Built Lens: Designing Environmental Engagement on Flathead Lake

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Abstract

Built Lens: Designing Environmental Engagement on Flathead Lake

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This thesis explores the capacity of the built environment to serve as a lens in mediating man's relationship with the relatively un-built environment at a site located on Flathead Lake. Our presence on Flathead Lake in northwestern Montana is a paradoxical one. Power generation, recreational activity resulting in development on the lake and rich farmland in the Flathead Valley have changed, and will continue to change, the form and appearance of the landscape. The desire to conserve is met with the realization that the lake's intrigue is born from human interaction with it. Those who have visited share a collective memory of a powerful place: a place deserving ritual designed to provoke the critical double awareness of joy and shame man should feel when realizing human impact on the environment. With an interpretive facility, trails, and landscape interventions, this thesis seeks to reduce the distance between visitors and the lake through architecturally choreographed immersive experience.

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INTRODUCTION: PRESENCE OF PARADOX

Sacrifice—of nature, of the interests of others, even of our earlier selves—appears to be an inescapable part of our condition, the unavoidable price of all our achievements. A successful ritual is one that addresses both aspects of our predicament, recalling us to the shamefulness of our deeds at the same time it celebrates what the poet Frederick Turner calls “the beauty we have paid for with our shame.” Without the double awareness pricked by such rituals, people are liable to find themselves either plundering the earth without restraint or descending into self-loathing and misanthropy. Perhaps it’s not surprising that most of us today bring one of those attitudes or the other to our conduct in nature. For who can hold in his head at the same time a feeling of shame at the cutting down of a great oak, and a sense of pride at the achievement of a good building? It doesn’t seem possible.[1]

-Michael Pollan, *A Place of My Own*

Our presence on Flathead Lake in northwestern Montana is a paradoxical one. Recreational activity resulting on development on the lake and rich farmland in the Flathead Valley have changed, and will continue to change, the form and appearance of the landscape. The desire to conserve is met with the realization that part of the lake’s intrigue is born from our interaction with it. Those who have visited share a collective memory of a powerful place: a place deserving ritual designed to provoke that critical “double awareness” described by Pollan. The proposal of an additional building to facilitate meaningful experiences on the lake is not without tension. Simultaneously, the building is a human imposed disturbance in the landscape, and can positively mediate the relationship between people and the lake through controlling human impact and altering human perspective. This thesis explores the ways in which architecture mediate the relationship between people and places as a lens. With an interpretive facility, trails, and landscape interventions, the design project seeks to reduce the distance between visitors and the lake through architecturally choreographed immersive experience.

1. Yellow Bay Hill from Yellow Bay State Park at sunset

Individuals with a passion for a place become stakeholders in the protection and future of that place. The relationships between places and people requisite for passion are developed through experiences that are engaging and memorable enough to motivate behavior changes. Aggregated positive interest in a particular landscape enables a culture of care for that landscape, referred to as cultural sustainability.[2] Whether the landscape in question is a city street or wildlife refuge, the notion of cultural sustainability based in human appreciation of a place is predicated upon anthropocentric understandings of the environment. There are many dimensions to the human experience of nature, and enjoyable time spent in the outdoors is unique for each person: individuals frame their experience with their own personal history and how they have decided to engage with the landscape. Interpretive centers exist to frame their respective landscape in geology, ecology, and history. In the case of interpretive shelters and buildings, design serves as the link between aesthetic appreciation and ecological health of the landscape. However, given the power of landscapes to motivate humans to cherish them, the role of built interventions in mediating the human experience with nature is questionable.

The theoretical and historical background for this project is drawn from environmental aesthetics and a study of visitor and interpretive centers in the past and present. The history and development of visitor and interpretive centers suggests that the desired model of human engagement with the landscape has changed over time.

ENVIRONMENTAL AESTHETICS AND THE BUILDING AS MEDIATOR

Design is a cultural act, a product of culture made with the materials of nature, and embedded within and inflected by a particular social formation; it often employs principles of ecology, but it does more than that... It translates cultural values into memorable landscape forms and spaces that often challenge, expand, and alter our conceptions of beauty.[3]

- Elizabeth Meyer, “Sustaining Beauty”

The field of environmental aesthetics is devoted to understanding the performative power of beauty to alter consciousness and discussing the subjectivity of aesthetic assessments of the landscape. Applying aesthetics to the environment can transform the landscape into an object, similar to a work of art. Because of potential objectification, the notion of the frame that emerges from the relationship of traditional aesthetics to art and is challenged in *Anti-Object* by Kengo Kuma and is an important part of how the design project in this thesis approaches mediating the relationship between people and place. Notions of beauty in environmental aesthetics are not static and limited to the visual, but are concerned with the impact of strong multi-sensory experience on the psyche. Built interventions in the landscape can provide the experiential link to ecological, historical, and geological narratives and facilitate immersive engagement in nature that promotes cultural sustainability. What follows is a description of the ideas surrounding cultural sustainability and its relationship to environmental aesthetics and then an exploration of the impact of applying frames to the landscape.

Sustainability usually addresses ecological, social, and economic vitality through technological solutions. Reasoning for environmental preservation often relies on the notion that it will help preserve economic resources, increase the population of a declining species, or provide a group of people with a recreational amenity. With regards to design, possibly more powerful than the way a single building manages storm water or uses natural lighting, is the potential impact of the experience facilitated by that


2. Yellow Bay Point and Flathead Lake Biological Station monitoring equipment

3. Design has the potential to link substantive information to experience

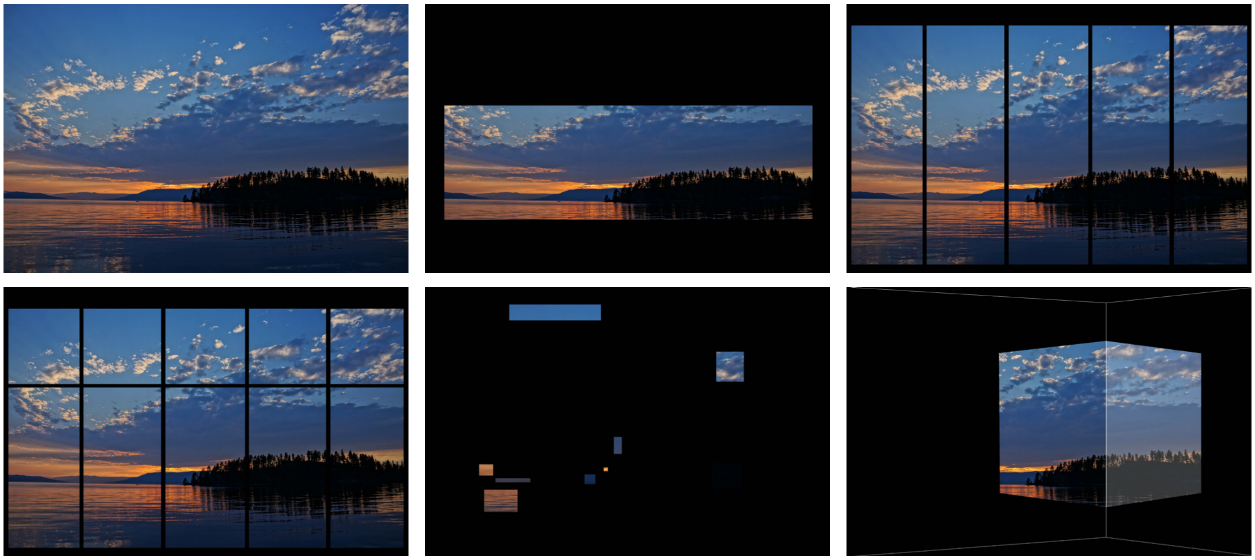
building. Designed spaces perhaps have the capacity to be sustainable through affecting people in a way that alters their behaviors. Philosophically speaking, the effect of experience through the senses is a phenomenon studied in the field of aesthetics. More specifically, the environmental aesthetics movement is concerned with evaluating the beauty of the landscape and the potential power of this beauty to inspire people to protect landscapes.

In the case of interpretive centers, it seems appropriate to broaden the understanding of sustainability to include the both the building's physical impact on the land and its broader cultural impact through improving the experience of visitors to parks. As a landscape architect, theorist, and professor at University of Virginia, Elizabeth Meyer is primarily concerned with designed landscapes in her manifesto, "Sustaining Beauty." Meyer takes a position that the impact of environmental beauty upon people should be harnessed as a means of making culture sustainable. Her argument that "immersive, aesthetic experience can lead to recognition, empathy, love, respect and care for the environment" is applicable to the role of interpretive centers in "rendering the outdoors intelligible."[4,5]

It is worth exploring how Meyer's ideas can by applied to the design of buildings while recognizing the differences between designed landscapes and buildings. While the landscape is equipped to mimic ecological processes, buildings have the potential to frame and reveal processes. Meyer advocates for beautiful design that can indirectly promote behaviors that are less harmful to undesigned landscapes and this idea has been applied to buildings through the recognition of beauty as a central tenant to the Living Building Challenge.[6]

Nature as Frame-able Experience

Western notions of aesthetics are rooted in men's deliberate creations and environmental aesthetics is dependent on comparisons between the beauty of artwork and the beauty of nature. Perhaps the most cogent parallel between art and the landscape is the presence of an appreciator and an object of appreciation.[7] With regard to the appreciation of natural beauty, there are two main schools of thought:



4. Impact of the frame on an picturesque image

one is predicated upon the idea that appreciation of nature is purely subjective, and the other argues that there are objective ways to appreciate the undesigned environment. The subjective camp has concluded that because the landscape has not been designed to provoke our senses, there cannot be sufficient theoretical underpinning to guide appreciation across multiple experiences. In other words, subjective theorists have stressed the fact that there is a right way to observe artwork, but not a right way to appreciate nature. For example, the appropriate appreciation of a Picasso painting requires the sense of sight and relies on an understanding of cubism. What is outside the frame is of little importance as is what is on the other side of the canvas, or how the painting tastes. Both schools of thought characterize the beauty of nature as inherently frameless. Allen Carlson, aesthetic philosopher and proponent of the objective view of environmental aesthetics writes:

> …environments not only move through time, they extend through space, and again without limit. There are no boundaries for our environment; as we move, it moves with us and changes, but does not end. Indeed it continues unending in every direction. In other words, the environmental object of appreciation is not "framed" as are traditional works of art, neither in time as are dramatical works or musical compositions nor in space as are paintings or sculptures.[8]

Carlson goes on to state that the appreciator decides what senses to use and defines their experience through a chosen duration and activity. The idea that appreciators, or visitors to parks deliberately frame their own experiences begs the question of why an interpretive center is even necessary, aside from providing amenities such as restrooms and drinking fountains. Especially from the subjectivist stance, there is no reason for an intermediary between nature and man.

The objectivist stance, more controversial in the realm of aesthetics, argues that despite the absence of an artist with intent, there is a correct way to appreciate nature and this is particularly important for environmental arguments relying on aesthetic qualities of a landscape. In "Objectivity in Environmental Aesthetics and Protection of the Environment," Ned Hettinger discusses variable

Not all lenses are equal.

Pay per view binoculars

vs.

Kastrup Sea Bath, Denmark, White Architecture

aesthetic appreciation (and displeasure) of less traditionally scenic landscapes and ecosystems in the absence of an established method of appreciating nature.[9] He illustrates one of the central problems with linking environmental protection and aesthetics through discussing negative and positive aesthetic assessments of a wildlife refuge:

> If these aesthetic judgments are merely matters of personal taste, one neither better nor worse than the other, then the aesthetic character of the refuge cannot play a legitimate role in determining its fate.[10]

Hettinger and Carlson both advocate for a more objective basis for aesthetic judgments in nature grounded in the natural sciences and history. Geology, ecology, and history equip the appreciator with a knowledge base analogous to that of an art critic.

The notion that scientific objectification of nature will enable fuller, more “correct” appreciation of the landscape is sympathetic to the programmatic goal of interpretive centers. If the physical manifestation, the architecture, or the interpretive center is considered in addition to the program, another objectivist argument is significant. Although nature may be physically frameless, leaving the appreciator in control of designing their own frame, there are better and worse self-imposed frames. Ned Hettinger argues that subjectivists “overstate the freedom involved” in framing natural objects. Yes, one could lick the side of a basalt cliff to appreciate it, but the taste

5. (Opposite page) Lens Diagram, while the lens is a powerful architectural tool, not all lenses effectively enhance experience. The pay per view binoculars at Mt. Rainier perhaps distance subject and object, whereas the Kastrup Sea Bath reduces distance between subject and object through engagement. Source: Rainier Photo source unknown, Kastrup Sea Bath photo by Amager Stranvej, http://www.archdaily.com/2899/kastrup-sea-bath-white-arkitekter-ab/

of the rocks would not provide a comprehensive understanding of the landscape. Likewise it would be futile to take in a mountainous horizon with a microscope. There are more appropriate methods and scales to utilize when framing the basalt cliffs or mountainous horizon. Objectivist environmental aesthetics suggest that interpretive centers can play a role in helping visitors frame the landscape through programmatically providing geological, ecological, and historical data and physically reinforcing appropriate scales. If interpretive centers can help choreograph enriching experiences through their own beauty and through appropriately framing the landscape, then they can fulfill what Elizabeth Meyer and the Living Building Challenge argues is the duty of sustainable design.

Kengo Kuma distinguishes between the frame and lens, arguing that the frame is limiting and the lens is connective. Both serve to mediate the relationship between humans and the environment, but the frame "robs the world of its multilayered and interactive character, reducing it to paltry objects."[11] The lens can successfully alter perception without distancing the observer and observed.

> The frame selects some particular element of the disordered environment while screening out all other elements. Through this process of elimination, it generates an object- an object summoned from the outside world. Thus the frame form is another name for objectification. The world regulated by or perceived through the medium of the frame form is a world of objects…Indeed, in its various guises, the frame form has been the basis of western perception and expression. It is a means of producing objects and will forever continue to be so.[12]

The punched opening is the built embodiment of the frame. In the project "Water/Glass" Kuma challenges the frame as the primary method of perception through the use of the floor and path to connect subject and object. An oval form of glass is lens like in its capacity to inclusively capture the surroundings.

The field of biophilics also investigates the aesthetic relationship between architecture and nature as a boon to human health and wellbeing as well as the environment. In short, biophilic theory posits that humans are innately attracted to nature and architecture should exploit what is essentially a genetic inclination to improve human health, learning and productivity in the built environment.[13] Additionally, incorporating natural elements into design has the potential to "foster an appreciation of

6a,b. (Right top and bottom) The Kiro-san Observatory designed by Kengo Kuma is only understood as an object from the air. Path enriches the experience and is a way of directing visitors to understand the site differently. Source: Kengo Kuma Associates, http://kkaa.co.jp/works/kiro-san-observatory/

nature, which in turn should lead to greater protection of natural areas as well as efforts to eliminate pollution and maintain a clean environment."[14]
The term "biophilia" as a genetic predisposition to appreciate nature was coined by renowned biologist and conservationist, Edward O. Wilson and has been most notably applied to architecture by Yale professor of forestry and environmental studies, Stephen R. Kellert, and University of Washington affiliate professor, Judith Heerwagen.[15] Many designers have embraced the notion of biophilia: Stephen Kieran, of Kieran Timberlake Architects, advocates for the "reestablishment of an aesthetic derived from man's connection to the natural world."[16]

In an independent, but related strain of theory articulated in *Origins of Architectural Pleasure*, Grant Hildebrand links architectural appreciation to primeval spatial preferences succinctly defined as prospect and refuge. The terms, prospect and refuge, borrowed from British geographer Jay Appleton, describe the two landscapes and spatial scenarios sought by homo sapiens throughout their evolution and struggle to survive. Refuge refers to smaller, darker, more protective spaces and prospect is related to brighter more expansive spaces associated with risk, but also potential. Hildebrand argues that within the built environment, humans tend to favor and deeply appreciate spatial recreations of prospect and refuge. Hildebrand's work is relevant in this project because of the role that it claims nature plays in architectural aesthetics, but also (and perhaps more importantly) as a tool to create more impactful experiences. The use of innate spatial preferences in design has the potential to produce deeper levels of engagement and consequently richer experiences and memories.

Aesthetics is a tool to understand how humans might appreciate the landscape, but it has shortcomings that are based in the limiting nature of the frame. The landscape is not an object and viewing it as such creates a distanced subject-object relationship that does not promote an understanding of how people and place interact. Objectification reduces the extent to which people understand their active role in making the environment what it is and what it will be in the future- humans must see themselves as part of the picture in order to have agency to manipulate landscapes sustainably. As

6c,d. (Left top and bottom) Glass and water obscure what is inside and what is outside rather than producing separation, Source: Kengo Kuma Associates, http://kkaa.co.jp/works/water-glass/

architectural devices, biophilics and notions of prospect and refuge move beyond the frame through suggesting that there are deep human-nature relationships that can be nurtured and cultivated through design: the built environment becomes a form of mediation. As a form of mediation, the built environment has the potential to act as an experiential lens while creating space for substantive frames of narrative.

7a. (Top) Yellow Bay Hill

7b. (Bottom) Site photo manipulated: Yellow Bay Hill Cut. Part of the hillside is removed, drawing attention to the form and existence of the landscape. The western shore of the Flathead Lake becomes visible through the frame carved from the hill. Yellow Bay Hill cannot be taken for granted when it is sliced.

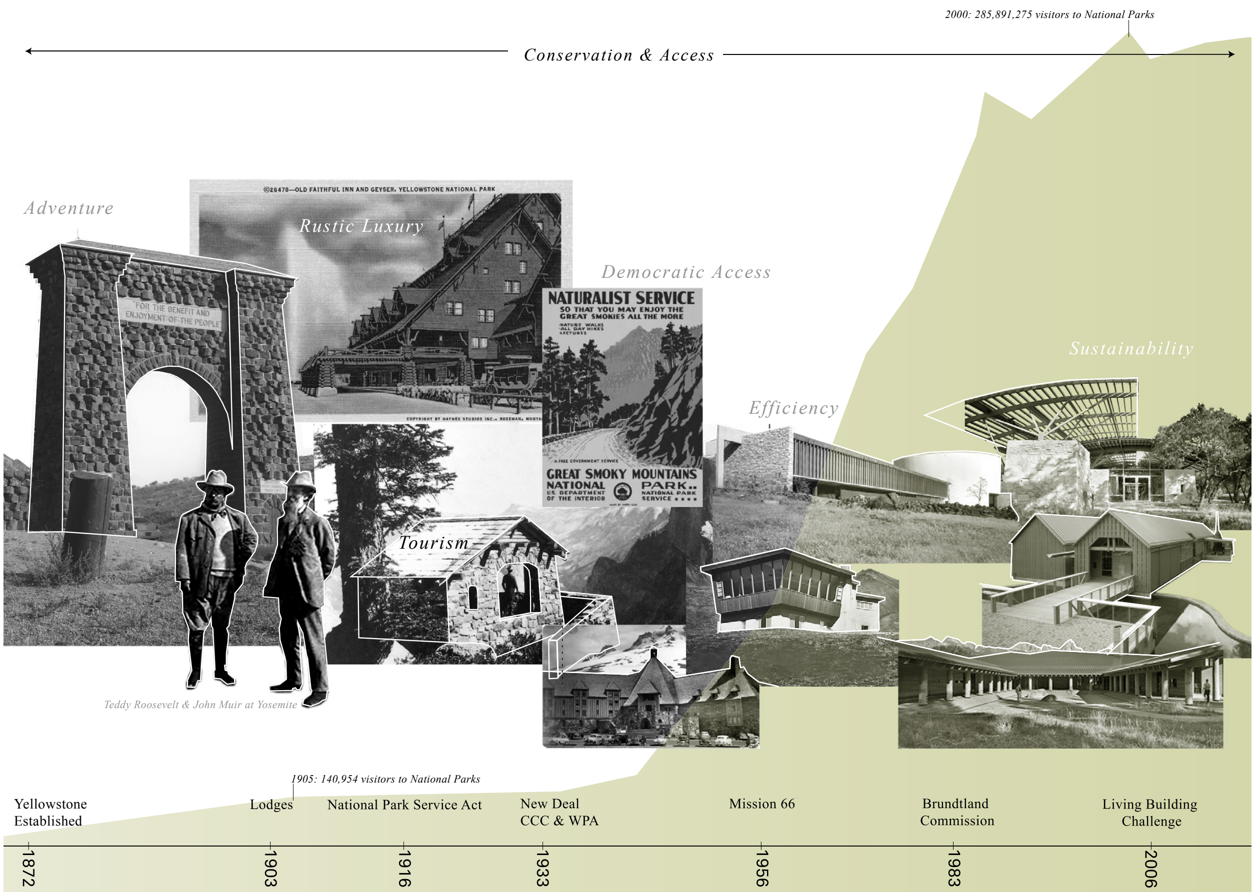
INTERPRETIVE CENTERS AS A MODEL FOR ENGAGEMENT

The real museum is outside the walls of the building, and the purpose of the museum work is to render the out of doors intelligible. It is out of this conception that a smaller museum, the trailside museum takes its origin.[17]

-Herman Bumpus, director of the American Museum Association, 1930

Interpretive centers exist at the intersection of people and place and can be understood as being responsible for mediating the relationship between the two. Historically, public buildings in the landscape have supported different forms of environmental engagement and suggested human relationships with the (relatively) un-built environment. The normative statements supported by buildings in the un-built environment are often predicated upon a distcint separation between what is "human" and what belongs to nature. The architectural development of interpretive centers as a typology has responded to constantly changing politics, ever increasing access to the parks since their inception, and shifting models of engagement based in scientific and popular culture. To some extent, all of the building types leading up to current interpretive centers have sought to orient visitors before exploration of the outdoors, but the desire to cater to American car culture has at times reduced the quality of immersive experiences in nature. As part of an orientation to the landscape, various interpretations of contextualism have been important as a way of suggesting man's role within nature. While the intent of providing interpretation throughout the parks was related to a mission that we might classify as related to sustainability today, the way that the buildings physically affected the landscape was not of great concern until more recently. The notion that Park Service buildings are expected to be at harmony with the site now extends beyond visual assessments of whether buildings blended in with their surroundings and is related to

Development of Interpretive Centers and Models of Environmenal Engagement



8. Shifts in politics environmental philosophy are mirrored in Park Service architecture.

both impact on ecosystems and efficient energy use.

The expansive parking lot at Old Faithful in Yellowstone National Park tells a story about the American pilgrimage to National Parks and is representative of one contemporary model of environmental engagement. License plates on RVs and cars with bug-splattered windshields indicate that people have traveled from every corner of the United States to see the geysers, paint pots, and bubbling mud. After Yellowstone was established as the first national park in the United States in 1872, only about 1000 tourists visited annually until rail reached Livingston and Cinnabar in Montana near the north end of the park in the 1880s. Today, visitors navigate through many rows of parking stalls before finding themselves at the boardwalk trail that encircles Old Faithful and then meanders through the other geysers. Shaggy bison lazily sit aside the trail while people of every age snap photos and eagerly check their watches, waiting for the predictable thermal explosion. An anticipatory murmur travels through the crowd as the time grows closer to the predicted event and then water and steam erupt from the mineral stained ground with volcanic force. A few minutes of violent eruption pass and then the crowd disperses: some pilgrims return to their cars, some head off on the interpretive trail and visitors center, and others walk to the Old Faithful Inn for a drink and lunch. The experience is one of convenience and crowds, built around the American road trip

9. Image of Old Faithful Lodge from 1912. The lodge embodies notions of rustic luxury. Source: National Park Service Historic Photos Collection

and for many probably lacks the level of immersion prerequisite for cultural sustainability.

The Old Faithful Inn, which still welcomes thousands of guests annually, embodies the era that followed the establishment of rail service to the park. The oldest portion of Old Faithful Inn, built in 1903, looms large adjacent to the geysers, with its distinctive pitched roof that supposedly emulates the form of nearby mountains. The bright outdoors gives way to an enormous and somewhat imposing six-story atrium contained by lodge pole pine balconies and a rhyolite fireplace and chimney.[18] Built for an experience of rustic luxury, the inn, like Lake McDonald Lodge in Glacier Park, or Long Peak Inn in Rocky Mountain National Park, is a predecessor to contemporary interpretive centers. The lodges were intended to provide immersive experiences in nature largely independent of ecological and geological narratives as we might understand them today. The desire to provide immersive experiences in the national parks led to the creation of a distinct typology based in site and appropriate rusticity derived from Thoreau and Muir's conceptions of nature and man's place within it. Understood as mysterious, powerful, and divinely beautiful, the natural environment was a place where men could return to truer, more fundamental, healthier ways of living accessed through the park lodges. Visitors could feel at harmony with the landscape through being surrounded by roughly hewn stone and timber in a form related most closely to Swiss mountain chalets.

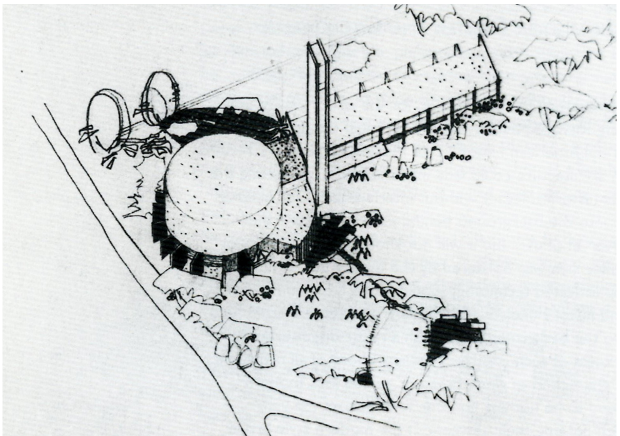
The early efforts to build lodges and museums in national parks were partly a response to the abuse that parks suffered after their establishment in late 19th century. Without interpretation or regulation, experiences in the parks were guided by the desire for adventure and profit. Visitors to Yellowstone often threw logs and rocks into the thermal features in hope that it might result in an eruption, cooked over dormant geysers, hunted bison and elk, and caused numerous forest fires with untended campfires.[19] When Stephen Tyler Mather, who would later help Frederick Law Olmstead draft the

10. The Glacier Overlook Historic Overlook in Yosemite is an early example of a contextual trailside museum. Source: Michael P. Gross and Ron Zimmerman, *Interpretive Centers: the History, Design, and Development of Nature and Visitor Centers*

National Park Service Act, visited Yosemite in 1914, he was shocked by the park's run down condition and concerned by loggers who threatened the great sequoias. Contemporaneously in Colorado, Enos Mills ran the Long's Peak Inn, a hotel aimed at both getting people into the wilderness and guiding their experience through education. Mill's efforts to educate and guide people to summit Long Peak in the Colorado Rockies led to the establishment of Rocky Mountain National Park. It was with concern for education and preservation that Mills, Mather, Olmsted, and Gilbert Grosvenor (1899-1954 editor of National Geographic) proposed the creation of the National Park Service (NPS). A common connection that Mills and Mather shared was a relationship with the elderly John Muir, who through his well-known writing, extolled the natural beauty of the American landscape and fought for its protection. With the creation of the NPS in 1916, the government committed funds to conserving parks and providing improved access to them with a new interest in educating tourists. The National Park Service Act also led to the creation of a new typology: the trailside museum. While the lodges were intended to provide amenities that led to an experience of rustic luxury, trailside museums were aimed at providing interpretation and education: a frame through which to understand the landscape. The advent of the NPS and trailside museums marked a shift in desired types of engagement with the parks (perhaps less immersive, but more educative) as well as a need to serve an increasing number of tourists as rail and the first cars made the American populous more mobile.

Early park structures and lodges tended to be extremely expressive in their formal and material relationships to site. In their comprehensive study of interpretive centers, Zimmermann and Gross identify "low profiles, local materials, and a scale proportional to the landscape" as the design strategies that "assured that these buildings harmonized with the spirit of place."[20] The 1920s and 30s saw a boom in construction of parks buildings, amenities, and nature museums through the combined leadership of the NPS, the American Association of Museums, and Franklin Roosevelt's "New Deal" Conservation Corps and Works Progress Administration.[21] Herman Bumpus, the director of the American Association of Museums stated that "The real museum is outside the walls of the building, and the purpose of the museum work is to render the out of doors intelligible. It is out of this conception that a smaller museum, the trailside museum takes its origin."[22] The National Registry of Historical Buildings nomination for the trailside museums in Yellowstone, for which Bumpus was responsible, states that the rustic character and form of the museums "suggested the smallness of man in relation to nature."[23] The notion that the design of the early park structures was concerned with leading visitors to understand their place and scale in nature is indicative of the importance of Thoreau and Muir's writing and is significant from a design perspective. The most influential architects working for the American Association of Museums in the 1920s, Herbert Meier and Thomas Vint, established a style that has come to be known as "Park Service Rustic," or "parkitecture". The expression of the trailside education centers and museums they designed in Yosemite would become replicated throughout the national parks system and became the norm for how the Park Service understood appropriate contextualism. With the advent of trailside museums, the lodges changed as well: they went from being single buildings to clusters of cabins surrounding a central lodge with amenities in order to disperse the mass throughout the landscape and reduce its scale. The broader access to parks reduced the previous level of luxury associated with tourism in the wilderness; a trend that would continue throughout the 20th century.

After WWII, the number of visitors to the national parks had increased exponentially, but the depression era projects had fallen into disrepair. In 1956, Mission 66 was undertaken by the National Parks Service to meet the new demands placed upon the parks with additional facilities and trails throughout the parks.[24] With a budget of $786,545,600, Mission 66 was a ten-year plan to provide maintenance to existing facilities and build new administrative buildings, campgrounds, housing units, and invest in a new type of Parks Service building, the visitor center. Responding to the American automobile culture, Mission 66 ushered in a new model of efficiency into the park experience, perhaps at the expense of the already eroded immersive experience. Visitor centers often combined restroom facilities, educational exhibits, dining, and park information services into a single building. FDR's "New Deal" had created the opportunity to create trailside museums and Mission 66 opened the door to visitor centers, both significant developments in the formation of the interpretive center typology.[25] By the late 1950s, there were new, more scientifically driven conceptions of landscapes and ecology and the notion that rusticity was the most appropriate way to relate to nature gave way to more stripped-down modern conceptions of site relationships that were initially seen as unharmonious with nature, especially by elements within the Park Service and some conservationists, including photographer Ansel Adams. These new buildings used a language of planes and horizontality and despite the criticism they received, actually tended to stand less prominently in the landscape than their early lodge predecessors. Materially, however, the Mission 66 buildings often



11a. (Left) Preliminary sketch of the Gettysburg Visitor Center and Cyclorama designed by Richard Neutra and Robert Alexander in 1962. Sketch by Neutra and Alexander, National Park Service Technical Information Center, Denver Service Center
11b. (Right) The completed Gettysburg Visitor Center, which has since been demolished in favor of a building deemed more contextually appropriate. Source: Lawrence S. Williams, Inc. Photography

used industrial materials of concrete, steel, and glass rather that site specific stone or timber. Visitor centers have been replicated at the state level in state parks and also at private industrial and infrastructural projects, such as dams and power plants.

By the 1990s, the ideas that had developed in ecology concerning biodiversity began to emerge in the Park Service. Concerns about endangered species led to efforts to more actively support habitats and talk of restricting the number of people allowed to access certain parts of parks. Since its inception in 1916, sustainability had been a part of the NPS mission to "conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations," but notions of technical sustainability of facilities did not become evident in the NPS' agenda until around 2000.[26] Threats to nature and biodiversity had never seemed quite so great as they did at the end of the 1990s and this prompted a shift in thinking about facilities and how they would promote understanding and responsibility in the parks. The concern in National Parks was felt in State Parks as well, and efforts to address the steadily increasing number of people arriving by car and the desire to be ecologically sensitive has led to renovation of older facilities to save resources, but also the creation of new facilities that are designed to have less impact on the environment. There have also been nostalgic debates within the NPS about the appropriateness of reintroducing elements of rustic architecture, which has led to buildings that are not rustic in form, but more materially related to site than their Mission 66 counterparts.

Today there is an expectation that park buildings respect their environments through form, materials, and performance (this is apparent in the case studies that follow). The aim of this thesis is to explore the ways in which architecture can provide the platform for an immersive experience that communicates site narratives and can promote a heightened awareness of the way that humans impact the environment.

CASE STUDIES

The Craig Thomas Discovery and Visitor Center
Grand Teton National Park, Wyoming | 2009 | Bohlin Cywinski Jackson Architects

We believe in an architecture that reveals and reinforces the nature of its circumstance, that springs from its place, that relates to the nature of people and enables them, and that is emotionally potent. And we believe in achieving this with materials that suit the circumstance and are psychologically charged…We used choreography and emotionally laden materials to connect people viscerally to the Teton landscape.[27]

-Peter Bohlin, "Circumstance"[24]

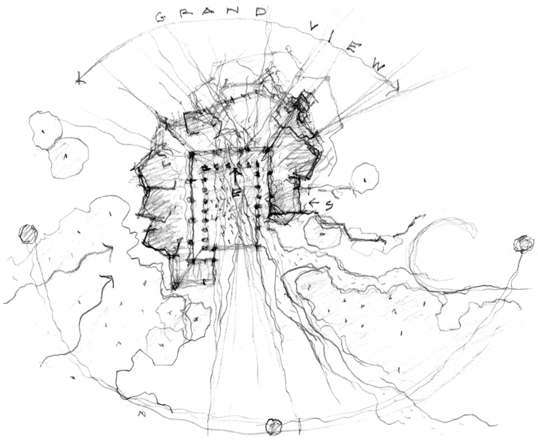
Tectonic uplift along an active fault gave birth to the Tetons, the highest among them, Grand Teton has an elevation of 13,770 feet. Of the many other peaks surrounding Grand, ten others reach over 12,000 feet in elevation. The mountains and the dramatically flat Teton Valley, the winding Snake River, the network of crystalline alpine lakes, and all of the wildlife that they host have inspired generations of people. The Grand Teton National Park has welcomed visitors since 1929 and offers a wide range of recreational activities including skiing, fishing, hiking, mountaineering, and cycling.

The geology and climate of the landscape have created the aquatic, alpine, meadow, sagebrush, and forest ecosystems thriving with biodiversity. Unique, but shared experiences of the product of the geology and ecology of the Tetons unites visitors to the park. Edward Riddell, one of the founding trustees of the Grand National Park Foundation that worked in conjunction with the NPS to fund the Craig Thomas Discovery and Visitor Center, expressed what the Foundation and NPS wanted from a new visitor center:

> We asked Bohlin Cywinski Jackson and Ralph Applebaum Associates to create a place that would change visitor's perception of the park. We wanted visitors to leave the center with new eyes for not only the obvious grandeur of the Teton peaks, but also for the other nuances, such as the smell of sage, the bugle of an elk, or the delicacy of an alpine forget-me-not. No small task, indeed.[28]

In asking that building and its contents alter the visitor's understanding of the park, Riddell and his colleagues desired a visitor center that could successfully frame the park with information relevant to multiple senses and at multiple scales.

Annually, around four million people visit Grand Teton National Park every year. For some, the visitor center is a point of departure and for others it is stop on the road. Regardless of how much time they intend to



12a. (Opposite page) Craig Thomas Discovery and Visitor Center entry court, photo by Nic Lehoux
12b. (Left) Peter Bohlin's conceptual sketch of the Discovery and Visitor Center
12c. (Right) Craig Thomas Discovery and Visitor Center interior with hearth, photo by Nic Lehoux

spend in the park, tourists arriving at the visitor center have to leave their cars and walk a short distance on a trail before arriving at the building. The trail serves to physically and mentally separate visitors from their cars and experience the park on foot. The center sits right at the transition from riparian forest to sagebrush meadow, which allows the building to be somewhat concealed amongst the trees from the approach allows a spectacular and unobstructed view of the Tetons. The building and the landscape interlock through an entry courtyard and the craggy roof reflects the nature of Tetons as well as a nod to both modernism and Park Service Rustic. The relationship between site and building is one of reciprocity: landscape and built form can be seen resonating within each other.[29]

The riparian forest to the north, east, and south of the center enters the building in the form of heavy timber frames constructed of logs and glue-laminated beams. Blackened steel plates in conjunction with stitch like wedges connect the fir columns to the concrete floor. The cedar siding, visibly held in place with galvanized fasteners, has been allowed to weather naturally. The material sensibility and scale of the wood is translated into the board formed concrete of the hearth and exterior walls. A window wall with steel mullions is held of the structure and tilts back in response to the view of the mountains. The materials and scale are reminiscent of the first National Park lodges, but the modern expression lends the building the quality of a sanctuary built to honor the outdoors.

As Peter Bohlin expressed in the passage taken from his essay "Circumstance," the spatial choreography at the center is meant to be evocative and lead to meaningful connections between the visitor and the landscape. The walk from the parking lot to the building is the first part of the choreographed sequence through the site. From the path, the entry is not visible until the visitor turns into the courtyard, where the view to the Tetons is deliberately occluded. Upon entry, the Tetons become visible through the window wall to the north and users must navigate through the staggered heavy timber frames that evoke images of the primeval forest.[30] The exhibit design, by Ralph Applebaum, uses a language of vertical shard-like elements that both show and tell the story of the formation of the Tetons through sculptural form that appears to be made by the same tectonic forces. The windows at the north seamlessly connect the interior and exterior while defining the realms of prospect and refuge with great deliberation.

13a. (Left) Romsdalen, Gerianger Fjord, Norway Trollstigen Plateau Visitor Center, source Reiful Ramstad Arkitekter http://www.reiulframstadarkitekter.no
13b. (Right) Romsdalen, Gerianger Fjord, Norway Trollstigen Plateau Trail, source Reiful Ramstad Arkitekter http://www.reiulframstadarkitekter.no
13c. (Right) Reiful Ramstad Arkitekter Site plan showing visitor center, trails, parking, and highway , source Reiful Ramstad Arkitekter http://www.

Trollstigen Plateau Visitor Center and Trail
Romsdalen, Geiranger Fjord, Norway | Completed 2012 | Reiful Ramstad Arkitekter

Located in the mountains of western Norway, the Trollstigen (troll's footpath in English) Mountain Road makes 11 hairpin turns as it climbs in elevation. Completed in 1936, the road took eight years to build and is comparable to the Road to the Sun in Glacier National Park with regard to attracting many tourists and going through dramatic, glacier carved terrain. As part of the National Tourist Routes program in Norway, a visitor center and trails ending in overlooks were built as destinations along the famed road.[31]

The visitor center, containing an information desk and café, separates a parking lot just off the Trollstigen Mountain Road from the access to a built trail with overlooks. The parking lot and visitor center sit on a piece of land at the convergence of two mountain rivers and the presence of water on the site, in the form of snow, ice, and liquid, was influential for the designers:

> Through the notion of water as a dynamic element – from snow, to running and then falling water- and rock as a static element, the project creates a series of prepositional relations that describe and magnify the unique spatiality of the site.[32]

The asymmetrical and jagged form of the building is a reflection of the mountains and seems to be rock-like sitting in the water. To the west of the visitor center, at the place of convergence of the two rivers, the basin over which the water flows was sculpted to have three jagged tiers. The sculpting of the waterway conflicts with the notion of an environmental aesthetic built on ecological health instead of frivolous and ecologically indifferent abstraction.

The industrial materials of concrete, steel, and glass are dominant in the project and reflect the need for resilience in the extreme weather and snowfall that keeps the visitor center inaccessible from November through May. Weathered steel and concrete are used for much of the path infrastructure

The location of the visitor center conveniently separates the parking lot, both physically and visually, from the remainder of the site and the pedestrian walkways. Despite the great effort to build pathways where a trail or more minimal structure may have sufficed, stairs make the most dramatic viewpoint inaccessible to those with mobility issues.

reiulframstadarkitekter.no

14a. (Opposite page, left) Tillamook Forest Center bridge sketch, 14b. (Opposite page, center) Bridge over Wilson River, 14c. (Opposite page, right)

Tillamook Forest Center
Tillamook State Forest, OR | Oregon Department of Forestry | 2005 | Miller Hull Partnership

August of 1933, the first of a series of wildfires struck the Tillamook forest and burned 240,000 acres of Douglas fir forest, some of it previously untouched by loggers. Three subsequent fires that occurred at 6-year intervals, the last in 1951, burned over 100,000 more acres and the prospect of logging in the area again seemed dim. The scorched landscape was a loss for the Oregonian timber sector and it prompted the state to start a reforesting program with the hope that the trees would survive and bring wealth back to the area. The reforestation effort essentially produced a 355,000-acre tree farm, which today, to the untrained eye, looks like a natural forest, but is a monoculture of 72 million trees of approximately the same size and age. The Tillamook Forest Center is tasked with telling the story of the Tillamook Burn and also creating a "special place to develop a deeper connection with Oregon's forests through experience and exploration."[33] The Center is a showcase of forestry in Oregon displaying and conveying information about wildfires, logging, and the slow gain of biodiversity in the re-planted Tillamook forest.

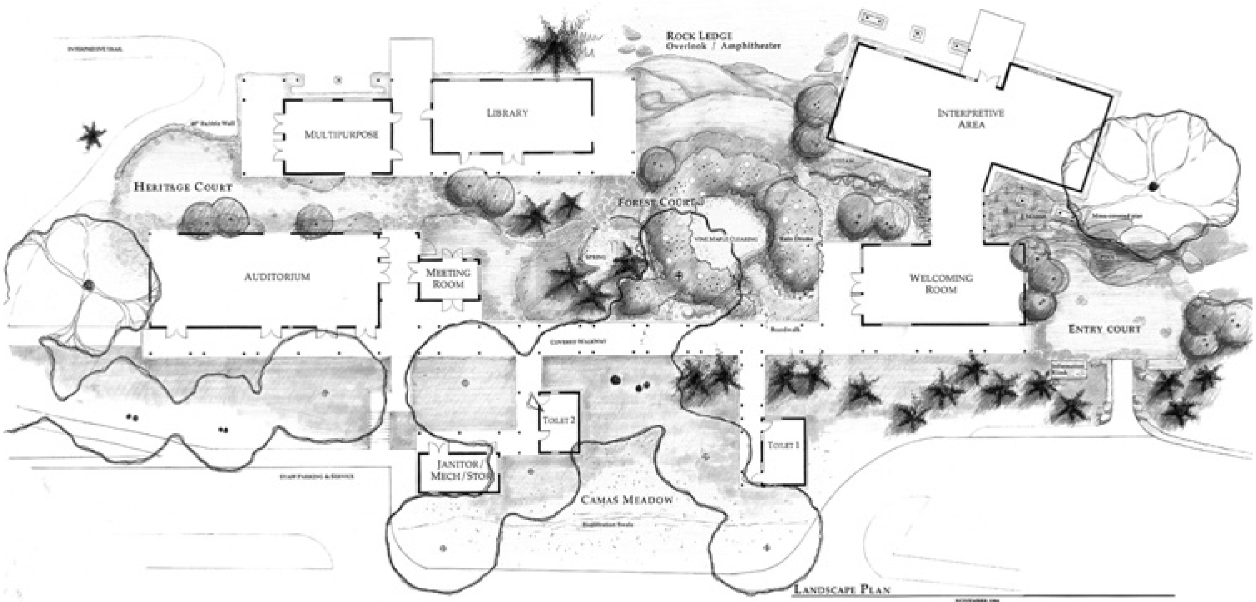
Founding partner of Miller Hull, Bob Hull has remarked that the site presented challenges because of being characterized by reforestation- it was not the pristine setting that one might expect for an interpretive center dedicated to forests.[34] The building responds to the tensions inherent to the working forest through two elongated, gabled forms that emulate historic barns that still dot the Coast Range throughout Oregon. The forest-industrial building both contrasts with its surroundings and becomes a part of them through letting the site fall at both ends of the building and extending across a rainwater pond at one end and over the Wilson River at the other end with a 250' bridge.[35] The rainwater pond serves as a heat sink in the warmer months, provides a means for controlling water on the site, and is used to flush the toilets. Physically, the building provides a link from the parking lot to a nature trail and campground and its raised position is reminiscent of sawmill skids once built to elevate logging equipment above the forest floor. Efforts to

Bridge structural detail photo, 144. (Opposite page, left) Tillamook Forest Center entry,
source: Miller Hull Partnership, http://www.millerhull.com/html/nonresidential/tillamook.htm, photos by Loren Nelson and Nic Lehoux
15a. (Opposite page) Cedar River Watershed Education Center site plan, source: Jones and Jones Architects and Landscape Architects

reduce the building's energy impact resulted in the use of an 89% efficient wood pellet boiler on site and the presence of a highly visible silo to store biofuel.[36] Through its forceful form and position within the landscape, the building responds to site, but also tells a story of agro-forestry and the timber industry.

Similarly to the form of the buildings, the materials very literally express a narrative of the Tillamook Forest. All of the framing lumber came from within 30 miles of the site and the remainder of the lumber is from sustainably managed forests. The use of locally sourced wood products was a priority.

The building encourages immersive experience by treating the interior space as if it is a part of one of the trails that traverses the site. Rather than entering a lobby that acts as a node between various exhibits, visitors immediately engage in interpretive exhibits designed by Aldridge Pears. Ample glazing offers views into the forest that the exhibits explain and visitors can view a tree stump left on the site by previous logging: the human intervention in the forest is meant to be seen and understood. A replica of a fire lookout tower acts as a landmark that can be glimpsed from Highway 6 and short winding drive brings tourists to a parking lot at the southeast end of the interpretive buildings. Entry requires crossing a bridge over the 65,000 gallon rainwater pond, where while it's raining water can be seen and heard cascading off a large metal scupper supported by salvaged steel from another logging site. The bridge acts as a transition and threshold into the exhibit hall in the long gabled building to the north. The southern building houses a theater for viewing a film about the Tillamook burn as well as space available for meetings and reserving for events. The path created 320'-foot long exhibit building doesn't end at the northwest doors, but continues via the bridge that crosses the Wilson River and then takes a turn with the Wilson River Trail that loops through the site and to the Jones Creek Campground. The sequential experience leads visitors through an educational promenade and then projects them into the forest.



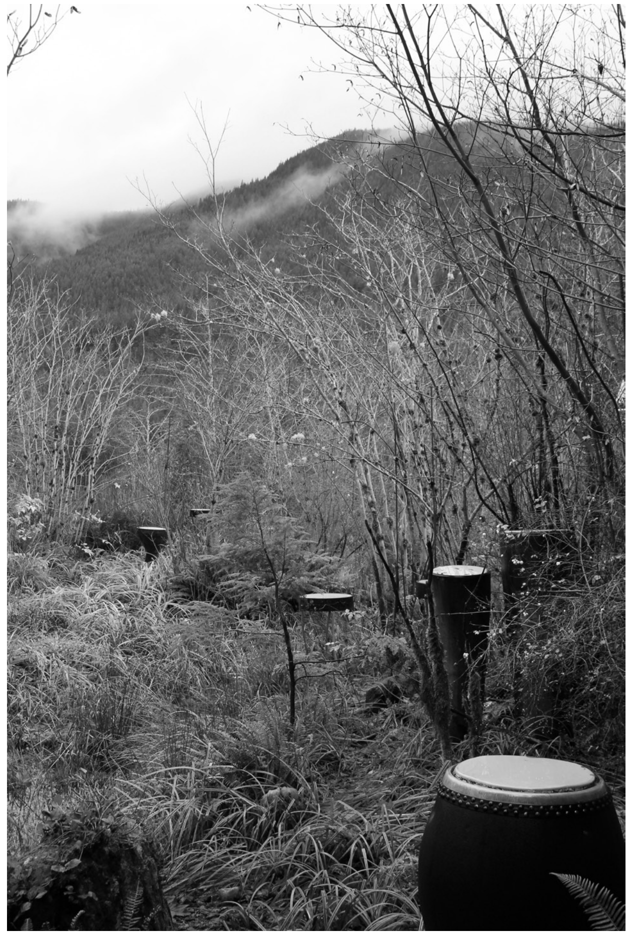
Cedar River Watershed Education Center
North Bend, Washington | Seattle Public Utilities | 2001 | Jones and Jones

The Cedar River Watershed Education Center is located just within the bounds of the watershed and sits above Rattlesnake Lake, offering views of the greenish crystalline lake and the ridge and peak beyond. A small campus of one story buildings with generous gabled roofs, including an interpretive center, heritage library, conference center, restrooms, and learning lab are oriented on either side of a linear path that echoes the former presence of a railroad. At the heart of the complex is the "Forest Court," where a constructed stream takes runoff from the roofs through a garden planted with native species. Rain drums designed in conjunction with local artist Dan Corson take advantage of the 60 inches of annual rainfall at the site and direct the water into an exaggerated auditory event.[38] The constructed stream also flows beneath a portion of the interpretive center and beyond, next to a trail that goes down to the Rattlesnake Lake shore. Another path connects the education center with the administrative offices for the water utility. Reciprocity between landscape and buildings is achieved through the shaggy green roofs and the presence of the "Forest Court" at the center of the campus.

The gabled roofs of the campus are either metal or covered with sod to reveal the way that earth and plant matter can filter rainwater and slow its flow. Though perhaps not comprehensible to many visitors, the component of sustainability inherent to watershed conservation is reflected in the sustainable design of the building. With regard to the education center, the Friends of the Cedar River Watershed expressed:

> Built with LEED certification by Jones & Jones architects, the facility echoes in design what the Center achieves through its programs. An integrated respect for the natural landscape and a focus on recycled materials are noteworthy components of the finished structures.[39]

In addition to using sustainably harvested timber, recycled materials, and concrete with at least 25% fly ash, the buildings also benefit from the use of

15b. (Left) Cedar River Watershed Education Center
15c. (Right) Cedar River Watershed Education Center Forest Court with rain drums

passive strategies and design that minimizes material use through exposed framing and structure. The buildings are naturally ventilated and use large overhangs to prevent too much solar gain in warmer months. A forced-air heating system is used to heat the buildings during the winter.

Spatial Sequence:

Parking is immediately adjacent to the center and the short paths to the building lead visitors to the covered pathway that connects the various parts of the program. Along the covered pathway, the sound of the rain drums precedes the entry to the interpretive center and the “Forest Court” acts as a node on the site. The way the program is broken up into several small buildings allows for exterior spaces to punctuate interior program with views to the lake and Rattlesnake Ridge. The interpretive portion of the exhibit involves an element of play for children through using ping-pong balls as a metaphor for raindrops that go through various tubes representing parts of the water cycle. While there are windows in the exhibition space, their presence and the view they provide seems secondary to the interior exhibit.

CASE STUDY CONCLUSIONS

Design Strategies

Several trends emerged throughout the case studies that provide guidance as far as ways that the architecture can support substantive narratives that frame the landscape.

Reciprocity

All of the projects demonstrate a relationship with site that presents neither merging nor clear contrast with the site. Interior and exterior spaces work together to knit together building and landscape.

Evocative use of prospect and refuge

View and spatial sequence often seem to serve larger notions of prospect and refuge. For example, at Tillamook, the minor bridge extending over a man-made water feature and a major bridge crossing the river act as transitions between the car and education and then between the refuge of the building to the prospect of the forest. The slant of the windows at the Craig Thomas Discovery and Visitor Center seems important for delineating the warmth of the interior from the expanse of the meadow and height of the mountains without abstracting them into something graphic. Likewise at the Cedar River Watershed, the view of Rattlesnake Lake and Mountain is appreciated from both inside the building, but also small exterior courtyards that divide the program elements of the complex.

Circumstantial materiality

The material sensibilities of the projects reflect their circumstance (in the words of Peter Bohlin) and consequently, or coincidentally, give the buildings a more rustic expression that they would otherwise have. Whether materials were selected for their emotional potency, sustainability, or cost, they help share the narrative of place to greater or lesser extents.

Choreography

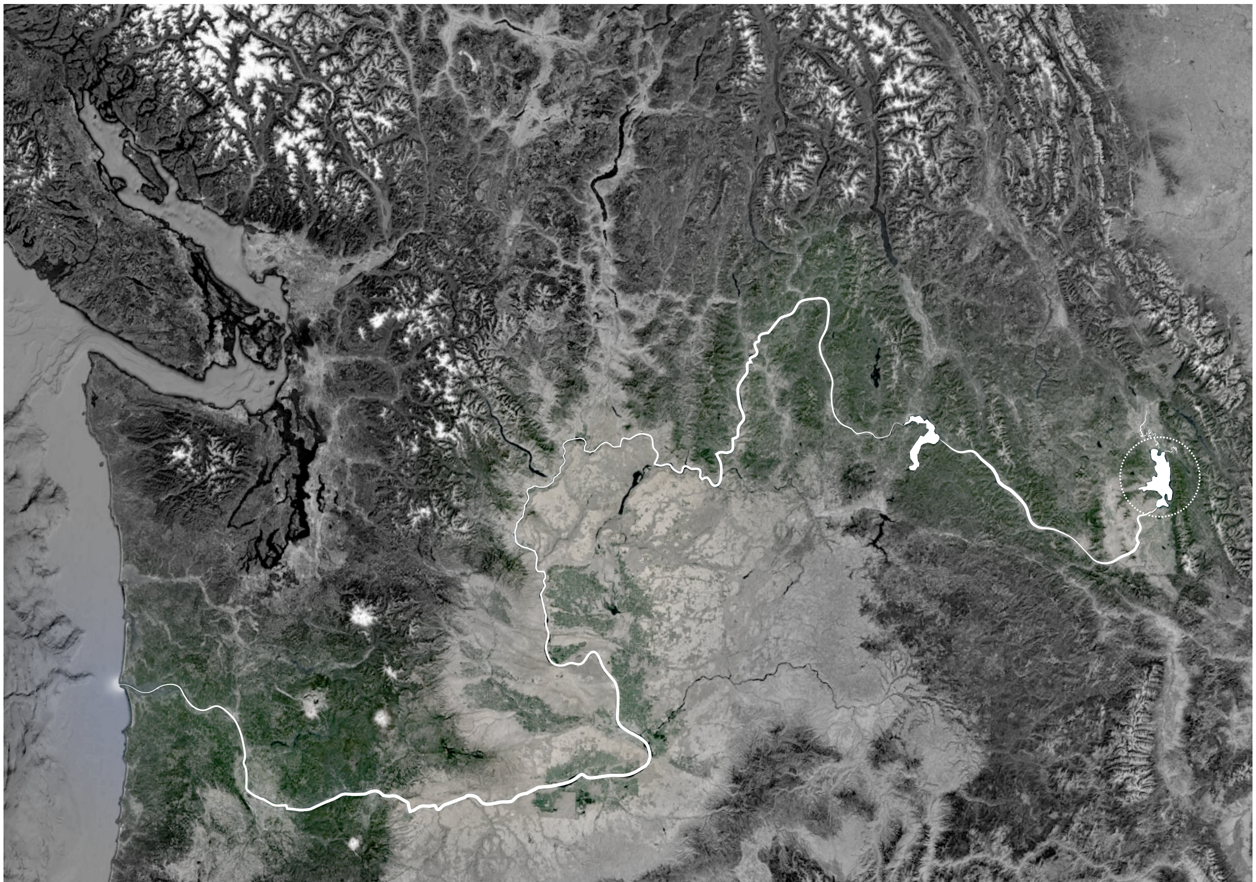
Path and sequence are an important part of directing visitors' awareness to various elements of the site and landscape. The architecture supports and revolves around choreography that reveals the nature of the site and its narratives. At Tillamook, the visitor is engaged through treating the building as an extension of the trail. The Cedar River uses a similarly linear strategy, but buildings and exterior spaces are clustered along the path instead of exhibits. At Grand Teton National Park, the site work and building work to withhold and reveal visual information for increased impact and potency.

SITE NARRATIVE AND EMERGENCE OF A TRAIL

Mr. President, in Western Montana we have what I consider to be the finest and most beautiful natural freshwater lake on the North American Continent, Flathead Lake. This lake is one of the scenic wonders of the west, it abounds with recreational potential. It is a sportsman's paradise. Along its shores you will find homes and summer cottages that are comparable to those anywhere in the Nation… This lake also plays an extremely important role in the generation of power and control of floodwaters in the Northwest.[40]

–Mike Mansfield, 1959

Flathead Lake sits just to the west of the Continental Divide in the Flathead Valley located at the southern end of the Rocky Mountain trench that extends 600 miles northward into the Yukon in Canada. The formation of the mountains surrounding the lake and rising above the trench began roughly 125 million years ago. Subduction of the Pacific Oceanic tectonic plate beneath the North American Continental plate caused uplift that created Rocky Mountains during the splitting up of Pangaea. The north end of the Mission Range (name for the part of the Rocky Mountains east of Flathead) split the glacier that filled the Rocky Mountain Trench during the last ice age 15,000 years ago and most likely all of the ice ages prior to that as well. The other lobe of the glacier that split off filled the current Swan Valley. Thousands of feet deep and around 20-miles wide, the glacier extended to Polson at the south end of the lake and covered all but the highest peaks of the Mission Mountains and the peaks to the north in present day Glacier National Park. Just to the south of the glaciers, the Great Lake Missoula formed due to an ice dam formed along the Clarks Fork River at the present day border of Montana and Idaho. Around 10,000 years ago, due to climactic changes, the ice dam gave way and the enormous lake, covering much of northwestern Montana drained across Idaho, Washington, and Oregon, following the path of the Columbia River. There was sufficient force and volume to carry car-sized boulders hundreds of miles to the coast. At the time of the great Missoula flood, the Flathead Lake Basin was still covered in



16. Flathead Lake to the Pacific Ocean- Google Earth satellite image, the white line follows the water of Flathead Lake to the Columbia River and ultimately to the Pacific Ocean.

ice. Today, the gravel, sand and rocks deposited at Polson and the smoothness of the mountains relative to the mountains further south (where there were no glaciers) are telltale signs of the glacial flows. The existence of Flathead Lake suggests that several centuries past the end of the last ice age and the Missoula Flood, a glacier continued to fill the basin of the current lake so that glacial outwash (sediment carried by the glacier deposited during the flow and melting of the glacier) flowed south of the Polson moraine instead of to the north of it.[41]

With a surface area of 191-square miles, Flathead Lake is the largest natural freshwater lake west of the Mississippi. Characterized by exceptionally clear (and at times cold) water, the lake is considered one of the cleanest populated lakes in the world, but has experienced degradation in the past decade due to increased nutrient pollution from residential and agricultural runoff that has occasionally caused toxic algal blooms.[42] Flathead Lake has fairly high water quality, but foresight, education, and commitment are required to prevent further degradation. Older residential development often disrupts natural shorelines and homes are often constructed extremely close to the water. Additionally, most homes around Flathead use septic systems and drain fields. Failures of these waste water systems result in contamination of the lake. Home to 25 species of fish, 10 of which are native and 15 are introduced, the lake is renowned with sport fisherman, which is positive in that recreational sportsmen are typically conservationists, but also presents threats to the ecosystem through the

17. Flathead Lake- Google Earth satellite image of Flathead Lake with lake facts, local geography, and site circled

addition of invasive species brought as bate or stuck on the hulls of boats.[43] Aquatic worms and zebra mussels, though small can have huge impacts on food chains and ultimately, water quality. Kokanee (land-locked) salmon were introduced to the lake at some point in the 1920s along with non-native white fish and in the mid-80s mysis duvudliana shrimp were introduced to increase the populations of Kokanee. The shrimp plan backfired and instead boosted populations of non-native lake trout and whitefish while negatively impacted Kokanee as well as native bull and cutthroat trout populations.[44]

The geological story of Flathead Lake's creation is echoed in the cosmological narratives of the Kootenai, the first known people to inhabit the area at the end of the last ice age. Creation stories describe not only Great Lake Missoula, but also the existence of an ice dam that collapsed. Three thousand year-old Kootenai pictographs, as well as newer additions from 1700-1900 AD, decorate cliffs on the western shores of the Lake.[45] The Kalispel (Pend d'Oreille) and Bitterroot Salish people also inhabited the region and represented the easternmost part of a group of tribes extending from the Pacific Coast to Montana that spoke Salish. Three thousand year-old Kootenai pictographs, as well as newer additions from 1700-1900 AD, decorate cliffs on the western shores of the Lake.[46] Today, these tribes are joined into the Confederated Salish and Kootenai Tribes of the Flathead Indian Nation (CTFN) and have a 1.3

Flathead Lake Biological Station

FLBS was founded in 1899 by Morton Elrod, UM Distinguished Professor of Biology, in Bigfork. The station moved to its present location in 1908.

FLBS is one of the longest continuously running biological stations and has collected an unparalleled amount of data concerning trophic cascade in the lake leading to deeper understanding of freshwater ecosystems

Students and researchers live and work at the station year round (though numbers are much smaller in the winter)

As public university property, the biological station is open to visitors and maintains the original Elrod cabin as a museum

Yellow Bay State Park

Park is on what used to be UM property

Despite proximity and public use, the park and FLBS are separately accessed

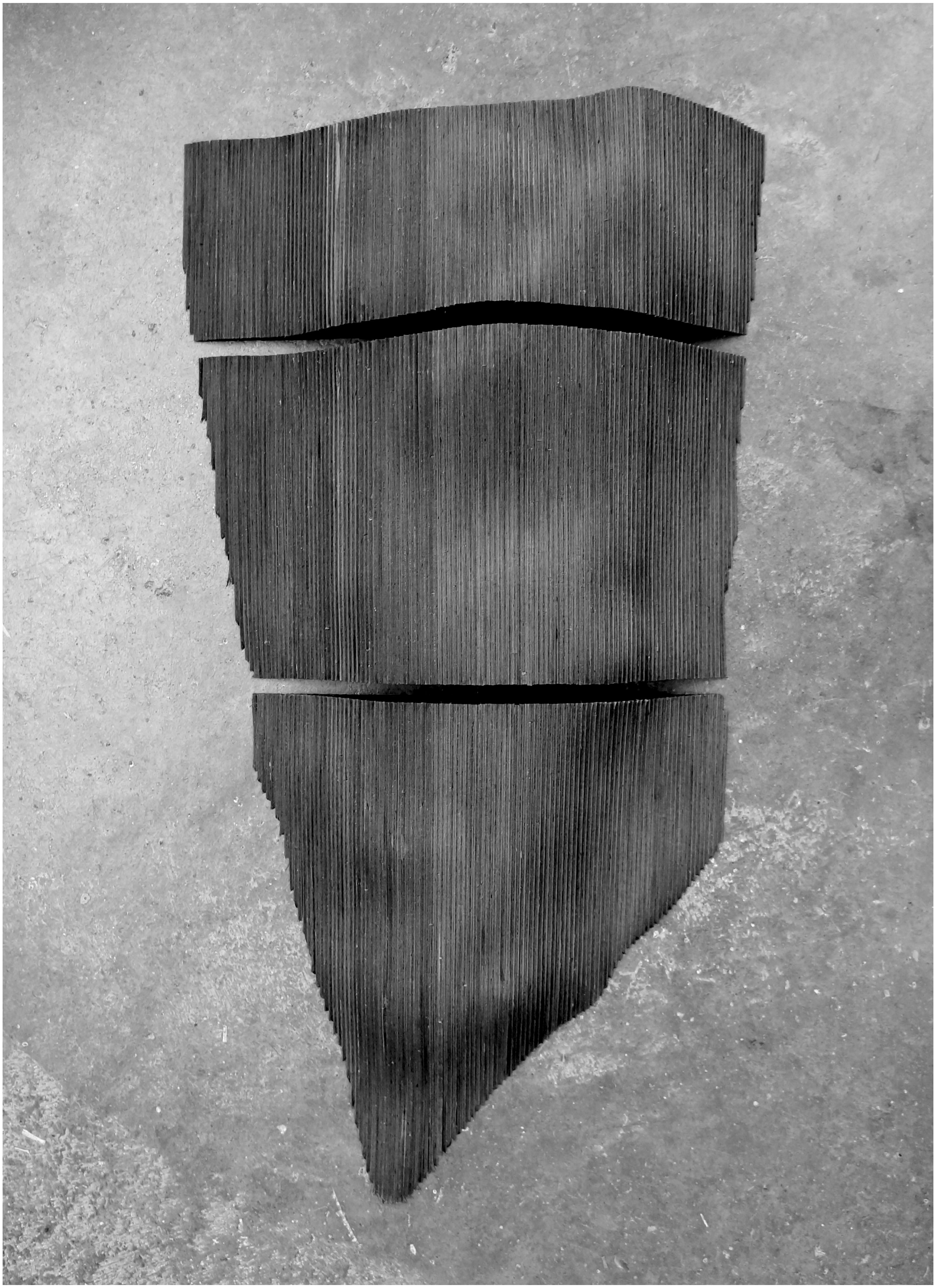
Currently provides 4 campsites, a boat launch, restrooms, and a picnic area

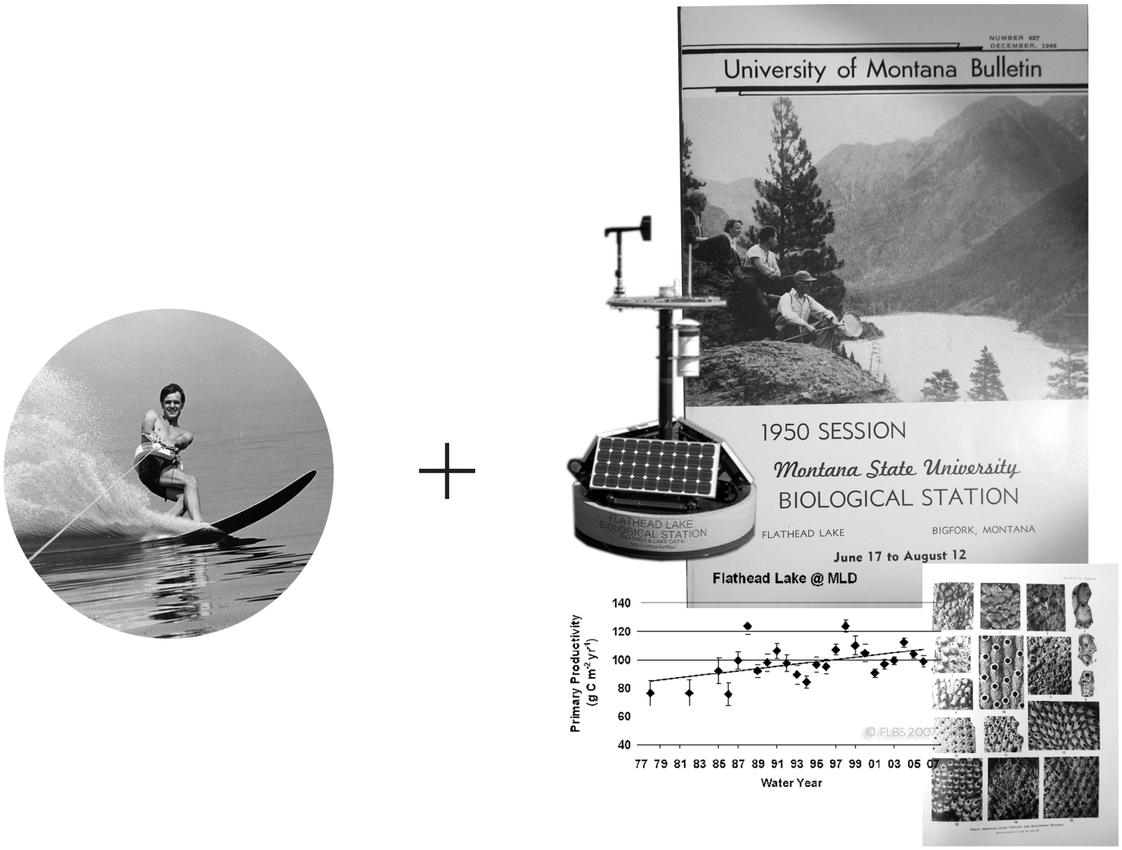
There are six state parks on the lake and three public boat launches on the east shore. The launch at Yellow Bay is the most protected and prefered amongst boaters (especially those with sail boats)

18. Yellow Bay from Above- Google Earth satellite image of Yellow Bay. The Flathead Lake Biological Station (brown overlay) occupies the peninsula and western side of the site. The Yellow Bay State Park (green overlay) is located on the inside of the bay.

million acre reservation in the southern half of the Flathead Valley.

The first non-native people to come to Flathead were surveyors and traders for the Hudson Bay Company in the late 1700s. Lewis and Clark bypassed the lake to the south and the next people to come to the Flathead Valley were Jesuit Missionaries who established the St. Ignatius Mission south of the lake in the 1850s.[47] By the 1870s, permanent ranches and farms were appearing north of the lake and the first sizable settlement of Ashley formed near present day Kalispell. Significant growth in the area did not begin until 1910, when despite a treaty granting the land around the southern half of Flathead to the CTFN, the federal government opened the land up to homesteading. The fertile valley to the south of the lake became populated with farms and cabins began appearing on the shores of the lake. Also in 1910, Glacier National Park was created, bringing more people to the region.[48] It was discovered around this time that the conditions around Flathead were particularly conducive to propagation of cherry trees and the first orchards were planted to the north at Woods Bay. In 1899, University of Montana biology professor, Morton J. Elrod, established the Flathead Lake Biological Station (FLBS) near present day Bigfork, which grew with logging and fishing industries. In 1908, the station was moved to its current location in Yellow Bay on the eastern lakeshore.[49] Yellow Bay





19. Photo of a model of the peninsula vertically stacked and cut in three as a way of exploring the geology of the point and sections through Yellow Bay Hill
20. Diagram illustrating combination of recreational and educational program elements

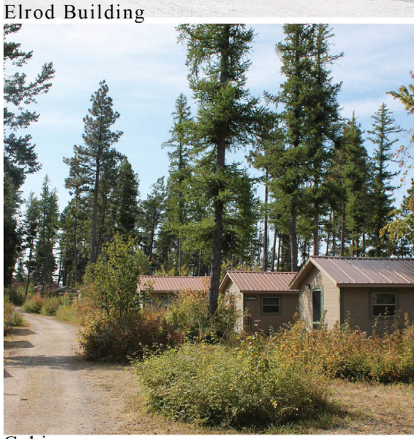
was named by white settlers because of an outcrop of yellow sedimentary rock of the point that defines the bay. To the Kootenai people, the Salish name of the area was *Čkwlkwlalqs,* loosely meaning "the place of the red bark trees," referring to the ponderosa pines that grow on Yellow Bay Hill and in the surrounding area.[50] FLBS on Yellow Bay is one of the oldest continuously operating biological stations in the country and has collected large amounts of data regarding lake ecology and water quality. Adjacent to the property that FLBS sits on is the 15-acre Yellow Bay State Park, offering four camping sites, restroom facilities, a boat launch, picnic tables, a small beach area, and a dock.

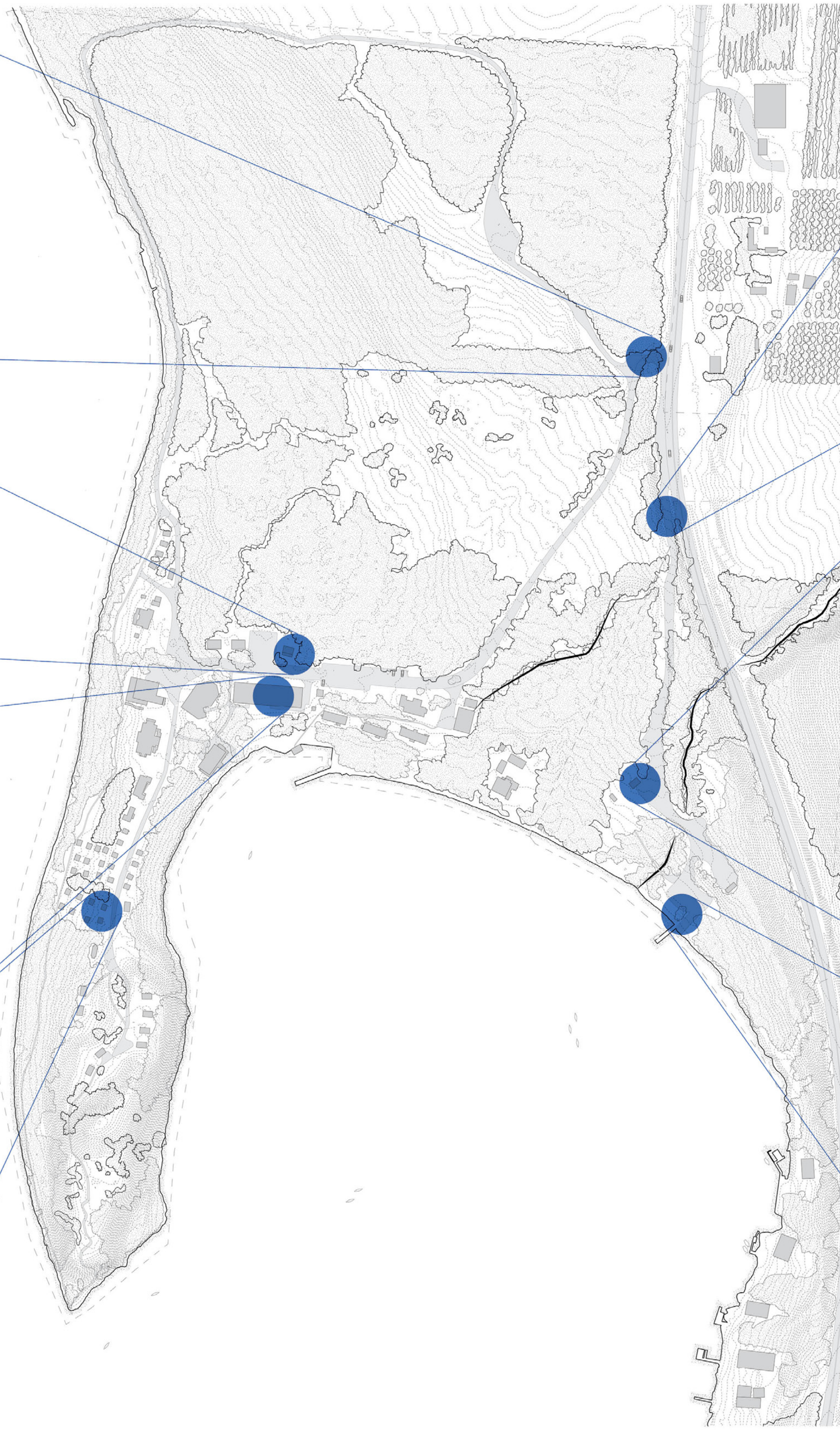
The combination of the recreational opportunities at Yellow Bay State Park and the ecological narrative offered by the adjacent FLBS has potential to create a deeply immersive experience. The facility should provide exhibition space for FLBS and all of the current services that the state park provides so that users could frame their overall engagement with the lake through both knowledge and tactile experience. FLBS is interested in discovering the ecological narrative of the lake and includes in its mission statement "providing information to the public on ecological issues."[51] While the biological station does publish academic papers and hold an open house once a summer, the institution does not have a space to regularly host visitors and exhibit the product of their ongoing research. As a limnology

Flathead Lake Biological Station Entry

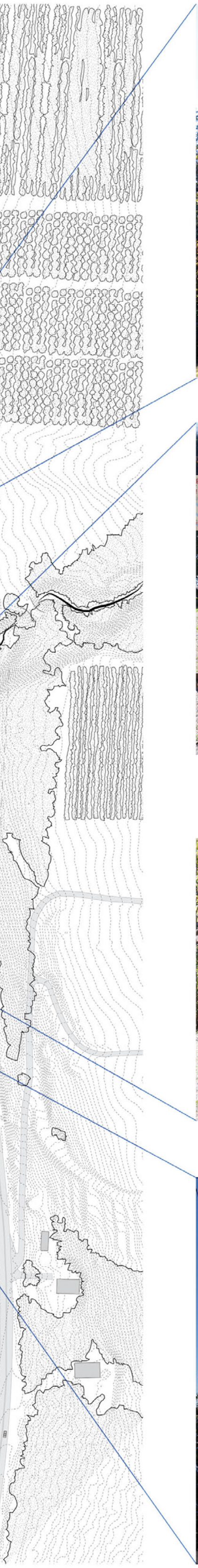

FLBS Museum: Historic Elrod Cabin

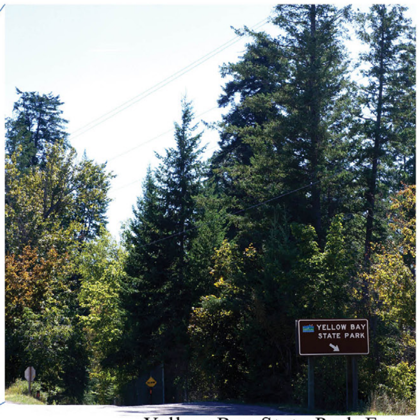

Elrod Building


Cabins



21. Diagram illustrating existing site plan and photos of site conditions





Yellow Bay State Park Entry

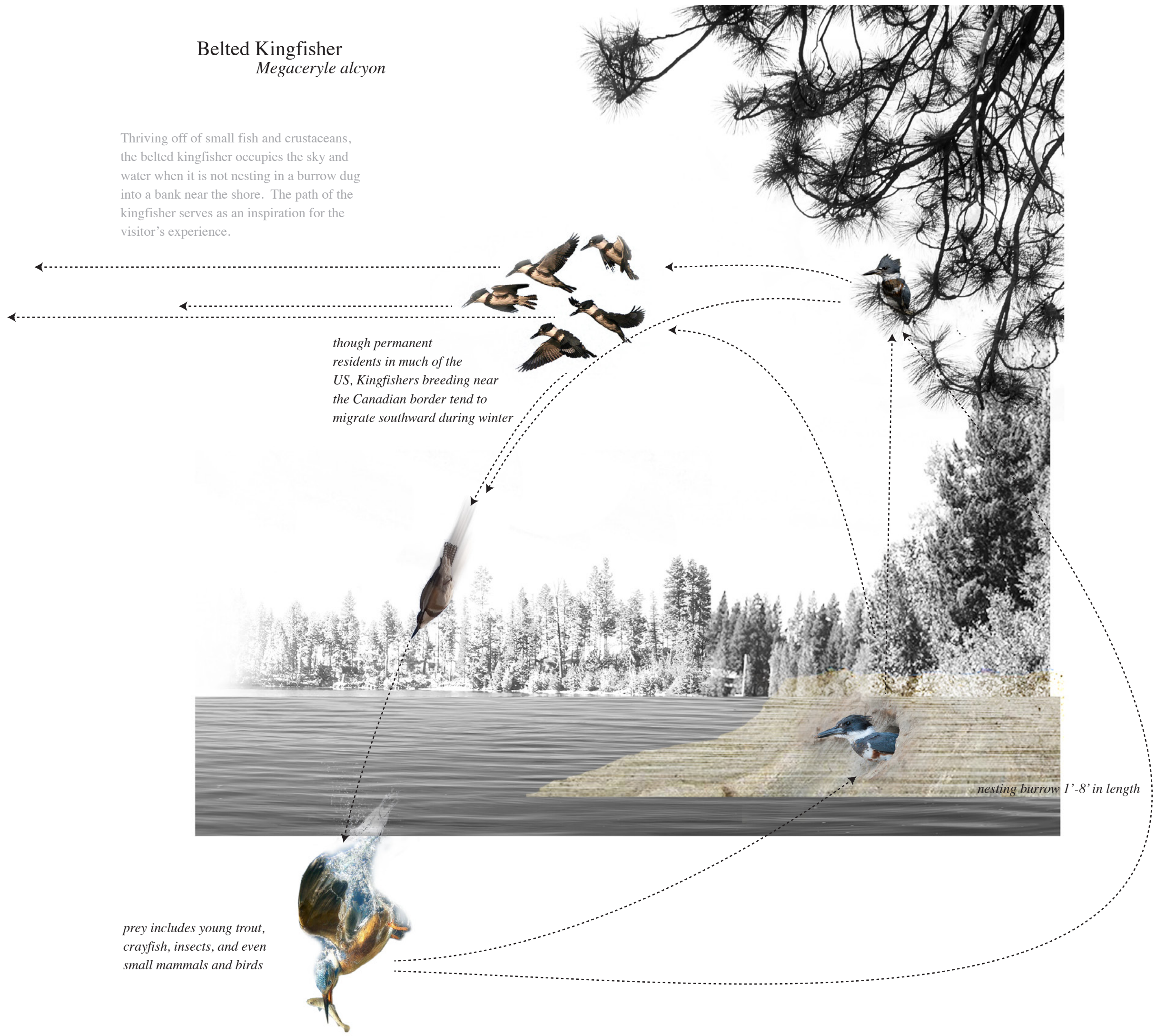
Yellow Bay State Park infomation point


Park toilets


Floating dock and boat launch

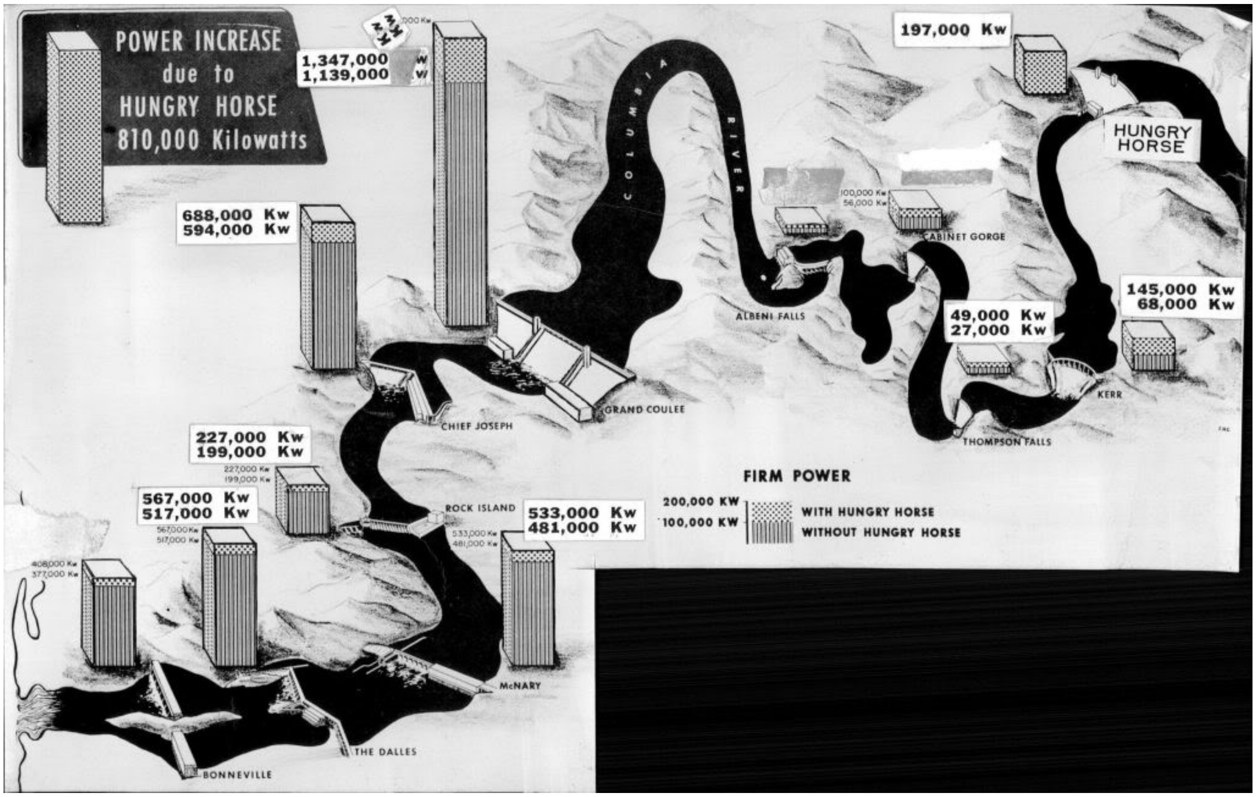
(freshwater ecology) facility, FLBS is well equipped to conduct research: there is a recently renovated freshwater lab, apartments and cabins for staff and students, a dining hall, a boat slip and 30-foot research vessel, a building containing offices, a research library, a conference room and lecture hall, a wastewater treatment plant, and a nature trail that loops around the site. However, the campus is not well suited to welcome the public despite the fact that it sits on public land and people are allowed to visit the station and participate in self-guided walking tours.

Currently, the Biological Station and Yellow Bay State Park have separate entries and are run as completely independent entities. If the barriers between the park and biological station were removed and their combined area was established as a single entity, frames of experience based in recreation and ecology could be brought together to provide meaningful, engaging experiences for visitors. The aggregated memory of the experiences had in Yellow Bay could lead to strengthened cultural sustainability of the Lake. Appreciating Flathead means connecting to thousands of years of formative geologic activity and recognizing the Flathead watershed as being part of the far larger Columbia watershed. The lake is a source of



irrigation, power, recreation, and habitat. While FLBS is concerned primarily with limnology, the various parts of the story work in tandem to provide a complete picture of why and how the lake exists in its current state.

FLBS has meticulously documented the plant and animal life on the lake and on biological station property. The vegetation is diverse and typical of low alpine environments. Ponderosa pines and Rocky Mountain maple shrubs dominate the Yellow Bay Hill (located on the peninsula), while other varieties of coniferous firs and pines characterize the Yellow Bay State Park (see Wildlife and History Appendix for complete list of vegetation and plant life). The diversity of bird species makes the state park an ideal location for birding. Figure 49 in the Wildlife and History Appendix shows the various species of birds, varying from osprey to hummingbirds and waterfowl, organized by what part of the forest-lake section each species tends to occupy. Of course the diagram is an abstraction and no bird spends all of its time in one strata of the section. The Belted Kingfisher is particularly difficult to place in section because Kingfishers nest underground, feed on the water, and spot prey from branches or the air (fig. 20). The Belted Kingfisher's path serves as inspiration for the



22. (Opposite) Path of the belted kingfisher- a model for sectional experience of the site
23. *Chicago Tribune* diagram from 1954 of dams in the Northwest. Mike Mansfield was partially responsible for the addition of Hungry Horse Dam.

type of full sectional experience human visitors to the site can have.

The lake has many dimensions: it is a geologic artifact of the Ice Age, a home for many species of plants, fish, birds, and animals, a platform for recreation, and a source of water for irrigation and power generation. The North, Middle, and South Forks of the Flathead River, carrying snowmelt, rain and glacial runoff from Glacier National Park, unite with the Stillwater and Whitefish rivers before entering Flathead Lake at the northeast end of the lake at Bigfork. The Swan River enters the lake at the northeast end through the relatively small Bigfork Dam, which generates 4000kW at peak capacity.[52] The Flathead River is controlled by the Hungry Horse Dam in Hungry Horse near the West Entry of Glacier Park and again at its exit from Flathead Lake by the Kerr Dam. Hungry Horse dam was built in 1952 and Kerr Dam in 1938: both provide power, flood control, and means to control water for irrigation. Kerr Dam can generate 194mW of power (1mW is enough for about 750 homes) and in the winter, the level of the lake is allowed to drop ten feet to an elevation of 2883’, which is closer to its naturally maintained level before the dam was put in place. The Confederated Salish and Kootenai Tribes of the Flathead Indian Nation (CTFN) share management and ownership of the Kerr Dam with the private PPL Corporation and will have the opportunity to purchase full ownership in 2015.[53] The rise in water level caused by the building and operation of Kerr Dam has eroded a shoreline that developed naturally over thousands of years and resulted in the deposit of large nutrient loads into the lake (leading to eutrophication

24. (in clockwise order starting at upper left corner) a. Current shoreline with existing trails dashed in, b. Repurcussion of raising the lake level 17-feet. Yellow Bay Hill becomes an island and land along the shore is flooded, c. A composite of the existing condition and a trail derived from the imagined shoreline, d. Proposed trails, nodes, and program

and reducing water quality). Runoff from farms and towns has also burdened the lake with phosphorus and nitrogen, which in combination with warmer temperatures can result in algae blooms.[54]

The lake's shoreline as people experience it today is not "natural" despite Flathead Lake being amongst the most pristine in the world for its size and climate.[55] The top ten feet are currently regulated and a proposal developed by the Army Corps of Engineers in the 1940s would have changed the shoreline even more drastically, raising the lake 17-feet above the current high level of 2893-feet to 2910-feet by 1945.[56] The proposal, meant to generate more power by the Bonneville Power Administration for use in war efforts, would have drastically changed the shoreline of the lake and flooded thousands of acres of farmland. Montanans were outraged by the proposal and a first term U.S. Representative, Mike Mansfield, who would later be the longest serving U.S. Senate Majority Leader, prevented the proposal from becoming realized. When interviewed decades later about his time in Congress, Mansfield responded that "Saving Flathead Lake," was his greatest achievement as a politician.[57]

On the Yellow Bay site, he impact of the unrealized proposal would have been dramatic, creating an island out of Yellow Bay Hill. The importance of visualizing the imagined shorelines of the 1943 proposal lies in the notion that humans constantly manipulate their landscapes and waterways in the name of transportation, power generation, agriculture, and development. The effects of raising the lake an additional seventeen feet have already been partially played out through seasonally raising the lake's level by ten feet from its natural mean level. The fact that the proposal did not become realized is just as important in that it demonstrates that public and political will can determine the future form of a landscape or body of water, even in the face of ever-increasing energy and resource demands.

From the imagined 1945 shoreline of Flathead Lake emerges a trail system for Yellow Bay. A trail that follows the seventeen-foot watermark at an elevation of 2910-feet stitches together two sites divided by parcel lines and state politics. Along this path are nodes that reveal more information about the site and the lake. A primary interpretive facility with recreational amenities is situated in the park to serve as a platform for disseminating the work of FLBS. A bridge that brings visitors into an old growth stand of trees connects the imagined shoreline and imagined island. Lastly, a tunnel marks the pre-Kerr Dam mean level of the lake and reveals underwater views of Yellow Bay.


Interpretive Exhibit
3000 sf
Camp Host Lodging
400 sf
Restrooms/Showers
600 sf
Office + Library
350 sf
Campsites (4)
800 sf
Data Exhibition Space
1000 sf
Boat Launch
Historic Elrod Cabin
Interpretive Exhibit
2400 sf


0'
125'
250'
375'

25. (Opposite) Proposed site plan with trails, interpretive center, landscape interventions, and parking
26. (Above) Rendering of primary interpretive building from the path starting at the visitor parking lot.

YELLOW BAY INTERPRETIVE CENTER DESIGN PROPOSAL

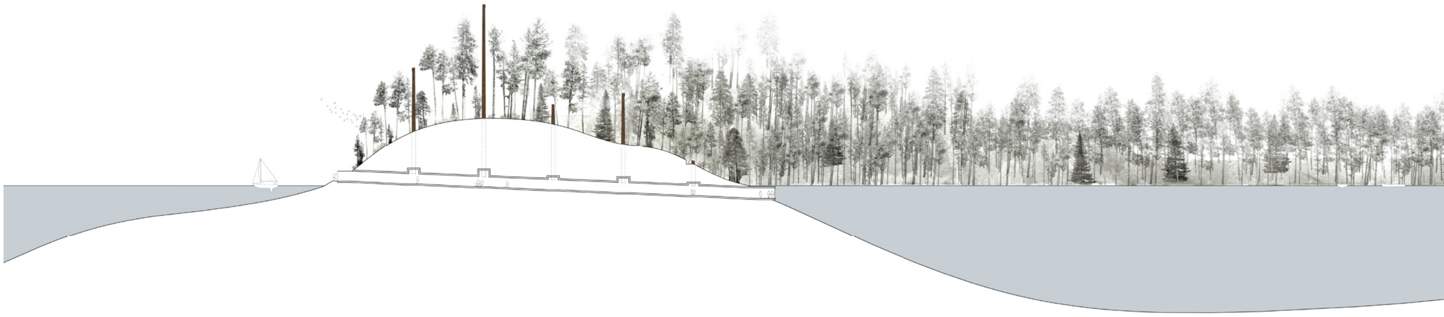
Three interpretive nodes are dispersed throughout the site along the imagined shoreline trail. The dispersal of the elements is intended to spread the energy of the interventions across the site and engage visitors in a way that requires them to fully experience the site. The first departure from the existing condition occurs at the entry to Yellow Bay State Park. In the proposal, the park and FLBS share a single entry in order to unify the two sites. A shared parking lot further unifies the entry and increases the public presence and accessibility to FLBS. Additionally, the entry strategy consolidates the parking and paved road surface on the site, replacing the former separate entry to the park, visitor parking at FLBS, and parking at the park for both day use and overnight camping.

An access road leads to the new boat launch, which is located to the northwest of the Yellow Bay Creek, rather than to the southeast. The placement of the boat launch and access road allows for the removal of the stream culvert and the restoration of the stream as a defining element of the park. The majority of the parking is placed at a distance from the primary interpretive facility so that visitors can

27. (Above) Rendering of exterior of deck in the primary interpretive building, the tallest periscope can be seen across the water
28. (Below) Site Section

decompress and experience the site on foot between the parking lot and park amenities. Visitors camping in the park pass the camp host lodging while walking to the campsites so that they can conveniently register and the camp host knows about overnight users. Visitors approaching the building from the boat launch parking (reserved for visitors with boats) walk by the historic Elrod Cabin, moved from its former site on the FLBS property, where the public seldom accessed it. The Elrod Cabin contains historic academic journals, sketches, photos, and specimens from the century long history of FLBS.

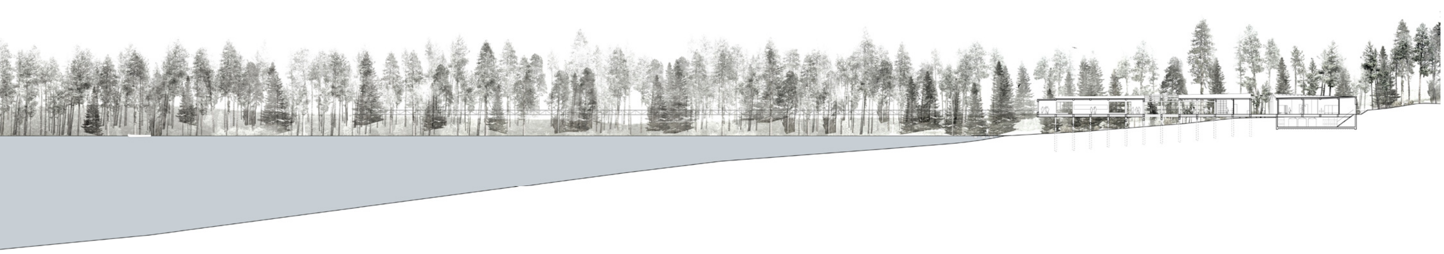
The camp host lodging and restrooms anchor the building into the ground. The remainder of the building reaches toward the shore similarly to a pier with a deck that sits seventeen feet above the summer

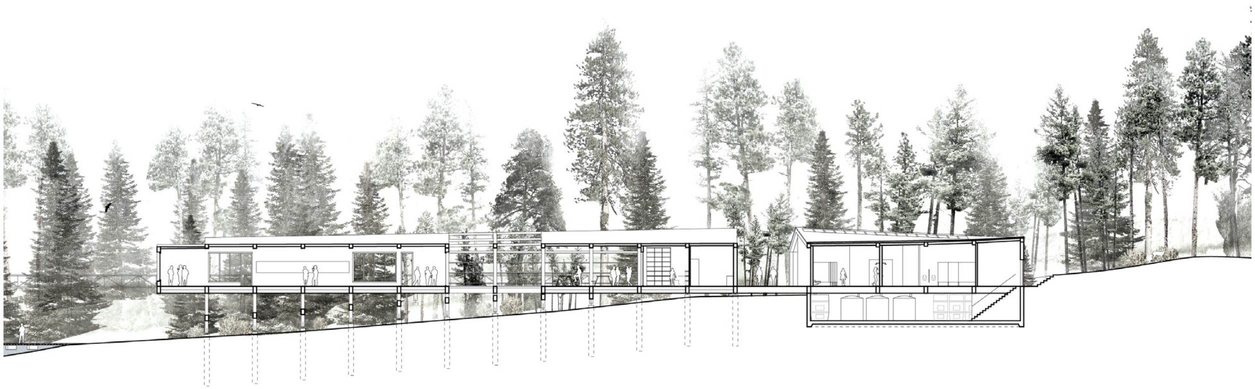



29. Rendering of the space in the interior of the FLBS exhibit space.

shoreline. The ground drops away from the deck and gives way to water as the deck disintegrates to allow light to penetrate to the earth. The deck serves as a platform for experiencing the lake through education and its supporting structure acts as a stiff diaphragm that ties back into the concrete foundation of the restrooms and camp host lodging.

A series of ever-changing glue laminated timber frames fixed with steel moment connections march toward the shore at fourteen feet on center, creating a grid for establishing disintegrated zones, interior spaces, and exterior spaces. The ridgeline of the roof drifts from one side to another in plan and rises in section as it moves toward the split in the building. The standing seam metal covering the roof becomes a shell over the frame, folding down to create solid,





30. Interpretive building section in context

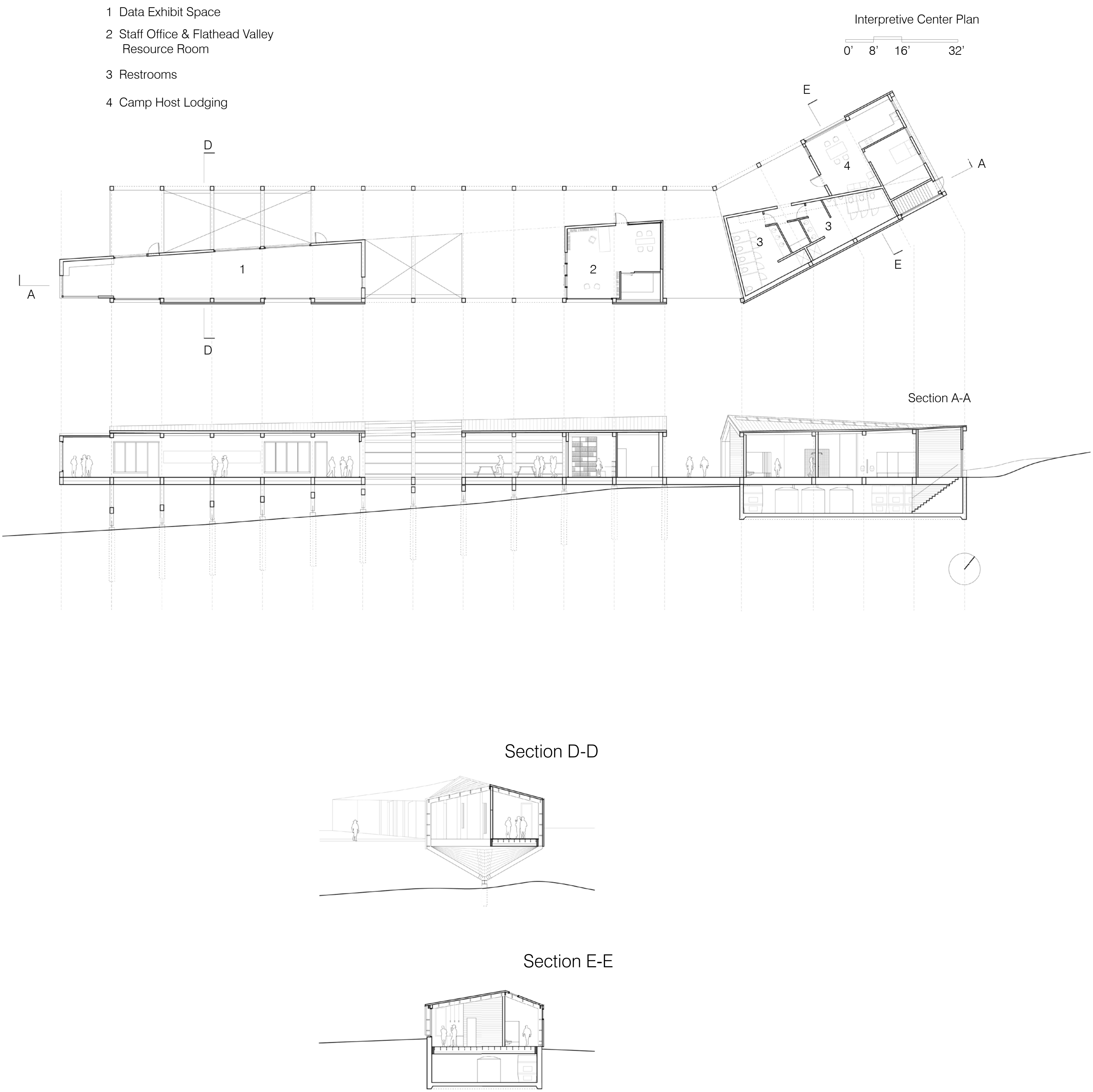
insulated walls or perforated screens. The highest points on the ridgeline occur on either side of the divide in the building, marking entry to the building and threshold to the part of the park that lies beyond.

The divide and kink in the building is a response to an intersection with the trail at 2910-feet (seventeen feet above summer lake level). On one side the trail as it enters the building are the restrooms and camp host lodging, on the other side are the office, Flathead Valley Resource Room, and beyond, the FLBS exhibition space. The proximity of the camp host and office to the entry is intended to help keep staff aware of the people and activities in the park and also to help visitors find information and personnel easily.

There are approximately equal proportions of interior and exterior space that through maintaining a consistent datum, emphasize the way that the topography yields to the water (and the water yields to the topography). The frames align to provide a view of the periscopes on Yellow Bay Hill so that the building and the periscopes rising from the tunnel can be understood as part of the same system. The interior space of the FLBS exhibit room is long and linear and at its end, a window directs the viewer's gaze out onto the lake past the end of the point. The exhibit space is intended to hold FLBS media regarding ecology and water quality. The end of the space with the lake window extends past the last glue-laminated frame and is a place for visitors to project themselves beyond the exhibit and building.

The bridge, like the main building, maintains the 2910-foot datum and is supported by triangulated, glue-laminated members that connect with concrete pile foundations at single points beneath the deck. The walkway, comprised of a truss supporting wood decking and two vertical trusses supporting handrails, acts as the rigid diaphragm. The bridge extends 600' between the imagined shoreline and imagined island that would have resulted from a seventeen-foot rise in lake level. Concrete pier foundations grow to emphasize the continuation of the path at both ends of the bridge. At the west end, two low walls suggest a bend in the trail as it follows the end of the imagined island. A concrete enclosure acts as a gatehouse where information about the flora and fauna might be posted and indicates the direction of the imagined shoreline at the east end of the bridge.

The bridge heightens awareness of the impact

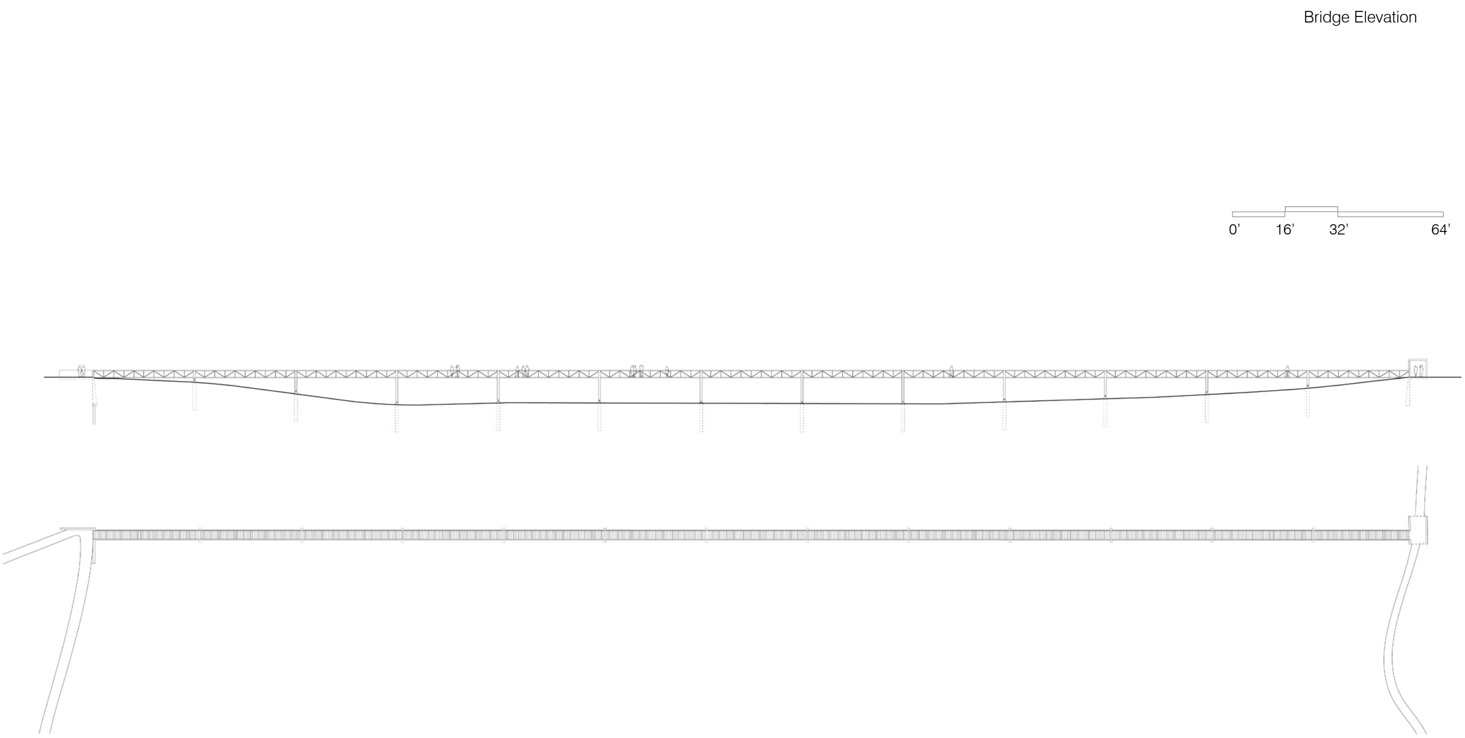


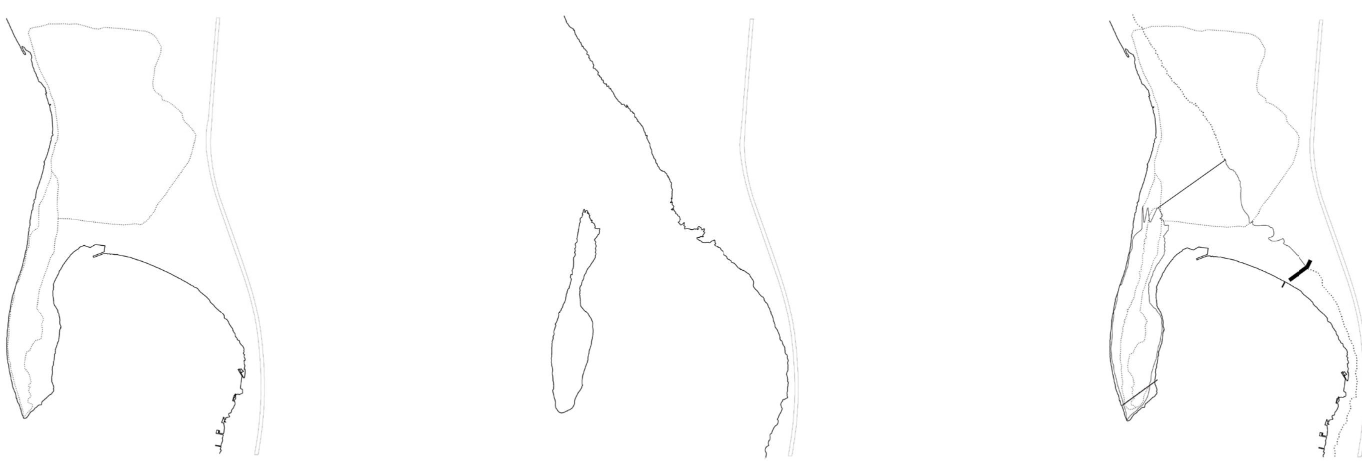
31. Orthographic drawings of interpretive building

32. Bridge from imagined east portion of shoreline trail

of raising the lake's level and brings visitors into a unique part of the site. The bridge is on part of the site relatively distanced from the water that offers passage through a rare stand of old growth trees. Walking on a lightweight bridge is different from walking on a trail and allows visitors to perceive their surroundings from a different perspective while illustrating an alternate history. To the west of the bridge, the trail deviates from the 2910-foot datum through a couple of switchbacks so that the visitor experiences the shore of the lake. Within the bay, there is refuge from the intense wind that perpetually rearranges the smooth rocks and driftwood along the lakeshore. Deviating from the 2910-foot level also permits the trail to move around the cluster of FLBS cabins on Yellow Bay Hill and brings visitors to the appropriate level to enter the periscope tunnel.

The tunnel carves through the bulge of the Yellow Bay Hill and takes visitors from the level of the existing summer full pool shoreline at 2893-feet to 2883-feet, ten feet beneath the water's surface in the summer. The 2883' is significant for two reasons: it was the mean level of the lake prior to the building of the Kerr Dam in 1938 and is the lowest that the lake is allowed to drop to in the winder while regulated by the dam today. The variable lake level results in the lower end of the tunnel being submerged in the summer once the lake reaches full pool and being exposed during the winter. There is a temporal, seasonal nature to the exposure of the tunnel and

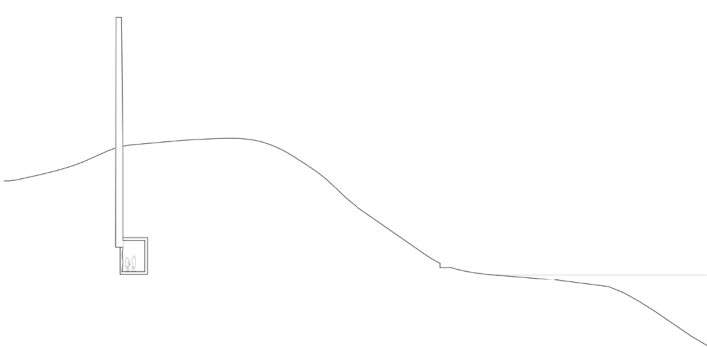




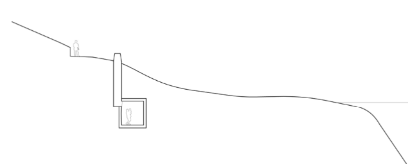
33. (Top) Orthographic drawings of bridge
34. Diagram illustrating conceptual role of bridge

35. Orthographic drawings of periscope tunnel

Tunnel Plan



Section B-B

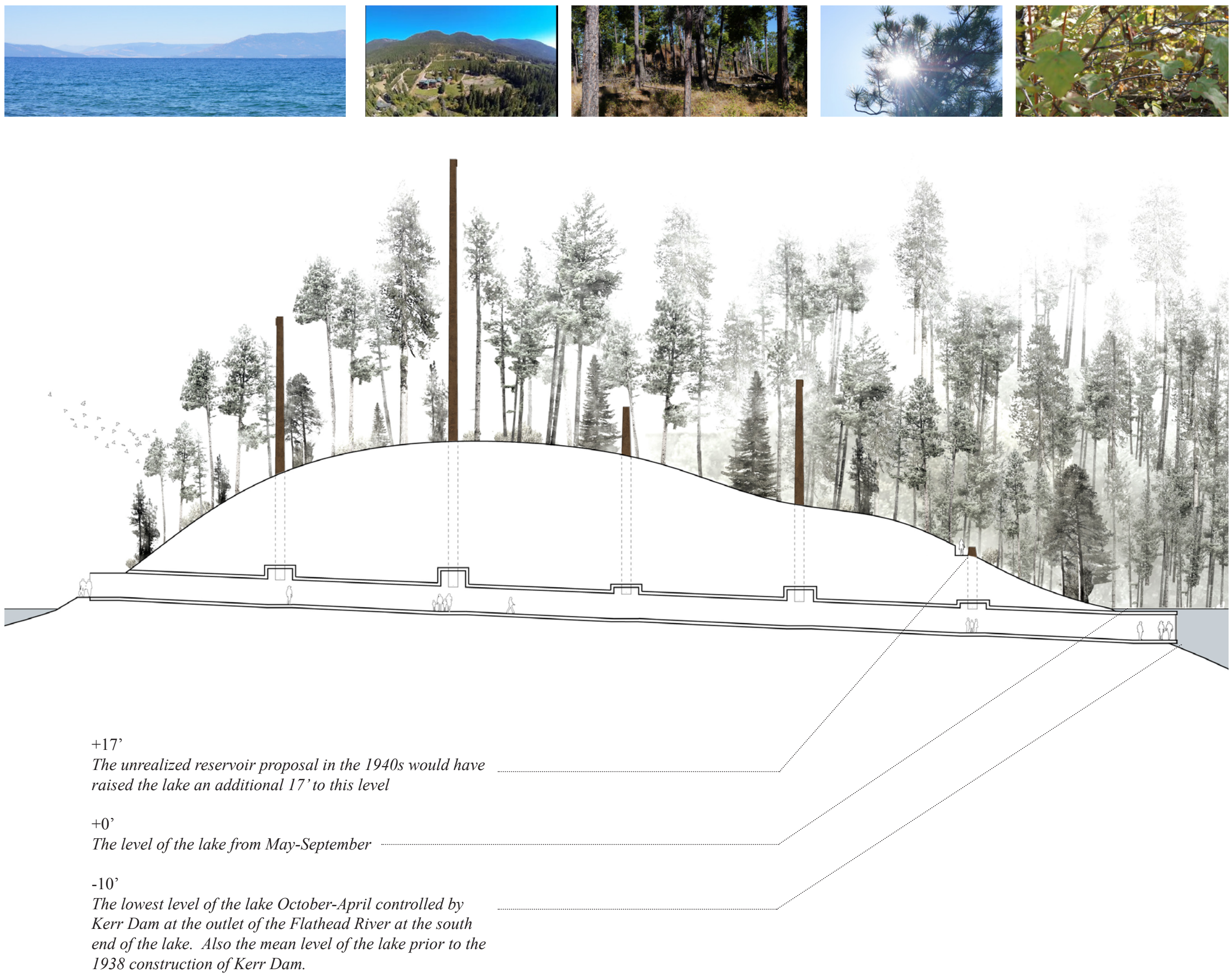


Section C-C

36. Periscopes as seen from on the lake

the kind of experience visitors would have while inside of it. Two walls of windows and an overhead slit at the low end of the tunnel reveal the rocks and ecology of the lake in a way that cannot normally be experienced while the ground level in tunnel reveals a historical shoreline. In the summer, the submerged end of the tunnel showcases the remarkable clarity of the lake. At other times of year, icy water might lap against lower parts of the windows or be beneath them entirely.

Along the 250-foot length of the ramped tunnel, there are 6 landings including the flat portion at the submerged end. The 5 other landings are accompanied by an image projected by a combination of a periscope and camera obscura. The ceiling rises accommodate a projection and provide spatial variation at each landing. The periscopes provide a means of visual ascension and bring down specific views that would otherwise be difficult to get by virtue of the high (or low) perspective. The projections are a way to curate the length of the tunnel and show different aspects of the lake and bay in real time in a way that is similar to the biological station cameras that film the bay and monitoring buoys on the lake. The periscopes capture views of the larger context of the lake and the cultivated hillsides on the east shore (yet another illustration of human impact), as well as views of treetops, tree



37. Section through tunnel, images above correspond to projected views

trunks, and bases along with visitors’ feet as they walk along the 2910-foot trail. The weathered steel of the thin periscopes is a reference to the red bark of the surrounding ponderosa pines and the Salish name of Yellow Bay: place of the red trees/posts/cylinders. The tallest periscope at 96-feet high, reaches the estimated height of the tallest ponderosas on the site according to the USDA soils report.[58]

Visitors get two changes to appreciate the projected views: once on the way to the submerged windows an again on the way back to the trail. The underwater view at the end might produce a shift in perspective that could make the journey of walking the tunnel in each direction a different experience.

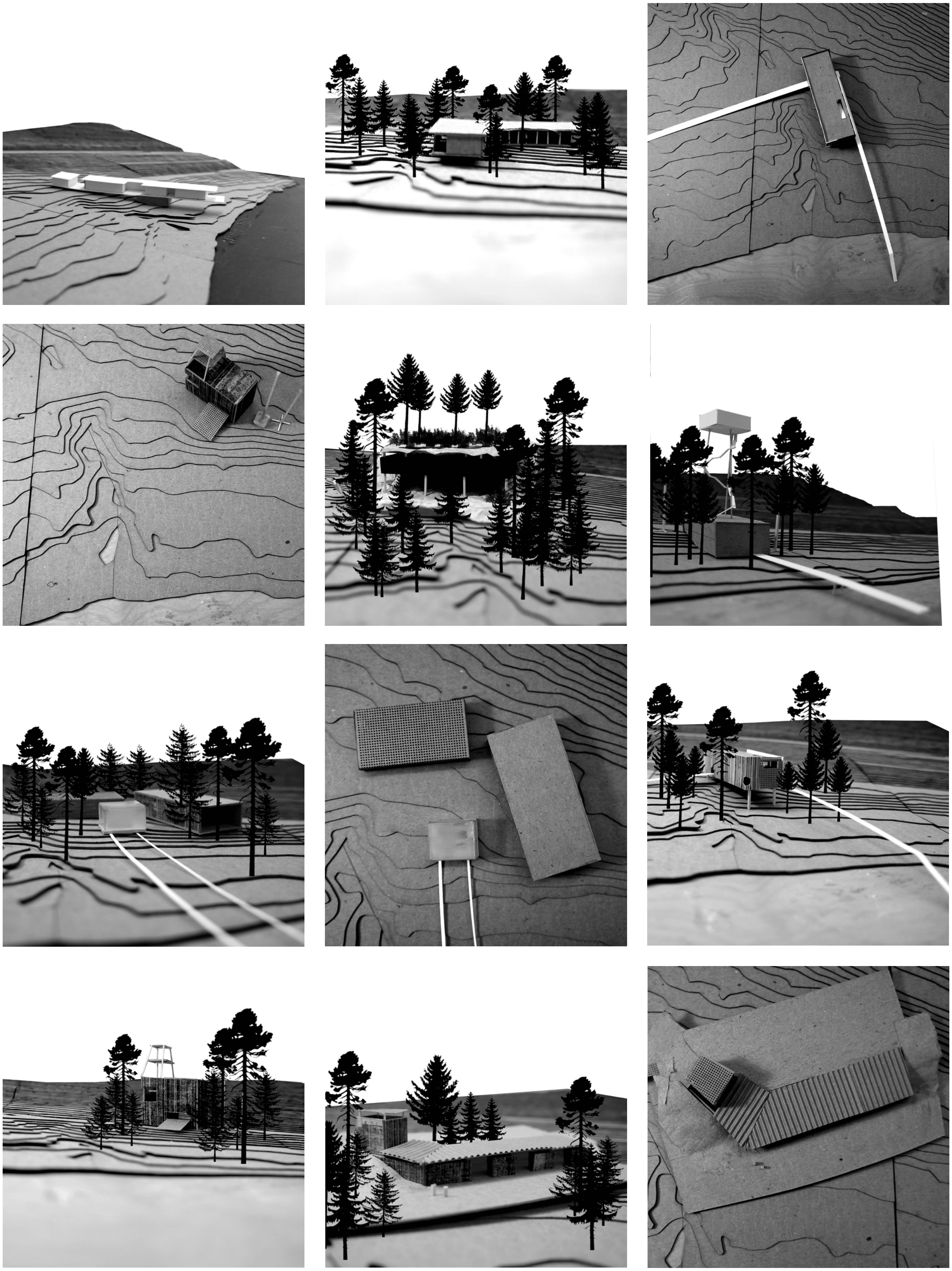
Upon arriving at the higher end of the tunnel, the visitor can either take the trail back towards the bridge, or continue along the shore and around the point where the yellow outcrop of rock, the namesake of the bay sinks into the water. The trail follows the shore around the points and then gradually climbs back up to the 2910-foot level. The shortest periscope serves as a marker and emerges from the hill at the point where the trail has reassumed the 2910-foot elevation. The shortest periscope also sends views of the trail and visitors into the tunnel.


38. View toward submerged end of tunnel from the last periscope landing

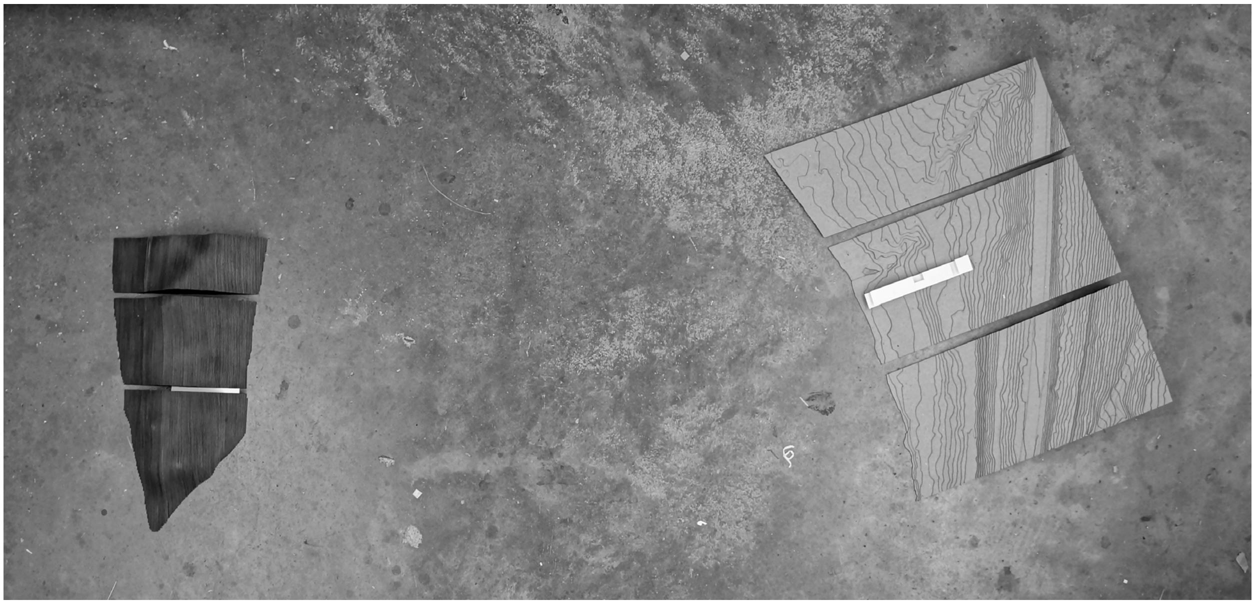
PROCESS AND REFLECTION

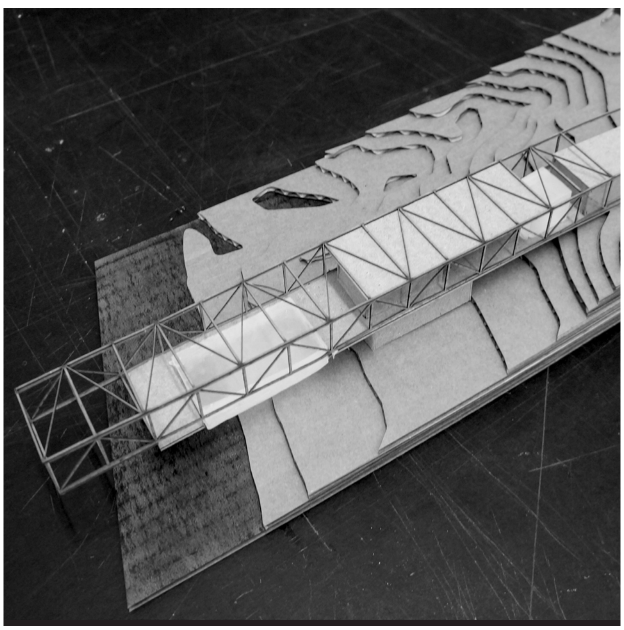
This thesis project forced me to experience the tension of working in a landscape that I personally feel strongly about. I was pulled between what felt to be polarities: designing an invisible and perhaps nostalgic project in order to respect the environment and directly addressing human impact for the ultimate end of transmitting a message. The tension can be felt in the project and became glaringly apparent at my final review. Generally reviewers had one of two responses, either that the project's success was in the conceptual nature of the bridge, tunnel, and trail and that the building failed to fit the framework, or conversely, that the building was the most successful part of the project and the remainder was elitist, arrogant, and arbitrary. I have wondered since the review whether there would have been ways to present and understand the sensitive and bold dimensions of the project differently so that they seemed to be complimentary instead of mutually exclusive forms of expression.

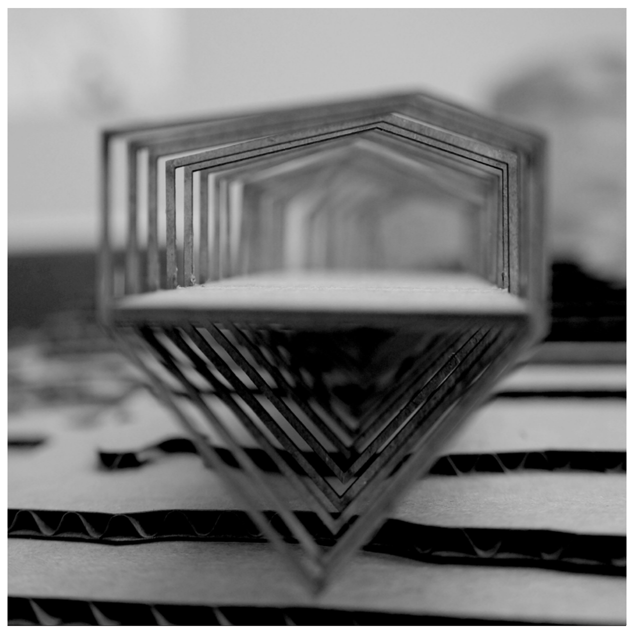
Before the idea of the trail emerged, there were two sides to the approach: one that was sited on the peninsula (this developed into the tunnel), and one that was sited in the park (which ultimately became the interpretive facility). The first models reflected the relevant parts of the site and in the park portion of the site, explored strategies of lifting, embedding, concentrating and dispersing mass. The conventionally layered park model contrasts with the vertically stacked peninsula (and ultimately the tunnel model) that references the sedimentary rock outcrop on the point. The approach for the interpretive facility did not become clear until the idea of the tunnel emerged and became an element that the interpretive facility had to respond to. Like the tunnel, the building became linear and the deck set a meaningful datum in section. The 2910-foot trail emerged as a way to link the elements and emphasize the datum established in the elements. The additional connective element of the bridge came later, after experimenting with the incorporation of a tower. Instead of a tower that would require stairs and bodily ascension, the periscopes developed in the tunnel and the bridge replaced the tower as the third element along the trail.



39. Conceptual model photos

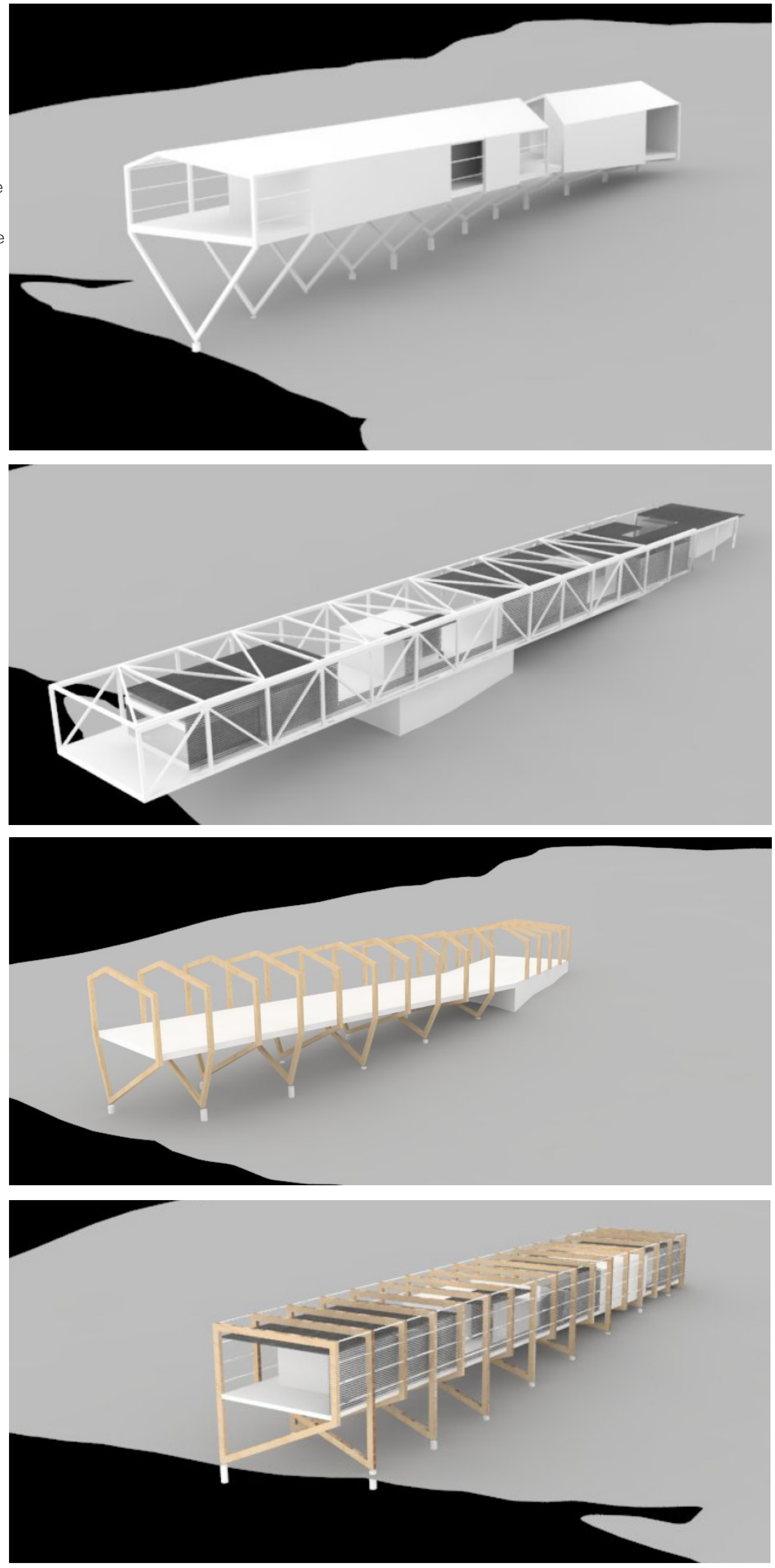


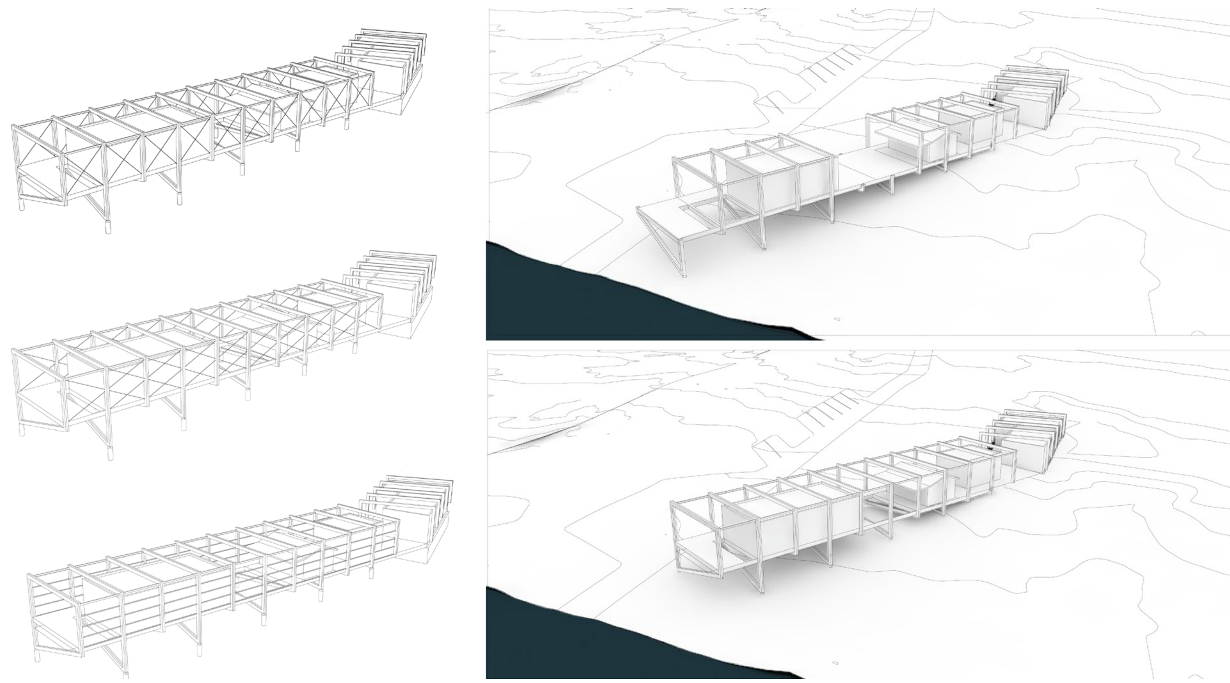




40. (Top) Topography models with interventions. The model of the peninsula is stacked vertically and the model of the park is stacked conventionally to show the different characters of the two sides of the site.
41. (Bottom left) One scheme for the interpretive building consisted of a large truss structure with insertions, including an insertion of the historic Elrod Cabin.
42. (Bottom right) The final scheme for the interpretive building started with this model, consisting of ever-changing frames

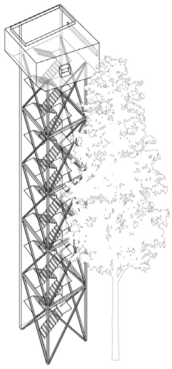
43. (From top to bottom) a. Image of an early iteration of the building where the frames have a tight wrapper and the enclosed space sits within the larger frame structure, b. In this iteration, a screen element sits inside of the truss and wraps around the enclosed spaces, c. a frame iteration where the foundations alternates sides, d. a confused scheme combining the truss and frame alternatives- this was abandoned because the frames above the deck had no structural purpose
44. (Top) Variations of secondary structure and



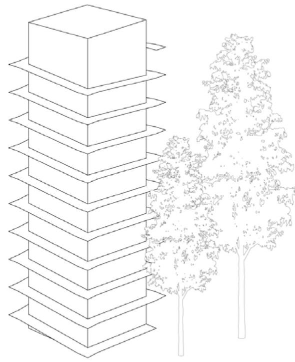


disintigration of deck and frames
45. (Bottom) Prior to introducing the periscopes to the tunnel, I explored different natural lighting strategies for the tunnel. Ultimately, the skylights were replaced with projections as a means to curate the length of the tunnel. The image to the far right illustrates an exploration of a more rusticated form for the interior of the tunnel.
46. (Opposite page) At one point, I was considering having the third element be a tower instead of the bridge. Ideas about visual, as opposed to bodily ascension ultimately became manifest in the tunnel periscopes.

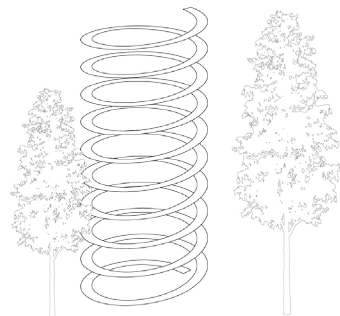
Out & back | bodily ascension



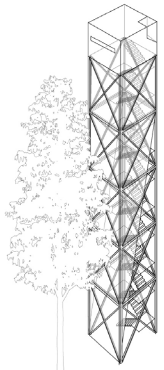
tower + stair + concrete wall + braced frame



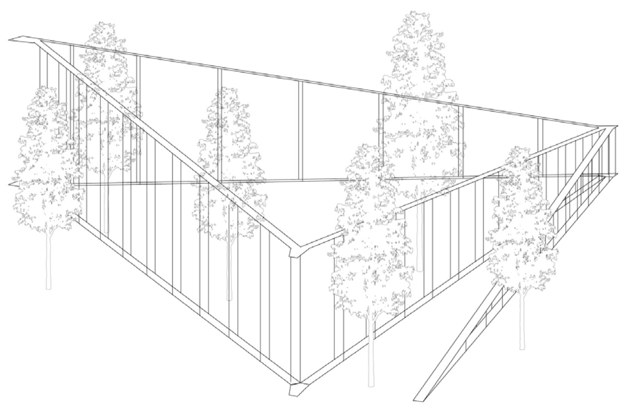
tower + square ramp



tower + spiral ramp

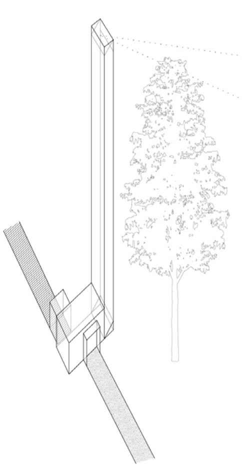


tower + stair + braced frame + skin

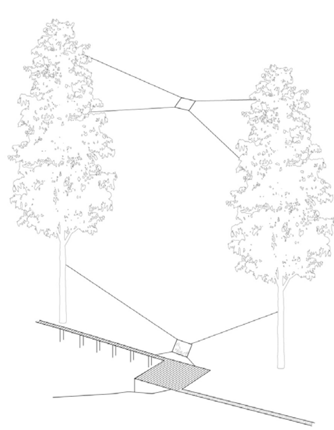


lifted trail

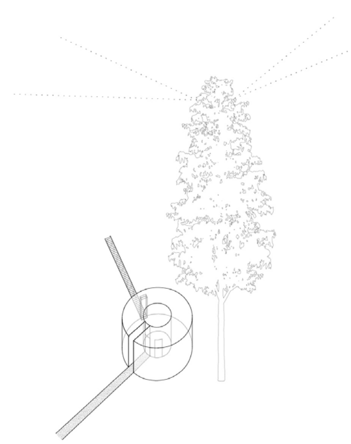
Through | visual ascension



tower + periscope



trail + open periscope



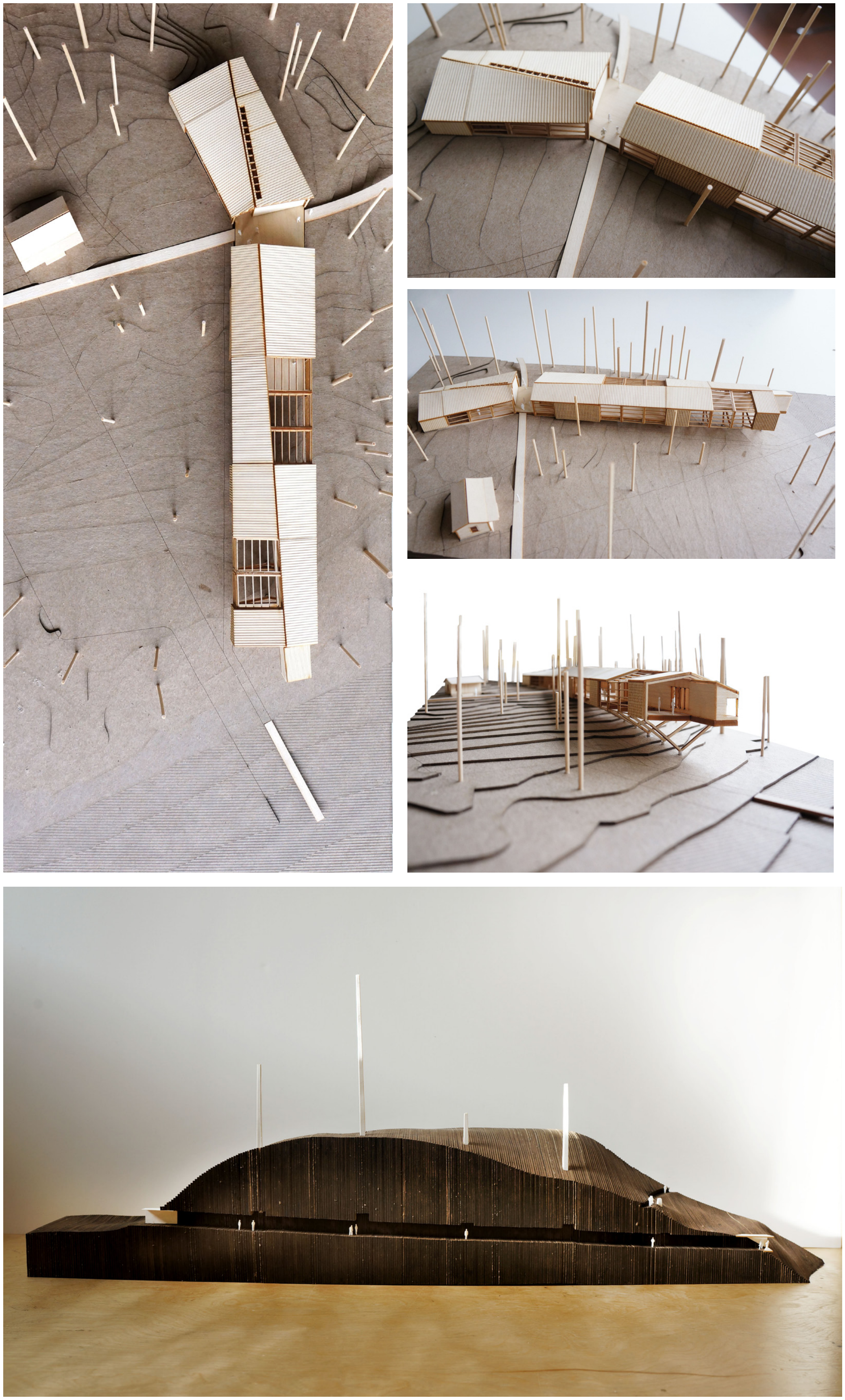
trail + sky frame + video installation

CONCLUSION

A lake is the landscape's most beautiful and expressive feature. It is Earth's eye; looking into which the beholder measures the depth of his own nature.

-Henry David Thoreau, *Walden*

Through becoming an experiential lens this project narrates a story about an imagined shoreline and human control of the landscape. The tension of building in what is understood to be "natural" and "scenic" is felt throughout the project. While the bridge and parts of the main interpretive facility sit lightly above the ground and the tunnel exhibition space is largely concealed underground, the combined gesture of these interventions and the trail is bold in its assertion that heightening awareness of human impact in such a place can change a visitor's perspective and bestow upon them a sense of responsibility for the fate of the landscape. Thoreau's assessment of lakes resonates with this project in that the interpretive center becomes as much about how humans manipulate the lake as it does about the lake itself. However, the development of a different way to think of buildings in relation to their context is more important than the final design outcome and its intentions. With regard to interpretive buildings, perhaps the difference between an immersive experience and a paltry one lies in the distinction between the lens and the frame.



47. Final model photos

48. Flora: data collected by FLBS, illustration by author

Trees: Coniferous

- Alpine Rocky Mountain Fir *Abies lasiocarpa or A. bifolia*
- Cedar (Arborvitae) Western Red Cedar *Thuja plicata*
- Douglas Fir *Pseudotsuga menziesii*
- Engelmann Spruce *Picea engelmannii*
- Larch *Larix occidentalis*
- Lodgepole Pine *Pinus contorta latifolia*
- Ponderosa Pine *Pinus ponderosa*
- Rocky Mountain Juniper *Juniperus scopulorum*
- Western Hemlock *Tsuga heterophylla*
- White Spruce *Picea glauca*

Trees: Deciduous

- Aspen and Cottonwood *Poplar*
- Aspen *Populus tremuloides*
- Black Cottonwood *Populus trichocarpa*
- Common Hackberry *Celtis occidentalis*
- Crabapple *Malus*
- Greenes Mountainash *Sorbus scopulina*
- Mountain Alder *Alnus tenuifolia*
- Paper Birch *Betula papyrifera*
- Water Birch *Betula fontinalis*
- Willow *Salix planifolia*

Vines

- Bittersweet *Celastrus*
- Grape *Vitis*
- Honeysuckle *Lonicera*
- Wild Strawberry *Fragaria virginiana*

Grasses

- Buffalo Grass *Buchloe dactyloides*
- Fox Sedge *Carex vulpinoidea*
- Foxtail Barley *Hordeum jubatum*
- Indiangrass *Sorphastrum avenaceum*
- June Prarie Grass *Koelreria macrantha*
- Little Bluestem *Andropogon scoparius*
- Squirreltail *Sitanion hystrix*
- Switchgrass *Panicum virgatum*

Rocky Mountain Maple (Ninebark) *Acer glabrum*

Shrubs

- Alder (Dwarf) buckthorn *Rhamnus alnifolia*
- American Red Raspberry *Rubus idaeus*
- Barberry *Barberis Mahonia repens*
- Bearberry (Kinikinnick) *Arctostaphylos uva-ursi*
- Bitter Wintergreen *Chimophila umbellata*
- Black Currant *Ribes americanum*
- Black Elderberry *Sambucus melanocarpa*
- Black Hawthorne *Crataegus douglasii*
- Bristly Black Currant *Ribes lacustre*
- Buffaloberry *Shepherdia canadensis*
- Canadian Gooseberry *Ribes oxyacanthoides*
- Cedar (Arborvitae) *Thuja plicata*
- Common Saskatoon or Serviceberry *Amelanchier alnifolia*
- Creeping Juniper *Juniperus horizontalis*
- Creeping Mahonia *Mahonia repens*
- Devil's Club *Oplopamax horridus*
- False Solomons Seal *Smilacina racemosa*
- Fool's Huckleberry *Menziesia ferruginea*
- Glandular Labrador Tea *Ledum glandulosum*
- Highbush Cranberry or Squashberry *Viburnum edule*
- Mountain Spray *Holodiscus discolor*
- Oregon Boxleaf, Falsebox *Pachistima myrsinites*
- Red & Yellow Berry Mountain Ash *Sorbus scopulina*
- Redosier Dogwood *Cornus stolonifera*
- Rocky Mountain Maple (Ninebark) *Acer glabrum*
- Rose *Rosa acicularis*
- Shrubby Potentilla or Cinquefoil *Potentilla fruticosa*
- Shubert Chokecherry *Prunus virginiana melanocarpa*
- Snowberry *Symphoricarpos albus*
- Thimbleberry *Rubus parviflora*
- Thinleaf Huckleberry *Vaccinium membranceum*
- Twinberry, Honeysuckle *Lonicera involucrata*
- Twining Honeysuckle *Lonicera dioica*
- Utah Honeysuckle *Lonicera utahonsis*
- Waterton Mockorange *Philadelphus lewisi*
- Western Mountain Heather (Alpine) *Cassiope mertensiana*
- Willow *Salix*
- Yew *Taxus brevifolia*

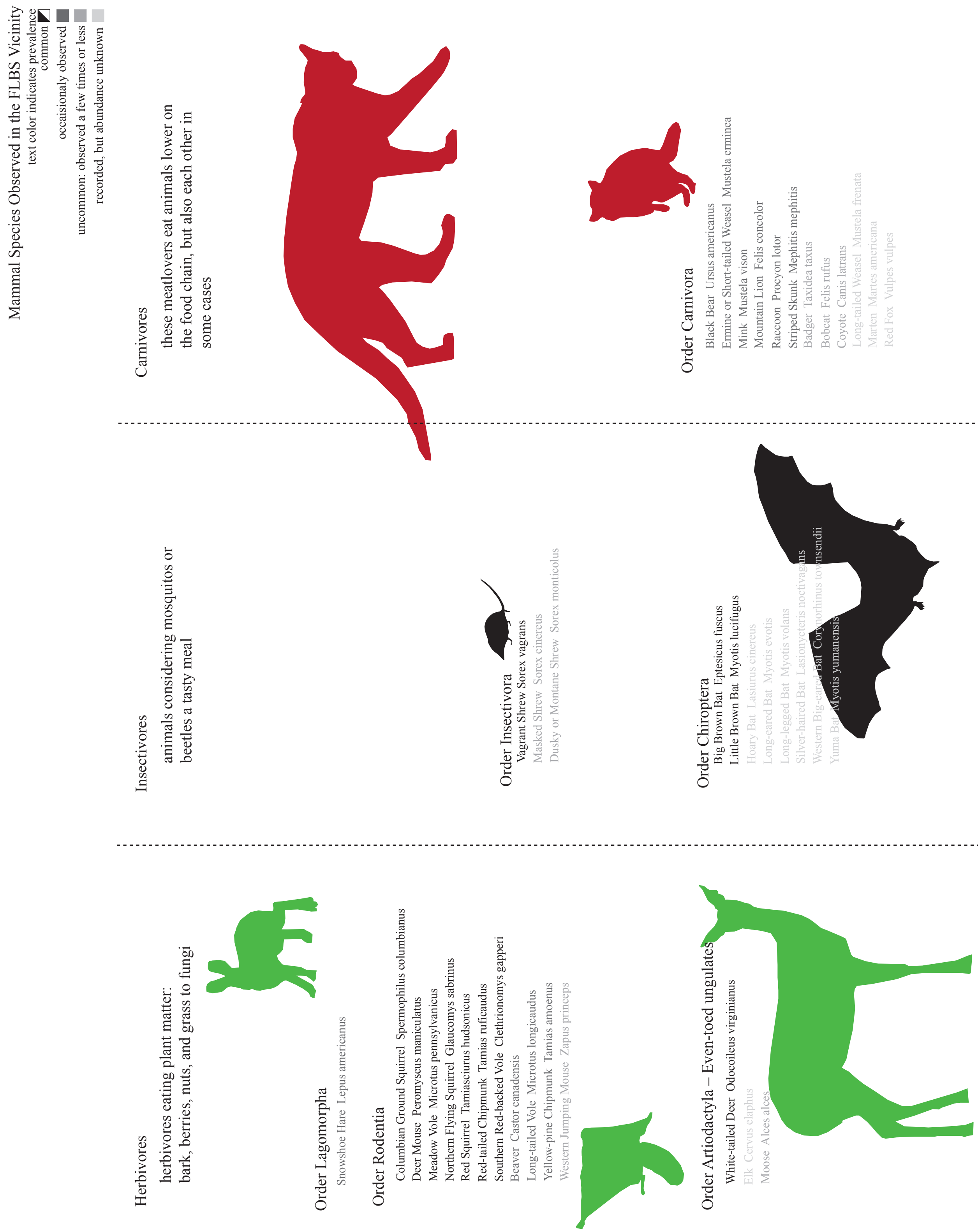
Erect Fireweed *Epilobium angustifolium L*

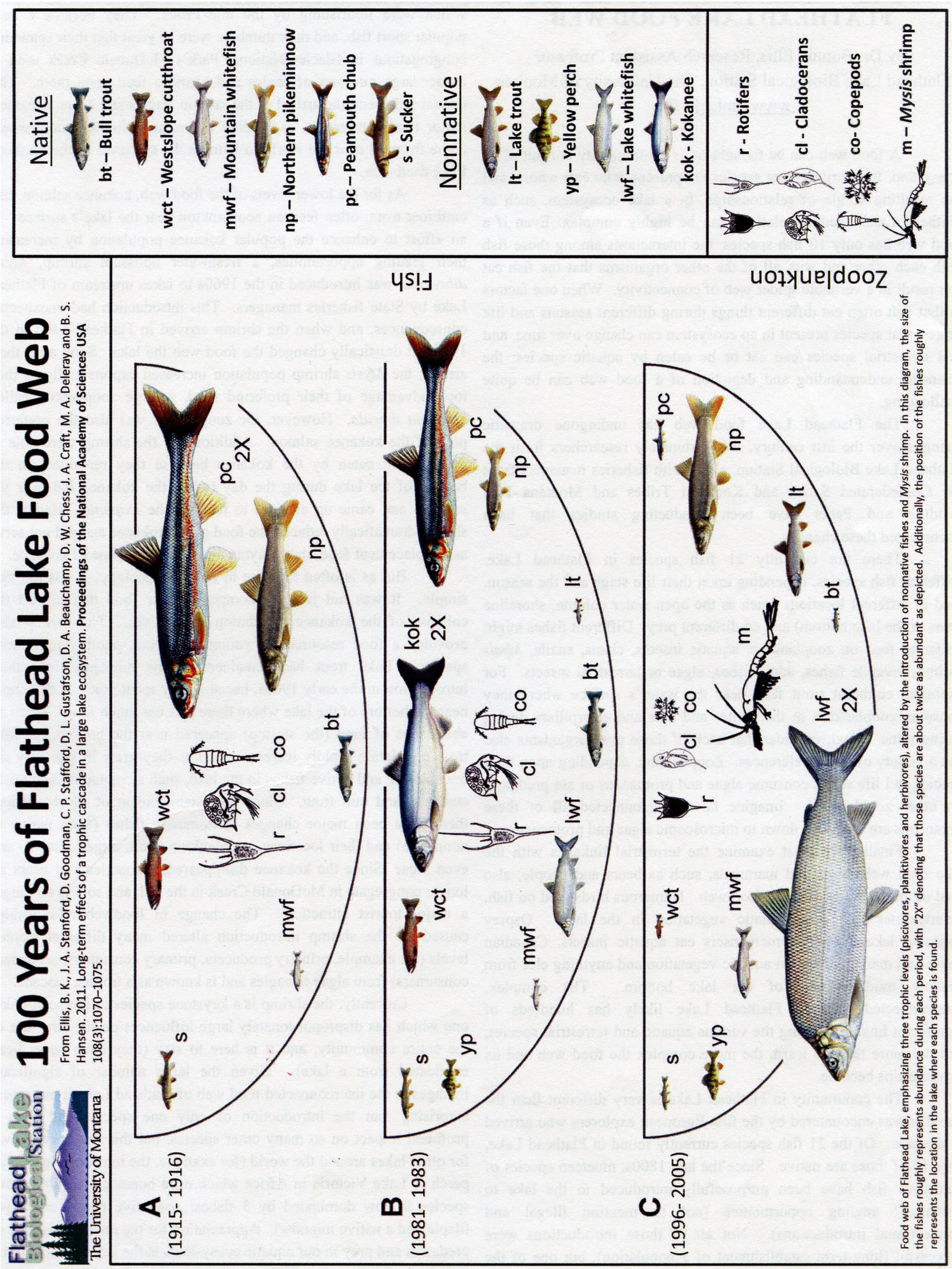
Smooth Aster *Aster laevis*

Perrenials

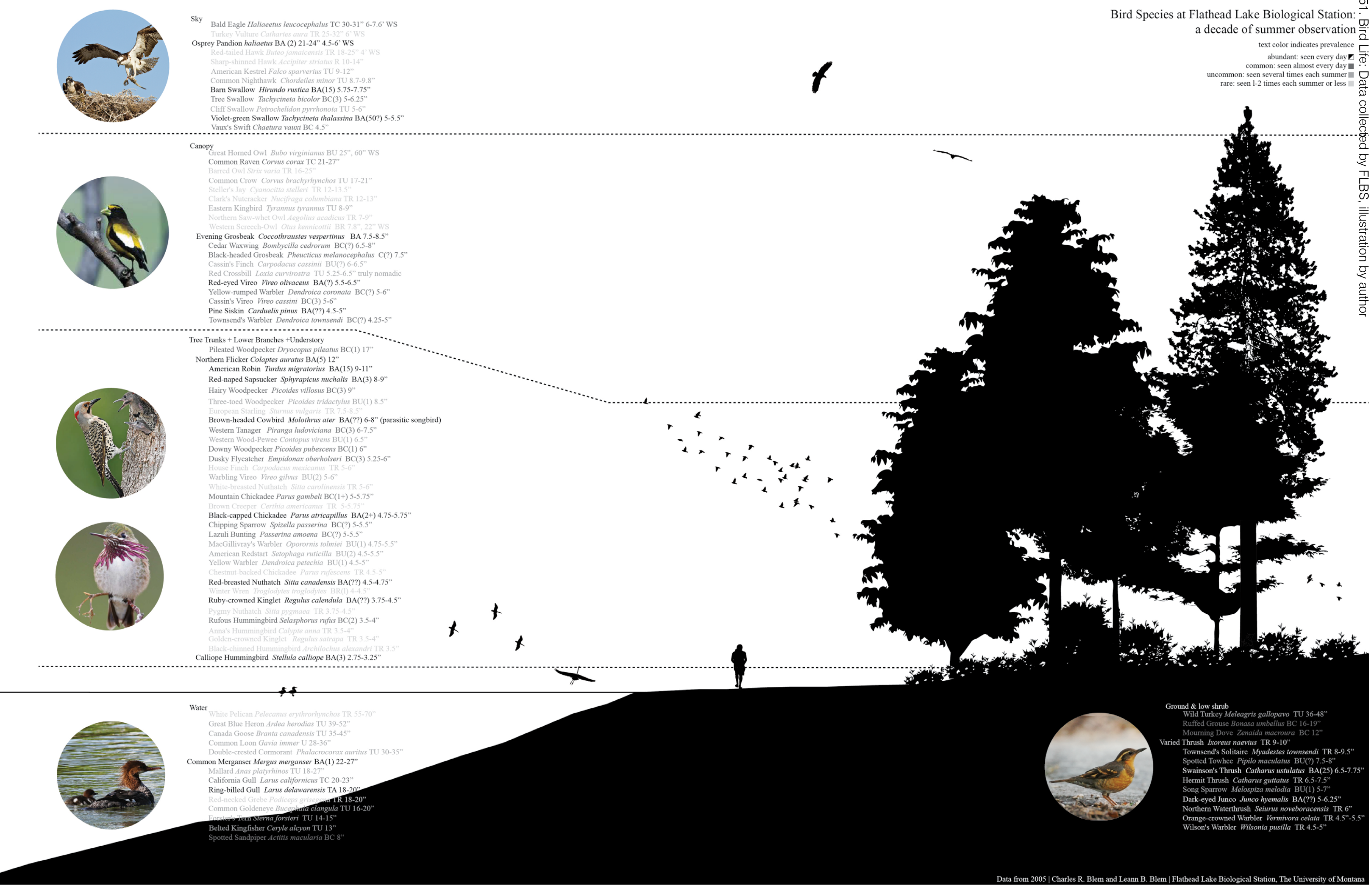
Alpine Broadleaved Fireweed *Epilobium latifolium L*
American Globeflower *Trollius laxus*
American Speedwell *Veronica americana*
American Vetch *Vicia americana*
Artic Aster *Eurybia sibirica*
Arnica *Arnica latifolia*
Arrowleaf Groundsel *Senecio triangularis*
Aspen Fleabane *Erigeron macathus*
Aster Bleabane *Erigeron sp.*
Ball Anemone *Anemone multifida*
Blue Camas *Camassia quamash*
Blue Flax *Linum perenne*
Blue Penstemon *Penstemon albertinus*
Blue Pleated Gentian *Bentiana calycosa*
Bunchberry Dogwood *Cornus canadensis*
Canada Goldenrod *Solidago canadensis*
Canada Thistle *Cirisium arvense*
Common Gaillardia *Gaillardia aristata*
Common Self Heal *Prunella vulgaris*
Cowparsnip *Heracleum lanatum*
Cudleaf Sagewort *Artemisia ludoviciane*
Erect Fireweed *Epilobium angustifolium L*
Gayfeather *Liatris punctata*
Harebell *Campanula rotundifolia*
Horsemint *Monarda fistulosa L*
Indian Paintbrush *Castilleja minuata*
Indian Tabacco/Umbrella Plant *Eriogonum umbellatum*
Jacobs Ladder *Polemonium pulcherrimum*
Larksur *Delphinium bicolor*
Leafybract Aster *Aster foliaceus*
Lyall's Angelica *Angelica arguta*
Mountain Sorrel *Oxygria digyma*
Mountain Spirea *Spirea densiflora*
Nodding Onion *Allium cernuum*
Northern Bedstraw *Galium boreale*
Pasque Flower *Anemone occidentalis*
Pearly Everlasting *Anaphalis margaritacea*
Purple Leafy Aster *Aster Frondosus*
Purple Penstemon *Penstemon fruticosus*
Queencup Beadlily *Clintonia uniflora*
Red Mountain Heath *Phyllococe empetriformus*
Rock Clematis *Clematis columbiana*
Roughfruit Fairybells *Disporum trachycarpum*
Rydbergs Evening Primrose *Oenothera biennis*
Sagebrush Buttercup *Ranunculus glaberrimus*
Shinyleaf Spirea *Spirea betulifolia*
Showy Aster *Aster conspicuus*
Silky Lupine *Luminus sericeus*
Silky Oxytrope *Oxytropis splendens*
Smooth Aster *Aster laevis*
Sticky Geranium *Geranium visosissimum*
Stonecrop *Sedum stenopetalum*
Threeleaf Foamflower *Tiarella trifoliata*
Threepetal Bedstraw *Galium trifidum*
Twinflower *Linnaea borealis*
Twisted Stalk *Streptopus amplexifolius*
Western Rattlesnake Plaintain *Goodyera oblongifolia*
Western Red Baneberry *Actea rubra*
Western Thimbleberry *Rubus parviflorus*
Western Yarrow *Achillea millefolium*
White Penstemon *Penstemon allbidus*
Wild Hollyhock *Lliamma rivularis*
Yellow or Blue Columbine *Aquilegia flavescens*
Yellow Goldenrod *Solidago missouriensis*
Yellow Penstemon *Penstemon flavescens*

49. Flora: data collected by FLBS, illustration by author




Flathead Lake Biological Station
The University of Montana
100 Years of Flathead Lake Food Web
From Ellis, B. K., J. A. Stanford, D. Goodman, C. P. Stafford, D. L. Gustafson, D. A. Beauchamp, D. W. Chess, J. A. Craft, M. A. Deleray and B. S. Hansen. 2011. Long-term effects of a trophic cascade in a large lake ecosystem. Proceedings of the National Academy of Sciences USA 108(3):1070–1075.
A
(1915- 1916)
s
wct
mwf
r
cl
co
pc
2X
np
bt
B
(1981- 1983)
s
yp
wct
kok
2X
pc
np
mwf
r
cl
co
lwf
bt
lt
C
(1996- 2005)
s
wct
yp
mwf
r
cl
co
m
pc
np
lt
lwf
2X
bt
Fish
Zooplankton
Native
bt – Bull trout
wct – Westslope cutthroat
mwf – Mountain whitefish
np – Northern pikeminnow
pc – Peamouth chub
s - Sucker
Nonnative
lt – Lake trout
yp – Yellow perch
lwf – Lake whitefish
kok - Kokanee
r - Rotifers
cl - Cladocerans
co- Copepods
m – Mysis shrimp
Food web of Flathead Lake, emphasizing three trophic levels (piscivores, planktivores and herbivores), altered by the introduction of nonnative fishes and Mysis shrimp. In this diagram, the size of the fishes roughly represents abundance during each period, with "2X" denoting that those species are about twice as abundant as depicted. Additionally, the position of the fishes roughly represents the location in the lake where each species is found.

51. Bird Life: Data collected by FLBS, illustration by author



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JULY 8, 1943.

Hon. FRANKLIN D. ROOSEVELT,
The White House, Washington, D. C.

MY DEAR MR. PRESIDENT: This is the most important letter I have ever written in my life, and I hope it comes to your personal attention because it affects the security and the welfare of 25,000 people directly, and 50,000 people indirectly. I have communicated with you before but have received, in return, answers from your secretary and I feel quite certain in my mind that you did not see the communications addressed to you. However, that is past and those communications were unimportant in comparison with this one.

On June 3 a public meeting was held at Kalispell, Mont., attended by the Bonneville Authority and the Army engineers for the purpose of discussing a proposal to raise Flathead Lake 17 feet by 1945 and 37 feet ultimately. This added water would furnish additional power to Grand Coulee and Bonneville Dams. If this project had gone through as contemplated it would have brought about the destruction of a large lumber industry; it would have affected the number of people enumerated above; it would have brought about the removal from their homes of people who had determined to spend the rest of their lives in the Flathead Valley; it would have inundated something like 50,000 acres of the best agricultural land in the country; it would have wiped out some towns completely, others partially; and it would have made a stinking morass of the most beautiful scenic area in the United States. Because of the opposition, and it was bitter, of the people in western Montana, the Federal authorities decided to look elsewhere for added power and they gave out the statement that the Flathead project as proposed was ended. Since then, meetings have been held at Priest River and Sandpoint in Idaho, and Portland, Oreg., but now the Bonneville people and the Army engineers are back in Montana looking over Flathead Lake again.

I beg you, Mr. President, in the name of my people, to do everything in your power to end this uncertainty in their minds. If we were convinced that tampering with Flathead Lake was a war need we would, I assure you, give our wholehearted assent to what was necessary. However, we do not believe that such is the case and we do know that there are other areas which could be developed, such as the Hungry Horse, Kootenai Lake, and the Cabinet Gorge, which would not affect the economy of the region as the Flathead Lake proposal would. The Flathead has sent between 3,000 and 4,000 of its sons and daughters into the armed forces of the United States to fight to protect their homes and their country. I sincerely hope that when they return they will not find they have won the war abroad only to find they have lost their valley and the homes which they love so much and cherish so dearly.

Montana has made many contributions to the war through its manpower, its buying of bonds, and in giving of its natural resources, but Montana has been treated shabbily since the war started and many of our people have been forced to leave the State for other parts of the country. We feel that we have been and are being treated unfairly in this Flathead matter and I assure you, Mr. President, that this is something that cannot be tossed off lightly. It is deadly serious and some assurance must be forthcoming from Washington so that the uncertainty and the fear which have come to be a part of the lives of our people out there can be done away with once and for all.

I beseech you to do everything in your power to stop this iniquitous activity which is being carried on and to assure the people of western Montana that nothing will be done to alter the status quo there insofar as Flathead Lake is concerned.

I repeat, Mr. President, this is the most important letter I have ever written to anybody and it is not a matter of politics with me but it is a matter of looking after the welfare and security of the people of western Montana. We look to you for help in this moment of urgency. Please do not fail us.

Respectfully yours,

MIKE MANSFIELD.

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