

# Reciprocal Refuges

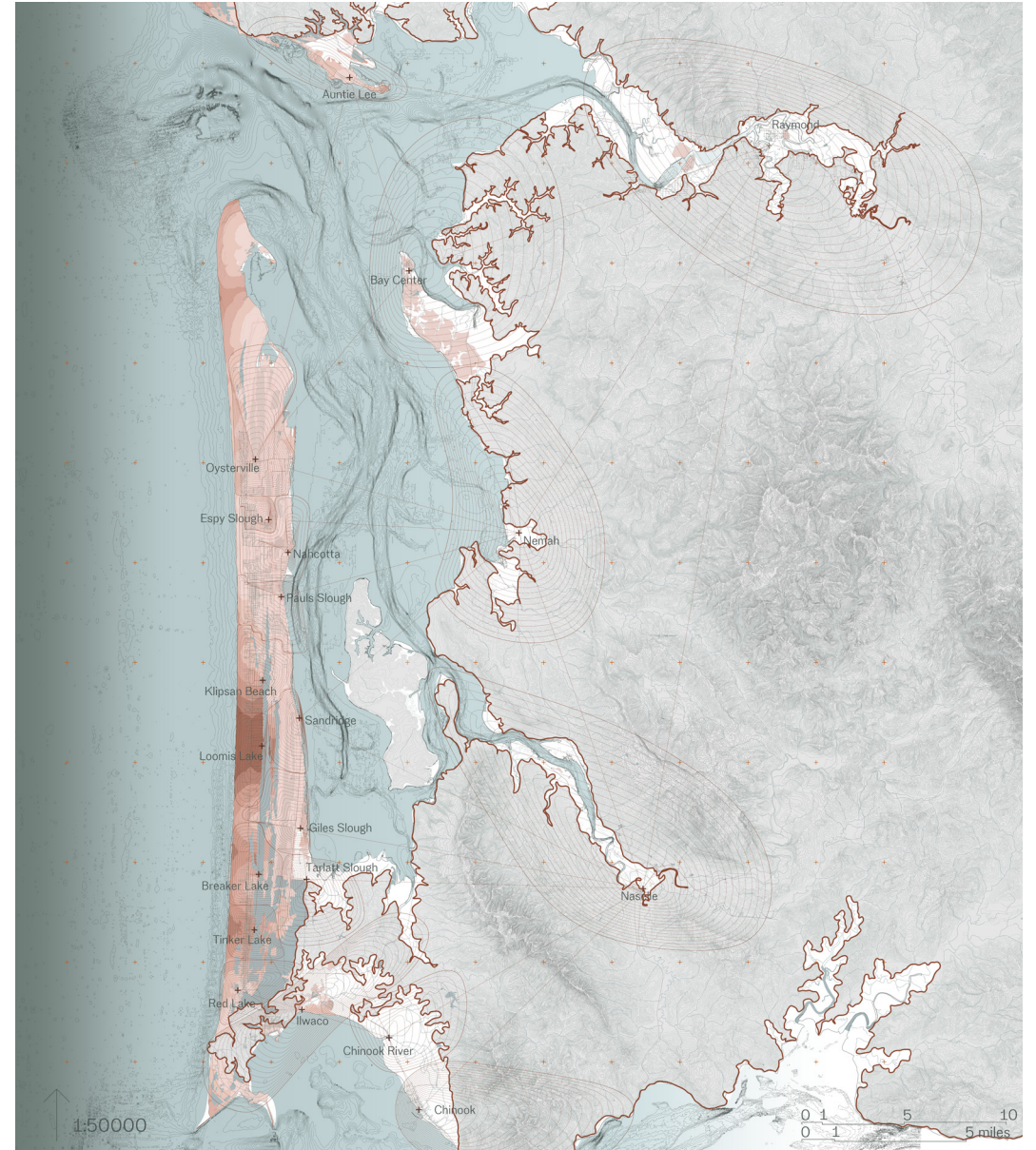
Margit Applegate

Master of Architecture Diploma

*Reciprocal Refuges* envisions a network of tsunami evacuation towers surrounding Willapa Bay, in present-day Washington State, USA, that responds dynamically to the lunar cycles and the seasonal migration of salmon through its waters.

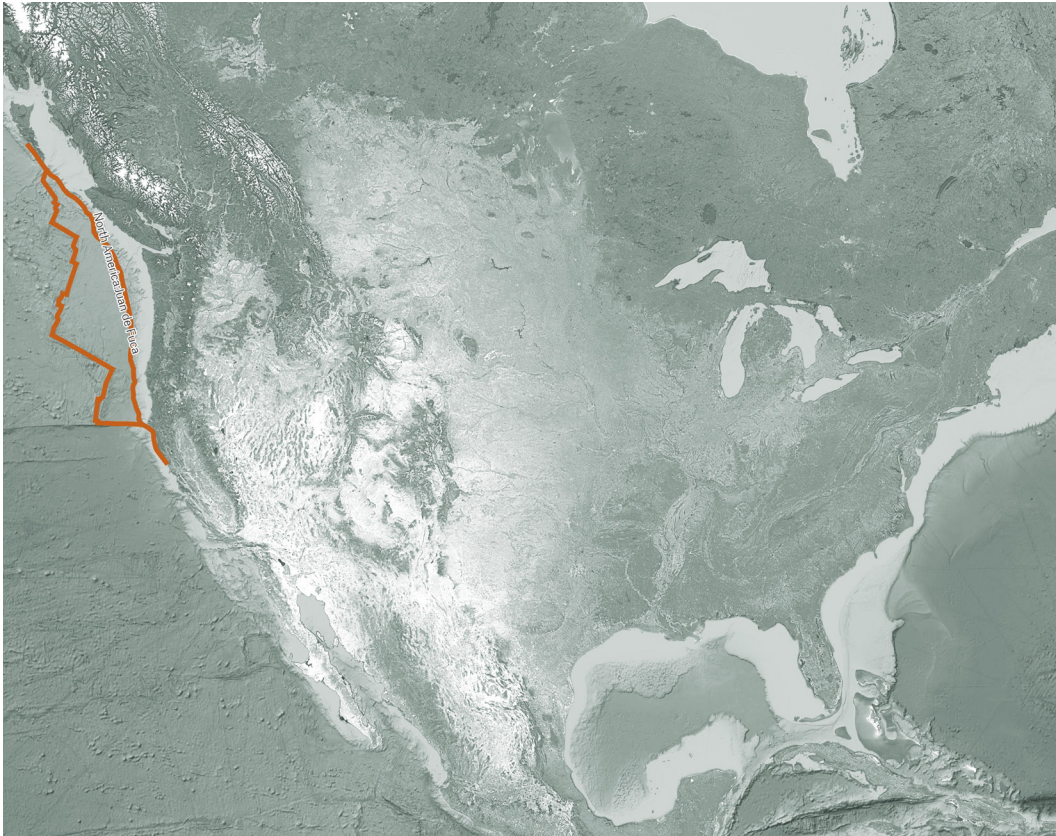
The design of the towers came from a desire to translate ancient knowledge systems into climate-resilient infrastructures. It began from the idea that Indigenous land management practices, which have been practiced sustainably in North America for thousands of years before colonial interventions, can be elevated as a means to imagine a climate adaptive future. This research aims to unravel contested histories and colonial understandings of land, so as to find new ways of belonging in the wake of ecological disasters caused by extractive capitalism.

This work is a repository of both scientific knowledge and Chinook ways of knowing, whose ancestral lands are situated within the region most vulnerable to tsunami events. It develops a lexicon to decipher— and weave together— the languages of multiple ontologies. This work creates space for a decolonial imaginary to emerge, in which architecture serves as a form of Indigenous reclamation, revitalizing ancient Chinook fishing technologies and engaging in reciprocity with the more-than-human world.



The Cascadia subduction zone—a 1,000-km “megathrust” fault extending from British Columbia to California, positioned roughly 100 km offshore, is predicted to experience a catastrophic 9.0-magnitude earthquake at any moment.

The area of impact will cover most of the West coast, and directly affect some 7 million people. When the next rupture happens, that region is predicted to suffer the worst natural disaster in the history of North America.<sup>1</sup>

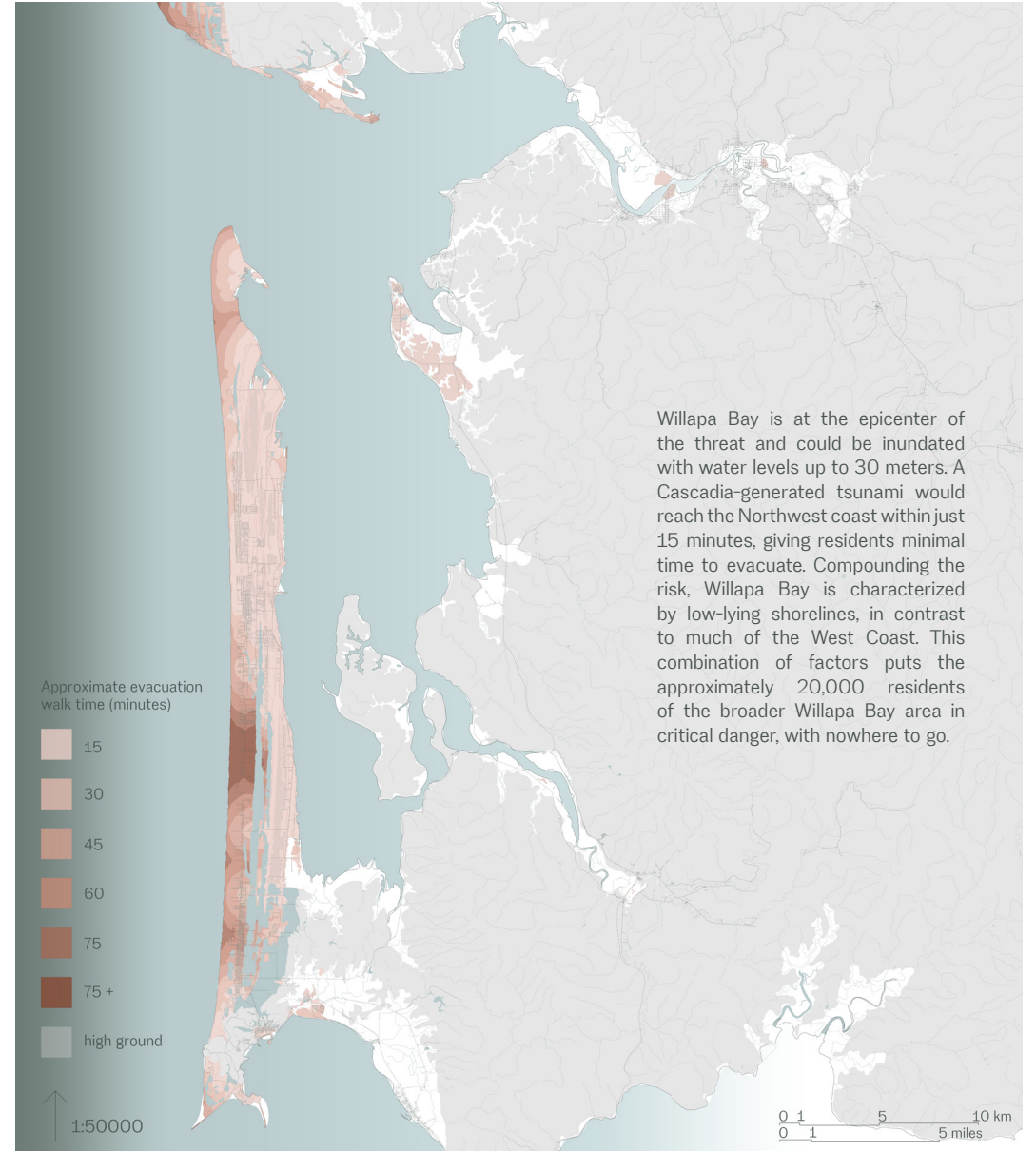


Predicted Tsunami Run-up



6 Inundation Line

Estimated walk time to high ground



On the other side of the Pacific, Japan has a very proactive approach to tsunami preparedness, with a focus on public education, early-warning systems, and dedicated evacuation infrastructure. Along its coastlines, the country has constructed hundreds of tsunami evacuation towers—elevated platforms designed to provide safe refuge for residents in areas where high ground is inaccessible. These towers, built to withstand powerful hydrostatic forces, exemplify Japan's commitment to minimizing loss of life during a tsunami.



The project follows Japan's initiative by constructing a network of tsunami evacuation towers along the coastline surrounding Willapa Bay. 20 tower locations are identified based on population density, distance to high ground, possible evacuation routes, and the estimated wave arrival time. Each tower is designed to serve residents within a 15-minute walking radius for able-bodied individuals.

However, significant questions remain. What happens to these towers in the 300 years between Cascadia subduction zone ruptures? How can they remain relevant to the community during the long intervals between disasters? Additionally, if towers must be as tall as 30 meters to withstand tsunami forces, how can they accommodate less-able-bodied individuals who may struggle with a complex network of stairs? Reciprocal Refuges, explores how such emergency infrastructure can serve the unique geographical and cultural needs of the communities it is designed to protect—both during and beyond times of crisis.



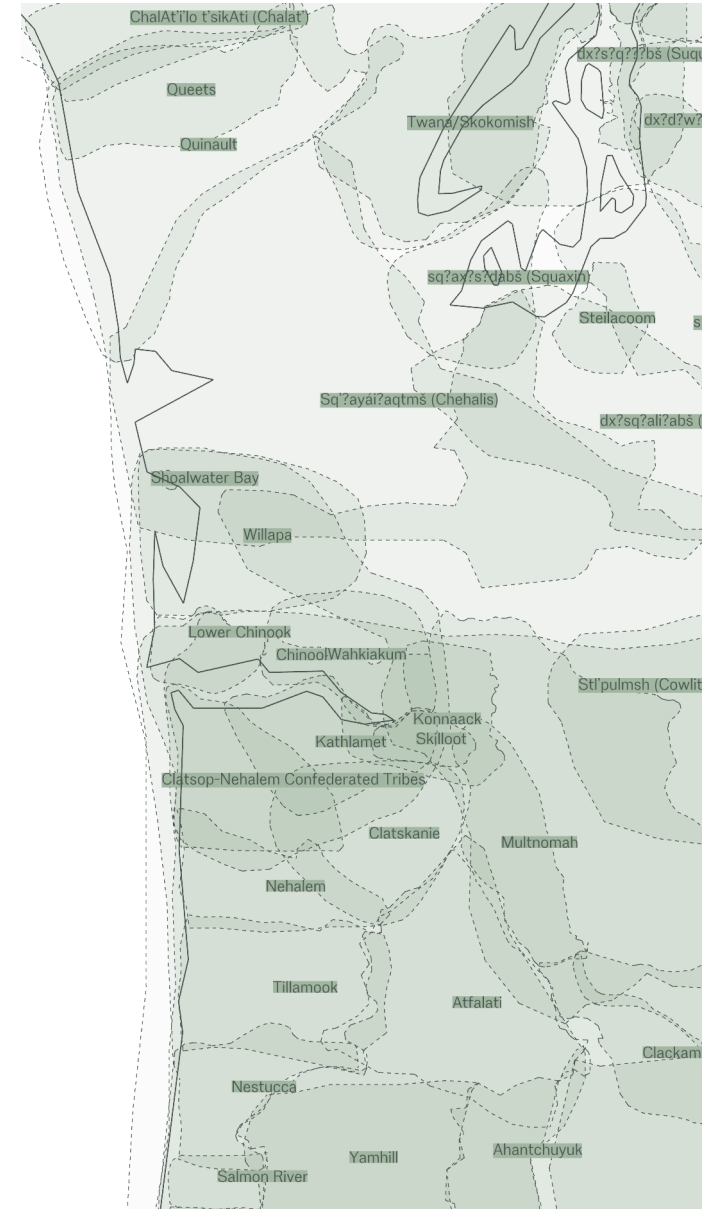
The last rupture of the Cascadian subduction zone was in 1700. The only evidence we have of this event is the oral history of the Chinook Nation- an Indigenous community native to the Washington coast. It was described by the Chinook people as “Thunderbird lifting Whale into the air and dropping him repeatedly to make the mountains shake violently”.

The Chinook people continue to live on their ancestral lands surrounding Willapa Bay, where they are at the forefront of advocating for tsunami preparedness. At the same time, they remain embroiled in a 120-year struggle for federal recognition as a sovereign nation. Federal recognition provides tribes with access to essential protections and benefits, such as housing, healthcare, educational opportunities, and emergency preparedness infrastructure, as compensation for the loss of their lands.

The urgent need for these structures offers an opportunity to translate ancient Chinook knowledge systems into climate-resilient infrastructures, and by doing so, unravel colonial understandings of land, so as to find new ways of belonging in the wake of ecological disasters.

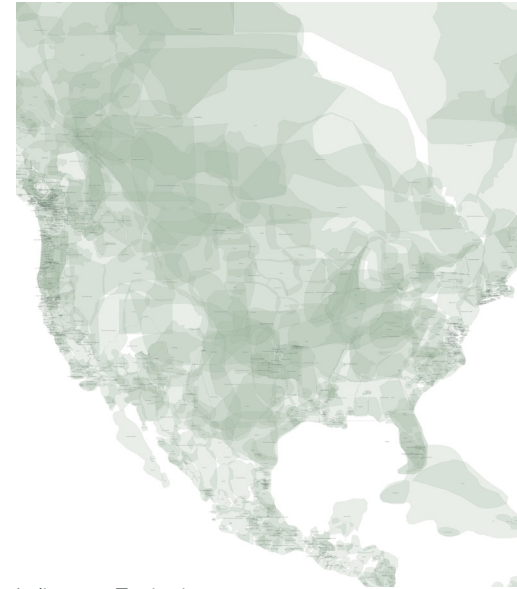
Reciprocal Refuges builds upon Chinook land management practices to imagine a network of towers that ensure safe refuge for all beings in the event of a tsunami.

Indigenous territories on the coast of present-day Washington prior to colonisation

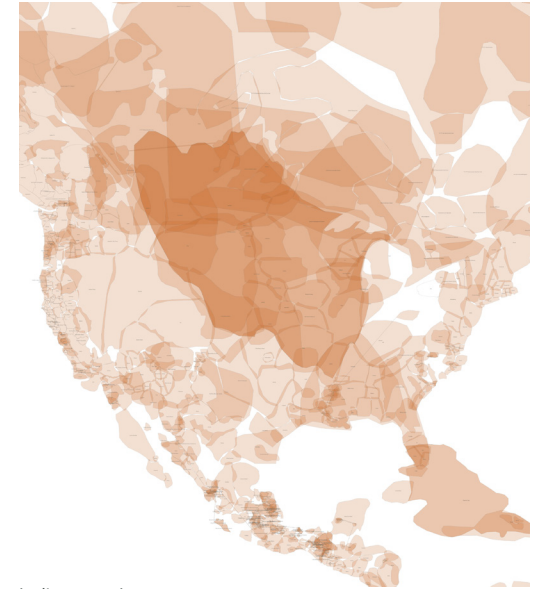


*Reciprocal* comes from the Indigenous worldview that humans must engage in reciprocity with the more-than-human world. Reciprocity is the responsibility of humans to care for the ecosystems that sustain them, in a continuous cycle of giving and receiving.

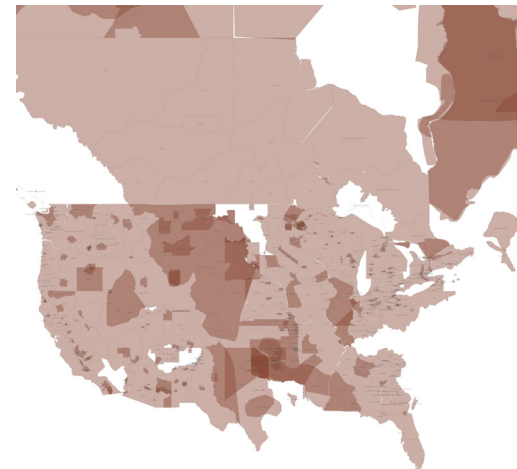
*Refuge* comes from the Latin, meaning a place to which one can flee to in moments of undoing.



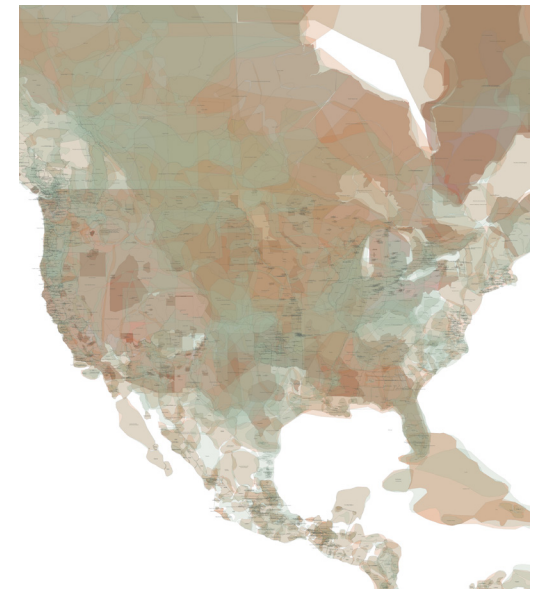
Indigenous Territories



Indigenous Languages



Treaties responsible for Indigenous Land seizure

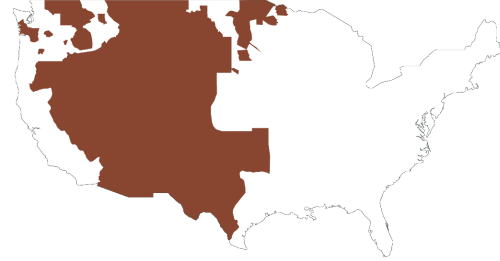


# Seizure of Indigenous Lands

1784



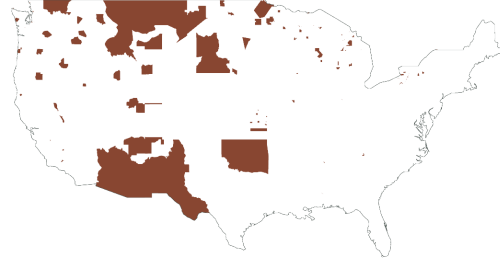
1860



1820



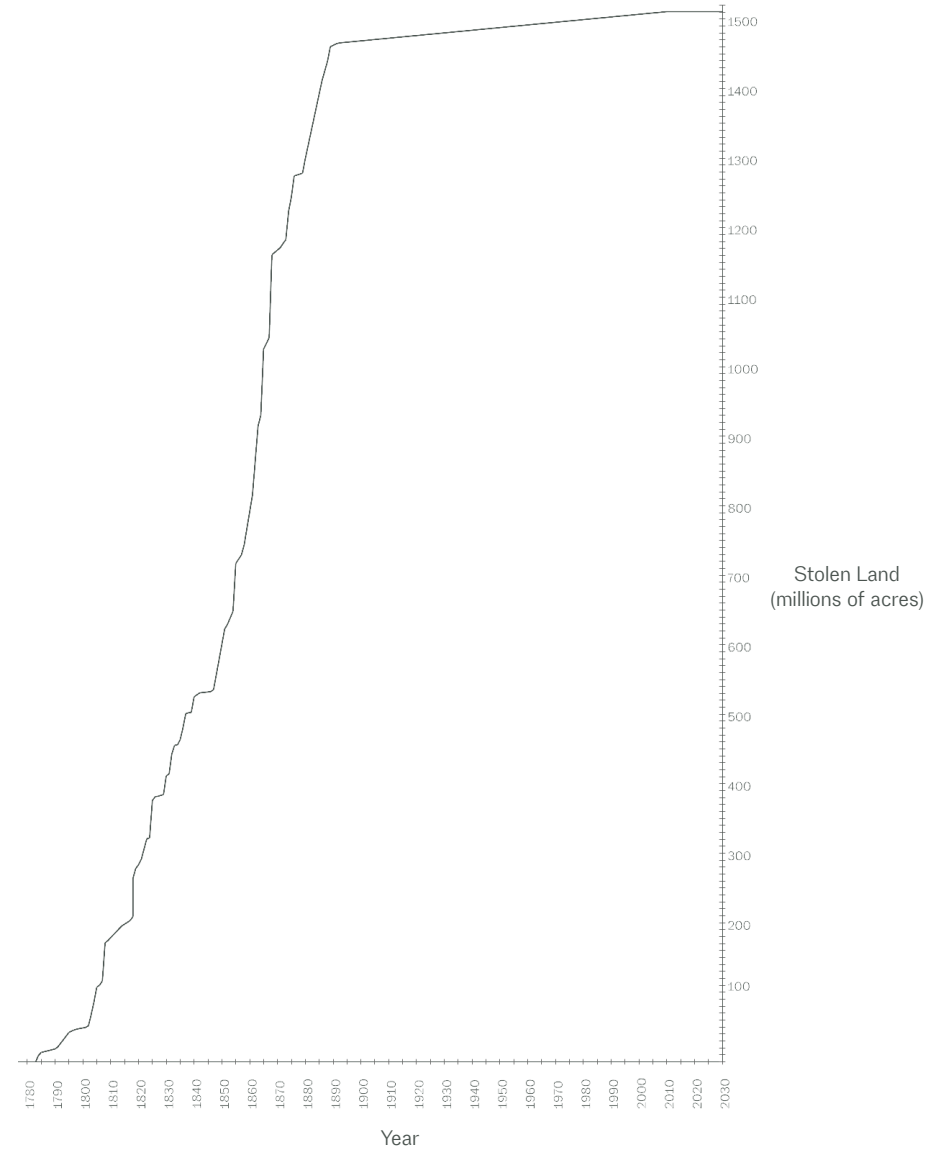
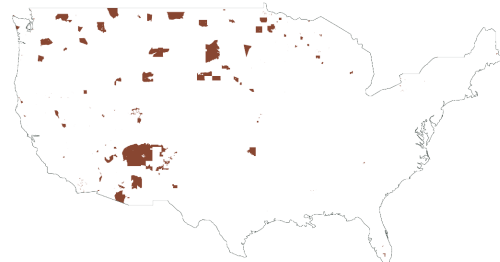
1880



1840



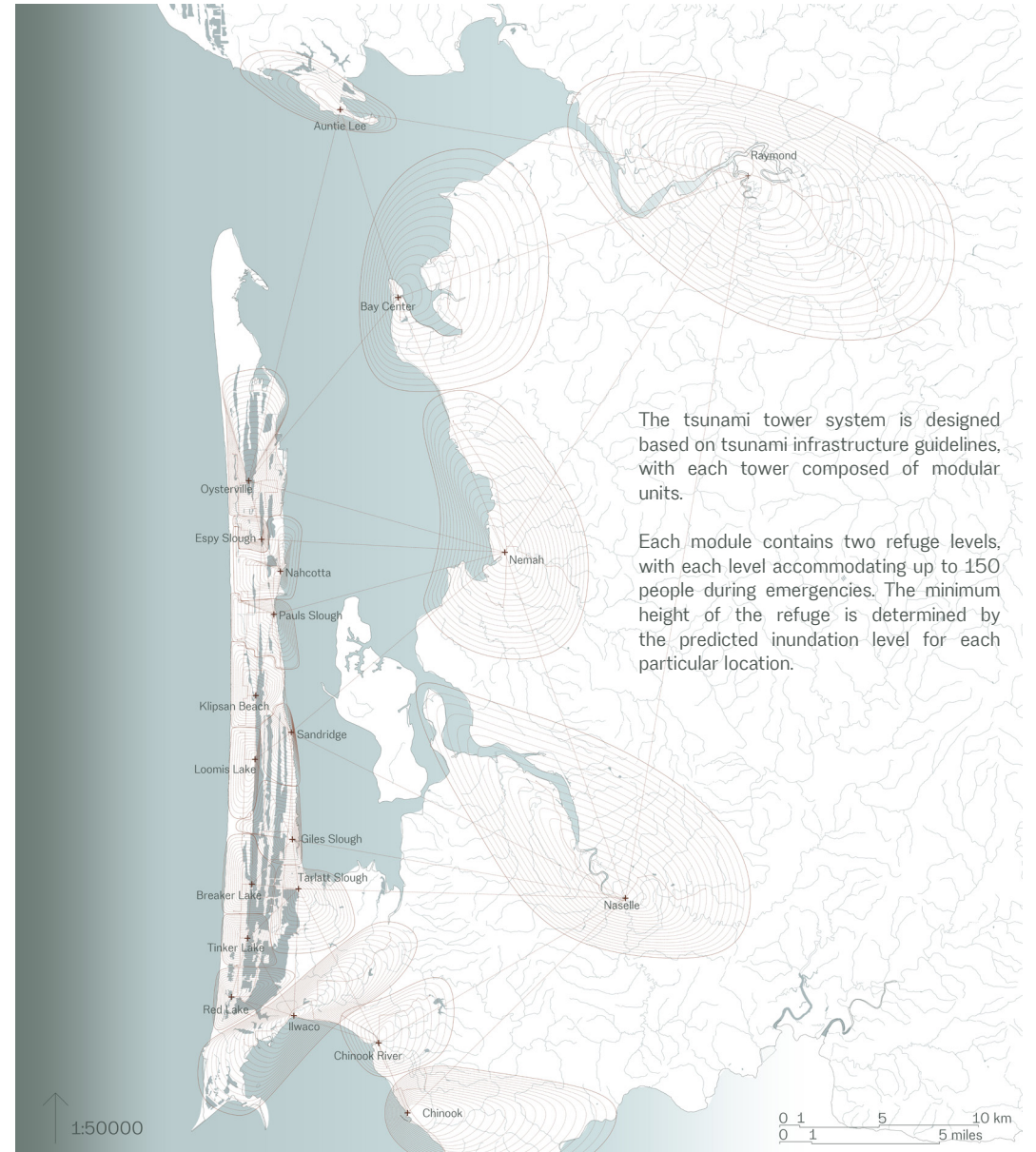
present-day reservations





location	wave arrival time (min)	# of people = 100	inundation level minimum height (ft)	# of modules
Nemah				
Chinook River				
Bay Center				
Sandridge				
Tarlatt Slough				
Giles Slough				
Loomis Lake				
Raymond				
Espy Slough				
Chinook				

location	wave arrival time (min)	# of people = 100	inundation level minimum height (ft)	# of modules
Breaker Lake				
Naselle				
Ilwaco				
Oysterville				
Nahcotta				
Red Lake				
Tinker Lake				
Auntie Lee				
Pauls Slough				
Klipsan Beach				

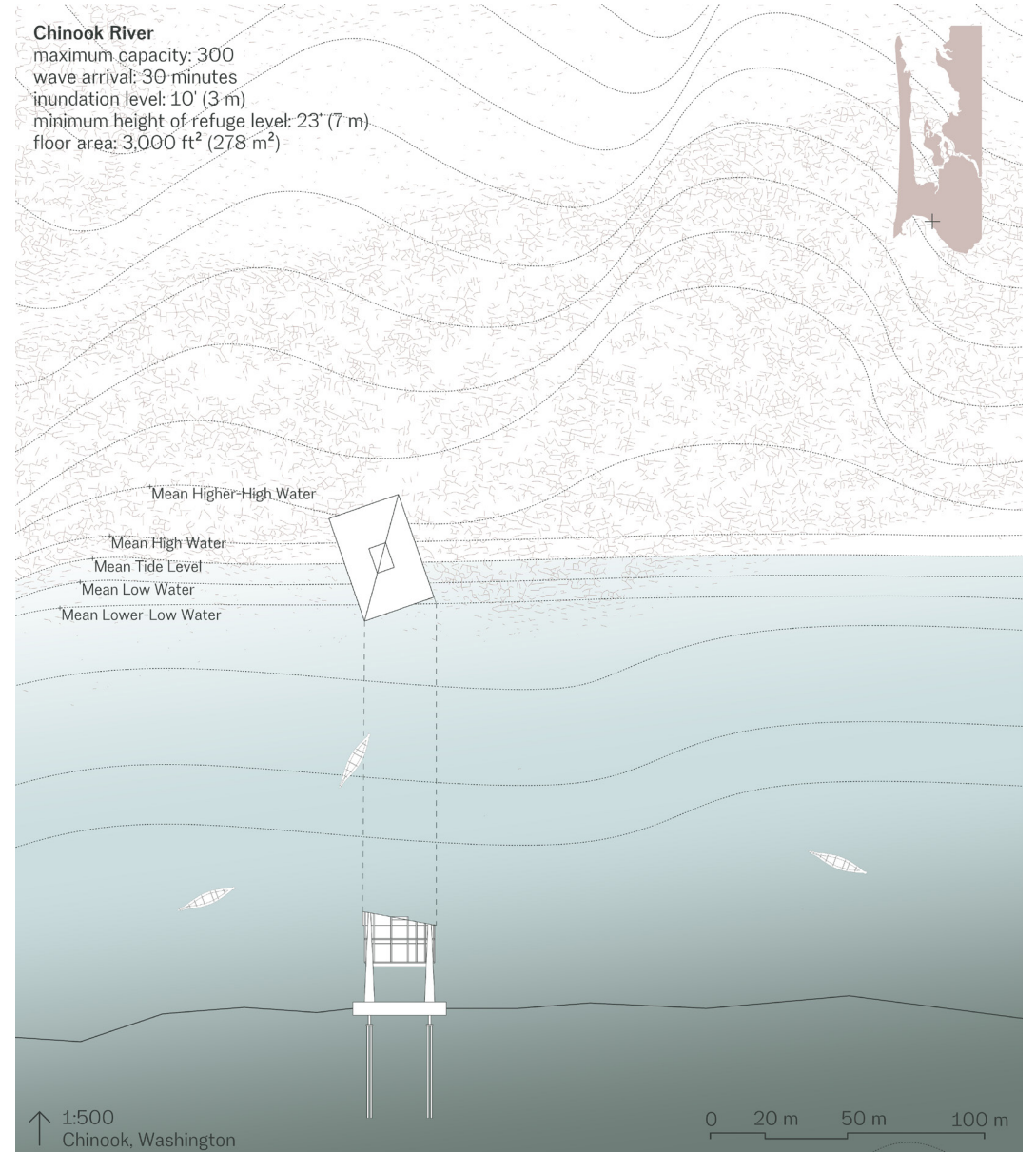


The tsunami tower system is designed based on tsunami infrastructure guidelines, with each tower composed of modular units.

Each module contains two refuge levels, with each level accommodating up to 150 people during emergencies. The minimum height of the refuge is determined by the predicted inundation level for each particular location.

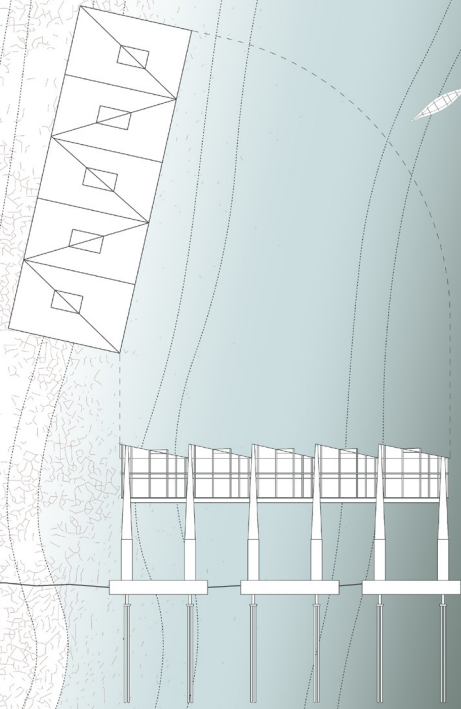
In the region surrounding the Bay, 20 tower locations are identified. 3 specific locations exemplify how the towers might agglomerate at 3 different scales:

1. Micro Scale at Chinook River
2. Medium scale at Loomis Lake
3. Mega scale at Nahcotta



**Loomis Lake**  
 maximum capacity: 1400  
 wave arrival: 15 minutes  
 inundation level: 22' (6.7 m)  
 minimum height of refuge level: 39' (12 m)  
 floor area: 15,000 ft<sup>2</sup> (1,393 m<sup>2</sup>)

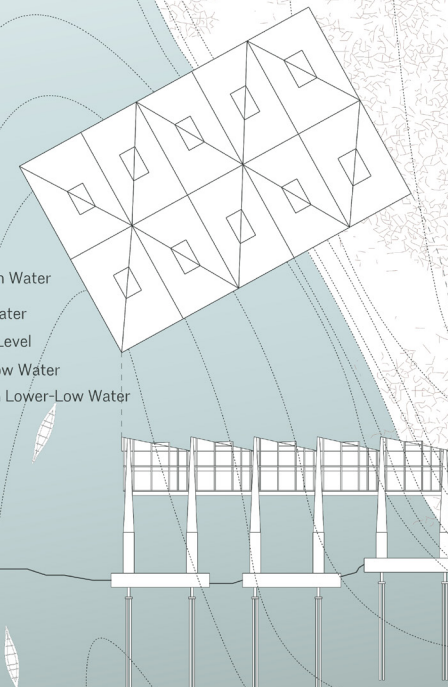
Mean Higher-High Water  
 Mean High Water  
 Mean Tide Level  
 Mean Low Water  
 Mean Lower-Low Water



↑ 1:500  
 Loomis, Washington

**Nahcotta**  
 maximum capacity: 3000  
 wave arrival: 20 minutes  
 inundation level: 10' (3 m)  
 minimum height of refuge level: 23' (7 m)  
 floor area: 30,000 ft<sup>2</sup> (2,787 m<sup>2</sup>)

Mean Higher-High Water  
 Mean High Water  
 Mean Tide Level  
 Mean Low Water  
 Mean Lower-Low Water

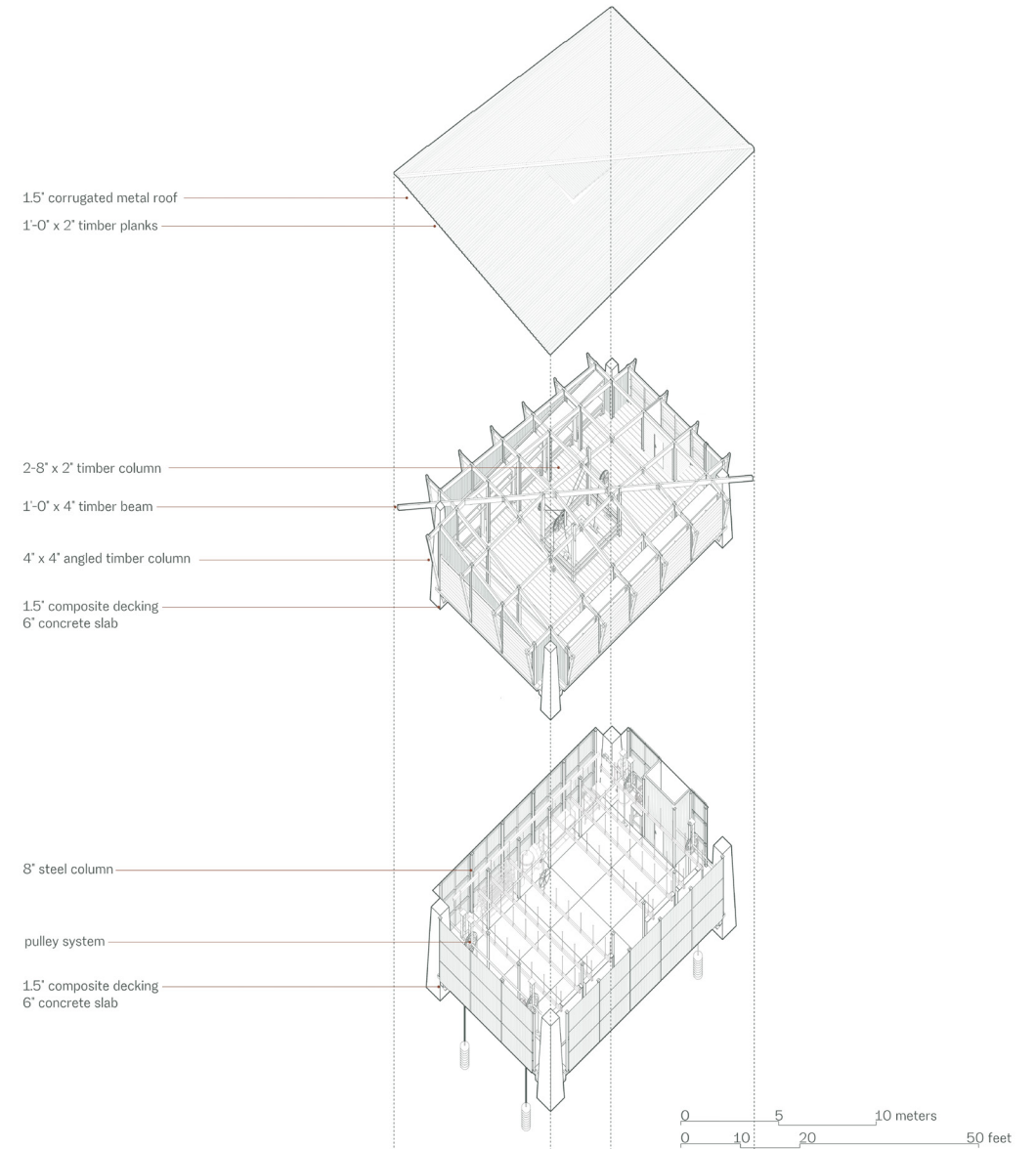
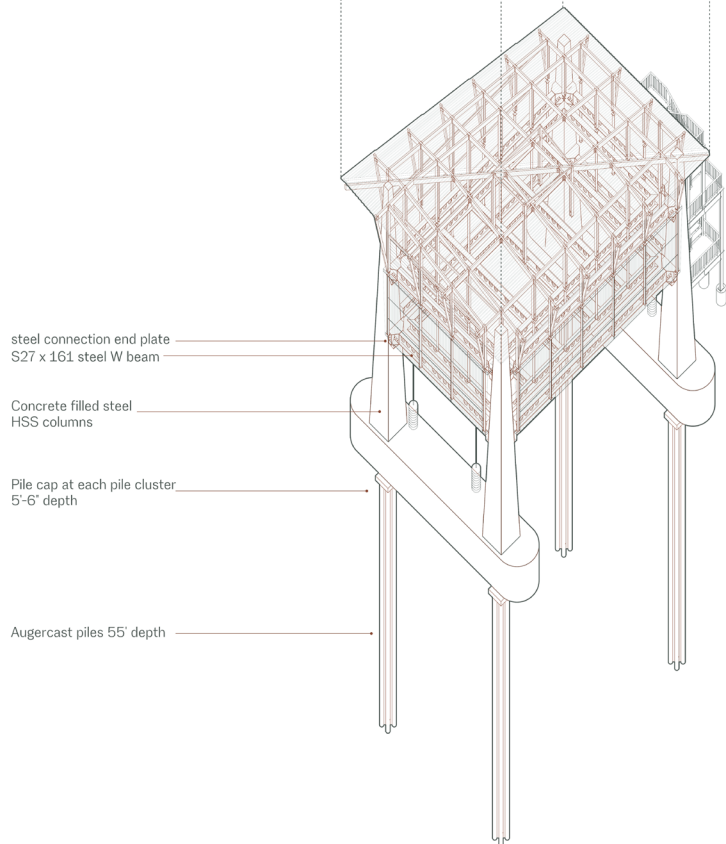


↑ 1:500  
 Nahcotta, Washington

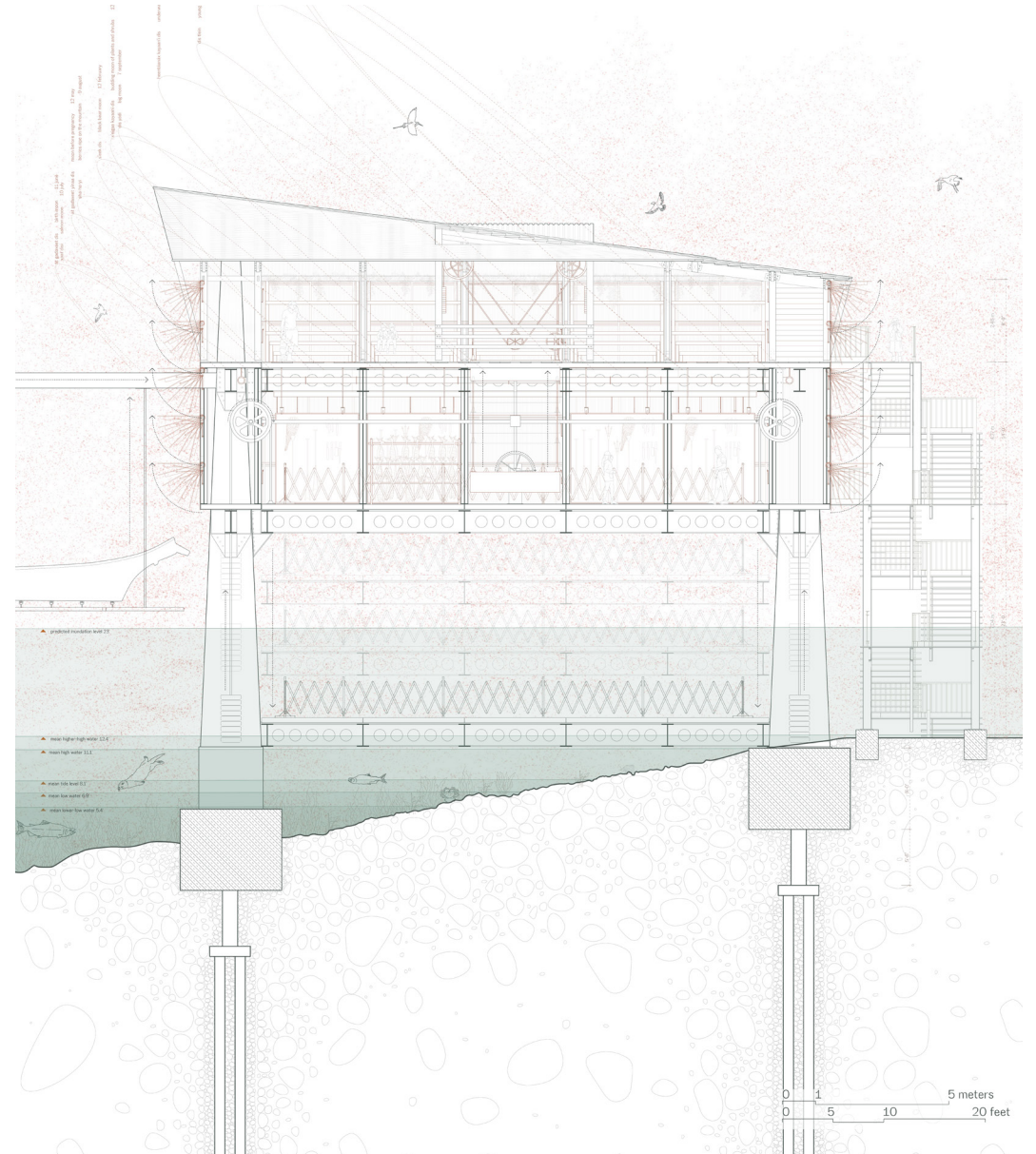
0 20 m 50 m 100 m

The module is supported by four 6-ft-wide concrete-filled steel HSS (hollow structural section) columns. These columns are anchored by a 10-ft-wide concrete footing secured with eight 55-ft-deep auger cast piles, and the columns are braced with a robust system of steel cellular beams.

The structural components are specifically designed to resist the extreme forces exerted by tsunami waves, ensuring the towers can withstand forces such as hydrodynamic loads, buoyant forces, and debris impact. The combination of reinforced concrete, steel bracing, and deep anchoring provides exceptional robustness. Rising above the landscape, these towers are meant to serve as enduring symbols of safety and resilience for the communities they protect.

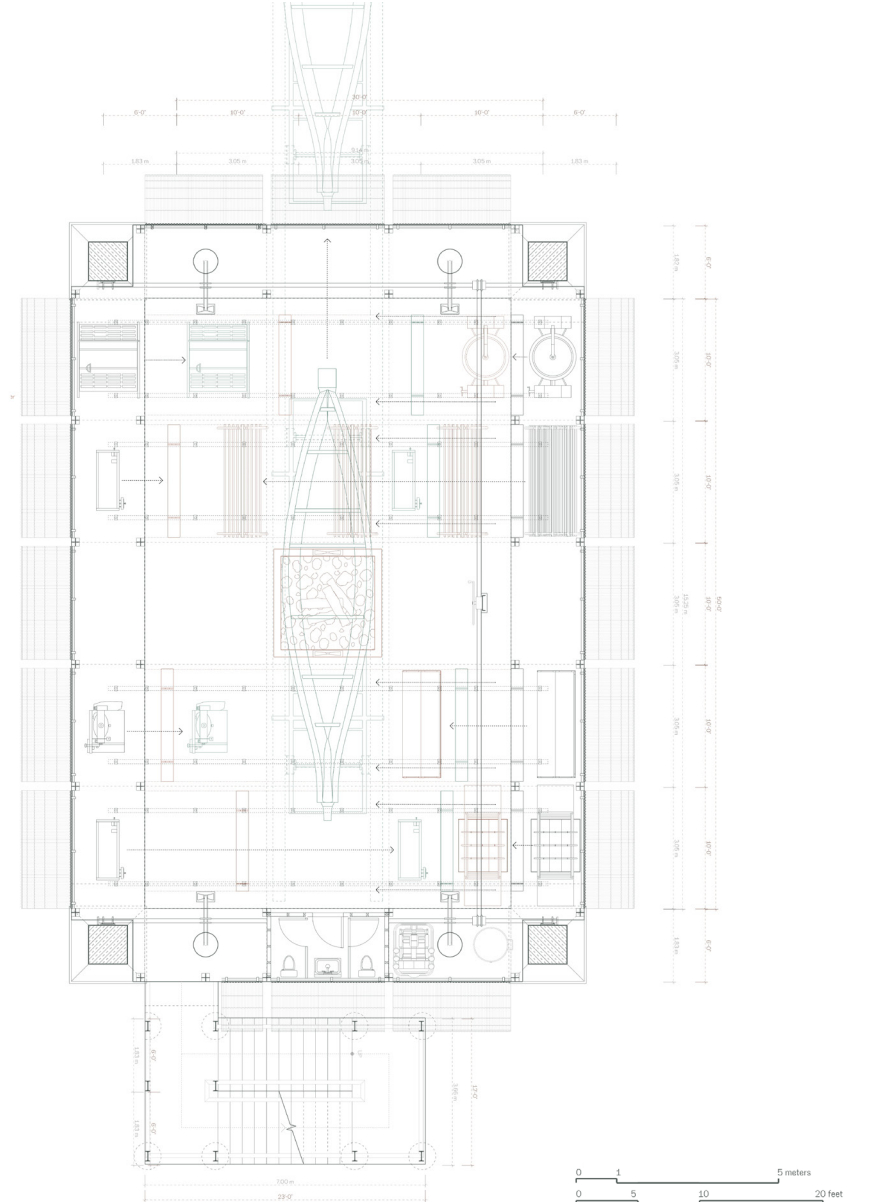
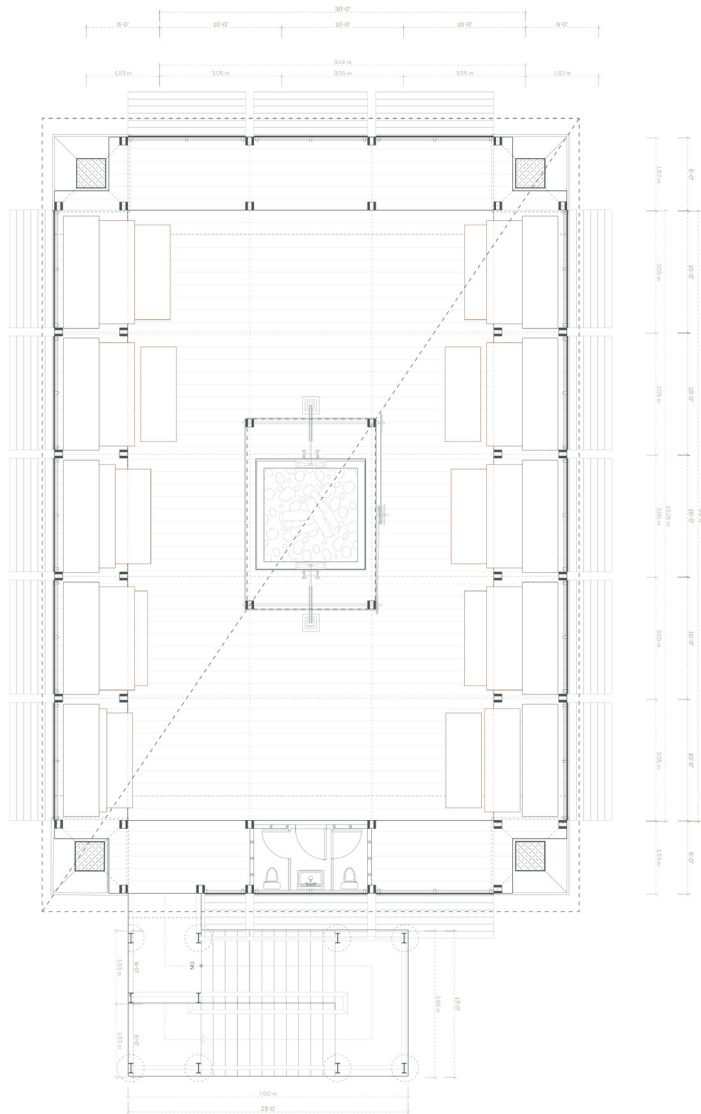


In order to efficiently move people of all capabilities to safety, the lower refuge level is equipped with a pulley-operated lift that travels between ground level and the refuge platform. Inspired by vertical lift bridge systems, the pulley mechanism can move significant weights without electricity, powered instead by a human-operated wheel. During the tsunami, refugees have the option to take the stairs or the lift.



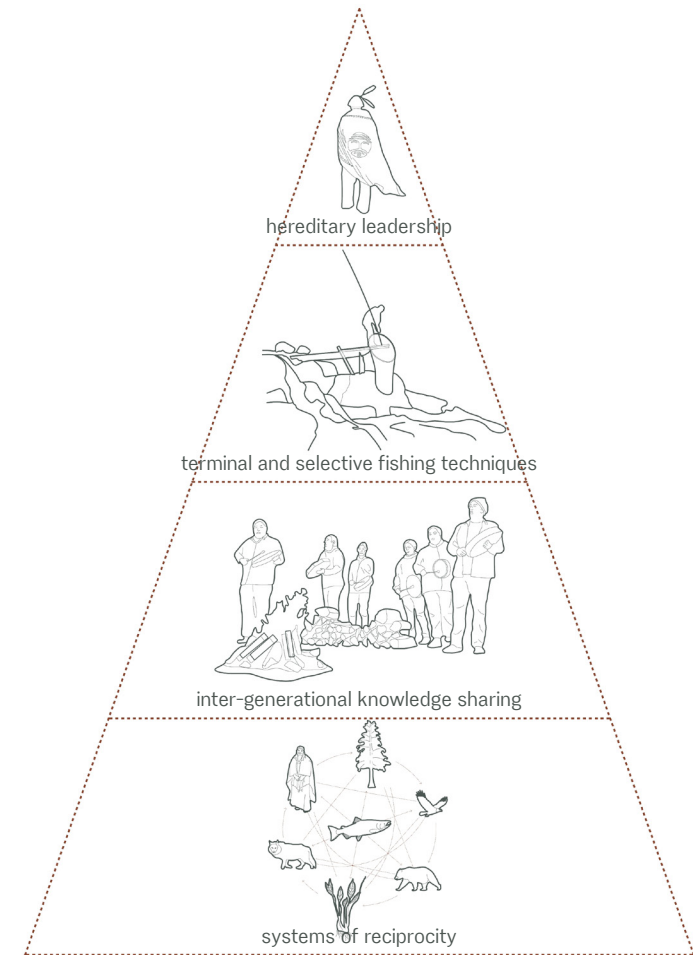
During the period before and after a tsunami event, the everyday function of the towers responds dynamically to the lunar cycles and the seasonal migration of salmon through the waters of the Willapa Bay estuary.

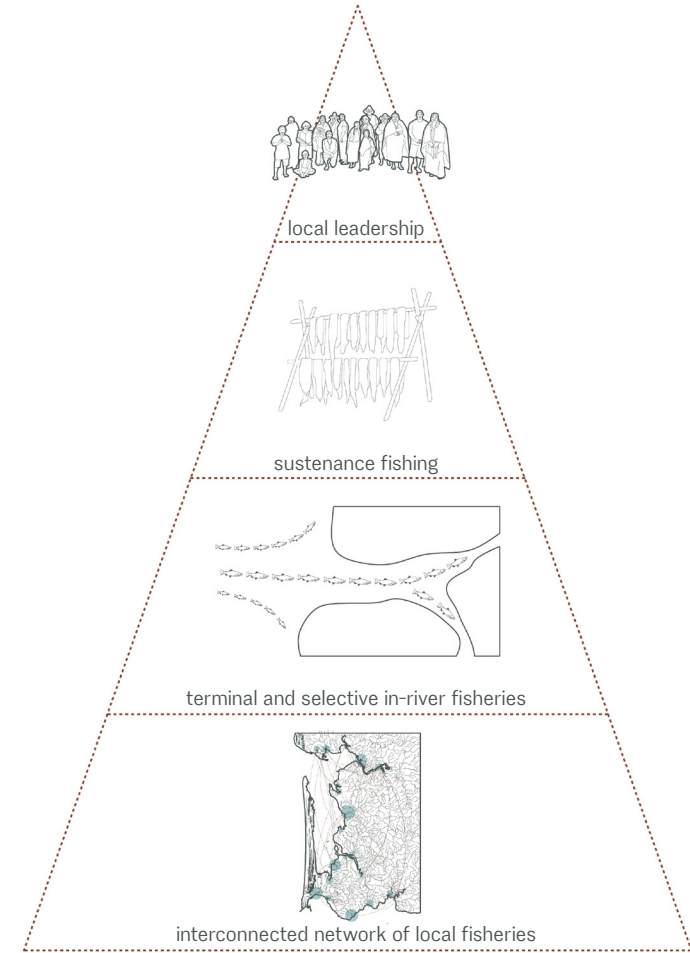
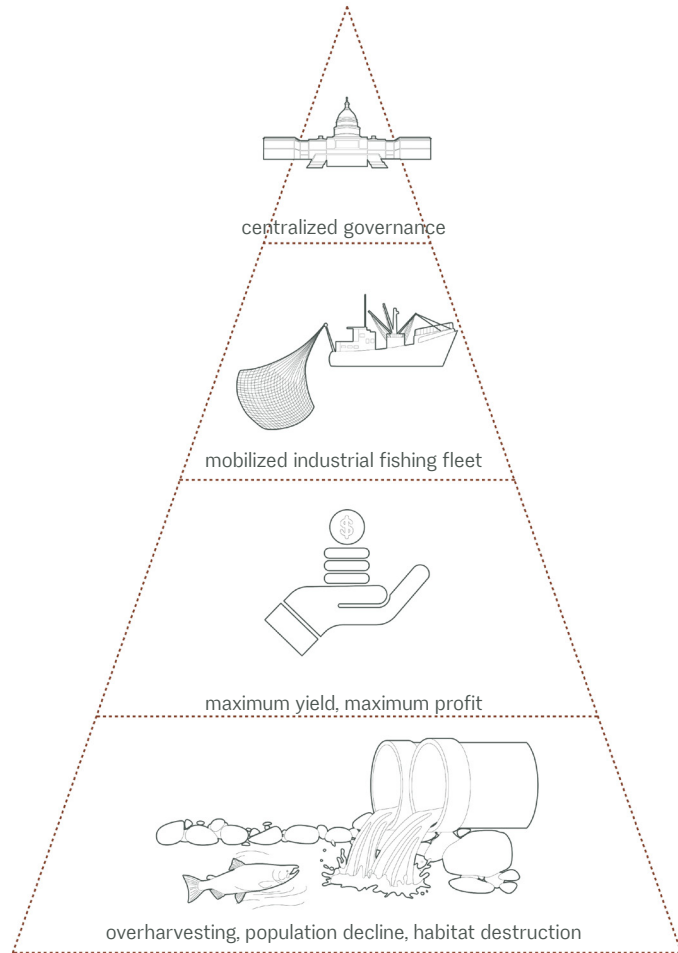
The first level serves as a fishery during the salmon's upstream migration and transforms into a traditional canoe workshop during the spawning season. The second level operates year-round as a plankhouse, a sacred ceremonial space central to Chinook culture.



Through millennia of reliance on salmon, members of the Chinook tribe have developed intricate land and water management systems rooted in spiritual stewardship practices. These practices prioritize the health of the ecosystem by focusing on what is left behind rather than what is taken, utilizing terminal and selective fishing techniques to sustain reciprocity.

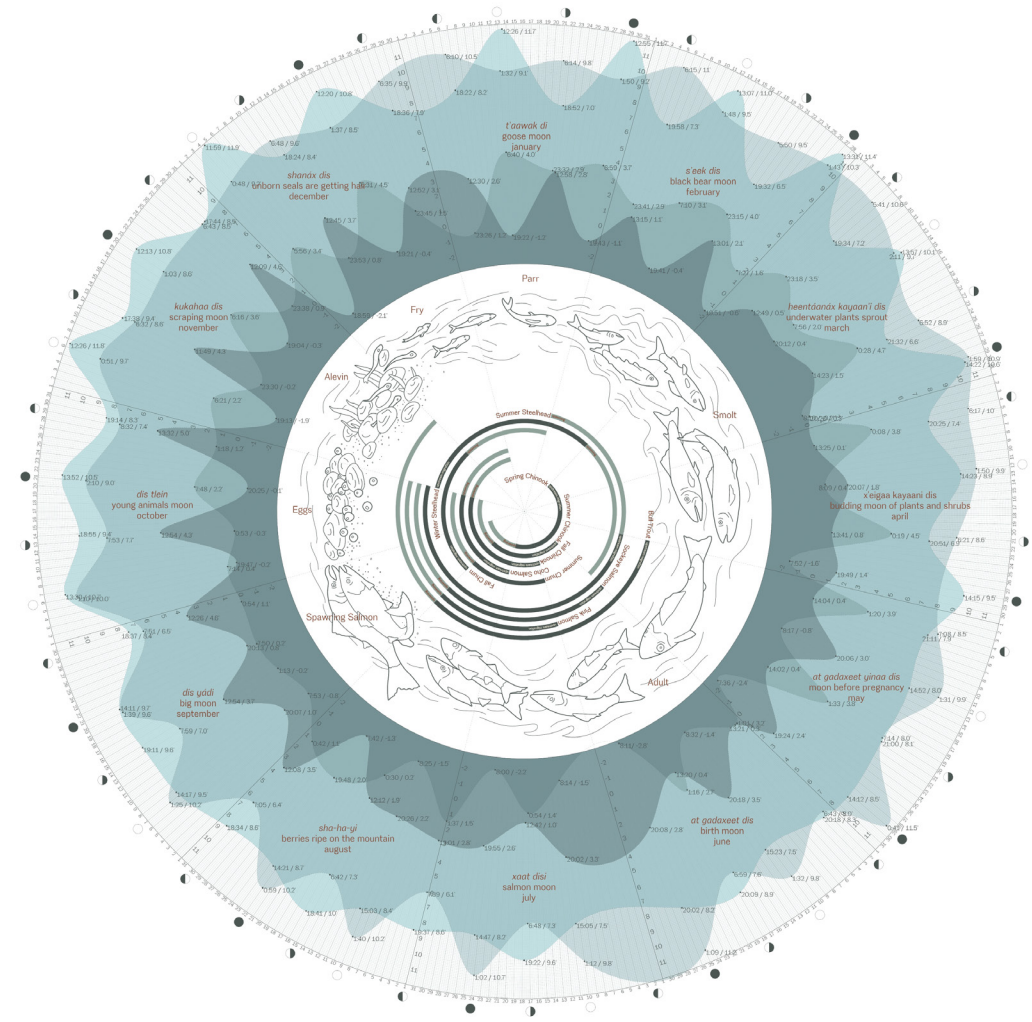
In contrast, contemporary industrial fishing—dominated by highly mobile fleets operating at vast spatial scales—has led to overharvesting, population declines, habitat destruction, and a disconnect between local knowledge and resource management. Reciprocal Refuges reimagines fisheries as interconnected networks functioning at biologically relevant scales.





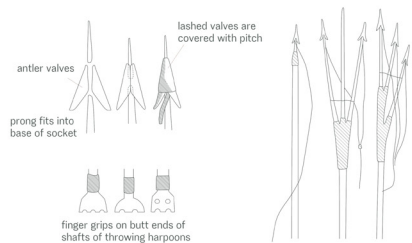
In addition to lifting people to safety, the moving platform is also used for fishing. It rises and falls with the natural tidal cycles, mirroring traditional Chinook fishing practices that align with specific tidal phases. Spearfishing and harpooning occur at low tide, while gill nets, dip nets, and weirs are used during high tide.

The fishery also features processing stations for cleaning, filleting, canning, and drying, merging traditional Chinook fishing practices with modern processing tools. This approach fosters sustainable practices grounded in a system of public reciprocity.

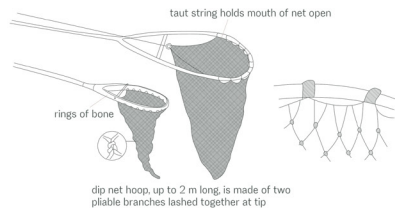


# Indigenous Fishing Techniques of the Pacific Northwest

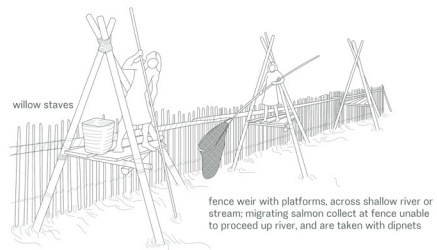
## Salmon Harpoon



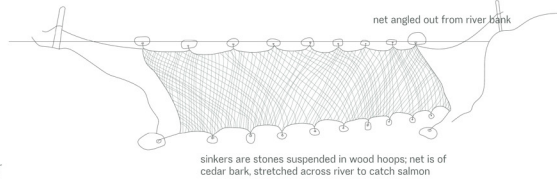
## Dip Net



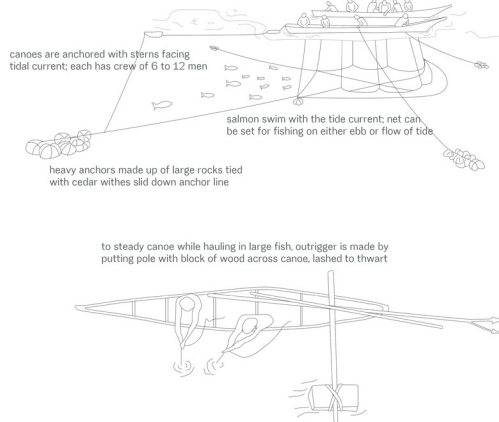
## Fence Weir with Tripods



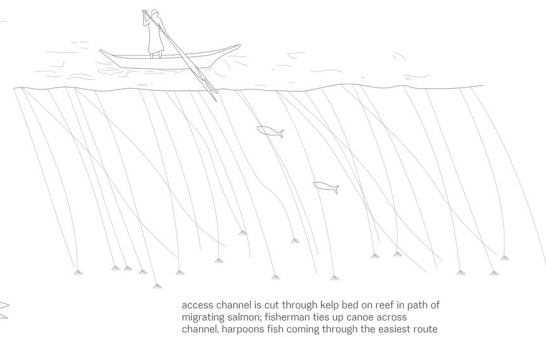
## Gill Nets



## Reef Net



## Harpooning salmon in deep water



Fishermen harvesting fish from seine, lower Columbia River c. 1900, <sup>8</sup>



The Fisherman c. 1910 <sup>7</sup>



Wishham Fishing Platform c. 1910 <sup>7</sup>



Spearing Fish c. 1910 <sup>7</sup>



Cowichan Salmon Weir c. 1920 <sup>4</sup>



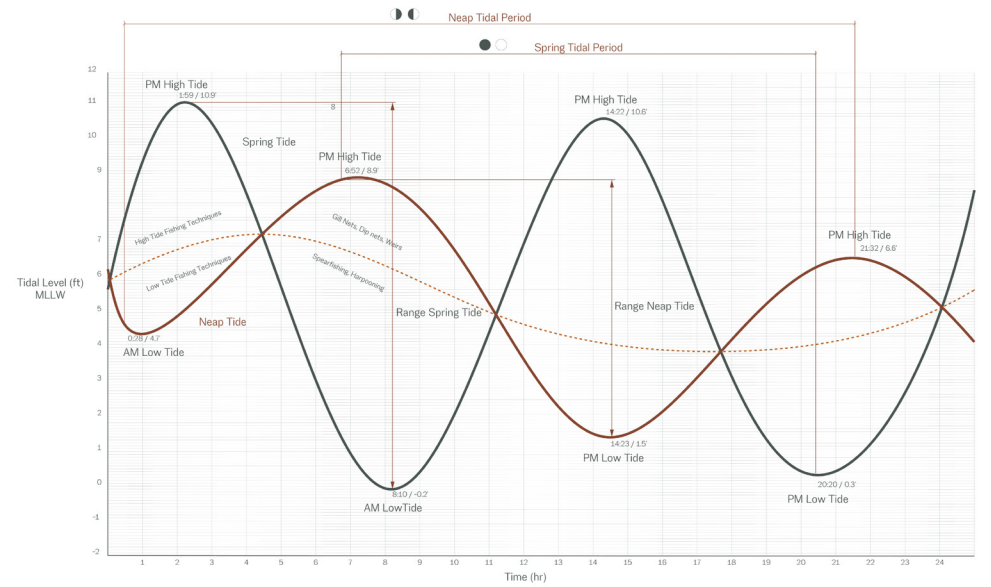
Heiltsuk Nation's fish weir in the Koeeye River in British Columbia, 2020



Dip Net Fishing in the Klickitat River, 2012 <sup>40</sup>



Lummi Reefnet, c. 1930s <sup>8</sup>





Fishery

Canoes have been an essential part of Indigenous cultures in the Pacific Northwest for millennia, serving as vessels for navigation. For the Chinook people, canoes, alongside salmon, are cornerstones of their culture. The canoe workshop houses Chinook canoe artifacts and traditional carpentry tools, preserving these important cultural practices.



Intertribal Canoe Journey, 2023 <sup>3</sup>



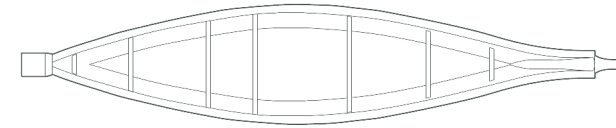
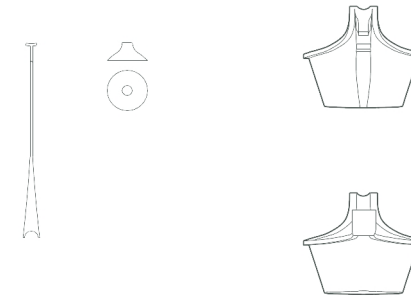
Chinook Canoe Family <sup>14</sup>



Wind Mountain c. 1910 <sup>7</sup>



Chief Comcomly Burial Canoe, 1961



*Kanawi kanamakwst*  
"All together now"

*Klmin 'Moon' Chinook Canoe* <sup>1</sup>

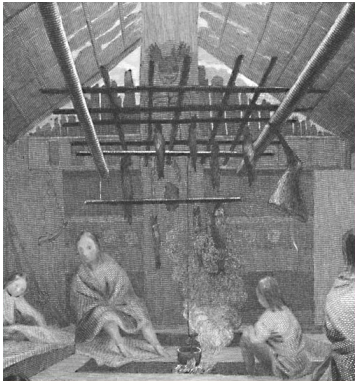


Canoe Workshop

The Chinookan plankhouse is a communal ceremonial space. It is characterized by the long, cedar planks used in its construction, and the central hearths.



Cathlapotle Plankhouse, 2018



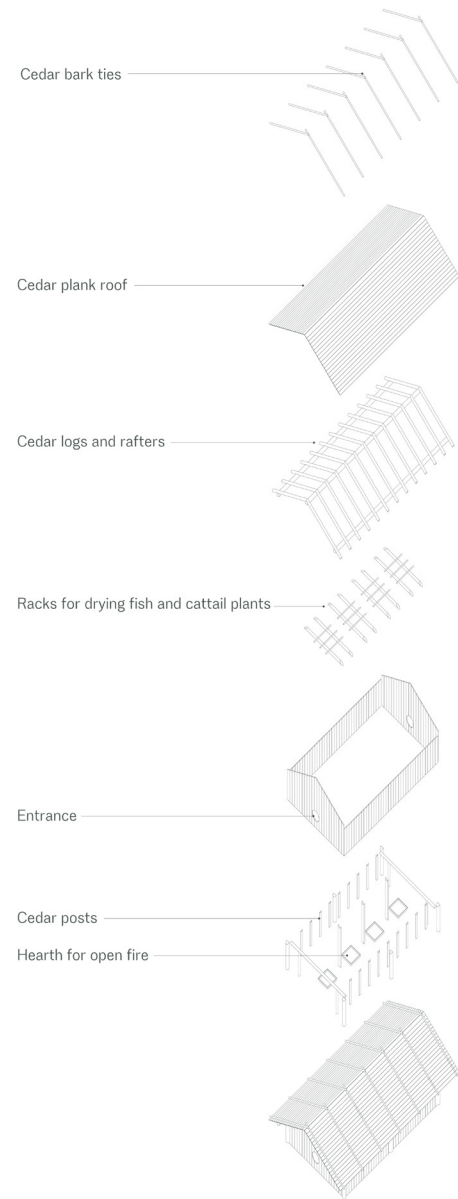
Chinook Lodge, 1844 <sup>13</sup>



Cathlapotle Plankhouse, 2018

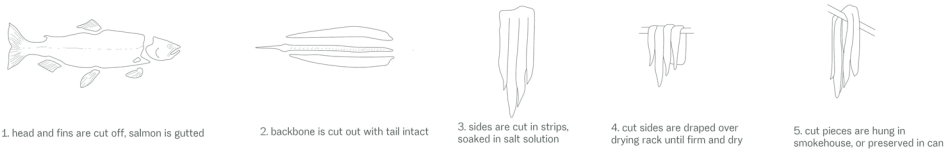


Plankhouse Welcome Dance, 2021 <sup>2</sup>

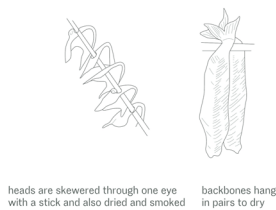


One of the most important ceremonies to take place in the plankhouse is the First Salmon Ceremony. Each year, when the first salmon begin their upstream migration, the Chinook welcome the salmon back to the place where their lives began. Only after four days of fish have moved safely by, is the First Salmon taken by the most honored fisher and prepared with ritual care. After the ritual, the community celebrates the arrival of the salmon with a feast and ceremonies, showing gratitude for the abundance provided by the fish.

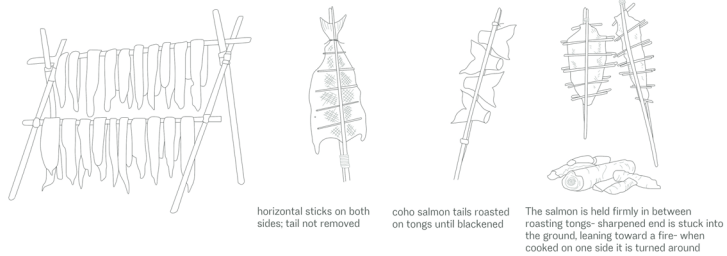
Preparation



Drying Salmon



Roasting Salmon



Quw'utsun elders prepare salmon, Cowichan Valley, 2024 <sup>9</sup>



Salmon cooked over fire by Chehalis Indian Tribe, 2015



Drying salmon, Yupik village, Andreafski River, Alaska



Preparing salmon near Celilo, OR, 2023 <sup>41</sup>



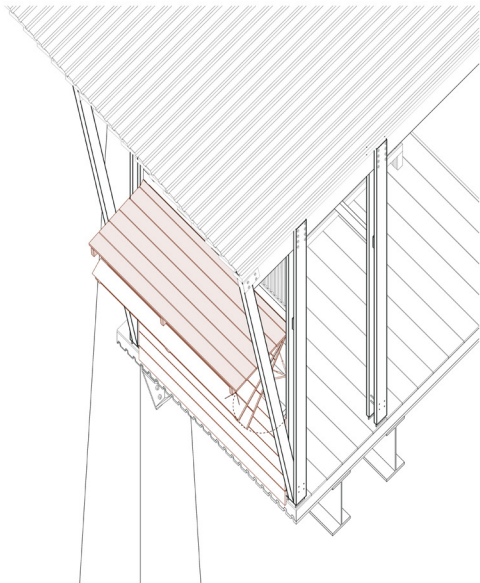
Lummi Nation's Ceremonial First Salmon, 2024 <sup>5</sup>



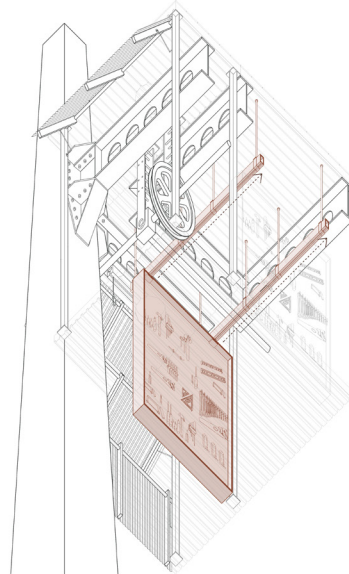
To facilitate the transitions between the three timelines— fishery, workshop, and emergency refuge—the tower is equipped with analog environmental controls, powered by human-driven mechanisms. The hearth, inspired by the pulley system of the moving platform, can be raised from the first level during the fishing season to the upper level for roasting salmon during ceremonies. The louvers open to regulate airflow. Movable walls on the first level provide storage for woodworking tools on one side and fishing equipment on the other. A boat lift conveys canoes in and out of the water for repair or storage. During a tsunami event, when the towers serve as refuges, all equipment, including the walls and benches, retracts into the facade, creating an open space for the refugees to gather.

Within these same facades, emergency supplies are stored to ensure that everyone has what they need to survive. These provisions are designed to sustain occupants for two full tidal cycles (or 48 hours), providing comfort and safety while the tsunami runs its course. From within the tower, refugees will have a secure vantage point, even as they watch their homes and communities succumb to the forces of nature below.

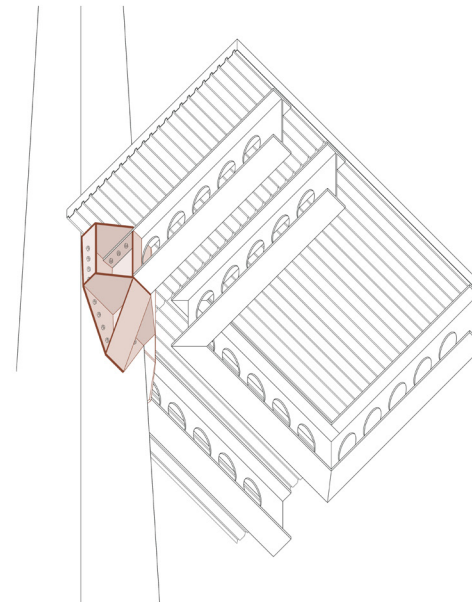
Operable Louvers



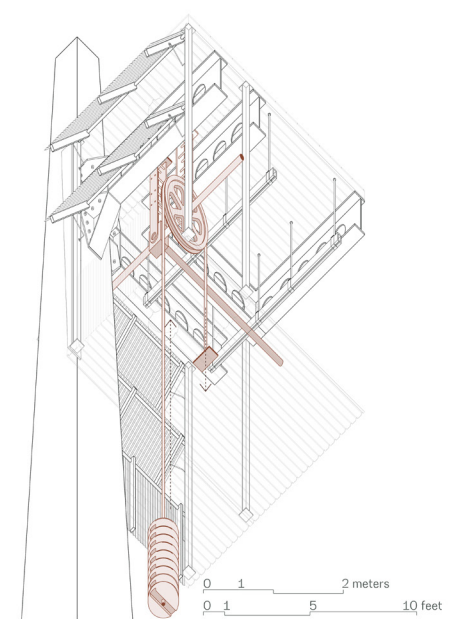
Movable Walls



Beam - Column Connection



Pulley System





The Indigenous peoples of the Pacific Northwest are said to live with one foot in the forest and one on the shore, gathering the abundance of both. The towers are designed to do the same, as a form of Indigenous reclamation, revitalizing ancient Chinook land management practices and fostering reciprocity with the more-than-human world.

Reciprocal Refuges is a repository of both scientific knowledge and Indigenous Ways of Knowing. My aim with this work has been to reframe an existential threat into an opportunity to imagine a climate adaptive future, in which the language of multiple ontologies are woven together into a space that advocates for a mutual flourishing of both land and people.



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