



Transportation Resilience and Durability Case Study Series

The Federal Highway Administration is developing a series of case studies exploring resilience and durability efforts at transportation agencies across the United States. The case studies are developed through in-depth interviews with a geographically diverse range of transportation agencies. These case studies explore how resilience and durability factor into various phases of transportation decision-making, the scales and types of resilience and/or durability projects at the agencies, and the types of resilience addressed.

Key Takeaways

- The Makah Tribe is working to ensure durability of its infrastructure against environmental threats such as earthquakes, heavy precipitation, mudslides, and tsunamis.
- Drafting an action plan and assessing community relocation options have been key resilience priorities for the Tribe.
- The remote location of the Tribe, paired with limited available funding and capacity, have challenged resilience efforts.

Makah Tribe Demographics (ACS 2019)

- There are 2,850 enrolled citizens, and 1,541 people live on the Reservation.
- English is the primary language for over 95 percent of Makah Reservation residents.
- There are 552 housing units on the 47 square mile Reservation.

The Makah Tribe has resided in a remote oceanside region in the northwestern tip of Washington State for thousands of years and has had to adapt to a changing environment to survive. The Tribe is now engaged in various climate change and resilience projects to ensure the community's long-term ability to live safely in their Tribal lands.

Resilience Context

The Makah Tribe is a federally recognized Tribe indigenous to Neah Bay at the northwestern tip of the Olympic Peninsula in Washington State (Figure 1). Only one paved roadway, Highway 112, serves the Makah Reservation at Neah Bay. If this route is blocked, travel to and from the Reservation is disrupted.

Per the Makah Tribe Resilience and Relocation Draft Plan, the Reservation is exposed to numerous environmental risks including high seismic activity, tsunami risk, high wind speeds, intense precipitation, small landslides, coastal storms and extreme flooding, and extended summer droughts where usable water is scarce. These have made much of the Tribe's modern infrastructure, such as roadways and the electrical system, as well as the health and safety of the community, exposed and vulnerable.

The Makah Reservation is located near the Cascadia Subduction Zone, an area of high seismic activity capable of producing a 9.0 magnitude earthquake and an associated tsunami. A strong earthquake and tsunami event pose an existential threat to the community. Increasingly heavy storm and precipitation events as a result of climate change will also increase the risk of flooding and reinforce the need for the community to relocate. About 60 percent of Makah Reservation residents currently live within the tsunami inundation zone (TIZ).



Figure 1. Location of the Makah Tribe. Source: Makah Tribe.

Several buildings of high cultural and functional importance also remain vulnerable to tsunamis and earthquakes. These include administrative offices, an energy substation, a cell tower, an early childhood education center, a Tribal cultural history museum with thousands of artifacts, a health care facility, a retirement home, and the Neah Bay School.

The commute to the nearest full-service community to Port Angeles is a 4-hour round trip drive. The Makah Tribe Administration is the largest employer with over 350 staff working for the local government. Local fisheries are also a primary employer for citizens. Many citizens of the Makah Tribe commute daily to off-reservation employment in neighboring communities. School buses also make multiple daily trips with K-12 students traveling to Clallam Bay along SR 112. Additionally, major grocery stores, hardware stores, hospitals, and other services are all one hour (Forks, WA) to two hours (Port Angeles, WA) away.

One citizen of the Makah Tribe defined its resilience as “preserving unique cultural elements while continuing community environmental traditions such as fishing, gathering, hunting, and harvesting food staples such as berries.” Resilience was also defined by this citizen “as ensuring community safety and preparedness as the Makah people have always done and will continue to do.” Their resilience is also the ability to protect and respond to the natural environment and live within the Tribe’s system of balance. A staff member of the Makah Tribe described Makah’s resilience goals of preserving cultural traditions, ensuring reliability of infrastructure and other services, and leaving the community and the natural environment in a better place than it was found.

The Makah community has engaged in multiple efforts to strengthen its capacity and long-term resilience. The Tribe initiated formal climate resilience projects in 2003 after an earthquake in the Olympic Peninsula region led to concern for the risk of a tsunami. This prompted work to identify tsunami evacuation locations and conduct other emergency planning. The Makah Tribe has other resilience projects which range from sustainable energy assessments, water conservation efforts, and natural disaster planning. These include scouting for tsunami relocation sites, conserving water through scaled back consumption policies over the summers, writing a resiliency plan, discussing resilience in stakeholder meetings and committees, applying for funding opportunities, and seeking alternative means to generate energy locally.

The Tribe’s History of Resilience

The Makah people have an extensive history of adapting to a changing landscape and climate. The Tribe’s land base historically encompassed 100’s of miles inland that is now the Olympic Peninsula region. Being a sea-going tribe it included the Salish Sea, shared with the neighboring Vancouver Island tribes. The Makah’s sailed canoes 1,000 of miles south and west on the Pacific Ocean for trade and to attend gatherings. The Makah have a deep connection with the land and waterways, developed over many millennia. The community relied on the ocean for sustenance from fishing and hunting marine mammals like seals and whales and maintained sustainable practices of unitizing their forest and land-based animals. The Makah people have long relied on natural resources for their art, infrastructure, and survival. For example, traditionally they used kelp, twisted tree limbs, and roots for fishing line; seal skins as buoys; sharpened mussel shells for whaling and sealing harpoons; crystalized stone micro blades and sharpened bone and ivory knives for carving. Still in use today are carved cedar boxes and masks for dancing at ceremonial events. The region’s rain forests provide the Makah people with resources such as wood for carving canoes, fishing and hunting gear, intricate wood carvings, and building longhouses; cedar bark for finely woven hats, blankets and clothing, baskets, and other materials; land animals and birds for food, fur, and skin; and plants for food, medicine, and other uses. Historically, these materials were traded by the Makah to other groups in the region, in Puget Sound, and to inland tribes seeking fresh and preserved foods, tools and artwork. These traditions continue today with several Tribal artisans who are world renowned makers of basketry, carved totems, masks, cedar boxes, canoes, silver & gold carved jewelry, paintings, and silk screens.

The Tribe's Resilience Challenges

The Makah Tribe has faced internal and external limitations that have inhibited its ability to implement its resilience strategies. These challenges date back to European settlement and the signing of the 1855 Treaty of Neah Bay, which ceded 469 square miles of original Makah lands to the United States Government. Because of the remote location of the Makah Reservation, the community can face major disruptions to travel, food, emergency services, medical services, commodity flow, and energy when Highway 112 is blocked by mudslides or fallen trees. Additionally, minimal access to funding has limited the Tribe's ability to secure the amount of money required to pursue some major resilience initiatives. Tribal staff dedicated to adapting to climate change and promoting resilience also have limited time and financial resources. Such constraints have inhibited the Tribe's resilience efforts and continue to be hurdles for the community to overcome.

Resilience Initiatives within the Tribe

Resilience Action Plan

Staff within the Makah Tribe are drafting a resilience action plan to improve preparedness for climate change and to strengthen community resilience. The resilience plan was informed by 90 community surveys and a series of in-depth community interviews. It incorporates the Tribe's long history of resource management and emphasizes the longevity of the community. The plan will reflect culturally appropriate resilience strategies including ones aimed at establishing economic sovereignty through commercial fishing; restoring the ecology of important harvest and cultural sites; teaching harvest, storage, and preparation of cultural foods to the community; taking care of elders by providing healthy and nutritious cultural foods; and restoring old coastal campsites for canoe paddlers. The resilience action plan addresses community relocation in several of its sections.

Addressing Road Access Limitations Along Route 112

Because of the risk of road blockage along Route 112, and the significance of it being the only route in and out of the Reservation, the Makah Tribe has identified logging roads and seaborne access for escape and emergency resupply of goods. Currently, the Tribe is in collaboration with Washington State DOT in planning alternate routes because of many occasions where the route has been inaccessible, such as when a major slide occurred on November 15, 2021 just west of Clallam Bay (Figure 2). Often during peak winter storm season, community members bring chainsaws in their vehicles to remove fallen trees in the case of events, as it can take several hours before Washington State DOT can respond.

Water Conservation Measures

The Makah Tribe has insufficient water for its needs and experiences extreme droughts in the summers with limited available water storage.

The community therefore has implemented water use restrictions each summer to ensure water is only utilized for necessary purposes (e.g., not for washing cars or watering lawns). The Tribe is considering installing a water containment system including a water treatment center, but insufficient funding remains an issue. Limited water supply impacts the Tribe's ability to take some resilience actions such as relocating critical infrastructure out of the TIZ and diversifying and developing economic opportunities locally. Drought, water shortages, and increasing water temperatures are projected to increase in frequency and severity with climate change impacting both natural resources and exacerbating resilience challenges.



Figure 2. A 2021 slide near Clallam Bay covered 325 feet of the highway. Source: WSDOT.

Sustainable Energy Development

There has been a focus within the Makah Tribe to improve energy self-sufficiency. Power outages are frequent and in the event of storms or seismic events that could leave the Tribe isolated, local and reliable alternative energy sources would be critical for public health and public safety. The Tribe is considering options for biomass energy production and has a long history of evaluating local renewable energy options that might address challenges. They are partnering with a researcher to evaluate the feasibility of small-scale wave energy to meet emergency backup power and freshwater generation needs as well.

Community Relocation Efforts

An assessment by the US Army Corps of Engineers determined that there would be a 15-minute window in a major tsunami event after an emergency warning for the community to evacuate to higher ground. Permanent relocation planning, as well as interim emergency preparedness, is an ongoing priority of the Tribe. In the interim, while work on permanent relocation continues, the Makah community has seven temporary containment trailers situated in evacuation areas with food, water, and other emergency supplies in case of disaster. In a major tsunami disaster, the community's emergency base camp would need to support the village population for 3-6 months before federal agencies could provide support.¹

The Makah Tribe has consulted with various government agencies over the past nearly twenty years, including the US Army Corps of Engineers and National Renewable Energy Laboratory, to consider community relocation and building site relocation options. Relocation is a necessary step towards a long-term goal of Tribal resilience. Tribal staff have worked with subject-matter experts from these agencies to conduct site visits and assess the feasibility for certain places for relocation. There is one relocation site at Cougar Hill, which is the most viable relocation site but alternative relocation sites are still needed (for certain facilities such as the school) to include all the community's essential facilities. The scale, scope, and level of coordination required in the community relocation effort requires substantial funding support and coordination assistance beyond existing resources to which the Makah Tribe currently has access. Tribal staff will continue to apply for funding opportunities to support this relocation effort.

Interagency Collaboration and Community Engagement

Interagency Committees Addressing Resilience

The Makah Tribe has three different interagency committees or groups dedicated to advancing community resilience and adapting to climate change. The Land Use Committee consists of members from agencies who discuss water quality planning, realty, public works, oversee the history museum, cover public safety, the environment, transportation, and housing. This committee conducts public outreach. The Land Use Committee has not met in person since the beginning of the COVID-19 pandemic. The Emergency Operations Committee plans for disasters and outages as well as identifies transportation and evacuation sites. Several of the same agencies on the Land Use Committee sit on this committee as well. This committee meets regularly and has integrated pandemic planning into its discussions. The Makah Climate Change Work Group has gathered and coordinated staff and community input on climate resilience and begun drafting a Climate Resilience Action Plan.

To strengthen community preparedness to storms, the Makah Tribe practices emergency evacuation drills, with monthly exercises at the local school. There is an evacuation plan that outlines where each section of the reservation is supposed to evacuate in case of emergency. These plans are communicated to residents across the reservation so that they are equipped for disaster scenarios.

¹ Evaluation of Makah Tribal Emergency Basecamp and Structural Analysis, US Army Corps of Engineers, 2016.

Next Steps

The Makah Tribe plans to develop a master plan for infrastructure relocation above the Tsunami Zone. This plan would include designs for new roads, water access, sewage, and power generation. The master plan would include preliminary cost estimates for relocating facilities and schools. In addition to the master plan, the Tribe also hopes to finalize its Resilience Action Plan in 2022 and continue efforts to secure funding for resilience projects.

For More Information

Resources

Makah Tribe's Website: <https://makah.com/>

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