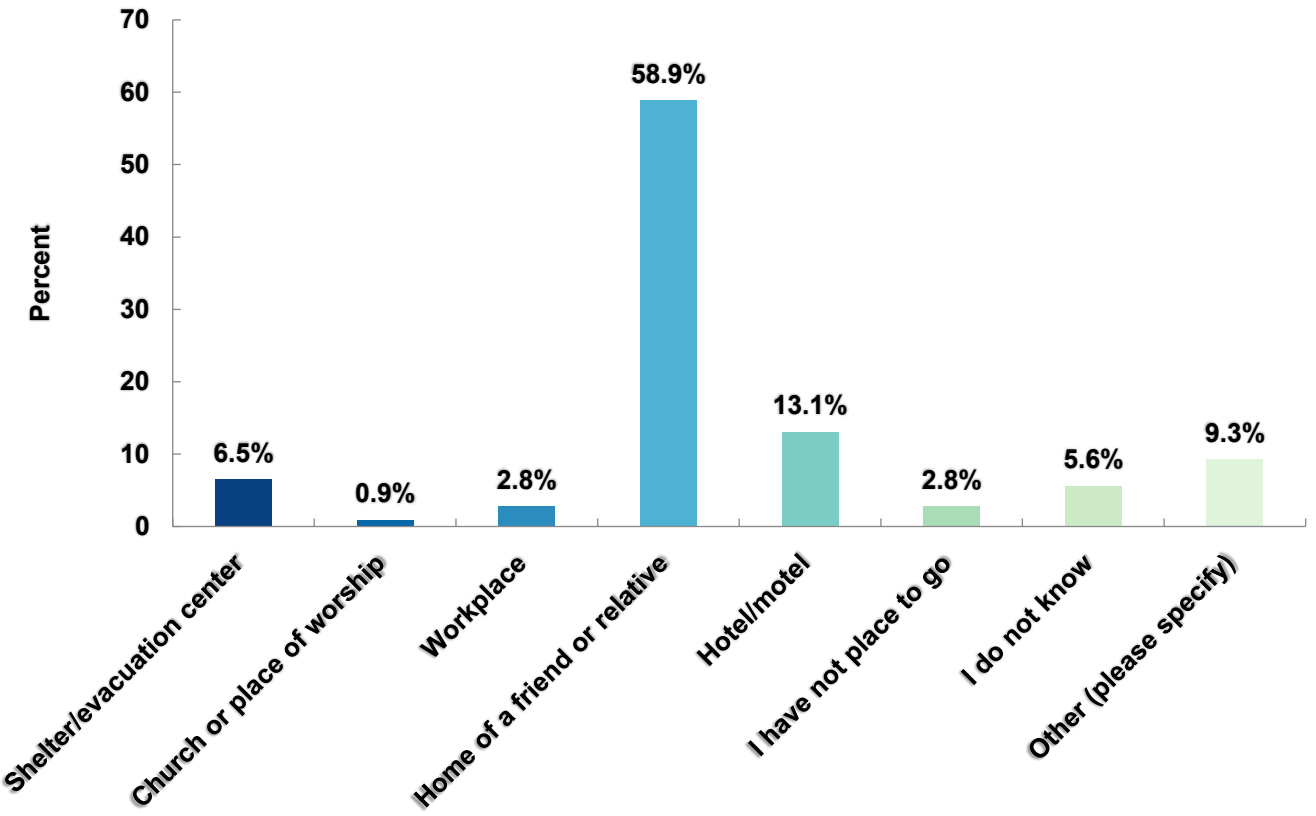
Value	Percent	Total Responses
Pet(s)	40.6%	43
Livestock	12.3%	13
Job	8.5%	9
Need to care for another person	5.7%	6
Spouse/Significant Other will not leave	9.4%	10
Need to stay and protect property	22.6%	24
Lack of money	9.4%	10
No place to go	14.2%	15
No transportation	0.0%	0
Traffic	21.7%	23
Lack of gas/fuel for vehicle	6.6%	7
Disability/Health Issues	0.9%	1
Other (please specify)	4.7%	5

Value	Percent	Total Responses
No obstacles would prevent me from evacuating	33.0%	35
I would refuse to evacuate, no matter what	0.9%	1

Spanish Survey Results

Value	Percent	Total Responses
Pet(s)	0.0%	0
Livestock	0.0%	0
Job	0.0%	0
Need to care for another person	0.0%	0
Spouse/Significant Other will not leave	0.0%	0
Need to stay and protect property	0.0%	0
Lack of money	0.0%	0
No place to go	0.0%	0
No transportation	0.0%	0
Traffic	0.0%	0
Lack of gas/fuel for vehicle	0.0%	0
Disability/Health Issues	0.0%	0
Other (please specify)	0.0%	0
No obstacles would prevent me from evacuating	100.0%	1
I would refuse to evacuate, no matter what	0.0%	0

Question 23: If you were to evacuate, where would you most likely stay? Please select the best answer.

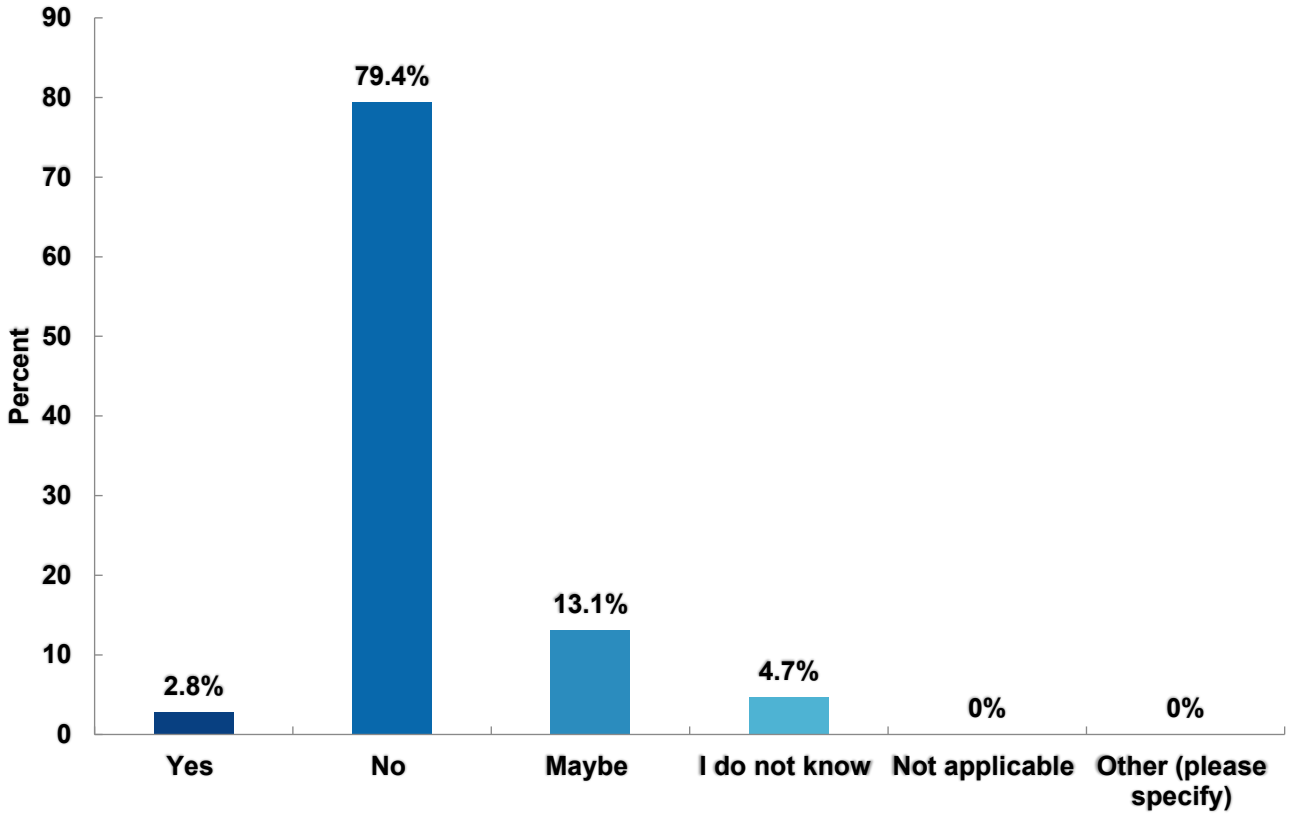


Value	Percent	Total Responses
Shelter/evacuation center	6.5%	7
Church or place of worship	0.9%	1
Workplace	2.8%	3
Home of a friend or relative	58.9%	63
Hotel/motel	13.1%	14
I have no place to go	2.8%	3
I Do Not Know	5.6%	6
Other (please specify)	9.3%	10
	Total	**107**

Spanish Survey Results

Value	Percent	Total Responses
Shelter/evacuation center	0.0%	0
Church or place of worship	0.0%	0
Workplace	0.0%	0
Home of a friend or relative	0.0%	0
Hotel/motel	100.0%	1
I have no place to go	0.0%	0
I Do Not Know	0.0%	0
Other (please specify)	0.0%	0
	Total	**1**

Question 24: In an evacuation, would you or anyone in your household require special assistance?

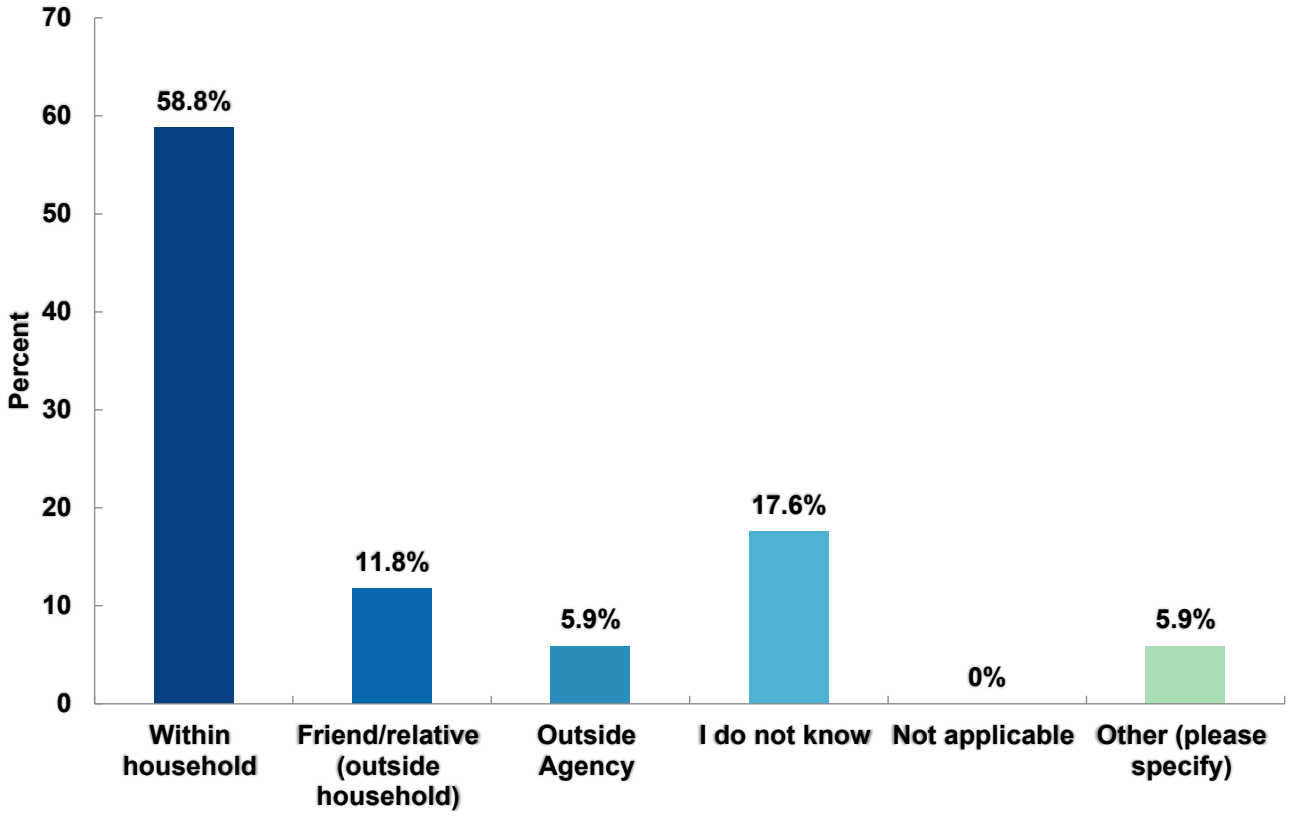


Value	Percent	Total Responses
Yes	2.8%	3
No	79.4%	85
Maybe	13.1%	14
I Do Not Know	4.7%	5
Not applicable	0.0%	0
Other (please specify)	0.0%	0
	Total	**107**

Spanish Survey Results

Value	Percent	Total Responses
Yes	0.0%	0
No	100.0%	1
Maybe	0.0%	0
I Do Not Know	0.0%	0
Not applicable	0.0%	0
Other (please specify)	0.0%	0
	Total	**1**

Question 25: If yes, would that assistance be provided by someone within your household, by an outside agency, or by a friend or relative outside your household?



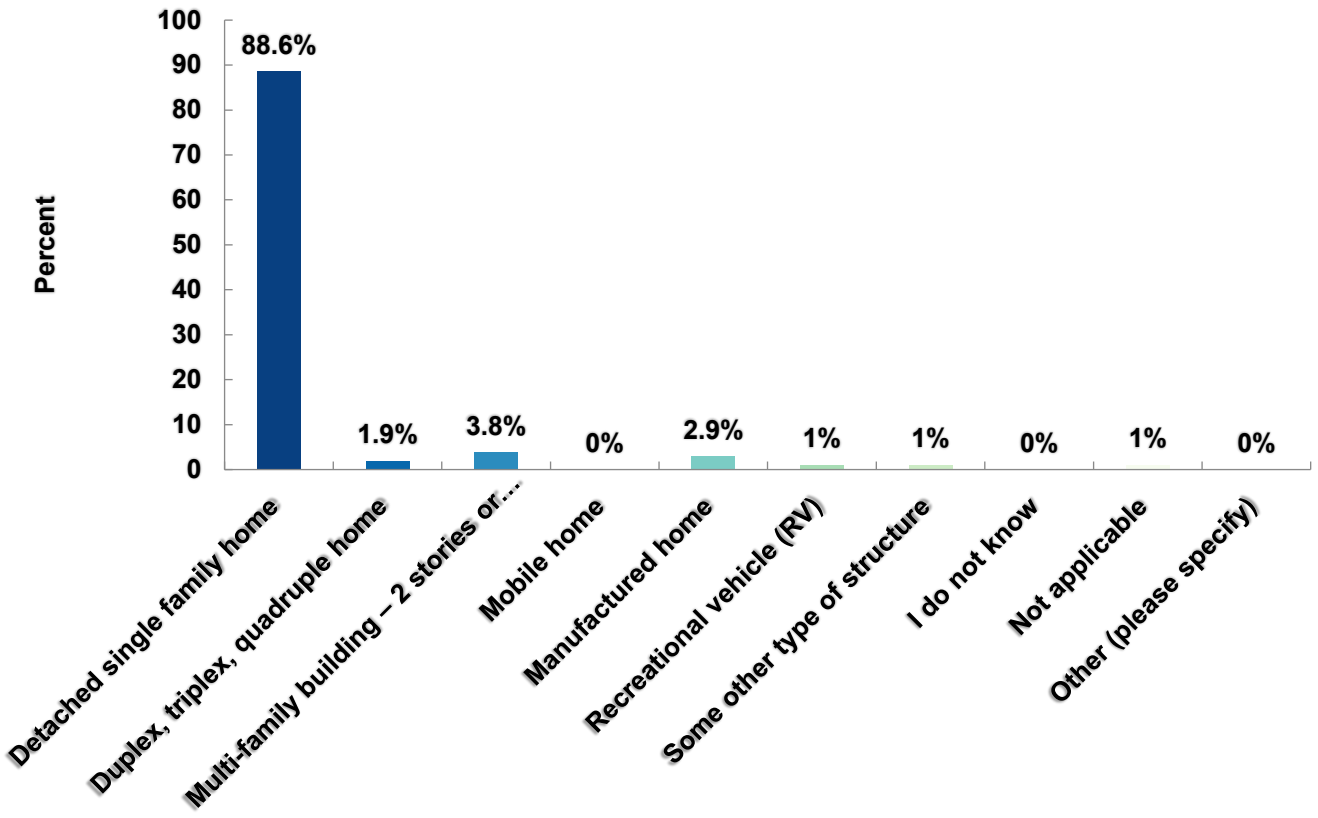
Value	Percent	Total Responses
Within household	58.8%	10
Friend/relative (outside household)	11.8%	2
Outside Agency	5.9%	1
I do not know	17.6%	3
Not applicable	0.0%	0
Other (please specify)	5.9%	1
	Total	**17**

Spanish Survey Results

Value	Percent	Total Responses
Within household	0.0%	0
Friend/relative (outside household)	0.0%	0
Outside Agency	0.0%	0
I do not know	0.0%	0
Not applicable	0.0%	0
Other (please specify)	0.0%	0
Total		**0**

Question 26: If applicable, please indicate what kind of outside assistance your household may need during an evacuation (e.g., transportation, medical, etc.). **REDACTED**

Question 27: What type of structure do you live in?



Value	Percent	Total Responses
Detached single family home	88.6%	93
Duplex, triplex, quadruple home	1.9%	2
Multi-family building – 2 stories or more (apartment/condominium)	3.8%	4
Mobile home	0.0%	0
Manufactured home	2.9%	3
Recreational vehicle (RV)	1.0%	1
Some other type of structure	1.0%	1
I Do Not Know	0.0%	0
Not applicable	1.0%	1
Other (please specify)	0.0%	0
	Total	**105**

Spanish Survey Results

Value	Percent	Total Responses
Detached single family home	0.0%	0
Duplex, triplex, quadruple home	0.0%	0
Multi-family building – 2 stories or more (apartment/condominium)	0.0%	0
Mobile home	100.0%	1
Manufactured home	0.0%	0
Recreational vehicle (RV)	0.0%	0
Some other type of structure	0.0%	0
I Do Not Know	0.0%	0
Not applicable	0.0%	0
Other (please specify)	0.0%	0
	Total	**1**

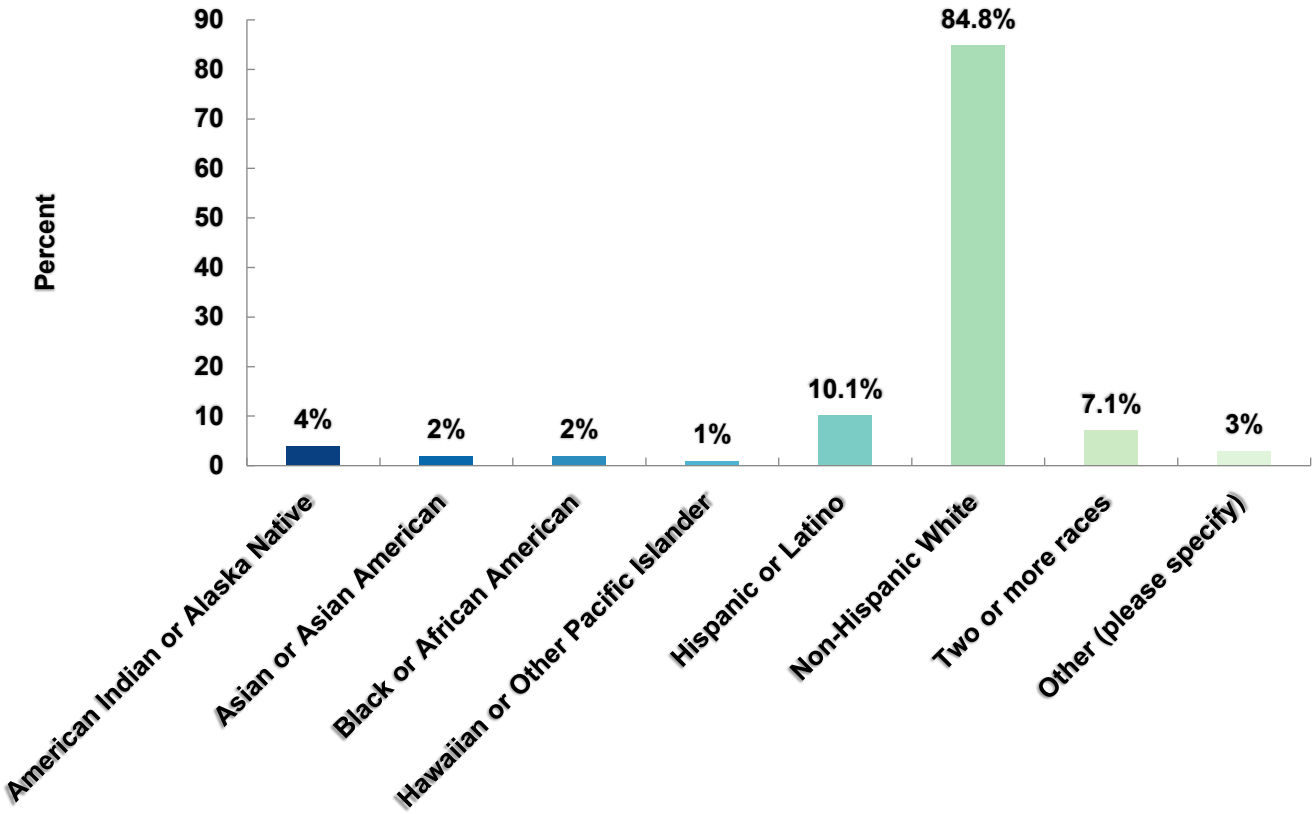
Question 28: How many people including yourself, are currently living in your household?

Value	Ages													
	5 Years and Under		*6 – 10*		*11 – 19*		*20 – 44*		*45 – 64*		*65 – 79*		*80 Years and Over*	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
1	4	66.7%	6	54.5%	8	53.3%	15	45.5%	25	47.2%	26	56.5%	7	100.0%
2	1	16.7%	4	36.4%	5	33.3%	15	45.5%	24	45.3%	19	41.3%	0	0.0%
3	0	0.0%	0	0.0%	1	6.7%	1	3.0%	2	3.8%	0	0.0%	0	0.0%
4	0	0.0%	0	0.0%	0	0.0%	1	3.0%	0	0.0%	0	0.0%	0	0.0%
5	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	1.9%	0	0.0%	0	0.0%
6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
7	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
8	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
9	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
10 or more	1	16.7%	1	9.1%	1	6.7%	1	3.0%	1	1.9%	1	2.2%	0	0.0%
Total Responses	**6**		**11**		**15**		**33**		**53**		**46**		**7**	

Spanish Survey Results

Value	Ages													
	5 Years and Under		*6 – 10*		*11 – 19*		*20 – 44*		*45 – 64*		*65 – 79*		*80 Years and Over*	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
1	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1	100.0%	1	100.0%	0	0.0%
2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
5	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
7	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
8	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
9	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
10 or more	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total Responses	**0**		**0**		**0**		**1**		**1**		**1**		**0**	

Question 29: Which of the following best describes your race/ethnicity? Please select ALL that apply.

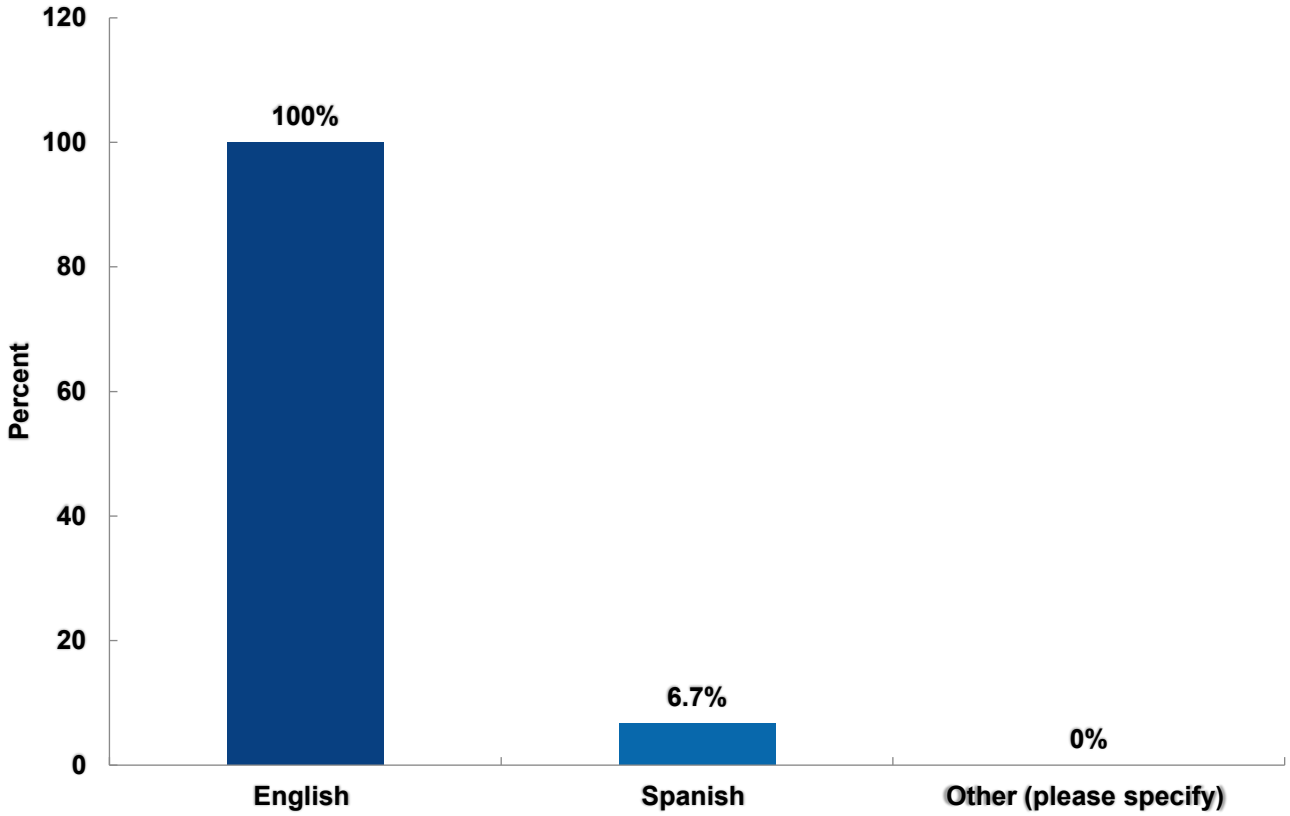


Value	Percent	Total Responses
American Indian or Alaska Native	4.0%	4
Asian or Asian American	2.0%	2
Black or African American	2.0%	2
Hawaiian or Other Pacific Islander	1.0%	1
Hispanic or Latino	10.1%	10
Non-Hispanic White	84.8%	84
Two or more races	7.1%	7
Other (please specify)	3.0%	3

Spanish Survey Results

Value	Percent	Total Responses
American Indian or Alaska Native	0.0%	0
Asian or Asian American	0.0%	0
Black or African American	0.0%	0
Hawaiian or Other Pacific Islander	0.0%	0
Hispanic or Latino	100.0%	1
Non-Hispanic White	0.0%	0
Two or more races	0.0%	0
Other (please specify)	0.0%	0

Question 30: Please indicate the language(s) spoken in your household. Please select ALL that apply.

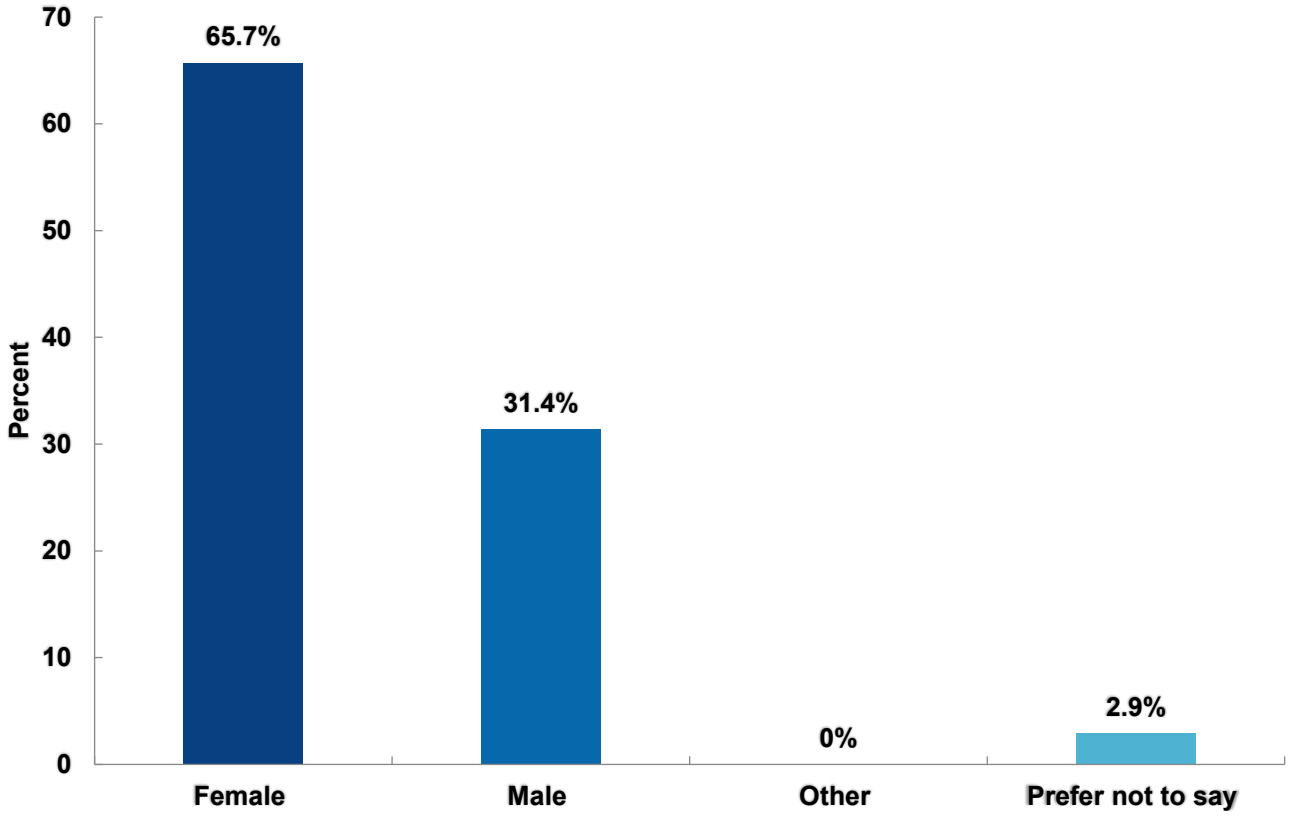


Value	Percent	Total Responses
English	100.0%	104
Spanish	6.7%	7
Other (please specify)	0.0%	0

Spanish Survey Results

Value	Percent	Total Responses
English	100.0%	1
Spanish	100.0%	1
Other (please specify)	0.0%	0

Question 31: Please indicate your gender identity.

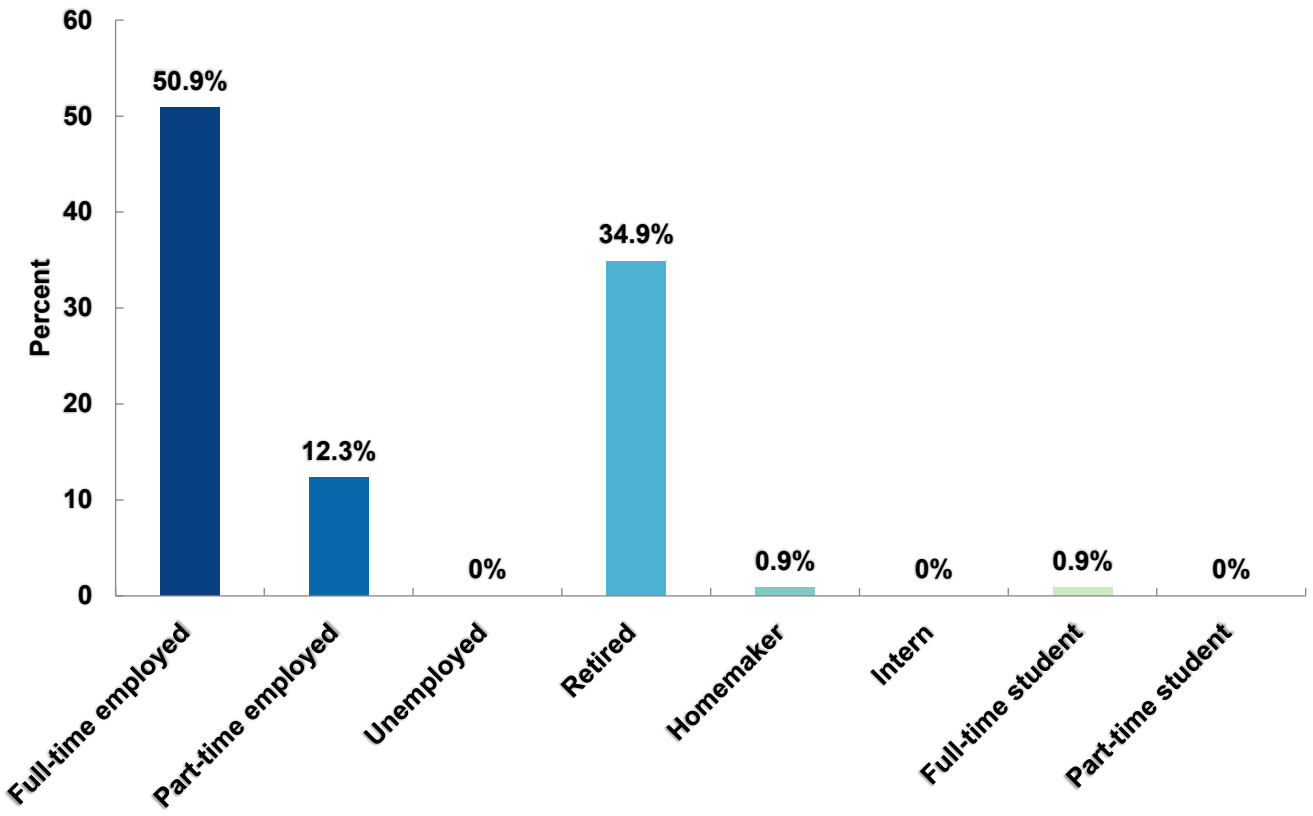


Value	Percent	Total Responses
Female	65.7%	69
Male	31.4%	33
Other	0.0%	0
Prefer not to say	2.9%	3
	Total	**105**

Spanish Survey Results

Value	Percent	Total Responses
Female	100.0%	1
Male	0.0%	0
Other	0.0%	0
Prefer not to say	0.0%	0
	Total	**1**

Question 32: What is your employment status?

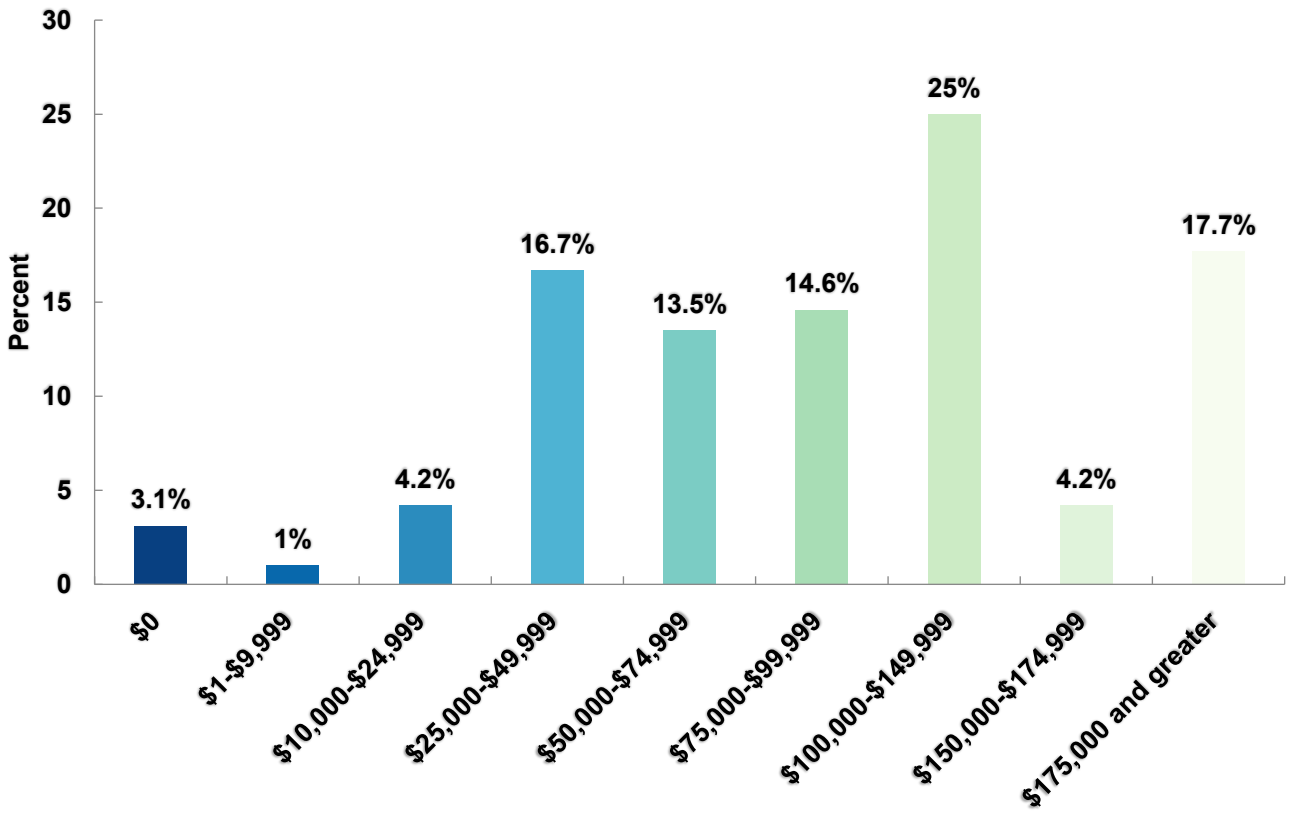


Value	Percent	Total Responses
Full-time employed	50.9%	54
Part-time employed	12.3%	13
Unemployed	0.0%	0
Retired	34.9%	37
Homemaker	0.9%	1
Intern	0.0%	0
Full-time student	0.9%	1
Part-time student	0.0%	0
	Total	**106**

Spanish Survey Results

Value	Percent	Total Responses
Full-time employed	100.0%	1
Part-time employed	0.0%	0
Unemployed	0.0%	0
Retired	0.0%	0
Homemaker	0.0%	0
Intern	0.0%	0
Full-time student	0.0%	0
Part-time student	0.0%	0
	Total	**1**

Question 33: What is your annual household income?



Value	Percent	Total Responses
$0	3.1%	3
$1-$9,999	1.0%	1
$10,000-$24,999	4.2%	4
$25,000-$49,999	16.7%	16
$50,000-$74,999	13.5%	13
$75,000-$99,999	14.6%	14
$100,000-$149,999	25.0%	24
$150,000-$174,999	4.2%	4
$175,000 and greater	17.7%	17
	Total	**96**

Spanish Survey Results

Value	Percent	Total Responses
$0	0.0%	0
$1-$9,999	0.0%	0
$10,000-$24,999	0.0%	0
$25,000-$49,999	0.0%	0
$50,000-$74,999	100.0%	1
$75,000-$99,999	0.0%	0
$100,000-$149,999	0.0%	0
$150,000-$174,999	0.0%	0
$175,000 and greater	0.0%	0
	Total	**1**

C.3. PUBLIC COMMENT PERIOD

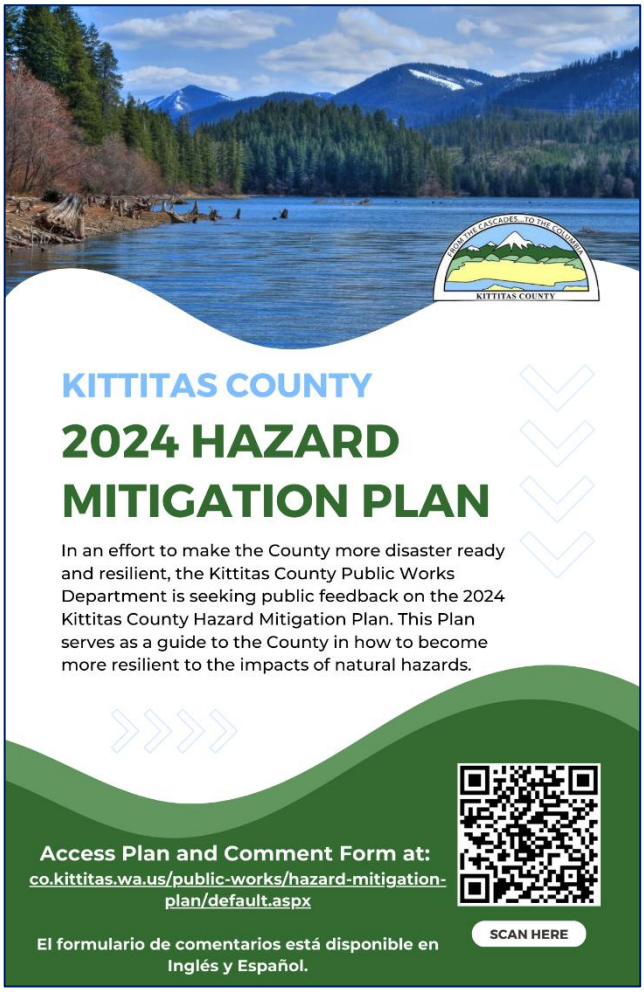
Once the draft Plan was completed, the public was given an opportunity to review and provide comments on Volume 1 (Countywide Planning Elements) and each of the jurisdiction annexes prior to submitting the Plan to the Washington Emergency Management Division and FEMA. The countywide public comment period began on October 7, 2024, and went on through November 7, 2024. Prior to the public comment period, the Core Planning Team conducted a strategy meeting with all plan participants that served as brainstorming session and helped determine the public outreach goals and proper outreach methods for the public comment period. Subsequently, the Core Planning Team developed a public outreach toolkit which included sample social media taglines, flyers, and infographics that stakeholders and plan participants could share with the community during the public comment period.

Kittitas County Public Works coordinated with its county departments and participating jurisdictions to ensure that the public had an opportunity to learn about the Plan, mitigation actions planned for their communities, and ways to get involved in the planning process.

The public comment period printed materials, website posts, and social media samples are included in this section.

Public Outreach Toolkit

Flyers, infographics, and social media taglines were created for the public comment period. All materials were available in English and Spanish. These materials were provided to all plan participants, stakeholders, and Steering Committee members to assist with the dissemination for public comment.









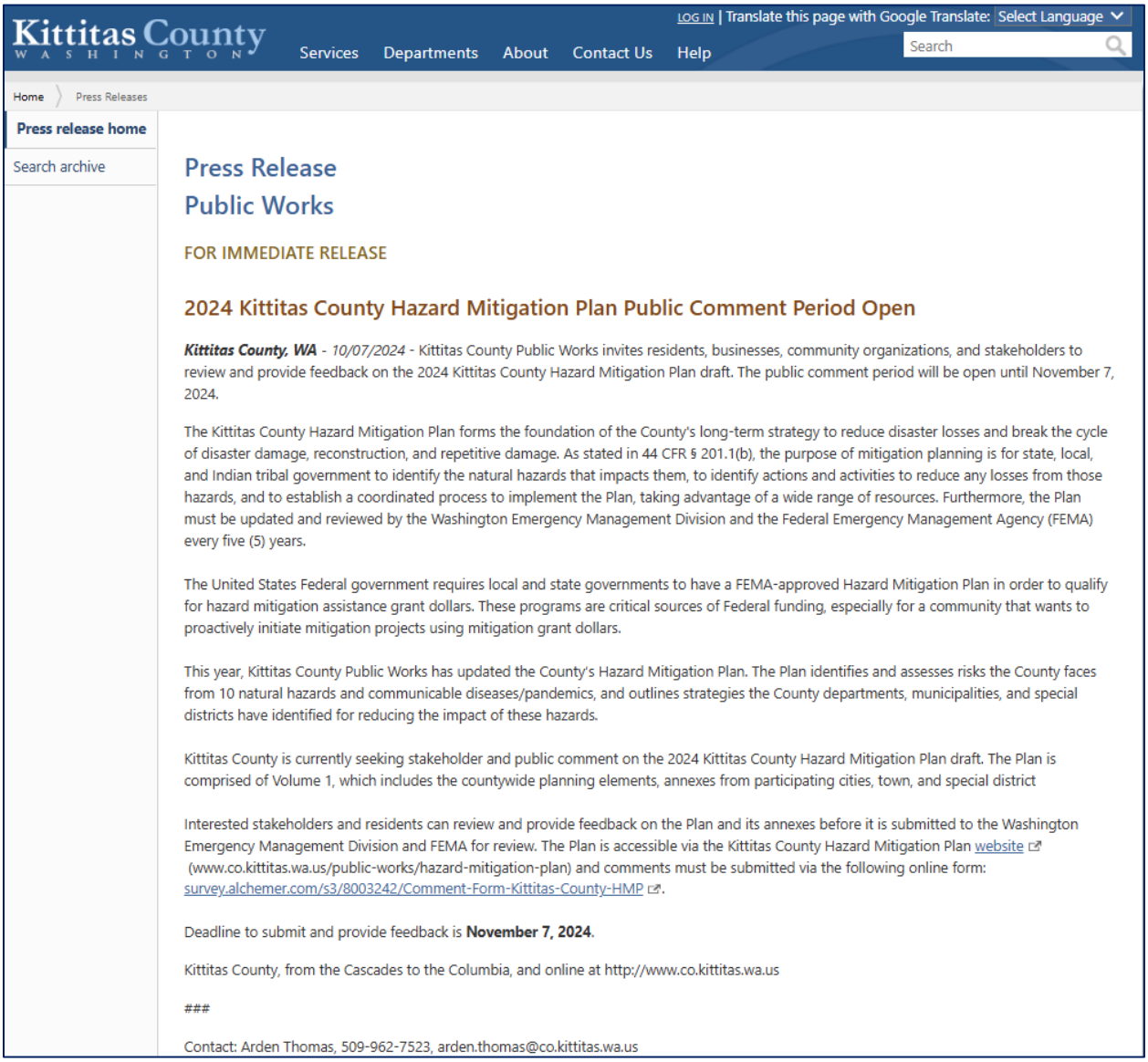
Kittitas County Public Works – Hazard Mitigation Plan Webpage

URL: https://www.co.kittitas.wa.us/public-works/hazard-mitigation-plan/default.aspx



Kittitas County Public Works – Hazard Mitigation Plan Press Release

URL: https://www.co.kittitas.wa.us/press/default.aspx?prID=12035



Kittitas County WASHINGTON

LOG IN | Translate this page with Google Translate: Select Language

Services Departments About Contact Us Help

Search

Home > Press Releases

Press release home

Search archive

Press Release
Public Works

FOR IMMEDIATE RELEASE

2024 Kittitas County Hazard Mitigation Plan Public Comment Period Open

Kittitas County, WA - *10/07/2024* - Kittitas County Public Works invites residents, businesses, community organizations, and stakeholders to review and provide feedback on the 2024 Kittitas County Hazard Mitigation Plan draft. The public comment period will be open until November 7, 2024.

The Kittitas County Hazard Mitigation Plan forms the foundation of the County's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repetitive damage. As stated in 44 CFR § 201.1(b), the purpose of mitigation planning is for state, local, and Indian tribal government to identify the natural hazards that impacts them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the Plan, taking advantage of a wide range of resources. Furthermore, the Plan must be updated and reviewed by the Washington Emergency Management Division and the Federal Emergency Management Agency (FEMA) every five (5) years.

The United States Federal government requires local and state governments to have a FEMA-approved Hazard Mitigation Plan in order to qualify for hazard mitigation assistance grant dollars. These programs are critical sources of Federal funding, especially for a community that wants to proactively initiate mitigation projects using mitigation grant dollars.

This year, Kittitas County Public Works has updated the County's Hazard Mitigation Plan. The Plan identifies and assesses risks the County faces from 10 natural hazards and communicable diseases/pandemics, and outlines strategies the County departments, municipalities, and special districts have identified for reducing the impact of these hazards.

Kittitas County is currently seeking stakeholder and public comment on the 2024 Kittitas County Hazard Mitigation Plan draft. The Plan is comprised of Volume 1, which includes the countywide planning elements, annexes from participating cities, town, and special district

Interested stakeholders and residents can review and provide feedback on the Plan and its annexes before it is submitted to the Washington Emergency Management Division and FEMA for review. The Plan is accessible via the Kittitas County Hazard Mitigation Plan website (www.co.kittitas.wa.us/public-works/hazard-mitigation-plan) and comments must be submitted via the following online form: survey.alchemer.com/s3/8003242/Comment-Form-Kittitas-County-HMP.

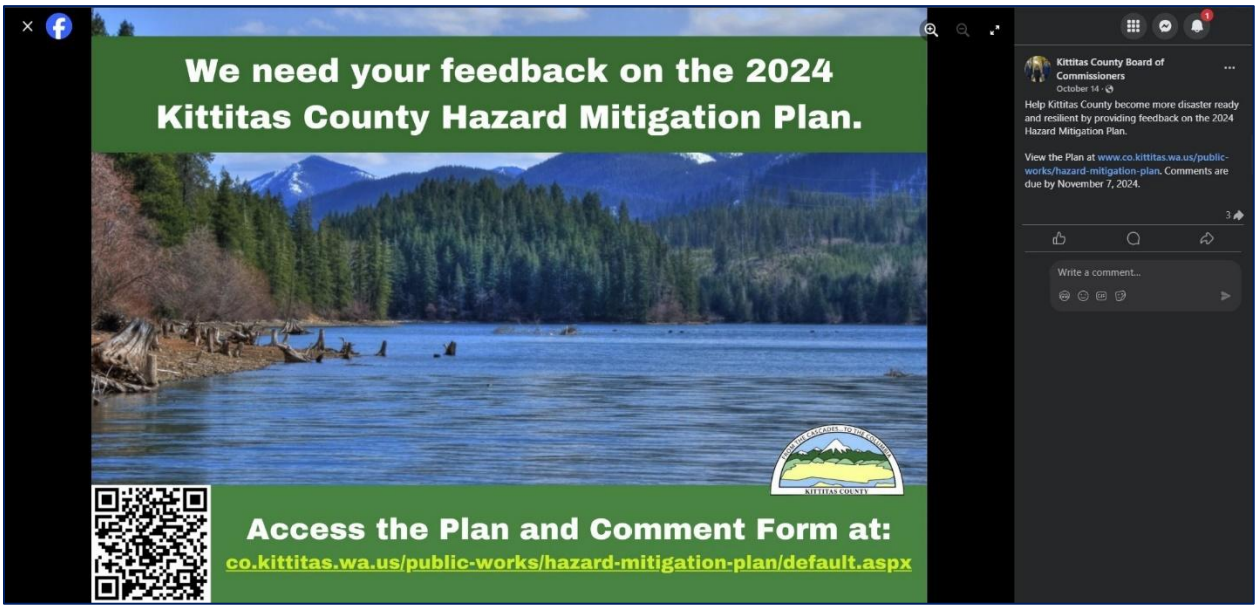
Deadline to submit and provide feedback is **November 7, 2024**.

Kittitas County, from the Cascades to the Columbia, and online at http://www.co.kittitas.wa.us

###

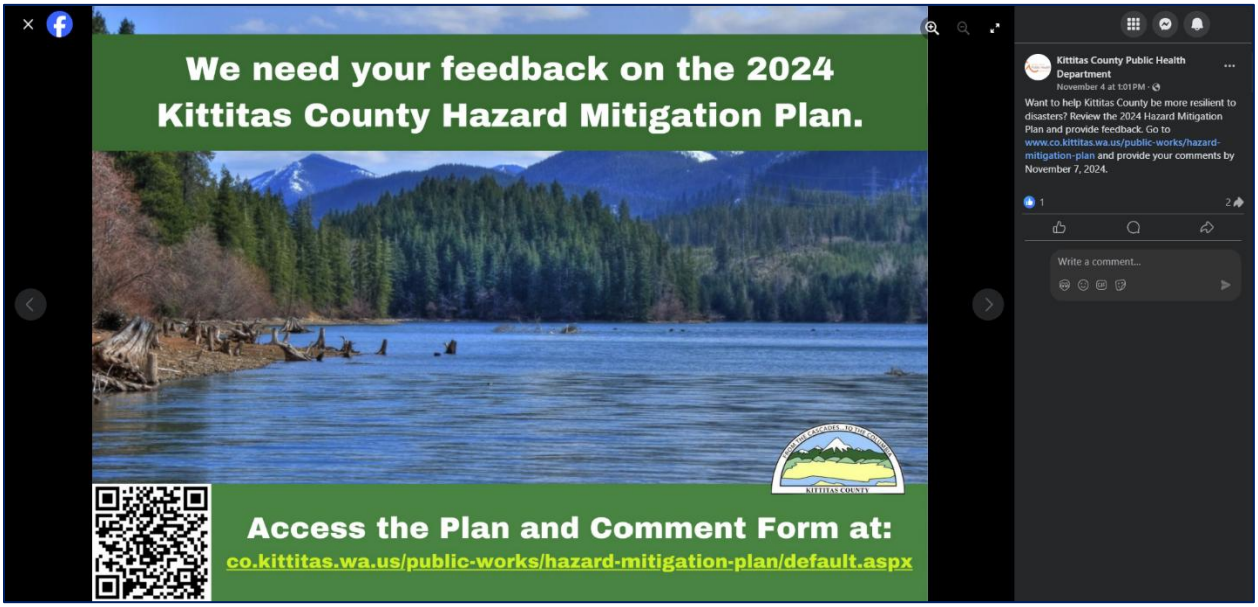
Contact: Arden Thomas, 509-962-7523, arden.thomas@co.kittitas.wa.us

Kittitas County Board of Commissioners Facebook Post



Kittitas County Public Health Department Facebook Posts

The Kittitas County Public Health Department had a total of 21 posts on Facebook throughout the public comment period. Posts were available in English and Spanish. The posts reached over 5,600 people, had over 5,700 impressions and 21 reactions, comments, and shares.

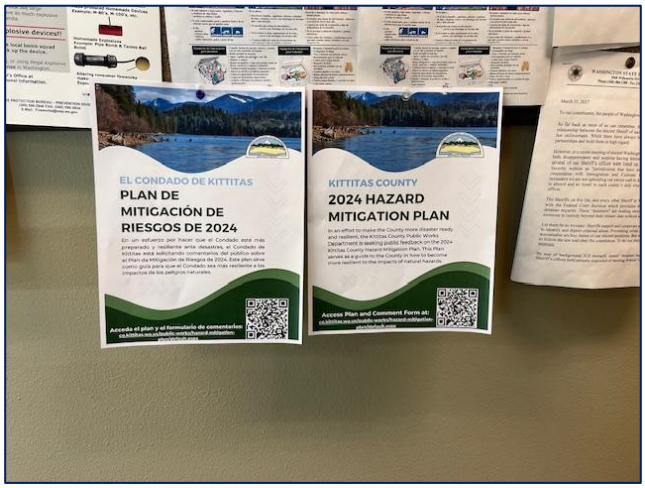




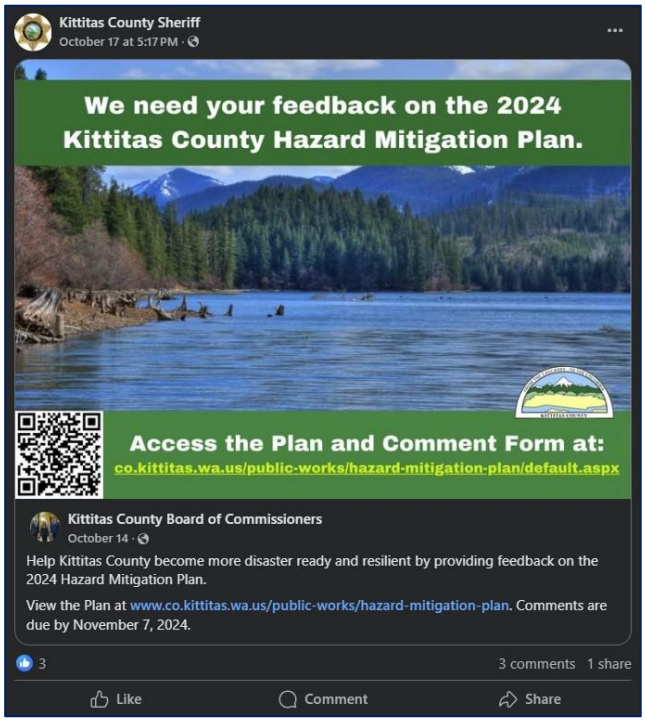
Kittitas County Sheriff's Office

English and Spanish flyers were posted throughout the Sheriff's Office lobby. Additionally, Kittitas County Board of Commissioners Facebook post was re-posted by the Sheriff's Office.





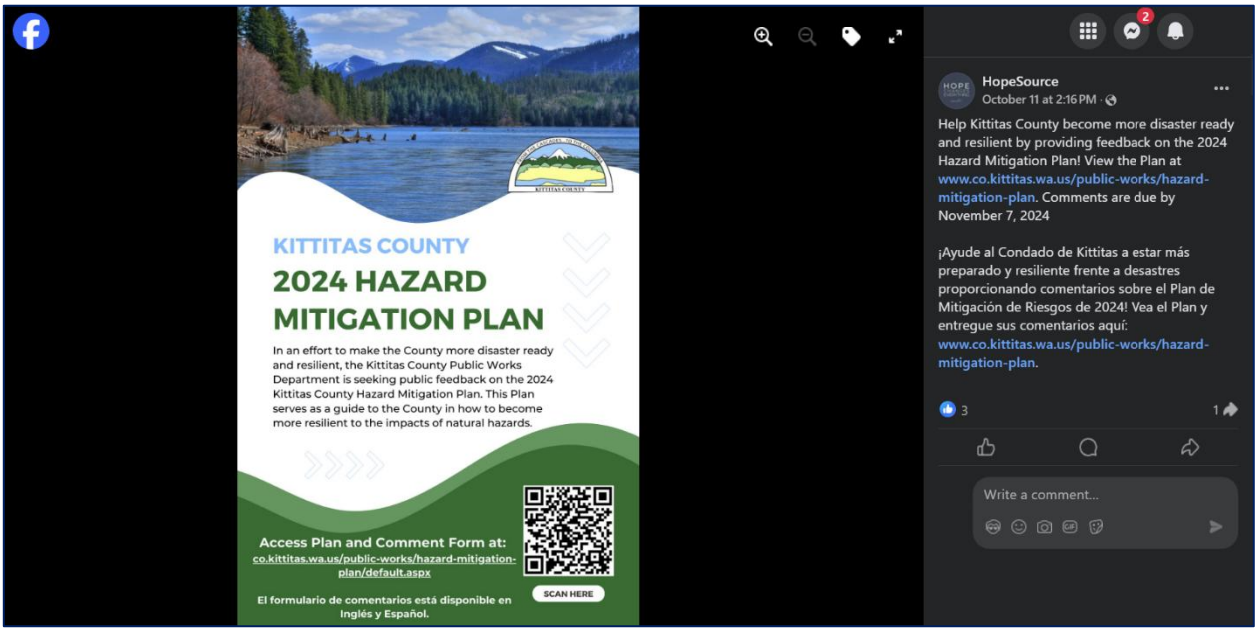




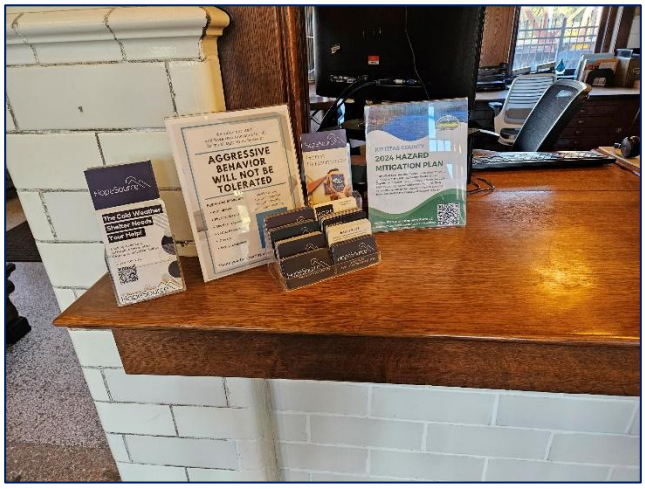
HopeSource

In an effort to reach the underserved population throughout Kittitas County, the Core Planning Team partnered with HopeSource to help distribute hazard mitigation information to the community. HopeSource is a private, non-profit organization that has been providing a wide range of human services in Kittitas County since 1966. HopeSource was created to address the needs of low-wealth households and has provided emergency and sustained support to thousands of families in the Upper and Lower Kittitas County.

English and Spanish flyers were posted throughout multiple HopeSource facilities – waiting room, lobby, office, food bank – and in their Dial A Ride as Kittitas County Connector vehicles. Additionally, a hard copy of the Plan was made available in the HopeSource building waiting room.

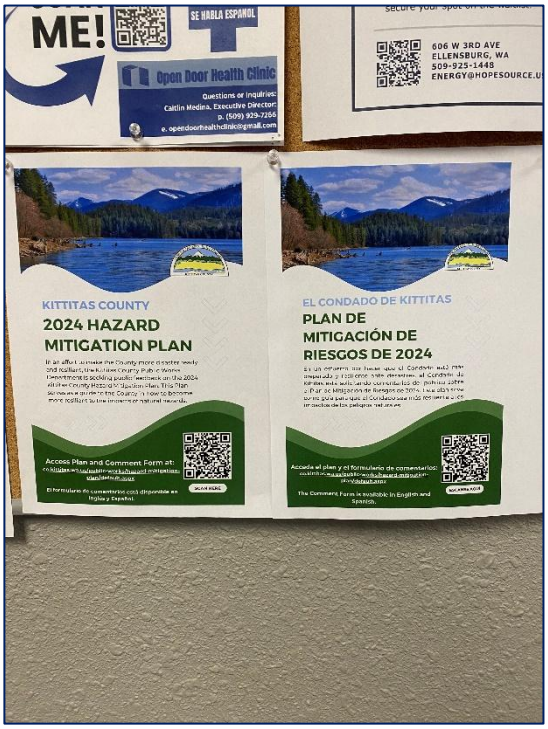

KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
In an effort to make the County more disaster ready and resilient, the Kittitas County Public Works Department is seeking public feedback on the 2024 Kittitas County Hazard Mitigation Plan. This Plan serves as a guide to the County in how to become more resilient to the impacts of natural hazards.
Access Plan and Comment Form at:
co.kittitas.wa.us/public-works/hazard-mitigation-plan/default.aspx
El formulario de comentarios está disponible en Inglés y Español.
SCAN HERE
HopeSource
October 11 at 2:16 PM
Help Kittitas County become more disaster ready and resilient by providing feedback on the 2024 Hazard Mitigation Plan! View the Plan at www.co.kittitas.wa.us/public-works/hazard-mitigation-plan. Comments are due by November 7, 2024
¡Ayude al Condado de Kittitas a estar más preparado y resiliente frente a desastres proporcionando comentarios sobre el Plan de Mitigación de Riesgos de 2024! Vea el Plan y entregue sus comentarios aquí: www.co.kittitas.wa.us/public-works/hazard-mitigation-plan.
Write a comment...


PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KCC


AGGRESSIVE BEHAVIOR WILL NOT BE TOLERATED
2024 HAZARD MITIGATION PLAN

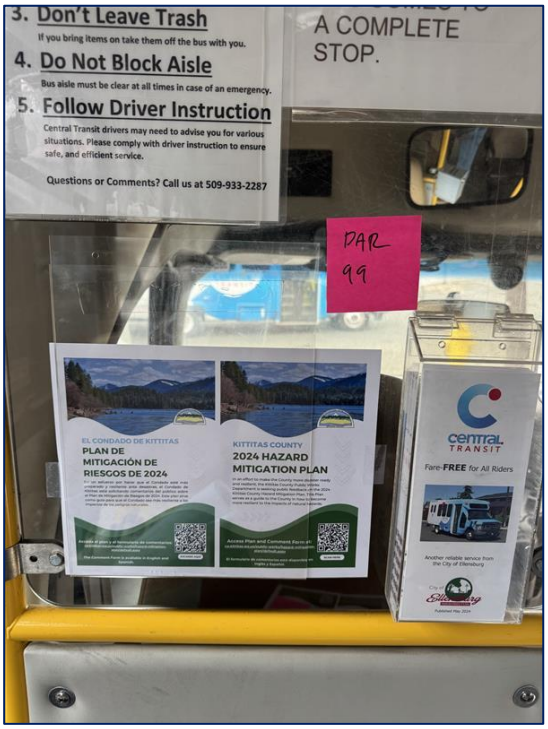

KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
HAZARD MITIGATION PLAN


HopeSource
Housing and Shelter
Energy and Weatherization
Transportation
Life Skills Education
Support Services and More
Learn more at www.hopesource.org

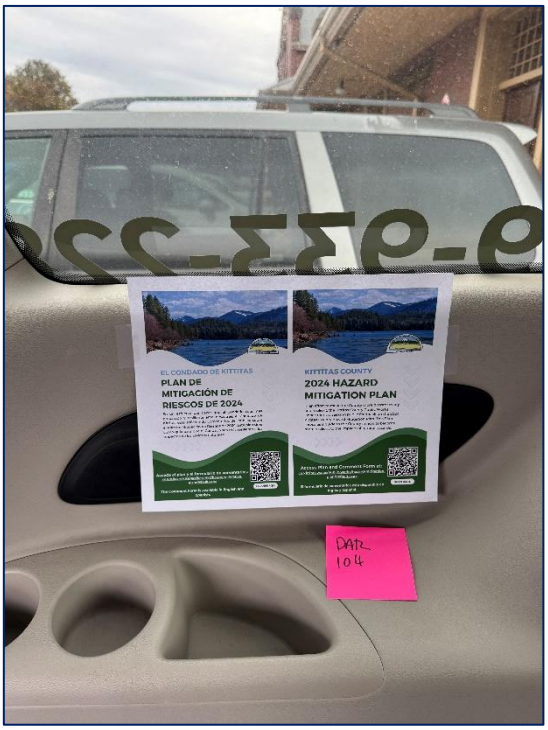

ME!
SE HABLA ESPAÑOL
Open Door Health Clinic
606 W 3RD AVE
ELLENSBURG, WA
509-925-1448
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024

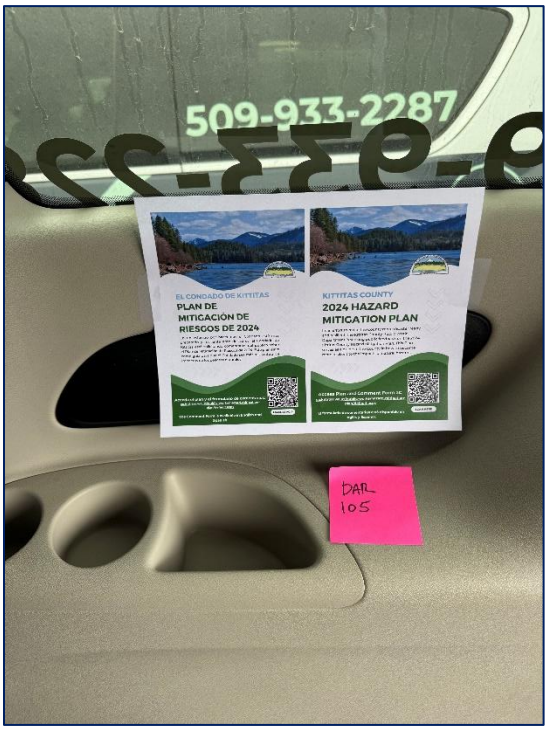

PASSENGERS MUST WEAR SEATBELTS.
NO FOOD OR DRINKS
PLEASE REMAIN SEATED UNTIL BUS COMES TO A COMPLETE STOP.
95
Central Transit Bus Rules
1. No Weapons
2. No Food or Drinks
3. Don't Leave Trash
4. Do Not Block Aisle
5. Follow Driver Instruction
central TRANSIT

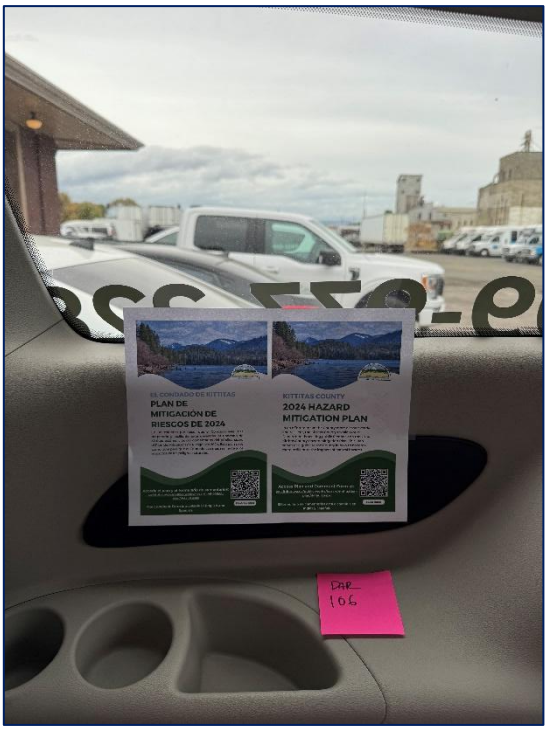

96
EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
Please read before entering.
IF YOU HAVE


3. Don't Leave Trash
If you bring items on take them off the bus with you.
4. Do Not Block Aisle
Bus aisle must be clear at all times in case of an emergency.
5. Follow Driver Instruction
Central Transit drivers may need to advise you for various situations. Please comply with driver instruction to ensure safe, and efficient service.
Questions or Comments? Call us at 509-933-2287
A COMPLETE STOP.
DAR 99
central TRANSIT
Fare-FREE for All Riders

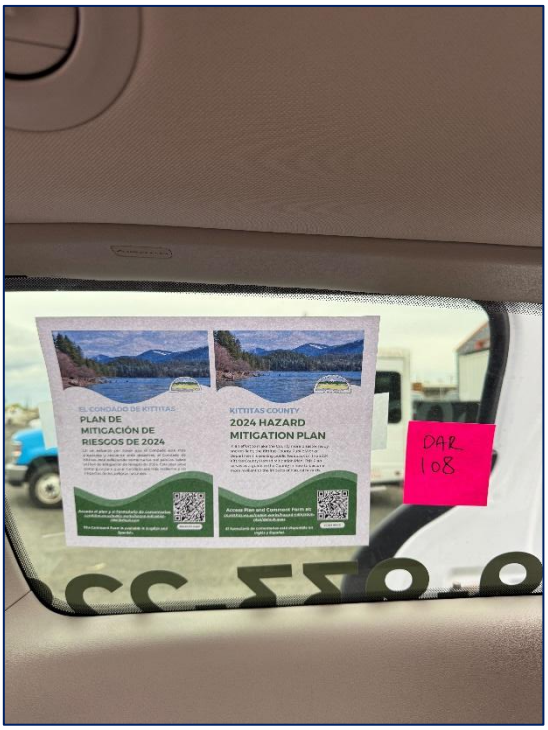

EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
DAR 102


EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
DAR 104

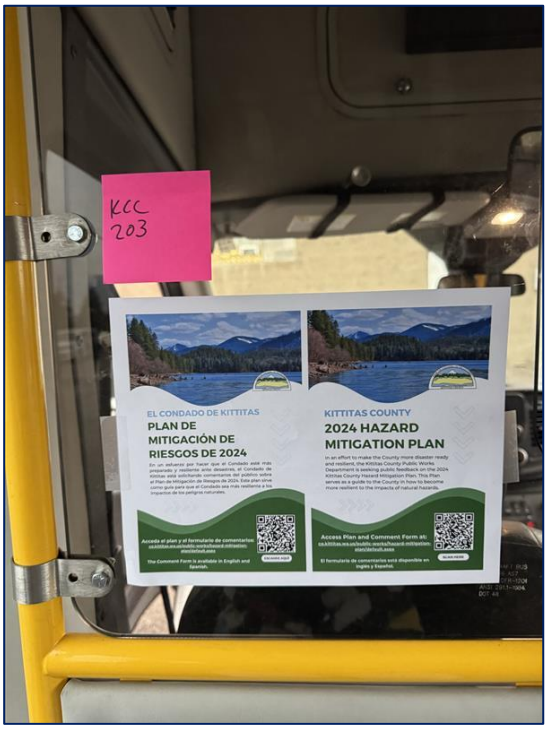

509-933-2287
EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
DAR 105


EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
DAR 106


EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
DAR 107


EL CONDADO DE KITTITAS
PLAN DE MITIGACIÓN DE RIESGOS DE 2024
KITTITAS COUNTY
2024 HAZARD MITIGATION PLAN
DAR 108



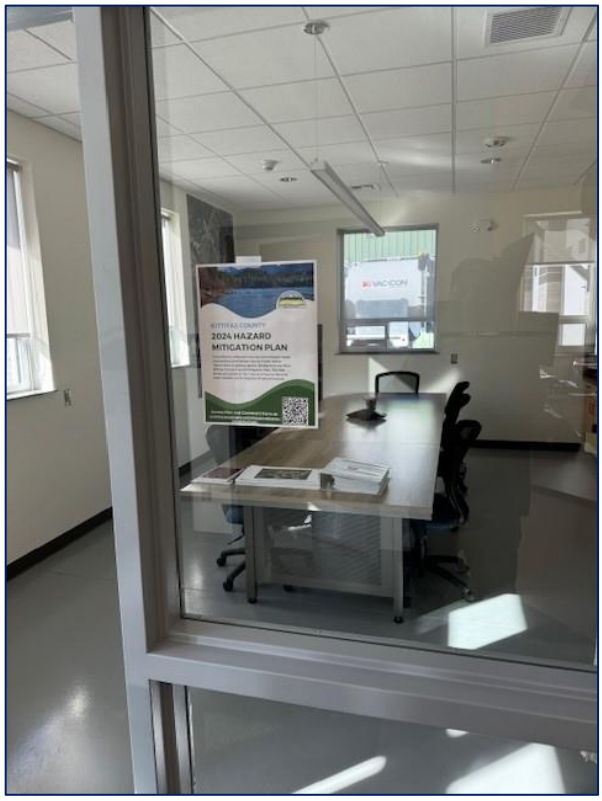


City of Ellensburg Facebook Post



Snoqualmie Public Utility District

The Snoqualmie Public Utility District posted flyers throughout the District's office and bulletin boards. Additionally, the District invited the public to review and provide feedback on the Kittitas County Hazard Mitigation Plan during the public announcements portion of the District's Board of Commissioners meeting on October 14, 2024.







SNOQUALMIE PASS UTILITY DISTRICT
KING AND KITTITAS COUNTIES

NOTICE OF MEETING BOARD OF COMMISSIONERS
Monday October 14, 2024, at 6:00 p.m.

Notice is hereby given that the Snoqualmie Pass Utility District will hold a Board Meeting on Monday Oct 14, 2024, commencing at 6:00 p.m., which will be held in person and held remotely. The meeting will be recorded. The meeting location is the District office located at 932 Hyak Drive East.

If you would like to attend the Board meeting, at the applicable time please call **425-292-2674** (Uber Conference number) or **www.uberconference.com/snoqpassutilitydist** to use your computer to join online. No access code is required. Unless you are giving a public comment during the time that is allowed for such, please mute your phone, as this is an open line, and background noise may disrupt the meeting.

Call to Order: *Introductions and roll call.* This meeting is being recorded.

- *Confirm how many people from the public joined the meeting remotely by phone. If they wish to talk- ask them to complete the signup form so they can be called upon when it is time.*

Approval of Agenda:

- *Amend or approve the agenda as presented.*

Approval of consent agenda:

- *The following items have either been previously discussed or are routine. At the Commissioner's request, times may be removed for further discussion. The Board may approve these items with a single motion.*
  - *i. Approval of draft meeting minutes Sep 23, 2024*
  - *ii. Approval of vouchers (General Fund No. 657010) for_____*
  - *iii. Approval of timecards and payroll reports*
  - *iv. Approval of banking transactions and transfers to County Treasurer*
  - *v. Approval of vouchers (PWB Fund No. 657335) for $466,027.17*
  - *vi. Approval of vouchers (DOH Water Fund No. 657334) for $770,162.61*
  - *vii. Approval of customer bill for meter damage.*

Public Announcements:

- Reminder to customers to register for the customer water meter portal and to set up usage alerts. Encourage customers to fix running toilets.
- This is the time of year that the District encourages residents to make note of where your water meter and sewer clean out is located. If a resident locates their sewer clean out the District would like to capture the location on our GIS system.
- Want to help Kittitas County be more resilient to disasters? Review the 2024 Hazard Mitigation Plan and provide feedback. Go to www.co.kittitas.wa.us/public-works/hazard-mitigation-plan and provide your comments by ***November 7, 2024.***

Public Comments: *(Public Comment on Agenda and Non-Agenda items is limited to 3 min per person, and 30 min max for each section). This is your only time to address the Commissioners. Commissioners do not engage in conversation, they simply listen. Please schedule a time to meet the Commissioner or GM outside of this business meeting for a more in-depth conversation.*

- Public Comment on agenda items only-
- Public Comment on non-agenda items only-

General Manager report & discussion items:

- Comments and updates on business activities and reports.
  - Staff projects and updates.
  - Capital Projects update.
  - Well rehab update.
  - Emergency Response Plan.
  - Health Lead inventory of the water system.
  - RFP's for Control Systems Integrators.
  - Published advertisement for phase 2 wastewater plant project.
  - Review the selling of water connections to property outside of the District boundary.

Old Business:

1. RFP's for Control Systems Integrators

New Business:

1. Discuss Res No. 2024-25 Sole Source Kubota Equipment for phase two wastewater treatment facility.
2. Discuss ops CTRL program to manage the District assets. Currently $7,088 for year one.
3. Review progress estimates for the water capital projects. Approve via the voucher approval.
4. Discuss Res No. 2024-26 adopt updated Emergency Response Plan.
5. Discuss the 2024 Kittitas County Hazard Mitigation Plan

Possible Board Action:

1. Select Control System Integrator
2. Approval of Res No. 2024-25 Sole Source Kubota Equipment.
3. Approval to purchase the ops CTRL program.
4. Approval of Res. No. 2024-26 Emergency Response Plan

Commissioner Comment:

Adjournment

SNOQUALMIE PASS UTILITY DISTRICT
PO BOX 131 (932 Hyak Drive East) Office: 425-434-6600
Email: customercare@snopass.org **Web Site:** www.snopass.org

Board of Commissioner Meetings are held at 6:00 p.m. on the 2nd and 4th Mondays of each month, located at the District office, 932 Hyak Drive East.

C.4. CONTINUED PUBLIC ENGAGEMENT

In order to keep the Plan current after it is approved, it is important to ensure that the public continues to be involved in the Plan and how it is carried out. To ensure continued public engagement, Kittitas County will ensure the Plan is available in the County's Hazard Mitigation webpage after it has been approved to allow the public an opportunity to provide continual feedback and input. As future needs and concerns arise, or if the public would like to provide feedback regarding the latest version of the Kittitas County Plan, the public is invited to use the comment form, which is provided on the website, to provide comments.

County Hazard Mitigation Webpage: https://www.co.kittitas.wa.us/public-works/hazard-mitigation-plan/default.aspx.

Comment Form: https://survey.alchemer.com/s3/8003242/Comment-Form-Kittitas-County-HMP

Incorporating hazard mitigation into other planning efforts can help the public learn about mitigation and its importance to their communities. Kittitas County will continue to collaborate with its stakeholders to ensure that the public has an opportunity to learn about the Plan, mitigation actions planned for their communities, and ways to get involved. Hazard mitigation will be a part of the County's community outreach strategy to include, but not limited to, public meetings, community events, social media, and public surveys throughout the year. Furthermore, the County will continue to ensure equitable outreach by working with other departments, non-profits, and agencies that collaborate with underserved communities throughout the County.

APPENDIX D. PLAN ADOPTION