Tulalip Tribes
2021
Hazard Mitigation Plan

Tulalip Tribes 2021 Hazard Mitigation Plan

June 2021

Prepared for:

Tulalip Tribes

6406 Marine Dr

Tulalip, WA 98271

Prepared by:

WSP

333 SW Fifth Ave, Suite 608

Portland, OR 97204

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Acknowledgements

Program Manager

Ashlynn Danielson
Tulalip Tribes Emergency Preparedness Manager
6406 Marine Drive, Tulalip, WA 98271
Phone: 360-716-4006| Email: adanielson@tulaliptribes-nsn.gov

Consultants

- Trevor Clifford, Project Manager, WSP
- Colleen Kragen, Mitigation Planner, WSP
- Brennah McVey, GIS Analyst, WSP

Special Acknowledgements

The update of this plan would not have been possible without the dedication and commitment to the planning process by the Tulalip Tribes 2020 Hazard Mitigation Steering Committee and Tulalip Tribes Tribal Council, and Tulalip citizens and community members. We greatly appreciate their time and dedication.

Executive Summary

The Tulalip Tribes 2021 Hazard Mitigation Plan (HMP) is a risk-informed, capabilities-based strategic planning document that identifies and prioritizes actions to mitigate all hazards facing the Tulalip Reservation. The HMP enables Tulalip Tribes to maintain eligibility for disaster-related federal grant assistance through the Disaster Mitigation Act (DMA) 2000.

Tulalip Tribes Previous Hazard Mitigation Planning Initiatives

Federal regulations require that a jurisdiction have a strategy for monitoring, evaluating, and updating their HMP. The Tulalip Tribes 2021 HMP update satisfies this requirement through an updated risk assessment, review of previous HMP actions and their status and determine if there is a need to update the overall strategy. Compliance with the DMA is contingent on the plan meeting these requirements. A jurisdiction covered by a plan that has expired is not able to pursue funding under the Robert T. Stafford Act, which requires a current HMP as a prerequisite.

Tulalip Tribes' Initial Response to the Disaster Mitigation Act

The Tulalip Tribes prepared its initial HMP in compliance with the DMA in 2006, which the Federal Emergency Management Agency (FEMA) approved in August 2006. A revision was developed in 2010 and approved in August 2010. In 2015, the Tribes participated in the Snohomish County 2015 HMP update and received a planning partner annex. The Tribe's defined purpose for the local HMP was to guide efforts to efficiently mitigate natural hazards on the Tulalip Reservation and work with other agencies to mitigate and respond to natural hazards that cross Reservation boundaries. The 2010 HMP identified the following goals:

- Protect people, property, and the natural environment.
- Ensure continuity of critical economic and public facilities and infrastructure.
- Promote resiliency to protect Tribal sovereignty and identity.
- Increase public awareness of natural hazards and involvement in hazard planning.

Tulalip Tribes Planning Area

The Steering Committee agreed that the Tulalip Tribes HMP should cover all the people, property, infrastructure, and natural environment within the exterior boundaries of the Tulalip Reservation (Figure 1). The Reservation was established by the Point Elliott Treaty of January 22, 1855 and by Executive Order of President U.S. Grant dated December 23, 1873. Planning area characteristics are described in Section 4. Building on the 2010 HMP, the focus of the 2020 hazard mitigation process is within the Tribal Reservation boundary, although it is noted the Tulalip Tribes have land and property outside the Reservation area.

Hazard Mitigation Overview

Hazard mitigation is the use of long- and short-term policies, programs, and projects to mitigate the risks from hazards, as well as to reduce loss of life, personal injury, and property damage to Tribal members and enterprises within the planning area. The Tulalip Tribes 2020 HMP identifies and prioritizes actions to reduce the risks from disasters to people, property, critical infrastructures and facilities, and environment within the planning area. The HMP complies with federal hazard mitigation planning requirements and establishes eligibility for the Tribe to receive disaster-related federal grant assistance under FEMA grant programs.

Plan Development Approach

Phase 1 – Organize Resources

A 29-person Steering Committee was established to facilitate the development of the Tulalip Tribes 2020 HMP, representing all departments and agencies from across Tribal Government. The Steering Committee participated in five workshops, beginning October 2019 and ending December 2020. These workshops were:

- Workshop 1: Hazard Mitigation Planning Overview and Project Kickoff
- Workshop 2: Risk Assessment
- Workshop 3: Hazard Mitigation Plan Strategy
- Workshop 4: Draft Plan Review
- Workshop 5: Plan Adoption

Phase 2 – Risk Assessment

The purpose of a risk assessment is to identify and assess the probability and severity of hazards and their potential impact on loss of life, personal injury, economic injury, and property damage from hazards. The goal is to determine the vulnerability of people, buildings, and infrastructure to create a solid foundation for mitigation planning. For this plan, risk assessment models for natural hazards were conducted with the most recent data and available technologies. The risk assessment included the following:

- Identification and ranking of hazards for inclusion in the HMP
- Assessment of the impact of hazards on physical, social and economic assets, including cost
- Identification of exposure and vulnerability to each hazard identified for inclusion
- Development of hazard profiles for the HMP

Phase 3 – Engage Tulalip Citizens and Community Members of the Reservation

The Steering Committee developed a strategy to engage Tulalip citizens and community members of the reservation, which was implemented by the Project Team and Tribal Government. The strategy included a survey and a tribal member open house, soliciting input from tribal members on the risk assessment, hazard mitigation strategy, and draft plan review. Tribal Government distributed the survey and materials to tribal members through media releases and social media, which are available in Appendix E.

Phase 4 – Write the Plan

The Steering Committee assembled an HMP that meets federal hazard mitigation planning requirements. A completed mitigation plan review crosswalk has been included in Appendix F of this plan. This completed crosswalk provides a comparative analysis between the content in the Tulalip Tribes HMP and the federal hazard mitigation planning requirements.

Phase 5 – Adopt and Implement the Plan

The Tulalip Tribes will review, approve, and adopt the HMP prior to submitting it to FEMA Region X for review and approval. Upon approval from FEMA Region X, the Tribe will implement the HMP. Additionally, the Steering Committee has established plan maintenance procedures to ensure the plan reflects the hazards and risks facing the tribe, and their capabilities to mitigate them.

Risk Assessment

The Steering Committee completed a survey to identify hazards for inclusion in the Tulalip Tribes 2021 HMP and a second survey to rank the most-likely (Table 1) and worst case scenarios (Table 2) for each hazard based on the on expected severity, magnitude, frequency, onset, duration and change in risk. The Steering Committee identified the following hazards for inclusion in the 2020 HMP:

- Active Assailant
- Earthquake
- Epidemic/Pandemic
- Flood and Sea Level Rise
- Hazardous Materials
- Mass Earth Movements
- Tsunami
- Severe Weather Events
- Wildfires

The Steering Committee decided to integrate heatwave and drought into the severe weather hazard profile and risk assessment given the overlapping nature of these hazards, streamlining plan content and improving utility. Additionally, the Steering Committee identified active assailant as a hazard of concern during the hazard identification and ranking survey, so it was not ranked but is included in the risk assessment section of this plan. Below are the averaged survey results for each hazard as scored by the Steering Committee, including the subsequent rank of each hazard.

Table 1 – Most-Likely Hazard

	Severity (1=lowest, 5=highest)	**Magnitude** (1=lowest, 5=highest)	**Frequency** (1=lowest, 5=highest)	**Onset** (1=slowest, 5=fastest)	**Duration** (1=shortest, 5=longest)	**Change in Risk** (1=up, 0=none, -1=down)	**Average**	**Rank**
Drought	2.2	3.9	3.1	2.5	3.4	1.0	3.03	1
Earthquake	2.6	2.6	2.1	4.6	3.0	0.7	2.96	2
Severe Weather	2.0	2.9	3.6	3.1	2.4	1.0	2.81	3
Wildfires	2.2	2.0	2.8	3.6	3.4	1.0	2.79	4
Tsunamis/Seiches	2.6	2.2	1.3	3.9	3.2	0.3	2.65	7
Heatwave	1.4	3.5	3.2	2.9	2.7	0.8	2.74	5
Mass Earth Movements	2.1	2.1	2.3	3.7	3.3	0.7	2.70	6
Pandemic	1.6	3.0	1.4	3.1	3.0	0.5	2.43	8
Flood	1.7	2.1	2.7	3.1	2.4	0.8	2.41	9
Hazardous Materials	1.4	2.0	1.3	3.3	2.9	-0.2	2.18	10

Table 2 – Worst-Case Hazard

	Severity (1=lowest, 5=highest)	Magnitude (1=lowest, 5=highest)	Frequency (1=lowest, 5=highest)	Onset (1=slowest, 5=fastest)	Duration (1=shortest, 5=longest)	Change in Risk (1=up, 0=none, -1=down)	Average	Rank
Earthquake	5.0	4.9	1.8	5.0	4.6	0.7	4.25	1
Wildfires	4.1	4.2	3.1	4.4	4.3	1.0	4.03	2
Tsunamis/ Seiches	4.6	4.1	2.0	4.7	4.6	0.3	4.02	3
Pandemic	4.1	4.7	2.1	4.0	4.0	0.5	3.78	4
Hazardous Materials	4.0	4.0	2.7	4.6	3.5	-0.2	3.75	5
Landslide/Mass Movements	3.9	3.7	3.1	4.0	3.4	0.7	3.62	6
Drought	2.9	4.0	3.9	2.6	3.8	1.0	3.41	7
Severe Weather	3.0	3.7	3.9	3.4	2.8	1.0	3.35	8
Heatwave	2.5	3.9	3.9	3.1	2.8	0.8	3.23	9
Flood	2.4	2.9	3.4	3.6	2.6	0.8	2.97	10

Goals

The Steering Committee adopted the following four goals for the Tulalip Tribes 2021 HMP during Workshop 3 – Mitigation Strategy:

1. Protect people, property and the natural environment.
2. Ensure continuity of critical economic and public facilities and infrastructure by building redundancy, resiliency, and strong partnerships.
3. Promote and strengthen resiliency to protect Tribal sovereignty and identity.
4. Increase public awareness of all hazards, preparedness, and involvement in hazards planning.

Mitigation Action Plan

The Steering Committee identified 30 hazard mitigation actions for inclusion in the Tulalip Tribes 2021 HMP to reduce or eliminate the loss of life and property resulting from hazard events; many of which are within the current capabilities of the Tulalip Tribes.

Implementation and Maintenance

Implementation of the Tulalip Tribes 2021 HMP will occur over the next five years and will require time and resources. A measure of the HMP's success will be its ability to adapt to changing risks facing the Tribes, and capabilities and capacity to mitigate those risks. The Tribes assumes responsibility for adopting the recommendations of this plan and committing resources towards its implementation. The framework established by this plan prioritizes actions where the benefits exceed the cost as informed by the Steering Committee. The Steering Committee developed this plan with extensive input from Tulalip citizens and community members of the reservation, their support implementing the actions identified in this plan will help to ensure the HMP's success.

The Steering Committee developed an annual plan maintenance strategy that includes the following steps to ensure successful implementation and maintenance:

- Progress reporting
- A strategy for continued engagement of Tulalip citizens and community members
- A commitment to plan integration with other relevant plans and programs
- Continued oversight from a plan maintenance Steering Committee

Tulalip Tribes 2021 Hazard Mitigation Plan

Part 1: Planning Process Overview and Tribal Profile

Part 1

1 Introduction to Hazard Mitigation Planning

1.1 Why Prepare This Plan?

1.1.1 The Big Picture

Hazard mitigation is the use of long- and short-term strategies to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster. It involves activities such as planning efforts, policy changes, programs, studies, improvement projects, and other strategies to reduce the impacts of hazards. Mitigation plans are key to breaking the cycle of disaster damage, reconstruction, and repeated damage.

Prior to 2000, federal disaster funding focused on relief and recovery after disaster occurred, with limited funding for hazard mitigation planning in advance. In October 2000, the Disaster Mitigation Act (DMA; Public Law 106-390) shifted the federal emphasis toward planning for disasters before they occur. The DMA requires state, local, and tribal governments to develop and adopt Federal Emergency Management Agency (FEMA) approved hazard mitigation plans as a condition for federal disaster grant assistance. Regulations to fulfill the DMA's requirements are included in Title 44 of the Code of Federal Regulations (44 CFR). Throughout the Hazard Mitigation Plan (HMP) applicable CFRs are described in textboxes in the relevant sections.

The responsibility for hazard mitigation is held by many, including private property owners, commercial interests, and local, state, tribal, and federal governments. The DMA encourages cooperation among state, local, and tribal authorities in pre-disaster planning and emphasizes the importance of community-based planning before disasters occur. The act also promotes sustainability, including the sound management of natural resources, local economic and social resiliency, and addressing hazards and mitigation in the largest possible social and economic context. The enhanced planning network described in the DMA helps local and tribal governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk-reduction projects.

1.1.2 Purposes for Hazard Mitigation Planning

The Tulalip Tribes continues to update their HMP to better identify and prioritize actions to reduce or alleviate risks from natural hazards, reducing the loss of life, personal injury, and property damage to Tulalip citizens, community members and businesses on the Reservation. This update to the HMP fulfills a DMA requirement that hazard mitigations plans be regularly updated to maintain eligibility for disaster-related federal grant assistance. This plan guides efforts to efficiently mitigate hazards on the Tulalip Reservation and to work with other agencies to mitigate and respond to hazards that cross Reservation boundaries.

1.1.3 Who Will Benefit from this Plan?

All Tulalip citizens, community members and businesses of the Tulalip Reservation are the ultimate beneficiaries of this HMP. The plan strives to reduce risk for those who live in, work in, and visit the Tulalip Reservation. It provides a viable planning framework for all foreseeable hazards that may have a negative effect. Participation in development of the plan by key stakeholders on the Reservation helps ensure that outcomes will be mutually beneficial. It is intended that this plan provide solutions that other jurisdictions can use and benefit from that can be cooperatively implemented. The plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.1.4 Contents of this Plan

This HMP is organized into three primary parts:

- Part 1 – Planning Process and Community Profile
- Part 2 – Risk Assessment
- Part 3 – Mitigation Strategy

Each part includes elements required under federal guidelines. DMA compliance requirements are cited at the beginning of subsections as appropriate to illustrate compliance.

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

- Appendix A – Acronyms and Definitions
- Appendix B – 2020 Tulalip Tribes Hazard Mitigation Plan Update and Tribal Survey and Results
- Appendix C – Tulalip Tribes Hazard Mitigation Plan Annual Progress Report
- Appendix D – Mitigation Strategy Evaluation and Mitigation Action Evaluation Forms
- Appendix E – Planning Process and Public Outreach
- Appendix F – FEMA Review Tool
- Appendix G – Plan Adoption Resolution
- Appendix H – Hazards
- Appendix I – References

1.1.5 Plan Approach

The process to develop the Tulalip Tribes HMP followed the subsequent objectives:

- Secure grant funding
- Form a planning team
- Define the planning area
- Establish a steering committee
- Coordinate with other agencies
- Review existing programs
- Engage Tribal members

1.1.6 Grant Funding

The planning effort was supplemented by a FEMA Pre-Disaster Hazard Mitigation Grant. The Tulalip Tribes Office of Emergency Management was designated to manage the project. Grant funding covered 60 percent of the cost for development of this plan.

2 Plan Update – What has Changed?

2.1 The Previous Plans

The Tulalip Tribes prepared its initial local HMP in compliance with the DMA in 2006, with FEMA approval being granted in August 2006. A revision was developed in 2010 and approved in August 2010. In 2015, the Tribes participated in the Snohomish County HMP 2015 updated and were included in a planning partner annex. The Tribe's defined purpose for the local HMP was to guide efforts to efficiently mitigate natural hazards on the Tulalip Reservation and work with other agencies to mitigate and respond to natural hazards that cross Reservation boundaries. The 2010 HMP identified the following goals:

- Protect people, property and the natural environment.
- Ensure continuity of critical economic and public facilities and infrastructure.
- Promote resiliency to protect Tribal sovereignty and identity.
- Increase public awareness of natural hazards and involvement in hazard planning.

Review and revision of the HMP included re-prioritizing the risk rating for hazards on the Reservation according to new information. Data from annual surveys and recent scientific studies was used to rank each identified hazard. Hazard rankings are identified in their hazard specific profiles, Sections 6-14. The 2010 plan recommended 20 actions for mitigating the risks presented by the identified hazards. Agencies were given specific responsibilities for implementing identified mitigation actions.

2.2 Why Update?

2.2.1 Federal Eligibility

The Code of Federal Regulations (CFR) Title 44 (44CFR) stipulates that hazard mitigations plans must present a schedule for being monitored, evaluated, and updated. This provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies. DMA compliance is contingent on meeting the plan update requirement. A jurisdiction covered by a plan that has expired is not able to pursue federal funding under the Robert T. Stafford Act.

44 CFR Section 201.7(d)(3)

Tribal governments must review and update plans to include changes in planning area development, their progress on local mitigation efforts since the last update, and any changes in priorities. These updated plans must be resubmitted to FEMA for approval within 5 years of the last update to continue to be eligible for non-emergency Stafford Act assistance and FEMA mitigation grant funding. The exception to this regulation is the Repetitive Flood Claims program.

2.2.2 Changes in Development

HMP updates must also reflect development changes in the planning area since approval of the previous plan. The update must describe development changes in hazard-prone areas that increased or decreased vulnerability. If no development changes impacted the Tribe's overall vulnerability, plan updates may validate the information in the previously approved plan. This requirement ensures that the mitigation strategy continues to address the risk and vulnerability of existing and potential development and takes into consideration possible future conditions that could impact vulnerability.

2.3 The Updated Plan – What is Different?

The plan has been significantly enhanced using recently updated best available data and technology, especially in the risk assessment portion of this update. This plan update followed the same basic planning process as was followed under the initial effort. The Steering Committee and Planning Team were critical components in the process. The updated 2020 plan differs from the 2010 plan in the following ways:

- Reorganization into three parts:
  - Planning Process & Community Profile
  - Risk Assessment
  - Hazard Mitigation Strategy
- Enhanced Risk Assessment
- Changes to hazards:
  - Addition of Sea Level Rise
  - Addition of Active Threat
  - Landslide changed to Mass Earth Movement, to include mudslides and debris flows
  - Heat Wave incorporated into Severe Weather
- Future climate conditions on hazards were profiled
- Enhanced public outreach effort was conducted

The Table 43 in Appendix I details the CFR requirements for HMPs and compares the previous plan with the 2020 update.

3 Plan Methodology

3.1 Formation of the Project Team

The Tulalip Tribes Office of Emergency Management (OEM) hired WSP to assist with the development and implementation of the plan update, heretofore referred to as the Project Team. WSP led the development of all plan sections and facilitated stakeholder workshops and open houses with Tulalip Citizens and community members of the reservation, reporting directly to the OEM project manager; Tulalip citizens and community members of the reservation comprise the "Public" for this plan. The Project Team was comprised of the following members:

- Ashlynn Danielson, Tulalip Tribes Office of Emergency Management–Project Lead
- Phillip North, Tulalip Tribes Climate Adaptation Planner–Project Lead
- Aaron Jones, Tulalip Tribes Treaty Rights Protection Specialist—Deputy Project Lead
- Vanessa Kelsey, Tulalip Tribes Office of Emergency Management – Deputy Project Lead
- Trevor Clifford, WSP—Project Manager
- Colleen Kragen, WSP—Resiliency Planner

The process to develop the Tulalip Tribes HMP followed the subsequent objectives:

- Secure grant funding
- Form a planning team
- Define the planning area
- Establish a steering committee
- Coordinate with other agencies

- Review existing programs
- Engage Tulalip citizens and community members of the reservation

3.2 Formation of the Steering Committee

Hazard mitigation planning enhances collaboration and support among parties whose interests can be affected by hazard losses. By working together, a broad range of stakeholders can identify and create partnerships to achieve a common vision for the community. A steering committee was formed to oversee all phases of the plan update. The members of the committee included key Tulalip Tribes staff, Tulalip citizens and community members, and other stakeholders from the planning area. The team confirmed a committee of 29 members at the kickoff meeting. Table 3 lists the steering committee members.

Table 3 – Steering Committee Members

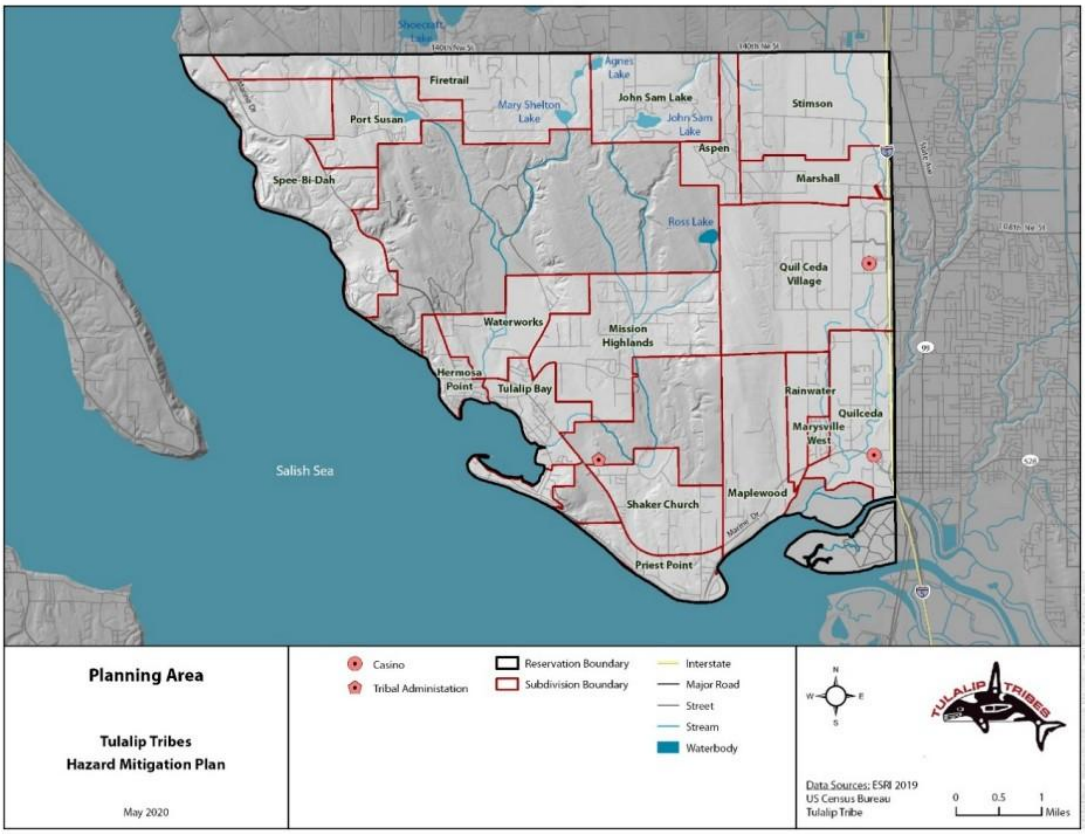
Name	Title	Department or Agency
Ashlynn Danielson (Chair)	Emergency Preparedness Manager	Tulalip Tribes OEM
Samuel Davis	Operations Director	Tulalip Tribes Public Works
Tal Severn	Fleet Manager	Tulalip Tribes Public Works
Mike Leslie	Utilities Manager	Tulalip Tribes Utilities
Vanessa Kelsey	Emergency Preparedness Coordinator	Tulalip Tribes OEM
Julia Gold	Planning Manager	Tulalip Tribes Planning
Ben Lubbers	Associate Planner II	Tulalip Tribes Planning
Lea Anne Burke	Associate Planner II	Tulalip Tribes Planning
Valerie Streeter	Stormwater Planner	Tulalip Tribes Natural Resources
Brett Shattuck	Restoration Ecologist	Tulalip Tribes Natural Resources
Kurt Nelson	Environmental Division Manager	Tulalip Tribes Natural Resources
Todd Zackey	Marine and Nearshore Program Manager	Tulalip Tribes Natural Resources
Shirley Jones	Director	Tulalip Tribes Housing
Jesse Paul	Construction Director	Tulalip Tribes Construction
Chris Sutter	Chief of Police	Tulalip Tribes Police
Ryan Shaughnessy	Fire Chief	Tulalip Bay Fire Department, Fire District 15
Gus Taylor	Executive Director	Tulalip Tribes Public Works
Paul Arroyos	Commander, Tribal Police	Tulalip Tribes Police
Robert Myers	Commander, Tribal Police F&W	Tulalip Tribes Police
Cameron Reyes	QCR Property Management	Quil Ceda Village

Name	Title	Department or Agency
Aaron Jones	Treaty Rights Protection Specialist	Tulalip Tribes Natural Resources
David Grover	Tulalip Forestry Representative	Tulalip Tribes Natural Resources
Jim Reinhardt	Deputy Fire Chief	Tulalip Bay Fire Department, Fire District 15
Ginny Ramos	Lead Code Enforcement	Tulalip Tribes Planning
Curtis Taylor	Maintenance Manager	Quil Ceda Village
Jereme Gobin	Utilities Manager	Quil Ceda Village
Christopher Wright	GIS Manager	Tulalip Data Services
Aliya Kara	GIS Analyst	Tulalip Data Services
Bernie Edge	Budget Administrator	Tulalip Tribes Police
Crystal L. Raymond, Ph.D.	Climate Adaptation Specialist	University of Washington, Climate Impacts Group
Phil North	Climate Adaptation Coordinator	Tulalip Tribes Natural Resources
Elishia Stewart	Elder Services Director	Tulalip Tribes Elder Services
Luke Reyes	Project Manager	Quil Ceda Village
Merrie Pablo	Elder Assistant	Tulalip Tribes Elder Services
Russell Moses	Tulalip Forester	Tulalip Tribes Natural Resources

3.3 Defining the Planning Area

The Steering Committee agreed that the Tulalip Tribes HMP should cover all the people, property, infrastructure, and natural environment within the exterior boundaries of the Tulalip Reservation (Figure 1). The Reservation was established by the Point Elliott Treaty of January 22, 1855 and by Executive Order of President U.S. Grant dated December 23, 1873. Planning area characteristics are described in Section 4. Building on the 2010 HMP, the focus of the 2020 hazard mitigation process is within the Tribal Reservation boundary, although it is noted the Tulalip Tribes have land and property outside the Reservation area.

Figure 1 – Planning Area



3.4 Engaging Tulalip Citizens and Community Members of the Reservation

Broad participation by Tulalip citizens and community members of the reservation in the planning process ensures varied points of view about the planning area's needs are being considered and addressed. Details of the Tulalip Tribes' involvement of Tulalip citizens and community members in the plan drafting process is in Appendix E of this plan; again, public is defined as Tulalip citizens and community members of the reservation.

44 CFR Section 201.7(c)(1)(i)

The public must be involved in the planning process. This includes providing the public with the opportunity to comment on the draft plan before the plan is finalized and approved. Additionally, Tribes must describe how the Tribal government defined "public."

The strategy for participation from Tulalip citizens and community members of the reservation in this plan process is emphasized in the following elements:

- Use a survey to determine if the public's perception of risk and support of hazard mitigation has changed since the initial planning process
- Attempt to reach as many planning area Tulalip citizens and community members as possible through the following activities:
    - Attendance at advertised public outreach events and meetings with live interaction

- Development of a hazard mitigation plan webpage on the Tulalip Tribes Office of Emergency Management website (tulaliptribes-nsn.gov/Dept/EmergencyManagement)
- Use of social media, such as the Tulalip News Facebook page (right)
- Development and advertisement of a public survey to collect pertinent information from Tulalip citizens and community members and the business within the Reservation.

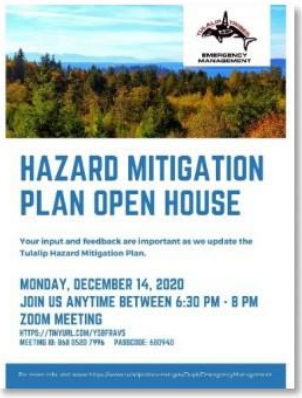
Tribal engagement was initiated soon after the first Steering Committee meeting. An online survey was developed to learn more about the Tribes' initial concerns prior to plan development. The initial online survey was distributed through social media (e.g., Facebook, Twitter, etc.) beginning on June 13th, 2019. Over the course of three months, 115 individuals responded to the survey and provided their feedback. Full survey questions and results are in Appendix B.

3.4.1 Tribal Involvement Results

Tribal citizens were encouraged to participate and provide feedback during all phases of the plan update process. 17 Tribal citizens attended Tribal Member Meeting #1, which was held October 9, 2019.

Survey

Public engagement began after the first Steering Committee meeting. The Planning Team developed an online survey to learn more about the public's initial concerns at the beginning of the planning process. Responders received the link to participate through Survey Monkey starting November 15th, 2019. By November 26th, 45 individuals responded to the survey and provided their feedback. Survey questions and results are summarized in Appendix B.

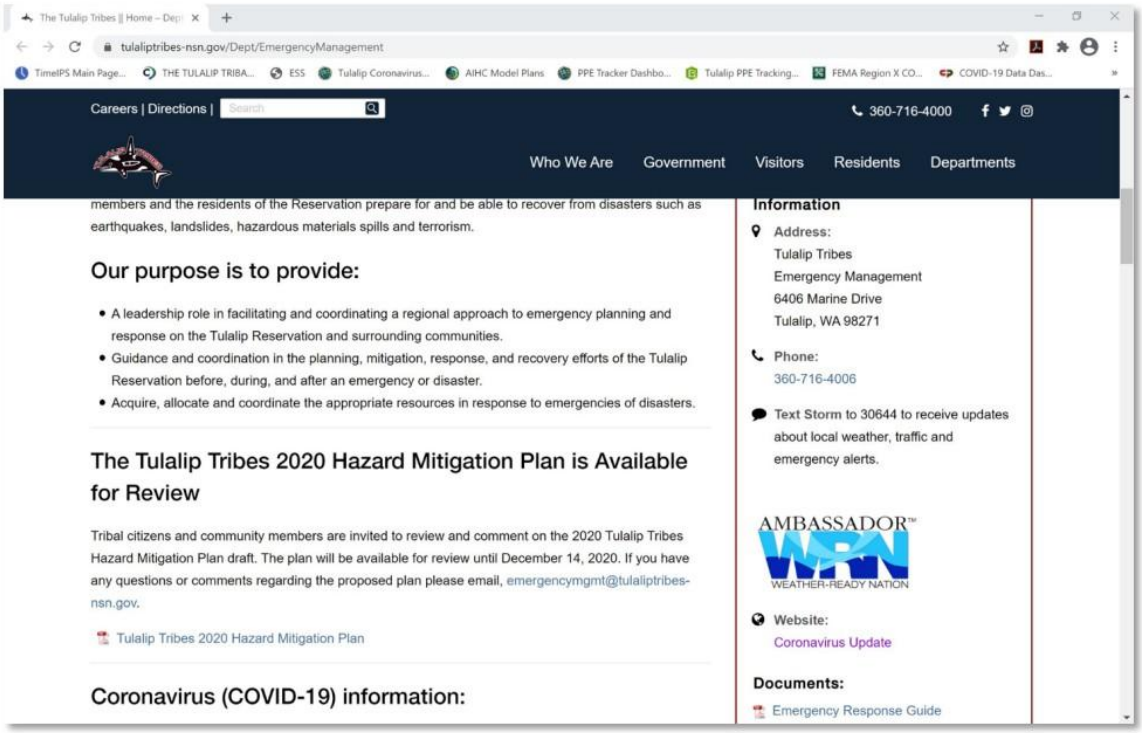


Tribal Citizens & Community Members Open Houses

On December 7th and 14th, 2020, OEM and WSP held virtual open houses for Tulalip citizens and community members of the reservation to review and comment on a draft of the Tulalip Tribes 2021 HMP.

Hazard Mitigation Plan Website/Webpage

All Tulalip citizens and community members were invited to participate in all phases of the plan update process and comment on HMP. The OEM website will include up-to-date information for the Tulalip citizens, available here: https://www.tulaliptribes-nsn.gov/Dept/EmergencyManagement.



3.5 Coordination with Other Agencies

In addition to representation of Tribal Government agencies in the Steering Committee, the project team engaged leadership from and membership of all Tribal Government agencies throughout the plan update to solicit input via email and workshop invitations.

Prior to adoption of the 2020 HMP, the Project Team invited all Tribal Government agencies to review and comment on the 2020 HMP during the Tulalip citizens and community members 30-day comment period; primarily through the OEM website and advertised through the Tulalip local news, on the Tribes' Facebook page, and the See-Yaht-Sub Newsletter. In addition, the complete draft plan was sent to FEMA Region X for pre-adoption review and to ensure program compliance.

44 CFR Section 201.7(b)

The mitigation planning process should include coordination with other tribal agencies, appropriate federal agencies, adjacent jurisdictions, and interested groups.

3.5.1 Review Existing Programs

Section 4.8 of this plan provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation actions. In addition, the following programs can affect mitigation within the planning area:

- Washington State Enhanced Hazard Mitigation Plan (October 2018)
- Tulalip Tribes Comprehensive Emergency Management Plan
- Tulalip Tribes Haz-mat Commodity Flow Study (2005)
- Hazardous Materials Response Plan (2007)
- Tulalip Tribes Public Assistance Administration Plan (2006)

44 CFR Section 201.7(b)

All ongoing Tribal planning efforts, and other FEMA mitigation programs and initiatives, should be integrated as much as possible with the hazard mitigation plan for consistency and cooperation between plans.

The Tulalip Tribes have incorporated hazard mitigation planning (including the 2005, 2010, and 2015 plans) into other planning efforts; greater integration of hazard mitigation planning into other planning efforts is a key element of the 2021 HMP. Previous HMPs have informed floodplain management initiatives, capital improvement plans, capital facility plans, and economic development and funding initiatives. These previous efforts have sought to reduce the exposure of and increase the resilience Tulalip Citizens and members of the community, assets, infrastructure, and the environment. One outcome of these efforts was the development and implementation of the Tulalip Tribes' Tribal Teen Community Emergency Response Team (CERT) initiative, which graduated 43 students and was partially funded by FEMA Region 10.

The previous HMP informed emergency planning efforts to the Tribes and the Risk Assessment forms the basis for identifying target capabilities and gaps for emergency response which drive planning, training, exercising, and funding decisions. Future planning efforts and updates of these documents will benefit from the updated 2021 Risk Assessment by enabling a more current, comprehensive assessment of specific target capabilities for preparedness, mitigation, response, and recovery.

3.6 Plan Development Chronology and Milestones

Table 4 – Steering Committee Meetings

Date	Event	Description
March 18, 2019	Tribes release a request for proposals to update their hazard mitigation plan	Secure contractor support to facilitate update of the Tribes' hazard mitigation plan
July 16, 2019	Tribes select WSP as their technical support contractor	Technical support secured
October 9, 2019	Steering Committee Meeting #1	- Overview of planning process, purpose, and requirements - Confirmation of the planning area - Update goals, objectives, and actions - Hazard identification and ranking - Capability assessment overview - Planning for Tribal engagement

Date	Event	Description
November 5, 2019	Steering Committee Meeting #2	- Update of the planning process - Capability assessment feedback - Hazard ranking feedback - 2010 strategy feedback - Discuss hazard and risk mapping - Risk assessment worksheet
September 30, 2020	Steering Committee Workshop #3, Delayed due to the novel coronavirus (COVID-19)	- Update of planning process - Review of to-date findings (e.g., capability assessment and hazard ranking - Review of adopting goals - University of Washington (UW) presentation on Climate Change and Wildfire Mitigation - Mitigation strategy development - HMP action prioritization worksheet
November 12, 2020	Steering Committee Workshop #4 Draft Plan Review	- Edit the draft formatting based on feedback - Update the Tribal History section based on current knowledge, send draft section to the Steering Committee for review before including - Complete capability and capacity assessment - Reviewing mitigation actions - Developing implementation and annual review plans - The Plan Update section will be updated to list Ashlynn as managing the updates

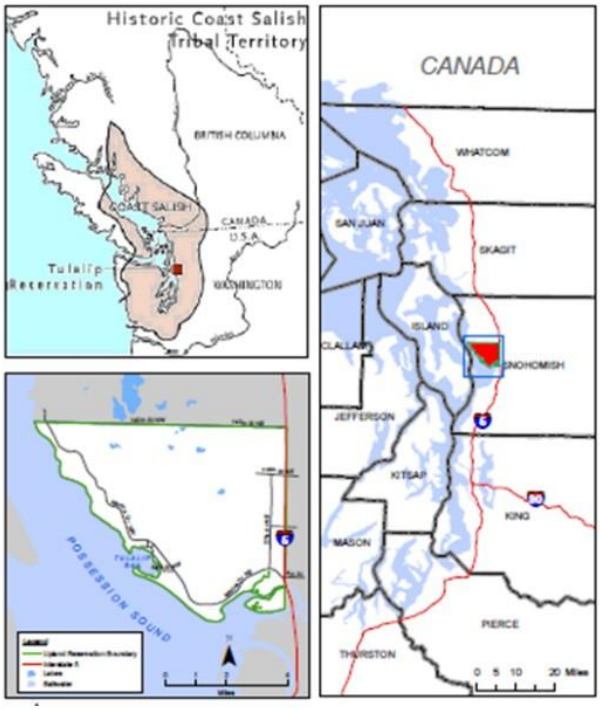
4 Tulalip Tribes Profile

4.1 History of the Tulalip Tribes – Remembering Where We Come From

Tulalip (pronounced Tuh'-lay-lup) is located on the eastern side of the Puget Sound in Washington State, nestled in a sheltered bay and surrounded by natural beauty (Inez, et al., 2020). The name came from a Lushootseed word which meant "far to the end," describing how a long sandbar on the south side of the bay caused canoes to row a wide arc before entering the bay (Inez, et al., 2020). Captain Vancouver even ran aground on a sandbar in 1792 and wrote about Tulalip in his journals. The Captain was given credit for discovering the land, although Tribes resided in the area long before any white man arrived. He met our ancestors and described them as "helpful and non-threatening" (Inez, et al., 2020). His "discovery" made the path for other settlers to come and claim land along the northern shore of Tulalip Bay. In 1853, Snohomish County saw its first white encampment and the construction of the first sawmill; at this time, Washington was not a state yet.

In 1855 leaders from Indian nations in the region gathered at Mukilteo, after giving up a large portion of land in western Washington. Some of the leaders requested the Reservation be established around Tulalip Bay because of the abundance of natural resources, including timber and creeks. This area encompassed 20,000 acres of forest and two freshwater streams with plenty of fish. "The Tulalip Tribes are federally recognized successors in interest to the Snohomish, Snoqualmie, and other allied tribes and bands signatory to the Treaty of Point Elliot" (Inez, et al., 2020, p.15). Together these tribes left their ancestral lands to live on the Tulalip Federal Reserve. After federal urging, the group of tribes formed a single government structure under the Indian Reorganization Act of 1934. "We have held to our agreements and promises for more than 150 years. And have honored our treaty commitments and, in turn, rely on the federal government to uphold our treaty rights" (Inez, et al., 2020, p.15).

Figure 2 Tribal Lands Map



4.1.1 Tribal Lands – Rooting the Tribes' Mitigation Program with a Sense of Place

Tribal members and families were allotted lands between 1883 and 1909, and the 1934 Indian Reorganization Act was the genesis for the Tulalip Tribes Government. On January 24, 1936, Tulalip Tribes' Constitution and Bylaws were approved. The Tribes named the reservation after the bay that it is adjacent to (Buffett, 2010).

4.1.2 Geographic Setting

The Tulalip Reservation of 22,000 acres is located on the north side of the Snohomish River mouth and along Possession Sound; approximately 35 miles north of downtown Seattle, Washington. The Reservation is bordered by Interstate-5 to the East, where most of urbanization has occurred. It is located on the north side of the mouth of the Snohomish River, and along the Possession Sound to the West and South. Figure 2 shows the general location of the Tulalip Reservation as well as the Usual and Accustom fishing areas.

4.1.3 Demographics

As of 2019, there are a total of 4,900 tribal members, 2,700 of which reside on the Tulalip Tribes (n.d.c.) reservation population is continuing to grow (n.d.q.). In 2010, there were a total of 10,631 people living on the Reservation; in 2017, the population decreased 6.2 percent to 9,974. Overall, there are 7,828 adults (18 years and over), of which 1,590 are 65 and older. Within the community, 1,675 people have a disability (United States Census Bureau, 2018).

4.2 Tribal Governance and Membership

4.2.1 Tribal Government

The Tulalip Tribes are self-governed and a sovereign nation. The seven-member Board of Directors is the governing body of the Tulalip Tribes. This includes a Chairperson, Vice Chairperson, Secretary, Treasurer, and Council Members (Tulalip Tribes, n.d.a.). The Tribes have incorporated a tribal municipality, Quil Ceda Village, to provide city services and infrastructure to help facilitate development of a major business park (Buffett, 2010).

The broader Tulalip Tribal Government is responsible for administering lands, loans, leasing, education, and health. They also administer social services, land use planning, environmental protection, police, criminal and civil courts, enrollment, water resources and roads, hunting and fishing and recreation (Buffett, 2010).

4.3 Tribal Departments

4.3.1 Enrollment

The Tulalip Tribes provide the following enrollment services (Tulalip Tribes, n.d.c.):

- Enrollment
- Tribal Identification (ID)
- Copies of Birth Certificates, Social Security Cards, Marriage Certificates, other documents
- Family Tree
- Notary - Free
- Enrollment Verification
- Tax Exempt Forms
- Spousal ID

4.3.2 Youth Services

Tulalip Youth Services offer positive youth support to Tulalip Tribal members under 18 years of age. The department is comprised of K-12 Tribal education and activities that provide tutorial and homework support, field trips, recreation and cultural activities, and financial assistance for extracurricular activities for qualified tribal members (Tulalip Education Division, n.d.).

4.3.3 Finance

The Finance Department provides efficient and effective financial services that benefit internal and external customers for the enhancement of the Tulalip Tribal Government (Tulalip Tribes, n.d.e.).

4.3.4 Office of Emergency Management

The Tulalip Tribes Office of Emergency provides services and programs to help Tulalip citizens and community members prepare for and be able to recover from disasters such as earthquakes, landslides, hazardous materials spills, and terrorism (Tulalip Tribes, n.d.b.)

4.3.5 Housing and Construction

Tulalip Housing Department provides affordable housing to more than 1,000 tribal members and their families. Over 100 housing residents are disabled or elders and over 350 are children. The department supports services including employment opportunities, low-income and tax credit housing, workforce housing rentals, homeownership opportunities, elder housing, disabled housing, emergency home repair loans, and seven parks (Tulalip Tribes, n.d.g.).

4.3.6 Planning Department

The Planning Department provides the Tulalip Tribes community with the services necessary to achieve the Tribes' vision for Reservation lands while protecting safety, public health, and general welfare. The Planning department asserts tribal authority over the Reservation to include land use, preparing, updating, and implementing long-range plans, and supporting the Tulalip Planning Commission (Tulalip Tribes, n.d.i.).

4.3.7 Public Works

Tulalip Public Works provide public service to all tribal maintained roads and government buildings in the most cost-efficient manner. Services include snow and ice removal, construction, storm water drainage, maintenance of tribal roadways and government parking lots, ditches, detention ponds, sidewalks, and sign maintenance (Tulalip Tribes, n.d.j.).

4.3.8 Tulalip Marina

Tulalip Tribes commercial fishermen lease berthage space at 65 available slips. The Marina provides docking for tribal members that own and operate as part of the commercial fleet. A dry storage facility is also available for lease to perform vessel work or for winter storage (Tulalip Tribes, n.d.n.).

4.3.9 Solid Waste and Recycling

The goal of the Tulalip Tribes Solid Waste and Recycling Program is to clean up and maintain a healthy environment on the Reservation by developing and implementing an Integrated Solid Waste Management Plan (ISWM). The purpose of the ISWM is to educate the children and the community in recycling and reducing waste with community meetings and functions that will educate the importance of recycling and its effects on the environment (Tulalip Tribes, n.d.l.).

4.3.10 Utilities Department

The Tulalip Utilities Department protects the health and welfare of the Tulalip citizens and community members, businesses, and visitors. It provides services to further increase development and economic growth (Tulalip Tribes, n.d.p.).

4.3.11 Natural Resources

The Tulalip Tribes Natural Resources Department co-manages resource protection on Tribal lands, consistent with treaty rights while honoring and restoring ecosystems to ensure the health of their people (Tulalip Tribes, n.d.h.). Current projects for the department include creek restoration, education and outreach programs, outdoor youth camps, habitat monitoring and research, invasive plant programs, salmon recovery, stormwater management, and wetlands protection. The Natural Resources Department also dedicates their time to addressing climate change as it effects the Tribes now and in the future. Their climate change program involves public outreach and education, a Climate Change Adaptation Plan implemented in 2015, a climate change reference library, and continually updated information about climate change in the news (Tulalip Tribes, n.d.h.).

4.3.12 Treaty Rights and Government Affairs

The Treaty Rights and Government Affairs Office is a newly established department responsible for collaboration with government agencies to ensure the protection and application of the Tulalip Tribes' treaty rights. The Office forms agreements and partnerships with all types of outside agencies and organizations to protect the resources vital to the Tribes' history and sustainability (Tulalip Tribes, n.d.m.).

In addition to working with other organizations, the Office implements regulatory policies and procedures for the Tribes at every level, local, regional, national, and international (Tulalip Tribes, n.d.m.).

4.4 Tribal Enterprises – Supporting Our People through Economic Growth

Businesses located within the city of Quil Ceda Village include the Seattle Premium Outlets shopping mall and retail chains Wal-Mart and Home Depot. The Tribes have their own businesses including two casinos, a bingo facility and two liquor stores (Buffett, 2010). The tribe's businesses provide 3,700 jobs and an estimated $270 million in annual revenue (Buffett, 2010). These businesses have resulted in increased revenue for the Tulalip Tribes, which has led to the development and expansion of tribal government services and facilities. The Tulalip Tribes businesses are (Buffett, 2010):

- Quil Ceda Creek Casino
- Quil Ceda Village
- Salish Networks
- Tulalip Amphitheatre
- Tulalip Bingo & Slots
- Tulalip Broadband
- Tulalip Clinical Pharmacy
- Tulalip Liquor Store & Smoke Shop
- Tulalip Market
- Tulalip Resort Casino

4.4.1 Tulalip Resort Casino

The Tulalip Resort Casino offers gaming, dinning, entertainment and lodging. It has over 2,400 slots, 35 tables and bingo sessions on its 200,000 square foot gaming floor attached to its resort with 360 guest rooms (Tulalip Tribes, n.d.k.).

4.4.2 Tulalip Tribal Gaming Agency

The Tulalip Tribal Gaming Agency ensures the integrity of gaming activity on Tribal land, the licensing of qualified individuals and entities and meets the gaming regulatory responsibilities of the Tulalip Tribal Gaming Commission (Tulalip Tribes, n.d.o.).

4.5 Natural and Cultural Resources – The Tribe as Stewards of the Land and Keepers of Our History

4.5.1 Climate

The Tulalip Reservation has the temperate climate typical of the Puget Sound coastal lowlands. Summers are dry with mild temperatures, and winters are rainy with occasional snow. The average temperature for January is 40° F and July is 62° F (Climate-Data.org, n.d.). Summer temperatures can reach 90° F, and winter lows can be near 0° F. The most rainfall occurs in the months of December and January, with an average annual rainfall of approximately 35 inches. Winter winds average 25 mph, and gusts up to 50 mph are not uncommon. Fog may occur in low lying areas such as Tulalip Bay and the Snohomish River Delta (Buffett, 2010).

4.5.2 Natural Resources

Seafood was a primary food resource for the native inhabitant's diet, including salmon, halibut, shellfish and whales. Cedar trees were the most important building material and were used to build longhouses and large canoes (Buffett, 2010). The Tribes continue to hunt, fished and collect plants throughout a very large area surrounding the reservation.

The Tribes and the State of Washington have co-management responsibility and authority over fish and wildlife resources. The Tulalip Natural Resources program carries out the Tribes' co-management responsibilities and protects the resources people depend on (Tulalip Tribes, n.d.h.).

Bernie Kai-Kai Gobin Salmon Hatchery

The Bernie Kai-Kai Gobin Salmon Hatchery is operated by the Tulalip Tribes and is located on the Tulalip Reservation. The hatchery raises and releases approximately 11.5 million juvenile salmon (2.4M chinook, 1.0M coho, and 8.0M chum salmon) each year. This provides fishing opportunities for tribal members and contributes to other commercial and sport fisheries in Washington, Oregon, British Columbia, and South East Alaska. The hatchery also raises a small number of cutthroat trout annually for planting in Reservation lakes and ponds to provide recreational fishing opportunities (Tulalip Tribes Natural Resources Department, n.d.b.).

Shellfish Program

The Tulalip Tribes Shellfish Program is responsible for the management of the Tribes' shellfish resource opportunities. The program also co-manages the marine resources within the Tribes' usual and accustomed (U&A). This resource includes the waters and habitats of the Salish Sea and encompasses several species of clams, multiple species of shrimp, Dungeness crab and other marine species. In addition to developing and maintaining records of commercial and non-commercial landings, the Shellfish Program conducts assessment and abundance surveys, condition of population, quality of product and beach/resource/restoration surveys. The Shellfish Program reviews shoreline permits and proposed developments that may affect the Tribes' resource and or opportunity (Tulalip Tribes Natural Resources Department, n.d.c.).

Timber, Fish & Wildlife Program

The Tulalip Tribes' Timber, Fish & Wildlife (TFW) Program is a regulatory participation program that works with forest landowners, the Washington State Department of Natural Resources (DNR) and other local, State, and Federal agencies to review proposed forest practices and other land-use activities. The program is composed of technical experts on fish resources and habitat, hydrology, geomorphology, unstable slopes, and wildlife and native northwest flora. The TFW program provides this expertise to stakeholders while fostering positive working relationships for the protection and enhancement of culturally important natural resources. The TFW program goal is to ensure the ability for tribal members to maintain and exercise their treaty protected rights (Tulalip Tribes Natural Resources Department, n.d.d.).

4.5.3 Cultural Resources

The Hibulb Cultural Center and Natural History Preserve's function is to revive, restore, protect, collect, interpret and enhance the history, spiritual beliefs and traditional cultural values of the Tulalip Tribes. The Center is 23,000 square feet with a 50-acre natural history preserve. The center features a main exhibit, a temporary exhibit, a longhouse, two classrooms, a research library and gift shop. The center was the first Tribal facility certified by the state of Washington (Tulalip Tribes, n.d.f.).

4.6 Development Trends – Looking to the Tribe's Future

Tulalip Tribes has experienced continued growth within the Reservation, increasing the number of Tulalip citizens and community members, properties, infrastructures and facilities exposed to hazards. Development in adjacent Snohomish County, including local jurisdictions and special districts, is increasing demand on shared resources, economic conditions and the natural environment, straining capacity and

increasing vulnerability. However, coordinated mitigation measures including planning and regulations, education and outreach efforts, and technical changes have sought to reduce the risk. Through partnerships with Snohomish County and other planning partners, the Tulalip Tribes seek to increase hazard awareness and risk reduction measures and ensure they are coordinated and consistent as growth continues.

The Tulalip Tribes plan to expand their economic potential in the near future. A $125 million casino on 15 acres is scheduled to be finished in early 2021. Construction on a 57,000 square foot Gathering Hall for up to 1,500 tribal members will be complete by February 2020. The first of a three-phase expansion will double the size of the marina and is currently underway. The marina expansion will include a store and a memorial for lost fishermen.

The Tulalip Tribes are also putting the environment first. The Tribes are working throughout their treaty lands to restore wildlife, fish and plants used throughout time.

4.7 Capabilities Assessment

The Steering Committee participated in a capabilities assessment workshop to identify the Tribes' current resources, abilities, and local area agreements that support the HMP. The assessment evaluated the following resource groups:

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

4.7.1 Planning and Regulatory

Planning and regulatory capabilities include the plans, policies, codes, and ordinances that mitigate the impacts of hazards.

Plan Title	Yes/No Year Adopted	Does the plan address hazards?	How does the plan identify projects to include in the mitigation actions?	How can the plan be used to implement mitigation actions?	Accomplishments (2015-2020)
Comprehensive/ Master Plan	Yes, 2009 update in progress	Update will	Land use, such as flooding		
Capital Improvements Plan	Yes	Yes	Infrastructure, Tulalip Bay		
Economic Development Initiative	Yes				

Plan Title	Yes/No Year Adopted	Does the plan address hazards?	How does the plan identify projects to include in the mitigation actions?	How can the plan be used to implement mitigation actions?	Accomplishments (2015-2020)
Local Emergency Operations Plan	Yes	Yes	See incident annexes		
Continuity of Operations Plan	No				
Transportation Plan	Yes				
Stormwater Management Plan	Partial draft				
Community Wildfire Protection Plan	No				
Climate Change Resiliency Plan	Yes, ongoing and iterative	Yes	The plan is a web-based compilation of ongoing and proposed actions that address hazards such as fire and flood hazard.	An important element of each climate plan is how it is implemented. The climate plan compliments the HMP in that it will detail how implementation will happen,	A coastal study was completed on historical erosion rates. An erosion forecasting study is underway. An evaluation of wildfire risk enhancement associated with climate change was also completed.
Comprehensive Emergency Management Plan	Yes, 2016				
Flood Plain Management Plan	No				
Coastal Erosion Assessment and Management Plan	In progress				

Plan Title	Yes/No Year Adopted	Does the plan address hazards?	How does the plan identify projects to include in the mitigation actions?	How can the plan be used to implement mitigation actions?	Accomplishments (2015-2020)
Other special plans (e.g., disaster recovery, climate change adaptation)					

Building Code, Permitting, Inspections for hazard mitigation	Yes/No Year Adopted	Describe the code and indicate if adequately enforced for hazard mitigation	Accomplishments (2015-2020)
Building Code	Yes IBC/IRC	Version/Year: 2012. Tulalip Tribes is considering updating to 2015 or 2018 in 2021.	
Building Code Effectiveness Grading Schedule (BCEGS) Score		Score:	
Fire Department ISO Rating		Rating:	
Site Plan Review Requirements	Yes	Permit Review Committee	

Land-use Planning and Ordinances for hazard mitigation	Yes/No Year Adopted	Describe the ordinance and its effectiveness for hazard mitigation	Is the ordinance adequately administered and enforced?	Accomplishments (2015-2020)
Zoning Ordinance	Yes 1995		Update 2021	
Subdivision Ordinance	Yes 2012			
Floodplain Ordinance	No	Setback from flood plains		
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	Yes	Land use code includes provisions for steep slopes		

Land-use Planning and Ordinances for hazard mitigation	Yes/No Year Adopted	Describe the ordinance and its effectiveness for hazard mitigation	Is the ordinance adequately administered and enforced?	Accomplishments (2015-2020)
Flood Insurance Rate Maps		There is no flood insurance program in Tulalip Tribes Reservation	Completed for HUD sponsored housing	
Acquisition of Land for Open Space and Recreation Uses	Yes	Lands acquired within and off the Reservation, including managed coastal retreat.	yes	
Other	Yes	Title 7 Land Use Code		

Rate the Overall Planning and Regulatory Capabilities				
Very Low	**Low**	**Moderate**	**High**	**Very High**

How can the Tribes expand Planning and Regulatory Capabilities and reduce risks?

National Flood Insurance Program If your Tribe participates in the NFIP, please fill in the table.			
NFIP Entry Date	**Current Effective Map Date**	**Number of Policies**	**Amount of Coverage (in $)**
n/a	n/a	n/a	

4.7.2 Administrative and Technical

Administrative and technical capabilities include staff and their skills and resources that may be leveraged for mitigation planning and implementation.

Administration	Yes/No	Is coordination effective?	Accomplishments (2015-2020)
Planning Commission	Yes, 7 volunteer members	A citizen committee that is appointed and/or elected, which reviews policies and codes.	
Mitigation Planning Committee	Yes	Established in 2020	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	Wildfire fuel management program; drainage maintenance at Boeing test site; Department of Solid Waste manages and clears drainage systems.	
Mutual aid agreements (includes inter-local agreements)	Yes, ILA and Snohomish County DEM		

Staff	Yes/No and FT/PT	Is staffing adequate to enforce regulations?	Is coordination effective between staff and agencies?	Are staff trained on hazards and mitigation?	Accomplishments (2015-2020)
Chief Building Official	Yes, contract				
Floodplain Administrator	No				
Emergency Manager	Yes				
Community Planner	Yes				
Civil Engineer	Yes, contract				
GIS Coordinator	Yes				

Staff	Yes/No and FT/PT	Is staffing adequate to enforce regulations?	Is coordination effective between staff and agencies?	Are staff trained on hazards and mitigation?	Accomplishments (2015-2020)
Other	Yes, OEM Duty truck				
Planning department	Yes, four full-time staff	No			

Technical	Yes/No Year Adopted	Has the capability been leveraged to assess or mitigate risk?	Accomplishments (2015-2020)
Warning Systems and Services (e.g., reverse 911, outdoor warning signals)	Yes, Text Alert		
Hazard Data and Information	Yes	2020 HMP	
Grant Writing/ Management Services	Yes		
HAZUS Analysis	No		
Other			

Rate the Overall Administrative and Technical Capabilities				
Very Low	**Low**	**Moderate**	**High**	**Very High**

How can the Tribe expand Administrative and Technical Capabilities and reduce risks?

4.7.3 Financial

Financial capabilities include funding sources that do not need to be repaid (e.g., government grants, taxes, user fees, and philanthropic sources) and finance (e.g., bonds, private lending).

Funding Resource	Access/Eligibility (Yes/No)	Has funding been leveraged for hazard mitigation, if so, how?	If not, could funding be used for mitigation and how?	Accomplishments
Capital Improvement Project Funding	Yes			
Authority to levy taxes for specific purposes (e.g., special assessment districts)	there are some, yes	Gasoline can be taxed. Businesses in the Village collect sales tax on items sold to the public.		
Utility Fees (e.g., electric, water, sewer, gas)	Yes			
Impact fees for new development	Yes, added for new developments (e.g., traffic impact fees and is case-by-case) specific to Quil Ceda Village.			
Stormwater Utility Fee	No			
Take on debt (e.g., General Obligation Bonds or Special Bond)	No			
Take on debt through private activities (e.g., loan)	No			
Community Development Block Grant	Yes			
Other Federal Funding Programs	Yes	-NAACCHO/MRC Grants		

		-FEMA		
State Funding Programs	Yes			
Insurance Products				
Other		Permitting Revenue		
Hard Dollars	Yes			

Rate the Overall Financial Capabilities				
Very Low	**Low**	**Moderate**	**High**	**Very High**

How can the Tribe expand Financial Capabilities and reduce risks?

4.7.4 Education and Outreach

Education and outreach capabilities include ongoing programs that local-to-federal government, nonprofit, and other organizations provide to communities which may leveraged to implement hazard mitigation actions and build community resilience. Please indicate which of the following programs currently exist and how they are or could be used to mitigate hazards and build resilience.

Program/Organization	Yes/No Year Adopted	Identify the program and describe how it relates to resilience and mitigation	How might it help implement resilience or mitigation activities?	Accomplishments (2015-2020)
Local Citizen Groups or nonprofit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	CERT		
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness)	Yes	CERT Training, PFA training, CPR/First Aid & preparedness trainings and outreach		
Natural disaster or safety related school programs				

Program/Organization	Yes/No Year Adopted	Identify the program and describe how it relates to resilience and mitigation	How might it help implement resilience or mitigation activities?	Accomplishments (2015-2020)
StormReady certification	No			
Firewise Communities certification	No			
Public-private partnership initiatives addressing disaster-related issues	Yes	COAD/VOAD/Red Cross		
Other				

Rate the Overall Education and Outreach Capabilities				
Very Low	**Low**	**Moderate**	**High**	**Very High**

How can the Tribe expand Education and Outreach Capabilities and reduce risks?

Tulalip Tribes 2021 Hazard Mitigation Plan

Part 2: Risk Assessment

Part 2

5 Risk Assessment

5.1 Introduction

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. It allows emergency management personnel to establish hazard mitigation priorities by identifying the probability of a hazard occurring and the exposure and vulnerability of populations, property and critical infrastructures and facilities to that hazard. The process focuses on the following elements:

- Hazard Identification and ranking – Determine the hazards that may impact a jurisdiction.
- Exposure Identification – Estimate the total number of people and properties in the jurisdiction that are likely to experience a hazard event if it occurs.
- Vulnerability identification and loss estimation – Assess the potential impact of a hazard on the populations, properties, environment, and critical infrastructures and facilities within a planning area and their capacity to mitigate its effects. Estimate potential life and economic losses that may result and potential avoided costs through mitigation.

44 CFR Section 201.7(c)(2)

Requires a risk assessment that provides a factual basis for activities proposed in the strategy to reduce losses from identified hazards. Tribal risk assessments must provide sufficient information to enable the tribal government to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. To protect privacy and security of critical facilities and cultural properties, information assessed is presented in aggregate, without details about specific properties.

5.2 Methodology

The hazard profiles (sections 6-14) were informed by qualitative and quantitative methods to describe each hazard, and the exposure of and vulnerabilities to populations, properties, critical infrastructures and facilities, and the natural environment within the planning area.

5.2.1 Qualitative Methods – Identifying and Prioritizing Hazards of Concern

The Steering Committee was asked to identify and prioritize hazards of concern based on the probability, frequency, magnitude, severity and warning time of each within the planning area, ranking them from high-to-low based on their subjective assumptions of the most-likely and worst-case scenarios. To inform the identification and prioritization of the hazards, the Steering Committee reviewed state and local hazard planning documents, as well as historical information on each hazard within the planning area. The rank of high, medium, and low was subjective to each member of the Steering Committee and based on their departments capabilities, the impact to the Reservation, historical analysis, exposure analysis (based on the spatial and modeling outputs), current infrastructure development and future infrastructure and land use development, economic, natural, and cultural resources, and exposure of residents.

The Steering Committee identified the following 10 hazards for inclusion in the Tulalip Tribes 2021 HMP and the results of the hazard ranking survey are reported in tables 5 and 6 (below).

- Active Assailant
- Earthquake
- Epidemic
- Flood and Sea Level Rise
- Hazardous Materials
- Mass Earth Movements
- Tsunami
- Severe Weather Events
- Wildfires

To streamline the content of the HMP and improve its utility, the Project Team consolidated drought into severe weather, resulting in nine hazards being included in the HMP; however, that decision was made after the Steering Committee had ranked the hazards.

Table 5 Most-likely Scenario

	Severity (1=lowest, 5=highest)	**Magnitude** (1=lowest, 5=highest)	**Frequency** (1=lowest, 5=highest)	**Onset** (1=slowest, 5=fastest)	**Duration** (1=shortest, 5=longest)	**Change in Risk** (1=up, 0=none, -1=down)	**Average**	**Rank**
Drought	2.2	3.9	3.1	2.5	3.4	1.0	3.03	1
Earthquake	2.6	2.6	2.1	4.6	3.0	0.7	2.96	2
Severe Weather	2.0	2.9	3.6	3.1	2.4	1.0	2.81	3
Wildfires	2.2	2.0	2.8	3.6	3.4	1.0	2.79	4
Tsunamis/Seiches	2.6	2.2	1.3	3.9	3.2	0.3	2.65	7
Heatwave	1.4	3.5	3.2	2.9	2.7	0.8	2.74	5
Mass Earth Movements	2.1	2.1	2.3	3.7	3.3	0.7	2.70	6
Pandemic	1.6	3.0	1.4	3.1	3.0	0.5	2.43	8
Flood	1.7	2.1	2.7	3.1	2.4	0.8	2.41	9
Hazardous Materials	1.4	2.0	1.3	3.3	2.9	-0.2	2.18	10

Table 6 Worst-case Scenario

	Severity (1=lowest, 5=highest)	Magnitude (1=lowest, 5=highest)	Frequency (1=lowest, 5=highest)	Onset (1=slowest, 5=fastest)	Duration (1=shortest, 5=longest)	Change in Risk (1=up, 0=none, -1=down)	Average	Rank
Earthquake	5.0	4.9	1.8	5.0	4.6	0.7	4.25	1
Wildfires	4.1	4.2	3.1	4.4	4.3	1.0	4.03	2
Tsunamis/ Seiches	4.6	4.1	2.0	4.7	4.6	0.3	4.02	3
Pandemic	4.1	4.7	2.1	4.0	4.0	0.5	3.78	4
Hazardous Materials	4.0	4.0	2.7	4.6	3.5	-0.2	3.75	5
Landslide/Mass Movements	3.9	3.7	3.1	4.0	3.4	0.7	3.62	6
Drought	2.9	4.0	3.9	2.6	3.8	1.0	3.41	7
Severe Weather	3.0	3.7	3.9	3.4	2.8	1.0	3.35	8
Heatwave	2.5	3.9	3.9	3.1	2.8	0.8	3.23	9
Flood	2.4	2.9	3.4	3.6	2.6	0.8	2.97	10

5.2.2 Quantitative Methods – Map-based Risk Assessment

Geospatial and other data were used to determine the extent of each hazard, exposure and vulnerability (i.e., risk) of persons, properties, critical infrastructures and facilities to each hazard within the planning area. National, state, county, and tribal databases were reviewed to locate available spatially based data relevant to the planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent and location of hazards when such datasets were available. Data used for this plan update represents the best science currently available. Maps are included in the hazard profile Sections 6-15 of this document.

All hazards with available geospatial data were analyzed using GIS to identify the level of risk and exposure to the community. The risk assessment included total and vulnerable population exposure and economic exposure of structures within the Reservation. For hazards with no geographic information, a qualitative analysis was conducted using the best available data and information.

Population Exposure: To estimate population exposure, the total and vulnerable populations in each census tract were distributed to the residential buildings within the planning area. The population within any exposed residential buildings is summed to find the number of people at risk of a hazard. We report the populations susceptible to each hazard by jurisdiction, considering only the residential buildings and 9,997 people within the reservation discussed in this HMP (United States Census Bureau, 2018). Socially vulnerable population categories considered include language, race, age, poverty, and disability. Population exposure is included in the hazard profile sections of this document.

Structural Economic Exposure: The economic exposure to each hazard considers 7,936 structures within the jurisdictions discussed in this HMP. The assessed total economic value of the structure is reported, including the structural value and assessed value of contents within. The total economic value of all exposed structures is added to find the value of structures at risk of a hazard. The economic exposure of buildings within each jurisdiction is reported in the hazard profile sections of this document.

Hazard Exposure Definitions: Hazard specific information for the GIS-based risk assessment is included below:

- *Earthquake* – The buildings and critical infrastructure that will experience at least a moderate amount of shaking during the South Whidbey Island Fault Earthquake scenario are considered vulnerable.
- *Liquefaction* – The buildings and critical infrastructure with at least a moderate risk of liquefaction are considered vulnerable.
- *Weather Events* – All buildings and critical facilities are considered vulnerable to an extreme weather event.
- *Flooding, Dam Failure, Tsunami* – The buildings and critical infrastructure within the 100yr floodplain, 500yr floodplain, tsunami inundation zone, or dam failure inundation zone are considered vulnerable.
- *Wildfire* – The buildings and critical infrastructure that are with at least a moderate wildfire hazard zone are considered vulnerable.
- *Mass Earth Movement* – The buildings and critical infrastructure that are within at least a moderate landslide hazard zone are considered vulnerable.
- *Soils* – The buildings and critical infrastructure built on soils classified as D, E, or F are considered vulnerable.
- *Volcano* – The buildings and critical infrastructure within a lahar zone are considered vulnerable.

5.2.3 Data Sources

The below table lists all the data and data sources used to develop maps and tabular outputs.

Table 7 - Geographic Information System Data Sources

Geographic Information System Data Sources	
Data	Source
Critical Facilities	ESRI, Snohomish County, jurisdictions and special districts
Structures	Snohomish County
Population	ESRI, U. S. Census
Earthquake	U.S. Geological Survey (USGS)
Hazardous Materials	Snohomish County, Environmental Protection Agency (EPA)
Weather Events	U.S. Department of Agriculture Natural Resources Conservation Service, National Oceanic and Atmospheric Administration (NOAA): National Climatic Data Center
Flooding	Snohomish County Digital Flood Insurance Rate Maps, the Federal Emergency Management Agency (FEMA)

Dam Failure	Snohomish County Public Utility District, City of Seattle City Light Department
Wildfire	Snohomish County, Washington State Department of Natural Resources
Mass Earth Movement	Washington State Department of Natural Resources
Volcano	USGS Cascade Volcano Observatory
Sea Level Rise	National Oceanic and Atmospheric Administration (NOAA)
Tsunami	NOAA, Washington State Department of Natural Resources
Landslide	FEMA

5.3 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;
- The amount of advance notice Tulalip citizens and community members are given to prepare for a specific hazard event; and
- Specific to sea level rise, there currently exists no standardized model for assessing sea level rise impacts.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. The Tribe was not able to update their critical infrastructures and facilities data for the 2020 HMP update. Between the 2020 and 2025 HMP, the Tribe will collect and validate critical infrastructures and facilities data to assist in estimating potential losses associated with other hazards.

6 Active Assailant

6.1 General Background

Active assailant events are increasingly common in the United States. Active assailant events can be premeditated, coordinated attacks with multiple assailants or an individual acting alone (Department of Homeland Security, 2017). These incidents are often unpredictable and can evolve quickly and typically occur in places of commerce, schools, public venues, and government facilities (Federal Bureau of Investigation, 2019). Typically, the immediate deployment of law enforcement is required to intervene and end the event (Department of Homeland Security, 2008).

According to the Federal Bureau of Investigation (2019), 277 active shooter incidents occurred in the United States between 2000 and 2018. Of them, 117 incidents (42 percent) occurred between the 2014 and 2018. In 2018, the FBI reported 27 incidents in 16 states, with 10 of those meeting the criterion for the federal definition of a "mass killing." In 2019, there were 28 incidents in 16 states, with 12 of those meeting the "mass killing" definition (Federal Bureau of Investigation, 2020).

Active assailants may use a variety of mediums during an incident, such as knives, bombs, guns, and/or cars. In July 2005, four suicide bombers killed 52 and injured hundreds in blasts on the London Underground network and a bus (Walawalkar, 2020). In 2014, a 16-year-old student with two knives went on a rampage at a Pennsylvania high school, stabbing 21 students and a security guard. In August 2017, a man drove his car into a crowd of protesters in Charlottesville, Virginia, killing one and injuring 28. In October 2017, a man rented a pickup truck and drove through a bike path along the Hudson River in New York City, killing 8 and injuring 11 others (Gibson, 2019). In August 2019, an active shooter killed 20 people and injured 26 in a mass shooting at a Walmart in El Paso, Texas.

DEFINITIONS

Active Assailant – An individual actively engaged in killing or attempting to kill people in a confined and populated area…in most cases, active assailants use firearm(s) and there is generally no pattern or method to their selection of victims.

Active Situation – Both law enforcement personnel and bystanders have the potential to affect the outcome of the event based upon their responses to the situation.

Active Shooter – One or more individuals actively engage in killing or attempting to kill people in a populated area using one or more firearms.

Extreme Risk Protection Orders – Designed to prevent individuals at high risk of harming themselves or others from accessing firearms, it allows family, household members, and police to obtain a court order when there is demonstrated evidence that the person poses a significant danger.

Mass Killings – Three or more killings in a single incident.

6.1.1 Potential Impacts from Active Assailants

The impacts of active assailant events include loss of life, injury, and trauma to the victims and their families. Although an assailant may be pursuing a particular person or target, most people involved in active assailant incidents are innocent bystanders. In the wake of an active assailant incident, fear of a similar event may occur in similar locations across the nation. Additionally, lasting trauma can impact the survivor and their family's ability to cope with daily life.

6.2 Tulalip Tribes Hazard Profile

An active assailant incident could occur throughout the reservation. Statistically, businesses and malls are the most likely locations, followed by schools and institutions of higher learning (Federal Bureau of Investigation, 2014).

6.2.1 Hazard Ranking

The active assailant hazard was identified for inclusion in the Tulalip Tribes 2021 HMP by the Steering Committee during the hazard ranking exercise; therefore, the hazard was not scored or ranked by worst case and most likely scenarios as most other hazards were.

6.2.2 Past Events

Between 2000 and 2020, there were 13 active assailant incidents in the State of Washington, and 3 in Snohomish County (Federal Bureau of Investigation, 2019); however, there have been no reported incidents on the Tulalip Reservation.

- On April 9, 2020, one man was killed and a second was injured a downtown Everett shooting near the Everett Public Library.
- On July 20, 2016, a 19-year-old armed with a rifle began shooting people attending a house party in Mukilteo; three people were killed, one wounded.
- On October 24, 2014, a 15-year-old freshman student armed with a handgun began shooting in the cafeteria of Marysville-Pilchuck High School; four students and the shooter were killed.

In nearby Snohomish County, multiple potential mass shooting/active assailant attacks were investigated and foiled by law enforcement before they occurred. For instance, in July of 2019, a man spent a couple hours firing shots from an Everett apartment, putting two holes in a neighboring apartment (Police Blotter, 2019). In February of 2018, a Snohomish County grandmother reported her 18-year-old grandson to the police after finding a journal with threats to shoot students (Bernhard, & Wilkinson, 2018). After investigation, the threats were considered credible and the man was arrested.

6.2.3 Location

Law enforcement may not be able to anticipate and plan for the location of an active assailant incident; However, assailants tend to select the location and plan their attacks. For example, a high percentage of school shootings are carried out by current or former students, and many shootings at businesses are done by current or former employees or by persons with some known grievance with the business.

In instances with no direct connection to the location, places with a high pedestrian presence and limited security capacity (i.e., soft target) are typically chosen (Gibson, 2019). Between 2000 and 2018, the most targeted locations were commerce (businesses open to pedestrian traffic, businesses closed to pedestrian traffic, and malls), educational institutions (Pre-K to 12), open spaces, and non-military government properties. Places of worship, health care facilities, and private residences are lowest on the list of targeted locations (Federal Bureau of Investigation, 2019)

6.2.4 Frequency

Across Washington State, seven mass shootings occurred between 1982 and 2020 (Statista Research Department, 2020). In nearby Snohomish County, three mass shootings occurred between 2014 to 2020. There is an increasing trend in the occurrence and frequency of active assailant events throughout the United States.

6.2.5 Severity

The severity of active assailant incidents can range from no deaths and few injuries to dozens of causalities and even more wounded survivors. Some of the most severe impacts are the trauma to victims and families, as well as the fear that is instilled in the public.

6.2.6 Warning Time

In weeks and months before an attack, many active assailants engage in behaviors that may signal impending violence. Some of these behaviors are intentionally concealed, while others are observable and reportable. Most assailants take time to plan and prepare for an attack, sometimes over weeks or months (Federal Bureau of Investigation, 2018). Once an incident has begun, there is little to no warning time. Those further away from the assailant have more time to implement action-based response options to increase survivability and save lives.

Due to many active assailant events being planned, law enforcement agencies may be able to stifle incidents before they happen. For example, in August 2019 a 22-year old male in Connecticut expressed on Facebook his interest initiating an active assailant event; a 25-year old male from Florida sent his ex-girlfriend texts threatening to commit a mass shooting, and; a 20-year old male in Ohio that threatened to carry out a mass shooting at a religious center (And one, Kaur, & Holcombe, 2019).

6.3 Cascading Impacts/Secondary Hazards

Cascading impacts and secondary hazards from active assailant incidents can include diminished business activity and revenue or loss of labor hours, while property damage may occur due to the weapon. Inundation of hospitals and medical centers after a large-scale active assailant event may result in excessive demand for blood and other vital supplies, putting survivors and pre-existing patients at risk. These incidents also put people at an increased risk for depression, suicide, or other mental health issues related to psychological trauma. Additionally, active assailant events have the potential to serve as a catalyst for demonstrations (e.g., anti-gun) that put additional strain on local law enforcement.

6.4 Potential Impacts from Future Climate Conditions

There is no evidence to show that future climate conditions would increase active assailant threats.

6.5 Exposure & Vulnerability

6.5.1 Population

The population on the Tulalip Indian Reservation is growing (Tulalip Tribes, n.d.p.); as the Tulalip Reservation population expands, more people are at risk for finding themselves at a location targeted by an active assailant.

6.5.2 Property

Property exposure and vulnerability to damage is not typically considered in active assailant incidents. Any building near the active assailant is vulnerable to damage and the severity of that damage is dependent on the weapon (e.g., firearm, explosive, vehicle).

6.5.3 Critical Infrastructures and Facilities

All critical facilities listed in the plan are exposed to an active assailant incident; however, the vulnerability of these facilities is not clear and would depend on the capacity to mitigate such an event (i.e., emergency response and evacuation plans, installed barriers, metal detectors, etc.).

6.5.4 Environment

The impact of an active assailant event on the environment is dependent on the weapon (e.g., firearm, explosive, vehicle, chemical agent, etc.).

6.6 Development Trends

The potential for an active assailant event in the Tulalip Reservation is not likely to lessen or prohibit future community development.

6.7 Issues

Important issues associated with active assailants and active shooters include (Washington Association of Sheriffs and Police Chiefs, 2018):

- No legislative requirements to address active assailant threats and issues
- Future changes in gun control laws from a federal, state, or county level
- Availability and funding for technology, mitigation equipment, and/or structural upgrades and safety retrofitting
- Availability and funding for police and security at government buildings or large public events
- Availability and funding for properly trained school resources officers
- Training for school staff and increased awareness for students, including drills
- Sufficient and effective school counselors, psychologists, mental health professionals, family engagement coordinators, school social workers
- Accessible and effective mental health services with improvements to the mental health system
- Encouragement to report suspicious or threatening behavior
- Suicide and bullying prevention outreach and education efforts
- Seattle Police Department. (n.d.) Extreme Risk Protection Orders

6.8 Hazard Map

No geospatial data is available for this hazard, therefore there is no map.

7 Earthquake

7.1 General Background

Earthquakes result due to the slip of a fault or volcanic activity that results in radiated seismic energy and may be felt when the ground shakes. They may last from a few seconds to over five minutes and may occur as a series of tremors over a period of several days.

Most seismic hazards occur or expected to occur on well-known active faults; however, determining if a fault is active or potentially active depends on geologic evidence that may not be available.

An earthquake is more likely to occur on a fault that moves rapidly, if an earthquake has recently occurred on that fault, experiences greater total displacements, or is aligned so that movement relieves accumulating tectonic stresses. There is a direct relationship between the length and location of a fault and its ability to generate damaging ground motion at a given site.

In some areas, smaller, local faults produce lower-magnitude earthquakes, 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.

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. Earthquakes are typically measured in both magnitude and intensity.

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. Most common is a strike-slip, normal, or thrust fault.

Focal Depth – The depth from the earth's surface to the hypocenter.

Hypocenter – The region underground where an earthquake's energy originates.

7.1.1 Potential Impacts from Earthquakes

Earthquakes may result in damage to or the destruction of buildings and infrastructures, such as roads and communications, electrical, gas, water and wastewater facilities and lines. They may also result in injury or death due to falling objects and debris, or the collapse of buildings and infrastructures.

7.2 Tulalip Tribes Hazard Profile

Tulalip Tribes is in a seismically active region, with hundreds of earthquakes occurring each year; however, most are only detectible by sensitive instruments. While many of these events register a magnitude of three (3) or lower on the Richter scale, earthquakes measuring up to 7.1 have been recorded. Additionally, magnitude eight (8) and greater magnitude earthquakes have occurred in the region, and similar seismic events are expected in the future; Table 8 describes these classes.

Table 8 – Earthquake Magnitude Classes

Earthquake Magnitude Classes	
Magnitude Class	**Magnitude Range**
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

7.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, earthquakes were ranked as number one worst-case scenario and the second most likely scenario.

Table 9 – Earthquake Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	Magnitude (1=lowest, 5=highest)	Frequency (1=lowest, 5=highest)	Onset (1=slowest, 5=fastest)	Duration (1=shortest, 5=longest)	Perceived Change in Risk	Average	Rank
Worst-case Scenario							
5.0	4.9	1.8	5.0	4.6	0.7	4.25	1
Most Likely Scenario							
2.6	2.6	2.1	4.6	3.0	0.7	2.96	2

7.2.2 Past Events

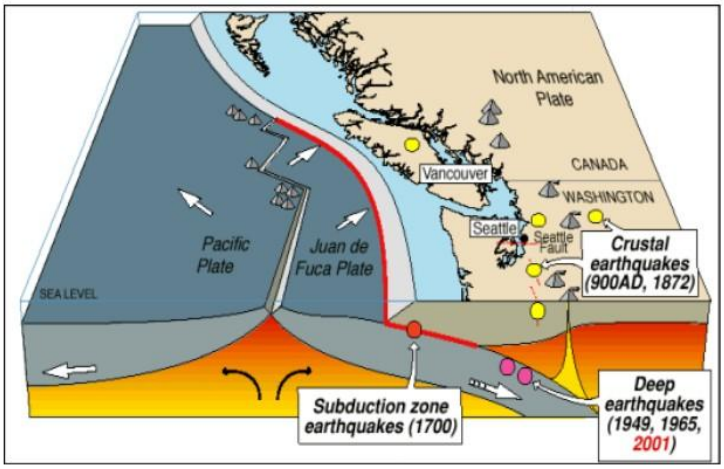
Western Washington State has experienced twenty damaging earthquakes in the last 125 years. Large earthquakes in 1946, 1949, 1965, and 2001 resulted in 16 deaths and more than $3.6 billion in damage. The last known Cascadia Subduction Zone (CSZ) megathrust earthquake occurred in January 1700 and was an estimated magnitude nine. These and other events are illustrated by the Pacific Northwest Seismic Network (n.d.a.) in Figure 3 to the right. Tulalip Reservation has not experienced an earthquake of a 3.0 magnitude or greater between January 2000 and May 2020 (Pacific Northwest Seismic Network, 2020); however, Snohomish County experienced two earthquakes that resulted in a disaster declaration (Federal Emergency Management Agency, 2019).

7.2.3 Location

More than 90 percent of earthquakes in the Pacific Northwest occur along the boundary between the Juan de Fuca plate and the North American plate, displayed in Figure 3, which is located approximately 50 miles off the coast of the United States and Canada.

The Tulalip Reservation is located on or near three source zones for earthquakes: the CSZ; a deep, intra-plate "Benioff" zone; and, a shallow (crustal) zone such as the Southern Whidbey Island Fault (SWIF). The CSZ, which extends from northern California to British Columbia, Canada, is prone to potentially catastrophic earthquakes (Pacific Northwest Seismic Network, n.d.a.). Earthquakes are generated in the CSZ when the Juan de Fuca Plate moves under the North American Plate in the Pacific Ocean. While shallow earthquakes of greater magnitude are expected to occur infrequently in this area, shallow earthquakes of up to magnitude four are more likely. In addition to the SWIF and the CSZ, the Reservation is exposed to deep intraplate, crustal faulting, and volcanic earthquakes (Pacific Northwest Seismic Network, n.d.b.).

Figure 3 Earthquake Types in Western Washington State



Cascadia Subduction Zone

The CSZ is where the Juan De Fuca plate slides under the North American plate; the sliding of one plate below another is called "subduction." The Juan De Fuca plate slides beneath the North American plate at approximately 1.5 inches annually, sinking into the earth's mantle. A CSZ event off the coast of Washington is likely to result in magnitude 8-9.5 earthquake lasting one to several minutes. Earthquakes at subduction zone boundaries produce the world's greatest earthquakes and may generate tsunamis and large aftershocks.

Deep, Intra-Plate "Benioff" Zone

Benioff deep zone earthquakes occur as the Juan de Fuca plate converges with the North American plate at depths of about 30 to 40 miles, resulting in earthquakes of 6-7.4 in magnitude. The largest recorded earthquakes resulting from this in the area were the 7.1-magnitude Olympia earthquake in 1949 and the 6.8 magnitude Nisqually earthquake in 2001. During the Olympia earthquake, strong shaking lasted approximately 20 seconds. During the Nisqually quake, shaking lasted from 30 seconds to more than 2 minutes. Since 1870, there have been seven deep earthquakes in the Puget Sound basin with measured or estimated magnitudes of 6.0 or larger. The epicenters of all these events have been within about 50 miles of each other, between Olympia and just north of Tacoma. Scientists estimate the recurrence interval for this type of earthquake to be 30-40 years for magnitude 6.5, and 50 to 70 years for magnitude 7.0. Because of their depth, intra-plate earthquakes are least likely to produce significant aftershocks.

Crustal Zone

In the Puget Sound region, crustal zone earthquakes occur in the crust of the North American plate and may register as a magnitude seven or greater on the Richter scale. Such earthquakes have the potential to cause greater loss of life and property than any other kind of disaster but may occur no more than once every 1,000 years.

The SWIF was assessed as capable of generating the largest crustal earthquake in Puget Sound. The SWIF is now known to be a broad, north-side-up fault zone dipping steeply to the northeast that projects onto the mainland near Everett and continues southeast towards Woodinville. Based on radiocarbon and stratigraphic data, researchers concluded that the SWIF could produce a magnitude 6.5 to 7.5 earthquake (Washington Department of Natural Resources, 2013).

The structure of the crust in the Puget Sound area is complex, with large sedimentary rock-filled basins beneath Tacoma, Seattle and Everett. The Tulalip Reservation is in the Everett Basin. This basin is laden with softer soils, posing the threat of earthquake effect intensification.

Seismologists have found evidence that a devastating crustal quake occurred on a fault near Seattle approximately 1,100 years ago. The Duvall Fault near Lake Margaret on the board of King and Snohomish counties has produced two magnitude 5.3 earthquakes in the past 70 years (1932 and 1996). How many other crustal faults pose significant earthquake hazards to the Puget Sound region is not yet known.

Crustal earthquakes are the least predictable of Puget Sound's seismic threats and are the most likely to be followed by significant aftershocks. Following a great crustal earthquake of magnitude 7.0 or more, one of the greatest dangers to human life is that buildings or other structures damaged in the initial shock but still in use and believed safe could collapse in a strong aftershock.

7.2.4 Frequency

The Puget Sound region experiences hundreds of earthquakes each year, the majority of which are below a magnitude of 3.0 and observed only by sensitive equipment. The USGS estimated that a CSZ earthquake has a 10 to 15 percent probability of occurrence in 50 years, and a crustal zone earthquake has a recurrence interval of about 500 to 600 years. In general, it is difficult to estimate the probability of occurrence of crustal earthquake events.

Earthquakes on the SWIF and Seattle Faults have a two (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.

7.2.5 Severity

An earthquake's severity may be expressed in terms of intensity and magnitude (United States Geological Survey, 2016). Intensity represents the observed effects of ground shaking at any specified location, which lessens with distance from the earthquake epicenter. Magnitude represents the amount of seismic energy released at the hypocenter of the earthquake and is based on the amplitude of the earthquake waves recorded on instruments. The Tulalip Reservation may experience magnitudes of earthquakes for each of the three source zones as follows:

- The CSZ at magnitude 9.0 with approximately four minutes of aftershocks,
- Benioff zone at magnitude 7.2 with no aftershocks, and
- The SWIF at magnitude 7.4 with some aftershocks.

7.2.6 Warning Time

There is currently no reliable way to predict when an earthquake will occur; however, the Pacific Northwest Seismic Network's ShakeAlert (n.d.) earthquake early warning system enables the detection of significant earthquakes and issues an alert to people and critical systems up to 30 seconds before shaking

arrives at the surface. While the warning time is short, it enables people to seek shelter and critical infrastructures or facilities to suspend operation (ShakeAlert, n.d.).

7.3 Cascading Impacts/Secondary Hazards

Earthquakes can result in secondary hazards, such as mass earth movements (e.g., landslides, mudslides, or avalanches), liquefaction, flooding from ruptured dams, broken levees, tsunamis or seiches, and fires that can erupt from broken gas lines and power lines. River valleys are vulnerable to mass earth movements, often as a result of loss of cohesion in clay-rich soils. Earthen dams and levees are highly susceptible to seismic events, and the impacts of their eventual failures can be considered secondary risk exposure to earthquakes. Depending on the location of the earthquake, a tsunami can be triggered. Tsunamis significantly damage many locations beyond what the earthquake struck.

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 and road foundations lose load-bearing strength and may sink quicksand-like into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

Additionally, fires can result from gas lines or power lines that are broken or downed during the earthquake. It may be difficult to control a fire, particularly if the water lines feeding fire hydrants are also broken.

7.4 Potential Impacts from Future Climate Conditions

The impacts of global climate change on earthquake probability are unknown; however, the secondary impacts of earthquakes are being magnified by climate change (McGuire, 2010). Soils saturated by repetitive storms could fail during seismic activity due to the increased saturation. The likelihood of mass earth movements in the wake of an earthquake may increase due to the compounding effects of a loss in hillside vegetation due to wildfires and heightened soil saturation due to extreme precipitation, changes in river hydrology, or sea-level weakens slope stability. Dams and/or levees storing increased volumes of water due to changes in the hydrograph could fail during seismic events. Fire risks associated with earthquakes could be significantly enhanced by drought conditions triggered by climate change (McGuire, 2010).

7.5 Exposure and Vulnerability

The exposure assessment outputs in this section were generated by intersecting earthquake hazard data with US Census data and Snohomish County Assessor data for populations and property.

7.5.1 Population

The entire population of the Tulalip Reservation is exposed to an earthquake hazard. Many areas in the Reservation have buildings that were built during the beginning of the twentieth century and were not subject to the building codes implemented over the last 30 years, which require that structures be able to better withstand earthquakes.

Vulnerability

There are an estimated 9,997 persons living in the impact area of a Seattle Fault earthquake scenario (United States Census Bureau, 2018). Three groups are particularly vulnerable to earthquake hazards (United States Census Bureau, 2018):

- **Persons with disabilities**—There are 1,591 persons with disabilities living on the Reservation. These persons may be vulnerable to earthquakes due to preexisting health conditions and reliance on medical devices that may be impacted by an earthquake. Additionally, debris from or damage to buildings and infrastructures may limit the mobility of persons with access and functional needs after an earthquake has occurred.
- **Population below poverty level**—This populations is vulnerable because they may not have the financial ability to secure or improve their homes to prevent or mitigate earthquake damage. Poorer Tulalip citizens and community members are also less likely to have insurance to compensate for losses in earthquakes. This means that these persons have the most to lose during an event, and at the same time are the least prepared to deal with losses.
- **Population over 65 years old**—There are 1,736 people over 65 years of age living on the Reservation. This population group is vulnerable to earthquakes because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly Tulalip citizens and community members also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

7.5.2 Property

All property and structures in the planning area are exposed to earthquakes; however, the vulnerability of those structures will depend on their construction date and adherence to building codes at that time, as well as any seismic retrofitting that has occurred since. According to the Snohomish County Assessor, there are approximately 7,936 buildings on the Tulalip Reservation with a total replacement value of $1.3 billion, many of which are residential.

Table 10 Value of Property Exposed to a Whidbey Island Fault Event with Very Strong to Severe Shaking

Value of Property Exposed to a Whidbey Island Fault Event with Very Strong to Severe Shaking				
Buildings Exposed	**percent of All Buildings**	**Assessed Value**		
		Structure	**Contents**	**Total**
7,936	100	$813,333,813	$501,159,412	$1,314,483,225

Vulnerability

All buildings on the Tulalip Reservation are vulnerable to the earthquake hazard. Older structures built before seismic codes were introduced in the 1980s are especially vulnerable. The most vulnerable structures are older critical and historic Tribal structures that were not built to current seismic code standards and have already experienced earthquakes. This includes structures such as St. Anne's Church and the Tribal Center. The Washington State Building Code Council identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development in Washington, structures across the Reservation have been organized by these time periods to understand vulnerability.

Table 11 – Age of Structures

Age of Structures within Tulalip Tribes		
Time Period	Number of Structures	Significance of Time Frame
1995-Present	3,039	Seismic codes are enforced.
1976-1994	3,104	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1961-1975	767	In 1975, significant improvements were made to lateral force requirements.
1941-1960	609	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions
1933-1940	174	In 1940, the first strong motion recording was made.
Pre-1933	243	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
Total	7,936	

7.5.3 Critical Facilities and Infrastructures

All critical facilities on the Reservation are exposed to the earthquake hazard. Table 12 lists the number of each type of facility exposed.

Table 12 – Critical Facilities Exposed to Earthquakes

Tulalip Reservation Critical Facilities Exposed to Earthquakes	
Category	**Number of Facilities Exposed**
Bridges	5
Dam	1
Fire/EMS	2
Hazmat	52
Tier II Hazmat	6
Marina/Docks	1
Medical	1
Police	1
Schools	8
Tribal Facilities	3
Wastewater Facilities	2
Total	**82**

Hazardous materials released from facilities and transportation-related releases can occur during an earthquake event. Transportation corridors such as I-5 can be disrupted during an earthquake and cause a release of materials into the surrounding environment. Facilities holding hazardous materials may be damaged during an earthquake and the surrounding area (i.e., communities and the natural environment) exposed to their contents; additionally, responders may be delayed due to debris blocking access for remediation.

Vulnerability

Critical infrastructures and facilities located on soils subject to liquefaction are more vulnerable to damage, especially if they are not built to seismic building code standards. Table 13 summarizes the results of critical facilities vulnerable to liquefaction.

Table 13 – Critical Facilities Exposed to a Medium Risk for Liquefaction

Tulalip Reservation Critical Facilities Vulnerable to a Minimum of Medium Risk for Liquefaction	
Category	**Number of Facilities Exposed**
Marine Drive Bridge	5
Marysville West Lift Station Wastewater Facility	1
Sunny Shores Community Club Water System	1
Total	**7**

7.5.4 Environment

Environmental problems that result from an earthquake can be numerous. For example, it is possible for streams to be rerouted after an earthquake. Rerouting can change the water quality, possibly damaging habitat and feeding areas. Additionally, it is possible that streams fed by groundwater wells will dry up because of changes in underlying geology. Secondary hazards, such as landslides will likely have some of the most damaging effects on the environment.

7.6 Development Trends

The geologic hazard portions of the planning area are heavily regulated pursuant to provisions stipulated for seismic risk under the International Building Code and are addressed in Title 7 of the Tulalip Tribal code. Development will occur in the planning area, but it will be regulated such that the degree of risk will be reduced through building standards and performance measures.

7.7 Issues

Important issues associated with an earthquake include but are not limited to the following:

- Appropriate geotechnical standards should be established that consider the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- Earthquakes could trigger other natural hazard events such as dam failures, landslides, or volcanic activity, which could severely impact Reservation facilities.
- A worst-case scenario would be the occurrence of a large seismic event during a flood or high-water event. Levee failures would happen at multiple locations, increasing the impacts of the individual events.

7.8 Hazard Maps

The impact of an earthquake is largely a function of ground shaking (ground motion accelerations), liquefaction (soil instability), and distance from the source (both horizontally and vertically). Mapping that shows the impacts of these components was used to assess the risk to 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, so each map is mutually exclusive of the other. For example, liquefaction classifications have no direct correlation to soil classifications. The mapping used in this assessment is described below. The maps are Figures 4 through 6 on pages 51 to 53.

7.8.1 Shake Maps

A shake map is a representation of ground shaking produced by an earthquake. 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 produced by 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 is designed as a rapid response tool to portray the extent and variation of ground shaking throughout an affected region immediately following significant earthquakes.

Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on estimated amplitudes where data are lacking, and site amplification corrections. These readings are recorded by state and federal agencies. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity.

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 scenarios describe the expected ground motions and effects of specific hypothetical large earthquakes for a region. Maps of these scenarios can be used to support all phases of emergency management. For the Tulalip Reservation planning area, shake maps are available for the following scenario:

- South Whidbey Fault Peak Ground Acceleration 7.4-Magnitude Scenario Shake Map (Figure 4 on the next page). This scenario is for a Magnitude 7.4 event with a depth of 0 miles and an epicenter 2 miles northeast of Langley.

Liquefaction Maps

In general areas with NEHRP Soils D, E, and F are also susceptible to liquefaction, 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. 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, creating sand boils, colloquially called “sand volcanoes.” Soil liquefaction maps are useful tools to assess potential damage from earthquakes. Figure 5 on page 52 shows the liquefaction susceptibility on the Tulalip Reservation.

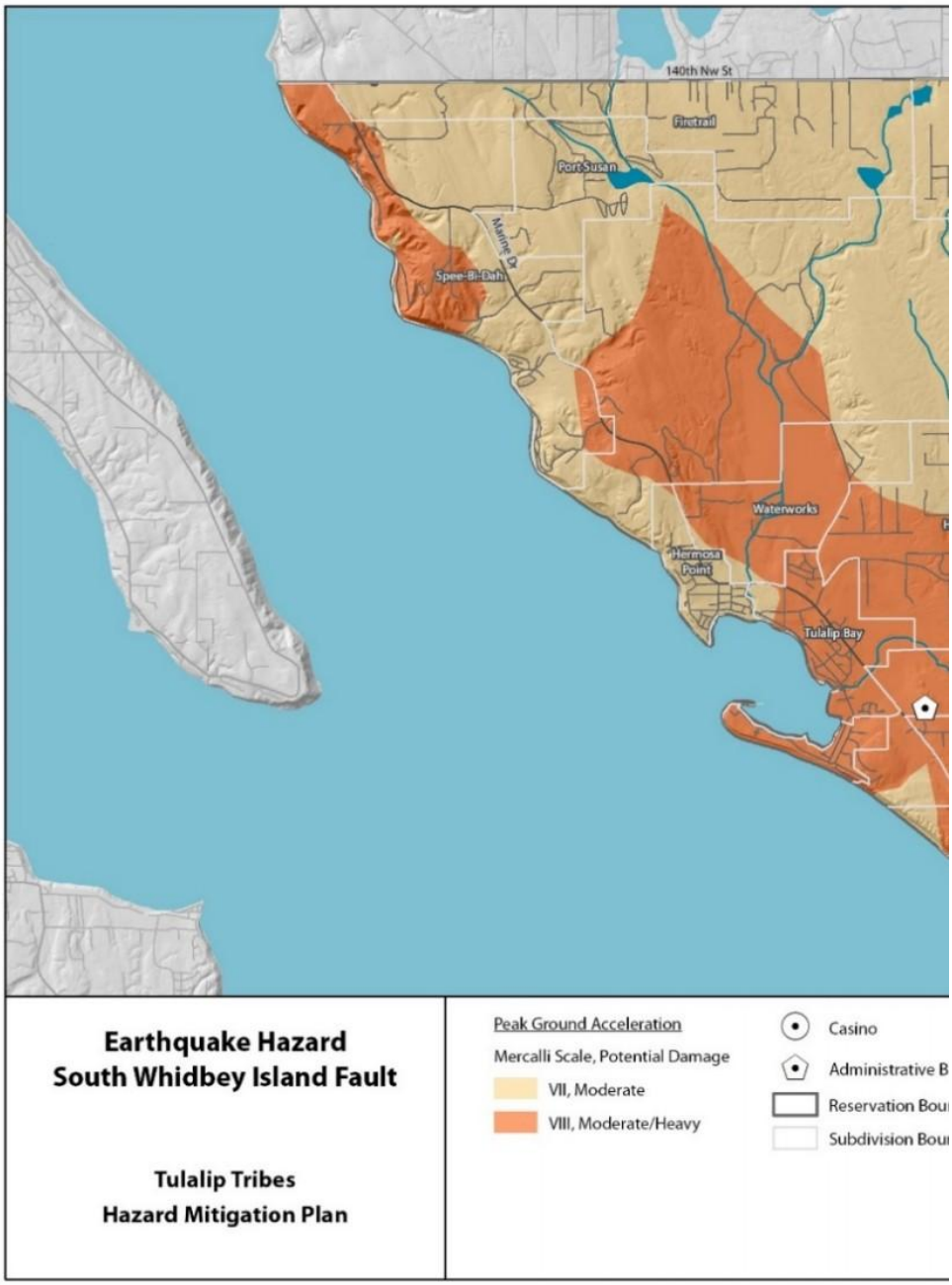
7.8.2 NEHRP Soil Maps

NEHRP soil types define the locations that will be significantly impacted by an earthquake. NEHRP Soils B and C typically can sustain low-magnitude ground shaking without much effect. The areas that are most affected by ground shaking have NEHRP Soils D, E, and F. Figure 6 on page 53 shows NEHRP soil classifications on the Reservation.

Table 14 – NEHRP Soil Classification System

NEHRP Soil Classification System		
NEHRP Soil Type	**Description**	**Mean Shear Velocity to 30 m (m/s)**
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

Figure 4 – South Whidbey Island Fault Shake Map



Risk Assessment – Earthquake

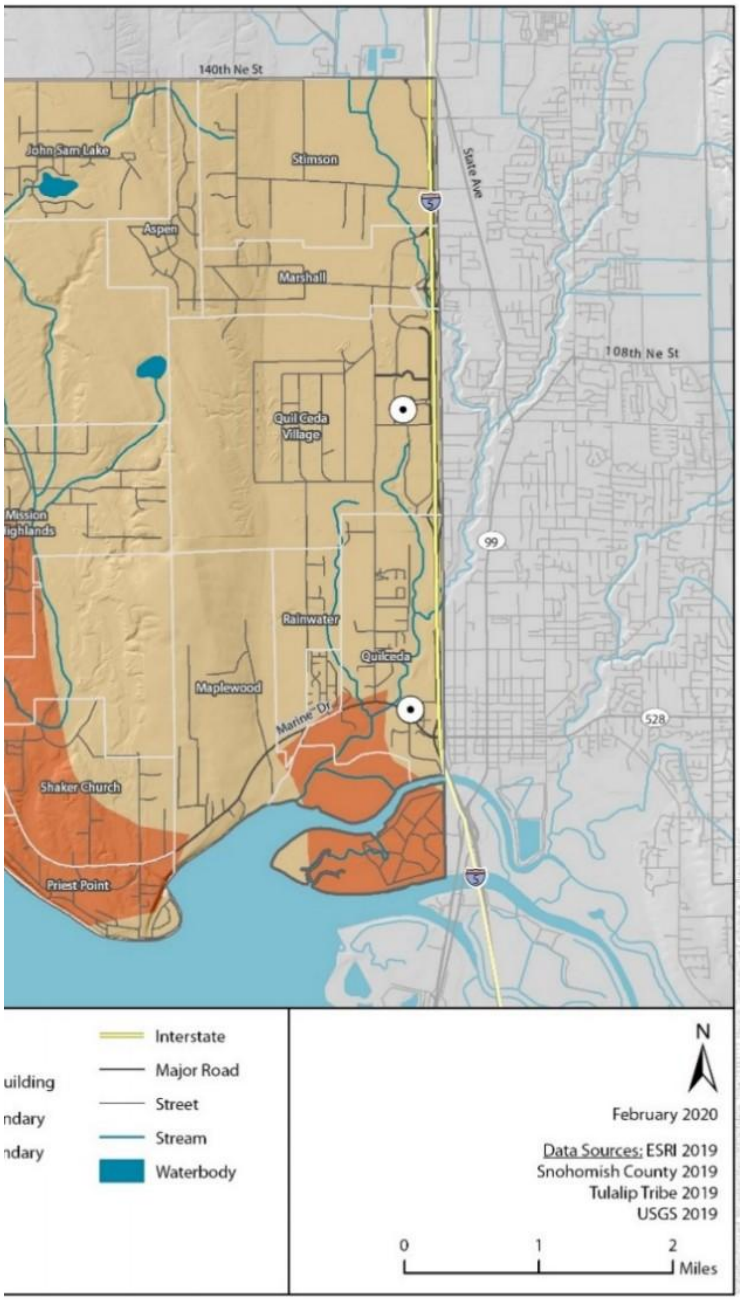
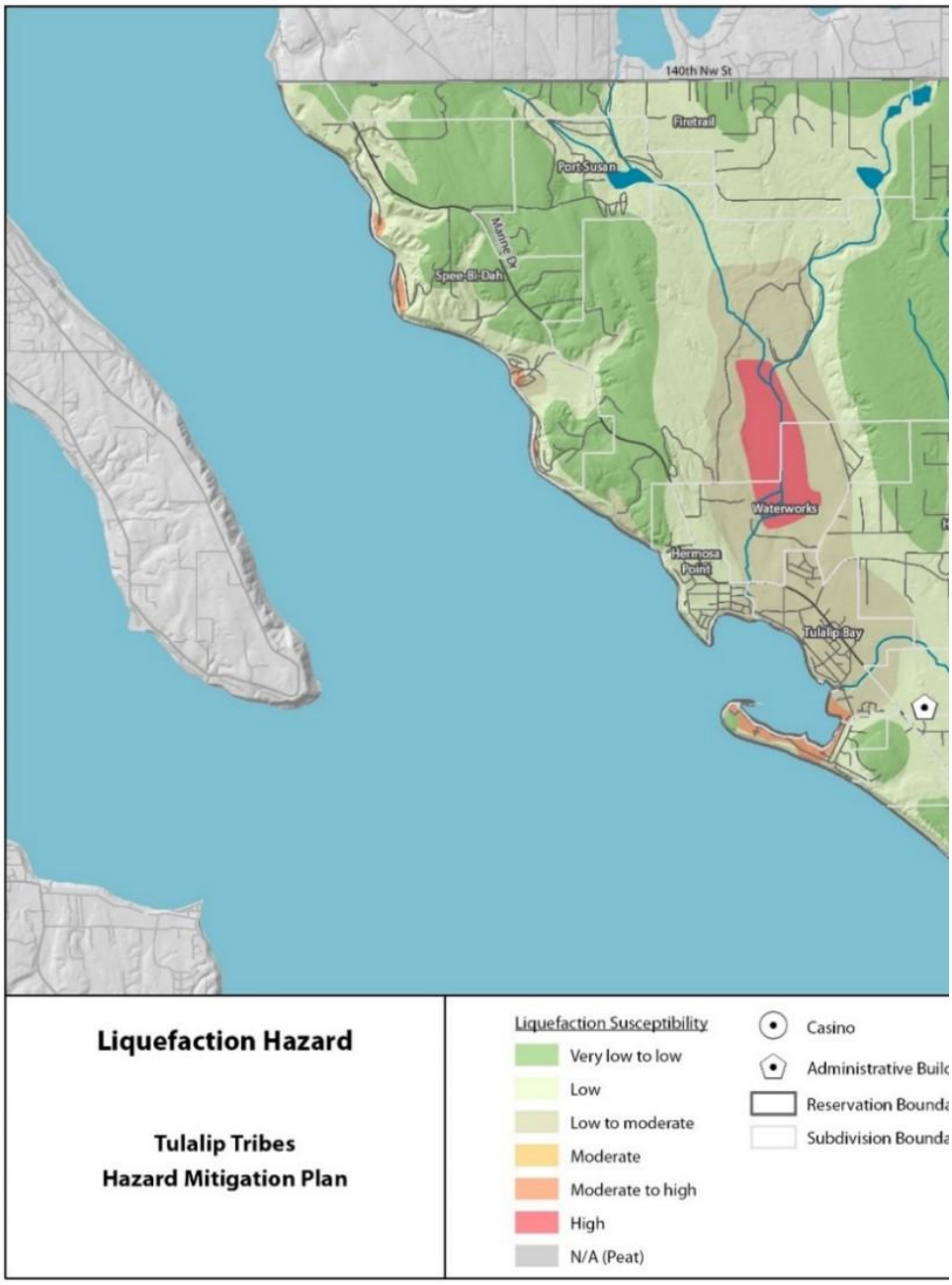


Figure 5 – Liquefaction Susceptibility



Tulalip Tribes 2021 Hazard Mitig

Risk Assessment – Earthquake

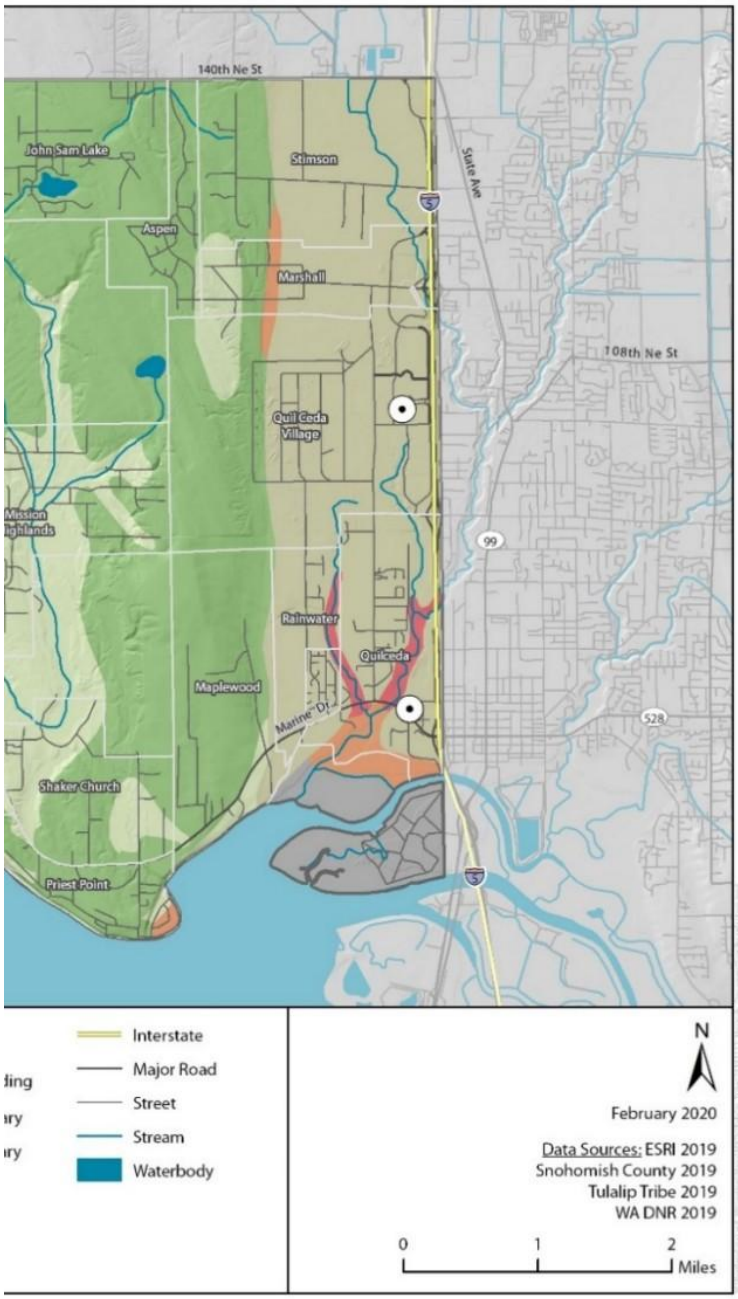
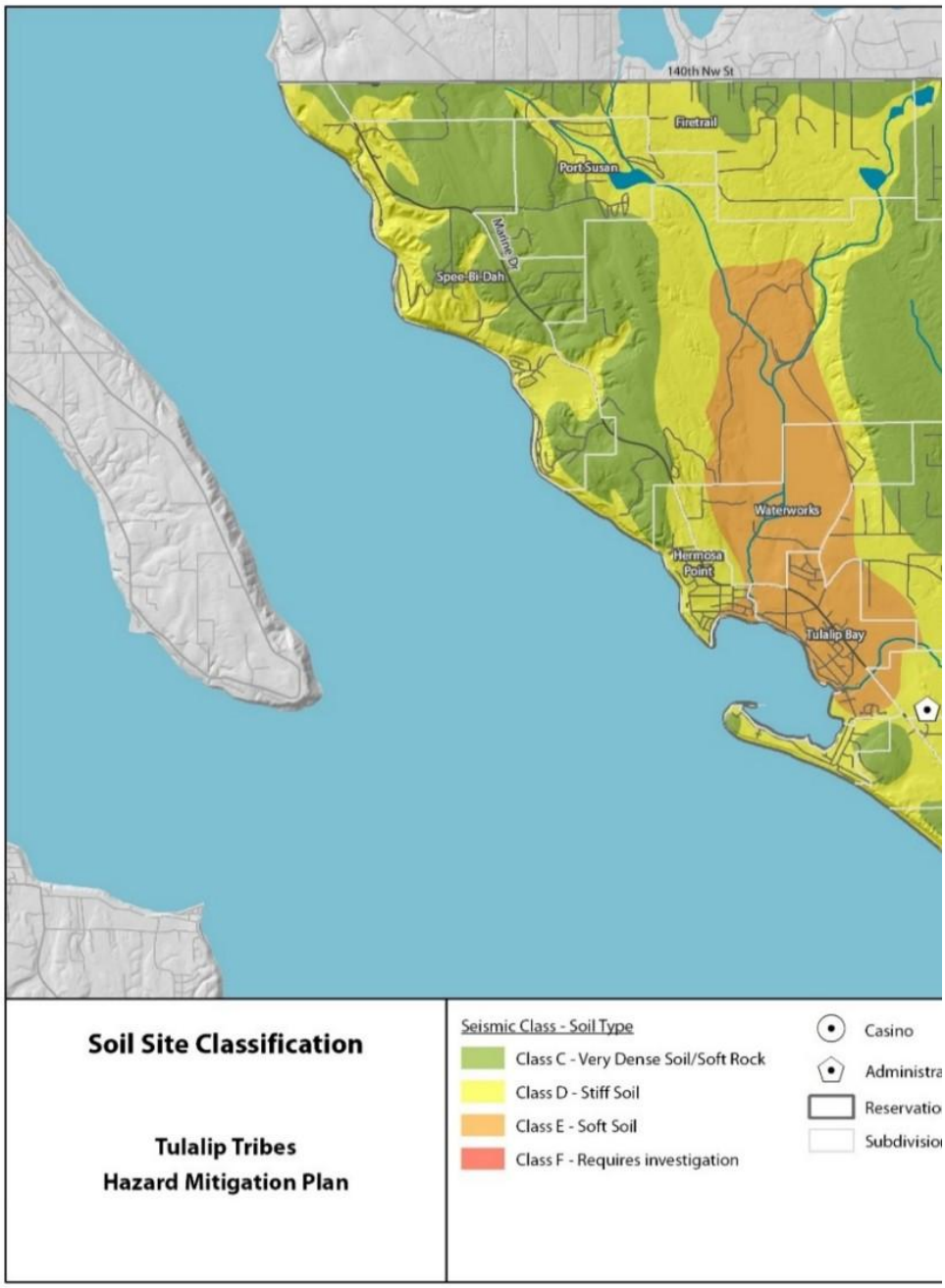
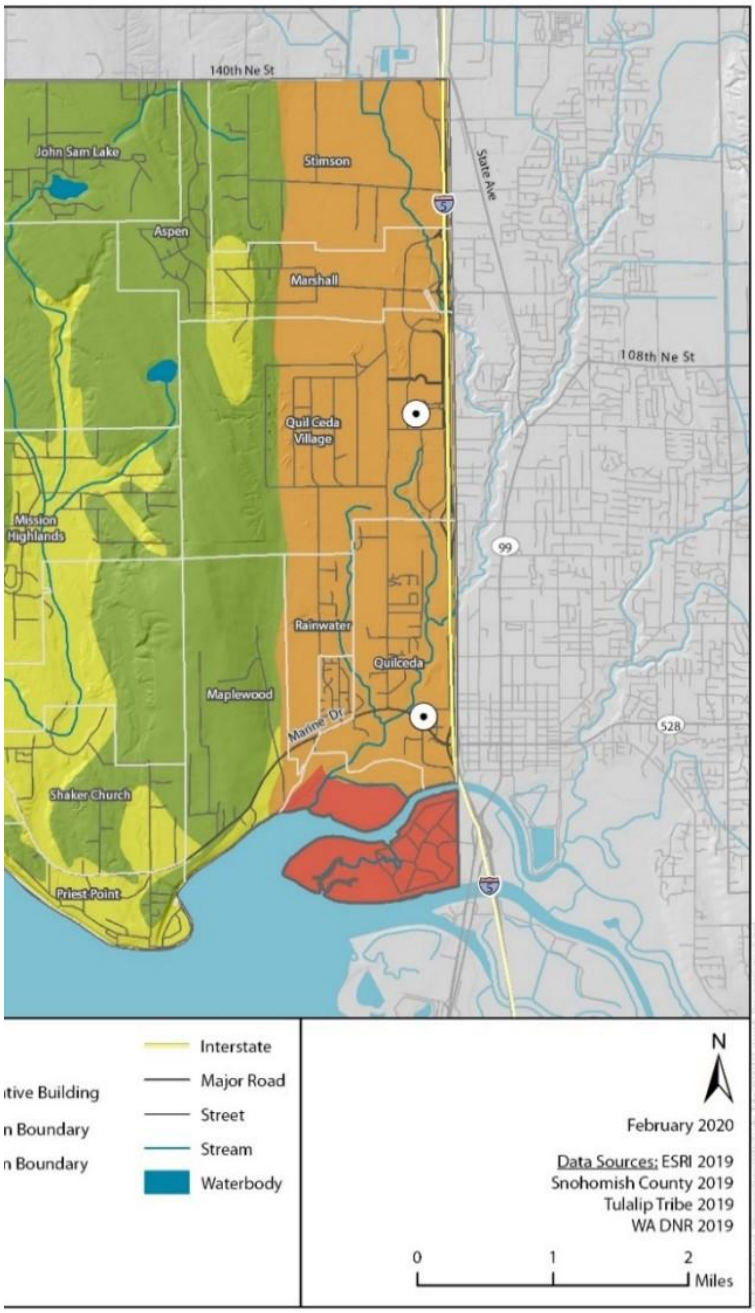


Figure 6 – National Earthquake Hazard Reduction Program (NEHRP) Soil Class



Risk Assessment – Earthquake



8 Epidemic

8.1 General Background

Epidemics are occurring more frequently and spreading faster and further the world over, including newly discovered and re-emerging diseases (World Health Organization, 2018b.). Additionally, new strains of pathogens and anti-vaccination movements are increasing vulnerability to newly discovered and re-emerging diseases (Washington Emergency Management Division, 2018).

Outbreaks may occur on a periodic basis (e.g., influenza), may be rare but result in a severe disease (e.g., meningococcal meningitis), occur after a disaster (e.g., cholera), or occur due to an intentional release of an agent (e.g., bioterrorism). Viruses, bacteria, parasites, fungi or toxins (i.e., agents) that cause outbreaks may spread by people, contaminated food or water, healthcare procedures, animals, insects and other arthropods, or directly from the environment. Some agents have multiple means of spreading, while others are only spread person to person (Washington Emergency Management Division, 2018).

8.1.1 Potential Impacts from Epidemics

Epidemics may affect an ever-greater numbers of people, having a significant impact on the local and potentially global economy, disrupting travel, trade and livelihoods (World Health Organization, 2018). A local outbreak may exceed the capacity of local medical staff and facilities while a pandemic may challenge the ability of local governments and organizations to provide essential community services , such as health care, law enforcement, fire and emergency response, communications, transportation, and utilities (Washington Emergency Management Division, 2018).

8.2 Tulalip Tribes Hazard Profile

Epidemics and outbreaks do not need to start on the Reservation to affect it. The Reservation is part of the greater Seattle metropolitan area, increasing the likelihood that a visitor to or a Tribal member working or studying off the Reservation during the day and returning at night carries a disease on to Reservation.

DEFINITIONS

Cluster – An aggregation of cases grouped in place and time that are suspected to be greater than the number expected.

Endemic – Refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area.

Epidemic – An increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.

Hyperendemic – Persistent, high levels of disease occurrence.

Outbreak – The same definition of epidemic but is often used for a more limited geographic area, jurisdiction, or group of people.

Pandemic – An epidemic that has spread over several countries or continents, usually affecting many people.

Sporadic – Refers to a disease that occurs infrequently or irregularly.

Medical Countermeasures – life-saving medicines and medical supplies that can be used to diagnose, prevent, protect from, or treat conditions associated with chemical, biological, radiological, or nuclear threats, emerging infectious disease, or natural disaster.

(Centers for Disease Control, 2012)

For example, the State of Washington has one of the highest rates of student vaccine exemptions in the nation; data for the 2017-2018 school year from the Department of Health shows 75 schools in King, Snohomish, Pierce, and Kitsap counties where at least 10 percent of K-12 students received an exemption for the measles-mumps-rubella (MMR) vaccine (Washington Emergency Management Division, 2018). Snohomish County, which is adjacent to the Reservation, has the highest rate of exemptions at 6 percent (Balk, 2019). The American Indian Health Commission Tribal Health Immunization Coalition (2019) in Washington, report from February 2019 did not have any data for Tulalip Tribes specifically; although the group indicated that the Indian Health Service Immunization data from the last three years achieved their target rates for childhood immunizations.

These high exemption and low immunization rates are below the recommended immunization percentages necessary to allow enable herd immunity in the community. Herd immunity is when enough of the population builds up a resistance through a vaccine or recovering from the disease, that the disease cannot continue to spread easily, protecting the small percentage of the population that is not immune. According to the Association for Professionals in Infection Control and Epidemiology (2020), the herd immunity percentage must be maintained, if it drops too low the disease can spread again rapidly. Therefore, vaccines are a vital component of herd immunity for those that can take the vaccine. Additionally, in May 2019 Washington State legislature passed a revision to the immunization exemption law for schools and childcare. The revision no longer allows MMR vaccine school and childcare exemptions for personal/philosophical beliefs and requires employees and volunteers at childcare centers to provide proof of their MMR immunizations or immunity (Washington State Department of Health, 2019).

Disease outbreaks may also be associated with bioterrorism. Bioterrorism is the intentional release of viruses, bacteria, or other germs that can sicken or kill people, livestock, or crops. These events could result in high mortality rates. Six potential agents that could pose the greatest threat to the area include: anthrax, botulism, plague, smallpox, tularemia, and viral hemorrhagic fevers.

Alternatively, imported foods have been linked to Salmonella outbreaks and are a potential point of exposure on the Reservation; warmer-than-usual water and air can cause more bacterial growth in ocean waters, contaminating shellfish and increasing chances to an infectious outbreak (Washington Emergency Management Division, 2018).

8.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in 0-1 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, pandemics/epidemics were ranked as the fourth worst-case scenario and the eighth most likely scenario.

Table 15 – Epidemic Hazard Ranking

Hazard Ranking Output

Severity (1=lowest, 5=highest)	Magnitude (1=lowest, 5=highest)	Frequency (1=lowest, 5=highest)	Onset (1=slowest, 5=fastest)	Duration (1=shortest, 5=longest)	Perceived Change in Risk	Average	Rank
Worst-case Scenario							
4.1	4.7	2.1	4.0	4.0	0.5	3.78	4
Most Likely Scenario							
1.6	3.0	1.4	3.1	3.0	0.5	2.43	8

8.2.2 Past Events

In 2009, Tulalip citizens and community members of the Tulalip Reservation were exposed to the H1N1 virus, also known as "swine flu," which resulted in more than 1,650 hospitalizations and deaths across the State of Washington; H1N1 was the first influenza pandemic of the 21st century (Washington State Department of Health, 2010).

Incidents of the measles virus have increased across the US from 375 cases in 2018 to 1,200 in 2019. While the virus was declared eliminated in 2000, cases have been confirmed in 31 of 50 states as 2019, including Washington State (Centers for Disease Control, 2020b). Clark County, in southwest Washington State, reported 71 cases in 2019, resulting in roughly 19,000 response hours and costing $864,679 (Clark County Public Health, 2019).

COVID-19

During the time of this HMP update, the world was experiencing the Coronavirus 2019 (COVID-19) pandemic. An in-depth review of COVID-19 and its effects will be included in the 2025 HMP update.

8.2.3 Location

All the Tulalip Reservation is susceptible to epidemics, not one specific location. Tulalip citizens and community members of the Reservation may be exposed when traveling or commuting off and returning to the reservation, bringing with them diseases.

8.2.4 Frequency

Due to increased air travel, commuters and population growth, the probability of an epidemic or outbreak occurring is growing. The frequency of epidemics is difficult to establish, depending largely on unique circumstances surrounding the outbreak and expansion into epidemics and eventually pandemics.

8.2.5 Severity

The severity of a disease or epidemic varies from individual to individual. Typically, vulnerable populations, specifically young children and elders, are more susceptible to acquiring communicable diseases due to immune system challenges and capabilities. In general, severity depends on the pathology of the disease, the health of the individual, vaccinations, and availability of treatments for symptoms or curing the disease.

8.2.6 Warning Time

Warning time for public health risks varies from a few hours or days to a few months, depending on the illness and outbreak.

8.3 Cascading Impacts/Secondary Hazards

While an obvious secondary hazard due to an epidemic does not exist, such an event could have a devastating impact to the economy. A reduction in workforce and labor hours would cause businesses and agencies to be greatly impacted. With a reduced workforce, there may be transportation route closures or supply chain disruptions, resulting in a lack of food, water, or medical resources.

Additionally, hospitals and public health facilities may be inundated with individuals that are infected with a disease and/or those concerned about having contracted it. Another impact may be fear or stigmatization, which may result in social isolation that results in mental health issues and/or social unrest.

8.4 Potential Impacts from Future Climate Conditions

There are several ways climate change can affect diseases as a result, human health. Climate change already has a significant impact on the insect populations in the US, which has contributed to a higher exposure of insect-borne illnesses. Climate change has increased average temperature. There are more warm days in the year and less extreme cold days during winter. Even slight temperature differences effect where insect populations are found and what diseases they carry. Insects, such as fleas, ticks, and mosquitoes, can carry diseases like Lyme, West Nile, malaria, zika, and so on. For Example, Jordan (2019) from the Stanford Woods Institute for the Environment explains that diseases have ideal temperatures where they spread the most effectively; malaria spreads best at 78 degrees and zika at 84 degrees. As temperatures in the US vary and rise in new areas due to climate change, these insects carrying diseases will also move and be found in new regions.

The World Health Organization (n.d.) identified potential changes in disease levels and transmissions impacted by climate change:

- Increased use of dams, canals, and irrigation to manage water flow changes can increase the risk of schistosomiasis, malaria, and helminthiasis.
- As annual average temperatures change new agricultural areas can succumb to infestation increasing the risk of malaria and Venezuelan hemorrhagic fever.
- Population increases in urban areas can affect sanitation and hygiene leading to increased cholera and dengue fever.
- Deforestation and populations spreading into wildland areas can cause a rise in insect populations bringing malaria, oropouche, and visceral leishmaniasis.
- Conversely, reforestation to combat tree loss can increase the risk of Lyme disease.

8.5 Exposure and Vulnerability

8.5.1 Population

All Tulalip citizens, community members and visitors to the Reservation could be exposed to or carriers of an infectious disease. A large outbreak or epidemic could have devastating effects on the population, especially those with compromised immune systems, persons with disabilities, persons over the age of 65, and socially vulnerable persons with limited access to adequate health care.

8.5.2 Property

Epidemics and diseases can have significant measurable impact on property in the within the Reservation. COVID-19 had a devastating impact to Tribal business properties, rendering businesses physically unsafe to operate causing long shutdowns and a great financial loss.

8.5.3 Critical Facilities and Infrastructure

While the capacity of health care facilities may be exceeded by infected persons seeking assistance, epidemics and diseases are not projected to have a significant impact on the critical facilities or infrastructures of the Tribes.

8.5.4 Environment

Epidemics can have significant impact on the lived environment on the Reservation. COVID-19 had environmental impacts due to transmission of the disease in lived environments causing illness and death.

8.6 Development Trends

The potential for an epidemic or outbreak is not likely to slow expected growth in the planning area.

8.7 Issues

Important issues associated with epidemics and outbreaks include:

- Providing culturally appropriate preventative health care to changing demographic and aging population, including vaccination and education to help reduce the impacts.
- Overuse and misuse of antibiotics contributing to antibiotic resistance.
- Medical and response personnel need to be integrated into a response to provide care when needed.
- Medical and response personnel must be adequately trained and supplied.
- A system needs to be in place for informing the public with a clear message and facts about the disease and care options.
- Health agencies and facilities require surge capacity management and adaptation to the rising number and needs of the area.

8.8 Hazard Map

There is no spatial data available for the epidemic/outbreak hazard for the Tulalip Tribes; therefore, there is no map.

9 Flood and Sea Level Rise

9.1 General Background

Floods are one of the most common hazards in the United States and may develop over a prolonged period of time or occur with little to no warning. The three most common types of floods are: (1) fluvial or waterbody-based floods, which occur due to excessive water accumulation in a body of water that results in that body overflowing its banks; (2) pluvial floods, which occur due an over accumulation of water on the surface in a short period of time due to poor drainage and may result in flash flooding, and; (3) coastal flooding or storm surge, which is often the result of high winds and the effects of which are dependent on the tide (Zurich, 2020).

Sea level rise (SLR) is putting a greater amount of stress on coastal ecosystems that protect coastal communities from storm surge and other coastal hazards (e.g., coastal erosion), provide places of recreation, and habitat for fish and wildlife (Lindsey, 2020). As sea levels rise, extreme coastal events that may be infrequent today (e.g., storm surge) will become more frequent and severe, resulting in increased coastal flooding (Portner et al., 2019). Additionally, SLR is likely to impede the drainage of waterbodies into the sea, resulting in greater fluvial flooding (Portner et al., 2019).

9.1.1 Potential Impacts from Floods

Floods are among the most frequent and costly natural hazards in terms of human hardship and economic loss. Floods may result in substantial damage to structures, landscapes and utilities, and jeopardize public safety. Flooding has resulted in roadway outages, delaying commuters and slowing supply chains. Standing water may result in the increase of vector borne illnesses and damp building materials may result in bacteria and mold.

9.2 Tulalip Tribes Hazard Profile

Flooding and sea level rise are threats within and surrounding The Tulalip Reservation (Buffett, 2010). The Tulalip Reservation does not experience the exposure or severity of flooding typically found in the region or in adjacent Snohomish County due to its topography; most

DEFINITIONS

Flash Flood—A flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons.

Fluvial / Riverine Flood—Fluvial, or riverine flooding, occurs when excessive rainfall over an extended period and causes a river to exceed its capacity.

Coastal (Surge Flood)—A coastal flood occurs in areas that lie on the coast of a sea, ocean, or other large body of open water. In this type of flood, water overwhelms low-lying land and often causes devastating loss of life and property.

Floodplain—The land adjoining a channel of a river, stream, ocean, lake, or other watercourse or waterbody that is susceptible to flooding.

100-Year Floodplain—The area flooded by the flood that has a 1-percent chance of being equaled or exceeded each year. The 1-percent annual chance flood is the standard used by most federal and state agencies.

500-year Floodplain—Also known as the 0.2-percent annual chance flood. The area inundated by floodwaters that has a 0.2-percent chance of being equaled or exceeded each year.

of the land is elevated on hills and bluffs above the floodplain (Buffett, 2010).

However, small creeks on the Reservation do occasionally overflow (i.e., fluvial flooding) and coastal flooding has occurred during severe weather events. Some of the Reservation's major infrastructure and critical facilities are located along the coast or on hydric soils in the low-lying flat areas along Quil Ceda Creek, putting those facilities at risk (Tulalip Tribes, n.d.o.). Flooding due to storm surge is likely to worsen by the end of the century as seas are expected to rise by more than three feet, increasing exposure, and storms are anticipated to become more frequent and/or intense, generating greater surge (Tulalip Tribes, n.d.o.). Sea level rise will also accelerate coastal erosion threatening Tribal facilities on the shores of Tulalip Bay and housing along the reservation coast.

9.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, floods were ranked as the number ten worst-case scenario and the ninth most likely scenario.

Table 16 – Flood and Sea Level Rise Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	**Magnitude (1=lowest, 5=highest)**	**Frequency (1=lowest, 5=highest)**	**Onset (1=slowest, 5=fastest)**	**Duration (1=shortest, 5=longest)**	**Perceived Change in Risk**	**Average**	**Rank**
Worst-case Scenario							
2.4	2.9	3.4	3.6	2.6	0.8	2.97	10
Most Likely Scenario							
1.7	2.1	2.7	3.1	2.4	0.8	2.41	9

9.2.2 Past Events

The Tulalip Reservation does not have an extensive history of flooding due in part to adequate drainage of waterbodies, limited development adjacent to these waterbodies, and its topography. Past documented flood events on the Reservation include (Buffett, 2010).

- **January 2013** – Flooding on Quil Ceda Boulevard
- **2006** – Properties located long Priest Point can experience two to three feet of flooding caused by overflow of the Snohomish River and/or strong storm surges. During the Super Bowl Storm of 2006, the Point was inundated by a combination of high tides and strong storm surge.
- **2000** – Blocked drainages caused significant street flooding in 2000. Firetrail Road flooded in three locations, from the overtopping of Cummings Lake and two washouts by small creeks crossing under the road.
- **1997** – The Upper Tulalip Creek Pond, used by the Tulalip Salmon Hatchery, is protected by a 70-year-old dam that overtopped during the New Year's Day Storm of 1997. Approximately 400,000

Coho salmon rearing in the pond were lost when the flood carried them over the dam and Totem Beach Road.

- **December 1996 – January 1997** – The Holiday Blast storm caused urban flooding on the Reservation as heavy rain runoff and exceptional volumes of snowmelt overwhelmed the Reservation's drainage systems.

9.2.3 Location

Fluvial Flooding

The Reservation is generally located outside of the Snohomish River floodplain. However, some areas prone to riverine flooding include: the marshy delta islands located near Ebey Slough and Steamboat Slough, known as Big Flats, as well as some of the marshy wetlands near the mouth of Quil Ceda Creek. Priest Point can be affected when heavy precipitation on the Snohomish River carry large amounts of silt and debris, which can damage bulkheads and property adjacent to the mouth of the river.

Pluvial Flooding

Flash flooding can occur on the small creeks located on the Reservation, including Tulalip Creek, Mission Creek, and the Quil Ceda River. Creeks feeding Weallup Lake and Lake Agnes are known to overflow and sometimes wash out Firetrail Road.

Storm Surge

Storm surges can affect beachfront areas within the Tulalip Reservation, including homes and businesses, bulkheads, marinas, docks, and ferry terminals.

9.2.4 Frequency

Minor flooding occurs annually, especially during the fall and winter, while damaging floods occur approximately every 5 years.

9.2.5 Severity

Flooding in the Tulalip Reservation is generally minor because most homes and critical facilities are located outside of floodplains. However, in areas where culverts are blocked or undersized, flooding can damage culverts and wash out or make roads impassable. Homes and waterfront infrastructure (e.g., docks in low-lying areas along the coast), such as Tulare Beach and Priest Point, can be damaged by storm surges or flooding in the Snohomish River.

9.2.6 Warning Time

The Tulalip Reservation is located at the mouth of the Snohomish River and would have up to several days advance warning of a riverine flood. Storm surge is harder to predict as Tulalip's location at the northern edge of the Convergence Zone creates the potential for unpredictable winds and severe weather to cause a massive storm surge that could damage low-lying waterfront properties.

9.3 Cascading Impacts/Secondary Hazards

Flooding may result in secondary hazards, including landslides, mudslides, debris flows, downed trees, train derailment, and erosion, particularly in areas of unstable slopes such as within burn scars. Water quality can also be degraded following a flood as a result of erosion and sedimentation or sewer overflows. Impacts to water quality can affect fisheries and other natural resources. Human health may also be affected as a result of increased pathogens in drinking water supplies.

Floods often damage infrastructure, resulting in communications and utility disruptions or energy emergencies, such as power outages. Flooding can also result in an increase in traffic accidents, displacement of Tulalip citizens and community members, and economic impacts due to the temporary or permanent closure of businesses and impacts to supply chains.

9.4 Potential Impacts from Future Climate Conditions

9.4.1 Flooding

Within the Tulalip Reservation, no changes in total precipitation have been observed and no significant changes are projected; however, precipitation totals of the wettest days are projected to increase 10-15 percent by 2050 and up to 22 percent by 2080 (Tulalip Tribes, 2018a). This means that the dry periods will become drier and the wet periods wetter, which is projected to increase seasonal groundwater levels and stream flows, resulting in greater fluvial and pluvial flooding. For example, the Snohomish basin peak streamflow is projected to increase 5-15 percent by 2040 (Tulalip Tribes, 2018a). Overall, there is strong evidence for an increase in the frequency and extent of flooding, particularly large changes for the more routine flood events (e.g. two-year and 10-year) (Mauger, Lee, & Won, 2018).

9.4.2 Sea Level Rise

Sea levels are projected to rise 16-18 inches by 2080 along the Tulalip Tribes coastline, exacerbating shoreline and coastal bluff erosion, storm surge, flooding, sewer backups, and groundwater intrusion. Creeks that experience tidal influence will experience tidal flooding that will result in the backing up of outflows during storm events, resulting in higher groundwater and more severe flooding during twice a day high tide fluctuation (Tulalip Tribes, n.d.f.).

Coastal inundation and the rate of bluff retreat is expected to increase due to climate-related intensification of erosion. Bluff-face stability will decrease due to intensified winter storms producing more rain, and in turn, more groundwater and surface flow. Both surface runoff and groundwater emerge through the bluff strata, affecting cohesion and leading to accelerate failures over time. Sea level rise will exacerbate erosion even further as higher high tides will erode the base of the bluffs (Tulalip Tribes, 2018b.).

The Tulalip Tribes Natural Resources Department has a *Climate Adaptation Plan* to protect critical Tribal resources and address the concerns of climate change. The adaptation plan discusses the concern of coastal erosion as a secondary impact of sea level rise (Tulalip Tribes, n.d.m.). Tulalip Bay is exposed to sea level rise and coastal erosion. The Tulalip Tribes Natural Resources Department is coordinating with the USGS and Coastal Geological Services of Bellingham, Washington, to conduct a study on the rate of erosion on the Tulalip outer coast. The project is projected to be completed in 2020, which is not in time to include the data in the 2020 HMP update but can be used in the next HMP revision (Tulalip Tribes, 2018b.).

9.5 Exposure

9.5.1 Population

Population counts of those living in the flood hazard areas within the Reservation were generated by distributing the population throughout residential buildings and calculating the population within the 100-year flood hazard area and the 3-foot sea level rise zone. This approach yielded an estimated exposed

population within the entire Reservation of 278 persons in the 100-year flood hazard area and 231 people in the 3-foot sea level rise zone.

Vulnerability

Research has shown that people living near or below the poverty line, the elderly, the disabled, women, children, ethnic minorities and renters have all been shown to experience more severe effects from disasters than the general population. A geographic analysis of demographics, using data from the U.S. Census Bureau, identified populations vulnerable to the flood and sea level rise hazard as follows:

- **Population over 65 Years Old –** It is estimated that 48 people in the census block that intersects the 100-year flood zone are over 65 years old. There are 40 people over 65 years old in the 3-foot sea level rise zone.
- **Population under 18 Years Old –** It is estimated that 59 people within census blocks located in or near the 100-year flood zone are under 18 years of age. There are 49 people under the age of 18 in the 3-foot sea level rise zone.

9.5.2 Property

The Tulalip Tribes began leasing land in the 1920's and have 474 leased lots and 112 ½ vacant lots around Tulalip Bay that varies in size and location (Tulalip Tribes, n.d.f.). The Tulalip Tribes (n.d.j.) Resort Hotel in Quil Ceda Village is owned and operated by the Tulalip Tribes of Washington. It opened by 2003 as Tulalip Casino, and was renamed in late 2007 due to a hotel addition. In addition, the Tulalip Tribes established the Quil Ceda Village, a municipality established by the Tribes within the Tulalip Indian Reservation. It includes the Quil Ceda Village Business Park, a commercial development constructed and operated by the Tribes to diversify its economy with funds generated by its successful casino operations, the first enterprise in the business park.

Table 17 summarizes the number of structures in the 100-year flood zone. The GIS analysis indicates that there are 220 structures within the 100-year flood zone. Table 18 summarizes the one structure exposed in the 2040 scenario of a 1-foot sea level rise. Table 19 summarizes the 179 structures exposed in the 2070 scenario of a 3-foot sea level rise.

Table 17 – Property in the 100-Year Flood Zone

Value of Property Exposed to 100-Year Flood Zone				
Buildings Exposed	**Percent of All Buildings**	**Assessed Value**		
		Structure	**Contents**	**Total**
220	3%	$21,490,601	$11,514,820	$33,005,421

Table 18 – Property Exposed to One Foot Sea Level Rise

Value of Property Exposed to 1-foot Sea Level Rise				
Buildings Exposed	**Percent of All Buildings**	**Assessed Value**		
		Structure	**Contents**	**Total**
1	0.01%	$114,970	$57,485	$172,455

Table 19 – Property Exposed to Three-Foot Sea-Level Rise

Value of Property Exposed to 3-foot Sea Level Rise				
Buildings Exposed	Percent of All Buildings	Assessed Value		
		Structure	Contents	Total
180	2%	$16,954,699	$8,477,349	$25,432,048

Vulnerability

All property and buildings within the Reservation exposed to sea level rise are vulnerable to sea level rise.

9.6 Critical Facilities

Critical facilities and infrastructure include police and fire stations, schools, and all tribal buildings including government buildings and housing. Essential facilities include buildings and businesses that are essential to the community's economy and/or safety after an event. These include the Tulalip Casino, Wal-Mart, Home Depot and other businesses that supply essential goods, such as food and equipment (Buffett, 2010). Although the Tulalip Clinic is not in the most recent GIS data set, the facility is at risk from potential inundation from flooding and/or sea level rise.

Table 20 summarizes the critical facilities and infrastructure in the 100-year flood zone; Table 21 summarizes the critical facilities and infrastructure in the 2040 scenario of a 1-foot sea level rise. Table 22 summarizes the critical facilities and infrastructure in the 2070 scenario of a 3-foot sea level rise. Critical facilities and infrastructure include utilities and associated infrastructure, roads, bridges, water and sewer systems, dikes and levees, railroads, and Tier II hazardous materials facilities.

Table 20 – Critical Facilities in 100-Year Flood Zone

Critical Facilities Within Tulalip Tribes 100-Year Flood Zone	
Shoecraft Lake Outlet Dam	1
Tulalip Landfill Hazmat Site	1
Marysville West Lift Station Wastewater Site	1
Total	**3**

Table 21 – Critical Facilities Exposed to One Foot Sea Level Rise

Critical Facilities Within Tulalip Tribes 2040 Scenario of a 1-foot Sea Level Rise	
Tulalip Landfill Hazmat Site	1
Marysville West Lift Station Wastewater Site	1
Total	**2**

Table 22 – Critical Facilities Exposed to Three Foot Sea Level Rise

Critical Facilities Within Tulalip Tribes 2070 Scenario of a 3-foot Sea Level Rise	
Tulalip Landfill Hazmat Site	1
Total	**1**

The following roads on the Tulalip Reservation are within the 100-year floodplain:

- Scenic Dr NW
- Tulare Way W
- Ruth Ave
- Priest Point Dr NE
- Garden Pl
- Totem Beach Rd
- Mission Beach Walk
- Marine Dr NE
- Log Dump Rd
- I-5

Vulnerability

The Northwest is projected to experience an increase in the frequency of extreme precipitation events as a result of climate change. Because inland power plants tend to be located in low-lying areas near rivers and floodplains, power plants serving the Tribal Trust Lands (TTLs) in the Northwest may become more vulnerable to critical disruptions in power production and operations as a result of flooding. Most coastal power plants in the Northwest are sufficiently elevated to reduce risk from sea level rise; however, four power plants in the Puget Sound, where many TTLs are located, included the Tulalip Reservation are less than four feet above sea level. These plants are increasingly vulnerable to damage from wave action or storm surge due to sea level rise (Office of Indian Energy, 2015).

9.6.1 Environment

Tulalip leads in preserving and restoring its land and waters. Tulalip accomplishes this goal by not only establishing environmentally friendly building practices, also by dedicating various departments to environmental rehabilitation. These departments include a salmon hatchery, a waste-water treatment facility, a forestry program, and a shellfish and wildlife recovery program (Tulalip Tribes, n.d.d.). The Capabilities and Capacity Assessments in this HMP address green structures, as environmentally focused buildings can result in higher risk for flooding.

Vulnerability

Salmon are central to the lifeways of the Tulalip people. Today, the salmon are threatened by a landscape transformed by resource extraction and development. Millions of people now live on Tulalip's historic lands adjacent to the Salish Sea. The freshwater ecosystem that salmon depend on are now degraded, with ubiquitous pollutants and altered natural hydrology due to the impacts of humans. Climate change is now threatening salmon populations at every stage of their lifecycle, from spawning streams with high

temperatures and low water to high winter flows (Tulalip Tribes, 2018c.). Addressing these vulnerabilities is essential to rebuilding the salmon population and to protect the environment for future generations.

9.7 Development Trends

The Tulalip Tribes appear to be well equipped to deal with future growth and development. The floodplain portions of the planning area are regulated in the Tulalip Tribal Code Title 7. Development will occur in the floodplain; however, it will be regulated such that the degree of risk will be reduced through building standards and performance measures. Tulalip Tribes (2020) Code 7.170.300 reads: "No plat shall be approved covering any land situated in an area prone to flooding without the prior written recommendation by the Natural Resources Department, with approval of the Board of Directors" (para. 5).

9.8 Issues

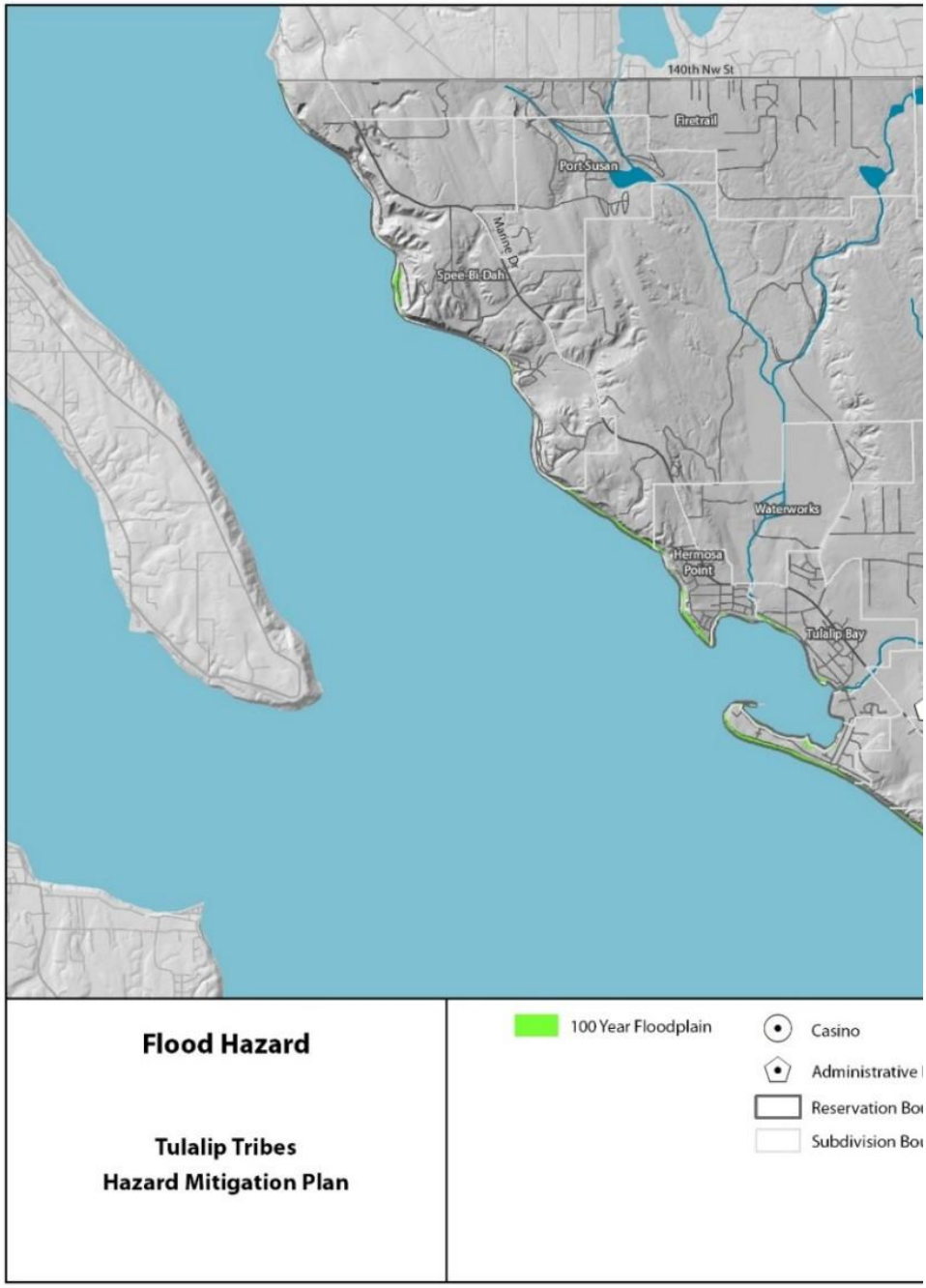
Important issues associated with flood hazards include but are not limited to the following:

- More information is needed on flood risk to support the concept of risk-based analysis of capital projects;
- There needs to be a sustained effort to gather historical damage data, such as high-water marks on structures and damage reports, to measure the cost-effectiveness of future mitigation projects;
- Ongoing flood hazard mitigation will require funding from multiple sources to continue;
- Tulalip citizens and community members living in a floodplain need to continue to be educated about flood preparedness and their sources available during and after floods;
- The risk associated with the flood hazard overlaps the risk associated with other hazards, such as earthquake and landslide. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards;
- The economy has an impact on the Tribe's abilities to manage its floodplains. Budget cuts and personnel losses can tax many resources needed to support floodplain management; and,
- FIRMs and DFIRMs do not provide accurate estimates of future risk due to climate change.

9.9 Hazard Maps

The hazard maps for flood and sea level rise are Figures 7-9 and are on the next page.

Figure 7 – Tulalip Tribes 100-Year Flood Zones



essment – Flood & Sea Level Rise

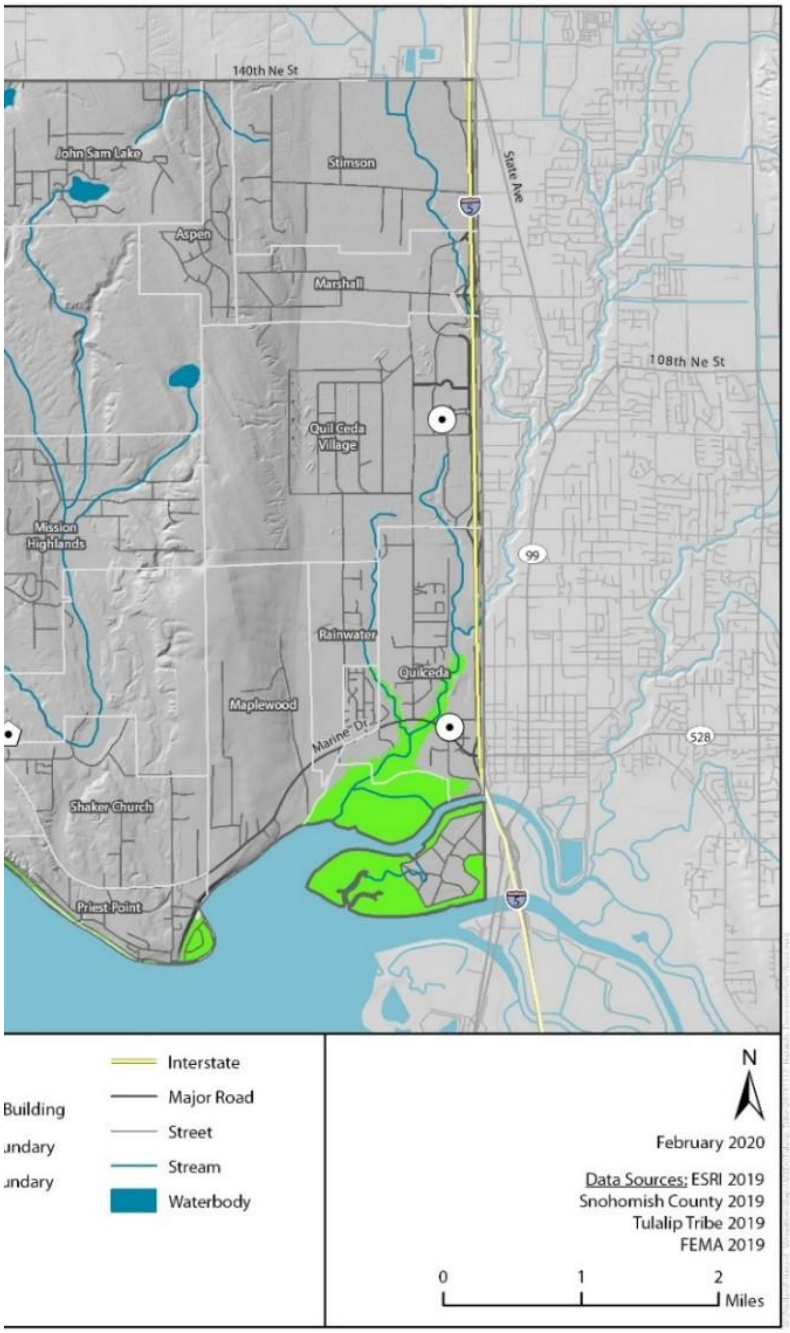
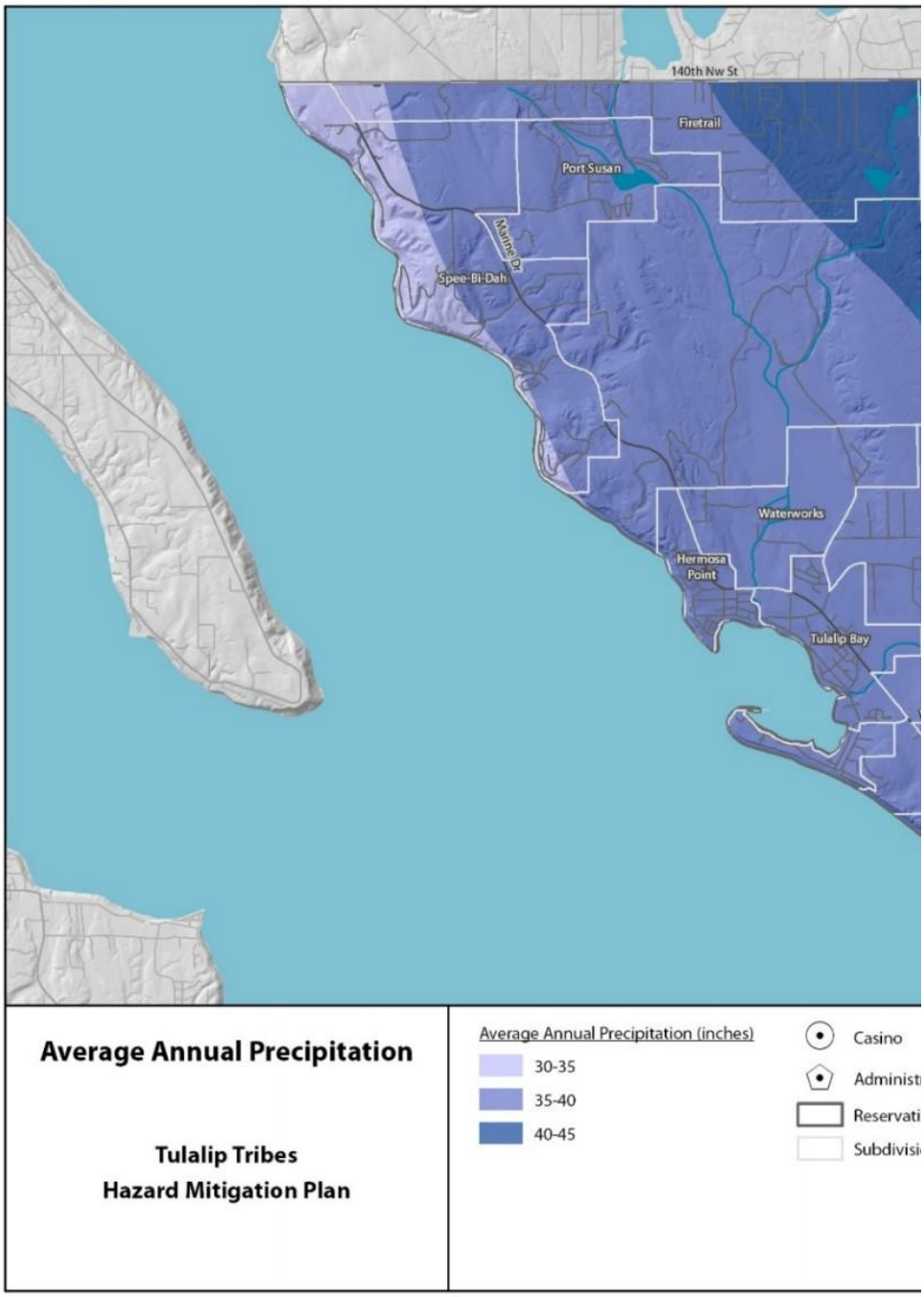


Figure 8 – Tulalip Tribes Average Annual Precipitation



essment – Flood & Sea Level Rise

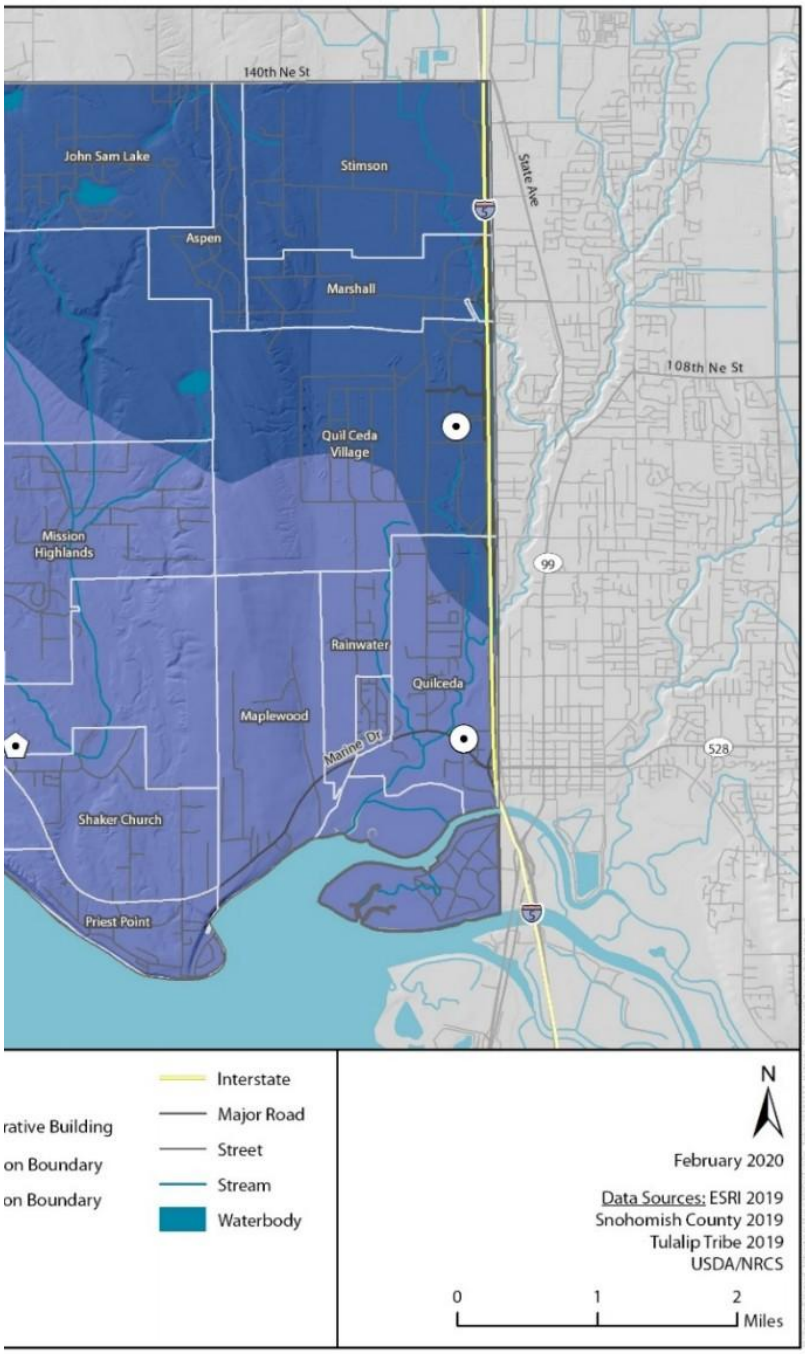
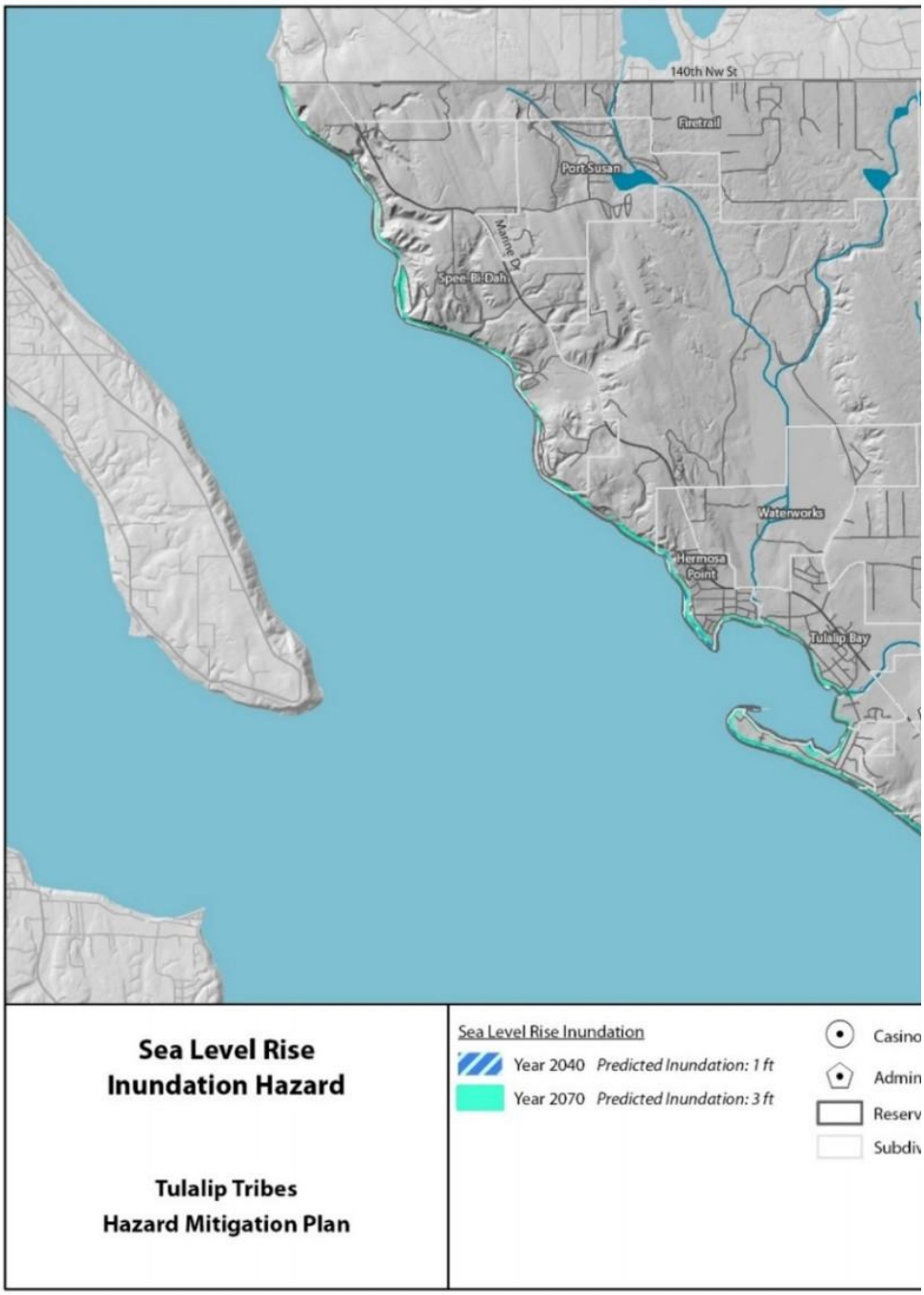
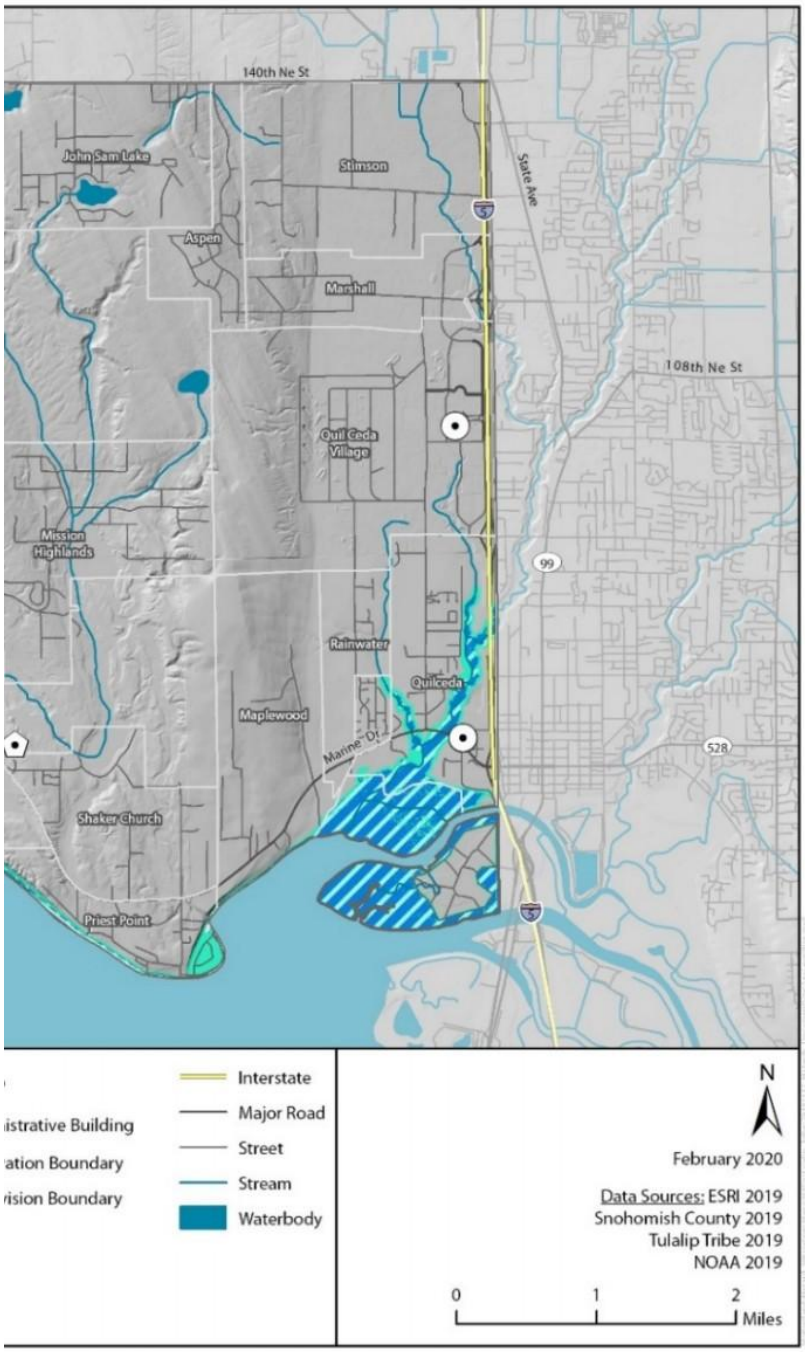


Figure 9 – Tulalip Tribes Sea Level Rise Inundation Zone



essment – Flood & Sea Level Rise



10 Hazardous Materials

10.1 General Background

A hazardous material event may cause damage to people, property, and/or the environment (i.e., soil, water, air). Hazardous materials are used and stored in homes, business, and facilities across the country and transported via ground, water and air. They pose an unreasonable risk to the health, safety, and property, and can include hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials.

In 1986, the Environmental Protection Agency (EPA) initiated the Emergency Planning and Community Right-to-know Act (EPCRA), requiring certain industries to report the locations and quantities of chemicals stored on-site. The Environmental Protection Agency (n.d.c.) makes this information available to the public via the *Toxic Release Inventory* database, which includes the release and transfer of toxic chemicals from facilities to certain sectors.

10.1.1 Potential Impacts from Hazardous Materials

Even small the smallest hazardous materials release can result in significant damage to people, property, and/or the environment. Damage from such releases depends on the material released and the geographic extent of contamination. While many releases are small, often able to be contained and cleaned up quickly with little damage to the environment, they may result in significant damage and cost thousands of dollars to cleanup; large releases may cost communities and companies millions of dollars.

DEFINITIONS

Hazardous Material – A substance or combination of substances that because of their concentration, physical, chemical, or infectious characteristics, may cause or contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness, or pose a present or potential hazard to human life, property, or the environment.

Hazardous Substance – Any agent that has the reasonable potential to cause death, disease, behavioral changes, cancer, genetic mutation, psychological problems, or physical deformations to an exposed person or their unborn children.

Hazardous Waste – A waste product that has the reasonable potential to be dangerous and cause harm to human health and/or the environment.

Marine Pollutant – A substance that is harmful to the environment, specifically the aquatic ecosystem.

Damage from hazardous materials may result from a material's flammability, toxicity, corrosiveness, chemical instability, and/or combustibility. Vapors from released materials can collect in houses and businesses, sometimes in low-lying areas, resulting in a fire or explosion, or the inhalation of toxic substances. Public health impacts of a release can vary from temporary skin irritation to death. Exposure can pose short- and long-term toxicological threats to humans, terrestrial and aquatic plants, and to land and marine wildlife. Materials released may seep through the soil and eventually into the groundwater, making water supplies unsafe to drink.

10.2 Tulalip Tribes Hazard Profile

The release of hazardous materials within and adjacent to the Tulalip Reservation, such as petroleum, toxic chemicals, gases and other hazardous materials, occur frequently. Point sources include transportation corridors (e.g., highways, railroads, air/flight paths, pipelines, and navigable waterways), and homes, businesses or other facilities. Major transportation routes adjacent to and through the Tulalip Reservation include I-5, 140th St NW, and Marine Drive. One of BNSF Railroad lines also runs along the east coast of the Reservation, presenting a threat in the event of a railcar incident.

10.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, hazardous materials incidents were ranked as the fifth worst-case scenario and the tenth most likely scenario.

Table 23 – Hazardous Materials Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	**Magnitude (1=lowest, 5=highest)**	**Frequency (1=lowest, 5=highest)**	**Onset (1=slowest, 5=fastest)**	**Duration (1=shortest, 5=longest)**	**Perceived Change in Risk**	**Average**	**Rank**
Worst-case Scenario							
4.0	4.0	2.7	4.6	3.5	-0.2	3.75	5
Most Likely Scenario							
1.4	2.0	1.3	3.3	2.9	-0.2	2.18	10

10.2.2 Past Events

There are no reported incidents in the Washington Department of Ecology Oil Spill Database or the Pipeline and Hazardous Materials Safety Administration (PHMSA) Incident Reporting Database for the Tulalip Reservation; However, Snohomish County experienced 150 oil spills between July 1, 2015 to September 30, 2019 (Washington Department of Ecology, 2018). 97 percent of these spills were under 100 gallons; 5 were 100 gallons and include:

- November 23, 2018 – 100 gallons spilled from a vehicle into a creek
- September 18, 2018 – 340 gallons spilled from a facility into fresh water
- July 27, 2018 – 100 gallons spilled from a facility into a storm water retention pond
- March 21, 2016 – 100 gallons spilled into fresh water after a truck collision on Hwy 530
- July 1, 2015 – 150 gallons of diesel spilled into a ditch

A review of the PHMSA incident reporting database indicates that Snohomish County has experienced 189 hazardous materials incidents along transportation corridors since 1975 (Pipeline and Hazardous Materials Safety Administration, 2020).

10.2.3 Location

Hazardous material releases are more likely to occur in areas surrounding fixed site facilities and along major transportation routes on the Reservation. For example, the probability of a major incident is higher along the I-5 corridor in the eastern portion of the planning area. In addition, there are six Tier II facilities (Table 24 and two EPA-designated Superfund Sites in on Tulalip Reservation: the Boeing Company Tulalip Test Site and the Tulalip Landfill (Environmental Protection Agency, n.d.a.). Tier II facilities are locations that store hazardous materials meeting or exceeding the Occupational Safety and Health Administration's threshold for materials stored and level of hazard.

Table 24 Tier II Facilities

Name	Address	Subdivision
PETROCARD INC 116TH MARYSVILLE	3104 116TH ST	Marshall
PUD NO 1 OF SNOHOMISH CO TULALIP SUBSTA	1615 MARINE DR	Maplewood
PUD NO 1 OF SNOHOMISH CO VILLAGE SUB	11018 27TH AVE NE	Consolidated Borough of Quil Ceda Village
SUBURBAN PROPANE MARYSVILLE	12820 34TH AVE NE	Stimson
THE HOME DEPOT STORE 4726	9310 QUIL CEDA BLVD	Consolidated Borough of Quil Ceda Village
WSP MARYSVILLE	2700 116TH ST NE	Marshall

10.2.4 Frequency

While the Tulalip Reservation experiences some hazardous materials incidents each year, most are small and result in little environmental, personal, or property damage. Tribal, federal, state, and local rules and regulations continue to become more stringent and lower the chances for an incident; However, the increased utilization of hazardous materials at home and in the workplace, and their growing transportation along major transportation routes, increases the likelihood that the Reservation could be affected by a hazardous material incident.

10.2.5 Severity

The severity of a hazardous material release depends on the type and volume released. The extent of a hazardous material release depends on whether the substance is released from a fixed (e.g., building) or mobile (e.g., vehicle) source, the size of the impacted area, the toxicity and properties of the substance, the duration of the release, and environmental conditions. Conditions that may worsen a release include weather, micro-meteorological effects of buildings and terrain, and maintenance failures.

Other factors that determine the severity of a potential incident include quick and solid decision-making by emergency officials, evacuation and shelter-in-place needs and communication, public health concerns, and relevant economic considerations. While most incidents are generally brief, the resulting recovery and cleanup can take time and money.

10.2.6 Warning Time

Hazardous material incidents usually offer little to no warning time before the incident occurs. People in the immediate vicinity have the least amount of warning and response time. Community members adjacent to the exposed area will usually have more time to shelter-in-place or evacuate.

10.3 Cascading Impacts/Secondary Hazards

Hazardous material incidents can result in the contamination of air, water, and soils, leaving lasting long-term exposure and negative impacts on plants, animals, and even humans. Large-scale incidents can require long-term health and environmental monitoring costs to monitor impacts on humans and the environment. With certain materials, there is a chance for fire, which can result in an urban fire or wildfire. Long-term environmental impacts can in turn cause negative economic impacts to tourism or fishing.

10.4 Potential Impacts from Future Climate Conditions

Hazardous materials facilities (i.e., storage tanks) and infrastructures (i.e., pipework) are increasingly exposed the flooding and other climate-related hazards due to climate change. Having been built in locations that may not have been previously exposed to flooding and therefore lacking floodproofing, hazardous materials facilities may be particularly vulnerable to the effects of flooding and at increased risk of a chemical release (World Health Organization, 2018a.).

10.5 Exposure

Exposure and vulnerability due to hazardous material incidents are difficult to quantify due to a range of natural, built environment, and human elements; however, the map in Figure 10 indicates the locations of Tier II, Superfund, and other hazardous materials sites within the Tulalip Reservation site.

10.5.1 Population

The entire population of the Tulalip Reservation is are exposed to a hazardous material event due to widespread use and storage throughout the community, particularly along the I-5 corridor due to the transportation of hazardous materials. The general population may be exposed to a hazardous material release through inhalation, ingestion, or dermal exposure.

Vulnerability

Persons with preexisting health conditions and persons over the age of 65 are particularly vulnerable to a hazardous materials event. Other vulnerable populations also include those who may not have adequate warning, such as linguistically isolated people, for example, there are some citizens on the Reservation that speak Spanish, and others that speak Russian.

10.5.2 Property

Some materials that are improperly stored in buildings have the potential to mix with incompatible substances which can result in polymerization, the production of heat, combustion or fire, or explosion.

Vulnerability

It is difficult to determine potential losses and vulnerabilities to properties due to the variable nature and amount of hazardous materials being stored. Hazardous material incidents can pose a serious long-term threat to property.

10.5.3 Critical Facilities and Infrastructures

Multiple critical facilities on the Tulalip Reservation are vulnerable to a hazardous material incident. It is difficult to quantify losses of critical facilities due to an incident. Potential losses may include inaccessibility, loss of service, contamination, and/or potential structural and content loss if an explosion occurs.

Vulnerability

Critical facilities store hazardous materials, increasing vulnerability and likelihood of an incident. Transportation infrastructure such as I-5 are used to transport hazardous materials and thus are vulnerable to potential disruption in the event of a materials release.

10.5.4 Environment

Environmental damage resulting from a hazardous material incident can be on a scale from limited to disastrous, ending up in the air, soil and water. As materials soak into the soil, they can kill microorganisms and nutrients that contribute to the livelihood of plants and animals. Hazardous materials can eventually reach the groundwater, potentially toxifying community drinking water systems. Materials that end up in bodies of water can kill off aquatic plants and animals, straining ecosystems.

10.6 Development Trends

The number and types of hazardous chemicals stored in and transported through the Reservation will likely continue to increase. As population grows, the number of people vulnerable to the impacts of hazardous materials incidents will increase. Population and business growth along major transportation corridors increases the exposure of these communities to transportation-related hazardous material releases. Revisiting Tribal, federal, state, and local hazardous material rules and regulations will help ensure safe handling and storage procedures are updated and enforced.

10.7 Issues

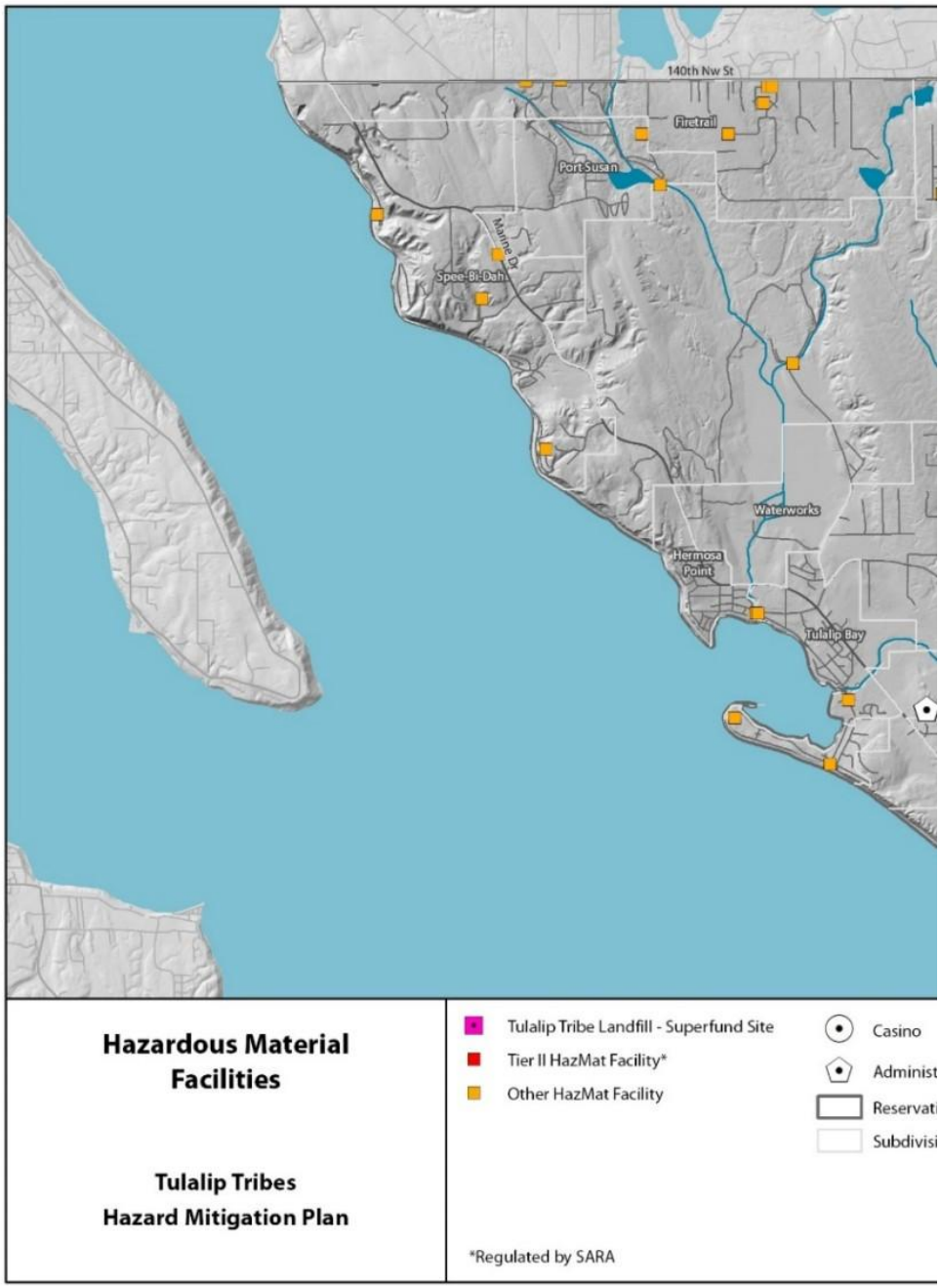
The major issues for hazardous materials incidents include the following:

- Continue all facets of emergency preparedness training for police, fire, public works, and public information staff to respond quickly.
- Work proactively with hazardous materials facilities to follow best management practices:
    - Placards and labeling of containers
    - Emergency plans and coordination
    - Standardized response procedures
    - Notification of the types of materials being transported through the planning area
    - Random inspections of transporters
    - Installation of mitigating techniques along critical locations
    - Routine hazard communication initiatives
    - Consideration of using safer alternative products
- Work with the private sector to enhance and create Business Continuity Plans in the event of an emergency.
- Maintain a regional emergency services information line that the public can contact 24 hours a day during an emergency incident.
- Coordinate with planning area school districts to ensure that their emergency preparedness plan includes preparation for hazardous material releases.

10.8 Hazard Maps

The map of hazardous materials facilities on the Tulalip Reservation is Figure 10 on the next page.

Figure 10 – Tulalip Reservation Hazardous Materials Facilities



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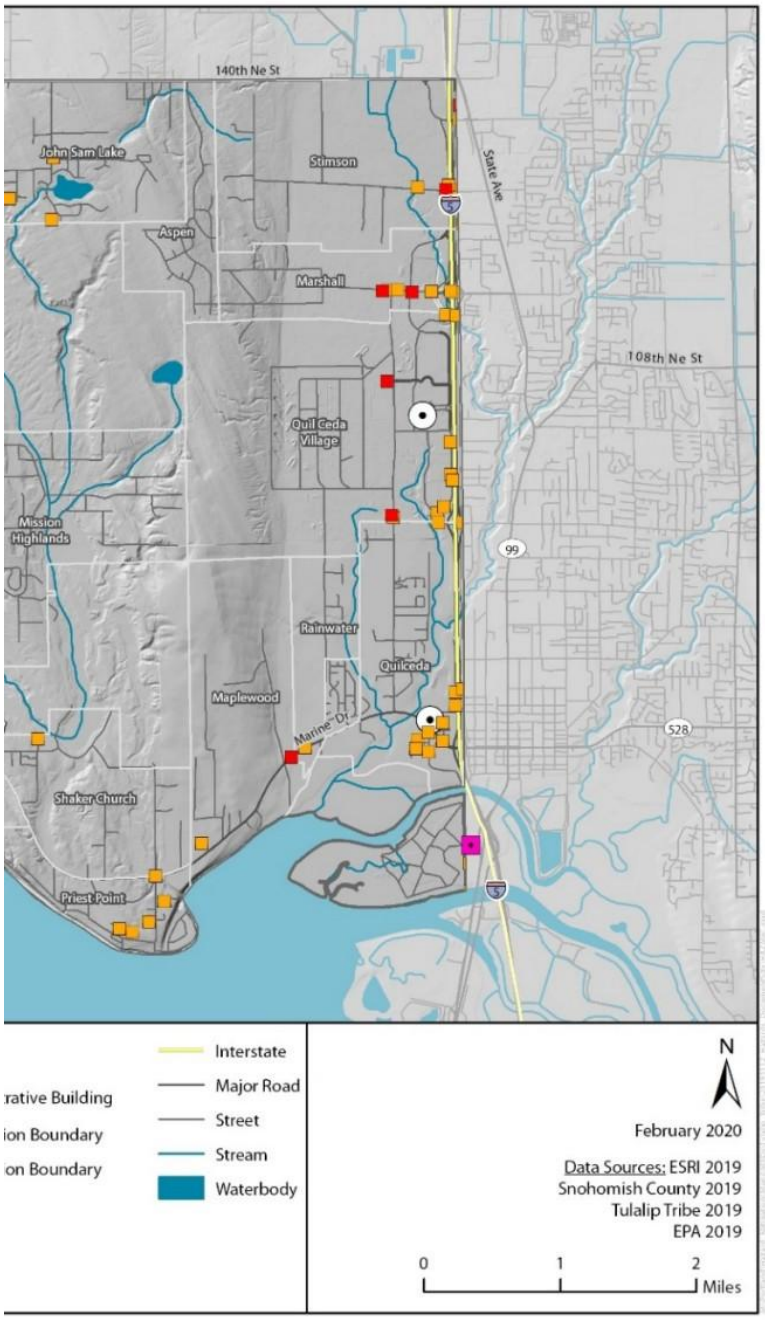


11 Mass Earth Movements

11.1 General Background

A mass earth movement is defined as a landslide, mudslide, rock fall, sinkhole, or debris flow. A landslide is the movement of a mass of rock, debris, or earth down a slope (United States Geological Survey, n.d.). A mudslide is a mass of water and fine-grained earth materials that flow down a stream, ravine, canyon, arroyo or gulch (Colorado Geological Survey, n.d.). Debris flow is a moving mass of loose mud, sand, soil, rock, water and air that travels down a slope under the influence of gravity. To be considered a debris flow, more than half of the solids must be larger than sand grains.

Mass earth movements signify any down-slope movement of soil, rock, or debris under the direct influence of gravity. The five modes of slope movement include: falls, topples, slides, spreads, and flows (United States Geological Survey, n.d.). Slope movement occurs when forces acting down-slope exceed the strength of the earth materials that compose the slope. Landslides can be initiated when slopes are already on the verge of movement by rainfall, snowmelt, changes in water level, stream erosion, changes in ground water, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors (United States Geological Survey, n.d.).

DEFINITIONS

Debris Flow – A form of rapid mass movement in which loose soil, rock and sometimes organic matter combine with water to form a slurry that flows downslope.

Landslide – The sliding movement of masses of loosened rock and soil down a hillside or slope.
Slope failures occur when the strength of the soils forming the slope is exceeded by the pressure, such as weight or saturation, acting upon them.

Mass Movement – A collective term for landslides, debris flows, falls and sinkholes.

Mudslide (or Mudflow) – A river of rock, earth, organic matter and other materials saturated with water.

Sinkhole – A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

11.1.1 Potential Damage from Mass Earth Movement

Mass earth movements can result in property damage or destruction, human injury, or loss of life. Displaced earth can dam rivers, destroy highways, and sever railroad lines. This can result in flooding, delayed response time for assistance, and train derailments. An event can occur with little to no warning, increasing the likelihood of damage from such an event.

11.2 Tulalip Tribes Hazard Profile

Generally, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as (University of Washington, 2015):

- A slope greater than 33 percent
- A history of landslide activity or movement in the past 10,000 years
- Stream or wave activity which has caused erosion, undercut a bank, or cut into a bank to cause the surrounding land to be unstable
- The presence of an alluvial fan, indicating vulnerability to the flow or debris or sediments

- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils (e.g. sand and gravel)

The most common type of slide is the shallow colluvial slide, which occurs in response to intense, short-duration storms. The less common, largest, and most destructive slides are deep-seated slides. Because the Tulalip Reservation was once covered by glaciers that advanced and retreated many times during the various ice ages, many areas have stratified soils that create a landslide risk.

Most landslides occur in January after the water table has risen during the wet months of November and December. In addition to the coastal bluffs, hillsides that were previously stable can become a landslide risk if the vegetation is removed. Water is involved in nearly all cases, and human influence has been identified in more than 80 percent of reported slides.

11.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, allowing for the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, mass earth movements were ranked as the sixth worst-case and most likely scenario.

Table 25 – Mass Earth Movement Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	**Magnitude (1=lowest, 5=highest)**	**Frequency (1=lowest, 5=highest)**	**Onset (1=slowest, 5=fastest)**	**Duration (1=shortest, 5=longest)**	**Perceived Change in Risk**	**Average**	**Rank**
Worst-case Scenario							
3.9	3.7	3.1	4.0	3.4	0.7	3.62	6
Most Likely Scenario							
2.1	2.1	2.3	3.7	3.3	0.7	2.70	6

11.2.2 Past Events

While there are no disaster declarations for landslides/mudslides in Tulalip Tribes, there were six disaster declarations in Snohomish County and six events listed in the National Oceanic and Atmospheric Administration (2020) Storm Events Database. Disaster declarations are shown in Table 40 of the Risk Assessment Appendix H.

In 1997, a large slide occurred in Woodway, just north of the Richmond Beach neighborhood. It cut 50 feet into the property above, passed over the railroad tracks and knocked a freight train into the Puget Sound. This slide gave an idea of what a major slide on the Tulalip Reservation might look like due to similarity in slope and soil conditions.

During the 1996 Holiday Blast storm, the Tulalip Reservation suffered road washouts caused by landslides on Tulare Beach Road and on a cliffside private road near Sunny Shores.

11.2.3 Location

The Tulalip Tribes Natural Resources Department has mapped landslides and potentially unstable slopes along the west coast of the Reservation that, along with mass earth movement hazard areas, are shown in the map in Figure 11. Landslides and mudslides in adjacent Snohomish County have previously occurred in conjunction with major storm systems. Heavy rains can overwhelm storm drainage systems, saturating soil, and increasing runoff on steep slopes. The 2014 Oso landslide resulted in a FEMA declaration and is the only known slide to have caused fatalities in the County.

The length of slide run-out is affected by many factors such as substrate composition, saturation, and slope angle and height (University of Washington, 2015). Current maps do not identify areas at risk of slide run-out. Scientific research is ongoing to understand how these and other factors determine slide run-out. Finally, the recognition of ancient dormant mass movement sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes, exceptionally wet weather conditions, natural weathering and strength reduction processes, and are vulnerable to construction-induced sliding.

11.2.4 Frequency

Mass earth movements can often be triggered by other natural hazards, such as earthquakes, heavy rain, floods or wildland fires. The frequency of mass earth movements is related to the frequency of these other hazards. On the Tulalip Reservation, movements typically occur during and after major storms but can occur any month of the year.

11.2.5 Severity

Mass earth movements destroy property, infrastructure, transportation systems, and can injure and take the lives of people. Slope failures cause an estimated 25 to 50 deaths and $3.5 billion in damage each year in the US (Rutledge, et al. 2014).

11.2.6 Warning Time

Mass movements can be rapid or slow-onset hazards, depending on velocity. The velocity of a mass earth movement may range from a slow creep of inches per year to many feet per second, depending on height, slope angle, material, and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. Currently there is no practical warning system for individual landslides. The standard operating procedure is to monitor situations on a case-by-case basis.

Generally accepted warning signs for landslide activity include (University of Washington, 2015):

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures, such as decks and patios tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls, or fences
- Offset fence lines
- Sunken or down dropped roadbeds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)

- Sudden decrease in creek water levels, although rain is still falling or just recently stopped
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of alignment
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together

11.3 Cascading Impacts/Secondary Hazards

Mass earth movements can cause several types of cascading impacts and secondary hazards. Landslides can block egress and ingress on roads, which can potentially isolate Tulalip citizens and community members or businesses. Roadway blockages caused by landslides can affect commercial, public and private transportation, resulting in economic losses for businesses or the Tribe. Utility poles can be knocked over, resulting in loss of power and communication. Structural destabilization is also a concern, resulting in property and monetary losses for businesses and homeowners. Earth movements can also block waterways, resulting in flooding, reduced water quality, and potential harming fisheries and spawning habitat.

11.4 Potential Impacts from Future Climate Conditions

Mass earth movement events are expected to increase globally because of climate change (McGuire, 2010). Within the Tulalip Reservation in particular, this is expected due to increased slope destabilization from a growing number of wildfires and more extreme precipitation events (University of Washington, 2015; Mauger, Lee, & Won, 2018 citation).

11.5 Exposure

11.5.1 Population

Population could not be examined by mass earth movement hazard areas because census block group areas do not coincide with the risk areas. However, the communities of Tulalip Shores, Tulare Beach, and Sunny Shores are extremely vulnerable to landslides.

Vulnerability

It is difficult to determine demographics of populations vulnerable to mass earth movements due to the nature of census block group data. Of those persons living within the Tulalip Reservation, 4,305 of them are potentially at risk.

11.5.2 Property

Table 26 shows the total number of buildings exposed, the percentage of all buildings exposed, and the assessed value of structures exposed to at least a moderate landslide hazard by jurisdiction; categories 4-6 (yellow) on Tulalip Tribes Landslide Hazard Areas map in Figure 11 Nearly 12,000 buildings worth an assessed value of approximately $32.3 billion are exposed to landslides.

Table 26 – Property Exposed to Landslides

Value of Property Exposed to Landslides				
Number Buildings Exposed	Percent of all Buildings Exposed	Assessed Value of Exposed Buildings		
		Structure	Contents	Total
370	5%	$44,649,525	$22,324,763	$66,974,288

Land used for forestry or parks are less vulnerable, while lands used for manufactured homes are highly vulnerable. The predominant land uses for parcels in the Tulalip Reservation are single-family, vacant, and manufactured homes.

Vulnerability

The Tulalip Reservation's main areas of exposure and vulnerability to landslides are to the homes located along the bluff along Port Susan and Possession Sound. Using GIS, 2010 Snohomish County Assessor's parcel data was overlaid onto the landslide hazard zones determined by the DNR and DCD studies and a 50-foot buffer was created around these zones. There are 3 critical facilities in these zones, several residential parcels, and portions of some roads.

11.5.3 Critical Facilities and Infrastructures

Table 27 summarizes the critical facilities exposed to the mass earth movement hazard. No loss estimation of these facilities was performed due to the lack of established damage functions for the mass movement hazard. A significant amount of infrastructure (e.g., roads, bridges, railroads, and utilities) can be exposed to mass movement (United States Geological Survey, n.d.).

Table 27 – Critical Facilities Exposed to Landslides

Critical Facilities Within Snohomish County's Landslides Hazard Areas	
I-5 and 116th St NE Interchange Improvement	1
Tulalip Shores Water System	1
Sunny Shores Community Club Water System	1
Total	**3**

Vulnerability

Areas of the Reservation vulnerable to mass earth movements include coastal roads and transportation infrastructure.

11.5.4 Environment

Environmental problems that result from mass movements can be numerous. Earth movements alter the landscape, impact the topography/morphology of both subaerial and submarine surfaces, rivers, streams, forests, and grasslands, and the habitats of native fauna, both on land and in water (Schuster & Highland, 2001). Mass earth movements that affect rivers can lead to blockage, the formation of lakes, or widespread flooding. Soil and sediment runoff can accumulate downslope, potentially blocking waterways, harming the quality of streams and other water (United States Geological Survey, n.d.).

11.6 Development Trends

The Tulalip Tribes is equipped to deal with future growth and development within the Reservation. Landslide hazard areas are included in the "environmentally sensitive lands," definition in the Tulalip Tribal Code Title 7, which includes slopes over 15 percent or otherwise subject to slope instability, potential landslide or significant erosion. Development will occur in landslide hazards within the Reservation, but it will be regulated such that the degree of risk will be reduced through building standards and performance measures.

11.7 Issues

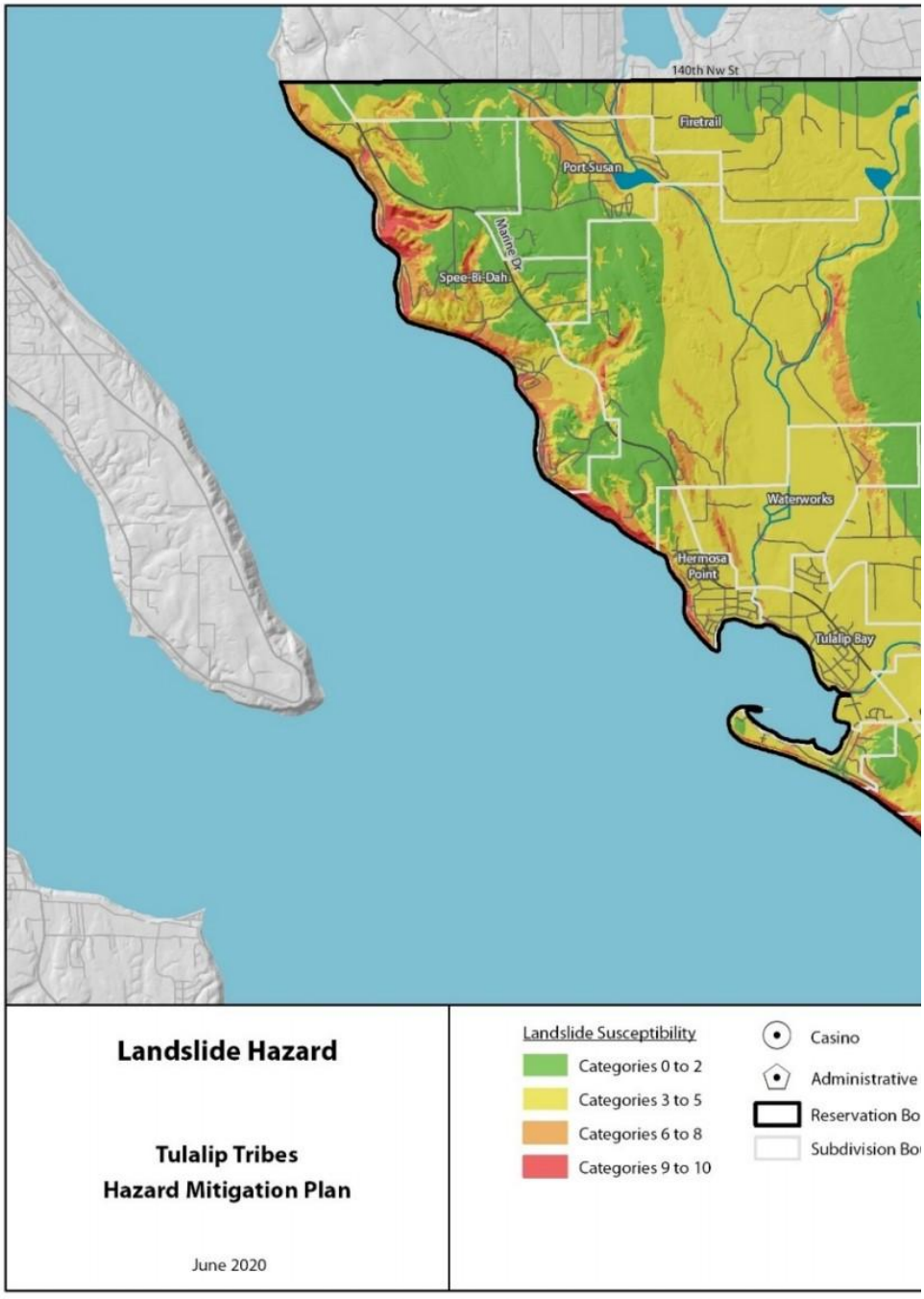
Important issues associated with landslides in the Tulalip Reservation include the following:

- Currently, there are no standards in place to estimate losses from landslides. Large landslides occur infrequently and tend to be very localized, damaging one or a few homes. However, cost estimations are useful in comparing to other hazards to prioritize and focus mitigation efforts.
- There are existing homes in mass movement-prone areas, specifically Mission Beach and Mission Beach Heights Road, Hermosa Point, Potlatch Beach Road and Priest Point Drive
- There are communities that are particularly vulnerable including Tulalip Shores, Tulare Beach, and Sunny Shores
- Future development could lead to more homes in mass movement prone areas.
- The data and science regarding the mapping and assessment of landslide hazards is constantly evolving. As new data and science become available, assessments of landslide risk should be re-evaluated.
- The impact of climate change on landslides is uncertain. If climate change impacts atmospheric conditions, then exposure to landslide risks is likely to increase.
- Landslides cause environmental changes, including temporary water quality degradation and habitat loss. However, these changes may also provide habitat benefits from sediment and nutrient transport.
- The risk associated with the landslide hazard overlaps the risk associated with other hazards such as earthquake, flood, tsunami and coastal erosion. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.
- Current landslide hazard mapping does not include areas potentially impacted from the run-out of landslides.

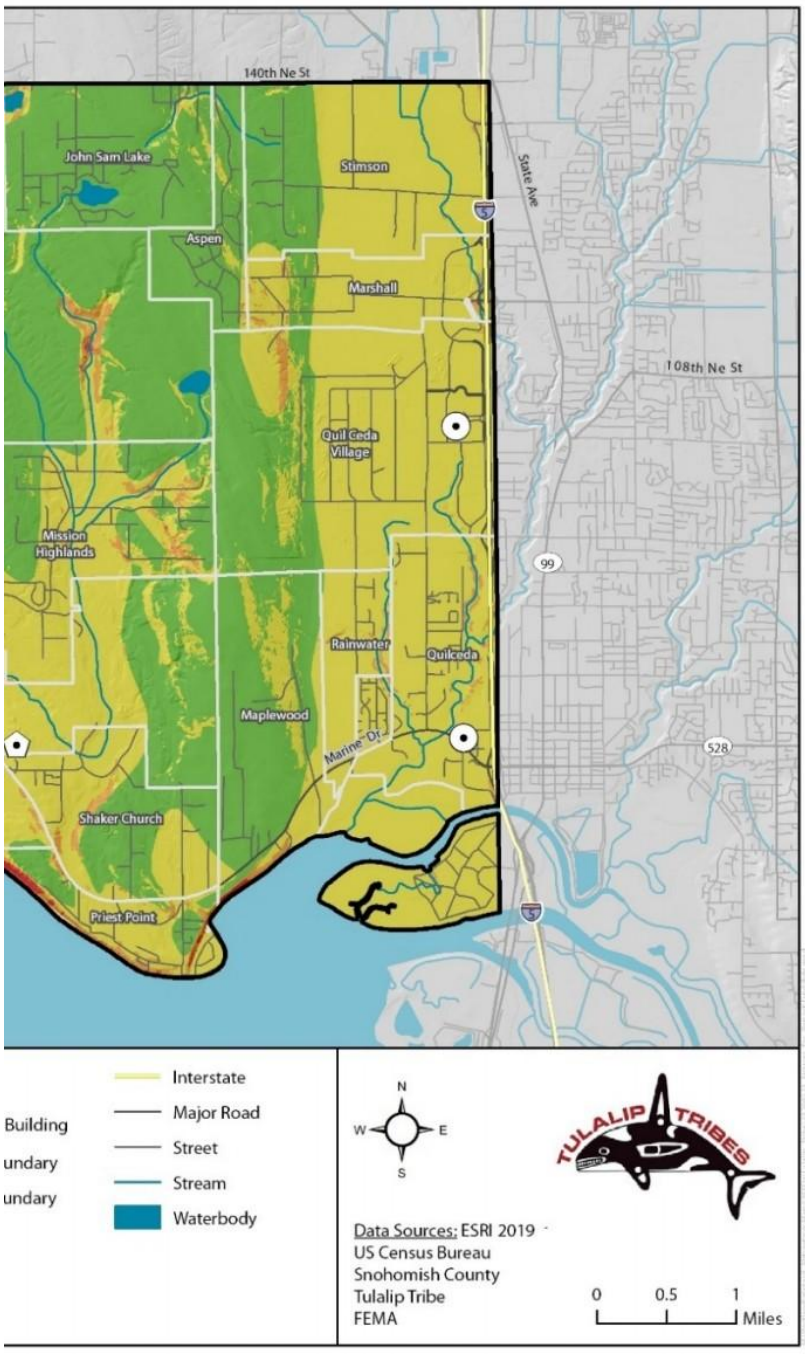
11.8 Hazard Map

The hazard map of landslide risk areas on the Tulalip Reservation is Figure 11 on the next page.

Figure 11 Landslide Hazard Map



ssment – Mass Earth Movements



12 Tsunami

12.1 General Background

Tsunamis are waves cause by earthquakes, volcanic eruptions, or landslides under the sea (National Oceanic and Atmospheric Administration, 2019b.). As waves travel inland, they build to higher heights as the depth of the ocean decreases (National Oceanic and Atmospheric Administration, 2019b.). Waves can reach heights of over 100 feet and can travel at speeds over 500 miles per hour, the same speed as a commercial jet plane (National Oceanic & Atmospheric Administration and National Weather Service, 2020). Major tsunamis occur about once per decade; 59 percent of the world's tsunamis occurred in the Pacific Ocean, 25 percent in the Mediterranean Sea, 12 percent in the Atlantic Ocean, and 4 percent in the Indian Ocean (National Oceanic & Atmospheric Administration and National Weather Service, 2020). Time before a tsunami hits can vary from minutes to hours; higher ground should be sought out immediately.

Natural warning signs for tsunamis include severe ground shaking from local earthquakes, water receding from the coast and exposing the ocean floor, reefs, and fish, and abnormal ocean activity (a wall of water) creating a loud roaring sound similar to that of a train or jet aircraft (National Oceanic & Atmospheric Administration and National Weather Service, 2020). A tsunami's height and impacts are influenced by local bathymetry and topography and the direction from which the tsunami arrives (National Weather Service, n.d.).

DEFINITIONS

Runup – A measurement of the height of the water onshore observed above a reference sea level.

Tsunami – Comes from the Japanese words for *harbor* ("tsu") and *wave* ("nami"); a long high sea wave caused by an earthquake, submarine landslide, or other disturbance.

Tsunami from a large undersea earthquake – The earthquake must cause significant vertical deformation on the seafloor for a tsunami to occur.

Tsunami Warning – Issued by PTWC when a potential tsunami with significant widespread inundation is imminent or expected.

Tsunami Watch – Issued when an event may later impact the watch area; may be upgraded to tsunami warning.

Seiches – A standing wave/oscillation in an enclosed or partially enclosed body of water that varies in a period from a few minutes to several hours.

Seiches may occur by local changes in atmospheric pressure, but more often are initiated by the motion of earthquakes or tsunamis. The word seiche is French for "to sway back and forth." Once the surface of the water is disturbed, gravity seeks to restore the horizontal service, resulting in vertical motion. This sloshing back and forth from one end of the body of water to the other helps the water return to equilibrium. The size, shape, and depth of the water body will influence the severity of seiches (Michigan Sea Grant, n.d.).

12.1.1 Potential Damage from Tsunamis

Tsunamis typically cause the most severe damage and casualties near their source. Tsunamis with runups over one meter are particularly dangerous to people and property, but smaller tsunamis can also be dangerous. Strong current can injure and drown swimmers, sink boats, and destroy infrastructure in harbors. Low-lying areas such as beaches, bays, lagoons, harbors, river mouths, and areas along rivers and

streams leading to the ocean are most vulnerable. Most tsunami damage and destruction are caused by flooding, wave impacts, erosion, strong currents, and floating debris. As water returns to the sea, it takes debris and people with it. In addition to loss of life and mass injuries, other potential impacts include damage to and destruction of homes and businesses, ports and harbors, cultural resources, utilities, and critical infrastructure and facilities. Utilities such as power, sewer, water, and communications may be lost or disrupted; transportation, health, and public safety services may be delayed. Tsunamis can also cause hazardous material releases, contaminating water supplies and threatening public health (National Weather Service, n.d.).

Seiches can result in disrupted commercial boating or vessel cargo operations by reversing the natural current of the water, causing the vessel to hit the pier, or a delay in operations due the threat of damage. In some situations, the water supply may be cut off due to differing water levels and movement. The water movement itself can result property damage to boats and piers; people on these docks or boats may not have adequate warning to leave the area, resulting in injuries or deaths.

12.2 Tulalip Tribes Hazard Profile

The Tulalip Tribes would feel the effects of an earthquake located in the Cascadia Subduction Zone, but a tsunami originating from that earthquake would pose minimal risk to the Reservation. The Southern Whidbey Island fault (SWIF) poses the greater danger from a tsunami. An earthquake along the SWIF could produce a tsunami with the ability to reach shores of the Reservation in 30 minutes, giving emergency management officials little time to warn and evacuate people (Schwarzen, 2005). The Reservation has inland bodies of water that could experience seiches, such as Weallup Lake, Mary Shelton Lake, Lake Agnes, John Sam Lake, and Ross Lake.

12.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, tsunamis/seiches were ranked as the third worst-case scenario and the seventh most likely scenario.

Table 28 – Tsunami Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	**Magnitude (1=lowest, 5=highest)**	**Frequency (1=lowest, 5=highest)**	**Onset (1=slowest, 5=fastest)**	**Duration (1=shortest, 5=longest)**	**Perceived Change in Risk**	**Average**	**Rank**
Worst-case Scenario							
4.6	4.1	2.0	4.7	4.6	0.3	4.02	3
Most Likely Scenario							
2.6	2.2	1.3	3.9	3.2	0.3	2.65	7

12.2.2 Past Events

Multiple distant and local tsunamis have struck the coast of Washington. Some notable events that have affected Washington include (Washington State Department of Natural Resources, n.d.):

- **March 27, 1964 (Distant Tsunami)** – An M9.2 earthquake occurred in Anchorage, Alaska, generating a tsunami that caused 110 deaths throughout different states affected on the Pacific Coast. In the Puget Sound region, the earthquake created seiches on 14 inland bodies of water (Buffett, 2010).
- **April 1, 1946 (Distant Tsunami)** – An M8.1 earthquake occurred in the Aleutian Islands of Alaska, resulting in a tsunami that caused 165 deaths and significant destruction in Alaska, Hawaii, and states bordering the Pacific Ocean. This event resulted in the formation of the Pacific Tsunami Warning Center.
- **January 26, 1700 (Local Tsunami)** – An estimated M8.7-9.2 earthquake occurred in the Cascadia Subduction Zone, creating waves up to 100 ft along the Washington and Oregon coast. The event is recorded in geologic record and in Native American oral history and was recorded in Japan on the same day.

There are no written records of damaging waves within the Puget Sound. Verbal accounts among the Snohomish Tribe, reported by Colin Tweddell in 1953, describe a great landslide-induced wave caused by the collapse of Camano Head at the sound end of Camano Island around the 1820s (Buffett, 2020). The slide buried a small native village, and the deadly tsunami claimed the lives of men, women, and children, assumed to be clamming on Hat Island two miles to the south (Buffett, 2010).

12.2.3 Location

Nearly every coast and river estuary are threatened by tsunamis. If an earthquake ruptures a fault at the surface of the ground and offsets the floor, it could generate a local tsunami (Washington Department of Natural Resources, 2013). There is also the threat of distant tsunamis, such as those from Alaska, although they are less likely to have devastating effects for the Tribe. The SWIF is capable of and is most likely to generate a tsunami that would affect the Reservation; however, it is not the only source. Earthquakes that occur throughout the region can trigger landslides, which may create or amplify tsunamis. The locations that are vulnerable to tsunami hazard are the Quil Ceda Creek watershed, Priest Point, Mission Beach, Tulalip Bay, Tulalip Shores, Spee-Bi-Dah, Tulare Beach, and Sunny Shores. The heaviest damage would be those areas directly across open water, such as Mission Beach and Priest Point. Seiches can occur in the Reservation's lakes and ponds.

12.2.4 Frequency

The frequency of tsunamis is related to the frequency of events that cause them – earthquakes, volcanic activity, or landslides. However, these three factors do not produce a tsunami every time. Major tsunamis occur about once per decade (National Oceanic and Atmospheric Administration & National Weather Service, 2020). A tsunami affecting the Tulalip Reservation has not happened since approximately 1820. There is a risk for the Tribes to experience effects from a tsunami, however the frequency of such an event is very low and a specific rate of occurrence has not been calculated yet.

12.2.5 Severity

Tsunamis are generated by earthquake-derived energy which results in sudden movements in the water column; severity depends on the location, magnitude, and depth. Most earthquake-generated tsunamis

come from magnitudes 7.0 and greater that are shallow (less than 62 miles below the surface). The earthquake must be big enough and close enough to generate vertical movement of the ocean floor. The amount of movement on the ocean floor, the size of the area which it occurs, and the depth of water at that point are all factors in determining severity of a tsunami (National Oceanic and Atmospheric Administration & National Weather Service, 2018).

Tsunamis can also be generated by landslides (rock falls, slope failures, debris flows, slumps, ice falls, or glacial calving). This can happen when a landslide enters the water and displaces it from above, or when what is displaced ahead of and behand an underwater landslide. Severity of the tsunami will depend on the amount of material that displaces the water, the speed, and the depth it moves to. This is a local tsunami that can impact coastlines with very little warning but poses little distant threat (National Oceanic and Atmospheric Administration & National Weather Service, 2020). Six inches of fast-moving water can carry away an adult; twelve inches can carry away a small car; and 18-24 inches can carry away most large SUVs, vans, and trucks (National Weather Service, n.d.).

12.2.6 Warning Time

For the Tribes, the single biggest warning of a potential tsunami is a large earthquake. Scientists also use networks of ocean sensors to detect and monitor tsunamis. The U.S. Tsunami Warning System is a system led by NOAA that uses observation networks to detect and measure earthquakes that could generate tsunamis and monitor tsunamis once they are generated. Washington State is served by the National Tsunami Warning Center, which monitors the observation networks, analyzes events, and can provide advance warning in case of a tsunami threat on the Washington Coast. There are four tsunami alert types (Washington State Department of Natural Resources, n.d.):

- Warning – get to high ground or inland immediately; tsunami imminent with flooding, powerful currents, and/or wave heights over 3 feet or unknown.
- Advisory – stay out of the water and away from the shore; strong currents and dangerous waves in or very near coastal water, wave heights of 1-3 feet.
- Watch – be prepared to act and stay tuned to local radio/TV/NOAA alert weather radios; tsunami is possible, alert level may change with more information
- Information Statement – no action needed; no tsunami impact expected, alert level may change with more information.

12.3 Cascading Impacts/Secondary Hazards

Tsunamis may bring in and produce tons of floating debris, threatening human lives and property. Ships moored in marinas or harbors may be destroyed or washed up onto shore or docks. As vessels are broken up, they release oil and other hazardous materials into the environment; if any facilities on shore store hazardous substances those may also be released, contaminating the floodwater. Coastal structures such as breakwaters, piers, port facilities, and public utilities may be swept away from the force of the water or the erosion of the foundation below. The destruction of this property can hurt the economy of the area and affect food, employment, and fuel. Utilities such as water, sewage, communications, and power may be disrupted or damaged. Damage to the Tulalip Bay Marina could have a serious effect on the Tulalip Tribes' economy.

Seiches create a "sloshing" effect on inland bodies of water. This effect can cause damage to moored boats, piers, and facilities close to the water like a tsunami.

12.4 Potential Impacts from Future Climate Conditions

The impacts of global climate change on tsunami probability are unknown; however, research is being conducted to identify and better understand any potential linkages (McGuire, 2010).

12.5 Exposure

The tsunami mapping used as the basis for this assessment is informed by a single scenario, the Seattle Fault earthquake event, and likely underrepresents areas at risk due to an event of greater magnitude (e.g., Cascadia).

12.5.1 Population

The population living in tsunami hazard areas was estimated using the percent of residential buildings within the tsunami hazard area multiplied by the total estimated population (United States Census Bureau, 2018). Using this approach, the estimated resident population living in tsunami hazard area is 684, or approximately 6.8 percent of the population. The populations that would be most exposed to tsunamis are those near the Quil Ceda Creek watershed, Priest Point, Mission Beach, Tulalip Bay, Tulalip Shores, Spee-Bi-Dah, Tulare Beach, and Sunny Shores. People visiting those areas would also be exposed. The Elder Housing Center is located on the edge of Tulalip Bay in the tsunami risk area, posing a particularly difficult situation for evacuation.

Vulnerability

Populations most vulnerable to tsunami hazards are the elderly, disabled, and very young who reside and visit those areas most exposed to tsunamis. Visitors in or around inundation areas are vulnerable, as they may not be familiar with tsunami hazards, warnings, or ways to reach higher ground in a quick manner.

12.5.2 Property

Spatial analysis indicates that there are 534 structures within the tsunami hazard areas. The estimated worth of building-and-contents exposed to the tsunami hazard is $97.5 million, representing 7.4 percent of the total replacement value of the planning area.

Table 29 – Properties Exposed to Tsunamis

Value of Property Exposed to Tsunamis				
Number Buildings Exposed	Percent of all Buildings Exposed	Assessed Value		
		Structure	Contents	Total
535	7%	$63,293,235	$34,251,105	$97,544,341

Vulnerability

All structures and property that are located along tsunami inundation areas would be vulnerable, and even more vulnerable with little to no warning time.

12.5.3 Critical Facilities and Infrastructures

There are 2 critical facilities in the tsunami hazard area. Table 30 shows a breakdown of critical facility types in the hazard area.

Table 30 – Critical Facilities Exposed to Tsunami Zones

Critical Facilities Within the Tulalip Reservation Tsunami Inundation Zones	
Marine Drive Bridge	1
Tulalip Tribes Marina	1
Total	**2**

Vulnerability

All critical infrastructures that are located along tsunami inundation areas would be vulnerable. Many of the Tulalip Tribes' critical facilities, such as the health clinic, marina, tribal center, gathering hall and elder housing are located along Tulalip Bay, and are extremely vulnerable.

12.5.4 Environment

A tsunami event has the potential to change the land, both above and below water. If the coast subsides (falls), flooding may be extended to unexpected areas and tsunami barrier may not be effective. Tsunami events can also make waterways unnavigable. Other consequences include permanent changes to beaches, coastal features, loss of or changes to wildlife habitat, and the availability of fresh water. Agricultural land inundated by saltwater can become unusable.

12.6 Development Trends

The Tribes is equipped to handle future growth within tsunami inundation areas. Inundation maps offer the Tribes a way to guide development away from tsunami-prone areas. With the coordination of plans, the Tribes and their Planning Department will be better able to make wise land use decisions as future growth impacts tsunami hazard areas.

12.7 Issues

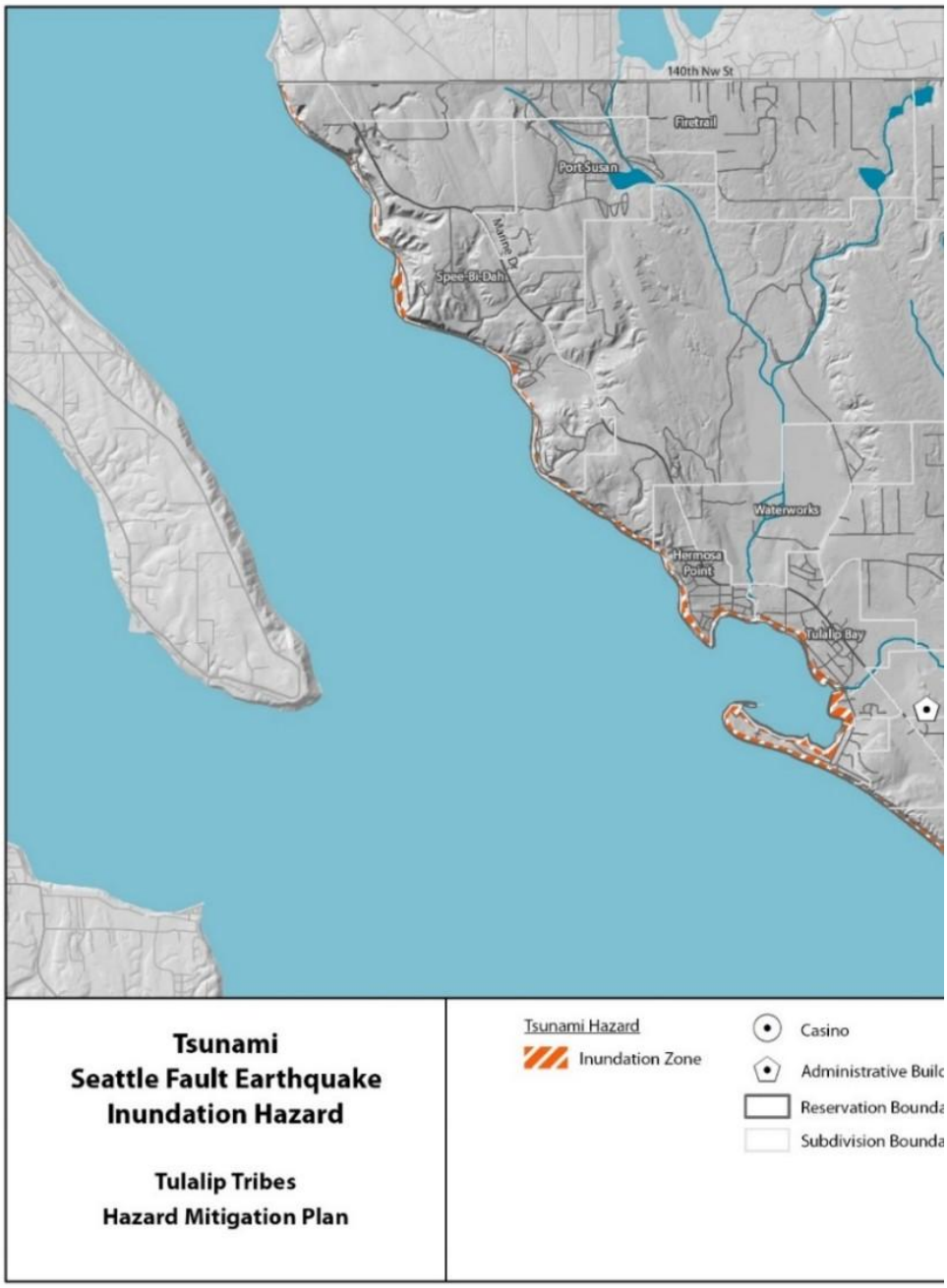
The planning team has identified the following issues related to the tsunami hazard for the planning area:

- Hazard Identification—To truly measure and evaluate the probable impacts of tsunamis on planning, hazard mapping based on probabilistic scenarios must continue to be updated regularly. The science and technology in this field are emerging. Accurate probabilistic tsunami mapping will need to be a key component for tsunami hazard mitigation programs to be effective.
- Enhancement of Current Capabilities—As tsunami warning technologies evolve, the tsunami warning capability within the planning area will need to be enhanced to provide the highest degree of warning.
- Vulnerable Populations Planning—Special attention will need to be focused on the vulnerable communities in the tsunami zone and on hazard mitigation through public education, outreach, and warning capabilities. This issue may be especially important for visitors to the Tulalip Reservation and the Elder Housing Center.

12.8 Hazard Map

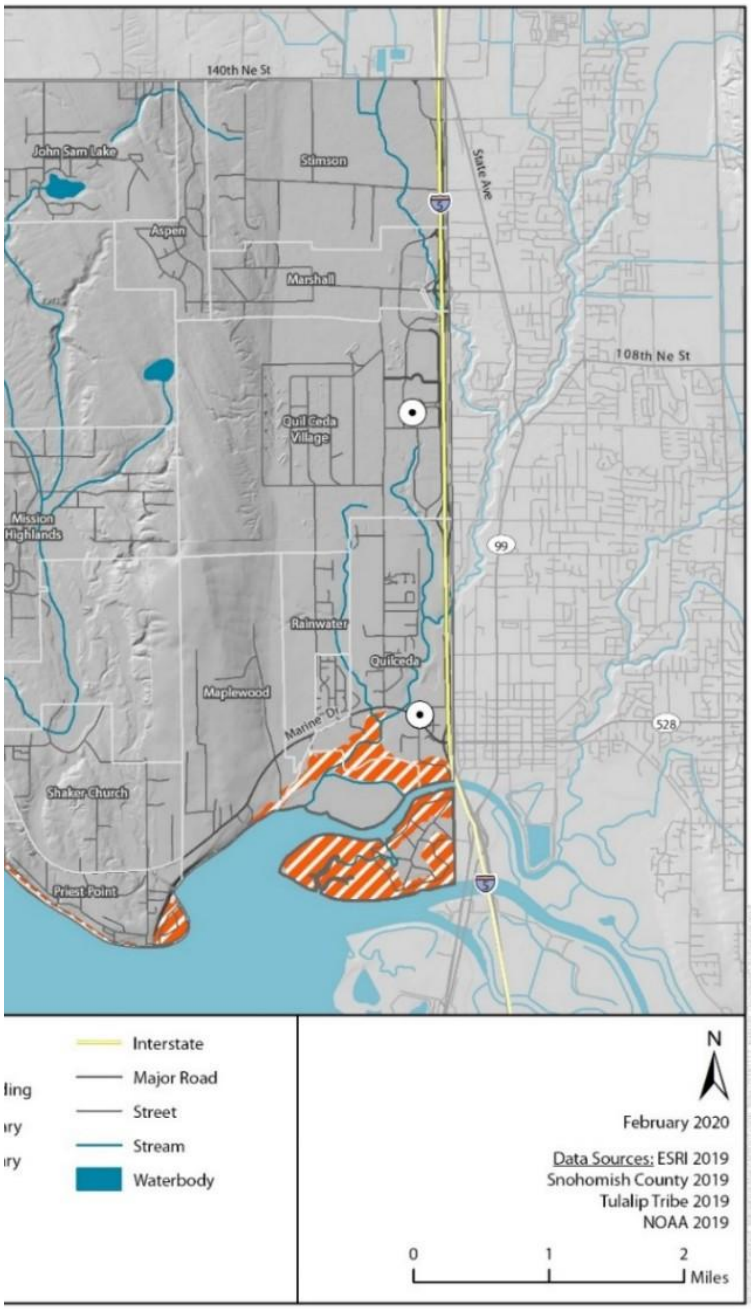
The hazard map of tsunami risk areas on the Tulalip Reservation is Figure 12 on the next page.

Figure 12 – Tulalip Reservation Tsunami Hazard Areas



Tulalip Tribe 2021 Hazard Mitiga

Risk Assessment – Tsunami



13 Severe Weather Events

13.1 General Background

Severe weather can be defined as dangerous meteorological or hydro-meteorological phenomena, of varying duration, with risk of causing major damage, serious social disruption and loss of human life, and requiring measures for minimizing loss, mitigation and avoidance (World Meteorological Organization, 2004). Severe weather can include tornados, severe thunderstorms, flash floods, damaging winds, large hail, and winter storms (Ready.gov, 2020).

Severe weather can be categorized into two categories: systems that form over wide geographic areas are classified as general severe weather; those with a more limited geographic area are classified as localized severe weather (World Meteorological Organization, 2004). Severe weather events are not the same as extreme weather; extreme weather refers to phenomena that are at the extremes of the historical distribution and are rare for a particular place and/or time (National Academy of Sciences, 2008).

13.1.1 Potential Impacts from Weather Events

Severe weather can cause damage from the weather itself or from cascading impacts/secondary impacts. Utility systems can be damaged, resulting in power outages and loss of communications. Damage to structures, infrastructure, and other property can disrupt transportation, delay immediate emergency assistance, or result in hazardous materials releases or oil discharges. Extreme cold and heat can both pose health risks, and droughts may bring economic losses and hardships to the community.

DEFINITIONS

Severe Local Storm – Small atmospheric systems including tornadoes, thunderstorms, and windstorms. Typically, major impacts from a severe storm are on transportation infrastructure and utilities. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area.

Thunderstorm – Typically 15 miles in diameter and lasting about 30 minutes, thunderstorms are underrated hazards. Lightning, which occurs with all thunderstorms, is a serious threat to human life. Heavy rains over a small area in a short time can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with thunderstorms.

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.

13.2 Tulalip Tribes Hazard Profile

The Tulalip Reservation's location on the Puget Sound and west of the Cascade Mountains gives it a predominately marine-type climate. Summers are cool and relatively dry; winter brings heavy rainfall with measurable rainfall occurring between 150-190 days each year. Thunderstorms occur approximately 10 days each year.

Few showers happen during the summer months of July and August. December and January bring precipitation, frequently recorded on 25 days or more each month. During the wet season, rainfall is

usually of light to moderate intensity and continuous over a long period rather than occurring in heavy downpours. Wind velocities can be measured at 40 to 50 mph every winter, with rare gusts of 75 to 90 mph.

Severe weather hazards that may affect the Tulalip Tribes include:

- Severe weather (heavy rain, severe thunderstorms, hailstorms, snowstorms, and windstorms)
- Extreme heat
- Drought

Severe weather hazards include heavy rain, severe thunderstorms, hailstorms, snowstorms, and windstorms. Damaging windstorms may be associated with thunderstorms, strong cold fronts that may produce little rain, or winter storms.

Extreme heat causes the most weather-related deaths in the United States. Extreme heat nights increase the risk for health effects for humans and animals because high heat and humidity hamper the body's ability to cool down. Extreme heat can also result in power outages due to increased demand for air conditioning, damage to transportation and other infrastructure, increased water demand, agricultural crop and livestock losses, and increased risk of wildfire (Centers for Disease Control, 2017).

Extended dry periods can occur during the summer months. The risk of drought increases when winter precipitation is less than average or more precipitation falls as rain rather than snow, decreasing the amount of water held in snowpack. Extended droughts can cause water shortages for agriculture, ranching, domestic and industrial uses, recreational uses, and for native animals and plants.

13.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, severe weather events were ranked as the eighth worst-case scenario and the third most likely scenario.

Table 31 – Severe Weather Event Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	**Magnitude (1=lowest, 5=highest)**	**Frequency (1=lowest, 5=highest)**	**Onset (1=slowest, 5=fastest)**	**Duration (1=shortest, 5=longest)**	**Perceived Change in Risk**	**Average**	**Rank**
Worst-case Scenario							
2.8	3.8	3.9	3.1	3.1	1.0	0.9	8
Most Likely Scenario							
1.9	3.4	3.3	2.8	2.8	1.0	0.9	3

13.3 Past Events

NOAA has recorded a total of 151 weather events in the Snohomish County area, which have resulted in approximately $117 million in property damage and 50 deaths. Table 42 in Appendix H summarizes these events since 1950 while Table 41 covers the 13 severe weather events in Snohomish County that resulted in presidentially declared disaster declarations. Table 40 lists disaster declarations specific to the Tulalip Tribes.

13.4 Location

Severe weather events have the potential to affect the entire Tulalip Reservation. Tulalip citizens and community members living in low-lying areas next to streams, lakes, or shorelines are more susceptible to flooding. Wind events are most common and damaging. Maps in Figures 13 and 14 show the distribution of average weather conditions over the Tulalip Reservation. Because of limited transportation infrastructure severe weather events can block roads with downed trees. This can leave people isolated and without power. In cases of people with health conditions this can be a life-threatening situation.

13.5 Frequency

Predicting the frequency of severe weather events in a constantly changing climate is a difficult task. Looking at Tables 40 to 42 in Appendix H, it can be assumed that the Tribes can expect to experience exposure to and adverse impacts from some type of severe weather event (typically a windstorm) at least annually. The Tulalip Reservation is likely to be impacted by one major snowstorm every ten years.

13.6 Severity

The effects on the Tulalip Reservation from a strong thunderstorm, tornado, windstorm or winter storm are likely to be similar: fallen trees, downed power lines and interruption of transportation lifelines, and damaged homes and buildings. Weather-related fatalities are uncommon, but as shown in Table 42 can occur. The most common problems associated with severe storms are immobility and loss of utilities. Roads may become impassable due to flooding, ice or snow, landslides, or trees. Power lines may be downed due to high winds and other services, such as water or phone, may not be able to operate without power.

13.7 Warning Time

Meteorologists can often predict the likelihood of a severe storm. This can give several days of warning time. However, the exact time of onset or severity are not so easily predicted. Some storms may come on more quickly and more severely than initially estimated, only giving a few hours of warning time.

13.8 Cascading Impacts/Secondary Hazards

The most significant secondary hazards associated with severe local storms are floods, falling and downed trees, landslides, and downed power lines. Rapidly melting snow combined with heavy rain and stormwater from heavy rains can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails. Severe weather can also result in heat-related illnesses and other human health risks.

13.9 Potential Impacts from Future Climate Conditions

Climate change has increased the frequency, intensity and duration of severe weather events (National Oceanic and Atmospheric Administration, 2019a) and future scenarios indicate that this trend is likely to continue (National Oceanic and Atmospheric Administration, 2013).

Across the Pacific Northwest (i.e., Idaho, Oregon, Washington), average annual temperatures are projected to increase 1.5-3.5 °F by 2035, 2.5-4.5 °F by 2055 and 5.5-8.5 °F by 2085 based on high emissions scenarios (National Oceanic and Atmospheric Administration, 2013). While temperature increases are projected across the Pacific Northwest, they are generally less along coastal areas such as the Tulalip Reservation (National Oceanic and Atmospheric Administration, 2013). Additionally, droughts are projected to become more common in the Pacific Northwest due to a longer dry season, even though hydrologic models suggest that average annual precipitation will remain the same (Mumbaco, K. and Mote, P., 2010). These warmer and drier conditions are expected to increase the duration, frequency, and extent of fires when compared to previous years (Halofsky, J., Peterson, D., and Harvey, J., 2020).

13.10 Exposure

13.10.1 Population

A lack of data separating severe weather damage from flooding and landslide damage prevented a detailed analysis for exposure and vulnerability. It can be assumed that the entire Reservation is exposed to some extent to severe weather events. Certain areas are more exposed due to geographic location. Populations living in heavily wooded areas may be more susceptible to wind damage and utility loss, while populations living in low-lying areas are at an increased risk for flooding.

Vulnerability

Vulnerable populations include the elderly, low-income, or linguistically isolated populations, people with life-threatening illnesses, and Tulalip citizens and community members living in areas that are isolated from major roads. Power outages can be life-threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe weather events and could suffer more secondary effects of the hazard.

13.10.2 Property

According to GIS data from the Tribes, there are 7,936 buildings on the Reservation, most of which are residential. Some residential structures were built without the influence of a building code with provisions for wind or snow loads. All the buildings are exposed to the severe weather hazard, but structures in poor condition may risk the most damage. The frequency and degree of damage will depend on specific locations.

Vulnerability

All the buildings are vulnerable to the severe weather hazard, but structures in poor condition or in particularly vulnerable locations may risk the most damage. Those that are located under or near overhead lines or near large trees may be damaged in the event of a collapse. The frequency and degree of damage will depend on specific locations.

13.10.3 Critical Facilities

All critical facilities exposed to flooding, addressed in detail in Section 9, are also likely exposed to severe weather. Additional 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. Consequently phone, water, and sewer systems may not function. Roads, particularly in the interior of the Reservation, may become impassable.

Vulnerability

Those critical facilities and infrastructure vulnerable to flooding are also vulnerable to severe weather. Proximity to forested areas are vulnerable to falling trees.

13.10.4 Environment

Severe storm events can radically affect the physical environment, altering natural landscapes and temporarily or permanently altering ecosystems. Natural systems 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 mass earth movements. Flooding caused by severe weather can cause stream channel migration. Storm surges can erode beachfront bluffs and redistribute sediment loads. Prolonged droughts can degrade flora and can lead to long-term changes in ecosystems.

13.11 Development Trends

All current and future development will be affected by severe storms. The ability to withstand impacts lies in comprehensive land use practices and consistent enforcement of codes and regulations for new construction. The Tribes has adopted the International Code Council, Inc. (2014) *2012 International Building Code* (IBC) and International Fire Code (IFC) with Washington State Building Code Council amendments. This code is equipped to deal with the impacts of severe weather events. Tulalip Tribes (2020) Title 7 Land Use codes also address many of the secondary impacts (flood and landslide) of the severe weather hazard. The Planning Department works closely with the Building Official to ensure compliance with all tribal and building codes. Equipped with these tools, the Tribes is prepared to deal with future growth and the associated impacts of severe weather.

13.12 Issues

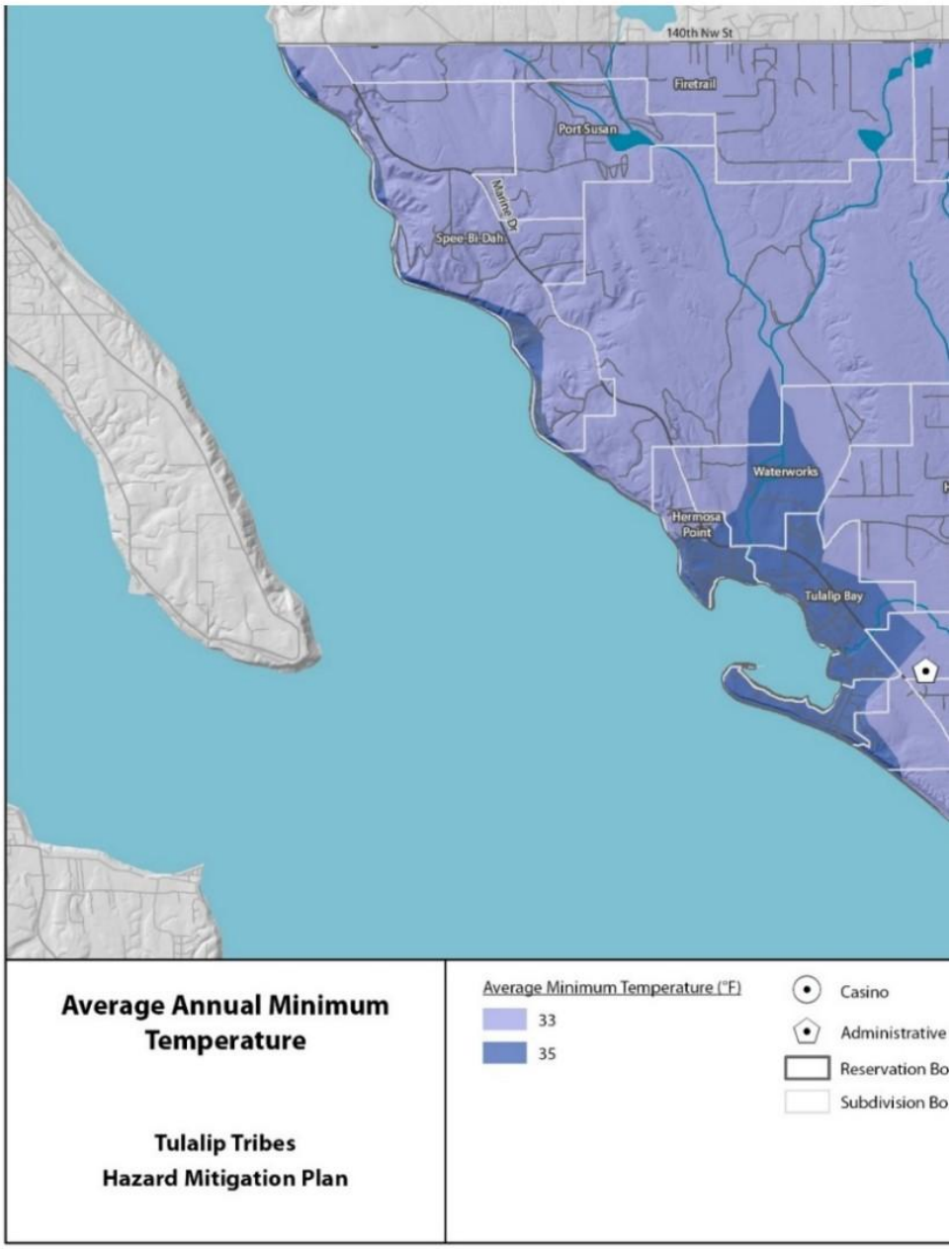
In general, every household and resident in the Reservation is likely to be exposed to severe weather, but some are more likely than others to experience isolation as a result. Those residing in the interior with limited transportation routes may have the greatest vulnerability to isolation from storms. Vulnerable populations are also at risk. Important issues associated with a severe weather in the Tulalip Tribes planning area include but are not limited to the following:

- The older building stock within the planning area is built to low or nonexistent building codes. These structures could be highly vulnerable to severe weather events such as windstorms.
- Redundancy of power supply.
- The capacity for backup power generation is limited.
- The Tribes' capacity to deal with snow and ice removal is limited and reliant on outside sources.

13.13 Hazard Maps

The hazard maps showing the average annual minimum and maximum temperatures on the Tulalip Reservation are Figures 13 to 14, starting on the next page.

Figure 13 – Tulalip Reservation Average Annual Minimum Temperature



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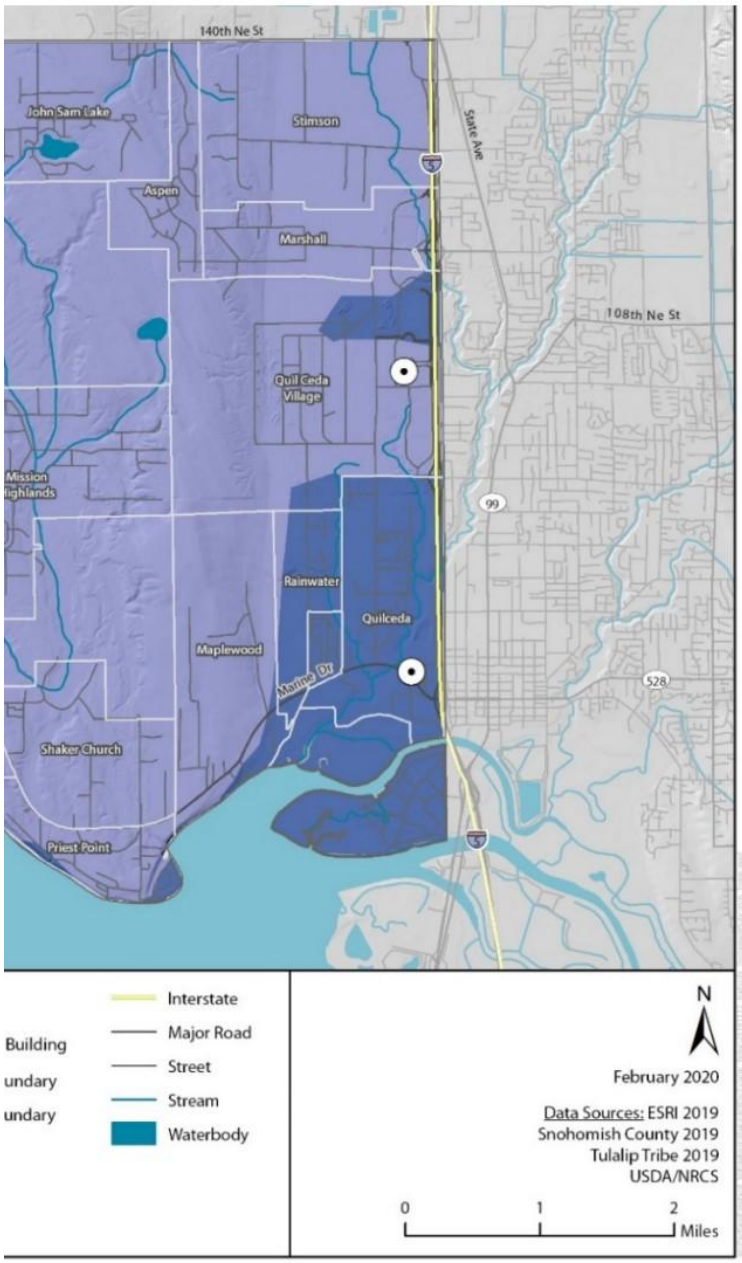
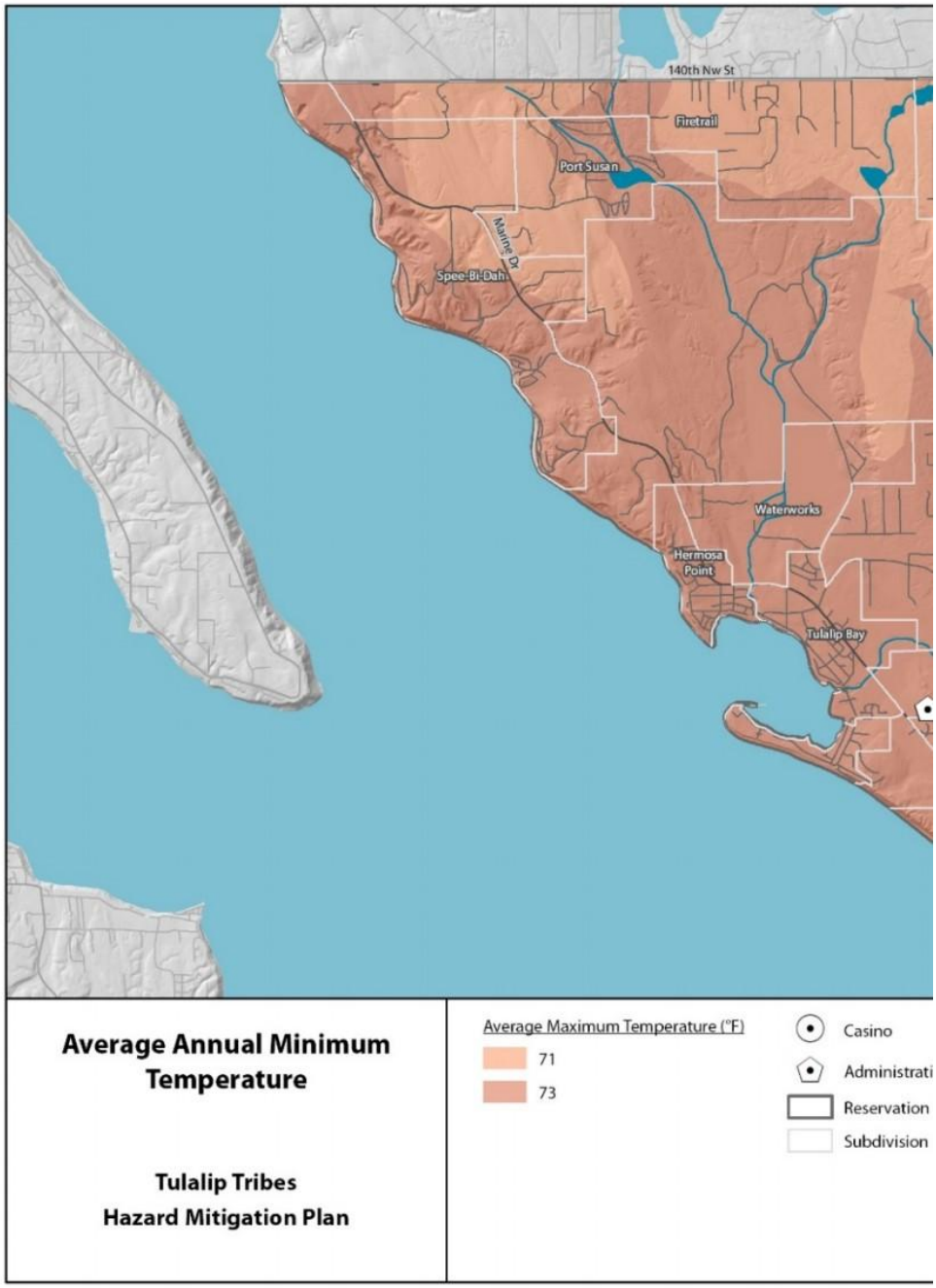


Figure 14 – Tulalip Reservation Average Annual Maximum Temperature



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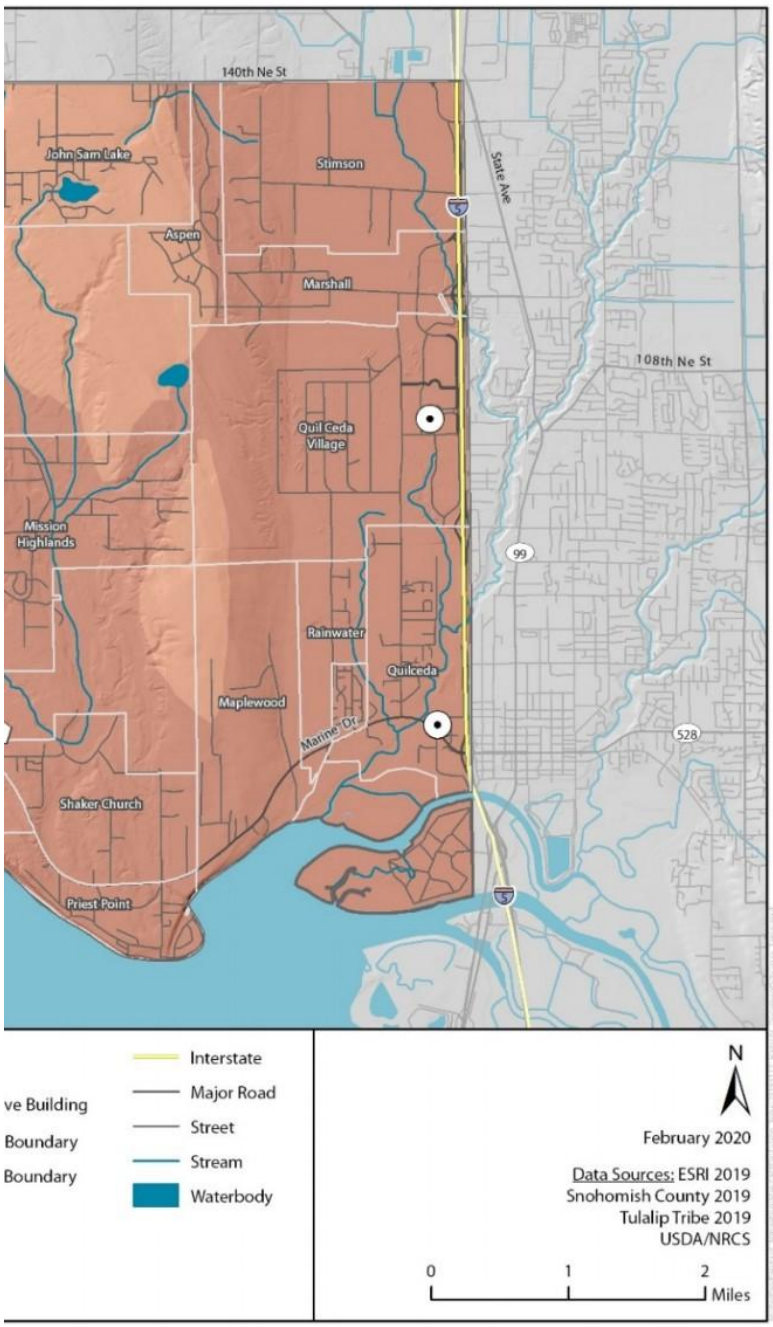


14 Wildfires

14.1 General Background

A reportable wildland fire is any fire involving vegetative fuels, including a prescribed fire that occurs in the wildland or urban-wildland interface areas. Natural fires are mainly caused by lightning. Many wildland fires are caused by human activity such as campfires, arson, and smoking. Wildfires can happen every month of the year; however, drought, snowpack, and local weather conditions such as high winds can expand the length of the fire season (Snohomish County, n.d.). How a fire behaves depends on the following:

- Fuel – Fuel Load plays a factor along with mixed fuel types (i.e. vegetative underbrush under the canopy). 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. Dead, dying, and diseased trees present a higher hazard (University of Washington, 2015).
- Weather – Strong, dry winds and relative humidity plays a large part in determining extreme fire conditions.
- Terrain – 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 (uphill vs. downhill). South facing slopes, box canyons, and saddles can intensify fire spread.

14.1.1 Potential Damage from Wildfire

Fire hazards present a sizable risk to vegetation and wildlife habitats. Wildfires can cause short-term destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term impacts include destruction of cultural and economic resources and community infrastructure, reduced access to affected cultural areas, and smaller timber harvests. Susceptibility to flooding and erosion increases through damage of watersheds. The potential for damage to life and property exists in areas designated as wildland-urban interface (WUI)

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.

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 area involved becomes so hot that all combustible materials ignite, even if they are not exposed to direct flame. Temperatures may exceed 1,000°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. Although firestorms seldom spread, once started, there is no known way of stopping them.

Wildland Urban Interface Area – An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

Wildfire – Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Because of their distance from firefighting resources, they can be difficult to contain and cause a great deal of destruction.

areas, where development is adjacent or among lands prone to wildland fire (University of Washington, 2015).

14.2 Tulalip Tribes Hazard Profile

The wildland fire season in the Tulalip Reservation usually begins in May and ends in the fall with rain in September or October. However, fires have occurred in every month of the year in nearby Snohomish County. Drought, depth of snowpack, and local weather conditions can expand the length of the fire season.

The majority wildland fires are human-caused and are ignited by arson, out of control recreational fires, lit cigarettes, debris burning, and children playing with fire. Map Figure 17 indicates the volume and locations of human-caused and lightning-caused wildfires from 1970-2019. Each year, human-caused fires damage on average more than 4,000 acres of state-protected lands in Washington (Snohomish County, n.d.).

Wildland fire is a normal part of most forest and range ecosystems in the temperate regions of the world. On the Reservation, warm winds from the east during drought conditions create threatening conditions. These winds, sometimes referred to as synoptic winds, reduce humidity, dry out fuel, and can be sustained and move with great speed. Synoptic winds are associated with some of the Pacific Northwest's most catastrophic wildfires (Snohomish County, n.d.).

14.2.1 Hazard Ranking

The Steering Committee completed a hazard ranking survey during the Tulalip Tribes 2021 HMP update process for a range of hazard-related factors based on worst case and most likely scenarios; definitions of the hazard ranking factors may be found in Table 39 in Appendix H. The results of the survey were averaged together for each factor to generate a total average score and rank, enabling the prioritization of hazards by type. When compared against the other hazards included in the 2020 hazard ranking survey, wildfires were ranked as the second worst-case scenario and the fourth most likely scenario.

Table 32 – Wildfire Hazard Ranking Output

Hazard Ranking Output							
Severity (1=lowest, 5=highest)	**Magnitude (1=lowest, 5=highest)**	**Frequency (1=lowest, 5=highest)**	**Onset (1=slowest, 5=fastest)**	**Duration (1=shortest, 5=longest)**	**Perceived Change in Risk**	**Average**	**Rank**
Worst-case Scenario							
4.1	4.2	3.1	4.4	4.3	1.0	4.03	2
Most Likely Scenario							
2.2	2.0	2.8	3.6	3.4	1.0	2.79	4

14.2.2 Past Events

Washington Department of Natural Resources (DNR) began tracking wildland fires in 1970. There have been 37 wildfires recorded on the Tulalip Reservation from 1970 to March 2020. The fires were all small and there is no data available regarding property or infrastructure damage (Washington Department of Natural Resource, 2019).

Snohomish County to the east of the Reservation has seen only six wildland fires of more than 100 acres during the last 49 years (Washington Department of Natural Resource, 2019). There is no record of any large wildland fire (greater than 1,500 acres) in the county since 1900. DNR has records of 977 wildland fire starts.

There is one wildfire event in the NOAA Storm Events Database for Snohomish County. A wildfire started in the Central Cascades and burned 848 acres across Snohomish and King Counties from September 4-15, 2017. It cost $4.5 million to suppress the fire (National Oceanic and Atmospheric Administration, 2020). There are no FEMA disaster declarations relating to wildfires.

14.2.3 Location

Analyzing past incidents, most wildfires occur in the heavily forested areas and undeveloped lands near the bluffs in the northwest part of the Reservation. Many wildfires have also occurred in the undeveloped and heavily forested lands of the interior, particularly in the areas around Marine Drive (Buffett, 2010). The map in Figure 16 shows wildland urban interface areas (WUIAs) for the Reservation as defined by DNR.

14.2.4 Frequency

Wildland fires will continue to happen naturally and by human activities. The Tulalip Reservation can expect at least one wildfire every year. These will typically be small and will cause little to no damage. However, the potential does exist for a larger fire to develop that results in significant damage to structures and natural resources, especially timber.

14.2.5 Severity

Past events indicate that wildfires would not be severe on the Tulalip Reservation. In a worst-case scenario, a wildfire spread by heavy winds may damage residential structures and developments, particularly those located in the dense and heavily forested areas of the interior. There are isolated areas with limited ingress and egress options, increasing the possibility for loss of life. Potential losses from wildland fire include human life, structures, and natural resources.

Smoke and air pollution from fires can be a health hazard, especially for vulnerable populations including children, the elderly, and those with respiratory and cardiovascular diseases. Wildland fire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. In addition, wildland fire can lead to ancillary impacts, such as landslides in steep ravine areas and flooding due to the impacts of silt in the local watersheds.

14.2.6 Warning Time

Wildland fires are typically caused by humans, so there is no way to predict when one might break out. Severe weather if often predicted, so special attention can be paid during weather events that may trigger wildland fires, such as dry lightning. If a fire does break out and spreads rapidly, Tulalip citizens and community members may need to evacuate within minutes. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

Dry seasons and droughts are factors that greatly increase fire likelihood. Once a fire has started, fire alerting is rapid in most cases. The spread of cellular and two-way radio communications has further contributed to a significant improvement in warning time.

The National Weather Service (NWS) can issue a fire weather watch when the potential for severe fire weather is forecasted. In addition, the NWS can issue a forecast warning called a red flag warning. This warning indicates that conditions are ideal for wildland fire combustion and rapid spread due to warm temperatures, low humidity, and stronger winds. Firefighters and other emergency officials track these forecasts and watches to prepare for potential wildfires.

14.3 Cascading Impacts/Secondary Hazards

Wildland fires can cause a range of secondary effects, which in some cases may be more widespread and have prolonged damage than the fire itself. Fires can cause economic losses in the reduction of harvestable timber and reduced tourism.

Wildland fires can cause the contamination of reservoirs and drinking water, destroy transmission lines, and contribute to flooding. Fires strip slopes of vegetation, exposing them to greater amounts of rain and runoff. This can weaken soils and cause failures on slopes. Major landslides can occur several years after a fire. Most wildland fires burn hot and for long durations that can bake soils, especially those high in clay content, increasing the imperviousness to the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding (University of Washington, 2015).

14.4 Potential Impacts from Future Climate Conditions

Fire in western ecosystems is determined by climate variability, local topography, and human intervention. Future climate conditions have the potential to affect multiple elements of the wildland fire system: fire behavior, ignitions, fire management, and vegetation fuels. The National Oceanographic and Atmospheric Administration (NOAA) National Center for Environmental Information climate summary on Washington State reported a mean annual temperature increase of approximately 1.5°F in the last twenty years (Frankson, et al., 2017). Winters since 1990 have had far less extremely cold temperature records.

The NOAA National Center for Environmental Information predicts unprecedented warming by the end of the 21st century, which will have a significant impact on wildland fire risks. As average mean temperatures increase and there are less extreme cold days the mountain range snow lines will recede to higher elevations and more precipitation will fall as rain instead of snow. Warmer temperatures will also mean earlier snow melt in the spring. The result of less snow and earlier runoff will be longer drier summer periods. Higher temperatures increase ground evaporation, with drier summers this causes vegetation to dry even more adding fuel for wildland fires. The Tulalip Public Works Department has observed that understory growth in the forest is lush by spring, creating a greater fire threat in summer when it dries out (Tulalip Tribes Natural Resources Department, n.d.a.). Stronger winds may spread fires, threatening WUIAs. Future droughts may further increase the frequency and severity of wildland fires.

14.5 Exposure

14.5.1 Population

Past events indicate that most fires occur in uninhabited areas. Additionally, many of the lands where these wildfires occur are in Tribal Trust Lands and are used primarily for forestry or are maintained as Conservation lands. There are approximately 823 people that live in an area exposed to at least a medium wildfire risk.

Vulnerability

Smoke and air pollution from surrounding wildfires can be a health hazard to Tulalip citizens and community members, especially for sensitive populations such as children, those above the age of 65, and persons with respiratory and cardiovascular disease. Public health impacts associated with wildfires include difficulty breathing and reduction in visibility. There are approximately 1,736 people on the Reservation over the age of 65 (United States Census Bureau, 2018).

14.5.2 Property

Property damage from wildland fires can be severe and can significantly alter entire communities. Since 1970, the earliest year for which the Department of Natural Resources (DNR) records are available, there have been 37 wildfires recorded on the Tulalip Reservation. These fires were all small and it is not known whether these fires caused any damage to property or infrastructure.

Table 33 displays the number of buildings exposed to the various wildfire hazard zones and their values within the planning area. Table 34 indicates the number of buildings located in the wildland urban interface. It is interesting to note that eight percent of properties within the reservation are located on lands with at least moderate exposure to wildland fires while 65 percent of properties are in the wildland urban interface.

Table 33 – Property Exposed to Moderate Wildfires

Value of Property Exposed to At Least Moderate Wildland Fire Hazards				
Buildings Exposed	**Percent of Buildings Exposed**	**Assessed Value**		
		Structure	**Contents**	**Total**
642	8%	$ 65,164,947	$32,735,294	$97,900,241

Table 34 – Value of Property Located in the Wildland Urban Interface

Value of Property Located in the Wildland Urban Interface				
Number of Buildings Exposed	**Percent of Buildings Exposed**	**Assessed Value**		
		Structure	**Contents**	**Total**
5,172	65%	$3338,708,535	$171,399,299	$510,107,764

14.5.3 Critical Facilities

Critical facilities and infrastructure for the Tulalip Reservation include police and fire stations, schools, and all tribal buildings including government buildings and housing. There are five facilities exposed to the wildland fire hazard. Table 35 identifies the facilities.

Table 35 – Critical Facilities Exposed to Moderate to Extreme Wildfires

Critical Facilities Exposed to Wildland Fire Hazards (Moderate to Extreme)	
Tulalip Shores Water System	1
Port Susan Camp Club 3 Water System	1
Sunny Shores Community Club Water System	1
Vista Glen Water System	1
The Home Depot Store 4726 (Tier II HAZMAT)	1
Total	**5**

Vulnerability

There would likely be little damage to the majority of infrastructure. Most roads would be without damage in normal scenarios. Power lines are vulnerable due to the poles being made from wood. Bridges are usually not directly impacted; however, wildland fires can create conditions in which bridges are obstructed.

14.5.4 Environment

Wildland fires can cause severe environmental impacts (University of Washington, 2015):

- **Damaged Fisheries** – Critical trout, salmon, and steelhead fisheries in the Pacific Northwest can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Soil Erosion** – The protective covering provided by foliage and dead organic matter is removed, leaving the soil 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.
- **Destroyed Endangered Species Habitat** – Catastrophic fires can have devastating consequences for endangered species.
- **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.

14.6 Development Trends

The Tulalip Tribes have a Planning Department that asserts tribal authority over the Reservation. This authority includes land use, preparing, updating, and implementing long-range plans, and supporting the functions of the Tulalip Planning Commission. The Planning Department prepares, updates, and implements land use plans, development regulations, and maps. This includes the Tulalip Tribes (2020) Comprehensive Plan Land Use codes (Title 7). Any development occurring or to occur in WUIAs can be managed with robust land use and building codes, which are addressed in the Tulalip Tribes (2020) Title 7 Land Use code.

Effective enforcement of land use and building codes is necessary to minimize risk to wildland fire hazards. The Planning Department works closely with the Building Official, Police Department, and Tax and Licensing Department to ensure compliance with Tribal Codes and permit conditions. The Tulalip Tribes took a major step to address the increasing risk of wildfires due to climate change. In December 2018, the Tulalip Tribes partnered with the Climate Impacts Group, Northwest Climate Adaption Science Center, and the Puget Sound Climate Preparedness Collaborative and participated in a workshop on *Managing Western Washington Wildfire Risk in a Changing Climate* (Morgan, Bagley, McGill, & Raymond, 2019).

14.7 Issues

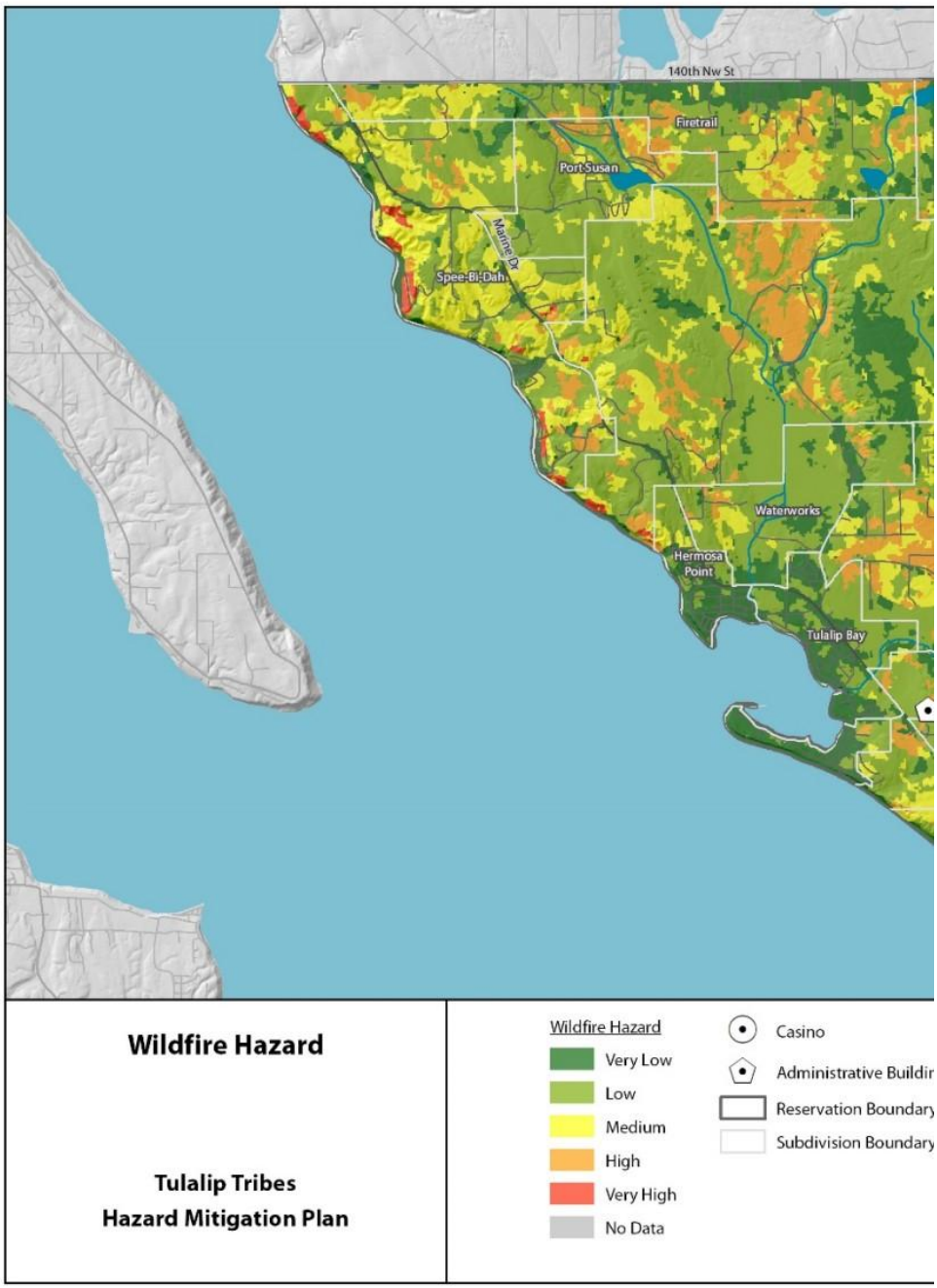
The major issues of for wildland fire are the following:

- Critical facilities or other buildings with wood-frame structures and combustible roofing materials in wildland urban interface areas
- The perception of large wildland fires as a relative low risk because a major event has not occurred within the planning area
- Lack of fire hydrants and other water sources in the Tulalip Reservation
- A general lack of knowledge of fire safety practices and evacuation routes
- A lack of cohesive countywide fire response and training for fire districts that do not actively fight wildland fires

14.8 Hazard Maps

The hazard maps showing the wildfire hazard area, WUI, and wildfire ignitions are Figures 15 to 17, starting on the next page.

Figure 15 – Tulalip Tribes Wildfire Hazard



Tulalip Tribe 2021 Hazard Mitiga

Risk Assessment – Wildfires

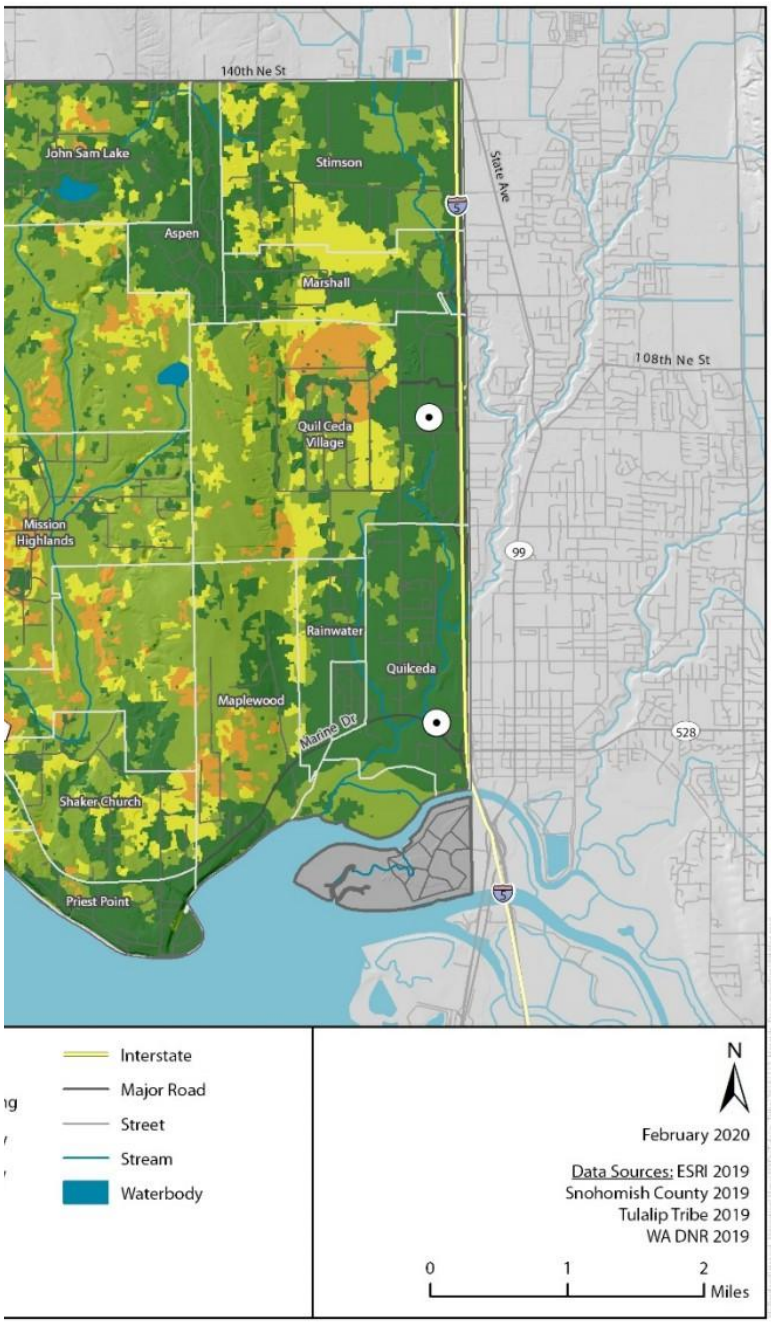
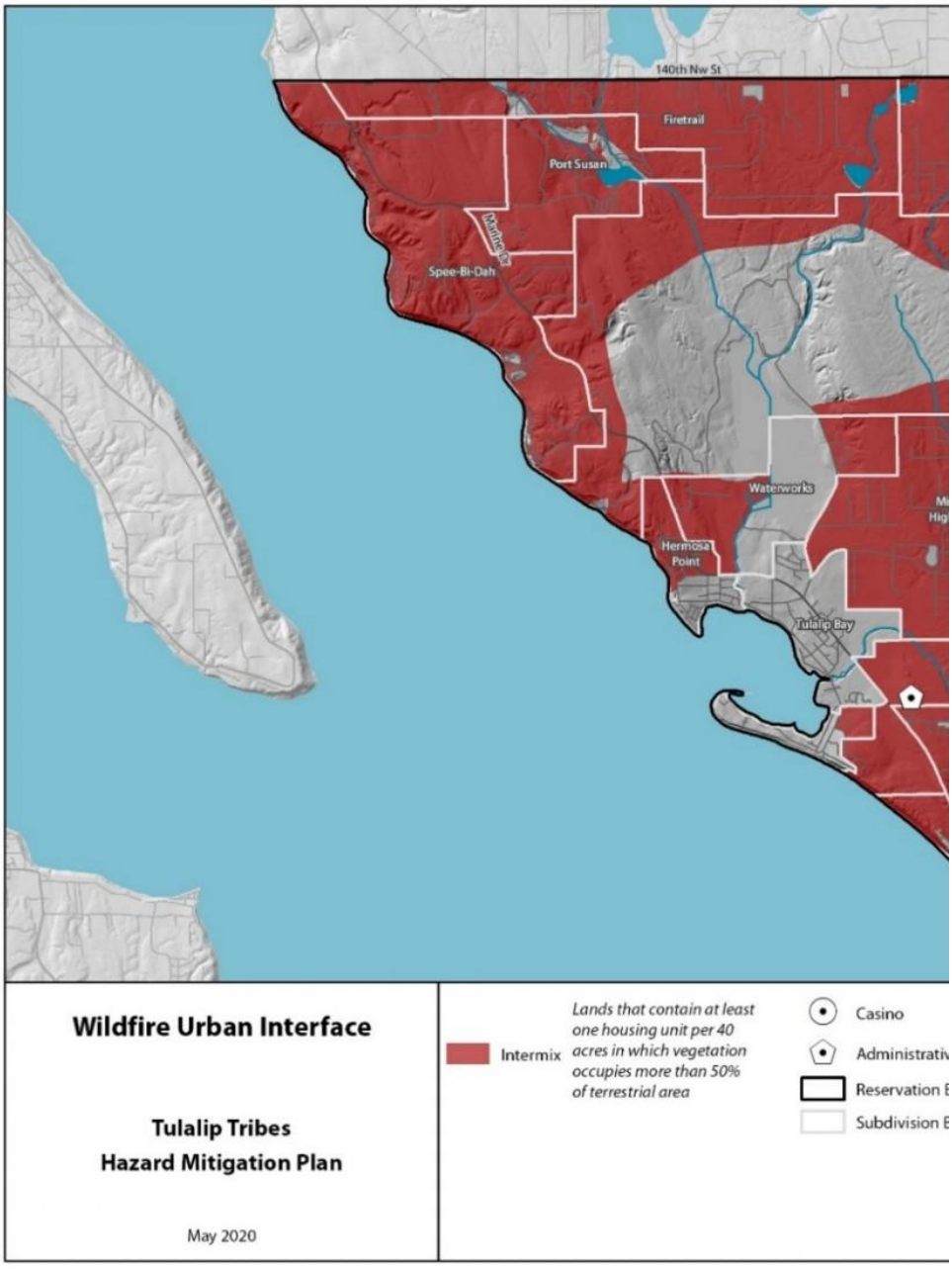


Figure 16 – Tulalip Tribes Wildland Urban Interface



Risk Assessment – Wildfires

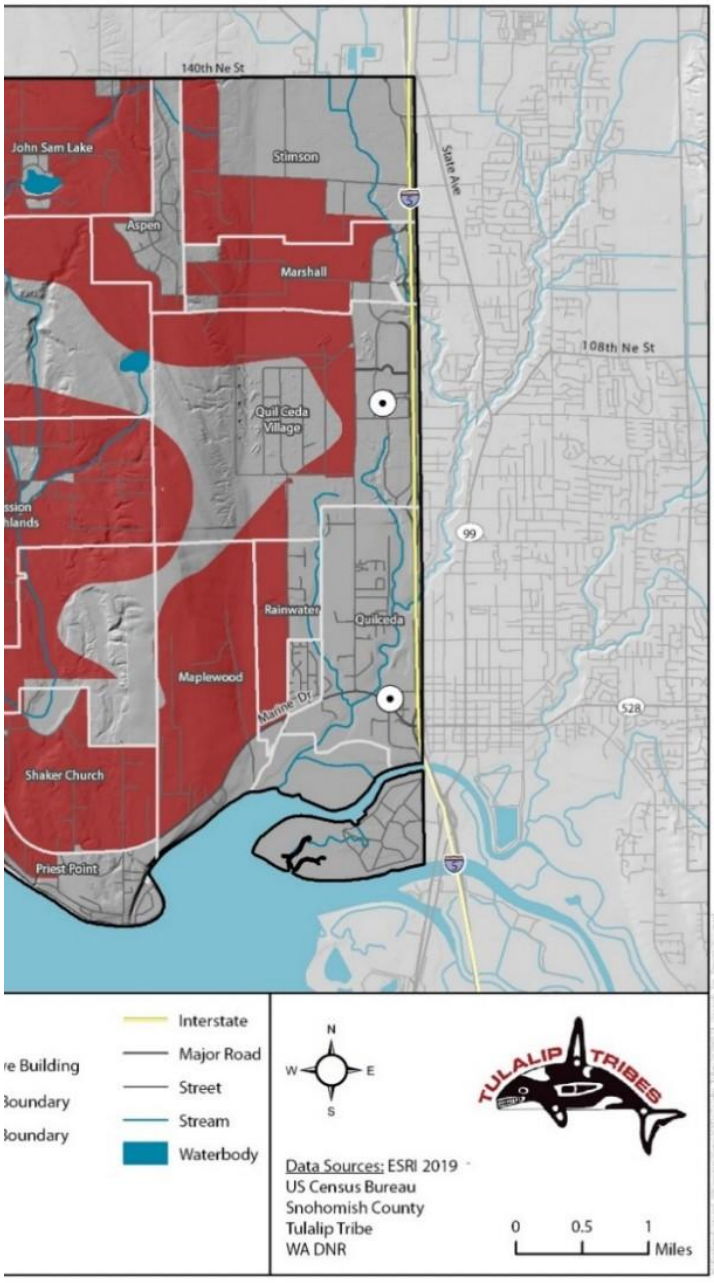
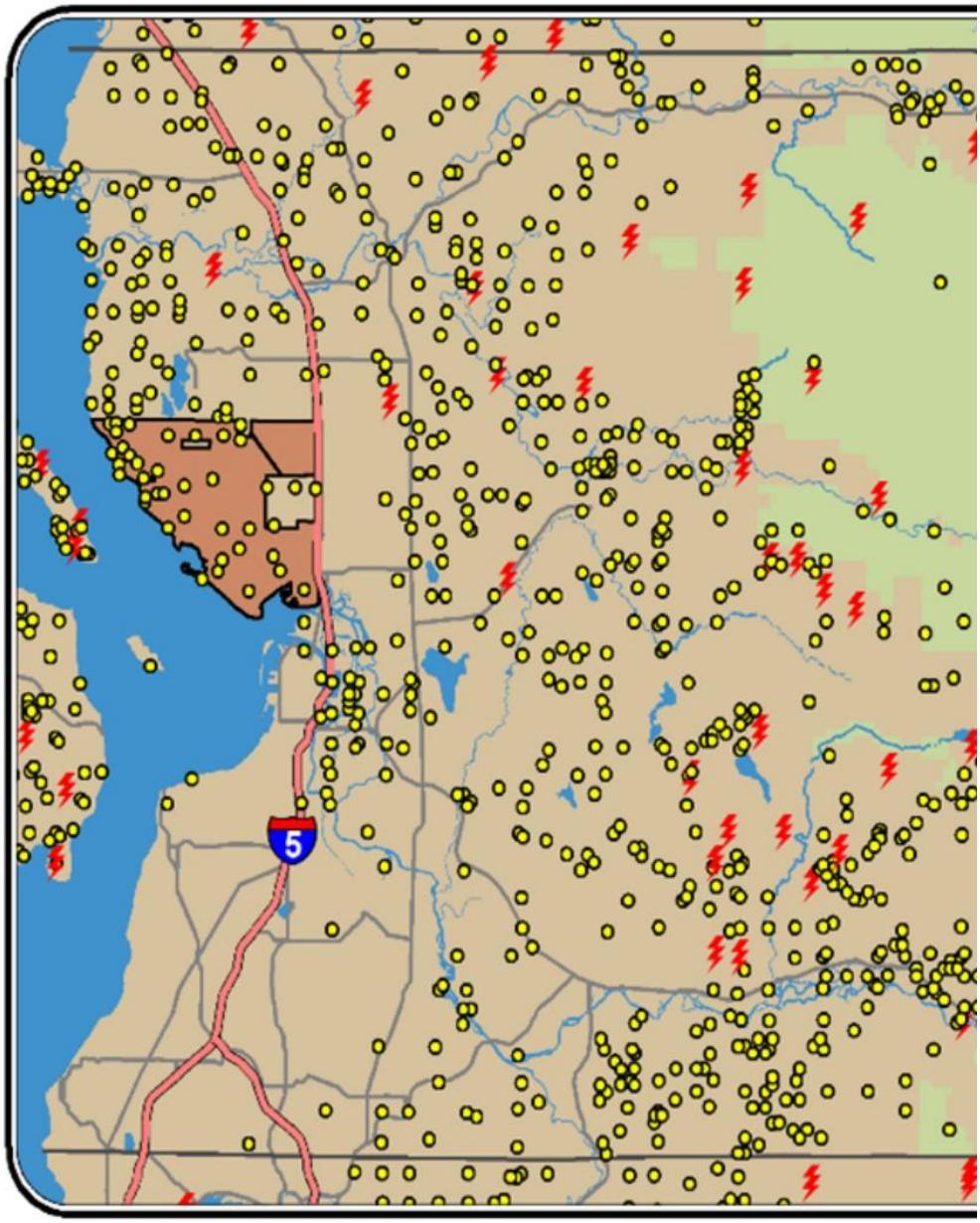
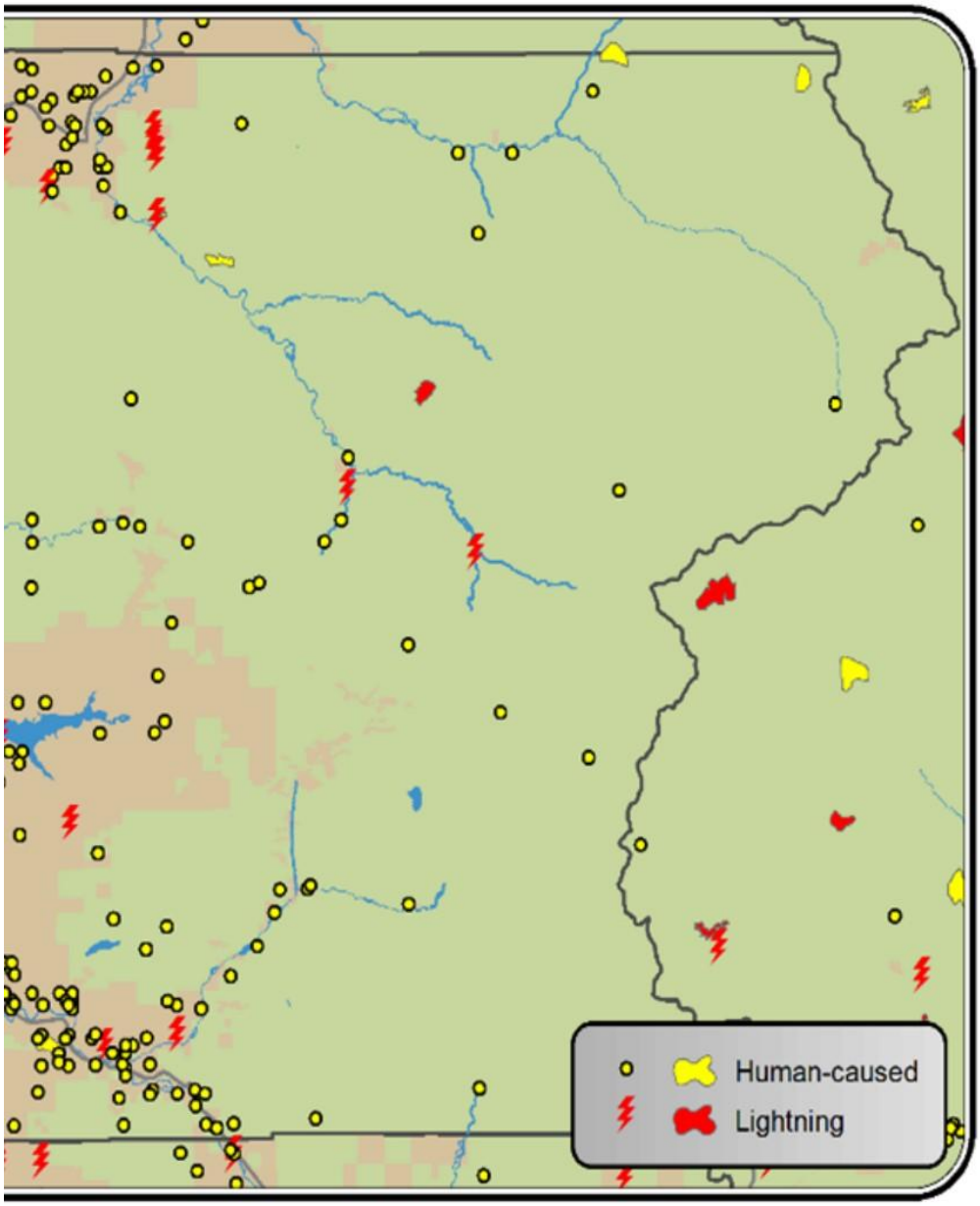


Figure 17 - Wildfire Ignitions for Tulalip Tribes and Snohomish County (Washingt



Risk Assessment – Wildfires

on Department of Natural Resources, 2020)



Tulalip Tribes 2021 Hazard Mitigation Plan

Part 3: Mitigation Strategy

15 Mitigation Strategy

15.1 Tulalip Tribes 2020 Hazard Mitigation Goals

Below are the four goals that have been adopted by the Tulalip Tribes 2020 Steering Committee. Achievement of these goals defines the effectiveness of a mitigation strategy. The goals are used to help establish mitigation strategy priorities.

1. Protect people, property and the natural environment.

2. Ensure continuity of critical economic and public facilities and infrastructure by building redundancy, resiliency, and strong partnerships.

3. Promote and strengthen resiliency to protect Tribal sovereignty and identity.

4. Increase public awareness of all hazards, preparedness, and involvement in hazards planning.

44 CFR Section 201.6(c)(3)(i)

States that hazard mitigation plans (HMPs) shall describe mitigation goals to reduce or avoid long-term vulnerabilities to identified hazards. The Steering Committee reviewed and established a set of four goals and 16 measurable objectives for this plan based on data from the preliminary risk assessment and the results of public outreach. The goals and objectives informed plan development, mitigation strategy identification, and prioritization, and are mutually reinforcing.

15.1.1 Actions

The following table includes hazard mitigation actions for Tulalip Tribes as informed by the risk and capability assessments, including prioritization for implementation and funding mechanisms.

Table 36 – Tulalip Tribes Mitigation Actions

ID	Name + Description	Action Status (New, Existing, Complete)	Goals Supported	Hazards Addressed
1	Identify most vulnerable infrastructure, homes, roads next to urban forest interface. Remove invasive species, thin, clear, areas in urban forest interface areas and replant fire resistant trees or non-fuel fire ignition prone native vegetation/shrubs to keep invasive from growing back. Natural Systems Protection	New	1	Wildfire
2	An emphasis on upgrading stormwater facilities. Plans and Regulations, Infrastructure/Capital Projects, Natural Systems Protection, Education	New	2	Flood, Level Severe Weathe Event
3	Develop interior road/evacuation route from Turk Dr to 91st St NE in QCV. Infrastructure/Capital Projects	New	1	Flood, Earthqu Mass Movem Wildfire
4	Build or connect an additional route in/out of the John Sam Lake neighborhoods. Or an early warning system to alert Tulalip citizens and community members to evacuate in a timely manner. Plans and Regulations, Infrastructure/Capital Projects, Natural Systems Protection	New	3	Earthqu Wildfire

٢t 3 – Mitigation Strategy

	Lead Entity	Support Entity	Implementation Timeline + Anticipated Cost + Funding Source	STAPLEE + Mitigation Effectiveness Score	Priority: High, Med, Low
٤	Tribal Government	Federal Government, State Government, County Government, Local Government	1-3 years 5k per acre treated Unknown	27	Med
Sea Rise, ٤r	Tribal Government	Federal Government, State Government, County Government, Local Government	Immediate Variable, approx. $500,000 Unknown	42	High
ıake, Earth ıent, ٤	Tribal Government	Federal Government, State Government, County Government, Local Government	1-3 years Approximately $1,000,000 Unknown	17	Low
ıake, ٤	County Government, Local Government, Tribal Government	Federal Government, State Government	More than 5 years $150,000+ Unknown	38	High

ID	Name + Description	Action Status (New, Existing, Complete)	Goals Supported	Hazards Addressed
5	Retrofit and reinforce Tribal owned and operated facilities to bring up to current earthquake code. Infrastructure/Capital Projects	New	1	Earthqu
6	Increase power supply independence and/or redundancy on the reservation to avoid power outage through plans and regulations, infrastructure/capital Projects, natural systems protection.	New	All	Flood, Level Epidem Severe Weathe Event, fire
7	Encourage surrounding Fire Districts to have 'brush truck' or necessary resources to aid in response efforts. Review (update) DNR response times. Plans and Regulation, Infrastructure/Capital Projects, Natural Systems Projection, Education and Awareness.	New	1	Wildfire
8	Replace old water lines.	New	1	Wildfire
9	Assure that the public is informed of the necessity of maintaining a 7-day supply of food and water, along with basic first aid and medical supplies. Provide Community Emergency Response Training (CERT)	Existing, continuous effort needed	1,3,4	All

	Lead Entity	Support Entity	Implementation Timeline + Anticipated Cost + Funding Source	STAPLEE + Mitigation Effectiveness Score	Priority: High, Med, Low
uake	Federal Gov-ernment	State Government, County Government, Local Government, Tribal Government	1-3 years $100,000 per building Unknown	17	Low
Sea Rise, ic, er Wild-	Tribal Government	Federal Government, State Government, County Government, Local Government	3-5 years Unknown Cost Grant Funding	20	Med
e	Tribal Government	Federal Government, State Government, County Government, Local Government	3-5 years $450,000 for three brush trucks Grant Funding	25	Med
e	Public Works	Utilities	5+ years >$1,000,000 Grant Funding	26	Med
	Emergency Management		Current, Ongoing $25,000/year	17	Low

ID	Name + Description	Action Status (New, Existing, Complete)	Goals Supported	Hazards Addressed
10	Create a community wide comprehensive education program to educate the public and private enterprise about hazards and hazard mitigation. Expand to include climate considerations	Existing	3,4	All
11	Identify critical community facilities and infrastructure that are without back up power generators to build energy grid resilience, laying groundwork for solar and batteries.	Existing, Ongoing (continue to update)	2	All
12	Develop a local Hazard Mitigation Plan and Continuity of Operations Plan for Quil Ceda Village.	Existing	1,2, 3, 4	All
13	Institute low impact development regulations for new developments as well as redevelopment projects. Policy to keep developers honest. Integrate climate considerations	Existing, Ongoing (continue to update)	1, 2, 3, 4	All
14	Implement higher regulatory standards for hazard prone and environmentally sensitive areas using best available science.	Existing, Ongoing	1, 2	All

	Lead Entity	Support Entity	Implementation Timeline + Anticipated Cost + Funding Source	STAPLEE + Mitigation Effectiveness Score	Priority: High, Med, Low
	Planning Department	Emergency Management; Tribal and/or federal gov.	1-3 years $25,000	17	Low
	Facilities and Implementation	Emergency Management	5+ years	15	Low
	Emergency Management		1-3 years $250,000		High
	Planning	Climate Adaptation	5 years		Low
	Planning	Natural Resources	Near term		Low

ID	Name + Description	Action Status (New, Existing, Complete)	Goals Supported	Hazards Addressed
16	Buy-out of landslide, flood and tsunami prone properties at Priest Point, and other coastal locations. Canceled leases at Mission Beach and bought out homes—do the same at Tulalip Bay Desire to differentiate tidal flooding and localized (inland) flooding due to precipitation Emphasize Quil Ceda Creek, which has already been identified as at flood risk due to sea level rise and storm surge Develop an implementation strategy.	Existing	1, 2, 3, 4	All
17	Have Tulalip become a TsunamiReady community. Integrate sea level rise	Existing	All	Tsunam Sea Rise
18	Utilize Geographic Information Systems (GIS) in existing and ongoing decision-making processes.	Existing	All	All
19	Create and maintain partnerships with all entities that impact the Tulalip Tribes to ensure that critical facilities and infrastructure are retrofitted or built to standards that make them less vulnerable in a hazard event. waterlines, sewer lines are very old in some places. Integrate climate considerations.	Existing, needs more funding	2	All

	Lead Entity	Support Entity	Implementation Timeline + Anticipated Cost + Funding Source	STAPLEE + Mitigation Effectiveness Score	Priority: High, Med, Low
	Tulalip Realty	Planning; Natural Resources	>$1,000,000 5+ Years	16	Low
ıi; Level	Emergency Management	Climate Adaptation	5 years $50,000	17	Low
	Tulalip Data Services	Planning	Current, ongoing $25,000	15	Low
	Tulalip Public Works	Local and Snohomish County governments	Current, ongoing $50,000	30	Med

ID	Name + Description	Action Status (New, Existing, Complete)	Goals Supported	Hazards Addressed
20	Improve\expand storm water drainage, dams, detention and retention system capabilities. Fisheries/Hatcheries building disaster ready. Incorporate climate considerations	Existing	1	flood
21	Have Tulalip become a Firewise community.	Existing	1,2,3	Wildfire
22	Have Tulalip become a StormReady community.	Existing	1,2,3	Severe Weathe
23	Assessments and mapping of critical facilities and infrastructure update	Existing, ongoing	1,2,3, 4	All
24	Promote use of new technology in hazard mitigation and emergency preparedness.	Existing	1,2,3, 4	All

	Lead Entity	Support Entity	Implementation Timeline + Anticipated Cost + Funding Source	STAPLEE + Mitigation Effectiveness Score	Priority: High, Med, Low
	Public Works	Natural Resources	Current, Ongoing >$1,000,000	17	Low
e	Emergency Management	Climate Adaptation; Planning	1-3 years $50,000	15	Low
er	Emergency Management	Climate Adaptation; Planning	1-3 years $50,000	15	Low
	Tulalip Data Services	Tribal Government	Current, ongoing $25,000	14	Low
	Emergency Management	Tribal Government	1-3 years $25,000	16	Low

Par

ID	Name + Description	Action Status (New, Existing, Complete)	Goals Supported	Hazards Addressed
25	Seismically retrofit and install back-up generators for the Tribal Center, Kenny Moses Building and the Quil Ceda Casino. Add: Elders Village, New Police Station, Gym	Complete	1, 2	Earthqu
26	Relocate homes located on the bluff at Hermosa Point. This may be a land swap conversation that will be important but difficult between family Tribal Government Some homes removed, but there is a need for demo money for leased homes along Tulalip Bay. Keep and consider sea level rise due to more intense storm effects on structures	Existing	1, 4	Sea Rise; S Weathe
27	Join the National Flood Insurance Program (NFIP).	Ongoing	1,2,3, 4	All
29	Develop climate change goals and policies	Complete	1,3,4	Flood, Level Severe Weathe

	Lead Entity	Support Entity	Implementation Timeline + Anticipated Cost + Funding Source	STAPLEE + Mitigation Effectiveness Score	Priority: High, Med, Low
uake	Public Works	Emergency Management	Complete	40	High
Level evere er	Tulalip Realty	Planning and Natural Resources	5+ years >$1,000,000	32	Med
	Planning	Tribal Government; Local government	Ongoing, current	19	Low
Sea Rise, er	Planning		Complete	34	High

15.2 Action Plan

All actions listed above include an action plan of prioritized initiatives to mitigate natural hazards. Tribal members were asked to weigh the estimated benefits against the estimated costs of a project to establish a parameter to be used in prioritization. This benefit-cost review was qualitative and did not include the level of detail required under certain FEMA grant programs. This qualitative approach was used because projects may not be implemented for up to 10 years, and the associated costs and benefits could change dramatically in that time. Each project was assessed by estimating the total cost of the initiative and assigning subjective ratings (high, medium, and low) to benefits as follows:

44 CFR Section 201.7(c)(3)(iii)

Requires a description of how the actions will be prioritized, implemented, and administered by the Tribal Government.

15.2.1 Cost

Participants were given a dollar range to choose from to estimate the cost of the proposed initiative:

- < $50,000
- < $100,000
- < $500,000
- < $100,000,000
- > $100,000,000

For many of the initiatives identified, the Tulalip Tribes may seek financial assistance under FEMA's hazard mitigation grant programs, including:

- Hazard Mitigation Grant Program
- Pre-Disaster Mitigation grant program
- Flood Mitigation Assistance grant program
- Repetitive Flood Claims grant program
- Emergency Management Performance Grant program
- Severe Repetitive Loss grant program

15.2.2 Benefit

Each action was self-evaluated using STAPLEE and Mitigation Effectiveness criteria, as described in Tables 37 and 38. Evaluators were asked to rate each STAPLEE and Mitigation Effectiveness criteria to come up with a total score that determined the relative suitability of each action.

Table 37 – STAPLEE Criteria

STAPLEE Criteria	Evaluation Rating
S: Is it Socially acceptable?	Strongly Agree = 5 Agree = 4 Neutral = 3 Disagree = 2 Strongly Disagree = 1
T: Is it Technically feasible and potentially successful?	
A: Does the responsible city agency/department have the Administrative capacity to execute this action?	
P: Is it Politically acceptable?	
L: Is there Legal authority to implement?	
E: Is it Economically beneficial?	
E: Will the project have a positive impact on the natural environment?	
Will historic structures or key cultural resources be saved or protected?	
Could it be implemented quickly?	

Table 38 – Mitigation Effectiveness Criteria

Mitigation Effectiveness Criteria	Evaluation Rating
Will the implemented action result in lives saved?	Strongly Agree = 5 Agree = 4 Neutral = 3 Disagree = 2 Strongly Disagree = 1
Could it be implemented quickly?	

The actions were ranked as a low benefit if the score was between 0 and 17; a medium benefit if the score was between 18 and 35; a high benefit if the score was 36 to 55. STAPLEE scores can range from a low of 9 to a high of 45. Mitigation effectiveness scores can run from a low of 2 to a high of 10. When these scores are combined, mitigation actions can score within a range of 11 to 55 points.

Most of these programs will require detailed benefit-cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA model process. The partners are committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the partners reserve the right to define benefits according to parameters that meet their needs and the goals and objectives of this plan.

15.2.3 Benefit-Cost Review

FEMA requires a formal Benefit-Cost Analysis (BCA) when applying for grants to fund hazard mitigation actions. In addition to the above high-level BCA to support action prioritization, WSP developed and provided BCA training to assist the Tribe in understanding the use and application of FEMA's benefit-cost analysis tool (BCAR). This training included:

- Best practices
- Process map
- Overview of structures and frameworks to ensure inputs and outputs are consistent
- Identification of factors included in analysis, enabling the understanding of BCAR output and implications
- Data hygiene

15.3 Plan Adoption

This plan will be submitted to FEMA Region X for review after formal adoption by the Tribe. If the Tribal government would like the option of being a subgrantee under Washington State, they must also submit the plan to the Washington Emergency Management Division for review and comment. A copy of the resolution is provided in Appendix G.

44 CFR Section 201.7(c)(5)

Requires documentation that the hazard mitigation plan has been formally adopted by the governing body of the Tribal government prior to submittal to FEMA for final review and approval. DMA compliance and its benefits cannot be achieved until the plan is adopted.

Tulalip Tribes' Tribal Government will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002, and will amend its plan whenever necessary to reflect changes in Tribal or Federal laws and statues.

15.4 Plan Implementation and Maintenance Strategy

This section details the formal process that will ensure that the Tulalip Tribes 2021 HMP remains an active and relevant document, ensuring 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 section also describes how participation from Tulalip Citizens and community members of the reservation will continue to be a part of the plan during the maintenance and implementation process. The plan's format allows sections to be reviewed and updated when new data becomes available, ensuring the plan stays current and relevant.

15.4.1 Plan Implementation

The effectiveness of the HMP depends on the implementation of the plan and incorporation of the outlined action items into existing partnership plans, policies, and programs. The updated plan includes a range of action items that, if implemented, would reduce losses from hazard events in the Tulalip Reservation. Together, the action items in the plan update provide the framework for activities that the Tribe can choose to complete over the next five years. The Steering Committee has established goals and objectives that will be implemented through the development of new plans, existing plans, policies, and programs.

The Tulalip Tribes Office of Emergency Management will assume lead responsibility for planning and facilitating implementation and maintenance meetings. The OES will act as the Tribe's point-of-contact for this plan. Although the OES will have primary responsibility for convening these meetings, plan implementation and evaluation will be a shared responsibility among all planning partners identified as leads in the mitigation action plans.

15.4.2 Steering Committee

The Steering Committee is made up of volunteers and paid staff who contributed greatly to the development of the updated plan. The purpose of this committee was to oversee the development of the plan update and make recommendations on key elements, including the maintenance strategy. It was the Steering Committee's position that an oversight committee with representation like that of the Steering Committee should have an active role in the maintenance strategy for this plan. Therefore, it is recommended that the Steering Committee remain as a viable body involved in key elements of the plan maintenance strategy.

The Steering Committee should include Tribal government staff, Tribal members, and other pre-identified key stakeholders. The Steering Committee will convene to perform annual reviews at a place and time to be determined. The make-up of this committee can be dynamic, which will allow differing views and for participants to have a say in the implementation of the plan. The OES will strive for true "stakeholder" representation on this committee. Individuals involved in this plan update process will be contacted and given the option to remain involved in the process.

Each year, Tribal Government will appoint a Steering Committee Chair to lead annual progress reporting. The Chair will be responsible for ensuring that the plan is reviewed and updated annually. Tulalip Tribes will be responsible for facilitating annual progress review workshops.

15.4.3 Annual Progress Report

The minimum task of the Steering Committee will be the evaluation of the progress of the plan. This review will include the following:

- Summary of any hazard events that occurred during the prior year and their impact on the planning area
- A review of successful mitigation initiatives identified in the plan
- A brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plans to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term project because of funding availability)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives within the partnership that involve hazard mitigation

For continuity, a mitigation strategy evaluation form will be used as a yearly progress report and submitted to the Steering Committee. The Mitigation Strategy Evaluation and Mitigation Action Evaluation forms are provided in Appendix D.

All lead entities will be responsible for submitting progress reports. From those progress reports, a formal annual report on the progress of the plan will be developed. This report will be used as follows:

- Posted on the website page dedicated to the Tulalip Tribes 2021 HMP
- Provided to the local media through a press release
- Presented in the form of a council/board report

15.4.4 Plan Updates

The planning partnership intends to update the plan on a five-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 100-mile square planning area
- A hazard event that causes loss of life

It will not be the intent of this update process to start from scratch and develop a new HMP for the Tulalip Tribes planning area. Based on needs identified by the planning team, this update will, at a minimum, include the elements below:

44 CFR Section 201.7(d)(3)

Requires that local HMPs be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the Disaster Mitigation Act of 2000.

- The update process will be convened through the Steering Committee
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies
- The action plans 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 partnership policies identified under other planning mechanisms, as appropriate (such as the general plan)
- The draft update will be sent to appropriate agencies and organizations for comment
- Tulalip citizens and community members of the reservation will be given an opportunity to comment on the update prior to adoption
- A new resolution will be adopted following the update

15.4.5 Continuing Tulalip Citizens and Community Members of the Reservation Involvement

Tulalip citizens and community members of the reservation will be regularly updated on the status of hazard mitigation actions through social media, such as Tulalip News, and events like National Night Out. Copies of the HMP annual progress reports will be distributed to stakeholders and the media, where appropriate, and hard copies of the Tulalip Tribes 2021 HMP will be available to Tulalip citizens and community members of the reservation. The Steering Committee indicated that the annual Backpack Giveaway

Additionally, a new Tulalip citizens and community members of the reservation involvement strategy will be initiated based on guidance from the Steering Committee each time the plan is updated. 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 local media outlets and social media.

15.4.6 Integration with Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan update is based on the best science and technology currently available. This information can be invaluable in making decisions required through other planning efforts, such as critical areas planning, growth management planning, and capital facilities planning. The Tribe will use information from this updated plan as the best available science and data on natural hazards impacting the reservation. Information in the updated plan can be used as a tool in other programs, such as the following:

- Land use planning
- Critical areas regulation
- Growth management
- Capital improvements
- Water Resource Inventory Area planning
- Basin planning

As information becomes available from other planning mechanisms that can enhance this plan, it will be incorporated via the update process.

Tulalip Tribes 2021 Hazard Mitigation Plan

Appendices

Appendix A: Acronyms and Definitions

Acronyms

Acronym	Definition	Acronym	Definition
BCA	Benefit-Cost Analysis	**ID**	Identification
BCAR	FEMA's Benefit-Cost Analysis Tool	**IRC**	International Residential Code
BFE	Base Flood Elevation	**ISWM**	Integrated Solid Waste Management Plan
CEMP	Comprehensive Emergency Management plan	**MCE**	Maximum Creditable Earthquake
CERT	Community Emergency Response Team	**MM**	Modified Mercalli Scale
CFR	Code of Federal Regulations	**NEHRP**	National Earthquake Hazards Reduction Program
cfs	Cubic feet per second	**NFIP**	National Flood Insurance Program
CIP	Capital Improvements Plan	**NCDC**	National Climatic Data Center
COVID-19	Novel Coronavirus 2019	**NGVD**	National Geodetic Vertical Datum
CRS	Community Rating System	**NOAA**	National Oceanic and Atmospheric Administration
DHS	Department of Homeland Security	**NWS**	National Weather Service
DMA	Disaster Mitigation Act	**OEM**	Office of Emergency Management
DNR	Department of Natural Resource	**PDM**	Pre-Disaster Mitigation Grant Program
DSO	Dam Safety Office	**PHMSA**	Pipeline and Hazardous Materials Safety Administration
EAP	Emergency Action Plan	**PGA**	Peak Ground Acceleration
EMD	Emergency Management Division	**PUD**	Planned Unit Developments
EPA	US Environmental Protection Agency	**RCW**	Revised Code of Washington
ESCA	Emergency services Coordinating Agency	**SCNHMP**	Snohomish County Natural Hazard Mitigation Plan
ESA	Endangered Species Act	**SFHA**	Special Flood Hazard Area
FCAAP	Flood Control Account Assistance Program	**SHELDUS**	Special Hazard Events and Losses Database for the US
FCD	Flood Control District	**SMA**	Shoreline Management Act
FEMA	Federal Emergency Management Agency	**STAPLEE**	Social, Technical, Administrative, Political, legal Economic, and Environmental
FERC	Federal Energy Regulatory Commission	**TFW**	Tulalip Tribes Timber, Fish, and Wildlife
FIRM	Flood Insurance Rate Map	**UBC**	Uniform Building Code
GIS	Geographic Information System	**UDC**	Unified Development Code
GMA	Growth Management Act	**UGA**	Urban Growth Area
HAZUS-MH	Hazards, United States-Multi Hazard	**USGS**	US Geological Survey
HIVA	Hazard Inventory and Vulnerability Analysis	**UW**	University of Washington
HMGP	Hazard Mitigation Grant Program	**WAS**	Washington Administrative Code
HMP	Hazard Mitigation Plan	**WRIA**	Water Resource Inventory Area
IBC	International Building Code	**WSDOT**	Washington State Department of Transportation

Definitions

100-Year Floodplain – The area flooded by the flood that has a 1 percent chance of being equaled or exceeded each year. This is a statistical average only; in fact, 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.

500-year Floodplain – Also known as the 0.2 percent annual chance flood. The area inundated by floodwaters that has a 0.2 percent chance of being equaled or exceeded each year.

Active Assailant – An individual actively engaged in killing or attempting to kill people in a confined and populated area. In most cases, active shooters use firearm(s) and there is generally no pattern or method to their selection of victims.

Active Shooter – One or more individuals actively engage in killing or attempting to kill people in a populated area using one or more firearms.

Active – Refers to both law enforcement personnel and citizens that have the potential to affect the outcome of the event based upon their responses to the situation.

Asset – Any manmade 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.

Benefit/Cost Analysis – 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.

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.

Benioff Earthquake – Sometimes called “deep quakes,” these occur in the Pacific Northwest when the Juan de Fuca plate breaks up underneath the continental plate, approximately 30 miles beneath the earth’s surface.

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, and fiscal capability.

Cluster – An aggregation of cases grouped in place and time that are suspected to be greater than the number expected.

Community Rating System (CRS) – 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.

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.

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 – Those 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 update, critical facilities include the following:

- 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
- Public and private utilities, facilities, and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events
- Government facilities, city hall, judicial, and emergency management

Crustal Earthquake – Crustal quakes occur at a depth of 5 to 10 miles beneath the earth's surface and are associated with fault movement within a surface plate.

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 and/or any controlling works, together with appurtenant works, that can or do impound or divert water.

Dam Failure – An uncontrolled release of impounded water due to structural deficiencies in the water barrier.

Debris Flow – A moving mass of loose mud, sand, soil, rock, water, and air moving down a slope under the influence of gravity.

Disaster Mitigation Act of 2000 (DMA) – A Public Law 106-390 that 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 – 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.

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. Earthquakes are typically measured in both magnitude and intensity.

Ecosystem Services – Ecosystem services are the benefits people obtain from the ecosystem. They are grouped in four broad categories:

- Provisioning, such as the production of food and water
- Regulating, such as control of the climate and disease
- Supporting, such as the nutrient cycles and crop pollination
- Cultural, such as spiritual and recreational benefits

Ecosystem services associated with natural hazard mitigation include, but are not limited to, the following: vegetated land cover can intercept and absorb water, retaining it and slowing its movement, helping to reduce flooding and its subsequent effects; vegetated stream buffers can help absorb water along streams and rivers, which reduces flooding by holding excess water; vegetated stream buffers can reduce bank erosion; floodplains can spread high volume flows, reducing stream velocity and flood levels; wetlands, such as coral reefs and coastal marshes, can offer shoreline protection in coastal regions and help reduce the impacts of storms, including erosion, by acting as a physical barrier and reducing wind and wave energy; tree and forest cover can reduce surface wind velocities; vegetative cover can reduce temperatures on micro- and macro-scales; vegetation can help to shade areas and reduce surface temperatures, mitigating the potential public health effects of extreme heat.

Elevated Temperature Material – Materials which are in a liquid phase at a temperature at or above 212 degrees Fahrenheit (°F); or is in a liquid phase with a flash point at or above 100°F; or is in a solid phase at a temperature at or above 464°F.

Emergency Action Plan (EAP) – A formal document that identifies potential emergency conditions at a dam and specifies preplanned actions to be followed to minimize property damage and loss of life. The EAP contains specific actions the dam owner should take to moderate or alleviate the problems at the dam, procedures on issuing early warning and notification messages to responsible downstream emergency management authorities, and inundation maps to show the emergency management authorities the critical areas for action in case of an emergency.

Endemic – Refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area.

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.

Epidemic – An increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.

Extreme Risk Protection Orders – Designed to prevent individuals at high risk of harming themselves or others from accessing firearms, it allows family, household members, and police to obtain a court order when there is demonstrated evidence that the person poses a significant danger.

Fault – A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other. Most common is a strike-slip, normal, or thrust fault.

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 area involved becomes so hot that all combustible materials ignite, even if they are not exposed to direct flame. Temperatures may exceed 1,000 degrees Celsius. 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. Although firestorms seldom spread because of the inward direction of the winds, once started, there is no known way of stopping them.

Flood – Inundation of normally dry land resulting from rising and overflowing of a body of water.

Flood Insurance Rate Map (FIRM) – 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 FIRM. 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 – Land area along the sides of a river that becomes inundated with water during a flood

Focal Depth – The depth from the earth's surface to the hypocenter.

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.

Hazardous Substance – Any biological agent and disease-causing material that has the reasonable potential to cause death, disease, behavioral changes, cancer, genetic mutation, psychological problems, or physical deformations to an exposed person or their unborn children.

Hazardous Waste – A waste product that has the reasonable potential to be dangerous and cause harm to human health and/or the environment.

Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program – 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.

High Hazard Dam – Dams assigned the high hazard potential classification are those where failure or operational issues will probably cause loss of human life.

Hyperendemic – Persistent, high levels of disease occurrence.

Hypocenter – The region underground where an earthquake's energy originates.

Interface Area – An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

Inundation Area – The area of land that would be flooded following a dam failure.

Lahar – A rapidly flowing mixture of water and rock debris that originates from a volcano. While lahars are most associated with eruptions, heavy rains, and debris accumulation, earthquakes may also trigger them.

Landslide – The sliding movement of masses of loosened rock and soil down a hillside or slope. Slope failures occur when the strength of the soils forming the slope is exceeded by the pressure, such as weight or saturation, acting upon them.

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. Any rural community, unincorporated town or village, or other public entity.

Marine Pollutant – A substance that is harmful to the environment, specifically the aquatic ecosystem.

Mass Killings – Three or more killings in a single incident.

Mass Movement – A collective term for landslides, debris flows, falls and sinkholes.

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 – Specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Mudslide (or Mudflow) – A river of rock, earth, organic matter, and other materials saturated with water.

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.

Outbreak – The same definition of epidemic but is often used for a more limited geographic area, jurisdiction, or group of people.

Pandemic – An epidemic that has spread over several countries or continents, usually affecting many people.

Peak Ground Acceleration (PGA) – A measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness – Actions that strengthen the capability of government, Tulalip citizens and community members, 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 the following: 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 – The average period in years between occurrences of a hazard (equal to the inverse of the annual frequency of occurrence).

Risk – 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 determined 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.

Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) – Public Law 100-107 signed 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.

Runup – A measurement of the height of the water onshore observed above a reference sea level.

Seiche – A standing wave in an enclosed or partly enclosed body of water, normally caused by earthquake activity. It can affect harbors, bays, lakes, rivers, and canals.

Severe Local Storm – Small atmospheric systems including tornadoes, thunderstorms, and windstorms. Typically, major impacts from a severe storm are on transportation infrastructure and utilities. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area.

Significant Hazard Dam – Dams where failure or operational issues result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.

Sinkhole – A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Sporadic – Refers to a disease that occurs infrequently or irregularly.

Stakeholder – Individuals and organizations that have a vested interest in a project and/or plan, such as business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, etc.

Steering Committee – The group that oversaw all phases of the HMP's development. The members of this committee included key city and tribal personnel, Tulalip citizens and community members, and other stakeholders from within the planning area.

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 in places where they can 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.

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 – Typically 15 miles in diameter and lasting about 30 minutes, thunderstorms are underrated hazards. Lightning, which occurs with all thunderstorms, is a serious threat to human life. Heavy rains over a small area in a short time can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with thunderstorms.

Tier II Facility – A facility that stores any substance for which a facility must maintain a Safety Data Sheet under the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. The reporting threshold requiring a Tier II report is 10,000 pounds for most chemicals. Extremely Hazardous Substances have a reporting threshold of 500 pounds or the Threshold Planning Quantity, whichever is lower. Tier II facilities can also store fuel but have higher reporting thresholds for gasoline and diesel fuel.

Tsunami – A long high sea wave caused by an earthquake, submarine landslide, or other disturbance.

Tsunami from a Large Undersea Earthquake – An earthquake that causes significant vertical deformation on the seafloor and generates a tsunami wave.

Tsunami Warning – Issued by Pacific Tsunami Warning Center when a potential tsunami with significant widespread inundation is imminent or expected.

Tsunami Watch – Issued when an event may later impact the watch area; may be upgraded to tsunami warning.

Virus – Refers to a program that infects computer files by inserting a copy of itself into the file.

Vulnerability – A description of 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.

Water Resource Inventory Area (WRIA) – Formalized under Washington Administrative Code (WAC) 173-500-040 and authorized under the Water Resources Act of 1971, Revised Code of Washington 90.54. The Washington Department of Ecology was given the responsibility for the development and management of these administrative and planning boundaries. These boundaries represent the administrative under pinning of this agency's business activities. The original WRIA boundary agreements and judgments were reached jointly by Washington's natural resource agencies (Ecology, Natural Resources, Fish and Wildlife) in 1970.

Watershed – An area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wild and Scenic River – A federal designation that is intended to protect the natural character of rivers and their habitat without adversely affecting surrounding property.

Wildfires – Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Because of their distance from firefighting resources, they can be difficult to contain and cause a great deal of destruction.

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.

Zero-Rise Floodway – An area reserved to carry the discharge of a flood without raising the base flood elevation. Some communities have chosen to implement zero-rise floodways because they provide greater flood protection than the floodway described above, which allows a 1-foot rise in the base flood elevation.

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: 2020 Tulalip Tribes Hazard Mitigation Plan Update and Tribal Survey Results

Summary of Survey

Limitations and Caveats:

The study had a small sample size with 45 respondents. A small sample may not reflect the entire population; although, the survey responses were useful for establishing hypotheses and general themes and concerns.

Respondent Profile

Respondents were primarily Tulalip citizens and community members, making up 77.78 percent of the participants. 37.78 percent of respondents were Tribal employees. 26.67 percent respondents marked other, most of which wrote in that they were Tribal members. 24.44 percent of respondents were landowners and 2.22 percent were business owners. 4.44 percent of respondents were elected officials.

Hazards Summary

- An average of one third of responders "strongly agreed" they were concerned about the hazards identified by the Steering Committee. An average of 44.66 percent "agreed," with that the hazards were a concern. None of the respondents ranked any hazard risk as "strongly disagree."
- The number of respondents impacted by a natural disaster was approximately one third higher than those that were not: 62.22 percent said "Yes," and 37.78 percent answered "No."
- Respondents ranked the hazard identified by the Steering Committee. They indicated their level of concern for each hazard from strongly agree to strongly disagree. Earthquakes registered as the highest risk perception at 53.33 percent strongly agreeing and 33.33 percent agreeing that it is a risk for the Tribe. Wildfires were a significant concern with 40.91 percent strongly agreeing and 38.64 percent agreeing. Sea level risk was also a higher concern with 44.44 percent strongly agreeing and 46.67 percent agreeing. Active Threats were at the low end with 31.82 percent strongly agreeing and 36.36 percent agreeing.
- Respondents noticed all the changes in the environment and/or community that were listed in the survey. Temperature changes ranked the highest at 82.22 percent and severe weather was second at 46.67 percent

Insurance

- 93.33 percent of respondents responded "no" to having flood insurance.

Mitigation Actions

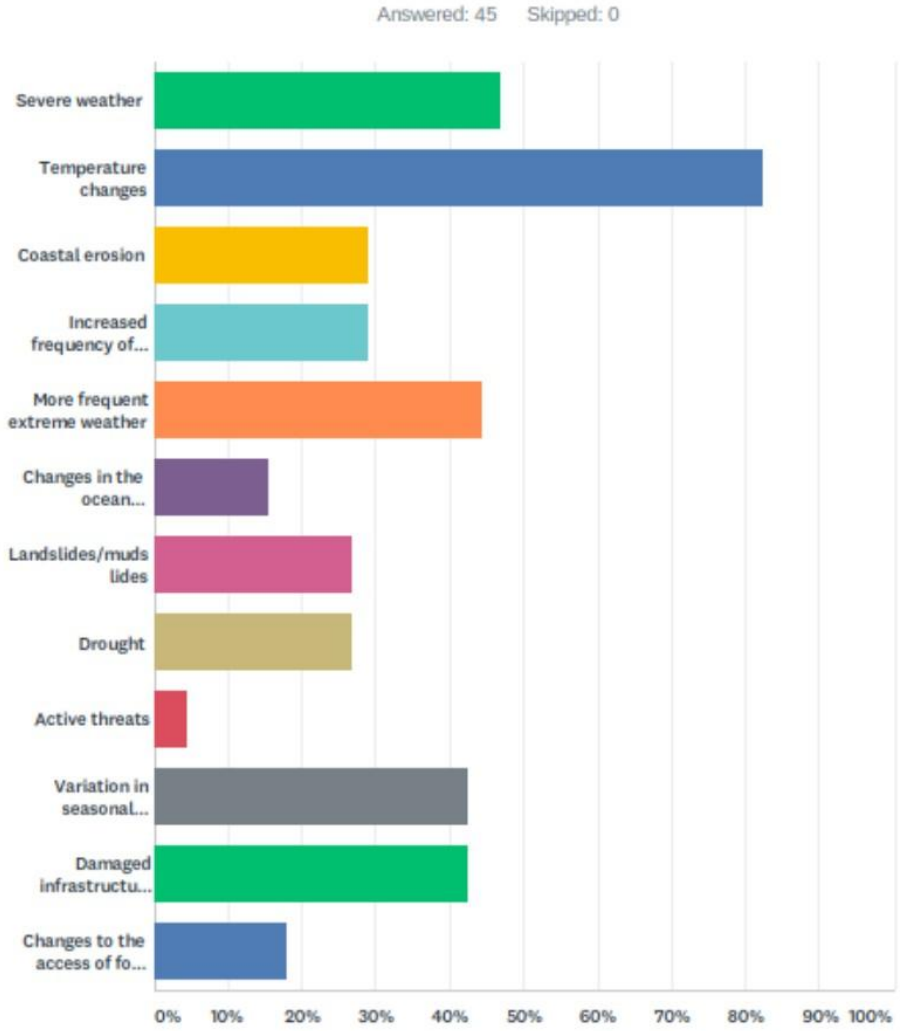
- Only 15.56 percent of respondents took actions to protect their home and/or business from the impacts of hazards, 73.33 percent have not.
- Twenty-six respondents marked that they had project ideas for how to protect the community from the impact of hazards.

Outreach

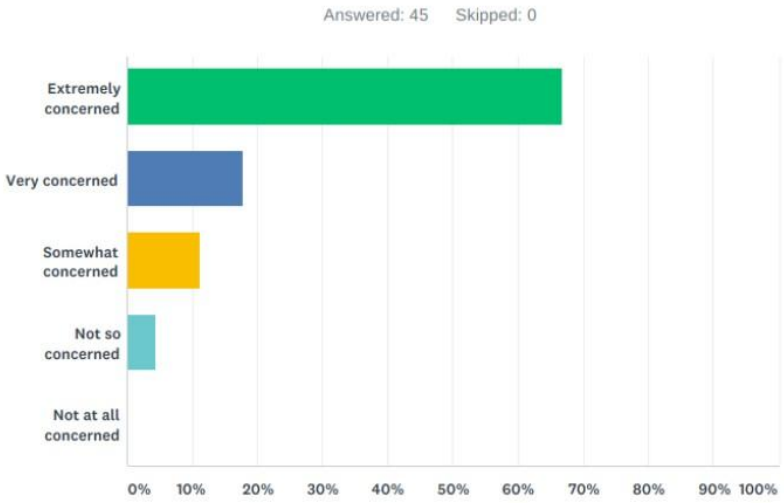
Almost all the respondents wanted to see and/or support community outreach actions in the future, a total of 44 out of the 45. 63.64 percent were interested in volunteer opportunities, 70.45 percent in educational events, while half were interested in policy and activism opportunities.

Survey Results

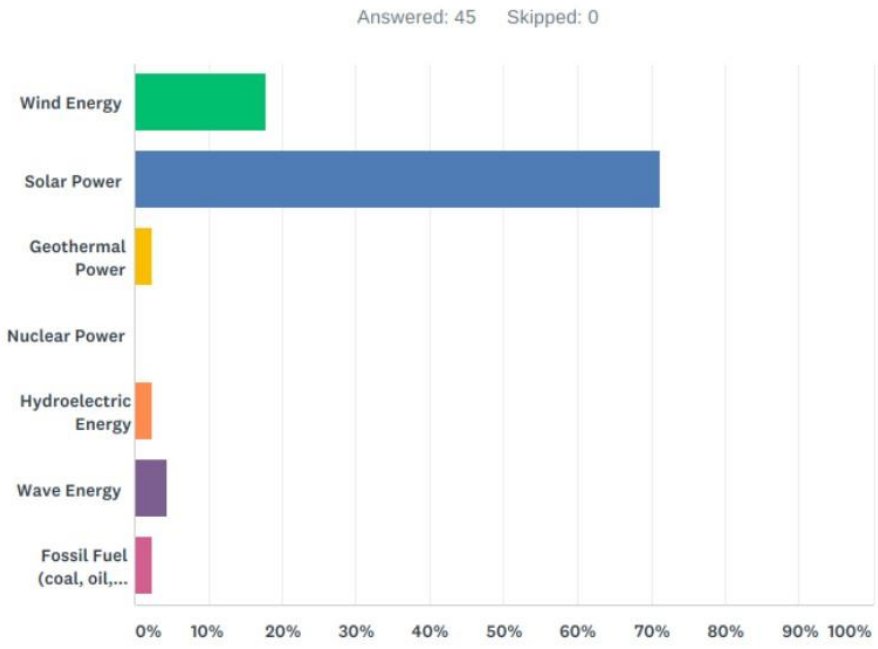
1. Have you noticed any of the following changes in the environment or community? (you can choose more than one)



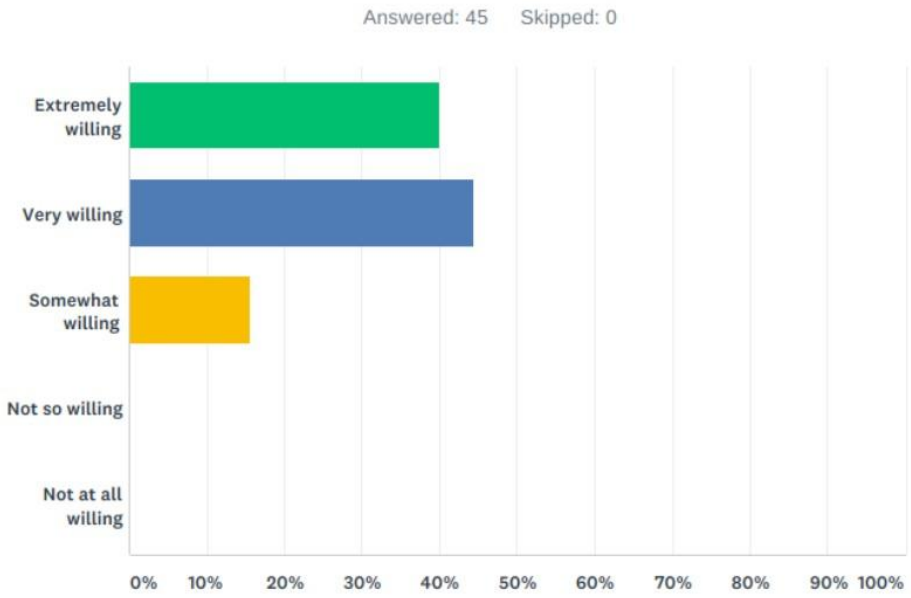
2. How concerned are you about how climate change can affect animals and plants, like orcas, salmon, and huckleberries?



3. Which of the following energy sources do you think will be MOST important in the next ten years?



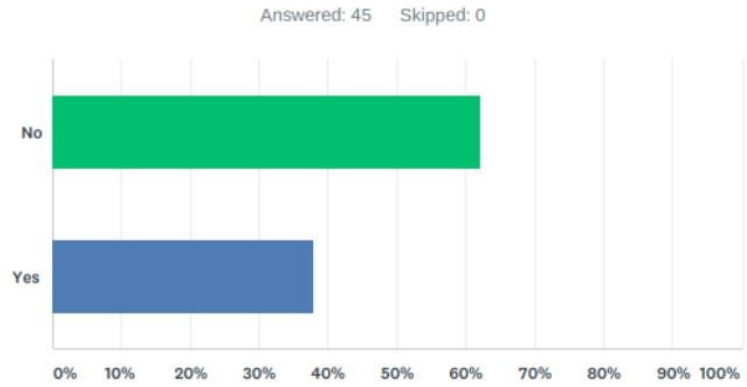
4. If changing your day-to-day behavior helps reduce impacts of a changing climate and build a more resilient community in the future, then how willing are you to adopt more sustainable practices and behaviors?



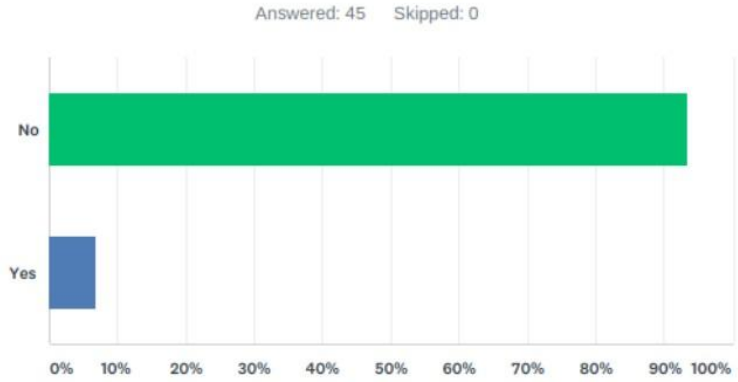
5. I am concerned about the following natural and human made hazards (strongly agree to strongly disagree)

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	TOTAL	WEIGHTED AVERAGE
Earthquake	53.33% 24	33.33% 15	13.33% 6	0.00% 0	0.00% 0	45	1.60
Wildfire	40.91% 18	38.64% 17	15.91% 7	4.55% 2	0.00% 0	44	1.84
Tsunamis/Seiches	24.44% 11	44.44% 20	22.22% 10	8.89% 4	0.00% 0	45	2.16
Pandemic	26.67% 12	46.67% 21	24.44% 11	2.22% 1	0.00% 0	45	2.02
Hazardous Materials	42.22% 19	33.33% 15	22.22% 10	2.22% 1	0.00% 0	45	1.84
Mass earth movement - Landslide/Mudslide	26.67% 12	53.33% 24	17.78% 8	2.22% 1	0.00% 0	45	1.96
Drought	27.27% 12	43.18% 19	20.45% 9	9.09% 4	0.00% 0	44	2.11
Severe Weather	35.56% 16	53.33% 24	8.89% 4	2.22% 1	0.00% 0	45	1.78
Heatwave	24.44% 11	51.11% 23	22.22% 10	2.22% 1	0.00% 0	45	2.02
Flood	24.44% 11	55.56% 25	13.33% 6	6.67% 3	0.00% 0	45	2.02

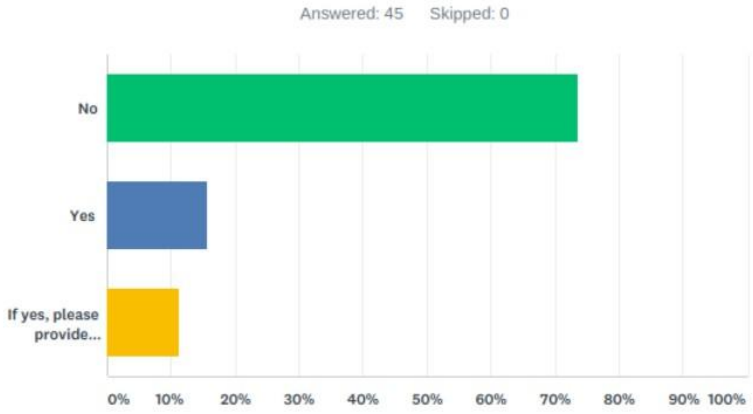
6. Have you been impacted by a natural or human-made hazard in your community?



7. Do you have flood insurance?

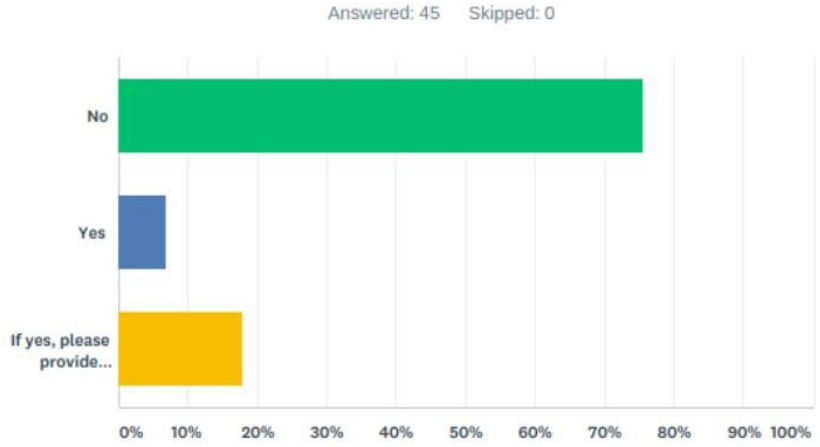


8. Have you taken actions to protect your home and/or business from the impacts of hazards?

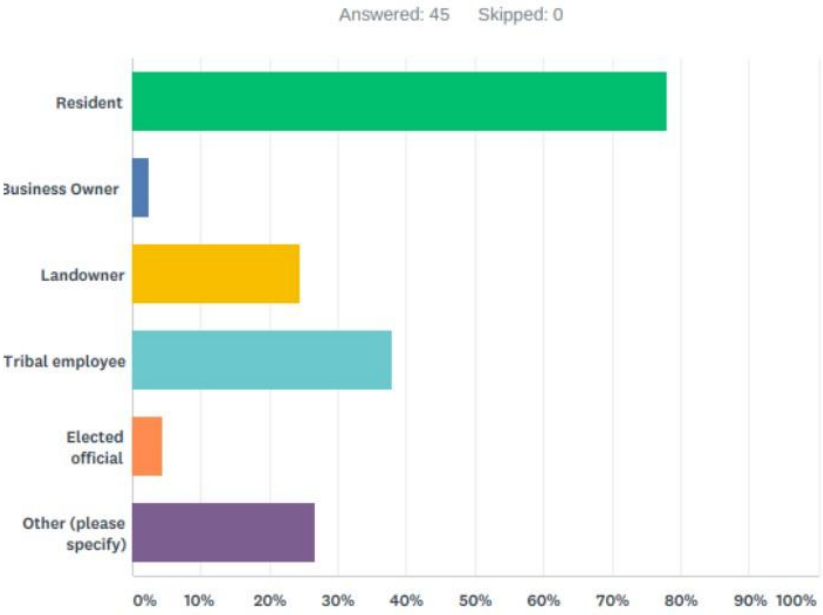


Appendix B

9. Do you have project ideas for how to protect the Tribe from the impacts of hazards?

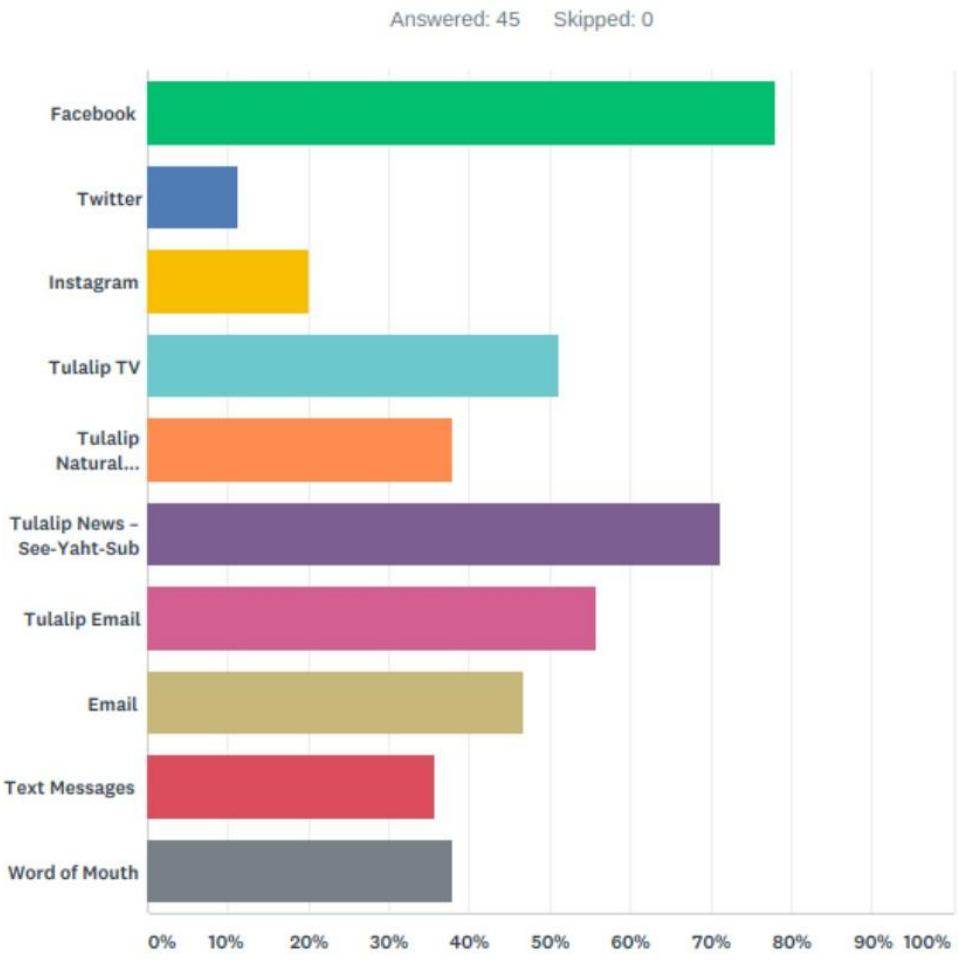


10. Which of the following best describes your role in the community? (you may select more than one)



Appendix B

11. Of the following, what do you think are the best platforms to learn more about climate change/hazard impacts on the Tulalip Tribes? (you may choose more than one)



12. When you think about a Tribal community that is prepared for disasters, what comes to mind?

1	Citizen Potawatomi Nation, Tim Zientek has training many in emergency preparedness and response for their Tribal community.
2	People that would be most concerned with a flood.
3	Basic needs, food, shelter, etc. followed by a responsive recovery plan.
4	Competency of awareness
5	Food, water, & temporary shelter for all those affected
6	Static EOC, MOU's with neighboring communities, fully stocked meeting hall, Teen CERT, CERT, fully staffed Emergency Management.
7	Preparedness measures
8	Team work - everybody has a roll to play
9	Not sure
10	Make sure there is enough water and food and blankets and flashlights
11	A plan that protects as many members as possible
12	Shelters
13	Water, food, shelter and medical supplies
14	Food security Emergency plans for how to communicate during emergency Educating community on ways to help
15	A plan and a multiple places that everyone is aware of and can reach from each end of the reservation (bunkers full of food, blankets, etc.)
16	That their smart. Disasters happens when you least expect them when no one is prepared. So if the tribe was prepared that had food/water/shelter planned for the community that could save our people. Or educate families if/when a disaster happens how to prepare And what to have (food,water, generator) so people have an idea how to survive the disaster without going crazy.
17	I'm not aware of anything that makes us prepared.
18	Not prepared
19	Not prepared
20	That we are no where near ready for a natural disaster
21	Having a shelter space put aside for when natural disaster hits for tribal members
22	A lot of stuff they teach people in CERT.
23	There should be a designated location on the reservation where members can go for food and shelter. Incident command, communication and transportation for tribal members needs to be factored in.
24	Families are given kits for at least 5 day's of emergency supplies. Families are given notice of what areas will be safe and how to get there in case of an emergency.
25	Be able to move people quickly out of danger..
26	Education of things to expect.
27	We have to be able to have a safe zone somewhere for members to go.
28	a community that has the resources and communication infrastructure to protect its members.
29	Survival.
30	Emergency Action Plan. A task force for the community during emergencys.
31	Infrastructure in place
32	Plan. Teach. Stock up.
33	Place where we can all gather and where supplies/food/etc are available
34	well informed community

Appendix C: Tulalip Tribes Hazard Mitigation Plan Annual Progress Report

Every year the Tribe will submit a Hazard Mitigation Strategy Evaluation Form. This provides the Planning Committee with all the information needed to compile a formal annual report on the progress of the plan. If any additional mitigation initiatives have been identified that were not previously addressed in the Tulalip Tribes 2021 HMP, the jurisdiction will also complete a Mitigation Action Evaluation Form to attach to the Strategy Evaluation Form.

Appendix C

Annual Hazard Mitigation Progress Reporting Form

Jurisdiction: _____

Prepared By: _____ Title: _____

For the 12-month period ending: _____ Date: _____

Instructions: Complete this form for each jurisdiction. Check the box beside Yes or No options.
Complete descriptions for each question to which a Yes response applies, inserting additional lines as needed.

During the preceding 12 months:

1. Did the jurisdiction experience any hazard events resulting in losses?

☐ No ☐ Yes – Describe (e.g., deaths, injuries, property damage, and indirect impacts such as loss of use, economic or environmental impacts, if a damage assessment was conducted, emergency or disaster declaration):

2. Have there been any observed impacts, physical changes, or new studies that would materially affect the hazards analysis?

☐ No ☐ Yes – Describe:

3. Have any additional mitigation initiatives been identified, that were not previously addressed in the Hazard Mitigation Plan?

☐ No ☐ Yes – For each new initiative, complete a Mitigation Action Evaluation Form.

4. Have any identified mitigation initiatives been completed and successful?

☐ No ☐ Yes – Review:

5. Were there targeted strategies in the past year that did not get completed?

☐ No ☐ Yes – Discuss:

6. Do any mitigation strategies in the current plan need timeline amendments (such as changing a long-term project to short-term project due to funding)?

☐ No ☐ Yes – Describe:

7. Have there been any changes in potential or new funding options, including grant opportunities?

☐ No ☐ Yes – Describe:

8. Were there any other planning programs or initiatives that involved hazard mitigation? If so, what was their impact?

☐ No ☐ Yes – Describe:

9. Has public awareness of hazards improved?

☐ No ☐ Yes – Describe:

Appendix E: Planning Process and Tulalip Citizens and Community Members of the Reservation

[Not included in this version due to size considerations. Please see more extensive version with this content.]

Appendix F: FEMA Review Tool

Appendix G: Plan Adoption Resolution

[Placeholder for Tulalip Plan Adoption Document]

Tulalip Tribal Government

Resolution #_____

Tulalip Tribes 2021 Hazard Mitigation Plan [Insert Date of Mitigation Plan]

WHEREAS the [insert Tribal governing body name] recognizes the threat that natural hazards pose to people and property within the Tulalip Tribes;

WHEREAS the Tulalip Tribes has prepared a multi-hazard mitigation plan in accordance with the Disaster Mitigation Act of 2000 and the requirements in Title 44 Code of Federal Regulations Section 201.7;

WHEREAS the Plan specifically addresses hazard mitigation strategies and plan maintenance procedures for the Tulalip Tribes;

WHEREAS the Plan recommends several hazard mitigation actions and projects that will provide mitigation for specific natural hazards that impact the Tulalip Tribes, with the effect of protecting people and property from loss associated with those hazards;

WHEREAS, adoption of this plan will make the Tulalip Tribes eligible for funding to alleviate the impacts of future hazards on the Reservation,

NOW THEREFORE BE IT RESOLVED by the [insert appropriate official titles] of the [insert Tribe name] that:

1. The Plan is hereby adopted as an official plan of the Tulalip Tribes.

2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them.

3. Future revisions and plan maintenance required by 44 CFR 201.7 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.

4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Tribal Council by [insert date] of each calendar year.

5. The Tulalip Tribes will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002; and will amend our plan whenever necessary to reflect applicable changes in Tribal or federal laws and statutes.

PASSED by the [insert appropriate title], this ___ day of ____ (month), _____(year).

[Provide various signature blocks as required]

Appendix H: Hazards

Definitions of Hazard Ranking Factors

Table 39 Definitions of Hazard Ranking Factors

Hazard Ranking Definitions					
Rating	**Severity**	**Magnitude**	**Frequency**	**Onset**	**Duration**
1	No injuries or deaths expected. Minimal damage or impacts to natural systems.	Single or limited number of properties impacted.	Less than every 25 years	Greater than 30 days of warning	Only brief moments
2	Between 1 and 5 injuries or deaths. Minimal to moderate damage or impacts to natural systems.	Neighborhood or small community impacted.	10–25 years	5–30 days of warning	1–24 hours
3	Between 5 and 25 injuries or deaths. Moderate damage or impacts to natural systems.	City or town impacted.	5–10 years	1–5 days of warning	Days to weeks
4	Between 25 and 50 injuries or deaths. Extensive damage or impacts to natural systems.	Entire county impacted.	1–5 years	1–10 hours of warning	Weeks to months
5	Greater than 50 injuries or deaths. Catastrophic damage or impacts to natural systems.	State and/or region impacted.	Once per year	No warning	Months to years

Tulalip Tribes Disaster Declarations

Table 40 Tulalip Tribes Disaster Declarations

Type of Incident	Date of Incident	Event	Deaths and Injuries	Disaster Number
Pandemic	March 12, 2020	COVID-19	8 death	EM-3507-WA
Economic	January 23, 2020	Fraser Chum Commercial Fishery	N/A	Pending Approval
Economic	October 28, 2013	Fraser River Sockeye Salmon	N/A	N/A
Economic	September 4, 2008	Frasier River Sockeye Salmon		

(Federal Emergency Management Agency (2020); National Oceanic and Atmospheric Administration Fisheries, 2020)

Appendix H

Comprehensive List of FEMA Disaster Declarations for Snohomish County

Table 41 Disaster Declarations for Snohomish County

Type of Incident	Date of incident	Event	Deaths and Injuries	Disaster Number
Severe Storm	March 4, 2019	Severe Winter Storms, Winds, Flooding, Landslides, Mudslides, Tornado	–	4418
Severe Storm	January 15, 2016	Severe Storms, Winds, Flooding, Landslides, Mudslides	–	4249
Severe Storm	October 15, 2015	Severe Windstorm	–	4242
Landslide/Mudslide	April 2, 2014	Flooding, Mudslides	–	4168
Landslide/Mudslide	March 24, 2014	Flooding, Mudslides	43 Deaths/12 Injuries	3370
Severe Storm	March 5, 2012	Severe Winter Storm, Flooding, Landslides, Mudslides	–	4056
Severe Storm	March 2, 2009	Severe Winter Storm, Snow	–	1825
Flood	January 7, 2009	Severe Winter Storm, Landslides, Mudslides, Flooding	–	1817
Severe Storm	December 8, 2007	Severe Winter Storm, Landslides, Mudslides	–	1682
Severe Storm	February 14, 2007	Severe Storms, Landslides, Mudslides, Flooding	–	1734
Severe Storm	December 12, 2006	Severe Storms, Flooding, Tidal Surge, Landslides, Mudslides	–	1641
Severe Storm	May 17, 2006	Severe Storms, Landslides, Mudslides	–	1671
Severe Storm	November 7, 2003	Severe Storms, Flooding	–	1499
Earthquake	February 28, 2001	6.8 Magnitude	400 injuries	1361
Flood	April 2, 1997	Heavy Rains, Snow Melt, Flooding, Landslides, Mudslides	–	1172
Severe Storm	January 17, 1997	Severe Winter Storm, Landslides, Mudslides, Flooding	–	1159
Flood	February 9, 1996	High Winds, Severe Storms, Flooding	–	1100
Severe Storm	January 3, 1996	Severe Storms, High Wind, Flooding	–	1079
Severe Storm	March 4, 1993	Severe Storms & High Wind	–	981
Flood	March 8, 1991	Severe Storms, High Tides	–	896
Flood	November 26, 1990	Severe Storms, Flooding	–	883
Flood	December 15, 1986	Severe Storms, Flooding	–	784
Volcanic Eruption	May 21, 1980	Mount St. Helens Eruption	57 Deaths	623
Flood	December 31, 1979	Storms, High Tides, Mudslides, Flooding	–	612

Type of Incident	Date of incident	Event	Deaths and Injuries	Disaster Number
Flood	December 10, 1977	Severe Storms, Mudslides, Flooding	–	545
Flood	December 1, 1975	Severe Storms, Flooding	–	492
Earthquake	April 29, 1965	6.5 to 6.7 Magnitude	6 deaths	196
Flood	December 29, 1964	Heavy Rains, Flooding	–	185

Severe Weather Events in Snohomish County Resulting in Deaths/Injuries or $25,000 or More in Damages

Table 42 Severe Weather Events in Snohomish County

Date	Type	Deaths or Injuries	Property Damage
November 13, 2017	High Wind	1 Death, 1 Injury	$3.5 Million
March 10, 2016	Strong Wind	-	$1.0 Million
November 17, 2015	Strong Wind	1 Death	$5.0 Million
September 20, 2015	Strong Wind	1 Death	$0
August 29, 2015	High Wind	-	$1.5 Million
December 11, 2014	Strong Wind	-	$500,000
November 11, 2014	High Wind	-	$4.0 Million
October 25, 2014	Strong Wind	-	$500,000
January 11, 2014	Strong Wind	-	$100,000
November 22, 2011	Strong Wind	-	$50,000
December 14, 2010	Thunderstorm Wind	-	$30,000
March 20, 2009	Strong Wind	1 Death, 1 Injury	$20,000
December 21, 2008	Heavy Snow	-	$3.0 Million
December 20, 2008	Heavy Snow	-	$200,000
December 17, 2008	Heavy Snow	-	$500,000
December 3, 2007	Heavy Rain	-	$10 Million
October 18, 2007	High Wind	-	$750,000
January 5, 2007	Strong Wind	-	$500,000
December 14, 2006	High Wind	-	$5.4 Million
November 26, 2006	Heavy Snow	-	$2.0 Million
March 8, 2006	Strong Wind	-	$50,000
August 6, 1997	Lightning	1 Injury	$0
April 10, 1997	Lightning	-	$35,000
September 15, 1996	Lightning	1 Death	$0
October 26, 1971	Tornado (EF1)	-	$25,000
	Tornado (EF2)	-	$25,000

(National Oceanic and Atmospheric Administration, 2020)

Appendix I: FEMA Code of Federal Regulatior

The Table below indicates the major changes between the two plans as t

Table 43 CFR Requirements

44 CFR Requirement	2010 Hazard
44CFR 201.7(b): An effective planning process is essential in developing and maintaining a good plan. The mitigation planning process should include coordination with other tribal agencies, appropriate Federal agencies, adjacent jurisdictions, interested groups, and be integrated to the extent possible with other ongoing tribal planning efforts as well as other FEMA mitigation programs and initiatives.	The Planning Proces Section I: Introduc discusses involveme FEMA approval. It about involving jurisdictions, or an the planning proces
44CFR 201.7(c)(2): A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Tribal risk assessments must provide sufficient information to enable the Indian tribal government to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The first part of Se Risk Assessment o and prioritization m
44CFR 201.7(c)(2)(i): The risk assessment shall include a description of the type, location, and extent of all natural hazards that can affect the tribal planning area. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	Section III: Risk Ana provides an over identified and asses Presidential Declar table of previous la impacted the Tribal

Appendix I

ıs Crosswalk

:hey relate to 44 CFR planning requirements:

Mitigation Plan	2020 Hazard Mitigation Plan
ss is addressed briefly in :tion. The introduction ent with the public and does not go into detail other agencies, y other stakeholders in s.	Sections 3.2 through 3.4 describe the public involvement process and the opportunities presented for comments on the plan during drafting stages and prior to plan approval. Section 3.3 describes the opportunity for other communities and agencies to be involved in the plan update process. Section 3.3 also provides an overview of the review and incorporation of plans, studies, reports, and technical information. 3.4 outlines Tribal member involvement in the assessment and planning processes.
ction III: Risk Analysis – utlines the assessment ethod.	Section 5.2 to 5.4 detail the methodology and tools utilized in the comprehensive risk assessment. The 9 hazards of concern looked at in the risk assessment were (1) active assailant, (2) earthquake, (3) epidemic, (4) flooding and sea level rise, (5) hazardous materials, (6) mass earth movement, (7) tsunami, (8) severe weather events, and (9) wildfire
ılysis – Hazards Profiled view of the hazards ssed. The following part ed Disasters includes a rge-scale disasters that area.	Sections 6-14 go through the comprehensive risk assessment for each hazard the Tribe identified as a risk, not just natural hazards. The updated hazard profiles include a general overview of the hazard and updated historical occurrences. Future probability was updated based on the latest data and studies. Scenarios were removed. Hazard maps were updated with the latest data and added to the end of the profiles.

44 CFR Requirement	2010 Hazard
44CFR 201.7(c)(2)(ii): The risk assessment shall include a description of the Indian tribal government's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the tribe.	Section III: Risk Ana list that descr vulnerability, and le
44CFR 201.7(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.	Each hazard profile to buildings, infra facilities potentiall hazard.
44CFR 201.7(c)(2)(ii)(B): The plan should describe an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.	Details of potenti hazard are included including an estim losses to vulnerab method to estimate
44CFR 201.7(c)(2)(ii)(C): The plan should provide a general description of land uses and development trends within the tribal planning area so that mitigation options can be considered in future land use decisions.	In Section V: Maintenance – Trib and Regulations, th incorporation of regulations that imp how those can measures.
44CFR 201.7(c)(2)(ii)(D): The plan should provide a general description of cultural and sacred sites that are significant, even if they cannot be valued in monetary terms.	Mitigation Action mapping and as facilities, including economic value.

Appendix I

Mitigation Plan	2020 Hazard Mitigation Plan
alysis contains a hazard ibes each hazard, vel of risk in detail.	Sections 6-14 of the plan addresses each hazard in detail and the Tribe's specific vulnerabilities and potential impacts to those hazards.
discusses vulnerability structure, and critical ly at risk from that	Sections 6-14 each hazard profile discusses vulnerability to buildings, infrastructure, and critical facilities potentially at risk from that hazard.
al impacts from each in the hazard profiles, ate of potential dollar le structures and the the loss.	Sections 6-14 detail the potential impacts from each hazard are included in the hazard profiles, including an estimate of potential dollar losses to vulnerable structures and the method to estimate the loss.
Implementation and al Capabilities: Planning e plan briefly describes other plans and act future land use and align with mitigation	Individual hazard profiles in Sections 6-14 include a part that assesses Tribal land use plans and codes and their ability to mitigate each hazard in future developments.
15 identifies a gap in ssessment of critical those with cultural and	Section 4.6 of the plan lists the Tribes' significant natural and cultural resources.

44 CFR Requirement	2010 Hazard
44CFR 201.7(c)(3): The plan should include a mitigation strategy that provides the Indian tribal government's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.	Section IV: Mitigati goals and mitigatic strategy for reducir the hazards listed identify existing programs and resou with the actions.
44CFR 201.7(c)(3)(i): The mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	Section IV: Mitigati Objectives defines goals.
44CFR 201.7(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	Section IV: Mitigati Actions and Activ actions included in action includes implementation gu particular emphasis buildings and infras
44CFR 201.7(c)(3)(iii): The mitigation strategy shall include an action plan describing how the actions identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the Indian Tribal government.	Section V: I Maintenance includ assessment with sources of fundir actions. Section V a for local plan inte monitoring process make up the mitig implementation stra

Appendix I

Mitigation Plan	2020 Hazard Mitigation Plan
on Actions provides the n actions that are the g potential losses from . The detailed actions authorities, policies, urces to assist the Tribe	Section 15 defines the entire mitigation strategy, including goals, actions, an action plan, plan adoption, and plan implementation and maintenance strategy. These pieces work together to support the Tribe with applying their mitigation actions, as well as ensuring the actions are regularly reviewed and updated.
on Actions – Goals and the Tribes' mitigation	Section 15.1 describes the Tribes' mitigation goals.
on Actions – Mitigation ities outlines all the the 2010 update. Each an analysis and uidance. There is no s on new and existing tructure in the actions.	Section 15.1.1 sets forth specific mitigation actions and projects for the Tribes to take to reduce risks from each hazard. Actions include considerations for new and existing buildings and infrastructure.
mplementation and es a current capabilities current and potential g for the mitigation lso outlines the process egration and the plan . These steps combined ation prioritization and ategy.	The Action Plan in Section 15.2 includes the costs, benefits, and a cost-benefit comparison. The Plan Adoption process is in Section 15.3. Section 15.4 describes the Plan Implementation and Maintenance Strategy, including the plan implementation process, the Steering Committee involvement, Annual Progress Reports, Plan Update procedures, Continuing Tribal Member Involvement, and Integration with Other Planning Mechanisms.

44 CFR Requirement	2010 Hazard
44CFR 201.7(c)(3)(iv): The mitigation strategy shall include a discussion of the Indian tribal government's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: An evaluation of tribal laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas; and a discussion of tribal funding capabilities for hazard mitigation projects.	Section V: I Maintenance – L Process includes
44CFR 201.7(c)(3)(v): The mitigation strategy shall include identification of current and potential sources of Federal, tribal, or private funding to implement mitigation activities.	Mitigation action included in each mi
44CFR 201.7(c)(4)(i): The plan maintenance process must include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan.	Section V: I Maintenance outli ensuring the plan is and updated alon plans.
44CFR 201.7(c)(4)(ii): The plan maintenance process must include a system for monitoring implementation of mitigation measures and project closeouts.	Section V: I Maintenance desc should and can revi on a regular responsibilities for and steps for monit
44CFR 201.7(c)(4)(iii): The plan maintenance process must include a process by which the Indian tribal government incorporates the requirements of the mitigation plan into other planning mechanisms such as reservation master plans or capital improvement plans, when appropriate.	Section V: I Maintenance – L Process explains incorporate other HMP maintenance

Appendix I

Mitigation Plan	2020 Hazard Mitigation Plan
mplementation and ocal Plan Integration	Integration with Other Planning Mechanisms process is addressed in 15.4.6. This section includes reviewing the HMP alongside other plans, regulations, and polices that relate to the HMP.
funding strategies are tigation action section.	Funding strategies are included in Section 15.2.1, Cost.
mplementation and ines the process for s reviewed, maintained, g with other relevant	Section 15.4.3 to 15.4.6 detail the multiple steps the Tribe can take to effectively review, maintain, and update their plan and ensure it is integrated with other relevant plans.
mplementation and ribes how the Tribe ew and update the plan basis, including the the plan maintenance oring.	Section 15.4.3 involves an Annual Progress Report to regularly monitor the plan's implementation and updating. Appendix D includes blank forms to assist the Tribe with their Mitigation Strategy Evaluation and Mitigation Action Evaluations.
mplementation and ocal Plan Integration how the Tribe can relevant plans into the process.	The plan maintenance process includes incorporation with other relevant plans. This is address in Section 15.4.6.

44 CFR Requirement	2010 Hazard
44CFR 201.7(c)(4)(iv): The plan maintenance process must include discussion on how the Indian tribal government will continue public participation in the plan maintenance process.	Section V: I Maintenance – Ong addresses public forward.
44CFR 201.7(c)(4)(v): The plan maintenance process must include a system for reviewing progress on achieving goals as well as activities and projects identified in the mitigation strategy.	Section V: I Maintenance inc Monitoring, Evalua Plan and Monitorin Actions.
44CFR 201.7(c)(5): The plan must be formally adopted by the governing body of the Indian tribal government prior to submittal to FEMA for final review and approval.	The adoption resolu

Appendix I

Mitigation Plan	2020 Hazard Mitigation Plan
mplementation and oing Public Participation involvement going	Continuing Tulalip citizen and community member Involvement is detailed in Section 15.4.5.
mplementation and ludes sections for ting and Updating the g Progress of Mitigation	Section 15.4.3 involves an Annual Progress Report to regularly monitor the plan's implementation and updating. Appendix D includes blank forms to assist the Tribe with their Mitigation Strategy Evaluation and Mitigation Action Evaluations.
ıtion is in Appendix D.	The adoption resolution form is in Appendix G.

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