The River at the End of the World: Architectural Coexistence Along the Klamath River

Peter Hagan

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Committee:

Peter Cohan

Jennifer Dee

Robert Hutchison

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Abstract

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Chair of the Supervisory Committee:

Peter Cohan

Architecture

This thesis explores the history of the Klamath River and the ever-changing landscape that it shapes and by which its path is determined. In late 2024, four out of the five dams blocking the Klamath River were removed allowing the river to return to its historical routes, opening pathways for migration and allowing the river to express natural behavior that can be observed through six different landscape sites: the spring, the floodplain, the ravine, the valley, the confluence, and the delta.

Today, as the river begins to distinguish its course through the landscape once again unimpeded, this project proposes interventions within these six distinct landscapes to allow for the witnessing of these characteristics of the river to reconnect with the cycles of water and wetness, and to think of new ways of observing and engaging with the realities of changing landscape. This thesis focuses on two sites in particular: the ravine and the delta. At the ravine a bridge is proposed to span the river at the site of a former train bridge crossing. From the bridge a tower is constructed to mark the changes in water level during and after the presence of the dams. At the delta site a series of walls are proposed, which structures are built, to help visitors observe the uncertainty of a landscape that is in constant change. Together, along with the six other sites, these two proposals constitute a different kind of relationship architecture may have with water and landscape.

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A thesis by
Peter Hagan

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Thank you to my family, to Rachel for your kindness and patience and never-ending interest.

Thank you to my cohort for being such an incredibly supportive and caring group of friends.

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Built frame from film photographs

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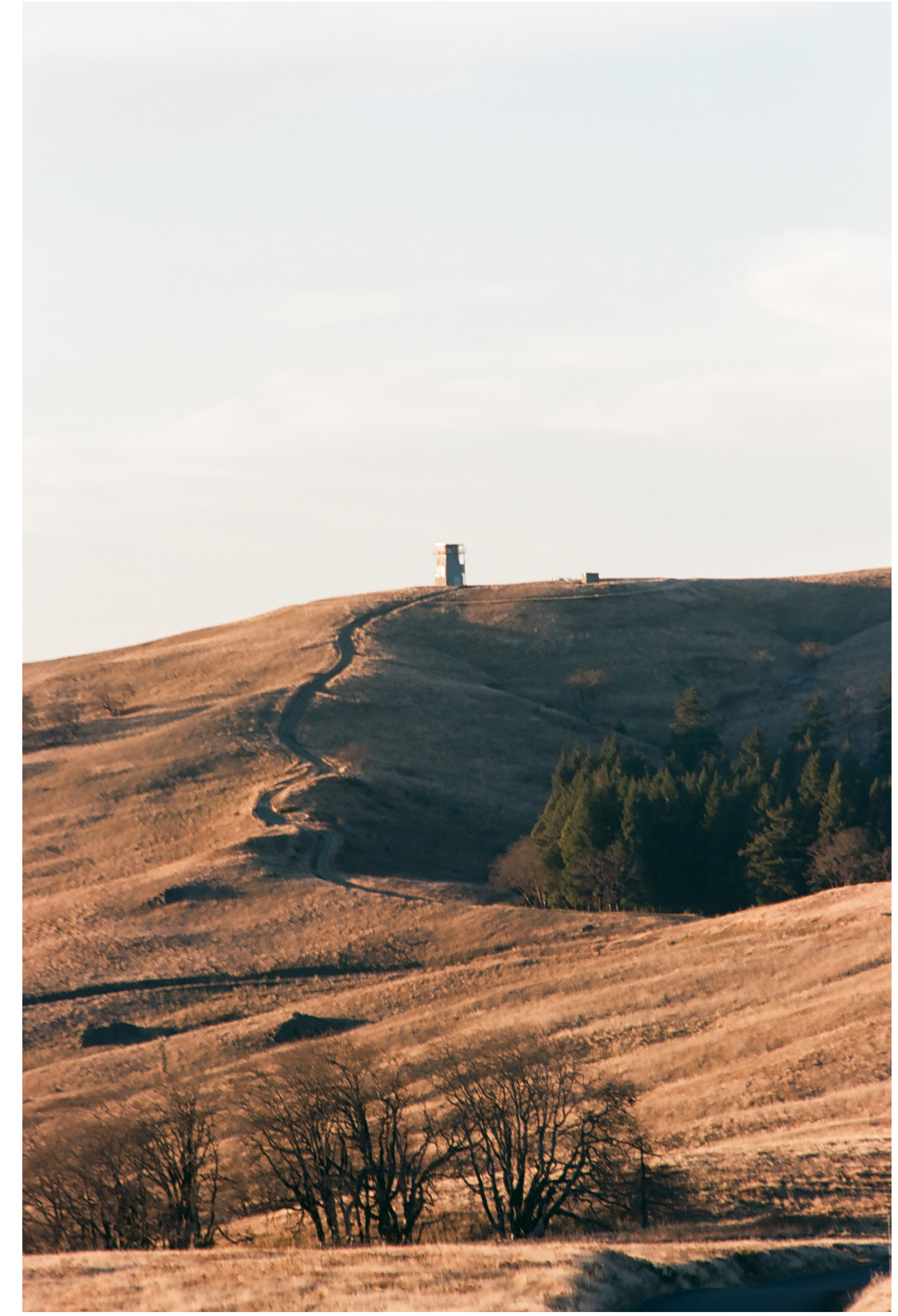


Fig. 2 Bald Hill in the Klamath Mountains, 2025

The Formation of a Landscape

Fig. 3

Tectonic activity on the west coast of the North American continent. Graphic over Google Earth image

The Klamath River tributary area spans from the basin and range of Northeastern California and Southeastern Oregon through the Cascade Mountain Range and Klamath Mountain Range until it reaches the Pacific in California's northern coast. Running over 260 miles from Gearhart Mountain, through Klamath Lake, past Klamath Falls, through the deep ravines and valleys carved over millions of years of hydrological force, and eventually exiting through the Klamath Mountain Range, the Klamath River is California's second largest river and historically has been a central artery for people, animals, and plant life to move into and out of the remote, mountainous interior of the continent. Historically, the Klamath River was home to hundreds of thousands of migrating coho salmon, Chinook salmon, steelhead, lamprey, cutthroat trout, and sturgeon that would move upriver from the Pacific as far as Klamath Falls, Oregon, traveling over 200 miles and gaining over 4,000 feet in elevation.[1] People, too, have used the Klamath River as a highway to travel into the interior, traditionally on dugout canoes made from Coastal Redwood Cedar trees that are 20 - 40-feet long and weigh over 500 pounds. The unique geological history of the west coast of North America is what makes the Klamath River different most rivers - while most rivers begin in the mountains and end in the floodplains, the Klamath River starts in flat floodplains, and then mountains before exiting into the ocean.

The geological zones of the region can be divided into three parts: the Klamath Mountains, the Cascade Mountains, and the Basin and Range of southern Oregon.

The formation of these distinct geological areas of the region originated when the ancient oceanic Farallon plate began subducting beneath the North American plate over 200 million years ago. The Farallon plate was one of three oceanic plates that comprised the vast ocean when all continental plates were merged into Pangea and as the plates shifted a new plate emerged at the nexus of the three oceanic plates - the Pacific plate. This rearrangement of tectonic forces deep beneath the ocean's surface forced the denser Farallon plate beneath the lighter North American plate and in turn created the coastal mountain ranges of the west coast of North America, the creation of the Cascade Mountains, and the unique volcanic and hydrological activity of the Basin and Range.

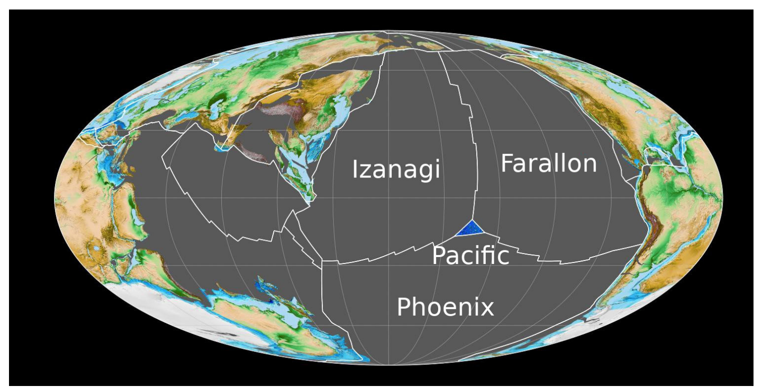


Fig. 4 Pangea, 180 million years ago. Source: Wikipedia

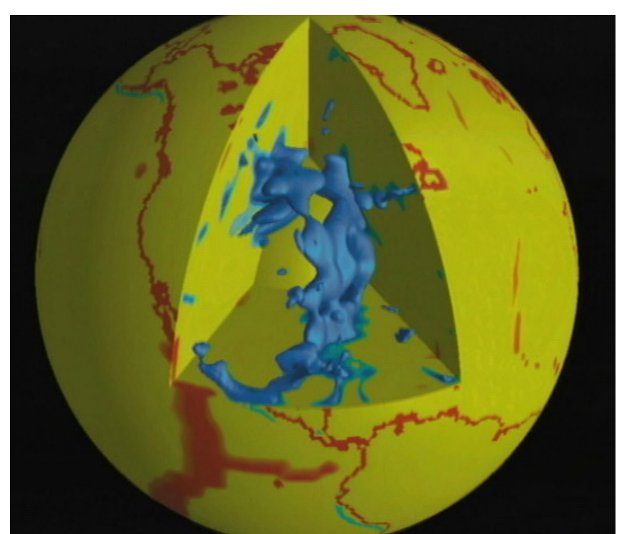


Fig. 5 The remnants of the Farallon plate deep within the Earth's mantel marked in blue, measured by seismic tomography. Source: Schmid, Christian, et. al.

Fig. 6 Geological features of the region. Graphic over Google Earth image

Fig. 7 Ribbon chert. Source: wikipedia

Fig. 8 Folded serpentinite near San Francisco. Source: Wikipedia

Fig. 9 Folded sandstone near Eureka. Source: Wikipedia

The Klamath Mountains

Fig. 10 Klamath Mountains from Highway 96.

Fig. 11 Klamath River near Happy Camp.

Fig. 12 Wildlife collage of the Klamath Mountains.
Source: Cal Poly Humbolt

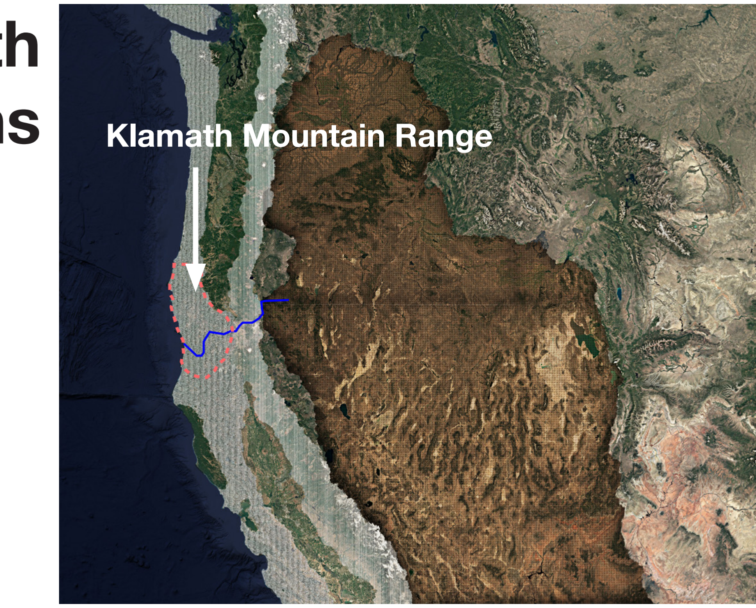


Fig. 13 Klamath Mountains higlighted.

Fig. 14 Bald Hill in the Klamath Mountains.

The coastal mountain ranges along the west coast of the North American continent are a result of the subduction of the ancient Farallon plate. As the Farallon plate subducted beneath the North American plate, it brought “exotic terranes” into contact with the coast of the North American plate, forcing a strange agglomeration of organic and inorganic minerals onto the landscape, folding and overlapping minerals into a mountainous melange called the Franciscan Complex. Millions of years ago, there was no coastline where the Klamath River now meets the ocean. This landscape has been assembled through the accumulation of island arcs, seamounts, coral reefs, and continental blocks that were carried along the surface of the Farallon plate as it subducted beneath the North American plate.[2] The Klamath Mountains are formed by the subduction of a part of the crust so ancient its only traces are found when we listen to echoes of seismic waves as they reverberate through the earth.

Because the Farallon plate is relatively cool compared to the surrounding mantel seismic waves travel at different speeds, reading the waves illustrates the presence of this plate, still merging with the earth.[3] The Farallon plate continues to exist today as the Juan de Fuca, Gorda, and Cocos plates, ominous reminders of the immense power of the landscape.

The Cascade Mountains

Fig. 15 Collage of wildlife in the Cascade Mountains.
Source: Oregon DEQ

The Cascade Mountain Range is a series of composite volcanoes - conical forms with magma chambers at the center. Volcanoes around the Klamath River are Mt. Shasta and Shastina, Medicine Lake Volcano, Mt. McLoughlin, and Crater Lake. These mountains are the surface expression of a continental volcanic arc formed by ongoing subduction of the Farallon plate pushing up magma and water into the less dense North American plate - a process that began about 40 million years ago while the volcanoes formed within the last few million years.[4]

In southern Oregon and northern California the range is dynamic: Mt. Shasta, one of the largest stratovolcanoes in the Cascades, has erupted multiple times in the past 10,000 years while nearby Medicine Lake Volcano has erupted as frequently in the form of a shield volcano[5]

Beyond their dramatic topography, these mountains influence hydrological patterns across the region - snowpack stored in the Cascades feeds rivers like the Klamath and the range serves as a climatic barrier that shapes precipitation patterns, determining ecosystems on either side of the Cascades.

Fig. 16 Cascade Mountains from Ashland, OR.

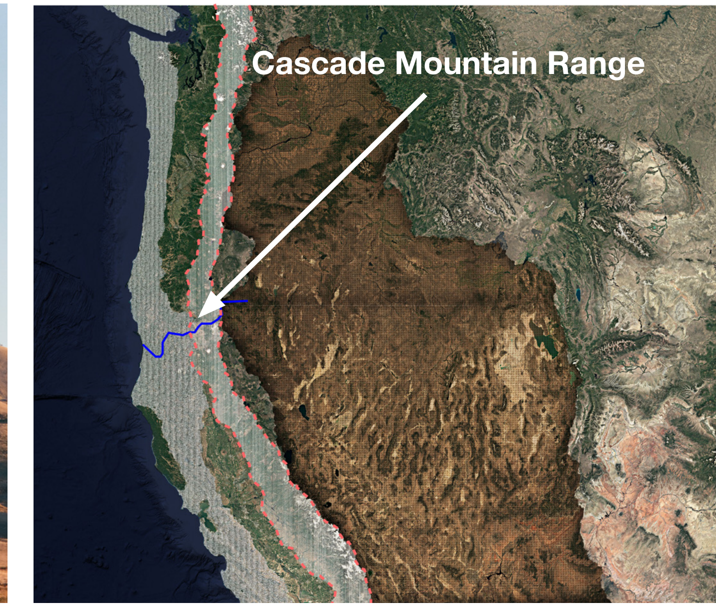


Fig. 17 Cascade Mountains hilighlighted.

Fig. 18 Cascade Mountains region near Mt. Shasta.

Fig. 19 Cascade Mountains region near Crater Lake.

Fig. 20 Cascade Mountains near Mt. Shasta.

Fig. 21 The former Iron Gate Dam reservoir.


Fig. 23 Frozen lake near Klamath Falls, OR.


Fig. 24 Strip mine near Klamath, OR.


Fig. 25 Landscape near Gearhart Mountain, OR.

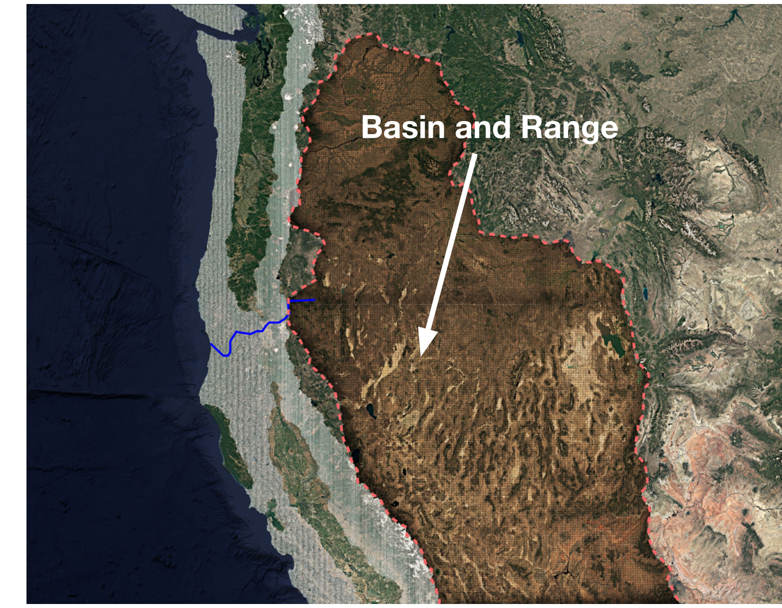


Fig. 26 Basin and Range Highlighted.

The Basin and Range region of the North American continent stretches from the Columbia Plateau in Eastern Oregon to Salt Lake City in the east, and down through Nevada, Arizona, and Sonora, Mexico to the south. The range is defined by broad linear mountain ranges that run north-south with deep valleys between them. The landscape was formed by the subduction of the Farallon plate lifting the crust of the earth away from the mantel, causing fissures to emerge, stretching the lithosphere apart.[6]

The regular stretching and compressing of the lithosphere has created this step-like landscape of vast open plains and high peaks. As the lithosphere dips downwards, fissures form and a fluids leak out of the Earth's crust creating hot springs, mineral springs, and cold water springs. At the northwestern edge of the Basin and Range channels form and meander through wide plateaus before eventually merging with the Klamath River.[7]


Fig. 28 Farmland near Gearhart Mountain, OR.


Fig. 29 A mine near Klamath Falls, OR.

Fig. 27 Sample of species in the Basin and Range region.

Basin and Range

The Path of the Klamath River

The Klamath River begins at over 4000 feet in elevation near Gearhart Mountain. Here, it is called Sprague Creek and it emerges from the earth at an indeterminate point, seeping from hundreds of different springs, some with names and some without: Dead Cow Creek, School Creek, Walker Creek, Lost Creek, Boulder Creek, and Deming Creek are a few that contribute to Sprague Creek, within just a few miles from Gearhart Mountain. Just 20 miles from the mountain, Sprague Creek again merges with other channels including the North Fork Sprague Creek and the Sycan River, becoming the Sprague River. After 30 more miles of oxbow lakes and sloughs the Sprague River pours into Klamath Lake, a 10,000 year old remnant of Lake Modoc. Klamath Lake is a pluvial lake, a site of moisture accumulation that was, historically, unable to escape because of its geological isolation.[8]

Etymologically, this is where the Klamath River begins - at the southern tip of Klamath Lake, the river pours into a wide floodplain, an ancient lakebed that was constrained by the tectonic shifts of widening valleys and rising mountain ranges.

While the route of the Klamath is ancient, dams built within the past century profoundly altered the ecology that has developed alongside the river.

The river heads west, carving a route through a basalt canyon, diving down 1,500 feet in elevation over 30 miles through a landscape that had formed during the active period period of the Cascade Mountains. The bedrock of this landscape is primarily basalt: remnants of ancient volcanoes dot the landscape and are visible from aerial photographs.

After passing through the Cascades, the Klamath River meets with the eastern edge of the Klamath Mountains and Coastal Mountain Range. On the east side of the range, the landscape is arid and the volcanic landscape shifts to complex folded and crumpled hills with Douglas fir forests or scrubby pine trees. The ecology and geology of the Klamath Mountains are extremely diverse and the river passes from an arid, high-altitude pine forest to wet inland temperate and cedar forests with steep canyons and high peaks that give way to rocky landscapes, eventually ending at the Pacific Ocean where heavy rains and enormous trees create an intimate and sublime landscape.

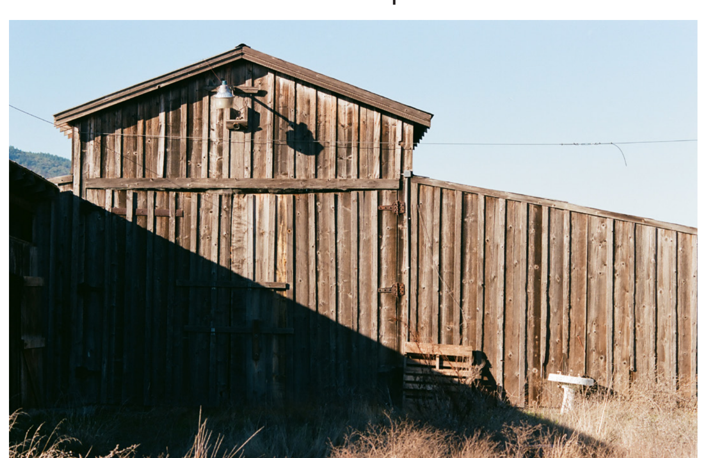


Fig. 30 Barn near Ashland, OR.

Fig. 31 Frozen spring near Gearhart Mountain, OR.

Fig. 32 Basalt hills in the Cascade Mountains near Ashland, OR.

Fig. 33 Confluence of the Trinity River and the Klamath River.

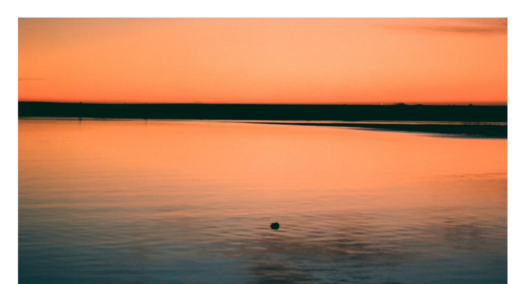
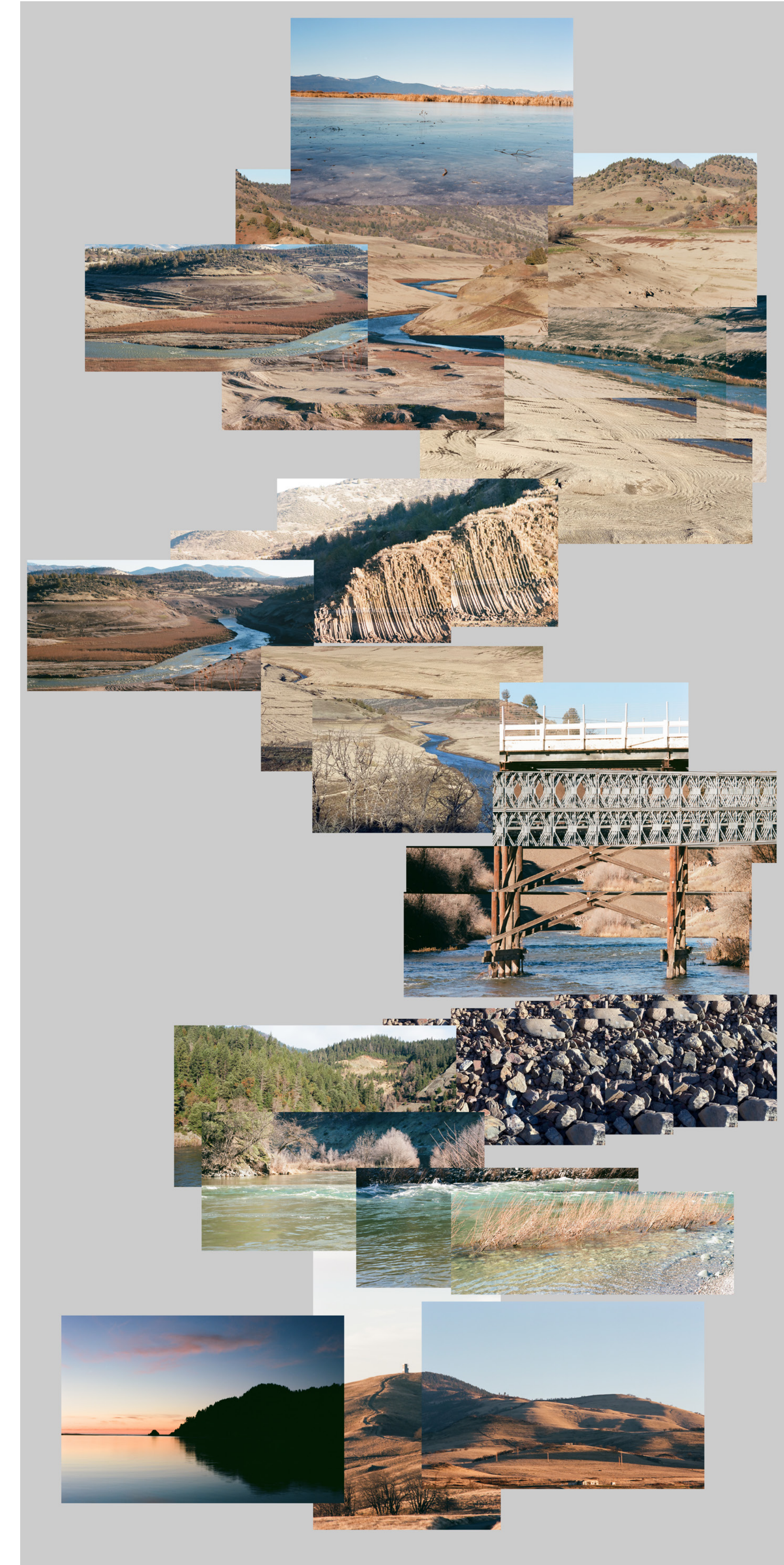


Fig. 34 Klamath River delta looking west at sunset.

Fig. 35 (right) Built frame of the entirety of the Klamath River.



II.

Fig. 1 Remains of the Iron Gate Dam, 2025

The Damming and Undamming of the Klamath River

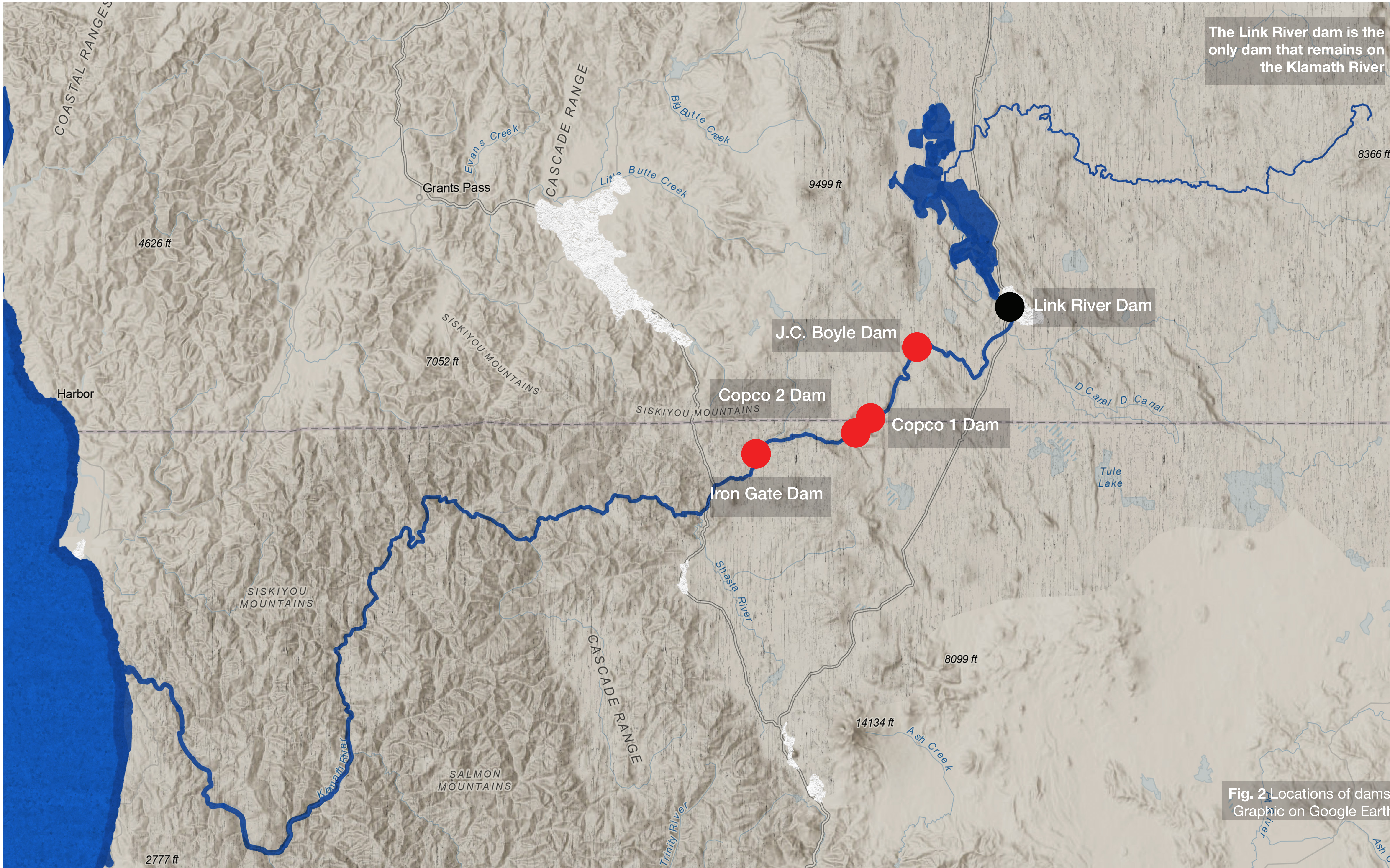


Fig. 2 Locations of dams. Graphic on Google Earth

Fig. 3 Dams along the Klamath River. Images from Google Earth and Thomas O'Keefe

Fig. 4 Men building diversion canals from the Klamath River in 1933. Source: Oregon Historical Society

Fig. 5 Building the Iron Gate Dam, 1964. Source: Oregon Historical Society.

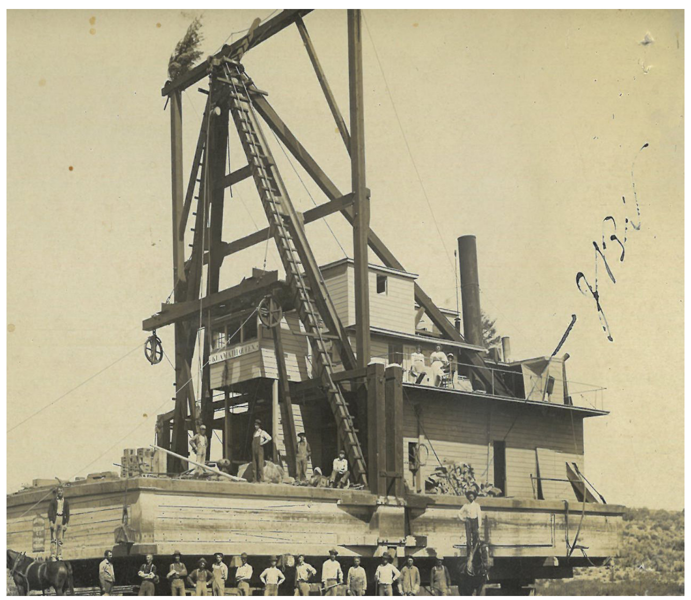


Fig. 6 Men building Copco 1 dam, 1922. Source: Oregon Historical Society

Fig. 7 Farms along the Klamath River in what is today the Topsy Reservoir. Source: Oregon Historical Society

Fig. 8 Diversionary canal for irrigation near Keno, OR. Source: Oregon Historical Society

Fig. 9 Link River Dam constructed in 1921. Source: Oregon Historical Society

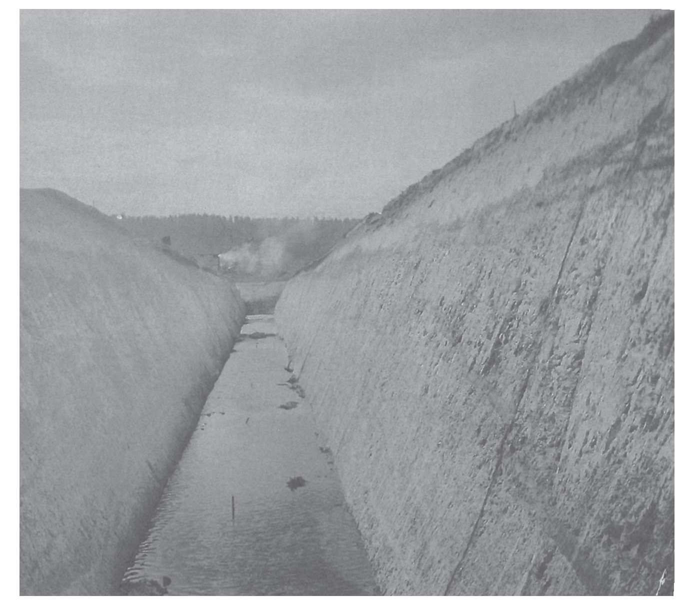


Fig. 10 Diversionary canal for irrigation near Keno, OR. Source: Oregon Historical Society

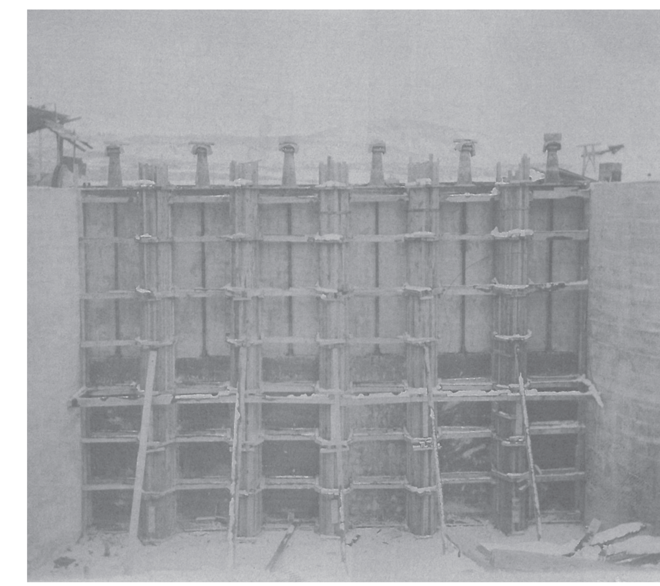


Fig. 11 Copco 2 Dam construction finished in 1925. Source: Oregon Historical Society

The Construction of the Dams

In the post-Civil War Era, white American soldiers were sent to Oregon to protect white settlers from perceived threats from indigenous Americans as the settlers migrated from California to southern Oregon. White settlers began establishing homesteads in the Klamath River Basin in the 1870s, displacing the Klamath, Modoc, Yaruk, Yurok, Shasta, and Yahooskin people as settlers established farms in the floodplains of the Klamath River.

By the mid-1870s, the U.S. Army began attacking the Klamath and Modoc people, forcing them to the Lava Beds on the Modoc Plateau but were eventually overrun by reinforcements from the American army. The surviving Klamath and Modoc people were forced two hundred miles north onto the Warm Springs Reservation along the Deschutes River.[1] Irrigation of settler farmland began shortly after with a series of ditches dug in 1882, irrigating 4,000 acres near the Oregon-California border.[2] Over the following thirty years, independent farmers excavated hundreds of miles of provisional canals to turn the landscape into arable territory, exacerbating risks of drought and escalating disputes over water rights to the point that the U.S. government established the Klamath River Reclamation Project.[3] In 1921 the California-Oregon Power Company (COPCO) built the Link River Dam at the modern-day site of Klamath Falls, the largest urban area in the Klamath River Basin for hydroelectric power and irrigation. Expecting greater migration from the development of the timber industry, COPCO built Copco Dam 1 in 1922 and Copco Dam 2 in 1925 about thirty miles downriver from the Link River Dam.[4]

By the 1950s expected demand for electricity use increased and Pacificorp invested in two more dams, the J.C. Boyle Dam in 1956, which was fifteen miles downriver from the Link River Dam, and the Iron Gate Dam in 1964, which was about fifty miles downriver from the Link River Dam. To build the dams earth was pulled directly from the surrounding landscape. These four dams created over twelve thousand square miles of reservoir that were pulled from during droughts in 1959, 1967, 1977, 1992, 1994, 2001, 2020, and 2021.[5]

The Dams and Changing Ecology

Building the dams had an enormous impact on the landscape, altering the ecology and landscape around the dams and downstream. There were four primary, interrelated ways the dams have altered the landscape.

Flooding

While infrequent, there have been three major floods since the completion of all of the dams. The first was the 1964 Christmas Flood that tore away the towns of Klamath, Orleans, Myers Flat, Pepperwood, and South Fork.[6] Only Klamath and Orleans were rebuilt; both had been logging towns that, once destroyed, were abandoned and then returned to the Yurok and Hoopa tribes who have rebuilt their lives there. Flooding occurred throughout the Klamath River Basin, from Klamath Falls to the ocean.

The second major flood occurred in 1997 when a warm front brought rain to the snowpack in the Klamath Mountains, melting the snow. Water found its way down into the Klamath, pulling rocks and trees with it, which collected in the river and flooded the Klamath from the confluence with the Trinity River to the valley near Happy Camp, CA.[7]
The most recent flood recorded along the Klamath was in 2005.[8] The 2005 flood was a storm-driven event of high water flow typical of the rainy season in the Lower Klamath River. As the river receded it left rocks and sediment in neighborhoods and on roads, isolating neighborhoods from the outside world.

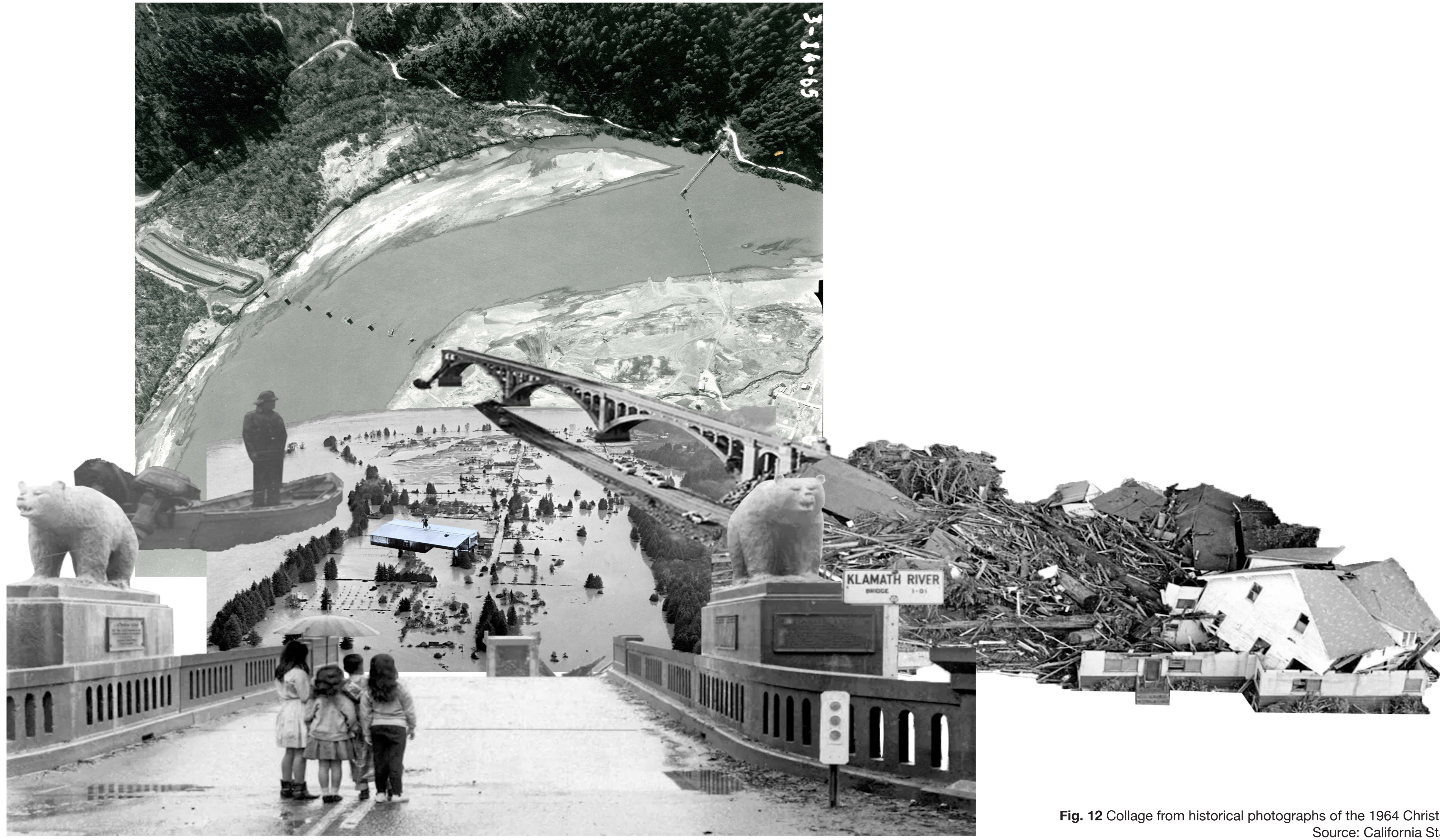


Fig. 12 Collage from historical photographs of the 1964 Christmas flood. Source: California State Library

Warmed Water

While the dams contributed to controlling all but the most intense floods the cost has been rising water temperatures. As water sits contained behind the dam it heats up in the sun and temperatures rise in even the deepest parts of the reservoir. When water is released it is significantly warmer and affects the development of native water-spawning insects and anadromous fish larvae.[9] Warming waters also supports the development of non-native plants and parasites that prey upon salmon and steelhead.[10]

During droughts, farms extract water from the reservoirs, lowering water levels and raising temperatures further. With low water flows, anadromous fish struggle to enter the river from the ocean and crowd together as they swim upstream. In 2002, migrating fall Chinook salmon crowded together to return to their spawning ground and passed parasites between them leading to the death of over 34,000 fish.[11]

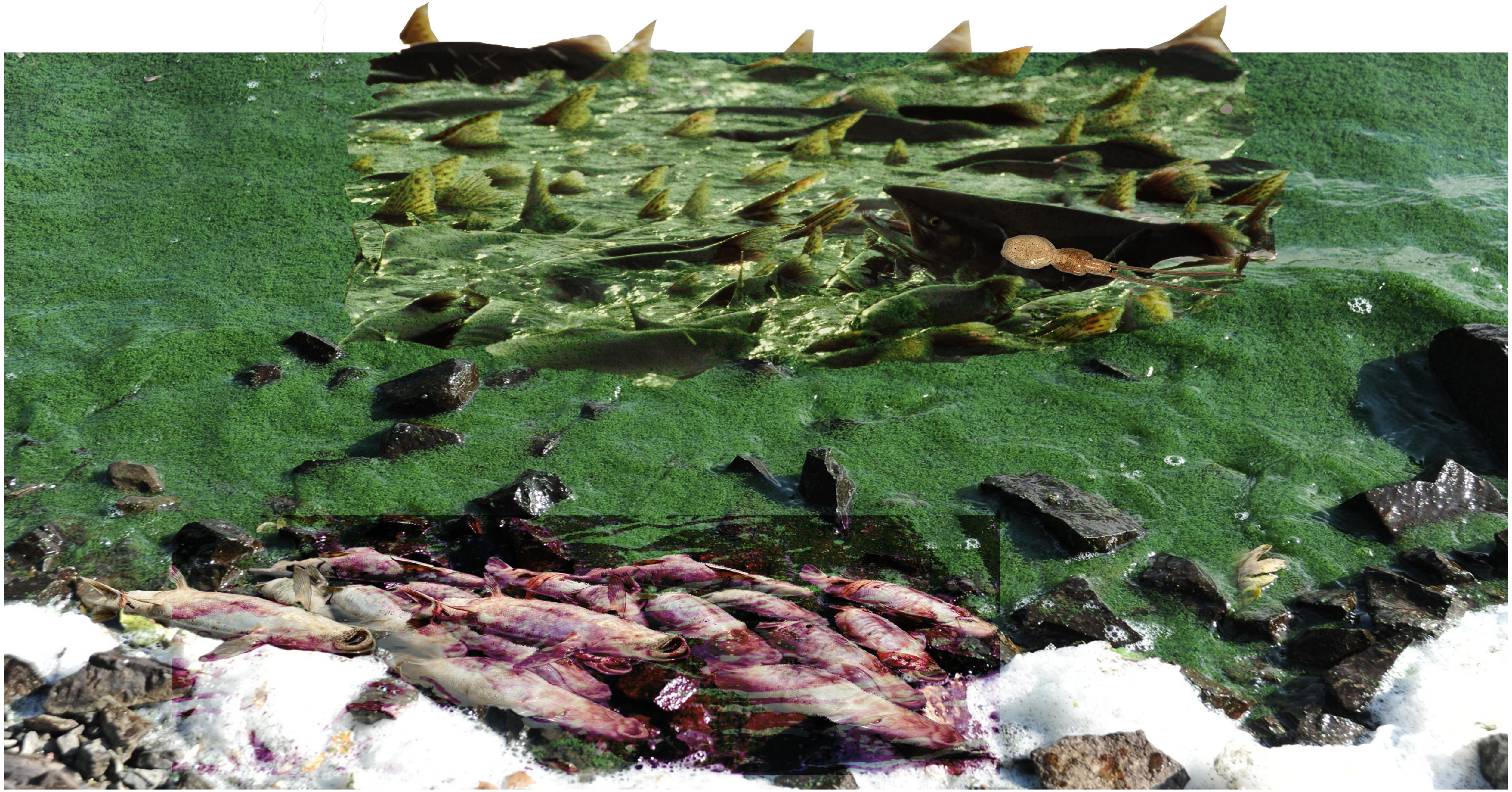


Fig. 13 Collage of the 2002 salmon kill
Source: Thomas O’Keefe; Yurok Tribal Council

Fig. 14 Salmon louse.
Source: Wikipedia

Fig. 15 Salmon kill.
Source: Yurok Tribal Council

Fig. 16 Salmon kill.
Source: Yurok Tribal Council

“We don’t know where you got that water, but do not touch it”[15]

Increased Algae and Decreased Dissolved Oxygen Content

Rising water temperatures and low water flow has created a different type of ecosystem that is more conducive to the growth of algae.[12] Climate change has exacerbated the problem - global rising temperatures warm the water further and help algae grow.[13] Algae blooms, once a rare occurrence in the Klamath River, now are an annual event. Plants suffer from the growth of cyanobacteria, which floats on the surface of the water preventing sunlight from penetrating the areas below, creating enormous underwater deserts. In turn, the microscopic predators of cyanobacteria consume huge volumes of oxygen, depleting the reservoirs and changing the dissolved oxygen content in water downstream.[14]

Interrupted Migration Routes

Historically, salmon, steelhead, and even lamprey have traveled up the Klamath River beyond the dams, with fishbones having been found in archaeological sites in the upper Klamath River Basin dating back over two thousand years.[16] Anadromous fish migration has been disrupted most by the Iron Gate Dam and while a fish ladder was built to encourage upstream migration it was a rare sight to see migrating fish above the Iron Gate. To support fish populations, California Fish and Wildlife established two salmon hatcheries, one at the base of the Iron Gate Dam and one in the reservoir above it but fish levels never returned to historical levels and the monoculture of fall Chinook salmon that were artificially supported were more susceptible to parasites and diseases.

While all built for either flood control or hydropower, all of the dams along the Klamath River have had unintended consequences on the life of the river: mass algeal blooms, higher water temperatures, reduced river flow, and not much power generated have proven the dams to be less successful than desired.

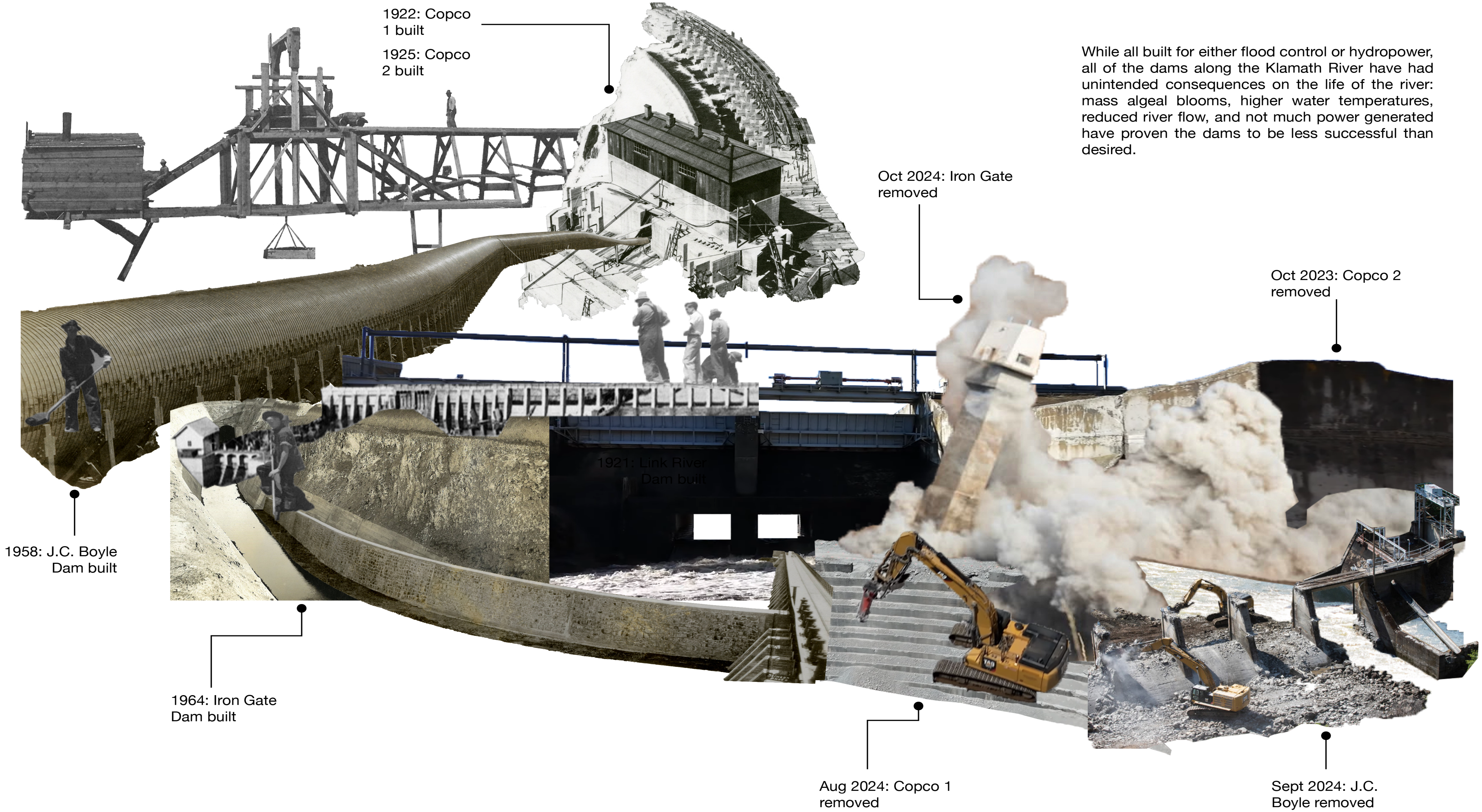


Fig. 17 Dam construction and deconstruction timeline collage.
Source: Oregon Historical Society and Swiftwater Films

Fig. 18 Collage from historical photographs from 1910-1930 at Requa, CA, at the Klamath River Delta
Source: California State Library

Undamming the Klamath

The 2002 Fish Kill was a turning point for communities who lived along the Klamath. The indigenous communities - Yurok, Klamath, Modoc, Hoopa, and Yaruk - had been pointing and tracking the negative impacts on the environment caused by the dams since the 1970s when Yurok fishermen protested regulations on salmon fishing at the Klamath River Delta. The Yurok took their boats to the river and set their nets, prompting tussles with the U.S. Fish and Wildlife Service who brandished guns.

Later that night the officials crept through Klamath and beach encampments, destroying barbecues, cutting and confiscating nets, and intimidating women and children.

But it wasn't until 2002, when tens of thousands of salmon and steelhead washed up on the shores of the river having succumbed to both warmer waters and parasites that national attention was pulled to the region. For the next twenty years, the Yurok led a movement to remove the dams on the Klamath, citing the dangerous ecological changes that occur from their presence, and that the dams simply were not living up to their potential - the dams produced less than 5% of COPCO's energy portfolio, the dams did little to mitigate flooding, they would need repairs within the next twenty years, and the sediment that had built up behind the dams would need to be dredged at some point in the future.[17] Pressure mounted and by 2022, twenty years after the Fish Kill, designs had been finalized to remove four out of the five dams along the river - first Copco 2, then Copco 1, J.C. Boyle, and finally the Iron Gate Dam.

Earth that had been removed for the construction of the dams was returned to where it was first extracted and by December, 2024, all of the dams had been removed, reconnecting thousands of miles of waterways to the ocean.

Today, the salmon have not recovered - in fact, the number of anadromous fish present is below the projected amount yet those fish who have returned to the river are traveling further up the Klamath than expected, many passing the Iron Gate barrier that had been such a daunting obstacle.[18]

Fig. 19 Link River Dam, near Klamath Falls, OR. The last remaning dam on the Klamath River.

Fig. 20 Iron Gate Reservoir, 2025. A pickup truck descends into the valley.

III.

Fig. 1 Iron Gate Reservoir, 2025

The Definition of a River

The Klamath River runs 257 miles, beginning at Gearhart Mountain and winding to the Pacific Ocean, cutting through the Klamath Mountains near the coastal range.

The Klamath River Basin is highlighted in blue and covers 15,751 square miles with a population of 114,000 people, or 7.2 people per square mile.

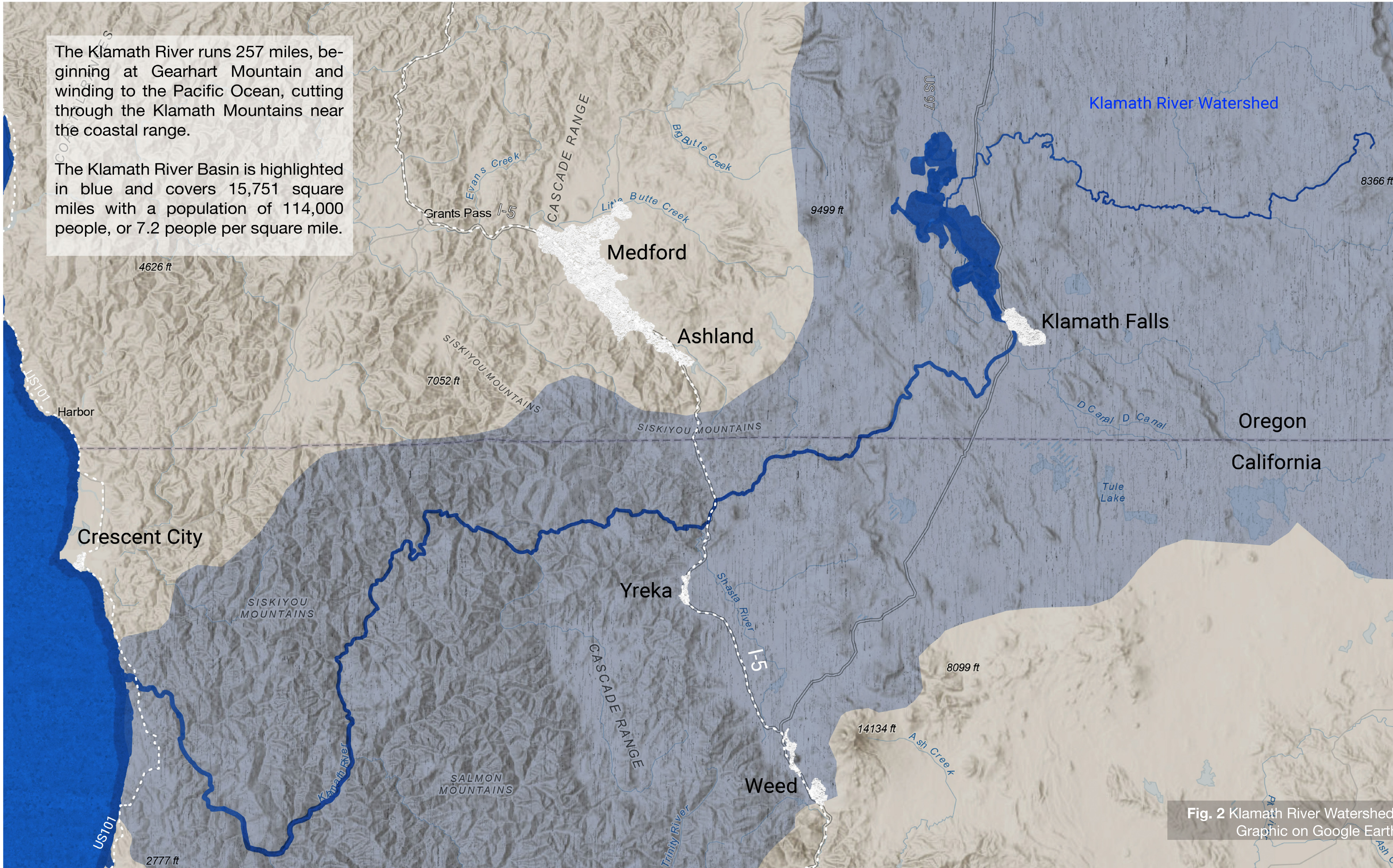


Fig. 2 Klamath River Watershed. Graphic on Google Earth

“A river’s source, if found, is always its second source, a disappearance into the earth that is always found elsewhere.”[3]

What is defined as a “river” in common language lacks the complexity of the actions and energies that occur in this zone. Where does the river begin? What do we define as the river’s banks when they seem to shift so frequently? When do tributaries become the river? What does crossing the line of the river mean when the river is only a line on a map? Dilip da Cuhna and Anuradha Mathur posit that the river is not solely the water that is contained within the banks but a marker of an intensity of wetness.[1] Through terms of wetness we can consider the limits of the river not by its banks but as landscape that is in the process of becoming wet.[2] Indeed, all landscape has a presence of wetness and at some point that wetness saturates the ground enough to form a river; therefore, wetness is not a property of an object and is not something we quantify (such as humidity or water content) and it is not a quantity - it is an intensive experience, a state of becoming. The river becomes a measure of degrees of intensities: the difference between dry and moist, between the skin and the rain, between air and fog, between qualitative and relational - there is nothing fixed and nothing isolated as there is no such thing as wetness in isolation, wetness is an event between bodies.

Let us consider the river not as a line but as a set of intensive properties: the erosion, deposition, evaporation, flow, mixing, turbulence, crashing, misting actualization of the differences in the features of the landscape, the elevation, pressure, temperature, and material.

The river is not just water but the wetness it causes, the sediment it stirs, the coolness it emits, the mud it pulls, and the life it generates - in these terms there are no fixed boundaries, there are only actions. It is a measure of thresholds, moments when changes occur as these thresholds are crossed like when a bank overflows and the land becomes a marsh, when rain becomes a creek, when the coolness of water condenses vapor in the air, or when fresh water mixes with saltwater. Rain, fog, and brackish water are not substances, they are events with intensive gradients that resist the constraint of definition; perhaps they are new behaviors taking hold while there continues to be a consistent shared quality, the quality of wetness.[4]

The Klamath River is an ongoing event where moisture accumulates and trends towards more moisture, the river moves across the landscape from the Basin and Range to the Pacific Ocean. Water emerges, soaks, floods, flows, scours, seeps, dives, furrows, erodes, pulls, shears, mixes, accretes, meanders, and fractures. It defines a path through and with landscape that has existed for over 20 million years.[5]

Here, this thesis proposes to understand the river through its relationship with landscape through six zones of transformation where the river performs different intensities that articulate different becomings. If we understand the river as more than a line crossing a landscape we begin to imagine architecture that embraces the behavior of a river rather than one that desires to control it.

These zones are the Spring, the Floodplain, the Ravine, the Valley, the Confluence, and the Delta.

Fig. 3 Klamath River near Happy Camp, CA.

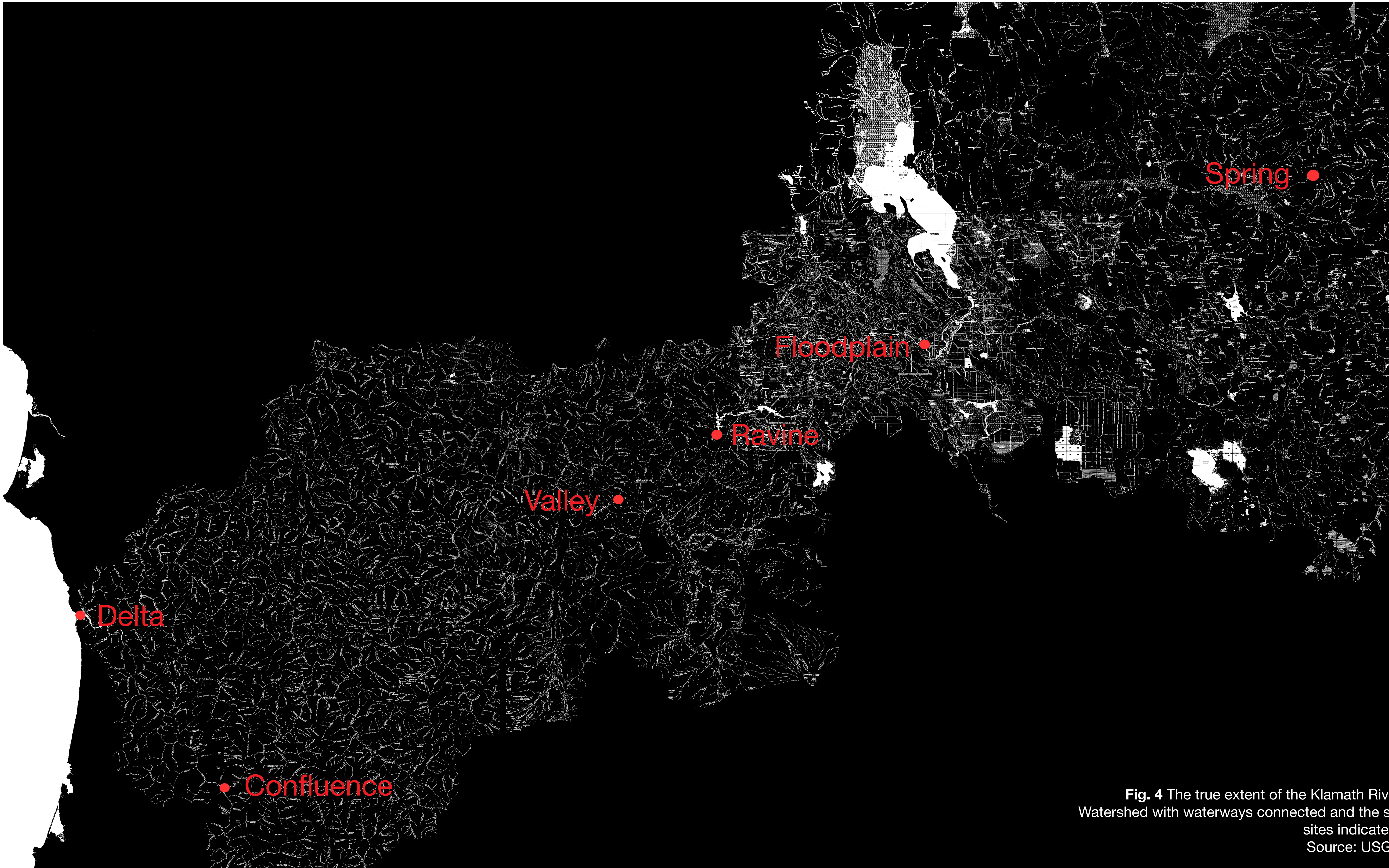


Fig. 4 The true extent of the Klamath River Watershed with waterways connected and the six sites indicated.
Source: USGS

IV.

Fig. 1 Basalt at the Narrows, 2025

Six Zones, Six Thresholds

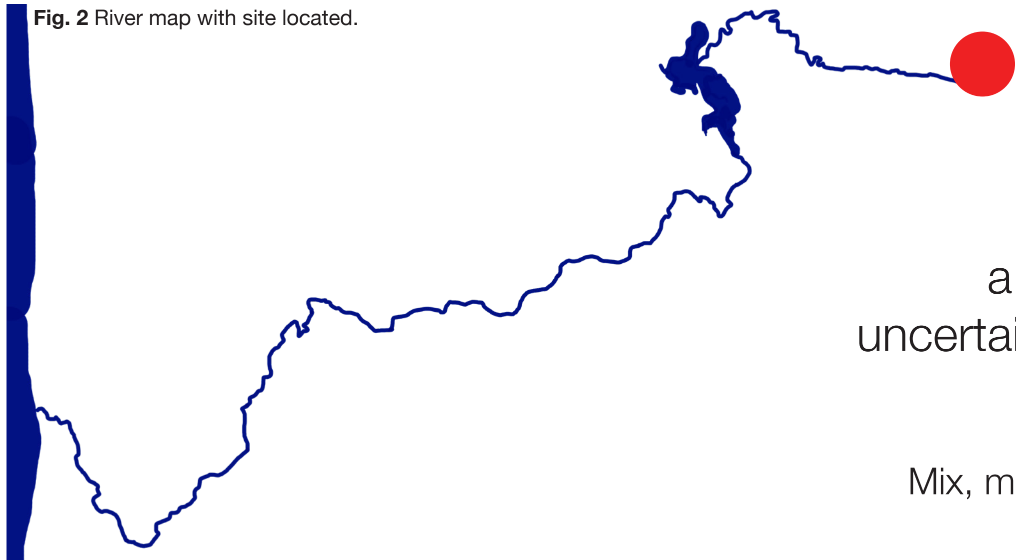


Fig. 2 River map with site located.

The Spring

emergence:
a place to observe the uncertain boundary between earth and water

Mix, merge, blend, glance, bend, contract, dilute

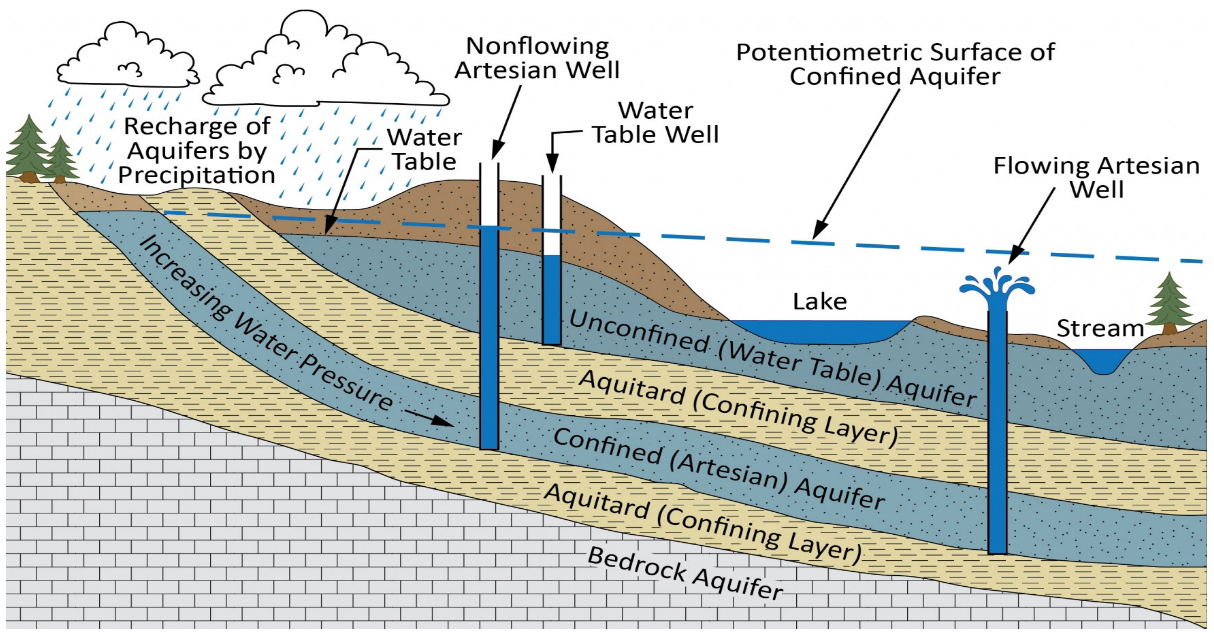


Fig. 3 Water flow action related to the spring.

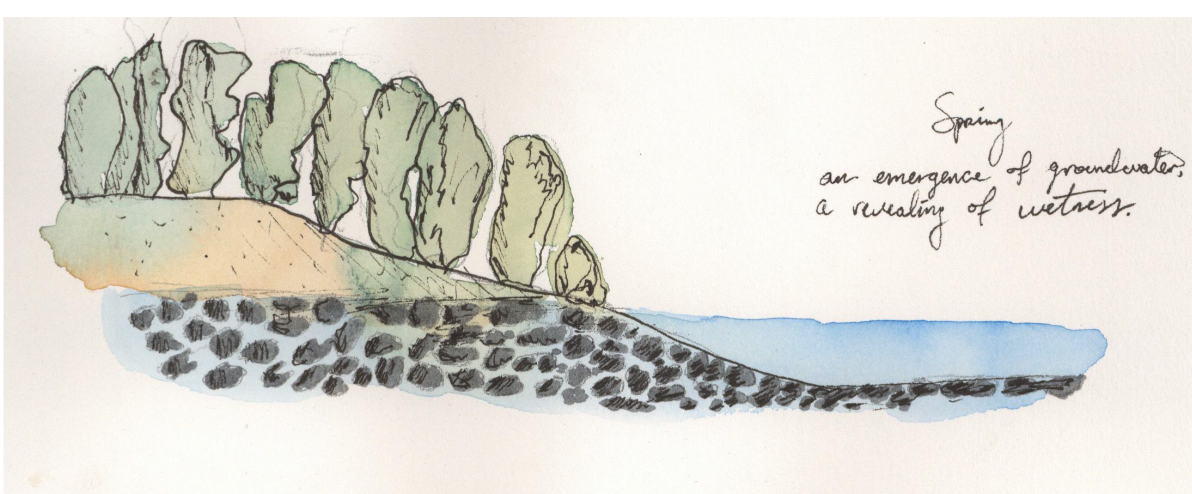


Fig. 4 Water flow action related to the spring.

Fig. 5 The spring at Gearhart Mountain.

Geographically, the spring of the Klamath River is located at Gearhart Mountain in the Basin and Range and is at an elevation of about 4,500 feet above sea level. The spring is a threshold of change, where the intensities of the characteristics of subterranean water becomes perceptible. There is no specific geographical source for the spring - water emerges where pressure, temperature, and saturation have reached a degree to allow for moisture to collect into a stream. The emergence crosses the threshold, not only is water moving from beneath the ground to the surface, but degrees of intensity have been met so that this act can occur at all. Emergence happens everywhere at the spring in the form of saturated earth and the presence of wetness is marked by the presence of peat, reeds, white bog orchids, and lupine.[1]

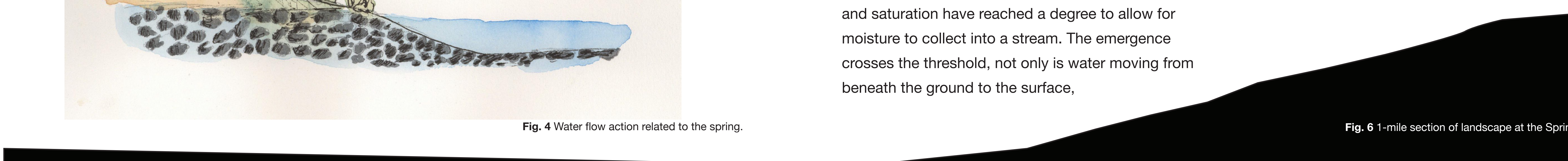


Fig. 6 1-mile section of landscape at the Spring.

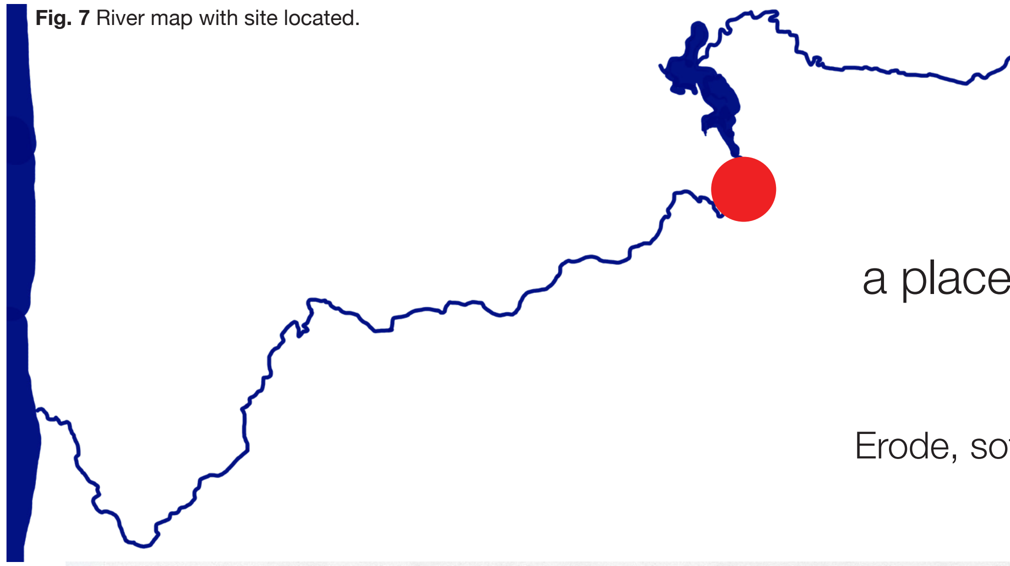


Fig. 7 River map with site located.

The Floodplain

flow:

a place to observe changing wetness

Erode, soften, blend, soak, meander, float, permeate

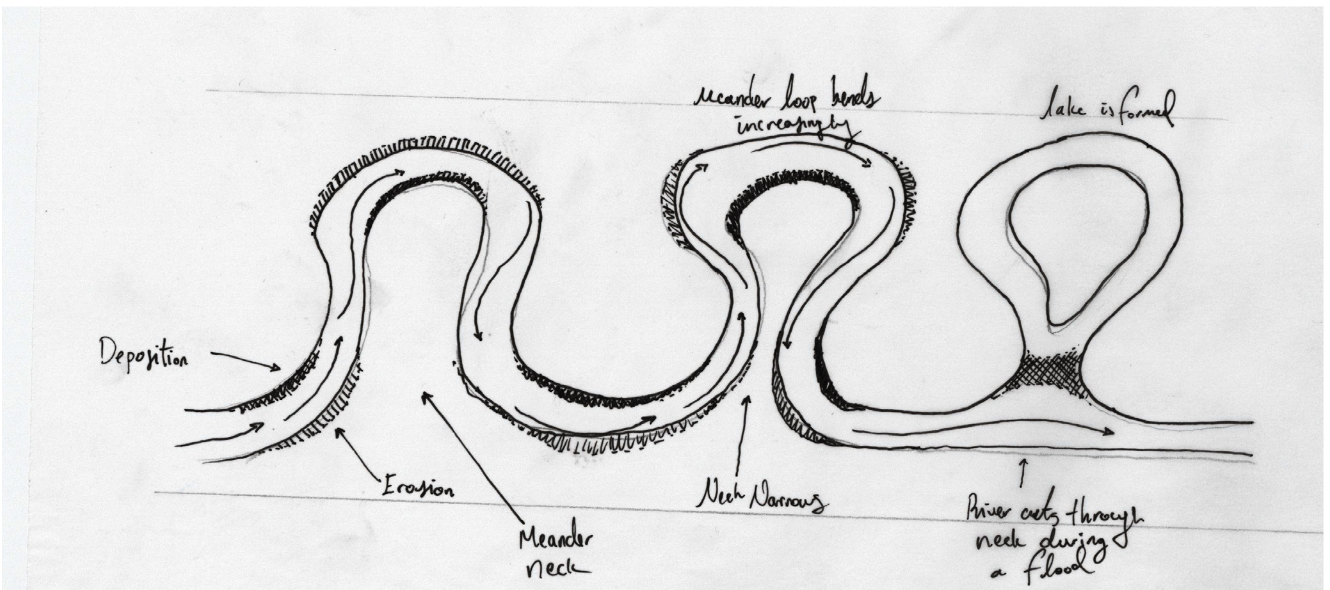


Fig. 8 Creation of an Oxbow lake.

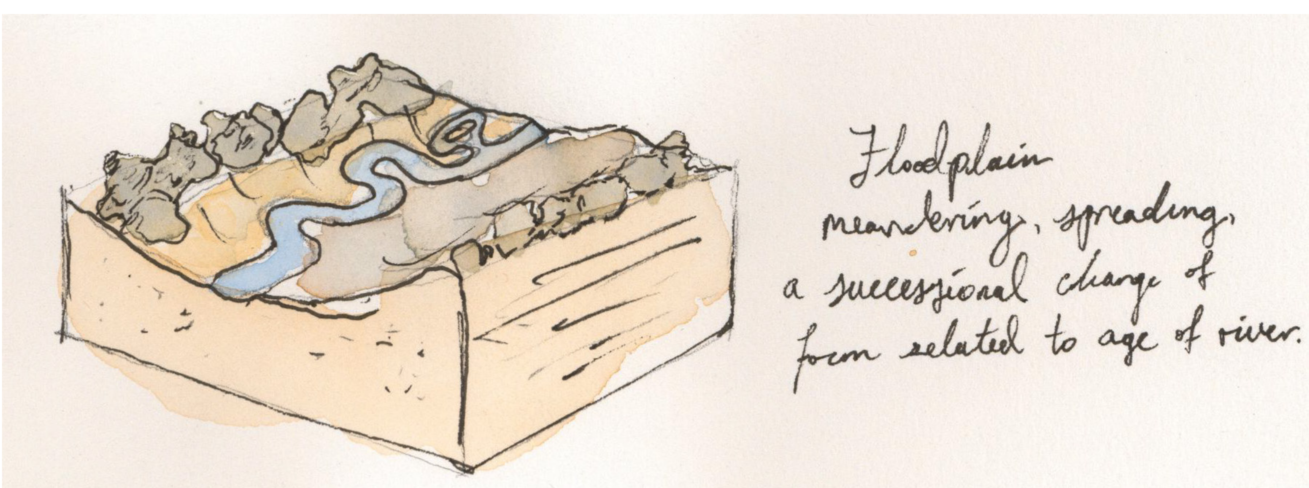


Fig. 9 Water flow action related to the floodplain.

Fig. 10 Frozen floodplain lake outside of Klamath Falls, OR.

A canoe moving from the Spring to the Floodplains will travel about 60 miles and is at an elevation of about 4,000 feet above sea level. The Klamath River flattens out here and moisture collects in the Floodplains and gathers at the path of the river. Similar to the Spring, moisture is everywhere and the intensity of wetness increases as one moves towards the river. The Floodplain hovers at the brink between soil moisture and surface water. As the river breaches its bank and rises above the soil line the land gives way, shifting to accommodate the increasing wetness.

What is farmland and what is wild wetland is only distinguished by the monoculture crops that are planted each year; the farm and native flora would take its place. Here, the threshold of a flow is present as the degree of wetness increases and decreases and the soil adjusts to accommodate these changes. During the most intensive periods of wetness the earth shifts dramatically, forming oxbow lakes and new routes, markers of the threshold of flow.

Fig. 11 1-mile section of landscape at the Floodplain.

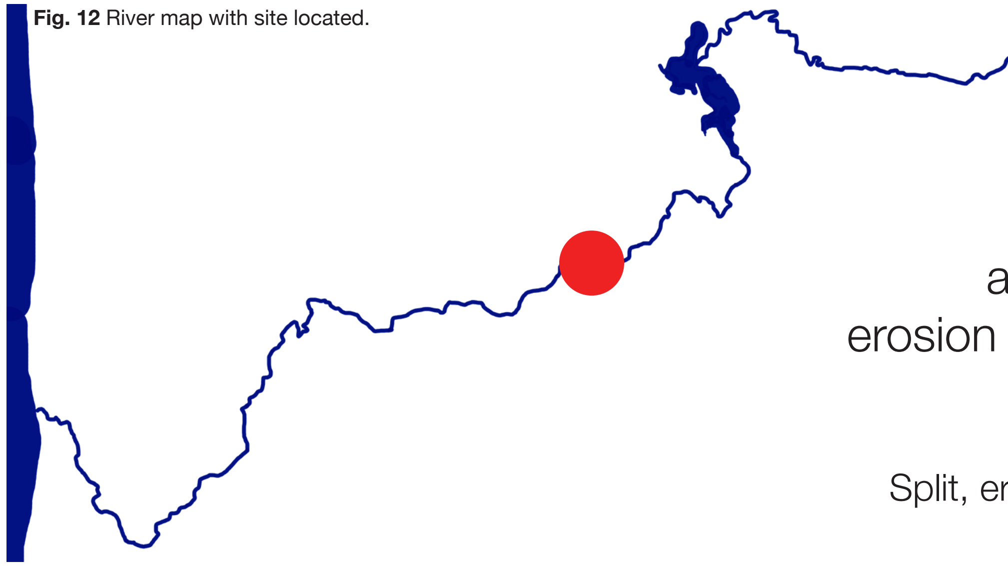


Fig. 12 River map with site located.

The Ravine

Scour:

a place to observe the erosion of land and migration of biological matter

Split, erode, fracture, furrow, mark, echo

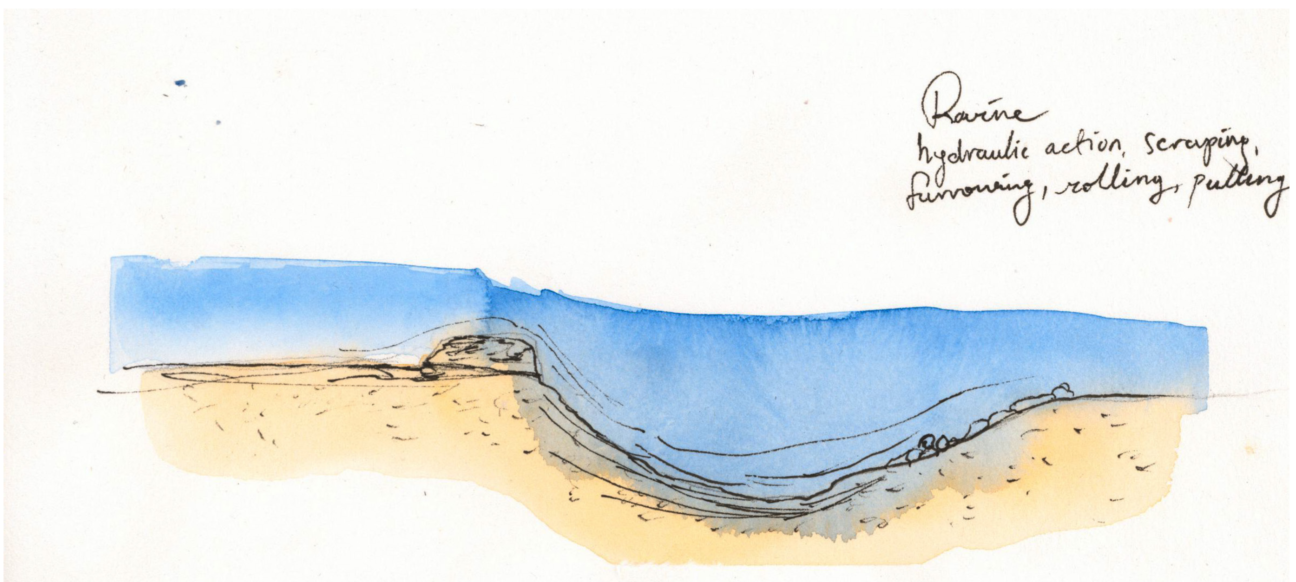


Fig. 13 Water flow action related to the floodplain.

Traveling just a few miles by canoe down the river the floodplain turns to a constrained ravine as the Klamath River dives into the Cascade volcanic zone at an elevation of about 4,000 feet. The Ravine is a zone of incision where the river intensities translate into layers cut through the earth. The river has, over that time, carved its path through the landscape, furrowing routes that deepen vertically rather than spread horizontally as was found in the Floodplain. Thresholds at the Ravine occur over longer periods and its form emerges from a landscape defined by gradients of rock hardness, fracture patterns, and ancient volcanic activity. Here, water moves quickly and wetness is concentrated in the river, increasing its pressure and tension on the surface of the landscape. As the pressure of the water overcomes the shear stress of the basalt the surface of the terrain erodes away and the ravine takes form. Leftover rocks that have moved downriver create eddies where flow velocity increases and the surface of the riverbed is pulled away downstream, deepening the form of the Ravine.

Fig. 15 Iron Gate Reservoir.

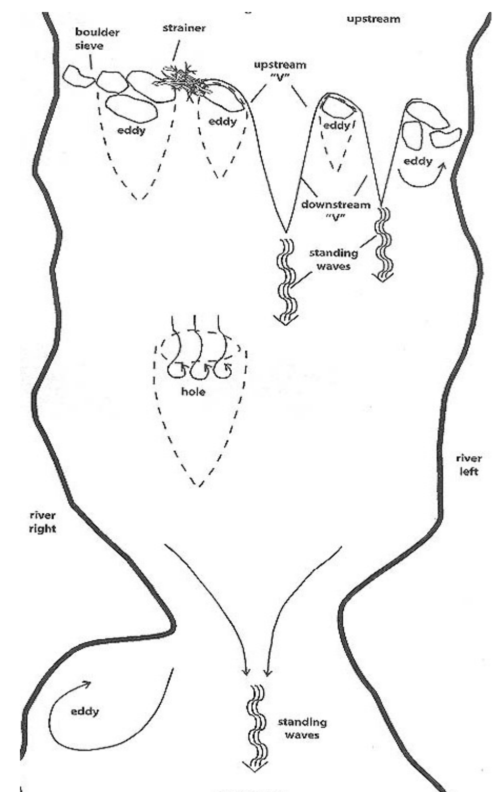


Fig. 16 The creation of eddies.
Source: entirelandscapes.space

Fig. 17 Iron Gate Reservoir

Fig. 14 1-mile section of landscape at the Ravine.

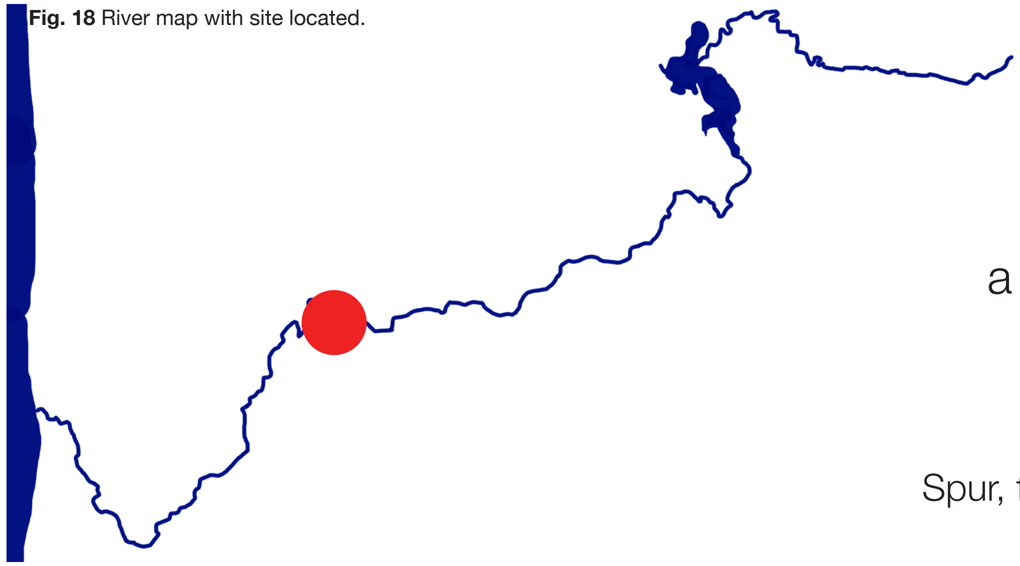


Fig. 18 River map with site located.

The Valley

Transference: a place to observe the turbulence

Spur, furrow, funnel, spin, run, lift

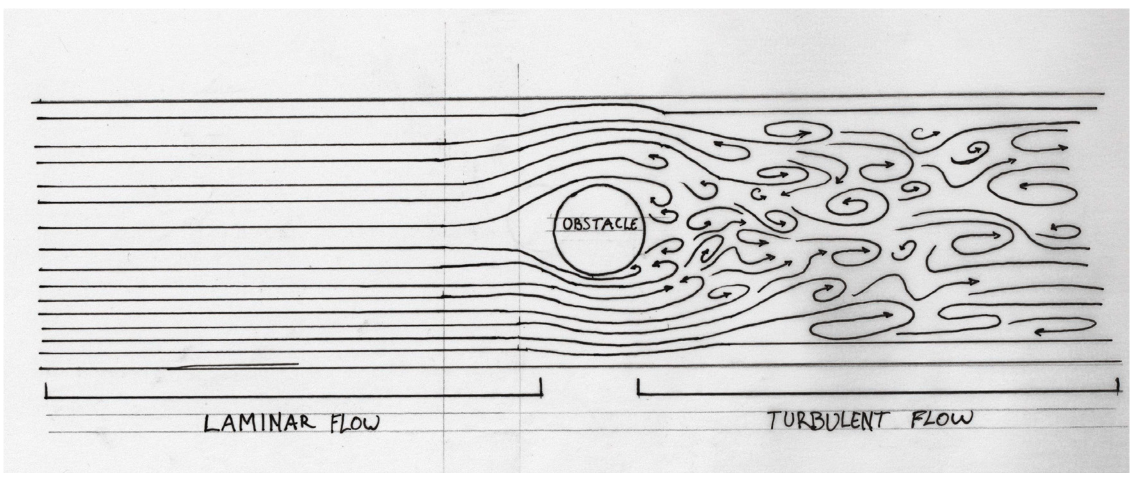


Fig. 19 Laminar flow.

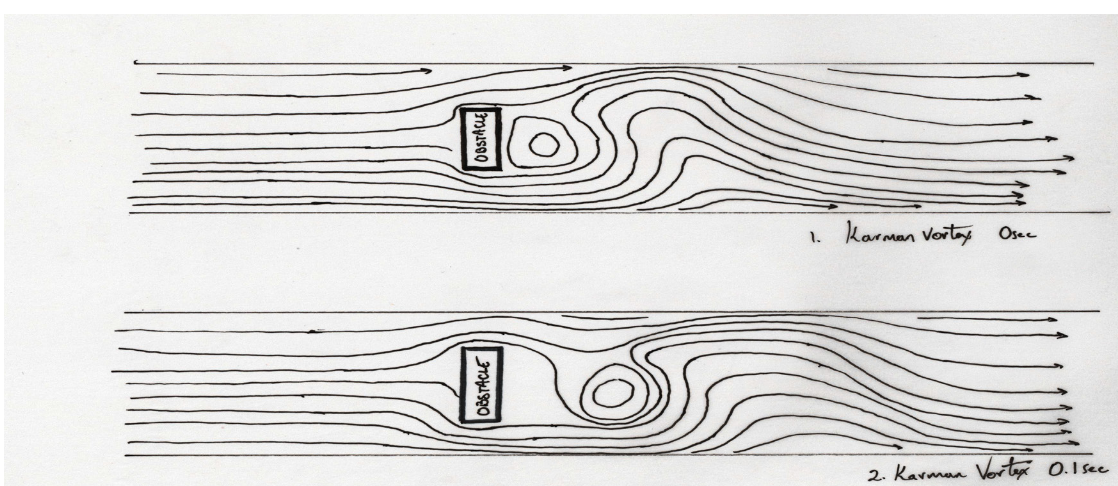


Fig. 20 Flow around an obstacle.

Fig. 21 View of the valley along Highway 96.

By canoe, the valley is about 45 miles downriver from the distinct landscape of the Ravine and is at an elevation of about 2,500 feet. The Valley is not a corridor as the Ravine might be described - it is wider and hillsides slope down rather than being precipitous cliffs. The form of the Valley emerges from its elevation, heavy rains, the velocity of water moving through the landscape, and sediment pulled from the Floodplain and Ravine over millions of years of cyclical action. On the eastern side of the Klamath Mountains the intensity of wetness is marked by vegetation threaded along the fissures in the landscape but in the middle of the Klamath Mountains where the valleys are deepest wetness is ubiquitous and moisture moves in from the ocean daily, saturating the ground and flora proliferates. The threshold that gives form to the valley is the transference of particles downstream, a reassembly of matter that is caught in the energetic pull of water as it is channeled down hillsides and into the river.

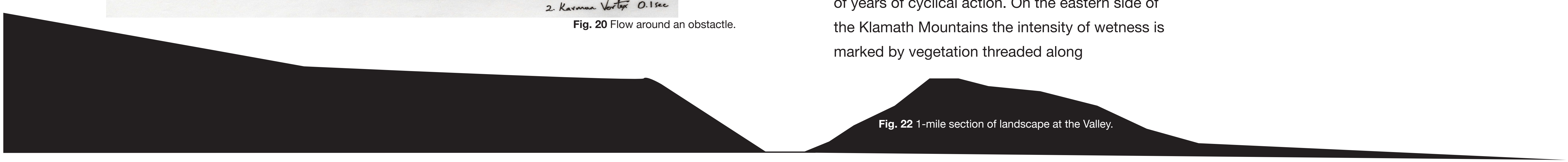


Fig. 22 1-mile section of landscape at the Valley.

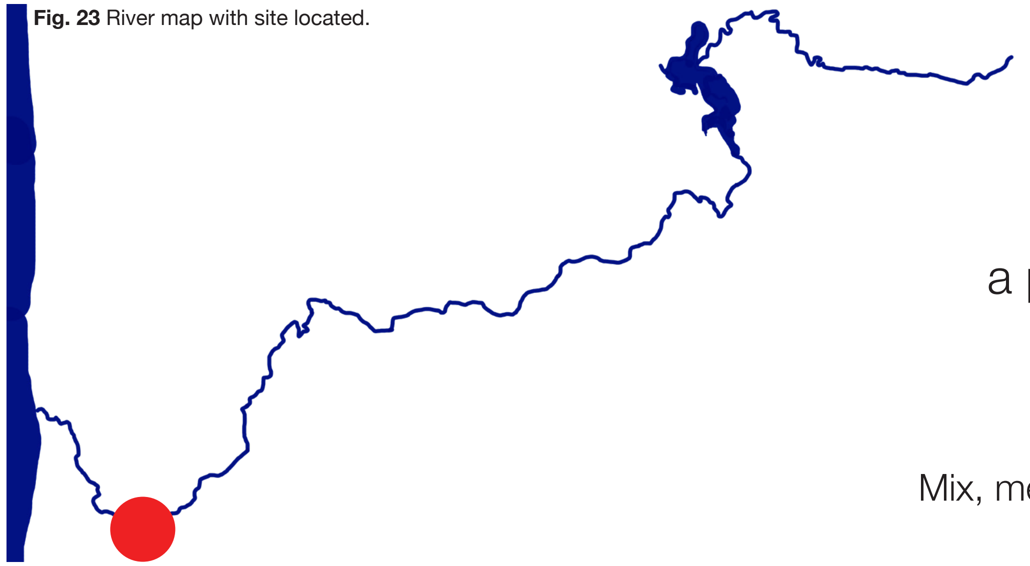


Fig. 23 River map with site located.

The Confluence

exchange: a place to observe the mixing of waters

Mix, merge, blend, glance, bend, contract, dilute

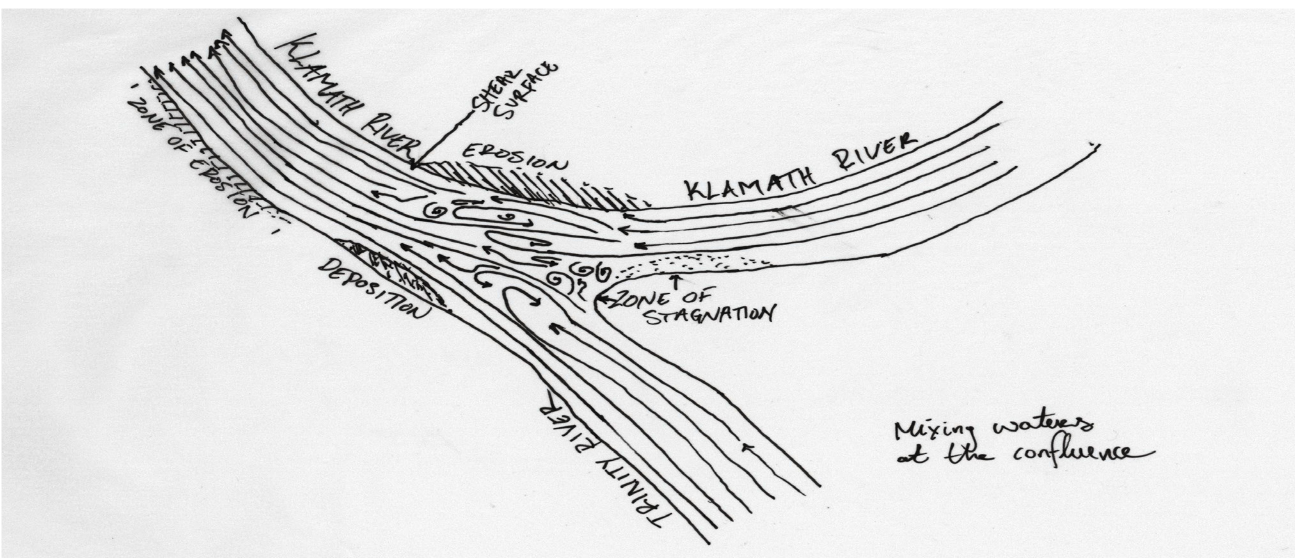


Fig. 24 Mixing waters.

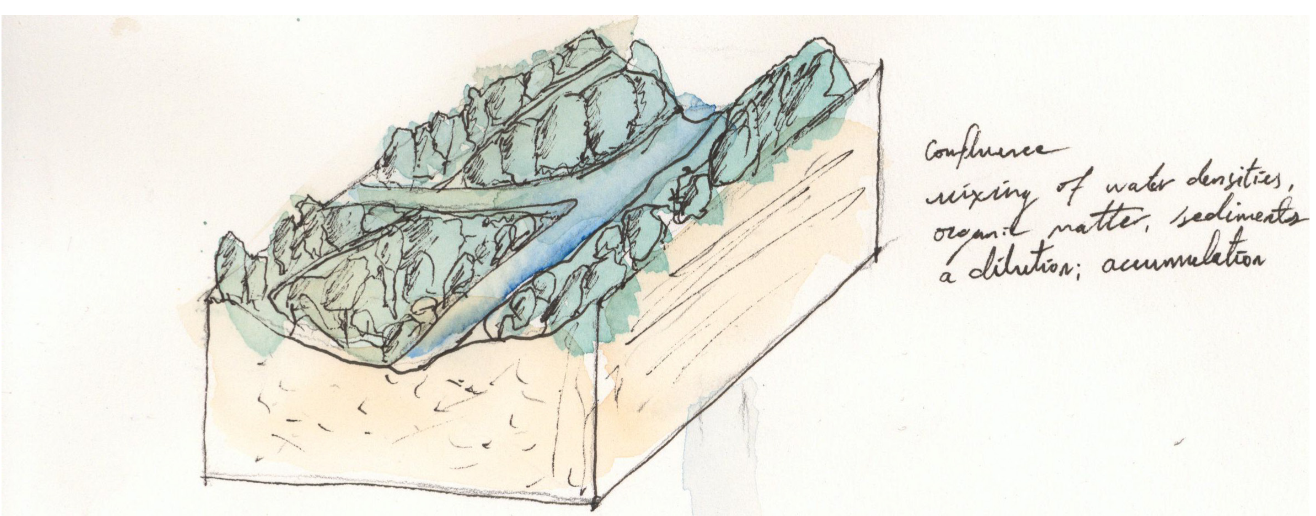


Fig. 25 Diagram of the confluence of rivers

Fig. 26 The confluence of the Trinity and Klamath Rivers in January, from the south bank looking across the Trinity RIver.

The Klamath River meets the Trinity River about 30 miles from the river delta and about 60 miles from the eastern edge of the Klamath Mountains The Trinity River merges with the Klamath at an elevation of about 180 feet above sea level. Descending from the surrounding snowfields of the Klamath and Trinity Mountains, water that moves down the Trinity is cool while, by this point along its course, the Klamath River has warmed and is heavy with sediment. When the two rivers meet the threshold is its confluence - neither river subsumes the other but the movement of water along the paths creates swirling patterns, shearing interfaces, and transient eddies.

Flow lines become visible ribbons as sediment traces the energy that carried it. At an uncertain point beyond the confluence the two rivers become one turbulent front. Where they meet, eddies form; the banks erode and sediment accumulates; slow-moving pockets of water create habitats for invertebrates and shifting turbulent areas pull at the surrounding earth. The confluence is a zone of continuous transformation, a mixed assemblage of the eroded landscapes.

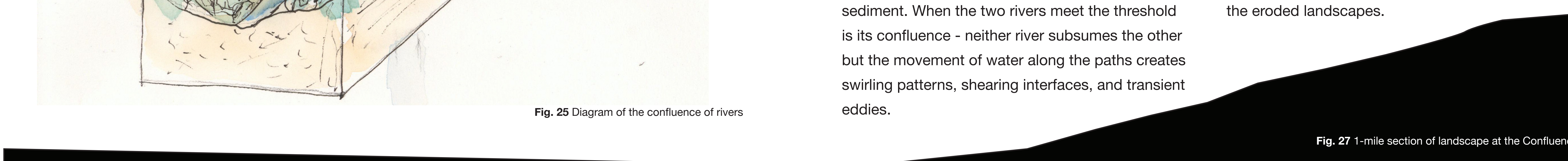


Fig. 27 1-mile section of landscape at the Confluence.

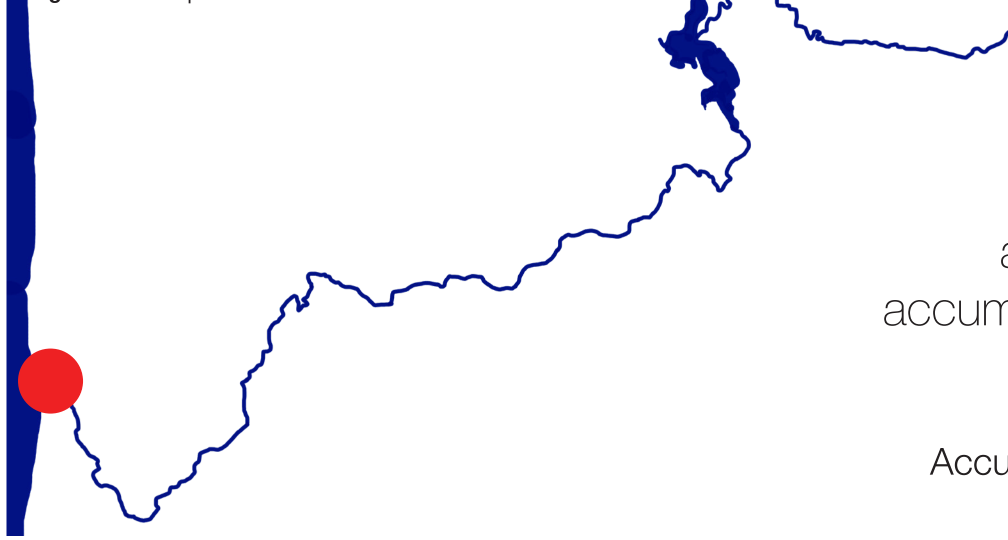


Fig. 28 River map with site located.

The Delta

accumulation:

a place to observe the accumulation and erosion of sediment

Accumulate, merge, erode, fold, swirl, shear

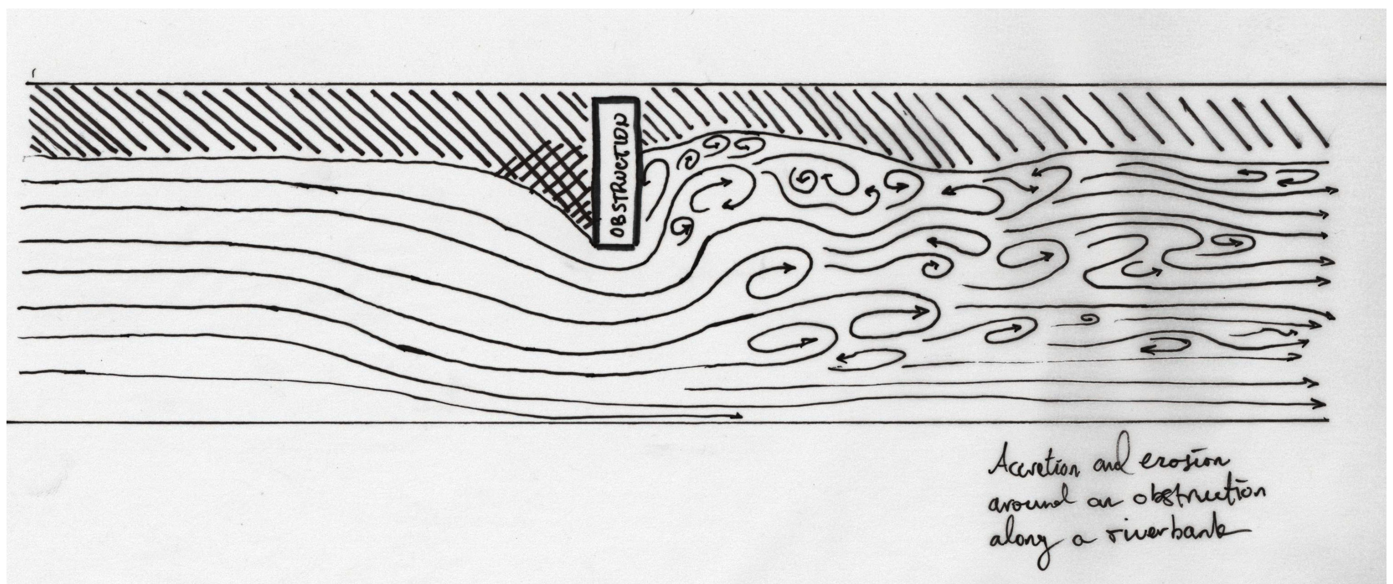


Fig. 29 Accretion around an obstacle in a river.

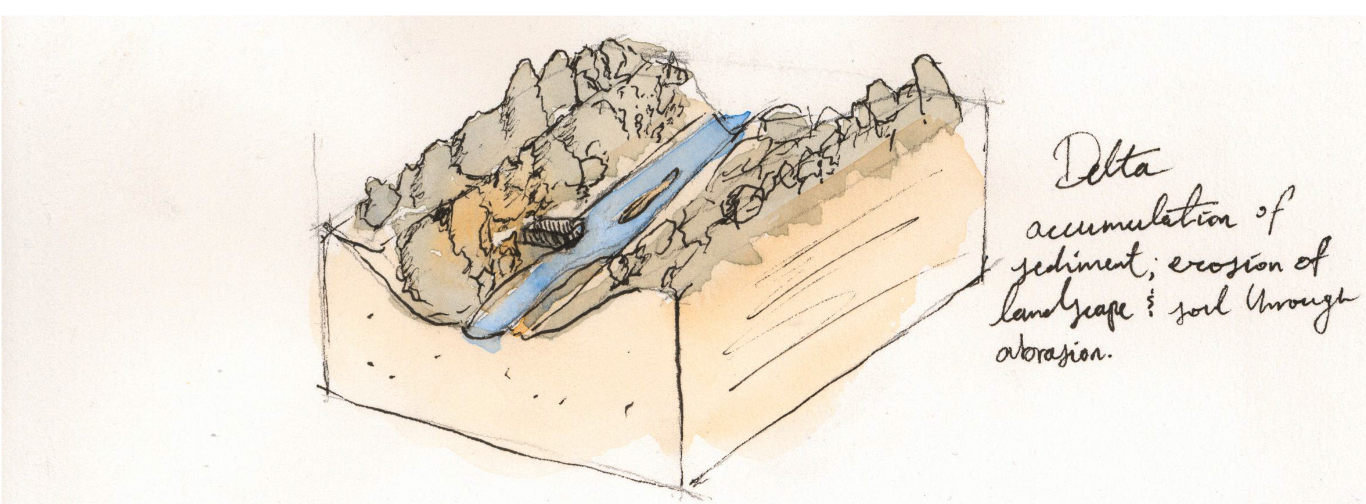


Fig. 30 Landscape of the delta.

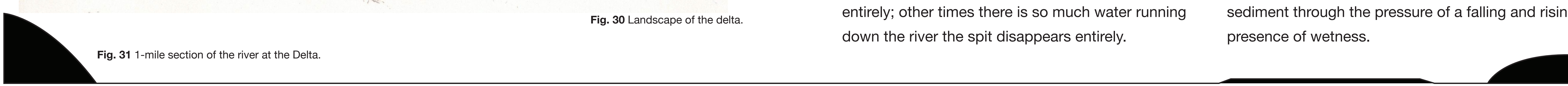


Fig. 31 1-mile section of the river at the Delta.

Fig. 32 The Klamath River delta at sunset in January, looking southwest.

The delta of the Klamath River, especially where its final slough bends before meeting the Pacific, is a zone of erosion and accretion, a zone where microscopic fragments of the landscape have drifted and settle to create riverbanks, islands, and the spit, a mile-long stretch of accreted earth formed by the tide and the river flow. The spit is always shifting - as tide rises and falls more or less sediment builds up and as seasonal changes bring more or less water down the river the opening that allows the river to exit through the spit shifts north and south. At times, when the tidal action is strongest, the spit closes entirely; other times there is so much water running down the river the spit disappears entirely.

The threshold of erosion and sedimentation that occurs at the spit also occurs all along the delta, forming channels through the sloughs of accumulated sediment that is so extensive entire islands with forests have formed in the middle of the river. Here at the delta, the banks of the Klamath shift with the tides and the flow of the river. The Klamath runs wide and deep here, scouring away the earth at the banks, pulling sediment out into the ocean. It is a zone of transformation where the fragile interaction of water and earth is an ever-adjusting reality of addition and subtraction of sediment through the pressure of a falling and rising presence of wetness.

V.


Fig. 1 Foundation at the Narrows, 2025

Design Responses

Fig. 2 An elk shedding its winter coat near the Klamath River Delta.

The design for the Klamath River must respond to each of the zones. The Spring, Floodplain, Ravine, Valley, Confluence, and Delta all express the actions of the river and degrees of wetness in remarkable ways. For this thesis, two of these six zones will be explored, the Ravine and the Delta. The designs intend to witness the becoming and the changes that accumulate and erode along the river, changes that occur in a day, throughout a season, or over decades. The two sites, the Ravine and the Delta, are different. The action at the Ravine is carving and oriented vertically and moisture is relatively constrained to the channels carved over millennia. The landscape of the Delta, however, changes seasonally and over decades. Some of that which is eroded from the Ravine eventually is deposited at the Delta, constructing the landscape over time, while organisms that travel from the Delta eventually arrive at the Ravine. They represent two ends of a spectrum of action occurring along the Klamath River.

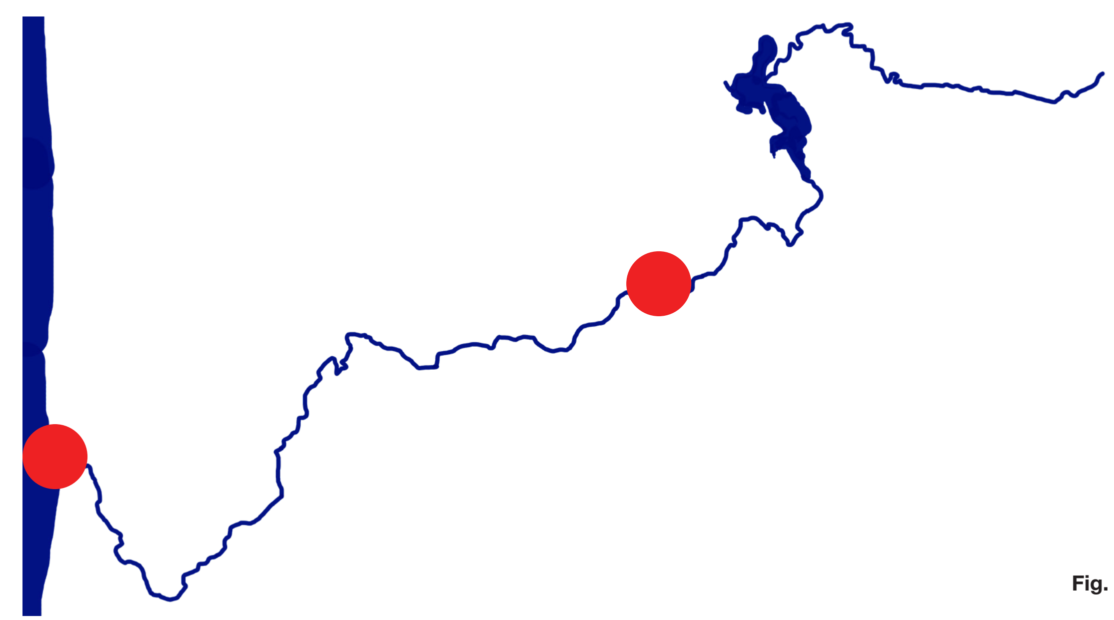


Fig. 3 River diagram with sites indicated.

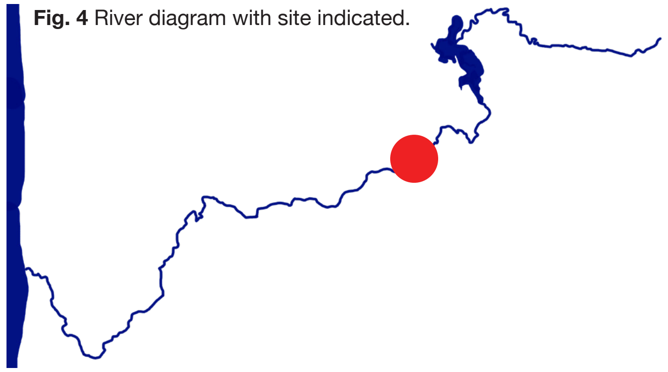


Fig. 4 River diagram with site indicated.

The Bridge at the Ravine

When the Iron Gate Dam was constructed in 1964 it created a reservoir, 4,630 square miles covering an area that previously was native sagebrush, willow, alder, cottonwood, and chokecherry, and then became farmland. Once the dam was built the reservoir raised water levels 70 feet on average throughout the 944 acres of surface area.[1] The longer the reservoir was present the more sediment gathered behind the dam, burying a deep ravine with a complex ecology.[2]

Once submerged beneath the reservoir created by the Iron Gate Dam, the ravine site is now revealed and with it the memories of the reservoir are also present. A calcified carbonate line fused with the basalt earth marking the different high water lines of the reservoir over the seventy years of its influence on the landscape.

Even as flowers return to the landscape a shadow of this sodium-infused datum remains, keeping plants from rooting, although as the land shifts this trace will disappear, in time. While the reservoir left its trace it also preserved the landscape that it covered.

Fig. 5 Klamath River with Iron Gate Reservoir filled and site indicated.

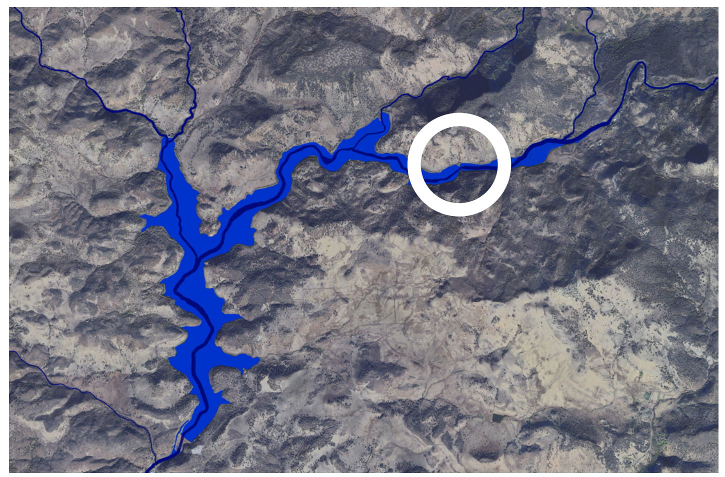


Fig. 6 Klamath River with Iron Gate Reservoir filled, site indicated, and river path indicated.

Fig. 7 Klamath River with Iron Gate Reservoir filled, site indicated, sediment highlighted, and river path marked.

Before the ravine was flooded the river had established a course and this was maintained while the dams were present. Indeed, the landscape beneath changed very little: riverbanks, fence posts, farming equipment, and old roads were all preserved as imprints beneath the sediment; what once was now is again.

Fig. 8 Klamath River near site with tributaries named.

As the reservoir was drained the landscape was revealed - the river returned to its former route and the old roads that connected the ravine farmland are traced in the topography and the regrowth of plants.

Among the preserved landscape are two foundations of a train bridge that had been removed before the Iron Gate Dam was built. The bridge spans a portion of the river called the Narrows, a pinch in the landscape where two basalt cliffs reach toward one another while the river cuts between them. The abutments of this former bridge were constructed from the surrounding basalt stones and concrete aggregate and are all that remain of the connection between an isolated farming community and the outside world. As the river regains energy that had been contained behind the dam, accumulated sediment is being pulled away and the abutments are being revealed.

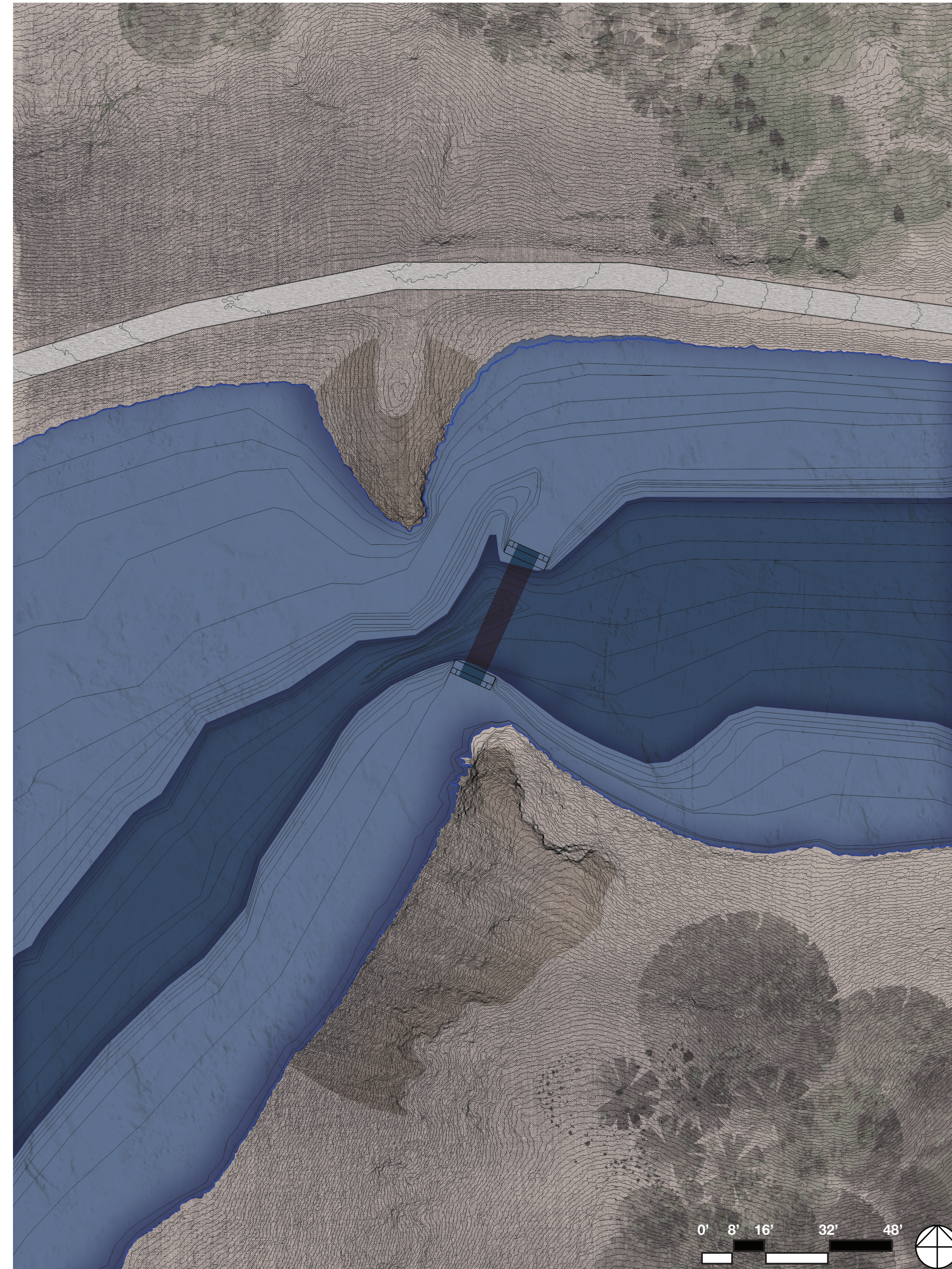
Former roads carved out of the topography are visible, too - narrow pathways that meet the abutments follow the curves of the hillside, containing former farmland next to the river.

Fig. 9 Site for bridge design with both foundations in view. Basalt columns on the opposite side of the river are stained by the height of the reservoir that is now drained.

Fig. 10 Ravine site, looking east towards the basalt columns.

To inhabit this landscape is to interact with the verticality of the topography. The Klamath River cuts through the terrain, occupying the base of the ravine and establishing an indeterminate low point in the landscape as the river scours the bottom, removing layers of sediment build-up from the reservoir. On either side of the river steep basalt hills rise, forming distinct continuous structures that create a strong sense of enclosure. The elevation change between the riverbed and the surrounding hills are marked by the difference in wetness, noise, and energy. Descending to the river there is a distinct moment when the moisture increases, a coolness reaches the skin, and the movement of air is determined by the flow of water; the noise of the movement of water is entirely subsuming. The energy of the water is irresistible and constrained as it runs deep between the two abutments, carving out a trough into the earth. The further one moves away from the water the more noticeable the lack of moisture becomes and even just ten feet above the water the temperature rises and the heat of the cloudless sky dries the skin. Rising even ten feet higher up to the water level of the former reservoir the air is noticeably drier and the moisture that was so present near the water has evaporated in the sun.

Fig. 11 (opposite) Ravine site topography with bridge submerged beneath reservoir level.
1' topographic intervals.



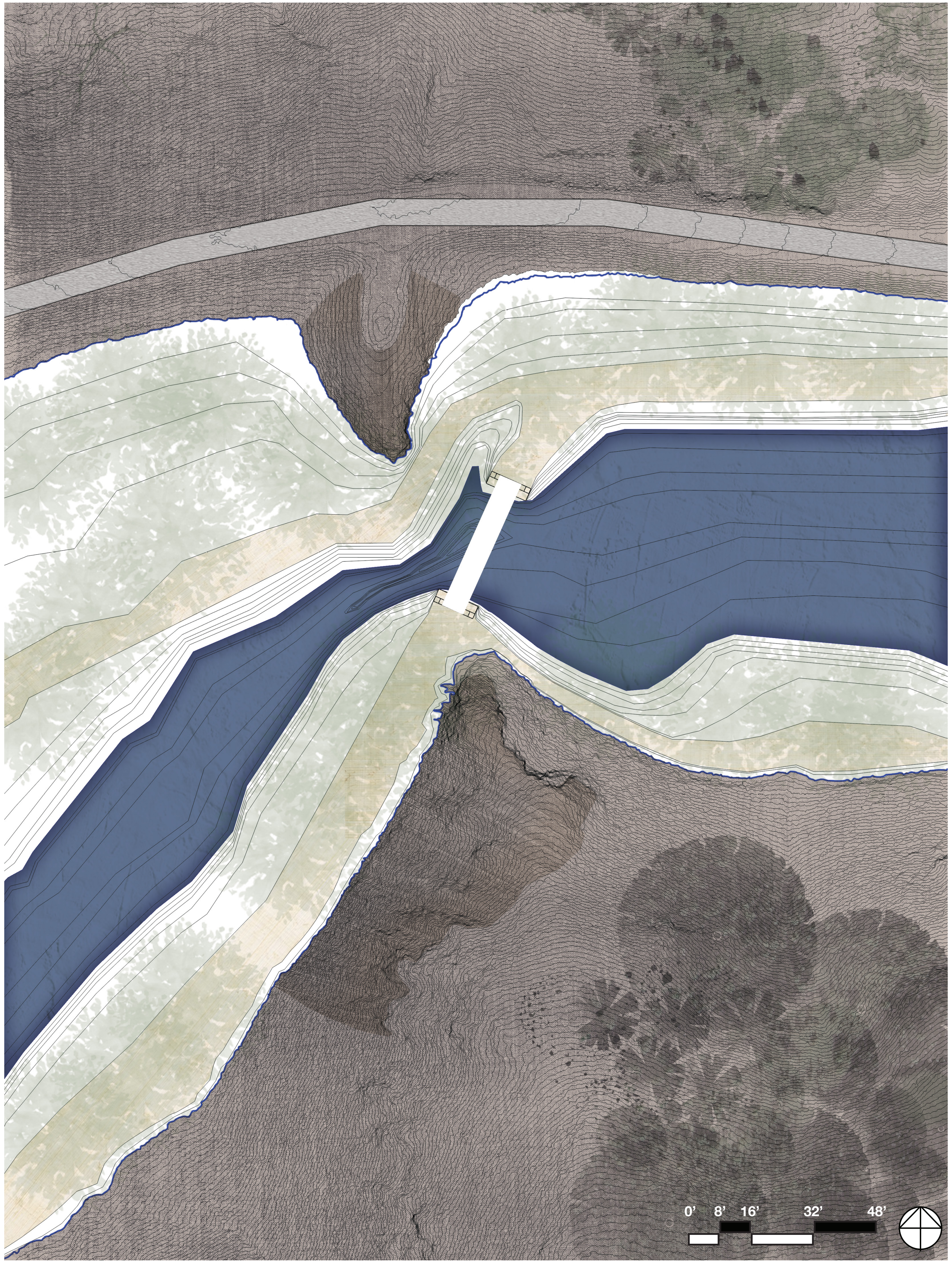


Fig. 13 West of the site the river flattens and erodes the built-up sediment.

Across the two abutments, a bridge is constructed - a line rebuilding the former structure, occupying only the abutments. The bridge is fifty-one feet long, once again connecting both sides of the river. The bridge is occupied by walking from the road down a short slope that merges with the former railroad. Stepping onto basalt stones that rise up to the height of the bridge, about five feet, one ascends onto the platform of the bridge. The bridge is a Howe truss structure that is mirrored on top and bottom and is constructed of manufactured wood that supports three platforms and the bridge crossing. The lowest platform is three feet above the water line, the second platform is ten feet above the bridge at the height of the former water line, and a final platform 20 feet above the bridge. The platforms are intended to be occupied by lying flat on one's stomach so that one is able to lean over the edge and observe the river at these different zones of intensity. Occupying each platform offers the opportunity to observe a different quality of the river.

Fig. 12 (opposite) Site revealed after the removal of the dam, with road highlighted.

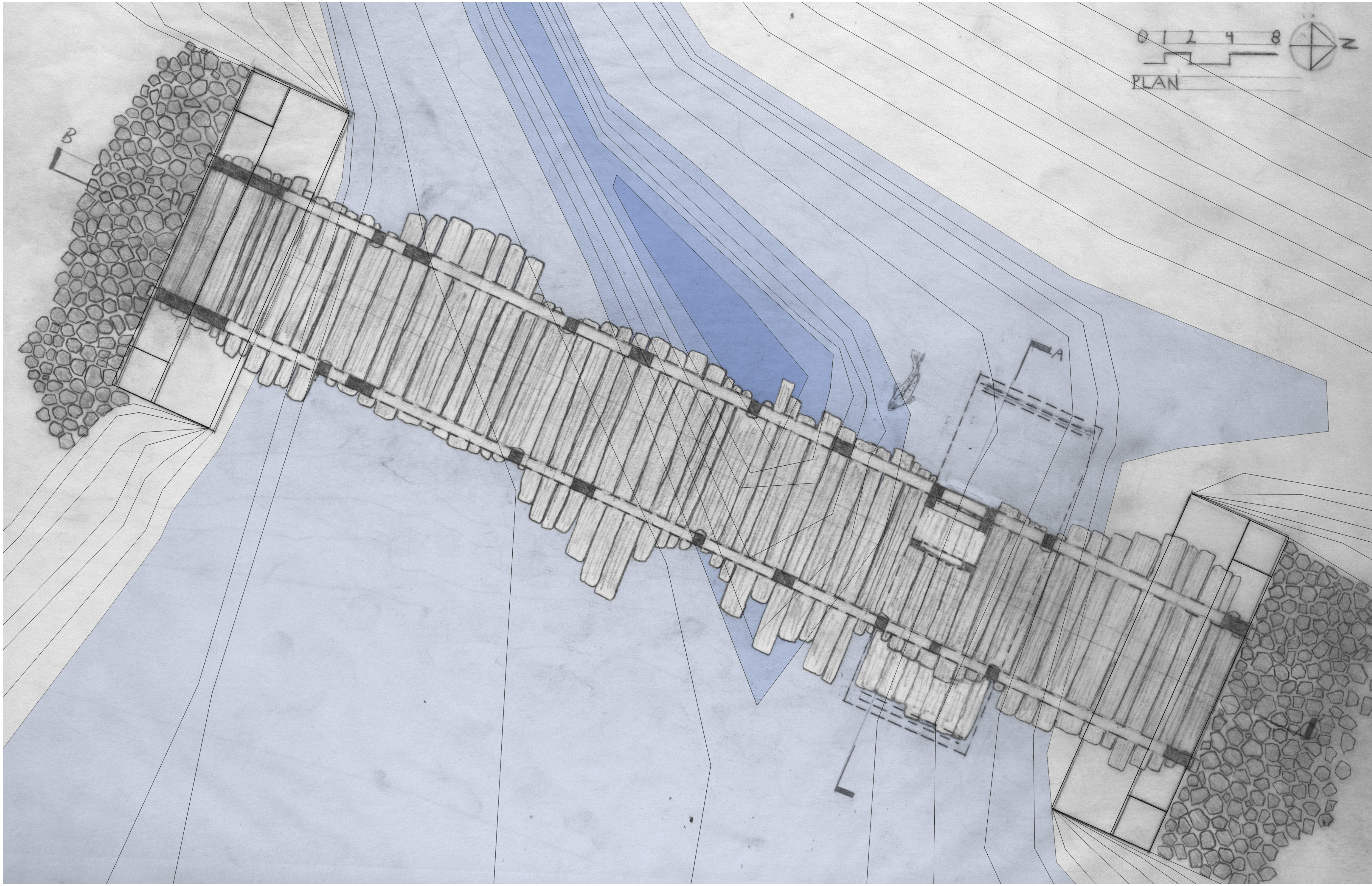


Fig. 14 Site plan.

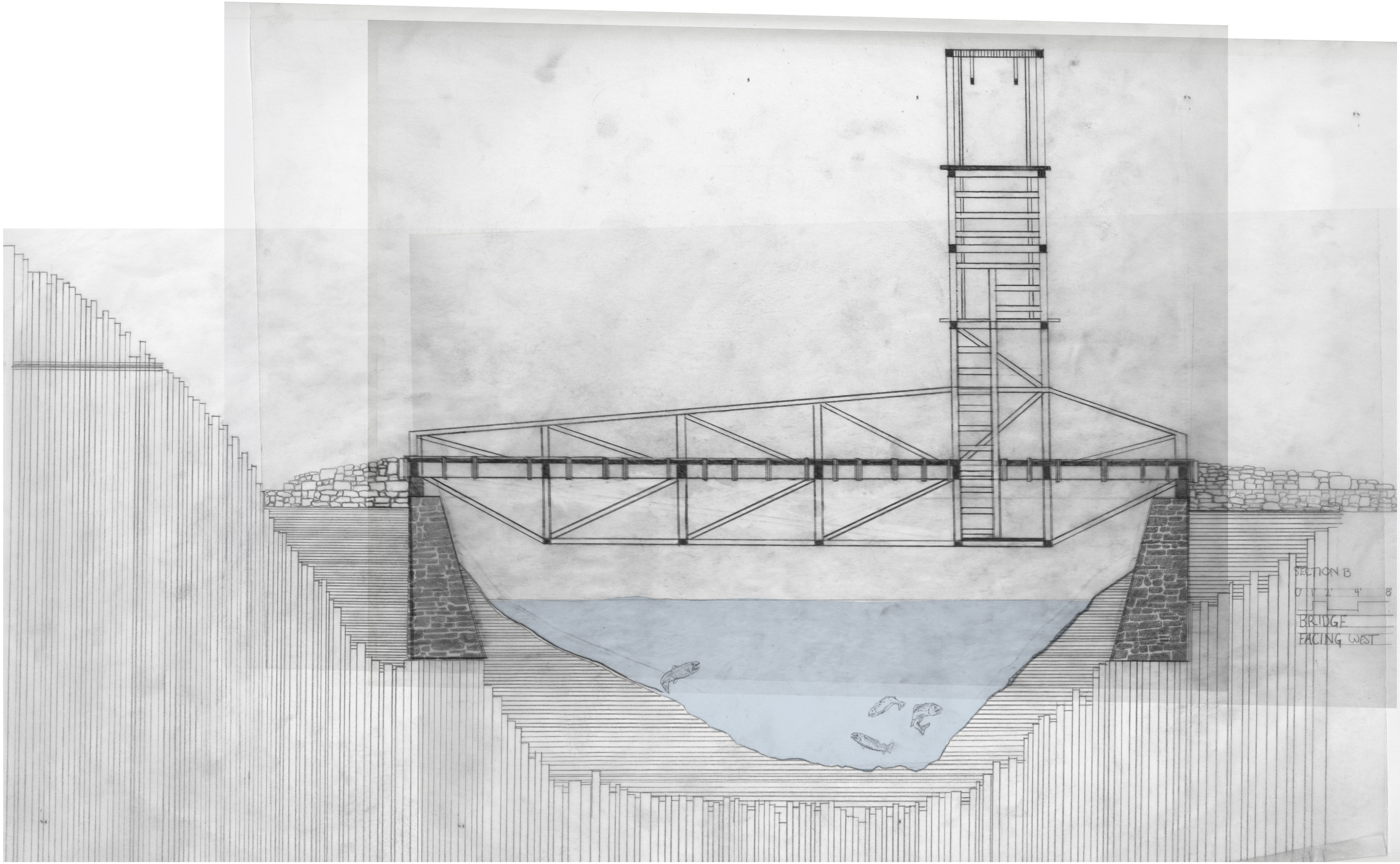


Fig. 15 Section B

Fig. 16 Built frame of site.

Fig. 17 Iron Gate Reservoir immediately after dam removal.
Source: Swiftwater Films.

Fig. 18 Iron Gate Reservoir in May, 2025.
Source: Swiftwater Films.

Fig. 18 Site in May, 2025.
Source: Swiftwater Films.

The lowest platform is close to the intensity of the river to allow for monitoring of organic matter moving up and down the river, the second platform is to raise one above height of the reservoir, and the third platform is a fish counting platform. The bridge crossing is made by lashing cedar planks to the structural members of the bridge, only cutting wood when needed to fit around the bridge structure.

Cedar planks are placed perpendicularly to the bridge structure and stick out beyond the structure so that it is possible to crawl out onto the overhanging plank to observe the river's action. Crossing the bridge brings one directly next to the basalt columns that have collapsed onto the old road.

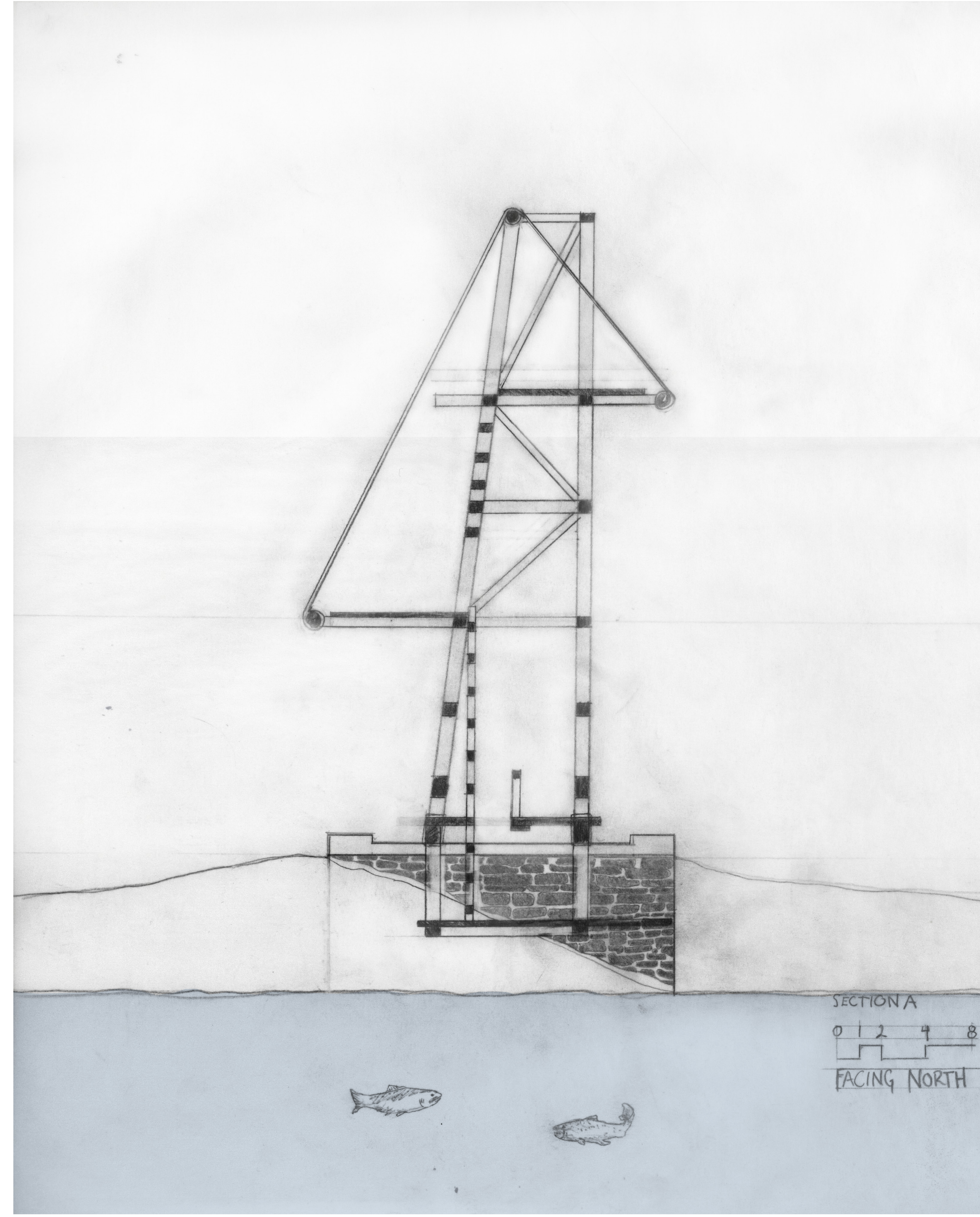


Fig. 19 Section A

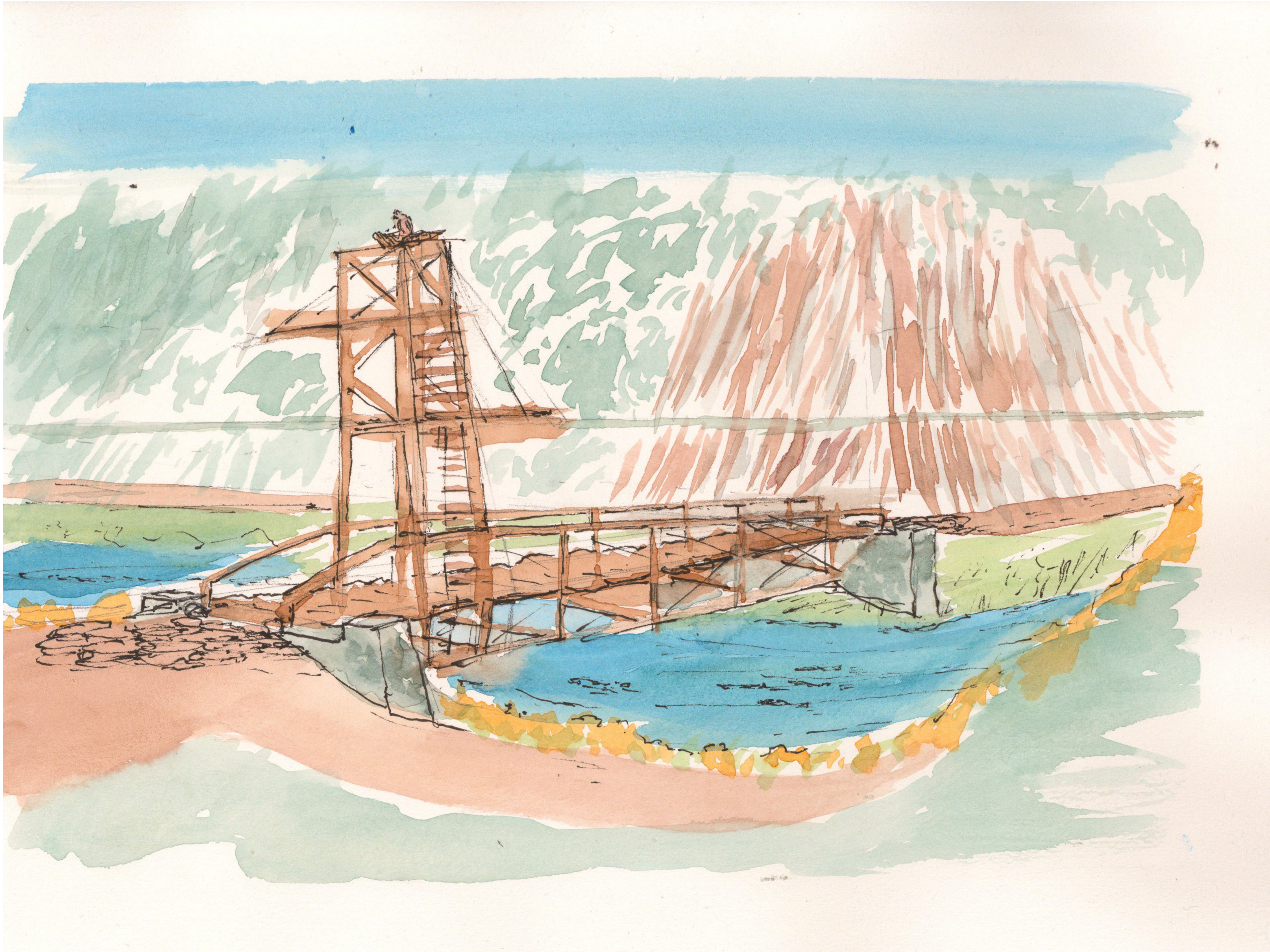


Fig. 20 Watercolor

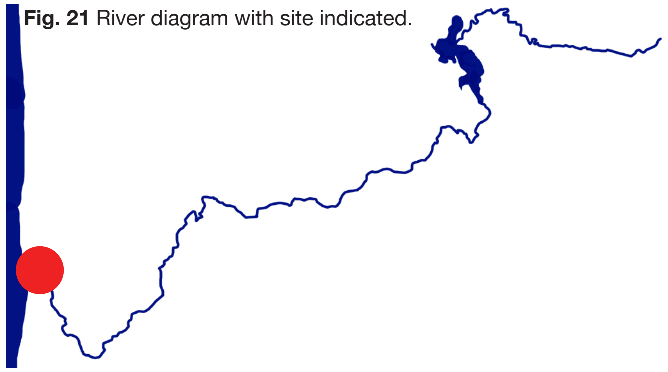


Fig. 21 River diagram with site indicated.

Accretion Walls at the Delta

The Klamath River delta is a relatively flat expanse of land where the river meets the Pacific Ocean. The network of branching channels, sloughs, and tidal inlets have developed over centuries through sediment deposition and shifting water flow patterns, creating a waterscape that is fragmented and saturated. The ground surface is uneven, at times marshy, muddy, and patchy vegetated wetland. It is a landscape that increases and decreases in saturation with the tide and seasonal changes. To the north and south, the delta is bordered by dense stands of coast redwood forest, which creates a distinct edge between the wooded uplands and the open, sediment-laden delta. The presence of both fresh and tidal waters result in a dynamic hydrological environment with changing water levels and salinity gradients so only salt-tolerant species can survive.[3]

The delta is a space of constant horizontal change. Each year sediment brought from the land is transported and deposited either along the banks at the delta or is pushed out deep into the ocean, sometimes creating enormous sediment plumes.

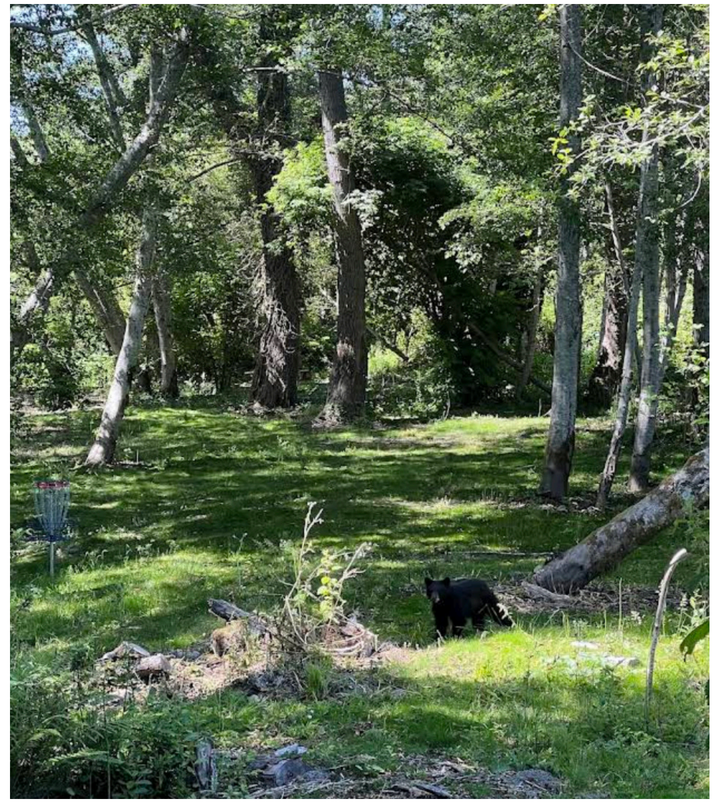


Fig. 22 Black bear on the site.
Source: Google, Max Schlapfer

Fig. 23 View of the Klamath River looking west towards the old Highway 101 Bridge that was destroyed in the 1964 flood.
Source: Google, Max Schlapfer

Fig. 24 View of the Klamath River looking west.
Source: Google, Max Schlapfer

Fig. 25 Map of site.

Fig. 26 Klamath River Delta 1988.
Source: Google Earth

Fig. 27 Klamath River Delta 1998.
Source: Google Earth

Fig. 28 Klamath River Delta 2003.
Source: Google Earth

Fig. 29 Klamath River Delta 2009.
Source: Google Earth

Fig. 30 Klamath River Delta 2012.
Source: Google Earth

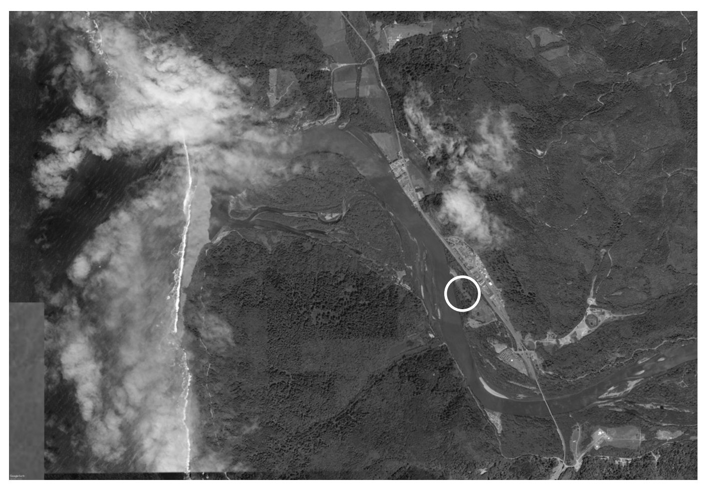


Fig. 31 Klamath River Delta 2016.
Source: Google Earth

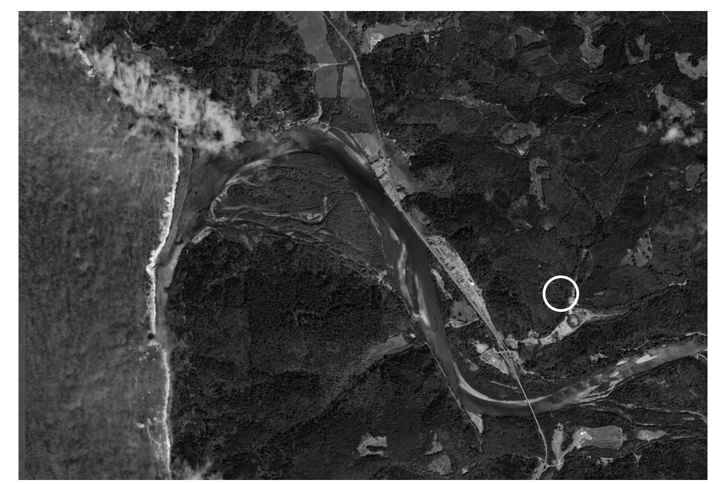


Fig. 32 Klamath River Delta 2019.
Source: Google Earth

Fig. 33 Klamath River Delta 2023.
Source: Google Earth

To witness these changes, a series of solid gabion and Cob walls are constructed along the west bank of the river, east of Highway 101 where it cuts through the town of Klamath. These walls would follow the direction of the topography to create a distinction between inside and outside, where inside would offer social space for the local community and the outside would be the shifting landscape, including the erosion and accretion that is so present in this zone. Figures 25 - 32 show the changing delta landscape.The spit, the area bordering the ocean, shifts its opening over time with the flow of water.

Sediment accumulates in the sloughs creating new islands and the banks erode from the shear force of the river. This action is most obvious at the brackish intersection between ocean and river but shear erosion occurs throughout this zone. The Delta site is in this erosion zone and was stabilized by the U.S. Army Corps of Engineers, who added 6,600 tons of rocks to slow erosion.

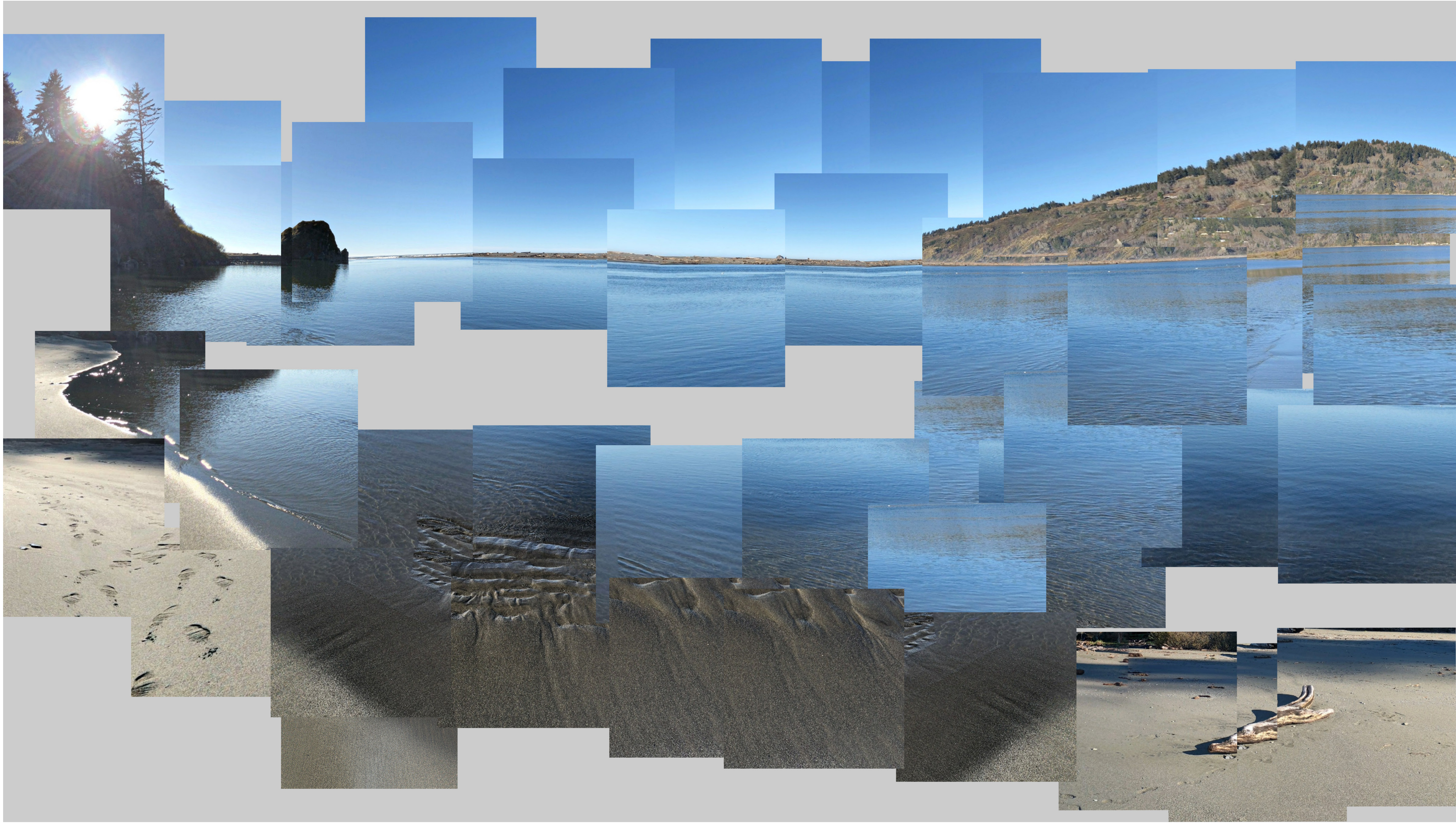


Fig. 34 Built frame, Klamath River Delta.
iPhone photographs.

The entirety of the lowland delta zone has, during floods, been entirely submerged beneath water however this area is mostly subject to the rise and fall of the tides and the seasonal river flows. Life along the delta is related to the rhythms of the river matching the water flows and the migration of anadromous fish. Bears, bobcats, coyotes, eagles, and sea lions congregate at the delta during spring and fall to prey upon salmon, steelhead, and lamprey as they travel upriver.[4] People, too, congregate at the river during the migration and fish for salmon, lamprey, and steelhead for the off-seasons. The Yurok people have lived next to the delta for tens of thousands of years and have constructed homes that can be added to and taken away from as the shifts occur. The structures of Yurok houses, sweat lodges, storage areas, and dance pits are built independently and walls and roofs are added or removed when people migrate to and from the site.[5]

The changing landscape at the delta is different from the ravine. Where the ravine is stagnant and scouring, the delta is dynamic and spreading - changes here happen horizontally: water rises, saturates, merges, dissolves, reemerges, shears, and deposits. The rate at which these changes occur is seasonal, annual, and over decades, with the delta soughs changing dramatically since the 1980s.[6] During low tide, the water level is two feet beneath the average and at high tide the water can reach up to six feet above the average height. As the climate changes high tide will reach eight feet above its current average.[7]

Fig. 35 Yurok dugout canoes.
Source: Vicki Gonzalez/CapRadio

Fig. 36 Yurok house.
Source: Wikipedia

Fig. 37 Salmon smoking room.
Source: Vicki Gonzalez/CapRadio

Fig. 38 Yurok dance pit.
Source: Jim Wilson/NYTimes

Fig. 39 Salmon smoking.
Source: Lisa Morehouse/NPR

Fig. 40 Site diagram of surrounding neighborhood

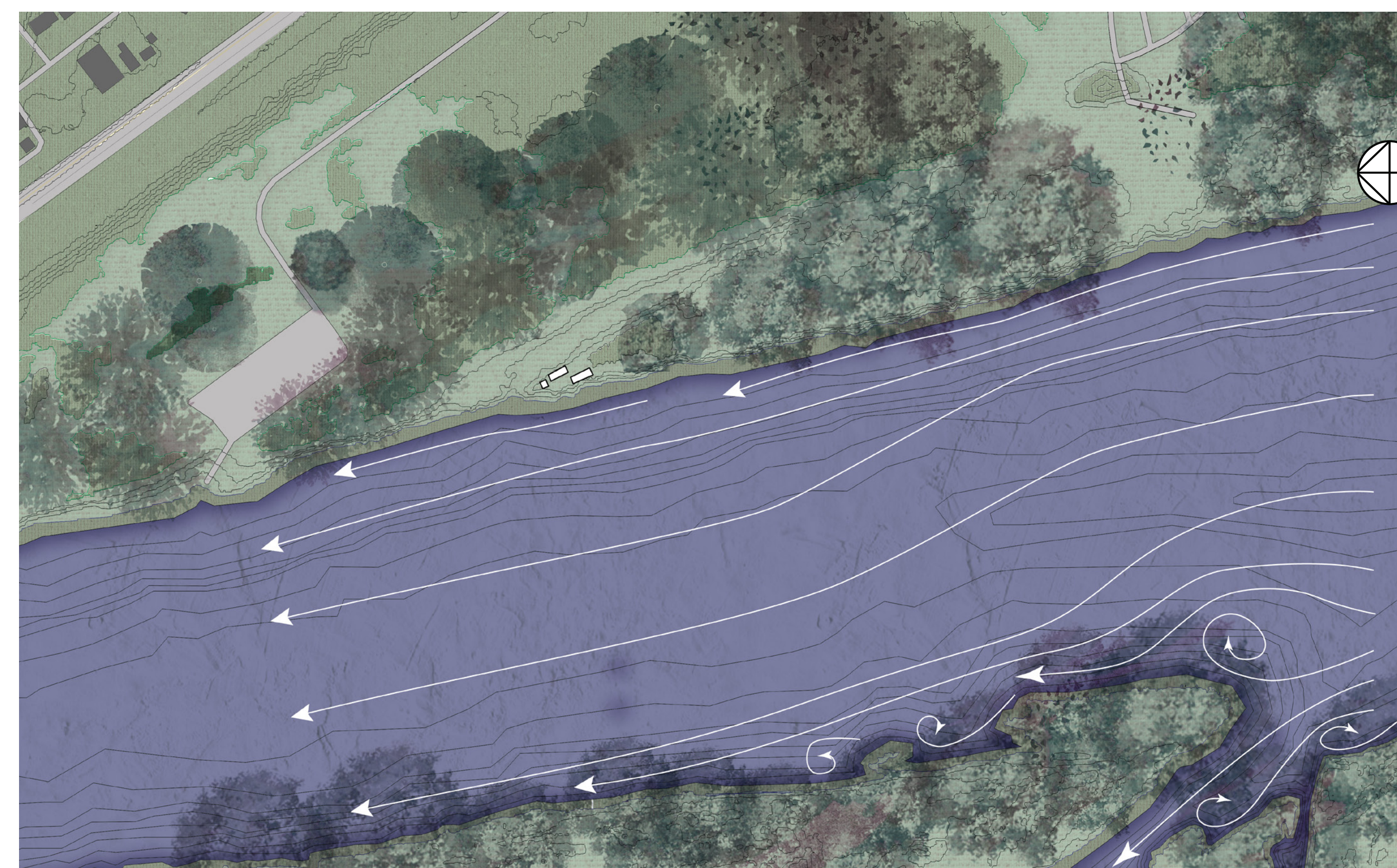


Fig. 41 RIver height of 0' above or below river average. Site indicated by white rectangles.

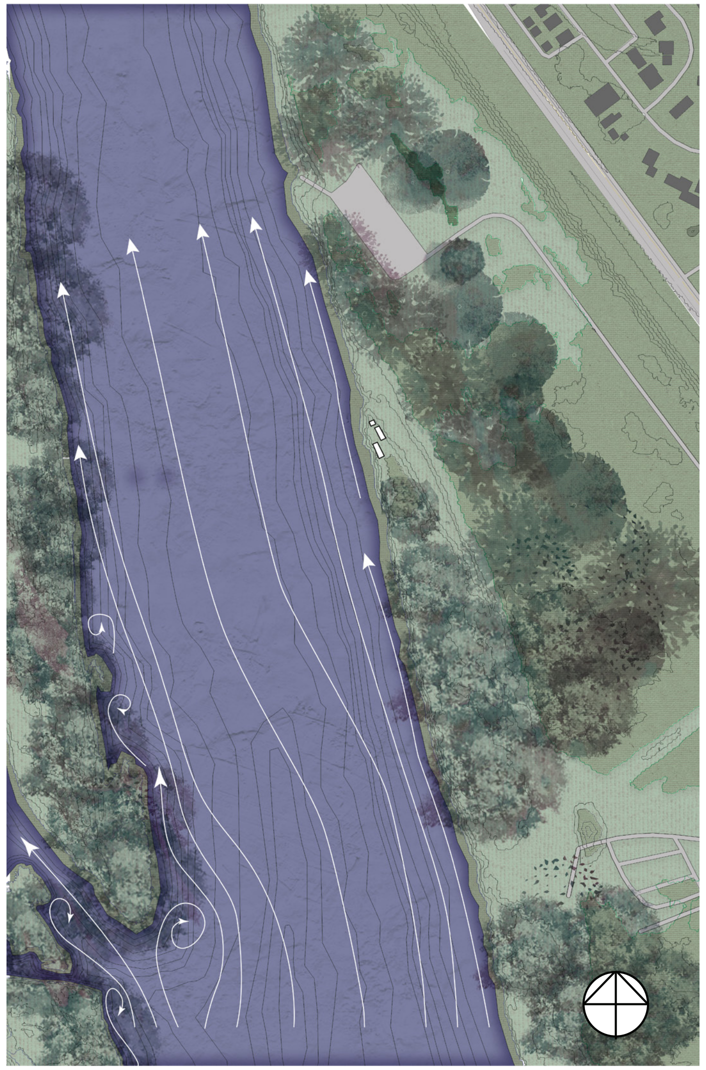


Fig. 42 RIver height of -2' below river average.

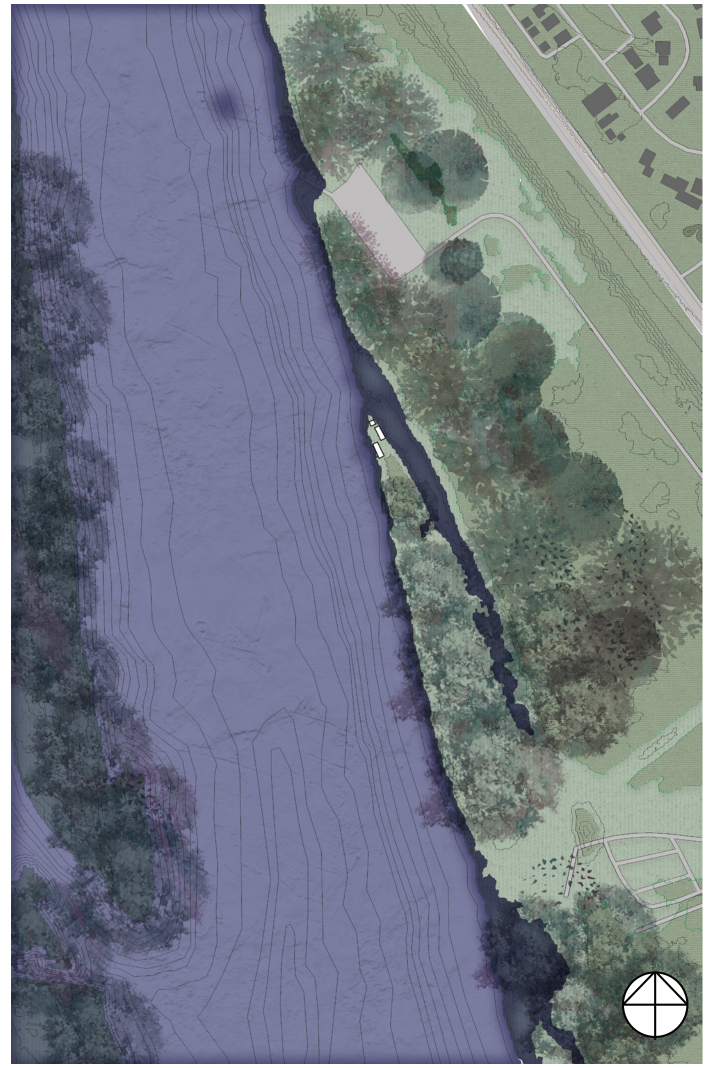


Fig. 43 RIver height of 2' above river average.

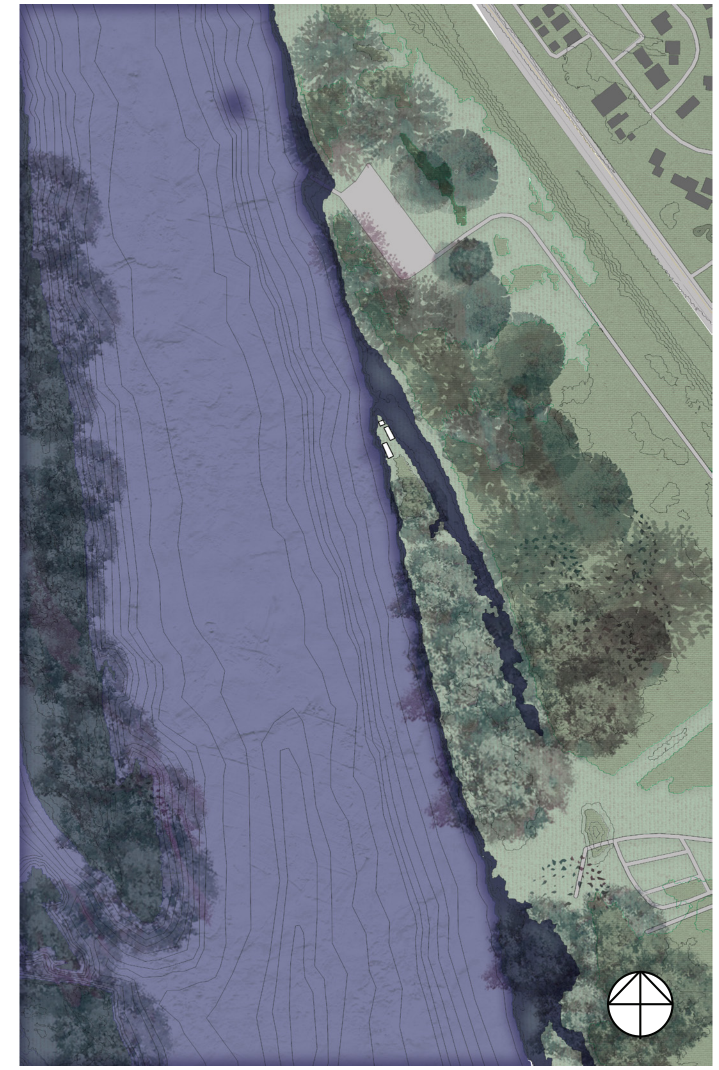


Fig. 44 RIver height of 4' above river average.

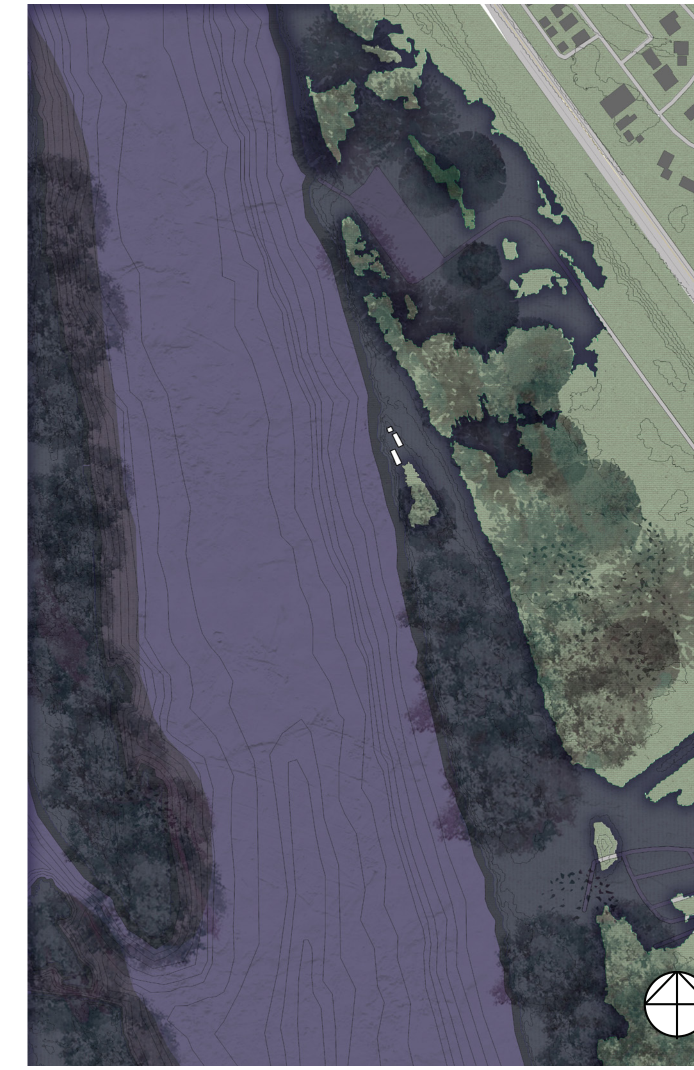


Fig. 45 RIver height of 6' above river average.

The longest wall on the site is at the six-foot high tide height directly next to the river. This wall makes the western wall of a boathouse storage for canoes that are common in the Yurok community. Entries to the boathouse are on the south and north sides of the structure and doors slide open to allow boats to enter and exit easily. The enclosure consists of a post and beam structure at ten-foot intervals with wooden purlins that support a living roof. As water levels rise, the boathouse eventually merges with the waterline so heavy canoes can slide easily into the structure.

The outer wall accumulates sediment: as the Klamath River erodes the shoreline the solid wall structure becomes a barrier to matter moving through the river, building a new topographical landscape as the river changes and erodes.

A second wall structure aligns with the topographical form on the eastern side of the site and creates a covered social space for outdoor gatherings that are common in the area. It offers space for picnic tables, seats, and a fire pit for smoking salmon.

On the east side of the wall is a small storage area for farming and building equipment. The roof of the structure is supported by the wall and a timber post and beam structure at ten-foot intervals with wooden purlins that support a living roof.

A final wall is on the north side of the site and aligns with the topography. Unlike the wall of the boathouse this wall will not accumulate sediment but will still provide a boundary for the changing tidal shifts as water inundates the area north of the structure.

Similar to the other spaces, this small salmon and lamprey smokehouse is a ten by ten-foot column and beam structure that holds up the roof. Cedar planks are leaned and tied to the structure to create an enclosed space as well as structure to hang fish from. The space is small out of necessity as the size must be small enough so that a fire is able to dry the air efficiently enough to cure the fish. In total the space can hold about one hundred individual fillets.

Fig. 46 RIver height at average annual height. Site plan and program graphic.

Fig. 47 RIver height at 2’ above annual height. Site plan and program graphic.

Fig. 48 RIver height at 4’ above annual height. Site plan and program graphic.

Fig. 49 RIver height at 6’ above annual height. Site plan and program graphic.

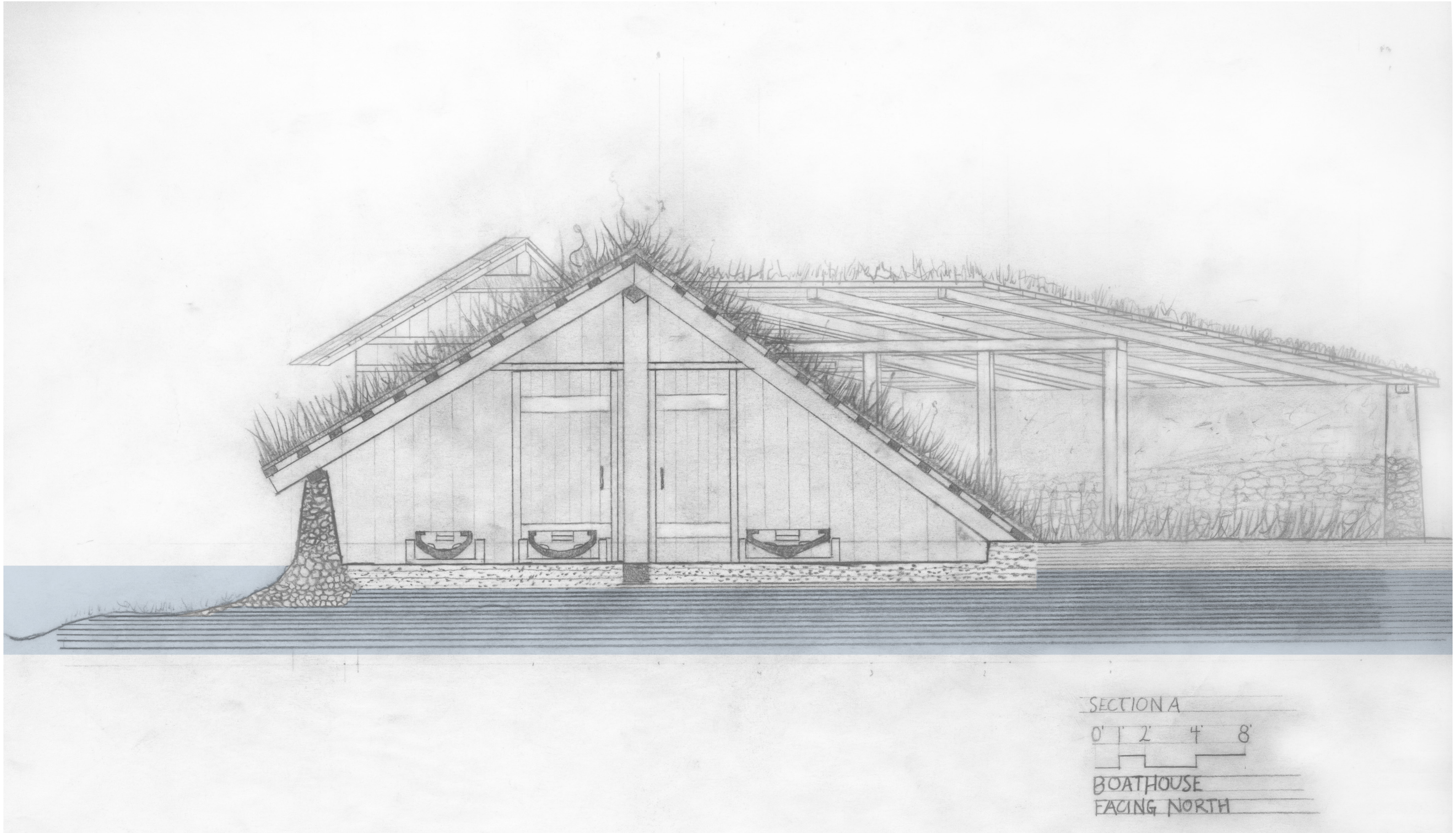


Fig. 50 Section A through the boathouse.

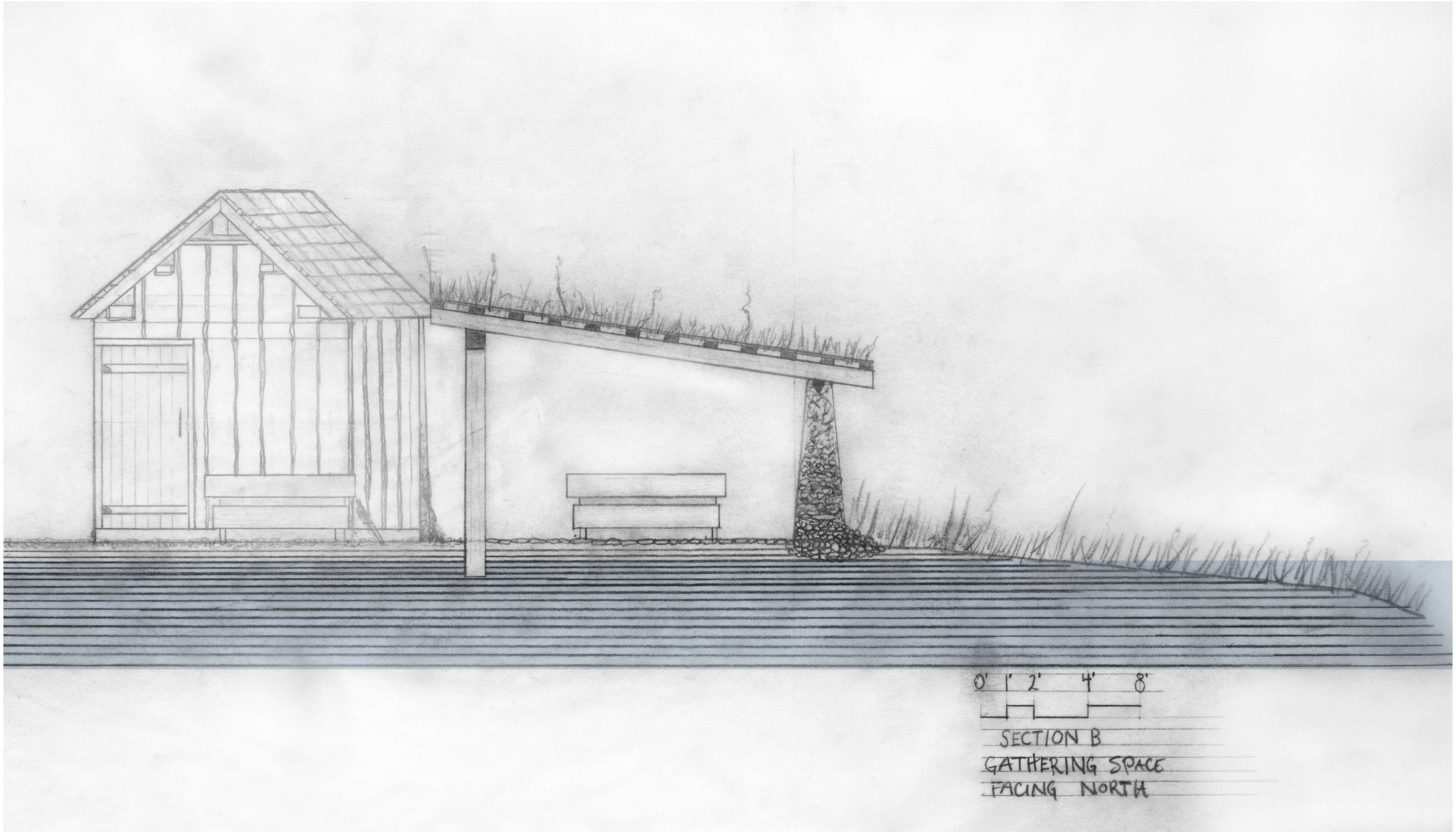


Fig. 51 Section B through the gathering space.

Fig. 52 Watercolor perspective.

A river's source is never truly its source and its end is never truly an end.

The Klamath River is always changing and is always defining the landsacpe around it. It was inevitable that the dams would be either removed or overcome and so is the reality of all built structures along the river. It is a place where impermanence is certain. The river speaks in its own way and perhaps architecture can share in that same language.

Note: All photographs have been taken and developed by the author on a Nikon FM on Ektar 100.

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