2025 DRAFT

THE CONFEDERATED TRIBES OF THE CHEHALIS RESERVATION
2025 HAZARD MITIGATION PLAN

BRIDGEVIEW CONSULTING, LLC
1708 155TH ST. NW | GIG HARBOR, WA 98332 | 253.380.5736

The Confederated Tribes of the Chehalis Reservation

2025 HAZARD MITIGATION PLAN

APRIL 2025

Prepared for:

The Confederated Tribes of the Chehalis Reservation
30 Niederman Road
Oakville, WA 98568

Prepared by:

BRIDGEVIEW CONSULTING

Bridgeview Consulting, LLC

1708 155th Street Northwest, Gig Harbor, WA 98332
Tel 253.380.5736

The Confederated Tribes of the Chehalis Reservation
Hazard Mitigation Plan
TABLE OF CONTENTS

LIST OF TABLES

No. *Title* *Page No.*

LIST OF FIGURES

ACKNOWLEDGMENTS

Project Managers

Clinton Davis
Emergency Management Manager
Confederated Tribes of the Chehalis Reservation
30 Niederman Road
PO Box 536
Oakville, WA 98568
(360) 709-1770

Glen Connley
Natural Resources Director
Confederated Tribes of the Chehalis Reservation
30 Niederman Road
PO Box 536
Oakville, WA 98568
(360) 273-5911

Emergency Management Department

Calvin Bray
Emergency Management Coordinator
30 Niederman Road
PO Box 536
Oakville, WA 98568
(360) 709-1691

Consultants

Bev O'Dea, Project Manager and Lead Planner, Bridgeview Consulting, LLC

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Disaster Mitigation Act (DMA; Public Law 106-390) is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and requirements for the national post-disaster hazard mitigation grant program were established.

In recognition of tribal sovereignty and the government-to-government relationship that currently exists between FEMA and Indian Tribal governments, FEMA amended 44 CFR 201 at 72 Fed. Reg. 61720 on October 31, 2007, and provided further amendments on September 16, 2009, amending 74 Fed. Reg. 47471 to consolidate and clarify the requirements for Indian Tribal governments. These amendments established protocol for Tribal Hazard Mitigation Plans to be separate from State and Local Mitigation Plans.

For consistency, 44 CFR 201.2 defines *Indian Tribal Government* as any Federally recognized governing body of an Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of Interior acknowledges to exist as an Indian Tribe under the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a.

The DMA encourages tribes, states, and local authorities to work together on pre-disaster planning, and it promotes sustainability as a strategy for disaster resistance. "Sustainable hazard mitigation" includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. The enhanced planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

Embracing this initiative as a foundation for proactive planning, The Confederated Tribe of the Chehalis Reservation has developed its 2025 Hazard Mitigation Plan (HMP) update in an effort to reduce loss of life and property resulting from disasters. While it is impossible to predict exactly when and where disasters will occur, or the extent to which they will impact the Tribe, with careful planning and collaboration among the relevant parties, it is possible to minimize losses that can occur from disasters. This has been and will continue to be the driving force behind this plan development. Utilizing the three primary characteristics of mitigation efforts to retreat, accommodate, or protect, the Tribe will develop techniques and practices that will contribute to the environment by developing non-regret actions which create multiple positive outcomes.

For planning purposes, *Hazard Mitigation* is defined as *long-term actions taken to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster.* It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards on the Confederated Tribes of the Chehalis Reservation. It recognizes that the responsibility for hazard mitigation lies with many, including private property owners; business and industry; and Tribal, local, state, and federal governments.

Many elements went into making this Tribal Hazard Mitigation Plan a success. The Tribe's Planning Team was instrumental in providing ideas, concepts, historical data and information, discussions, and support needed to develop this plan. Development of the update was completed in coordination with the Planning Team members and the Tribe's consultant, Bridgeview Consulting, LLC.

PLAN DEVELOPMENT METHODOLOGY

Development of the hazard mitigation plan included five phases:

- Phase 1—Organize and review
- Phase 2—Risk assessment
- Phase 3—Engage the public
- Phase 4—Assemble the plan
- Phase 5—Plan adoption

Phase 1—Organize and Review

Under this phase, the Hazard Mitigation Planning Team (hereinafter Planning Team) was assembled to oversee the development of the plan update. The Planning Team consisted of Tribal staff and Tribal citizens, other stakeholders in the planning area, and a consultant who provided technical support to the Planning Team. Coordination with other tribal, county, state, and federal agencies involved in hazard mitigation occurred from the onset of this plan's development through its completion. A multi-media public involvement strategy which centered on a hazard preparedness questionnaire/survey was developed during Phase 1, as well as identification of public presentations at various events which were scheduled to occur during the plan's development. Also occurring during Phase 1 was a comprehensive review of the Tribe's previous Hazard Mitigation Plan (2021), Washington State's Enhanced Hazard Mitigation Plan (2023), and a comprehensive review of existing programs within the planning area that may support or enhance hazard mitigation actions. A key function of the Planning Team was to review and update existing goals as appropriate, and to develop measurable objectives for the 2025 update.

For future planning purposes, the Hazard Mitigation Planning Team adopted June 30, 2024 as the end date for incidents, information, and data incorporated in this plan. Future planning efforts shall commence with incidents and information beginning July 1, 2024 forward.

Phase 2—Risk Assessment

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. This process assesses the vulnerability of people, buildings, cultural resources, and infrastructure to natural hazards. It focuses on the following parameters:

- Hazard identification and profiling
- Identification of Cultural resources
- The impact of hazards on physical, cultural, social and economic assets
- Vulnerability identification
- Estimates of the cost of damage or costs that can be avoided through mitigation.

The risk assessment for this hazard mitigation plan meets the requirements outlined in Chapter 44 of the Code of Federal Regulations (44 CFR). Phase 2 occurred simultaneously with Phase 1, with the two efforts using information generated by one another to generate valid data, supported by sound analysis.

Phase 3—Engage the Public

Specific to tribal plans, 44 CFR 201.7 states that tribal governments may define who they feel constitute "public" within the planning realm, as many tribal citizens have difficulty or apprehension about how to honor traditional beliefs and cultural attributes while still fully participating in the mitigation planning process. For this process, the Planning Team defined "Public" as tribal members, tribal staff, the contractor, and stakeholders which provide services to the CTCR, such as the various fire service agencies." Other stakeholders which provide information to the tribe based on the hazard of concern, such as Washington State Department of Natural Resources, Washington State Department of Ecology, USGS, and a select number of other agencies, were also included to some extent. Additional information on the Tribe's "public" is contained within Chapter 2 – Planning Process, Section 2.1.7.

Under this phase, a public involvement strategy was developed by the Planning Team that maximized the capabilities of the Tribe, while still maintaining their cultural beliefs and responsibilities to the Elements. The Planning Team provided information necessary for inclusion within the document. One of the first steps taken was the development of a contact list which included individuals whose input was needed to complete this plan to its fullest capacity. Additionally, the strategy also included: Tribal Business Committee updates; public outreach to review the hazards of concern and draft plan; distribution of the draft plan to Planning Team members; utilization of a hazard mitigation survey; use of the Tribe's existing website dedicated to the plan, and social media releases throughout various stages in the process. Public engagement also included information from Thurston, Mason, Lewis, and Grays Harbor Counties, the counties in which the Chehalis Tribe owns and maintains properties. Throughout the course of this project, numerous meetings were held, in addition to briefings provided to various stakeholders involved in this effort. This strategy was deemed by the Hazard Mitigation Planning Team as a key function in the success of this planning effort.

Phase 4—Assemble the Plan

The Planning Team assembled key information from Phases 1 and 2 into a document to meet the DMA requirements. Under 44 CFR 201.7, a Tribal Hazard Mitigation Plan must include the following:

- A description of the planning process
- Risk assessment
- Mitigation Strategy
  - Goals
  - Review of alternatives
  - Prioritized "action plan"
- Plan Maintenance section
- Documentation of Adoption

Phase 5—Plan Adoption and Maintenance

The Emergency Manager and Project Manager for this plan was tasked with briefing the Tribal Business Committee on the plan prior to its adoption. Customarily, the adoption would occur after the Tribe received FEMA Approval of the HMP (Approval Pending Adoption – APA notice); however, as authorized within 44 CFR 201.7, given the current circumstances with FEMA plan review on hold until the current administration can review FEMA's programs, the Tribe elected to adopt prior to submission to ensure compliance to the greatest extent possible with respect to plan requirements, as well as to expedite the process for receipt of final approval as soon as possible, rather than FEMA issuing the APA and then adoption, which can delay final FEMA approval. In addition, the Wildfire Chapter for this HMP also serves as the Tribe's CWPP, which provides additional funding and wildfire support through Washington State Department of Natural Resources. As the HMP supports certain areas of the CWPP to reduce redundancy of maintaining the same information in both plans, the Tribe felt it was most prudent to adopt the HMP to allow for submission and review of the CWPP as soon as possible. A copy of the Adoption Resolution is included in Chapter 14.

This document, as written, includes a plan implementation and maintenance section that details the formal process for ensuring that the plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the plan's progress annually and producing a plan revision every five years. This process seeks to keep a steering body that meets the criteria of the original Hazard Mitigation Planning Team intact to perform this annual review. This phase includes strategies for continued public involvement and incorporation of the recommendations of this plan into other planning mechanisms of the Tribe, such as comprehensive plans, capital improvement plans, application of building codes, and development design guidelines.

With the potential pending revisions to FEMA's various programs, the Tribe may elect to utilize the annual review process identified in the Plan Maintenance Section to address any new requirements which may develop under the new administration.

This page intentionally left blank.

CHAPTER 1.
GENERAL INFORMATION

1.1 PURPOSE AND AUTHORITY

The federal Disaster Mitigation Act (DMA) emphasizes the importance of planning for disasters before they occur by requiring tribes, states, and local governments to develop hazard mitigation plans as a condition for federal grant assistance. The DMA (Public Law 106-390; approved by Congress October 10, 2000), amended the Stafford Disaster Relief and Emergency Assistance Act by repealing its previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need to closely coordinate mitigation planning and implementation.

Hazard Mitigation Plan Requirements for Indian Tribal Governments

Requirements for Indian tribal governments were consolidated and clarified when the U.S. Federal Emergency Management Agency (FEMA) amended Title 44 of the Code of Federal Regulations (44 CFR; Section 201) on October 31, 2007 (72 Fed. Reg. 61720) and again on September 16, 2009 (74 Fed. Reg. 47471). These amendments were made in recognition of the status of tribal sovereignty and the government-to-government relationship between FEMA and Indian Tribal governments. They established a protocol for Tribal hazard mitigation plans to be separate from state and local mitigation plans. Final mitigation planning guidelines became effective March 2010. Tribal hazard mitigation plan requirements differ from local hazard mitigation plan requirements and are more like the requirements for a state-level type plan. This Hazard Mitigation Plan (HMP) for the Confederated Tribes of the Chehalis Reservation (herein Chehalis Tribe or CTCR) was developed under those guidelines. The federal statutes define *Indian Tribal Government* as "any Federally recognized governing body of an Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of Interior acknowledges to exist as an Indian Tribe under the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479(a)" (44 CFR 201.2).

1.1.1 Response to DMA

Underlying Principles of the DMA

The intent behind hazard mitigation is to reduce or alleviate loss of life, personal injury, property, and environmental damage that can result from a disaster through long- and short-term strategies. It involves planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many, including private property owners; business, industry, and local, state, and federal government. The DMA encourages tribes, states, and local authorities to work together on pre-disaster planning, promoting sustainability for disaster resistance. *Sustainable hazard mitigation* includes the sound management of cultural and natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. The enhanced planning network called for by the DMA helps tribes and governments articulate accurate needs for mitigation, resulting in faster allocation of funding, and more cost-effective risk reduction projects.

In an effort to support the underlying principles of the DMA, the Chehalis Tribe developed their first Hazard Mitigation Plan in 2010 as a stand-alone plan. An update to the document was developed in 2016, but the final document did not go through FEMA approval, nor adoption. As such, for purposes of updates to items such as previous strategies, the 2010 adopted and approved plan was utilized. Utilizing the 2010 document as a starting point, the Chehalis Tribe developed its 2021 update, again as a stand-alone plan - *The Confederated Tribe of the Chehalis Reservation's 2021 Hazard Mitigation Plan.* This 2025 update further expands on the 2021 edition and demonstrates the Tribe's continued efforts to ensure the safety of their Tribal Citizens, staff, and visitors to the Chehalis Reservation and surrounding lands, while also continuing to be a good stewards to the environment by practicing sound and sensible mitigation efforts.

This 2025 plan has been developed in accordance with requirements of 44 CFR 201.7, including criteria addressing the planning process, risk assessment, mitigation strategy, plan maintenance, and the adoption process. To the greatest extent possible, data from the previous plan has been incorporated into this document; however, in some instances, data referenced is no longer available, and as such, there are new additions to this document which were previously not addressed or included. Likewise, some materials from the previous plan were considered no longer relevant, accurate, or applicable, and were therefore removed. Throughout this document, reflection to the previous plan is made when data was incorporated. The previous plan was utilized as a starting point and was fully reviewed during this update process by all Hazard Mitigation Planning Team Members.

1.1.2 Progress Report of 2021 Hazard Mitigation Plan

Since the 2021 Hazard Mitigation Plan (HMP) was approved, the Tribe has completed many initiatives identified throughout that document in an attempt to serve the population and increase economic growth throughout the planning area. Chapter 13 identifies the current status of the strategies contained in the previous plan. However, for purposes of this update, the 2023 and 2024 Annual Progress Reports identify the following:

2023 Report:

- 17 out of 27 initiatives (62.9%) reported on-going action towards the initiative's completion;

- 4 out of 27 initiatives (18.8%) were reported as having been completed;[1] and
- 6 out of 27 initiatives (28.2%) reported no action taken.

2024 report:

- 19 out of 27 initiatives (70.37%) reported on-going action towards the initiative's completion;
- 7 out of 27 initiatives (25.92%) were reported as being complete; and
- 4 out of 27 initiatives (14.81%) reported no action taken.

The 2021 plan maintenance strategy identified an annual meeting with all planning partners as its method of tracking project completion and identification of hazard impact. Such meetings did not occur every year due to COVID response, staffing levels, and workloads; however, the Tribe's Emergency Management did conduct the 2023 and 2024 annual reviews, which are available on the CTCR's Public Safety website. Data from those reviews have been incorporated into this update, identifying impact from the hazards of concern, as well as the status of the 2021 initiatives. Copies of the Annual Progress Reports are available on the Tribe's Website.[2]

The Tribe feels that the Maintenance Strategy contained in Chapter 13 remains effective and it will be carried forward for this 2025 update. The Tribe's Emergency Manager will continue to work with the Tribal Business Committee in the Tribe's continued quest to reduce the risk and vulnerability to the Chehalis People.

In addition to implementation of some of the 2021 mitigation strategies, the Chehalis Tribe has developed a number of different plans and completed several studies, all of which have enhanced the Tribe's ability to support mitigation-friendly infrastructure development. During development of these various planning efforts, data from the previous Hazard Mitigation Plan were integrated to the greatest extent possible, with the HMP data serving as a starting point. A detailed list of the various efforts which support mitigation is contained within the Capability Matrix (Chapter 4).

Integrating mitigation efforts into the daily practices of the CTCR has become commonplace to a large extent. A number of Tribal Departments' daily practices support mitigation, including the Planning Department, Natural Resources Department, and Community and Culture, among others. These departments, as well as others, have continued to incorporate mitigation activities into various day-to-day functions.

[1] These include actions which are on-going in nature, but for which during the reporting year some element of the initiative was completed.

[2] Annual Reports available at: About Us - The Chehalis Tribe

A few examples of those efforts include:

- Land use development projects emphasizing smart planning by utilizing the risk data to assist in selecting site locations;
- The Tribe continues to purchase farmlands in frequently flooded areas with the sole intent of restoring the lands to its natural habitat to create open space and reduce the negative impact of flooding;
- Building materials and standards based on recommended codes, and overall assessment of the communities' usage of new construction to determine if multiple purposes exist, such as a community center which can also be used as a shelter.
- In addition, during FEMA's 2017 flood study which occurred in Grays Harbor County, the Tribe provided its own maps and information to ensure FEMA included the Tribe in the 2020 National Flood Insurance Rate Maps identifying, for the first time, the flood hazard area on the Chehalis Reservation. That data has been utilized for this 2025 update.
- Since completion of the 2021 plan, the Natural Resources Department received grant funding to complete a study of the vegetation on Tribal lands. That grant also provided additional funds to complete a more enhanced risk assessment. The Tribe elected to utilize those additional funds not only for the risk assessment element, but to develop a Community Wildfire Protection Plan (CWPP), which will serve as the Wildfire Chapter (Chapter 11) to this HMP. Data from the vegetation study will also be provided to USDA and USFS to enhance the LANDFIRE data for future updates to that data as it serves as a primary source of information for development of the CWPP.
- During planning stages, project development includes prioritizing mitigation efforts based on impact (positive and negative), such as the project's proximity to 100-year floodplain, landslide risk, and assessing the impact of climate change, among others.

The updated version of the hazard mitigation action plan is a key element of this plan. For the purpose of this document, mitigation action items are defined as: *activities designed to reduce or eliminate the long-term losses resulting from the impacts of natural hazards of concern*. It is through the implementation of the action plan that the Tribe can strive to become disaster-resilient through sustainable hazard mitigation.

Although one of the driving influences for preparing this plan was grant funding eligibility, that is not the focus of this plan, but rather, an added benefit. It was important to the Chehalis Tribe that it examine initiatives that would work through all phases of emergency management and that contribute to, rather than remove from, the environment.

It was also significant to the Tribal Citizens that the mitigation efforts include mainstreaming adaptive, 'no-regrets' strategies which improved their abilities to live with the hazards of concern, while not adversely impacting their beliefs and culture. They have adopted a philosophy of *accommodate, retreat, or protect* when developing their mitigation strategies. As such, some of the initiatives outlined in this plan are not grant-eligible, and grant eligibility was not the focus of the selection. Rather, the focus was on the initiative's effectiveness in achieving the goals of the plan, and whether or not they are within the Tribe's capabilities. Detailed descriptions for these actions can be found in Chapter 13.

1.1.3 Funding Sources

Once the 2025 Hazard Mitigation Plan is approved by FEMA, the Tribe will again be eligible for funding under the Stafford Act. FEMA grant programs provide various funding opportunities to support mitigation planning and projects to reduce potential disaster damages. It is the intent of the Tribe to pursue grant opportunities in the future to assist in mitigating against the Tribe's hazards of concern. Some of those current grant opportunities available which support mitigation efforts are delineated in Table 1-1. Additional funding sources are identified within the Strategy section of this document.

TABLE 1-1
GRANT OPPORTUNITIES

Program	Enabling Legislation	Funding Authorization	Hazard Mitigation Plan Requirement	
			Grantee	Sub-Grantee
Public Assistance, Categories A-B (e.g., debris removal, emergency protective measures)	Stafford Act	Presidential Disaster Declaration	☑	☑
Public Assistance, Categories C-G (e.g., repair of damaged infrastructure, publicly owned buildings)	Stafford Act	Presidential Disaster Declaration	☑	☑
Individual Assistance (IA)	Stafford Act	Presidential Disaster Declaration	☑	☑
Fire Management Assistance Grants	Stafford Act	Fire Management Assistance Declaration	☑	☐
Hazard Mitigation Grant Program (HMGP) Planning and Project Grant	Stafford Act	Presidential Disaster Declaration	☑	☑
Flood Mitigation Assistance (FMA)	National Flood Insurance Act	Annual Appropriation	☑	☑
Severe Repetitive Loss (SRL)	National Flood Insurance Act	Annual Appropriation	☑	☐
Repetitive Flood Claims (RFC)	National Flood Insurance Act	Annual Appropriation	☑	☐
Tribal Homeland Security	Dept. of Homeland Security	Annual Appropriation	☑	☐

TABLE 1-1 GRANT OPPORTUNITIES				
			Hazard Mitigation Plan Requirement	
Program	Enabling Legislation	Funding Authorization	Grantee	Sub-Grantee

☑ = Tribal Hazard Mitigation Plan Required
□ = No Tribal Hazard Mitigation Plan Required

1.2 IMPLEMENTATION AND ASSURANCES

Full implementation of the recommendations of this plan will require time and resources. This plan reflects an adaptive management approach in that specific recommendations and plan review protocols are provided to evaluate changes in vulnerability and action plan prioritization after the plan is adopted. The true measure of the plan's success will be its ability to adapt to the ever-changing climate of hazard mitigation. Funding resources are always evolving, as are programmatic changes based on new mandates. The Chehalis Tribe has a long-standing tradition of proactive response to issues that may impact its members. The Tribe is forward thinking and strives whenever possible to improve the lives of its members, and the residents living in the planning area. This tradition is reflected in the development of this plan, as it is not an easy task to accomplish.

The Tribal Business Committee will assume responsibility for adopting the recommendations of this plan and committing Tribal resources towards its implementation. The framework established by this plan will help identify a strategy that maximizes the potential for implementation based on available and potential resources. It commits the Tribe to pursue initiatives when the benefits of a project exceed its costs, and adequate resources are available. Most important, the Tribe developed this plan with community input. These techniques will set the stage for successful implementation of the recommendations in this plan.

As established within 44 CFR 13.11(c), the Tribal Business Committee will continue to comply with all applicable federal statutes and regulations in effect, including those periods during which the Tribe receives grant funding to ensure grant contract compliance, and scheduled project quarterly and closeouts reports as identified and required within each specific grant. In compliance with 44 CFR 13.11(d) and 2 CFR Parts 200 and 3002, the Tribe, whenever necessary, will reflect new or revised federal statutes or regulations, or any material changes in Tribal policy or operation. It is understood that the Tribe will submit those amendments for review and approval in coordination with FEMA Region X. The Tribe, through assigned project managers and grant coordinators, will work with the granting authority to ensure all necessary reports (quarterly and closeout) and documentation as required by specific grants are completed in compliance with the established regulations.

This plan is intended to cover all properties owned and operated by the Confederated Tribes of the Chehalis Reservation, no matter what their location. This includes all fee and trust lands, as well as those areas associated with the Tribe's Usual and Accustomed Fishing and Hunting areas. These areas are inclusively referred to as the tribal planning area.

1.3 WHO WILL BENEFIT FROM THIS PLAN?

All tribal citizens and businesses of the Confederated Tribes of the Chehalis Reservation are the ultimate beneficiaries of this hazard mitigation plan. The plan reduces risk for those who live in, work in, and visit the planning area. It provides a viable planning framework for all foreseeable natural hazards. Participation in development of the plan by Tribal Hazard Mitigation Planning Team Members (and outside stakeholders as requested by the Tribe) helped ensure that outcomes will be mutually beneficial. The plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.4 HOW TO USE THIS PLAN

This hazard mitigation plan is organized into four primary parts, each of which includes elements required under federal guidelines to attain plan approval:

- Part 1— Introduction
- Part 2— The Planning Process
- Part 3— Community Profile
- Part 4— Risk Assessment
- Part 5—Mitigation Strategy.

The following appendices provided at the end of the plan include information or explanations to support the main content of the plan:

- Appendix A—A glossary of acronyms and definitions.
- Appendix B—An example template for progress reports to be completed as this plan is implemented.

1.5 CHANGES BETWEEN THE 2021 AND 2025 PLAN UPDATE

While plan information has been updated as appropriate, limited differences exist between the 2021 Hazard Mitigation Plan and the 2025 layout. The plan continues to address all planning requirements identified within 44 CFR 201.7 as they existed at the start of this planning process in September 2024. Any revisions to the governing CFR will be addressed in future plan updates, or annual reviews as appropriate. All materials identified in the previous plan have been incorporated and updated as appropriate. This document is also intended to meet the mitigation plan requirements for the Tribal Declarations Guidance.

The plan itself is a comprehensive update of all data and includes best available science which has been enhanced since completion of the previous plan. New studies, reports, and scientific data has been reviewed, and all risk data has been updated to the greatest extent possible with that new data (discussed in detail in the profiles).

Hazards previously identified in the 2021 plan were reviewed and carried over as determined appropriate by the Hazard Mitigation Planning Team, providing information on which to determine a risk-informed approach to all areas of emergency management. The Landslide hazard was again not addressed for this edition of the plan update due to limited impact. The Wildfire Chapter (Chapter 11) was enhanced to meet the requirements of a CWPP. (The Tribe may seek approval of the CWPP by its local fire service providers and State DNR after adoption of the HMP by the Business Committee.) Non-natural hazards were not addressed in this update with the exception of hazardous materials sites.

Based on the risk assessment, all maps, charts, graphics, and associated data have been updated to reflect current findings. Specific methodology for how each assessment was completed is included in Chapter 5.

The same method for the risk ranking of the hazards of concern was utilized for this 2025 update, discussed in Chapter 12. The approach utilized is simplistic in nature and will make future updates less difficult. Social Vulnerability is also addressed in greater detail in this plan, as well as information concerning programs and efforts in place to help address issues associated with social vulnerability.

Structure data was updated to include tribal structures and infrastructure, adding new structures and land mass acquired by the Tribe since completion of the last plan. This will more accurately reflect the actual losses which the Tribe can potentially experience as a result of hazard impact. It is understood that this list will be continually updated to include additional structures and land mass as it is acquired.

Census data was updated with the most current data available; however, there are limitations with respect to US Census data, as only very limited information was available specific to the Tribe. Such are indicated.

The Capabilities Assessment was updated to include a clearer perspective as to the capabilities of the Tribe, while also demonstrating areas on which focus must be given with respect to deficiencies which exist. In many instances, those deficiencies were identified as potential action items/strategies within Chapter 13. The previous goals and objectives were reviewed and confirmed by the Planning Team as appropriate.

Specific strategies and action items identified previously have been discussed in detail in Chapter 13. Those strategies carried over to the 2025 plan are identified, and new strategies and action items are identified. Specific focus was placed on new construction (or newly acquired structures), as the Tribe is actively expanding. Additional items which reflect differences between the previous and current plan update are referenced throughout the plan itself where appropriate and significant.

This page intentionally left blank.

CHAPTER 2.
PLANNING PROCESS

2.1 PLANNING RESOURCE ORGANIZATION

The process followed to develop the Confederated Tribes of the Chehalis Reservation's Hazard Mitigation Plan had the following primary objectives, which are discussed in detail in the following sections:

- Secure grant funding
- Define the planning area
- Establish a Planning Team
- Coordinate with other agencies
- Review existing programs
- Engage the public (as defined by the Tribe)

2.1.1 Funding of the 2025 Hazard Mitigation Plan

This planning effort was funded through a combination of Tribal General Funds (for the HMP) and Washington State Department of Commerce, Climate Resilience Funds (for the CWPP).

2.1.2 Defining the Planning Area

This document constitutes a Tribal Hazard Mitigation Plan for the Confederated Tribes of the Chehalis Reservation. The Plan covers all lands owned and operated by the Chehalis Tribe, whether fee or trust, and whether currently owned, or acquired during the lifecycle of this plan.

The Reservation was first established in 1864 for the Lower and Upper Chehalis people. The planning area is inclusive of the territory within the present boundaries of the Chehalis Indian Reservation as was established by Executive Order of July 8, 1864, and to such other lands without such boundaries as may hereafter be added under any law of the United States, except as otherwise provided by law. The planning area also

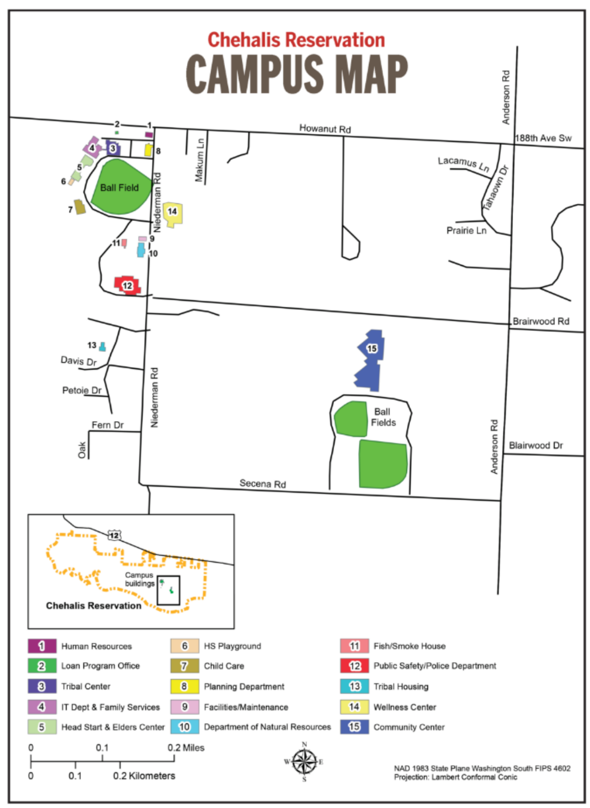


Figure 2-1 Chehalis Reservation Campus

includes those areas utilized and established for the hunting and fishing rights of members, including the right to take fish in usual and accustomed places as provided by treaty or executive order.[3]

The Reservation encompasses fee and trust lands in the areas of Thurston, Grays Harbor, and Lewis Counties, all within Washington State. Maps projected throughout the document are for planning purposes only, and do not represent the exact Reservation Boundary as that changes with some frequency as they relate to fee and trust lands.

The Chehalis Reservation Boundary is located in southwestern Washington State in a river valley formed by the confluence of the Black River and the Chehalis River. The mountains of Capitol Forest and the Doty Hills to the north border the valley.

The Reservation is in excess of 5,800 acres in size; however, not all of the acreage within the Tribe's Reservation boundary is tribally owned. There are ~4,865 acres of tribally owned land in Grays Harbor County; ~1,228 acres of tribally owned land in Thurston County, and ~18 acres in Lewis County. Primary land use within the Reservation boundary consists of agricultural areas, residential neighborhoods, and forested stands. Thurston County land mass includes several of the Tribe's commercial areas, while Lewis County land remains primarily open space.

Tribal government is primarily located in Oakville, Washington, within Grays Harbor County. For purposes of this HMP, the primary area of focus for generalized data is Grays Harbor County, with analysis on critical facilities performed within Grays Harbor and Thurston Counties. While the Tribe owns lands in Lewis County, there are currently no structures on those lands; however, should the Tribe develop any of its properties within Lewis County during the lifecycle of this plan, the intent would be for this plan to also cover those areas with respect to potential recovery for damages as a result of a disaster event.

The current and historical paths taken by the Chehalis and Black Rivers dominate the Chehalis Reservation. The current river channels within the Reservation contain approximately (10) ten miles of the Chehalis River and approximately (3) three miles of the Black River, upstream from the mouth of the river. Many wetlands, sloughs and oxbow ponds are remnants of old river channels. Tribal members utilize the river in many ways, but primarily for harvesting salmon in customary fishing sites. The principal fish harvested are Spring Chinook Salmon, Coho Salmon, Fall Chum Salmon, Fall/Summer Chinook Salmon and Winter Steelhead.

The large quantity of wetlands, riparian areas and water features along with unique land features such as acres of natural prairie lands, provide habitat for a great variety of flora and fauna. Some

[3] https://www.codepublishing.com/WA/ChehalisTribe/#!/ChehalisTribeCB.html

of the major animal species found in the area include elk from the Olympic Elk Herd, white-tailed deer, river otter, opossum, raccoon, bald eagle, great blue heron, and kingfisher.

Historically surrounded by thick forests, the Chehalis Reservation currently has over 2,700 acres of forested stands. There are many stands of White Oak and Douglas Fir as well as riparian areas consisting of a mixture of Western Red Cedar, Big Leaf Maple, Cottonwoods and Alder trees. Many of the stands are second growth populations due to the heavy logging that occurred here within the past 100 years. Additional unique flora found on the Reservation includes camas, shooting stars, wild strawberries, and white oak.

The regular flooding of the rivers has created fertile soils in the valley. The rich soils combined with the long growing season provide a productive agriculture zone. Agriculture became prevalent in the valley and on the Reservation once European settlers moved to the area in the late 1800s. At the peak of farming activities on the Reservation, there were approximately 1,100 acres of land used for raising crops like hay or alfalfa or pasturelands for livestock, with the Chehalis Tribe at one point raising Buffalo on the pasturelands. The average elevation for the Reservation is approximately 82 ft at Mean Sea Level (MSL), with some tribal properties existing at almost sea level.

2.1.3 Formation of the Tribal Hazard Mitigation Planning Team

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. As of this 2025 HMP update, the CTCR elected to integrate planning efforts, and utilize the opportunity to also develop the CTCR's Community Wildfire Protection Plan (CWPP). In support of those efforts, the Tribe elected to utilize its existing Emergency Management Assistance Group (EMAG) as its Hazard Mitigation Planning Team (hereinafter Planning Team).

The EMAG is made up of various Tribal staff and citizens, as well as outside stakeholders who provide services to the CTCR. The Planning Team was formed to help provide information and input into the plan development. For the 2025 update, the Tribe's Historic Preservation Office added a member to work on the EMAG. Other stakeholders from within the planning area were also identified by Tribal Staff to provide relevant information. The Chehalis Tribe retained Bridgeview Consulting, LLC., to assist with development and implementation of the HMP and CWPP. The Bridgeview Consulting Project Manager, Beverly O'Dea, assumed the role of the lead planner, reporting directly to the Tribe's Project Managers, Clinton Davis and Glen Connelly. Table 2-1 lists the members of the team.

2.1.4 Planning Team Meetings

The Planning Team agreed to meet as needed throughout the course of the plan's development. These meetings occurred via conference calls, webinar meetings, and in person one-on-one discussions. The Planning Team addressed a set of objectives based on the work plan established. Various members met beginning November 2024 through the plan's completion, soliciting subject matter expertise from team members as needed depending on the issue being addressed. Members identified actively participated in the planning process.

TABLE 2-1
PLANNING MEMBERSHIP

Name	Position	Planning Task
Clinton Davis	Emergency Manager, Project Manager	Assisted with all tasks associated with the HMP and CWPP development, including consultant solicitation; served as project manager for the HMP portion of the plan, coordinating the capture of information as needed, working with all tribal departments. Mr. Davis served as lead on several public outreach events for both the CWPP and HMP and also conducted regular briefings to Department Heads and others on the scope and project throughout the effort. Mr. Davis assisted with the update of the critical facilities data; conducted plan review during drafting stages, as well as during final review prior to plan going public.
Glen Connelly	Director, Chehalis Tribe Department of Natural Resources	Served as Project Manager for the CWPP portion of the planning efforts; conducted Council Briefings; provided general information on the Chehalis Tribe, including historical information on hazards of concern and the Tribe's enrollment in the NFIP and recent flood studies (Chehalis Basin). Provided information on tribal capabilities and the current existing plans in place; reviewed risk assessment and draft plan once completed.
Calvin Bray	Emergency Management Coordinator	Assisted with all areas of the plans' development. Conducted public outreach efforts at various events throughout the planning process. Provided assistance with data capture and development; assisted with update of the critical facilities list; provided review of risk ranking and hazard profiles; completed draft plan review.
Dan Penn	Historic Preservation Office	Assisted with plan development and reviews.
Mary DuPris	General Manager	Assisted with public outreach and distribution of information; provided input and data into plan; reviewed and commented on draft plan; assisted with plan adoption.

TABLE 2-1
PLANNING MEMBERSHIP

Name	Position	Planning Task
Bryan Sanders	Building Official, Planning Department	Provided information throughout process; reviewed all portions of plan; provided information concerning risk; assisted with identification of assets to be included in risk assessment; assisted with draft and final review.
Chief Kelly Edwards	Public Safety Director / Police Chief	Provided review of hazard profiles; provided historical knowledge of hazard impact; conducted review of draft plan; provided Council briefings.
Alejandro Licea	GIS Analyst	Assisted with the development of critical asset list; provided GIS data for parcel data and roadway layer. Assisted in plan review; provided GIS and mapping assistance as needed throughout planning process.
Miguel Santiago	IT Communications Coordinator	Assisted with public outreach; established HMP website; provided input into risk assessment and hazard profiling; reviewed risk assessment; reviewed and commented on draft plan.
Amy Loudermilk	Director of Planning	Provided historic hazard data on impact to the tribe; provided information on the natural resources of the tribe, including the fish hatcheries; provided information on the long-range and strategic plans of the CTCR; provided information concerning several existing plans in place; conducted review of the draft hazard profiles and draft plan once complete.
Angela Bennett	Wellness Center, Quality Control	Attended meetings, provided input within area fo expertise, conducted plan review.
Misty Secena	Risk Manager	Assted with data capture for update of the critical facilities list, including structure identification and valuation. Provided information on previous insurance claims for use in identifying previous hazard impact.
Janessa Bumgarner	Lucky Eagle Casino CEO	Provided information on Lucky Eagle Casino and Lucky Eagle Hotel; reviewed risk assessment and draft plan once completed.
Chief Rhoads	Grays Harbor Fire District #1 Fire Chief	Attended meetings, provided previous impact information; reviewed and commented on hazard profiles and risk assessment; conducted plan reviews.
Beverly O'Dea,	Bridgeview Consulting, LLC	Project Manager and Lead Planner

2.1.5 Coordination with Other Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.7(b)). This task was accomplished by the Planning Team as follows:

- **Planning Team Involvement**—Tribal department and various agency representatives were invited to participate on the Planning Team.
- **Agency Notification and/or Use of Information**—The following agencies were notified of the planning effort, provided relevant data, invited to participate in the plan development process, or were kept apprised of plan development milestones. These notifications took place via email or telephonic contact:
  - FEMA Region X – various personnel
  - Grays Harbor and Thurston Counties (Emergency Managers)
  - Washington State Department of Natural Resources (various divisions)
  - Washington State Department of Ecology (various divisions)

  These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process. These agencies supported the effort by providing feedback on issues, or by providing necessary data.
- **Pre-Adoption Review**— Agencies listed above were provided an opportunity to review and comment on this plan, primarily through the Tribe's website, which was utilized for the hazard mitigation plan update. E-mails were distributed containing information concerning draft review, as well as a link to download the plan if desired.
- **Social Media** – The Tribe utilized various social media platforms throughout the process to advise of the projects, distribute survey information, and distribute meeting notices.
- **Newsletters—**In addition to the above, the Tribe distributes a regular newsletter, which announced plan development and milestones. The newsletter also directed Tribal citizens to the newly developed website, and the on-line survey.
- **Press Release –** The Tribe also distributed a press release which announced the planning effort, and provided the address to the *Hazard Mitigation Survey*, asking citizens to complete the document. The Press Release was distributed through the various social media sites and posted on the Tribe's website. Information concerning the HMP process and survey were included.

- **Flyers –** The Tribe also distributed flyers announcing the planning process, as well as inviting tribal members to take the survey. Flyers were distributed in various ways, including through handouts with elders' meal delivery.

Some of the various stakeholders and their respective areas of participation are identified in Table 2-2. This list is not all-inclusive, but does demonstrate the various topics and agencies utilized/contacted.

TABLE 2-2
STAKEHOLDERS AND AREAS OF PARTICIPATION

Stakeholders		**Data and Information Provided**
FEMA Region X	Ted Perkins Joseph Green, Mitigation Program Manager	Flood hazard information Risk Report (Chehalis River) FEMA Plan review
WA DNR	Jesse Duvall	Landslide Data (reviewed but hazard not included) CWPP Workgroup Member
WA DOE	Jerry Franklin, Risk Map Coordinator	Flood data, SRL and CRS data and information;
WA DOE	Diane Fowler, Community Right to Know Coordinator	Reporting Hazmat sites in counties
WA EMD	Kevin Zerbe	Provided generalized comments on portion of the HMP. NFIP Loss Data
USGS		Earthquake and Volcano Data
Thurston County Emergency Management	Emily Schoendorf	CWPP Workgroup Member
Thurston County Conservation District	Stephanie Bishop Community Sustainability Program Director	CWPP Workgroup Member; attended CWPP & HMP outreach events; plan review
Grays Harbor Emergency Management	Hannah Cleverly, EM Manager Nick Faley, EM Program Manager	Provided information specific to Grays Harbor County; conducted review of draft plan.

2.1.6 Review of Existing Information

Chapter 4 of this plan provides a detailed overview of existing information, laws, and ordinances in effect within the planning area that can affect hazard mitigation initiatives. As a whole, hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports, and technical information (44 CFR, Section 201.7(c)(1)(iii)), such as those identified below, many of which can affect mitigation within the planning area:

- Confederated Tribe Chehalis Constitution
- Chehalis Tribe 2021 Hazard Mitigation Plan
- 2009, 2020 Comprehensive Flood Hazard Management Plan
- Grays Harbor County 2017 RiskMap Report
- Grays Harbor County National Flood Insurance Study (2020)
- Chehalis Tribe Comprehensive Emergency Management Plan
- CTCR Resiliency Action Plan (2021)
- Chehalis Tribe Emergency Operations Plan
- Grays Harbor County Hazard Mitigation Plan (2024)
- Thurston County Hazard Mitigation Plan (2024)
- Lewis County Hazard Mitigation Plan (2024 – pending approval)
- State of Washington Enhanced Multi-Hazard Mitigation Plan (2018, 2023)
- Washington Department of Ecology Hazardous Materials Annual Report for Grays Harbor, Thurston and Lewis Counties
- Various watershed restoration project reports
- Various papers and studies concerning the impacts of climate change
- Interpretive Map Series: Earthquake Hazard Maps and Seismic Risk Assessment for Washington
- Chehalis Tribe Transportation Plan (2016)
- Chehalis Tribe Preliminary Engineering Report (Wastewater) (2017)
- Chehalis Vegetation Study (2024)

An assessment of all Tribe’s regulatory, technical, and financial capabilities to implement hazard mitigation initiatives is presented in Chapter 4. Many of these relevant plans, studies and regulations are cited in the capability assessment.

2.1.7 Public Involvement

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR Section 201.7(b), 201.7(c)(1)(i) and 201.7(c)(1)(ii)).

Public Defined

For this planning effort, "public" is defined as tribal citizens, tribal employees, the contractor, and some members of surrounding jurisdictions. While surrounding jurisdictions and governmental agencies had some involvement in the planning effort, the Planning Team was limited to Tribal government, Tribal citizens, Tribal employees, and the contractor. Part of the reason for this decision was to preserve information concerning the Tribe's cultural resources and economic hubs.

Public Outreach Strategy

The strategy for involving the public in this plan emphasized the following elements:

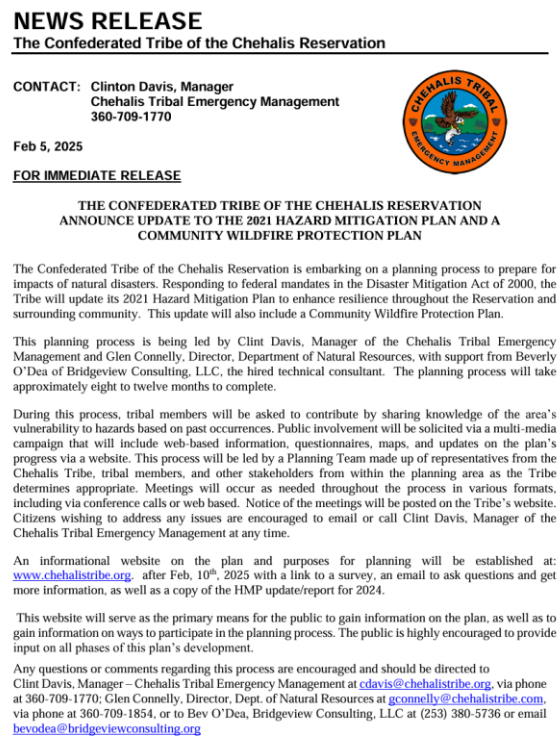
- Include Chehalis Tribal citizens and staff on the Planning Team. Including staff would allow members who are not registered tribal members to respond. The Tribe's HMP Project Manager facilitated the exchange of information throughout this effort with various Planning Team Members.
- Use a questionnaire/survey to determine general perceptions of risk and support for hazard mitigation and to solicit direction on alternatives. The questionnaire was available to anyone wishing to respond via the website, as well as hard copies being made available if requested. The Tribe also posted a news release in the Tribal Newsletter, seeking response and input.

Figure 2-2 Planning Notice 2025 HMP Update

- Utilize existing distribution lists to disseminate and capture relevant information. These lists historically have reached both tribal and non-tribal citizens. (At present, the Tribe has over 1,500 employees, including both tribal and non-tribal members.)
- Identify and involve planning area stakeholders (non-tribal).

To achieve this, the Planning Team utilized websites, various social media platforms, media outlets, email distribution lists, monthly newsletters, CodeRed, and utilized existing in-person and web-based meetings to gain input, as follows:

- Issued News Releases announcing HMP and CWPP process, as well as the availability of the Draft HMP, inviting public input, participation, and comment (see Figure 2-3).
- Utilized existing email address lists to reach tribal members, residents of the surrounding communities, and CTCR staff.
- The Chehalis Tribe developed a webpage to post meeting announcements, risk findings, and draft plan materials in addition to the survey link.
- During routine meetings, Planning Team Members discussed the planning effort and directed interested parties to the website to gain better insight of the on-going endeavors, and to solicit input.
- The Public Safety Director, Chief Kelly Edwards, provided briefings during Business Committee and department head meetings, both of which are open to the public.
- Planning Team Members also identified non-tribal stakeholders who possessed relevant information, which were queried for specific data for inclusion in the plan update.
- The Tribe's Project Manager for this update also conducted one-on-one interviews to capture relevant information as appropriate, and to disseminate information which was captured during the plan's development.



NEWS RELEASE
The Confederated Tribe of the Chehalis Reservation

CONTACT: Clinton Davis, Manager
Chehalis Tribal Emergency Management
360-709-1770

Feb 5, 2025

FOR IMMEDIATE RELEASE

THE CONFEDERATED TRIBE OF THE CHEHALIS RESERVATION ANNOUNCE UPDATE TO THE 2021 HAZARD MITIGATION PLAN AND A COMMUNITY WILDFIRE PROTECTION PLAN

The Confederated Tribe of the Chehalis Reservation is embarking on a planning process to prepare for impacts of natural disasters. Responding to federal mandates in the Disaster Mitigation Act of 2000, the Tribe will update its 2021 Hazard Mitigation Plan to enhance resilience throughout the Reservation and surrounding community. This update will also include a Community Wildfire Protection Plan.

This planning process is being led by Clint Davis, Manager of the Chehalis Tribal Emergency Management and Glen Connelly, Director, Department of Natural Resources, with support from Beverly O'Dea of Bridgeview Consulting, LLC, the hired technical consultant. The planning process will take approximately eight to twelve months to complete.

During this process, tribal members will be asked to contribute by sharing knowledge of the area's vulnerability to hazards based on past occurrences. Public involvement will be solicited via a multi-media campaign that will include web-based information, questionnaires, maps, and updates on the plan's progress via a website. This process will be led by a Planning Team made up of representatives from the Chehalis Tribe, tribal members, and other stakeholders from within the planning area as the Tribe determines appropriate. Meetings will occur as needed throughout the process in various formats, including via conference calls or web based. Notice of the meetings will be posted on the Tribe's website. Citizens wishing to address any issues are encouraged to email or call Clint Davis, Manager of the Chehalis Tribal Emergency Management at any time.

An informational website on the plan and purposes for planning will be established at: www.chehalistribe.org. after Feb, 10th, 2025 with a link to a survey, an email to ask questions and get more information, as well as a copy of the HMP update/report for 2024.

This website will serve as the primary means for the public to gain information on the plan, as well as to gain information on ways to participate in the planning process. The public is highly encouraged to provide input on all phases of this plan's development.

Any questions or comments regarding this process are encouraged and should be directed to Clint Davis, Manager – Chehalis Tribal Emergency Management at cdavis@chehalistribe.org, via phone at 360-709-1770; Glen Connelly, Director, Dept. of Natural Resources at gconnelly@chehalistribe.com, via phone at 360-709-1854, or to Bev O'Dea, Bridgeview Consulting, LLC at (253) 380-5736 or email bevodea@bridgeviewconsulting.org

Figure 2-3 CTCR News Release 2025 HMP and CWPP Projects

Planning Team Input

The majority of the members of the Planning Team live or work in the planning area. The make-up of the Planning Team proved to be integral in the success of this planning effort, as a representative from almost every department of the tribe was represented. This helped to add a historical perspective to this team that proved to be valuable in identifying direction for the plan development process.

Survey

A Hazard Mitigation Survey was developed by the Planning Team Members. The survey was designed to help identify vulnerable areas; to gauge household preparedness, and to identify the level of knowledge of tools and techniques that assist in reducing risk and loss from hazards. The answers helped guide the Planning Team in selecting goals, objectives, and mitigation strategies. The survey was disseminated throughout the planning area by multiple means, including hard-copy distribution and web-based. A web-based version of the survey was also made available on the hazard mitigation plan website.

Survey Results

Of the total responses received to the survey, review of the data indicates the following:

- 77 percent of respondents have previously been impacted by a natural disaster. Of those impacted, 68 percent were impacted by a flood event; 82 percent impacted by a severe weather event, 23 percent were impacted by wildfire, and 38 percent have been impacted by an earthquake.
- 48 percent have been impacted by 1-3 disaster events, with 15 percent impacted by five or more disasters; 55 percent of respondents indicate that the disasters have occurred while they have lived or worked in the tribal planning area, with 42 percent indicating their ability to utilize their residence was impacted, and 50 percent indicating their place of work was impacted.
- 91 percent of respondents indicate that they are familiar with the hazards of concern that have the potential to impact them; 47 percent of respondents maintain homeowners' insurance, with 0 percent, 6.7 percent and 3.3 percent carrying specialized earthquake flood and wildfire insurance, respectively. 10 percent carry no insurance. 61 percent of respondents own their residences.
- When queried, 47 percent of respondents indicate that they are somewhat prepared with respect to self-preparedness, while 27 percent indicate they are adequately prepared; 10 percent indicate they are well prepared, and 17 percent indicate they are not prepared at all.
- Preparedness efforts include 81 percent of responders receiving first aid/CPR training and have installed smoke detectors on each level of their residence; 35 percent have taken mitigation actions to reduce the risk of wildfire; 46 percent have developed a fire escape plan, with 28 percent having established a family meeting place or out-of-area phone contact. 60 percent of respondents have medical supplies, including medications, with 56 percent having stored food and water.
- When questioned about the hazards of greatest concern, flood, severe weather and wildfire are the hazards of greatest concern, followed by earthquake, hazardous materials spills, and the impacts of climate change. Landslide and tsunami were the hazards of

least concern. These rankings very closely resemble the results of the planning team with respect to the hazards of greatest concern.

- The Internet (52 percent), public awareness campaigns (42 percent), social media (58 percent) and Tribal Newsletters (68 percent) are the selected means of obtaining hazard information, with tribal meetings (48 percent) also being effective. These were the avenues utilized by the planning team to disseminate information during the development of the hazard mitigation plan.
- When queried about knowing evacuation routes in the case of wildfire, 63 percent of respondents indicated they knew the route. 38 percent of respondents have 2 vehicles, with 28 percent having 3 or more vehicles, and 16 percent having one vehicle.
- The majority of respondents (34 percent) ranged in age from 41 to 50, with 34 percent ranging in age from 51 to over 61, and 31 percent between the ages of 18-40.

Public Meetings

Various public meetings occurred throughout the development of the HMP and CWPP (see Figure 2-4). In addition, the Chehalis Tribe also conducted public outreach events via the internet and web, and made use of existing meetings already scheduled, such as Business Committee and department head meetings. Such events allowed attendees to examine information and still have direct conversations with project staff, as each outreach effort provided direct contact information in addition to planning team member attendance.

Figure 2-4 March 3, 2025 Public Outreach Meeting Presentation of Risk

Information generated from the risk assessment was shared with attendees via in-person meetings, posted on the Tribe's website, and maps printed and posted throughout tribal facilities. Notices were distributed in several different ways, making use of existing capabilities and resources (see Figure 2-5).

Maps, charts, and data were provided for the hazards to which the planning area is most vulnerable. The hazard profiles and risk assessment findings were published on the Tribe's website once completed, asking for citizen review and comments.

Planning Team Members were available to answer questions, with email addresses also provided to enable reviewers to have the ability to email questions and comments.

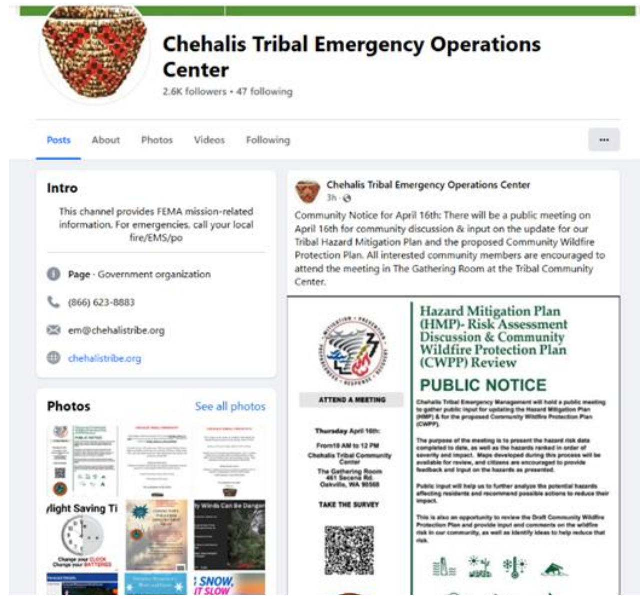


Figure 2-5 Notice of Hazard Data Availability

Questions posed/comments received include:

1. Can individual homeowners request an assessment for home fire ignition zone improvement?
2. What if my neighbor doesn't clean up his stuff around their house and I have to deal with it?
3. Will there be additional meetings presenting the risk information?
4. Past flooding and wind events reduced the respondent's ability to reach the main WWTP facility during critical events.
5. Request to replace or provide a fire extinguisher to each resident on the reservation.
6. Concerns over train derailments (hazmat and fire), and increased wildfire danger due to "lots of grass and prairies" where the respondent lived.

Citizens were asked to complete the on-line survey if they had not yet done so, and each was given an opportunity to provide written comments to the Planning Team. The Planning Team also distributed flyers, providing information on the project. During public meetings, hard copies of the survey were also made available, as well as the flyer containing the QR Code and survey address.

Each distribution also provided the Tribe's website address on which all information was maintained, including the link to the survey. Flyers were distributed at various times throughout the process, including the March CWPP outreach effort, through the Elder's Lunch Program, which included the distribution of handouts when distributing elders' meals, and at Business Committee Meetings. Additional specific details of outreach events are identified in Table 2-2.

Comments received were reviewed and vetted through the Planning Team Members, and data incorporated as appropriate. The initial draft plan was distributed to the Planning Team Members beginning April 7, 2025. After comments and information gathered during the review process were incorporated, the final draft plan was again distributed for review by all Tribal Citizens. Copies of the plan were made available via the Tribe's Mitigation webpage. Notice of its availability was provided through multiple sources, including website postings, internal email distribution lists, CodeRED distribution lists, and employee distribution lists. The draft plan was available from April 17, 2025 – May 5, 2025. Comments received are indicated above.

The final public meeting was held on xxxxx, during which time the plan was presented to the Tribal Business Committee, and at which time the Committee approved and adopted the plan.

News Releases / Newsletters

The Tribe's Newsletter (see Figure 2-6), which is distributed electronically and hardcopy to Tribal Citizens, was also utilized during this process to regularly to provide information concerning on-going efforts with respect to the survey, and on-going planning effort. By engaging the public through the public involvement strategy, the concept of mitigation was introduced to the public, and the Planning Team received feedback that was used in developing the components of the plan.

The Confederated Tribes of the Chehalis Reservation, 'People of the Sands'

CHEHALIS TRIBAL NEWSLETTER

MARCH 2025 FIND HISTORY, HERITAGE & RESOURCES AT CHEHALISTRIBE.ORG

Inside **A wee bit of luck** Youth hunt down treats on St. Patrick's Day page 3

Fall prevention Elders learn ways to stay safe at home page 4

Handcrafted balms, salves Dedicated volunteers make gifts for Elders Luncheon page 6

Tribe focuses on wildfire preparedness

Firewise Program assesses community risks, protection needs

By Bobbie Bush

Chehalis Tribe Advances Wildfire Preparedness through Firewise Program

The Chehalis Tribe's Emergency Management Team hosted a pivotal meeting for the Chehalis Tribal Community Wildfire Protection Plan (CWPP) at the Gathering Room on March 3. The meeting served as an important step in addressing wildfire risks within the community and laying the foundation for a comprehensive protection strategy.

The CWPP core group is assessing the county's wildfire threat and risk conditions, aiming to collaborate with rural fire departments, cooperators and

See **PREPARATION** / *page 5*

Figure 2-6 April Tribal Newsletter

Business Committee Meetings and Website

At the beginning of the plan development process, information was added to the Chehalis Tribe's website to inform and keep the public advised on plan development milestones and to solicit relevant input. Discussions during Tribal Business Committee meetings also occurred, during which the Public Safety Director, Kelly Edwards, and CWPP Natural Resources Director/Project Manager Glen Connelly, provided status updates on the process, solicited information from meeting attendees, and advised of the various project milestones. Tribal leaders, directors, and some tribal citizens attended the various meetings, which are regularly scheduled meetings.

The Chehalis Tribe's website address was publicized in all press releases, mailings, flyers, questionnaires, and public meetings. Information on the plan development process, the Planning

Team, the questionnaire, and phased drafts of the plan were made available to the public on the site. The Tribe intends to keep their website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

2.1.8 Plan Development Chronology/Milestones

Table 2-3 summarizes some of the important milestones in the development of the plan, including some of the public outreach events.

TABLE 2-3
PLAN DEVELOPMENT MILESTONES

Date	Group	Description
2024		
May	Initiate consultant procurement	Seek a planning expert to facilitate the process
June	Select Bridgeview Consulting, LLC to facilitate plan development	Facilitation contractor secured
Nov	Internal Planning Team Meetings (Project Managers, EM Coordinator, Consultant)	Website material developed; Frequently Asked Questioned posted to website, Press Release prepared. Notice distributed on EM Facebook page, an Email blast to all tribal employees, residents, and Tribal owned businesses announcing the HMP and CWPP projects.
2025		
Jan	Identify Additional Planning Team Members; Project Kick-Off Meeting	Formation of the Planning Team began in November; however, due to the holiday season, the Project Managers elected to hold off the HMP kick-off meeting until January. CWPP meetings began in November and included efforts underway in surrounding jurisdictions. As hazard information was completed, information was distributed to internal planning team members. Tasks at the kick-off meeting included review of the existing plan and any new existing documentation which supported the HMP and CWPP effort (e.g., studies, other planning documents, etc.). The Goals and Objectives and Critical Facilities definition, which were carried forward from previous plan edition, was previously provided via email, and confirmed again at the kick-off meeting. Hazards of Concern were also discussed, with no additional hazards identified. The Planning Team identified potential public outreach efforts for presentation of plan and risk information; existing community meetings were utilized as outreach efforts. It was determined that the Tribe would also again use existing Facebook and email distribution lists, as well as CodeRed, which reached tribal and non-tribal citizens, employees, and stakeholders from surrounding communities.
Jan	Survey Launched	Deployed Survey via web, developed posters with the survey address and link, which was included in Tribal Newsletter. Email distributions were also made to tribal citizens, staff, and tribal enterprises.

TABLE 2-3
PLAN DEVELOPMENT MILESTONES

Date	Group	Description
Feb	Public Outreach	Press release was issued discussing the HMP/CWPP process and inviting public participation. Survey link and the Tribe's website for the HMP update was distributed.
March 3	Public Outreach Event – Initial Risk Data provided for public review.	Planning Team Members presented information on various hazards of concern, with a focus on the Draft Community Wildfire Protection Plan recently completed. Representatives from Tribal and State DNR, as well as Fire Service Agencies were present to answer questions. Physical maps, charts and graphs for the various hazards of concern were printed and provided as handouts, in addition to large maps posted throughout the facility.
March 14	Planning Meeting	Additional public outreach events were identified; findings of the risk assessment were discussed. Mitigation Strategies (update of existing strategies and new strategies) and capabilities assessment were discussed.
March 20	Planning Team Internal Review Completed Hazard Profiles	Final hazard profiles were distributed for review and comment to internal planning team.
April	Public Outreach	Distribution of the April Newsletter to all tribal members and citizens discussing the Wildfire Hazard.
April 8	Draft Plan Review	Planning Team Members were provided with a copy of the draft plan for review and comment.
April 16	Public Outreach Event	Planning team members again presented maps and data on the HMP and CWPP inviting public comment; a copy of the draft plan was made available for review and comment.
April 16	Draft Plan Review – Public Comment Period Opened	Notice of the plan's availability was sent out via internal and public Facebook posts, CodeRed, and via various email lists, as well as at public meetings occurring during the open review period. The public review period lasted April 16-May 5, 2025. The Draft HMP was made available on the Tribe's Website, as well as a hard copy at the Emergency Management Office. Comments received were integrated into the final plan as appropriate prior to its submission for review and final adoption by the Tribe's Business Committee.
May	Business Committee Meeting Public Comments on Draft Plan Adoption of HMP and CWPP	During the Tribe's Business Committee Meeting, the Tribe's Natural Resource Director and Public Safety Director provided an overview of planning process, hazards addressed, and the current status of the HMP and CWPP. After review and public comments during the meeting, the Tribal Business Committee adopted the 2025 HMP and CWPP. After adoption, the Business Committee directed that the plan be submitted to the State and FEMA for review and approval.

TABLE 2-3 PLAN DEVELOPMENT MILESTONES		
Date	**Group**	**Description**
May	Plan Submittal	Draft Plan submitted to the State and FEMA Region X for review. The plan was also submitted to Washington State DNR for adoption of the CWPP element.
xxx	Plan Approval	Final plan approved by FEMA

This page intentionally left blank.

CHAPTER 3.
CONFEDERATED TRIBES OF THE CHEHALIS RESERVATION PROFILE

3.1 HISTORY AND GOVERNMENT

Governed by a constitution, the Confederated Tribes of the Chehalis Reservation was first established in 1864 for the Lower and Upper Chehalis people. The bands and tribes that make up the present day Chehalis Tribe include the Upper Chehalis, Lower Chehalis, Cowlitz, Satsop, and Qwalioqua. These bands lived on, hunted and fished from the headwaters of the Chehalis River to Grays Harbor and Willapa Bay and from the area of Olympia on the north, down to the Cowlitz River and its environs in the south.

The Chehalis tribal governing body is the General Council, which is comprised of all enrolled members 18 years of age and older. The Business Committee, a five-member body elected by the General Council for two-year terms, oversees tribal administration and business. The Business Committee is composed of the Tribal Chairman, Vice Chairman, Secretary, Treasurer, and Fifth Council Member. The elected Business Committee members govern the Reservation and all trust lands belonging to the Tribes members.

The tribe's administrative functions are overseen by the general manager who reports directly to and receives policy direction from the Business Committee. The general manager oversees tribal operations through a departmental structure. The tribe's organizational structure and management system promote a separation of policymaking and management functions and establish clear lines of authority within the organization.

The Chehalis Tribe provides a wide variety of public services to the community, including: Law Enforcement, Corrections, a Tribal court system, Medical/Dental Services, Head Start/Early Head Start, Elders meals and center, Vocational Rehabilitation, Education, Planning, Natural Resources, cultural and heritage programs and mental and behavioral health services, including substance abuse counseling.

History

Historically, the indigenous population of the Chehalis originally occupied a specific geography within the Chehalis watersheds. These watersheds encompassed a region from the foothills of the Cascade mountain range to the Pacific Ocean in the southwest region of the state of Washington. "Chehalis" is a collective name for several Salish Tribes living on the Chehalis River, its affluent, and in Grays Harbor. The Chehalis people have lived on a reservation since the 1850's; however, important archaeological, cultural, and historic sites are scattered throughout the original indigenous geography.

The Chehalis Tribe is not a treaty tribe, but in 1864, by executive order, land was set aside for the Chehalis Reservation. In 1939, the Confederated Tribes of the Chehalis Reservation was formed and approved by the federal government and its Constitution was amended in 1973 (Chehalis).

3.2 LOCATION AND GEOGRAPHY

The Confederated Tribes of the Chehalis Reservation is located in southwestern Washington State in a river valley formed by the confluence of the Black River and the Chehalis River. The Reservation boundary is located within Grays Harbor and Thurston Counties, with the Tribe owning additional land mass in Lewis County.

The Reservation is approximately 6,100 acres in size, and consists of agricultural areas, residential neighborhoods, and forested stands. The mountains of Capitol Forest and the Doty Hills to the north border the valley. The average elevation for the reservation is about 82 ft Mean Sea Level, with some tribal properties existing at almost sea level.

The current and historical paths taken by the Chehalis and Black Rivers dominate the Chehalis Reservation. The current river channels within the Reservation contain approximately (10) ten miles of the Chehalis River. Many wetlands, sloughs, and oxbow ponds are remnants of old river channels.

Tribal members utilize the river in many ways, but primarily for harvesting salmon in customary fishing sites. The principal fish harvested are Spring Chinook Salmon, Coho Salmon, Fall Chum Salmon, Fall/Summer Chinook Salmon and Winter Steelhead.

Historically surrounded by thick forests, the Chehalis Reservation currently has over 2,700 acres of forested stands. There are many stands of White Oak and Douglas Fir as well as riparian areas consisting of a mixture of Western Red Cedar, Big Leaf Maple, Cottonwoods and Alder trees. Many of the stands are second growth populations due to the heavy logging that occurred within the past 100 years.

Geology of the Chehalis River Valley is a thick deposit of glacial sand and gravel filling the entire area between the Black Hills to the North and the Doty Hills to the South. Recent geomorphology created rich bottomland in between higher gravelly terraces. Ground water percolates easily through the permeable gravelly outwash deposits and the underlying bedrock serves to conserve this water at depths of less than 100 feet. The porous gravelly outwash deposits allow easy lateral as well as vertical movement of the water.

The regular flooding of the rivers has created fertile soils in the valley. The rich soils combined with the long growing season provide a productive agriculture zone. Agriculture became prevalent in the valley and on the Reservation once European settlers moved to the area in the late 1800's. At the peak of farming activities on the Reservation, there were approximately 1,100 acres of land used for raising crops like hay or alfalfa or pasturelands for livestock.

The large quantity of wetlands, riparian areas, and water features along with unique land features such as acres of natural prairie lands, provide habitat for a great variety of flora and fauna. Some of the major animal species found in the area include elk from the Olympic Elk Herd, white-tailed deer, river otter, opossum, raccoon, bald eagle, great blue heron, and kingfisher. Unique flora found on the Reservation includes camas, shooting stars, and wild strawberries.

The Skookumchuck River is a 45-mile long tributary of the Chehalis River. The Skookumchuck River begins with several tributaries in the Snoqualmie National Forest in the foothills of the Cascade Mountains, and flows west past the town of Bucoda in Thurston County, to its confluence with the Chehalis River near Centralia, in Lewis County. The Skookumchuck Dam was built in 1970, creating the Skookumchuck Reservoir. The dam provides water supply for the Centralia Steam Electric Plant and supplements flows for fish resources. The Chehalis Reservation has been impacted by floodwaters entering the Chehalis River from the Skookumchuck on many occasions as a result of rain falling in the foothills of the Cascade Mountains.

3.3 CLIMATE

In general, the area and the basins that drain to it have a temperate maritime climate with cool, dry summers and mild, wet winters. Precipitation is highly dependent on altitude. Low-lying areas receive this precipitation predominantly as rain, while higher elevations receive a significant proportion as snow. Low-lying areas near the cities of Centralia and Chehalis receive approximately 45 inches of average annual rainfall. The headwaters of the Skookumchuck and Newaukum rivers receive up to 100 inches of annual rainfall. The greatest precipitation within the basin occurs in the Willapa Hills, where the average annual water-equivalent precipitation is as high as 135 inches. Average annual precipitation in the Black Hills is less than other areas and ranges as high as 90 inches.

The prevailing wind direction on the Reservation is influenced by the surface temperature of the Pacific Ocean, the Coast, Cascade Ranges, and the position and intensity of the large high- and low- pressure centers that lie over the ocean. Wind is from the southeast in winter and southwest in summer. During late spring and summer, a prevailing westerly and northwesterly flow of air into Puget Sound brings a dry season beginning in May which reaches a peak in July. In late fall and winter, a prevailing southwesterly and westerly air flow from the Pacific Ocean results in a wet season beginning in October which lasts until the beginning of the dry season in May. During winter, the combined influence of low-pressure systems off the Pacific coast and cold air from the Fraser River Canyon produce strong northeasterly winds. Windspeeds vary by month, with January and April customarily gaining highest speeds, and September lowest speeds.

The ocean currents that flow along Washington State's coast and the Pacific westerlies (also known as the jet stream or storm track) influence the Tribe's moderate climate. The Chehalis Reservation has a temperate climate with dry warm summers and mild winters. Over the course of a year, the temperature typically varies from 33°F to 74°F and is rarely below 23° or above 85°F. On average, the area experiences only one or two days when the temperature is over 90 degrees, which is cooler than many places in Washington.

Snowfall is seldom heavy and varies greatly from year to year. When averaged, the area receives ~3 inches per year, which is much lower than the state-wide average, with precipitation falling approximately 168 days per year.

November is the wettest month, and the driest month is July with 1.3 inches. The wettest season is Spring with 34 percent of yearly precipitation (~43 inches) and 11 percent occurs in Autumn, which is the driest season. The annual rainfall means that certain portions of the Tribal Planning Area, such as the Grays Harbor County area, is wetter than most places in Washington.

3.4 DEMOGRAPHICS, DEVELOPMENT AND REGULATION

Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. Population changes are useful socio-economic indicators. A growing population generally indicates a growing economy, while a decreasing population signifies economic decline.

3.4.1 Tribal Enrollment

Based on Chehalis Enrollment data, enrolled tribal population as of 2025 is approximately 978 citizens. Approximately 835 enrolled members live on or near the Reservation, although members reside in all areas of the world. The Chehalis do anticipate a continued increase in population, with more tribal citizens returning to the area.

3.4.2 Age Distribution

In general, as a group, the elderly (65 and over) are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 5 are also particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

According to Census data (2023), the median age distribution on the Reservation is 43.5 years.[4] Based on Census data, approximately 20 residents are under 5 years of age, with 110 residents over the age of 65.

3.4.3 Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. Personal household economics significantly impact people's decisions on evacuation: those who cannot afford gas for their cars will likely decide not to evacuate.

U.S. Census Bureau data identifies the median household income to be $51,563 (2023 figures), with $66,105 being the median household income. Approximately 23.8 percent of families have fallen below the poverty line in the past 12 months (2023 Census data).[5]

3.4.4 Disabled Populations

The 2010 U.S. Census Bureau estimates 54 million (non-institutionalized) Americans with disabilities in the U.S. This equates to about one-in-five persons. People with disabilities are more likely to have difficulty responding to a hazard event than the general population. Knowing that local government is the first level of response to assist individuals, coordination of efforts to meet

[4] Census Report. Accessed 1 April 2025. Available at: My Tribal Area

[5] ibid

the access and functional needs of individuals with disabilities is paramount to life safety efforts. In this respect, it is important for emergency managers to distinguish the differences between *functional* and *medical* needs to allow them to plan accordingly for incidents which require evacuations and sheltering needs. Pre-determining the percentage of population impacted with a disability will provide emergency management personnel and first responders the information necessary to pre-plan by having individuals available who can provide those services necessary to meet the requirements of those with access and functional needs.

The 2023 Census identified 128 individuals with disabilities specific to the Chehalis Tribe, with five of those under the age of 5 years, and 63 individuals aged 65 and over having a disability. (U.S. Census Report, 2023).[6]

3.4.5 Economy

The Confederated Tribe of the Chehalis Reservation are unique from many other tribes in that they have established a sales tax for businesses existing on the Reservation. Not all businesses on tribal properties are tribal enterprise. In many instances, properties which are owned by the Tribe are leased to outside vendors. Examples include the Jack in the Box, Burger King, Burger Claim, Starbucks and H&R Block, as well as others.

The Tribe also has established a fuel, cigarette, and hospitality tax, which fund various tribal programs, such as for roadways and law enforcement. The Tribe is currently in the process of establishing an alcohol tax program, which when established, will make the Chehalis Tribe the first tribe in the United States to administer such a tax.

The Confederated Tribes of the Chehalis Reservation also requires all businesses operating within the reservation boundaries, or on tribal-owned fee or trust land, to have a valid tribal business license. This includes businesses based in other cities that enter the Chehalis Reservation as part of their work such as, contractors, consultants and small vendor and merchants. Even companies with a temporary presence require a business license.

In addition, the Tribe itself has several major businesses, employing over 1,500 staff. Enterprises include the Confederated Construction Company, the Lucky Eagle Casino, Lucky Eagle Hotel, Marriot Fairfield Inn, Great Wolf Lodge (pictured right), three End of Trail Convenience and Gas Stations,

[6] Ibid.

several restaurants, a cigarette stamping business, the Anderson RV Park, and the Oakridge Golf Course, among other establishments.

One of its newest enterprises is the Talking Cedar Distillery and Brewery. Over the course of the last several years, the CTCR successfully lobbied to overturn a 180-year-old law barring Native American tribes from producing alcohol. Investing over $25 million into its restaurant, brewery, and liquor distillery, the 35,000 square foot facility is the among the biggest in Washington, set to produce 1.8 million gallons of bourbon, vodka, and gin.

Since completion of the last plan, the Tribe has also acquired the Black River Blueberry Farm, known as the *Black River Blues* located on Rochester, WA (pictured right). During the lifecycle of this plan, the Tribe does anticipate completion of additional economic endeavors.

3.5 MAJOR PAST HAZARD EVENTS

Presidential disaster declarations are typically issued for hazard events that cause more damage than tribal governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, tribal and public entities. In some instances, grant funding from disaster declarations are also matched by state programs and funds, for which the Tribe may be eligible.

Table 3-1 identifies all Federal Disaster Declarations which have occurred in Grays Harbor, Thurston, and Lewis Counties since 1972 for which presidential disaster declarations were issued, or in the case of fire, where the fire management was issued.

Unfortunately, many natural hazard events do not trigger or rise to the level of a federal disaster declaration but nonetheless have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for hazards of concern. Limited dollar loss data is available to identify impact to the Chehalis Tribe most events. The CTCR have identified the capture of such loss data as a strategy for future planning efforts, as well as to support grant opportunities.

TABLE 3-1
DISASTER HISTORY 1962-2020

Disaster Number	Declaration Date	Incident Type	Title	Grays Harbor	Thurston	Lewis
FM5359	9/9/2020	Fire	Bordeaux Road Fire		X	
4682	1/12/23	Severe Storm	Severe Winter Storm, Straight-line Winds, Flooding, Landslides and Mudslides			X
4650	3/23/2022	Flood	Severe Winter Storms, Straight-Line Winds, Flooding (Tribal Declaration)	X		X
4635	1/5/2022	Flood	Severe Storms, Straight-Line Winds, Flooding, Landslides and Mudslides			X
4593	4/8/2021	Severe Storm	Severe Winter Storm, Straight Line Winds	X		X
4539	4/23/2020	Severe Storms	Severe Storms, Flooding, Landslides and Mudslides (Jan 20-Feb 10, 2020 incident period)	X	X	X
4481	3/22/2020	Biological	COVID-19	X	X	X
4418	3/4/2019	Severe Storm	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, Mudslides, Tornado (12/10-24/2018 incident period)	X		

TABLE 3-1
DISASTER HISTORY 1962-2020

Disaster Number	Declaration Date	Incident Type	Title	Grays Harbor	Thurston	Lewis
4309	4/21/2017	Flood	Severe Winter Storms, Flooding, Landslides, Mudslides			X
4253	2/2/2016	Flood	Severe Winter Storm, Straight-Line Winds, Flooding, Landslides, Mudslides (Dec 1-14, 2015 incident period)	X		X
4249	1/15/2016	Severe Storm	Severe Storms, Straight-Line Winds, Flooding, Landslides and Mudslides			X
4242	10/15/2015	Severe Storm(s)	Severe Windstorm	X		
4056	3/5/2012	Severe Storm(s)	Severe Winter Storm, Flooding, Landslides, and Mudslides (Jan 14-23, 2012 incident period)	X	X	X
1963	3/25/2011	Severe Storm	Severe Winter Storm, Flooding, Landslides, Mudslides			X
1825	3/2/2009	Severe Storm(s)	Severe Winter Storm, Record and Near Record Snow (Dec 12, 2008 – Jan 5, 2009 incident period)	X	X	X
1817	1/30/2009	Flood	Severe Winter Storm, Landslides, Mudslides, and Flooding (Jan 6-16, 2009 incident period)	X	X	X
1734	12/8/2007	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mudslides (Dec 1-17, 2007 incident period)	X	X	X
1682	2/14/2007	Severe Storm(s)	Severe Winter Storm, Landslides, and Mudslides	X	X	X
1671	12/12/2006	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mudslides (Nov 2-11, 2006 incident period)	X		X
1641	5/17/2006	Severe Storm(s)	Severe Storms, Flooding, Tidal Surge, Landslides, and Mudslides	X		

TABLE 3-1
DISASTER HISTORY 1962-2020

Disaster Number	Declaration Date	Incident Type	Title	Grays Harbor	Thurston	Lewis
1499	11/7/2003	Severe Storm(s)	Severe Storms and Flooding (Oct 15-23 incident period)	X	X	
1361	3/1/2001	Earthquake	Earthquake	X	X	X
1172	4/2/1997	Flood	Heavy Rains, Snow Melt, Flooding, Land and Mudslides (March 18-28, 1997 incident period)	X	X	
1159	1/17/1997	Severe Storm(s)	Severe Winter Storms, Land and Mudslides, Flooding, Ice, Snow) (Dec 26, 1996- Feb 10, 1997 Incident period)	X	X	X
1100	2/9/1996	Flood	High Winds, Severe Storms, Flooding (Jan 26, 1996 – Feb 23, 1996 incident period)	X	X	X
1079	1/3/1996	Severe Storm(s)	Severe Storms, High Wind, and Flooding (Nov 7 – Dec 18, 1995 incident period)	X	X	X
1037	8/2/1994	Fishing Losses	The El Nino (The Salmon Industry)	X		
981	3/4/1993	Severe Storms	Severe Storms, High Winds (Incident period January 20-21, 1993)		X	X
886	3/8/1991	Severe Storms	High Tides, Severe Storm (Incident period 12/30 – 31, 1990)			X
883	11/26/1990	Flood	Severe Storms, Flooding	X		
852	1/18/1990	Flood	Severe Storms, Flooding	X	X	X
784	12/15/1986	Severe Storms	Severe Storms, Flooding			X
623	5/21/1980	Volcano	Volcanic Eruption, Mt. St. Helens	X	X	X
612	12/31/1979	Flood	Storms, High Tides, Mudslides, Flooding	X		

TABLE 3-1 DISASTER HISTORY 1962-2020						
Disaster Number	**Declaration Date**	**Incident Type**	**Title**	**Grays Harbor**	**Thurston**	**Lewis**
545	12/10/1977	Flood	Severe Storms, Mudslides, Flooding	X	X	X
492	12/13/1975	Flood	Severe Storms and Flooding	X	X	X
414	1/25/1974	Severe Storms	Severe Storms, Snowmelt, Flooding		X	X
328	3/24/1972	Flood	Flooding		X	
322	2/1/1972	Flood	Severe Storms and Flooding	X	X	X
300	2/9/1971	Flood	Heavy Rains, Melting Snow, Flooding	X		X
196	5/11/1965	Earthquake	M6.7; 7 fatalities ~$12.5M damages		X	
185	12/29/1964	Flood	Heavy Rains and Flooding	X		X
137	10/20/1962	Severe Storms	Columbus Day Windstorm	X	X	X
EMERGENCY DECLARATIONS						
3227	9/7/2005	Coastal Storm	Hurricane Katrina Evacuation	X	X	X
SIGNIFICANT LOCAL INCIDENTS						
NA	NA	Landslides/Floods	Heavy Rains and Landslides (Countywide not declared) 1/4/2017-1/5/2017	X		

The most common disasters to occur within the three counties, flood and severe storm, are further broken down by month, year, recurrence intervals (not based on order of magnitude), probability of occurrence, and FEMA ranking as illustrated in Table 3-2. For these generalized purposes, recurrence intervals are determined by the number of events divided by the number of years to obtain an average. In some instances, recurrence intervals based on magnitude are contained within the hazard profiles. The recurrence intervals are not based on the order of magnitude, but rather on the event, no matter what the magnitude. The Percent Probability of Occurrence is calculated by the dividing the number of events by years, and then multiplying that sum by 100 to create the percent probability of an event occurring in any given year.

TABLE 3-2
STORM DISASTER HISTORY
MONTH, RECURRENCE, AND PROBABILITY OF OCCURRENCE

Hazard Type	Jan	Feb	Mar	Ap	May	June	July	Aug	Sept	Oct	Nov	Dec	Total	Years of Occurrence (60)	FEMA Rank	Recurrence / Years (No Order of Magnitude)	Probability/ (Percent risk that an event may occur)
GRAYS HARBOR																	
Flood	2	4	1	2	0	0	0	0	0	0	1	4	**14**	64, 71, 72, 75, 77, 79, 90 (x2), 96, 97, 09, 16, 20, 22	1	4.3	23.33
Severe Storm	2	1	3	2	1	0	0	0	0	1	1	2	**13**	96, 97, 03, 06 (x2), 07 (x2), 09, 12, 15, 19, 21, 24	2	4.61	21.67
THURSTON																	
Flood	3	2	2	2	0	0	0	0	0	0	1	2	**12**	72 (x2), 74, 75, 77, 90 (x2), 96, 97, 09, 20, 22	1	5.0	20.0
Severe Storm	2	1	3	0	0	0	0	0	0	0	1	2	**9**	93, 96, 97, 03, 06, 07 (x2), 09, 12	2	6.2	16.07
LEWIS																	
Flood	4	4	2	2	0	0	0	0	0	0	1	4	**17**	64, 71, 72, 74, 75, 77, 86, 90 (2), 91, 96, 09, 16, 17, 20, 22	1	3.5	28.3
Severe Storm	4	1	4	2	0	0	0	0	0	0	0	2	**13**	93, 96 (x2), 97, 06, 07(x2), 09, 11, 12, 16, 20, 21, 23, 24	2	4.6	21.7
Flood Sub-total	**9**	**10**	**5**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**10**	**43**				
Sever Storm Sub-total	**8**	**3**	**10**	**4**	**1**	**0**	**0**	**0**	**0**	**1**	**2**	**6**	**35**				
TOTAL	**17**	**13**	**15**	**10**	**1**	**0**	**0**	**0**	**0**	**1**	**5**	**16**	**78**				

3.6 LAND USE AND FUTURE DEVELOPMENT TRENDS

As a sovereign tribe, decisions on land use are governed by tribal government, who maintain legislative and policy-making authority. The Chehalis Tribe does require permitting for construction occurring on the Reservation or on Tribal lands.

Figure 3-1 Chehalis Forested Lands

In 2004 the CTCR adopted its first Comprehensive Land Use Plan and Zoning Ordinance. Land use categories are divided into six (6) zones: Chehalis Forested Lands (see Figure 3-1 as an example), Agricultural/Rural, Commercial, Mixed-Use, Residential/Commercial, and Residential (see Figure 3-2). Sensitive Lands include Environmental and Cultural lands and may overlay any other zone. Figure 3-3 is an interactive map published by the CTCR, and is available for viewing at Planning Department - The Chehalis Tribe.

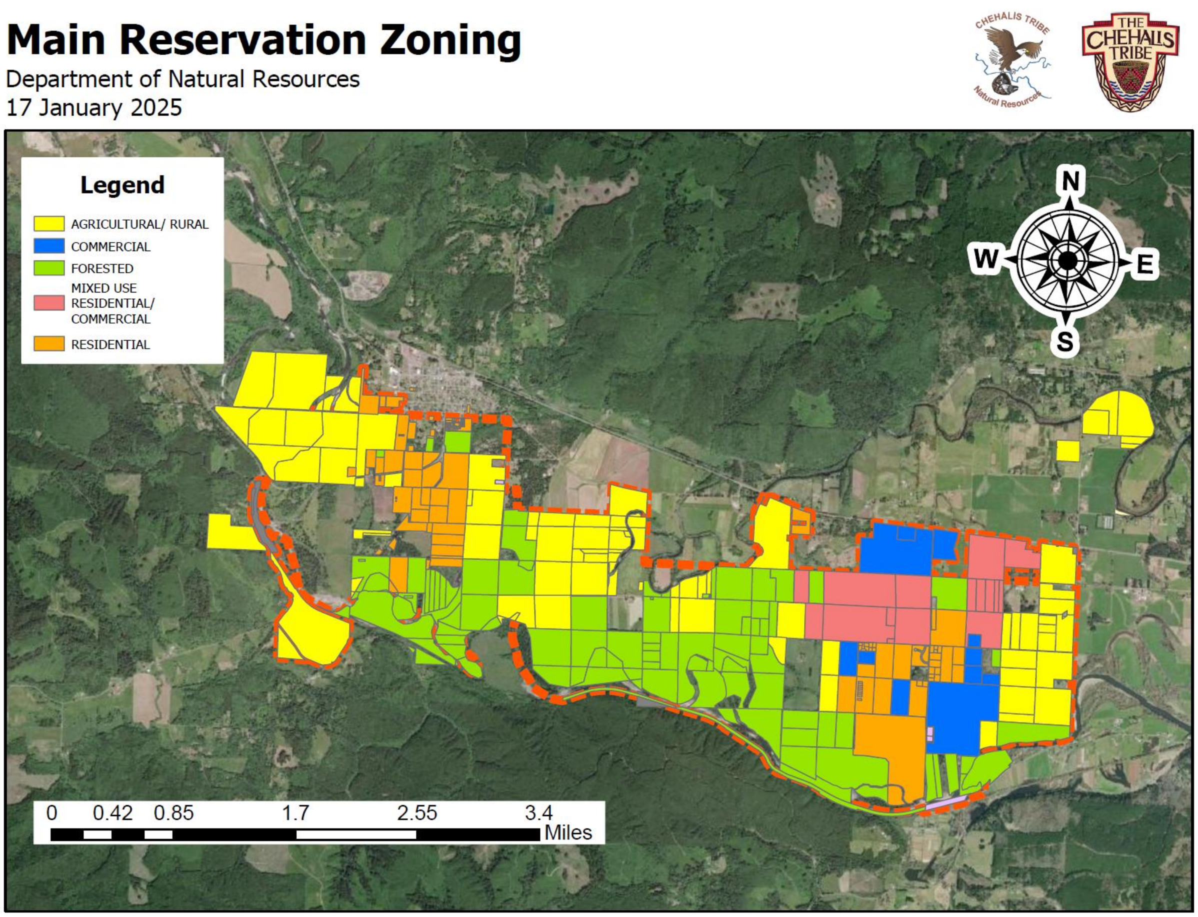


Figure 3-2 Main Reservation Zoning (2025)

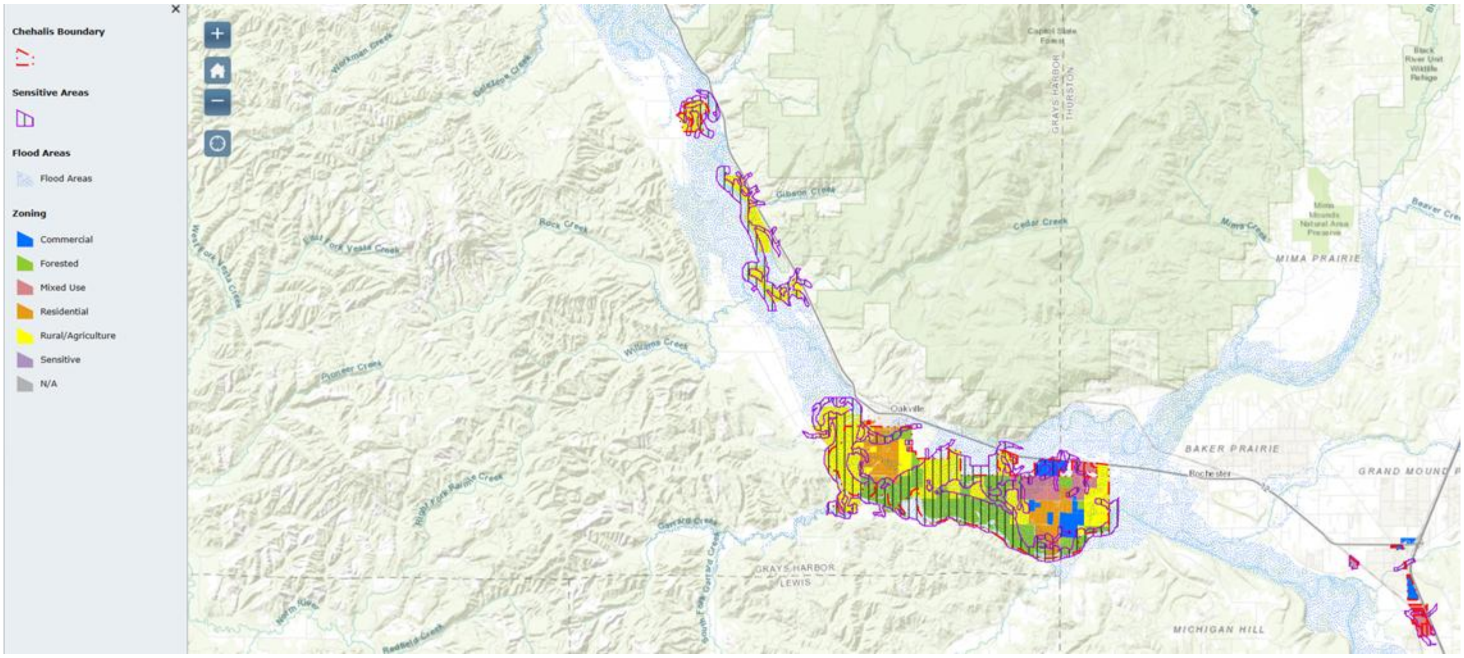


Figure 3-3 CTCR Zoning Map

One of the primary residential areas is located along the north and south sides of Howanut and on both sides of Anderson Road. Tribal government administration, housing authority, public safety, health and social services are located within this area.

Homeownership includes individual trust allotments and HUD housing developments (including rentals) located in the areas of Makum Road, Tahown Road, Sickman Loop, Davis Drive, and Oak Lane. This land has been the traditional development area within the reservation due to its location above the 100-year floodplain. Community water, roads and other utilities have been developed within this area, but the tribe utilizes every possible means to ensure that new development does not have an adverse impact on the hazards of concern.

Much of the owned tribal lands are considered culturally sacred; however, there are specific areas which are particularly more significant, such as burial grounds and areas designated for archaeological preservation. These factors reduce the amount of land available for economic development and community facilities, and are areas on which any type of land development is either totally restricted, or highly monitored.

In addition, the Tribe's cultural resource protection program provides protection to ancestral and sacred sites and landscapes in cooperation with federal, state, and local land management agencies, private developers, and landowners.

Sensitive Lands

The purpose of this designation is to identify those lands that are either uniquely sensitive to the impacts of development or where development poses an unreasonable threat to the health and welfare of reservation residents. All bodies of water on the reservation are designated as sensitive areas, including the lands immediately adjacent and bordering waterways as shown in the list below:

- Both banks of the Chehalis River;
- Land from the riverbank 300 ft landward from the bank within the Reservation exterior boundaries;
- Both banks of the Black River;
- Land adjacent to the Black River 300 ft from the riverbank of both sides;
- Both banks of Willamette Creek; and
- Land adjacent to Willamette Creek 150 ft from the creek banks on both sides.

Permitting and Enforcement

Development is permitted on rural and residential lands. The issuance of permits is based upon review of utilities, suitability of soils for septic installation, existing development patterns, and environmentally and culturally sensitive areas. Rural residential development is built to established densities of one dwelling unit per acre. Development must conform to the Chehalis Building Ordinance and will serve as the primary Rural Residential use area for the Reservation. The Tribe does have a Building Official on staff who inspects all construction on which the Tribe or Tribal lands are involved. CTCR has agreements in place with both Grays Harbor and Thurston Counties to allow for the use of the Tribe's inspector.

All persons conducting any construction and related activities within the boundaries of the Chehalis Indian Reservation or on trust lands are required to obtain a permit from the Chehalis Indian Tribe. This includes, but is not limited to the following types of projects: preparation of a site for the construction of a building; design and installation of septic systems; the construction of any new structure or construction that alters the exterior of an existing structure; road construction; construction or repair of culverts and drainage ditches; construction of any water or flood related project; dredging; drilling; dumping; filling; removal of any sand, gravel, or minerals; and clearing and grading.

Any individual or firm who fails to obtain a permit as required under the ordinance is issued a notice of violation that may include a stop work order.

At present, new buildings funded with Federal dollars are required to be built to existing International Building Code (IBC) standards. The CTCR has always utilized the most stringent codes in place at the time of construction when any construction or remodeling has occurred. Once complete, this 2025 update to the Hazard Mitigation Plan, along with existing development regulations, will be utilized to support land use development in the future by providing vital information on the risk associated with natural hazards in the planning area, and support development in such a way as to reduce the impact of the hazards on the Tribal citizens and visitors to the planning area. The Tribe will incorporate by reference the Hazard Mitigation Plan in any future comprehensive or land use plans as completed. This will ensure that all future trends in development can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan, as well as continue to protect the natural environment.

Future Development

Future development during the life cycle of this plan includes economic expansion. Currently, the following are under review for future development (these areas have been included within the current risk assessment):

- Residential structures, including single family and multi-unit complexes;
- Expanded Golf Course; and
- Expansion of the Talking Cedar Brewery;

In addition, as the 2021 update was occurring, the Lewis County Flood Control Zone District proposed a flood control dam be built in the main stem of the Chehalis River just upriver from the town of Pe Ell to lessen flood damages.

When the dam was first proposed, the Tribe came out strongly against it due to the negative impacts on the environment and ecosystems in the area. As of this 2025 update, the Tribe continues to maintain the opinion that a dam will damage the ecosystem, damage the already declining salmon populations, and damage culturally significant areas upstream. The Washington State Department of Ecology is working on a new Environmental Impact Statement (EIS) for the latest version of the proposed dam and is scheduled to release an updated draft EIS in late 2025/early 2026.

Since the dam was first proposed, a new stakeholder group was formed called the Chehalis Basin Board. The Tribe is a member of the Chehalis Basin Board, which is the body overseeing the development of the Chehalis Basin Strategy.

The Strategy is a holistic approach to achieving flood damage reduction and aquatic species restoration in the Chehalis Basin. The Strategy is managed by the Dept. of Ecology via their Office of the Chehalis Basin, which was created by statute to manage the issues in the basin.

The Tribe continues working with the other members of the Chehalis Basin Board to investigate both dam and non-dam alternatives to reduce flood damage in the basin. They are scheduled to complete their flood project analysis sometime in early 2026 and make decisions on what flood reduction actions and what habitat restoration actions should move forward as part of the Strategy.

Since the original HMP was developed, the Tribe historically practiced low-impact mitigation alternatives to help reduce the vulnerability and risk to the Tribe and its Peoples, while also keeping at the forefront the protection of the natural environment. The Tribe has done this through sound land use practices, such as property acquisition for the purpose of returning land to wetlands or open space. The Tribe feels that with such regulations and practices in place, it will be able to expand and grow with limited increased risk and vulnerability.

The Tribe has taken extreme measures to ensure that land use occurring on the Reservation has not negatively impacted or increased the hazard risk or vulnerability. The land use development which has occurred to date has not only taken into account the hazards of concern, but has been specifically developed in such a way as to reduce the impacts of the hazards.

Examples of the positive and low-impact activities undertaken by the Tribe are discussed throughout the document, but include, among other efforts, acquisition of properties for open space, including the removal of structures from those properties, and elevation of previously flooded structures in conjunction with FEMA projects. Additional projects are further discussed in Chapter 13.

Figure 3-4 Chehalis Tribes' (2024) Tribal Elders Center

3.6.2 Critical Facilities and Infrastructure

Critical facilities and infrastructure are those that are essential to the health and welfare of the population. These become especially important after a hazard event. Critical facilities typically include police and fire stations, schools, shelters, and emergency operations centers, among others. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need, and the utilities that provide water, electricity, and communication services to the community. Also included are “Tier II” facilities and railroads, which hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event. As defined for this Hazard Mitigation Plan, critical facilities are focused on tribal-owned facilities, and include, but are not limited to the following:

- Tribal owned facilities such as department, agency, council facilities, and administrative offices that provide essential services to the Chehalis People.
- Emergency response facilities needed for disaster response and recovery, including, but not limited to: public safety buildings; emergency services buildings; emergency operations centers; emergency supply storage facilities, and shelters.
- Medical and health facilities and offices used during both emergency response or in the normal course of business.
- Facilities that may be used to house or shelter disaster victims, such as: schools/day care facilities, gymnasiums, churches, senior, or community centers.
- Utilities and infrastructure vital to maintaining or restoring normal services to the areas damaged by the disaster.
- Community gathering places, including culturally significant areas, parks, community centers, structures, and meeting halls.
- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials.
- Cultural sites that are vitally important to maintaining the Tribe’s cultural history, language, and traditions, such as burial grounds, archaeological sites, and artifact storage facilities.

The Planning Team developed a detailed list of those structures meeting the identified definition, which was utilized as the primary source of risk assessment during this process.

The critical facilities identified for this plan update incorporate ~55 structures, including culturally significant structures, five tribal-owned bridges, and a tiny home village of six structures, all situated in one central location. The list itself is not provided within this document and is considered confidential. The Tribe will continue to rely on the Thurston and Grays Harbor Counties’ HMP to identify critical or essential facilities which are not owned or managed by the Tribe which are at risk to the hazards of concern.

For emergency management planning purposes, building structure values considered in this plan which are owned and operated by the Chehalis Tribe total approximately $363 million. Table 3-3, Figure 3-5 illustrates the critical facilities in the Tribal Planning Area, inclusive of both the reservation boundary, and off reservation lands.

TABLE 3-3 CRITICAL FACILITIES		
Critical Facilities Types	**Count**	**Building**
Agricultural	1	$1,031,129
Commercial	16	$252,713,924
Cultural / Gathering	1	$22,821,773
Government/Administration	12	$6,653,418
Hazmat (Tribal Owned gas stations)	3	$10,087,555
Industrial (Brewery)	1	$500,000
Medical	4	$9,654,292
Protective	1	$4,189,983
Residential – Tiny Home (six units in one location)	1	$394,734
Schools (Daycare, Head Start)	2	$31,122,502
Shelters	3	$12,176,700
Transportation (bridges)	5	$5,155,000
Wastewater	3	$4,415,949
Water	2	$2,326,208
Totals	**55**	**$363,243,167**

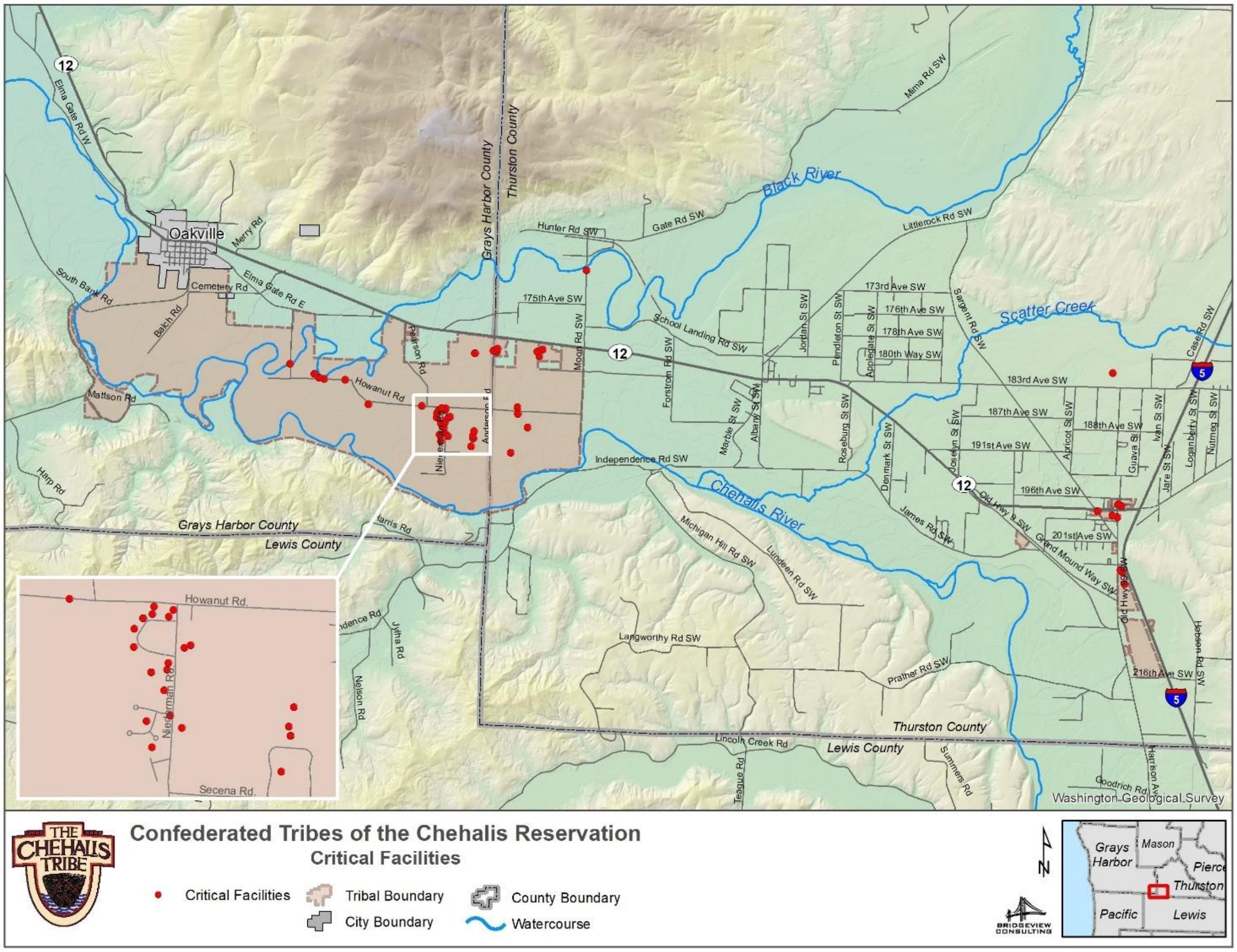


Figure 3-5 Chehalis Tribe Critical Facilities and Infrastructure on Reservation Boundary

3.6.3 Age and Type of Building Stock

The year of construction is significant in determining the potential impact from various hazards due to construction standards in place at the time. Structures built pre-1972 historically have maintained lower building standards than current codes in place. New construction is built to higher standards.

Tribal structures considerably older in nature and considered pre-code include:

- A vintage agricultural barn - 1930.
- Blueberry Farm (acquired since last update) - 1964
- Storage building - 1935
- Oakridge Golf Course Restaurant - 1960
- Head Start/Elder’s Center - 1970

- IT/ Behavioral Health, and Social Services - 1972

All of these structures are wood framed with the exception of the storage building, which is wood/metal combined construction. These structures may be eligible for seismic retrofit due to their age, and the use of the structure. It should be noted that these structures may have undergone some level of updating or remodeling, which could potentially impact the building codes in place.

Three structures were built during the time period 1974-1979, all wood framed, as follows:

- Loan Program Office -1978
- Behavioral Health Wellness House – 1974
- Talking Cedar Temporary Brewing – 1979

Ten structures were built between 1980-1986:

- Natural Resources structure, Fish Hatchery Storage Facility, and the Tribal Community Water System (Tower) – 1980
- Human Resources structure – 1983
- Confederated Construction Company Shop and the Fish Hatchery – 1985
- Tribal Housing Authority – 1986
- Social Health/IT – 1983
- Black River Bridge – 1984
- Briawood Distribution Center and Cold Storage - 1986

The remaining structures were built post-1990. The most recent construction occurring between 2020 - 2024 includes the development of the Talking Cedar Distillery Restaurant and Storage (2020), six Tiny Homes (2021), a Skatepark (2024), and a new Elder's Building (2023), which also serves as a shelter.

- Several structures are modular in nature, with some mobile homes used as office structures.
- The majority of structures are one story, with the Great Wolf Lodge being the tallest structure at eight stories built in 2007. The hotels are 4-5 stories and are built post-2000.
- The majority of the structures owned by the Chehalis Tribe are constructed of wood, several slab on grade, with a few metal structures included.

- No structure included in the risk assessment has a basement.

3.6.4 Transportation

Transportation Planning is performed within the Planning Department, including responsibility for the Indian Reservation Roads (IRR) inventory program, the Tribal Transportation Improvement Plan, road construction and maintenance, sidewalk construction, and public transportation.

The majority of roadways on the Reservation are owned and maintained by the Chehalis Tribe. Current fuel taxes charged by the Tribe are utilized for maintenance of Tribal roadways. In addition to Tribal funding, in some cases, the Bureau of Indian Affairs (BIA) also uses the Tribal Indian Reservation Road Inventory to determine funding for planning and construction of roads critical for the Chehalis Tribe. The Tribe also provides financial assistance and support when possible for federal, state and county roadways in the area which lead onto the Reservation, or Tribal properties.

The Chehalis Reservation Transportation Plan (2017) identifies over 60 miles of roads under the jurisdiction of the CTCR. Major transportation in the area consists of State Routes 8, 105, 107 and 109, as well as U.S. Routes 12 and 101. US Highways 12 and 101, and State Routes 8 and 105, are the main thoroughfares connecting Grays Harbor County to the east, south, and north. SR 8 crosses the Grays Harbor/ Thurston County line approximately 4 miles east McCleary, and terminates in Elma at its intersection with US 12. US Highway 12 enters the county southeast of Oakville and terminates at the US Highway 101 intersection in Aberdeen. US Highway 101 is miles in length and runs from Pacific County to Jefferson County. Other lesser State Routes include 105 (23.1 mi), 107 (8 mi), 109 (40.5 mi), and 115 (2.3 mi).

Several roadways within the Tribe's Long-Range Transportation Plan (2016) identify roadways which require enhancements to help ensure the safety of travelers, including ditch work to appropriately follow watercourses, illumination, guardrails, etc. The Tribe has identified this as a potential strategy over the course of the lifecycle of this plan.

The Chehalis Reservation is served by the Rural and Tribal Transportation Program for public transportation. Currently, four routes service the communities of Rochester, Tenino, Bucoda, Rainier, Yelm, and the Nisqually and Chehalis Reservations. There is also an on-demand service where riders can schedule a pick-up. Transit provides intercity travel between the rural communities, and feeds into service areas of Intercity Transit and Twin Transit, allowing riders to connect to public transportation in urban areas, such as Olympia and Centralia.

3.6.5 Bridges

At present, the Tribe has constructed and is responsible for five bridges on the Reservation. Estimated cost of the bridges exceed $5.15 million. Figure 3-5 (above) illustrates the location of the bridges, categorized as Transportation on the map.

3.6.6 Rail

The Puget Sound and Pacific Railroad (PSAP) is headquartered in Elma, Washington. The PSAP interchanges with the Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) Class I railroads. The PSAP runs through the forest lands of Washington State and serves major lumber customers with transportation services. Freight moves over 108 miles of track in Northwest Washington. The Track runs parallel to State Route 12 along the boundary of the Chehalis Reservation, with the railway crossing the norther portion of the Reservation upstream of the Chehalis River.

Major commodities shipped include lumber, logs, and chemicals for the pulp and paper mills. The PSAP provides an integral service to national account lumber companies moving their products throughout North America. Located on the PSAP is the Port of Grays Harbor that is the only deep-draft shipping port on Washington's coast, only 2 hours from open sea, and centrally located between the Seattle and Portland markets. A continuous rail loop throughout the marine terminal complex allows the free flow of cargo in and out of the facility. The rail loop is designed to handle and store unit-trains as well as smaller sets of rail cars; however, included in those shipments are chemicals which, if released, would be environmentally devastating, as the rail lines cross over tributaries of the Chehalis River and numerous creeks, which ultimately feed into the ocean.

3.6.7 Power

Power providers for the Tribal Planning Area include Grays Harbor PUD and Puget Sound Energy for Thurston County. Lewis County properties do not contain structures. While power outages occur with some frequency at least annually, no planning team member can recall a significant power outage lasting 5 or more days, with the exception of the ice storm which occurred in January 2012.

3.6.8 Hazardous Materials

The planning area has five hazardous materials sites of various types situated within a one-mile radius of tribal structures as identified by Washington State Department of Ecology's Hazardous Materials Annual Report (2024). These sites include structures owned by the City of Centralia, two propane distribution centers, a facility owned by the Town of Bucoda, and a fuel distribution center. These structures are in addition to the Tribe's (owned) gas station facilities.

Hazardous materials can be released for many reasons, including as a potential terrorist target, human error, or the structural integrity being compromised by a natural hazard event, such as an earthquake, flood, or landslide (among others). Release of hazardous materials could cause significant damage to the environment and people.

This page intentionally left blank.

CHAPTER 4.
CAPABILITY ASSESSMENT

The Planning Team performed an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of the Chehalis Tribe's mission, regulations, programs, and policies in place, and evaluates the capacity to carry them out. Table 4-1 summarizes the legal and regulatory capabilities of the Tribe. Table 4-2 summarizes the administrative and technical capability. Table 4-3 summarizes fiscal capability. Table 4-4 identifies mitigation efforts which are on-going in the planning area. This information illustrates an integration of on-going tribal planning efforts, including FEMA programs and initiatives, among others.

TABLE 4-1
LEGAL AND REGULATORY CAPABILITY

	Tribal Authority or Program in Place	Other Jurisdictional Plan or Program in Place	State Mandated	Comments
Codes, Ordinances & Requirements				
Building Code IBC Standards Adopted	Y		Y	The CTCR has developed Title 11 – Land Use and Public Health which identifies building code standards in place.
Floodplain Ordinance				Title 11 Section 20 identifies the Tribe's Flood Damage Prevention Ordinance, adopting the Grays Harbor County Flood Maps.
Stormwater Management	Y	Y	Y	Follow WA State Stormwater Manual
Growth Management	Y			The Tribe established its first Comprehensive Land Use Plan in 2004, which has been updated regularly since that time. While the Tribe is not required to address growth management in the same manner as counties and cities in the state of Washington, it has developed smart land use decisions which are consistent with the county and state requirements as applicable.

TABLE 4-1
LEGAL AND REGULATORY CAPABILITY

	Tribal Authority or Program in Place	Other Jurisdictional Plan or Program in Place	State Mandated	Comments
Site Plan Review	Y			Planning serves as lead on reviews, in conjunction with review and comment from DNR. The Tribe does have a Building Official that also serves as the Building Inspector. The Official is utilized for inspection purposes for all Tribal structures, both on and off the Reservation. The CTCR has agreements in place with Thurston and Grays Harbor Counties for that purpose.
Tribal Health and Safety	Y	Y	Y	Health and Safety as it relates to public health of tribal citizens is addressed to by Tribal Health, who administers programs and provide direct medical services. For some matters, the Tribe works with the various counties and State Dept. of Health to provide various types of health campaigns.
Climate Change Adaptation	Y		Y	The Tribe is very actively engaged in various climate change issues through, among other departments, Natural Resources. Since development of the 2004 HMP, the Chehalis Tribe has had and continues a practice of purchasing frequently flooded lands with the intent of restoring such lands to their natural environment, embracing climate change adaptation practices as climate change continues to impact and exacerbate frequently flooded areas as a result of, among other causes, increased precipitation.
Environmental Protection	Y			Tribal programs as well as EPA regulated programs.

TABLE 4-1
LEGAL AND REGULATORY CAPABILITY

	Tribal Authority or Program in Place	Other Jurisdictional Plan or Program in Place	State Mandated	Comments
Forestland-Urban Interface Fire Protection Act	Y			The Tribe works closely with its local fire protection service entities and enlists the aid of property owners toward the goal of turning properties into less volatile zones, enhancing firefighter safety and effectiveness. While not mandated, the Tribe is actively involved in forestland protection activities. With development of this HMP, it will now contain a CWPP as its wildfire chapter, dealing with forestlands and the Urban Interface Protection Act.
Planning Documents				
Improvement Plan	Y			Improvement plans exist for developed areas, and several undeveloped parcels.
Floodplain or Basin Plans or Activities	Y			The Tribe is actively engaged in the Chehalis Basin Strategy, a state-led planning effort to reduce flood damages and protect aquatic species in the entire Chehalis watershed.
Capital Improvement Plan	Y			The Tribe has a plan in place for future development and enhancement of existing structures.
Habitat Conservation or Clean-Up Plans	Y			Yes. Including Climate Change Adaptation Plan, air/water quality monitoring, creosote clean-up, among others.

TABLE 4-1
LEGAL AND REGULATORY CAPABILITY

	Tribal Authority or Program in Place	Other Jurisdictional Plan or Program in Place	State Mandated	Comments
Community Wildfire Protection Plan	Y	N	N	With this 2025 HMP update, the Tribe developed its first CWPP as the Wildfire chapter. The Tribe continues to work with all of the local fire service agencies which support Tribal response to fires. The Tribe also does participate in planning initiatives as available with surrounding communities to ensure forest health, and works with the local fire suppression organizations as needed. The Tribe provides information to Tribal citizens concerning reducing wildfire risk in the area, and encourages the FireWise Program. The Tribe has established within Title 11, Section 35 an Outdoor Burning ordinance identifying acceptable practices. The Tribe does require an outdoor burn permit for outdoor fires greater than four feet. The Natural Resource Department Director may also issue burn bans.
Transportation Plan	Y			Tribal Transportation Improvement Program, Long Range Transportation Plan, Transportation Safety Plan, Highway 12 Safety Plan.
Response/Recovery Planning				
Comprehensive Emergency Management Plan / Emergency Operations Plan	Y			Yes, adopted in 2021 as part of the previous HMP process. Since completion, emergency management has completed additional annex documents.

TABLE 4-1
LEGAL AND REGULATORY CAPABILITY

	Tribal Authority or Program in Place	Other Jurisdictional Plan or Program in Place	State Mandated	Comments
Threat and Hazard Identification and Risk Assessment	Y			Completed in 2021. Information from this HMP will support the Natural Hazards portion a THIRA. The EQ hazard has been identified within the THIRA as the hazard of greatest concern.
Post-Disaster Recovery Plan	N			The Tribe has various plans in place to address disaster impact, but no specific recovery plan. The emergency manager has again identified this as a potential strategy over the lifecycle of this plan.
Continuity of Operations Plan	Y			Completed in 2021; portions updated 2024.
Administration, Boards, and Commission				
Mitigation Planning Committee	Y			A Hazard Mitigation Committee was established to develop this plan. Those members will remain on the committee during the lifecycle of this plan and will conduct the annual reviews as identified in the plan maintenance section. The 2023 and 2024 annual reviews are available on the Tribe's website at: About Us - The Chehalis Tribe.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems, chipping, etc.)				Several programs are in place to reduce impact from the hazards of concern, including various environmental and climate change programs. The Tribe is also in the process of completing its CWPP in conjunction with this 2025 HMP update, which has identified additional maintenance programs to help reduce wildfire risk.
Mutual Aid Agreements / Memorandums of Understanding	Y		N	The Tribe has MOUs with various entities from which it receives and provides various services.

TABLE 4-2 ADMINISTRATIVE AND TECHNICAL CAPABILITY		
Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Planning Department Staff
Professionals trained in building or infrastructure construction practices (building officials, fire inspectors, etc.)	Yes	Natural Resources Department and Planning Department
Engineers or inspectors specializing in construction practices?	Yes	Planning Department
Planners or engineers with an understanding of natural hazards	Yes	Several in various Tribal Departments.
Staff with training in benefit/cost analysis	Yes	Tribe has performed BCAs.
Surveyors	Yes	Contracted services as needed.
Personnel skilled or trained in GIS applications	Yes	GIS professionals on staff.
Personnel skilled or trained in Hazus use	No	
Scientists familiar with natural hazards in local area	Yes	In various departments.
Emergency Manager	Yes	Designated Emergency Manager; Department is within Public Safety/Law Enforcement.
Grant writers	Yes	On staff.
Warning Systems/Services	Yes	Through County services.
Hazard data and information available to public	Yes	Risk assessment maps are available for review in person and on website. Various flood hazard maps also available.
Maintain Elevation Certificates	Yes	On file with Grays Harbor County for residential structures in flood zones.

TABLE 4-3 FISCAL CAPABILITIES	
Financial Resources	**Accessible or Eligible to Use?**
1. Community Development Block Grants	Yes
2. Capital Improvements Project Funding	Yes
3. Authority to Levy Taxes for Specific Purposes	Yes. As of 2025 update, several in place.
4. User Fees For Water, Sewer, Gas or Electric Service	Yes - Water

TABLE 4-3 FISCAL CAPABILITIES	
Financial Resources	**Accessible or Eligible to Use?**
5. Impact Fees for Buyers or Developers of New Development/Homes (Not at present, but potentially may occur during life cycle of HMP)	Yes
6. Incur Debt through General Obligation Bonds	Yes
7. Incur Debt through Special Tax Bonds	Yes
8. Incur Debt through Private Activity Bonds	Yes
9. Could Withhold Public Expenditures in Hazard-Prone Areas	Yes
10. State-Sponsored Grant Programs	Yes
11. Bureau of Indian Affairs Sponsored Grant	Yes
12. Indian Health Services Grant	Yes
13. U.S. Dept. of Agriculture, Rural Development Agency	Yes
14. U.S. Environmental Protection Agency	Yes
15. U.S. Fire Administration	Yes
16. Tribal Homeland Security Grants	Yes
17. Stafford Act Grants	Yes
18. Healthy Forest Restoration Act	Yes

TABLE 4-4 ON-GOING MITIGATION EFFORTS		
Mitigation Effort	Available? Yes/No	Department/Agency/Position
Hazardous Vegetation Abatement Program	Y	Through various partnerships with the Forest Service
Fire Safe Councils or Fire Wise Community	Y	In process with this 2025 update.
Chipper program	Y	In process with this 2025 update.
Defensible space inspections program	Y	In process with this 2025 update.
Creek, stream, culvert, or storm drain maintenance or cleaning program	Y	Actively involved in management throughout the planning area.
Stream restoration program	Y	Various on-going efforts as well as several completed efforts.
Erosion or sediment control program	Y	Actively involved in various restoration projects throughout the area in support of erosion and sediment control efforts.
Other		

4.1 EXISTING REGULATIONS

Some pertinent federal laws are described below. It should be noted that the Confederated Tribes of the Chehalis Reservation is a sovereign nation, and as such is not required to adhere to any local or state planning regulations; however, in an effort to be a good steward and neighbor, the Chehalis Tribe does strive to plan in consideration of state and local requirements. The Tribe must comply with applicable federal regulations for construction and maintenance of facilities, such as those administered by HUD and EPA, as well as other federal agencies. This places a significant burden upon the Tribe as it is doubly impacted in their efforts when developing land use authority and other regulatory statutes. The Tribe does assert that application of such regulations during its land use development has reduced the impact and vulnerability from the hazards of concern.

4.1.1 Federal

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Grant Program funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. Criminal and civil penalties are provided for violations of the ESA. Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach. The EPA recognizes that Indian Tribes face serious human health and environmental problems and are working with the Indian Tribes to protect the health and environment of waters in Indian Country.

The Chehalis Tribe has EPA approved surface water quality standards that were created to protect the water resources of the Tribe's Usual and Accustomed Area. The Tribe's Department of Natural Resources actively monitors the streams in rivers of the watershed. Additional information is available at: https://www.epa.gov/wqs-tech/water-quality-standards-regulations-confederated-tribes-chehalis-reservation

Presidential Disaster Declarations

Presidentially declared disasters are disaster events that cause more damage than state, tribe or local governments/resources can handle without federal assistance. A Presidential Major Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities. A Presidential Emergency Declaration can also be declared, but assistance is limited to specific emergency needs. Tribal entities have the option of seeking a direct Presidential Declaration, and are not required to join county or state declarations.

Non-FEMA Disaster Declarations

Disaster declarations can also be granted by other federal agencies other than FEMA, such as the Department of Housing and Urban Development, Small Business Administration, and the Bureau of Indian Affairs, among others. In such cases, similar to a Presidentially declared event, funds are designated to help recover from the impact of disaster events, and in some instances, carry a match requirement. Those funds are limited to specific needs and are limited in nature.

4.1.2 State and County Level Planning Initiatives

The Chehalis Tribe must comply with all applicable Federal regulations, which many times are much more stringent than those regulations which state or local jurisdictions must address, placing a much heavier burden on the Tribe as they continue to grow and develop tribal lands. As a sovereign nation, the CTCR is not subject to state or local requirements; however, in the spirit of being a good neighbor and in partnership with the surrounding jurisdictions, the Tribe does consider its local communities in all of its planning initiatives. Some planning initiatives in which the Chehalis Tribe has participated include the following state and local planning initiatives:

- Guidelines for Greenhouse Gas Emissions
- Washington State Building Code
- Thurston, Lewis, and Grays Harbor Counties' Hazard Mitigation Plans
- Climate Change Adaptation Planning
- Chehalis River Basin Planning

4.1.3 General Public Safety Information

Emergency Management:

Emergency management functions are the responsibility of the Public Safety Director, who has designated the Emergency Manager as the primary lead for this effort; however, duties for emergency management planning are shared throughout several departments. The various departments have taken proactive steps to enhance the Tribe's capabilities with respect to emergency response and recovery efforts for both pre-and post-disaster efforts as discussed throughout this plan.

While many of these activities (such as this mitigation plan) have been grant funded through various federal programs, policy development to enhance resilience of the Tribe has been funded through other Tribal funds, demonstrating the Tribe's commitment to developing a robust and applicable *all hazards* emergency management program. During the life cycle of this plan, the Chehalis Tribe will continue to seek funds to assist in the development of various response plans, including potentially a: Comprehensive Emergency Management Plan; Continuity of Operation's Plan, and a Recovery Plan, which will further enhance the Tribe's resiliency to disasters.

National Incident Management System (NIMS):

The Confederated Tribes of the Chehalis Reservation (CTCR) has adopted the National Incident Management System (NIMS) as its operating structure for emergency events.

Schools, Community Centers, and Shelters:

There are no elementary, middle, or high schools owned or operated by the Tribe; however, the Tribe does maintain childcare and Head Start facilities. The Elders' Center also serves as the Head Start facility. Since completion of the last plan, a new Elders' Center has been built. The Elders' Center provides daily meals for seniors and does have a kitchen facility. There is also a Tribal Community Center, which serves as a gathering place for Tribal citizens. All of these facilities could be utilized as emergency shelters as needed, including cooling and warming shelters.

The Tribe's various hotels have also served as shelters during incidents, including housing emergency responders.

The Lucky Eagle Casino parking garage maintains a heliport, which has been utilized for medical evacuation. The Casino hotel is activated for support during emergency operations, during which times all gaming ceases operations. During times of incidents or activation, the hotel houses emergency workers, including police, social services, and casino employees. The kitchen is utilized to provide meals for workers, as well as serving as back-up for the food services for the jail. The Lucky Eagle Casino and Hotel are reliant on propane and gas-powered generators, which is brought in from one of the End of Trails facilities, when possible.

The Great Wolf Lodge also has an area used for medical evacuation for helicopters on the south parking lot. The Lodge itself serves as a shelter for tribal members, employees, and emergency workers for the eastern portion of the Reservation. It also serves as a medical facility to treat the sick and injured during times of incidents. The Great Wolf Lodge does have generators in place to maintain operations.

Disaster Declaration Policy:

The Tribe does have an established Disaster Declaration Policy which allows it to request disaster assistance directly to FEMA (and others). The Chehalis Tribe does have the capacity to administer its own grant and recovery program and would be able to establish an Administrative Plan to administer and track any such grants it receives as a result of any disaster. The Confederated Tribes of the Chehalis Reservation has previously gone directly to FEMA for disaster declarations.

Law Enforcement and Jail:

Law Enforcement services are provided by the Chehalis Tribal Police Department, which is composed of 30 commissioned and non-commissioned personnel, including two Fish and Wildlife Officers. Law Enforcement operations are 24/7. The Tribe also has a 64-person jail facility, with 12 corrections officers.

Hazardous Materials Response:

There are no personnel trained for a large-scale Hazmat response, but the CTCR does have some capacity to do limited cleanup. The Reservation relies on WSP and WDOE for hazmat response and cleanup, but the Lucky Eagle Casino does maintain a contract for services for hazmat incidents occurring at the Casino and its facilities and grounds.

Gaming (Gambling) Enforcement:

The Lucky Eagle Casino has its own security staff which manage the Casino and its hotel. If needed, law enforcement support is provided by Chehalis Tribal Police, or the Thurston County Sheriff's department, as necessary.

Tribal Court:

There is a Court facility housing a Court of General Jurisdiction. The Tribe has criminal, civil, domestic violence, probate, and juvenile operations.

Medical/ Fire Services / Ambulance / Hospital:

Fire services are provided by Grays Harbor Fire District 1 and West Thurston Regional Fire Authority; AMR Ambulance provide both ALS and BLS. The closest hospital is Providence in Centralia. The CTCR does maintain a fairly significant medical staff, including physicians, dentists, physicians' assistants, registered nurses, a lab (for minor issues), and a pharmacy. This includes both contracted and full-time staff. Medical services, including Behavioral Health, are provided to all tribal members, as well as employees with medical coverage. Previously, during COVID response, servicers were open to everyone, whether tribal or non-tribal. The medical facility has the capacity to operate and assist with medical treatment should local area hospitals be at capacity, or should access to the hospitals be restricted.

This page intentionally left blank.

CHAPTER 5.
HAZARD IDENTIFICATION AND RISK ASSESSMENT METHODOLOGY

5.1 OVERVIEW

The DMA requires measuring potential losses to critical facilities and property resulting from natural hazards. A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing. Natural hazards can exist with or without the presence of people and land development. However, hazards can be exacerbated by societal behavior and practice, such as building in a floodplain, along a sea cliff, or on an earthquake fault. Natural disasters are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

The goal of the risk assessment is to determine which hazards present the greatest risk and what areas are the most vulnerable to hazards. The Tribe is exposed to many natural and other hazards. The risk assessment and vulnerability analysis helps identify where mitigation measures could reduce loss of life or damage to property in the planning region. Each hazard-specific risk assessment provides risk-based information to assist the Tribe in determining priorities for implementing mitigation measures.

The risk assessment approach used for this plan entailed using geographic information system (GIS), Hazus hazard-modeling software, and hazard-impact data to develop vulnerability models for people, structures and critical facilities, and evaluating those vulnerabilities in relation to hazard profiles that model where hazards exist. This approach is dependent on the detail and accuracy of the data used. In all instances, this assessment used Best Available Science and data to ensure the highest level of accuracy possible.

This risk assessment is broken down into three phases, as follows:

> The first phase, hazard identification, involves the identification of the geographic extent of a hazard, its intensity, and its probability of occurrence (discussed below). This level of assessment typically involves producing a map. The outputs from this phase can be used for land use planning, management, and development of regulatory authority; public awareness and education; identifying areas which require further study; and identifying properties or structures appropriate for mitigation efforts, such as acquisition or relocation.
>
> The second phase, the vulnerability assessment, combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to the hazard. It then attempts to predict how different types of property and population groups will be impacted or affected by the hazard of concern.

This step assists in justifying changes to building codes or regulatory authority, property acquisition programs, such as those available through various granting opportunities; developing or modifying policies concerning critical or essential facilities, and public awareness and education.

The third phase, the risk analysis, involves estimating the damage, injuries, and costs likely to be incurred in the geographic area of concern over a period of time. Risk has two measurable components:

1. The magnitude of the harm that may result, defined through the vulnerability assessment; and
2. The likelihood or probability of harm occurring.

Utilizing those three phases of assessment, information was developed which identifies the hazards that affect the planning area, the likely location of natural hazard impact, the severity of the impact, previous occurrences, and the probability of future hazard events. That data, once complete, is utilized to complete the Risk Ranking process described in Chapter 12, which applies to all of the data captured.

The following is provided as the foundation for the standardized risk terminology utilized in this effort:

- Hazard: Natural, human caused or technological source or cause of harm or damage, demonstrated as actual (deterministic/historical events) or potential (probabilistic) events.
- Risk: The potential for an unwanted outcome resulting from a hazard event, as determined by its likelihood and associated consequences. For this plan, when possible, risk includes potential future losses based on probability, severity and vulnerability, expressed in dollar losses. In some instances, dollar losses are based on actual demonstrated impact, such as through the use of the Hazus model. In other cases, losses are demonstrated through exposure analysis due to the inability to determine the extent to which a structure is impacted.
- Extent and Location: The area of potential or demonstrated impact within the area in which the analysis is being conducted. In some instances, the area of impact is within a geographically defined area, such as a floodplain. In other instances, such as for severe weather, there is no established geographic boundary associated with the hazard, as it can impact the entire area.
- Severity/Magnitude: The extent or magnitude on which a hazard is ranked, demonstrated in various means, e.g., Richter Scale.
- Vulnerability: The degree of damage, e.g., building damage or the number of people injured.
- Probability of Occurrence and Return Intervals: These terms are used as a synonym for likelihood, or the estimation of the potential of an incident to occur.

5.2 HAZARD IDENTIFICATION AND PROFILES

For this plan, the planning partners and stakeholders considered the full range of natural hazards that could impact the planning area. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Based on the review, the Planning Team confirmed the following natural hazards that this plan addresses as the hazards of concern:

- Drought
- Earthquake
- Flood
- Severe Weather
- Volcano
- Wildfire

The list of hazards remains consistent with the previous plan, with slight modifications to incorporate new studies completed since 2021. The Planning Team again determined that the landslide risk on the Chehalis Reservation and tribal lands is very limited and will not be included. The majority of the slope for the CTCR is less than 15 percent. (See Table 5-1 and Table 5-2.)

Utilizing Washington State Department of Natural Resources' (DNR) Landslide Compilation layer, USGS' 7.5-minute quadrangles and the 100,000 geologic mapping, there are no structures within 500 feet of the historic landslide, or unstable slope zones. There are also no structures within 500 feet of a steep slope. As such, the landslide hazard will not be further reviewed during this 2025 update, but will again be reviewed during the 2030 update to ensure that any new structures acquired or developed by the Tribe over the lifecycle of this plan do not fall within the landslide hazard area.

It should be noted that while the Reservation itself has never been impacted by a landslide, the surrounding planning area has experienced slides which have impacted ingress and egress to the Reservation and tribal lands. Roadways previously impacted include Highway 12 into Grays Harbor. In addition, portions of the Chehalis River (off the Reservation) have also experienced landslides.

TABLE 5-1
CRITICAL FACILITIES WITHIN LANDSLIDE HISTORIC OR UNSTABLE SLOPE ZONES

Hazard Zone	Government Function	Cultural Resource/ Gathering Place	Industrial	Hazardous Materials	Medical	Protective Services	Schools	Shelter	Commercial	Transportation	Water	Wastewater	Total
Within Historic Landslide or Unstable Slope	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Within 500ft. of Historic Landslide or Unstable Slope	0	0	0	0	0	0	0	0	0	0	0	0	**0**

TABLE 5-2
CRITICAL FACILITIES WITHIN LANDSLIDE STEEP SLOPE ZONES

Hazard Zone	Government Function	Cultural Resource/ Gathering Place	Industrial	Hazardous Materials	Medical	Protective Services	Schools	Shelter	Commercial	Transportation	Water	Wastewater	Total
Steep Slopes (40% or >21.8°)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gentle Slopes (15% - 40% or 8.53° - 21.8°)	0	0	0	0	0	0	0	0	0	0	0	0	0

Based on the full spectrum of hazards addressed, it is the intent of the Tribe to use this risk assessment in lieu of preparing a separate hazard identification and vulnerability assessment for other planning efforts which may require same.

The hazard profiles describe the risks associated with identified hazards of concern. Each chapter describes the hazard, the planning area's vulnerabilities, and, when possible, probable event scenarios. The following steps were used to define the risk of each hazard:

Identify and profile the following information for each hazard:

- General overview and description of hazard;
- Identification of previous occurrences;
- Geographic areas most affected by the hazard (extent and location);
- Event frequency estimates;
- Severity estimates;
- Warning time likely to be available for preparedness or response activities;
- Risk and vulnerability assessment, which includes identification of impact on people, property, economy, the environment, and impact from climate change.

5.3 RISK ASSESSMENT PROCESS AND TOOLS

The hazard profiles and risk assessments describe the risks associated with each identified hazard of concern. Each chapter describes the hazard, the planning area's vulnerabilities, and probable event scenarios. Chapter 12 summarizes all analysis through completion of the Calculated Priority Risk Index (CPRI) for hazard ranking.

Once the profiles were completed, the following steps were used to define the risk vulnerability of each hazard:

- Determine exposure to each hazard—Exposure was determined by overlaying hazard maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to each hazard.
- Assess the vulnerability of exposed facilities—Vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and Hazus (discussed below) were used in this assessment.
- Where specific quantitative assessments could not be completed, vulnerability was measured in general, qualitative term, summarizing the potential impact based on past occurrences, spatial extent, and subjective damage and casualty potential. Those items were categorized utilizing the criteria established in the CPRI (see below).

- The final step in the process was to assign a significance level determined by review of the results of vulnerability based on the CPRI schedule, assigning an ordinal assessment based on the following classifications:
  - □ Extremely Low—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
  - □ Low—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
  - □ Medium—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
  - □ High—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
  - □ Extremely High—Very widespread with catastrophic impact.

5.3.1 Calculated Priority Risk Index Scoring Criteria

For the 2025 update, the Planning Team again utilized a Calculated Priority Risk Index Score for each hazard of concern, addressing impact primarily at the reservation level. In some cases, this may include areas off of the reservation, but vulnerabilities are focused on tribal-owned structures. Vulnerabilities are described in terms of critical facilities, structures, population, economic values, and functionality of government which can be affected by the hazard event as identified in the below tables. Hazard impact areas describe the geographic extent a hazard can impact the tribe and are uniquely defined on a hazard-by-hazard basis. Mapping of the hazards, where spatial differences exist, allows for hazard analysis by geographic location. Some hazards can have varying levels of risk based on location. Other hazards cover larger geographic areas and affect the area uniformly. Therefore, a system must be established which addresses all elements (people, property, economy, continuity of government) in order to rate each hazard consistently. The use of the Calculated Priority Risk Index allows such application, based on established criteria of application to determine the risk factor. For identification purposes, the six criteria on which the CPRI is based are probability, magnitude, geographic extent and location, warning time/speed of onset, and duration of the event. Those elements are further defined as follows:

Probability

Probability of a hazard event occurring in the future was assessed based on hazard frequency over a 100- year period (where available). Hazard frequency was based on the number of times the hazard event occurred divided by the period of record. If the hazard lacked a definitive historical record, the probability was assessed qualitatively based on regional history and other contributing factors. Probability of occurrence was assigned a 40% weighting factor, and was broken down as follows:

Rating	Likelihood	Frequency of Occurrence
1	Unlikely	Less than 1% probability in the next 100 years.
2	Possible	Between 1% and 10% probability in the next year, or at least one chance in the next 100 years.
3	Likely	Between 10% and 100% probability in next year, or at least one chance in the next 10 years.
4	Highly Likely	Greater than 1 event per year (frequency greater than 1).

Magnitude

The magnitude of potential hazard events was evaluated for each hazard. Magnitude is a measure of the strength of a hazard event and is usually determined by using technical measures specific to the hazard. Magnitude was calculated for each hazard where property damage data was available and was assigned a 25% weighting factor. Magnitude calculation was determined using the following: *Property Damage / Number of Incidents) / $ of Building Stock Exposure = Magnitude.* In some cases, the Hazus model provided specific people/dollar impact data. For other hazards, a GIS exposure analysis was conducted. Magnitude was broken down as follows:

Rating	Magnitude	Percentage of People and Property Affected
1	Negligible	Less than 5% Very minor impact to people, property, economy, and continuity of government at 90%.
2	Limited	6% to 24% Injuries or illnesses minor in nature, with only slight property damage and minimal loss associated with economic impact; continuity of government only slightly impacted, with 80% functionality.
3	Critical	25% to 49% Injuries result in some permanent disability; 25-49% of population impacted; moderate property damage; moderate impact to economy, with loss of revenue and facility impact; government at 50% operational capacity with service disruption more than one week, but less than a month.
4	Catastrophic	More than 50% Injuries and illness resulting in permanent disability and death to more than 50% of the population; severe property damage greater than 50%; economy significantly impacted as a result of loss of buildings, content, inventory; government significantly impacted; limited services provided, with disruption anticipated to last beyond one month.

Extent and Location

The measure of the percentage of the people and property within the planning area impacted by the event, and the extent (degree) to which they are impacted. Extent and location were assigned a weighting factor of 20%, and were broken down as follows:

Rating	Magnitude	Percentage of People and Property Affected
1	Negligible	Less than 10% Few if any injuries or illness. Minor quality of life lost with little or no property damage. Brief interruption of essential facilities and services for less than four hours.
2	Limited	10% to 24% Minor injuries and illness. Minor, short term property damage that does not threaten structural stability. Shutdown of essential facilities and services for 4 to 24 hours.
3	Critical	25% to 49% Serious injury and illness. Major or long-term property damage, that threatens structural stability. Shutdown of essential facilities and services for 24 to 72 hours.
4	Catastrophic	More than 50% Multiple deaths Property destroyed or damaged beyond repair Complete shutdown of essential facilities and services for 3 days or more.

Warning Time/Speed of Onset

The rate at which a hazard occurs, or the time provided in advance of a situation occurring (e.g., notice of a cold front approaching or a potential hurricane, etc.) provides the time necessary to prepare for such an event. Sudden-impact hazards with no advanced warning are of greater concern. Warning Time/Speed of onset was assigned a 10% weighting factor, and was broken down as follows:

Rating	Probable amount of warning time
1	More than 24 hours warning time.
2	12-24 hours warning time.
3	5-12 hours warning time.
4	Minimal or no warning time.

Duration

The time span associated with an event was also considered, the concept being the longer an event occurs, the greater the threat or potential for injuries and damages. Duration was assigned a weighting factor of 5%, and was broken down as follows:

Rating	Duration of Event
1	6-24 hours
2	More than 24 hours
3	Less than 1 week
4	More than 1 week

Chapter 13 summarizes the analysis conducted by way of completion of the Calculated Priority Risk Index (CPRI) for hazard ranking.

5.3.2 Hazus and GIS Applications

Earthquake and Flood Modeling Overview

In 1997, FEMA developed the standardized Hazards U.S., or Hazus model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology, with new models for estimating potential losses from hurricanes, floods, and tsunami (although still limited in nature).

Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.

- Is administered by the tribal or local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Levels of Detail for Evaluation

HAZUS provides default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

Building Inventory

GIS building data utilizing detailed structure information for tribal facilities was developed for all critical facilities. Building information was developed using best available Tribal data, including building address points, aerial imagery, Tribal First insurance data, and Chehalis Tribe staff resources. Building and content replacement values were estimated using values from various sources, including valuation by Chehalis Tribe staff and insurance records for replacement values.

The following methods were used to assess specific hazards for this plan:

Flood

A GIS exposure analysis of critical facilities and the Tribal Planning Area was performed for the current FEMA regulatory 100- and 500-year flood hazard data, to include the 2020 Chehalis Reservation FIRM, the 2017 Grays Harbor County FIRM, and the 2016 Thurston County FIRM.

Earthquake

An Earthquake shake map prepared by the U.S. Geological Survey (USGS) was used for the analysis of this hazard. A modified version of the National Earthquake Hazard Reduction Program (NEHRP) soils inventory was used. One scenario event was modeled for exposure analysis:

– The scenario event utilized was the Cascadia M9.0 Earthquake.

Drought, Severe Weather, Volcano, and Wildfire

For drought, severe weather and wildfire, historical data is not adequate to model future losses as no specific damage functions have been developed. However, GIS is able to map hazard areas and calculate exposure if geographic information is available with respect to the location of the hazard and inventory data. Areas and inventory susceptible to some of the hazards of concern were mapped and exposure was evaluated. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment. Locally relevant information was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, tribal staff, emergency management personnel and others. The primary data source was Tribal staff, including various GIS data sets, augmented with county, state, and federal datasets. Additional data sources for specific hazards were as follows:

Drought—The risk assessment methodologies used for this plan focus on damage to structures. Because drought does not impact structures, the risk assessment for drought was more limited and qualitative than the assessment for the other hazards of concern. The impact from drought also references fish loss associated with the negative impact of climate change on water levels, and sedimentation issues resulting from drought situations.

Landslide— While this hazard was not profiled within the HMP, the Planning Team did a simple assessment to determine the limited impact. Historic landslide hazard data was used to assess exposure to landslides using Washington State Department of Ecology Landslide Susceptibility data. This data depicts landslide susceptibility at a 10-meter resolution across the state of Washington. Utilizing elevation data and WA DNR identified slope susceptibility at anything greater than 40 percent slope, 100’ and 500’ buffers were used to identify any potential critical facilities falling within these potential landslide hazard areas. It should be noted that *this data is for mitigation planning purposes only, and should not be considered for life safety matters.* Based on the limited impact, no landslide hazard analysis was conducted. The hazard will again be reviewed for inclusion in the 2030 update. Additional landslide data is available at: http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/landslides

Severe Weather—Severe weather data was downloaded from various sources, including the Natural Resources Conservation Service and the National Climatic Data Center, PRISM, Tornado Project, and other sources as referenced. A lack of data separating severe weather damage from flooding, windstorms, and landslide damage prevented a detailed analysis for exposure and vulnerability, as well as the fact that there are no generally accepted damage functions for the hazard. For planning purposes, it is assumed that the entire planning area is exposed to some extent to severe weather. Certain areas are more exposed due to geographic location and local weather patterns, as well as the response capabilities of local first responders.

Volcano - There are currently no generally accepted damage functions for volcanic hazards in risk assessment platforms such as Hazus or any GIS system for the ash fall associated with the hazard. There would also be too many variables to associate with any type of plume modeling for ash. No historical data was available specifically for the Chehalis Tribe with respect to impact and losses associated with the eruption of Mount St. Helens on which impact could be based. Therefore, for planning purposes, it is assumed that the entire planning area is exposed to some extent to ash accumulations from eruption of Mt. Rainier, Mt. Saint Helens, or Mt. Adams. Those structures would be vulnerable to the excessive weight of tephra and rainfall. Certain areas are more exposed to ash accumulations due to geographic location and local weather patterns, as well as the response capabilities of local first responders. No structures were within the Lahar inundation zones.

Wildfire— There is currently no validated damage function available to support wildfire mitigation planning because no such damage functions have been generated. Instead, dollar loss estimates were developed by calculating the value of exposed structures identified utilizing the various LANDFIRE Fire Regime datasets, the WHP data, the National Response Index, and the Wildfire Risk to Communities data, among other sources as available for the tribal planning area.

5.3.3 Probability of Occurrence and Return Intervals

Natural hazard events with relatively long return periods, such as a 100-year flood or a 500-year earthquake, are often thought to be very unlikely. In reality, the probability that such events occur over the next 30 or 50 years is relatively high.

Natural hazard events with very long return periods, such as 100 or 500 or 1,000 years, have significant probabilities of occurring during the lifetime of a building:

- Hazard events with return periods of 100 years have probabilities of occurring in the next 30 or 50 years of about 26 percent and about 40 percent, respectively.
- Hazard events with return periods of 500 years have about a 6 percent and about a 10 percent chance of occurring over the next 30 or 50 years, respectively.
- Hazard events with return periods of 1,000 years have about a 3 percent chance and about a 5 percent chance of occurring over the next 30 or 50 years, respectively.

For life safety considerations, even natural hazard events with return periods of more than 1,000 years are often deemed significant if the consequences of the event happening are very severe (extremely high damage and/or substantial loss of life). For example, the seismic design requirements for new construction are based on the level of ground shaking with a return period of 2,475 years (2 percent probability in 50 years). Providing life safety for this level of ground shaking is deemed necessary for seismic design of new buildings to minimize life safety risk. Of course, a hazard event with a relatively long return period may occur tomorrow, next year, or within a few years. Return periods of 100 years, 500 years or 1,000 years mean that such events have a 1 percent, a 0.2 percent or a 0.1 percent chance of occurring in any given year.

5.4 LIMITATIONS

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study;
- Incomplete or outdated inventory, demographic or economic parameter data;
- The unique nature, geographic extent and severity of each hazard;
- Mitigation measures already employed; and
- The amount of advance notice residents have to prepare for a specific hazard event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. *The outputs from the risk assessment are generalized, and do not predict precise results. As such, they should be used only to understand relative risk for planning purposes only; not life-safety measures.*

This page intentionally left blank.

CHAPTER 6. DROUGHT

6.1 GENERAL BACKGROUND

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

DEFINITIONS

Drought—The cumulative impacts of several dry years on water users and agricultural producers. It can include deficiencies in surface and subsurface water supplies and cause impacts to health, well-being, and quality of life.

Hydrological Drought—Deficiencies in surface and subsurface water supplies.

Socioeconomic Drought—Drought impacts on health, well-being, and quality of life.

Drought is a prolonged period of dryness severe enough to reduce soil moisture, water, and snow levels below the minimum necessary for sustaining plant, animal, and economic systems. Droughts are a natural part of the climate cycle. For this plan, the Tribe has elected to use Washington's statutory definition of drought (RCW Chapter 43.83B.400), which is based on both of the following conditions occurring:

- The water supply for the area is below 75 percent of normal.
- Water uses and users in the area will likely incur undue hardships because of the water shortage.

6.2 HAZARD PROFILE

6.2.1 Extent and Location

Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- Agricultural—Drought threatens crops that rely on natural precipitation, while also increasing the potential for infestation.
- Water supply—Drought threatens supplies of water for irrigated crops, for communities and for fish and salmon and other species of wildlife.

- Fire hazard—Drought increases the threat of wildfires from dry conditions in forest and rangelands.

In Washington, where hydroelectric power plants generate nearly three-quarters of the electricity produced, drought also threatens the supply of electricity. Unlike most disasters, droughts normally occur slowly but last a long time. Drought conditions occur every few years in Washington.

On average, the nationwide annual impacts of drought are greater than the impacts of many of the other natural hazard, with droughts primarily impacting the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

Drought affects groundwater sources, but generally not as quickly as surface water supplies, although groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest. Reduced water levels in wells also means that the wells are subject to saltwater intrusion.

The area's drinking water comes from the local watersheds (Chehalis Basin and Deschutes) and is provided by individual wells in the Southbank area of the Reservation, with the CTCR providing water on the main portions of the reservation via two water towers and water storage system. Local municipal water purveyors also provide water, including Oakville City Water for residential properties within their distribution area, and Thurston County Water for properties in Thurston County. Drought conditions within the planning area may increase pressure on local aquifers, with increased pumping potentially resulting in saltwater intrusion into freshwater aquifers. Should this occur, it could cause restrictions on economic growth and development, impacting the economy of the Tribe.

6.2.2 Previous Occurrences

In the past century, Washington has experienced several drought episodes, including several that lasted for more than a single season—1928 to 1932, 1992 to 1994, and 1996 to 1997. Table 6-1 identifies additional drought occurrences in the state.

TABLE 6-1
DROUGHT OCCURRENCES

July-August 1902	No measurable rainfall in Western Washington
August 1919	Drought and hot weather occurred in Western Washington
July – August 1921	Drought in all agricultural sections.
June-August 1922	The statewide precipitation averaged 0.10 inches.
March – August 1924	Lack of soil moisture retarded germination of spring wheat.
July 1925	Drought occurred in Washington
July 21-August 25, 1926	Little or no rainfall was reported.
June 1928-March 1929	Most stations averaged less than 20 percent of normal rainfall for August and September and less than 60 percent for nine months.
July – August 1930	Drought affected the entire state. Most weather stations averaged 10 percent or less of normal precipitation.
April 1934-March 1937	The longest drought in the region's history – the driest periods were April-August 1934, September-December 1935, and July-January 1936-1937.
May – September 1938	Driest growing season in Western Washington.
1952	Every month was below normal precipitation except June. The hardest hit areas were Puget Sound and the central Cascades.
January – May 1964	Drought covered the southwestern part of the state. Precipitation was less than 40 percent of normal.
Spring 1966	Drought throughout Washington
June – August 1967	Drought throughout Washington
January – August 1973	Dry in the Cascades.
October 1976 – September 1977	Worst drought in Pacific Northwest history (at that point in time). Below normal precipitation in Olympia, Seattle, and Yakima. Crop yields were below normal and ski resorts closed for much of the 1976-77 season. The 1977 drought led to widespread water shortages and severe water conservation measures throughout Washington. More than 70 public and private drinking-water operations reported water-supply problems. Wheat and cattle were the most seriously affected agricultural products in the state. The Federal Power Commission ordered public utilities on the Columbia River to release water to help fish survive. Agriculture experienced drought-related losses of more than $400 million.
2001	Governor declared statewide Stage 2 drought in response to severe dry spell.

TABLE 6-1 DROUGHT OCCURRENCES	
June – September 2003	Federal disaster number 1499 assigned to 15 counties. The original disaster was for flooding, but several jurisdictions were included because of previous drought conditions. The 2001 drought came on rapidly. Between November 2000 and March 2001, most of the state's rainfall and snowpack totals were only about 60 percent of normal. The 2001 event was a result of warm weather melting snowpack into streams a month earlier than normal. Nine large utility companies statewide advised the Washington State Department of Health that they were highly vulnerable to the drought. Washington declared a statewide drought emergency on March 14, 2001. As a result of the 2001 drought, 90,000 acres of agricultural land were taken out of production; thousands of acres of orchards were unused, and the sugar beet industry was out of production.
March 10, 2005 Governor Declared Drought	Precipitation levels was below or much below the average from November through February, with extremely warm fall and winter months, adversely affecting the state's mountain snowpack. A warm mid-January removed much of the remaining snowpack, with March projections at 66 percent of normal, indicating that Washington might be facing a drought as bad as, or worse, than the 1977 drought. Late March rains filled reservoirs to about 95 percent. State legislature approved $12 million supplemental budget that provided funds to buy water, improve wells, and implement other emergency water supply projects. Wildfires numbers was about 75 percent of previous five years, but acreage burned was three times greater.
2015	2015 was the year of the "snowpack drought." Washington State had normal or near-normal precipitation over the 2014-2015 winter season. However, October through March the average statewide temperature was 40.5 degrees Fahrenheit, 4.7 degrees above the 20th century long-term average and ranking as the warmest October through March on record. Washington experienced record low snowpack because mountain precipitation that normally fell as snow instead fell as rain. The snowpack deficit then was compounded as precipitation began to lag behind normal levels in early spring and into the summer. With record spring and summer temperatures, and little to no precipitation over many parts of the state, the snowpack drought morphed into a traditional precipitation drought, causing injury to crop and aquatic species. Many rivers and streams experienced record low flows.

TABLE 6-1 DROUGHT OCCURRENCES	
2019	On May 20, 2019, Governor Jay Inslee issued an emergency drought declaration in 24 watersheds statewide. According to the Washington State Department of Ecology, very dry conditions over several months and a diminished snowpack impacted streamflow, which were identified to be well below normal conditions across most of the state.[7] Watersheds west of the Cascades crest, which are more rain dependent than rivers on the east side, flowed at much below normal levels. Some rivers set record daily lows for historic May flows. Statewide, at the time the declaration was ordered, only four (4) percent of rivers were flowing at levels above normal. Streamflows were strong in the southeast corner of the state. Twenty-seven out of 62 watersheds were declared for drought as of May 20, 2019. Portions of Grays Harbor, Thurston and Lewis Counties and several of its watersheds were among those identified as having a drought emergency. The Small Business Administration provided SBA loans to cover both economic impacts on businesses dependent on farmers and ranchers that have suffered agricultural production losses, and businesses directly impacted by the disaster.
2020	Several months in a row of below-average precipitation brought drought to the Pacific Northwest in spring 2020, with only the northwestern corner of Washington, around Seattle, free of any kind of drought or abnormal dryness. As the region's dry summer approached, the winter and spring precipitation deficits posed a threat to livestock operators, farmers, and fish, and heightened the risk of wildfires. In this event, while precipitation falling as snow was initially at normal levels, the higher-than-average temperatures caused rapid snow melt, with runoff coming earlier in the year causing high rates of soil moisture evaporation.
2021	The spring of 2021 was the second driest on record, and then an unprecedented late-June heatwave smashed temperature records across the state. In response, Washington State Department of Ecology issued an emergency drought declaration in July 2021 covering 96 percent of the state. Thurston, Grays Harbor and Lewis Counties were all impacted and included in the Drought Emergency Declaration. Only Seattle, Everett, and Tacoma – cities with ample water storage – escaped the designation. The USDA also designated 14 Washington counties as primary natural disaster areas due to the 2021 drought, opening emergency loans to farmers. 8742495_disaster_WA_signed.pdf

[7] Source: https://waterwatch.usgs.gov/?m=real&r=wa

TABLE 6-1 DROUGHT OCCURRENCES	
2022	Historically low water levels closed most recreational fishing on most streams of the Olympic Peninsula. The Small Business Administration provided economic injury disaster loans to 20 Washington counties.
2023	Grays Harbor County, which would include the CTCR, was approved for SBA-drought related damages to crops resulting from drought situation.[8]
2024	On April 16, 2024, the state issued a Drought Declaration due to the low levels of precipitation (both snow and rain) throughout the state. All but limited areas of Seattle, Tacoma, and Everett were impacted (see Figure 6-1 below).

Figure 6-1 Washington State Dept. of Ecology - April 16, 2024 Drought Declaration Areas

[8] SBA: Economic Injury Disaster Loans Available to Washington Small Businesses: Accessed 2 Dec 2024. Available online at: SBA Economic Injury Disaster Loans Available to Washington Small Businesses | U.S. Small Business Administration

6.2.3 Severity

In 1989, the Washington State Legislature gave permanent drought relief authority to the Department of Ecology and enabled them to issue orders declaring drought emergencies. (RCW 43.83B.400-430 and Chapter 173-166 WAC). In Washington State, the statutory criteria for drought is a water supply below 75% of normal and a shortage expected to create undue hardship for some water users.

While droughts customarily do not directly impact structures, droughts do impact individuals (farmers, laborers, etc.), the agricultural and natural resource industries, and other precipitation-dependent sectors. Lack of snowpack has forced ski resorts into bankruptcy. There is increased danger of forest /wildland fires. Millions of board feet of timber have been lost. Loss of forests and trees increases erosion, causing damage to aquatic life, irrigation, and power development by heavy silting of streams, reservoirs, and rivers. The health of forests is also a concern with respect to infestation associated with weakened trees due to drought.

Nearly all areas of Washington are vulnerable to drought. The coastal areas of Washington, the Olympic Peninsula, and areas in Central Washington just east of the Cascades are particularly vulnerable. Many of these areas sustain crops that are dependent upon moisture through the winter and spring, and dryer conditions in the summer.

The severity 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. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, wildlife, and fishing, which can impact people indirectly. When measuring the severity of droughts, analysts typically look at economic impacts.

A drought lasting for more than one season would most likely reduce the annual snowpack accumulated at high elevations in the Cascade Mountains, thereby reducing normal stream flows in local rivers and creeks. Should an extreme, long-term drought occur, a large portion of the population of area would be impacted. Customarily when such events occur, the initial response is to institute a voluntary water conservation measures, particularly in those communities which receive water supplies from the depleted watersheds. Such was the case with the 2019 drought.

The water supply for the planning area is obtained from various sources, including municipal water systems, the Chehalis Tribe's water storage system, and from private wells, all of which are fed from the Chehalis and Black Rivers, and its tributaries with reliable, glacial sources. The effects of an extreme, long-term drought could result in inadequate stream flows and ground water recharge, thereby resulting in the implementation of strict water conservation measures.

A substantial reduction in stream flow along the Wynoochee River could also severely impact the generation of electricity from the hydroelectric dam which is situated in Grays Harbor County. A reduction in hydroelectric generation will result in increased electricity rates or could also result in brown outs.

The National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure drought impacts and severity to map their extent and locations. The Palmer Drought Severity Index (PDSI) and Crop Moisture Index (CMI) are indices of the relative dryness or wetness effecting water sensitive economies. The PDSI indicates the prolonged and abnormal moisture deficiency or excess. The CMI gives both short-term and the current status of the potential for an agricultural drought or moisture surplus, which can change rapidly from week to week. Both indices indicate general conditions and not local variations caused by isolated rain. Input to the calculations include the weekly precipitation total and average temperature, division constants (water capacity of the soil, etc.) and previous history of the indices.

The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. It can be used to help delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires. The CMI can be used to measure the status of dryness or wetness affecting warm season crops and field activities.

What follow are a series of maps indicating current conditions as they relate to Drought. These maps change very frequently and are intended to demonstrate information available to viewers. This information is also relevant when looking at potential fire danger as well. Additional information and current monthly data are available from the NOAA website at the following address: Climate Prediction Center - Monitoring & Data: Drought Monitoring

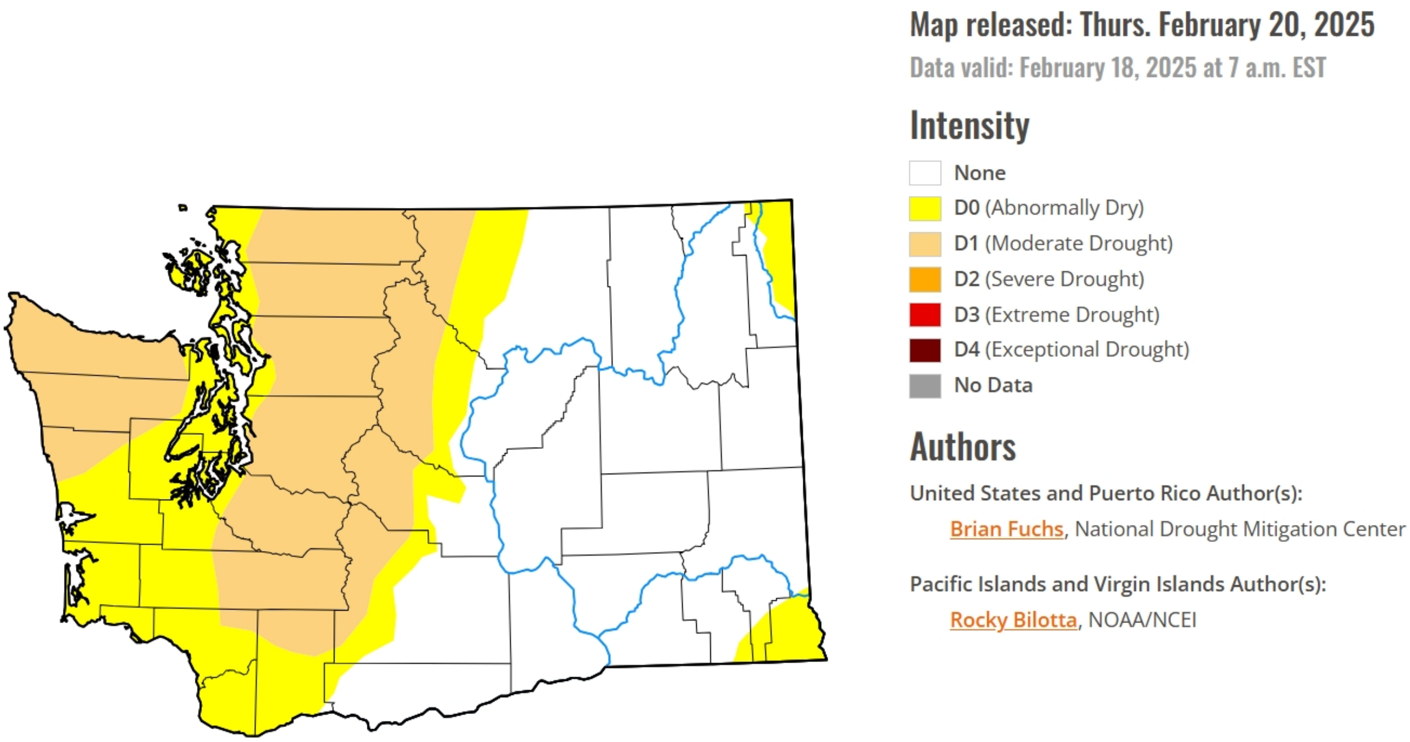


Figure 6-2 February 2025 Drought Monitor (Western Region - Washington)

Source: NOAA Current Map | U.S. Drought Monitor

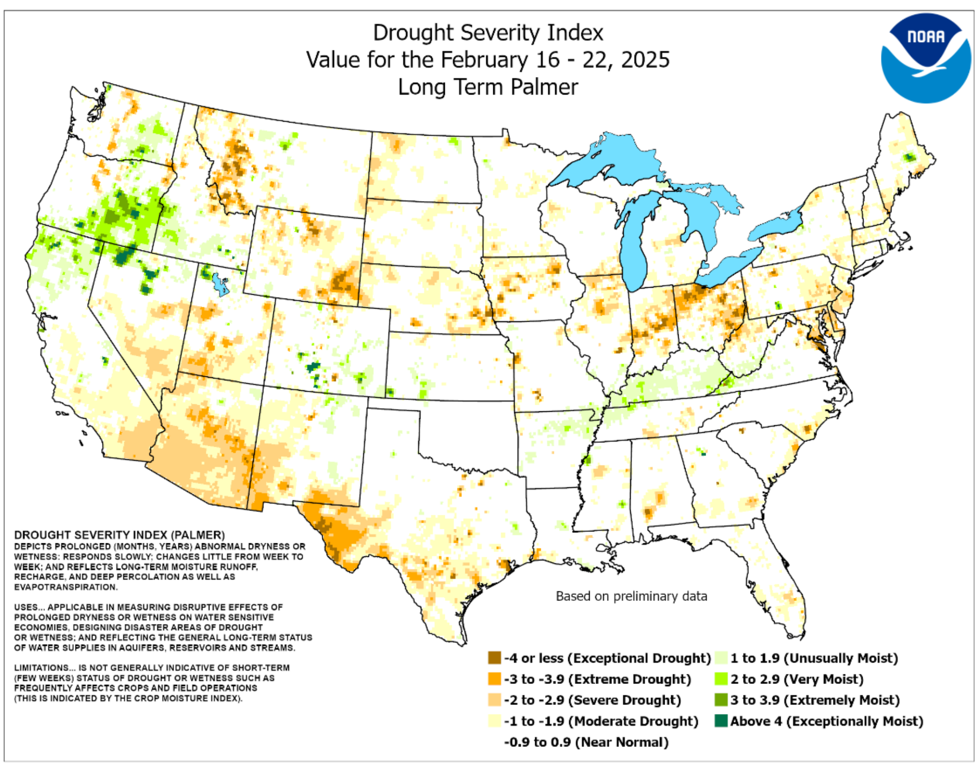


Figure 6-3 Palmer Drought Severity Index February 2025

Source: NOAA PDSI.png (2200×1700)

The ***Palmer Crop Moisture Index*** measures short-term drought on a weekly scale and is used to quantify drought's impacts on agriculture during the growing season. See figure below for the current information available as of this update.

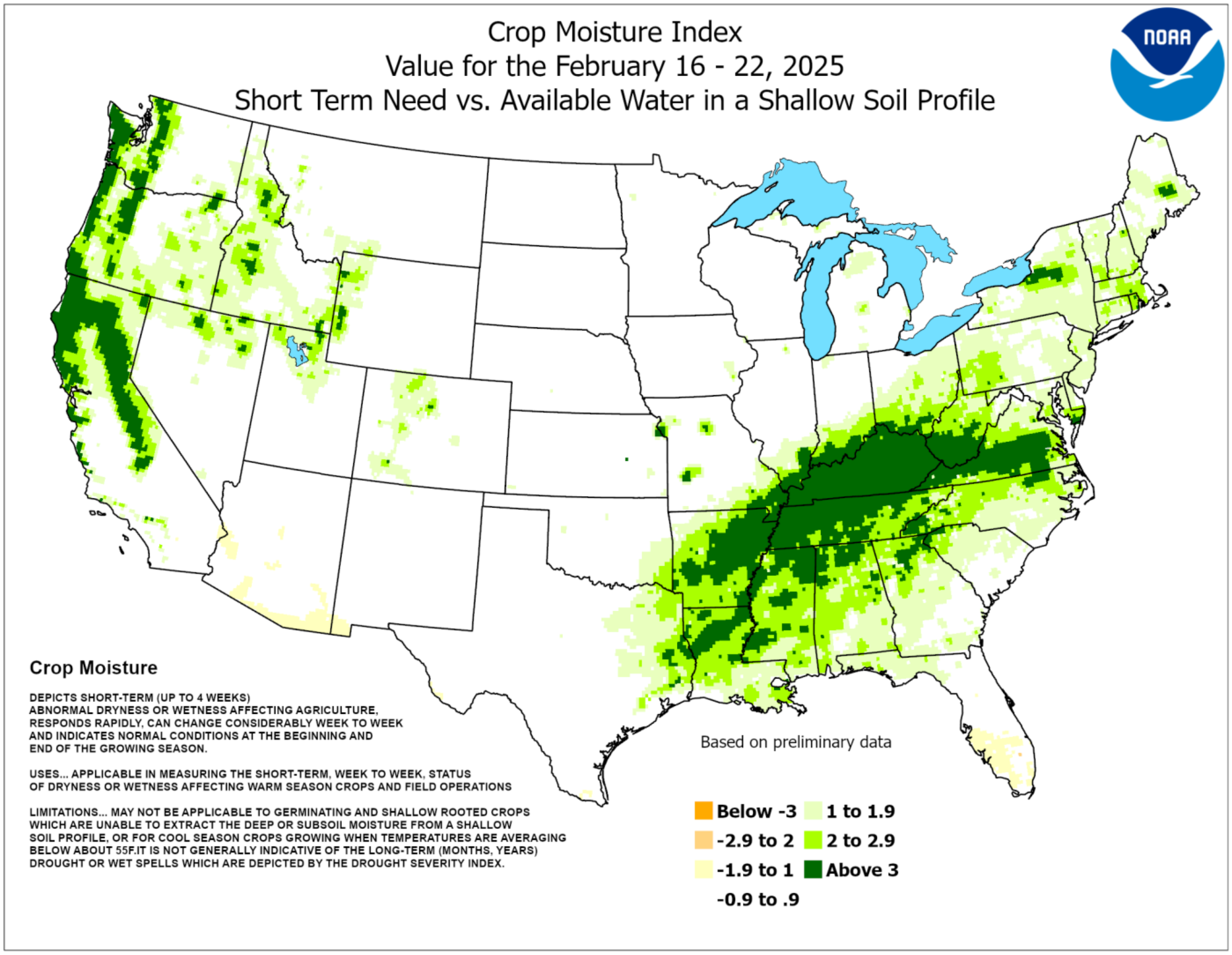


Figure 6-4 Crop Moisture Index as of February 2025

Source: NOAA https://www.weather.gov/ncrfc/LMI_WS_DroughtLinks

6.2.4 Frequency

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation.

In temperate regions, including Washington, long-range forecasts of drought have limited reliability. In the tropics, empirical relationships have been demonstrated between precipitation and El Niño events, but few such relationships have been demonstrated above 30º north latitude. Meteorologists do not believe that reliable forecasts are currently attainable one season or more in advance for temperate regions.

A great deal of research has been conducted in recent years on the role of interacting systems in explaining regional and even global patterns of climatic variability. These patterns tend to recur periodically with enough frequency and with similar characteristics over a sufficient length of time that they offer opportunities to improve the ability for long-range climate prediction. However, too many variables exist in determining the frequency with which a drought will occur. According to the Washington State Hazard Mitigation Plan (HMP) (2013) "[a]t this time, reliable forecasts of drought are not attainable for temperate regions of the world more than a season in advance."

Review of the State's 2023 HMP indicates that it is anticipated that the probability of a drought (of any severity) occurring is 24 percent annual. "Drought (including "abnormally dry" classification) is expected to increase in extent, intensity, frequency, and duration in WA, driven primarily by climate change. The geographic distribution of drought hazards is expected to increase, with western WA becoming more drought prone as climate change continues (WA EMD HMP, 2023).[9]

Below is the U.S. Seasonal Drought Outlook as predicted by NOAA for the period December 1, 2024 – February 28, 2025. Review of the data at this point in time illustrates the potential for drought removal throughout much of Washington; however, with the impact of climate change and the potential changes occurring with La Nina now being predicted to develop by the end of December 2024 and into January 2025, a drought situation, at some level, could again occur within Washington.

[9] Based on the State's 2023 HMP, probabilities were determined based on the percent annual chance of at least one major event occurring (i.e., a state- or federal level disaster declaration), with the data based on historical data between 1980 and 2022.

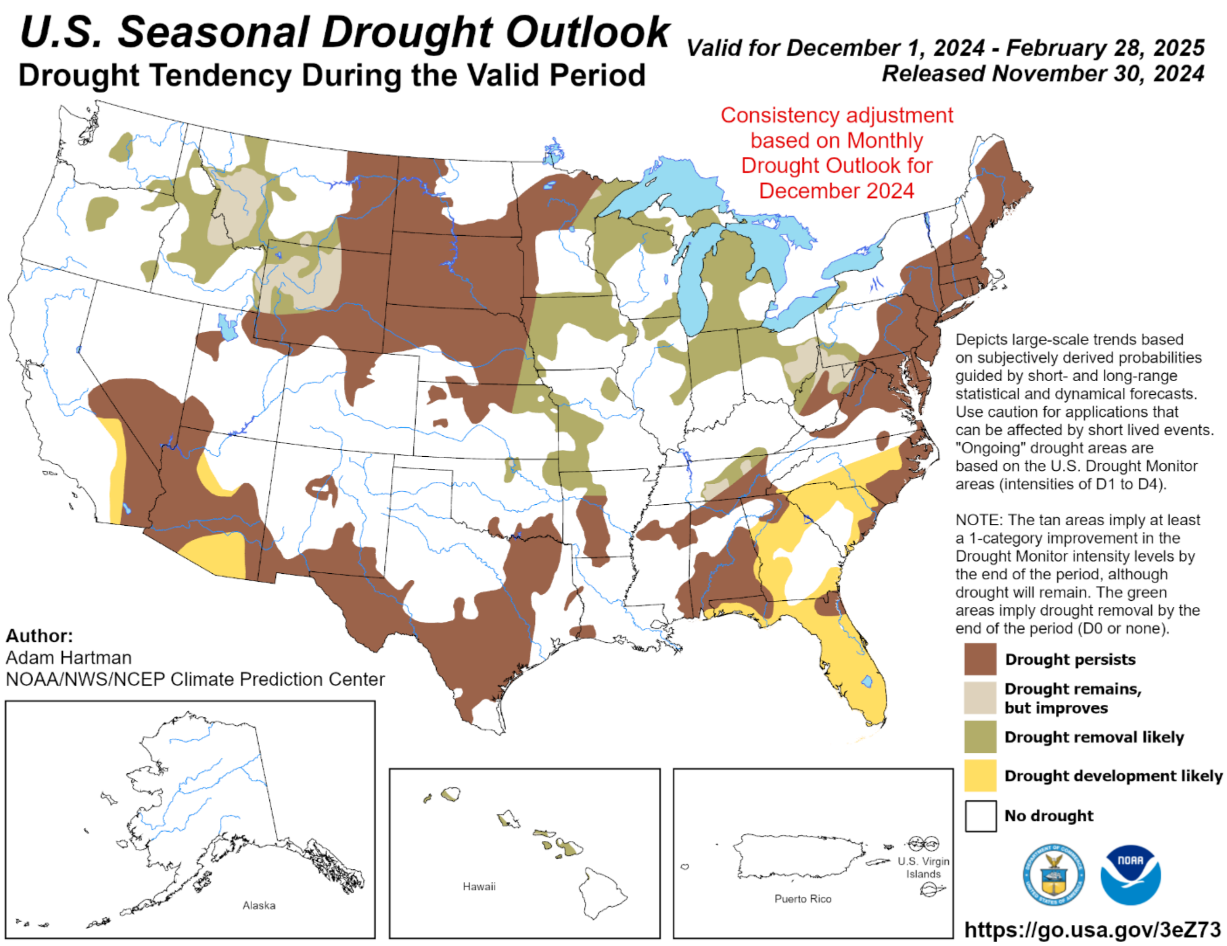


Figure 6-5 NOAA - US Seasonal Drought Outlook Prediction

Source: NOAA https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php

6.3 VULNERABILITY ASSESSMENT

6.3.1 Overview

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental, and social activities. The vulnerability of an activity associated with the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand.

All people, property and environments in the planning area could be exposed to some degree to the impacts of moderate to extreme drought. Areas densely wooded, especially areas in parks which host campers, increase the exposure to forest fires. Additional exposure comes in the form of economic impact should a prolonged drought occur that would impact fishing, fish rearing, recreation, agriculture, and timber harvesting, which is a primary source of income in the planning area. Prolonged drought would also decrease capacity within the watersheds, thereby reducing fish runs and, potentially, spawning areas.

Warning Time

A drought is not a sudden-onset hazard. Droughts are climatic patterns that occur over long periods, providing for some advance notice. In many instances, annual situations of low water levels are identified months in advance (e.g., snowpack at lower levels are identified during winter months), allowing for advanced planning for water conservation.

Meteorological drought is the result of many causes, including global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast resulting in less precipitation. Only general warning can take place, due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions. It is often difficult to recognize a drought before being in the middle of it. Droughts do not occur spontaneously; they evolve over time as certain conditions are met.

Scientists do not know how to predict drought more than a few months in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Weather anomalies may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale. In temperate regions such as Washington, long-range forecasts of drought have limited reliability. Meteorologists do not believe that reliable forecasts are attainable at this time a season or more in advance for temperate regions.

6.3.2 Impact on Life, Health, and Safety

A drought directly or indirectly impacts all people in affected areas. Most notably, the Chehalis Reservation, Grays Harbor, and Thurston Counties as a whole have a fairly large number of privately owned wells, which may be impacted by reduced water flows and aquifers to supply drinking water. While portions of the Chehalis Reservation do receive municipal water services from Thurston County, that, too, could be impacted by a drought situation, calling for water restrictions and conservation measures by end-users.

A drought can also result in farmers not being able to plant crops or the failure of planted crops, a significant level of the established economy in the region. This results in loss of work for farm workers and those in related food processing jobs. Other water- or electricity-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs, impacting income. A drought can also harm recreational enterprises that use water (e.g., swimming pools, water parks, and water-sport companies) as well as landscape and nursery businesses. With much of Washington's energy coming from hydroelectric plants (including the plant within Grays Harbor County), a drought means less inexpensive electricity coming from dams and probably higher electric bills. All people will pay more if utilities (water or power) increase their rates. This has become an issue within Washington State previously, when a lack of snowpack has decreased hydroelectric generating capacity, and raised the electric prices, impacting residents.

Wildfires are often associated with drought. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. This increases the risk to the health and safety of the residents within the planning area, especially those in wildland-urban interface areas. Smoke and particles embedded within the smoke are of significant concern for the elderly and very young, especially those with breathing problems. Since completion of the last plan, and occurring during this update, the Chehalis Reservation as well as the State as a whole experienced extremely unhealthy air quality as a result of smoke from wildfires burning in Washington, Oregon, California and Canada. As a result of increased wildfire risk, since completion of the last plan, the CTCR have issued annual burn bans the last four years (2021-2024) starting in July, ending in October or November.

Social Vulnerability

In many instances, those impacted by drought are often the most socially vulnerable, including those with lower per capita income. Associated factors with a socially vulnerable population also includes health issues - populations that work outdoors and cannot escape the unhealthy smoke in the air from associated wildfires or the heat often times associated with drought; those who cannot easily afford increased costs associated with purchasing water due to drought-driven declines in the availability or quality of drinking water, or the increased cost of power associated air purification systems or air conditioners. The age of the population is also associated with those socially vulnerable, including both the young and the elderly. The area has a high population of elderly living on the Reservation, many with pre-existing health conditions.

6.3.3 Impact on Property

No structures will be directly affected by drought conditions, though some may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

6.3.4 Impact on Critical Facilities and Infrastructure

Critical facilities will continue to be operational during a drought unless impacted by fire. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

6.3.5 Impact on Economy

As indicated above, economic impact from a drought is associated with different aspects, including, among others, the potential loss of agri- and aqua-cultural production and, of importance within the tribal planning area, tourism, and entertainment.

The area's agricultural producers are among the less than two percent of the population in the United States today that produce the food and fiber consumed by the remaining population and they do it more efficiently and at less cost to the consumer than any other industrialized country in the world. Loss of revenue to these producers would impact not only the owners, but the employees, and ultimately surrounding businesses and entertainment centers.

Additional economic impact stems from the potential loss of critical infrastructure due to fire damage and impacts on industries that depend on water for their business, such as aquaculture and fishing industries, the new distillery, and water-based recreational activities and areas. The Chehalis Tribe does rely heavily on the various enterprises such as the Lucky Eagle Casino, the Great Wolf Lodge (hotel and water park), the RV Park, and the new distillery.

Problems of domestic and municipal water supplies have historically been corrected by building another reservoir, a larger pipeline, new well, or some other facility. The Chehalis Tribe is reliant on private and public water sources for its water supply, with some of the tribal properties reliant on wells and water towers to supply water.

A drought impacting the watersheds' supply would be significant. With drought conditions increasing pressure on aquifers and increased pumping, which can result in saltwater intrusion into freshwater aquifers, resultant reductions or restrictions on economic growth and development could occur. Given this potential, a drought situation, if prolonged, could restrict building within specific areas due to lack of supporting infrastructure, thereby impacting the economy of the Chehalis Tribe by limiting growth. In addition, impact to or the lack of hydroelectric generating capacity associated with drought conditions as a result of reduced precipitation levels could raise electric prices throughout the region.

A substantial reduction in streamflow could severely impact the generation of electricity from the hydro-electric dams located in the area (Grays Harbor County). A reduction in hydro-electric generation will result in increased electricity rates for all residents and businesses in the area.

6.3.6 Impact on Environment

Environmental losses from drought are associated with aquatic life, plants, animals, wildlife habitat, air and water quality, forest fires, landscape quality, biodiversity, and soil erosion, among others.

The Chehalis and Black Rivers are home to several species of salmon, as well as unique wildlife, flora, and fauna. A severe drought could cause reduced stream flows, thereby creating a major environmental and economic impact on local salmon runs due to potentially warmer waters and low water levels. With the fish hatchery releasing approximately 25,000 fry each year, a drought situation could impact their ability to survive, which would have long-term impacts on future salmon runs due to the lifecycles for fish spawning.

Some effects are short-term, and conditions quickly return to normal after the drought. Other effects linger or even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation, but many species will eventually recover from this effect. Degraded landscape quality, including soil erosion, may lead to a more permanent loss of biological productivity. Soil erosion also contributes to increased flooding with the reduced channel capacity.

Public awareness and concern for environmental quality has led to greater attention to these effects. Drought conditions within the planning area could increase the demand for water supplies. Water shortages would have an adverse impact on the environment. If such conditions persisted for several years, the economy of the area could experience significant environmental setbacks.

6.3.7 Impact from Climate Change

The impact from climate change on drought will be significant. With historic records demonstrating increased temperature rise, the results will only further exacerbate drought stations. Drought plays a significant role in the wildfire system, fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. Climate change will further change the use of water available for fish spawning due to increased temperatures. It will also impact availability for agricultural growers for their crops; with decreased precipitation in the form of snow, water levels will fall, creating water shortages for use by consumers as drinking water, irrigation and watering of livestock, and firefighters to control and fight fires.

6.4 FUTURE DEVELOPMENT TRENDS

With an increase in population, there is also a propensity to increase water demands, as well as increase demands on other infrastructure, and increase the potential for wildfires. Practicing a low water-use lifestyle will increasingly become the norm for many as summer flows substantially reduce many of our rivers. Reducing water use will help meet future needs and result in cost savings and decrease energy use, helping preserve the environment.

The Chehalis Tribe continues to provide information, tools, and incentives to assist Tribal Citizens, local residents, businesses, other local governments, and water providers to design and implement comprehensive and proven conservation strategies. As the Chehalis Tribe continues to acquire lands within the planning area, in many instances, such is done with the intent to re-establish its natural environment. Such actions help to protect the area, and significantly reduce the impacts from drought. Maintaining watersheds in their natural state will help provide shade along waterways, helping to reduce water temperatures and preserve aquatic life.

6.5 ISSUES

Combinations of low precipitation and unusually high temperatures could occur over several consecutive years, especially in response to climate change. Intensified by such conditions, extreme wildfires could break out throughout the area, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water, causing social and political conflicts. Low water tables could increase issues of life, safety, and health, while also impacting the economy both for loss of potential agricultural income, but also with respect to decreased ability to construct new housing due to lack of ability to provide water. If such conditions persisted for several years, the economy of the region could experience setbacks, especially in water dependent industries.

6.6 IMPACT AND RESULTS

Based on review and analysis of the data, the Planning Team has determined that the probability for impact from Drought throughout the area is likely. The area has experienced drought conditions, with drought incidents occurring in 2015 and 2019. The State experienced one of its driest summers on record for the last 30 years in 2017, with several counties in the state also issuing declarations in April and June 2019. The spring or summer of 2021, 2022, and 2024 set record temperatures not only in Washington, but in some instances worldwide. Such events are occurring more frequently.

With anticipated increase in temperatures as a result of climate change, drought situations will only intensify. In addition, higher temperatures anticipated with climate change would increase vulnerability of the population due to excessive heat, potential health impacts due to smoke from wildfires, while also potentially impacting power supplies at the hydro-dam in the area.

Current water supplies are relatively resistant to short-term drought episodes. Should a severe, long-term drought occur, it will be vital that tribal government, local elected officials, and private industries work cooperatively to help ensure efforts are made to protect public water supplies, aid agriculture and local industry, and safeguard fish and stream flows.

Based on the potential impact, the Planning Team determined the CPRI score to be 2.35, with overall vulnerability determined to be a medium level.

CHAPTER 7.
EARTHQUAKE

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Its epicenter is the point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth. Earthquakes often occur along a fault, which is a fracture in the earth's crust.

> **DEFINITIONS**
>
> **Earthquake**—The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.
>
> **Epicenter**—The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.
>
> **Fault**—A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.
>
> **Focal Depth**—The depth from the earth's surface to the hypocenter.
>
> **Hypocenter**—The region underground where an earthquake's energy originates
>
> **Liquefaction**— Loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

7.1 GENERAL BACKGROUND

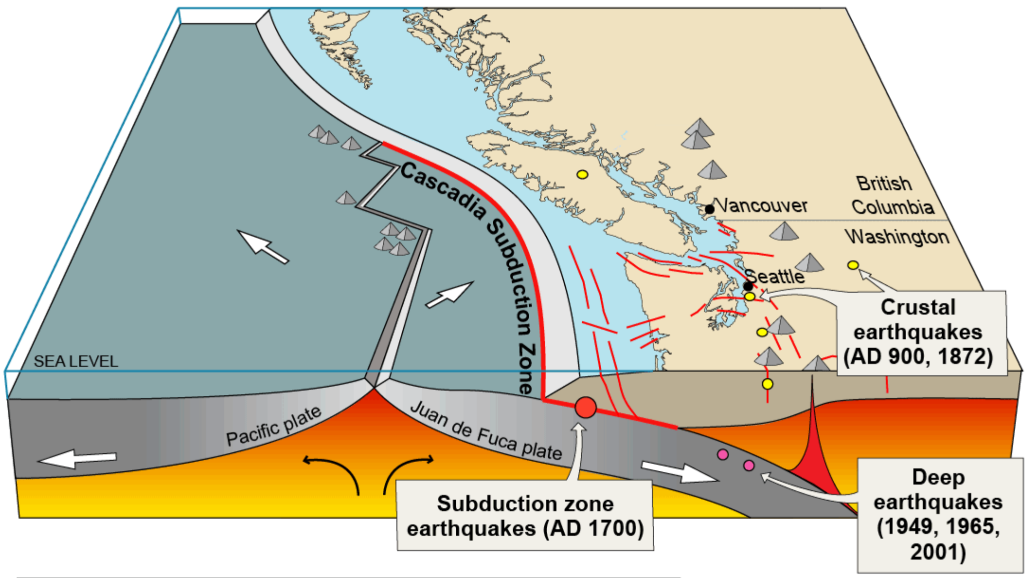
Most destructive quakes are caused by dislocation of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). Potentially active faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

It is generally agreed that three source zones exist for Pacific Northwest quakes: a shallow (crustal) zone; the Cascadia Subduction Zone; and a deep, intraplate "Benioff" zone. These are shown in Figure 7-1. More than 90 percent of Pacific Northwest earthquakes occur along the boundary between the Juan de Fuca plate and the North American plate.



Source	Max. Size	Recurrence
Subduction zone	M 9+	200–600 years
Deep Juan de Fuca plate	M 7+	30–50 years
Crustal faults	M 7+	Hundreds of years?

*figure modified from USGS Cascadia earthquake graphics at http://geomaps.wr.usgs.gov/pacnw/pacnweq/index.html

Figure 7-1 Earthquake Types in the Pacific Northwest and Recurrence Intervals

An earthquake will generally produce the strongest ground motions near the epicenter (the point on the ground above where the earthquake initiated) with the intensity of ground motions diminishing with increasing distance from the epicenter. The intensity of ground shaking at a given site depends on four main factors:

- Earthquake magnitude
- Earthquake epicenter

- Earthquake depth
- Soil or rock conditions at the site, which may amplify or de-amplify earthquake ground motions.

For any given earthquake, there will be contours of varying intensity of ground shaking with distance from the epicenter. The intensity will generally decrease with distance from the epicenter, and often in an irregular pattern, not simply in concentric circles. The irregularity is caused by soil conditions, the complexity of earthquake fault rupture patterns, and directionality in the dispersion of earthquake energy.

7.2 EARTHQUAKE CLASSIFICATIONS

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as *magnitude* (size or power based on the Richter Scale); or by the impact on people and structures, measured as *intensity* (based on the Mercalli Scale). Magnitude is related to the amount of seismic energy released at the hypocenter of an earthquake. It is determined by the amplitude of the earthquake waves recorded on instruments. Magnitude is represented by a single, instrumentally determined value for each earthquake event. Intensity indicates how the earthquake is felt at various distances from the earthquake epicenter. Table 7-1 presents a classification of earthquakes according to their magnitude.

TABLE 7-1
EARTHQUAKE MAGNITUDE CLASSES

Magnitude Class	Magnitude Range (M = magnitude)
Great	M > 8
Major	7 <= M < 7.9
Strong	6 <= M < 6.9
Moderate	5 <= M < 5.9
Light	4 <= M < 4.9
Minor	3 <= M < 3.9
Micro	M < 3

Estimates of moment magnitude roughly match the local magnitude scale (ML) commonly called the Richter scale. One advantage of the moment magnitude scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, moment magnitude is now the most often used estimate of large earthquake magnitudes.

Intensity

There are many measures of the severity or intensity of earthquake ground motions. The Modified Mercalli Intensity scale (MMI) was widely used beginning in the early 1900s. MMI is a descriptive, qualitative scale that relates severity of ground motions to the types of damage experienced. MMI values range from I to XII (USGS, 1989). Table 7-2 compares the moment magnitude scale to the modified Mercalli intensity scale.

TABLE 7-2
EARTHQUAKE MAGNITUDE AND INTENSITY

Magnitude (Mw)	Intensity (Modified Mercalli)	Description
1.0—3.0	I	I. Not felt except by a very few under especially favorable conditions
3.0—3.9	II—III	II. Felt only by a few persons at rest, especially on upper floors of buildings. III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it is an earthquake. Standing cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0—4.9	IV—V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing cars rocked noticeably.
5.0—5.9	VI—VII	VI. Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. VII. Damage negligible in buildings of good design and construction; slight in well-built ordinary structures; considerable in poorly built or badly designed structures. Some chimneys broken.
6.0—6.9	VII—IX	VIII. Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	VIII and higher	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

More accurate, quantitative measures of the intensity of ground shaking have largely replaced the MMI and are used in this mitigation plan. These scales use terms that can be physically measured with seismometers, such as the acceleration, velocity, or displacement (movement) of the ground. The intensity may also be measured as a function of the frequency of earthquake waves propagating through the earth. In the same way that sound waves contain a mix of low-, moderate- and high-frequency sound waves, earthquake waves contain ground motions of various frequencies. The behavior of buildings and other structures depends substantially on the vibration frequencies of the building or structure versus the frequency of earthquake waves. Earthquake ground motions also include both horizontal and vertical components.

Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the probability that certain ground motion accelerations will be exceeded over a time period of interest. A common physical measure of the intensity of earthquake ground shaking, and the one used in this mitigation plan, is peak ground acceleration (PGA). PGA is a measure of the intensity of shaking relative to the acceleration of gravity (g). For example, an acceleration of 1.0 g PGA is an extremely strong ground motion, which does occur near the epicenter of large earthquakes. With a vertical acceleration of 1.0 g, objects are thrown into the air. With a horizontal acceleration of 1.0 g, objects accelerate sideways at the same rate as if they had been dropped from the ceiling. A PGA equal to 10% g means that the ground acceleration is 10 percent that of gravity, and so on (see Figure 7-2).[10]

Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures. The following generalized observations provide qualitative statements about the likely extent of damage for earthquakes with various levels of ground shaking (PGA) at a given site:

- Ground motions of only 1% g or 2% g are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
- Ground motions below about 10% g usually cause only slight damage.
- Ground motions between about 10% g and 30% g may cause minor to moderate damage in well-designed buildings, with higher levels of damage in more vulnerable buildings. At this level of ground shaking, some poorly built buildings may be subject to collapse.

[10] USGS. Accessed 26 Feb 2025. Available at: https://earthquake.usgs.gov/earthquakes/search/

- Ground motions above about 30% g may cause significant damage in well-designed buildings and very high levels of damage (including collapse) in poorly designed buildings.
- Ground motions above about 50% g may cause significant damage in most buildings, even those designed to resist seismic forces.

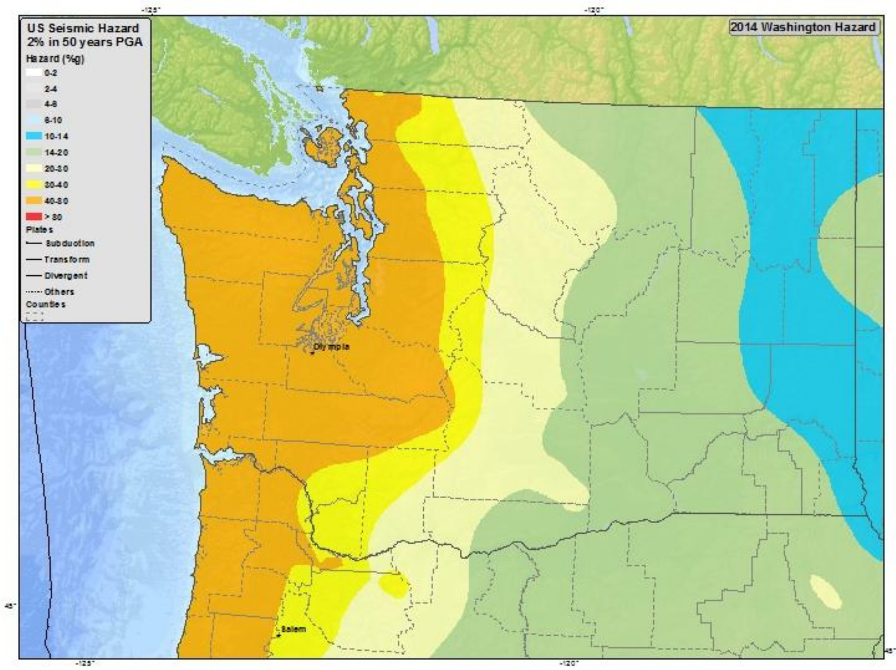


Figure 7-2 USGS PGA for Washington State (2014)

PGA is the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake.

PGA values are directly related to these lateral forces that could damage "short period structures" (e.g. single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). The amount of earthquake damage and the size of the geographic area affected generally increase with earthquake magnitude:

- Earthquakes below M5 are not likely to cause significant damage, even near the epicenter.
- Earthquakes between about M5 and M6 are likely to cause moderate damage near the epicenter.

- Earthquakes of about M6.5 or greater (e.g., the 2001 Nisqually earthquake in Washington) can cause major damage, with damage usually concentrated fairly near the epicenter.
- Larger earthquakes of M7+ cause damage over increasingly wider geographic areas with the potential for very high levels of damage near the epicenter.
- Great earthquakes with M8+ can cause major damage over wide geographic areas.
- A M9 mega-quake on the Cascadia Subduction Zone could affect the entire Pacific Northwest from British Columbia, through Washington and Oregon, and as far south as Northern California, with the highest levels of damage nearest the coast.

Table 7-3 identifies damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

TABLE 7-3
COMPARISON OF MERCALLI SCALE AND PEAK GROUND ACCELERATION

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage: Resistant Buildings	Potential Structure Damage: Vulnerable Buildings	Estimated PGA[a] (%g)
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17%—1.4%
IV	Light	None	None	1.4%—3.9%
V	Moderate	Very Light	Light	3.9%—9.2%
VI	Strong	Light	Moderate	9.2%—18%
VII	Very Strong	Moderate	Moderate/Heavy	18%—34%
VIII	Severe	Moderate/Heavy	Heavy	34%—65%
IX	Violent	Heavy	Very Heavy	65%—124%
X—XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA measured in percent of g, where g is the acceleration of gravity
Sources: USGS, 2008; USGS, 2010

7.3 EFFECT OF SOIL TYPES

Liquefaction is a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft, unconsolidated sedimentary soils. The National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 7-4 summarizes NEHRP soil classifications, as well as identifying by acre(s) the types of soils on the Chehalis Reservation, and on properties owned by the Tribe.

NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. Areas that are commonly affected by ground shaking and susceptible to liquefaction have NEHRP Soils D, E and F. Table 7-5 identifies the number and types of tribal-owned structures within each soil classification. Figure 7-3 illustrates the areas in which the soil classifications are situated.

TABLE 7-4
TYPES OF NEHRP SOIL CLASSIFICATIONS ON CHEHALIS TRIBAL LANDS

NEHRP Soil Type	Description	Chehalis Indian Reservation Soils Type (in acres)	Off-Reservation Owned Lands Soils Type (in acres)	TOTAL
A	Hard Rock	0.00	0.00	0.00
B	Firm to Hard Rock	50.42	58.24	108.66
C	Dense Soil/Soft Rock	175.89	63.45	239.34
D	Stiff Soil	726.26	131.75	858.01
E	Soft Clays	4917.14	698.66	5615.8
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	0.00	0.00	0.00

TABLE 7-5
CHEHALIS TRIBE CRITICAL FACILITIES / INFRASTRUCTURE IN NEHRP SOIL CLASSIFICATIONS

NEHRP Soil Type	Description	Government Function	Cultural Resource/Gathering Place	Industrial	Hazardous Materials	Medical	Protective Services	Schools	Shelter	Commercial	Transportation	Water	Wastewater	Total
A	Hard Rock	0	0	0	0	0	0	0	0	0	0	0	0	**0**
B	Firm to Hard Rock	0	0	0	0	0	0	0	0	0	0	0	0	**0**
C	Dense Soil/Soft Rock	0	0	1	2	0	0	0	0	6	0	0	0	**9**

TABLE 7-5 CHEHALIS TRIBE CRITICAL FACILITIES / INFRASTRUCTURE IN NEHRP SOIL CLASSIFICATIONS														
NEHRP Soil Type	**Description**	**Government Function**	**Cultural Resource/Gathering Place**	**Industrial**	**Hazardous Materials**	**Medical**	**Protective Services**	**Schools**	**Shelter**	**Commercial**	**Transportation**	**Water**	**Wastewater**	**Total**
D	Stiff Soil	0	0	0	0	0	0	0	0	1	0	0	0	**1**
E	Soft Clays	12	1		1	4	1	2	2	6	5	2	3	**39**
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

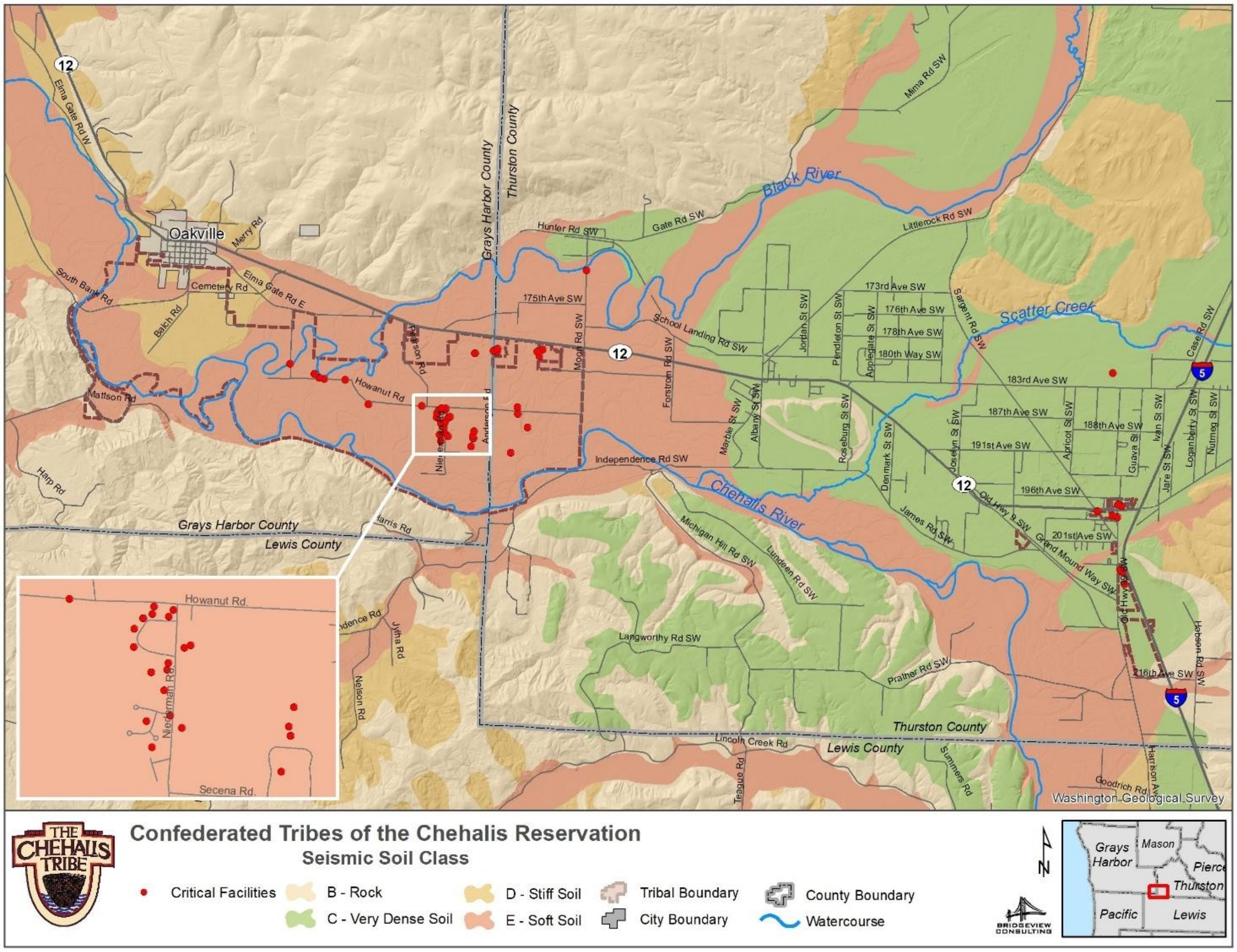


Figure 7-3 NEHRP Soil Classifications Tribal Planning Area

7.3.1 Fault Classification

The U.S. Geologic Survey defines four fault classes based on evidence of tectonic movement associated with large-magnitude earthquakes during the Quaternary period, which is the period from about 1.6 million years ago to the present:

- Class A—Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed by mapping or inferred from liquefaction or other deformational features.

- Class B—Geologic evidence demonstrates the existence of Quaternary deformation, but either (1) the fault might not extend deep enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.

- Class C—Geologic evidence is insufficient to demonstrate (1) the existence of tectonic faulting, or (2) Quaternary slip or deformation associated with the feature.
- Class D—Geologic evidence demonstrates that the feature is not a tectonic fault or feature; this category includes features such as joints, landslides, erosional or fluvial scarps, or other landforms resembling fault scarps but of demonstrable non-tectonic origin.

7.4 HAZARD PROFILE

Seismic-related hazards include ground motion from shallow (less than 20 miles deep) or deep faults; liquefaction and differential settling of soil in areas with saturated sand, silt, or gravel; and tsunamis that result from seismic activities. Earthquakes also can cause damage by triggering landslides or bluff failure. The Puget Sound region is entirely within Seismic Risk Zone 3, requiring that buildings be designed to withstand major earthquakes measuring 7.5 in magnitude. It is anticipated, however, that earthquakes caused from subduction plate stress can reach a magnitude greater than 8.0.

High-magnitude earthquakes are possible in planning area when the Juan de Fuca slips beneath the North American plates. Deep zone or Benioff zone quakes have occurred within the Juan de Fuca plate (1949, 1965, and 2001) and can be expected in the future.

7.4.1 Extent and Location

Washington State as a whole is one of the most seismically active states in United States. Figure 7-4 depicts the faults known or suspected to be active within the state.

There are a number of faults running near or through Grays Harbor County, including the Grays Harbor Fault Zone, the Willapa Bay Fault Zone, Saddle Hills Fault Zone, Langley Hill fault, and Canyon Creek fault, which is located north and east in the County, bordering Mason County near the Olympic National Forest. The Saddle Mountain fault was first recognized in the early 1970's. Drowned trees and trench excavations demonstrate that the fault produced a MW 6.5-7.0 earthquake 1,000-1,300 years ago, likely occurring with the MW 7.5 Seattle fault earthquake 1,100 years ago. Additional earthquakes have been modeled on a hypothesized earthquake linking the Canyon River and Saddle Mountain faults, but further work is needed to demonstrate the feasibility of this source. Because the fault has only been demonstrated to be in the northeast corner of Grays Harbor County, far from the built environment, the scenario generates only minor estimated damage.

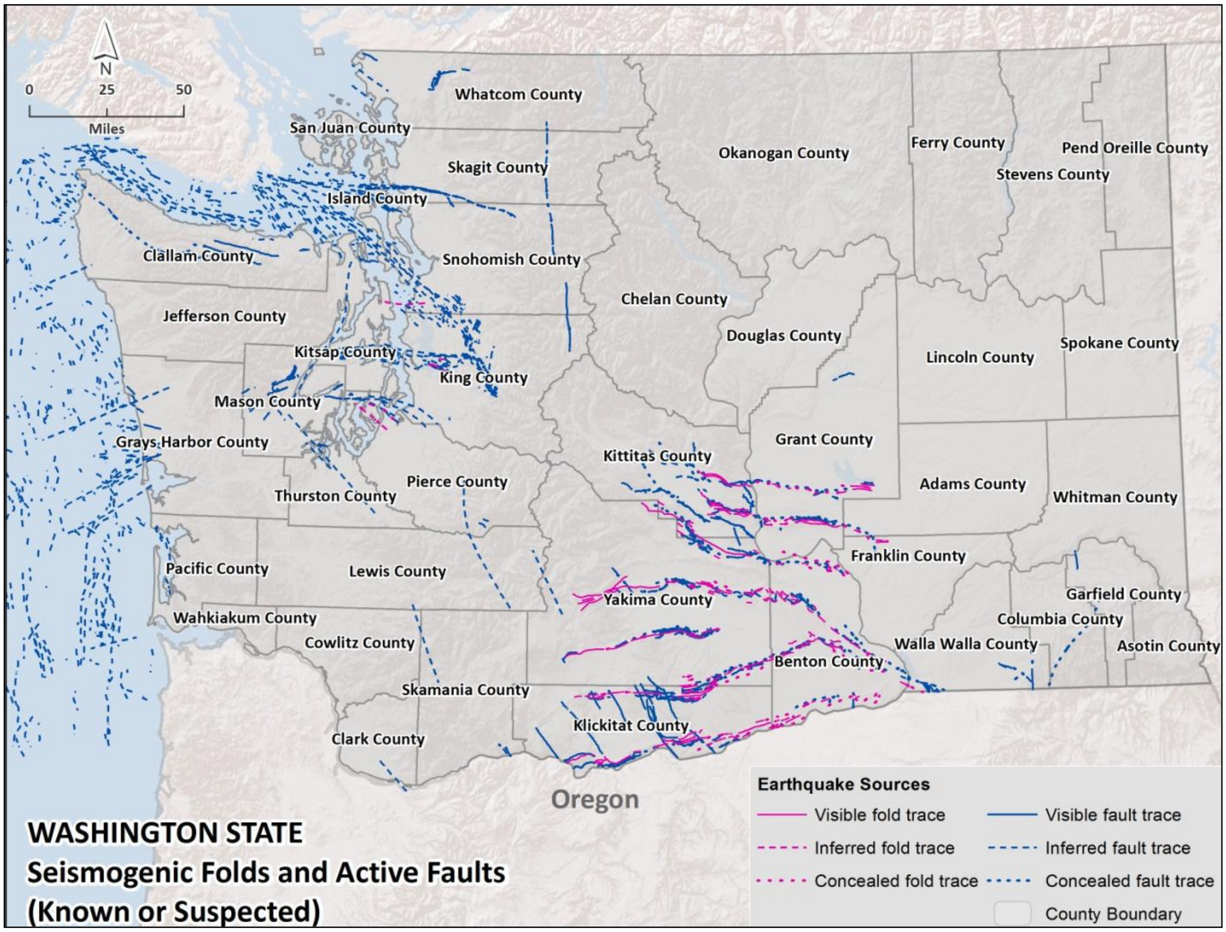


Figure 7-4 Washington State Seismogenic Folds and Active Faults

Within Thurston County, evidence suggests that an Olympia fault structure may exist across the north end of the County. A strong earthquake is estimated to have occurred nearly 1,100 years ago, which resulted in rapid one to three-meter subsidence in lowland forests near present day McAllister Creek, the Nisqually River, and at Little Skookum Inlet. Review of the Thurston County HMP (2017) illustrates that a magnitude 6.0 or greater earthquake originating from a surface fault could render incredible destruction; however, more research is necessary to verify the existence of the Olympia fault structure and its probability of rupturing.

Lewis County's location on the western side of Washington increases the probability of frequent earthquakes. According to the Pacific Northwest Seismic Network and review of Lewis County's 2024 HMP (pending approval), there have been more than 100 earthquakes in Lewis County since 1970, ranging from less than 1.0 to 4.5.

Ground shaking from earthquakes on shallow faults typically last from 20 to 60 seconds and are localized to the source. At present, there are no known faults which cross the reservation boundary, or are near tribal owned land. Additional information on local faults is available from

Washington State Department of Natural Resources Scenario catalogue, available online at: https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/earthquakes-and-faults#what-are-faults-and-earthquakes?.9

Hazard Mapping

Identifying the extent and location of an earthquake is not as simple as it is for other hazards such as flood, landslide, or wildfire. The impact of an earthquake is largely a function of the following factors:

- Ground shaking (ground motion accelerations)
- Liquefaction (soil instability)
- Distance from the source (both horizontally and vertically).

Mapping that shows the impacts of these components was used to assess the risk of earthquakes within the planning area. While the impacts from each of these components can build upon each other during an earthquake event, the mapping looks at each component individually. The mapping used in this assessment is described below.

ShakeMaps

A shake map is a representation of ground shaking produced by an earthquake (Peak Ground Acceleration). The information it presents is different from the earthquake magnitude and epicenter that are released after an earthquake because shake maps focus on the ground shaking resulting from the earthquake, rather than the parameters describing the earthquake source. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A shake map shows the extent and variation of ground shaking in a region immediately following significant earthquakes.

Ground motion and intensity maps are derived from peak ground motion recorded on seismic sensors, with interpolation where data are lacking and site-specific corrections. Color-coded intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. Two types of shake map are typically generated from the data:

- A probabilistic seismic hazard map shows the hazard from earthquakes that geologists and seismologists agree could occur. The maps are expressed in terms of probability of exceeding a certain ground motion, such as the 10 percent probability of exceedance in 50 years. This level of ground shaking has been used for designing buildings in high seismic areas.

- Earthquake scenario maps describe the expected ground motions and effects of hypothetical large earthquakes for a region. Maps of these scenarios can be used to support all phases of emergency management.

For this plan development, the Cascadia M9.0 Earthquake Scenario was utilized to illustrate potential impact. Figure 7-5 illustrates the shaking intensity.

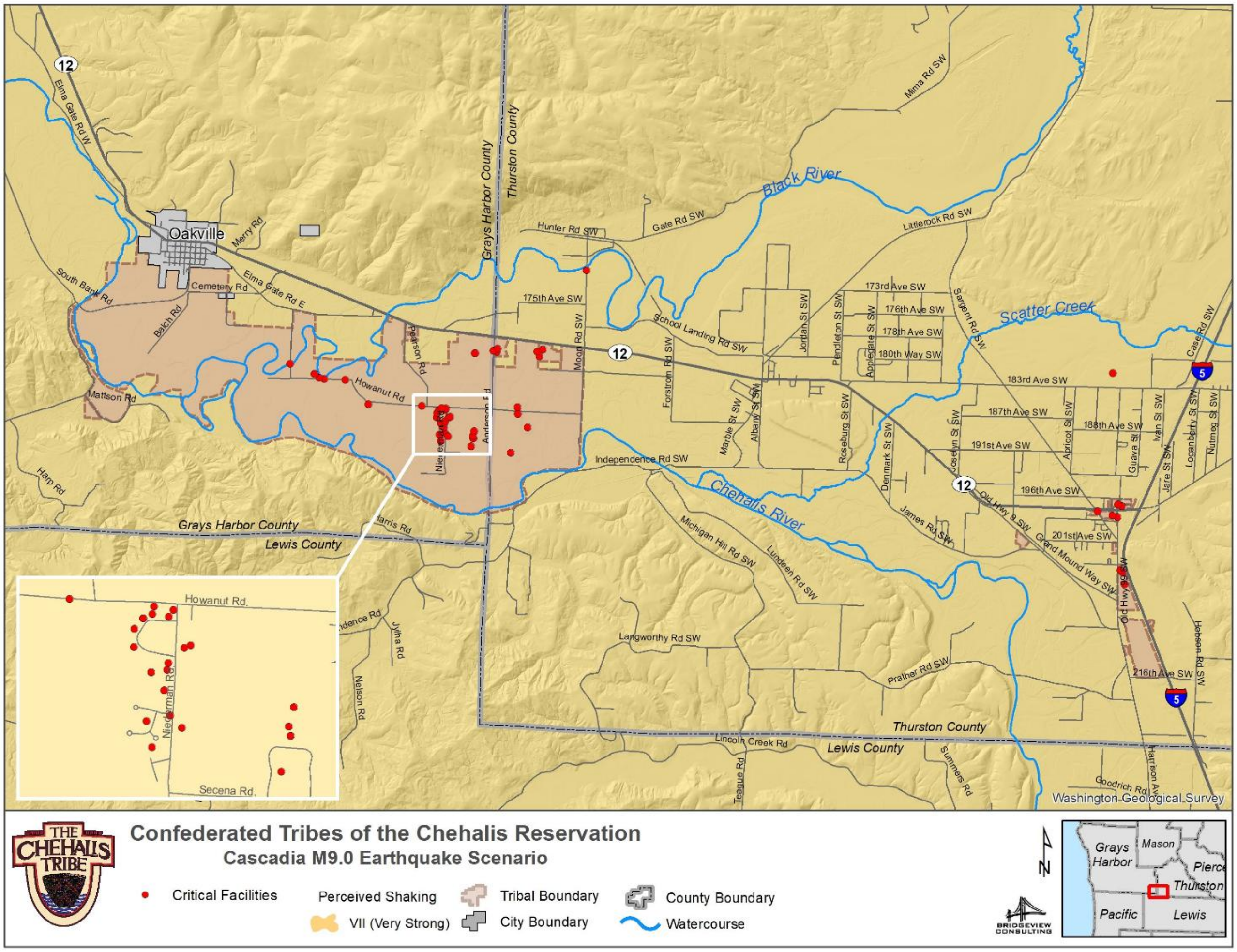


Figure 7-5 Cascadia M9.0 Earthquake Scenario Modified Mercalli Shaking Intensity

Liquefaction Maps

Soil liquefaction maps are useful tools to assess potential damage from earthquakes. When the ground liquefies, sandy or silty materials saturated with water behave like a liquid, causing pipes to leak, roads and airport runways to buckle, and building foundations to be damaged. In general, areas with NEHRP Soils D, E and F are susceptible to liquefaction. If there is a dry soil crust, excess water will sometimes come to the surface through cracks in the confining layer, bringing liquefied sand with it and creating sand boils. Figure 7-6 shows liquefaction susceptibility in the surrounding areas where tribal structures are located.

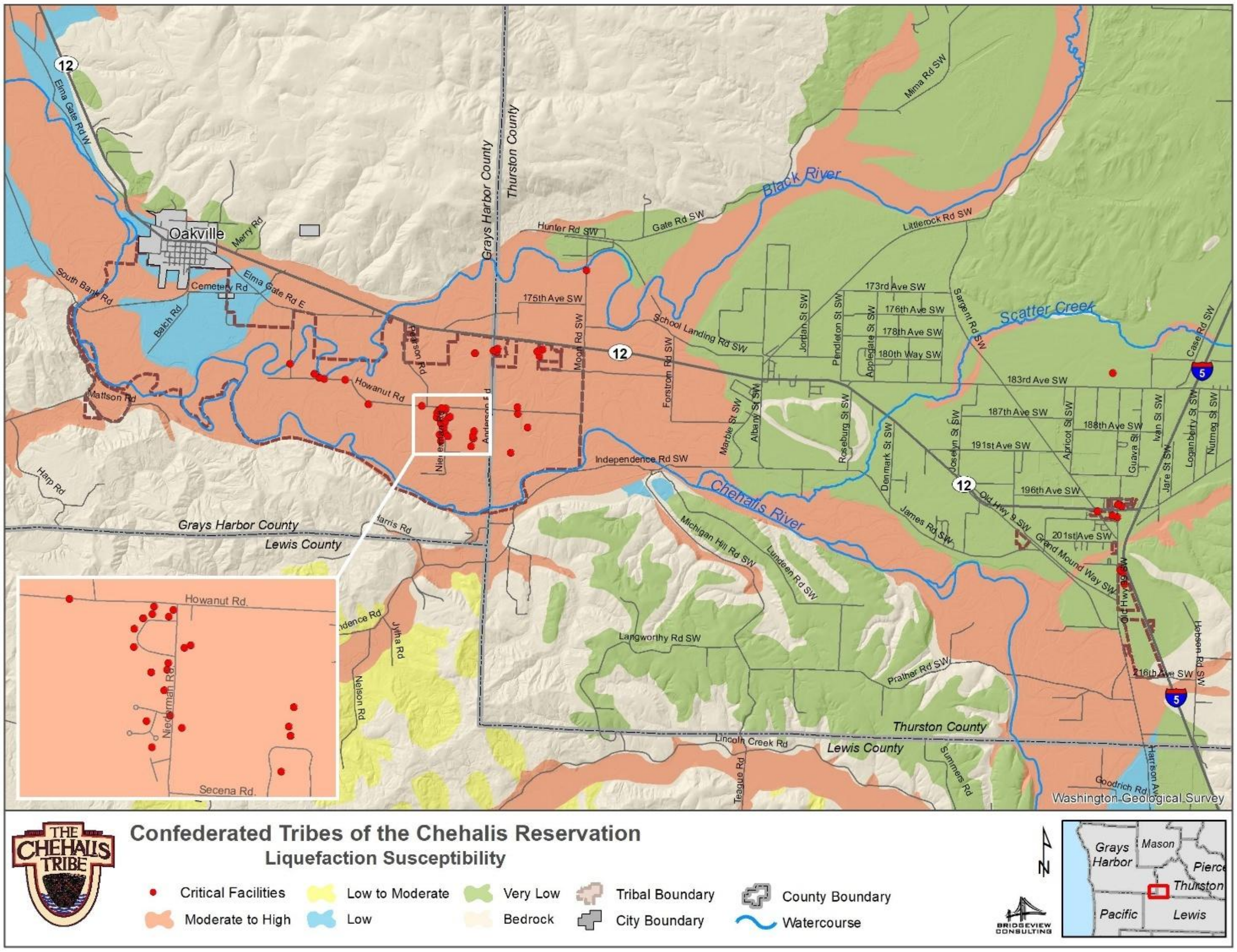


Figure 7-6 Liquefaction Susceptibility Zones in Tribal Planning Area

7.4.2 Previous Occurrences

Earthquakes have been reported in the area from as early as the 1872 North Cascades quake. Figure 7-7 identifies historic quakes that have occurred.[11] Table 7-6 lists a sampling of past seismic events that have affected the Puget Sound area.[12]

One disaster declaration has occurred in recent past as a result of earthquake damage – the Nisqually Earthquake, which occurred on February 28, 2001 (discussed below).

[11] WADNR Earthquake Energy and Frequency. Accessed 28 Feb 2024. Available online at: https://www.dnr.wa.gov/pictures/ger/ger_hazards_eq_mag_freq_1140.png?ahvn0n

[12] PNSN, 2024 PNSN Recent Events | Pacific Northwest Seismic Network

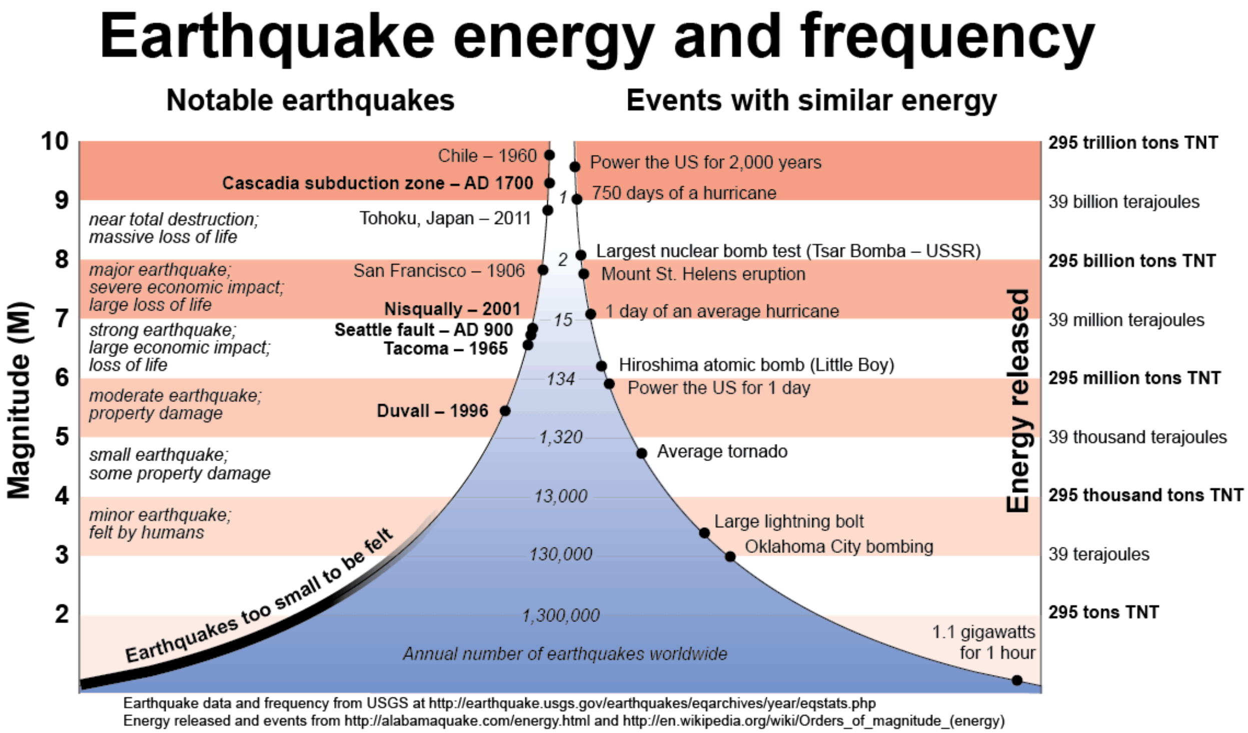


Figure 7-7 Earthquake Energy and Frequency

Although earthquakes have been reported in Grays Harbor County from as early as the 1872 North Cascades quake, no earthquake creating major damage has been definitively identified within the county prior to the advent of the Puget Sound Seismic Network in 1969.

- A 1944 earthquake did cause minor damage around Grays Harbor College, but it was presumably a local event.

- Some of the largest recorded earthquakes in Grays Harbor County were the July 3, 1999, M_w5.8 and the June 10, 2001, M_w5.0 Satsop quakes. These were located 5-10 miles north of Satsop, at depths of about 25 miles, which makes them Benioff Zone events, a type of earthquake that takes place in the subducting crust. There were no fatalities, but there was heavy damage to the Grays Harbor County Courthouse. The PUD Station in Aberdeen, which is the main connection between Grays Harbor and the Bonneville Power Administration, was also damaged, causing power outages in Aberdeen and Hoquiam. It was the deepest earthquake in the area in 20 years. Structures cost of damage included County Road System, $12,500; Public Buildings & Equipment, $10,000,000 and damage to the private sector, $1,115,000 for a total of $1,457,500.

- The Nisqually earthquake occurred February 28, 2001, with the epicenter about 11 miles northeast of the City of Olympia, lasting approximately one minute. It was a deep magnitude 6.8 event and due to extensive damage in several counties, was declared

Federal Disaster #1361. Impacts included major traffic tie-ups in the eastern portion of Grays Harbor County as cars were rerouted around damage in other counties, small power outages and temporary closure of state offices. Highway 12 near Porter was closed for a period of time with reports of minor buckling and cracks on local roadways. Cracks in buildings and falling bricks also resulted from the shaking. The Chehalis Tribe was reimbursed by FEMA approximately $30,000 for damage to tribal facilities.

TABLE 7-6
HISTORICAL EARTHQUAKES IN THE PLANNING AREA*

Year	Magnitude	Epicenter
7/12/2024	3.5	Morton
11/24/2023	3.1	Longview
6/22/2021	3.3	Olympia
6/12/2021	3.8	Olympia
9/11/2020	3.1	Centralia
12/1/2019	3.4	Goat Rocks
1/3/2018	3.8	Mt. St. Helens
3/14/2017	3.2	Morton
12/9/2016	3.3	Mt. St. Helens
10/28/2015	3.3	Morton
9/3/2015	3.1	Mt. St. Helens
2/18/2015	4.3	Ellensburg
6/26/2013	4.3	Wenatchee Area
2/14/2011	4.3	Spirit Lake/Mt. St. Helens
11/16/2010	4.2	Mossyrock Area
1/30/2009	4.5	Seattle-Tacoma Urban Area
6/20/2003	3.6	Carnation
5/30/2003	3.7	Port Orchard
9/21/2002	4.1	Friday Harbor
5/2002	4.2	Friday Harbor, San Juan Islands
2/28/2001 (DR 1361)	6.8	Olympia (Nisqually)
6/10/2001	5.0	Matlock
7/3/1999	5.8	5 miles north of Satsop
8/1997	3.4	Unknown*
7/1997	3.1	Duvall
6/23/1997	4.7	Bremerton
7/1996	5.4	5 miles east-northeast of Duvall

TABLE 7-6
HISTORICAL EARTHQUAKES IN THE PLANNING AREA*

Year	Magnitude	Epicenter
5/3/1996	5.5	Duvall
1/29/1995	5.1	Seattle-Tacoma
4/14/1990	5.0	Deming Area
2/14/1981	5.5	Mt. St. Helens
9/9/76	4.5	Union
5/11/1965 (DR 196)	6.6	18.3 KM N of Tacoma
4/29/1965	6.5	11 miles North of Tacoma
4/13/1949	7.1	Olympia
1/13/1949	7.0	8 miles east-northeast of Olympia
6/23/1946	7.3	Strait of Georgia
2/14/1946	6.3	Puget Sound
4/29/1945	5.7	North Bend (8 miles south/southeast)
11/13/1939	5.8	Puget Sound – Near Vashon Island
5/15/1936	5.7	Southwest Washington
7/17/1932	5.3	Central Cascades
1/23/1920	5.5	Puget Sound
12/6/1918	7.0	Vancouver Island
8/18/1915	5.6	North Cascades
1/11/1909	6.0	Puget Sound
4/30/1882	5.8	Olympia area
12/15/1872	6.8	Pacific Coast

*List is not all inclusive of every earthquake to occur as there are hundreds of earthquakes that occur annually in the state. Those illustrated are a random sampling, but do include any earthquake of a M5 and greater are identified. Additional data is available from the Pacific Northwest Seismic Network
PNSN Events | Pacific Northwest Seismic Network

7.4.3 Severity

Earthquakes can last from a few seconds to over five minutes; they may also occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage, or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides, or releases of hazardous material, compounding their disastrous effects.

Small, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

USGS ground motion maps based on current information about fault zones show the PGA that has a certain probability (2 or 10 percent) of being exceeded in a 50-year period. The PGA is measured in %g. Figure 7-8 shows the PGA with a 2 percent exceedance chance in 50 years in Washington.

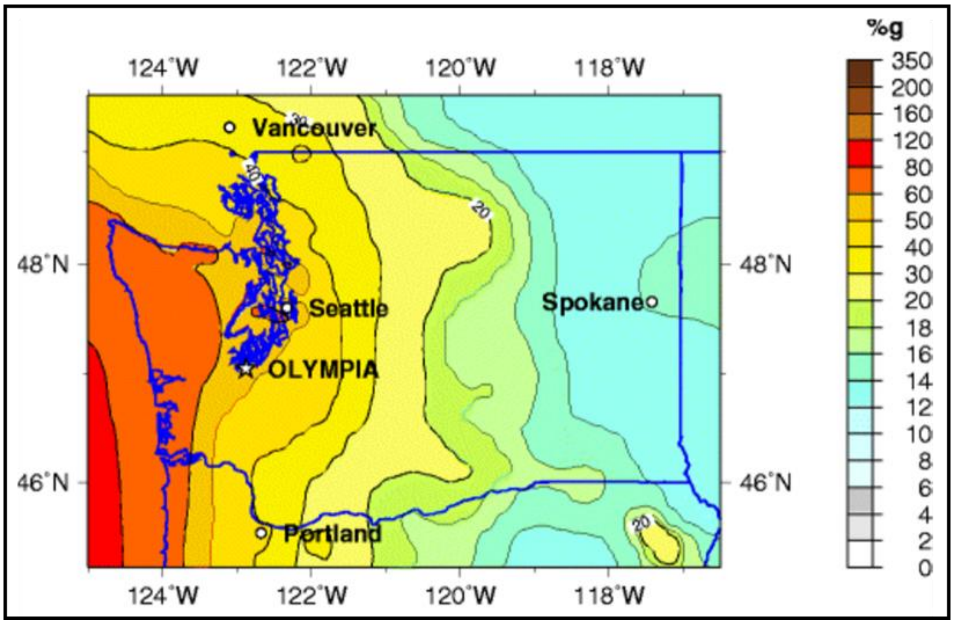


Figure 7-8 PGA with 2-Percent Probability of Exceedance in 50 Years, Northwest Region

A Cascadia Subduction Zone earthquake is felt to be the largest earthquake threat to the state as a whole. Abundant physical evidence for the 1700 earthquake includes evidence for abrupt tectonic subsidence along the Copalis River and subsequent drowning of a spruce and cedar forest, as well as producing both near- and far-tsunamis. This event was estimated to be about M9 and is one of the largest earthquakes in historic or paleoseismic record. The evidence for this earthquake is documented in Atwater and others (2005) and Goldfinger and others (2012). The fault runs from California to British Columbia, and has an average recurrence interval of approximately 500 years for earthquakes of ~M9. Researchers predict a 10 to 14 percent chance that another could occur in the next 50 years.

Effects of such a major earthquake in the region could be catastrophic, providing the worst-case disaster. Potentially thousands of residents could be killed, and a multitude of others left injured and homeless. Figure 7-9 illustrates the potential peak ground velocities for such an event (Frankel, 2018).

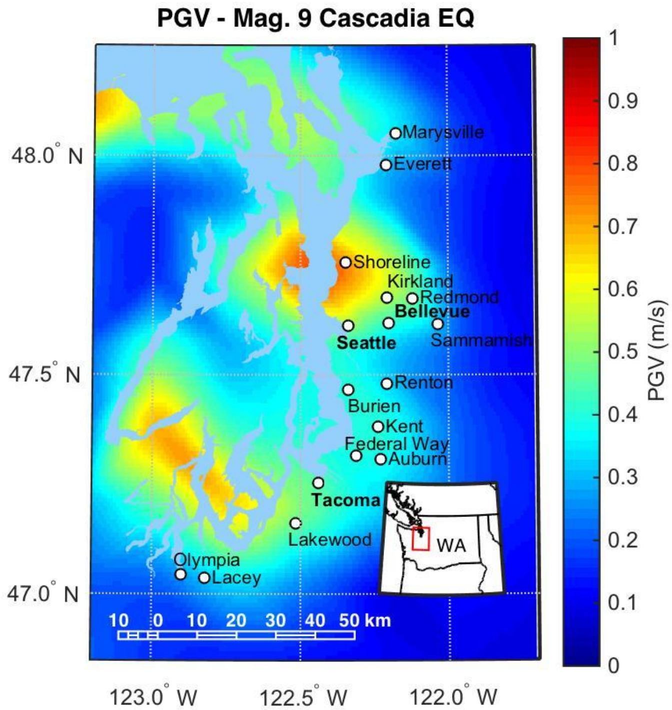


Figure 7-9 Estimated Peak Ground Velocities - M9.0 Cascadia Subduction Zone Earthquake

7.4.4 Frequency

Scientists are currently developing methods to more accurately determine when an earthquake will occur. Recent advancements in determining the probability of an earthquake in a given period use a log-normal, Brownian Passage Time, or other probability distribution in which the probability of an event depends on the time since the last event. Such time-dependent models produce results broadly consistent with the elastic rebound theory of earthquakes. The USGS and others are beginning to develop such products as new geologic and seismic information regarding the dates of previous events along faults becomes more and more available (USGS, 2015a).

- Current estimates of the likelihood of another potentially damaging intraplate earthquake during a 50-year time window with the Puget Sound region put the probability at 84 percent, with somewhat lower probabilities as one goes southward (Earthquake Hazard Program, 2012).
- Scientists currently estimate that a Magnitude-9 earthquake in the Cascadia Subduction Zone occurs about once every 500 years. The last one was in 1700. Paleoseismic investigations have identified 41 Cascadia Subduction Zone interface earthquakes over the past 10,000 years, which corresponds to one earthquake about every 250 years. About half were M9.0 or greater earthquakes that represented full rupture of the fault zone from Northern California to British Columbia. The other half were M8+ earthquakes that ruptured only the southern portion of the subduction zone.

- The 300+ years since the last major Cascadia Subduction Zone earthquake is longer than the average of about 250 years for M8 or greater and shorter than some of the intervals between M9.0 earthquakes.
- Scientists currently estimate the frequency of deep earthquakes similar to the 1965 Magnitude-6.5 Seattle-Tacoma event and the 2001 Magnitude-6.8 Nisqually event as about once every 35 years. The USGS estimates an 84-percent chance of a Magnitude-6.5 or greater deep earthquake over the next 50 years.
- Scientists estimate the approximate recurrence rate of a Magnitude-6.5 or greater earthquake anywhere on a shallow fault in the Puget Sound basin to be once in about 350 years. There have been four earthquakes of less than Magnitude 5 in the past 20 years.
- Earthquakes on the Seattle Faults have a 2-percent probability of occurrence in 50 years. A Benioff zone earthquake has an 85 percent probability of occurrence in 50 years, making it the most likely of the three types.

7.5 VULNERABILITY ASSESSMENT

7.5.1 Overview

Several faults within the planning region have the potential to cause impact, although there are no faults in the immediate area of the Reservation. Within Grays Harbor County, there are several faults along the coastal areas, and north of Ocean Shores which would have the potential to impact Tribe, including potential tsunami impact from sleeper waves traveling up the rivers which drain into Grays Harbor Bay. Within Thurston County, the Olympia fault is approximately 22 miles east of the Reservation.

While the intensity of ground motions diminishes with increasing distance from the epicenter, impact is nonetheless possible. As a result, the entire population of the planning area is exposed to both direct and indirect impacts from earthquakes. The degree of direct impact (and exposure) is dependent on factors including the soil type on which homes and structures are constructed, the proximity to fault location, the type of materials used to construct residences and facilities, etc. Indirect impacts are associated with elements such as the inability to evacuate the area as a result of earthquakes occurring in other regions of the state as well as impact on commodity flow for goods and services into the area, many of which are serviced only by one roadway in or out. Impact from other parts of the state could require shipment of supplies via a barge due to impact to roadways.

The following are also general areas of vulnerability to be considered:

- Hazardous materials incidents may occur as the result of damage to local oil refineries, chemical plants, rail lines and major petroleum pipelines. Transportation along the rail lines of chemicals is concerning.
- Levees and salt-water dikes may be damaged.
- Large hydroelectric dams may be damaged or possibly fail.
- Localized seiche action in local waters in Grays Harbor or Thurston Counties may result in increased levels of damage along shoreline areas.
- The arrival of outside resources to assist with debris removal, repair of critical facilities, and sheltering of victims may be delayed due to severe damage in adjacent areas with larger populations and needs.
- The overall economy of the area and possibly the region could be affected.
- Large areas lying within the floodplains, such as the Chehalis Reservation, are susceptible to liquefaction.
- Many of the critical facilities and critical infrastructure may fall within these liquefaction zones.

Warning Time

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short, but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

7.5.2 Impact on Life, Health, and Safety

The entire population of the planning area is exposed to direct and indirect impacts from earthquakes. This would include residents, visitors, and employees of the Confederated Tribes of the Chehalis Reservation. This would also include individuals seeking services or referrals for health and other services which the CTCR provide. Also for consideration would be the number of tourists traveling to the ocean beaches or other counties in the area which would travel through the Chehalis Reservation. Grays Harbor County estimates 4 million people visit their beaches annually. Many of these would be traveling by or through the Chehalis Reservation.

Two of the most vulnerable populations to a disaster incident such as this are the young and the elderly. Linguistically isolated populations and those living below poverty level are also more susceptible. The planning area as a whole (when looking at county-based data) have a fairly high population of retirees and individuals with disabilities, both higher than the state averages.

The need for increased rescue efforts and/or to provide assistance to such a large population base could tax the first-responder resources in the area during an event. At present, the Tribe does not have its own fire or EMS services, but relies on the local municipalities to provide such services. Although many injuries may not be life-threatening, people will require medical attention and, in many cases, hospitalization. Potential life-threatening injuries and fatalities are expected; these are likely to be at an increased level if an earthquake happens during the afternoon or early evening, particularly during summertime. This would be a significant factor when considering the daily population at the Tribal offices and services provided by the Tribe, as well as individuals staying at the various hotels owned by the Tribe, the Lucky Eagle Casino, Great Wolf Lodge, Marriott Hotel, or at any event such as a concert or conference held at any of the Tribal facilities. Populations based on average daily attendance could exceed 6,000 individuals, not including a large-scale event such as a concert.

The degree of exposure is also dependent on many factors, including the soil type on which structures are built, quality of construction, their proximity to fault location, etc. Whether impacted directly or indirectly, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures would undoubtedly isolate populations on the reservation, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

It should be noted that there are significant variables that exist in the data which is used to populate the inputs necessary to reach conclusions identified within this document, including the type of structure, year built, remodeling, engineered assessments, etc. All of these factors play a significant role in determining potential impact, and therefore any outputs are considered to have a high rate of error unless better, more accurate (engineered) building specific data is utilized. Such efforts far exceed the scope of this project, and as such, outputs gained during this process should be considered for planning purposes only, and in no manner should be considered for life-safety measures.

7.5.3 Impact on Property

All structures owned by the Tribe are at risk to impact from earthquake. This current plan development included ~55 structures, including five bridges owned and maintained by the Tribe, with a total structure and content value in excess of $363 million. Due to the area of impact and the proximity to a fault or epicenter location, those structures could also be impacted. Fortunately, when reviewing the structure list utilized for this assessment, the majority of structures owned are newer, with fewer than 10 structures included in this assessment older in nature (pre-1974).[13] Older structures have an increased impact potential. The Tribe also has land

[13] Not every structure owned by the CTCR were included within the scope of this project. The focus was on the critical facilities identified by the Tribe based on the definition of critical facilities developed by the Planning Team.

mass in various areas along the Chehalis and Black Rivers. The Tribe has restored some of the area back to its natural environment, with structures removed. Those remediated project areas could be impacted by secondary hazards of landslides or hazardous materials exposure many times associated with earthquakes.

Building Age

Structures that are in compliance with the Uniform Building Code (UBC) of 1970 or later are generally less vulnerable to seismic damage because 1970 was when the UBC started including seismic construction standards based on regional location. This stipulated that all structures be constructed to at least seismic risk Zone 2 standards.

The CTCR adopted the UBC in 1979, and in 2005, by Resolution 2005-87, adopted the 2003 International Building Codes, and its successors thereto. As such, it is assumed that buildings in the planning area constructed after those dates are built to the highest standards. When federal funding is utilized for any construction, the Tribe in actuality must adhere to more stringent guidelines than the state regulations require based on stipulations imposed to receive federal funding. Based on the location of the Chehalis Reservation, it falls under seismic zone D-2, which is the standard to which more recent housing stock is built.

In some cases, the CTCR has purchased structures not built by the Tribe, and which are not on trust lands (or were not at the time of purchase). In such instances, those structures must adhere to the existing building codes in place at the time of construction. Within the State of Washington, the State adopted the UBC as its state building code in 1972, so it is assumed that buildings in the planning area built after 1972 were built in conformance with UBC seismic standards and have less vulnerability. It should be noted, however, that issues such as code enforcement and code compliance could impact this assumption. In 1994, seismic risk Zone 3 standards of the UBC went into effect in Washington, requiring all new construction to be capable of withstanding the effects of 0.3 g. More recent housing stock is in compliance with Zone 3 standards. In July 2004, the state again upgraded the building code to follow International Building Code Standards. While the “zones” are still referenced, they are, in large part, no longer used in the capacity they once were as there can be different zones within political subdivisions, making it difficult to apply.

Chapter 3, Section 3.6.3 identifies the age of structures owned by the CTCR which were included in this update.

7.5.4 Impact on Critical Facilities and Infrastructure

Similar to the impact to property, all critical facilities are exposed to the earthquake hazard, with a total dollar value in excess of $363 million. The degree of impact from an earthquake is largely determined based on proximity, magnitude, and ground motion causing liquefaction. Based on the distribution of structures owned by the Chehalis Tribe within the planning area, it can be determined that impact may not be similar. For purposes of this update, the Planning Team identified a M9.0 Cascadia scenario event Shake Map for its focus to identify potential exposure.

Based on the M9.0 Cascadia-type scenario event Shake Map, review of the identified critical facilities and infrastructure information captured during this process provides the following, which would apply with respect to application of building codes and age of the critical facilities and infrastructure, particularly when considering the ability of structures to withstand ground shaking:

- Several tribal structures are considerably older in nature, some potentially falling on the Historic Preservation List (1930 Wilson Barn).
- One storage building was built in 1935 of wood and metal combined.
- The Oakridge Golf Course Clubhouse was built at some point in the 1960's. That site did expand since completion of the last plan in 2021, with current codes applied.
- The Child Care, Behavioral Health / Wellness House, Tribal Center, Confederated Construction Company office, the Talking Cedar Annex, the Loan Programs office, and the structure housing IT and Behavioral Health were all constructed during the 1970-1979 timeframe. It was during that time that construction standards first started addressing the seismic and other codes for greater ability to withstand impacts from such events. These buildings may not withstand a significant earthquake in the same manner as buildings of newer construction.
- Seven structures are built during the 1980-1989 timeframe, including the Tribal Community Water System, the fish hatchery, a two-story Natural Resources Building, which includes a lab facility, the Tribal Housing Authority building, and Human Resources building. Several of these structures were built with concrete/slab flooring and wood post frame; two were constructed with a wood and metal combination.
- A total of 29 structures assessed in this 2025 update were built during the time period of 1990 to 2024. These structures include two sewage treatment facilities, the various hotels, casino, which includes the parking garage and office space, the water park, gas stations, the concessions building at the ball field, which serves as a shelter, including an emergency shelter for animals. The newest structures include the distillery and its storage facility, which were under the final phases of development at the time the 2021 plan was completed, a skatepark, the tiny homes, and a new Elder's Building, which would also serve in the capacity of a shelter.

- There is one mobile home built in 1998, anchored on concrete runners, which serves as a governmental office, as well as two modular structures built in 1997 and 1998, both on concrete foundations.

The majority of the structures owned by the CTCR are constructed of wood, several slab on grade, with a few metal structures included. No structure identified has a basement.

Earthquakes can also cause disruption to communications, electrical power, wastewater and potable water services and supplies. Such disruptions should be expected. Earthquakes may also trigger fires, dam failures, landslides, or releases of hazardous material. Hazardous materials releases can occur during an earthquake from both fixed facilities or transportation-related incidents, leaking into the surrounding area or an adjacent waterway, having a disastrous effect on the environment.

In the event of a major earthquake, areas lying within the floodplain are susceptible to liquefaction. Magnitude 7+ earthquakes can potentially trigger slope failures as well. The potential for landslide-induced roadway closure is of concern, in addition to the steep and/or unstable slopes in various locations susceptible to landslides. While the Tribe itself has never experienced a landslide, roadways leading on and off the reservation have previously been impacted by landslides. The Chehalis and Black Rivers are situated in the reservation. Liquefaction along the tributaries of the rivers could increase flooding, as well as potentially shifting the course of the rivers. The Tribe also owns and maintains five bridges on the reservation, which would be vulnerable to liquefaction.

Of the 50 structures and five bridges analyzed, the following can be extrapolated from the analysis:

Liquefaction:

- 45 structures and all five bridges are in the moderate-to-high liquefaction zone, with soil type D-E.
- 10 structures are in the very low liquefaction zone, with all but one in soil type C, and one in C-D.

Ground Shaking:

- 50 structures and five bridges are subject to *Very Strong Shaking*, sustaining (presumably) *Moderate Damages*; nine (9) of those structures fall within soil type C and one in soil type D; 45 fall within soil type D-E, which includes the five bridges.

The Tribe does own a water system with two storage tanks on the main reservation. It also owns three wastewater systems. The water supply is utilized for residences and businesses in the area, as well as for agricultural purposes and livestock. Those structures are in a moderate to high liquefaction zone. All sustain *Very Strong Shaking,* with *Moderate to High Damage*, and all are in soil type D-E.

Beyond the five bridges owned by the Tribe which impact is identified above, there are several additional bridges potentially impacted which must be utilized for ingress and egress to the area as a whole which are not owned or operated by the CTCR.

Bridges are one of the most vulnerable components of highway transportation systems and the loss of bridges will have a direct effect the delivery of emergency services. Very few bridges in the area have been retrofitted to withstand the effects of a major earthquake. In addition, bridge foundations are typically located in soils susceptible to liquefaction, thereby allowing bridge piers to move and bridge girders to collapse. Based on bridge and roadway impact, commodities could also be at issue, potentially requiring supplies by air.

The Tribe has previously experienced isolation as a result of roadways being impacted by flood events on a fairly regular basis annually. While flood-related impact has lasted for only a few days (unless it was a significant flood), that may not be the case during an earthquake, particularly a widespread earthquake such as anticipated with a Cascadia event, or as experienced with the Nisqually Earthquake in 2001. In the case of an earthquake, given the rural locations, it may take significantly longer for the state, county, and local municipalities to be able to make repairs, allowing for traffic flow.

While new structures and roadways are built to current code standards, they could nonetheless be impacted. Many of the roadways in the area have also been funded through Tribal grant programs, and are part of the National Tribal Transportation Facility Inventory. The Tribe works in unison with local municipalities to maintain roadways in good repair.

As indicated, an earthquake could cause isolation if the roadways were impacted. Closure of major arterials would also require increased evacuation periods, in some instances by several hours, if passage is possible. With a potential ensuing tsunami as a result of an earthquake (whether a near or distant tsunami), residents and tourists along the coastline of Grays Harbor and Thurston Counties would attempt to flee the area. If roadways were impacted, evacuation and emergency response would be significantly hindered, as would the ability for communities to quickly recover.

7.5.5 Impact on Economy

Economic losses due to an earthquake include damage to building (valued in excess of $363 million), including the cost of structural and non-structural damage, damage to contents, and loss of inventory, loss of wages and loss of income. The Tribe also has various established tax bases, which would be impacted by loss of revenue by other service providers on the reservation (e.g., sales tax, tax on tobacco and alcohol). Economic impact would include loss to the various business ventures owned and operated by the CTCR.

In addition, loss of goods and services may hamper recovery efforts, and even preclude residents from rebuilding within the area, further impacting potential income streams. No specific loss data is available with respect to the Tribe's loss of inventory, wages, income, revenue, or taxes.

7.5.6 Impact on Environment

Earthquake-induced landslides up or down-stream of rivers or streams can significantly impact habitat on the Chehalis Reservation. It is also possible for streams to be rerouted after an earthquake. This can change water quality, possibly damaging habitat and feeding areas. The tribe annually releases ~25,000 salmon of different species which it rears in its hatcheries. There is a possibility of streams fed by groundwater drying up because of changes in underlying geology. There also exists the impact from hazardous materials impacting the environment, including the coastlines, estuaries, and watersheds, among others.

7.5.7 Impact from Climate Change

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity, according to research into prehistoric earthquakes and volcanic activity.

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction or an increased propensity for slides during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

7.6 FUTURE DEVELOPMENT TRENDS

The Chehalis Tribe does utilize the International Building Code as established within the areas of construction. Such requires structures to be built at a level which supports soil types and earthquake hazards (ground shaking). As existing buildings are renovated, provisions are in place which require reconstruction at higher standards. The Tribe regularly reviews and updates its land use code to maintain compliance with various regulatory agencies, including federal requirements for new construction. As such, the Tribe does not feel that development since the last plan was completed has increased their vulnerability beyond the mere fact that new structures have been acquired, which increases the overall valuation of structures owned and potentially at risk. This also applies to increased residential population on the Reservation. As the Tribe continues to grow, the vulnerability to the residents and structures will increase based on volume; however, the increased population and structures does not increase the level risk.

7.7 ISSUES

While the planning area has a high probability of an earthquake event occurring within its boundaries, an earthquake does not necessarily have to occur in the planning area to have a significant impact as such an event would disrupt transportation to and from the region as a whole, and impact commodity flow. As such, any seismic activity of 6.0 or greater on faults in or near the planning area would have significant impact. Potential warning systems could give approximately 40 seconds notice that a major earthquake is about to occur. This would not provide adequate time for preparation. Earthquakes of this magnitude or higher would lead to massive structural failure of property on NEHRP C, D, E, and F soils. Levees and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. These events could cause secondary hazards, including landslides and mudslides that would further damage structures. River valley hydraulic-fill sediment areas are also vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction would occur in water-saturated sands, silts, or gravelly soils such as those that exist along riverbeds and banks.

Earthquakes can cause large and sometimes disastrous landslides and mudslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building, bridge and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes. Earthquakes at sea can generate destructive tsunamis.

7.8 IMPACT AND RESULTS

Based on review and analysis of the data, the Planning Team has determined that the probability for impact from an Earthquake throughout the area is highly likely. A Cascadia-type event, such as that utilized as the scenario modeled for this update, has a high probability of occurring within the region. Likewise, all structures owned and operated by the CTCR would be impacted to some degree, with newer buildings theoretically sustaining less damage as a result of more stringent building codes in place.

When considering the ranking of this hazard, the Planning Team also considered additional factors given the widespread impact a Cascadia event would have on western Washington. Items considered include:

A Cascadia-type earthquake could generate a large amount of damage within the general planning area in which the reservation is situated, or in areas where the tribe owns landmass. Municipalities within both Grays Harbor and Thurston Counties have a large number of older structures, particularly in the downtown hub areas and in areas of close proximity to the Tribe. In this respect, the Planning Team considered not only Tribal-owned structures, but also structures which are residences for Tribal citizens; those which provide services to Tribal citizens (e.g., hospitals, medical offices, etc.); or on which Tribal businesses rely (e.g., supply-chain). Collapse or damage to the structures could divert emergency response personnel away from the Reservation or tribal structures.

Further consideration was given with respect to the distance between tribal-owned enterprises, with some of these areas greater than 25 miles apart, and the response capabilities both by the tribe itself, or through services provided by County or local service providers.

While the Tribe maintains law enforcement, given the potential inaccessibility of roadways in the Grays Harbor area which have previously been impassible, or impact to the I-5 corridor, the potential for law enforcement response from one area to other areas may be impacted. Such would also be the case for fire response, ambulance transport, or medical services. All of these services are ones for which the Tribe must rely on surrounding communities to provide.

In addition, with the potential of a Cascadia event generating a tsunami, evacuation from the beach areas would significantly increase traffic on major and local roadways. Depending on the area, in some cases, tsunami waves are anticipated to make shore in Grays Harbor within 15 minutes. The structural integrity of roadways coming from other portions of Grays Harbor County would undoubtedly also be impacted from the earthquake itself, leaving tourists or residents attempting to evacuate isolated in the rural areas, including areas immediately around and on the reservation. Grays Harbor County estimates in excess of 4 million tourists visiting the county annually. Should a Cascadia event occur during a summertime month when a high number of tourists are in the County, resources would be significantly taxed in addition to roadway congestion making travel extremely difficult, if not impassable.

Several tribal structures such as the hotels, community center, and casino serve as shelters and/or staging areas in emergency situations for tribal citizens, employees of the Tribe, or emergency response workers. The Tribe also has two areas utilized for heliports, including for medical evacuations. Issues with roadways could severely limit the ability to gain access to those shelters.

The Tribal Clinic provides an extensive list of services and medical treatment, and is fully staffed with physicians, dentists, advanced-degree nurses, a lab, and a pharmacy. The structure potentially could be utilized as a make-shift hospital if needed, in addition to providing treatment for non-life threatening injuries; something which may be difficult to access in the days following a significant event due to roadways being impassable. Built of concrete construction in 2006 to more substantial codes, the structure itself maintains large sheets of glass. Review of Hazus impact data utilized for the 2021 HMP illustrated that the structure would be subject to potentially very strong shaking as a result of a Cascadia-type event, as well as a potentially high level of impact from liquefaction. Functionality to some degree is expected on day one of the incident, but there is anticipated a fairly significant percentage of moderate impact due to ground shaking. As such, the structure would have to be assessed to ensure stability of the glass and the integrity of the building before it could be utilized. The structure is outside of the landslide area as identified in this process. Such facility would be of significant benefit to the Tribe, as well as first responders who may be injured, or other citizens within the community.

Many tribal structures assessed in this process are not as old as structures within the county hubs and may sustain less damage. However, population at the economic hubs of the Tribe (casino, water park, etc.,) have the potential for a high population count who may need assistance, evacuation, or medical attention. Potential injuries could lead to mass-casualty events at multiple tribal locations, taxing capabilities.

Based on the potential impact, the Planning Team determined the CPRI score to be 3.65, with overall vulnerability determined to be a high level.

CHAPTER 8.
FLOOD

Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA, 2010). Most communities in the U.S. have experienced some kind of flooding, after spring rains, heavy thunderstorms, coastal storms, or winter snow thaws. Floods are one of the most frequent and costly natural hazards in terms of human hardship and economic loss, particularly to communities that lie within flood-prone areas or floodplains of a major water source.

DEFINITIONS

Flood—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Floodplain—The land area along the sides of a river that becomes inundated with water during a flood.

100-Year Floodplain—The area flooded by a flood that has a 1-percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1-percent annual chance flood is the standard used by most federal and state agencies.

Floodway—The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

8.1 GENERAL BACKGROUND

Flooding is a general and temporary condition of partial or complete inundation on normally dry land from the following:

- Riverine flooding, including overflow from a river channel, flash floods, alluvial fan floods, dam-break floods and ice jam floods;
- Local drainage or high groundwater levels;
- Fluctuating lake levels;
- Coastal flooding;
- Coastal erosion;
- Unusual and rapid accumulation or runoff of surface waters from any source;
- Mudflows (or mudslides);
- Collapse or subsidence of land along the shore of a lake or similar body of water that result in a flood, caused by erosion, waves or currents of water exceeding anticipated levels;
- Sea level rise; and
- Climate Change

8.1.1 Flooding Types

Many floods fall into one of three categories: riverine, coastal, or shallow. Other types of floods include alluvial fan floods, dam failure floods, and floods associated with local drainage or high groundwater. For this hazard mitigation plan, riverine/stormwater flooding are the main flood types of concern for the planning area.

Riverine

Riverine floods are the most common flood type. They occur along a channel and include overbank and flash flooding. Channels are defined ground features that carry water through and out of a watershed. They may be called rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas.

Flash Floods

A flash flood is a rapid, extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). The time may vary in different areas. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising floodwaters (NWS, 2009). The CTCR would be susceptible to a flash flood only from a Skookumchuck Dam failure.

Coastal Flooding

Coastal flooding is the flooding of normally dry, low-lying coastal land, primarily caused by severe weather events along the coast, estuaries, and adjoining rivers. These flood events are some of the more frequent, costly, and deadly hazards that can impact coastal communities. Factors causing coastal flooding include:

- Storm surges, which are rises in water level above the regular astronomical tide caused by a severe storm's wind, waves, and low atmospheric pressure. Storm surges are extremely dangerous, because they are capable of flooding large coastal areas.

- Large waves, whether driven by local winds or swell from distant storms, raise average coastal water levels and individual waves roll up over land.

- High tide levels are caused by normal variations in the astronomical tide cycle (discussed below).

- Other larger scale regional and ocean scale variations are caused by seasonal heating and cooling and ocean dynamics.

Coastal floods are extremely dangerous, and the combination of tides, storm surge, and waves can cause severe damage. Coastal flooding is different from river flooding, which is generally caused by severe precipitation. Depending on the storm event, in the upper reaches of some tidal rivers, flooding from storm surge may be followed by river flooding from rain in the upland watersheds. This increases the flood severity due to river rise as well as potentially impacting bridge support structures, causing their failure. Within the National Flood Insurance Flood Maps (discussed below), coastal flood zones identify special flood hazard areas (SFHA) which are subject to waves with heights of between 1.5 and 3 feet during a 1-percent annual chance storm (100-year event).

Tidal Flooding

Spring tides, the highest tides during any month, occur with each full and new moon. When these coincide with a northerly wind piling water, tidal flooding can occur. The tides can also enhance flooding in delta areas when rivers or creeks are at or near flood stage. Such flooding is also a threat to low-lying farmlands in the area. Tidal impact is of most concern in delta areas when rivers are at flood stage and high tide exacerbates the situation. Concerns about tidal flooding are anticipated to increase due to the impacts of global climate change and sea level rise.

8.1.2 Dam Failure

Dam failures in the United States typically occur in one of four ways (Association of State Dam Safety Officials, 2012):

- Overtopping of the primary dam structure, which accounts for 34 percent of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts for 20 percent of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters. The prominent causes are earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage. The most likely disaster-related cause of dam failure in the planning area is related to earthquakes. Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

The potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public.

There have been no reported incidents of dam failure impacting the Confederated Tribes of the Chehalis Reservation.

Washington Department of Ecology Dam Safety Program

The Dam Safety Office (DSO) of the Washington Department of Ecology regulates over 1,000 dams in the state that impound at least 10 acre-feet of water. The DSO has developed dam safety guidelines to provide dam owners, operators, and design engineers with information on activities, procedures, and requirements involved in the planning, design, construction, operation, and maintenance of dams in Washington. The authority to regulate dams in Washington and to provide for public safety is contained in the following laws:

- State Water Code (1917)—RCW 90.03
- Flood Control Act (1935)—RCW 86.16
- Department of Ecology (1970)—RCW 43.21A .

Where water projects involve dams and reservoirs with a storage volume of 10 acre-feet or more, the laws provide for the Department of Ecology to conduct engineering review of the construction plans and specifications, to inspect the dams, and to require remedial action, as necessary, to ensure proper operation, maintenance, and safe performance. The DSO was established within Ecology’s Water Resources Program to carry out these responsibilities.

The DSO provides reasonable assurance that impoundment facilities will not pose a threat to lives and property, but dam owners bear primary responsibility for the safety of their structures, through proper design, construction, operation, and maintenance. The DSO regulates dams with the sole purpose of reasonably securing public safety; environmental and natural resource issues are addressed by other state agencies. The DSO neither advocates nor opposes the construction and operation of dams.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation, and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (U.S. Army Corps of Engineers, 1997).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. There are 3,036 dams that are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC staff inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems;
- Complaints about constructing and operating a project;
- Safety concerns related to natural disasters;
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC staff monitors and evaluates seismic research and applies it in investigating and performing structural analyses of hydroelectric projects. FERC staff also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC staff visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

The FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

Hazard Ratings

The DSO classifies dams and reservoirs in a hazard rating system based solely on the potential consequences to downstream life and property that would result from a failure of the dam and sudden release of water. The following codes are used as an index of the potential consequences in the downstream valley if the dam were to fail and release the reservoir water:

- 1A = Greater than 300 lives at risk (High hazard);
- 1B = From 31 to 300 lives at risk (High hazard);
- 1C = From 7 to 30 lives at risk (High hazard);
- 2 = From 1 to 6 lives at risk (Significant hazard);
- 3 = No lives at risk (Low hazard).

The Corps of Engineers developed the hazard classification system for dam failures shown in Table 8-1. The Washington and Corps of Engineers hazard rating systems are both based only on the potential consequences of a dam failure; neither system takes into account the probability of such failures.

TABLE 8-1
CORPS OF ENGINEERS HAZARD POTENTIAL CLASSIFICATION

Hazard Category[a]	Direct Loss of Life[b]	Lifeline Losses[c]	Property Losses[d]	Environmental Losses[e]
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
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

TABLE 8-1
CORPS OF ENGINEERS HAZARD POTENTIAL CLASSIFICATION

Hazard Category[a]	Direct Loss of Life[b]	Lifeline Losses[c]	Property Losses[d]	Environmental Losses[e]

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
c. Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers, 1995

The owner of a dam is responsible for developing an inundation map, which is used in determining exposure to a potential dam failure or breech during development of dam response plans. Presently, no such maps are available for public release for any of the dams as inundation maps are considered privileged information. Therefore, it is difficult to estimate the population living within the inundation zone beyond the information designated in the dam classification analysis. Without the ability to perform an inundation study, it is also not possible to estimate property losses from a dam failure which could ultimately affect the planning area.

While no dam failure inundation studies are available, in some instances those inundation areas coincide with flood hazard areas. Review of the flood profile may provide a general concept of structures at risk, although, based on the size of the dams, damage would vary. As development occurs downstream of dams, it is necessary to review the dams' emergency action plans and inundation maps to determine whether the dams require reclassification based on the established standards.

There are no dams on the Reservation; however, the FERC-regulated Wynoochee Dam on the Wynoochee River is within Grays Harbor County. The Wynoochee Dam is 28 miles north of Montesano, a neighboring community to Oakville, the closest city to the Chehalis Reservation. The dam is owned by the city of Aberdeen, also in Grays Harbor. It was built by the United States Army Corps of Engineers in 1972. In 1994, Tacoma Power added a hydroelectric generating plant downstream from the dam. The dam regulates the flow of the Wynoochee River, creating Wynoochee Reservoir.

The Skookumchuck Dam is located on the Skookumchuck River in Thurston County, approximately 10 miles upstream from Centralia. On a tributary of the Chehalis River, the dam is an earth-filled structure, it is a run-of-river dam constructed in 1970. TransAlta maintains ownership of the dam. In 1990, a small powerhouse was constructed to produce hydro power from the site. The Washington Department of Fish and Wildlife (WDFW) uses a portion of the water for a fish-rearing facility downstream of the dam.

There have been no reported incidents of dam failure at either the Wynoochee or Skookumchuck Dams. However, the Skookumchuck Dam is an earthen dam that feeds the Chehalis River upstream from the Reservation. If this dam were to fail, it is felt by the CTCR that this could potentially cause a flash flood on the Reservation.

8.1.3 Measuring Floods and Floodplains

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon. Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources, but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

In the case of riverine or flash flooding, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat (NWS, 2011):

- 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.

8.1.4 Flood Insurance Rate Maps

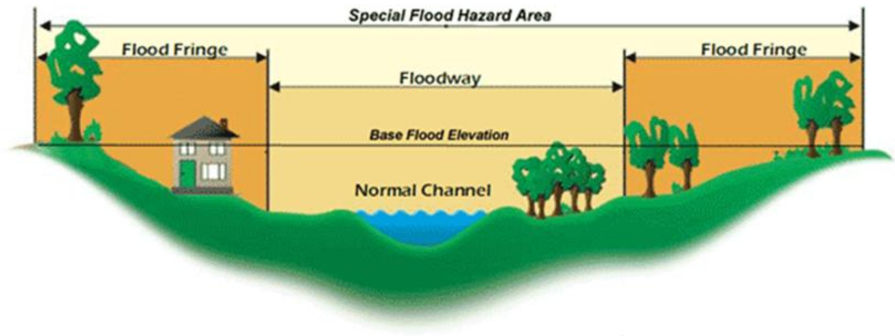


Figure 8-1 Flood Hazard Area Referred to as a Floodplain

According to FEMA, flood hazard areas are defined as areas that are shown to be inundated by a flood of a given magnitude on a map (see Figure 8-1). These areas are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Three primary areas make up the flood hazard area: the floodplains, floodways, and floodway fringes.

Flood Hazard Areas

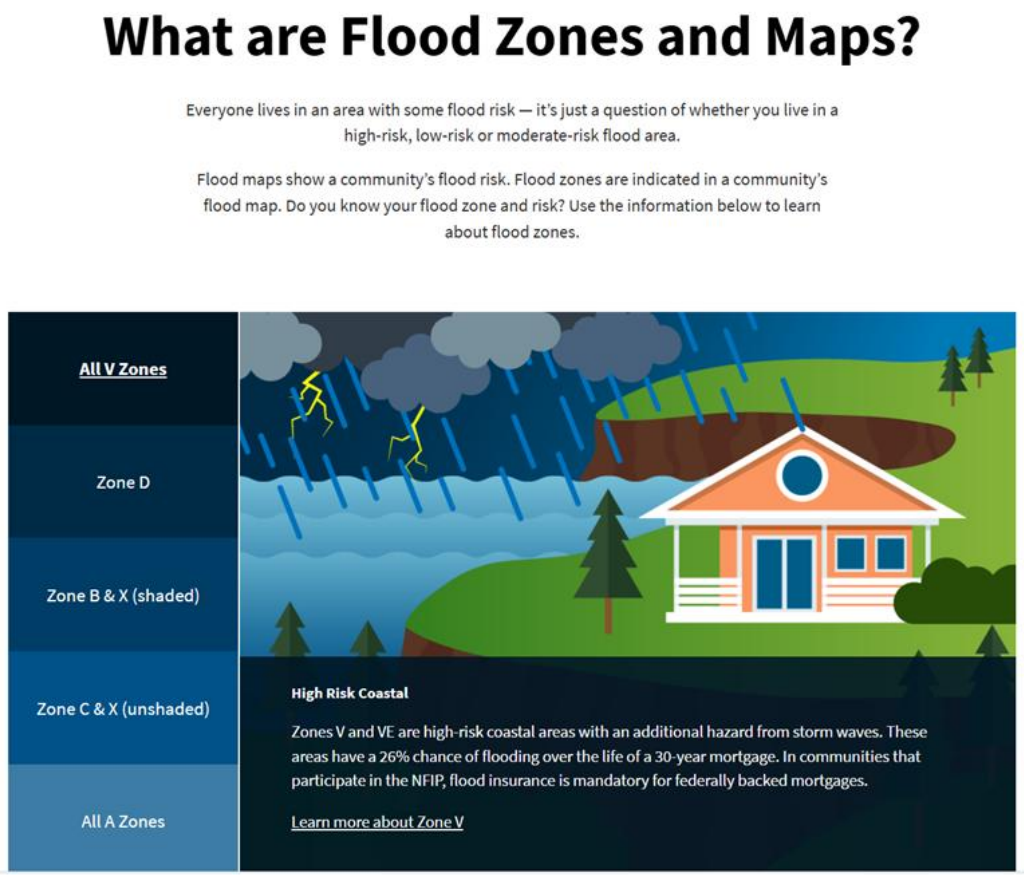


Figure 8-2 FEMA Flood Zone and Maps (FEMA Website)

Flood hazard areas are delineated on FEMA's Flood Insurance Rate Maps (FIRM), which are official maps of a community on which the Federal Insurance and Mitigation Administration has indicated both the special flood hazard areas (SFHA) and the risk premium zones applicable to the community.

These maps identify the geographic areas or zones that FEMA has defined according to varying levels of flood risk, and include: special flood hazard areas; the location of a specific property in relation to the special flood hazard area; the base (100-year) flood elevation at a specific site; the magnitude of a flood hazard in a specific area; and undeveloped coastal barriers where flood insurance is not available. The maps also locate regulatory floodways and floodplain boundaries—the 100-year and 500-year floodplain boundaries (FEMA, 2003; FEMA, 2005; FEMA, 2008, FEMA 2024). Figure 8-2 is a FEMA graphic discussing the various flood zones. Table 8-2 identifies the various rate map zones. Reviewers wishing additional information on the National Flood Insurance Program can find information at: | Flood Zones | FloodSmart

TABLE 8-2 FLOOD INSURANCE RATE MAP ZONES	
Moderate to Low Risk Areas: Areas of moderate or minimal hazard are studied based upon the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in a community's flood insurance study. The failure of a local drainage system can create areas of high flood risk within these zones. Flood insurance is available in participating communities but is not required by regulation in these zones. Nearly 25-percent of all flood claims filed are for structures located within these zones.	
Zone	**Description**
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floodplain area with a 0.2% (or 1 in 500 chance) annual chance of flooding. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than one (1) square mile.
C and X (unshaded)	Area of minimal flood hazard usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.
High Risk Areas: Special Flood Hazard Areas represent the area subject to inundation by 1-percent-annual chance flood. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply to participating communities in these zones.	
Zone	**Description**
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30 (old map format)	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format). Older maps still utilize this numbered system, but newer FEMA products no longer use the "numbered" A Zones. (Zone AE is used on new and revised maps in place of Zones A1–A30.)
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the

TABLE 8-2 FLOOD INSURANCE RATE MAP ZONES	
	life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
High Risk - Coastal High Hazard Areas (CHHA): These represent the area subject to inundation by 1-percent-annual chance flood, extending from offshore to the inland limit of a primary front al dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. Structures located within the CHHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory purchase requirements apply in the following zones.	
Zone	**Description**
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
VE, V1-30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
Undetermined Risk Areas	
Zone	**Description**
D	Areas with possible but undetermined flood hazard. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

The frequency and severity of flooding are measured using a discharge probability, which is a statistical tool used to define the probability that a certain river discharge (flow) level will be equaled or exceeded within a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

A structure located within a 1 percent (100-year) floodplain has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage. The 100-year flood is a regulatory standard used by federal agencies and most states to administer floodplain management programs. The 1 percent (100-year) annual chance flood is used by the NFIP as the basis for insurance requirements nationwide. FIRMs also depict 500-year flood designations, which is a boundary of the flood that has a 0.2-percent chance of being equaled or exceeded in any given year (FEMA, 2003; FEMA, 2005). It is important to recognize, however, that flood events and flood risk are not limited to the NFIP delineated flood hazard areas. Table 8-3 illustrates the estimated probability of flood events as utilized by the NFIP.

TABLE 8-3
ESTIMATED PROBABILITY OF FLOOD EVENT

EVENT	ANNUAL CHANCE OF OCCURRENCE
10-year flood	10%
25-year flood	4%
50-year flood	2%
100-year flood	1%
500-year flood	0.2%

8.1.5 National Flood Insurance Program (NFIP)

The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damage. The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (FEMA's 2002 *National Flood Insurance Program (NFIP): Program Description*). There are three components to the NFIP: flood insurance, floodplain management, and flood hazard mapping. Nearly 20,000 communities across the U.S. and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary.

For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

NFIP participants must regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

NFIP Status and Severe Loss/Repetitive Loss Properties

The Confederated Tribe of the Chehalis Reservation is a member in good standing of the NFIP, Community #530334B. The Tribe does have regulatory authority within its land use planning which regulates development to current NFIP and IBC standards. The Tribe has no previous claim history under the NFIP.[14]

Repetitive Flood Claims

Residential or non-residential (commercial) properties that have received one or more NFIP insurance payments are identified as repetitive flood properties under the NFIP. Such properties are eligible for funding to help mitigate the impacts of flooding through various FEMA programs, subject to meeting certain criteria and maintaining a Repetitive Loss Strategy. Repetitive flood claims provide funding to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claim payments for flood damages.

A Repetitive Loss Strategy must identify the specific actions taken to reduce the number of repetitive loss properties, which must include severe repetitive loss properties, and specify how the Tribe intends to reduce the number of such repetitive loss properties. In addition, the hazard

[14] Based on email from Washington State Emergency Management Division 02/28/2025.

mitigation plan must describe the strategy it will take to reduce the number of these properties, including the development of Tribal hazard mitigation plan.

In preparation of this plan, the Planning Team did review Washington State's 2023 Hazard Mitigation Plan, which does contain a Repetitive Loss Strategy. While a sovereign nation and not required to adhere to state policies and procedures, the Chehalis Tribe, as appropriate, will continue to work with the state in its endeavor to reduce impact from flooding within the tribal planning area. At the CTCR's election, this may include seeking opportunities for mitigation funds under the various Stafford Act Grant Programs.

- As of February 28, 2025, the Tribe has no repetitive flood claims.[15]

Tribal Repetitive Loss Strategy:

The Chehalis Tribe will continue to address repetitive loss properties by ensuring that new construction is built to the highest building code standards required, and also continue to view the mitigation plan for identified areas of risk. As was previously done, the Tribe will continue to mitigate structures within the floodplain, including, if feasible, to move structures out of the floodplain or to take other such corrective actions as appropriate.

The Planning Team will use the five-year updates of this Hazard Mitigation Plan as an opportunity to evaluate hazard management laws, regulations, and policies, and work with the Tribe's legal and planning departments to create the most effective and efficient regulatory authority when necessary to do so to continue to mitigate flood issues on the properties owned by the CTCR.

Severe Repetitive Loss Program

The severe repetitive loss program is authorized by Section 1361A of the National Flood Insurance Act (42 U.S.C. 4102a), with the goal of reducing flood damages to residential properties that have experienced *severe* repetitive losses under flood insurance coverage and that will result in the greatest savings to the NFIP in the shortest period of time. A severe repetitive loss property is a residential property that is covered under an NFIP flood insurance policy and:

- a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

- b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

[15] Ibid.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any 10-year period, and must be greater than 10 days apart.

- As of February 28, 2025, the Confederated Tribes of the Chehalis Reservation have no severe repetitive loss properties.[16]

The Community Rating System

The Community Rating System (CRS) is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions.

- The Confederated Tribes of the Chehalis Reservation are not a CRS Community.

8.2 HAZARD PROFILE

8.2.1 Extent and Location

Flooding is the most common hazard occurring in the tribal planning area, and is mostly due to riverine flooding. The severity of flood damage is dependent upon ground elevation, the surrounding topography, peak flow volumes, surface flow velocities, tides, driving winds, and, in some instances, the potential storm surge impacting the drainage of the Chehalis River.

The CTCR has sustained one loss of life due to a flood event which occurred in 1996 as a result of the inability for the tribal member to access emergency medical care due to inundation, and the inability for emergency vehicles to gain access to the area, and making it impossible for the tribal member to evacuate.

The entire reservation falls within the Chehalis River Basin, which is one of the largest river basins in the state of Washington outside of the Columbia River Basin, with approximately 75 percent of the reservation falling within the 100-year floodplain. The Chehalis River flows in a westerly direction through much of the reservation, ultimately draining into Grays Harbor. The Chehalis River has a total drainage basin of 2,114 square miles (inclusive of both on and off reservation miles).[17] The River itself is 174 miles long, and is divided into two watersheds: the Upper Chehalis (WRIA #23) and the Lower Chehalis (WRIA #22). Once leaving the Reservation, the Chehalis River continues northwest where it joins the tributaries of the Satsop and Wynoochee rivers near the City of Montesano. The Chehalis River becomes increasingly affected by tides beyond this

[16] Ibid.

[17] FEMA 2020 Flood Insurance Study.

location and gradually widens into the Grays Harbor estuary where it is joined by several other rivers, becoming Grays Harbor.

Due to its large drainage area, the Chehalis River tends to rise slowly over a long period. The three common scenarios for flooding on the Chehalis River include:

- When rains fall over all southwestern Washington and all regional rivers and streams rise.
- The Chehalis River can also experience flooding when there is little or no rain in Thurston or Grays Harbor counties, but heavy rain in Lewis and Pacific counties, or in the foothills of the Cascade Mountains, impacting the Skookumchuck as it drains into the Chehalis.
- Flooding also occurs when heavy rain falls in Grays Harbor County, but not in Thurston or Lewis counties. Feeder streams can then fill the Chehalis and cause water to back up into Thurston or Lewis counties, depending on the streams involved.

The Black River flows in a southerly and westerly direction until it reaches the confluence with the Chehalis River on the reservation. Approximately 9.7 percent of the basin is agricultural land, while approximately 85 percent is forestland.

Much of the area is a predominately marine climate, with mild wet winters dictating weather patterns throughout the area. Flood season usually begins in October when heavy rainfall occurs, lasting through April. Atmospheric Rivers often become stationary over the region, bringing long periods of rainfall. Precipitation in the form of rain averages 58 inches, with three inches of snow per year on average.

During long periods of rainfall, river and stream channels fill to overflowing. Intense precipitation combined with mild temperatures will cause snowmelt on the south slopes of the Olympic Mountains that can also induce or increase flooding, or in the foothills of the Cascade Mountains. River floods happen most often when winter storms bring heavy rain from the southwest.

More recently, the ability of weather forecasters to provide early warning to citizens when significant weather-related events are to occur does provide residents with the ability to evacuate prior to the weather system arriving. Due to the geologic and physical environment of the Chehalis Reservation, the area may flood up to five times annually. In most cases these smaller events are minor and more of a nuisance-type, causing disturbance to daily life in the area. Roadways regularly are blocked both by floodwaters, causing people to be unable to engage in normal activities of traversing roadways, and causing isolation of the area.

FEMA Flood Maps

FEMA performed a Flood Insurance Study (FIS) for Grays Harbor County originally in 1981. Those maps did not officially include the Chehalis Reservation. In 2016-2017 the paper flood maps from 1981 were updated to a digital format, which did include some changes made due to comments provided during the appeal period. FEMA conducted a new flood study for the Chehalis River for the areas in the Grays Harbor County, which includes the Chehalis Reservation. That study and the resulting new maps went effective September 18, 2020. The Chehalis River update for the areas in the Thurston County maps went effective June 19, 2020. The Chehalis River update for the areas in the Lewis County maps are only in the preliminary stage from November 2010. That study will eventually be revised due to a change in policy with respect to levees.

Maps generated from Grays Harbor and Thurston Counties have been utilized in this analysis. The various flood zones associated with the two studies are illustrated in Figure 8-3, which illustrates the 100- and 500-year flood hazard areas on which tribal properties are located.

As a result of the various flood studies completed in the area to date, depth grid data was also developed, showing the potential depth of floodwaters for a 100-year event in the planning area. Figure 8-4 and Figure 8-5 illustrate the depth grids for the 1-percent-annual-chance flood for the riverine areas. These maps also illustrate the roadways which are impacted by various depths. These roadways many times become inundated and underwater during flood events, impacting the Tribe's ability to evacuate, as well as impacting other people's ability to evacuate from other areas of Grays Harbor or Thurston Counties. As indicated, the 1996 flood resulted in the death of one tribal member due to their inability to evacuate, or to gain emergency medical services.

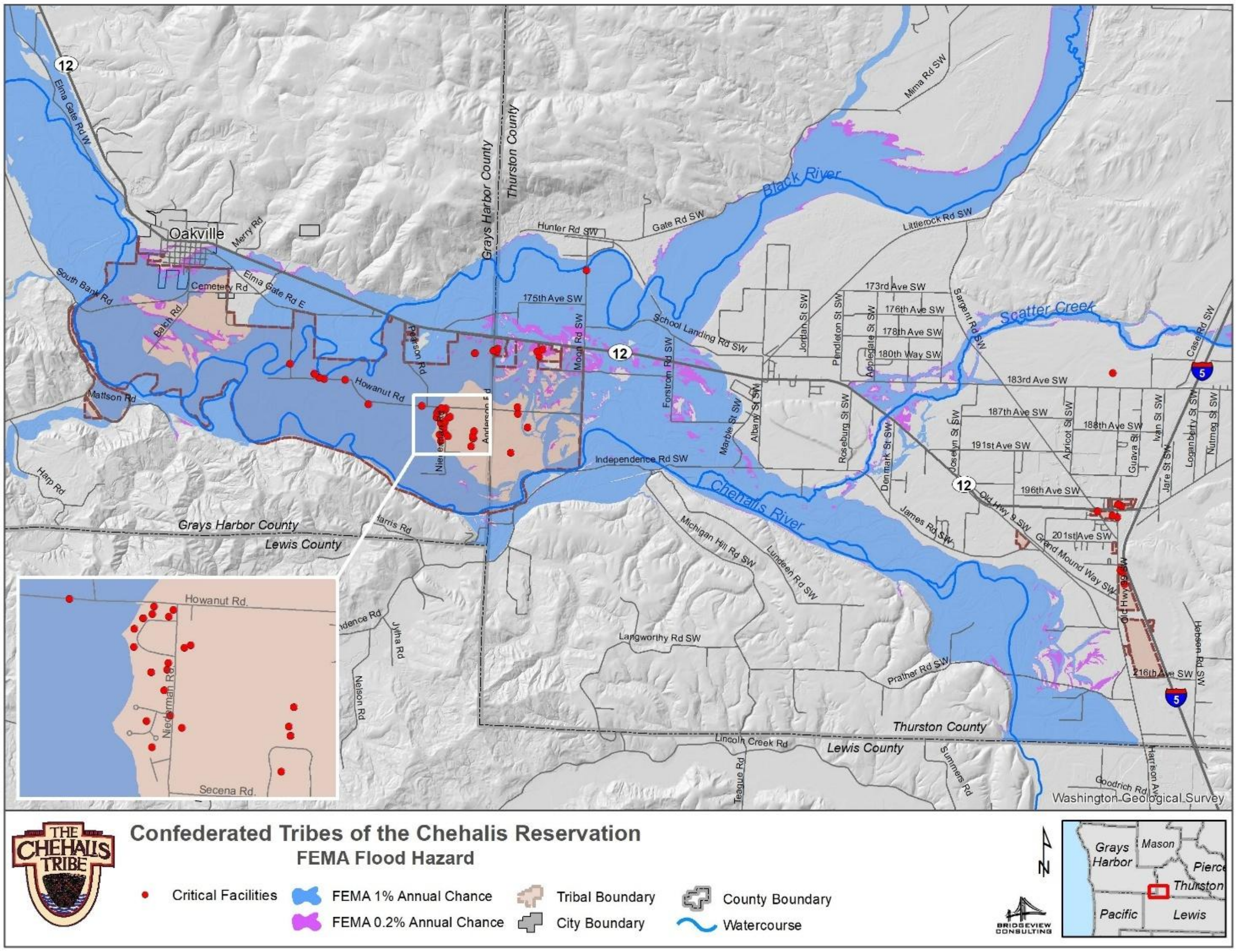


Figure 8-3 Chehalis Reservation Flood Hazard Areas

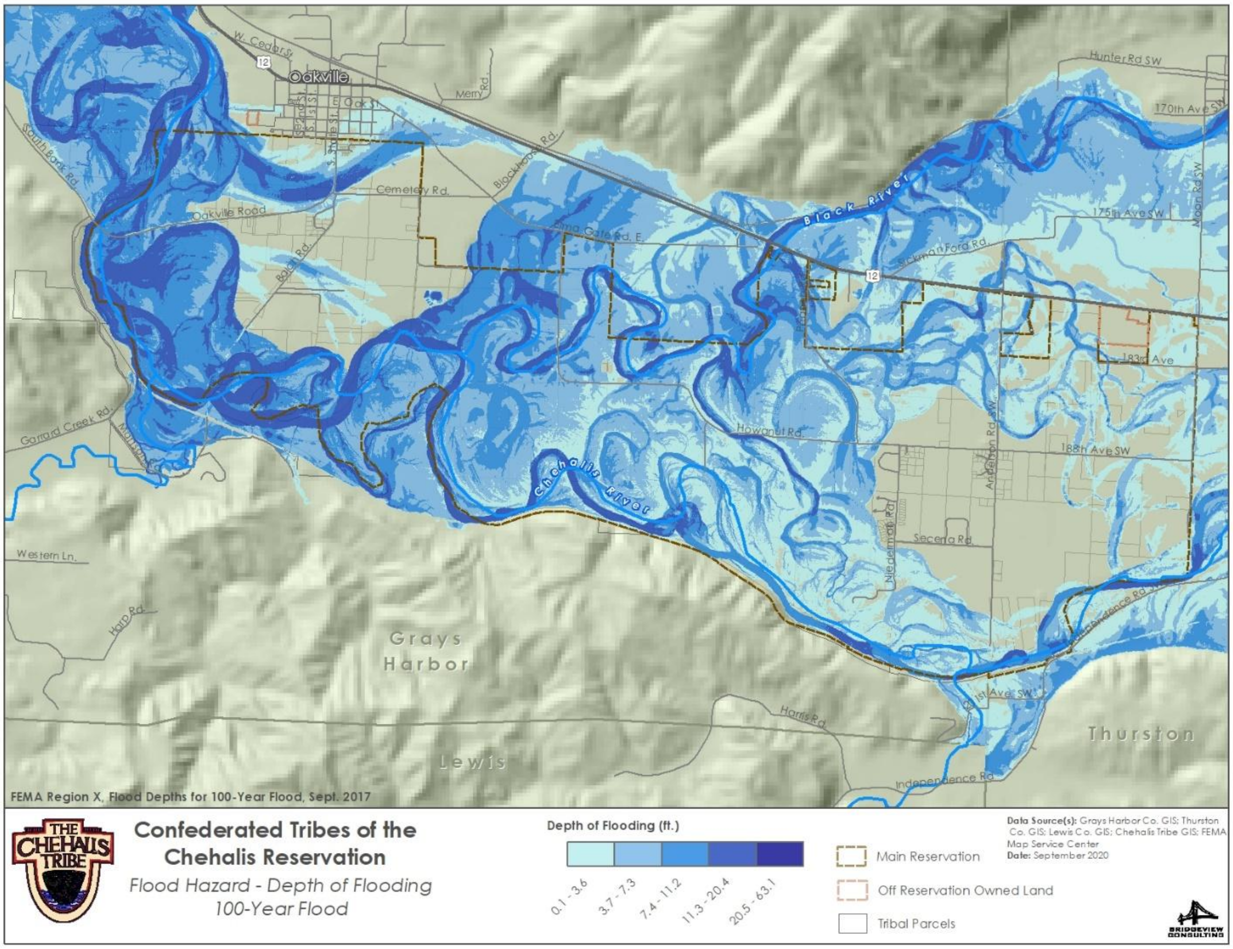


Figure 8-4 Chehalis Reservation Flood Depth for 100-year Flood Event

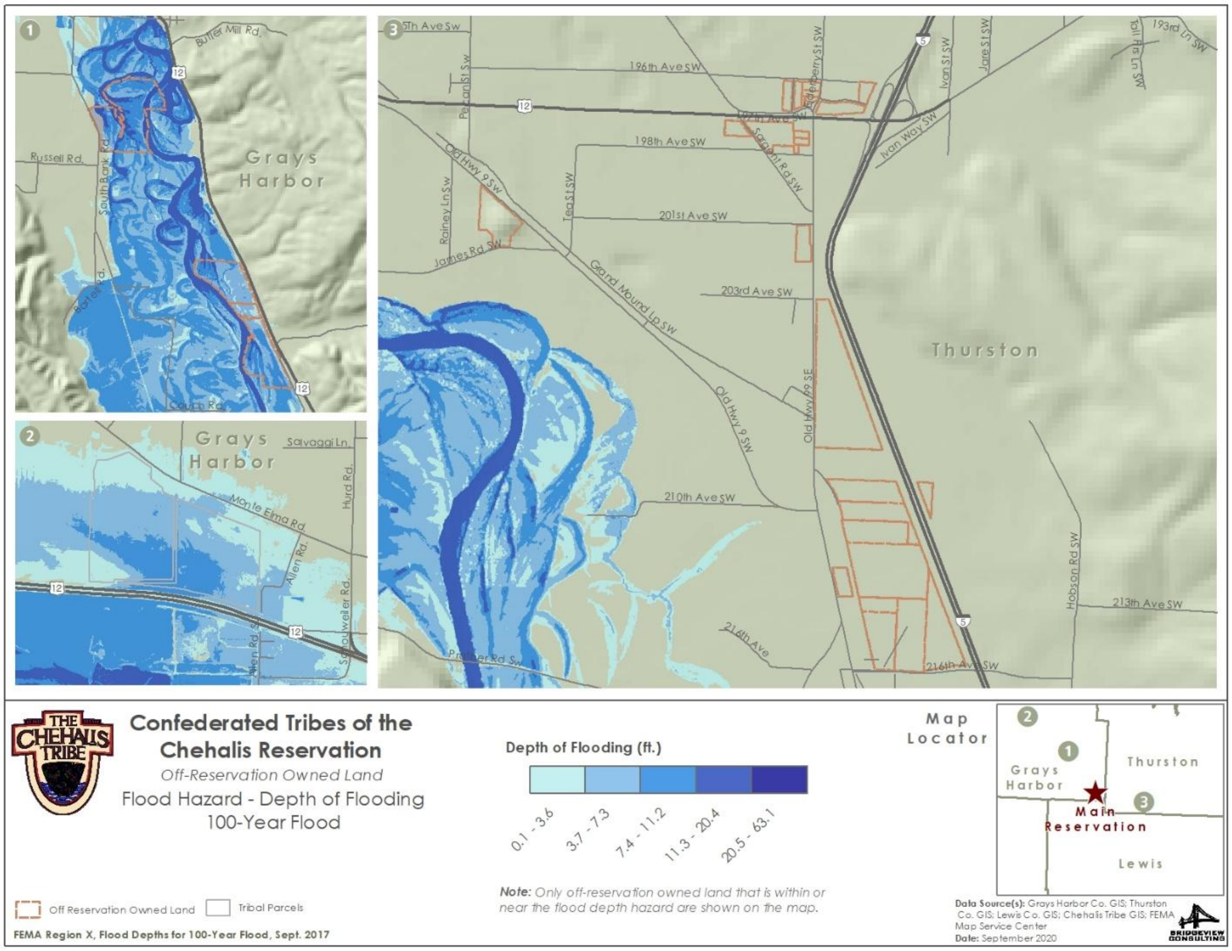


Figure 8-5 Chehalis Tribe Off-Reservation Flood Depth for 100-year Flood

8.2.2 Previous Occurrences

Major floods in the planning area have resulted from intense rainstorms customarily between October and April, with one flood event occurring in May within Grays Harbor County. The highest months for declared flood or flood-included events occur in December for all three counties, with Lewis County also having four flood events in January and February. As identified in Chapter 3, Section 3.5 – Major Past Hazard Events Table, the planning area has received 17 disaster declarations typed by FEMA as Flood events (inclusive of Grays Harbor, Thurston, and Lewis Counties). There are also several events typed by FEMA as Severe Storm, which include flooding.

Large floods have occurred in 1986, 1990, 1996, 2007, 2009, and 2021-2022, several of which were ranked as the flood of record at the time of its occurrence. A brief overview of some of these more memorable incidents follows. The CTCR have no dollar figures which indicate loss impact from all of the events listed, but have provided the data they do have. CTCR has identified the capturing of such data as a mitigation strategy for use in future updates. Where data has been captured, it is included.

- 1990 – (DR 852) Major flooding occurred along the Chehalis (and other) Rivers. Lewis County experienced two deaths as a result of the event; residents in care centers required evacuation. Interstate 5 closed for several days between Chehalis and Thurston Counties, impacting evacuation. Red Cross Shelters were open throughout the three counties.

- 1996 – (DR 1100) The 1996 flood covered 75 percent of the reservation with measured flood depths up to 10 feet. All access routes, including Howanut Road, Anderson Road, and Moon Road were under one to four feet of fast-moving water. U.S. Highway 12, which provides access to many secondary roads, also was flooded, and Interstate 5 was flooded and closed for several days. One death occurred on the Reservation as a result of the inability for emergency medical services to gain access to the flooded area and provide medical aid.

- 2007 - (DR-1734) December 2-3, 2007. Snow followed by a “Pineapple Express” caused major flooding. During the 2007 flood, the water moved swiftly and covered the Chehalis Reservation to record water depths within 24 hours of notification of flooding. At the east end of the Chehalis Reservation, water overtopped Anderson Road. Up to two feet of water overtopped U.S. Highway 12 and flowed into the Black River east of Anderson Road. Southeast of the Reservation, Independence Road was overtopped near the bridge and a section of the Chehalis River channel migrated south and eroded a portion of the abandoned railroad grade. The central portion of the Chehalis Reservation, at the confluence of the Chehalis and Black rivers, was flooded from U.S. Highway 12 south to the abandoned railroad grade. Floodwater ponded upstream of the western glacial terrace and rose high enough to overtop Blockhouse Road and flow down Harris Creek. Between the glacial terrace and Oakville, bridges and culverts were overtopped, road pavement was damaged, and houses were flooded. At the west end of the Reservation, portions of Balch Road were damaged and the east approach to the Sickman-Ford Bridge was overtopped and damaged. Elsewhere within the Chehalis Reservation, gravel driveways and rural roads were scoured clean of gravel. Wells and septic systems were swamped and well heads were overtopped. Five homes in the central area of the Reservation (on Howanut Road, on the east-west segment just south of the Black River) were inundated with up to 4 feet of water. Of the five homes, two had not previously reported flood damage.

  Properties owned by the Tribe and located outside of the Chehalis Reservation experienced various degrees of flooding as a result of the 2007 flood. One of the Tribe’s convenience stores which was constructed one foot above the 1996 flood elevation at the intersection of Anderson Road and U.S. Highway 12 location, experienced a half foot of flooding, resulting in damage to floors and product. Two properties located downstream of the Reservation which were inundated with flood waters as a result of the 1996 flood experienced only minor damage from the December 2007 flood. Damage included sediment deposition in fields and damage to fencing from the accumulation of flood debris; however, the structures themselves on these properties were not damaged by the December 2007 flood.

East of the Chehalis Reservation, Interstate 5 closed for 20 miles between Chehalis and Grand Mound for five days, with some portions of Interstate 5 covered with 10 feet of water. WA DOT estimated that closure resulted in $47 million in lost economic output statewide. Some of these economic losses were felt on the Reservation because of the closure of Tribal businesses (Lucky Eagle Casino, Eagle's Landing Hotel, and two convenience stores) and the associated loss of retail sales and revenue. Firefighters and sheriff's deputies from all three counties evacuated hundreds of people stranded by the high water. Many people had to seek help at local shelters because of dwindling gasoline and food supplies available. Figure 8-6 identifies areas of the Reservation which were impacted by the 2007 flood event (CTCR 2010 HMP).[18] Figure 8-7 and Figure 8-9 are aerial photographs of the impact of the 2007 flood on the Reservation.[19]

[18] CTCR Flood Hazard Management Plan (2009). Accessed 15 Sept 2020. Available online at: file:///D:/Dropbox/Chehalis%202020/HMP/Supporting%20Data/Chehalis-Tribe-CFHMP.pdf

[19] CTCR Flood Impact Photos courtesy of Glen Connelly, CTCR Dept. of Natural Resources Director.

Figure 8-6 CTCR Impact Areas from 2007 Flood Event

Figure 8-7 December 2007 Flood Trails End of Trail Gas Station/Store #2

Figure 8-8 December 2007 Flood

- 2009 - A major weather system delivered a stream of moisture-laden tropical air to the Pacific Northwest resulted in significant flooding throughout western Washington on January 7 and 8, 2009. Total rainfall for January 6-7 ranged from 6 to 15 inches with the highest amounts occurring in the Cascade Range. Statewide, 15 counties were declared as a result of flooding and landslides caused by the severe weather. Provisional data from U.S. Geological Survey long-term stream gages indicated peaks with recurrence intervals equal to or greater than 100 years occurred in eight major river basins in western Washington; Cedar, Chehalis, Cowlitz, Hoko, Naselle, Puyallup, Snohomish, and Stillaguamish River Basins. (USGS High Water Marks, 2009). Considered a major flood, discharge in Grand Mount reached 50,300 cubic feet

- 2015 - An atmospheric river passed over parts of western Washington. Over the following 48 hours, intense precipitation fell on much of the coast and interior of the state. The two-day storm total was 7.16 inches at Hoquiam Airport (based on WA State Climatologist reports). The area experienced many landslides, including the City of Hoquiam where several slides damaged (at least) eight houses. This was a historic flood of record. The CTCR were forced to close all of its enterprises as a result of the flood event.

- January 2022 (DR 4650 – CTCR Declared) The CTCR faced considerable losses from a January 6-9, 2022 flooding event. The Tribe sustained approximately $1.38 million in losses to its various enterprises, including the casino fuel stations, and smoke shop. Well water testing was required, as well as treatment of the water. Bottled water was distributed for drinking. Sheler locations were also established at Great Wolf Lodge, the Casino and the Marriot hotel. The hotels were utilized for staffing of response/emergency management team members, and for the relocation of evacuated tribal members. Multiple roadways and bridges were flooded. The Casino closed and ceased gaming operations for multiple days. Several factors led up to the event, including a snowstorm which started on December 25, 2021, lasting until December 30, 2021. During this event the area saw heavy snow accumulation in the surrounding mountains and watersheds. The Reservation experienced low land snow totals up to and around 8 inches. Temperatures during this event stayed well below freezing until January 3, 2022. Beginning January 4, 2022, a heavy rain event (pineapple express) moved into the area at the same time temperature moved above freezing with highs in the 40's. The combination of heavy rains and enhanced snow melt caused all the river systems in the valley to overspill their banks. Major flooding was recorded on two Chehalis River tributaries, the Newaukum river and upper Skookumchuck river. The Chehalis River experienced moderate flood stage in the towns of Centralia and Chehalis. Here at the Reservation the Chehalis River rose above Major flood stage at the Grand Mound gage peaking at 145.21 feet on January 8, 2022. During this time, the Black River also experienced major flooding, peaking at 98.03 feet on January 8, 2022.[20]

- November/December 2023 – An atmospheric river brought large amounts of rainfall to western Washington in late November and early December this year. The flood gage on the Chehalis River near Grand mound crept up to 143.32 hitting the minor flooding status and the Black river overflowed, affecting the western part of the Tribal lands. Roads along Howanut and Elma Gate were covered with running water and temporarily impassible for several days. One community member was relocated due to a medical procedure, but housing was not affected significantly.

- November/December 2024 - An atmospheric river brought large amounts of rainfall to western Washington in late November and early December this year. The flood gage on the Chehalis River near Grand mound crept up to 141.6, hitting the minor flooding status and the Black river rose to 81 feet but did not overflow. Roads along Howanut and Roadhouse Rd were briefly covered with water on one side but were still passable. Since this report covers only until the end of 2024, the winter weather season is just beginning and there may be more water/flood issues going into 2025 (see CTCR 2024 HMP Annual Report at About Us - The Chehalis Tribe).

[20] CTCR January 2022 After Action Report.

8.2.3 Severity

The severity of a flood depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams that have the potential to impact an area; but an equally important factor is the land's absorbency. When it rains, soil acts like a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff.

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. 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 severity is often evaluated by examining peak discharges. The USGS maintains current stream gage data, and is available real-time for viewing. Figure 8-9 illustrates the type of data available from the USGS. Readers may elect to obtain data on stream gages directly from the USGS at: https://waterdata.usgs.gov/wa/nwis/rt.

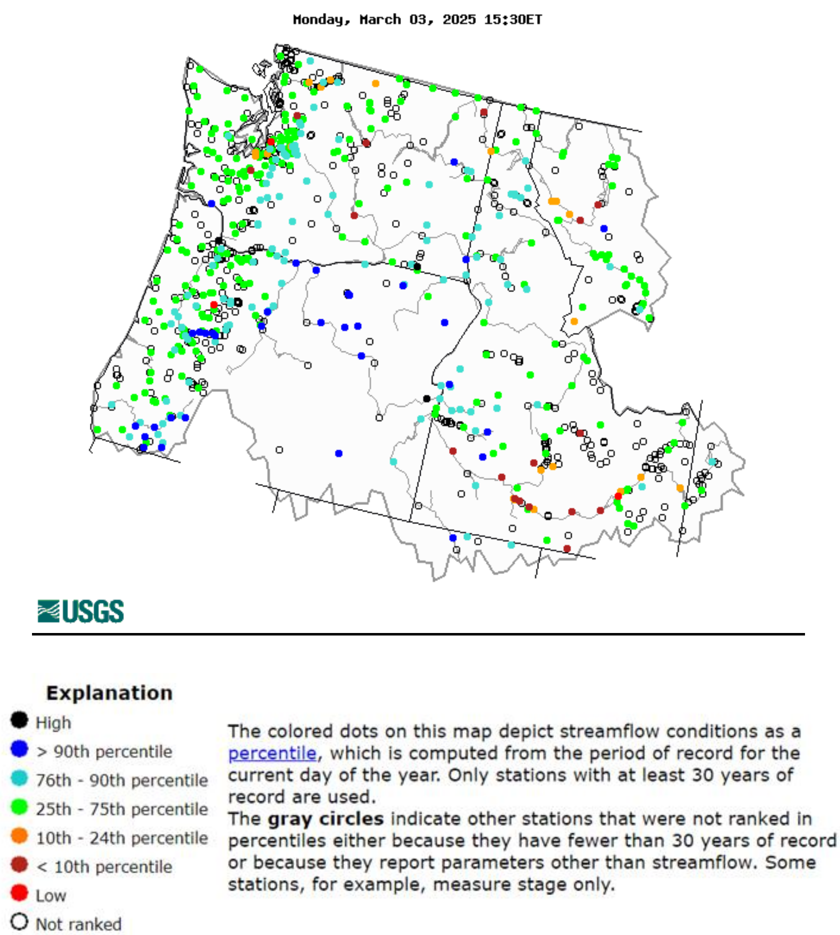


Figure 8-9 USGS Stream Flow Data for the Pacific Northwest on March 3, 2025

Flooding within the Chehalis Reservation comes with different levels of severity and impact. Review of the CTCR's Flood Hazard Management Plan (2009, 2020) and USGS gage data identifies various ways in which the CTCR has previously been impacted by a flood event, including the following: [21]

- Flooding within the Chehalis Reservation restricts access to the Reservation for periods of one or more days, isolating portions of the Reservation, and may cause failure of individual water and wastewater systems.
- Flooding of Chehalis Reservation lands many times requires immediate evacuation of non-residents, or ensuring residents remain within a building or other location while a dangerous situation exists outside the building or location. Historic floods have severely limited access to basic goods and services.
- Severe flooding can also contribute to the formation of swift-moving water in floodways that is capable of significantly endangering residents and their property. Flooding of this type can affect more than two-thirds of the Chehalis Reservation.
- Flooding from 15-year or greater recurrence interval storm is severe and endanger roads and many structures within the floodplain.
- At 146.03 feet above sea level, the Chehalis River will cause severe near-record flooding, with deep and swift floodwaters inundating the Independence Valley. Flooding will occur all along the river, including headwaters, tributaries, and other streams within and near the Chehalis River Basin.
- At 144.53 feet above sea level, the Chehalis River will cause major flooding, inundating roads and farmlands in Independence Valley. Deep and swift floodwaters will cover SR-12 and Independence and Moon Roads. Flooding will occur all along the river including headwaters, tributaries, and other streams within and near the Chehalis River Basin.

[21] The Confederated Tribes of the Chehalis Reservation completed a Flood Hazard Management Plan in 2009, which was updated in 2020 when FEMA issued new flood maps for the CTCR. That document incorporated a hydraulic model used to estimate water surface elevations and the potential impact. That data coupled with FEMA's most current NFIP maps remain the best available science. Data from the FHMP is incorporated extensively within this flood hazard profile in various areas, but in detail within the *Severity* and *Frequency* portions of the document. Reviewers may wish to read that document for more detail, which is available on request to the Tribe.

- At 142.53 feet above sea level, the Chehalis River will flood several roads in Independence Valley with swiftly moving water including SR-12 and James, Independence, Moon and Anderson Roads. Floodwaters will cut off access to and from Chehalis reservation and inundate nearby farmlands and some residential structures may be threatened.

- At 141.0 feet above sea level, the Chehalis River will flood several roads in Independence Valley including James Road, Independence Road and Moon Road. Floodwaters will also cover nearby farmlands.

- At 139.53 feet above sea level, the Chehalis River will locally spill out of its banks into nearby fields and over a few roads.

8.2.4 Frequency

Floods are commonly described as having a 10-, 50-, 100-, and 500-year recurrence interval, meaning that floods of these magnitudes have (respectively) a 10-, 2-, 1-, or 0.2-percent chance of occurring in any given year. These measurements reflect statistical averages only; it is possible for two or more rare floods (with a 100-year or higher recurrence interval) to occur within a short time period. Assigning recurrence intervals to historical floods on different rivers can help indicate the intensity of a storm over a large area.

The Chehalis Reservation is subject to minor flooding up to five times annually. The frequency of flooding is caused by the unique geologic and physical environment of the Chehalis Reservation. These minor floods occur on the west, central, and eastern areas of the Chehalis Reservation, and cover up to half of the Reservation for periods of one or more days. Although minor, these smaller events tend to limit access to residential and commercial areas of the Chehalis Reservation, isolating specific neighborhoods for periods of up to two days, disrupting services, including individual wells and wastewater systems. [22]

Flooding sufficient to limit access to the Reservation, covering one or more Reservation access roads occur with a frequency of about every 2.6 years. Flood events up to and above a 15-year frequency cover 75 percent of the reservation lands, with incremental encroachment on roads and homes, jeopardizing bridges, property fences, wells and septic systems, and other structures. During such events, residents of the central part of the Chehalis Reservation must be evacuated to higher ground. It is often difficult or impossible to leave the reservation for up to seven days, during which time emergency services may also be unavailable. Such an incident occurred during the 1996 flood, when the Tribe experienced a fatality resulting from the inability to access

[22] CTCR Flood Hazard Management Plan (2009, 2020). Accessed multiple times. Available upon request to the Tribe.

emergency medical care. The 2022 flood also required evacuation of tribal members, who sheltered at the Marriot Hotel.

Major floods resulting in severe impacts, including evacuation of people from residences in low-lying areas, and the inundation of major access roads, such as U.S. Highway 12, has historically occurred every 9 to 11 years. Consecutive years of major flooding (double floods) occur about every 20 years.[23]

Within the planning area, Lewis County sustained 17 declared *Flood* incidents during the period 1964-2024, not inclusive of *Severe Storm/Weather* incidents which also include an element of flood. Thurston County sustained 12 declared events, and Grays Harbor County sustained 14 declared events, also not inclusive of *Severe Storm/Weather* incidents. Utilizing the number of events occurring within the 60 year span of records to establish recurrence intervals (not based on order of magnitude), floods within Lewis County occur approximately ever 3.5 years, with a probability of occurrence in any given year of 28.3 percent. Thurston County's recurrence interval is approximately every 5.0 years, with a probability of occurrence in any given year of at 20 percent. Grays Harbor County's recurrence interval is approximately ever 4.3 years, with a probability of occurrence in any given year of 23.33 percent.

The Washington State Hazard Mitigation Plan identifies Grays Harbor County, the County in which a significant portion of the reservation exists, as being the county "Most Vulnerable and At-Risk to Flooding," with a frequency rate of one approximately every three years (October 2010). However, what customarily constitutes the "normal" flood season of October through April in Western Washington does not apply to the Chehalis River, which has received flood warnings issued by the National Weather Service during the month of July – normally one of the state's dryer months.

Flood events have continued to increase over the decades, with the majority of the declared incidents impacting the Reservation being flood related. As damages have grown in frequency and in size, flood management efforts have been accelerated by the Chehalis Tribe to help reduce the impact of flooding. In many cases, these actions were funded or developed by the Tribe, and in some cases, by Tribal Members directly.

During development of the 2020 NFIP maps, the Tribe worked with FEMA to provide more relevant information, which was included within the maps. Once completed, the new 2020 maps represented a much more accurate flood study than had historically existed as the Chehalis Reservation had been excluded previously from studies. The new maps are also in a digital format, making them much easier to utilize. These are the first NFIP maps which included an

[23] Ibid.

actual flood study covering the Reservation and are the maps which were utilized in completing this hazard profile.

The Chehalis Indian people historically occupied a large area within the Chehalis River watershed and have been located on the Chehalis Reservation since the 1850s. As the longest inhabitants of this land, the Chehalis people take its preservation very seriously. Tribal members hold the Chehalis and Black Rivers with great respect, and accept all aspects of river behavior (including flooding) as a functioning part of their community.

The Tribal members wish to preserve the historic character and natural environment of the Chehalis and Black rivers and their floodplains and thus prefer to avoid mechanical and structural in-stream measures to reduce flood impact. As such, the CTCR have completed several remediation projects within the Chehalis Basin which favor the environment in an effort to restore the watersheds to their normal habitat. In addition, the CTCR and homeowners have worked with FEMA to complete two home elevations, the third elevation project completed independent of FEMA by the homeowner directly.

8.3 VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For this planning purpose, the flood hazard areas identified include the 1-percent (100-year) and 0.2 % (500-year) floodplains. These events are those generally considered by planners and evaluated under federal programs such as the NFIP. The following text evaluates and estimates the potential impact of flooding on Tribal assets.

8.3.1 Overview

All types of flooding can cause widespread damage throughout rural and urban areas, including but not limited to: water-related damage to the interior and exterior of buildings; destruction of electrical and other expensive and difficult-to-replace equipment; injury and loss of life; proliferation of disease vectors; disruption of utilities, including water, sewer, electricity, communications networks and facilities; loss of agricultural crops and livestock; placement of stress on emergency response and healthcare facilities and personnel; loss of productivity; loss of continuity of government, and displacement of persons from homes and places of employment.

Warning Time

Due to the sequential pattern of meteorological conditions needed to cause flooding, it is unusual for a flood to occur without some warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

The potential warning time a community has to respond to a flooding threat is a function of the time between the first measurable rainfall and the first occurrence of flooding. The time it takes to recognize a flooding threat reduces the potential warning time to the time that a community has to take actions to protect lives and property. Another element that characterizes a community's flood threat is the length of time floodwaters remain above flood stage. Flood threat systems in the planning area consist of a network of precipitation gauges throughout the watersheds and stream gauges at strategic locations that constantly monitor and report stream levels. This information is fed into a U.S. Geological Survey forecasting program, which assesses the flood threat based on the amount of flow in the stream (measured in cubic feet per second). In addition to this program, data and flood warning information is provided by the National Weather Service (NWS). All of this information is analyzed to evaluate the flood threat and possible evacuation needs.

The NWS issues watches and warnings when forecasts indicate rivers may approach bank-full levels. When a watch is issued, the public should prepare for the possibility of a flood. When a warning is issued, the public is advised to stay tuned to a local radio station for further information and be prepared to take quick action if needed. A warning means a flood is imminent, generally within 12 hours, or is occurring. Local media broadcast NWS warnings.

River Gauges

The Chehalis Tribe provided funds to purchase the flood gauge on Independence Bridge and partners with the USGS to maintain the gauge and manage the data. The CTCR chose the specific location because it is close to the upstream edge of the Chehalis Reservation and gives the Tribe a better real time data of local conditions. The Tribe utilizes the USGS gauge at Grand Mound to predict conditions downstream on the reservation. The Grand Mound gauge and the Independence gage are downstream of the confluence of the Skookumchuck River. The Tribe is working to develop a correlation the Grand Mound gage with the Independence gage to better predict when flooding will reach the reservation area. Depending on the type of flood, flows can take 1.5 – 4 hours to move form Grand Mound to Independence.

8.3.2 Impact on Life, Health, and Safety

The impact of flooding on life, health, and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time is provided to residents. The Chehalis Tribe has experienced the loss of one life as a result of the 1996 flood during a time when medical aid could not access the area due to inundation of floodwaters over roadways.

Exposure to life, health, and safety represents the population living in or near floodplain areas that could be impacted should a flood event occur. Currently, there are approximately 835 individuals living on the reservation – all of which are exposed to the flood hazard as a result of isolation during most flood events, even those more minor in nature.

With respect to the CTCR, however, exposure cannot be limited to only those who reside in a defined hazard zone, but rather, everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or when their access to emergency services is compromised during an event). That degree of impact will vary and is not measurable with any specificity.

Of significant consideration and concern to the CTCR is the number of tourists and guests utilizing the various tribal enterprises who can be impacted during periods of flooding. Tourism is a very large economic base for the CTCR. Within the planning region as a whole, many tourists travel through the area at all times of the year not only for Tribal enterprises, but also to the various ocean beaches or other counties. Guests and consumers visiting the various enterprises owned by the CTCRs can exceed 6,000 people per day. Grays Harbor County estimates in excess of 4 million visitors annually to the County, in addition to residents and employees of the surrounding communities. Many of these visitors pass through or near the Reservation.

In addition, there are also tribal employees, both full and part-time, working for tribal government or its various enterprises which would factor in for consideration. Estimated employee count for the CTCR is ~1,600. This figure does not include extra crews brought on specifically for construction of new structures or facilities by the Confederated Construction Company.

The Tribe also has various health and social service programs which provide services to all tribal members and employees, whether a member of the Confederated Tribes of the Chehalis Reservation or not. In some instances, such as with the COVID response, the Tribe provided testing for anyone in the area – whether a tribal member or not.

When a significant flood occurs, motorists could be trapped in the area. Likewise, services customarily provided by the tribe would not be available to those in need. One of the services provided is through its pharmacy. If roadways are impacted, pharmaceuticals cannot be delivered to the pharmacy, and individuals in need would either not be able to gain access to the pharmacy itself because of roadway impact, or the medication may not be available due to commodity flow issues and access to the pharmacy by suppliers. The Tribe also has a jail facility, which can hold up to 64 individuals, as well as jail staff.

Of the population exposed, the most vulnerable include the economically disadvantaged, and the populations under 5 years of age, or over the age of 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the net economic impact on their family. The population over the age of 65 is also more vulnerable because they are more likely to seek or need medical attention which may not be available due to isolation during a flood event and they may have more difficulty evacuating. Currently, the tribe has approximately 140 individuals over the age of 65 or under the age of 5.

The number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. Therefore, injuries and deaths generally are not anticipated but can occur as the Chehalis Tribe has already experienced during the 1996 flood. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from people trying to cross flooded roadways or channels during a flood. However, with roadways being impacted due to floodwater overtopping them, or landslides occurring off the reservation which close transportation routes down, there potentially could be a significant number of individuals impacted.

8.3.3 Impact on Property

Review of the flood hazard areas indicates that 10 structures are within the 100-floodplain; three commercial properties, one gathering/shelter facility, one agricultural location, and five transportation elements (bridges). There were also five additional structures within the 500-year floodplain; two facilities which house government functions, one hazardous materials location (gas station/convenience store), and two commercial properties.

The Tribe has initiated various buyouts and restoration projects on tribal lands which are subject to impact from floods, with several of those projects still underway to help mitigate the impact of floods in the area. Such activities have been extremely important to the Tribe in protecting its lands and the environment.

8.3.4 Impact on Critical Facilities and Infrastructure

As indicated, all facilities identified for this plan update are considered critical in nature. No residential or non-essential structures were identified for assessment; however, they will be added in future updates as time allows. As such, all properties identified in Section 8.3.3 are critical facilities exposed in the FEMA 100-year flood hazard areas.

The total structure value for the critical facilities at risk in the 100-year flood zone are approximately $8.04 million. Approximately $5.2 million of those funds are associated with the tribal-owned bridges. With the exception of the golf course, which is estimated to be built in the 1960's and is of wood construction, the remaining structures were built to current code, post-2000. The Blueberry Farm barn, which was acquired since completion of the 2021 plan, was built in 1964 and is valued at $1.03 million. The Anderson RV Park contains covered barbeque areas and power and sewer connections on each campsite, while the Tribal Enterprise building is constructed of wood. With respect to the impacted bridges, one was built in 1973. Depending on when construction commenced may make a difference in the code to which the bridge was constructed. The remaining bridges were built in 1984, 1995, and two in 2010.

The total structure value for the critical facilities at risk in the 500-year flood zone are approximately $8.93 million. One structure was built in 1935, well before applicable building codes. The Confederated Construction Company facility was built in 1968, and is of wood construction. The Fish Hatchery's storage facility was constructed in 1980, also of wood construction. The two remaining structures, the Enterprise Warehouse and the End of Trail 2 (hazmat facility) were both built post-2000, one of steel and the other of wood, respectively.

In addition, the majority of all roadways both on the reservation and leading to the reservation could be inundated to different depths, causing isolation. Such has been the case many times historically on the reservation.

8.3.5 Impact on Economy

Impact on the economy related to a flood event would include loss of property, inventory, equipment, and loss of business revenue. Also included is a sales tax base for non-tribal businesses operating on tribal lands. Flooding would have the potential to impact revenue generated by the Tribe on such a tax base. Also for consideration with respect to economic loss, as was the case with the 2022 flood, the Casino and Marriot Hotel ceased operations and served as shelter and staging locations for first responders and tribal members who were evacuated from their homes due to the flood. In many cases, due to the large area in which Tribal lands and structures are located, one of the area may be impacted, while other areas are not. The Casino and Hotel are identified within the Tribe's Comprehensive Emergency Management Plan as shelter and staging locations, so impact from other areas of the Tribe which are flooded still have the ability to impact tribal operations and its economy even if the structures themselves are not flooded.

Flooding has the potential to impact all industrial sectors. Depending on the duration between the onset of the event and recovery, businesses within the area may not be able to sustain the economic loss of their business being disrupted for an extended period of time. The Tribe does have several business ventures in place, which could be significantly impacted. The existing loss data includes commercial structures owned by the CTCR.

In addition to the Tribe's economic loss, Tribal citizens who work for either the Tribe or non-native surrounding businesses would be impacted due to loss of income. There is also a high volume of agricultural lands in the surrounding counties which may be subject to flooding, with inundation affecting croplands. Forestland is also vulnerable to floods. As such, all of those industrial sectors could also be negatively impacted.

8.3.6 Impact on Environment

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses. Flooding has significant impact on migrating fish, which can be washed onto roadways or over leaves, with no possibility of escape, or the chemicals or pollutants can wash into rivers and streams, killing the fish and their food supplies. The CTCR do have a fish hatchery, which rears and releases 25,000 fish annually.

Floodplains can support ecosystems that are rich in quantity and diversity of plant and animal species. A floodplain can contain 100 or even 1000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly; however, the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick growing compared to non-riparian trees.

8.3.7 Impact from Climate Change

According to University of Washington scientists, global climate changes resulting in warmer, wetter winters are projected to increase flooding frequency in most Western Washington river basins. Future floods are expected to exceed the capacity and protective abilities of existing flood protection facilities, threatening lives, property, major transportation corridors, communities, and regional economic centers. University of Washington climate predictions estimate that within the Chehalis Basin, the 100-year flood of 2080 will likely be 22-26 percent higher than it is today.

Changes in Hydrology

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted. Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events (e.g. 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

As hydrology changes, what is currently considered a 100-year flood may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.

8.4 FUTURE DEVELOPMENT TRENDS

Development has affected the natural features of the land over time as the area has been developed from a wilderness to the present day. Along with development came land alterations that have been a factor in increasing the magnitude and frequency of floods in the area. Encroachment on floodplains by structures and fill material reduces carrying capacity and increases flood heights and velocities.

The local municipalities in the area are subject to the provisions of the Washington State Growth Management Act (GMA) which regulate identified critical areas, but until those lands directly impacted can be returned to their normal condition, flooding will continue.

The CTCR has established land use regulations, including a flood ordinance consistent with NFIP standards. This is particularly true in its application of the ordinance since the Tribe now has FEMA flood maps, which help identify the areas of concern. The Tribe is prepared to address flooding issues through various mitigation activities, including its restoration projects, and building outside of the floodplain when new construction occurs. In some cases, when development may occur in the floodplain, it is regulated such that the degree of risk and vulnerability is reduced through building standards and performance measures as the Tribe deems appropriate, thereby decreasing the level risk and vulnerability.

8.5 ISSUES

Large portions of the Tribal lands have the potential to be impacted from a flood event, generally in response to a succession of winter rainstorms. Storm patterns of warm, moist air are normal events, usually occurring between October and April. Such events can cause some level of flooding in the area, although flooding can occur at any time.

A worst-case scenario for a flood event would be a series of storms that result in high accumulations of runoff surface water within a relatively short time period, especially when occurring simultaneously with a high-tide event which would impact the Chehalis River's ability to discharge. These types of events have occurred in the planning area. High in-channel flows would cause watercourses to scour, possibly washing out roads or impacting bridges, creating more isolation problems. In the case of multi-basin flooding, repairs could not be made quickly enough to restore critical facilities and infrastructure. While human activities influence the impact of flooding events, human activities can also interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

8.6 IMPACT AND RESULTS

Based on review and analysis of the data, the Planning Team has determined that the probability for impact from Flood throughout the area is highly likely. The area can experience up to five flood events annually, albeit not to the level of a disaster declaration. However, the area has been impacted several times at the level to gain a federal disaster declaration.

While structural damage may vary due to flood depths and existing floodplain management regulations, the Tribe has been fortunate in that limited building structures have been impacted, but roadways both on and off the reservation are regularly impacted, causing isolation. In addition, tribal restoration projects have also been impacted. Based on the potential impact, the Planning Team determined the CPRI score to be 3.25 with overall vulnerability determined to be a high level.

CHAPTER 9.
SEVERE WEATHER

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. It includes thunderstorms, downbursts, wind, tornadoes, waterspouts, and snowstorms. Severe weather differs from extreme weather, which refers to unusual weather events at the extremes of the historical distribution.

General severe weather covers wide geographic areas; localized severe weather affects more limited geographic areas. The severe weather event that most typically impacts the planning area is a damaging windstorm, which causes storm surges exacerbating coastal erosion. Flooding and erosion associated with severe weather are discussed in their respective hazard chapters. Snow historically does not accumulate in great amounts in the area, although even small amounts can impact the area through traffic-related issues and safety for citizens walking in areas of snow accumulation or ice. Excessive heat and cold, while they have occurred, are rare and the CTCR has never received a disaster declaration for either type of event.

DEFINITIONS

Freezing Rain—The result of rain occurring when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to six tons of ice, creating a threat to power and telephone lines and transportation routes.

Hail Storm—Any thunderstorm which produces hail that reaches the ground is known as a hailstorm. Hail has a diameter of 0.20 inches or more. Hail is composed of transparent ice or alternating layers of transparent and translucent ice at least 0.04 inches thick. Although the diameter of hail is varied, in the United States, the average observation of damaging hail is between 1 inch and golf ball-sized 1.75 inches. Stones larger than 0.75 inches are usually large enough to cause damage.

Severe Local Storm—"Microscale" atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Thunderstorm—A storm featuring heavy rains, strong winds, thunder and lightning, typically about 15 miles in diameter and lasting about 30 minutes. Hail and tornadoes are also dangers associated with thunderstorms. Lightning is a serious threat to human life. Heavy rains over a small area in a short time can lead to flash flooding.

Tornado— Most tornadoes have wind speeds less than 110 miles per hour are about 250 feet across, and travel a few miles before dissipating. The most extreme tornadoes can attain wind speeds of more than 300 miles per hour, stretch more than two miles across, and stay on the ground for dozens of miles They are measured using the Enhanced Fujita Scale, ranging from EF0 to EF5.

Windstorm—A storm featuring violent winds. Southwesterly winds are associated with strong storms moving onto the coast from the Pacific Ocean. Southern winds parallel to the coastal mountains are the strongest and most destructive winds. Windstorms tend to damage ridgelines that face into the winds.

Winter Storm—A storm having significant snowfall, ice, and/or freezing rain; the quantity of precipitation varies by elevation.

9.1.1 Semi-Permanent High- and Low-Pressure Areas Over the North Pacific Ocean

During summer and fall, the circulation of air around a high-pressure area over the north Pacific brings a prevailing westerly and northwesterly flow of comparatively dry, cool, and stable air into the Pacific Northwest. As the air moves inland, it becomes warmer and drier, resulting in a dry season. In the winter and spring, the high pressure is further south and low pressure prevails in the northeast Pacific. Circulation of air around both pressure centers brings a prevailing southwesterly and westerly flow of mild, moist air into the Pacific Northwest. Condensation occurs as the air moves inland over the cooler land and rises along the windward slopes of the mountains. This results in a wet season beginning in October or November, reaching a peak in winter, and gradually decreasing by late spring.

West of the Cascade Mountains, summers are cool and relatively dry while winters are mild, wet, and generally cloudy. Measurable rainfall occurs on 150 days each year in interior valleys and on 190 days in the mountains and along the coast.

Thunderstorms occur up to 10 days each year over the lower elevations and up to 15 days over the mountains. Damaging hailstorms are rare in western Washington. During July and August, the driest months, two to four weeks can pass with only a few showers; however, in December and January, the wettest months, precipitation is frequently recorded on 25 days or more each month. Snowfall is light in the lower elevations and heavier in the mountains. During the wet season, rainfall is usually of light to moderate intensity and continuous over a long period rather than occurring in heavy downpours for brief periods; heavier intensities occur along the windward slopes of the mountains.

Within the planning area, severe storms customarily occur during the winter, bringing heavy rains, strong winds, and high waves. Storms bring in approximately 70 to 100 inches of rain per year. While high winds are commonplace along the coastline of Grays Harbor County, they are less frequent in the eastern portion of the county where the Tribal Reservation is located. The annual peak speed of 55 mph can topple chimneys, utility lines, and trees, with the entire planning area is vulnerable to windstorms. Historically, there are 7 days annually when high temperature is over 90 degrees, which is average when compared to other parts of Washington. December has the coldest nighttime temperatures for the area, with an average of 33.9 degrees, which is warmer than many places in Washington. There are four months during the year during which temperatures rage 70-85 degrees; June, July, August and September.[24] On average, the area receives approximately 3" of snow per year.

Atmospheric Rivers

Atmospheric rivers (see Figure 9-1) are relatively long, narrow regions in the atmosphere – like rivers in the sky – that transport most of the water vapor outside of the tropics. These columns of vapor move with the weather, carrying an amount of water vapor roughly equivalent to the average flow of water at the mouth of the Mississippi River. When the atmospheric rivers make landfall, they often release this water vapor in the form of rain or snow. those that contain the largest amounts of water vapor and the strongest winds can create extreme rainfall and floods, often by stalling over watersheds vulnerable to flooding. These events can disrupt travel, induce

[24] Climate in Oakville, WA. Accessed 3 Sept 2020. Available online at: https://www.bestplaces.net/climate/city/washington/oakville

mudslides and cause catastrophic damage to life and property. A well-known example is the "Pineapple Express," a strong atmospheric river that is capable of bringing moisture from the tropics near Hawaii over to the U.S. West Coast. [25]

El Niño-Southern Oscillation (ENSO) cycle is a scientific term that describes the fluctuations in temperature between the ocean and atmosphere in the east-central Equatorial Pacific. ENSO is one of the most important climate phenomena on Earth due to its ability to change the global atmospheric circulation, which in turn, influences temperature and precipitation across the globe. Though ENSO is a single climate phenomenon, it has three states, or phases, it can be in. The two opposite phases, “El Niño” and “La Niña,” require certain changes in both the ocean and the atmosphere because ENSO is a coupled climate phenomenon. “Neutral” is in the middle of the continuum.

- La Nina (translated from Spanish as “little girl”) is a natural ocean-atmospheric phenomenon marked by cooler-than-average sea surface temperatures across the central and eastern Pacific Ocean near the equator. La Nina typically brings above-average precipitation and colder-than-average temperatures along the northern tier of the U.S., along with below-average precipitation and above-average temperatures across the South.
- An El Nino (translated from Spanish as “little boy”) is marked by warmer-than-average sea surface temperatures in the region. Typical El Niño effects are likely to develop over North America during the upcoming winter season. Those include warmer-than-average temperatures over western and central Canada, and over the western and northern United States. Wetter-than-average conditions are likely over portions of the U.S. Gulf Coast and Florida, while drier-than-average conditions can be expected in the Ohio Valley and the Pacific Northwest. The presence of El Niño can significantly influence weather patterns, ocean conditions, and marine fisheries across large portions of the globe for an extended period of time.

[25] NOAA – The Science Behind Atmospheric Rivers. (2015). Accessed 15 Sept 2020. Available online at: https://www.noaa.gov/stories/what-are-atmospheric-rivers

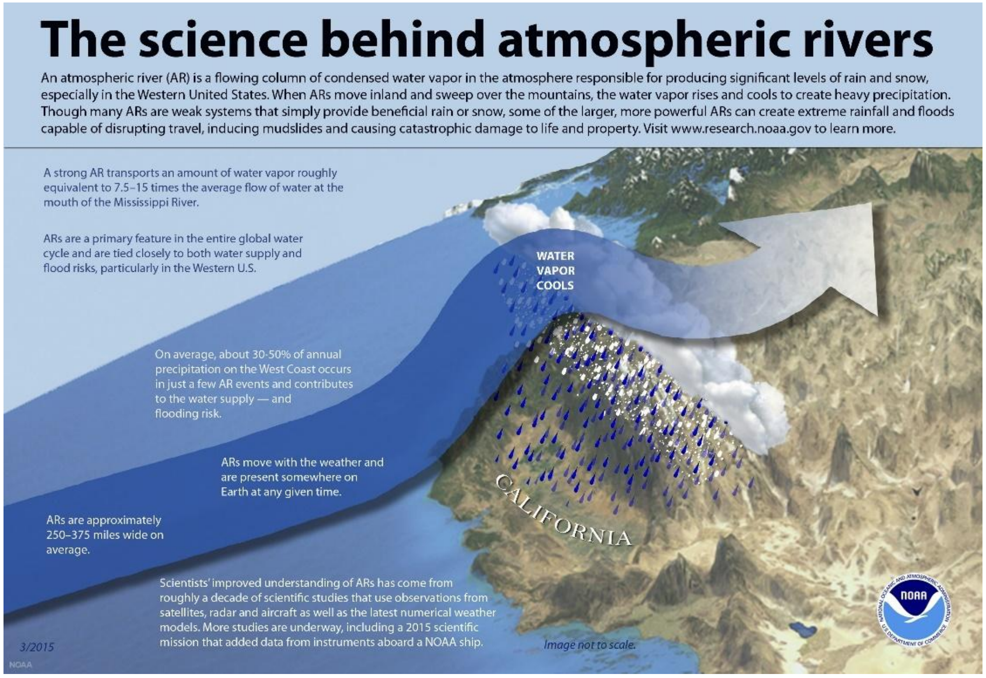


Figure 9-1 Atmospheric Rivers

9.1.2 Thunderstorms

A thunderstorm is a rain event that includes thunder and lightning. A thunderstorm is classified as “severe” when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), or tornado. Thunderstorms have three stages (see Figure 9-2):

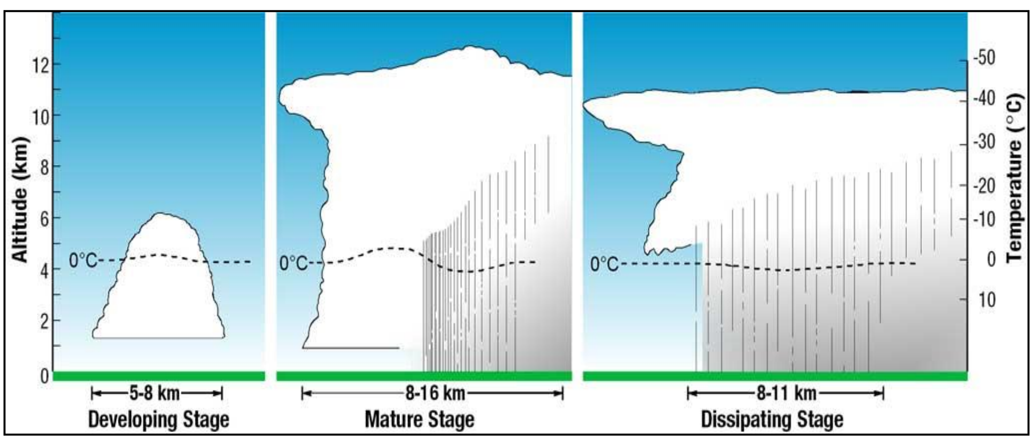


Figure 9-2 The Thunderstorm Life Cycle

Three factors cause thunderstorms: moisture, rising unstable air (air that keeps rising once disturbed), and a lifting mechanism to provide the disturbance. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise (hills or mountains can cause rising motion, as can the interaction of warm air and cold air or wet air and dry air) it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the earth surface to the upper atmosphere (the process of convection). The water vapor it contains begins to cool and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound heard as thunder. There are four types of thunderstorms:

- **Single-Cell Thunderstorms—**Single-cell thunderstorms usually last 20 to 30 minutes. A true single-cell storm is rare, because the gust front of one cell often triggers the growth of another. Most single-cell storms are not usually severe, but a single-cell storm can produce a brief severe weather event. When this happens, it is called a pulse severe storm.

- **Multi-Cell Cluster Storm—**A multi-cell cluster is the most common type of thunderstorm. The multi-cell cluster consists of a group of cells, moving as one unit, with each cell in a different phase of the thunderstorm life cycle. Mature cells are usually found at the center of the cluster and dissipating cells at the downwind edge. Multi-cell cluster storms can produce moderate-size hail, flash floods and weak tornadoes. Each cell in a multi-cell cluster lasts only about 20 minutes; the multi-cell cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm.

- **Multi-Cell Squall Line—**A multi-cell line storm, or squall line, is a long line of storms with a continuous well-developed gust front at the leading edge. The storms can be solid, or have gaps and breaks in the line. Squall lines can produce hail up to golf-ball size, heavy rainfall, and weak tornadoes, but they are best known as the producers of strong downdrafts. Occasionally, a strong downburst will accelerate a portion of the squall line ahead of the rest of the line. This produces what is called a bow echo. Bow echoes can develop with isolated cells as well as squall lines. Bow echoes are easily detected on radar but are difficult to observe visually.

- **Super-Cell Storm—**A super-cell is a highly organized thunderstorm that poses a high threat to life and property. It is similar to a single-cell storm in that it has one main updraft, but the updraft is extremely strong, reaching speeds of 150 to 175 miles per hour. Super-cells are rare. The main characteristic that sets them apart from other thunderstorms is the presence of rotation. The rotating updraft of a super-cell (called a mesocyclone when visible on radar) helps the super-cell to produce extreme weather events, such as giant hail (more than 2 inches in diameter), strong downbursts of 80 miles an hour or more, and strong to violent tornadoes.

Review of data compiled by John Jensenius, Jr. of the National Lightning Safety Council, Washington has experienced no deaths related to lightning during the period 2006-2024 (see Figure 9-3). [26] The data also identifies that the victims of lightning fatalities are most often engaged in leisure activities (see Figure 9-4). Of those, the 80 percent of fatalities were male.

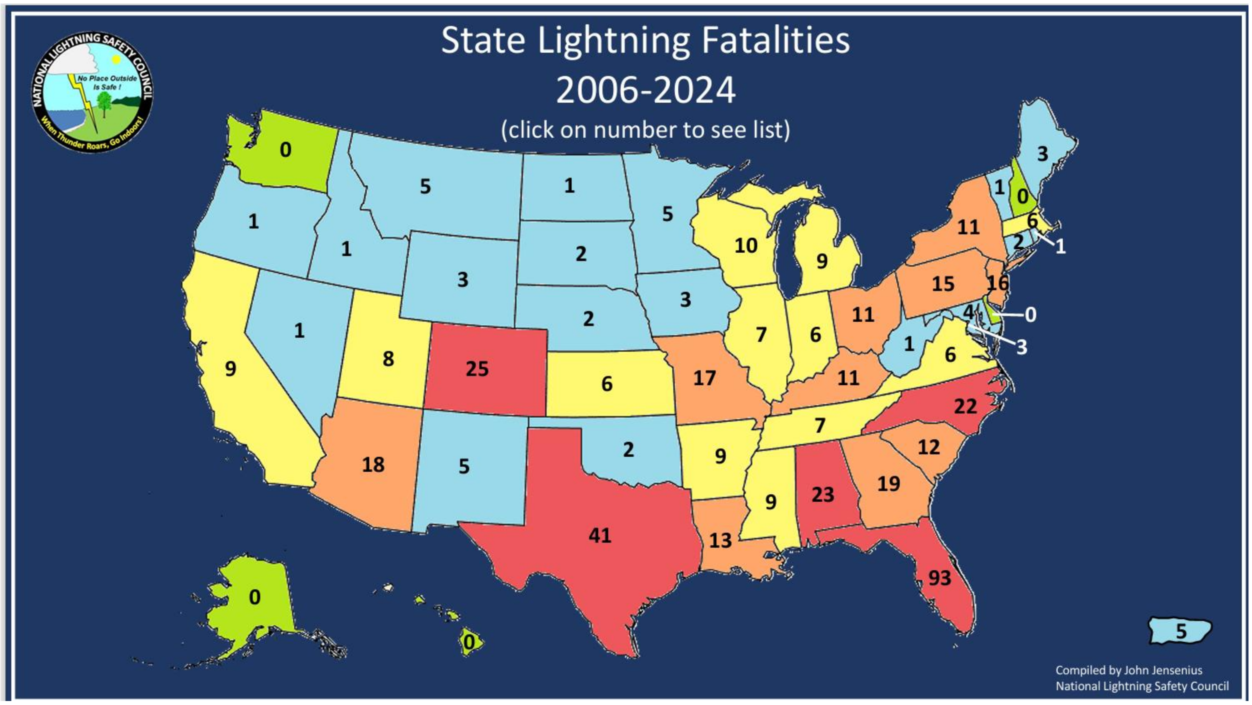


Figure 9-3 Lightning Fatalities by State (2006-2024)

[26] National Lightning Safety Council. Accessed 4 March 2025. Available online at: PowerPoint Presentation

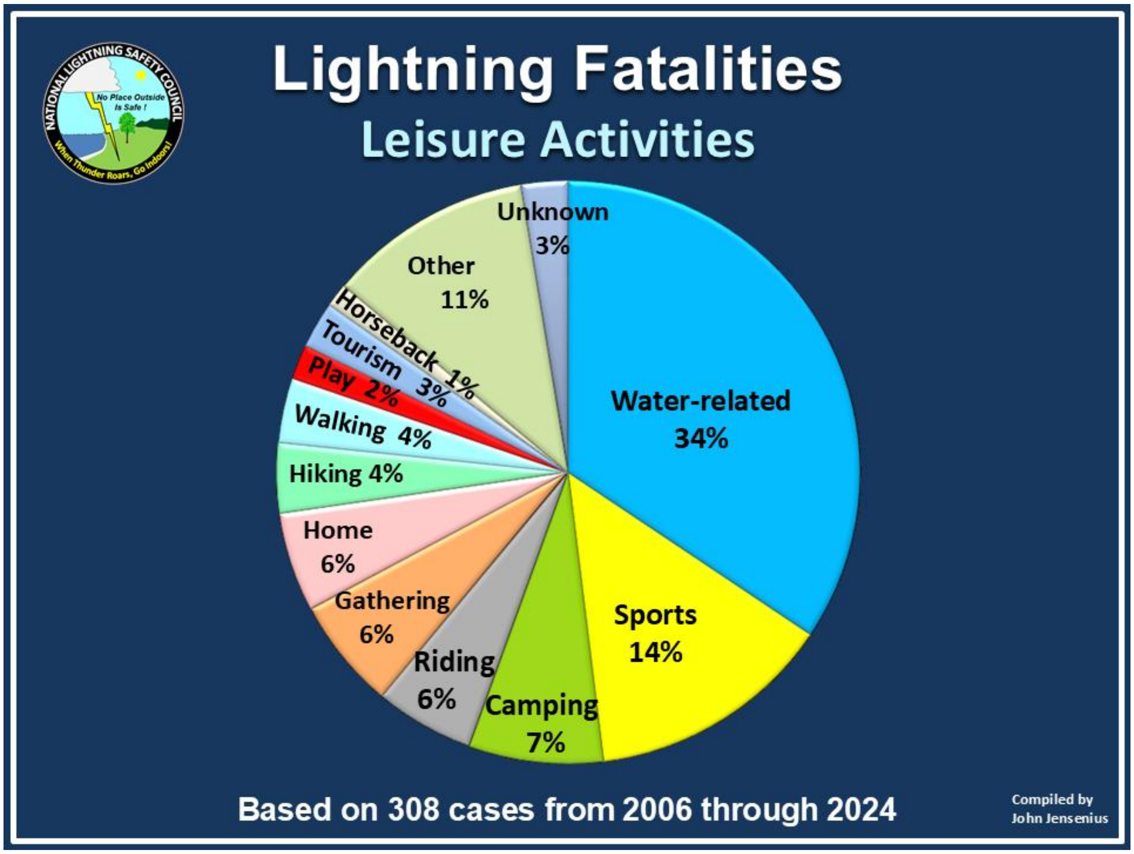


Figure 9-4 Lightning Fatalities by Leisure Activities

9.1.3 Damaging Winds

Damaging winds are classified as those exceeding 60 mph, although winds at 55 mph can cause structural damage. Damage from such winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. There are seven types of damaging winds:

- **Straight-line winds —**Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts —**A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts—**A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes

producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.

- **Microbursts—**A small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two 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—**A gust front is 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 derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word "derecho" is of Spanish origin and means "straight ahead." Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.

- **Bow Echo—**A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

There are four main types of windstorm tracks that impact the Pacific Northwest as identified in Figure 9-5. These four tracks are distinguished by two basic windstorm patterns that have emerged in the Puget Sound Region: the South Wind Event and the East Wind Event. South wind events are generally large-scale events that affect large portions of Western Washington and possibly Western Oregon.

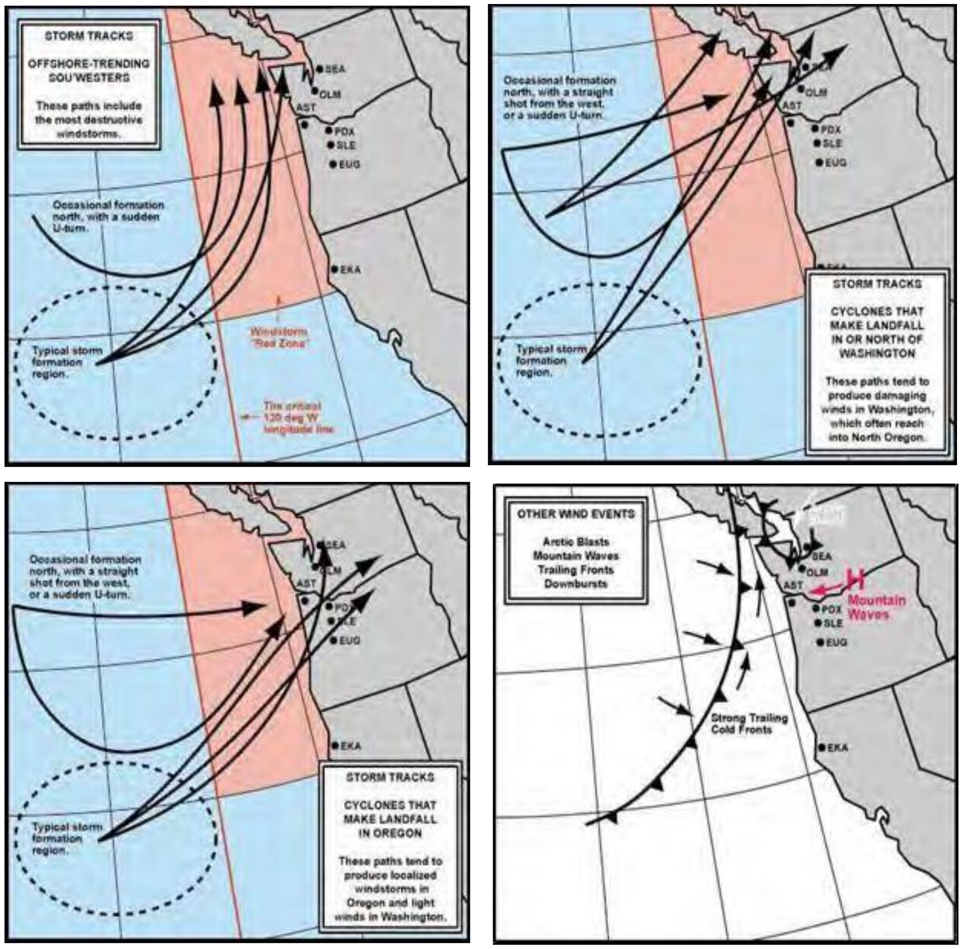
In contrast, easterly wind events are more limited. High pressure on the east side of the Cascade Mountain Range creates airflow over the peaks and passes, and through the funneling effect of the valleys, the wind increases dramatically in speed. As it descends into these valleys and then exits into the lowlands, the wind can pick up enough speed to damage buildings, rip down power lines, and destroy fences. Once it leaves the proximity of the Cascade foothills, the wind tends to die down rapidly.

National Wind Zones are featured in Figure 9-6, while Grays Harbor County's Wind Zone Map is illustrated in Figure 9-7. For Grays Harbor County, the Exposure Category is "C." These zones were utilized to guide structure development beginning with the 2006 International Building Code. In the case of the CTCR for properties within Grays Harbor County, the building code wind speed requirement is established at 130 mph.[27] The exposure zones further identify areas that are at higher risk from impacts of high winds. The closer development is to open waters and on top of steep cliffs, the higher the design criteria required through building code.

For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities are determined for the site at which the building or structure is to be constructed. Also taken into account is the variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. Based on the International Building Code, the zones are further broken down into surface roughness categories and are defined as follows:

- Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
- Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, grasslands, and all water surfaces in hurricane-prone regions.
- Surface Roughness D. Flat, unobstructed areas, and water surfaces outside hurricane-prone regions. This category includes smooth mud flats, salt flats and unbroken ice.

[27] Grays Harbor County Planning and Building Design Criteria Wind Zone Map. Accessed 5 March 2025. Available online at: http://cms5.revize.com/revize/graysharborcounty/docs/16ClimateGeographicDesignCriteria.pdf



Source: Oregon Climate Service, 2015

Figure 9-5 Windstorm Tracks Impacting the Pacific Northwest

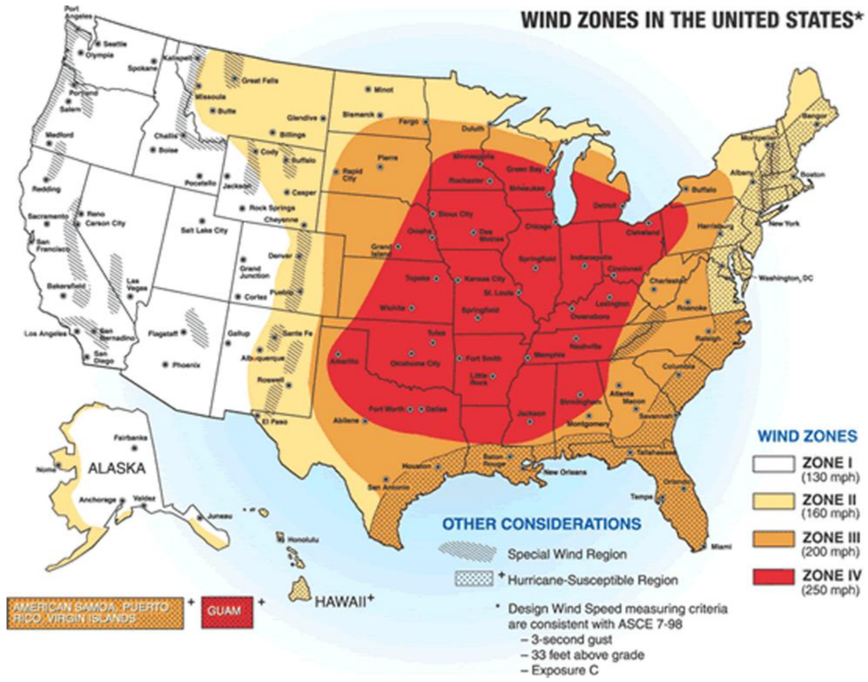


Figure 9-6 United States Wind Zones

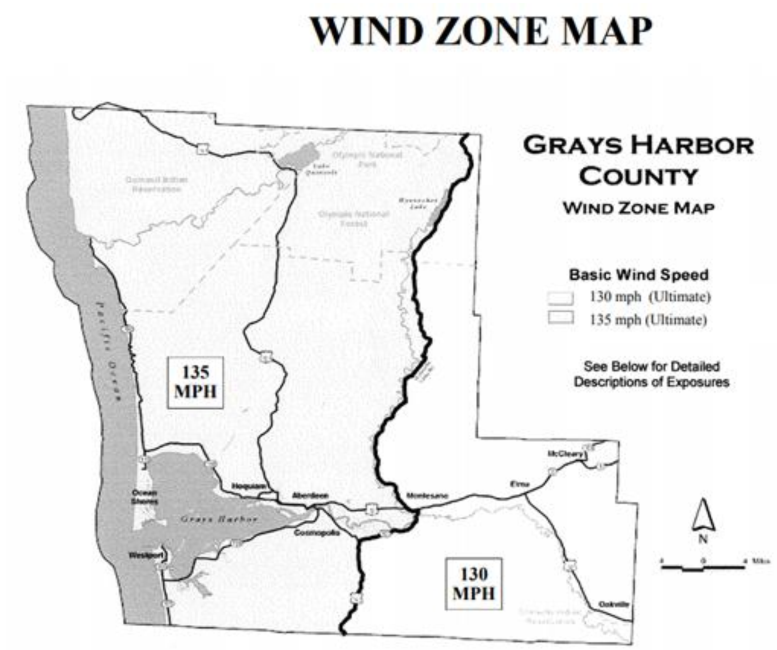


Figure 9-7 Grays Harbor County Wind Zone Map

The strongest winds are generally from the south or southwest and occur during fall and winter. In interior valleys, wind velocities reach 40 to 50 mph each winter, and 75 to 90 mph a few times every 50 years. The highest summer and lowest winter temperatures generally occur during periods of easterly winds.

9.1.4 Hail Storms

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Recent studies suggest that super-cooled water may accumulate on frozen particles near the back side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice.

9.1.5 Ice and Snow Storms

The National Weather Service defines an ice storm as a storm that results in the accumulation of at least 0.25 inches of ice on exposed surfaces. Ice storms occur when rain falls from a warm, moist, layer of atmosphere into a below freezing, drier layer near the ground. The rain freezes on contact with the cold ground and exposed surfaces, causing damage to trees, utility wires, and structures (see Figure 9-8).

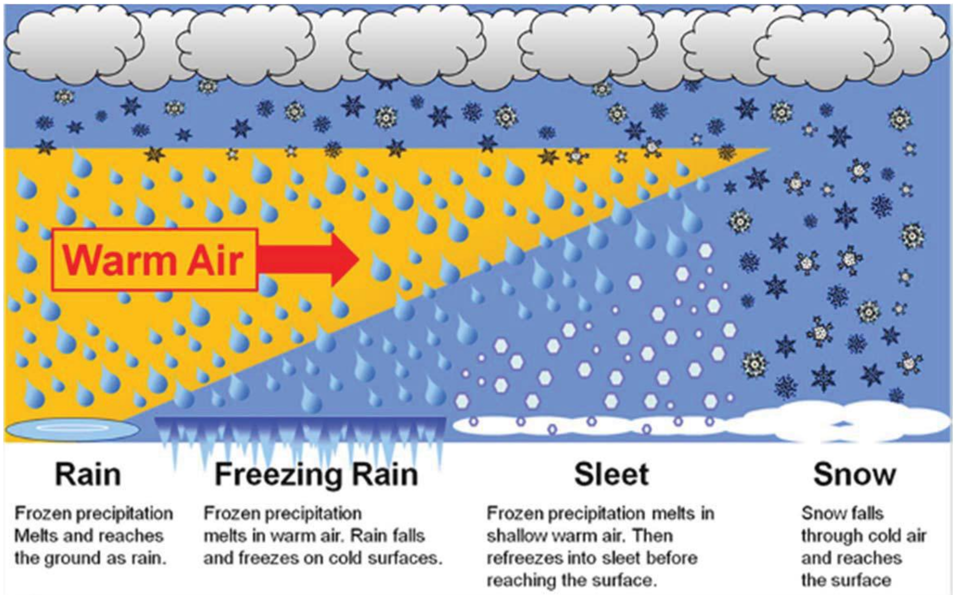


Figure 9-8 Types of Precipitation

Precipitation falls as snow when air temperature remains below freezing throughout the atmosphere. In many climates, precipitation that forms in wintertime clouds starts out as snow because the top layer of the storm is usually cold enough to create snowflakes. Snowflakes are just collections of ice crystals that cling to each other as they fall toward the ground. Precipitation continues to fall as snow when the temperature remains at or below 0 degrees Celsius from the cloud base to the ground. The following are used to define snow events:

- Snow Flurries. Light snow falling for short durations. No accumulation or light dusting is all that is expected.
- Snow Showers. Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- Snow Squalls. Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant. Snow squalls are best known in the Great Lakes Region.
- Blowing Snow. Wind-driven snow that reduces visibility and causes significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.
- Blizzards. Winds over 35mph with snow and blowing snow, reducing visibility to 1/4 mile or less for at least 3 hours.

Portions of the planning area do experience a significant amount of snow on a regular basis, particularly in those areas abutting the mountainous regions.

9.1.6 Extreme Temperatures

Extreme temperature includes both heat and cold events, which can have a significant impact on human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes “extreme cold” or “extreme heat” can vary across different areas of the country, based on what the population is accustomed to within the region (CDC, 2014).

Extreme Cold

Extreme cold events are when temperatures drop well below normal in an area. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered “extreme cold.” Extreme cold can often accompany severe winter storms, with winds exacerbating the effects of cold temperatures by carrying away body heat more quickly, making it feel colder than is indicated by the actual temperature (known as wind chill). Figure 9-9 demonstrates the value of wind chill based on the ambient temperature and wind speed.

Exposure to cold temperatures, whether indoors or outside, can lead to serious or life-threatening health problems such as hypothermia, cold stress, frostbite or freezing of the exposed extremities such as fingers, toes, nose, and ear lobes. Hypothermia occurs when the core body temperature is <95ºF. If persons exposed to excessive cold are unable to generate enough heat (e.g., through shivering) to maintain a normal core body temperature of 98.6ºF, their organs (e.g., brain, heart, or kidneys) can malfunction. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat. Infants and the elderly are particularly at risk, but anyone can be affected.

Extremely cold temperatures often accompany a winter storm, so individuals may have to cope with power failures and icy roads. Although staying indoors as much as possible can help reduce the risk of car crashes and falls on the ice, individuals may also face indoor hazards. Many homes will be too cold—either due to a power failure or because the heating system is not adequate for the weather. The use of space heaters and fireplaces to keep warm increases the risk of household fires and carbon monoxide poisoning.

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 9-9 NWS Wind Chill Index

During cold months, carbon monoxide may be high in some areas because the colder weather makes it difficult for car emission control systems to operate effectively. Carbon monoxide levels are typically higher during cold weather because the cold temperatures make combustion less complete and cause inversions that trap pollutants close to the ground (USEPA, 2009).

Extreme Heat

Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several days or weeks are defined as extreme heat (FEMA, 2006; CDC, 2006). An extended period of extreme heat of three or more consecutive days is typically called a heat wave and is often accompanied by high humidity (Ready America, Date Unknown; NWS, 2005). There is no universal definition of a heat wave because the term is relative to the usual weather in a particular area. The term heat wave is applied both to routine weather variations and to extraordinary spells of heat which may occur only once a century (Meehl and Tebaldi, 2004). A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle and which may have adverse health consequences for the affected population (Robinson, 2000). Figure 9-10 identifies some of those consequences and associated temperatures. [28]

Certain populations are considered vulnerable or at greater risk during extreme heat events. These populations include the elderly age 65 and older, infants and young children under five

[28] NCDC, 2000

years of age (see Figure 9-11), pregnant woman, the homeless or poor, the overweight, and people with mental illnesses, disabilities and chronic diseases (NYS HMP, 2008).

Depending on severity, duration, and location, extreme heat events can create or provoke secondary hazards, which include dust storms, droughts, wildfires, water shortages and power outages (FEMA, 2006; CDC, 2006). This could result in a broad and far-reaching set of impacts throughout a local area or entire region. Impacts could include significant loss of life and illness; economic costs in transportation; agriculture; production; energy and infrastructure; and losses of ecosystems, wildlife habitats, and water resources (Adams, Date Unknown; Meehl and Tebaldi, 2004; CDC, 2006; NYSDPC, 2008).

Relative Humidity (%)	Temperature (°F) 80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke / Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Figure 9-10 Heat Stress Index

Wind-Chill Factor Chart (in Fahrenheit)

Air Temperature	Wind Speed in mph: Calm	5	10	15	20	25	30	35	40
40	40	36	34	32	30	29	28	28	27
30	30	25	21	19	17	16	15	14	13
20	20	13	9	6	4	3	1	0	-1
10	10	1	-4	-7	-9	-11	-12	-14	-15
0	0	-11	-16	-19	-22	-24	-26	-27	-29
-10	-10	-22	-28	-32	-35	-37	-39	-41	-43

Comfortable for out door play | Caution | Danger

Heat Index Chart (in Fahrenheit %)

Air Temperature (F)	Relative Humidity (Percent): 40	45	50	55	60	65	70	75	80	85	90	95	100
80	80	80	81	81	82	82	83	84	84	85	86	86	87
84	83	84	85	86	88	89	90	92	94	96	98	100	103
90	91	93	95	97	100	103	105	109	113	117	122	127	132
94	97	100	103	106	110	114	119	124	129	135			
100	109	114	118	124	129	130							
104	119	124	131	137									

Figure 9-11 Heat and Wind Chill Index for Children

9.1.7 Tornado

A tornado is a violently rotating column of air extending between, and in contact with, a cloud and the surface of the earth. Tornadoes are often (but not always) visible as a funnel cloud. Tornadoes are rated by their intensity and damage to vegetation and property. There are two common rating scales, the Fujita scale (F-Scale) and the Enhanced Fujita Scale (EF-Scale). The Fujita scale is a tornado scale introduced in 1971 by Tetsuya Fujita and the scale evaluates total damage. In the United States the Fujita scale was replaced with the Enhanced Fujita scale, which is now the primary scale used the United Sites and Canada. The Enhanced Fujita scale not only considers damage, but also takes into account wind speed. Figure 9-12 illustrates the two tornado rating scales.

On a local-scale, tornadoes are the most intense of all atmospheric circulations and wind can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long. Tornadoes can occur throughout the year at any time of day but are most frequent in the spring during the late afternoon. As shown in Figure 9-13, Washington has a low risk compared to states in the Midwestern and Southern U.S.; however, the area does have recorded Tornadoes.

Enhanced Fujita Scale	
EF-0	65 - 85 mph winds
EF-1	86 - 110 mph
EF-2	111 - 135 mph
EF-3	136 - 165 mph
EF-4	166 - 200 mph
EF-3	>200 mph

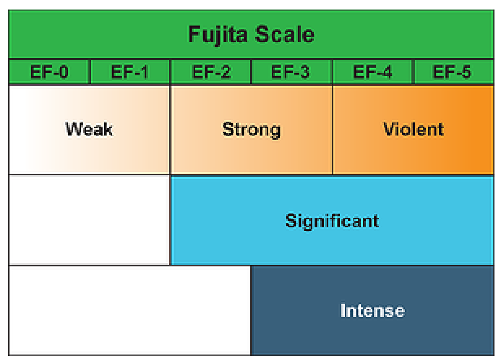


Figure 9-12 Tornado Ratings

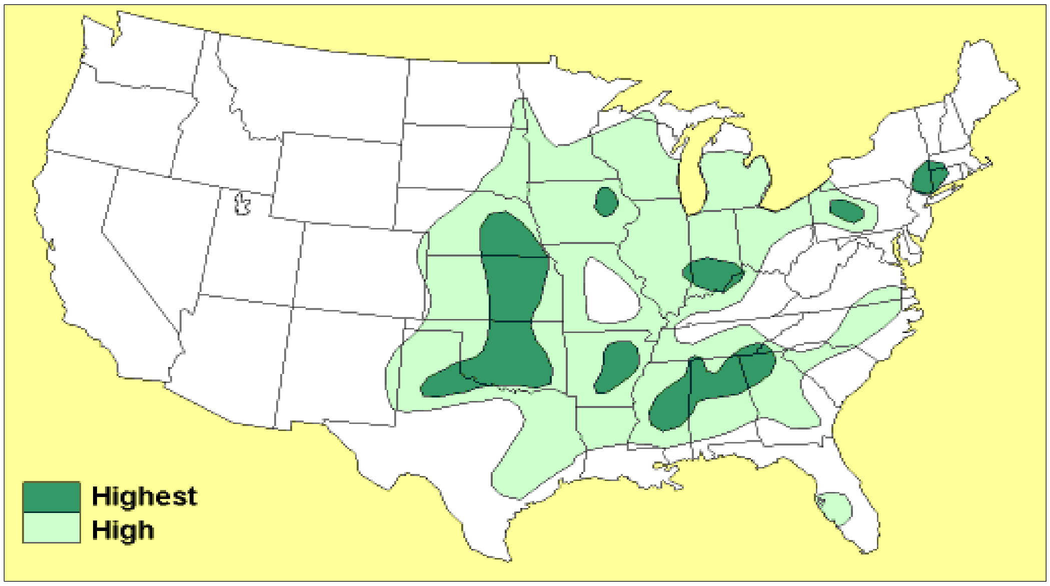


Figure 9-13 Tornado Risk Areas in the United States

9.1.8 Weather Related Fatalities

Figure 9-14 identifies the number of weather fatalities based on 10-year and 30-year averages.[29] Extreme heat is the number one weather-related cause of death in the U.S. over the 30-year average, followed by flood.

[29] NOAA, 2020. Accessed 5 March 2025. Available online at [Weather Related Fatality and Injury Statistics]

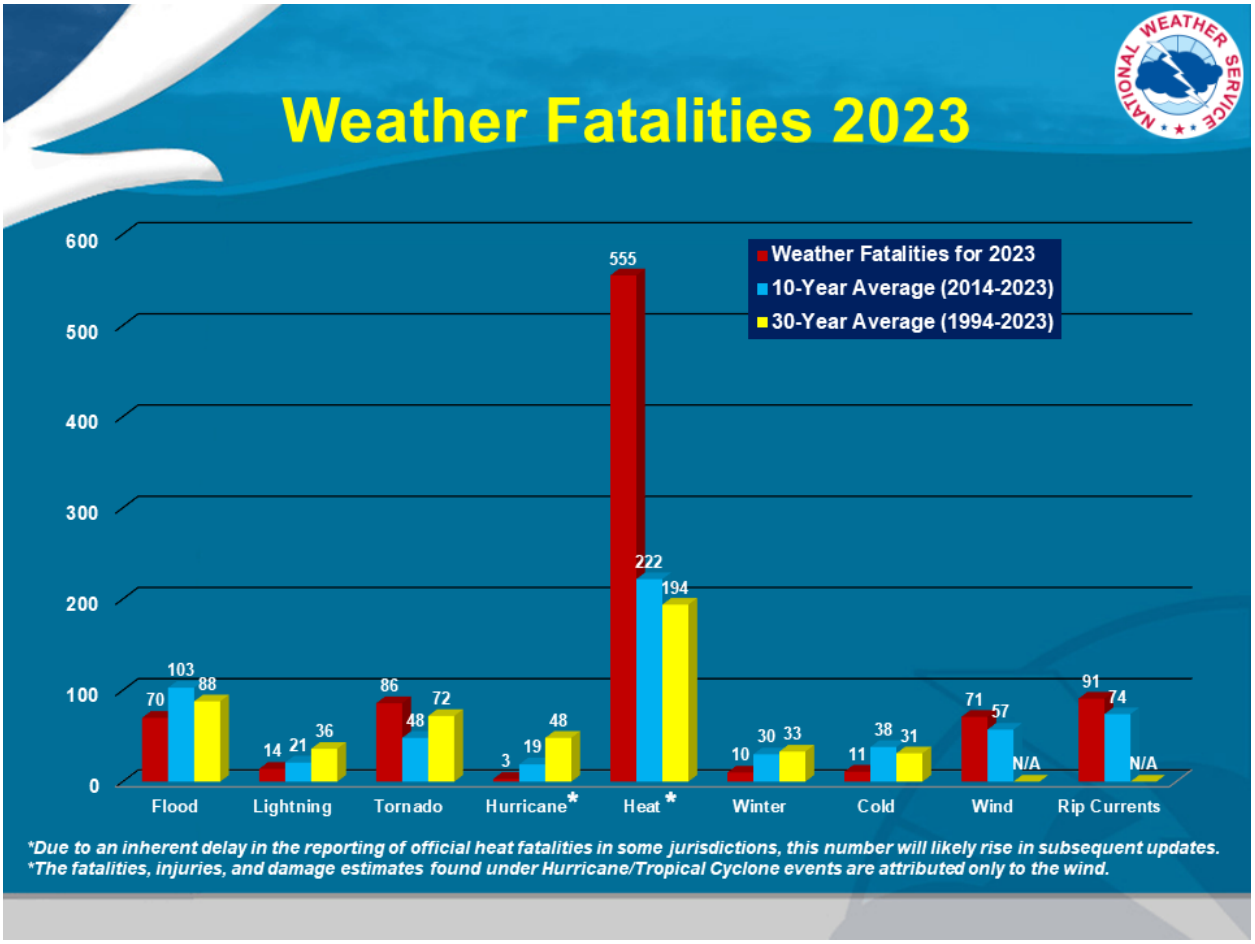


Figure 9-14 Average Number of Weather-Related Fatalities in the U.S.

9.2 HAZARD PROFILE

9.2.1 Extent and Location

The entire planning area is susceptible to the impacts of severe weather. Severe weather events customarily occur during the months of October to April, although they have occurred year-round.

Since completion of the 2021 plan, the area has experienced tornadoes, strong winds, rain, and snow. Historically, the area has also experienced thunder or lightning storms, although rare with none occurring since the 2021 was completed.

Communities in low-lying areas next to coastlines, rivers, streams, or lakes are more susceptible to flooding as a result of storm surge. Severe storms and storm surges also cause channel migration, and can travel inland for many miles along waterways. Such has been the case with the Chehalis River.

Severe storms and weather also affect transportation. Access is sometimes unpredictable as roads are vulnerable to damage from severe storms, flooding, and landslide/erosion.

Wind events are damaging to the planning area. Winds coming off of the Pacific Ocean can have a significant impact on the planning region as a result of both the wind and associated storm surge and increased precipitation. For the planning region as a whole, wind events are one of the most common weather-related incidents to occur, often times leaving the area without power, although customarily not for long extended periods. Due to the geologic makeup of the area, winds can be accelerated in small areas.

A tornado is the smallest and potentially most dangerous of local storms. A tornado is formed by the turbulent mixing of layers of air with contrasting temperature, moisture, density, and wind flow. This mixing accounts for most of the tornadoes occurring in April, May, and June, when cold, dry air moving into the Puget Sound region from the north or northwest meets warm, moister air moving up from the south. If a major tornado struck a populated area, damage could be widespread and include structure impact, business closure, fatalities, increased levels of homeless due to structure impact, and routine service disruptions such as telephone or power. Due to the (often) short warning period, livestock are commonly the victims of a tornado or windstorm.

9.2.2 Previous Occurrences

Chapter 3, Table 3-1 provides the Disaster History Table inclusive of all three counties, identifying the various declared Severe Weather events.

Based on review of various NOAA, NCDC, and FEMA data, as identified in Chapter 3, Table 3-2, since 1964, when reviewing all three counties in which the CTCR own structures or land, the months of March, January, and December have had the highest severe weather incidents, with ten, seven, and six events occurring, respectively, in each of those months.

Table 9-1 describes several of the more significant sever weather events impacting the area since 1960 (the list is not all inclusive, but represents a sampling of impact to the area). In addition to the federally declared events identified, the area also sustains impact from other events which do not rise to the level of a declaration but have significant impact on the area.

Table 9-2 identifies hazard events occurring since completion of the last plan which have been identified within the NOAA's Storm Events Database, as well as the Tribes' 2023 and 2024 HMP Annual Reports.[30],[31] Table 9-3 identifies the findings from the National Risk Index concerning the various types of weather identified, identifying the type of hazard, the respective risk index, its

[30] NOAA Storm Events Database. Accessed multiple times. Available online at: Storm Events Database | National Centers for Environmental Information

[31] CTCR 2023 and 2024 HMP Annual Reports. Accessed multiple times. Available at: About Us - The Chehalis Tribe.

annualized frequence, number of previous occurrence of the hazard type within the given timeframe, the historic loss rating, and the expected annual loss rating.[32] The complete reports for the County are available on the Tribe's website.

TABLE 9-1
DECLARED SEVERE WEATHER EVENTS IMPACTING PLANNING AREA SINCE 1960

Date	Type	Deaths or Injuries	Property Damage
October 1962 DR 137	Windstorm	7 in Washington; 46—combined all state's impacted	$235 million in property damage; 15 billion board feet of timber valued at $750 million
Description: Most powerful non-tropical storm to impact lower 48 states. Impact felt in Washington, Oregon, and California. Damaged over 50,000 buildings throughout regions impacted. Power in some areas out for 3+ weeks. Wind speeds ranged from 88 mph in Tacoma to 160 mph in Naselle, WA. There was extensive damage with power and telephone outages throughout the entire county. Trees were blown down in the North Beach area and the Markham Branch of the Northern Pacific Railroad was blocked. Many trees were blown down in Copalis beach and along the highway and the road was blocked from Montesano west to Grass Creek. An estimated 35 million board feet of timber was lost according to Wilton Vincent, Rayonier Land Department Manager. The Grays Harbor PUD facilities damage was $50,000 with total damages in the county reported to be approximately 2.5 million dollars. Grays Harbor, Thurston and Lewis Counties impacted.			
January 1993 (Disaster 981*)	(Listed as Flood Event) Severe storm and high wind	Five lives lost.	Unknown
Description: A powerful low-pressure system swept through central Western Washington, causing great destruction, numerous injuries, and the loss of five lives. Winds averaging 50 miles per hour with gusts to over 100 miles per hour caused trees to fall and knocked out power to 965,000 customers. Wind gusts of 70 mph were reported at Twin Harbors. The framework for a new Washington State Dept. of Fisheries storage building at the Highway 12 and Devonshire Interchange collapsed, and a roof was torn off a mobile home in Satsop. There were widespread power outages. Lewis and Thurston Counties included in disaster declaration.			
November 1995 (Disaster 1079)	Flooding, severe storm, and high winds	Unknown	Unknown
Description: Heavy rains lead to flooding throughout the region.			
Dec. 1996—Jan. 1997 (Disaster 1159)	Severe winter storm, flooding, landslides and mudslides.	24 deaths statewide	Statewide: Stafford Act assistance $83 million; SBA $31.7 million; total losses $140 million statewide

[32] FEMA National Risk Index. Accessed multiple times. Available online at: [National Risk Index | FEMA.gov]

TABLE 9-1
DECLARED SEVERE WEATHER EVENTS IMPACTING PLANNING AREA SINCE 1960

Date	Type	Deaths or Injuries	Property Damage
Description: Saturated ground combined with snow, freezing rain, rain, rapid warming and high winds within a five-day period produced flooding and landslides. 37 counties were impacted, with large power outages throughout the impacted counties. Grays Harbor, Thurston and Pierce included in disaster declaration.			
October 2003 (Disaster 1499)	Severe Storm and Flooding	Unknown	Statewide losses PA >$9 million IA >$5.5 million
Description: Heavy rains, severe storms. Grays Harbor and Thurston County included in disaster declaration.			
January 2006 (Disaster 1641)	Severe winter storm, flood, landslide, mudslide, tidal surge	Unknown	Unknown
Description: Heavy rains			
December 2006 (Disaster 1671)	Severe winter storm, flood, landslide, mudslide, tidal surge	Unknown	Statewide PA >$29 million; IA >$5M
Description: Heavy rains from November 2 – 11, 2006 along with high tidal surge caused flooding in several Western Washington counties. Grays Harbor County was one of 11 counties to receive Individual Assistance as a result of the impact.			
December 2006 DR 1682	Severe winter storm, wind, landslides, and mudslides	One fatality in McCleary	Unknown
Description: Severe winter storm caused landslides and mudslides throughout region. Grays Harbor County experienced hurricane-force winds and heavy rains on the coast causing 22,000 customers to lose power; a million were without power in the State. The "Hanukkah Eve Windstorm of 2006" downed power lines, trees, and building debris which caused many road closures and left the county in a state of emergency. In Montesano, a roof that blew off a three-story building fell onto Pioneer Avenue, settling partially on a local bank and taking out a streetlight. Ocean Shores was also hit hard by the weather with power outages and trees across roads. A McCleary man was killed when the top of a tree snapped off in the wind and crashed into his home crushing him in his bed. A woman was injured when a gust blew a light pole down on the Chehalis River Bridge sending it crashing onto her windshield and trapping her inside her vehicle. Aberdeen's Finance Director stated damage caused by the storm could exceed $2 million; Hoquiam reported more than $400,000 in damage and another $1 million in downed trees on its watershed property. Grays Harbor, Thurston and Lewis Counties included in disaster declaration.			
December 2007 (Disaster 1734)	Severe storm, flooding, landslides, and mudslides	Unknown	Unknown

TABLE 9-1
DECLARED SEVERE WEATHER EVENTS IMPACTING PLANNING AREA SINCE 1960

Date	Type	Deaths or Injuries	Property Damage
Description: Severe winter storm, including record and near record snowfall and heavy rains and winds. the great Coastal Gale of December 1-3, 2007 impacted the entire western coastline from northern California to Canada. Over a period of three days, two separate storms lashed the area with hurricane-force gusts and heavy rain. The region between Newport, OR and Hoquiam, WA received the strongest gale since the great Columbus Day Storm of 1962.[33] Grays Harbor, Thurston and Lewis Counties included in disaster declaration.			
December 2008 (Disaster 1825)	Severe winter storm, record and near record snow	Unknown	Public Assistance to all declared counties was over $5.5 million
Description: Severe winter storm, including record and near record snowfall and heavy rains and winds. Grays Harbor, Thurston and Lewis Counties included in disaster declaration.			
January 2012 (Disaster 4056)	Severe winter storm, flooding, landslides, and mudslides	Unknown	PA program only available >$30 million for impacted communities; no IA.
Description: Severe winter storm, including heavy rains and snow, which caused flooding, landslides and mudslides. Grays Harbor, Thurston and Lewis Counties included in disaster declaration.			
October 2015 (Disaster 4242)	Severe windstorm	Unknown	PA program only available >$6 million for impacted communities, no IA.
Description: A severe windstorm, including straight-line winds, impacted six counties in Western Washington on August 29, 2015. (Grays Harbor County only.)			
December 2015 (Disaster 4253)	(Listed as Flood) Severe winter storm, straight-line winds, flooding, landslides and mudslides	Unknown	PA program only available, no IA.
Description: Severe winter storm, including record and near record snowfall and heavy rains and winds. Grays Harbor and Lewis Counties included in disaster declaration.			

[33] http://www.climate.washington.edu/stormking/

TABLE 9-2 SEVERE WEATHER EVENTS 2018-2024*		
Incident Type	**Date(s)**	**Chehalis Planning Area** (Including Grays Harbor, Thurston and Lewis County events)
Lightning	NA	0
Hail	NA	0
Wind	10/25/2021 11/4-5/2022	An active weather pattern set up in October, bringing multiple rounds of wind and precipitation to both the lowlands and mountains of western Washington. A particularly stronger system in late October was responsible for stronger winds, heavier precipitation, and high surf. Olympia ASOS reported a gust of 50 mph around 0445L on 10/25/21. An atmospheric river pushed heavy rain and gusty winds throughout Western Washington causing numerous damage reports as wind advisories and high wind warnings were issued. Lewis county EM called to say 9 houses were damaged or destroyed from high wind
Cold/Wind Chill	10/26/2023	A record low temperature of 23 degrees was set in Olympia Airport on October 26th, tying the old record of 23 set in 1971.
Excessive Heat	7/26-30/2022	A long stretch of hot weather continued to impact the Southwest Interior through the end of the month. Another record high temperature of 99 degrees was set at the Olympia airport the afternoon of July 30th. This broke the previous record of 97 degrees set in 1965.
Heavy Snow	2/11/2019 2/12/2021 12/26-27/2021	A major snowstorm blanketed Western Washington with heavy snow. Reports received of 4-6 inches. Significant snowfall impacted the Lower Chehalis Valley beginning during the late afternoon and early evening hours of February 12 and continuing through the overnight period into February 13. Snowfall amounts during this general timeframe ranged from between 5-9 inches. Snow gradually tapered into the afternoon hours on February 13, with little additional snowfall accumulation thereafter. Winter storm brought heavy snow to Lower Chehalis Valley Area, resulting in 8-12 inches of snow accumulation.
Ice Storms	12/22-23/2022	After a series of snow events in the lowlands and mountains of western Washington, a system off the Pacific brought a modifying airmass towards the area right before the Christmas holiday. Warmer Pacific air was able to overrun lingering cold air very near the surface, producing a warm layer of classic characteristic of a freezing rain profile. As such, measurable ice accumulation led to hazardous impacts across the area, most noticeably to roadways and travel. First reports of freezing rain were provided by spotters on the night of the 22nd, where multiple collisions were the result from freezing rain along I-5. It was also reported that ice was beginning to coat surfaces in Chehalis late that evening. By 4am on the 23rd, reports of 0.2 inches of ice were received

TABLE 9-2
SEVERE WEATHER EVENTS 2018-2024*

Incident Type	Date(s)	Chehalis Planning Area (Including Grays Harbor, Thurston and Lewis County events)
		out of Tumwater and then by 10am, reports from around Olympia measured around 0.25 inches of ice. Lacey, nearby to Olympia received around 0.23 inches of ice.
	Jan-Feb 2023	On January 23, 2023, the Chehalis Tribe initiated a response to icy roads and rain from several winter storms and issued advisories through the CODE RED system, as well as social media and web pages. Traction sanding and warning signs aided in keeping staff and community members aware of fall hazards. While not closing any roads, there were multiple days of icy conditions that affected travel to from the Tribe.
Winter Storms / Winter Weather	12/1/2022	A period of winter weather set in at the beginning of December, generally resulting in an average of 1 inch of new snow Dec 1-3.
	2/25/2023	Light to moderate snow fell across the Southwest Interior late in the day on Feb 25th through the morning hours on Feb 26th. In general, most reports of new snow ranged from 2 inches or less, however, a few reports of 5 inches were reported.
	10/24-27/2023	Record low temperatures reported in areas of Grays Harbor and Thurston Counties.
	January-February 2024	On January 15, 2024 the Chehalis Tribe initiated a response to rain from several winter storms and issued advisories through the CODE RED system, as well as social media and web pages. Warning signs aided in keeping staff and community members aware of falling tree hazards. There were 2-3 days of icy conditions that affected travel to/from the Tribe.
	2/14-15/2024	An upper level trough moving across Western Washington through mid-February will produce widespread precipitation along with localized low elevation snowfall. Report of 4 inches in Thurston County areas.
	3/6/2024	A record low temperature of 21 degrees was set in Thurston County (at Olympia airport) on March 6th, which ties the old record of 21 degrees in 1975.
		Review of NOAA data shows a total of 11 days during the period 1/1/2018-9/30/2024 during which the CTCR experienced some type of winter weather or winter storm.

*Data for this table is captured from NOAA Climatic Data, which does not indicate whether event was declared. As dates vary, comparison to disaster declaration dates is not conclusive. As such, some of the events listed in this table may include declared events.

TABLE 9-3
NATIONAL RISK INDEX SUMMARY OF HAZARDS FOR TRIBAL PLANNING AREA

Hazard (Period of Record based on # of years)	Risk Index			Annualized Frequency (/Events per year)			Events on Record (Period of Record # years)			Historic Loss Rating			Expected Annual Loss Rating		
Jurisdiction	**Grays Harbor**	**Thurston**	**Lewis**	**Grays Harbor**	**Thurston**	**Lewis**	**Grays Harbor**	**Thurston**	**Lewis**	**Grays Harbor**	**Thurston**	**Lewis**	**Grays Harbor**	**Thurston**	**Lewis**
Cold Weather (16)	NR	NR	VL	0	0	0	0	0	0	N	NR	RL	N	N	VL
Hail (34)	VL	VL	VL	0	0	0	1	1	2	VL	RL	RL	VL	VL	VL
Heat (16)	VL	RL	RL	0.4	1.3	0.9	6	20	14	VL	VL	VL	VL	RL	RL
Ice Storm (67)	RL	RM	RL	0.6	0.6	0.5	35	42	35	VL	VL	VL	RL	RM	RL
Lightning (22)	VL	RL	VL	0.4	0.6	0.9	8	12	20	VH	VH	VH	VL	RL	VL
Strong Wind (34)	VL	VL	VL	0	0	0	1	1)	1	VL	RL	RM	VL	VL	VL
Tornado (72)	VL	RL	VL	0.1/	0	0.2	3	4	3	VL	RL	VL	VL	RL	VL
Winter Weather (16)	VL	RL	RL	1.6	1.1	10.7	23	16	173	VL	VL	VL	VL	RL	RL

Table Defined	
Risk Index	Scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value. Ratings refer to the qualitative terms that describe the relative risk of an area within the same geographic level. Ratings include: NR=Not Rated; N=None; VL=Very Low; RL=Relatively Low; RM=Relatively Moderate; H=High; VH=Very High
Annualized Frequency	Values determined by utilizing the number of events on record and the period of record.
Events on Record	Various data sources utilized to identify events on record
Historic Loss Rating	Ratings refer to the qualitative terms that describe the relative risk of an area within the same geographic level. These rating categories range from “Very Low” to “Very High”. As these values are based on the specific geographic area, there is no fixed range of scores or values that correspond to the rating categories.
Expected Annual Loss Rating	Rating for hazard types are calculated using data for only a single hazard type, and reflect a community's relative expected annual loss for only that hazard type.

Review of data identifies:

- Eight severe weather events occurring in the Tribal Planning Area have included high winds, while two included snow.
- With respect to tornadoes, Figure 9-15 identifies the magnitude and number of tornadoes occurring within the state since 1950[34],[35]. The planning area as a whole has experienced several tornadoes since 1950; however, none have impacted the Chehalis Reservation.
  - The largest tornado in the planning area was an F2, occurring in Lewis County on November 10, 1965. Lewis County has sustained a total of four tornadoes. Thurston County has experienced three tornadoes, the largest an F1 on May 27, 2004, the strongest recorded in the County. Grays Harbor has experienced three tornadoes, two rating as F0s and one rating an F1 occurring on October 10, 2020. That tornado occurred near Neilton in proximity to the Quinault Indian Nation. The Quinault Indian Nation did have reports of downed trees, consistent with peak winds of approximately 90 mph. Review of NOAA data does not identify any tornado events occurring within the planning area since completion of the last plan; however, Planning Team Members do recall that Grays Harbor County did have incidents during late 2024 (November and December) which included tornado warnings resulting from water spouts forming in the ocean. No damages were reported.
- Since completion of the last plan, there have been no lightning or hail reported events to have occurred in the planning area which have impacted the Tribe.

[34]https://www.seattletimes.com/seattle-news/weather/tornado-touches-down-on-kitsap-peninsula-rips-roof-off-home-weather-service-says/ *NOAA National Weather Service as cited in the Seattle Times*

[35] NOAA as cited by Kitsap Sun. A history of twisters: Tornadoes in Washington since 1950. Accessed 6 March 2025. Available at: Tornadoes in Washington since 1950 | kitsapsun.com

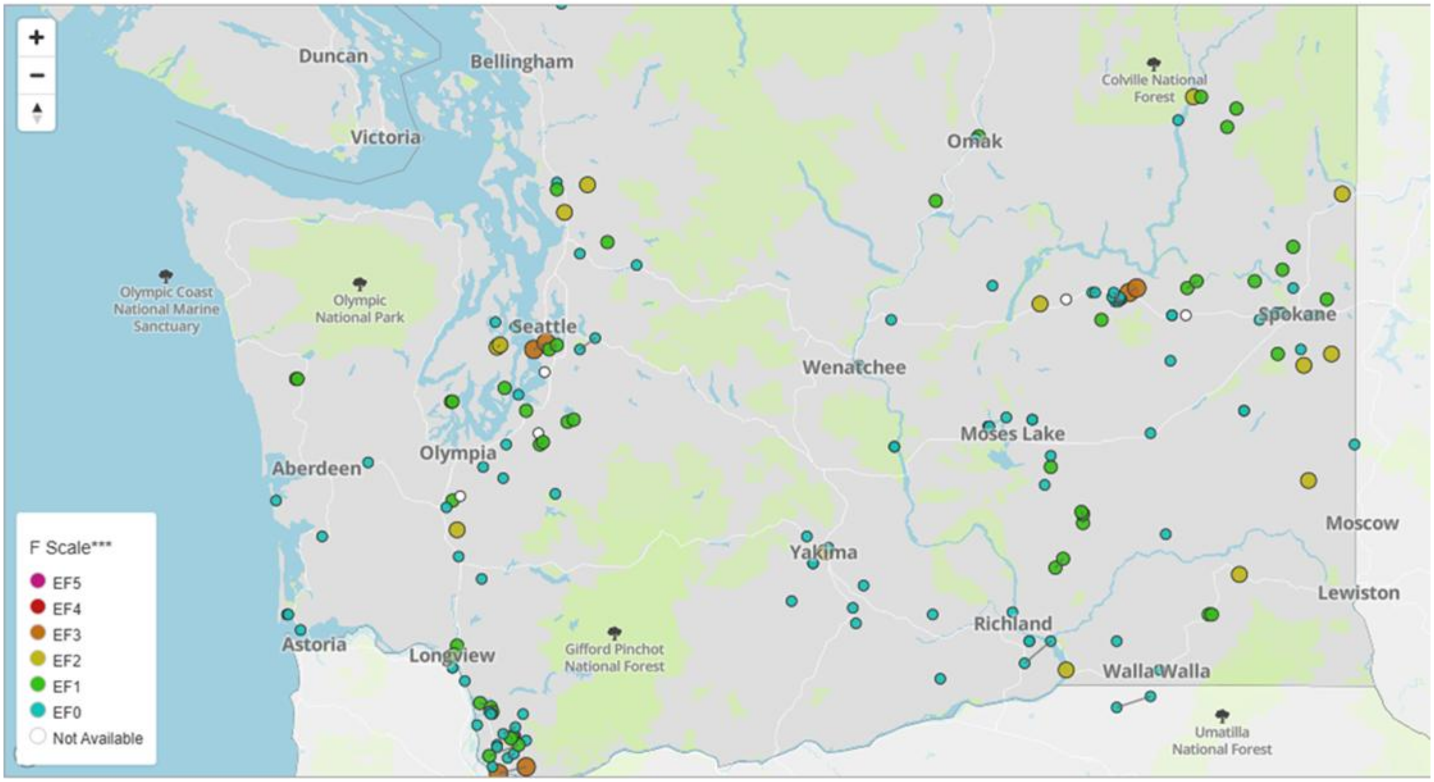


Figure 9-15 Tornado History in Washington 1950 - 2024

9.2.3 Severity

The most common problems associated with severe storms are immobility and loss of utilities. Roads become impassable due to flooding, downed trees, ice or snow, or a landslide, increasing the potential for injuries or death. Downed trees in the area do have the potential to impact ingress and egress to certain areas, and the Tribe does assist County and State personnel to help clear debris from the roadways as necessary after a weather event.

Windstorms are common in the planning area, occurring many times throughout the year. The predicted wind speed given for wind warnings issued by the National Weather Service is for a one-minute average, during which gusts may be 25 to 30 percent higher. Windstorms are a threat within the planning area due, in part, to the densely wooded areas, and the potential for falling trees. Windstorm events have included straight-line winds, tornado, and winter storms.

The strongest winds are generally from the south or southwest and occur during fall and winter, although severe windstorms are associated with summertime storms. In interior valleys, wind velocities reach 40 to 50 mph each winter, but gusts can exceed 75+ mph. The highest summer and lowest winter temperatures generally occur during periods of easterly winds.

Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power. Physical damage to homes and facilities caused by wind do occur, although unless it is a significant windstorm, the impact is usually limited in nature. Several of the Tribal owned critical facilities do have backup power generators, although not all. In addition, a limited number of residential structures in the area maintain generators, leaving the elderly and young citizens, and those citizens with disabilities more vulnerable to the impacts of power outages.

Lightning can cause severe damage and injury, although no such injuries or damages have been reported within the tribal planning area.

Due to the amount of snow customarily received in the region, even a small accumulation of ice or snow can, and has, caused havoc on transportation systems due to terrain, the level of experience of drivers to maneuver in snow and ice conditions.

Ice storms, especially when accompanied by high winds, can have an especially destructive impact within the planning region, with both being able to close major transportation corridors and bridges, and also its impact on the densely wooded areas. Accumulation of ice on trees, power lines, communication towers and wiring, or other utility services can be crippling, and create additional hazards for residents, motorists, and pedestrians.

During the last 30 years, Western Washington has had an average annual snowfall of ~11 inches per year, with the snowfall customarily occurring during November through March, although snow has fallen as late as April. Due to the span of tribal lands, the areas closest to the coast in Grays Harbor typically receive less snow than areas in-land, such as Lewis and Thurston Counties.

As a result of significant snow or ice accumulations, routine services could be disrupted, and businesses could be forced to close for an extended period, impacting availability of commodities. As a result of the heavily forested areas, debris accumulations would also be high, causing additional difficulties with access along major arterials, further impacting logistical support and commodities.

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the wind chill temperature index. Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin’s temperature to drop (NWS, 2009).

On November 1, 2001, the NWS implemented a new wind chill temperature index. It was designed to more accurately calculate how cold air feels on human skin. Figure 9-9 (above) shows the new wind chill temperature index[36]. The Index includes a frostbite indicator, showing points where temperature, wind speed and exposure time will produce frostbite to humans. The chart shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops (NWS, 2009).

The extent of extreme high temperatures is generally measured through the heat index (shown above). Created by the NWS, the Heat Index accurately measures apparent temperature of the air as it increases with the relative humidity. The Heat Index can be used to determine what effects the temperature and humidity can have on the population (NCDC, 2000).

9.2.4 Frequency

The severe weather events are often related to high winds and associated other winter storm-type events such as heavy rains and landslides, and occasionally snow. Severe storms (which include flooding) are the second most declared event for the CTCR and the planning area. The CTCR experiences some form of a severe storm annually, although in most cases, such events do not always rise to the level of a declared disaster. While snow events do occur, they customarily are not significant, nor last for extended periods of time. Table 9-3 (above) and Chapter 3, Table 3-2 also discuss recurrence intervals and frequency.

The National Weather Service reports that Washington state averages 2.5 tornadoes per year, which ranks in the bottom ten states.[37] Washington State Department of Ecology has estimated frequency intervals for wind speed as follows:

WIND SPEEDS EXCEED	FREQUENCY
55 MPH	Annually
76 MPH	~ 5 years
83 MPH	~10 years
92 MPH	~25 years
100 MPH	~50 years
108 MPH	~100 years

[36] NWS, 2008

[37] http://mynorthwest.com/1220169/common-tornadoes-washington-state/

9.3 VULNERABILITY ASSESSMENT

9.3.1 Overview

Severe weather incidents can and regularly do occur throughout the entire planning area. Similar events impact areas within the planning region differently due to the geographic makeup of the area, even though they are part of the same system. While in some instances some type of advanced warning is possible, as a result of climatic differences, topographic and relative distance to the coastline, the same system can be much more severe in certain areas than others. Therefore, preparedness plays a significant contributor in the resilience of the citizens to withstand such events.

Warning Time

Meteorologists can often predict the likelihood of some severe storms. In some cases, this can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm, and the rapid changes which can also occur significantly increasing the impact of a weather event.

9.3.2 Impact on Life, Health, and Safety

The entire planning area is susceptible to severe weather events. Populations living at higher elevations with large stands of trees or above-ground power lines may be more susceptible to wind damage and black- out conditions, while populations in low-lying areas are at risk for possible flooding and landslides associated with the flooding as a result of heavy rains. Increased levels of precipitation in the form of snow also vary by area, with higher elevations being more susceptible to increased accumulations. During snow events, the Tribe becomes impacted due to school closures and employees who are unable to come to work due to the accumulation of snow on roadways, particularly in those areas with hills or steeper terrain. Resultant secondary impacts from power outages during cold weather event, when combined with the high population of elderly residents significantly impacts response capabilities and the risk factor associated with such weather incidents. Within the densely wooded areas, increased fire danger during extreme heat conditions increases the likelihood of fire, which increases risk to human life.

Particularly vulnerable populations are the elderly and very young, low income, linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Currently, the CTCR have approximately 143 (of ~835) registered Tribal Citizens between the ages of 0-5 and 65 and over. Extreme temperature variations, either heat or cold, are of significant concern for both the elderly and the young, increasing vulnerability of those populations. Likewise, falling trees and debris could cause injury or death to citizens and visitors to the reservation.

The National Severe Storms Laboratory states that of injuries related to ice and snow:[38]

    - About 70% occur in automobiles.
    - About 25% are people caught out in the storm.
    - Majority are males over 40 years old.
- Of injuries related to exposure to cold:
    - 50% are people over 60 years old.
    - Over 75% are males.
    - About 20% occur in the home.

Due to the somewhat limited roadways for ingress and egress via primary transportation routes, even minor incidents have the potential to impact the ability to travel throughout the area. Such issues are of concern as a result of the potentially limited access for evacuation purposes by first responder if vital Advanced Life Support is required, as well as for general evacuation purposes during a period where power is out, and individuals attempt to leave the area. In addition, the rural setting of the Chehalis Reservation can increase impacts as the reservation is located at the furthest end of two county public utilities. Oftentimes, this means that the reservation must wait longer for power restoration in the event of a storm. Historically, power has been restored relatively quickly, although some areas have remained without power for 48 hours based on review of data from previous significant windstorm events.

In addition, approximately 50 percent of the reservation's population is dependent on well water, which must be pumped and septic systems with also utilize pumps. During power outages, many residents may be completely lacking drinking water or sewer services. When combined with flooding associated many times with a severe weather event, the likelihood of such ramifications increases.

Planning Team members recall two incidents of weather events (2012 and ~2018) during which power failed for approximately 8-10 hours. The event was in conjunction with a snow/ice event as there was concern over the cold temperatures impacting the elderly living on the reservation. Power was restored by 8:00 p.m. on the day it went out.

9.3.3 Impact on Property

Loss estimations for severe weather hazards are not based on modeling utilizing damage functions, as no such functions have been generated. For planning purposes, all properties and buildings within the planning area are considered to be exposed to the severe weather hazard,

[38] http://www.nssl.noaa.gov/education/svrwx101/winter/

but structures in poor condition or in particularly vulnerable locations (hilltops or exposed open areas, or low-lying coastal areas) may be at risk for the most damage.

The Chehalis Reservation, like most of western Washington is vulnerable to high winds because of the climatic conditions and prevalence of 100 ft to 150 ft tall conifer trees. High winds weaken standing trees and structures weighted with snow or ice. Two predominating species, Douglas fir, which are planted extensively on the reservation as a timber crop and western hemlock have shallow later root systems with top heavy crown. These types of trees are particularly vulnerable to falling when soils are soaked from ongoing rainfall. Sustained high winds and gusts cause tress to sway significantly; repetitive swaying can weaken a tree's root hold in the saturated soils and force it to topple. Current estimations of crop value were not determined as part of this update, but the Planning Team members felt it would be significant.

The frequency and degree of damage will depend on specific locations and severity of the weather pattern impacting the region. It is improbable to determine the exact number of structures susceptible to a weather event, and therefore emergency managers and public officials should establish a maximum threshold, or worst-case scenario, of susceptible structures. For planning purposes, loss estimations for structure value only may exceeds $291 million.

9.3.4 Impact on Critical Facilities and Infrastructure

It should be assumed that all critical facilities are vulnerable to some degree, with older structures built pre-code being more susceptible to impact from a severe weather event. As many of the severe weather events include multiple hazards, information such as that identifying facilities exposed to flooding (see Flood profile) are also likely exposed to severe weather. Additionally, facilities on higher ground may also be exposed to wind damage or damage from falling trees. The most common problems associated with severe weather are loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated. While historically not a significant problem due to the rapid response by local power distributors to re-establish power, as population continues to increase into more rural areas, that may not always be the case.

Within the planning region, hydroelectric energy from dams produce a significant amount of power to areas falling well outside of the planning area. Major power lines travel from the dam through a large swath of the area in general. As such, wind events also have the potential to impact power supplies in large metropolitan areas well outside of the tribal planning area.

In addition, power, phone, internet, water, and sewer systems may also not function properly during severe weather events. Cell towers may be damaged; landlines may be impacted via flood or landslide event. Power outages may impact wells, municipal water, and sewer systems. Primary water and sewer services to portions of the reservation are provided by the Tribe itself, as well as individual wells, Thurston County Water, and Oakville Sewage, among other providers. The Tribe maintains two water storage towers which distribute water to the Grays Harbor portion of the Reservation. There are also septic systems on the Reservation, which could be impacted by severe weather events. A power outage may impact the Tribe's ability to provide services.

Roads may become impassable due to ice or snow or from secondary hazards such as landslides which occur off the Reservation, such as has previously occurred on several instances. Incapacity and loss of roads are the primary transportation failures, most of which are associated with secondary hazards. Landslides that block roads are caused by heavy prolonged rains. High winds can cause significant damage to trees and power lines, with obstructing debris blocking roads, incapacitating transportation, isolating population, and disrupting ingress and egress. Snowstorms can impact the transportation system, impacting not only commodity flow, but also the availability of public safety services into impacted areas. Of particular concern are roads providing access to isolated areas and to the elderly, or areas where there is only one primary access route.

Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting both electricity and communications not only for households, but also public safety dispatching. Loss of electricity and phone connection would result in isolation because some residents will be unable to call for assistance, with cell phone operability weak in certain areas of the planning area.

9.3.5 Impact on Economy

Prolonged obstruction of major routes due to severe weather can disrupt employees' ability to get to work, as well as the shipment of goods and other commerce, both on and off the reservation. With a large portion of the economic base for the CTCR being the Casino, various hotels, construction company, and the Great Wolf Lodge, among others, severe weather events would impact the economy of the Tribe. Such was the case with snowstorms which occurred in 2008 and 2012. Both of those events temporarily closed tribal enterprises, although the Tribe cannot assign an economic impact for those incidents.

Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines, as well as negatively impacting the Tribe's timber crop. Freezing rain/snow on power and communication lines can cause them to break, disrupting electricity and communication, further impacting business within the region, and potentially continuity of government operations.

Prolonged outages would impact consumer spending as a result of lost revenue, (food) spoilage, lack of production/manufacturing, and loss of tax base, etc. Large, prolonged storms can have negative economic impacts for an entire region, and this would be particularly true for the CTCR, as they are a primary employer throughout much of the planning area.

All severe weather events have the potential to also impact tourism, including visitors to the various business ventures owned by the Tribe. Accommodation and entertainment services account for a large percentage of the Tribe's economy, both employee-based and as the employer/owner, with entertainment and recreation significant contributors.

Combined, these categories account for the majority of the Tribe's economy. Each of these occupation classes are highly vulnerable to impacts from severe weather events, and as such, would have a significant impact on the economy, particularly if an event lasted for several days, or the resulting impacts continued for significant periods of time.

9.3.6 Impact on Environment

The environment is highly exposed to severe weather events. Natural habitats such as streams and trees are exposed to the elements during a severe storm and risk major damage and destruction. Prolonged rains can saturate soils and lead to slope failure. Flooding events caused by severe weather or snowmelt can produce river channel migration or damage riparian habitat, also impacting spawning grounds and fish populations for many years. The Tribe does maintain an active fish hatchery, which could also be potentially impacted by various severe weather events. Storm surges can erode riverbanks and redistribute sediment loads. Extreme heat can raise temperatures of rivers, impacting oxygen levels in the water, threatening aquatic life.

9.3.7 Impact from Climate Change

Climate change presents a challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. This increase in average surface temperatures can also lead to more intense heat waves that can be exacerbated in urbanized areas by what is known as urban heat island effect. Additionally, the changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. All of these impacts could have significant economic consequences.

With the increase in average ambient temperatures, since the 1980s, unusually cold temperatures have become less common in the contiguous 48 states (U.S. EPA, 2013). This trend is expected to continue, and the frequency of winter cold spells will likely decrease, including snow pack. As ambient temperatures increase, more water evaporates from land and water sources. The timing, frequency, duration, and type of precipitation events will be affected by these changes. In general, more precipitation will fall as rain rather than snow.

9.4 FUTURE DEVELOPMENT TRENDS

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The Tribe does have land use regulations in place, and does adhere to strict implementation of the International Building Codes as well as additional land use authority as established within the various jurisdictions in which non-trust properties are situated. These codes are equipped to deal with the impacts of severe weather incidents by identifying construction standards which address wind speed, roof load capacity, elevation, and setback restrictions, among others.

While under the Growth Management Act, public power utilities are required by law to supply safe, cost effective and equitable service to everyone in the service area requesting service, most lines in the area are above-ground, causing them to be more susceptible to high winds or other severe weather hazards. However, growth management is also a constraint, which could possibly lead to increased outages or even potential shortages, as while most new developments expect access to electricity, they do not want to be in close proximity to substations. The political difficulty in sighting these substations makes it difficult for the utility to keep up with regional growth. The Tribe does not generate its own power, although some facilities do have generators for emergency use. As such, the Tribe must rely on public infrastructure to provide this service to them.

Land use policies currently in place, when coupled with informative risk data such as that established within this mitigation plan will also address the severe weather hazard. In addition to the local land use authority, the CTCR must also address Federal land use requirements for any projects funded with federal dollars. That, when coupled with the land use tools currently in place, the Tribe will be well-equipped to deal with future growth and the associated impacts of severe weather. Since completion of the last plan, the Tribe has conducted mitigation activities that have reduced the impact of the severe weather hazard, particularly when flooding is a component of the severe weather event.

9.5 ISSUES

Important issues associated with a severe weather in the planning area include the following:

- Older building stock in the planning area are built to low code standards or none at all. These structures could be highly vulnerable to severe weather events such as windstorms. While many structures owned by the CTCR are newer (post-1975), and built to higher code standards, tribal citizens living throughout the planning area could be impacted as a result of the lower building code standards in their residential structures.
- Redundancy of power supply must be evaluated and increased planning-region wide in order to understand the vulnerabilities more fully in this area.

- The capacity for backup power generation should be enhanced, especially in areas of potential isolation due to impact on major thoroughfares or evacuation routes, or structures which ensure continuity of government.
- Isolated population centers could exist if roadways are impacted.
- Climate change may increase the frequency and magnitude of winter flooding or storm surges, thus exacerbating severe winter events.

9.6 IMPACT AND RESULTS

Based on review and analysis of the data, the Planning Team has determined that the probability for impact from a severe weather event throughout the area is highly likely, but the impact is more limited when removing resulting flood events from the severe weather category.

The entire area experiences some severe storm or weather event annually, be it wind, rain, snow, ice, or extreme heat. When severe weather events occur, the storms do have the ability to impact the area, posing a danger to life and property, as well as possibly causing economic losses. While snow and ice do occur, impact and duration are somewhat limited, reducing life safety dangers as advanced warning many times allows residents to take precautionary measures (extra food, not driving, etc.).

Wind is a very significant factor, which can cause power outages, as well as impacting transportation to transport both citizens and goods. While the local PUD/utilities maintain excellent records for low incidents of long-term power outages, the possibility does exist. Historically, severe weather events that occur are of a relatively short duration, with more localized impacts, and thankfully, power outages have not been for extended periods of time, but shorter in duration.

Based on the potential impact, the Planning Team determined the CPRI score to be 3.05, with overall vulnerability determined to be a high level.

CHAPTER 10.
VOLCANO

The Cascade Range of Washington, Oregon and California has volcanoes close to the Confederated Tribe of the Chehalis Reservation. The primary effect of the Cascade volcanic eruptions on the county would be ash fall, with some disruption of service due to impact on surrounding counties. The closest potential impact to the Reservation are from Mt. Rainier (~66 Euclidian miles) and Mount St. Helens (~63 Euclidian miles).

The distribution of ash from a violent eruption is a function of wind direction and speed, atmospheric stability, and the duration of the eruption. As the prevailing wind in this region is generally from the west, ash is usually spread eastward from the volcano. Exceptions to this rule do, however, occur. Ash fall, because of its potential widespread distribution, suggests some limited volcanic hazards.

DEFINITIONS

Ash—Ash is a harsh acidic with a sulfuric odor, consisting of small bits of pulverized rock and glass, less than 2 millimeters (0.1 in) in diameter. Ash may also carry a high static charge for up to two days after being ejected from a volcano. When an ash cloud combines with rain, sulfur dioxide in the cloud combines with the rainwater to form diluted sulfuric acid that may cause minor, but painful burns to the skin, eyes, nose, and throat.

Lahar—A rapidly flowing mixture of water and rock debris that originates from a volcano. While lahars are most commonly associated with eruptions, heavy rains, and debris accumulation, earthquakes may also trigger them.

Lava Flow—The least hazardous threat posed by volcanoes. Cascades volcanoes are normally associated with slow moving andesite or dacite lava.

Stratovolcano—Typically steep-sided, symmetrical cones of large dimension built of alternating layers of lava flows, volcanic ash, cinders, blocks, and bombs, rising as much as 8,000 feet above their bases. The volcanoes in the Cascade Range are all stratovolcanoes.

Tephra—Ash and fragmented rock material ejected by a volcanic explosion

Volcano—A vent in the planetary crust from which magma (molten or hot rock) and gas from the earth's core erupts.

10.1 GENERAL BACKGROUND

Hazards related to volcanic eruptions are distinguished by the different ways in which volcanic materials and other debris are emitted from the volcano (see Figure 10-1). The molten rock that erupts from a volcano (lava) forms a hill or mountain around the vent. The lava may flow out as a viscous liquid, or it may explode from the vent as solid or liquid particles. Ash and fragmented rock material can become airborne and travel far from the erupting volcano to affect distant areas.

Monitored volcanoes generally give signs of reawakening (volcanic unrest) before an eruption because it takes time for magma to move from its storage area, several miles beneath the volcano, to the surface. As magma moves to the surface, it breaks open a pathway, which produces earthquakes; it goes from higher to lower pressures, resulting in the release of volcanic gases; and as the amount of magma decreases in the storage area and temporarily pools at shallower levels it deforms the earth. All these processes can be monitored, although none can be measured directly.

Volcanic events often differ from other natural hazards because the duration of unrest and eruptive activity are generally longer. Although volcanic unrest prior to eruptions can be only hours, these short timescales most frequently occur at volcanoes that have erupted in the recent past (years to decades). At volcanoes like Mount Rainier and Mount St. Helens (those in closest proximity to the Chehalis Reservation), their conduit systems which convey magma to the surface have solidified and will have to be fractured and reopened for the next magma batch to reach the surface. Thus, it is anticipated that several days to weeks of warning will occur before an eruption, although hazardous events such as small steam and ash explosions and expulsion of water to form lahars may occur before an eruption begins. While Mount St. Helens has continued to emit steam on occasion since its last eruption, scientists feel that advanced warning of a significant magnitude would provide some level of advanced notice.

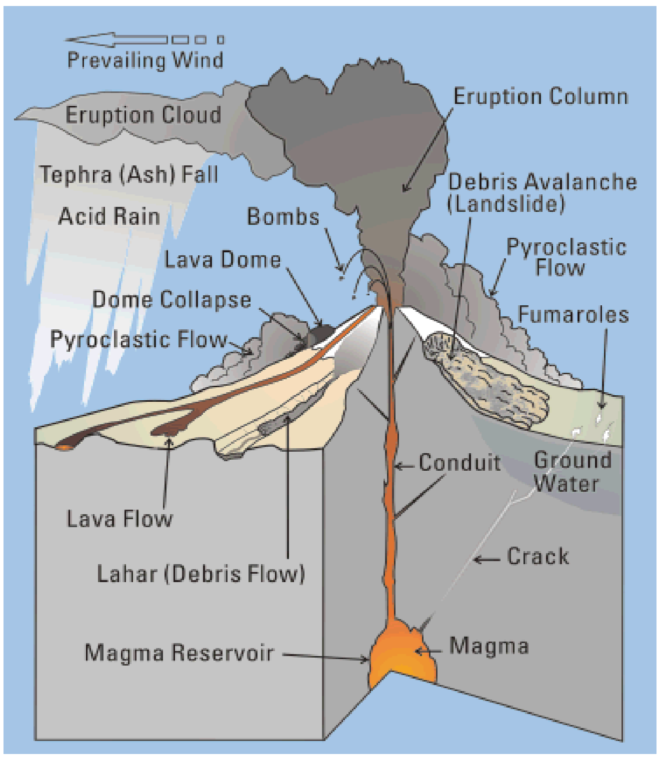


Figure 10-1 Volcano Hazard

The most recent eruption in Washington State, the eruption of Mount St. Helens in 1980, is identified as a Plinian eruption, which are the most violent of types, including violent ejection of very large columns of ash, followed by a collapse of the central portion of the volcano. It should be noted that a volcano has the potential to exhibit various styles of eruption at different intervals, changing from one form or type to another as the eruption progresses.

10.2 HAZARD PROFILE

10.2.1 Extent and 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 U.S. Figure 10-2 shows the location of the Cascade Range volcanoes, most of which have the potential to produce a significant eruption. The straight-line distance of the major volcanoes of potential impact on the Reservation are as follows:

- Mount Baker— ~148 miles east/northeast
- Glacier Peak— ~130 miles east/northeast
- Mount Rainier— ~65 miles southeast
- Mount Adams – ~89 miles southeast
- Mount St. Helens – ~62 miles southeast

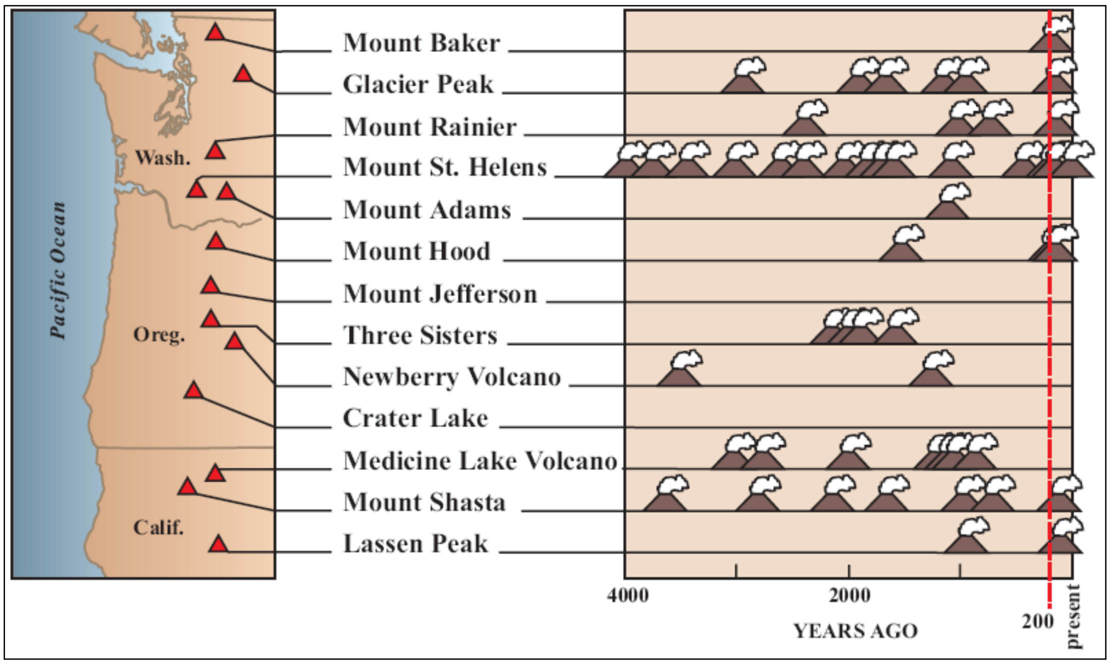


Figure 10-2 Past Eruptions of Cascade Volcanoes

Mt. Baker is one of the youngest volcanoes in the Cascade Range. Glacier Peak is the most remote of the five active volcanoes in Washington, not visibly prominent from any major population center, although in previous times, it produced some of the largest and most explosive eruptions in the state.

Based on review, the volcanoes most likely to impact the planning area are Mount Rainier and Mount St. Helens. Mount Adams, at 12,280 feet, could also cause Tephra to fall within the area. Figure 10-3 illustrates the distance and locations of the various volcanoes in the area, and the potential amount of tephra accumulation (Chehalis HMP, 2021). Figure 10-4 is a photo of Mount St. Helens.

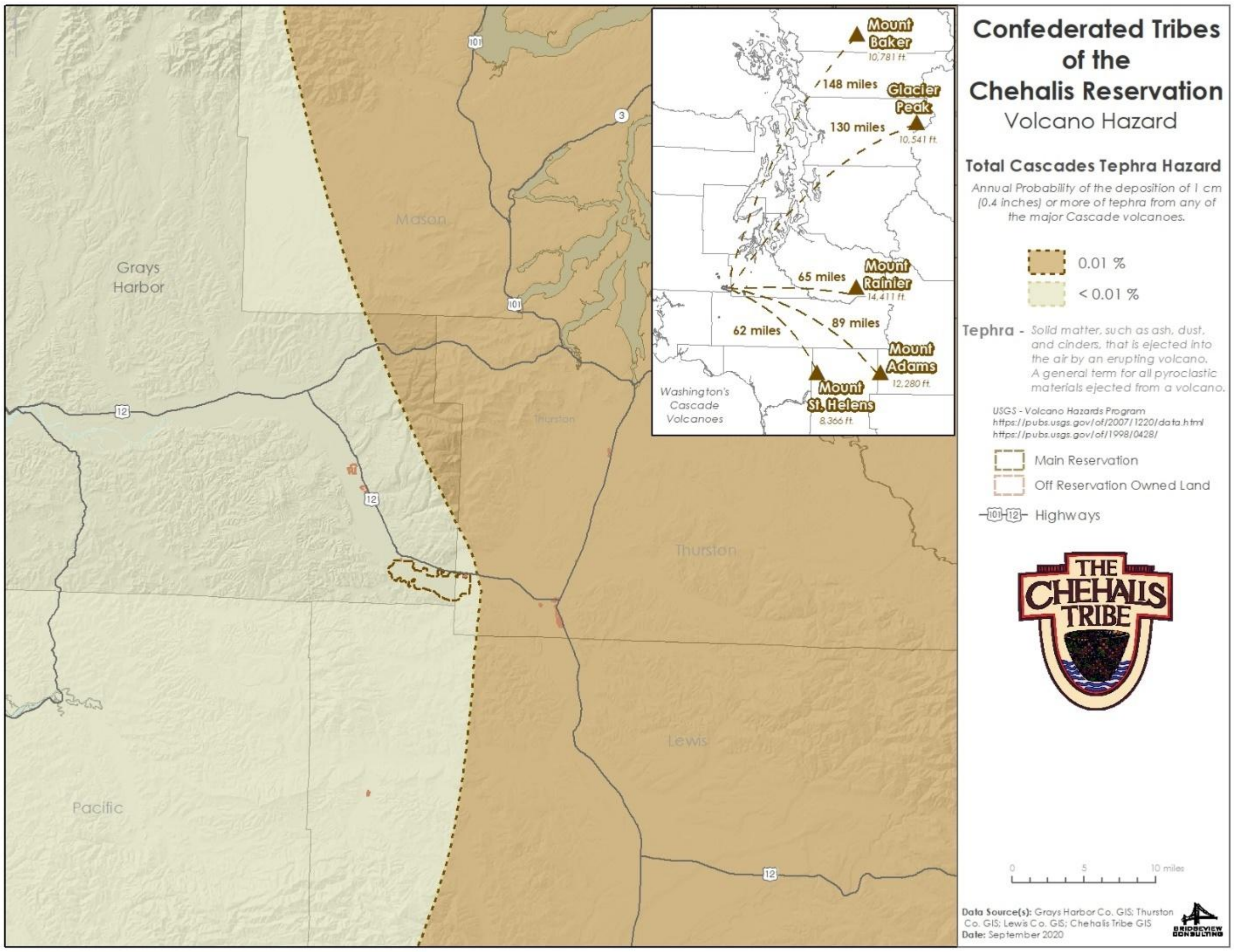


Figure 10-3 Potential Tephra Accumulation

10.2.2 Previous Occurrences

Table 10-1 summarizes past eruptions in the Cascades. During the 1980 Mount St. Helens eruption, 23 square miles of volcanic material buried the North Fork of the Toutle River and there were 57 human fatalities. During the last 4,000 years, Mount St. Helens (pictured in Figure 10-4) has erupted more frequently than any other volcano in the Cascade Range.

The May 18, 1980, eruption produced the largest terrestrial landslide in recorded history, reducing Mount St. Helens' summit by 1,300 feet. Within 15 minutes of the initial eruption, a vertical plume of volcanic ash rose over 80,000 feet, with a dense ash cloud turning daylight into darkness. The volcanic ash cloud traveled east across the United States in three days and encircled Earth in 15 days. Figure 10-5 is an illustration of the ash cloud.[39]

The May 18th eruption carried huge amounts of ash to the east all the way to the State of Montana in a matter of hours. Grays Harbor County escaped the initial ash fall because of prevailing wind direction; however, a smaller but significant eruption on May 25, 1980 affected the planning area for a short period of time. Prevailing winds from the southeast during this eruption deposited ash from the volcanic plume over the Reservation and Grays Harbor County from east to west (Grays Harbor County All Hazards Mitigation Plan, 2005).

Planning Team Members do remember the blackening of the sky from the ashfall during the second eruption, which occurred during the Tribal Days Baseball Tournament. The baseball fields are located in Oakville, which is in Grays Harbor County. With many visitors camped out near the baseball fields, visitors and players had to leave due to the amount of ashfall accumulation. Tents collapsed under the weight of the ash, and the remaining games were cancelled due to the unhealthy air quality.

The eruptions of Mount St. Helens in 1980 deposited only a scant layer of ash in Thurston County, but the fallout did not pose a significant hazard to the region. Thurston County winds prevail from the south and west, therefore ash is more likely to disperse east of Cascades. If Mount Rainier or Mount St. Helens were to erupt, a resultant ash plume would require an easterly wind to deposit ash in Thurston County. The USGS calculated a 0.02 percent annual probability for a significant ash deposit of one centimeter or greater for the southeastern tip of the county and 0.01 percent for most of the county and its most populated areas. There is a low probability of a volcanic tephra event impacting Thurston County.

Lahars (volcanic mudflows) filled rivers with rocks, sand, and mud, damaging 27 bridges and 200 homes and forcing 31 ships to remain in ports upstream. The May 18, 1980 eruption was the most economically destructive volcanic event in U.S. history. Since the 1980 eruption, Mount St. Helens again became more active during the 2004-2008 time period, when growing lava domes displaced and then divided Crater Glacier into east and west lobes, with lava oozing onto the crater floor, building domes taller than the Empire State Building and restoring 7 percent of the volume lost in 1980.[40]

---

[39] Kitsap Daily News. (2018) May 18, 1980: 38 years ago. Accessed 3 March 2025. Available at: May 18, 1980: 38 years ago, a volcanic anniversary of ash, mudslides and devastation from Mount St. Helens | Kitsap Daily News

[40] USGS Publication accessed 3 March 2025. Available at: https://pubs.usgs.gov/gip/103/

Figure 10-4 Shoestring Glacier on Mount St. Helens (viewed from southeast)
(Source: USGS files. Photo taken May 1965)

Figure 10-5 May 18, 1980 Ash Cloud over Ephrata from Mount St. Helens Eruption
(Source: Kitsap Daily News photo posted by Michael S. Keys on Facebook)

TABLE 10-1 PAST ERUPTIONS IN WASHINGTON		
Volcano	Number of Eruptions	Type of Eruptions
Mount Adams	3 in the last 10,000 years, most recent between 1,000 and 2,000 years ago	Andesite lava
Mount Baker	5 eruptions in past 10,000 years; mudflows have been more common (8 in same time period)	Pyroclastic flows, mudflows, ash fall in 1843.
Glacier Peak	8 eruptions in last 13,000 years	Pyroclastic flows and lahars
Mount Rainier	14 eruptions in last 9000 years; also 4 large mudflows	Pyroclastic flows and lahars
Mount St Helens	19 eruptions in last 13,000 years	Pyroclastic flows, mudflows, lava, and ash fall

10.2.3 Severity

Eruption durations are quite variable, ranging from hours to decades. At present, when an eruption begins scientists cannot foretell when it will end or whether the activity will be intermittent or continuous. Worldwide, the average eruption duration is about two months, although the most recent eruptions in the Cascades have been of greater duration (Mount St. Helens, Washington: intermittent activity from 1980 to 1986 and continuous activity from late 2004 to early 2008; Lassen Peak, California: intermittent activity from 1914 to 1917).

The explosive disintegration of Mount St. Helens' north flank in 1980 vividly demonstrated the power that Cascade volcanoes can unleash. The thickness of tephra sufficient to collapse buildings depends on construction practices and on weight of the tephra (tephra is much heavier wet than dry). Past experience in several countries shows that tephra accumulation near 10 cm is a threshold above which collapses tend to escalate. A 1-inch deep layer of ash weighs an average of 10 pounds per square foot, causing danger of structural collapse.

Ash is harsh, acidic and gritty, and it has a sulfuric odor. Ash may also carry a high static charge for up to two days after being ejected from a volcano. When an ash cloud combines with rain, sulfur dioxide in the cloud combines with the rainwater to form diluted sulfuric acid that may cause minor, but painful burns to the skin, eyes, nose, and throat. Westerly winds dominate in the Pacific Northwest normally sending volcanic ash east and north–eastward about 80–percent of the time, though ash can blow in any direction. As indicated, one of the smaller but significant eruptions of Mount St. Helens on May 25th did affect the area for a short period of time when prevailing winds from the southeast during the eruption deposited ash over the area.

Figure 10-6 shows probability of tephra accumulation from Cascade volcanoes in the Pacific Northwest (tephra is fragmented rock material ejected by a volcanic explosion). Wind in western Washington blows to the west, northwest and southwest only 10 percent of the time, so tephra from eruptions of Mount St. Helens or Mt. Rainier customarily would be far more likely on the east side of the volcano, but as witnessed by the May 25th eruption, ash did fall over the Grays Harbor portion of the planning region. While no totals were recorded by the Tribe or the counties, even a relatively small amount of ash in the planning area could have a significant impact with respect to individuals with health or breathing issues, mechanical or motorized devices, fish and other natural wildlife, and the forest and plant life. Three inches of ash begins to exceed load capacities of some building rooftops and can cause structural failure. Failure may also occur with lower depths of ash when combined with excess precipitation. Wet ash is known to cause power lines to short. Ash removal and disposal would likely be the greatest cost to both the public and private sectors. The 1980 eruption of Mount St. Helens posed a major nuisance for communities in Eastern Washington. In Yakima, ash removal took 10 weeks and cost $2.2 million (1980 figures).

The Tribe does have a fish hatchery from which they release approximately 25,000 smolt annually. The hatchery maintains three outside tanks, as well as a series of inside raceways in which the fry are reared. Annually, Coho salmon and steelhead are released into both the Black and Chehalis Rivers. As such, even a small amount of ash could have a devastating impact on the stock.

Figure 10-6 illustrates the previous areas of ash accumulations based on historic events. Figure 10-7, Figure 10-8 and Figure 10-9 identify the volcano hazard zones from Mount St. Helens, Mount Rainier, and Mount Adams, respectively, as identified by the USGS. These are the volcanoes which have the potential to impact the CTCR through ash accumulations.

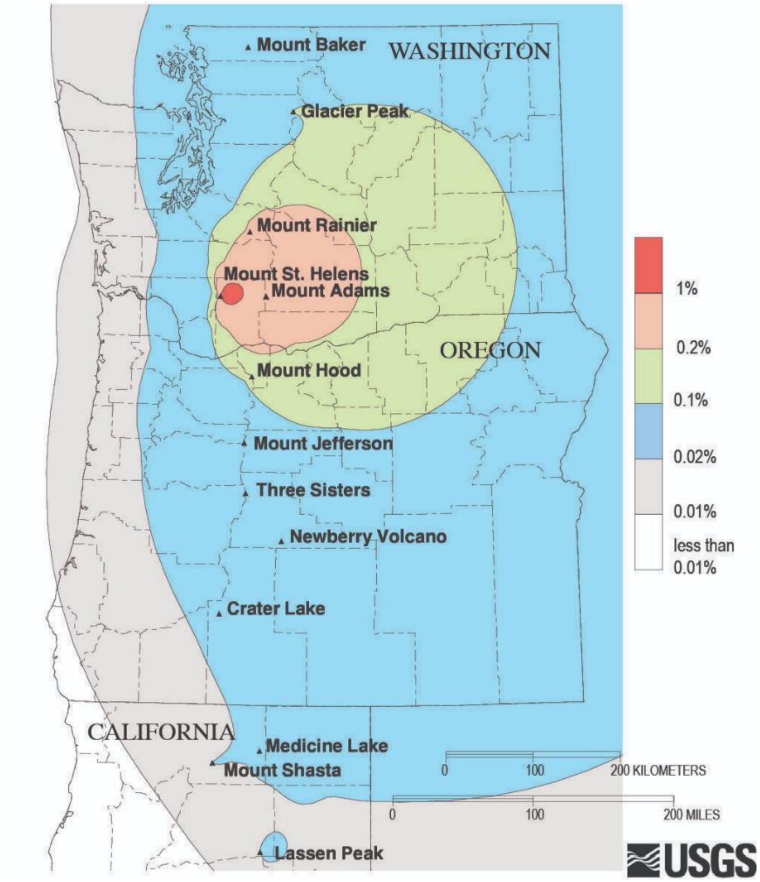


Figure 10-6 Probability of Tephra Accumulation[41]

[41] USGS One-Year Probability Map. Accessed 3 March 2025. Available online at: https://www.usgs.gov/media/images/map-showing-one-year-probability-accumulation-1-centimeter

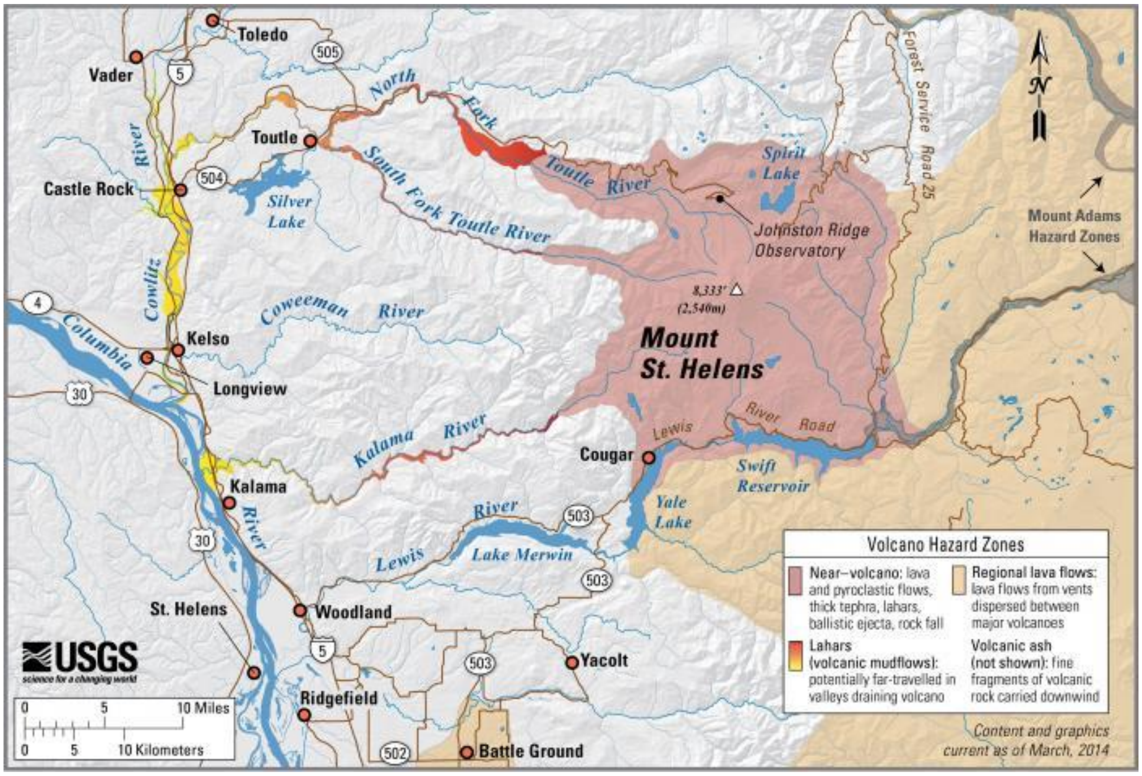


Figure 10-7 Volcano Hazard Zones From Mount St. Helens
Source: USGS. http://volcanoes.usgs.gov/vsc/multimedia/cvo_hazards_maps_gallery.html

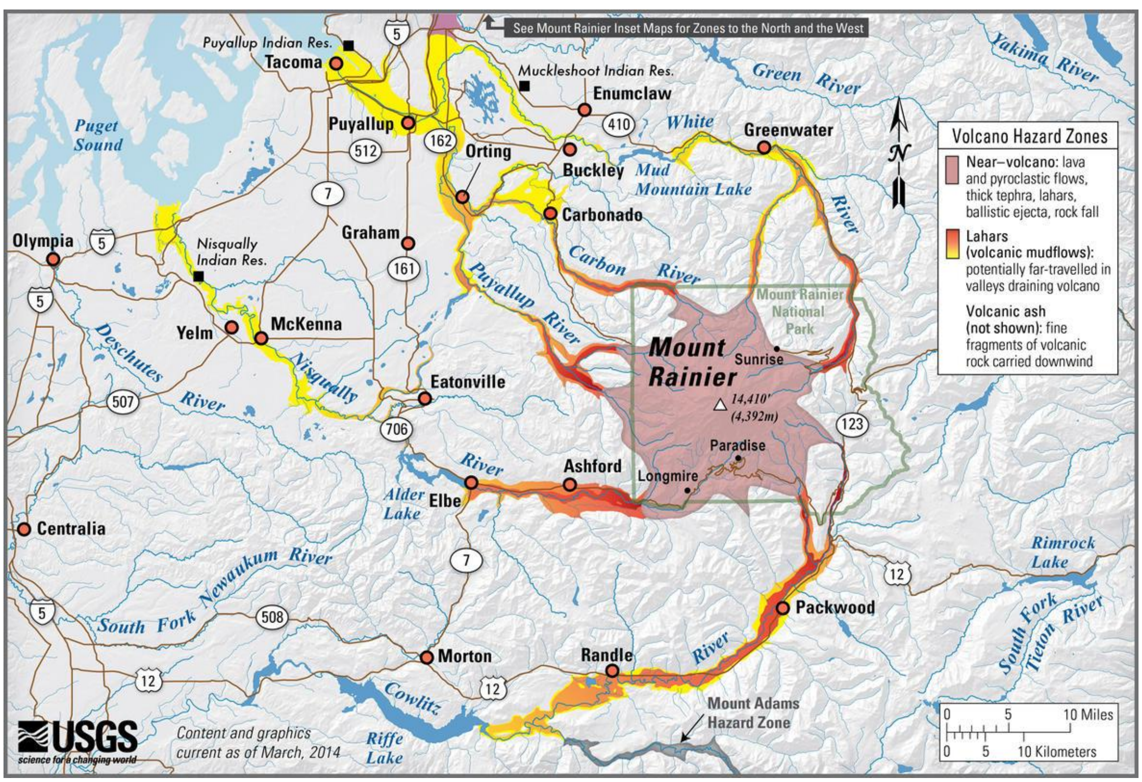


Figure 10-8 Volcano Hazard Zones from Mount Rainier

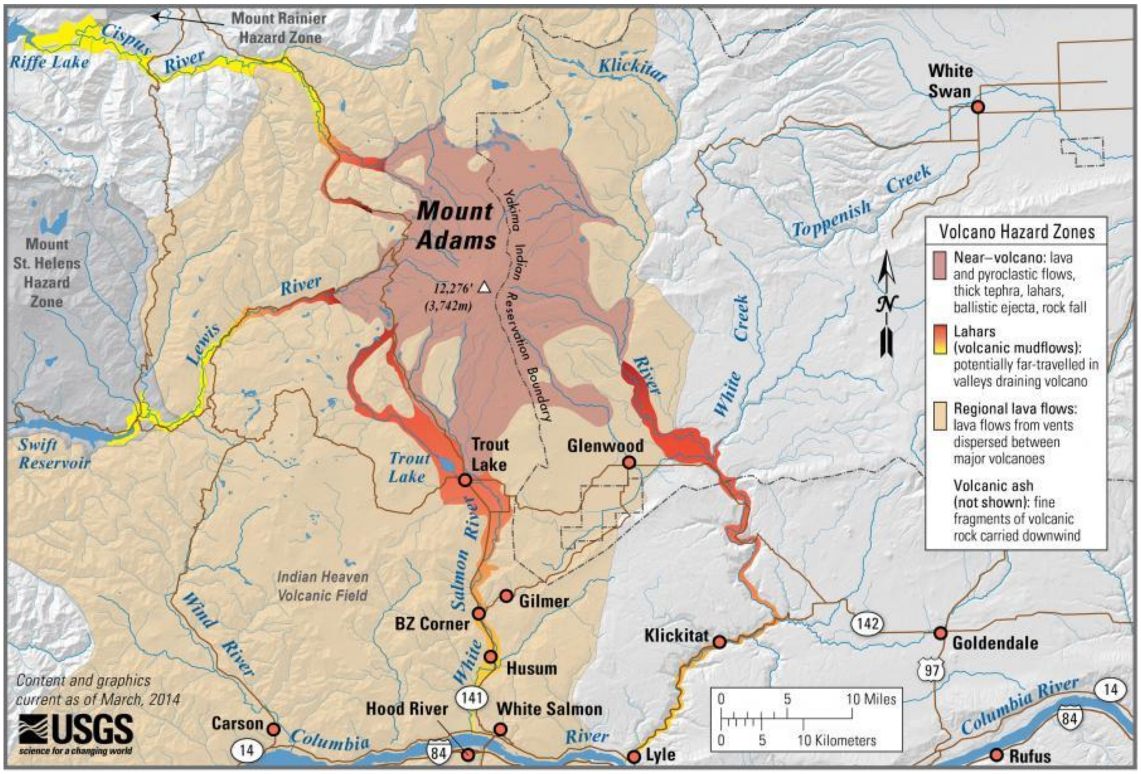


Figure 10-9 Volcano Hazard Zones from Mount Adams

10.2.4 Frequency

Many Cascade volcanoes have erupted in the recent past and will be active again in the foreseeable future. Given an average rate of one or two eruptions per century during the past 12,000 years, these disasters are not part of everyday experience; however, in the past hundred years, California's Lassen Peak and Washington's Mount St. Helens have erupted with terrifying results. Review of USGS's latest updated in 2023, scientists feel that "Mount St. Helens' high frequency of eruptions during the recent geologic past and its two eruptive episodes of the past three decades indicate a high probability of renewed eruptive activity," although timelines historically are long-range.[42]

The U.S. Geological Survey classifies Glacier Peak, Mt. Adams, Mt. Baker, Mt. Hood, Mt. St. Helens, and Mt. Rainier as potentially active volcanoes in Washington State. Mt. St. Helens is by far the most active volcano in the Cascades, with four major explosive eruptions in the last 515 years. There is a one (1) in 500 probability that portions of two counties in the state will receive four (4) inches or more of volcanic ash from any Cascade volcano in any given year. The

[42] USGS Volcanic Hazards at Mount St. Helens. (2023) Accessed 3 March 2025. Available online at: Volcanic Hazards at Mount St. Helens | U.S. Geological Survey

probability increases to one (1) in 1,000 that parts, or all, of three or more counties will receive same quantity. There is a one (1) in 100 annual probability that small lahars or debris flows will impact river valleys below Mount Baker and Mount Rainier, with a less than 1:1,000 annual probability that the largest destructive lahars would flow down Glacier Peak, Mount Adams, Mount Baker or Mount Rainier. Based on USGS analysis, the area of the Reservation has a 0.01 to <0.01 percent probability of ash or tephra collection in any given year within the Reservation (see Figure 10-3 and Figure 10-6 above).

10.3 VULNERABILITY ASSESSMENT

10.3.1 Overview

As indicated, the Planning Team did report ashfall as a result of Mount St. Helens' May 25, 1980 eruption, with a baseball tournament cancelled and campers evacuating the area due to the ash accumulations causing tents to collapse, and the health risk associated with the inhalation of ash. Planning team members could not remember the amount or depth of ash accumulations. Given the acidic nature of ash, the impact to the environment was also of great concern.

The closest Cascade volcanoes to the planning area are Mt. Rainier, Mount St. Helens, and Mt. Adams. A lahar is not of primary concern for those volcanoes within the region as identified in the above graphics, but secondary impacts from ash and commodity flow could cause low to moderate issues.

According to the USGS analysis, westerly winds dominate in the Pacific Northwest sending volcanic ash east and north–eastward about 80–90 percent of the time, though ash can blow in any direction. However, even 10 percent of ash reaching the planning area could have a negative impact on the natural resources and the agricultural economy. The potential for fire danger also increases as a result of static charge contained within the ash.

Ash and chemical products in the any of the rivers in the area could contaminate water supply. Transportation for ships, boats, and vehicles traveling into the area could carry additional ash into the region, washing off during rains and contaminating the ground and water bodies, or potentially being impacted by ash with respect to visibility, and mechanically if large amounts of ash accumulate in engines' air intake systems. In addition, transportation interruptions as a consequence of eruption and impact on surrounding counties could cause moderate impact on the planning region as a whole (Grays Harbor, Thurston and Lewis Counties), as commodity flows would decrease, as well as interruptions to power transmission, telecommunications outages, and potentially medical services. Residents with health issues, especially those with breathing difficulties, would also be impacted, even by small amounts of ash.

Warning Time

Constant monitoring by the USGS and the Pacific Northwest Seismograph Network (PNSN) at the University of Washington of all active volcanoes means that there will be more than adequate warning time before an event. Newly standardized Alert Levels issued by USGS volcano observatories are based on a volcano's level of activity. These levels are intended to inform people on the ground and are issued in conjunction with the Aviation Color Code. The highest two alert levels (Watch and Warning) are National Weather Service terms for notification of hazardous meteorological events, terms already familiar to emergency managers that are becoming increasingly more familiar to the public.

The U.S. Geological Survey (USGS) volcanic alert-level system provides the framework for the preparedness activities of local jurisdictions, tribal governments and state and federal agencies. The USGS ranks the level of activity at a U.S. volcano using the terms "Normal", for typical volcanic activity in a non-eruptive phase; "Advisory", for elevated unrest; "Watch", for escalating unrest or a minor eruption underway that poses limited hazards; and, "Warning", if a highly hazardous eruption is underway or imminent. These levels reflect conditions at a volcano and the expected or ongoing hazardous volcanic phenomena. When an alert level is assigned by an observatory, accompanying text will give a fuller explanation of the observed phenomena and clarify hazard implications to affected groups. The USGS Cascade Volcano Observatory works in conjunction with PNSN to provide constant monitoring and notification when activities increase. Figure 10-10 depicts one of the sensors used by USGS and PNSN for monitoring purposes.

Figure 10-10 USGS Monitoring Equipment

Since 1980 and 2004, Mount St. Helens has settled into a pattern of intermittent, moderate, and generally non-explosive activity, and the severity of tephra, explosions, and lava flows have diminished. All episodes, except for one very small event in 1984, have been successfully predicted several days to three weeks in advance. However, scientists remain uncertain as to whether the volcano's current cycle of explosivity ended with the 1980 explosion. The possibility of further large-scale events continues for the foreseeable future.

10.3.2 Impact on Life, Health, and Safety

The entire population of the planning area, as well as any tourists traveling through to the various tourist attractions could be exposed to ash and its side effects. When an ash cloud combines with rain, sulfur dioxide in the cloud combines with the rainwater to form diluted sulfuric acid that may cause minor, but painful burns to the skin, eyes, nose, and throat. Given the high amount of annual rainfall, this increases the potential impact on the population. The elderly, very young and those who experience ear, nose and throat problems are especially vulnerable to the tephra hazard, as well as the ash itself causing respiratory issues.

In addition, the high number of tourists who annually visit the area would potentially increase the number of people to which the region would have to provide emergency services, housing, and associated support. The Casino maximum capacity at any given point is approximately 2,500 individuals, not inclusive of the various restaurants, attached hotel, or entertainment/concert venue. The Great Wolf Lodge has an average daily visitor count exceeding 1,500 guests. Grays Harbor County has an average population of over 4 million annually who travel in direct proximity to the reservation, potentially carrying ash to the area on their vehicles if the ash has not been carried directly to the area based on wind direction.

10.3.3 Impact on Property

Loss estimations for the volcano hazard could not be based on modeling utilizing damage functions, as no such functions have been generated. The Reservation is not within any lahar zone for any of the identified mountains of greatest concern.

All of the planning area and tribal structures to some degree would be exposed to ash fall and tephra accumulation in the event of a volcanic eruption. The age of some of the current building stock does not lend itself to be able to withstand large amounts of accumulation of ash on rooftops, as a one-inch deep layer of ash weighs an average of 10 pounds per square foot. This added weight to the aged buildings would increase the danger of structural collapse. Additionally, ash is harsh, acidic, and gritty, and may carry a high static charge for up to two days after being ejected from a volcano. This static charge has the potential for igniting forest fires in the densely forested areas.

10.3.4 Impact on Critical Facilities and Infrastructure

None of the critical facilities within the planning region would be exposed to lahar inundation, but all would be exposed to the weight of ash, and, because of the age of some of the building stock, may fail to withstand the weight of the ash due to lower building codes in place at the time of construction. All transportation routes in the area would be exposed to ash fall and tephra accumulation, which could create hazardous driving conditions on roads and highways and hinder evacuations and response. Commodities would also be impacted by transportation related issues as a result of a lahar in other areas of the state, and the impact on major roadways, including north/south-bound I-5 and east/west I-90. Both serve as major thoroughfares not only for the Washington State, but in shipment of commodities via rail, air, or water to and from other parts of the nation, and globally. Utilities, including water treatment plants and wastewater treatment plants are vulnerable to contamination from ash fall, as well as impact from the ash itself that could damage motors. Power and communication lines can also be impacted by wet ash causing lines to short.

10.3.5 Impact on Economy

Economic impact could result from potential aqua- and agri-cultural losses, the loss of tourism due to suspended travel and visitors to the area, structural losses, including businesses and governmental offices/buildings. Lost tax revenues from businesses disrupted by structural damage or as a result of fewer patrons would impact the Tribe's economy due to its collection of sales tax, among other avenues. The tourism industry would also be impacted for a substantial amount of time if ash impacts are significant. Economic impact would also fall upon tribal members who work at tribal or other enterprises which could not operate as a result of impacts to ash.

10.3.6 Impact on Environment

The environment is highly exposed to the effects of a volcanic eruption. Even if the related ash fall from a volcanic eruption were to fall elsewhere, the watersheds, lakes, rivers, and tributaries are vulnerable to damage due to ash fall since ash fall can be carried throughout the area by its rivers and streams. A volcanic blast would expose the local environment to other effects, such as lower air quality, and many elements that could harm local vegetation and water quality, adversely impact wildlife and fish habitat. The sulfuric acid contained in volcanic ash could be very damaging to area vegetation, increasing the risk of wildfire danger, as well as impacting the health of local wildlife.

10.4 FUTURE DEVELOPMENT TRENDS

The CTCR utilize the most recent building codes adopted by the State of Washington, which requires more stringent regulations with respect to support and payload structuring of facilities. Land use development has little influence as the area is not directly impacted by a Lehar zone. However, building codes with respect to load capacity does influence the ability to withstand impact. The Tribe has adopted current IBC standards, which address the load capacity. Given such codes are in place, the Tribe believes that development which has occurred since completion of the last plan has not exacerbated the impact of the Volcano hazard.

10.5 ISSUES

In the event of a volcanic eruption, there would probably not be any direct loss of life in the planning area as a result of the eruption (unless a tribal member were traveling into the areas impacted). However, there could be significant health issues related to ash fall and health concern (especially for the young, elderly and those with breathing issues). In addition, there is also the potential for the increase in motor vehicle accidents, and potential structural damage if large amounts of ash accumulate as a result of the weight of the ash. The potential exists for impact on the agricultural and aquaculture communities for all species of life, and the tourist industry, all of which would have an economic impact not only on the Tribe, but on the entire planning region. There would also be the possibility of severe environmental impacts due to ash within area lakes and streams, with the water supply potentially impacted by ash. A large area could be affected by this, and it is felt that the most severe impacts would be on the planning area's environment and the water supply.

10.6 IMPACT AND RESULTS

Based on review and analysis of the data, the Planning Team has determined that the probability for impact from Volcanic eruption throughout the area is medium, with impact also determined to be at a medium level. The area has experienced some level of ashfall with the last eruption of Mount St. Helens, and with its hatchery and potential population at risk when including tourists, the Planning Team felt this to be of medium impact.

Implementation of mitigation strategies which help increase load capacities on roofs could potentially help reduce the number of structures at risk, along with air purification systems potentially lessening the impact on the population, but the environmental and economic impact cannot be so easily mitigated. Based on the potential impact, the Planning Team determined the CPRI score to be 1.35, with overall vulnerability determined to be a low level.

CHAPTER 11.
COMMUNITY WILDFIRE PROTECTION PLAN

11.1 INTRODUCTION

The Confederated Tribes of the Chehalis Reservation (CTCR) and surrounding landscape exhibits a complex wildfire environment that presents a significant risk to public and firefighter safety, and the built and natural environment.

Washington State as a whole, as well as the surrounding region, has been subject to numerous damaging wildland fires, is influenced by local extreme wind and weather conditions, has varied terrain with a mosaic of different vegetation types, and is characterized by wildland urban interface (WUI) development patterns that can exacerbate wildfire risk.

As a key component of the Healthy Forest Restoration Act of 2003, a Community Wildfire Protection Plan (CWPP) serves as a mechanism for community input and identification of areas presenting high wildfire risk, as well as identification of potential projects intended to mitigate such risk. Further, the CWPP process is intended to provide the community a forum for identifying values at risk from wildfire, which may include people, property, natural resources, cultural values, economic interests, and infrastructure.

The identification of these values at risk by the community strongly influences the potential wildfire hazard mitigation projects identified in this CWPP. This CWPP was developed by the CTCR with input and direction from stakeholders and the community. The purpose of this collaboratively-prepared CWPP is to serve as a fire protection planning document that presents the Tribe's physical characteristics, wildfire hazard, assets at risk from wildfire, vegetation/fuel management projects and specifications, and goals and action items intended to reduce wildfire risk in the Tribe. The ultimate goal of this CWPP is to protect lives, property, and natural resources threatened by wildland fire.

DEFINITIONS

Conflagration—A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup and explosions are usually the elements behind a wildfire conflagration.

Firestorm—A fire that expands to cover a large area, often more than a square mile. A firestorm usually occurs when many individual fires grow together into one. The involved area becomes so hot that all combustible materials ignite, even if they are not exposed to direct flame. Temperatures may exceed 1000°C. Superheated air and hot gases of combustion rise over the fire zone, drawing surface winds in from all sides, often at velocities approaching 50 miles per hour. Within the area of the fire, lethal concentrations of carbon monoxide are present; combined with the intense heat, this poses a serious life threat to responding fire forces. In very large events, the rising column of heated air and combustion gases carries enough soot and particulate matter into the upper atmosphere to cause cloud nucleation, creating a locally intense thunderstorm and the hazard of lightning strikes.

Interface Area—An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together.

Wildfire—Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Due to their distance from firefighting resources, they can be difficult to contain and can cause a great deal of destruction.

This document, as written, serves as the Wildfire Chapter of the Tribe's 2026 Hazard Mitigation Plan, under concurrent development with this CWPP. Maps projected throughout the document are for planning purposes only, and do not represent the exact Reservation Boundary as that changes with some frequency as they relate to fee and trust lands.

A wildfire is defined as any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson. The wildfire season in Washington usually begins in April, picks up in early July, and generally ends in late September; however, wildfires have occurred every month of the year. Fires during the early and late shoulders of the fire season usually are associated with human-caused fires; fires during the peak period of July, August and September often are related to thunderstorms and lightning strikes. Drought, snowpack, and local weather conditions can expand the length of the fire season. Wildfires started by lightning burn more state-protected acreage than any other cause. In recent years, climate change and drought conditions have extended the wildfire seasons, while also exacerbating the impact by increasing not only damages, but also the severity and management of those fires.

11.2 PURPOSE AND NEED

In response to several significant fires occurring throughout the United States from 1995 to 2000, in 2009, Congress passed the Federal Land Assistance, Management, and Enhancement Act (FLAME Act), which directed the U.S. Department of Agriculture (USDA) and the Department of Interior (DOI) to develop a national cohesive wildland fire management strategy. The Cohesive Strategy is centered around three goals to achieve its vision:

1) Restore and maintain landscapes: Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
2) Fire adapted communities: Human populations and infrastructure can withstand a wildfire without loss of life and property.
3) Wildfire response: All jurisdictions participate in making and implementing safe, effective, efficient, risk-based wildfire management decisions.

In furtherance of that strategy, in a 2012 USFS Technical Report NRS-89, it was recommended that a Community Wildfire Protection Plan (CWPP) should fit into the larger picture of planning for natural disasters as a best practice. As such, it was recommended that a CWPP should be incorporated within the Natural Hazards Mitigation Plan. Benefits illustrated in the report include the use of "a variety of data already collected" for the HMP process, making it "easier to link the CWPP to other planning efforts."[43] As such, for ease in use and to reduce redundant

[43] USFS. (2012). Accessed 6 May 2024. Available on-line at: [Best management practices for creating a community wildfire protection plan (usda.gov)]

information, certain areas of this plan will reference sections of the 2026 HMP. Those areas should be considered as though they are fully incorporated within the body of this document.

In response to the FLAME Act and other similar federal initiatives, the Tribe adopted the 2020 Hazard Mitigation Plan, which identified the development of a CWPP and enhancing GIS data (to complete a more robust risk assessment) as projects to help identify areas of concern, and potential fire-related mitigation efforts.

Section 11.1.4 of the 2020 Hazard Mitigation Plan identified the initial planning efforts to begin development of a CWPP, while Section 13, Table 13-2 identified various strategies to help reduce the impact from wildfires (as well as other hazards of concern). Specifically, strategies supporting such efforts include:

- #6, which helps ensure a continued supply of water during and after an event, identifying a needs assessment to determine requirements for equipment and materials necessary to ensure water storage facilities and distribution sources remain operational.
- #19 and #23, which identify public outreach efforts and development of a FireWise program as initiatives to reduce the wildfire risk, to provide public education, and to complete exercises and drills as they relate to the hazards of concern.
- Additional initiatives identified include incorporating stronger build codes to enhance fuels reduction through, for example, landscaping regulations, and to ensure access road reinforcement (used for both evacuation and public safety vehicles).
- As indicated, the HMP also identified the acquisition of additional GIS data to enhance future risk assessments (multiple strategies). In support of that strategy, in 2024, the Tribe applied for and received grant funding for completion of a vegetation study, which was conducted on tribal lands. The development of this CWPP incorporates some of that data as applicable, while also funding the development of this CWPP, and allowing for future progress utilizing the data to enhance climate change adaptation, among other areas of integration.

The CTCR recognizes the potential for significant loss of life, property, cultural and natural resources from wildland fire. In an effort to align with the Cohesive Strategy, CTCR stakeholders expressed an interest in formalizing this CWPP to address the Strategy's and Mitigation Plan's goal at a Tribal level. This alignment reinforces the importance of collaboration among all local, state, tribal, and federal partners, and helps organize the multi-faceted nature of wildfire topics and mitigation strategies. With those goals in mind, this CWPP identifies areas at risk at the Tribal level, prioritizes fuel treatments in general as a strategy, and further recommends ways to reduce structural ignitability by developing risk-reducing strategies at the Tribal level based on capabilities. The Tribe's Public Safety Department, Office of Emergency Management has also begun the process of local-area public outreach to establish FireWise Communities throughout the Tribal Planning Area.

11.3 HISTORY

Community Wildfire Protection Plans have been in place since shortly after the Healthy Forests Restoration Act (HFRA) was signed into law in 2009. HFRA legislation included incentives for the United States Forest Service (USFS) and the Bureau of Land Management (BLM) to give consideration to local community priorities when developing forest management and hazardous fuels reduction projects.

What are the benefits of developing a CWPP?

- Reducing the direct and indirect social, economic, and environmental costs of wildfire
- Coordinating wildfire risk reduction with other community values & priorities
- Bringing together diverse interests to tackle local wildfire challenges and opportunities
- Identifying potential resources and funding for mitigation activities
- Increasing community awareness and engagement in risk reduction

The National Cohesive Wildland Fire Management Strategy is a collaborative process to seek national, all-lands solutions to wildland fire management issues.[44] The Cohesive Strategy has a long list of goals and performance measures establishing a common understanding among all entities interacting in the wildland-urban interface. The Cohesive Strategy required that all wildland fire protection entities assist in the development and implementation of Community Wildfire Protection Plans and comparable land resource management plans to create fire-adaptive communities.

In 2023, the Wildland Fire Leadership Council presented an Addendum to the strategy to identify critical emphasis areas and challenges which were not previously identified or addressed in the 2014 National Cohesive Wildland Fire Management Strategy framework to now include:[45]

1. Climate change;
2. Workforce capacity, health, and well-being;
3. Community resilience (preparation, response, and recovery); and
4. Diversity, equity, inclusion, and environmental justice.

[44] U.S. Forest Service. Accessed 6 May 2024. Available online at: The National Cohesive Wildland Fire Management Strategy and Risk Analysis – Phase III Report (forestsandrangelands.gov)

[45] U.S. Forest Service. Accessed 5 January 2024. National Cohesive Wildland Fire Management Strategy Addendum Update (forestsandrangelands.gov) (2023 Update)

CWPPs are the primary tool that communities use to prioritize wildfire risk reduction and resilience. They can bring together multiple sources of information, activities, and interests into one document, while focusing the reduction activities at the local, community level.

There are three minimum requirements for a CWPP according to HFRA:

1. Show collaboration between tribal, local, and state agencies, in consultation with federal agencies and other interested parties;
2. Identify and prioritize fuel treatments to reduce hazardous fuel areas; and
3. Recommend strategies to reduce the ignitibility of structures.

Those requirements have been met through the CWPP/HMP process. While CWPPs are not legally binding documents, given changing climate conditions and national budgets, they are an effective tool to help communities plan for unknowns with respect to wildfire, while increasing wildfire resilience through established mitigation strategies that provide long-term benefits.

11.4 SCOPE

The landscape for the planning area boundary was established to include all of the properties distributed through the wide-spread areas of the wildland-urban interface - utilizing the same defined planning area boundaries as those identified in the Hazard Mitigation Plan to which this document is a component. This includes all Tribal lands (fee or trust) within Grays Harbor, Thurston, and Lewis Counties. Such lands are not contiguous in nature but are effectively referred to as the Tribal Planning Area. Lands acquired after completion of this CWPP/HMP should also be considered as part of this document with respect to strategies identified and grant eligibility. Future land mass acquired after plan approval and adoption will be incorporated into the risk assessment during future plan updates.

This CWPP is a strategic document that assesses the Tribal landscape, identifying areas with fire risk based on available wildfire information from the various subject matter experts such as Washington State Department of Natural Resources (WDNR), and the U.S. Forest Service (USFS) and the U.S. Department of Agriculture (USDA), among others. The intent of this document is to provide generalized information and over-arching strategies with the expectation that local communities, fire service agencies, the Tribe's CWPP coordinators, and the outlying communities with which they work focus on their immediate areas of concern, identifying additional assets at risk and strategies to reduce the potential for and impact from wildfires within their specific communities as each community has its own unique qualities. It is a starting point for additional community input in the quest to establish more resilient communities. This provides all of the communities the ability to customize their approach based on the community's unique needs.

Similar to the HMP development process, a CWPP also utilizes a collaborative process involving various organizations and agencies described in Chapter 2 of the HMP. Details of the process followed, planning meetings, and plan participants is maintained in Chapter 2 to reduce redundancy of efforts.

In general, the CWPP planning process included five steps:

1. Collection of data about the extent and periodicity of hazards.
2. Observations and estimations about risks, structures and infrastructure to risk areas, access, and potential treatments.
3. Mapping or identification of data relevant to pre-disaster mitigation control and treatments, structures, resource values, infrastructure, risk assessments, and related data.
4. Facilitation of public involvement utilizing a public survey, news releases, public meetings, public review of draft documents, and acknowledgement of the final plan by the signatory representatives.
5. Final drafting of the document compiling the first four steps into one final document.

11.5 LIMITATIONS AND RESTRICTIONS

Wildfire planning is a precise science. During an active fire, data changes very frequently based on weather, topography, wind, vegetation, previous wildfires occurrences, accessibility to areas, land use, and available resources utilized for firefighting, among other factors. Likewise, the landscape in the Tribal Planning Area changes regularly, making annual review of the wildfire hazard profile paramount. As such, no wildfire analysis was conducted as a result of this project. Rather, this project presents existing data developed by various federal and state subject-matter expert agencies (as referenced and cited) to identify areas where wildfires may occur based on established criteria. The websites referenced and utilized within this profile change information and data regularly and allow for the viewing of the data presented in different formats. Likewise, other hazards of concern identified within the HMP, such as Drought and Climate Change, also provide valuable information concerning wildfire impact. Those hazards and the tools and data utilized to determine their impact also change very frequently. As such, readers are encouraged to review the various sources referenced to gain greater understanding and perspective of the data presented.

11.6 GENERAL BACKGROUND

11.6.1 Wildland Urban Interface Areas

In 2001, Congress mandated the establishment of a Federal Register which identifies all urban wildland interface communities within the vicinity of Federal lands, including Indian trust and restricted lands that are at high-risk from wildfire. The list assimilated information provided from States and Tribes and is intended to identify those communities considered at risk.

The wildland urban interface (WUI) is the area where development meets wildland areas. This can mean structures built in or near natural forests, or areas next to active timber and rangelands. The federal definition of a WUI community is an area where development densities are at least three residential, business, or public building structures per acre. For less developed areas, the wildland-intermix community has development densities of at least one structure per 40 acres. Review of the Federal Registry lists several communities within all three counties in which the Tribe owns lands as having areas at high-risk within the vicinity of Federal lands.[46]

Figure 11-1 and Figure 11-2 identify the WUI boundaries throughout the Tribal Planning Area, as established by Washington State Department of Natural Resources, the source deemed the subject matter expert within Washington State.

When identifying areas of fire concern, in addition to the Federal Register, FEMA and the Washington Department of Natural Resources along with other federal partners also determine communities at risk based on fire behavior potential, fire protection capability, and risk to social, cultural, and community resources. These risk factors include areas with fire history, the type and density of vegetative fuels, extreme weather conditions, topography, number and density of structures and their distance from fuels, location of municipal watersheds, and likely loss of housing or business. The criteria for making these determinations are the same as those used in the National Fire Protection Association's *NFPA 299 Standard for Protection of Life and Property from Wildfire*. Based on these criteria, the Tribal Planning Area encompasses locations considered to be at high risk.

Wildfires can occur on any lands—private, state, tribal, and federal land. Fires can spread across these multiple land ownerships. As a result, wildland firefighting is by necessity most often a multi-agency effort. Efforts to reduce the likelihood of a fire and its intensity (related to fuels and topography) can have significant consequences on homeowner and firefighter safety, as well as on the built environment, especially homes. As with many hazards, wildfires do not respect property boundaries, burning across various types of land ownership. Efforts to mitigate the likelihood or intensity of wildfires can have significant impact on lands and properties. Fuel treatments on specific lands can help lower the intensity of a wildfire, reducing the risk to surrounding homes and property.

The biggest land ownership inclusive of all land within the three counties encompassing the Tribal Planning Area is the federal government, which includes U.S. Forest Service (USFS) lands. Application of mitigation efforts on the USFS lands could help reduce impact to surrounding properties. At the local level, municipalities can help reduce the susceptibility of homes to

[46] https://www.federalregister.gov/documents/2001/01/04/01-52/urban-wildland-interface-communities-within-the-vicinity-of-federal-lands-that-are-at-high-risk-from

wildfire through things such as land use planning or the application of building codes. Homeowners can focus on the areas immediately surrounding their homes by landscaping, or placing screens on eave vents, thereby reducing fuel sources or the spread of fire by limiting ignition by embers.

When viewing the capabilities in place, social, and economic factors must also be reviewed, as those elements can make it more difficult for some people to prepare for, respond to, and recover from wildfire. Vulnerable populations may lack access to resources, experience cultural and institutional barriers, have limited mobility, limited ability to speak or understand English, or have medical conditions which can influence their response to wildfire.

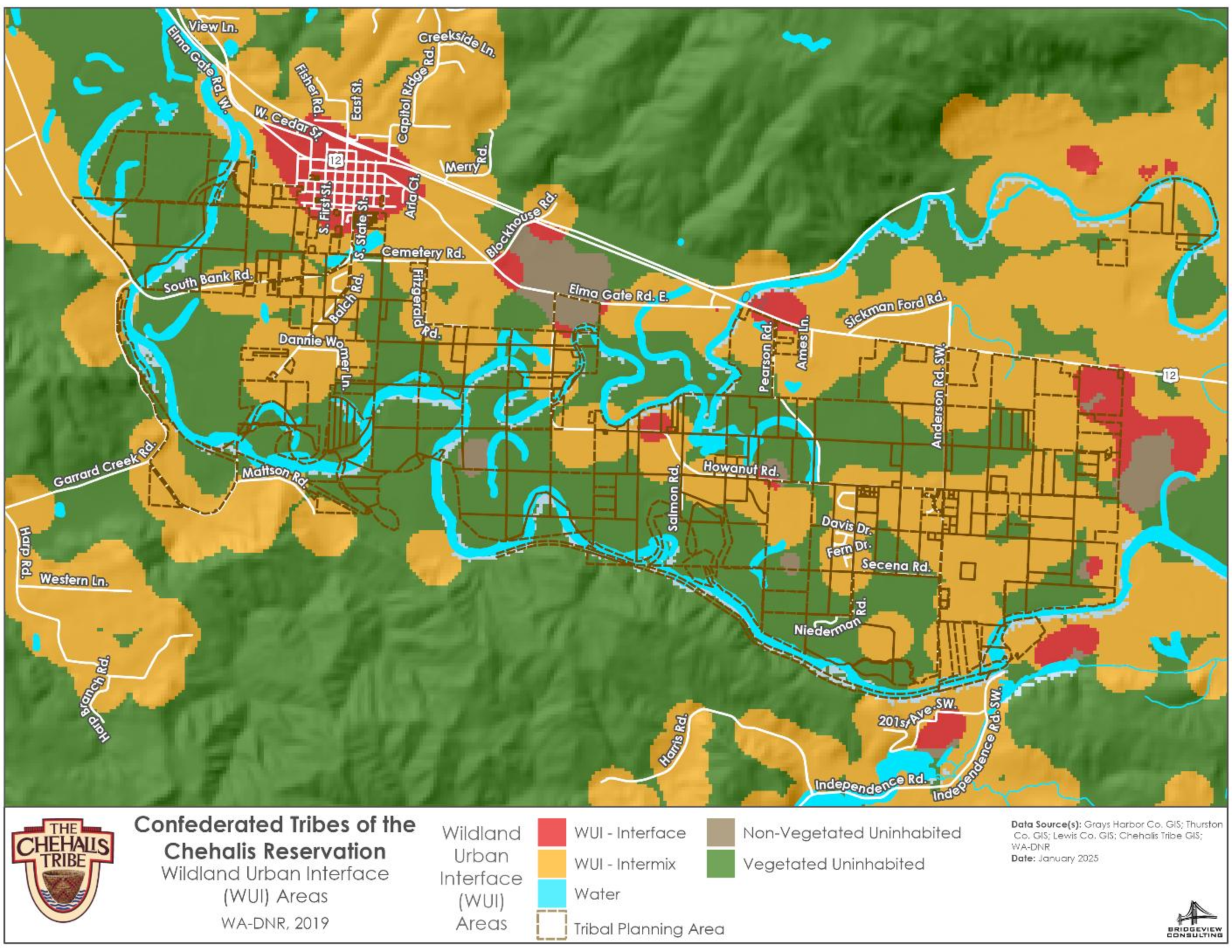


Figure 11-1 - CTCR Reservation Boundary WUI Areas

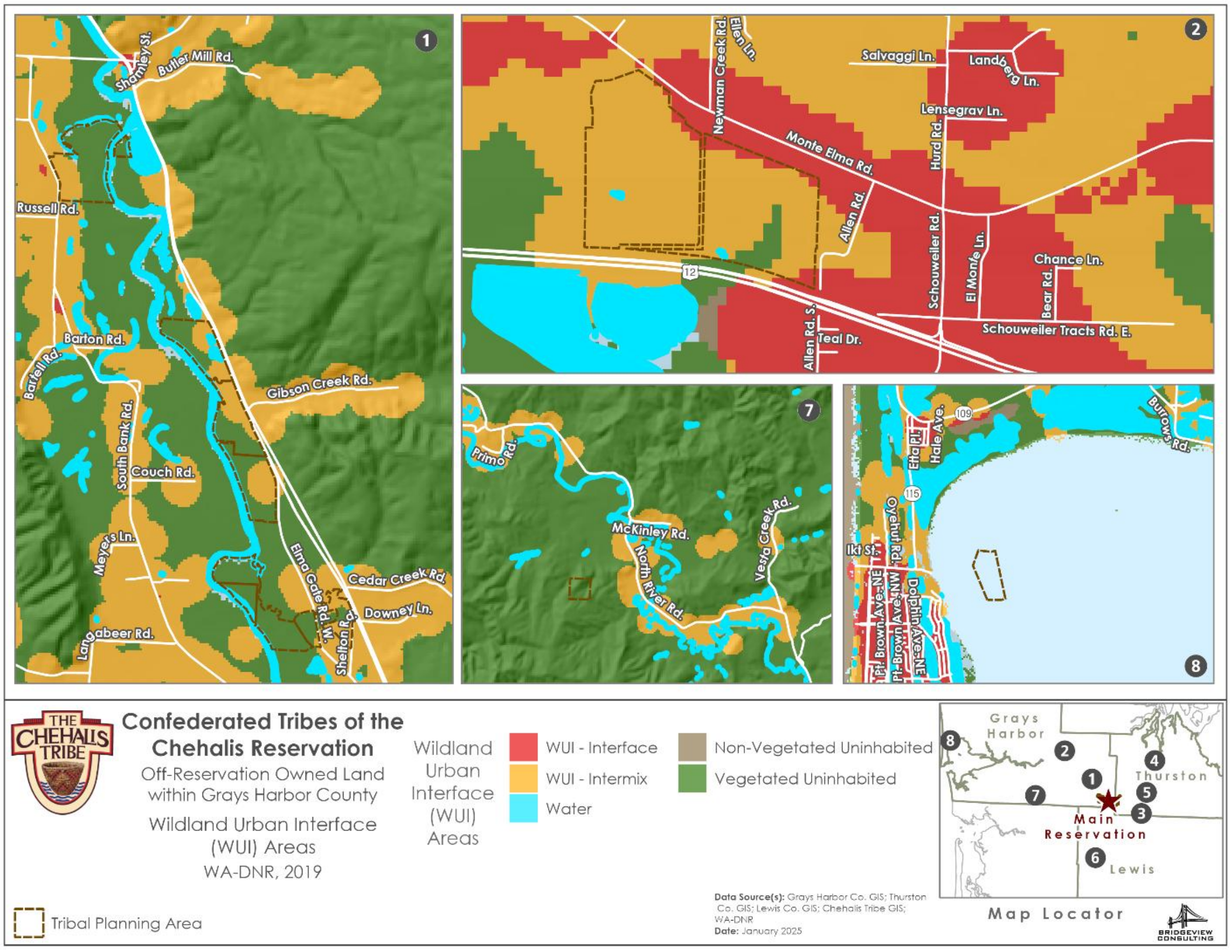


Figure 11-2 Tribal Lands within WUI Boundaries in Grays Harbor County

11.7 IDENTIFYING WILDFIRE RISK

Risk to communities is generally determined by the number, size, and types of wildfires that have historically affected an area; topography; fuel and weather; suppression capability of local and regional resources; where and what types of structures are in the WUI; and what types of pre-fire mitigation activities have been completed. Identifying areas most at risk to fire or predicting the course a fire will take requires precise science. The following data sets are most useful in assessing risk in the area:

- **Topography (slope and aspect) and Vegetation (fire fuels)**—These are two of the most important factors driving wildfire behavior.
- **Weather**—Regional and microclimate variations can strongly influence wildfire behavior. Because of unique geographic features, weather can vary from one neighborhood to another, leading to very different wildfire behavior.

- **Critical Facilities/Asset Location**—A spatial inventory of assets—including homes, roads, fire stations, and natural resources that need protection—in relation to wildfire hazard helps prioritize protection and mitigation efforts.

11.8 WILDFIRE BEHAVIOR

The wildfire triangle (see Figure 11-3; DeSisto et al., 2009) is a simple graphic used in wildland firefighter training courses to illustrate how the environment affects fire behavior. Each point of the triangle represents one of three main factors that drive wildfire behavior: weather, vegetation type (which firefighters refer to as "fuels"), and topography. The sides represent the interplay between the factors. For example, drier and warmer weather combined with dense fuel loads (e.g., logging slash) and steeper slopes will cause more hazardous fire behavior than light fuels (e.g., short grass fields) on flat ground.

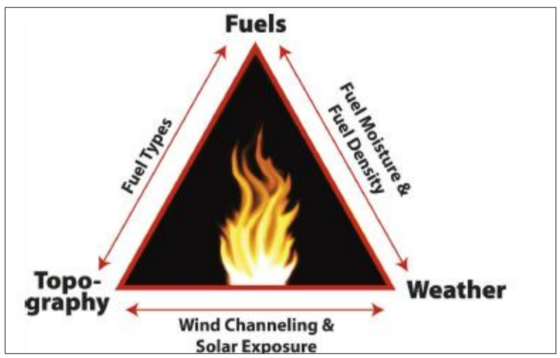


Figure 11-3 Wildfire Behavior Triangle

The following are key factors affecting wildfire behavior:

- **Fuel**—Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Snags and hazard trees—those that are diseased, dying, or dead—are larger but less prolific west of the Cascades than east of the Cascades.

- **Weather**— Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. Of particular importance for wildfire activity are wind and thunderstorms:
    - Strong, dry winds produce extreme fire conditions. Such winds generally reach peak velocities during the night and early morning hours. East wind events can persist up to 48 hours, with wind speed reaching 60 miles per hour.

  - The thunderstorm season typically begins in June with wet storms and turns dry with little or no precipitation reaching the ground as the season progresses into July and August.

- **Topography—**Topography includes slope, elevation, and aspect. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of landforms (fire spreads more easily uphill than downhill).

- **Time of Day**—A fire's peak burning period generally is between 1 p.m. and 6 p.m.

- **Forest Practices—**In densely forested areas, stands of mixed conifer, hardwood and softwood stands that have experienced thinning or clear-cut provide an opportunity for rapidly spreading, high-intensity fires that are sustained until a break in fuel is encountered.

Fires can be categorized by their fuel types as follows:

- **Smoldering**—Involves the slow combustion of surface fuels without generating flame, spreading slowly and steadily. Smoldering fires can linger for days or weeks after flaring has ceased, resulting in potential large quantities of fuel consumed. They heat the duff and mineral layers, affecting the roots, seeds, and plant stems in the ground. These are most common in peat bogs but are not exclusive to that vegetation.

- **Crawling**—Surface fires that consume low-lying grass, forest litter and debris.

- **Ladder**—Fires that consume material between low-level vegetation or forest floor debris and tree canopies, such as small trees, low branches, vines, and invasive plants.

- **Crown**—Fires that consume low-level surface fuels, transition to ladder fuels, and also consume suspended materials at the canopy level. These fires can spread rapidly through the top of a forest canopy, burning entire trees, and can be extremely dangerous (sometimes referred to as a "Firestorm").

Wildfires may spread by jumping or spotting, as burning materials are carried by wind or firestorm conditions. Burning materials can also jump over roadways, rivers, or even firebreaks and start distant fires. Updraft caused by large wildfire events draw air from surrounding area, and these self-generated winds can also lead to the phenomenon known as a firestorm.

Forestlands in the planning area are susceptible to disturbances such as those caused by logging slash accumulation, forest debris accumulations due to weather damage, and periods of drought and high temperature, which creates additional fuels. Forest debris from western red cedar, western hemlock, and Sitka spruce can be especially problematic and at risk to wildfires when slash is accumulated on the forest floor, because such debris resists deterioration. When ignited, these fuels can be explosive and serve as ladder fuels carrying fire from the surface to the canopy.

11.9 WILDFIRE IMPACT

The potential for significant loss of life or injuries and damage to property exists with all wildfires. Loss caused by a wildfire can include the destruction of homes, businesses, critical facilities and infrastructure, timber, wildlife habitat, scenic vistas, and watersheds, among others.

Long-term effects include smaller timber harvests, reduced access to affected recreational areas, invasive species, and destruction of cultural and economic resources and community infrastructure, among others. Vulnerability to flooding also increases due to the destruction of watersheds, which can then change the landscape of the community.

11.9.1 Secondary Hazards

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildfires cause the contamination of reservoirs, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soil and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soil, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

11.10 HAZARD PROFILE

11.10.1 Extent and Location

The Washington State HMP does not identify Grays Harbor, Thurston or Lewis Counties County as being at significant or high risk (an identified “hot spot”) to wildfire danger. This is not to say that wildfires cannot occur, as they can occur in any area of the state; however, based on historic records for the last 50 years, impact has been more limited in nature (see 2023 State HMP, Figure 31, p.76).[47]

Significant wildfire events over the course of the last several years have diminished in the actual number of fires statewide since Washington experienced one of its worst fire seasons ever in 2020; however, those fires that have occurred showed increases in acres burned, and the personnel and equipment needed to manage the events. This, in large part, is due to the availability of fuel.

Given the Tribal Planning Area's rural land use complexity, densely wooded areas in some portions of the Tribal Planning Area, agricultural lands with fast-burning grasses, and its proximity to the various large park systems (both federal and state), the planning team did feel that the entire region is susceptible to impact from wildfire, either as a direct result, or as a secondary result from health or economic impact.

The Tribal Planning Area is a more sparsely populated planning region. Much of the area also has a lower median household income, with higher rates of poverty when compared to the other areas of the state. Studies have shown a correlation between lower and higher socioeconomic status, and the impact of wildfires. Historically, rural areas where income and employment status may be lower than state average, or where land use associated with undeveloped or minimally developed areas tend to be associated with larger fires.

Figure 11-4 and Figure 11-5 identify the wildfire hazard potential (WHP) based on USFS *Wildfire Risk to Communities* data. The data illustrates the five classes of wildfire hazard as very low, low, moderate, high, and very high. Areas mapped with higher WHP values represent fuels with a higher probability of experiencing torching, crowning, and other forms of extreme fire behavior under conducive weather conditions. This data also highlights places where vegetation treatment resources may be best utilized. Review of the data identifies the Tribal Planning Area at low-to-moderate risk levels on the CTCR Reservation. Areas within Thurston and Lewis Counties in proximity to tribal lands identify very low, low, and moderate risk levels. Figure 11-6 and Figure 11-7 illustrate those areas in conjunction with CTCR critical facilities. Again, while the levels may appear to be low, this does not mean that fires cannot occur, but rather based on historic events, vegetation, etc., the risk factor is lower than in other areas. This data is further defined by the USFS, available for review at [Wildfire Hazard Potential | US Forest Service Research and Development].

[47] Washington State Enhanced Hazard Mitigation Plan (2023). Accessed multiple times. Available online at: [2023_WA_SEHMP_final_20231004.pdf]

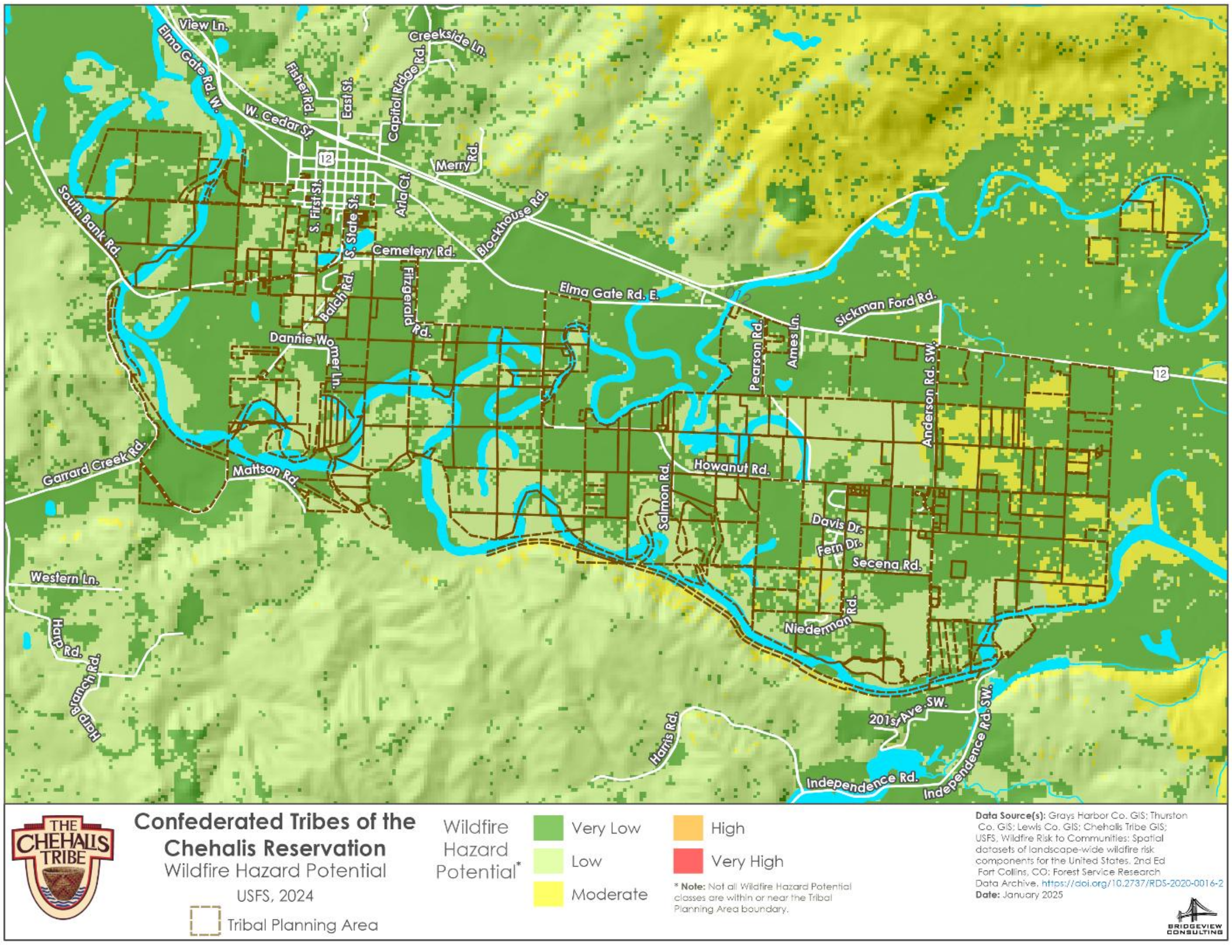


Figure 11-4 CTCR Reservation Wildfire Hazard Potential (USFS)

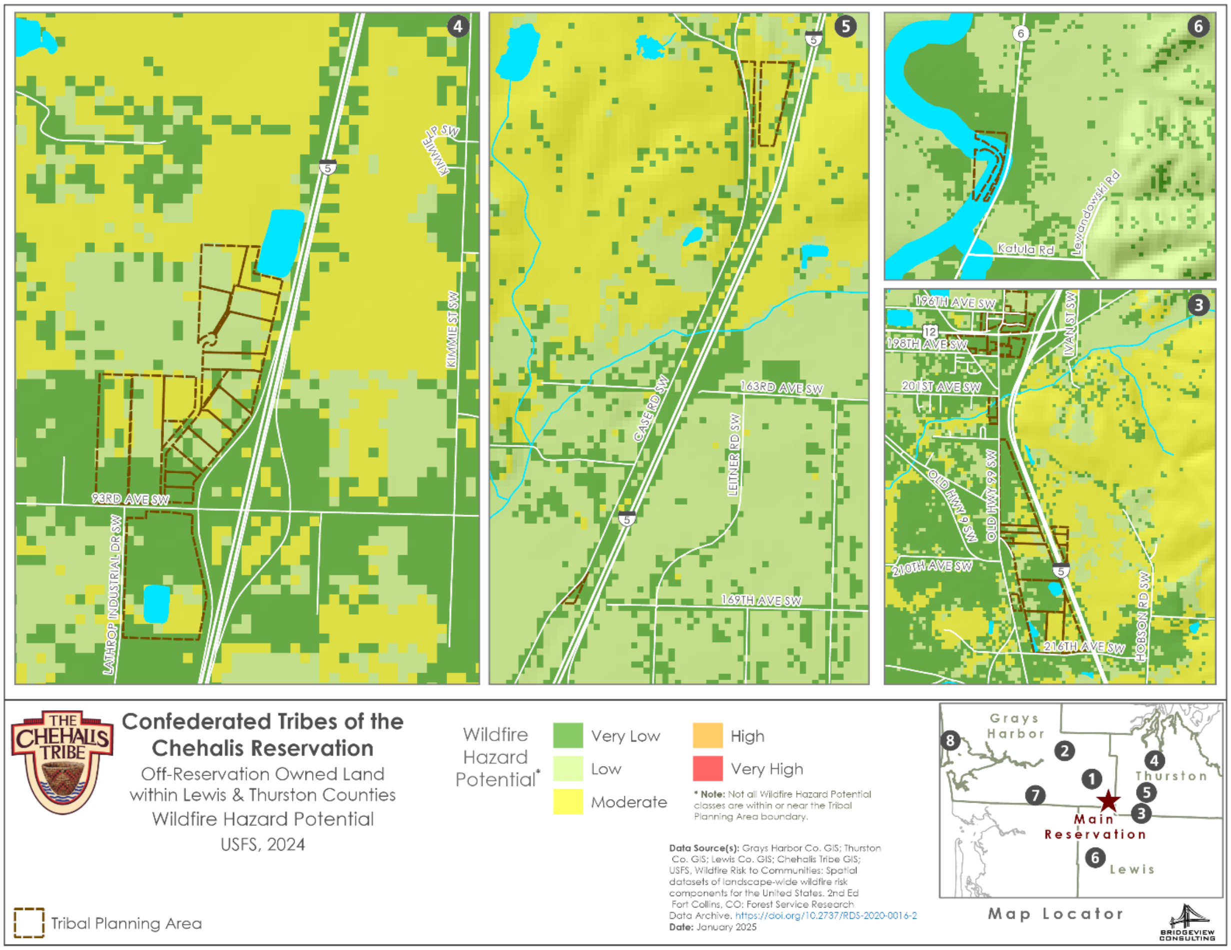


Figure 11-5 Wildfire Hazard Potential for CTCR Owned Lands (USFS)

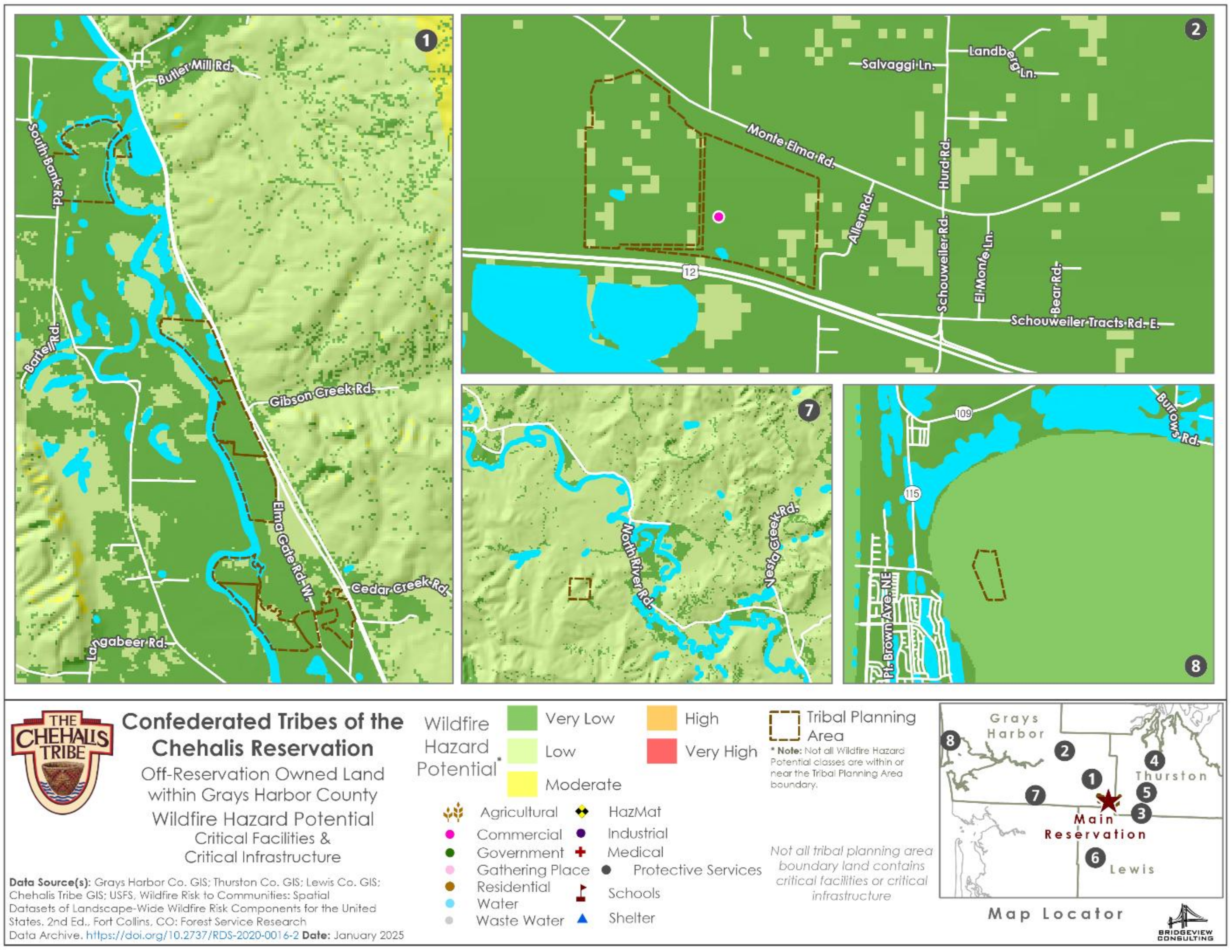


Figure 11-6 CTCR Critical Facilities at Risk within Wildfire Hazard Zones

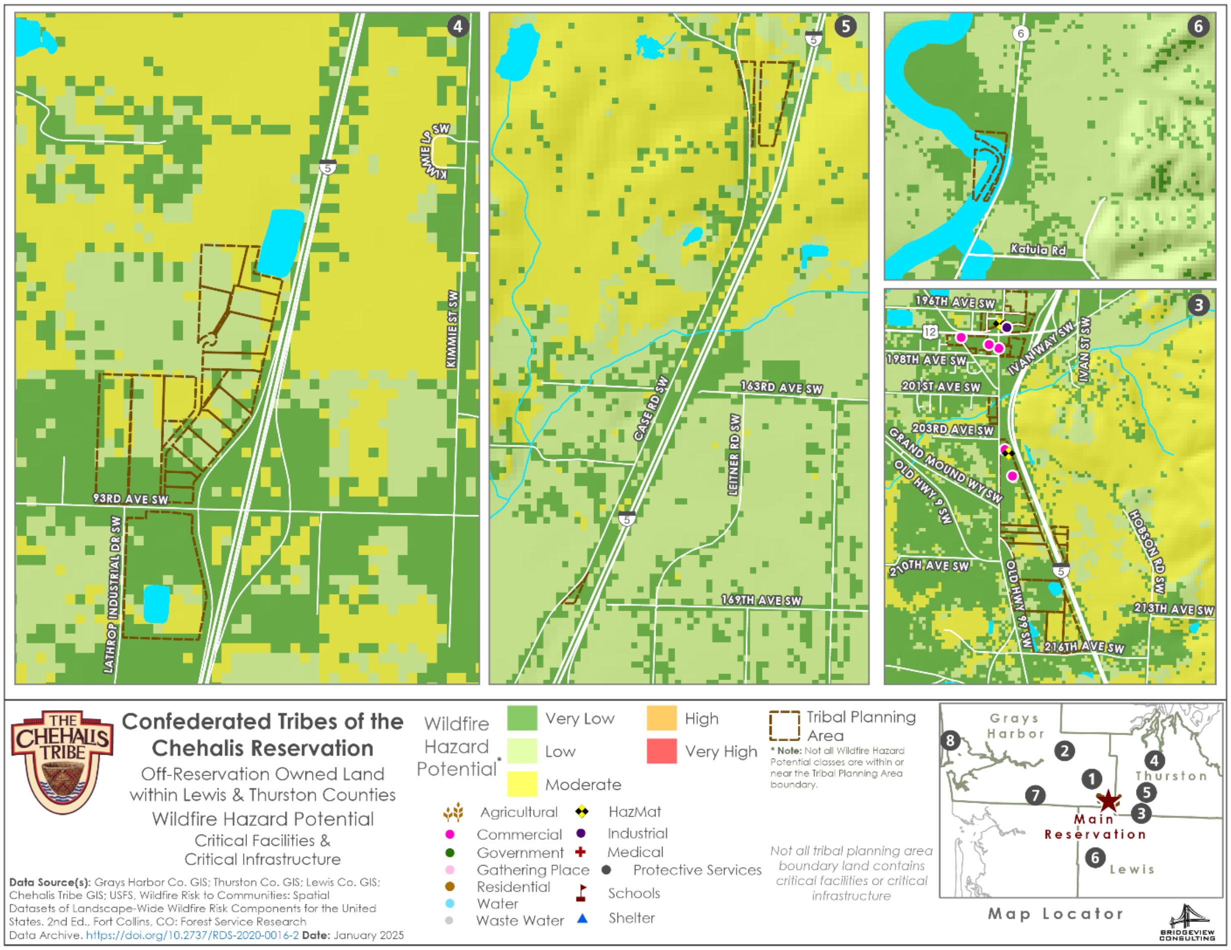


Figure 11-7 CTCR Critical Facilities at Risk within Wildfire Hazard Zones

11.10.2 Previous Occurrences

Wildfires have been a common occurrence throughout Washington for thousands of years. Evidence from tree rings or fire-scarred trees indicates cycles of prehistoric fires burned in many locations in both Eastern and Western Washington. Natural fire occurrences are directly related, but not proportional, to lightning incidence levels. It is rare for a summer to pass without at least one period of lightning activity. Lightning incidence is greatest during July and August, though storms capable of igniting fires have occurred from early spring to mid-October. Lightning storms generally track in a southwest to northeast direction.

Within Washington, lightning storms are typically followed by light to moderate amounts of precipitation. The rainfall may extinguish the fires, while high fuel moisture inhibits spread. However, prolonged periods of warm, dry weather, especially in combination with east winds, often reveal numerous latent “sleepers.” While most lightning fires are less than a quarter acre in size, occasional large fires during dry periods account for most of the burned acreage. Wildfires can also occur at all times of the year, sparked by lightning. As of this update, Grays Harbor County experienced lightning (and water-spout) events occurring in late-November.

The CTCR have never received a disaster declaration for a wildfire incident. Planning Team Members do not remember there ever being an incident which required evacuation orders to be issued as a result of a wildfire occurring in the Tribal Planning Area. All three surrounding counties have previously issued burn bans, which the Tribe has also issued. The Tribe does have regulatory authority in place to issue and enforce burn bans.

The following information gathered from local hazard mitigation plans (as well as other data cited) helps identify previous incidents occurring within the Tribal Planning Area, which helps to identify the potential risk associated therewith.

Since 2020, Thurston County has received one Fire Mobilization Declaration due to the Bordeau Road Fire, which destroyed two homes and two out buildings, and burned 268 acres in the Littlerock area before it was extinguished. While the fire did not directly impact the Reservation via acres burned, it did have significant impact on them with respect to smoke, and at times, ingress and egress to areas of the Reservation due to road closures. Tribal members were also concerned that the fire could move south and cross over the Black River, causing damage and potential environmental impact. Review of Thurston County's HMP (2024) identifies one additional fire of significance occurring in 2017. It further indicates the majority of the Reservation (or tribal lands falling within Thurston County) fall within the Wildland Urban Intermix Zone, with limited areas falling within the Interface Zone. The majority of the County wherein the Tribal Planning Area is situated falls within the very-low or low wildfire hazard classifications (Thurston County HMP, 2024, Map 4.9.4, p. 4.9-20).

There have been no declared fire events in Lewis or Grays Harbor Counties. Review of Lewis County's 2024 HMP (approval pending), does indicate two large fires occurring in recent years – the Goat Rocks Fire, which burned 6,196 acres in 2022, and the Cowlitz Complex fire, which burned 721 acres in 2023. Further review indicates that large portions of the eastern section of the county are at higher risk, going from low/medium threat levels in the western portions of the county, to high/very high threat levels in the eastern portions of Lewis County. Lands currently owned by the CTCR within Lewis County are in the western portions of the County, and presumably at a lower risk.

Review of Grays Harbor County's 2024 HMP indicates an increase in wildfire occurrences during the period 2018-2023, with 300 wildfire events of various types and severity occurring. When averaged, this equates to ~60 fires per year occurring. The majority of the county (60 percent) falls within the Wildland Urban Intermix Zone, with some areas in closer proximity to the municipal hubs falling within the Interface Zone (38 percent). The interface zones are at higher risk to direct ignition from fires occurring as a result of proximity and density customarily found within the interface areas (Grays Harbor HMP, Figure 13-7, p. 13-16). Grays Harbor County also has a large land mass associated with federal parks and ocean beaches, with both drawing a significantly higher rate of tourists (millions) than the other counties in which the CTCR own land/structures, further increasing the wildfire danger. While FEMA's National Risk Index identifies Grays Harbor County's Wildfire risk as very low, review of the County HMP indicates that its planning team did not agree with that finding, and feels it is at a higher risk level, particularly depending on the location of the fire given that portions of the county are much wetter than the inland areas, which have experienced drought-like conditions. The inland areas are those associated with the CTCR.

Review of Lewis County's HMP, which incorporates the Homepage - Wildfire Risk to Communities national dataset, found that almost the entire population (94.8%) reside in areas with a very low fire likelihood (0% to 0.01% annual chance).

On a state and national scale, review of various national and state level datasets indicates no large fires occurring in the Tribal Planning Area; however, large fires in these instances are identified as burning 1,000 acres or more.

According to the National Interagency Coordination Center (NICC) (2024), during 2023, nationally there were 56,580 wildfires that burned 2,693,9100 acres. The total number of fires and acres burned were both below the five- and ten-year averages (see Figure 11-8).[48] The number of acres burned were also well above both the five- and ten-year national averages.

Review of the NICC data for the geographic area of the Northwestern states, which includes Washington and Oregon, wildfires in 2023 represented seven percent of the national total (see Figure 11-9).[49]

Review of data at a national level also provides us with a snapshot of potential resource needs. As wildfires know no boundary, resource requests are frequently made nationally for local assets and response teams. A few examples follow.

- In 2023, Canada experienced an unprecedented wildfire season which burned over 45 million acres. The United States was one of 12 countries that mobilized wildland fire personnel to Canada to provide assistance.
- In August of 2023, the Town of Lahaina and Upcountry Fires on Maui, Hawaii also experienced a wind-drive fire which killed at least 100 people and burned more than 2,000 structures. This fire represents the nation's deadliest wildfire in over 100 years.

[48] annual_report_2023_0.pdf (nifc.gov)

[49] https://www.nifc.gov/fireInfo/fireInfo_stats_lightng.html

- As of this 2025 update, wind-driven wildfires raging throughout California caused the death of several people, while also destroying entire communities. Firefighting response not only included Washington resources, but resources from other countries as well.

While it is necessary to provide resources to other entities being impacted, in sending those resources, it depletes assets and resources within the local communities. While the State of Washington does have compacts in place for local agencies to assist one-another, response times could be increased – in some cases significantly, if resources are depleted.

When viewed nationally, human-caused fires within the Northwestern region accounted for only seven percent of the national total for 2023, but those human-caused fires accounted for 15 percent of the national total of acres burned. Table 11-1 illustrates the numbers of human- and lightning-caused fires, as well as the acres burned for 2023 (most recent full-year reporting).

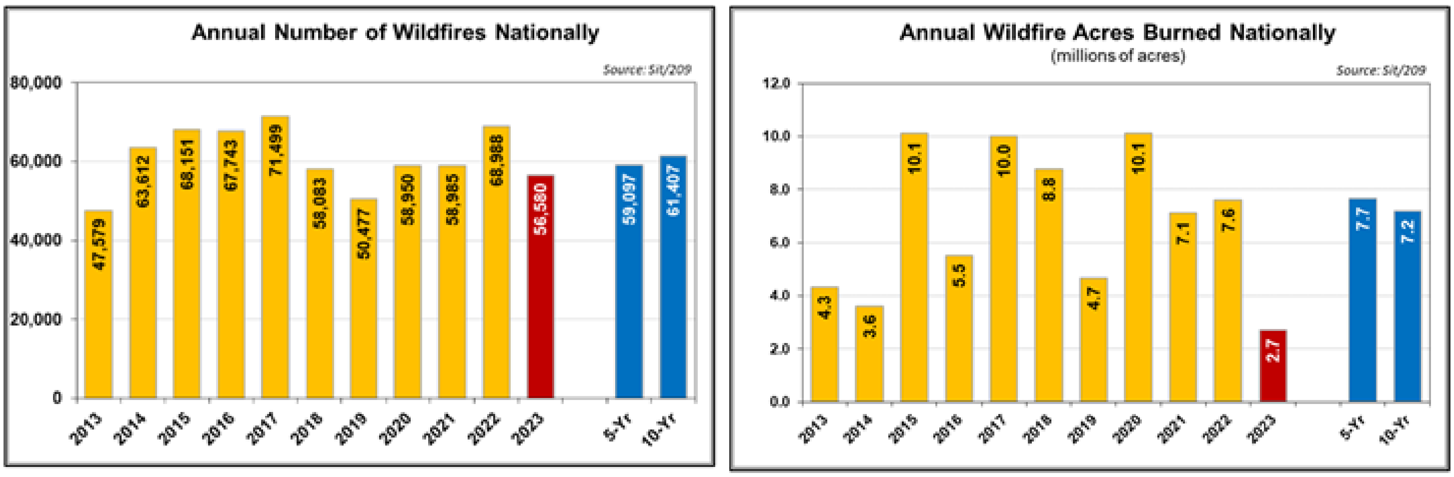


Figure 11-8 Annual Number of Wildfires and Acres Burned Nationally (2023)

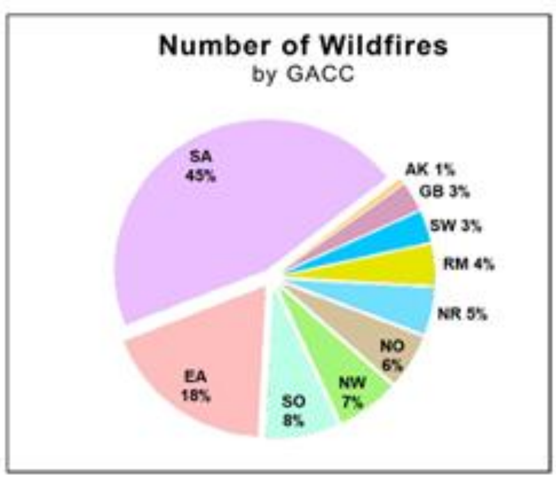


Figure 11-9 Percent of National Wildfires by Geographic Area - 2023

TABLE 11-1 WASHINGTON STATE 2023 FIRE HISTORY BY TYPE AND ACRES						
Agency	**Fires – Human**	**Acres – Human**	**Fires – Lightning**	**Acres- Lightning**	**Fires – Total**	**Acres - Total**
BIA	189	2,198	25	824	214	3,022
BLM	51	20,563	8	471	59	21,034
C&L	9	1,060	1	0	10	1,060
DNR	983	90,374	123	1,505	1,106	91,878
FS	147	704	116	15,738	263	16,442
FWS	24	5,246	1	14	25	5,260
NPS	5	1	21	7,467	26	7,468
ST	3	4,626	1	526	4	5,152
TOTALS	**1,411**	**124,772**	**286**	**26,545**	**1,707**	**151,316**

NOAA data illustrates the months of July, August, and September as the months most often impacted by wildfire within the Tribal Planning Area, although they can occur at any time if the conditions are right.[50] With the increased temperatures associated with climate change, which also increases the drought potential, it is anticipated that the wildfire season will expand.

11.10.3 Severity

Potential losses from wildfire include human life, structures and other improvements, economic losses, and impact or loss to natural and cultural resources. The severity of the fire is dependent on many factors, including fuels, moisture content, previous treatments or other mitigation efforts which have occurred, topography of the environment, and resources available to fight the fires, among other factors.

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations such as children, the elderly and those with respiratory and cardiovascular diseases, particularly if fine particulate matter, or particles smaller than 2.5 micrometers, are inhaled deeply into the lungs, which increases the severity of certain types of health concerns.

[50] NOAA National Centers for Environmental Information. Storm Events Database. Accessed 20 Feb. 2025. Available at: Storm Events Database - Search Page | National Centers for Environmental Information

Between 2012 and 2022, there were four years when most of Washington's population lived in areas where there was "unhealthy" or worse air quality for at least one day according to the Washington State Department of Ecology's Air Quality Index.[51] Often when a larger population is exposed, it is due to smoke from distant wildfires that covers Washington (and beyond) for multiple days. Depending on the meteorological conditions, smoke from more local wildfires can also impact large population centers. The particulate matter in the atmosphere (smoke, dust, or pollution) can also block sunlight by absorbing or by scattering light. During the 2023 wildfires occurring in Canada, much of the United States was impacted by the wildfire smoke, with temperatures falling below projections as the smoke blocked the sunlight. Approximately 80 million people nationwide (as far down as the Carolinas) were impacted by the smoke.

Wildfire may also threaten the health and safety of those fighting the fires. Wildfire can also lead to ancillary impacts such as landslides in steep ravine areas and flooding due to the impacts of silt in local watersheds. A large-scale wildfire would destroy the natural habitat for generations.

Extreme fires, when they occur, are characterized by more intense heat and preheating of surrounding fuels, stronger flame runs, potential tree crowning, increased likelihood of significant spot fires, and fire-induced weather (e.g., strong winds, lightning cells). Extreme fire behavior is significantly more difficult to combat and suppress and can drastically increase the threat to homes and communities.

Due to many years of fire suppression, logging, and other human activities, the forests and rangelands of the planning area have changed. Areas that historically experienced frequent, low-severity wildfires now burn with much greater intensity due to the build-up of understory brush and trees. At times, this equates to fires which are larger and more severe, killing the trees and vegetation at all levels. The combination of steep slopes, canyons, open rangeland, and fuel type have a history and potential for fast moving and fast spreading wildfires.

The planning area is also vulnerable to wind-driven fires, whose embers could easily ignite grasses, and fields, and cause spot fires in more populated areas, increasing the severity of the fire. While the Tribe has never issued evacuation orders as a result of a wildfire, with the continued impact of climate change and increased summertime temperatures, wildfire risk and the intensity of wildfires will continue to grow.

While large wildfires regularly occur within Eastern Washington, large fires within Western Washington have historically occurred less frequently, although that is seen to be changing as larger fires have occurred within Western Washington since completion of the 2020 plan. Due to firefighting efforts, many wildfires have been contained with limited impact on acreage burned or structure loss. According to Washington State Department of Natural Resources, the 2022

[51] Washington State Department of Ecology – Air Quality Program Interactive Map. Smoke Forecast (wa.gov)

wildfire season was the "least destructive in a decade with just over 140,300 acres burned" (WA DNR, 2022).[52]

11.10.4 Frequency

The State's HMP indicates a 70 percent annual probability for a wildfire declaration each year within Washington (WA HMP, p. 75). The demonstrated frequency of wildfires and their severity has increased significantly over the last 50 years, with large fires becoming more likely in both eastern Washington and western Washington.

As previously indicated, the CTCR has never been directly impacted by a wildfire; however, the surrounding communities have, with Grays Harbor County seeing a significant increase over the course of the last 10 years.

Fires historically burn on a regular cycle, recycling carbon and nutrients stored in the ecosystem, and strongly affecting species within the ecosystem.[53] As human development expands further into fire-prone landscapes, the influence of human activities will impact when and where wildfires occur, increasing both risk and vulnerability to people, property, the economy, and the environment, including both natural and cultural resources.

The US Forest Service (USFS) and the US Department of Agriculture's (USDA) Wildfire Risk to Communities data illustrates the overall likelihood of the CTCR experiencing a wildfire is 19 percent greater when compared to all other reservations and their identified off reservation trust lands nationwide (see Figure 11-10), including those in the more populated areas.

When compared statewide, homes on the CTCR or reservation trust lands have, on average, greater risk than 31 percent of other tribal areas and counties in the state to experience a wildfire.[54] (NOTE: In calculating the Risk to Homes, USDA and USFS includes a 2.4 km or ~1.5-mile buffer around populated areas to incorporate the risk of embers.)

---

[52] Washington State Department of Natural Resources. Available online at: [Late wildfire season underscores importance of forest management – Washington Forest Protection Association (wfpa.org)]

[53] The Wildfire Risk to Communities data integrates wildfire likelihood and wildfire intensity from simulation modeling. Together, wildfire likelihood and intensity represent hazard. To translate this into terms specific to the effect of fire on homes, Wildfire Risk to Communities uses a generalized concept of susceptibility for all homes. In other words, Wildfire Risk to Communities assumes all homes that encounter wildfire will be damaged, and the degree of damage is directly related to wildfire intensity. Wildfire Risk to Communities does not account for homes that may have been mitigated. For more information, see: [Wildfire Risk to Communities]

[54] USDA, USFS – Wildfire Risk to Communities. Accessed 15 Feb 2025. Available online at: [Wildfire likelihood in Chehalis Reservation and Off-Reservation Trust Land - Wildfire Risk to Communities]

Review of the data also indicates that the CTCR is more likely to experience wildfire from a direct source (81 percent of buildings) versus an indirect source (19 percent of buildings). This means that homes may be ignited by adjacent flammable vegetation, as well as indirect sources, such as embers (see Figure 11-11).[55] These direct- and indirect-exposure zones are also areas where mitigation activities will be most effective at protecting homes and other buildings from wildfires (see Figure 11-12).

Frequency can also be associated with drought patterns related to large-scale climate patterns in the Pacific and Atlantic oceans. The El Niño–Southern Oscillation varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a 65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region. El Niño years bring drier conditions to the Pacific Northwest and, often, more fires. We have also seen that as human development has expanded into the more fire-prone landscapes, the influence of human activities has begun to shadow climate change in effecting when and where wildfires occur, demonstrating the need to address the issue at policy or programmatic levels to address the socioeconomic influences associated with human ignitions.

[55] Wildfire Hazard Potential | US Forest Service Research and Development

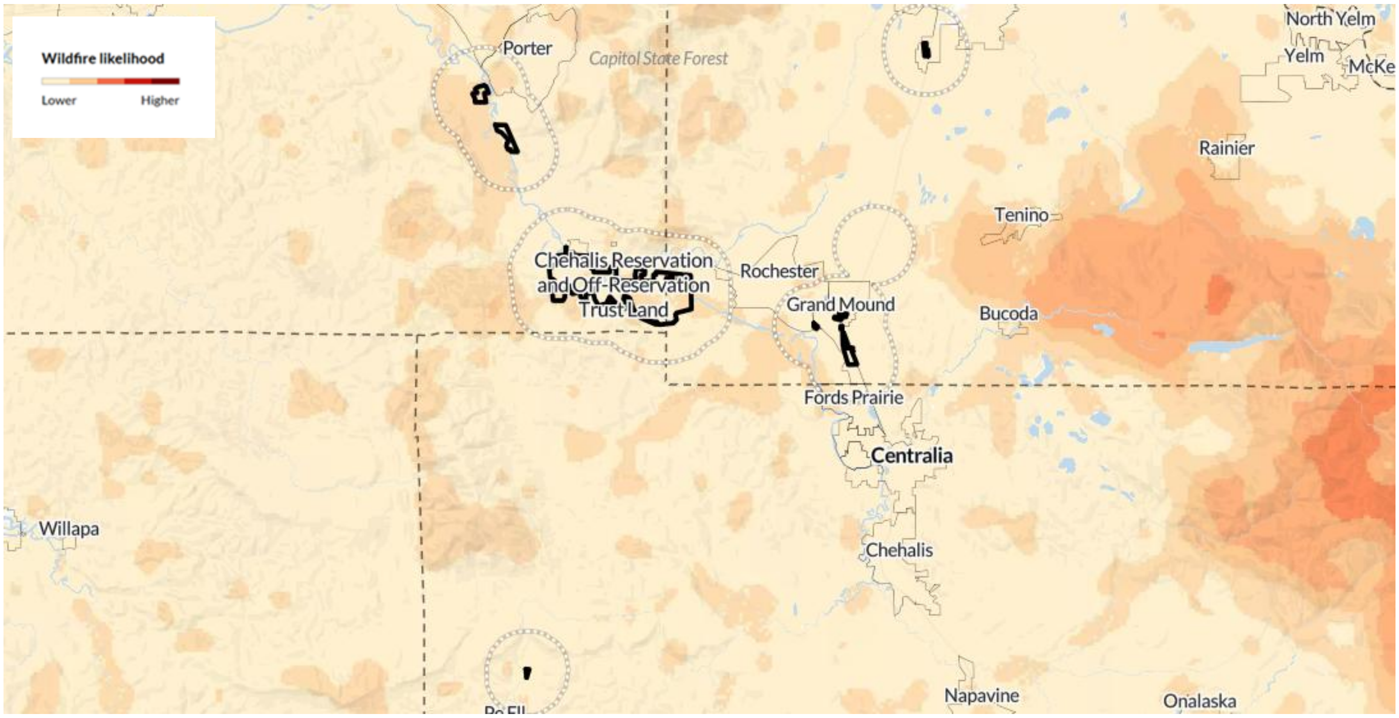


Figure 11-10 FEMA Wildfire Risk to Communities - Likelihood of Occurrence – All Lands

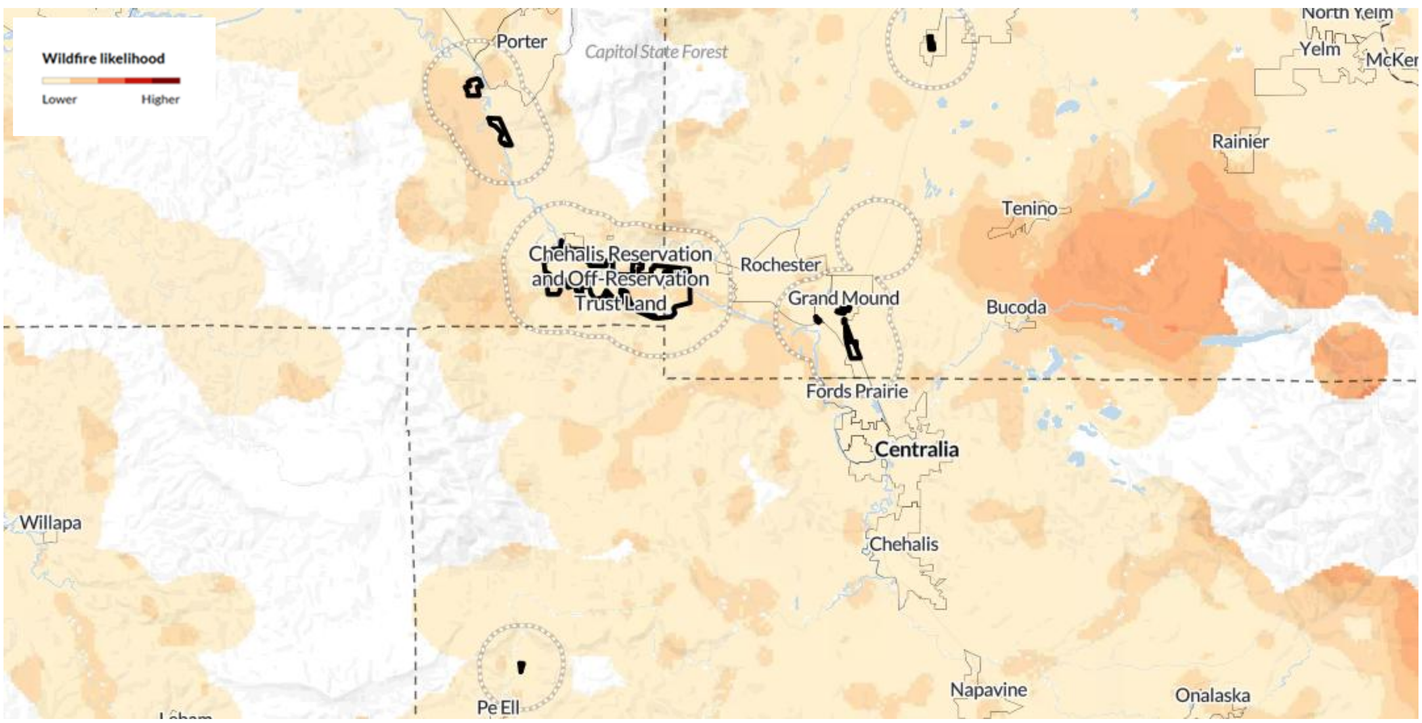


Figure 11-11 Wildfire Risk to Communities Likelihood of Occurrence - Populated Areas

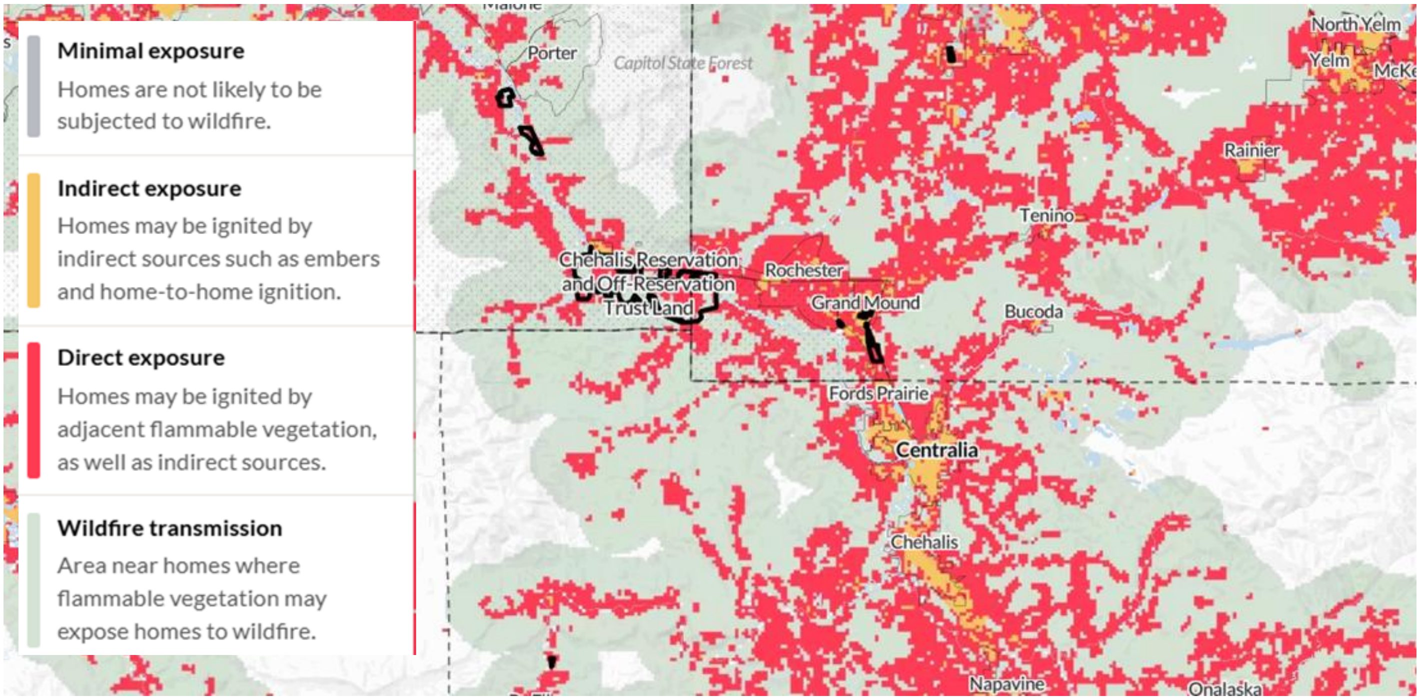


Figure 11-12 Wildfire Exposure Zones

LandFIRE

Landscape Fire and Resource Management Planning Tools, (LANDFIRE) is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing geo-spatial data and information utilized to support wildfire planning, management, and operations. The LANDFIRE Project produces maps of simulated historical fire regimes and vegetation conditions (among others) using the LANDSUM landscape succession and disturbance dynamics model (see LANDFIRE at Homepage | LandFire for additional information).

Historic Fire Regimes

Many ecosystems are adapted to historical patterns of fire. These patterns, called "fire regimes," include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. A fire regime refers to the frequency and intensity of natural fires occurring in various ecosystem types. Alterations of historical fire regimes and vegetation dynamics have occurred in many landscapes in the U.S. through the combined influence of land management practices, fire exclusion, insect and disease outbreaks, climate change, and the invasion of non-native plant species. Anthropogenic influences on wildfire occurrence have been witnessed through arson, incidental ignition from industry (e.g., logging, railroad, sporting activities), and other factors. Likewise, wildfire abatement practices have reduced the spread of wildfires after ignition, in theory reducing the risk to both the ecosystem and the urban populations living in or near forestlands.

LANDFIRE's Fire Regime Groups identified in Table 11-2 provides information on the Vegetation Condition Class, the Fire Return Interval Years – Historic Fire Regimes, and impact for those associated regimes.

TABLE 11-2
LANDFIRE HISTORIC FIRE REGIMES DATA (2024)

Class	Vegetation Condition Class*	Historic Fire Regimes** (Fire Return Interval Years***)	Impact	Vegetation Departure (Percent)
1	1-A	0-5	Very Low	0-16
2	1-B	6-15	Low	17-33
	1-C	16-35		
3	2-A	0-5	Moderate to Low	34-50
4	2-B	6-15	Moderate to High	51-66
	2-C	16-35		
5	3-A	36-100	High	67-83
6	3-B	101-200	Very High	84-100
	4-A	36-100		
	4-B	101-200		
	V-A	201-500		
	V-B	501 or more		

* Vegetation Condition Class (VCC) represents a categorization of the associated Vegetation Departure. It indicates the general level to which current vegetation is different from the estimated modeled vegetation based on past reference conditions.

**Fire Regime Groups (FRG) characterize the presumed historical fire regimes within landscapes based on interactions between vegetation dynamics, fire spread, fire effects, and spatial context.

***Fire Return Interval (FRI) quantifies the average period between fires under the presumed historical fire regime.

Figure 11-13 , Figure 11-14 , and Figure 11-15 identify those various Fire Regime Groups that exist in the Tribal Planning Area (not all regimes are applicable). Table 3 illustrates the number of acres falling into the existing Fire Regime Groups. Review of the data indicates that the majority of the area falls into Regime Groups V-A (5-A) and V-B (5-B).

TABLE 11-3
CTCR ACRES IN FIRE REGIME GROUPS

	Regime 1-B	Regime 3-A	Regime 5-A	Regime 5-B	Water	Total
Tribal Planning Area	26.89	143.57	1847.22	3496.53	384.98	5899.18

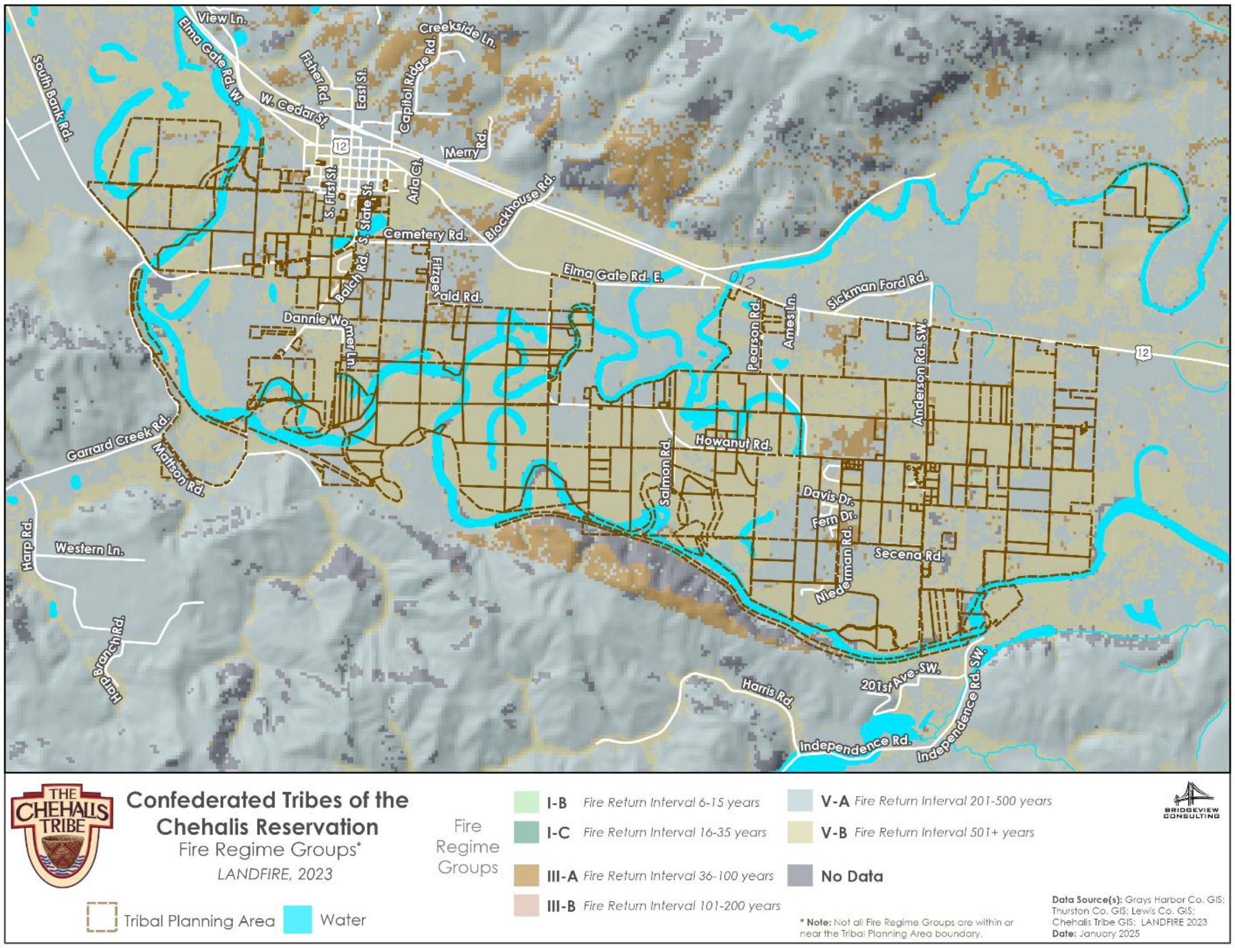


Figure 11-13 Fire Regime Groups - Chehalis Reservation

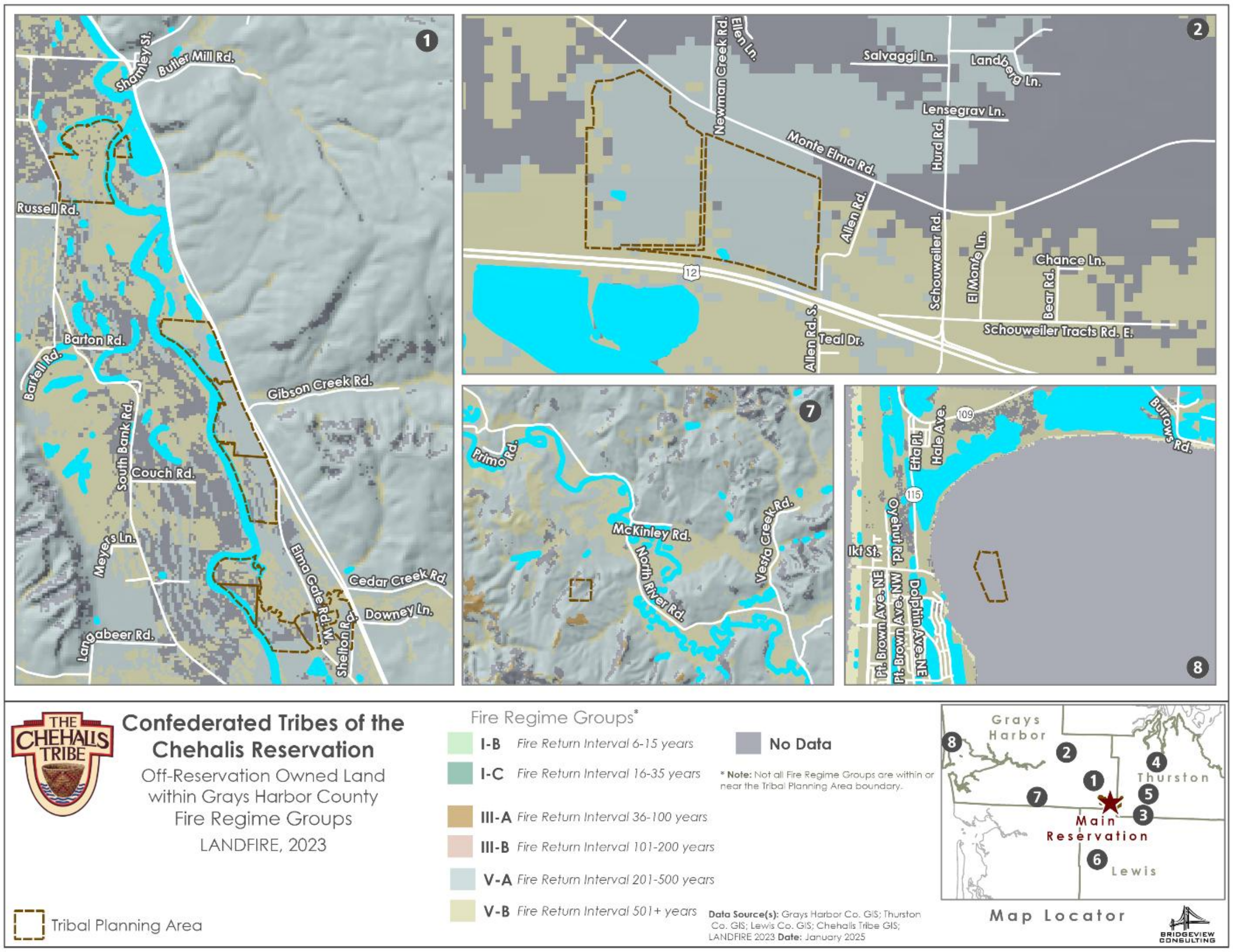


Figure 11-14 Fire Regime Groups for Tribal Lands Within Grays Harbor County

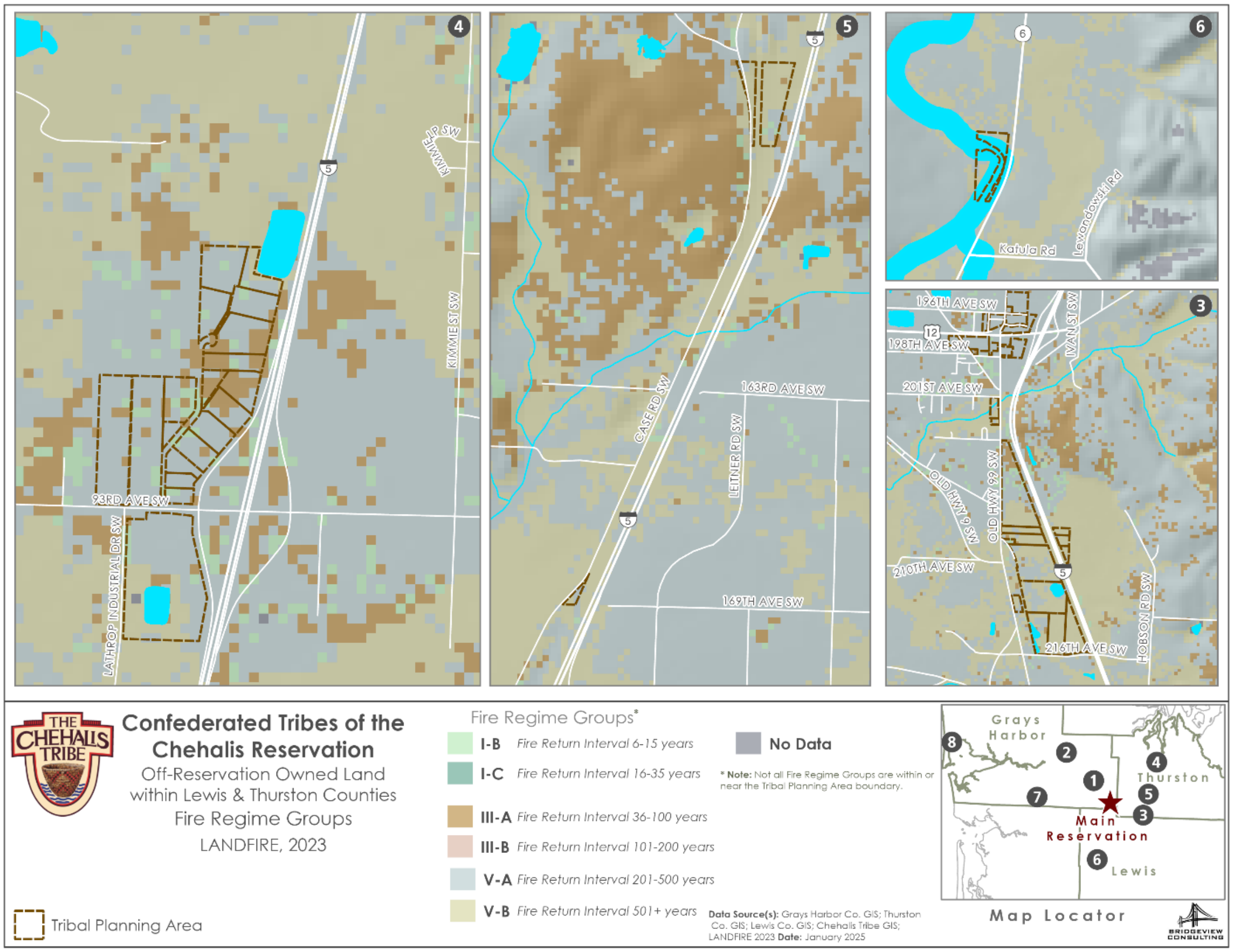


Figure 11-15 Fire Regime Groups for Tribal Lands Within Lewis and Thurston Counties

Mean Fire Return Interval

The simulated historical Mean Fire Return Interval (MFRI) data layer quantifies the average number of years between fires under the presumed historical fire regime. MFRI is intended to describe one component of historical fire regime characteristics. It is not a predictive model, and information presented should be used for reference only as the variables existing with respect to predictive wildfire planning continually change. Figure 11-16 , Figure 11-17 , and Figure 11-18 illustrate the projected MFRI for the Tribal Planning Area as illustrated by LANDFIRE.

As illustrated, the Mean Fire Return Interval for the area varies greatly, with much of the area in order of acres per yearly groupings in the 10-15, 80-90, 401-500 and 650-900 year ranges, respectively.

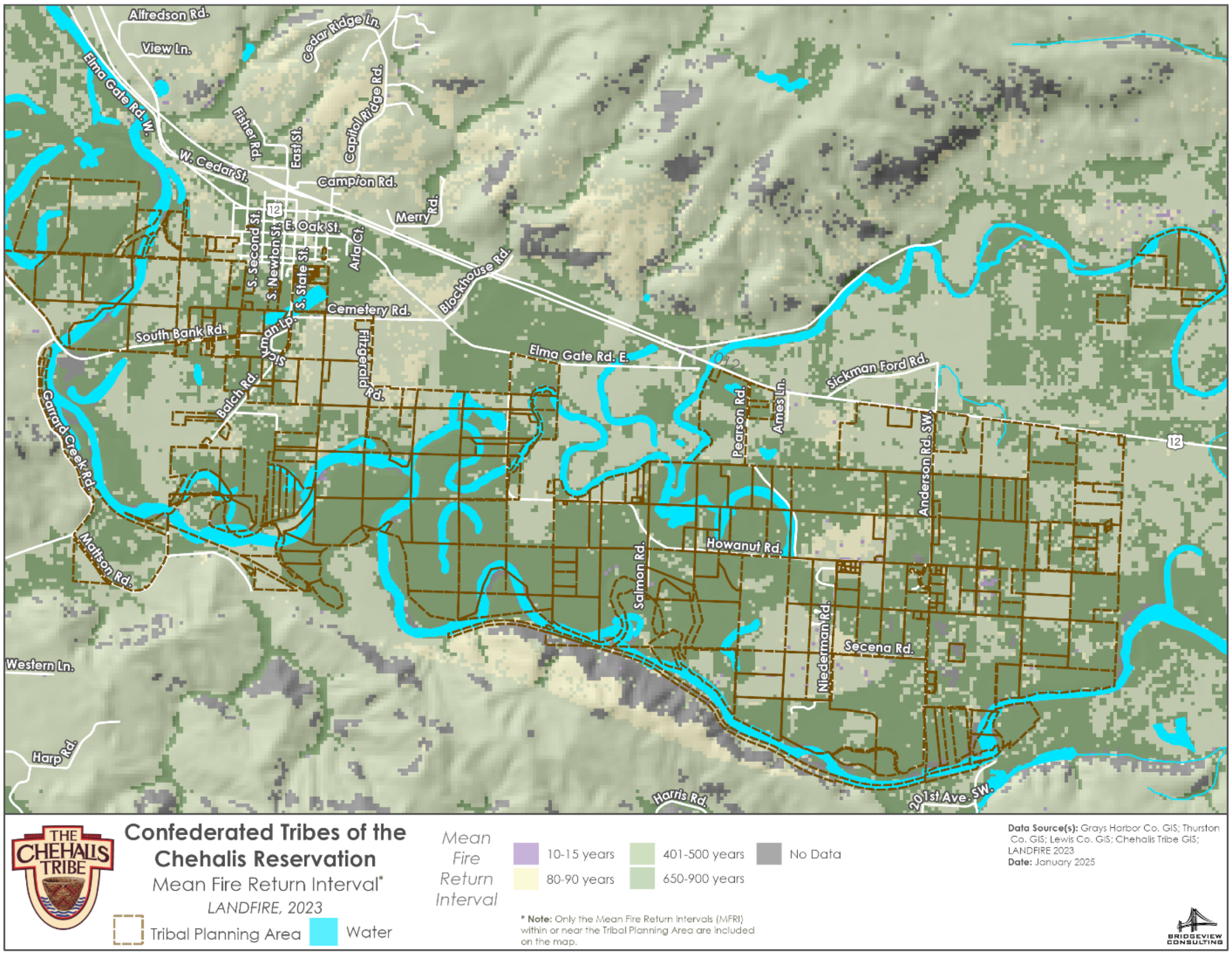


Figure 11-16 Mean Fire Return Interval - Chehalis Reservation

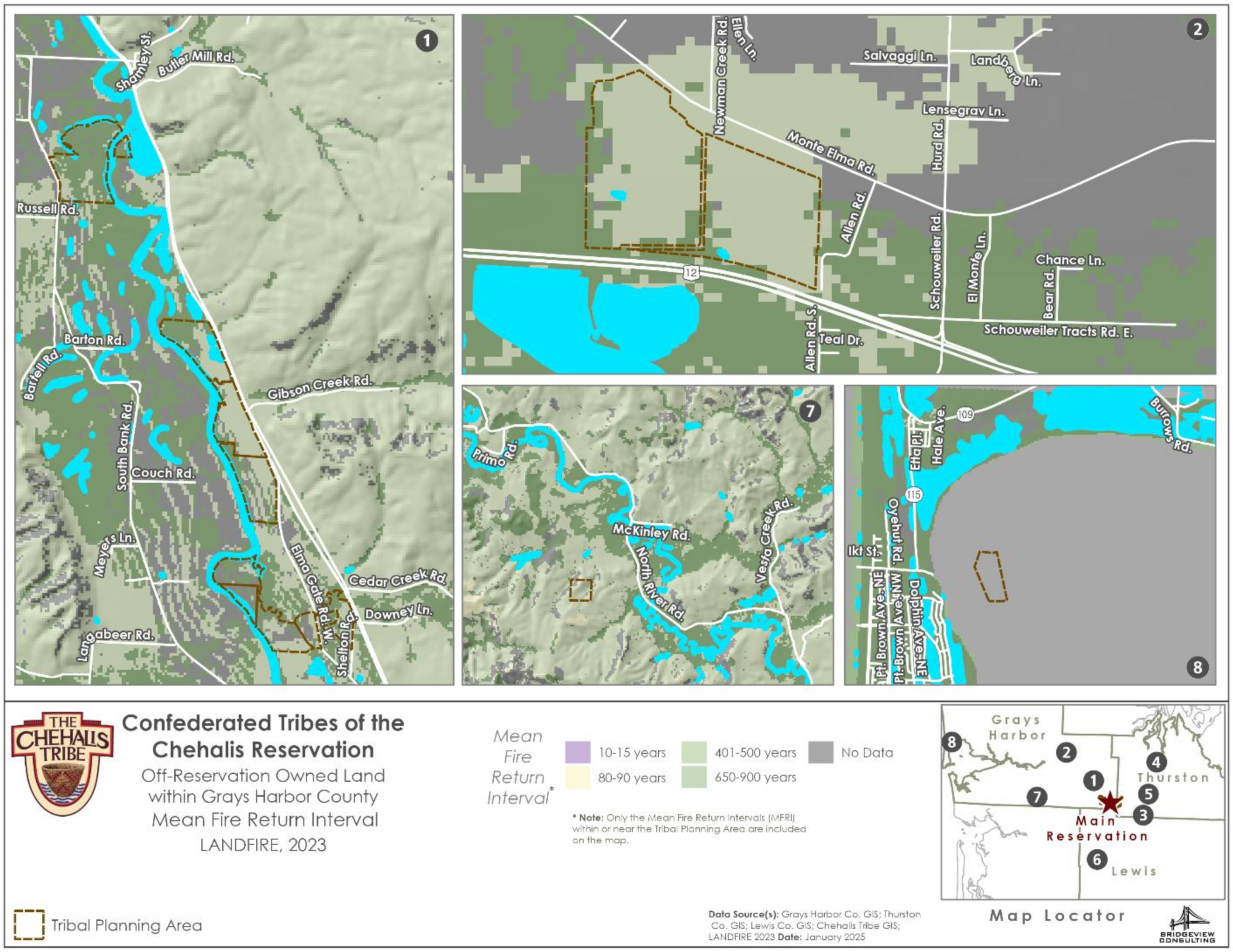


Figure 11-17 Mean Fire Return Intervals for Tribal Lands Within Grays Harbor County

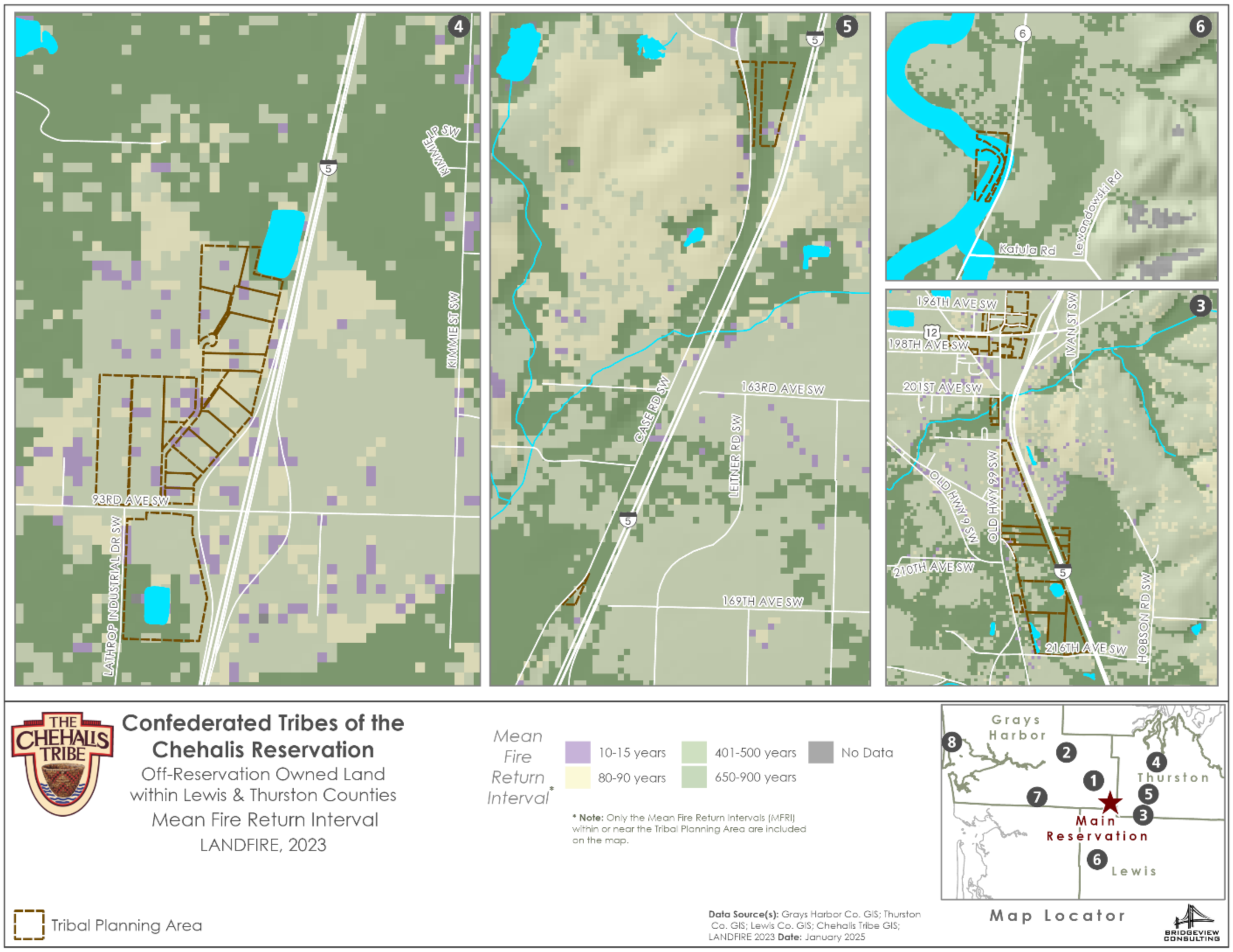


Figure 11-18 Mean Fire Return Interval for Tribal Lands Within Lewis and Thurston Counties

Vegetation Departure or Fuel Disturbance

The LANDFIRE Project also produces maps of vegetation and measurements of vegetation departure from simulated historical reference conditions, although in some instances, the data may be somewhat outdated in nature due to the continuing wildfires and resulting changes to the landscape. LANDFIRE also relies on the impacted tribal and municipal agencies to provide data to them as an update practice.   The vegetation disturbance identifies changes in the vegetation based on previous wildfires or on various mitigation efforts applied to help reduce wildfire impact. The Bureau of Indian Affairs Timber Strike Team completed a Forest Inventory for the Chehalis Reservation in 2023-2024 which included vegetation data that can be used for future wildfire planning efforts.

The existing vegetation data currently in LANDFIRE represents a categorization of the associated vegetation departure data layer and indicates the general level to which current vegetation is different from the simulated historical vegetation. The variation of vegetation class directly influences fire, as vegetation itself influences the rate of burn, intensity of the burn, and the frequency of burns. Some vegetation is much more vulnerable to ignition (shiny-leave vegetation customarily contains more oils, making them more vulnerable to ignition), while others are more difficult to contain once fire ignition occurs. Such factors contribute to the vulnerability of an area to wildfires. Figure 11-19 , Figure 11-20 , and Figure 11-21 illustrate the fuel disturbance within Tribal Planning Area.

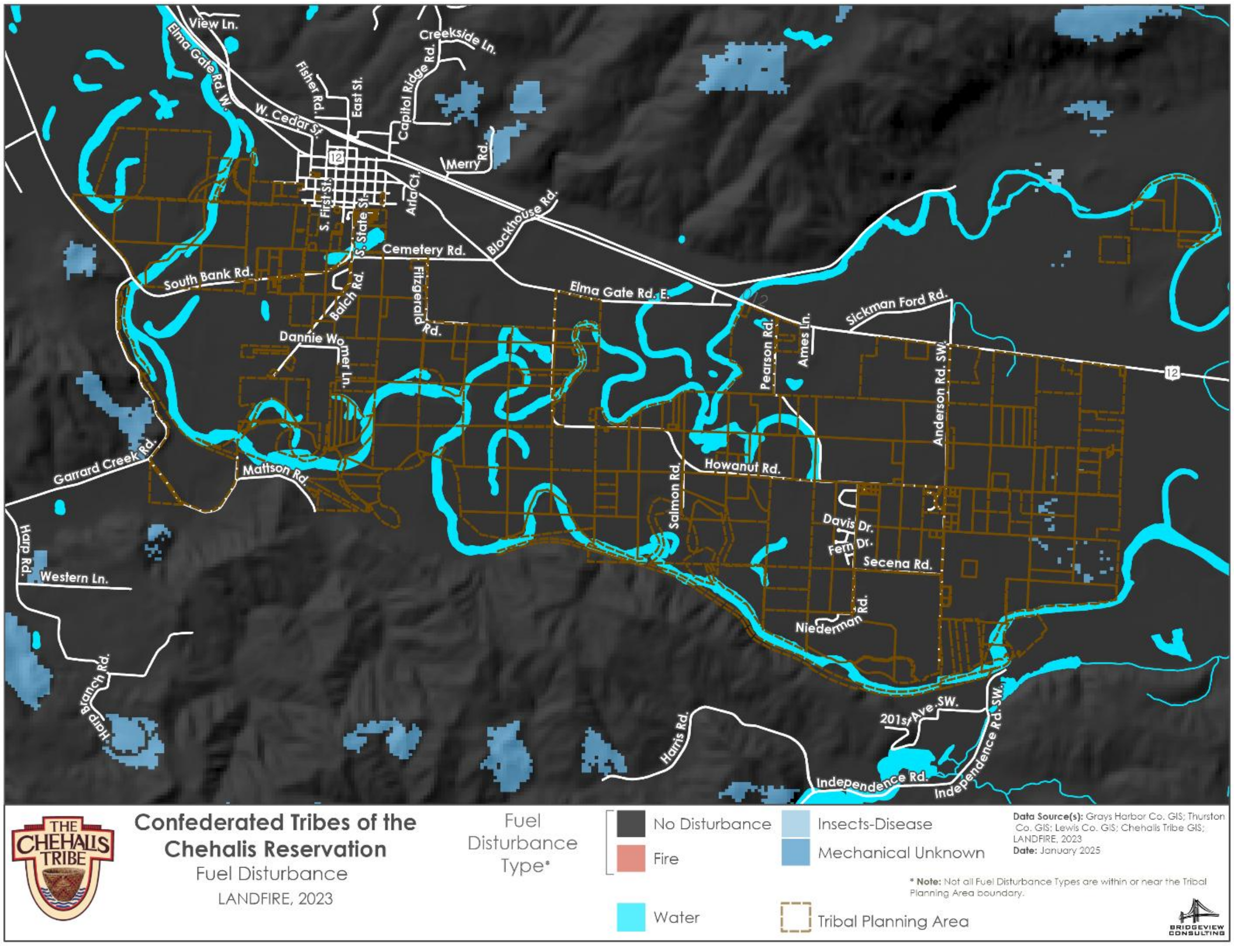


Figure 11-19 LANDFIRE Fuel Disturbance - Chehalis Reservation

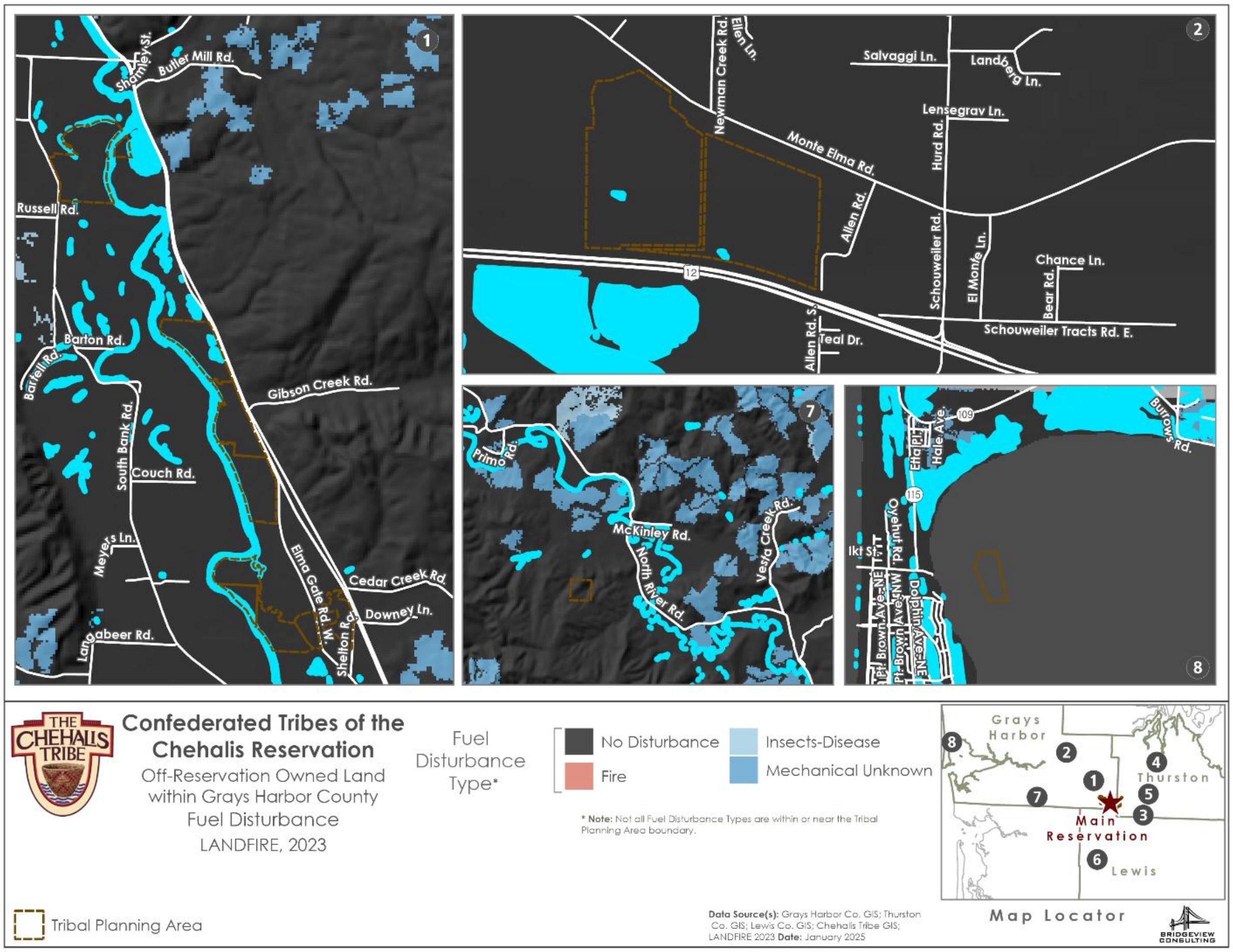


Figure 11-20 LANDFIRE Fuel Disturbance for Tribal Lands Within Grays Harbor County

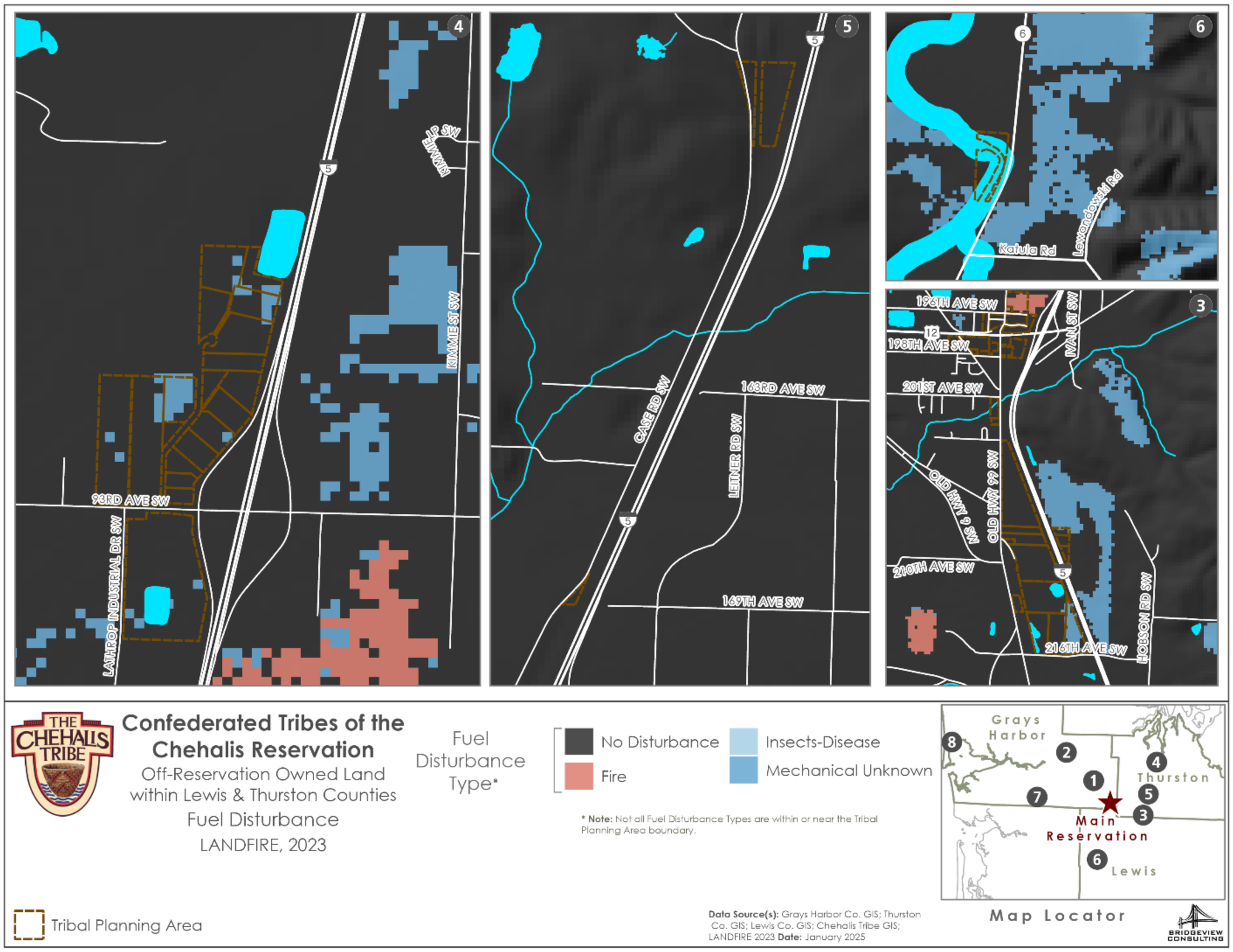


Figure 11-21 LANDFIRE Fuel Disturbance for Tribal Lands Within Lewis and Thurston Counties

11.11 VULNERABILITY ASSESSMENT

11.11.1 Overview

Structures, critical facilities, above-ground infrastructure, and natural environments are vulnerable to the wildfire hazard (see Figure 11-22).

Understanding the relationship between weather, potential fire activity, and geographical features enhances the ability to prepare for the potential of wildfire events. This knowledge, when paired with emergency planning and appropriate mitigation measures, creates a safer environment.

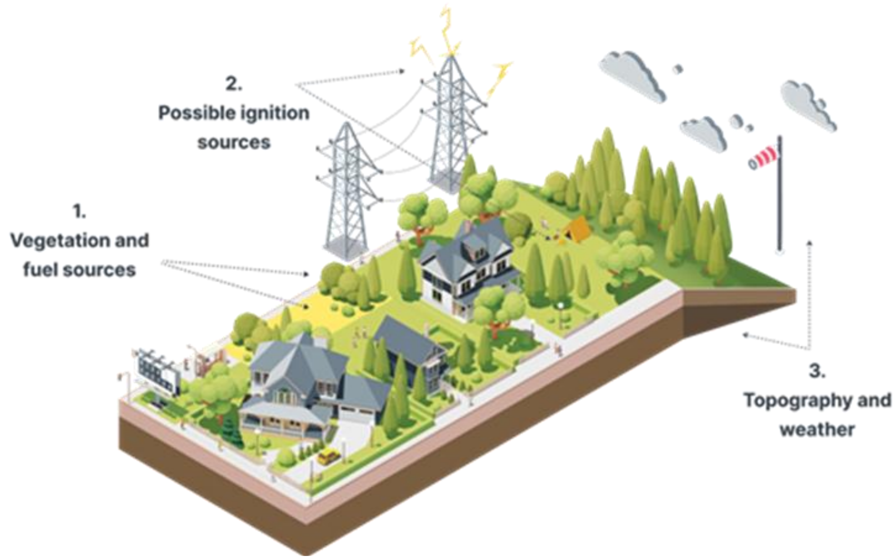


Figure 11-22 Potential Wildfire Factors

Wildfire studies can analyze weather data to assist firefighters in understanding the relationship between weather patterns and potential fire behavior. Fire forecasting examines similarities between historical fire weather and existing weather and climate values. These studies have determined that for areas such as the Tribal Planning Area, any combination of two of the following factors can create more intense and potentially destructive fire behavior, known as extreme fire behavior:

- Sustained winds
- Relative humidity less than 40 percent
- Temperature greater than 72º Fahrenheit
- Periods without precipitation greater than 14 days in duration
- 1,000-hour fuel moisture less than 17 percent.

If a fire breaks out and spreads rapidly, residents may need to evacuate within a short timeframe. The three counties and the Tribe do have an evacuation notification system in place to provide early notice to its residents. That evacuation notice follows the "Ready, Set, GO!" evacuation campaign, and consists of Level 1, Level 2, and Level 3 evacuation orders, with Level 3 being the most significant.

Customarily, a fire's peak burning period generally is between 1 p.m. and 6 p.m. In normal situations, fire alerting would commence quickly, helping to reduce the risk. However, in more remote locations of the area, or in areas where cell phone services are sporadic at times, warning time and calls for assistance may be reduced.

Methodology

There is currently no validated damage function available on which to base wildfire analysis in the same manner as other hazards as no such damage functions have been generated. Instead, estimates to identify potential loss utilized the Wildfire Risk to Communities, WHP, and the LandFIRE Fire Regime datasets as cited.

Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out, but there are factors which can be considered as increasing potential risk. For example, since fireworks can often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest.

Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm. As indicated, there are evacuation notification systems in place to provide early notice to its residents.

11.11.2 Impact on Life, Health, and Safety

The maps used in the analysis show areas of relative importance in determining fire risk, though they do not provide sufficient data for a statistical estimation of exposed population. Exposure to wildfire is dependent upon many factors. While there are no recorded fatalities from wildfire in the planning area, a statistical number of the population vulnerable is also impossible to determine with any accuracy due to the high number of variables that impact fire scenarios.

The population at risk must also take into consideration tourists given the Tribe’s proximity to the campsites, parklands, and other high-tourist destinations. With high tourism rates more than doubling the population during the summertime months in some areas (such as Grays Harbor County), there is an increase in the population vulnerable to fire. This would also be true of Tribal owned enterprises, such as Great Wolf Lodge, Tribal hotels, and the Casino.

For planning purposes, on average, the Tribe estimates ~1,000+ people to be on/in Tribal owned structures and enterprises, although that number would fluctuate greatly given the time of year, as well as holidays.

Given the increase in tourism during the summer months, when fire danger is at its greatest, increased consideration must be taken into account for fire response. Fire districts in those areas do increase first responders, particularly for those incidents which historically have shown an increase in population, such as festivals and other community events.

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly and those with respiratory and cardiovascular diseases. The Tribal Planning Area has a high population of retirees and individuals over 65, further increasing the potential impact on the fire hazard. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). 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. Wildfire also threatens the health and safety of those fighting fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

11.11.3 Impact on Property

Property damage from wildfires can be severe and can alter entire communities. The potential exposure of the structures in the Tribal Planning Area should a fire occur is high, particularly when looking at more remote areas. The unincorporated portions of the counties in which the Tribe owns properties and the Reservation itself all have some degree of exposure to wildfire hazards, with the potential for embers sparking fires carried by winds at great distances from the original fire. This means that all structures are vulnerable to wildfires to some degree – even areas with the lowest risk are vulnerable because any structure in the path of a wildfire, regardless of its severity, can be impacted. Table 11-3 (above) identifies the number of acres within each Fire Regime.

Density in certain areas of the three counties in which the Tribe owns land and the age of building stock are contributing factors in assessing property vulnerability to wildfire. Many of the buildings throughout the planning area are of significant age, with many being constructed with wood frames and shingle roofs. There are also structures in remote areas, making access difficult. This increases the risk to the Tribal owned structures, many of which are also dated, with wood frames and shingle roofs.

The Tribe has identified incorporating non- or less-combustible building materials as potential mitigation measures which can be taken to reduce the impact of wildfires on the communities. When granting opportunities become available, with the completion of this CWPP, the Tribe will seek funding opportunities to assist this effort.

Review of Wildfire Risk to Communities data (illustrated in Figure 11-12 above) identifies that approximately 96 structures (19 percent) are exposed to indirect exposure; 410 structures (81 percent) were exposed to direct exposure. [56],[57]

11.11.4 Impact on Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. In the event of wildfire, there would likely be more limited damage to most infrastructure. Most roads and railroads would be without significant damage except in the worst scenarios. Fueling stations could be significantly impacted. Power lines are also significantly at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Table 11-3 (above) identifies critical facilities exposed to the wildfire hazard throughout the planning area based on Fire Regime. Table 11-4 identifies the critical facilities within the Wildfire Hazard Potential Zone. Table 11-5 further identifies the critical facilities within each of the applicable Fire Regime Groups.

TABLE 11-4
CRITICAL FACILITIES/CRITICAL INFRASTRUCTURE WITHIN WILDFIRE HAZARD POTENTIAL ZONES

Critical Facilities/Critical Infrastructure	Very Low	Low	Moderate	High	Very High	N/A	Total
Agricultural	0	0	0	0	0	1	1
Casino	0	0	0	0	0	1	1
Commercial	4	1	0	0	0	12	17
Gathering Place	0	0	0	0	0	1	1
Government	3	1	0	0	0	28	32
Medical	1	0	0	0	0	1	2
Protective (Police/Fire)			0	0	0	1	1
TOTAL	8	2	0	0	0	45	55

[56] For additional information, see FEMA Wildfire Risk to Communities data Wildfire Risk reduction zones in Chehalis Reservation and Off-Reservation Trust Land - Wildfire Risk to Communities

[57] Review of the data is unclear with respect to whether these are only Tribal-owned structures, or structures in proximity to Tribal lands.

During a wildfire event, hazardous material storage containers could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. The materials could leak into surrounding areas, saturating soil, and seeping into surface waters, having a disastrous effect on the environment. Given the transportation corridors through the counties, non-fixed assets used to transport chemicals could also be at risk, particularly if transportation corridors are impacted or congested due to evacuation. All three counties also have rail systems which carry hazardous materials. Grays Harbor County has previously experienced rail car spills and semi-truck accidents which have involved hazardous materials, including multiple fuel tanker fires. While these have not occurred on tribal lands, the tribe could sustain impact if chemicals were spilled into waterways, or through dispersion via air.

TABLE 11-5
CRITICAL FACILITIES AND INFRASTRUCTURE EXPOSED TO FIRE REGIME AREAS*

	Regime 3-A	Regime 5-A	Regime 5-B
Agricultural		1	
Casino	1		
Commercial	1	7	7
Cultural / Gathering Place / Shelter			4
Government		6	4
Hazmat	1	2	
Industrial		1	
Medical		3	1
Natural Resources			2
Power			
Protective Services			1
Residences (Tiny Homes)			1
Schools			2
Transportation		1	4
Wastewater		1	2
Water			2
Total	**3**	**22**	**30**

*Only fire regimes impacting the CTCR are identified in this table.

11.11.5 Impact on Economy

The tribal economy is largely dependent on the service industries and entertainment. A large-scale wildfire could damage or destroy structures, inventory, and equipment. The economy would suffer from loss not only from the revenue generated by the commercial structures, but tribal members working at the various enterprises owned by the Tribe would also suffer loss of income. Tourism to the area generated by the Casino, the hotels and the Great Wolf Lodge would also impact the local economy of the three counties in which tribal lands and enterprises are situated. For non-trust lands, the loss of structures would also influence the tax base from lost revenue in the counties. The Tribe also collects taxes on some of its enterprises, including tobacco, alcohol and fuel.

Secondary impacts include erosion on burned slopes leading to runoff and contributing to flooding, landslides, and impacts to salmon-bearing streams. Wildfires could destroy homes, hotels, restaurants, and other tourist facilities while wildfires in farmlands could destroy crops, pasture lands used for grazing, farms, equipment, herds, and structures, all of which operate within the CTCR.

11.11.6 Impact on Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts:

- Destroyed Endangered (and other) Species Habitat—Catastrophic fires can have devastating consequences for endangered species.
- Damaged Fisheries—Critical fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality. The Tribe does have a hatchery within its boundaries.
- Soil Erosion—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- Spread of Invasive Plant Species—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- Disease and Insect Infestations—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- Soil Sterilization—Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for

ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

11.11.7 Impact From Climate Change

Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. Climate change also may increase winds that spread fires. Forest response to increased atmospheric carbon dioxide could contribute to more tree growth and thus more fuel for fires, although the effects of carbon dioxide on mature forests are still largely unknown. In turn, increased high-elevation wildfires could release stores of carbon and further contribute to the buildup of greenhouse gases.

Hot dry spells, as we have experienced during the summer months over the last several years create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation and soil moisture. When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

11.12 MITIGATION STRATEGIES - INCREASING RESILIENCY OF LANDSCAPES

As with all mitigation strategies, the intent is to take action in advance of a disaster or event to help reduce the impact when an event occurs, thereby increasing the resilience of the community in the aftermath of a fire. Increasing the resilience of the landscapes involves and requires an integrated approach, involving all stakeholders.

We know factually that by applying various mitigation actions in advance of a fire, it reduces the potential vulnerability when a fire occurs. In some instances, this may mean allowing the fire to run its natural course, allowing resources to be redirected. By applying mitigation efforts in advance, in most instances, the risk or impact level is reduced. In so doing, it allows decision makers the opportunity to prioritize other areas and actions during times of fire.

Specific CWPP actions to increase the resilience of the Tribal landscape are:

- To review and identify priority landscapes and potential treatments options before fires begin.
- Implement post-fire recovery activities that provide opportunities to leverage long-term, post-fire planning that can support future wildfire reduction and prescribed fire activity.

The Tribe has identified the following general mitigation strategies. The list is not all-inclusive but serves as a starting point for the various communities comprising the CTCR of available options as funding allows.

11.12.1 Fuels Reduction

- Design and prioritize fuel treatments to reduce fire intensity, structure ignition, and negative wildfire impacts to values. Examples include:
    - Slashing and under burning or pile burning (including controlled burns)
    - Commercial harvesting
    - Chipping
    - Thinning
- Where feasible, implement strategically placed fuel treatments to interrupt fire spread across landscapes.
- Use and expand fuel treatments involving mechanical, biological, or chemical methods where economically feasible and sustainable, and where they align with landowner objectives.
- Reduce the risk of wildfire by removing fuels, especially small-diameter trees, while maintaining forest structure to protect ecosystem components.

11.12.2 Capacity Building for Municipal and Fire Service Agencies

- Establish and maintain defensible spaces around critical facilities and infrastructure.
- Implement water source improvements for firefighting efforts.
- Install surveillance cameras in high-risk areas for early detection.
- Support the acquisition of firefighting equipment and resources.
- Develop and enforce fire codes and standards to which new development occurs.
- Seek out and secure financial assistance to support projects that enhance wildfire resilience and safety communitywide (e.g., fire-resistant home upgrades).

11.12.3 Prescribed Fire

- Recognize prescribed fires as an important fuel treatment and ecological restoration tool, where appropriate.
- Continue and expand the use of prescribed fire to meet landscape objectives, improve ecological conditions, and mitigate negative wildfire impacts on human development.
- Ensure that prescribed fire planning includes the management of smoke in accordance with the Clean Air Act and the regulations and policies of the Environmental Protection Agency (EPA).

- Ensure that prescribed fire planning follows tribal, federal, and local (where applicable) regulations.

11.12.4 Community Involvement, Education, and Outreach

- Encourage community members to participate in wildfire prevention efforts around their homes and throughout their neighborhood.
- Upgrade or install fire-resistant roofing, siding, and windows - research suggests that "the only effective home protection treatment is treatment in, on, and around the house (see Figure 11-23).
- Develop and implement a comprehensive wildfire education program, such as Firewise USA, Wildfire Ready Neighbors, and Ready, Set, Go!
- Establish community emergency response teams and associated training programs.
- Organize community events, workshops, seminars or other training sessions on wildfire preparedness, evacuation plans, and wildfire prevention activities.
- Develop emergency preparedness kits to include vital or critical documentation scanned to a thumb drive.

The CTCR's CWPP actively works to support individual homeowners' efforts with respect to removing or reducing ignition sources, as well as actively training to ensure wildfire fighting capabilities by both volunteers and fire service providers. There are many programs which promote local community mitigation efforts. One of those is to become a Firewise Community.

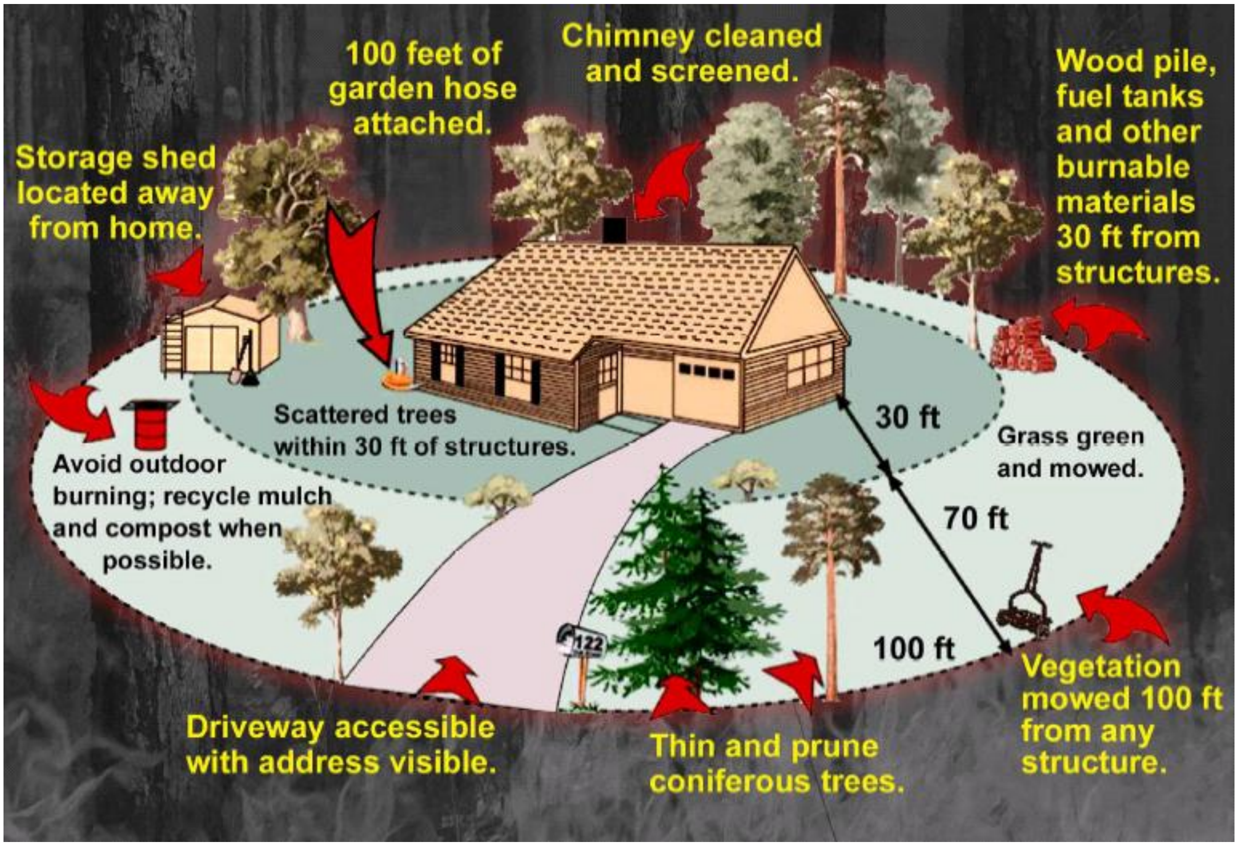


Figure 11-23 Measures to Protect Homes from Wildfire

Firewise Communities USA™

The NFPA's Firewise USA program encourages local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. Firewise is a key component of Fire Adapted Communities – a collaborative approach that connects all those who play a role in wildfire education, planning, and action with comprehensive resources to help reduce risk. The CTCR encourages the Firewise Program throughout the Tribal Planning Area.[58]

Additional support for strategy development comes from the Wildfire Risk to Communities, which identifies Risk Reduction Zones, or areas where mitigation activities will be most effective at protecting homes and other buildings from wildfires. Figure 11-12 (above) identifies those zones. Each zone applies various types of potential mitigation efforts as follows:

- Indirect Exposure Zones - Provides an opportunity to reduce places for embers to land and ignite. Mitigation activities include making homes more ignition resistant by, for example, establishing a 5-foot noncombustible zone around homes, or by applying land use planning strategies which disrupt the potential for a wildfire to spread and intensify,

[58] http://www.firewise.org/usa-recognition-program/state-listing-of-partcipants.aspx

reducing risks to people and homes, while also making wildfire response safer and more effective.

- Direct Exposure Zones - Also includes reduction of vegetation to carry fire to homes, and reducing places for embers to land and ignite, but also includes reducing hazardous fuels to modify fire behavior or creating defensible spaces to help anchor wildfire response activities.
- Wildfire Transmission Zones – These areas reduce continuity of vegetative fuels to slow fire spread, and include reducing hazardous fuels through burning, thinning, pruning, chipping, and mechanically removing fuels to reduce the amount and continuity of burnable vegetation.

Wildfire mitigation is most effective when multiple strategies are combined which, when applied, reduce ignition sources, disrupt the potential for wildfire spread, and reduce wildfire intensity. Through the CWPP process, each community should annually identify priority areas within these zones to help reduce the impact of wildfire.

11.13 FUTURE DEVELOPMENT TRENDS

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

These are also areas of high tourism, which would increase the potential for evacuees during fires, as well as potentially increasing the population which could ultimately cause wildfires and be at risk, increasing both risk and vulnerability.

The largest variable is not necessarily only with respect to development trends. It may also include the rate at which the various vegetation has been changed from vegetation classes due to development and, where they have occurred, previous fires. With the integration of the Tribe’s 2024 Forest and Vegetation Inventory data into the LandFIRE data, this will provide updated information on which the Tribe will be able to more accurately determine wildfire risk, as well as focus areas for mitigation. As population and structure count increases, this will also potentially increase fires.

The Tribe is optimistic that increased population growth will occur. As areas of the Reservation and the three counties become more urbanized, the potential exists that the fire risk will increase as urbanization tends to alter the natural fire regime, and the growth will expand the urbanized areas into undeveloped wildland areas, increasing the number of vulnerable structures and people living in higher risk areas. The CTCR feels that with respect to the Reservation, expansion of the wildland-urban interface can be managed with strong land use and building codes. With continued expansion of the Community Wildfire Protection Plan strategies and continued community involvement, the number of wildfires and impact therefrom will be reduced.

11.14 ISSUES

The major issues for wildfire are the following:

- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones. Emergency Management personnel and the local fire agencies work with community organizations to help ensure adequate and accurate information is disseminated. This will hopefully lead to Emergency Management and the local fire agencies seeking out and applying for grants to assist in mitigation activities.
- Vegetation management activities should include enhancement through expansion of target areas as well as additional resources.
- Wildfires could cause land or mud slides as a secondary natural hazard, even on relatively flat grounds.
- Climate change will negatively impact the wildfire hazard.
- Future growth into the interface areas should continue to be managed.
- Building code standards should continue to be reviewed and enhanced where practical, potentially including items such as residential sprinklers and prohibitive combustible roof standards.
- Increased fire department water supply is needed in high-risk wildfire areas. This may require the acquisition of water buffalos or development of other means to ensure adequate water supplies at all times.
- Working with local fire service agencies supporting the CTCR, certifications and qualifications for fire department personnel and volunteers should remain a primary focus for the protection and safety of first responders. In some instances, the lack of funding limits equipment, personnel, and the ability to attend relevant training.
- Working with the local service agencies supporting the CTCR, ensure that firefighters and volunteers are trained in basic wildfire behavior, basic fire weather, and that company officers and chief level officers are trained in the wildland command and strike team leader level.

A worst-case scenario would include an active fire season throughout the American west, spreading resources thin. Firefighting teams would be exhausted or unavailable. Many federal assets would be responding to other fires that started earlier in the season. While local fire districts outside of the planning area would be extremely useful in the urban interface areas, many districts have limited wildfire capabilities or experience, and they would have a difficult time responding to the ignition zones. Even though the existence and spread of the fire is known, it may not be possible to respond to it adequately, so an initially manageable fire can become out of control before resources are dispatched.

To further complicate the problem, heavy rains could follow, causing flooding and landslides and releasing tons of sediment into rivers, permanently changing floodplains, and damaging sensitive habitat and riparian areas. Such a fire followed by rain could release millions of cubic yards of sediment into streams for years, creating new floodplains and changing existing ones. With the forests removed from the watershed, stream flows could easily double. Flood that could be expected every 50 years may occur every couple of years. With the streambeds unable to carry the increased discharge because of increased sediment, the floodplains and the flood elevations would increase.

11.15 RESULTS

Based on review and analysis of the data, the Planning Team has determined that the probability for some type of impact from a Wildfire (e.g., smoke, required evacuation, or an actual ignition) throughout the area is highly likely, with the impact becoming more widely dispersed.

While the Tribe itself has had limited fires on the Reservation or any of its owned lands, the areas in which the Tribe maintains properties experience some level of wildfire annually, with the number of fires, acres burnt, and the severity of the fires increasing.

Each year, the wildfire season also becomes longer, particularly with dryer and hotter conditions as experienced over the last several years, and with the heat domes that have also been experienced since the last plan’s completion. With densely wooded areas and prairies throughout the tri-counties, the impacts of climate change, and the increased drought conditions continue to increase both in probability and severity of fire danger, with the wooded areas and prairies becoming more susceptible as a result of lack of soil moisture, infestation of unhealthy forests resulting from drought, and the degradation of the health of the vegetation. Annually since completion of the last plan, the State of Washington has issued Drought Emergency Declarations due to the reduced precipitation falling statewide. Grays Harbor, Lewis, and Thurston Counties have been identified as counties under those various declarations, which in many instances have resulted in the Small Business Administration making loans available in those impacted areas.

Deviation from normal vegetation classes resulting from previous fires also increases the fire danger and risk. With the impact of climate change also modifying weather patterns, the potential exists for increased lightning strikes, which can cause fires to ignite and burn for days before detection in remote locations. Construction into the wildfire hazard areas undoubtedly will continue to expand, thereby continuing to increase the risk of fires.

Implementation of mitigation strategies which help reduce wildfire risk, such as landscape regulations, chipping programs, maintaining defensible space, and mandatory sprinkler systems could potentially help reduce the number of structures at risk. Likewise, continued partnerships such as those between the Conservation Districts, DNR, USFS, BLM, and local communities continue to be an asset in the region, but resources to fight fires continue to be limited due to funding. As was the case over the course of the last several years, resources nationwide were significantly depleted during the wildfire season due to the number of fires burning in all areas to which resources at all levels of government were deployed. Such active seasons reduce response personnel and equipment availability to the area. Based on the potential impact, the Planning Team determined the CPRI score to be 3.15 with overall vulnerability determined to be a high level.

Approval of the Confederated Tribes of the Chehalis Reservation

2025 Community Wildfire Protection Plan

The applicable local government, local fire departments or their representatives, and the state entity responsible for forest management approve the Confederated Tribes of the Chehalis Reservation Community Wildfire Protection Plan (CWPP). This plan represents the Tribe's initial CWPP.

This plan is intended to serve as a planning tool for fire and land managers and residents to assess risks associated with wild land fire and identify strategies and make recommendations for reducing those risks.

The entities listed below participated in the development of, and/or reviewed and are in support of the 2025 Confederated Tribes of the Chehalis Reservation CWPP, and agree that the CWPP is viable, complete, and realistic in terms of risk reduction and implementation.

Confederated Tribes of the Chehalis Reservation

____	____________________________
Chair, Business Committee	Date

Confederated Tribes of the Chehalis Reservation

____	____________________________
Kelly Edwards Public Safety Director / Police Chief	Date

Confederated Tribes of the Chehalis Reservation

____	____________________________
Clinton Davis Public Safety Emergency Manager	Date

Confederated Tribes of the Chehalis Reservation

____ ______________________________

Glen Connelly | Date
Natural Resources Director

____ ______________________________

Washington State Forester | Date
Washington State Department of Natural Resources

____ ______________________________

Western WA Region Fire District Manager | Date
Washington State Department of Natural Resources

____ ______________________________

Fire Chief | Date
Fire District #_____

____ ______________________________

Fire Chief | Date
Fire District #____

____ ______________________________

Fire Chief | Date
Fire District #____

CHAPTER 12.
HAZARD RANKING AND SOCIAL VULNERABILITY

The risk ranking process conducted by Planning Team members assessed the probability of each hazard's occurrence, as well as its likely impact on the people, property, and economy of the planning area. Also of significant concern to the Chehalis Tribe is the impact of these hazards on the environment, which factor was also taken into consideration during this plan update.

For some hazards, estimates of risk were generated with data from Hazus, using methodologies promoted by FEMA. For other hazards, citizens, and Planning Team members (who have an extensive historic perspective and knowledge base concerning the impact of hazards on the Tribe) provided invaluable information during this process. That information had a significant impact on the risk ranking process.

In ranking the hazards, the Planning Team completed a Calculated Priority Risk Index worksheet for each hazard (Figure 12-1). The Index examines the various criteria for each hazard (probability, magnitude/severity, geographic extent and location, warning time, and duration) as discussed in Chapter 5, defines a risk index for each criterion according at four levels (1-4), and then applies a weighting factor.

The result is a score that has been used to rank the hazards for the Tribe. Table 12-1 presents the results of the Calculated Priority Risk Index (CPRI) scoring for the hazards of concern. Once the hazard ranking was completed, the Planning Team also assigned an ordinal scale to identify the level of significance based on the CPRI score and rank, assigning a low-to-high rating of concern or significance. Those ratings are categorized into the following levels, with Table 12-2 presenting the overall results:

- Extremely Low—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- Low—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- Medium—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- High—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- Extremely High—Very widespread with catastrophic impact.

<table>
<tr><th rowspan="2">CPRI Category</th><th colspan="3">Degree of Risk</th><th rowspan="2">Assigned Weighting Factor</th></tr>
<tr><th>Impact/ Level ID</th><th>Description</th><th>Impact Factor</th></tr>
<tr><td rowspan="4">Probability</td><td>Unlikely</td><td>• Rare with no documented history of occurrences or events.
• Annual probability of less than 1% (~100 years or more).</td><td>1</td><td rowspan="4">40%</td></tr>
<tr><td>Possible</td><td>• Infrequent occurrences; at least one documented or anecdotal historic event.
• Annual probability that is between 1% and 10% (~10 years or more).</td><td>2</td></tr>
<tr><td>Likely</td><td>• Frequent occurrences with at least two or more documented historic events.
• Annual probability that is between 10% and 90% (~10 years or less).</td><td>3</td></tr>
<tr><td>Highly Likely</td><td>• Common events with a well-documented history of occurrence.
• Annual probability of occurring. (1% chance or 100% Annually).</td><td>4</td></tr>
<tr><td rowspan="4">Magnitude/ Severity</td><td>Negligible</td><td>• People – Injuries and illnesses are treatable with first aid; minimal hospital impact; no deaths. Negligible impact to quality of life.
• Property – Less than 5% of critical facilities and infrastructure impacted and only for a short duration (less than 24-36 hours such as for a snow event); no loss of facilities, with only very minor damage/clean-up.
• Economy – Negligible economic impact.
• Continuity of government operating at 90% of normal operations with only slight modifications due to diversion of normal work for short-term response activity. Disruption lasts no more than 24-36 hours.
• Special Purpose Districts: No Functional Downtime.</td><td>1</td><td rowspan="4">25%</td></tr>
<tr><td>Limited</td><td>• People – Injuries or illness predominantly minor in nature and do not result in permanent disability; some increased calls for service at hospitals; no deaths; 14% or less of the population impacted. Moderate impact to quality of life.
• Property – Slight property damage -greater than 5% and less than 25% of critical and non-critical facilities and infrastructure.
• Economy – Impact associated with loss property tax base limited; impact results primarily from lost revenue/tax base from businesses shut down during duration of event and short-term cleanup; increased calls for emergency services result in increased wages.
• Continuity of government impacted slightly; 80% of normal operations; most essential services being provided. Disruption lasts >36 hours, but <1 week.
• Special Purpose Districts: Functional downtime 179 days or less.</td><td>2</td></tr>
<tr><td>Critical</td><td>• People – Injuries or illness results in some permanent disability or significant injury; hospital calls for service increased significantly; no deaths. 25% to 49% of the population impacted.
• Property – Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure).
• Economy - Moderate impact as a result of critical and non-critical facilities and infrastructure impact, loss of revenue associated with tax base, lost income.
• Continuity of government ~50% operational capacity; limited delivery of essential services. Services interrupted for more than 1 week, but <1 month.
• Special Purpose Districts: Functional downtime 180-364 days.</td><td>3</td></tr>
<tr><td>Catastrophic</td><td>• People - Injuries or illnesses result in permanent disability and death to a significant amount of the population exposed to a hazard. >50% of the population impacted.
• Property – Severe property damage >50% of critical facilities and non-critical facilities and infrastructure impacted.
• Economy – Significant impact - loss of buildings /content, inventory, lost revenue, lost income.
• Continuity of government significantly impacted; limited services provided (life safety and mandated measures only). Services disrupted for > than 1 month.
• Special Purpose Districts: Functional Downtime 365 days or more.</td><td>4</td></tr>
<tr><td rowspan="4">Geographic Extent and Location</td><td>Limited</td><td>Less than 10% of area impacted.</td><td>1</td><td rowspan="4">20%</td></tr>
<tr><td>Moderate</td><td>10%-24% of area impacted.</td><td>2</td></tr>
<tr><td>Significant</td><td>25%-49% of area impacted.</td><td>3</td></tr>
<tr><td>Extensive</td><td>50% or more of area impacted.</td><td>4</td></tr>
<tr><td rowspan="4">Warning Time / Speed of Onset</td><td><6 hours</td><td>Self-explanatory.</td><td>4</td><td rowspan="4">10%</td></tr>
<tr><td>6 to 12 hours</td><td>Self-explanatory.</td><td>3</td></tr>
<tr><td>12 to 24 hours</td><td>Self-explanatory.</td><td>2</td></tr>
<tr><td>> 24 hours</td><td>Self-explanatory.</td><td>1</td></tr>
<tr><td rowspan="4">Duration</td><td>< 6 hours</td><td>Self-explanatory.</td><td>1</td><td rowspan="4">5%</td></tr>
<tr><td>< 24 hours</td><td>Self-explanatory.</td><td>2</td></tr>
<tr><td><1 week</td><td>Self-explanatory.</td><td>3</td></tr>
<tr><td>>1 week</td><td>Self-explanatory.</td><td>4</td></tr>
</table>

Figure 12-1 Calculated Priority Risk Index

TABLE 12-1
2021 CALCULATED PRIORITY RANKING SCORES

Hazard	Probability	Magnitude and/or Severity	Geographic Extent and Location	Warning Time	Duration	Calculated Priority Risk Index Score
Drought	3	2	2	1	4	2.35
Earthquake	4	3	4	4	1	3.65
Flood	4	3	4	1	2	3.25
Severe Weather	4	3	3	1	2	3.05
Volcano	1	1	2	1	4	1.35
Wildfire	3	2	2	4	1	2.65

The Calculated Priority Risk Index scoring method has a range from 0 to 4. “0” being the least hazardous and “4” being the most hazardous situation.

TABLE 12-2
2025 CALCULATED PRIORITY RANKING SCORES

Hazard	Probability	Magnitude and/or Severity	Geographic Extent and Location	Warning Time	Duration	Calculated Priority Risk Index Score
Drought	3	2	2	1	4	2.35
Earthquake	4	3	4	4	1	3.65
Flood	4	3	4	1	2	3.25
Severe Weather	4	3	3	1	2	3.05
Volcano	1	1	2	1	4	1.35
Wildfire	3	3	3	4	3	3.15

The Calculated Priority Risk Index scoring method has a range from 0 to 4. “0” being the least hazardous and “4” being the most hazardous situation.

TABLE 12-3 2021 HAZARD RANKING		
Hazard in Ranked Order	**CPRI Score**	**Level of Concern and Significance**
Earthquake	3.65	High
Flood	3.25	High
Severe Weather	3.05	High
Wildfire	2.65	Medium
Drought	2.35	Medium
Volcano	1.35	Low

TABLE 12-4 2025 HAZARD RANKING		
Hazard in Ranked Order	**CPRI Score**	**Level of Concern and Significance**
Earthquake	3.65	High
Flood	3.25	High
Wildfire	3.15	High
Severe Weather	3.05	High
Drought	2.35	Medium
Volcano	1.35	Low

12.1.1 Social Vulnerability

Social vulnerability refers to the demographic (age, sex) and socioeconomic factors (such as poverty, lack of access to transportation, and crowded housing) that adversely affect communities that encounter hazards and other community-level stressors. These stressors can include natural or human-caused disasters (such as tornadoes or chemical spills) or disease outbreaks (such as COVID-19). Social vulnerability in terms of this HMP represents the susceptibility of these social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.

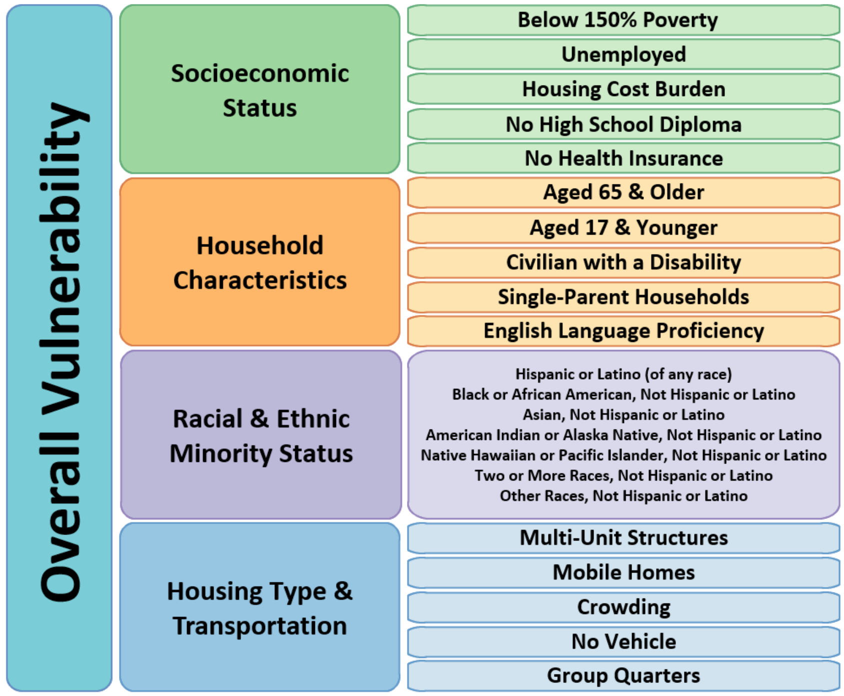


Figure 12-2 Four Major Areas of Social Vulnerability

As a consequence-enhancing risk component of the National Risk Index, a 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 community's Social Vulnerability Score measures its national rank or percentile. A higher Social Vulnerability Score results in a higher Risk Index score.

Community resilience is the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.

As a consequence-reduction risk component of the National Risk Index, a Community Resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. A community's Community Resilience score measures its national rank and is inversely proportional to a community's risk. A higher Community Resilience score results in a lower Risk Index score.

Based on the National Risk Index findings, the following reflect the social vulnerability of the local communities, as well as the communities' resilience score for the three counties in which the

CTCR have land and structures. As this data is based on the Census Track Level, the Index does not define the scores at the Reservation level:[59]

Grays Harbor County:

- Social groups in Grays Harbor County, WA have a Very High susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.
- Communities in Grays Harbor County, WA have a Relatively Moderate ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.

Thurston County

- Social groups in Thurston County, WA have a Relatively Low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.
- Communities in Thurston County, WA have a Relatively High ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.

Lewis County

- Social groups in Lewis County, WA have a Relatively High susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.
- Communities in Lewis County, WA have a Relatively Moderate ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.

[59] FEMA National Risk Index. Accessed multiple times. Available online at: Map | National Risk Index

CHAPTER 13.
MITIGATION STRATEGY

The development of a mitigation strategy allows the community to create a vision for preventing future disasters. This is accomplished by establishing a common set of mitigation goals and objectives, a common method to prioritize actions, and evaluation of the success of such actions.

Once identified, the goals and objectives establish an overall mitigation strategy by which the Tribe will enhance resiliency of the planning area. When combined with the Risk Assessment data developed during this plan update, the Planning Team identified a set of mitigation action items (sometimes referred to as initiatives or strategies) which, when implemented, will help reduce the impact of the hazards on the Chehalis Reservation.

13.1 GOALS AND OBJECTIVES

Hazard mitigation and community wildfire protection plans must identify goals and objectives for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.7(c)(3)(i)). In identifying the goals, the Planning Team reviewed the goals from the previous 2021 Hazard Mitigation Plan and confirmed those goals and objectives for this 2025 update. The Planning Team felt the goals and objectives remained specific to the needs of the CTCR, while still allowing for alignment with the various other surrounding tribes and the counties. The 2025 Goals and Objectives are as follows:

- Goal 1—Reduce natural hazard-related injury and loss of life.
- Goal 2—Reduce property damage.
- Goal 3—Promote a sustainable economy.
- Goal 4—Maintain, enhance, and restore the natural environment's capacity to absorb and reduce the impacts of natural hazard events.
- Goal 5—Increase public awareness and ability to respond to disasters.

TABLE 13-1
PROPOSED 2020 OBJECTIVES

Objective Number	Objective Statement	Goals for which it can be applied
O-1	Acquire (purchase), retrofit, or relocate structures in high hazard areas.	1, 2, 3, 4
O-2	Encourage open space uses in hazardous areas or ensure that if building occurs in these high-risk areas that it is done in such a way as to minimize risk.	1, 2, 3, 4, 5

TABLE 13-1 PROPOSED 2020 OBJECTIVES		
Objective Number	Objective Statement	Goals for which it can be applied
O-3	Use best available data, science and technologies to improve understanding of location and potential impacts of hazards, and to promote disaster resilient communities that minimize risk.	1, 2, 3, 4, 5
O-4	Consider the impacts of natural hazards in all planning mechanisms that address current and future land uses in the Tribal Planning Area.	1, 2, 4, 5
O-5	Preserve the Cultural Resources of the Chehalis Tribe.	1, 2, 3 ,4, 5
O-6	Establish a partnership among the Tribal Government and Tribal business leaders with surrounding area government and business community to improve and implement methods to protect life, property, and the environment.	1, 2, 3, 4, 5
O-7	Enhance community emergency management capabilities to prepare for, protect from, respond to, recover from, and mitigate the impact of hazards.	1, 2, 3, 4, 5
O-8	Encourage hazard mitigation measures that result in the least adverse effect on the natural environment and that use natural processes, while preserving and maintaining the cultural elements of the Chehalis Tribe.	2, 3, 4

13.2 MITIGATION ACTION ITEM IDENTIFICATION AND ANALYSIS

For the 2025 update, particular attention was given to new and existing buildings and infrastructure with respect to developing appropriate mitigation strategies. Emphasis was also placed on the community lifelines, seeking to identify projects which enhance lifelines necessary to support all phases of emergency management, with particular attention on response and recovery supported by mitigation initiatives. Priority was also given to both wildfire- and flood-prevention strategies. Additional broad-based Wildfire strategies were added in support of the CWPP element of the plan.

FEMA defines mitigation initiatives as sustained measures, which if enacted, will reduce or eliminate the long-term risk from hazards. Whether by preparing citizens for disasters, training responders, or structural infrastructure protection, the actions ultimately should help protect our citizens and enhance social and economic recovery during such times when disasters do strike.

In an effort to help develop sound mitigation initiatives for this update, FEMA's 2013 *Catalog of Mitigation Ideas* was presented to the Planning Team and served as the beginning point in the development of the Tribe's initiatives. The FEMA document includes a broad range of alternatives for consideration in the planning area, in compliance with 44 CFR (Section 201.7.c.3.ii). Many of the action items or initiatives can be applied to both existing structures and new construction, as identified below. The catalog provides a baseline of mitigation initiatives that are backed by a planning process, are consistent with the planning partners' goals and objectives, and are within the capabilities of the Tribe to implement.

The Planning Team developed strategies/action items that are categorized and assessed in several ways:

- By what the alternative would impact – new or existing structures, to include efforts which:
  - Manipulate/mitigate a hazard;
  - Reduce exposure to a hazard;
  - Reduce vulnerability to a hazard;
- By who would have responsibility for implementation:
  - Individuals;
  - Businesses;
  - Government (Tribal, County, Local, State and/or Federal).
- By the timeline associated with completion of the project, based on the following parameters:
  - Short Term = to be completed in 1 to 5 years
  - Long Term = to be completed in greater than 5 years
  - Ongoing = currently being funded and implemented under existing programs.
- By the type of mitigation activity involved (most of which also coincide with CRS activities):
  - **Prevention -** Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. This includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
  - **Public Information and Education -** Public information campaigns or activities which inform citizens and elected officials about hazards and ways to mitigate them – a public education or awareness campaign, including efforts such as: real estate disclosure, hazard information centers, and school-age and adult education, all of which bring awareness of the hazards of concern.
  - **Structural Projects** —Efforts taken to secure against acts of terrorism, manmade, or natural disasters. Types of projects include levees, reservoirs, channel

improvements, or barricades which stop vehicles from approaching structures to protect.

- **Property Protection** – Actions taken that protect the properties. Types of efforts include: structural retrofit, property acquisition, elevation, relocation, insurance, storm shutters, shatter-resistant glass, sediment and erosion control, stream corridor restoration, etc. Protection can be at the individual homeowner level, or a service provided by police, fire, emergency management, or other public safety entities.
- **Emergency Services / Response** —Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities (e.g., sandbagging).
- **Natural Resource Protection** – Wetlands and floodplain protection, natural and beneficial uses of the floodplain, and best management practices. These include actions that preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Recovery** —Actions that involve the construction or re-construction of structures in such a way as to reduce the impact of a hazard, or that assist in rebuilding or re-establishing a community after a disaster incident. It also includes advance planning to address recovery efforts which will take place after a disaster. Efforts are focused on re-establishing the planning region in such a way as enhance resiliency and reduce impacts to future incidents. Recovery differs from response, which occurs during, or immediately after an incident. Recovery views long-range, sustainable efforts.

- Benefit: By whom the strategy benefits:
  - A specific structure or facility;
  - A local community;
  - Tribal level benefits;
  - Regional level benefits.

During development of these strategies, the Planning Team conducted a comprehensive review of the previous action plan to determine which actions were completed, which should carry forward to the updated plan, ones which remain relevant but for which no action has occurred since the last plan, and projects which were no longer feasible and should be removed from the plan. Review of the 2023 and 2024 HMP Annual Report was also conducted to gain additional information on the status of the previous initiatives.

For this 2025 update, two new sections were developed in Table 13-2 which provides the 2025 Status of the 2021 initiatives, as well as the 2025 initiatives for this update. In addition to the referenced FEMA Catalog, many of the hazard mitigation initiatives recommended in this plan were selected from among the examples presented from other planning and strategic documents – integrating various planning efforts already in existence to the greatest extent possible.

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
1. Retrofit or move tribal facilities to better withstand impact from a natural hazard event. This includes structures within the floodplain, or areas impacted by flood events. This would include land acquisition and removal of structures to allow for open space and the return to natural environments.										
New and Existing	All	1, 2, 3, 4, 5, 6, 7, 8	Planning	High	General Fund, HMGP, HUD	Long-Term	N	Structural, Natural Resource Protection, Recovery, Property Protection	Tribal	O, CF
2025 Status: Work is ongoing on this initiative. The Tribe recently obtained land from Briarwood Farms, with possible future use to include new structures. When built, the structures will be built to the existing codes in place to ensure resilience.										
2. Evaluate and enhance the current capital improvements program for drainage projects to provide better flood control in known flood problem areas. This would include working with Grays Harbor or Thurston Counties as the Tribe deems appropriate.										

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New and Existing	CC, F, LS, SW, T	1, 2, 3, 4, 5, 7, 8	Planning	High	State Ecology FCAAP, HMGP, HUD, USACE, EPA	Long-Term	Yes – Modified to expand from identification of a specific culvert to broaden potential.	Protection, Prevention, Natural Resources	Tribal, Local, County, Region	O, CF
2025 Status: The Tribe continues working with Grays Harbor and Thurston Counties emergency management and public works departments, as well as members of the various Flood Hazard Planning Committees. Since completion of the last plan, the Chehalis Basin flood maps were completed, which were utilized in this HMP update. Those maps help identify areas of concern with respect to construction of capital improvement projects as they relate to flood control. The Tribe and the Counties continue to explore avenues to address flood control issues within the planning area as flooding many times causes impassable roadways, impacting first responder's ability to operate, as well as impacting evacuation routes.										
3. Working with local, county, and state agencies as appropriate, seek project funding or relocation funding for roads with histories of dangerous and unsafe driving conditions, and those with a history of flooding, instability, or lacking safety guidelines to ensure safe accessibility to the Reservation. This is particularly important during times of evacuation from impact from all hazards of concern.										
Existing	EQ, F, SW, V, WF	3, 4, 5, 6, 7, 8	Planning	High	HMGP, USDOT, WADOT	Long-Term	Y	Emergency Services, Protection, Prevention	Tribal, Local, County, Region	N, CF
2025 Status: No progress has been made since completion of the 2021 plan; however, the Tribe does feel this project remains extremely relevant given the impact on evacuation and first responder response abilities when roadways become impassable. As funding opportunities arise, the CTCR will continue to explore avenues for joint projects with the counties to enhance roadways.										

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
4. Seek grant funding for acquisition of properties within high-hazard areas to help restore the natural habitat of the area/watershed.										
Existing	All	1, 2, 3, 4, 5, 7, 8	Natural Resources	High	HMGP	Long-Term	Y	All	Facility, Tribal	O, CF
2025 Status: The Tribe has previously purchased properties utilizing tribal funds which have been returned to their natural state. As of this 2025 update, the Tribe has acquired additional properties since completion of the last plan, but the decision on its use has not yet been determined by the Tribal Business Committee. The Tribe continues to view these no-impact initiatives fundamental to restoring its lands to a natural state, and as such, this initiative is considered on-going in nature and will continue forward.										
~~5. Remove road embankment fill under Balch Road, which currently acts as a levee. This project would increase river conveyance during flooding and reduce upstream flood levels, while also enhancing fish spawning.~~										
New and Existing	All	3, 4, 5, 6, 7	Planning, NR	Low	General Fund	On-Going	Y	Natural Resources, Response, Recovery	Facility, Tribal, Local	R
2025 Status: As a result of a 2009 flood event, the flood waters washed out an unused portion of Balch Road, which was acting as a levee. Consequently, the floodwaters can now flow more naturally through the area, and the land remains open space, helping to reduce the flood risk in other areas. As such, this project is removed.										
6. Conduct a needs assessment to determine logistical requirements for equipment and parts for wells, water storage facilities, purification systems, and water distribution sources to ensure for continued supply of water after a major event. This may include generators to allow wells to continue operations.										
Existing	All	3, 4, 5, 7,	Planning	Low	General Fund	Short-Term	Y	Emergency Services, Protection	Tribal, Local, County	O, CF
2025 Status: The Tribe is currently working on installation of new wells, and will continue to explore opportunities to ensure water supplies after a major event during the life cycle of this plan.										

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
7. Replace U.S. Highway 12 bridge at Black River. The existing bridge is a multi-span, steel truss and concrete beam structure constructed in 1932 and provides important access for the Reservation between SR 8 and Interstate 5. Currently, the bridge and road prism constrict high flows. This hydraulic condition is causing bank erosion and bed scour, which prompted repairs in 2001 to protect the bridge piers and abutments. The failure of these critical components could result in loss of the bridge during a significant storm event. In addition to the possible loss of access, a joint Tribe/ WSDOT study (WSDOT 2005) found that erosive conditions resulting from the constriction likely are degrading existing Black River aquatic and riparian habitat, which is inconsistent with the Tribe's guiding principles.										
New	All	All	Planning	High	WSDOT, USDOT, BIA	Long-Term	Y	All	Tribal	CF
2025 Status: CTCR continues to work on this project, but at present, are still awaiting further information concerning the level of work needed, and the associated cost.										
8. Continue to design and build facilities to meet or exceed seismic (or load) standards, including redundant essential equipment. Apply current IBC standards to all renovation or replacement of existing facilities, structures, and/or equipment.										
New and Existing	EQ, LS, SW, V, WF	1, 2, 3, 4, 7, 8	Planning	Medium	HMGP	Long-Term	Y	Prevention	Tribal	C, CF

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
2025 Status: The CTCR remain current with respect to adoption of building codes necessary to ensure structures built or remodeled are built to current code. The Tribe does have a Building Official on staff, who also serves as the Building Inspector for all Tribal-owned structures, including structures built by the Tribe off of the Reservation. The Tribe continues to work on acquiring redundant systems and equipment to ensure continued operations and provision of services of those essential elements and lifelines during emergencies. In furtherance of that, since completion of the last plan, the Tribe has begun installation of two new wells to ensure redundancy with respect to providing water to areas impacted by disasters. This includes the Tribe's ability to ensure an adequate water supply should the need arise for fighting wildfires. The Tribe will continue to explore enhancements and redundant systems within all new construction and remodels. As future code updates occur, with the development of the CWPP and the implementation of the FireWise Program, enhancements to include additional building codes such as sprinkler systems, landscaping, and the use of fire retardant or less flammable building materials may also be reviewed and updated.										
9. Implement various activities that support mitigation efforts to reduce the negative influence of natural hazards impacting the Tribal Planning Area and the watersheds as a whole.										
New and Existing	All	All	Natural Resources	High	General Fund, HLS, Health	On-Going	Y – Modified	All	All	C, O, CF
2025 Status: Since the 2021 plan was completed, the Tribe's Natural Resources Department applied for and received a grant from Washington State Department of Commerce (Tribal Climate Resilience Fund) to complete a vegetation study on the Reservation, as well as to develop a CWPP to help identify high fire danger risk areas. The CWPP serves as the Wildfire chapter of this HMP. With that CWPP and this HMP, the CTCR were able to develop and implement mitigation activities to reduce that risk from wildfire, helping to ensure the resilience of the CTCR. The data also provided opportunities for extensive public outreach efforts to educate the residents and tribal members about the wildfire (and other) risks, and ways that they can help mitigate the spread and impact of wildfire. The CWPP also supports the FireWise Program recently implemented by the CTCR. With the vegetation study, the Tribe will also be able to determine the deviation of the vegetation growth from that normally occurring and help to identify the potential impact from climate change on the vegetation. Combined, these various elements will help in working towards enhancing forest health, which ultimately will reduce the wildfire danger on the Reservation.										

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
10. Utilize data gathered during risk assessment to identify capital projects that, when modified, increase the resilience of the Tribal structures and conveyances to damage, or that allow a more expedited process for recovery from the impact of disaster incidents.										
New and Existing	All	All	EM, Tribal BC, Facilities	Low	General Funds, Grants	Long-Term	Y	Recovery, Prevention, Structural	Tribal	C, O, CF
2025 Status With this 2025 HMP update, the CTCR again reviewed and revised its critical facilities list, which can be utilized during rapid windshield assessments and damage assessments, as needed. The data in the critical facilities list provides, among other things, the value (building and structure), stories, and type of construction – information needed to help determine impact from disasters. The risk assessment also identifies hazard areas, which information can be utilized when capital projects or improvements are considered, allowing for the implementation of mitigation activities which help reduce the impact on structures and infrastructure. As identified in the plan maintenance section of the 2021 HMP, the CTCR also completed an annual review of the HMP, addressing project status, disaster or significant event histories, and the monetary loss impact from that event (both structure impact and economic impact). This allowed for retention of impact data for use during this update, and also for the purpose of Stafford Act grant applications, which require the identification of previous events impacting the project, helping to achieve the required Benefit Cost Analysis rating by demonstrating previous occurrences and damages.										
11. Consider projects enhancing resistance of tribal structures to impact from hazards of concern, such as: seismic bracing of equipment, piping and fixtures, removal of high hazard beams; increased load capacity from wind, snow, and volcanic ash; utilizing building materials more resistant to wildfire, assisting to decrease the spread of wildfire, or access road reinforcement allowing for ingress and egress.										
New and Existing	EQ, LS, SW, V, WF	1, 2, 3, 4, 7	Facilities, Planning	High	General Funds, OR DOT, US DOT, HMGP	Long-Term	Y-Modified	Emergency Services, Recovery, Prevention, Structural	Tribal	

TABLE 13-2 HAZARD MITIGATION ACTION PLAN MATRIX										
Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
2025 Status: Since completion of the last plan, several projects and initiatives falling within this category have been completed. A few examples include a new bridge on Howanut, which was completed by the CTCR's Fisheries division; application of new pavement on Anderson Road, elevating the roadway to allow for use during severe weather and flooding events; and construction of a new Elder's facility, which also serves as a shelter for the Tribe. In addition, in 2024, the Tribe gained authority over specific roadways previously maintained by Grays Harbor County. This provided the CTCR with much greater control over roadways frequently impacted by flood events, which historically have impacted evacuation and response efforts by first responders.										
12. Implement a recovery system to ensure maximum FEMA reimbursement for disaster response, repair, mitigation and recovery, which will capture and track damages sustained, emergency activities, associated expenses (mileage, supplies, expendables, outside vendors, etc.), employee time, and dedicated resources.										
New and Existing	All	7	EM, Finance, Tribal BC	Medium	EMPG, General Fund	On-Going	Y	Emergency Services, Response, Recovery	Tribal	C, O, CF
2025 Status: Update of 2021 Hazard Mitigation Plan is in process with this submission. Training with FEMA Assistance is ongoing. Updated initiative training on FEMA's Public & Individual Assistance Program processes is also underway. The Tribe has begun collecting damage information as significant events occur, and with the 2024 HMP Annual Progress Report, has also captured event information for use in future HMP update, as well as future grant applications.										
13. Utilize data from the current risk assessment to update GIS capacity and capabilities. The risk assessment provides both geographic boundaries at potential risk which can be used for land use planning, capital improvement project planning, or in identifying evacuation routes, etc. The structure data developed for the critical facilities list established for this process will allow for viewing of structures at risk in a hazard area; for use in windshield assessment after an incident; to identify structures impacted for use when requesting a disaster declaration; or in identifying areas of impact and dollar losses to support public assistance. The wildfire data can be utilized to illustrate areas benefitting from application of suppression tactics or treatments, or to track treatment areas, supporting grant applications.										

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New and Existing	All	3, 7	GIS/NR	Low	General Fund, HMGP	On-Going	Y-Modified	Emergency Services, Prevention, Protection	Tribal	C, O, CF
2025 Status: CTCR's GIS does capture information with respect to the hazards of concern, as well as providing information on the critical facilities list. They also maintain the data with respect to new properties acquired by the CTCR to ensure those areas can be addressed in future HMP updates. With the completion of this 2025 update, the CTCR will again utilize the data moving forward, and ensure it is kept current.										
14. Identify and train Tribal staff, youth, and volunteers that will be utilized for emergency management efforts. Training to be considered includes ICS classes for NIMS compliance, ATC 20/45, Disaster Site Worker Training, Emergency Response Training, and Damage Assessment.										
New	All	3, 6, 7	EM, HR, Facilities, LE	Medium	General Fund, HLS	On-Going	Y	Emergency Services	Tribal	C, O
2025 Status: EM staff have attended various training efforts to ensure continued NIMS compliance, as well as the application of the ICS. The CTCR has previously adopted (and with this update again adopts) the NIMS for its common operating structure during incidents and events. Planning is also currently underway for a DART and/or CERT Program. Progress has also been made in adding potential candidates to serve in various capacities, including an update to the COOP plan (in-progress) which identifies additional staffing necessary during times of COOP activation and response activities. Since completion of the last plan, the Tribe's EM became a certified FEMA trainer in different classes and will now be able to administer training directly to Tribal members. This will help expedite the delivery of training.										
15. Work with Tribal and local transit organizations to develop an exercise related to evacuation of residents.										
New	All	3, 5, 7	EM	Medium	DOT, HMEP, EMPG, Fire Grants, HUD, DOH	Short-Term	Y	Emergency Services, Recovery	Tribal, Local, County	C, O, CF

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
2025 Status: Since completion of the 2021 plan, a Tribal Evacuation Plan was completed, which is an Annex to the CEMP. An exercise was conducted in 2024 to help define the roles for individual tribal members and to help them to understand the reasons for evacuating, along with their own personal emergency preparedness. From that exercise, an AAR was developed, including a corrective plan. The Tribe is currently reviewing the AAR and making recommendations for updates and enhancements to the Evacuation Plan.										
16. Leverage resources and partnerships to train and exercise together to ensure continuity during real world events.										
New	All	7	EM	Medium	General Budget, HLS, DOJ Grants	On-Going	Y	Emergency Services, Prevention	All	C, O, CF
2025 Status: A Tribal Evacuation Plan has been completed since completion of the 2021 plan, which is part of the CEMP as an Annex. An exercise was planned for 2024 for to help define the roles for individual tribal members and to help them to understand the reasons for evacuating, along with their own personal emergency preparedness. The Tribe also conducted Active Shooter Training in 2023 for Run-Hide-Fight, training 45 students, as well as 12 Train the Trainer Instructors. The Tribe also conducted a Tabletop Exercise for Hazmat in April 2024.										
17. Develop (or update) plans to ensure response and recovery efforts. This includes working with the casino, counties, and local municipalities to look at communications and interoperability issues.										
New and Existing	All	7	EM, Planning	Medium	Various depending on plan	On-Going	Y	Prevention, Emergency Services, Recovery	All	C, O, CF
2025 Status: Since completion of the 2021 plan, the Tribe has updated various plans, as well as developing new plans, as follows: 2025 Tribal Hazard Mitigation Plan, Emergency Management Plan, Evacuation Plan, and Continuity of Operations Plans have all been recently updated and approved. All of these plans have continued to expand the roles and responsibilities within the Tribe, as well as within the surrounding counties' service providers, such as Fire Services, EM Coordination, etc.										
18. Conduct public outreach on risk-reduction techniques for communicable diseases through public education campaigns which increase awareness of healthy behaviors, including during times when shelters are established.										

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New	All	3, 6, 7	Tribal Health, Human Services, Casino	Low	General Fund	Short-Term	Y	Public Education, Response, Recovery, Emergency Services	All	C, O, CF
2025 Status: Since completion of the 2021 plan, a new Wellness Director has been hired. As the Department updates and develops future Pandemic, RSV, and Flu plans, they continue to educate tribal members and staff on preparedness and response activities. The Tribe may continue to seek grant funding to both develop plans, and also conduct exercises to test those plans.										
19. Consider developing programs and public outreach efforts which support community participation in incentive-based programs, such as FireWise, StormReady Programs, and the NFIP.										
New and Existing	Drought, F, LS, SW, WF	3, 6, 7	EM, Planning	Low	General Fund	Short-Term	Y	Emergency Services, Public Education	Tribal, Local, County	C, O, CF
2025 Status: Since completion of the last plan, the Natural Resources Department received a Washington State Department of Commerce grant to complete a vegetation study for use in identifying wildfire risk, potential climate change impacts, and help determine forest health on properties owned by the CTCR. A portion of those funds were also used to develop the 2025 Community Wildfire Protection Plan, which serves as the wildfire chapter of this HMP update. The Tribe has also completed its FIREWISE application, with its preliminary plan submitted.										
20. Adopt the Tribal Hazard Mitigation Plan as an element of any comprehensive plan that the Tribe has developed in order to ensure linkage between the various documents.										

TABLE 13-2 HAZARD MITIGATION ACTION PLAN MATRIX										
Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New and Existing	All	All	Planning	Low	General Fund	Long-Term	Y	Prevention, Public Information, Property Protection, Emergency Services, Natural Resource Protection	Tribal	O, CF
2025 Status: The Planning Department is part of the 2025 HMP Planning Team. Once the HMP is adopted by the Tribal Business Committee, the information will be utilized to inform other planning documents and public outreach efforts on the CTCR. The Risk Assessment Data and CWPP analysis will continue to remain available for department and citizen review online, as well as hard copy.										
21. Utilizing data from this HMP, update the Emergency Operations Plan (EOP) to include all hazards of concern to establish management and operations during emergency or disaster situations.										
New and Existing	All	All	EM, LE, Planning	Low	General Fund, THLS	Short-Term	Y	Emergency Services, Recovery	Tribal	C, O, CF
2025 Status: Various updates to the CEMP have been completed since the last plan was completed, including an Evacuation Plan, COOP, CEMP and ESF updates. The HMP Risk Assessment helps to inform citizens on the hazards of concern, and the information developed is used to help identify hazard-specific documents and response training.										
22. Develop a post-disaster action plan for all hazards of concern that addresses: debris management, cultural/historical data gathering, substantial damage assessment, and grant management.										
New and Existing	All	All	EM, Finance, Planning, Cultural Heritage	Low	General Fund, BIA, THLS	Long-Term	Y	Emergency Services, Recovery	Tribal	C, O, CF

TABLE 13-2
HAZARD MITIGATION ACTION PLAN MATRIX

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
2025 Status: Since completion of the last plan, the Tribe has completed a Debris Management Plan, which is actively being trained to ensure recovery of losses. Grant management continues to be in accordance with the terms of the granting agency, including quarterly (and other) reporting. The Tribe has also engaged in damage assessment training, as well as developing procedures to insure information is captured which supports disaster recovery efforts.										
23. Consider codes and ordinances which positively influence the resiliency of the tribe from the hazards of concern, such as land use development; landscaping ordinance for fuel reduction; building codes for minimum seismic stability; flood damage prevention ordinance to cumulatively track substantial improvements and damage, etc.										
New and Existing	D, F, LS, SW, WF	All	Tribal BC, Planning	Low	General Fund	Long-Term	Y	Prevention, Natural Resources, Structural	Tribal, Local, County	O, CF
2025 Status: All new buildings constructed are meeting updated codes. Older structures being remodeled or updated also much meet the most relevant codes in place.										
24. Secure funding to acquire generators to maintain critical infrastructure, including for water systems (wells).										
New and Existing	CC, EQ, F, LS SW, WF	6, 7	Facilities	Medium	HMGP, THLS, BIA, DOH, General Fund	Short-Term	Y	Emergency Services, Recovery	Facilities, Tribal	C, CF
2025 Status: Backup storage for water and well additions continue to be in process, although two new wells have been put on line since completion of the last plan. Additional efforts are under review and development.										
25. Raise Moon Road south of U.S. Highway 12 in a manner to improve emergency access during flooding and provide a second access road engineered to contemporary standards to the reservation during emergencies. This project would include smoothing the grade of the road to remove dips, providing a road shoulder, redesign of the Moon Rd/188th intersection and installation of appropriately sized culverts to allow floodwater passage.										

TABLE 13-2 HAZARD MITIGATION ACTION PLAN MATRIX										
Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New and Existing	All	All	Planning	High	Grants – Stafford Act and BIA, WSDOT	Long-Term	Y	Prevention, Protection, Natural Resources	Region	CF
2025 Status: Since completion of the last plan, traffic access has been restricted for cars utilizing portions of 188th Ave. SW. As such, this initiative may no longer be relevant, but until final determinations can be made, the Tribe will maintain the initiative until the next HMP update when a final determination can be made**.**										
26. Construct shelter facility for use during disaster incident. Facility can also be used as a warming, cooling, or feeding shelter during extreme weather events. Shelter should be constructed large enough to enable sheltering of citizens visiting the Tribal Planning Area, including Casino guests who may be stranded as a result of sudden-onset incident (e.g., earthquake).										
New	All	3, 4, 5, 6, 7, 8	EM in conjunction with Red Cross	High	HUD Block Grants, General Fund, HMGP, HLS, Fire Grants	Short-Term	Y	Prevention, Structural, Protection, Natural Resources	Tribal, Local, County, Region	C, CF
2025 Status: The CTCR are currently planning and budgeting for portable shelters from DLX utilizing two grants from DOH and Public Health. These structures will be utilized as shelters, medical support, and IC command. A permanent shelter is currently identified as the Community Center, which has a 300-person capacity. As new construction occurs, the tribe does attempt to integrate structure use for multiple purposes.										
27. Work with state to obtain spill response trailers to allow Tribe to respond to hazardous materials spills occurring in the Tribal Planning Area.										

TABLE 13-2 HAZARD MITIGATION ACTION PLAN MATRIX										
Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New and Existing	All	3, 4, 5, 6, 7, 8	EM	High	State Grants/ Programs	Short-Term	N	Emergency Services, Protection, Prevention, Recovery, Structural, Natural Resources	Regional	
2025 Status: Currently, the Tribe has a plan in place to utilize the 110 Battalion from State EMD and State Guard for spill response. As of this update, this process is still active.										
28. Work with local fire service providers and homeowners to identify areas where fuel treatment applications would be of benefit to help protect assets at risk from wildfires.										
New and Existing	WF	3, 4, 5, 6, 7, 8	EM	High	State Grant Programs;	Short-Term	N	Emergency Services, Protection, Prevention, Recovery, Structural, Natural Resources	Regional	
29. Continue to expand the FireWise program throughout the Tribal Planning Area, with a goal of identifying two new areas annually.										

TABLE 13-2 HAZARD MITIGATION ACTION PLAN MATRIX										
Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency (listed first) and others potentially involved	Estimated Cost	Sources of Funding	Timeline	Included in Previous Plan?	Initiative Type: Emergency Services, Property Protection, Prevention, Recovery, Structural Projects, Public Info., Natural Resources	Who or What Benefits from Action? Facility, Tribal, Local, County, Region	2025 Status C=Completed, CF=Carried Forward, O=On-Going, N=No Action Taken, R=Removed
New and Existing	WF	3, 4, 5, 6, 7, 8	EM	Low	State Grants/ Programs	Short-Term	N	Emergency Services, Protection, Prevention, Recovery, Structural, Natural Resources	Regional	
30. Explore the potential of establishing a Wildfire Ready Neighbors program with assistance from WA DNR, local area fire service providers, or Grays Habor Conservation District to conduct home site visits to assess the risk of wildfire on property.										
New and Existing	WF	3, 4, 5, 6, 7, 8	EM, Natural Resources	Low	State Grant, Firewise Micro-grant, Local Funds	Short-Term	N	Emergency Services, Protection, Prevention, Recovery, Structural, Natural Resources	Regional	

13.3 BENEFIT/COST REVIEW

Once established, the action plan must then be prioritized according to some form of a benefit/cost analysis of the proposed projects and their associated costs. The benefits of proposed projects were weighed against estimated costs 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). A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

Cost ratings were defined as follows:

- **High**—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds or grants).
- **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. If partial funding is available, or the project is a joint project with other agencies, *Partial* is also identified as an option.
- **Low**—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Benefit ratings were defined as follows:

- **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.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

For many of the strategies identified in this action plan, the Tribe may seek financial assistance under the HMGP or other grant programs which may require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, the Tribe reserve the right to define “benefits” according to parameters that meet the goals and objectives of this plan.

13.4 ACTION PLAN PRIORITIZATION

Table 13-3 lists the priority of each initiative, using the same parameters used in selecting the initiatives. A qualitative benefit-cost review was performed for each of these initiatives. The priorities are defined as follows:

- **High Priority**—A project that meets multiple objectives (i.e., multiple hazards), has benefits that exceed cost, has funding secured or is an ongoing project and meets eligibility requirements for the HMGP or PDM grant program. High priority projects can be completed in the short term (1 to 5 years).

- **Medium Priority**—A project that meets goals and objectives, that has benefits that exceed costs, and for which funding has not been secured but that is grant eligible under HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is secured. Medium priority projects will become high priority projects once funding is secured.
- **Low Priority**—A project that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for HMGP or PDM grant funding, and for which the time line for completion is long term (1 to 10 years). Low priority projects may be eligible for other sources of grant funding from other programs.

TABLE 13-3
PRIORITIZATION OF MITIGATION INITIATIVES

Initiative #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant Eligible?	Can Project be Funded Under Existing Programs/ Budgets? (Yes / No / Partial)	Priority (High, Med., Low)
1	8	H	H	Y	Y	P	H
2	7	H	H	Y	Y	P	H
3	6	H	M	Y	Y	N	H
4	7	H	H	Y	Y	P	H
~~5~~	~~5~~	~~H~~	~~M~~	~~Y~~	~~Y~~	~~P~~	~~M~~
6	4	M	L	Y	N	Y	M
7	8	H	H	Y	Y	P	H
8	6	H	H	Y	Y	Y	H
9	8	H	H	Y	Y	P	H
10	8	H	H	Y	Y	Y	H
11	5	H	M	Y	Y	Y	H

TABLE 13-3
PRIORITIZATION OF MITIGATION INITIATIVES

Initiative #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant Eligible?	Can Project be Funded Under Existing Programs/ Budgets? (Yes / No / Partial)	Priority (High, Med., Low)
12	1	M	M	Y	M	Y	M
13	2	M	L	Y	N	Y	L
14	3	M	L	Y	N	Y	L
15	3	M	L	Y	N	Y	M
16	1	M	L	Y	Y	Y	M
17	1	M	M	Y	N	P	M
18	3	H	L	Y	Y	Y	H
19	3	M	L	Y	N	Y	L
20	8	H	L	Y	N	Y	H
21	8	H	M	Y	Y	P	H
22	8	H	L	Y	N	Y	H
23	8	H	L	Y	N	Y	H
24	2	H	H	Y	Y	N	H
25	8	H	H	Y	Y	N	H
26	6	H	H	Y	Y	N	H
27	6	H	M	Y	N	N	M
28	6	H	H	Y	Y	N	H
29	6	H	L	Y	Y	Y	H
30	6	H	L	Y	Y	Y	H

13.5 ADDITIONAL MITIGATION PROJECTS AND EFFORTS TO REDUCE RISK

In addition to the above project status, the Tribe has also completed other mitigation-related efforts, including land use development trends which have reduced the impacts of various hazards of concern. Those projects include, but are not limited to:

- Wetland projects, which include detention storage basins, ponds, reservoirs, etc., to allow water to temporarily accumulate to reduce pressure on culverts and areas with low water crossings, reducing impact from flooding.
- Fish Passage Restoration Project.
- Establish and enforce a burn ordinance that requires burn permits, restricts campfires, and controls outdoor burning on Tribal owned lands, reducing the risk of wildfire.
- For those projects off of the Reservation or on non-trust lands, establish a system whereby the Tribe's building ordinances are applied to ensure the highest level of integrity for new construction, including entering into agreements with both Grays Harbor and Thurston Counties to utilize the Tribe's Building Official for inspections.

Chehalis Department of Natural Resources

The Natural Resources Department is involved in environmental monitoring, protection, and restoration in marine, freshwater, and terrestrial environments. Projects include a wide range of activities from stormwater monitoring, plant and animal population studies and climate change analysis to full scale river restoration projects and debris removal. Staff use traditional ecological knowledge and insights from Tribal citizens to influence its work to ensure availability of traditional use materials and native foods for current and future generations.

Policy Partnerships

The Tribe participates in several policy organizations aimed at protecting natural resources within the planning area, such as with FEMA and the various Flood Insurance Studies, as well as other studies. By collaborating with various stakeholders, the Tribe is able to increase support for projects restoring and preserving resources important to the Tribe.

Protection

In addition to restoring and acquiring parcels for conservation, the Tribe also works to protect properties outside of Tribal control by ensuring existing regulations are properly implemented and enforced. This involves collaboration and occasionally confrontation with a variety of local, state, and federal rule-makers and enforcers. Fish and wildlife know no jurisdictional boundaries; therefore, it is critical to protect the environment on and off Tribal land.

Conservation

Habitat restoration is critical to maintaining and enhancing cultural opportunities for Tribal citizens; however, projects on private land are often limited and have no guarantee of longevity. Thus, the Chehalis Tribe has continued to focus on land acquisition as a means of habitat conservation. Benefits of an acquisition strategy for conservation include:

- Ensuring protection from development in perpetuity;
- Allows for larger scale restoration projects that would not otherwise be practical on occupied land (e.g., bank armoring removal, floodplain reconnection); and
- Provides exclusive access to Tribal citizens to exercise their cultural practices (depending on the funding source).

CTCR has pursued a policy of also purchasing farmland located primarily on the floodplain specifically for conservation purposes, including reforestation, wildlife habitat, and wetlands development. In many instances, this requires the removal of structures to provide for open space.

Wastewater Management

The CTCR also developed a Master Plan for their Reservation that included seven decentralized Membrane Bioreactor Sewage Treatment Systems (MBR) for wastewater treatment. The first MBR was installed to treat wastewater from the new Public Safety Building. Flow is fed from a 3,500 gallon septic tank into a single train MBR, with discharge from the facility sent to a nearby drain field (see Figure 13-1).[60] Such actions further reduce potential impact from on-going development by utilizing the lay of the land for retention areas, and building smaller, less-impacting structures which maintain greater open space.

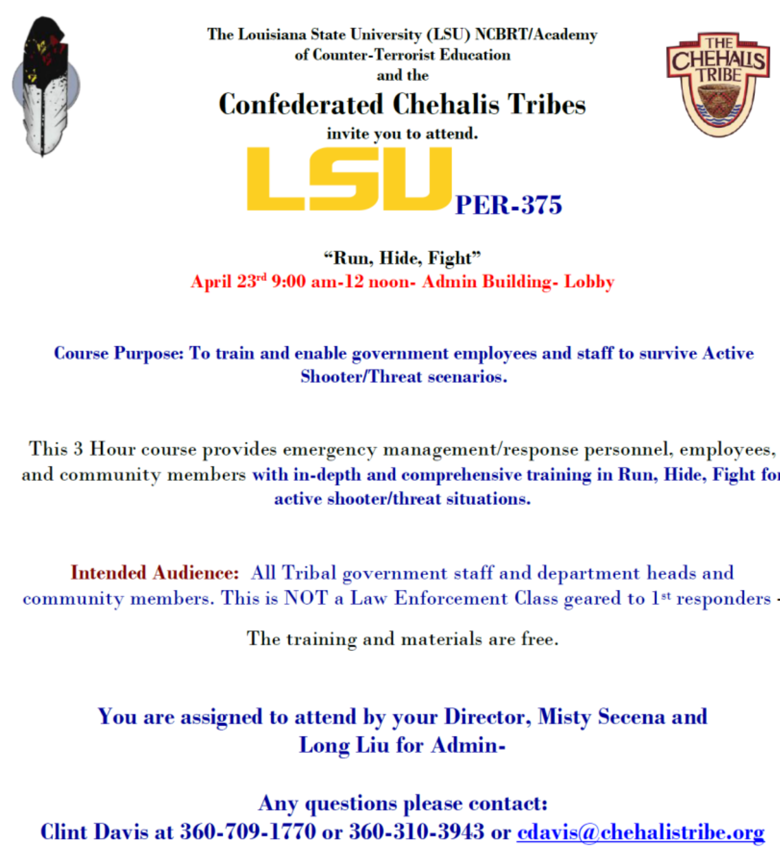
[60] https://mbrcentral.com/case-study/chehalis-public-safety-building/#:~:text=The%20Confederated%20Tribes%20of%20the%20Chehalis%20Reservation%20located,treat%20wastewater%20from%20their%20new%20Public%20Safety%20Building.

Figure 13-1 One of two Enviroquip MBR Systems owned by the CTCR

Emergency Management

The Emergency Management staff have completed advanced training with FEMA, the State EMD and with our local county partners in Grays Harbor and Thurston. Staff also updated Federal Disaster Declaration requirements for Tribal governments, as well as having our own Emergency Manager, Clint Davis, certified as a State Approved/FEMA Instructor, so he can deliver training to our own employees and staff.

The EOC checklists have been updated and the EMAG group was apprised of its use in emergencies, as well as updating their COOP plan for secondary staff to fill positions when primaries are down, out of area, or not available



The Louisiana State University (LSU) NCBRT/Academy
of Counter-Terrorist Education
and the
Confederated Chehalis Tribes
invite you to attend.
LSU PER-375

"Run, Hide, Fight"
April 23rd 9:00 am-12 noon- Admin Building- Lobby

Course Purpose: To train and enable government employees and staff to survive Active Shooter/Threat scenarios.

This 3 Hour course provides emergency management/response personnel, employees, and community members **with in-depth and comprehensive training in Run, Hide, Fight for active shooter/threat situations.**

Intended Audience: All Tribal government staff and department heads and community members. This is NOT a Law Enforcement Class geared to 1st responders -

The training and materials are free.

You are assigned to attend by your Director, Misty Secena and Long Liu for Admin-

Any questions please contact:
Clint Davis at 360-709-1770 or 360-310-3943 or cdavis@chehalistribe.org

Additional food, water treatment and medical supplies have been updated and radios for emergency communication deployed. Ongoing CPR/1st aid and Active Threat Training is 85% complete for Tribal employees and will continue to be expanded to community members in 2025.

Active education and planning for flood events have been implemented; a robust 2025 Training Calendar is planned. See 2023 and 2024 Annual HMP Reports About Us - The Chehalis Tribe

13.6 MITIGATION MEASURES AND PROJECT CLOSE OUT

Mitigation measures and project close outs are the responsibility of the department identified in the actual strategy or identified by grant application. The Planning Team shall share information regarding projects as they are implemented and completed.

The Chehalis Tribe is a relatively small jurisdiction with limited staff. Initiation and submission of projects utilizing federal or state grant funds falls under the Chehalis Grant Development and Review Policy. The policy furthermore documents the grant development and review process, assuring that grants submitted on behalf of the Confederated Tribes of the Chehalis Reservation by tribal staff or by intertribal consortia are duly authorized, meet a professional standard, and are consistent with tribal goals and objectives. The policy further assures that:

- The applying department has the legal authority to apply for assistance and the capability to ensure proper planning, management, and completion of the project, including funds sufficient to pay any matching share of the project.
- Authorized representatives of the funding agency will be granted access to and the right to examine all records related to the award.
- Federal and federally originating state grant funded projects will comply with all federal regulations, inclusive of personnel administration, non- discrimination and civil rights, labor standards, environmental standards, historic preservation, animal welfare, lobbying and political activities, drug-free workplace, maintenance of effort, and financial standards including audit and non-supplanting of funds.

The policy includes a process assuring department review, financial/budget approval, approval of the General Manager and approval by resolution of the Chehalis Business Committee.

Projects utilizing tribal funds are authorized through tribal authorization processes, which is similar to the Tribe's Grant Development and Review Policy and assures departmental review, financial (budget) approval, approval of the General Manager, and approval by resolution of the Chehalis Business Committee.

Projects specific to the HMP mitigation strategies will be reviewed annually by the Planning Team and Emergency Manager.

CHAPTER 14.
IMPLEMENTATION AND MAINTENANCE

14.1 PLAN ADOPTION

A hazard mitigation plan must document that it has been formally adopted by the governing body of the jurisdiction requesting federal approval of the plan (44 CFR Section 201.7(c)(5)). DMA compliance and its benefits cannot be achieved until the plan is adopted. This plan was adopted by the Tribal Council in June 2025. A copy of the resolution is provided in Figure 14-1.

INSERT RESOLUTION

Insert Plan Adoption Resolution

Figure 14-1 Resolution Adopting Hazard Mitigation Plan

14.2 PLAN MAINTENANCE STRATEGY

A hazard mitigation plan must present a plan maintenance process that includes the following (44 CFR Section 201.7(c)(4)):

- A section describing the method and schedule for monitoring, evaluating, and updating the mitigation plan over a 5-year cycle; a system for monitoring implementation of mitigation measures and project closeouts.
- A system for reviewing progress on achieving goals, as well as specific activities and projects identified in the mitigation plan.
- A process by which Tribal governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.
- A discussion on how the community will continue public participation in the plan maintenance process.

This chapter details the formal process that will ensure that the Hazard Mitigation Plan remains an active and relevant document and that the Chehalis Tribe maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. This chapter also describes how public participation will be integrated throughout the plan maintenance and implementation process. It also explains how the mitigation strategies outlined in this Plan will be incorporated into existing planning mechanisms and programs, such as comprehensive land-use planning processes, capital improvement planning, and building code enforcement and implementation. The Plan’s format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

14.2.1 Plan Implementation

The effectiveness of the hazard mitigation plan depends on its implementation and incorporation of its action items into existing local plans, policies, and programs. Together, the action items in the Plan provide a framework for activities that the Chehalis Tribe can implement over the next five years. The Planning Team has established goals and objectives, and has prioritized mitigation actions that will be implemented through existing plans, policies, and programs. Implementation of the long-term and short-term objectives/goals will be dependent on securing funding for each of the strategies identified in the plan. The Tribe will actively pursue a variety of funding opportunities identified in the various plans and prioritized by the various departments and programs under the direction of Chehalis Business Committee.

The Emergency Management Manager will have lead responsibility for overseeing the Plan implementation and maintenance strategy. Plan implementation and evaluation will be a shared responsibility among all departments and agencies identified as lead agencies in the mitigation action plan.

The implementation of all short-term mitigation actions will primarily be monitored by the Emergency Manager on an ongoing basis until implementation is complete, unless identified otherwise. Long-term actions being actively implemented will be monitored on an ongoing basis, or at least annually as needed. Long-term actions planned for the future will be reviewed during plan updates every five years.

The system for reviewing progress on achieving goals, objectives, and specific actions included in the mitigation strategy will be based on a progress report of all objectives and actions. This progress report will be reviewed annually by the Emergency Manager. As described in the previous section, progress on mitigation actions will be described in an annual report to the Chehalis Business Council and in the five-year update of the Hazard Mitigation Plan.

Project Tracking

In addition to the work products described in approved work plans for projects funded by FEMA's grant programs, quarterly or semi-annual (depending on reporting requirements of funding agencies) performance reports that identify accomplishments toward completing the work plan commitments, a discussion of the work performed for all work plan components, a discussion of any existing or potential problem areas that could affect project completion, budget status, and planned activities for the subsequent quarter (and/or annual and/biannual basis depending on the funding agency requirements and Tribal regulations) will be submitted to the funding agency by the assigned Project Manager and/or Grant Coordinator. The agency-specific final grant closeout documents will also be prepared by the appropriate tribal personnel at the conclusion of the performance period and submitted to the funding agency.

14.2.2 Planning Team

The existing Planning Team oversaw the development of the HMP and made recommendations on key elements of the plan, including the maintenance strategy. The principal role of the Planning Team in this plan maintenance strategy will be to review the annual progress report and provide input on possible enhancements to be considered at the next update. Future plan updates will be overseen by a Planning Team similar to the one that participated in this plan development process. As such, keeping an interim Planning Team intact will provide a head-start on the next plan. It will be the Planning Team's role to review the progress report in an effort to identify issues needing to be addressed by future plan updates.

14.2.3 Annual Progress Report

The minimum task of the ongoing annual Planning Team meeting will be the evaluation of the progress of its individual action plan during a 12-month performance period. This review will include the following:

- Summary of any hazard events and the impact these events had on the planning area;
- Review of mitigation success stories;
- Review of continuing public involvement;
- Brief discussion about why targeted strategies were not completed;
- Re-evaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding);
- Recommendations for new projects;
- Changes in or potential for new funding options (grant opportunities);
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The Planning Team has created a template for preparing a progress report (see Appendix B). The Planning Team will prepare a formal annual report on the progress of the plan that will be presented to Tribal Business Committee during the reporting period.

Annual progress reporting is not a requirement specified under 44 CFR. However, it may enhance opportunities for funding. While failure to implement this component of the plan maintenance strategy will not jeopardize compliance under the DMA, it may jeopardize the opportunity to leverage funding opportunities with other agencies.

14.2.4 Plan Update

CFR 201.7 requires that tribal hazard mitigation plans be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the DMA (44 CFR, Section 201.7(d)(3)). The CTCR intends to update the hazard mitigation plan on a 5-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than five years based on the following triggers:

- A Presidential Disaster Declaration that impacts the planning area;
- A hazard event that causes loss of life; or
- New data becomes available which significantly changes the findings of the risk assessment.

It will not be the intent of future updates to develop a completely new hazard mitigation plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a Planning Team.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plan will be reviewed and revised to account for any initiatives completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms (such as the comprehensive plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- Tribal Business Council will adopt the updated plan.

14.2.5 Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the Tribe's website and by providing copies of annual progress reports at various public outreach meetings, including the Chehalis Annual Meeting, which occurs annually in November. Copies of the plan will be shared with the various Tribal departments and tribal citizens as requested. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new Planning Team. This strategy will be based on the needs and capabilities of the Tribe at the time of the update. At a minimum, this strategy will include the use of social media tools, the Tribe's website, and also potentially utilizing media outlets within the planning area.

14.2.6 Incorporation into Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The Chehalis Tribe, through its various on-going capital improvement projects has planned for the impact of natural hazards. The plan development process provided the opportunity to review and expand on policies in these planning mechanisms. The Emergency Operations Plan and development policies are complementary documents that work together to achieve the goal of reducing risk exposure.

The Chehalis Tribe will create a linkage between the hazard mitigation plan and future land use plans by identifying a mitigation initiative as such and giving that initiative a high priority. Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan may include the following:

- FEMA Flood Insurance Studies

- Emergency response plans
- Capital improvement programs
- Tribal codes
- Community design guidelines
- Restoration plans
- Water-efficient landscape design guidelines
- Stormwater management programs
- Community Wildfire Protection Plans
- Vegetation Studies
- Transportation Plans
- Climate Adaptation Plans

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

REFERENCES

Ahrens, James. 2013. Lightning Fires and Lightning Strikes. National Fire Protection Association Fire Analysis and Research Division. Accessed at: https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Lightning-Fires-and-Lightning-Strikes

American Geosciences Institute. 2020. How much do landslides cost the U.S. in terms of monetary losses? Accessed online 21 July 2020. Available at: https://www.americangeosciences.org/critical-issues/faq/how-much-do-landslides-cost-terms-monetary-losses

Climate Impacts Group. 2019. Climate Impacts Group website. Accessed online at http://cses.washington.edu/cig/res/res.shtml

Federal Emergency Management Agency (FEMA). The Disaster Process & Disaster Aid Programs. Federal Emergency Management Agency Website Accessed 29 Oct 2020 at https://www.fema.gov/pdf/rrr/dec_proc.pdf

Federal Emergency Management Agency (FEMA). 2017. Using HAZUS-MH for Risk Assessment, How to Guide, FEMA (433). July 2017.

Federal Emergency Management Agency (FEMA). National Flood Insurance Program, Community Rating System; CRS Coordinator's Manual.

Frankle, A., E. Wirth; N. Marafi, J. Vidale, W. Stephenson. Bulletin of the Seismological Society of America. (2018) 108 (5A):2347-2369. Accessed online 9 Sept. 2020, Available at: https://pubs.geoscienceworld.org/ssa/bssa/article-abstract/108/5A/2347/544772/Broadband-Synthetic-Seismograms-for-Magnitude-9?redirectedFrom=fulltext

Headwater Economics. 2018. "The Full Community Costs of Wildfire". Accessed online at: https://headwaterseconomics.org/wp-content/uploads/full-wildfire-costs-report.pdf

International Strategy for Disaster Reduction. (2008). "Disaster Risk Reduction Strategies and Risk Management Practices: Critical Elements for Adaptation to Climate Change."

Meehl, G., and Tebaldi, C. 2004. More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century. Accessed online at: https://science.sciencemag.org/content/305/5686/994/tab-pdf

Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E. 2018. Projected Sea Level Rise for Washington State – A 2018 Assessment. A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, University of Oregon, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project. (Updated 07/2019.)

NASA, 2019. NASA Global Climate Change article "Can Climate Affect Earthquakes, Or Are the Connections Shaky?" Accessed online on January 2, 2020 at https://climate.nasa.gov/news/2926/can-climate-affect-earthquakes-or-are-the-connections-shaky

National Weather Service (NWS). 2019. Wind Chill Chart. Accessed online on 22 Sept 2020 at: https://www.weather.gov/safety/cold-faqs - New

NOAA. 2014. National Climatic Data Center website. Accessed Oct., Nov., Dec. 2020: https://www.ncdc.noaa.gov/stormevents/

OTA (Congressional Office of Technology Assessment). 1993. Preparing for an Uncertain Climate, Vol. I. OTA–O–567. U.S. Government Printing Office, Washington, D.C.

Pacific Northwest Seismic Network (PNSN). 2019. Cascadia Historic Earthquake Catalog, 1793-1929 Covering Washington, Oregon, and Southern British Columbia. Accessed online at http://assets.pnsn.org/CASCAT2006/Index_152_216.html

Sherrod, D. R., Mastin, L. G., Scott, W. E., and Schilling, S. P., 1997, Volcano hazards at Newberry Volcano, Oregon: U.S. Geological Survey Open-File Report 97-513, 14 p., 1 plate, scale 1:100,000, Accessed online on December 9, 2019 at: https://pubs.usgs.gov/of/1997/0513/

Spatial Hazard Events and Losses Database for the United States maintained by Arizona State University Spatial Hazard Events and Losses Database. https://cemhs.asu.edu/sheldus Accessed Sept. 2020.

Tilling, Robert, I. et.al. 1990. Eruptions of Mount St. Helens: Past, Present, and Future, U.S. Geological Survey Special Interest Publication.

U.S. Environmental Protection Agency (EPA). 2006. Excessive Heat Events Guidebook. EPA 430-B-06-005. Available online at http://www.epa.gov/heatisld/about/pdf/EHEguide_final.pdf

U.S. Environmental Protection Agency (EPA). 2010. Climate Change Indicators in the United States. U.S. Environmental Protection Agency, Washington, DC, USA

U.S. Environmental Protection Agency (EPA). 2011. Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, EPA Response to Public Comments. U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency (EPA). 2019. Climate Change Facts: Answers to Common Questions. U.S. EPA Website. Accessed October 2020 at: https://www.epa.gov/climate-research

U.S. Environmental Protection Agency (EPA). 2013. 2016. Climate Change Indicators in the United States. https://www.epa.gov/climate-indicators

U.S. Geological Survey (USGS). 1989. The Severity of an Earthquake. U.S. Government Printing Office: 1989-288-913. Accessed online at: http://pubs.usgs.gov/gip/earthq4/severity_text.html

U.S. Geological Survey (USGS). 2008. An Atlas of ShakeMaps for Selected Global Earthquakes. U.S. Geological Survey Open-File Report 2008-1236. Prepared by Allen, T.I., Wald, D.J., Hotovec, A.J., Lin, K., Earle, P.S. and Marano, K.D.

U.S. Geological Survey (USGS). 2010. Rapid Assessment of an Earthquake's Impact. U.S. Geological Survey Fact Sheet 2010-3036. September 2010.

U.S. Geological Survey (USGS). 2012. "Earthquake Hazards Program: Pacific Northwest." Last modified July 18, 2012. Available on-line at https://www.usgs.gov/natural-hazards/earthquake-hazards/earthquakes.

U.S. Geological Survey (USGS). 2020. USGS Fault Database, accessed online at https://earthquake.usgs.gov/hazards/qfaults/

U.S. Geological Survey (USGS). 2019. The Modified Mercalli Intensity Scale. USGS website accessed online at: https://www.usgs.gov/natural-hazards/earthquake-hazards/science/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects

U.S. Geological Survey (USGS). 2020. *Landslides 101*. 2020. Accessed 21 July 2020. Available online https://www.usgs.gov/natural-hazards/landslide-hazards/science/landslides-101?qt-science_center_objects=0#qt-science_center_objects

U.S. Global Change Research Program (USGCRP). 2009. Global Climate Change Impacts in the United States. Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

Washington State Enhanced Hazard Mitigation Plan. (Various editions 2013, 2018). Accessed various times. Available online at: https://mil.wa.gov/enhanced-hazard-mitigation-plan

This page intentionally left blank.

APPENDIX A. ACRONYMS AND DEFINITIONS

APPENDIX A.
ACRONYMS AND DEFINITIONS

ACRONYMS

CFR—Code of Federal Regulations

cfs—cubic feet per second

CIP—Capital Improvement Plan

CRS—Community Rating System

CTCR – Confederated Tribes of the Chehalis Reservation

CTE – Chehalis Tribal Enterprise

DFIRM—Digital Flood Insurance Rate Maps

DHS—Department of Homeland Security

DMA —Disaster Mitigation Act

EAP—Emergency Action Plan

EPA—U.S. Environmental Protection Agency

ESA—Endangered Species Act

FEMA—Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

FIRM—Flood Insurance Rate Map

FIS—Flood Insurance Study

GIS—Geographic Information System

HAZUS-MH—Hazards, United States-Multi Hazard

HMGP—Hazard Mitigation Grant Program

IBC—International Building Code

IRC—International Residential Code

MM—Modified Mercalli Scale

NEHRP—National Earthquake Hazards Reduction Program

NFIP—National Flood Insurance Program

NOAA—National Oceanic and Atmospheric Administration

NWS—National Weather Service

PDM—Pre-Disaster Mitigation Grant Program

PDI—Palmer Drought Index

PGA—Peak Ground Acceleration

PHDI—Palmer Hydrological Drought Index

SFHA—Special Flood Hazard Area

SHELDUS—Special Hazard Events and Losses Database for the US

SPI—Standardized Precipitation Index

USGS—U.S. Geological Survey

DEFINITIONS

100-Year Flood: The term “100-year flood” can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1 percent annual chance flood, which is now the standard definition used by most agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the “100-year” or “1% chance” flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program (NFIP) are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as “watersheds” and “drainage basins.”

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic and/or water reactive materials;
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events, and
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

For the purposes of this planning effort, the Planning Team elected to define all structures on the reservation, including culturally significant areas, as critical facilities due to the impact the loss of one structure would have on the Tribe.

Cubic Feet per Second (cfs): Discharge or river flow is commonly measured in cfs. One cubic foot is about 7.5 gallons of liquid.

Dam: Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris Avalanche: Volcanoes are prone to debris and mountain rock avalanches that can approach speeds of 100 mph.

Debris Flow: Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

Debris Slide: Debris slides consist of unconsolidated rock or soil that has moved rapidly down slope. They occur on slopes greater than 65 percent.

Disaster Mitigation Act of 2000 (DMA); The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program, and new requirements for the national post-disaster hazard mitigation grant program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water- whether from rainfall, snowmelt, springs, or other sources- flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community’s Flood Insurance rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community’s floodplain as the Special Flood Hazard Area (SFHA).

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Fog: Fog refers to a cloud (or condensed water droplets) near the ground. Fog forms when air close to the ground can no longer hold all the moisture it contains. Fog occurs either when air is cooled to its dew point or the amount of moisture in the air increases. Heavy fog is particularly hazardous because it can restrict surface visibility. Severe fog incidents can close roads, cause vehicle accidents, cause airport delays, and impair the effectiveness of emergency response. Financial losses associated with transportation delays caused by fog have not been calculated in the United States but are known to be substantial.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour (mph)) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program: HAZUS-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The HAZUS-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. HAZUS-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mass movement: A collective term for landslides, mudflows, debris flows, sinkholes, and lahars.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Actions: Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking: This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates are based on the methodology for each hazard as identified within this plan.

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Stream Bank Erosion: Stream bank erosion is common along rivers, streams and drains where banks have been eroded, sloughed, or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair. Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Sustainable Hazard Mitigation: This concept includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: These terms refer to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

APPENDIX B.
SAMPLE PROGRESS REPORT

APPENDIX B.
SAMPLE PROGRESS REPORT

The Confederated Tribes of the Chehalis Reservation
Hazard Mitigation Plan
Annual Progress Report

Reporting Period: *(Insert reporting period)*

Background: The Confederated Tribes of the Chehalis Reservation developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the Tribe organized resources, assessed risks from natural hazards, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, the Tribe maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed on-line at:

INSERT LINK

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on _____, 2020, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before _______, 20__. As of this reporting period, the performance period for this plan is considered to be __% complete. The Hazard Mitigation Plan has targeted __ hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- __ out of __ initiatives (__%) reported ongoing action toward completion.
- __ out of __ initiatives (__%) were reported as being complete.
- __ out of __ initiatives (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the Tribe's Hazard Mitigation Plan. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of the Confederated Tribes of the Chehalis Reservation. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area

- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Hazard Mitigation Plan Planning Team: The Hazard Mitigation Plan Planning Team, made up of stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on ______, 20___. It was determined through the plan's development process that a Planning Team would remain in service to oversee maintenance of the plan. At a minimum, the Planning Team will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Planning Team membership is as indicated in Table 1.

TABLE 1.
PLANNING TEAM MEMBERS

Name	Title	Jurisdiction/Agency

Natural Hazard Events within the Planning Area: During the reporting period, there were __ natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- ____________________________
- ____________________________

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each initiative. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each initiative and the prioritization process.

Address the following in the "status" column of the following table:

- *Was any element of the initiative carried out during the reporting period?*
- *If no action was completed, why?*
- *Is the timeline for implementation for the initiative still appropriate?*
- *If the initiative was completed, does it need to be changed or removed from the action plan?*

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	Timeline	Priority	Status	Status (X, O,✓)
Initiative #__—_______________________[description]				
Initiative #__—_______________________[description]				
Initiative #__—_______________________[description]				
Initiative #__—_______________________[description]				
Initiative #__—_______________________[description]				
Initiative #__—_______________________[description]				
Initiative #__—_______________________[description]				

Completion status legend:

✓= Project Completed
O = Action ongoing toward completion
X = No progress at this time

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory, and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Planning Team, the following recommendations will be noted for future updates or revisions to the plan:

- ______________________________
- ______________________________
- ______________________________
- ______________________________
- ______________________________
- ______________________________

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the Tribe's governing board and to local media outlets and the report is posted on the Tribe's Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to: EM@Chehalistribe.org*