Engaging Wilderness:
A Visitor Center and Ranger Station for the US Forest Service in Central Washington

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Abstract

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The idea of the wilderness as a physical place and as a cultural image has existed since the founding of the United States. Cultural attitudes toward wilderness have fallen into two broad categories: viewing wilderness as a resource to be used for the sake of civilization; and as an amenity that provides a counterpoint to cities. Civilization and wilderness are not opposed, rather they are on a spectrum, with places being more urban or more wild. Architecture can mediate between resource and amenity views of the wilderness by emphasizing the experiential qualities of being in the wilderness, and by using sustainable and responsive design to support resource conservation. The United States Forest Service (USFS) manages the conservation of millions of acres of public land as a resource to be used in perpetuity and as a recreation amenity. This thesis demonstrates how the architecture of Forest Service buildings can be both a steward of the the land and enhance the visitor experience in wilderness. It proposes a new ranger station and visitor center in the Wenatchee National Forest in Leavenworth, Washington as part of the USFS' national network of built infrastructure. This thesis demonstrates how architecture facilities for a government agency focused on environmental sustainability can be equally sustainable.

ENGAGING WILDERNESS

A VISITOR CENTER + RANGER STATION FOR THE US FOREST SERVICE IN CENTRAL WASHINGTON

Master of Architecture Thesis

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INTRODUCTION

Nature continues to play a primary role in the shaping of America's cultural identity. The idea of the wilderness as a physical place and as a symbolic image has existed since the founding of the United States. Cultural attitudes toward wilderness have fallen into two broad categories: viewing wilderness as a resource to be used for the sake of civilization; and as an amenity that provides a counterpoint to cities.

The notion that there is a separation between civilization and wilderness, is a false separation, an artificial boundary that reinforces the idea that wilderness should be devoid of anything suggesting a human presence. This approach ignores the effect humans have had historically on shaping and inhabiting the wilderness. Civilization and wilderness are not opposed, rather they are on a spectrum, with places being more urban or more wild. This spectrum definition of wilderness allows for a greater understanding of how humans occupy and build in wilderness. Given varied cultural viewpoints of the wilderness as a resource or an amenity, how can architecture mediate between differing viewpoints?

Architecture can mediate between Resource and Amenity views of the wilderness by emphasizing the experiential qualities of being in the wilderness. Architecture can emphasize a connection to place, engage attention, provide sensory experiences, and provoke a sense of exploration and discovery. Architecture can

also use sustainable and responsive design to support resource conservation while enhancing visitor experiences.

The United States Forest Service (USFS) manages public land as both a material resource to be used and as a recreation amenity. Their network of architecture and infrastructure, of buildings, trails and campgrounds spans across the nation. America's cultural image of the wilderness as a protected and valued natural resource calls for a new approach to the built environment that reflects the natural environment it strives to conserve and protect.

The architecture of Forest Service buildings can be both a steward of the the land and enhance the visitor experience in the natural environment. This thesis demonstrates how architecture facilities for a government agency focused on environmental sustainability can be equally sustainable. It proposes a new ranger station and visitor center in the Washington state as part of the USFS' national network of built infrastructure. The ranger station serves as basecamp for regional forest service operations, as an information center for the public and as a place for environmental education.

fig. 1 - America's cultural identity is based in part on the relationship to nature.

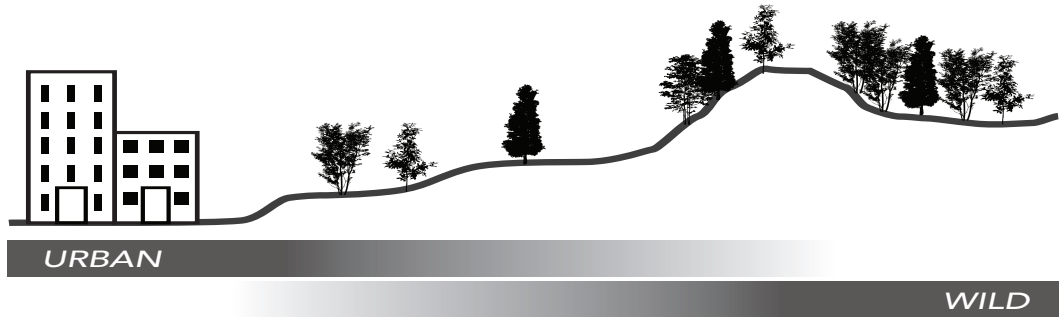
2

AMERICAN WILD // WILD AMERICAN

SHIFTING ATTITUDES TOWARDS NATURE AND WILDERNESS

The concept of the wilderness as a physical place and cultural image has played a significant role in the United States since its founding. But the meaning of this "natural landscape" is not fixed, it is tied to cultural perceptions that have changed over time. As William Cronon has observed, the typical notion of "wilderness" is an untouched nature located far from the reaches of man and civilization.[1] He argues that this perceived separation between civilization and wilderness is an artificial division. Cronon argues the "implication of this boundary is that the two should be kept quite separate, and that wilderness in particular should be devoid of anything suggesting an ongoing human presence."[2] This approach ignores the enormous effect humans have had on shaping and inhabiting the wilderness.

The term "wilderness" defies a simple explanation. Environmental historian Roderick Nash notes "there is no specific material object that is wilderness. The term designates a quality (as the '-ness' suggests) that produces a certain mood or feeling in a given individual and… is so heavily freighted with meaning of a personal, symbolic, and changing kind as to resist easy definition."[3] Etymologically the word wilderness means "a place of wild beasts."[4] The term was historically used to describe uninhabited places where civilization was absent, an uncultivated and unpopulated place. Nash argues that applying



City park

What happens here?

Remote trail

these definitions of wilderness to specific tracts of land is problematic, raising the question of the degree of human presence in wilderness. How wild must an area be to be considered wilderness? How much civilization is allowed to still be considered wilderness?[5] Rather than define wilderness and civilization in absolute terms, Nash offers a "spectrum of conditions or environments ranging from the purely wild on the one end to the purely civilized on the other - from the primeval to the paved."[6] Near the most wild end of the spectrum the influence of humans is infrequent and the presence of built infrastructure is reduced to a minimum. On the civilized end, human presence increases and "nature" may be experienced as a city park. Nash argues "wilderness" can thus be defined as the range from the middle to the "natural" end of this range.[7] A spectrum definition of wilderness is less absolute: the presence of an occasional trail or campground does not exclude an area from being considered wilderness, rather it moves it along the spectrum slightly closer toward civilization. Wilderness does not exist on its own apart from humanity and civilization but rather it is a product of human creation.[8] Wilderness must thus be understood as a human construct, which has been used as a resource, a frontier, and an amenity throughout US history.

fig. 2 - The Urban/Wild spectrum is more useful for understanding wilderness than a static definition.
fig. 3 - A spectrum definition of wilderness includes everything from city parks to remote trails.

WILDERNESS AS RESOURCE

"The conquest of wild country gave meaning and purpose to pioneer existence."
Nash, American Wilderness in Historical Perspective, 3

In America the concept of wilderness emerged as early as the founding of the first settlements that set up the contrast between civilized and wild realms. As Roderick Nash notes above it was the conquering of the "wild" lands that defined cultural attitudes. He observes that wilderness at this time was considered a dangerous unknown landscape. Pilgrim writer William Bradford noted in 1620 that they could not see much of the landscape in New England, only "a hideous and desolate wilderness, full of wild beasts and wild men - and what multitudes there might be of them they knew not."[9]

Settlers and frontiersmen of this period needed to clear this untamed land in order to survive and create permanent settlements. According to Nash, forests were seen as "the most formidable barrier standing between [settlers] and success."[10] Those densely wooded areas were harvested for lumber and land was cultivated for agricultural production. Settlers took control of the land acre by acre using the wilderness as a means to ensure their survival. Their attitudes toward nature is reflected in historic accounts that characterized the wild country as an "enemy to be conquered, subdued, or vanquished by a pioneer army."[11] Settlers perceived the wilderness as a savage, raw territory to be tamed and converted into a useful resource.

European-American settlers viewed Native Americans as part of the dangerous wilderness to be conquered. As Cronon observes, ignoring the presence of indigenous cultures on the landscape perpetuates "a cultural myth that encourages us to 'preserve' peopleless landscapes that have not existed in such places for millennia."[12] The perception of nature as a resource to be controlled and conquered continues to influence how we view wilderness today. The idea that humans must tame the wilderness in order to build a civilization are still evident in how present day organizations seek to manage forest landscapes.

fig. 4 - Landscape painting highlights the contrast between untamed wilderness and a pastoral settlement
fig. 5 - Landscape painting showing a frontier family creating a living by overcoming the wilderness

WILDERNESS AS FRONTIER

"[The] attraction of primitivism... [the belief that] the best antidote to the ills of an overly refined and civilized modern world was a return to simpler, more primitive living."
Cronon, The Trouble With Wilderness, 7

In American history the term frontier is linked to the boundary between the wild and civilized, and between the known and unknown. Pioneers "referred to the continually moving line at which their civilization abutted the wilderness as the 'frontier'."[13] This view of frontier wilderness depends entirely on a cultural attitude separating civilized from uncivilized places. The "myth of the frontier" refers to the idea that wilderness offers boundless opportunities and places value on self-reliance. As William Cronon argues, the wilderness was seen as an escape from civilization, a return to a more primitive, simpler life. A key element of the the frontier myth "was the powerful sense among certain groups of Americans that wilderness was the last bastion of rugged individualism."[14] As seen in Figure 6, *Across the Continent*, the railroad symbolizes progress, forming the dividing line between nature and settlement. The growing perception was of the wilderness as a more pure and freer place than urban cities.

In the 1890s Frederick Jackson Turner was highly influential in linking America's national identity to the wilderness. His writing about the "myth of the frontier" caused "many Americans began to ponder the significance of wilderness in shaping them as individuals and as a society."[15] With the rise of industrialization and urbanization, the frontier was increasingly encroached upon by civilization. Turner argued that if the frontier was the source of national character, then the impending loss of the frontier threatened the country's identity. Turner's argument positioned the American frontier as a fleeting part of the United States' cultural identity that could be lost if the frontier was lost. According to Cronon, Turner's writings changed American attitudes toward wilderness. "The myth of the vanishing frontier lay the seeds of wilderness preservation… To protect wilderness was in a very real sense to protect the nation's most sacred myth of origin."[16] If American identity relied on the wilderness, then it was necessary to protect and conserve this natural landscape.

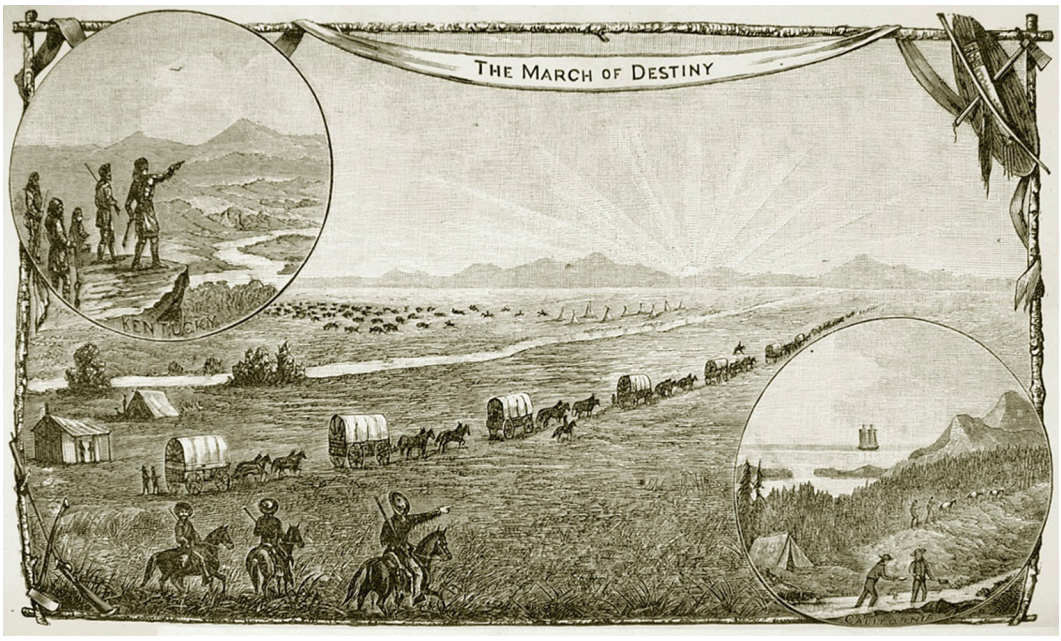


fig. 6 - Across the Continent: Westward the Course of Empire Takes Its Way
fig. 7 - Conquering the Wilderness: The March of Destiny

WILDERNESS AS AMENITY

"Wild, natural objects such as mountains and forests ceased being regarded as 'horrible' and were deemed worthy of awe and admiration."
Nash, American Wilderness in Historical Perspective*, 6*

Environmental historians agree that Americans' attitudes toward wilderness began shifting in the 1800s. There was a growing belief that the natural landscape held value beyond just as a resource for raw goods. Roderick Nash states that the wilderness was viewed as a place of purity "uncorrupted by man's artificial constructions, [and for] some Americans the ideal medium for the perception and worship of God."[17] Cultural attitudes toward wilderness had shifted from a desire to control a fearful place to a desire to be present in and experience the wilderness. This was not a wholesale cultural shift, but rather the emergence of a more nuanced response to wilderness.

Nash argues that with industrialization and urbanization, Americans became increasingly separated from the wilderness. No longer needing to experience the natural landscape in terms of everyday survival, the need to conquer and control that landscape lessened. This shifting perception of the wilderness from a position of survival to leisure allowed people to appreciate it for other reasons.[18] Rather than being seen as an uninhabited place to be conquered and consumed, this wilderness became a destination, a place for urban dwellers to experience a less domesticated landscape.

As seen in Asher B. Durand's *Kindred Spirits* of 1849 (Figure 8), the landscape is depicted as an idyllic retreat for the artist, Thomas Cole, and the poet, William Cullen Bryant. By spending more leisure time in the natural environment, people began to see beauty and spirituality in these kinds of panoramic vistas. Landscapes were described as sublime, so beautiful and awe-inspiring that they had a spiritual impact on the spectator.

Influential writers of the time, including Ralph Waldo Emerson, Henry David Thoreau, and John Muir helped to change public attitudes toward the outdoors. Thoreau, writing of his experiences at Walden Pond, argued for finding a balance

fig. 8 - The painting Kindred Spirits *shows landscape as an enjoyable destination for artists and writers.*
fig. 9 - Looking Up The Yosemite Valley*, an 1865 painting by Albert Bierstadt.*

between civilization and wilderness, stating that neither was sufficient on its own.[19] Painters from the Hudson River School also captured scenes of sublime landscapes that conveyed awe-inspiring scenes of the wilderness. Albert Bierstadt's 1865 painting *Looking Up The Yosemite Valley* features the sublime wilderness landscape, representing an expanding movement that viewed wilderness as an untainted source of spirituality (Figure 9).

A series of key events in the second half of the nineteenth century solidified the perception of the wilderness as an amenity. In 1864 the US government granted the state of California control of Yosemite Valley provided that they manage the wilderness "for public use, resort, and recreation."[20] Even though the area was small, it set the precedent of preserving land in the public domain.[21] In 1872 the US Congress created Yellowstone National Park in Wyoming, Montana, and Idaho to preserve over 3,500 square miles of wilderness. Nash argues this was "the world's first act of large-scale wilderness preservation in the public interest," but that it was done so to preserve the natural "curiosities" of the landscape as a spectacle.[22]

In 1885 a large forest preserve was set aside in the Adirondack region of New York to protect the watershed that supplied New York City with drinking water and provided water to the Erie Canal commercial waterway.[23] Finally the creation of Yosemite National Park in 1890 expanded the area of preservation from the 1864 boundaries and was "the first to be undertaken with the understanding that it was wilderness, not geysers or a watershed, which was being protected."[24]

In 1881 the Division of Forestry was created under the Department of Agriculture. This initial organization studied and reported on forest issues, but lacked authority to implement policy changes. As national awareness grew during the following years, "it was apparent to many that the remaining forests represented a great, but vulnerable, national asset that needed to be protected from unbridled despoliation for the sake of posterity."[25] The first official move towards protecting the nation's forests came in 1891 with the Forest Reserve Act which

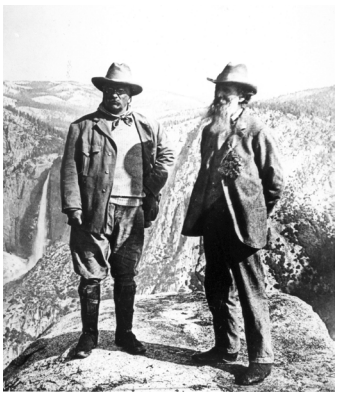


fig. 10 - Teddy Roosevelt and John Muir in the newly formed Yosemite National Park.
fig. 11 - A tourist at the Grand Canyon, another early landscape preserved for its sublime qualities.
fig. 12 - Backcountry Forest Service crew at the Eight Mile Guard Station in the Okanogan-Wenatchee National Forest.
fig. 13 - The outdoors were viewed as a place of recreation, offering experiences not available in the city.

allowed for forested land to be set aside as national reserves and put millions of acres of timber land in the west under federal protection.[26] In 1905 management of these forests were put under the authority of a new organization, the United States Forest Service.

The founding of the Forest Service marked official acknowledgement that wilderness lands could be used for both material resources and for the public good. Cultural attitudes toward the wilderness changed from being either resource or amenity focused, to an understanding that both are important and must coexist on the same land. The United States Forest Service was founded under the direction of Gifford Pinchot, the first Forest Service Chief. During this era the rangers' activities focused on creating maps and trails for the public, regulating grazing permits, and preventing forest exploitation.[27] Their role as stewards of the land enabled them to mediate both the resource view of the wilderness held by commercial organizations, and the amenity view of the wilderness held by the general public.

Throughout the history of the United States, Americans' attitudes toward wilderness shifted from viewing it as a dangerous setting, to a resource to be used in service of civilization, to an amenity to be protected and enjoyed. At the nexus of these potentially conflicting interests the United States Forest Service is charged with both conserving forest resources and managing public access to federal lands.

fig. 14 - Loggers in Northern California taking a break while felling a redwood tree.
fig. 15 - Forest Ranger and day use visitors at Eagle Creek in Oregon.

3

EXPERIENCE // PERFORMANCE

ROLE OF ARCHITECTURE IN MEDIATING RESOURCE + AMENITY VIEWS

Architecture can mediate between resource and amenity views of the wilderness by improving the experiences of wilderness visitors and by reducing the negative impacts of buildings and users on the environment. Architecture can emphasize the experiential qualities of being in the wilderness by emphasizing a connection to place, engaging attention, providing sensory experiences, and provoking a sense of exploration and discovery. Architecture can reduce humans' impact on the wilderness through sustainable and responsive design that supports resource conservation.

Architecture designed to maximize sustainability can simultaneously reduce resource consumption and minimize impact on local ecosystems.[28] There are now many standard metrics for assessing a building's sustainable qualities, the most well known of which is LEED (Leadership in Energy and Environmental Design).[29] Among other requirements, LEED rewards reduced energy and water use and decreased greenhouse gas emissions.[30] Another particularly rigorous metric is the Living Building Challenge. Certification criteria include having net positive energy and water use (by producing more onsite than is consumed) and using ecologically friendly materials produced near the project.[31]

Living Buildings are an example of "off-the-grid" architecture because they are not connected to a municipal utility system. These buildings do not get electricity, water, or waste disposal from a utility company and thus must use alternative solutions to provide basic building amenities. Once constructed, off-the-grid buildings are resource self-sufficient and their reduced resource demand minimizes their negative impact on local ecosystems. Highly sustainable buildings are also referred to as "high performance buildings."[32] Living Building criteria focus on both buildings and occupants by promoting healthy interior environments for employees and visitors. Two metrics in particular seek to create "environments that optimize physical and psychological health and well being"[33] and "nurture the innate human/nature connection."[34]

High performance, off-the-grid buildings provide a framework for architecture to be experientially engaging and resource efficient. By achieving net zero energy, water, and waste, built facilities can teach resource conservation and be stimulating places to visit and work.

fig. 16 - Active systems like solar panels aid in energy production onsite and are a teaching tool at the Omega Center.
fig. 17 - Passive systems like sun shading reduce energy consumption and give form to the Mojave Ranger Station.

EXPERIENCE

There are many experiential conditions associated with being in the wilderness. Although this is not an exhaustive list of wilderness experiences it does include experiences which architecture can enhance, particularly how visitors identify a place as being unique and how they move through and inhabit a space.

CONNECTION TO PLACE

Every place has specific experiential qualities that define it, including temperature, seasonal change, materiality, and lighting. Wilderness spaces are experienced moment by moment and those experiences change throughout the day and across seasons. Visiting a place in early morning or late afternoon are two different experiences with different qualities. Architecture can emphasize a connection to place by highlighting natural daylighting, using local materials, and providing seasonal experiences.

FOCUS ATTENTION NEAR & FAR

Being in the woods allows attention to focus on both the immediate and the distant. Attention varies between the scale of a leaf or pine cone and a distant mountain range. Architecture emphasizes these qualities through material use, sight lines, and careful attention to detailing.

SENSORY ENGAGEMENT

A walk in the woods engages all senses: feeling the warmth of dappled sunlight through trees, hearing a bird chirp or stream gurgle, or feeling a gentle breeze. Architecture can support sensory engagement experiences by focusing on materials and a connection between the building and the landscape.

EXPLORATION & DISCOVERY

Moving through the wilderness is done on set paths and trails, but there is always the opportunity to move off the trail and freely explore an area. Architecture integrated into the landscape supports movement into, through and out of buildings, merging the interior with the exterior and encouraging exploration.

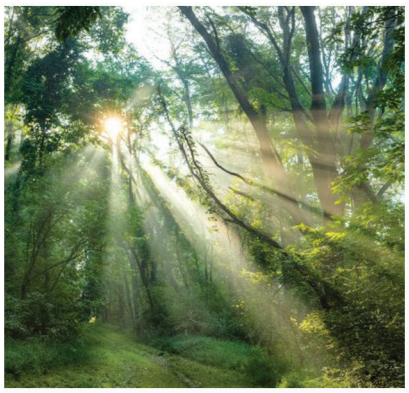
CONNECTION TO PLACE 	Understanding this specific *place* through materials, climate, daylight, and seasonal change.	
FOCUS ATTENTION NEAR & FAR 	Attention focused on the small, immediate scale and on the long range scale.	
SENSORY ENGAGEMENT 	All senses engaged at multiple scales.	
EXPLORATION & DISCOVERY 	Opportunities for exploration and discovery. A set path to deviate from and return to.	

fig. 18 - Diagram of wilderness experiences.

PERFORMANCE

Architecture can reduce humans' impact on the wilderness through sustainable and responsive design that supports resource conservation. Architecture can use local materials, pursue net zero water and energy use, and reduce material consumption during construction.

MATERIALS

Using unique and locally sourced materials gives the building a quality of being from "here" and reflects the region's vernacular architecture, even if the form changes. Careful design and construction methods can reduce resource consumption. Buildings can be designed to allow deconstruction or adaptation in the future.

ENERGY

Architecture can support energy production and reduce energy consumption. Energy can be produced onsite from solar panels, ground source heat pumps, or wind turbines. Energy consumption can be reduced by decreasing heating and cooling costs through natural ventilation, and lighting costs through natural daylighting. Architecture should strive for net zero energy use on an annual basis.

WATER

Rain water and snow can be captured onsite and stored in cisterns for non-potable uses, or treated onsite for use in the buildings. Bioswales and constructed wetlands can treat grey water and storm water runoff before it reenters local streams. Architecture should strive for net zero water use on an annual basis.

WASTE

Careful planning and construction can minimize waste production while building new structures. Waste from sitework or construction can be recycled or reincorporated into a project later in the process. Designing a building to be taken apart reduces future building waste.

MATERALS	Locally sourced materials that provide unique connection to this *place*. Reduce resource consumption.	
ENERGY	Reduce resource consumption by achieving net zero energy use.	
WATER	Reduce resource consumption by achieving net zero water use	
WASTE	Reduce resource consumption by minimizing waste production.	

fig. 19 - Diagram of performance strategies for architecture.

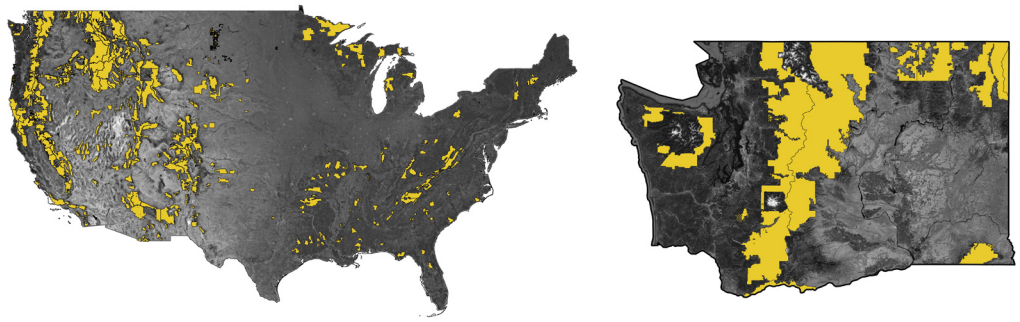
4

UNITED STATES FOREST SERVICE

An agency of the US Department of Agriculture, the United States Forest Service (USFS) manages over 193 million acres of the country's national forests and grasslands. Officially established in 1905, the mission of the organization is to "sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations."[35] The USFS is the largest forest research organization in the world, one of the largest wildland firefighting operations, and manages the largest land area for outdoor recreation in the United States. Their everyday work seeks to find a balance between resource use and protection, and public recreation. Forest Service employees organize logging and resource use; manage conservation of vegetation and wildlife habitat; fight wildfires and research wood products; and construct, maintain, and operate trails, campgrounds and amenity facilities.

The United States has 154 national forests in 44 states. Each national forest is subdivided into ranger districts with local ranger stations. This allows Forest Service employees to better understand their specific forest ecosystem and visitor needs. The Forest Service has over 35,000 employees nationally including foresters, ecologists, engineers, range conservationists, firefighters, surveyors, hydrologists, archaeologists, soil scientists, fisheries and wildlife biologists, geologists, heavy equipment operators and mechanics, and recreation managers.[36]

fig. 20 - 1914 Fire Patrol Vehicle
fig. 21 - Horse and Ranger in the Okanogan-Wenatchee National Forest backcountry
fig. 22 - 1927 logging operation on the Okanogan-Wenatchee National Forest
fig. 23 - Wenatchee Hotshots firefighting crew



The dual view of wilderness as resource and amenity continues to be evident in how the Forest Service operates today. The forests must be both a place to harvest materials and a site to recreate in nature. Much of the USFS' budget is spent on preventing and fighting forest fires. After a particularly large and destructive forest fire in 1910, the Forest Service established standards for fighting forest fires including hiring large crews of seasonal firefighters and creating fire fighting bases.[37] Firefighting operations occur during the peak summer visitor season. Many permanent fire bases are incorporated into ranger stations which accommodate this utilitarian function alongside their public amenities and visitor centers.

The Forest Service controls the natural resources on forest lands. Timber resources are cataloged, logged and sold to timber mills. In many places the public is still allowed to gather firewood from national forests. Logging operations take place on the same forest lands that have hiking and biking trails, campgrounds and recreational roads, and sensitive wildlife habitat. The Forest Service must balance the material resource needs of the region with the publics' desire for accessible outdoor spaces and remote wilderness areas.

The Forest Service builds and maintains campgrounds, hiking trails, and boat launches for public recreation. In Washington State alone, there are over 300 campgrounds and thousands of miles of backcountry trails.[38] In addition to the ranger stations and visitor centers, these recreation sites are the infrastructure through which many Americans interact with national forests and the outdoors.[39]

fig. 24 - Map of all 154 National Forests and 20 Grasslands in the United States
fig. 25 - Map of National Forests in Washington

fig. 26 - Day hikers exploring the forest
fig. 27 - Logging on the Wenatchee National Forest
fig. 28 - Rangers on the Willamette National Forest
fig. 29 - Backpackers in the Mt. Hood National Forest

USFS ARCHITECTURAL HISTORY

The architecture of the Forest Service from the last century can be categorized into distinct eras. During each era the Forest Service prioritized different criteria in designing their buildings. The Forest Service began developing recreation sites in 1916 by building campgrounds and cabins in popular and scenic forest areas near cities. The first campground was at Eagle Creek outside of Portland, Oregon in the Mt. Hood National Forest.[40] This first site included an entrance station, campgrounds, bathrooms and fireplaces (Figure 30). These early built works were designed in a "rustic" style. The rustic style "arose out of concern over the effects of the advancing Industrial Age. Proponents believed that mass production threatened people's appreciation of natural materials and craftsmanship."[41] The "rustic" style prioritized use of natural, local materials and handcraftsmanship. At Eagle Creek this is seen in the heavy rock bases and log construction of the information station, and campsite table, and kitchen (Figures 31, 32).

During the Great Depression in the 1930s, the Civilian Conservation Corps (CCC) and Works Progress Administration (WPA) built recreation facilities for many Forest Service sites. The Forest Service began employing professional architects and landscape architects to create facility improvement plans and design more recreation amenities. A 1936 USFS report catalogued existing building types and created drawings of typical built works including campgrounds, day-use shelters, roads, and trails. To provide more amenities to forest visitors and meet infrastructure demands, new building types were designed and standardized. New built works included camping shelters, scenic vistas, amphitheaters, bathhouses, playgrounds, fire lookout towers and ski areas.[42]

The "rustic" style continued to dominate during the CCC era. The standardization of building types and the expansion of facilities resulted in visually similar Forest Service buildings nationally. "Stone masonry and log structures predominated, and the massive scale of structural elements and site furnishings implied permanence and connection to the landscape."[43] The criteria

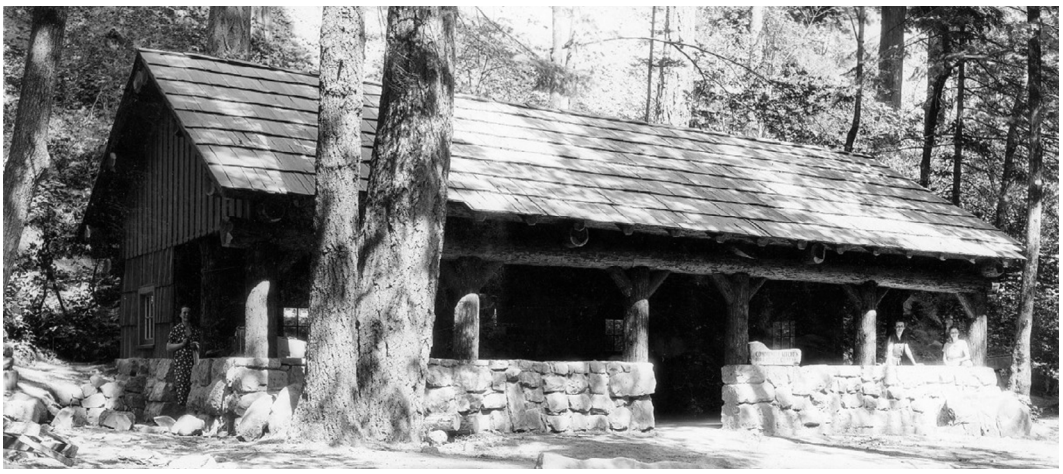


fig. 30 - Information station at Eagle Creek
fig. 31 - Camp kitchen and log picnic table at Eagle Creek
fig. 32 - Camp kitchen at Eagle Creek
fig. 33 - CCC built day use shelter and group kitchen

during this era was to create a national visual identity of Forest Service buildings based on the existing "rustic" style. Buildings expressed natural materials and showcased details and craftsmanship (Figure 34). Regional variations occurred to reflect local materials, but they all followed the "rustic" style (Figures 35, 36, 37).

The CCC completed a staggering number of public works projects nationally: 48,060 bridges, 13,513 cabins and dwellings, 10,231 fire lookout houses and towers, 707,226 miles of forest roads, 142,102 miles of foot trails, 101,777 acres of campground development.[44] Given the consistent "rustic" style and the sheer number of built works, buildings from this era became the default Forest Service style for the following decades.

In the 1950s and 1960s the Forest Service undertook a program called "Operation Outdoors" to upgrade its facilities. Forest Service architecture from this era "consciously departed from the nostalgic rustic style and embraced the tenants of the international style and modern design."[45] Buildings and infrastructure focused on functional, simple modern designs with manufactured materials instead of handcrafted natural materials. These buildings had little ornamentation compared to previous eras and materials did not have to be natural or locally sourced (Figures 38, 39, 40).

In the decades since "Operation Outdoors" the Forest Service continues to use and maintain many of the Modern era buildings alongside the rustic CCC era buildings. The Forest Service maintains these older facilities and attempts to adapt them to the current and future needs of the agency and the public. In the early 2000s the Forest Service worked with architects and landscape architects to write the *Built Environment Image Guide* to serve as a design guide for Forest Service architecture across the country.[46] This document is intended to create a cohesive architectural vision for the Forest Service across all national forests. The *Built Environment Image Guide* recommends a regional approach to design, understanding that a ranger station in Washington has a different site context than a ranger station in New Mexico.[47] However, the *Built Environment Image*

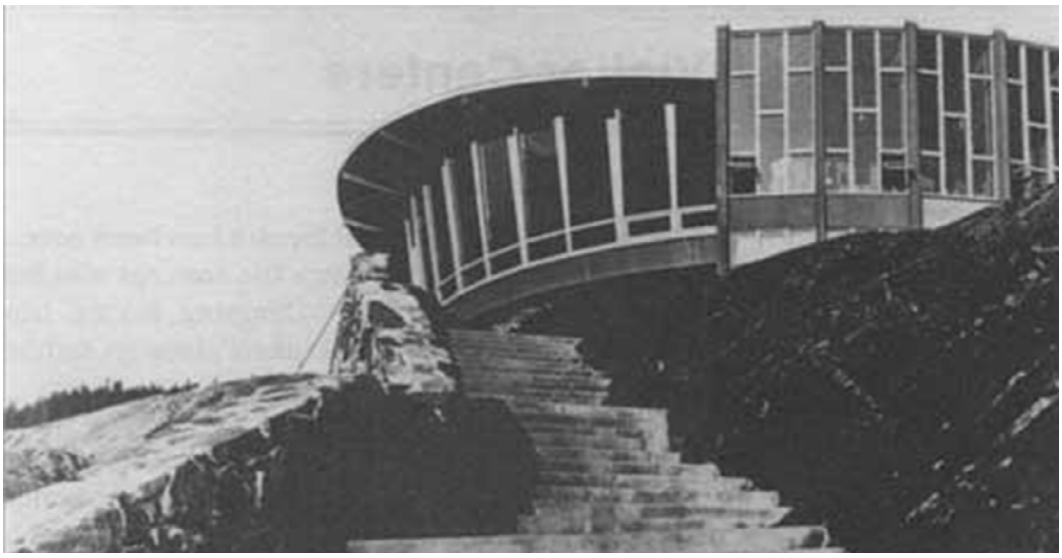


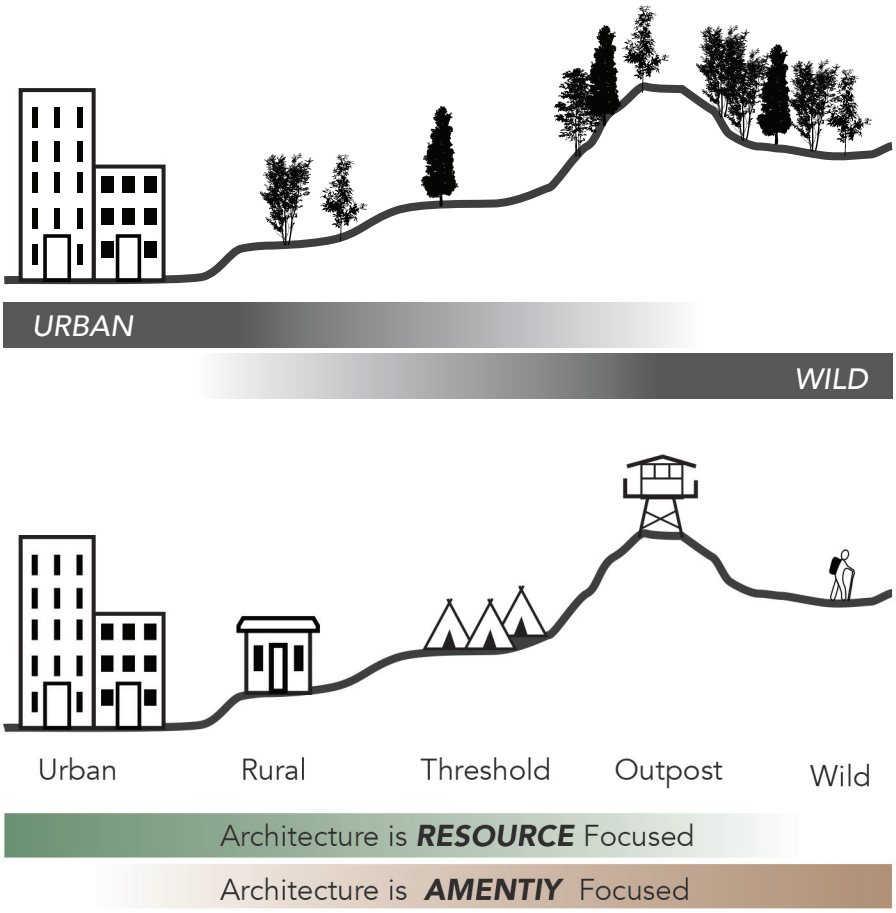
fig. 34 - CCC built Chelan Ranger Station on the Wenatchee National Forest
fig. 35 - CCC built fire lookout on the San Juan National Forest - 1939
fig. 36 - Picnic shelter built by the CCC shows off rustic log construction
fig. 37 - CCC built ranger station on the Bighorn National Forest - 1938
fig. 38 - Mendenhall Glacier Visitor Center on the Tongass National Forest - 1961

Guide proposes a return to the rustic aesthetic rather than addressing current needs of the public and Forest Service employees.[48]

Previous eras of Forest Service architecture prioritized a range of values from the 1930s "rustic" style, to the 1960s "modern" materials and designs, to the current trend of returning to the rustic aesthetic of the CCC era. The criteria valued during previous eras do not reflect the need for sustainability today. The architecture of the Forest Service needs new design criteria to reflect the resource demands and sustainability values of today, while still respecting the existing building typologies and the urban/wild spectrum. The US Forest Service works to conserve nature, their buildings must do the same. The architecture of the USFS can be a steward of the land and enhance visitor experiences in nature.

Architecture can mediate between civilization and wilderness by reducing the negative impacts of buildings and users on the environment, and by improving the experience of people who visit these places. The Forest Service needs a new architectural framework: a dual focus approach that emphasizes the experiential aspect of being in the wilderness and highly sustainable building performance. By achieving net zero energy, water, and waste, these built facilities can help communicate the values of the USFS, be healthy and comfortable workplaces, be sites to teach resource conservation, and stimulating places to visit. The cultural image of the wilderness as a protected and valued natural resource calls for a new approach to the Forest Service built environment that reflects the natural environment it strives to conserve and protect.

fig. 39 - Region 6 Forest Science Lab in Olympia, Washington - 1967.
fig. 40 - Colville National Forest Headquarters in northeastern Washington.
fig. 41 - Prefabricated concrete pit toilet bathroom, one of many across National Forests in the northwest.
fig. 42 - Cabinet Ranger District on the Kootenai National Forest in western Montana.



USFS BUILDING TYPOLOGIES

From its inception the United States Forest Service has sought to mediate between their task of managing and conserving natural resources and facilitating public access to the outdoors. This struggle is evident in their complex built infrastructure that must provide shelter for administration of the agency and amenities for public recreation. USFS buildings must be a balance between workplace and public interface, serving the daily needs of employees and also accommodating forest visitors. These buildings can be classified into categories based on how they function in relation to these two distinct uses and based on their location on the spectrum between civilization and wilderness.

fig. 43 - Diagram of Urban-Wild Spectrum

URBAN

These buildings are in urban areas and are focused on the practical administrative needs of the Forest Service. They house regional and national administrative offices and are used by USFS employees. The Region 6 administrative office that serves Oregon and Washington is in an 18-story office building in downtown Portland, Oregon.[49] These buildings are designed purely as agency offices and the public does not use them for forest recreation.

fig. 44 - National USFS office in Washington, D.C.
fig. 45 - Southwest Region USFS office in Albuquerque, New Mexico

RURAL

These buildings are in rural areas, often in small towns near a national forest. The buildings are used for a variety of utilitarian functions by the Forest Service and accommodate public access and information centers.[50]

Ranger stations are the primary buildings on rural sites and are the main Forest Service building in each ranger district. They house offices for forest rangers, geologists, hydrologists, and others who split their work between the forest and a typical office. These sites are also visitor centers and provide information and resources for forest visitors. Ranger stations have current information about trail conditions, weather, and fire activity in their ranger district. The public can get up-to-date information from these sites before heading into the wilderness. Some rural sites have education centers where school groups can learn about forest management, resource use, and fire prevention.

Rural sites are also home to regional fire fighting bases. There are offices for fire management teams, storage areas for supplies, and amenities for off-duty fire fighters. Because the Forest Service builds many roads, trails and campgrounds, these rural sites are also used for vehicle and heavy-equipment storage and maintenance.

fig. 46 - Entiat Ranger Station on the Wenatchee National Forest

fig. 47 - Inside the office of a forest ranger
fig. 48 - Incident command center during a wildfire
fig. 49 - This visitor center provides outdoor seating space for visitors - Huron-Manistee National Forest
fig. 50 - Students count tree rings as they learn about forest ecology through hands-on activities
fig. 51 - Rural work centers are the base of operations - Salmon-Challis National Forest

THRESHOLD

These sites are closer to the wilderness than rural towns and provide public recreation amenities like campgrounds, rental cabins, day use shelters, boat launches and trailhead kiosks. The Forest Service builds these sites for public recreation on the forest land they manage. Recreational visitors must share this forest amenity space with logging and grazing activities. There is a wide range of facilities because of the wide range of uses to accommodate. Facilities vary in scale and the number of visitors they serve. At the start of hiking, biking, and horseback riding trails there is an informational kiosk and minimal restrooms. These sites are located where trails meet roads, sometimes at a campground or day use area.

Campgrounds, boat launches, and day use shelters are built near popular scenic places, often alongside rivers and lakes. Campgrounds provide overnight camping spots for tents and recreational vehicles and parking for vehicles. Camping sites have built amenities like picnic tables, campfire rings, and bathroom facilities ranging from pit toilets to flush toilets with showers. Boat launches and docks provide water access for boaters and fishermen. Facilities range from docks with small marinas for power boats to rocky beaches for kayaks. Most sites are only available in the spring, summer and fall, but there are facilities that provide winter recreation access for skiing, snowshoeing, and snowmobiling.

These facilities are integral to the Forest Service mission of providing forest recreation opportunities for the public. Campgrounds, trails, boat launches and day-use shelters are the sites through which most people experience national forests. In the Pacific Northwest, Forest Service facilities are used by more than 60 percent of all forest visitors.[51] These facilities require regular monitoring, maintenance and cleaning by USFS employees to accommodate an increased number of forest visitors.

fig. 52 - Typical campground site with fire ring, picnic table and tent area
fig. 53 - This winter recreation site is gateway to snowshowing and corss country ski trails
fig. 54 - Boat dock at a campground provides water access for campers and day use visitors

OUTPOST

Outpost buildings are minimal structures located deeper in the wilderness and inaccessible by road. These buildings include fire lookout towers, supply caches, and backcountry cabins.

To assist in fire prevention in the early 1900s, manned lookout towers were built on mountains and ridges to spot fires. The fire lookout personnel that manned these positions live in the towers, continually looking for signs of smoke or fire.[52] Even with modern technology the USFS still staffs some lookout towers during the summer. Although some unused locations have been dismantled, many are still standing and are popular day hiking destinations during the summer and snowshoeing sites in the winter. Because of their functional siting for fire spotting, they have incredible views of the surrounding areas.

Backcountry cabins served as both early recreation buildings and as supply caches for Forest Service rangers. Cabins and yurts are rented out as luxury backcountry camping sites, while open-air huts provide free shelter for backpackers. Backcountry Forest Service crews work for up to a week at a time in the forest and supply caches provide a secure place to store trail maintenance equipment. These sites are accessed via hiking, ATV and horse trails. The Forest Service builds these trails to provide access deep into the national forests and wilderness areas. Trails require maintenance and are cleared of brush and downed logs every spring.

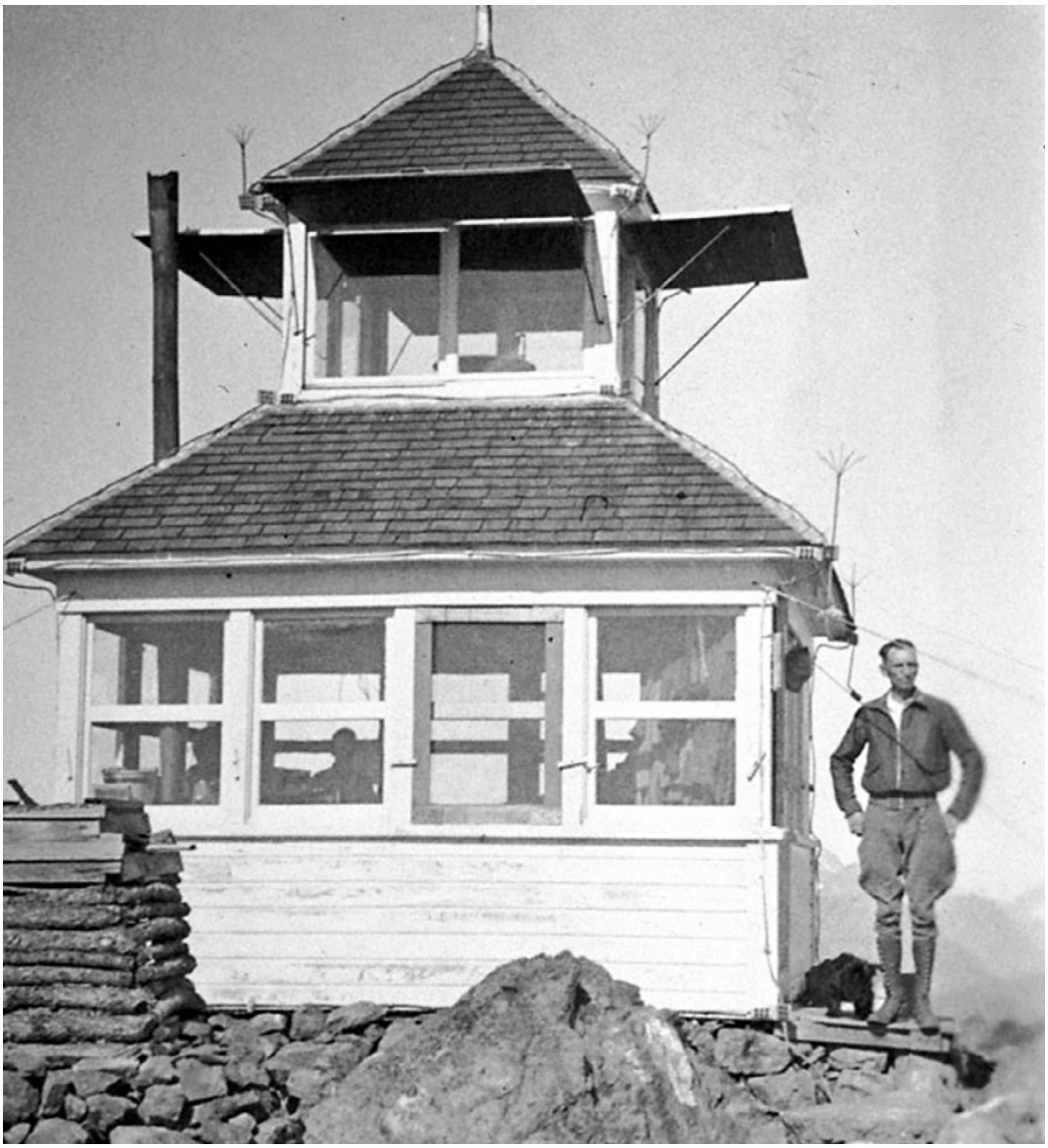


fig. 55 - The summer 1923 fire lookout standing next to the Goat Peak Lookout - Okanagan National Forest
fig. 56 - The 'A' frame Twin Lakes Cabin was built in 1963 and is rented by the Forest Service and is only accessible via water
fig. 57 - The Low Gap Shelter's simple accomodations provide just enough refuge for hikers

WILD

This is the opposite end of the spectrum from *Urban* and does not include any Forest Service buildings. The built infrastructure is limited to hiking trails, trail signs, and rough-hewn bridges. The 1964 Wilderness Act recognized wilderness as "an area of undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions."[53] This act created federally protected Wilderness Areas where buildings and roads are prohibited, many of which are within national forests.

This thesis focuses on the *Rural* category. As the Forest Service strives to accommodate resource use and protection, and public recreation, this is the primary area where these dual interests overlap. The "urban" end of the spectrum offers little to no forest recreation for the public, while the "wild" end prohibits buildings, roads, and resource extraction. The *Rural* typology highlights the balance between resource and amenity the best and includes the most 'architectural' built works.

fig. 58 - Day hikers head into the wilderness

fig. 59 - Lakeside campsite with a view of the Sawtooth Mountiains
fig. 60 - Forest Service trail crew clear downed logs blocking a hiking trail
fig. 61 - On a popular hiking trail, a bridge spans the river and eases travel

5

BUILDINGS IN THE WILD: CASE STUDIES

A primary objective of this thesis is to explore how architecture can be a steward of the environment and enhance visitors' experiences in nature. It investigates how Forest Service buildings can meet the functional needs of employees and the recreational desires of visitors, educate visitors about the natural world, and conserve nature through reduced water, energy and material use.

The USFS' network of rural buildings span in scale and use from ranger stations, to visitor centers, research stations, and community spaces. Based on this range of scale and use, the design must draw inspiration from similar building typologies. The following precedents were chosen for their architectural response to sustainable design, site context, and material use. These precedents provide guidelines and metrics for the design response.

1. Tillamook Forest Interpretive Center
2. Omega Center for Sustainable Living
3. Mojave Rivers Ranger Station
4. Dixon Water Foundation - Josey Pavilion

fig. 62 - Tillamook Forest Interpretive Center
fig. 63 - Omega Center for Sustainable Living
fig. 64 - Mojave Rivers Ranger Station
fig. 65 - Dixon Water Foundation – Josey Pavilion

TILLAMOOK FOREST INTERPRETIVE CENTER

Miller Hull Partnership / Tillamook, Oregon / 2005 / Size: 14,300 s.f.

The Tillamook Forest Center is an interpretive and education center in the Tillamook State Forest. Throughout the 1900s a series of large forest fires destroyed much of the old growth forest on this site. A reforestation program has since rejuvenated the forest and it is now used for harvesting timber and public recreation. The Tillamook Forest Center tells the story of this forest as a site of education and interaction. The Forest Center was "envisioned as a place where visitors could learn how their lives are connected to the natural environment. The project… [serves] as a living example of sustainable building design, construction, and operating practices with minimal environmental impact on its surroundings."[54] The Tillamook Forest Center includes offices, exhibition space, a community room, an amphitheater, an outdoor classroom, and interpretive trails. The facility layout accommodates indoor and outdoor education and creates a sequence of interaction opportunities for visitors.

The facility is approached via a pedestrian plaza and bridge that span over a wetland pond. The pond stores rainwater that is later used for non-potable purposes in the building and as a heat exchange to assist in cooling the building during the warm summer months. Surrounding the building are walking trails with interpretive and immersive exhibits. On the inside, the facility is split into two halves, one side dedicated to informational exhibits and education, and the other containing offices, the amphitheater and community room. On the other end of the building a pedestrian bridge spans across the Wilson River and connects to additional walking trails.

The architecture of the Tillamook Forest Center showcases wood harvested from the sustainably managed Tillamook State Forest. Much of it was grown, harvested and milled within 30 miles of the site. The building is naturally ventilated and naturally day lit, which help it be 20 percent more energy efficient than was required by local building codes. In the winter it is heated with wood pellets, a fuel made with wood byproduct that previously was considered waste.

fig. 66 - View of water retention pond, outdoor classroom seen on the right.
fig. 67 - Intersection of building and walking trails.
fig. 68 - A 250' pedestrian bridge connects the Forest Center to a nearby campground and trail system.

OMEGA CENTER FOR SUSTAINABLE LIVING

BNIM / Rhinebeck, New York / 2009 / Size: 6,205 s.f.

The Omega Institute is an educational retreat center in New York. This facility is a wastewater treatment center for 119 buildings on the Omega Institute campus. The building meets the utilitarian needs of a water treatment plant and serves the community as a model of sustainable building. The facility treats wastewater onsite and has classrooms and a laboratory. Rather than separate the utilitarian functions and the amenity functions, the building merges the two. Visitors, staff and the community see and experience the water treatment process and are educated on "local, regional and global water issues."[55]

The building sits low on the landscape and is sited to optimize daylight, ventilation, and solar production. Solar panels provide 100 percent of the energy needs of the building and its occupants. The roof is pitched to collect rainwater and direct it to wetland ponds onsite. The roof canopy extends over an outdoor classroom adjacent to a wetland treatment area, and interior water treatment tanks are filled with living plants. These sites are a dynamic place for visitors to learn about the function of the building in an engaging manner.

The Omega Center is a Living Building and meets net zero energy, net zero water, and net zero waste criteria. All energy consumed by the building and its occupants is produced by on-site renewable sources and the building is 98 percent day lit and 78 percent naturally ventilated.

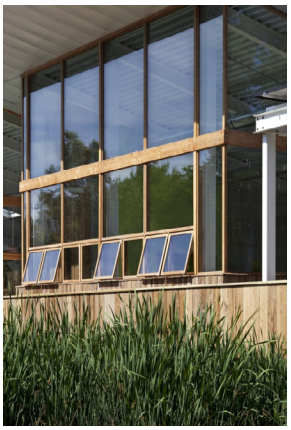


fig. 69 - Functional and amenity spaces are architecturally defined but still interact with each other.
fig. 70 - The pitched roof directs water to the constructed wetland. Primary interior spaces view out to the wetland.
fig. 71 - The building has a campus wide function but the front entrance is human scaled and features reclaimed wood.
fig. 72 - Operable glazing increases occupant comfort.

MOJAVE RIVERS RANGER STATION

Marcy Wong Donn Logan Architects / Acton, California / 2011 / Size: 12,000 s.f.

North of Los Angeles, California, the Mojave Rivers Ranger Station is a regional Forest Service office in the Angeles National Forest. The ranger station is on the western edge of the Mojave Desert in a hot and dry climate. The facility responds to this harsh climate while accommodating the functional needs of the Forest Service and providing amenities for the public.

Deep roof overhangs help keep the building cool during the hot summer, which often stays above 100 degrees for days at a time. Thin film solar panels provide energy for the building and a geothermal ground source heat pump helps cool the building during the hot summer. A trellis and slatted sun shades protect windows from unwanted heat gain during the summer but allow sun penetration during the winter. The trellis and sunshades also create a covered outdoor amenity space. Operable windows assist in cross ventilation and allow employees to control the climatic comfort of their office area. The building is long and narrow to provide day lighting from two sides and allow cross ventilation.[56]

A series of large earth-colored concrete walls separate the building into different zones and support the sun trellis. These walls meet the seismic needs of this southern California site and act as thermal mass to store thermal heat. On the inside, offices areas are divided into open and closed spaces to accommodate the variety of different professions employed by the Forest Service. Each department has individual working spaces, but they also can come together in open group areas.

fig. 73 - The tinted concrete wall reflect the surrounding tone of the Sonoran Desert.
fig. 74 - A trellis and sunshade block summer heat gain and create semi-sheltered outdoor space.
fig. 75 - The massing divides the ranger station into three areas based on interior program.

DIXON WATER FOUNDATION – JOSEY PAVILION

Lake|Flato Architects / Decatur, Texas / 2014 / Size: 5,400 s.f.

The Dixon Water Foundation advocates for healthy watersheds by encouraging sustainable land management and ranching practices. Their goals are to promote ranching as a way to use natural resources sustainably and to educate the public to restore and protect watersheds. The Josey Pavilion is an educational, event and meeting space that "embodies the foundation's mission… [and] provides a perfect setting for learning about natural resources and how good land management can conserve them."[57]

The Josey Pavilion is a Living Building with net zero energy, water and waste. The open-air pavilion has a low energy demand and capitalizes on passive strategies rather than mechanical systems. The pavilion comprises two buildings connected by a roof and walkway that sit low on the land to merge into the surrounding prairie. The two buildings frame an outdoor classroom under an existing live oak tree. The pavilion is sited to protect the outdoor classroom from harsh winter winds from the northwest. The wood slat doors are opened in the summer to let cool summer breezes flow through and maximize ventilation in the main gathering spaces. The slat doors have a 30 percent openness factor, similar to the live oak tree that sits outside. The roof cupola pulls warm air up and out of the pavilion, aided by several large ceiling fans. The deep roof overhangs shade the porch and help keep gathering spaces cool during the summer. The Josey Pavilion acts as a teaching tool for the public by showing how architecture can enhance the environmental quality of an area and provide visitor amenities.

fig. 76 - All lumber is salvaged and reused or FSC certified.
fig. 77 - The two buildings frame an outdoor classroom around an existing tree. Deep porch overhangs reduce sun heat gain.
fig. 78 - Multiuse rooms open to the outdoors, creating engaging classrooms.

CASE STUDY CONCLUSIONS

The case studies reveal similarities in sustainably designed buildings that have a focus on context, sustainble methods, and materials. Together they provide design guidance for high performance, site specific design interventions at a Rural scale.

DESIGN STRATEGIES

Buildings are relatively small, minimizing their footprint on the site while still providing necessary enclosed space. All of the precedents use defined outdoor space or unconditioned semi-enclosed areas for required program functions. This reduces the area needed for interior conditioned space and allows areas to be flexible and adapt over time. Architecture is used to tell a story about the site, history, and program. At the Omega Center visitors learn about water treatment at all scales of the building. At the Tillamook Forest Center the walking trails are integrated with the building and bridge, moving under and through the structure and connecting across the river. The bridge offers a new vantage point to view the building and the landscape. Multiple building volumes, canopies, roofs, and bridges are used to separate program spaces. The negative spaces between buildings are framed by the architecture and become useable spaces. Separate building volumes, roof canopies, and existing trees are used to frame outdoor areas and amenity spaces.

SITE CONTEXT

Buildings connect to the site physically and psychologically. Building designs are based on site-specific access, topography, water features, solar access, prevailing winds, and existing trees and rocks. They also offer experiences to the visitors and employees that would not otherwise be present on these sites. The architecture connects previously separated areas (Tillamook), makes utilitarian functions visible to visitors (Omega Center), provides opportunities for prospect and refuge, and creates engaging spaces to learn about the surrounding landscape (Tillamook, Omega, Mojave, Josey Dixon).

SUSTAINABLE METHODS

Active and passive systems are integrated to reduce energy and water consumption. The Omega Center, Mojave Ranger Station, and Josey Pavilion use deep overhangs to prevent unwanted solar heat gain in the summer, but allow winter sun to penetrate and passively warm the building. Omega Center and Mojave Rivers use natural day lighting to reduce energy consumption. Passive ventilation is achieved through operable windows, moveable walls, and flexible indoor-outdoor spaces. The Josey Pavilion uses slatted walls to block colder winds in the winter and allow cooling breezes in the summer.

MATERIALS

Materials are locally sourced to reduce carbon emissions from transportation. Materials have haptic qualities that "feel" appropriate to the region and connect users to the material and place. The Tillamook Forest Center uses wood from the surrounding forest, connecting visitors to their larger surroundings. The color of the concrete in the Mojave Rivers Ranger Station is evocative of the surrounding desert soil and adobe construction.

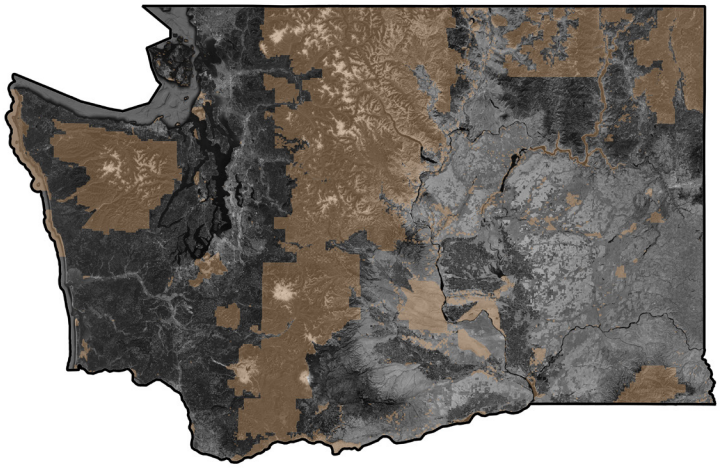
fig. 79 - Three different national forests. Each requires unique site-specific design based on local forest conditions.

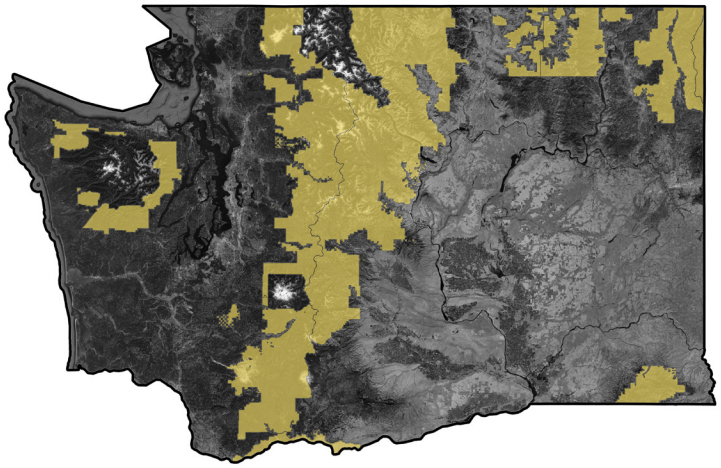
6

WENATCHEE NATIONAL FOREST

The Forest Service manages the majority of public land in Washington across ten national forests (Figures 80, 81). The Okanagan-Wenatchee National Forest comprises two forests jointly administered by a primary office in Wenatchee, Washington and has 450 permanent employees. Together they stretch from the Canadian border to Mount Rainier. Individually, the Wenatchee National Forest is the largest in Washington covering nearly two million total acres, nearly 20 percent larger than the next largest forest.[58] Wenatchee National Forest is further divided into five ranger districts: Naches, Cle Elum, Wenatchee River, Entiat, and Chelan, each of which is managed by a district ranger from a local ranger station.[59] Wenatchee River Ranger District is the largest of the five, is located in the center of the forest and includes the popular Enchantments area of the Alpine Lakes Wilderness.

The Wenatchee National Forest was first established in 1908 with headquarters based in Leavenworth.[60] By 1916 there were 63 ranger stations and administrative sites spread across the forest. In 1920 the forest headquarters moved to Wenatchee and the Leavenworth site became a subsidiary ranger station and seat of the Leavenworth Ranger District. After the enactment of the Wilderness Act in 1964, several large areas of Wenatchee National Forest were designated wilderness areas, including the Alpine Lakes Wilderness in 1976. In





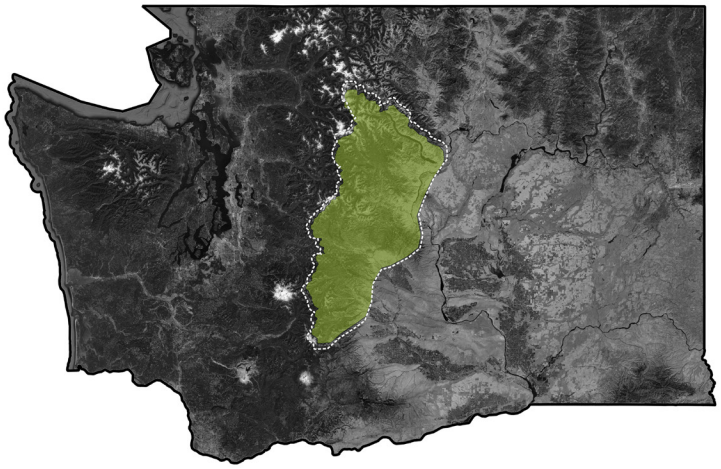
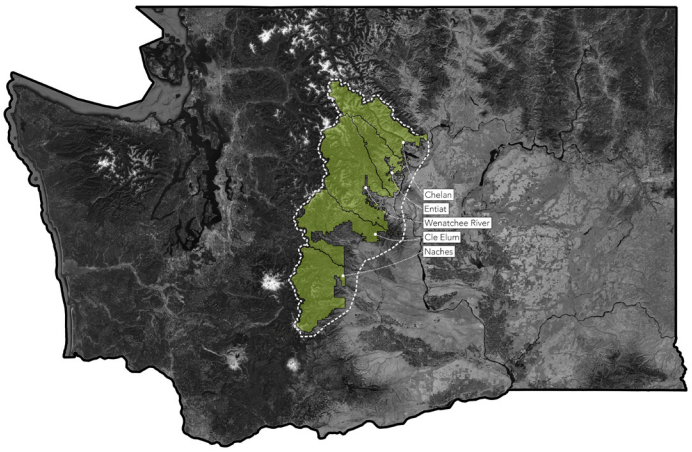


fig. 80 - All public land in Washington State.
fig. 81 - All Forest Service land in Washington State.
fig. 82 - Wenatchee National Forest.



2000 the Leavenworth Ranger District was combined with an adjacent district and renamed the Wenatchee River Ranger District with a ranger station in Leavenworth.

Within the Wenatchee River Ranger District, the ranger station in Leavenworth emerges as an opportunity to examine the balance between resource and amenity in the wilderness. Forest Service architecture and infrastructure is part of a network that spans throughout the entire forest. Trails and forest roads connect ranger stations, campgrounds, and lookout towers. As the network expands, new structures replace old ones on existing sites, an approach that can lower the impact on the environment and integrate new structures into the network of existing infrastructure. The proposed site is currently in use by the Forest Service.

The Wenatchee River Ranger Station in Leavenworth is the primary Forest Service building for this district and is the base of operations for all nearby USFS activities. The ranger station contains utilitarian functions key to managing the forest, and also accommodates recreation visitors coming to the district. Wenatchee National Forest largely surrounds the town of Leavenworth and the Wenatchee River Ranger Station is a necessary stop for outdoor recreation visitors. Leavenworth is in the center of the national forest and is a two hour drive due east from Seattle. Interstate 90, Highway 2, and the railroad bisect the forest, bringing in visitors from around the state and moving timber out to regional mills.

fig. 83 - Wenatchee River Ranger District is in the middle of Wenatchee National Forest.

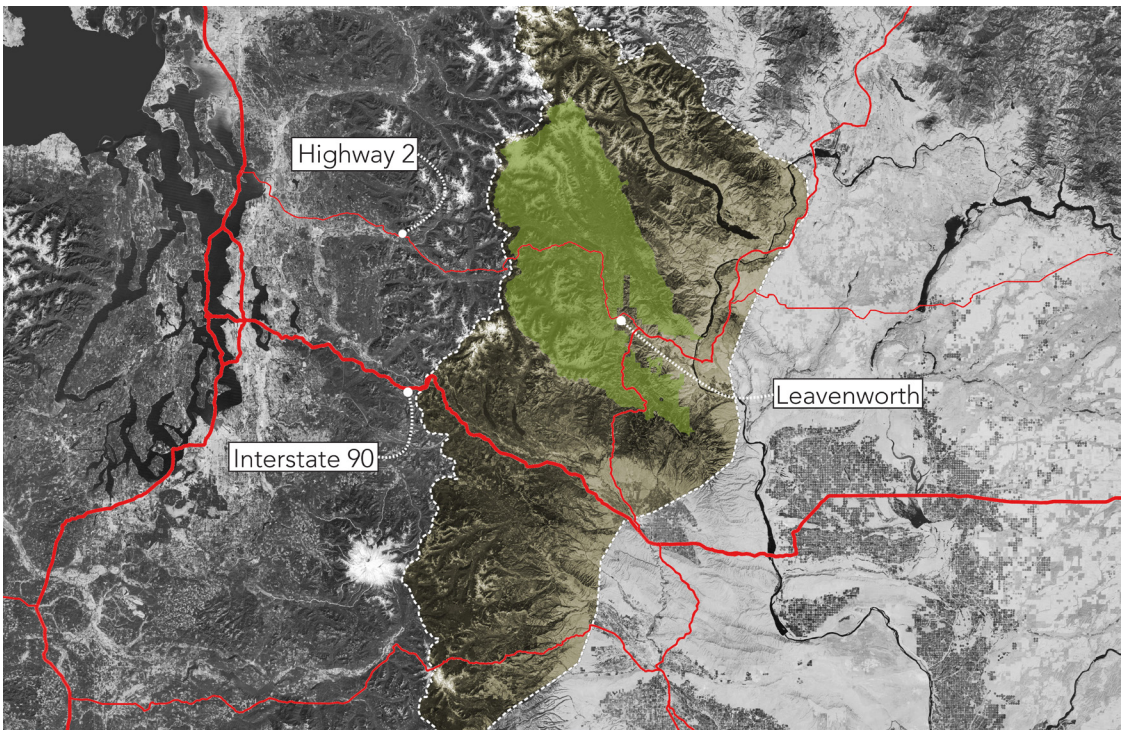


fig. 84 - Wenatchee River Ranger District is due east of Seattle, accessible via Highway 2 or I-5.
fig. 85 - Wenatchee River Ranger Station in Leavenworth is the administrative seat for this ranger district.

CLIMATE

The climatic conditions of central Washington are different than elsewhere in the state. From west to east, Wenatchee National Forest extends from the wet Cascade Mountains to the arid landscape of the upper Columbia River.[61] This varied landscape ranges from elevations higher than 9,000 feet to lower than 1,000 feet. Compared to western Washington, Leavenworth has a full four seasons, with hot summers and cold snowy winters.

SUN

Leavenworth is located at 47.4 degrees north latitude with the majority of days being sunny or partly cloudy. This area is well positioned for solar panel energy production from March through October. The winter months are more overcast, but still have 10-15 days of sun or partly cloudy conditions.[62]

WATER

Leavenworth has an average of 96 precipitation days per year with an overall accumulation of 40 inches of rain and 120 inches of snow.[63] Surface water flows to the Wenatchee River which runs through Leavenworth. There is a riverfront park in town where Icicle Creek meets the Wenatchee River. Icicle Creek flows down from the Cascades and the Alpine Lakes Wilderness Area and is frigid with snow melt during the spring. During summer, the Wenatchee River slows in flow and warms up, becoming a popular rafting location. During the winter a small ski hill opens on the slopes north of town.

ENERGY

Leavenworth is warm in the summer and cold in the winter. The average summer high temperature is 81 degrees; the average winter low is 22 degrees.[64] Even during the warm summer months, there are large diurnal temperature swings with cool nights. Throughout the year, only 21 percent of days are 70 degrees or warmer. An adaptive comfort model for building design would meet 100 percent of indoor comfort temperatures. This approach involves passive solar heat gain, and user controlled ventilation, in addition to heating during the winter.

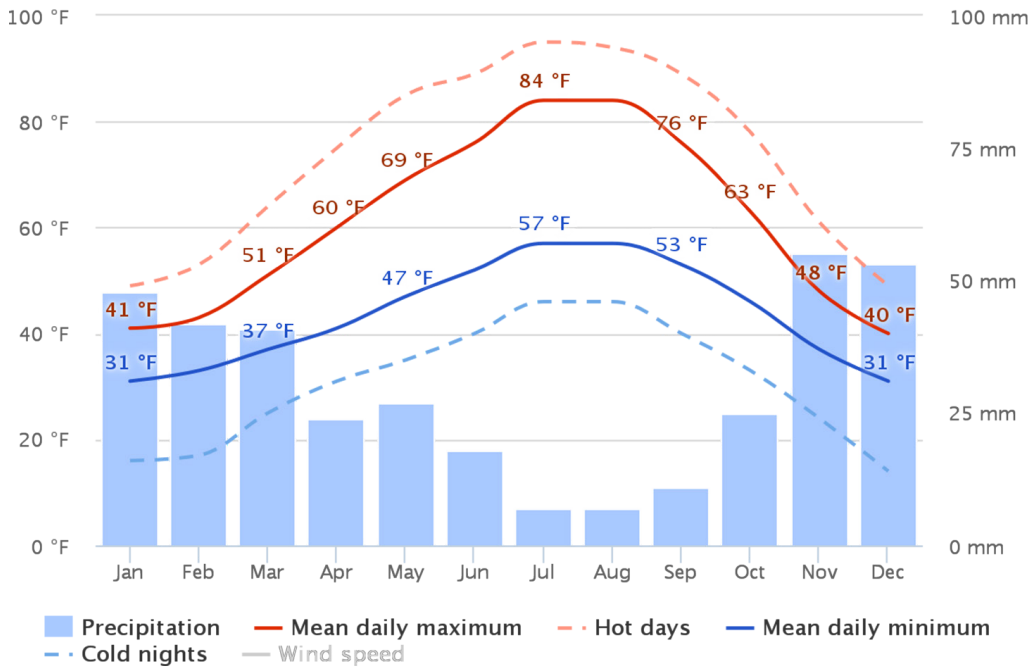


fig. 86 - Average temperatures and precipitation

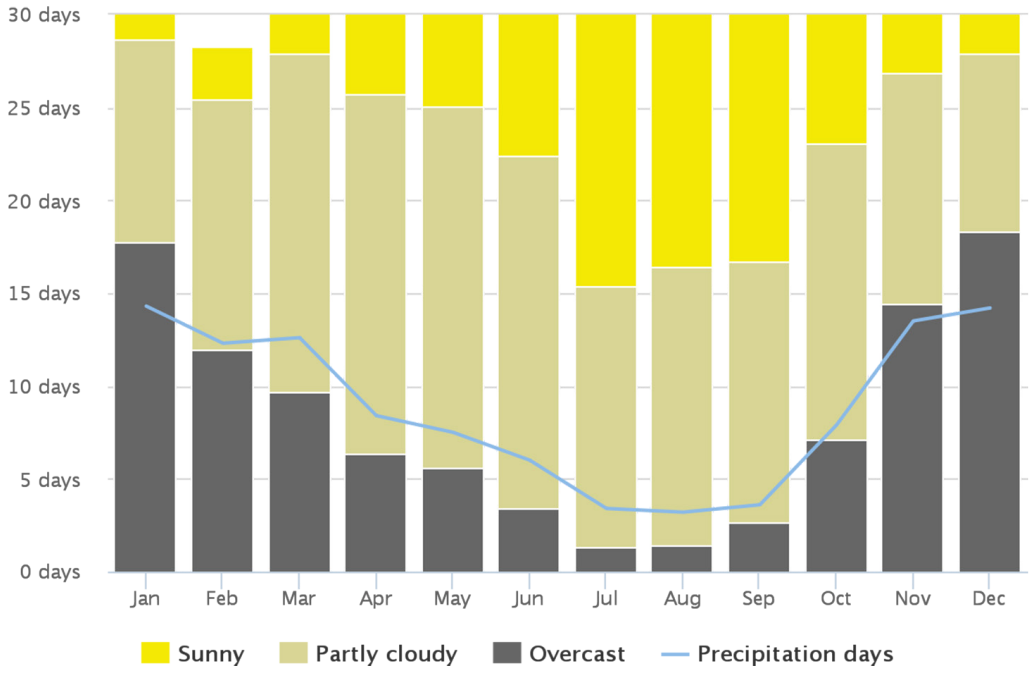


fig. 87 - Cloudy, sunny and precipitation days

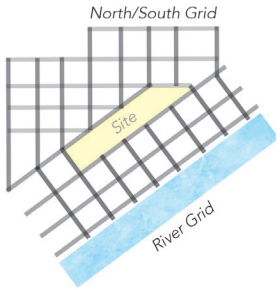
LEAVENWORTH, WASHINGTON

Leavenworth is located in the Upper Wenatchee Valley, where the Wenatchee River joins with Icicle Creek. The town was founded in the 1800s as a mining community and provided a base of operations for miners and trappers headed into the Cascade Mountains.[65] In the late 1800s the Great Northern Railway Company came to Leavenworth and bolstered a burgeoning timber industry. A sawmill in Leavenworth provided the economic backbone of the region. When the railroad rerouted in the early 1900s, the sawmill closed and the town was left in economic hardship for decades. In the 1960s Leavenworth transformed itself into a tourist town. The town changed their main street appearance into a faux-Bavarian village and created a year-round series of festivals and events. This strategy worked and the town of Leavenworth is now a popular tourist destination with over two million visitors each year.[66]

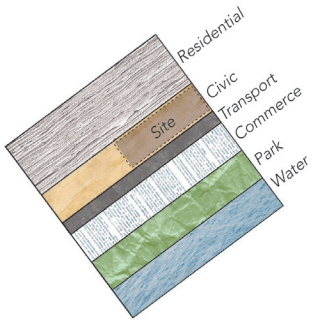
This area of central Washington is popular for outdoor recreation. The Enchantments area of the Alpine Lakes Wilderness is nationally known and is accessed just outside of town. The forest and mountains have always been an important part of this region's identity, but within the town the predominant experience is the faux-Bavarian tourist haven that ignores the surrounding landscape. Throughout Leavenworth's history, the town's identity has been based on both resource and amenity views of the wilderness. From the early years when the outdoors were viewed as a resource potential for mining and logging, to more recently as a picturesque amenity to be enjoyed. Today, logging and mining still occur alongside hiking and biking, and the region must support both views of the wilderness.

The Wenatchee River Ranger Station sits within the town of Leavenworth on Highway 2. The Wenatchee River and Highway 2 run from the northwest to the southeast in this region, but for the length of Leavenworth the river takes a big bend to the northeast, and then another large bend back to the southeast. The highway follows the Wenatchee River.

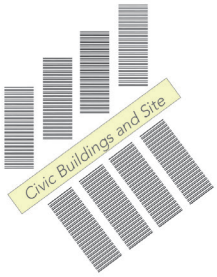
fig. 88 - The Alpine Lakes Wilderness Area is accessed via Leavenworth.
fig. 89 - Outside Leavenworth, the mountains and forest are the predominent experience.
fig. 90 - Icicle Creek outside of Leavenworth.



Grid Shift



Town Layers



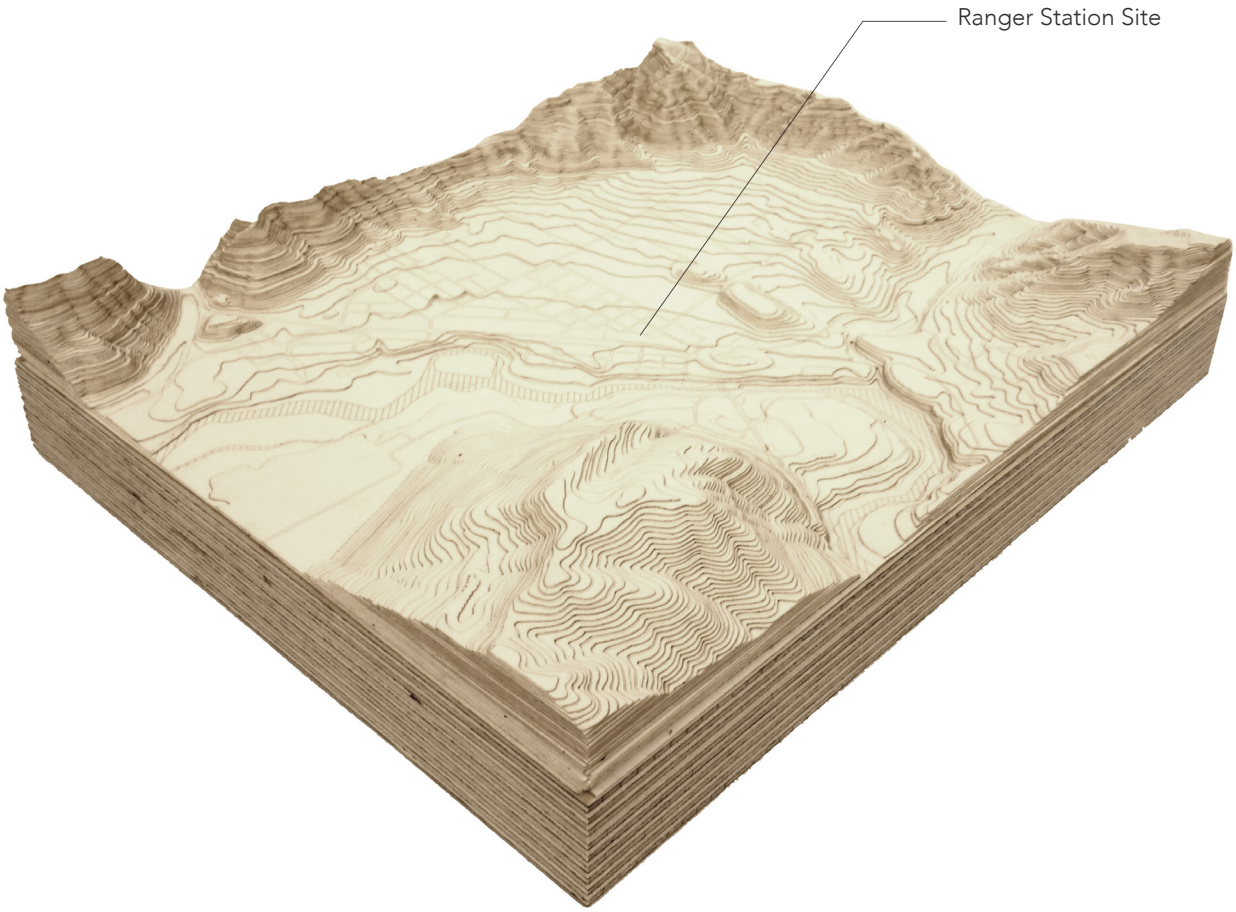
Connection Difficulty

This bend in the river and highway create an interesting set of conditions within the town of Leavenworth. The original town grid was arranged parallel to the river on a northwest/southeast axis. The railroad and highway followed this development, but later growth aligned to a north/south grid. The USFS ranger station site sits at the junction of these two grids.

The highway and the river arrange the town into a series of layers. A residential neighborhood is to the north and west of the highway. A long row of civic and cultural buildings (including the ranger station site) separate the residential neighborhood from the highway. A small commercial downtown is nestled between the south side of the highway and the Wenatchee River.

fig. 91 - Town organization diagrams.
fig. 92 - Wenatchee River Ranger Station site in Highway 2.

fig. 93 - Leavenworth is a tourist town with influxes of visitors year round. This is the predominent experience in town.
fig. 94 - A typical downtown tourist building.



SITE MODEL

It is important to understand the relationship between the town of Leavenworth and the surrounding mountains. The Upper Wenatchee Valley is completely surrounded by hills and mountains. A 1″ = 1500′ topographical model was used to study the importance of topography in this area.

fig. 95 - 1:1500 site model showing valley topography. 80 layers of watercolor paper on plywood.

AERIAL

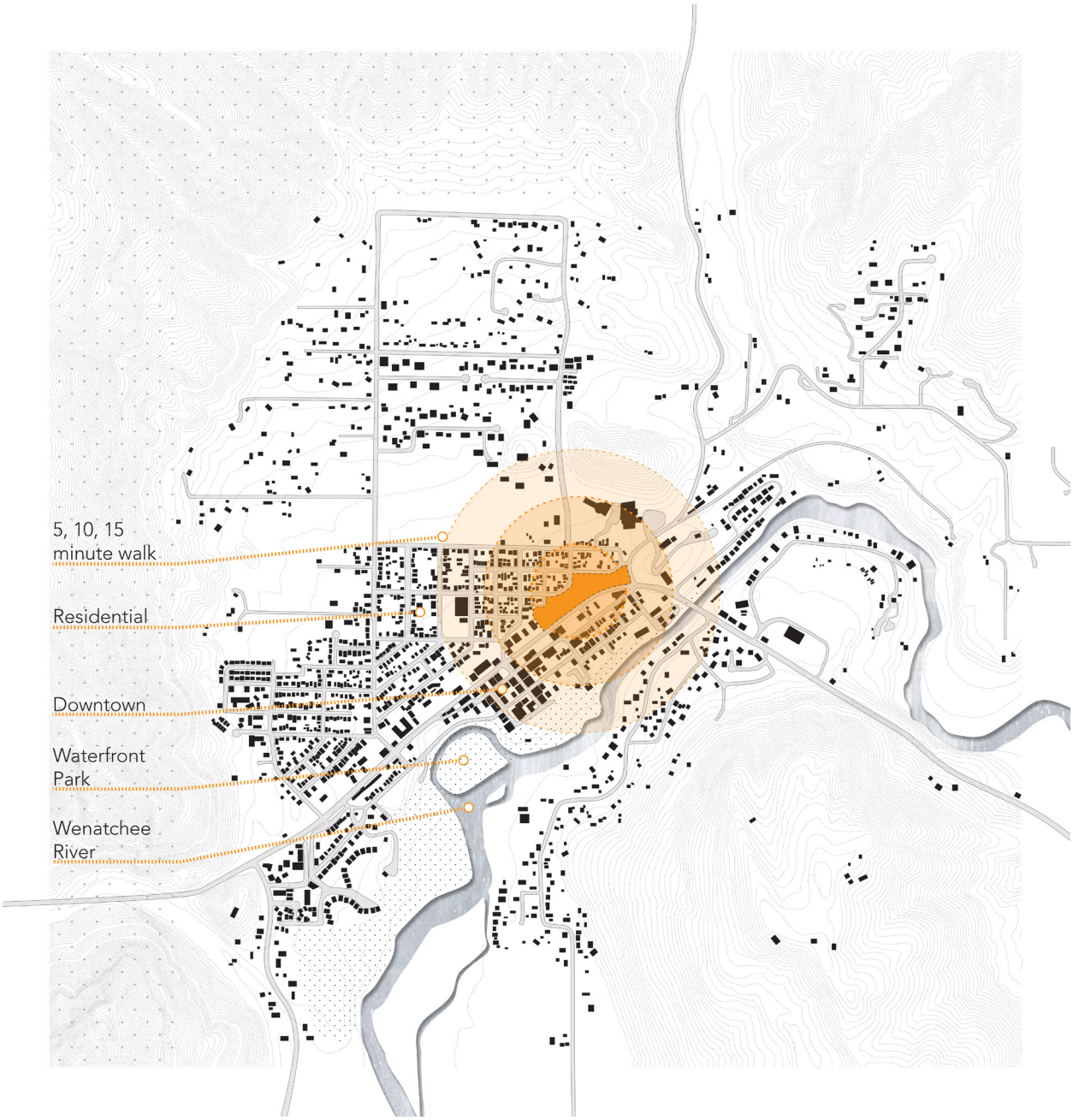
Leavenworth is a small town surrounded on all sides by mountains. This aerial map highlights the proximity of the surrounding forests and shows the prominence of the Wenatchee River.

fig. 96 - Aerial map of the Upper Wenatchee Valley

TERRAIN

The elevation within the town is fairly flat with gentle slopes leading down to the Wenatchee River. On the edges of town the mountains rise 5,000 - 8,000 feet with steep slopes. The mountains are visually prominent from many places in town.

fig. 97 - Topography map of the Upper Wenatchee Valley



PROXIMITY

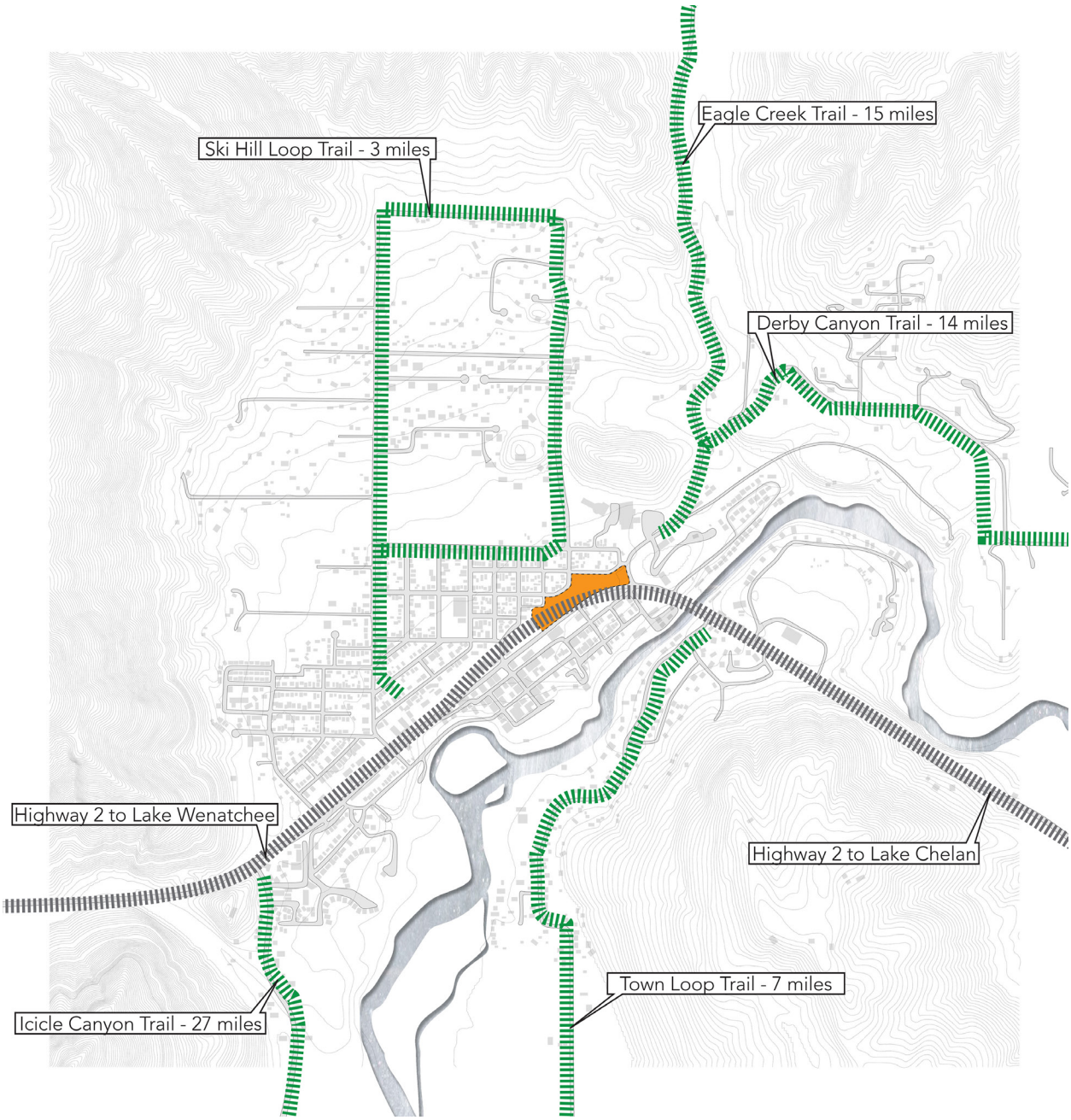
On a figure ground map the different areas of town are identifiable. The fine grain residential area is north of the highway. The commercial tourist area has larger buildings and is between the highway and the river. There are several larger educational and institutional buildings throughout town. Most tourists arrive by car, but the town itself is easily walkable.

fig. 98 - Figure ground map of the Upper Wenatchee Valley

FOREST

The Wenatchee National Forest surrounds much of the town. To the north and west it includes the steep slopes on the edges of town. A large city park follows the edge of the Wenatchee River.

fig. 99 - Forest map of the Upper Wenatchee Valley

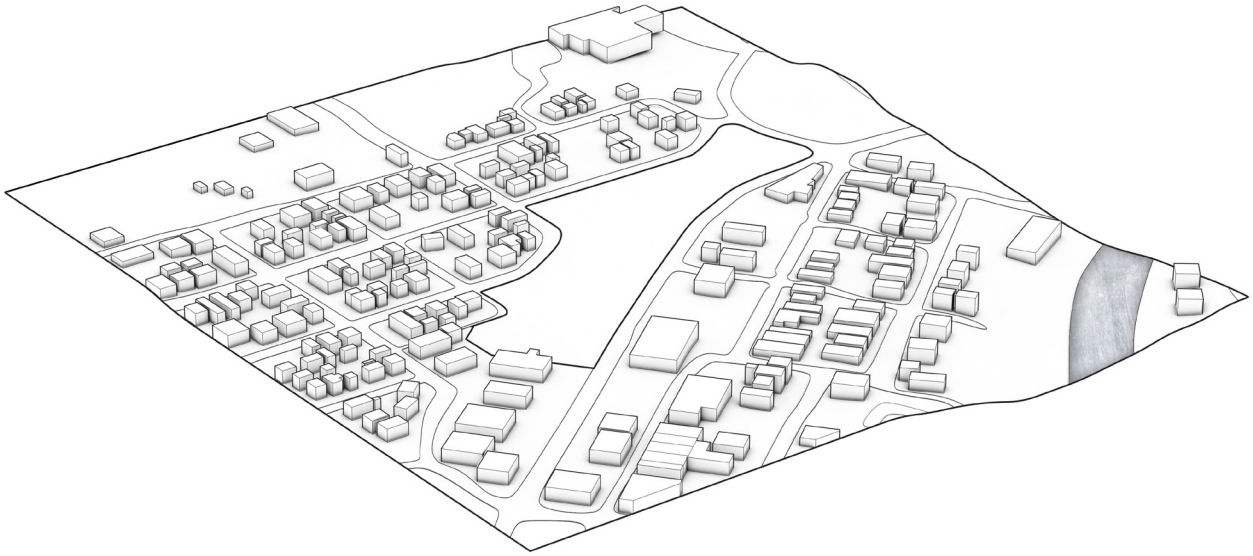


TRAILS

A series of existing biking, hiking, and walking trails lead from Leavenworth out to the mountains. The surrounding hills and national forest have many additional trails to explore. The trails from town connect with this larger system, but they do not connect together in town.

fig. 100 - Trail map of the Upper Wenatchee Valley

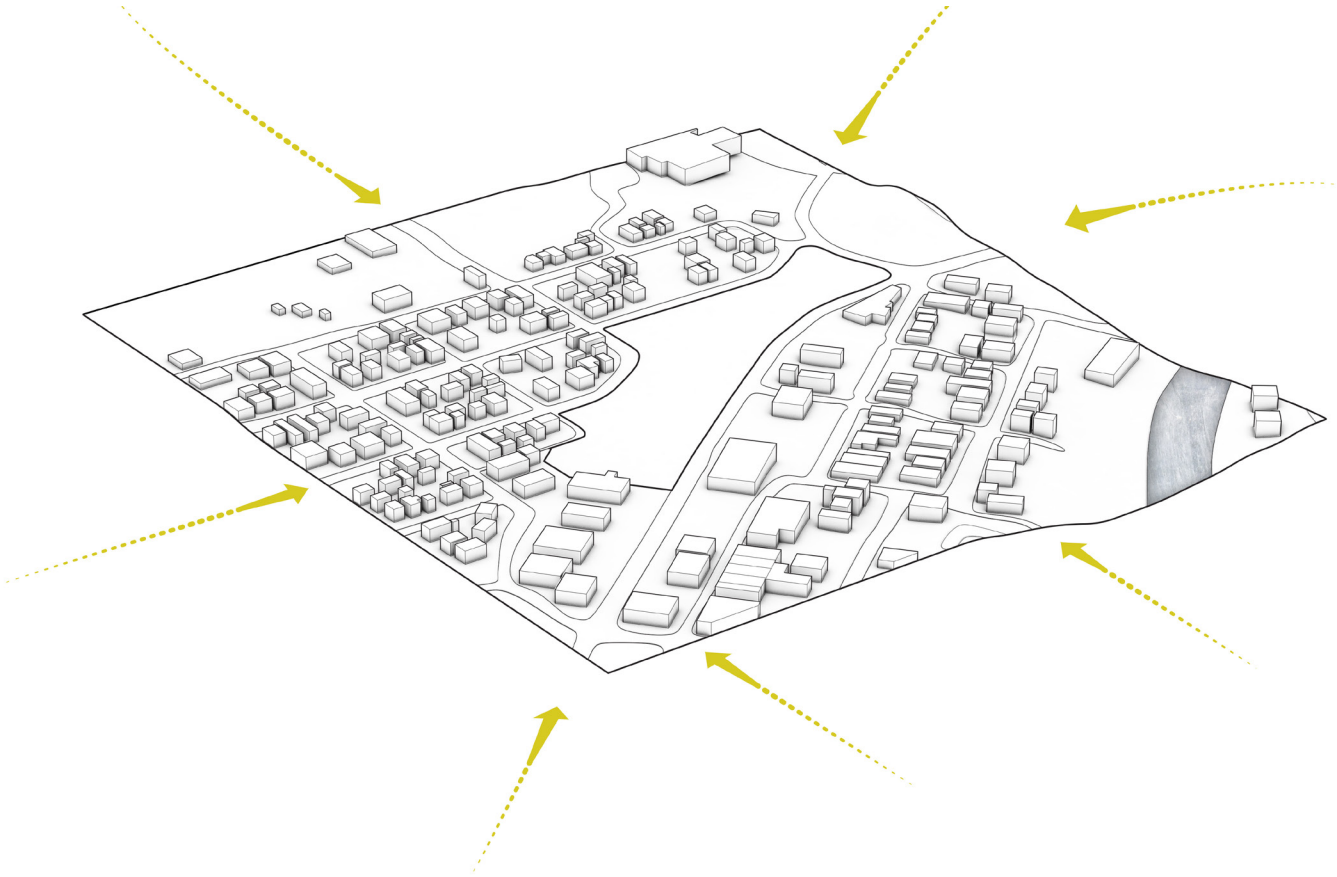
SITE RESPONSE



SITE

The site is 9.5 acres and sits on Highway 2. It separates the residential neighborhood from the commercial downtown.

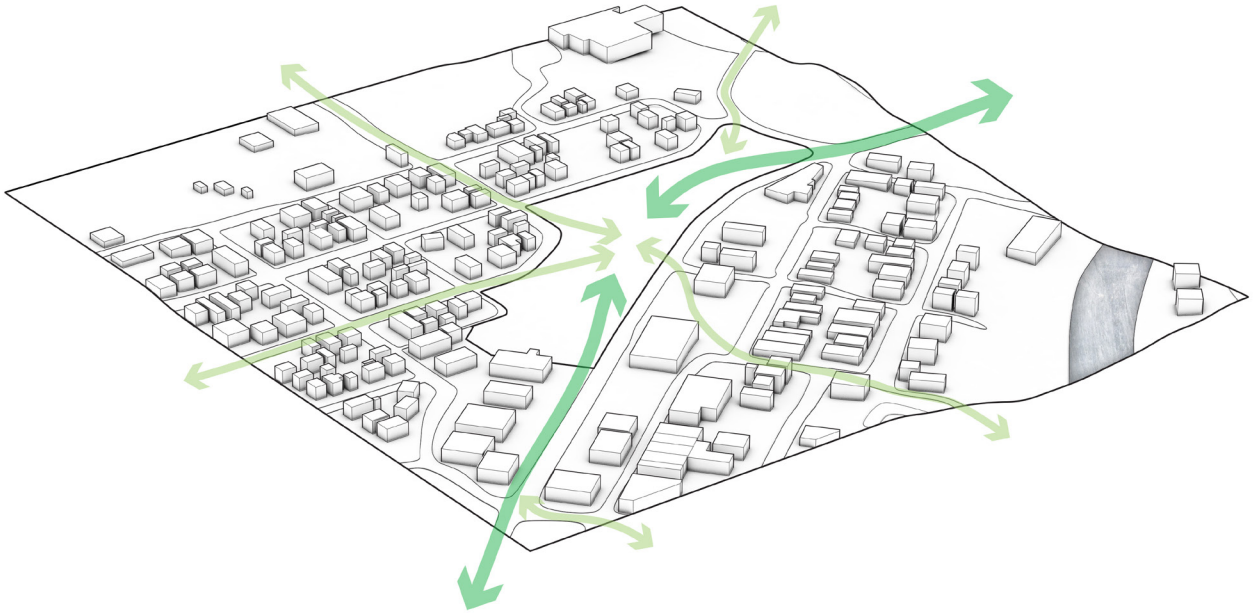
fig. 101 - Diagram: 9.5 acre site along Highway 2



EXISTING TRAILS

The existing trails come into town near this site, but they do not connect anywhere and the trail system is not legible.

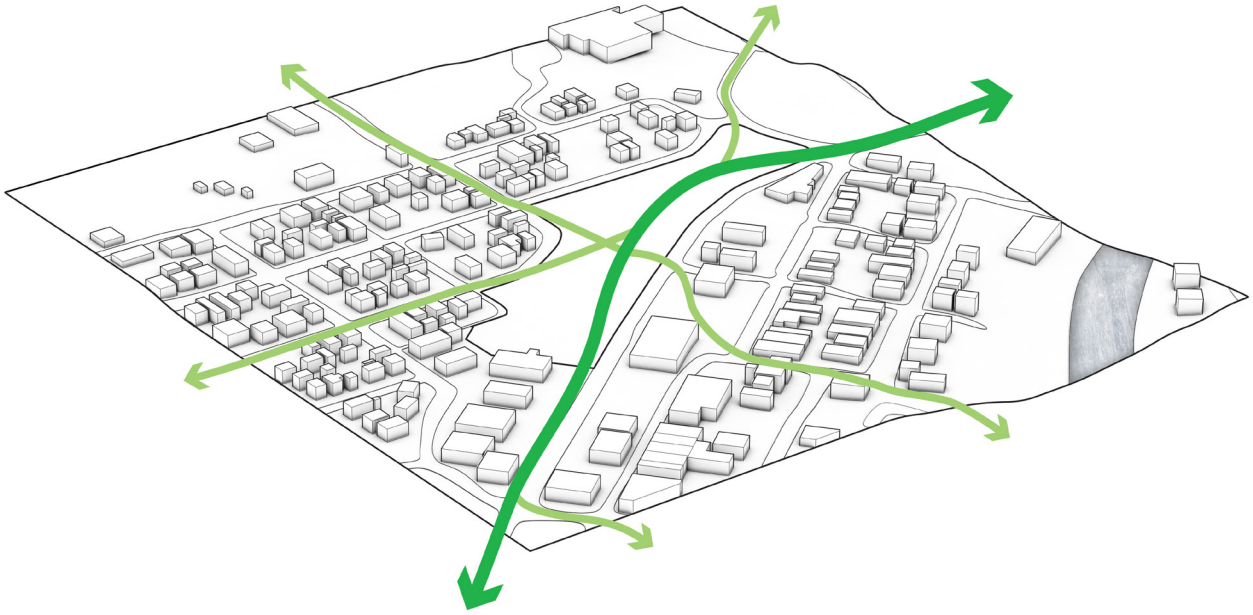
fig. 102 - Diagram: existing trails do not connect



CONNECT TRAILS

The site location provides an opportunity to connect the existing trails on and through this site. This builds on an existing system and expands the trail network.

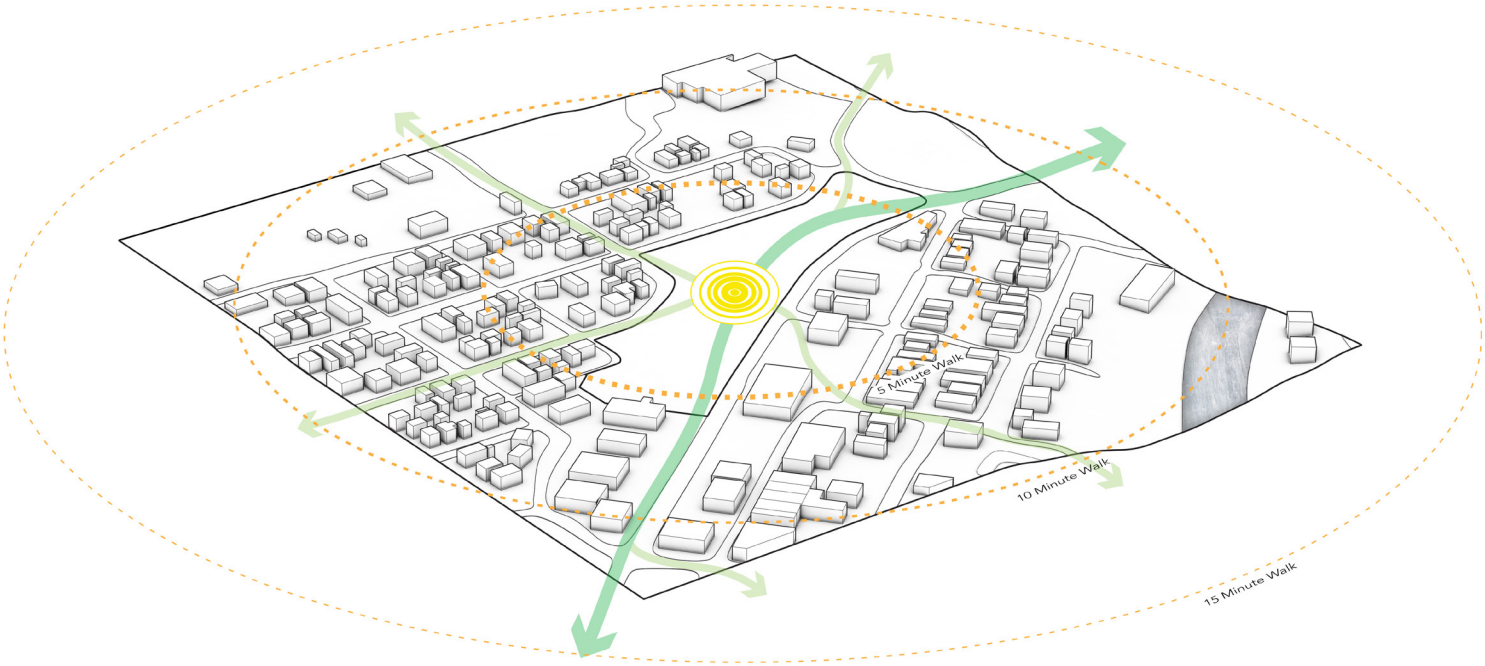
fig. 103 - Diagram: opportunity to connect existing trails



PRIMARY TRAIL

The primary trail creates a long linear path that runs the length of the site. This main path connects the downtown to trails leading out to the forest. This path runs parallel to the highway, providing a more pleasant pedestrian experience.

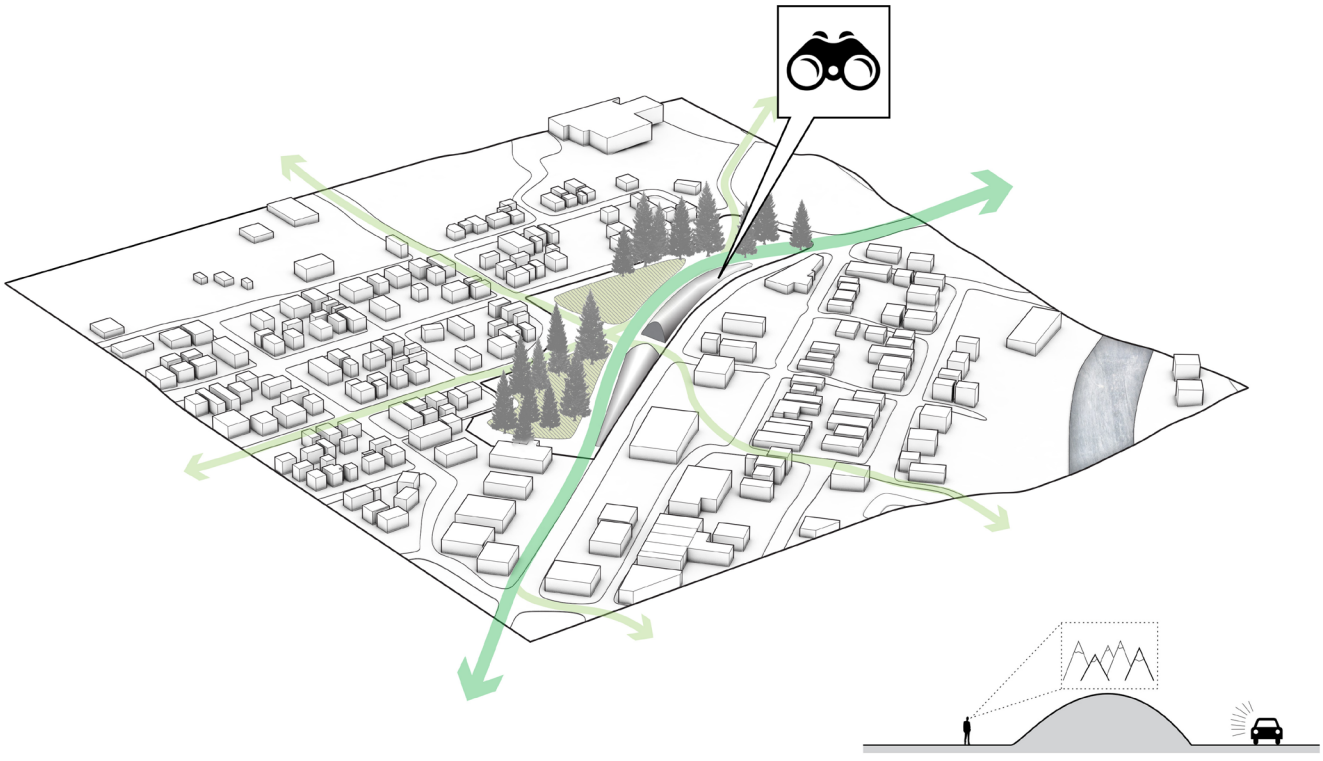
fig. 104 - Diagram: primary trail creates linear spine



BUILD AT TRAIL CROSSING

The trail crossing at the center of the site is an opportunity to build around. Clustering program around this intersection utilizes trail connections in all directions. Building in the center of the site adds to the experience of moving from the edges onto and through the site.

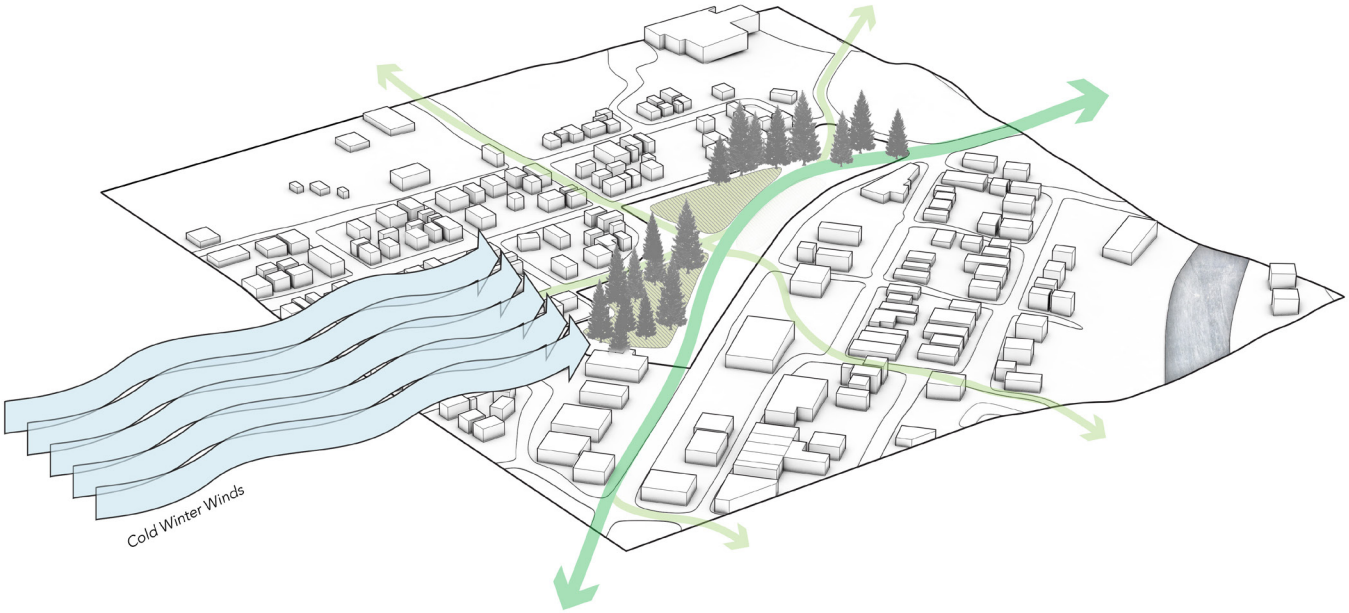
fig. 105 - Diagram: opportunity to build at trail crossing



TOPOGRAPHY

The site is primarily flat so a shift in the topography creates a berm between the trail and the highway. This helps block some of the highway noise, but also raises the horizon line, bringing the eye up to look at surrounding mountains.

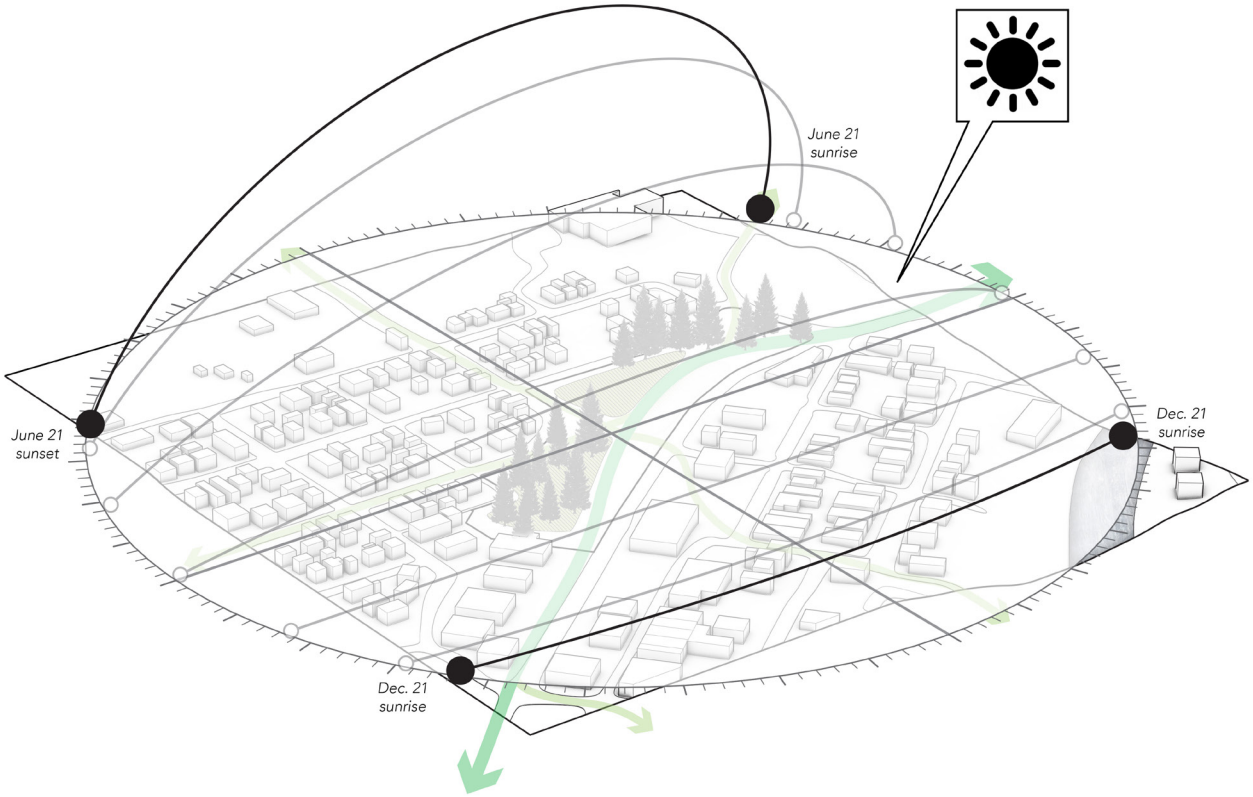
fig. 106 - Diagram: use topography to block noise and direct attention



CLIMATE CONDITIONS: WIND

There are cold winter winds from the west that blow down the river canyon. Trees on site can be used to shelter buildings from these winds.

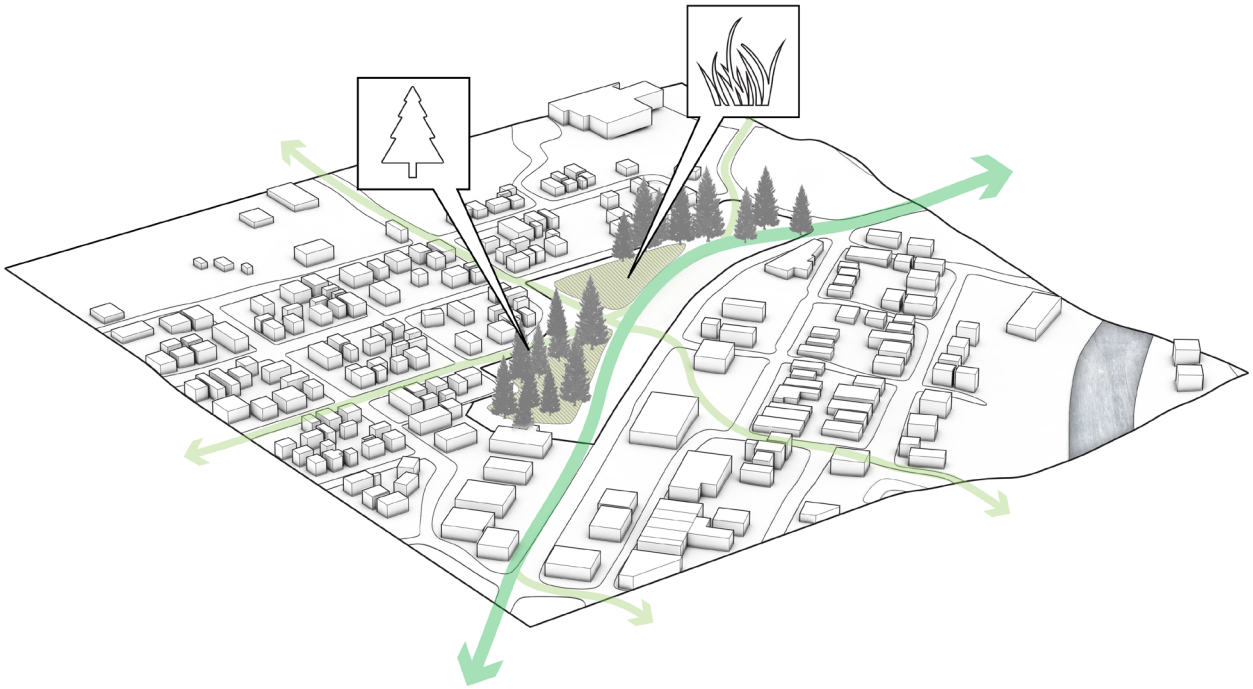
fig. 107 - Diagram: cold winter winds



CLIMATE CONDITIONS: SUN

Buildings need to be oriented to shade against high angle hot summer sun. During the winter low angle sun can be used for passive solar heating.

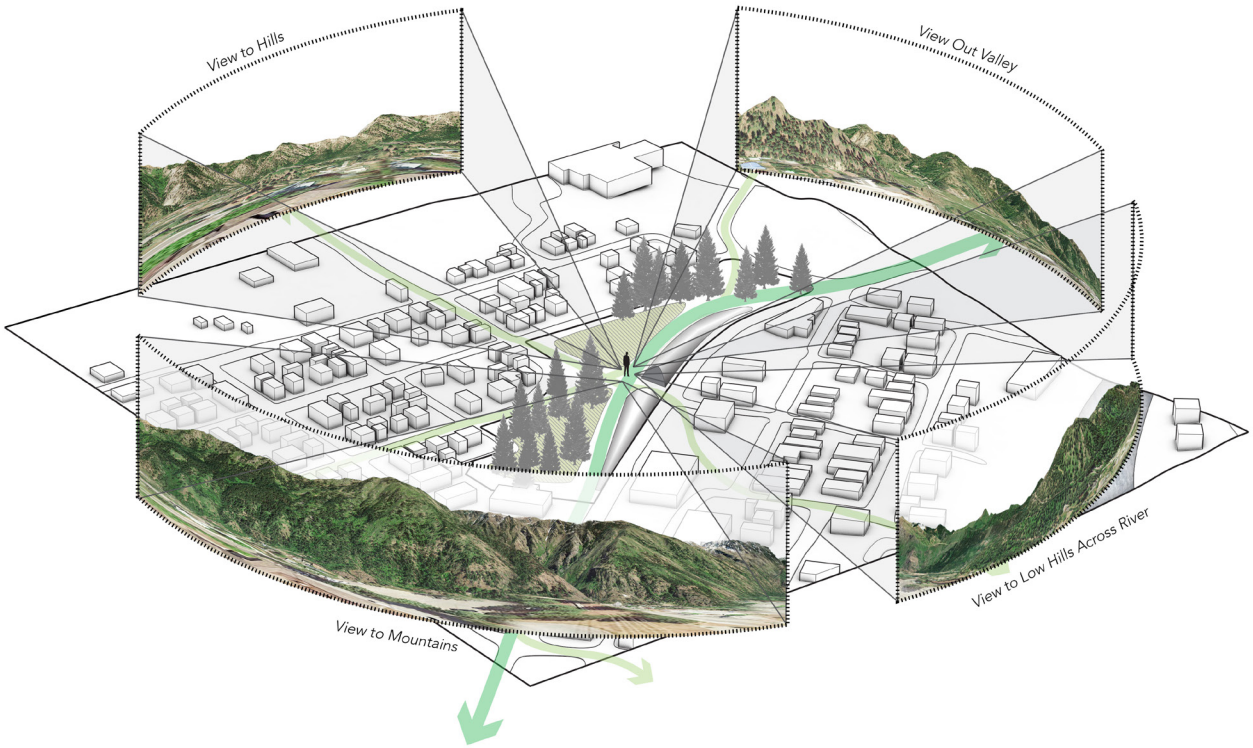
fig. 108 - Diagram: sun angles



FOREST + MEADOW

The trail crossings frame two main areas. The area to the west has many existing trees and is more forest focused. The other has fewer trees and is more meadow focused.

fig. 109 - Diagram: trails create two areas, a forest and a meadow



VIEWS

The topography is visually prominent from the site. To the west and north are mountains, to the east a valley that follows the river, and to the southeast, a large hill on the other side of the river.

fig. 110 - Diagram: views are oriented to surrounding topography

7

RANGER STATION + VISITOR CENTER

DESIGN PROPOSAL FOR THE WENATCHEE RIVER RANGER DISTRICT

The ranger station is the heart of the ranger district and is the base of operations for Forest Service activities. It is also the first stop for national forest visitors to get up-to-date information before heading into the wilderness. In Leavenworth, the ranger station program comprises three main program areas: a Visitor Center, a Ranger Station, and a Wildfire Center.

The Visitor Center provides recreation visitors with forest information, hands-on exhibits, and community event space. This is the primary public area and is the main amenity space that visitors experience. The Ranger Station has offices for Forest Service employees including botanists, geologists, range technicians, and the district ranger. The Wildfire Center has space for incident command, research offices, and fire fighting equipment storage. The Forest Service builds and maintains roads, trails and campgrounds in this ranger district, and the district headquarters provide space for equipment storage and maintenance.

The Forest Service is a large institution in a small town like Leavenworth. Using the site as an outdoor public space for the town lets the USFS give back to the local community. Across this site are a series of walking paths and trails woven through native plantings and bioswales. This site serves as trailhead for the surrounding trail system.

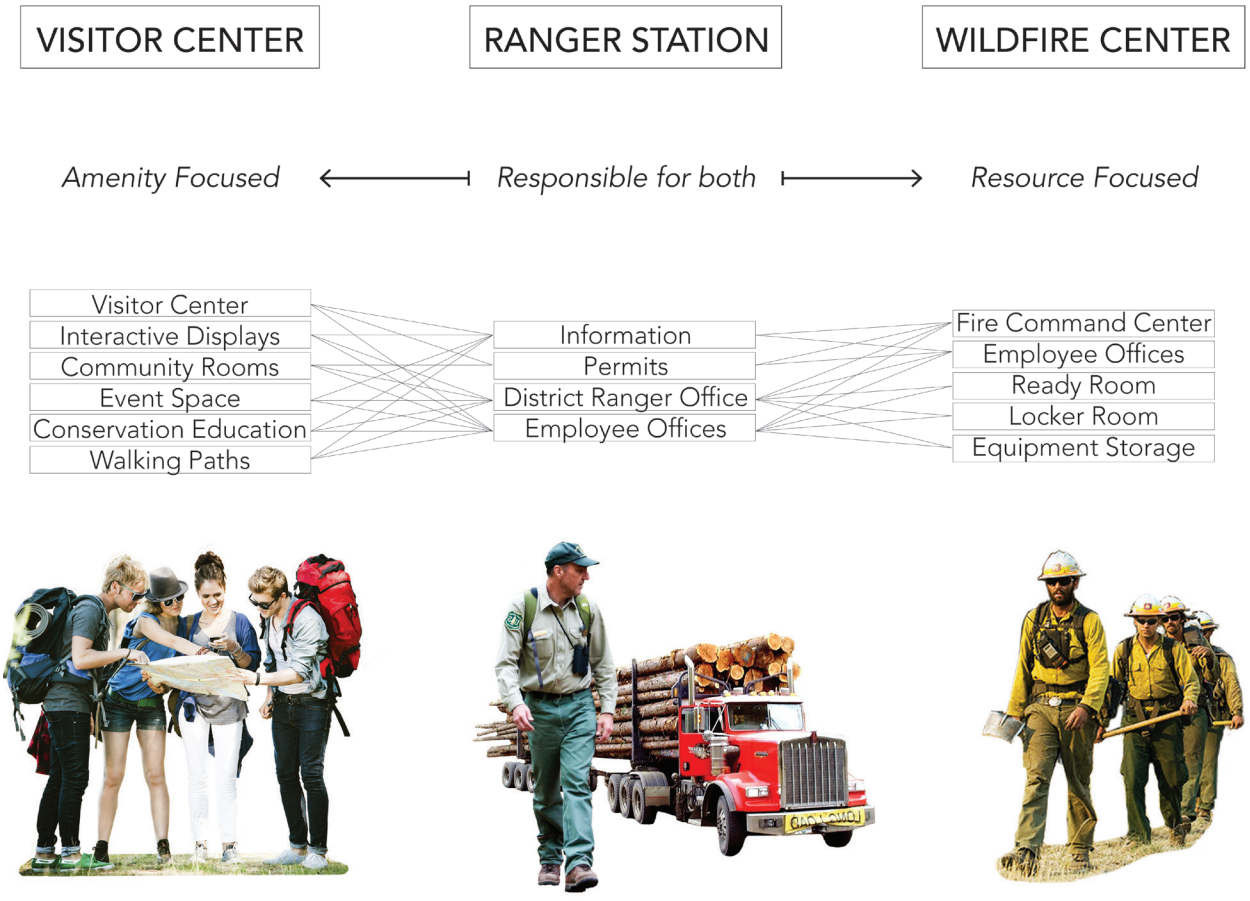
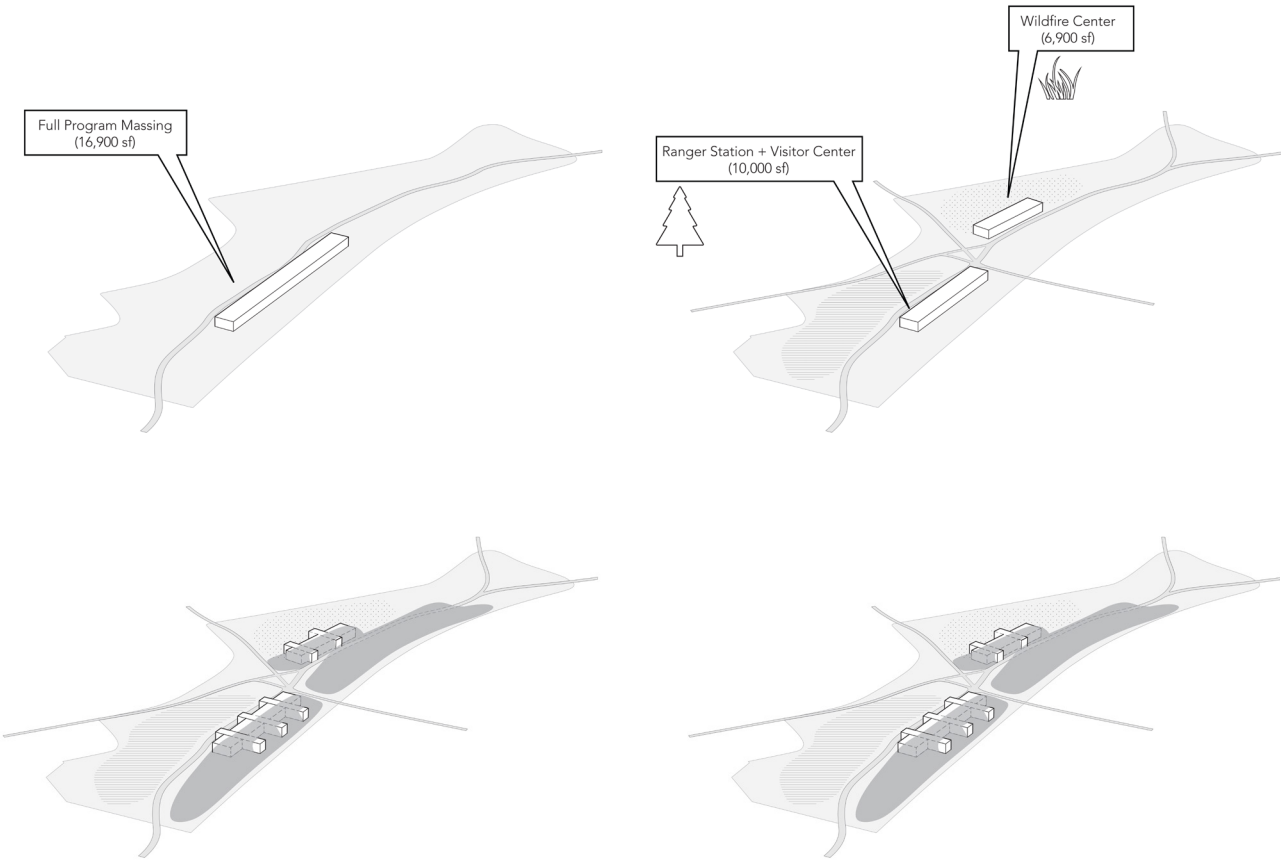


fig. 111 - Program diagram of three major elements.

EXPERIENTIAL SEQUENCE

The site response capitalizes on existing trails and new connections to create an experiental sequence through the site. The experiential movement diagram (Fig. 110) shows the sequence from the town, moving first through protective trees and a forested area, and meandering through an open meadow. In this sequence visitor attention is focused on both the immediate surroundings and the far views.

fig. 112 - Experiential movement diagram



BUILDING MASSING

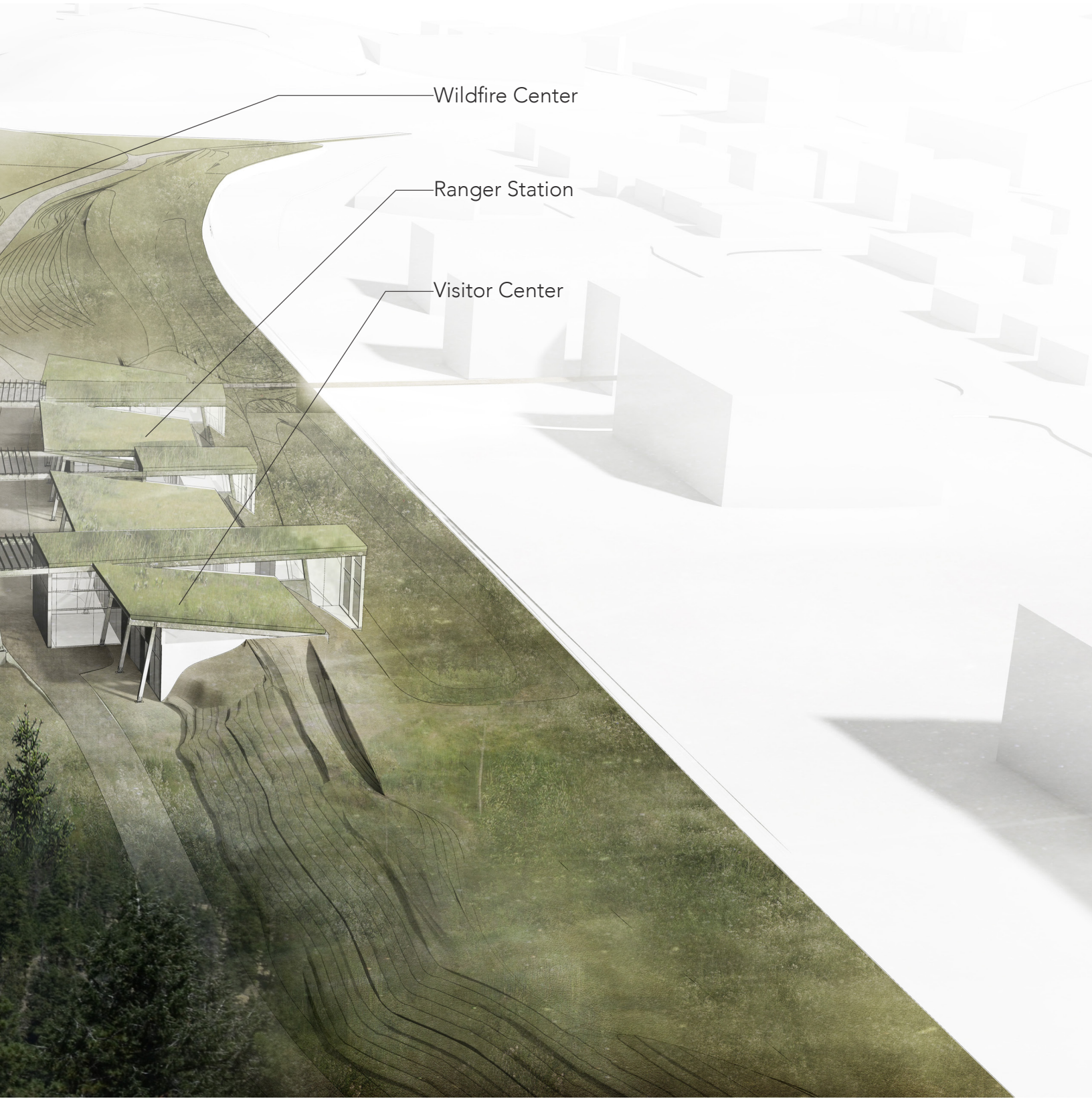
The total program massing is 16,900 square feet on a 9.5 acre site. The full program massing is arrayed into one bar aligned with the primary trail (top left). Splitting this mass into two at the trail crossing allows the Ranger Station (10,000 s.f.) to be in the forest area to the west, closer to the downtown tourist area (top right). This split also allows the Wildfire Center (6,900 s.f.) to be on the east, at the edge of the meadow. During the summer fire season the Wildfire Center can use the open meadow to stage fire fighting equipment.

Both buildings are embedded into the berm that separates the trail from the highway (bottom left). When you're inside the buildings, this focuses your attention outward onto the site, not the highway. Transition and circulation spaces bisect the buildings and berm, and become visual landmarks for the road and trail (bottom right).

fig. 113 - Program massing diagram

AERIAL

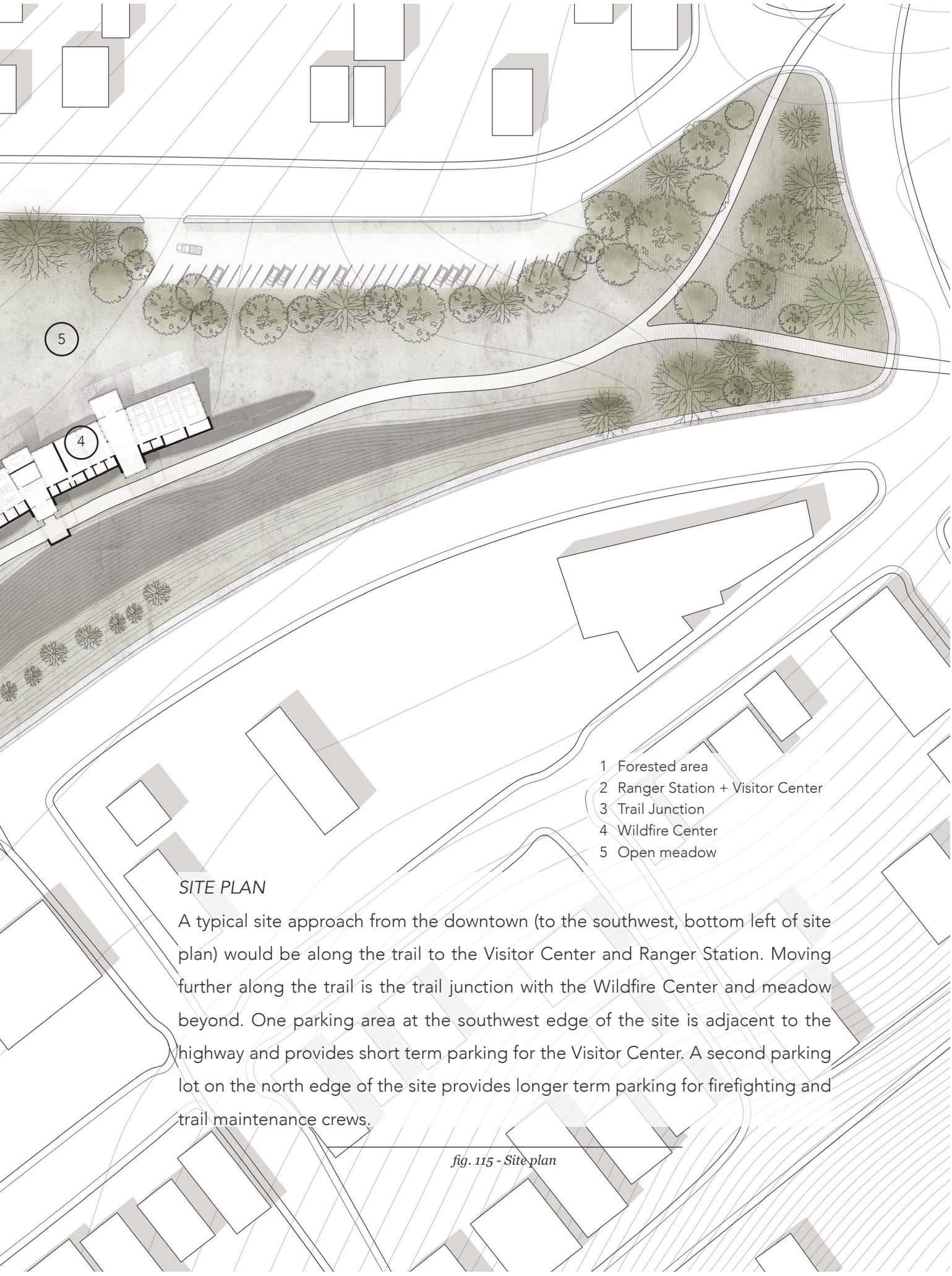
The Ranger Station and Visitor Center are in the foreground, the Wildfire Center is in the distance. Highway 2 is to the south (right side) of the site. The Ranger Station is embedded into the berm and separates the highway from the trail.



In the foreground of the Ranger Station, the entry hall cuts through the berm, allowing movement into and through the building, and also acting as a beacon from the trail and road.

fig. 114 - Aerial view


1
2
3

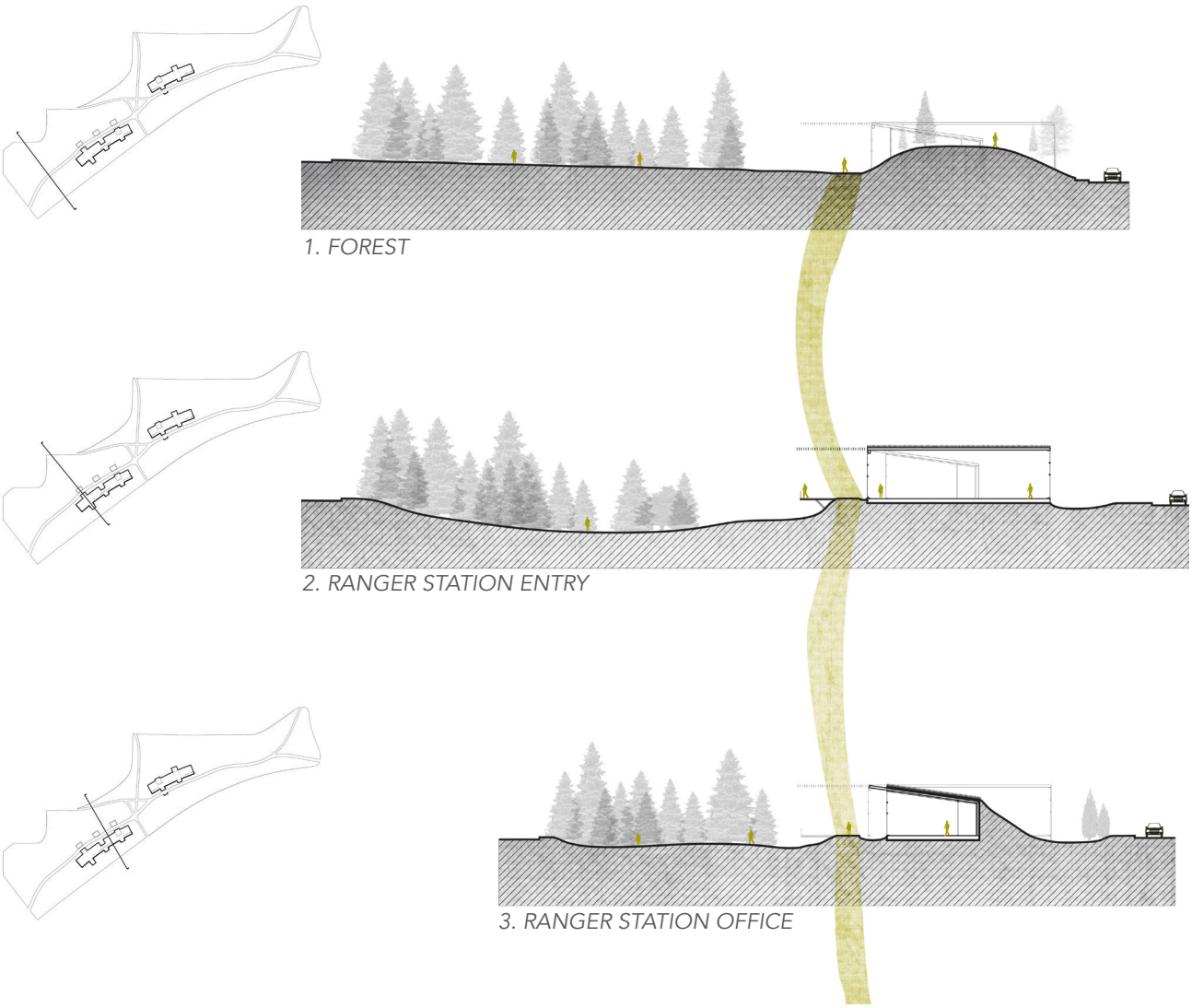


1 Forested area
2 Ranger Station + Visitor Center
3 Trail Junction
4 Wildfire Center
5 Open meadow

SITE PLAN

A typical site approach from the downtown (to the southwest, bottom left of site plan) would be along the trail to the Visitor Center and Ranger Station. Moving further along the trail is the trail junction with the Wildfire Center and meadow beyond. One parking area at the southwest edge of the site is adjacent to the highway and provides short term parking for the Visitor Center. A second parking lot on the north edge of the site provides longer term parking for firefighting and trail maintenance crews.

fig. 115 - Site plan

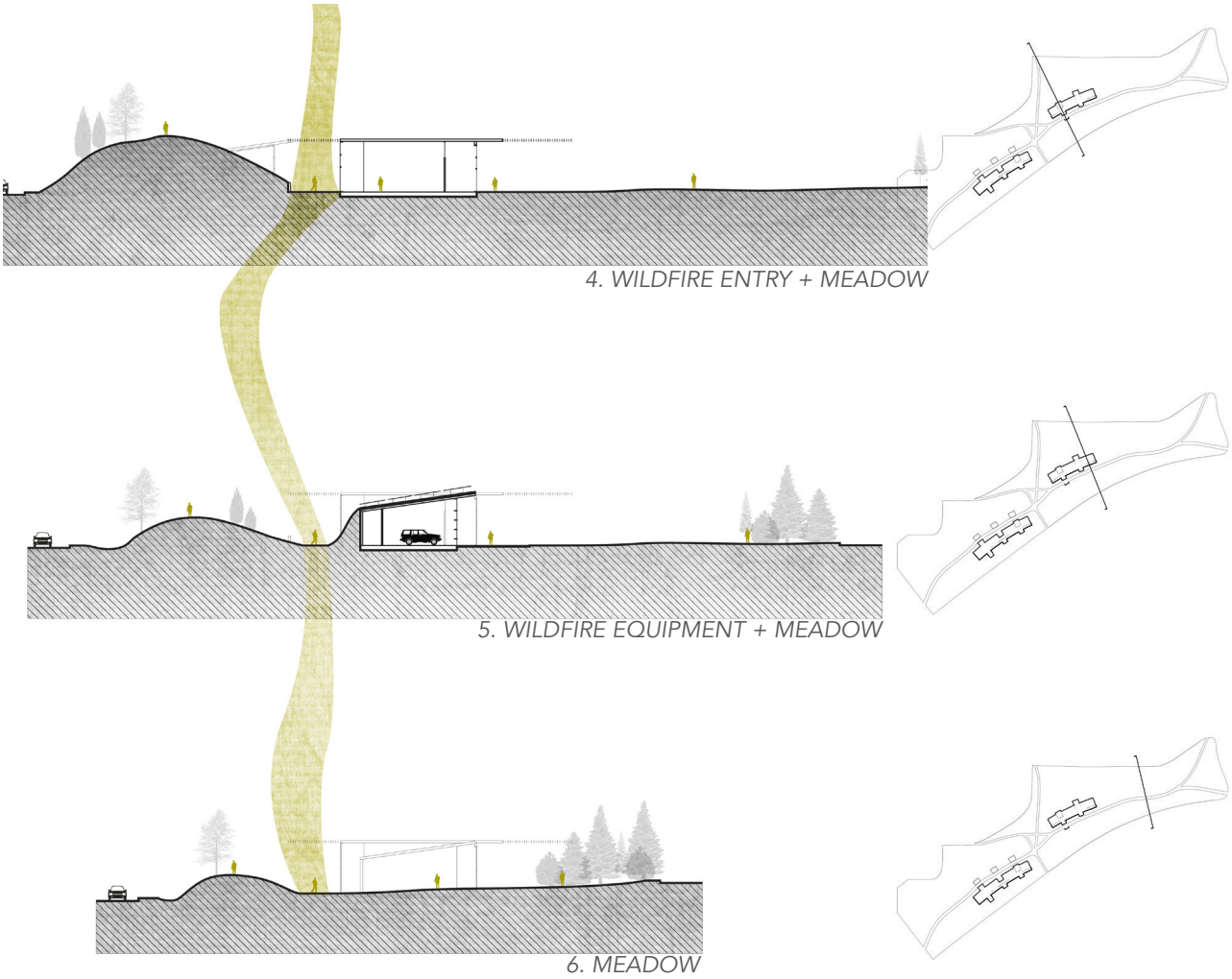


TRAIL SECTIONS - LOOKING EAST

A series of sections through the site show the experience of along the trail.

1. The trail enters the site and the berm begins to rise on your right, blocking the view and sound of the highway. The forest grows tall on your left.
2. You pass under the canopy extending from the building. You can see through the Visitor Center entrance and berm to the highway and town. You pause on the perch and look out over the little valley and forest.
3. As you pass the Ranger Station offices, you see employees working inside.

fig. 116 - Trail sections looking east



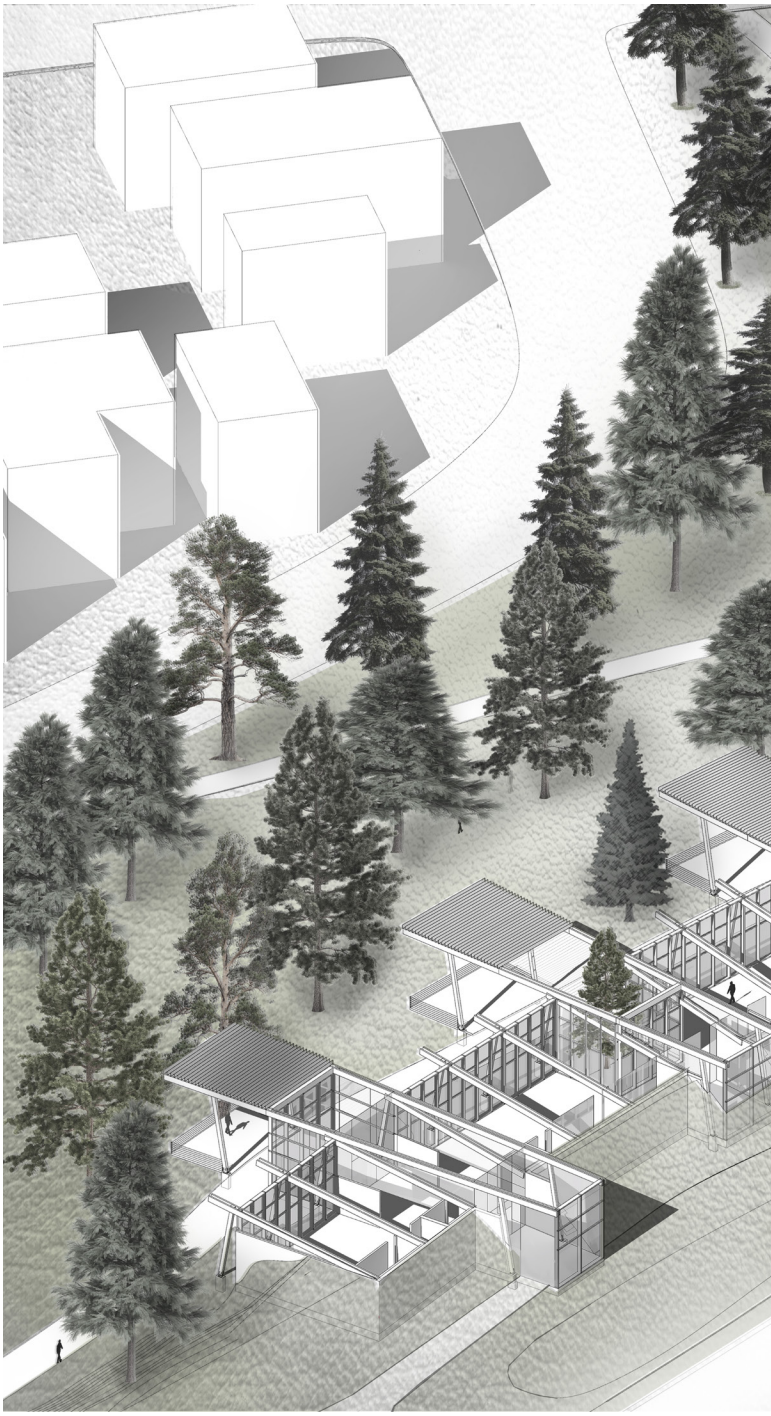
TRAIL SECTIONS - LOOKING WEST

4. After the trail junction the path moves between a berm and the Wildfire Center. As you pass the building entrance the roof canopy overhead extends and shelters a seating space carved into the berm.
5. Moving between the highway berm and the building berm, you feel nestled into the landscape and pause to take in the view from atop the berm.
6. You move past the Wildfire Center and look back into the meadow. There are no close trees here blocking your view of the distant mountains. As you continue along the trail the berm tapers down and the trail heads out of town.

fig. 117 - Trail sections looking west

AXONOMETRIC

The long length of the buildings are nestled into the berm. A structural repetition of bypass glulam columns and beams define the main spaces. Program transitions and circulation spaces are cut through the building and berm, projecting a glass mass out toward the road and a light roof canopy out over the trail. The structural system is simple and repetitive, which allows particular elements to define the experience. The glassy projections toward the highway act as beacons along the road, the mass scaled to an automobile. On the trail side the roof canopies project at regular intervals, creating a series of covered perches. The assembly of smaller parts is scaled to the pedestrian.



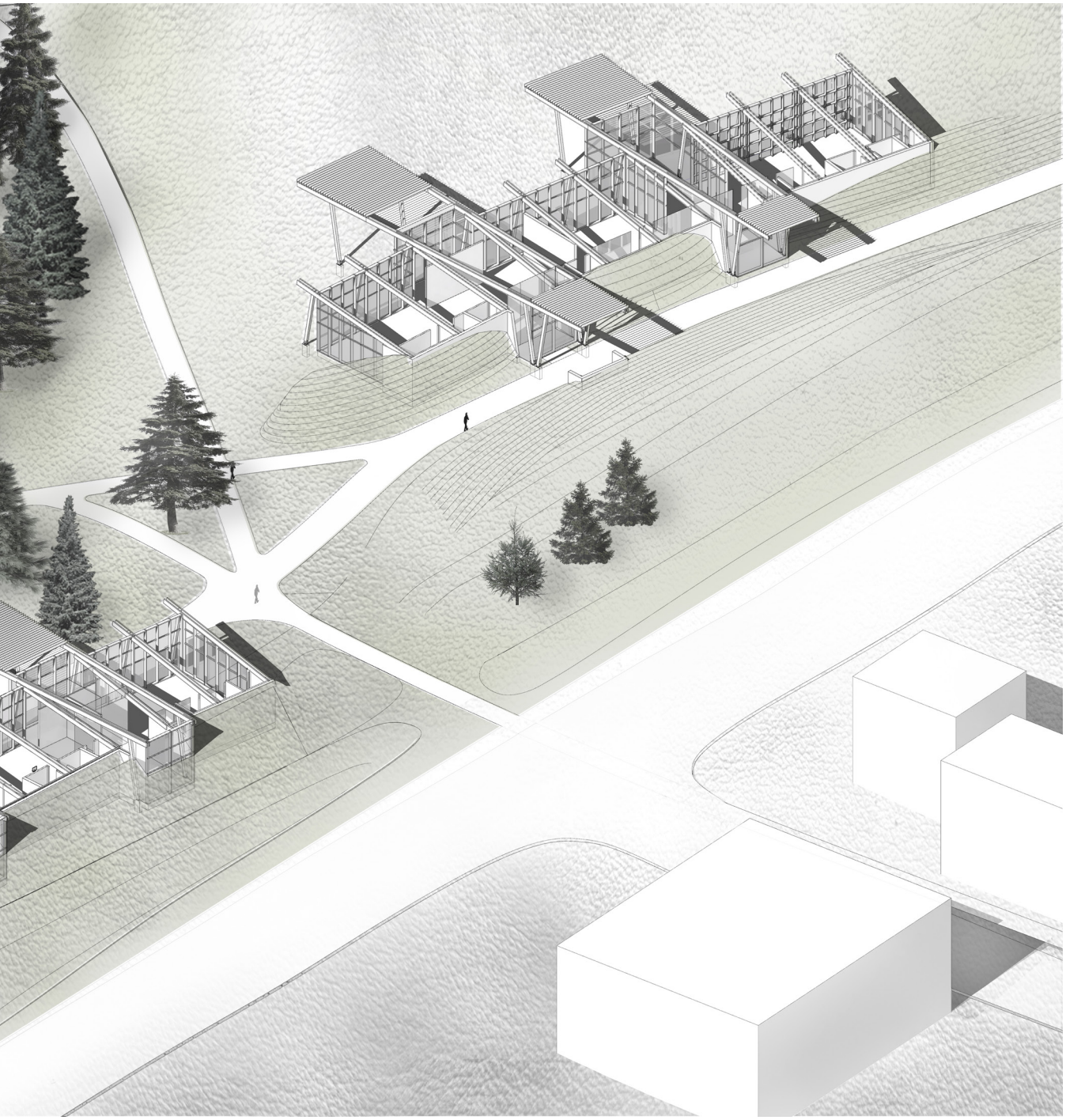
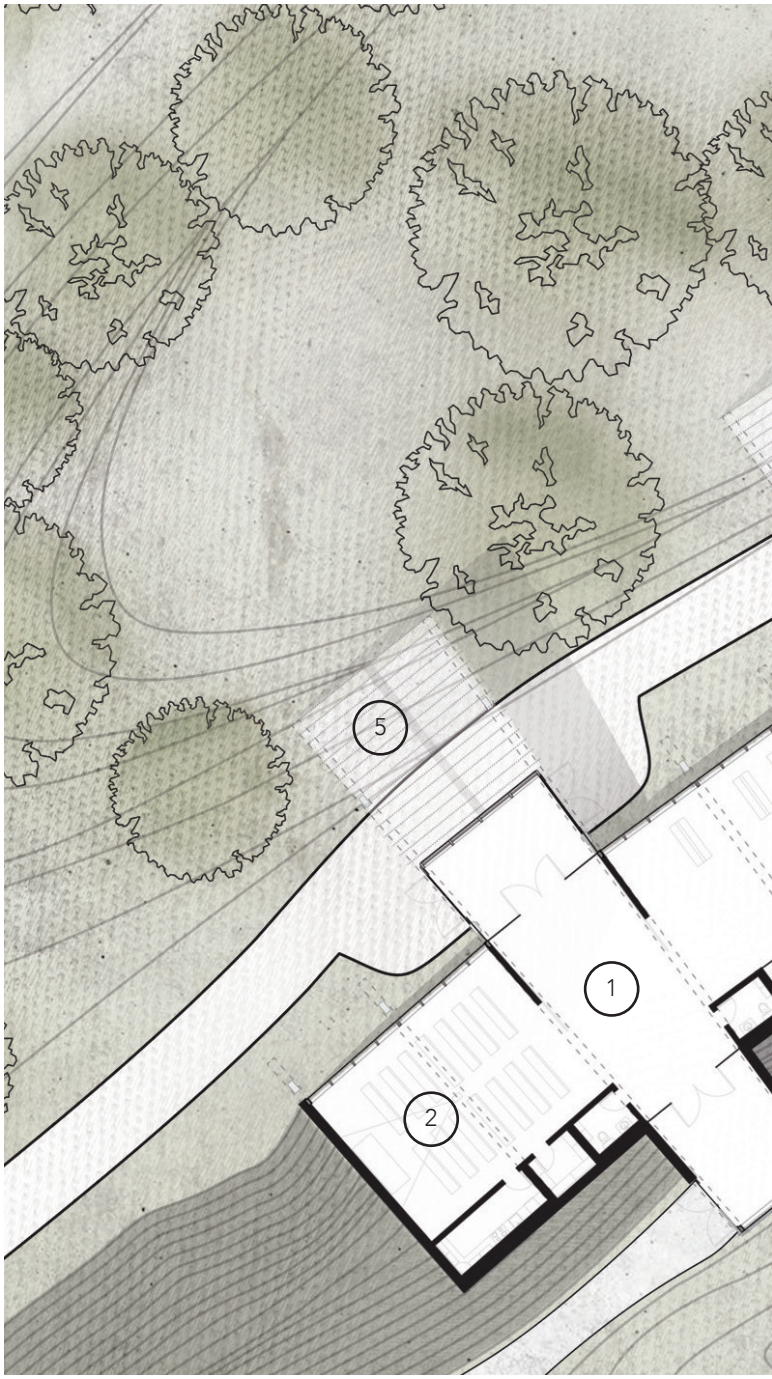


fig. 118 - Roof off axonometric showing building and site relationship

RANGER STATION PLAN

The glulam column/beam bypass system is arrayed along the trail at 20' on center. This structural system sets the rhythm and organization for the building. Private offices, storage and utility rooms are nestled into the berm. An open floor area is oriented to the view outside. The entry hall cuts through the building and berm, which allows access from either the road or the trail. The entry hall and community room are at the west end of the building and can be used by community groups independent of the Visitor Center operating hours. The Visitor Center provides information about current forest conditions and sells outdoor permits. A second cut through the building contains an outdoor courtyard and district ranger office and acts as a transition between the public and more private sides of the building. Forest Service offices and meeting rooms fill the east end of the building. The program ranges from 'most public' on the west end to 'most private' on the east end.



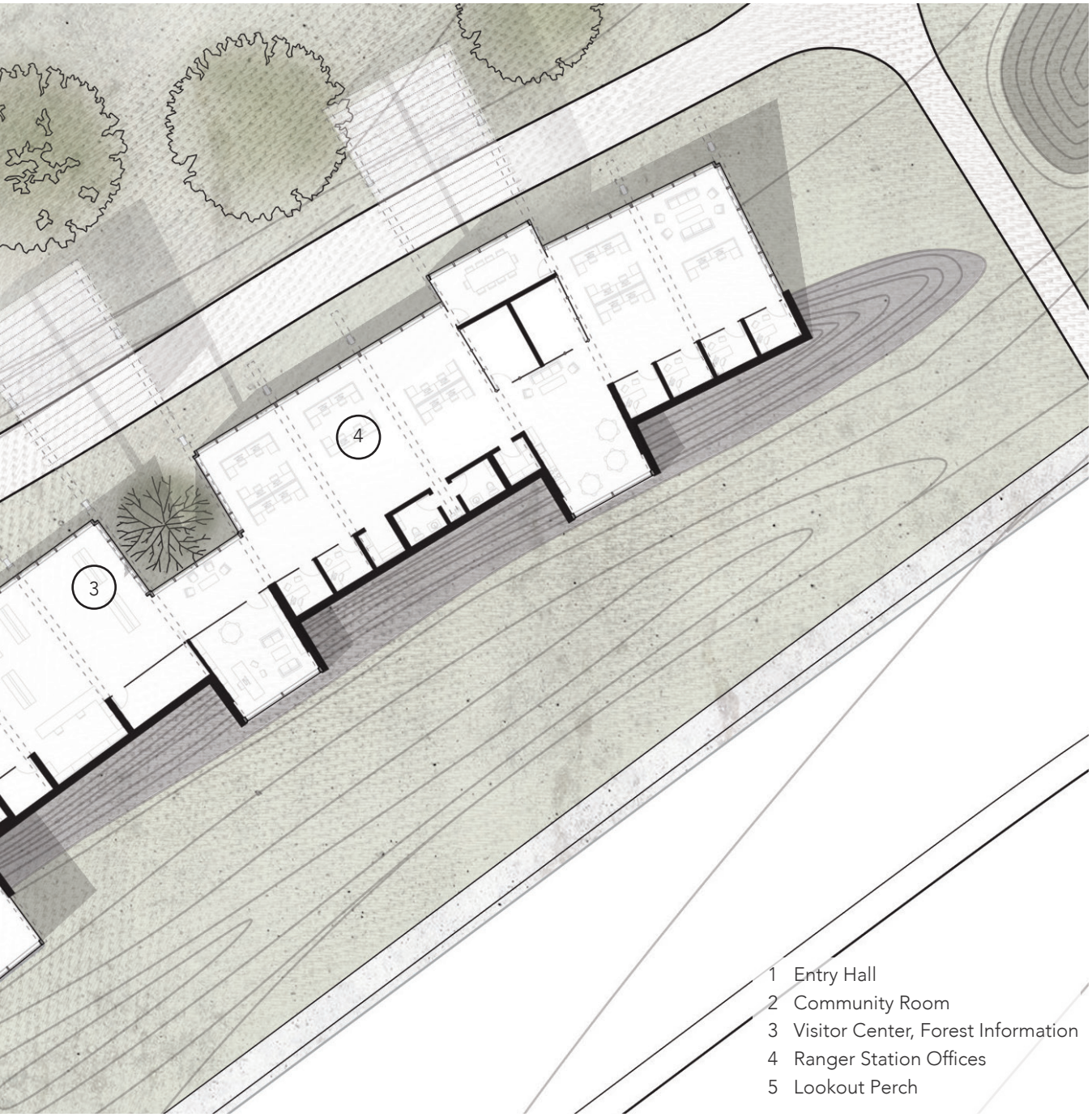


fig. 119 - Ranger Station and Visitor Center plan

SECTION PERSPECTIVE - ON THE TRAIL

A section perspective cut through the Ranger Station offices highlight the relationship between interior and exterior. The building offers an experience of prospect and refuge for employees and visitors. The green roof and berm are not visible from inside, but their presence is felt because they create a solid exterior wrapping that directs all attention outward to the site. Inside the Visitor Center

the rain water collection and treatment process is made visible to educate visitors about water conservation. The building blocks sound and sight of the highway. Visitors are welcome to stay on the trail to their destination, or wander across the site to explore different trees and native plants.

fig. 120 - Section perspective of the Ranger Station offices, trail, and valley

fig. 121 - View of Visitor Center entrance from the trail

fig. 122 - View of the Ranger Station from down in the valley

fig. 123 - Inside the Visitor Center. Ranger Station offices are in the distance.

fig. 124 - Ranger Station offices are focused on the outdoors.

ON THE TRAIL - Fig. 121 on pages: 102-103

On the right, the berm rises and engulfs the building. The bypass beams and columns project from the structure, creating a canopy over the trail at the lookout perches and creating an ordered rhythm. The perches are a moment to slow down and pause along the trail, an opportunity to view the rest of the site. The Visitor Center entrance merges into the trail, an obvious and welcoming entrance.

IN THE VALLEY - Fig. 122 on pages: 104-105

Down in the valley visitors are amongs the trees and look up to the Ranger Station. Moving to a lower topography in the valley brings the horizon line and eye level up, directing visitors to gaze up and over the surrounding town. From this view the building blocks the berm, the highway, and the commercial buildings. The trail is a primary path across the site, but visitors can move freely and enjoy the area like the forests outside of town. Landscape is experienced in both a more 'wild' version in the valley, and in a more curated version in the building courtyard. This site is not an imitation of the wilderness, but rather highlights and emphasizes some of the experiential qualities of being in the wilderness.

VISITOR CENTER - Fig. 123 on pages: 106-107

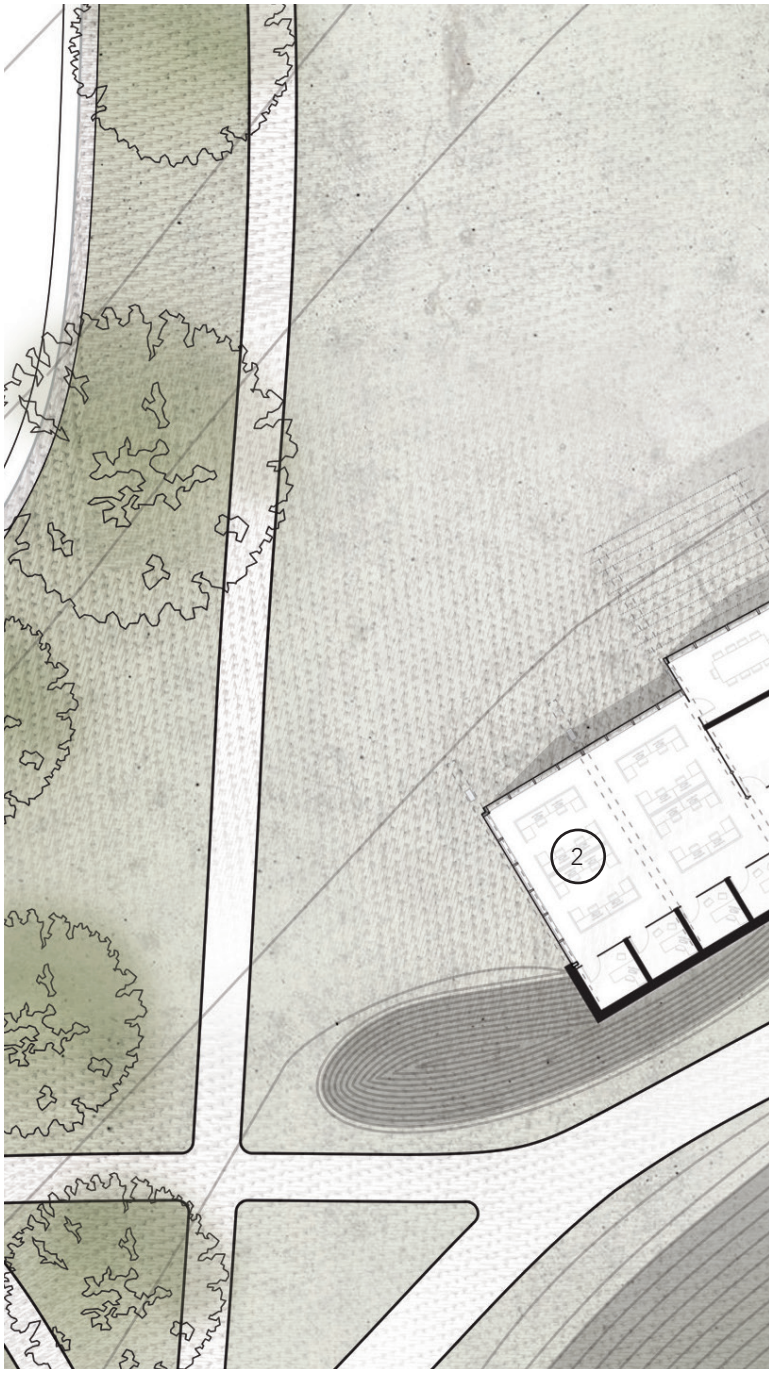
The Visitor Center is the most visited public location on this site. It is the destination for recreation visitors needing a permit or looking for a hiking recommendation. The Visitor Center represents the identity of the Forest Service and is the first site of visitor interaction with the organization. Exhibits provide tactile and sensory experiences to connect people with the native flora and fauna. Although the Visitor Center is part of the built and conditioned space, in reality the entire site is part of the Visitor Center experience. The walking paths and native plantings provide an informative and engaging experience not available inside.

RANGER STATION OFFICES - Fig. 124 on pages: 108-109

The Ranger Station is visited less frequently by the public, but is the daily base of operations for Forest Service employees. Staff includes botanists, geologists, range technicians, GIS specialists, and the district ranger. Many projects span multiple disciples and open work stations allow employees to work collaboratively. The general office area has the best views out to the trails and site. Private offices look out onto the open area with the outdoors beyond. The window height to room depth is optimized for natural daylighting. Employees can easily see how people are using the trails and outdoor areas onsite, a microcosm of how visitors may use the forests.

WILDFIRE CENTER PLAN

The Wildfire Center northeast from the Ranger Station along the trail. The same structural system and organizing principles are used. The entry hall is accessed from the trail where the roof structure and canopy extend out over the path. The research offices and meeting rooms are on the west end of the building, closer to the Ranger Station. The Incident Command is in the center, with storage and maintenance on the eastern end of the building. This program arrangement allows each section of the building to be shut down when not in use to save electricity and heating. During a wildfire in the ranger district the response team can use the building and meadow as a base of operations. The Incident Command area is designed to be flexible and accommodate different sizes of teams working together. The circulation/ transition bar between Incident Command and equipment storage opens out to the meadow which can be used to stage equipment before sending it out to a wildfire.



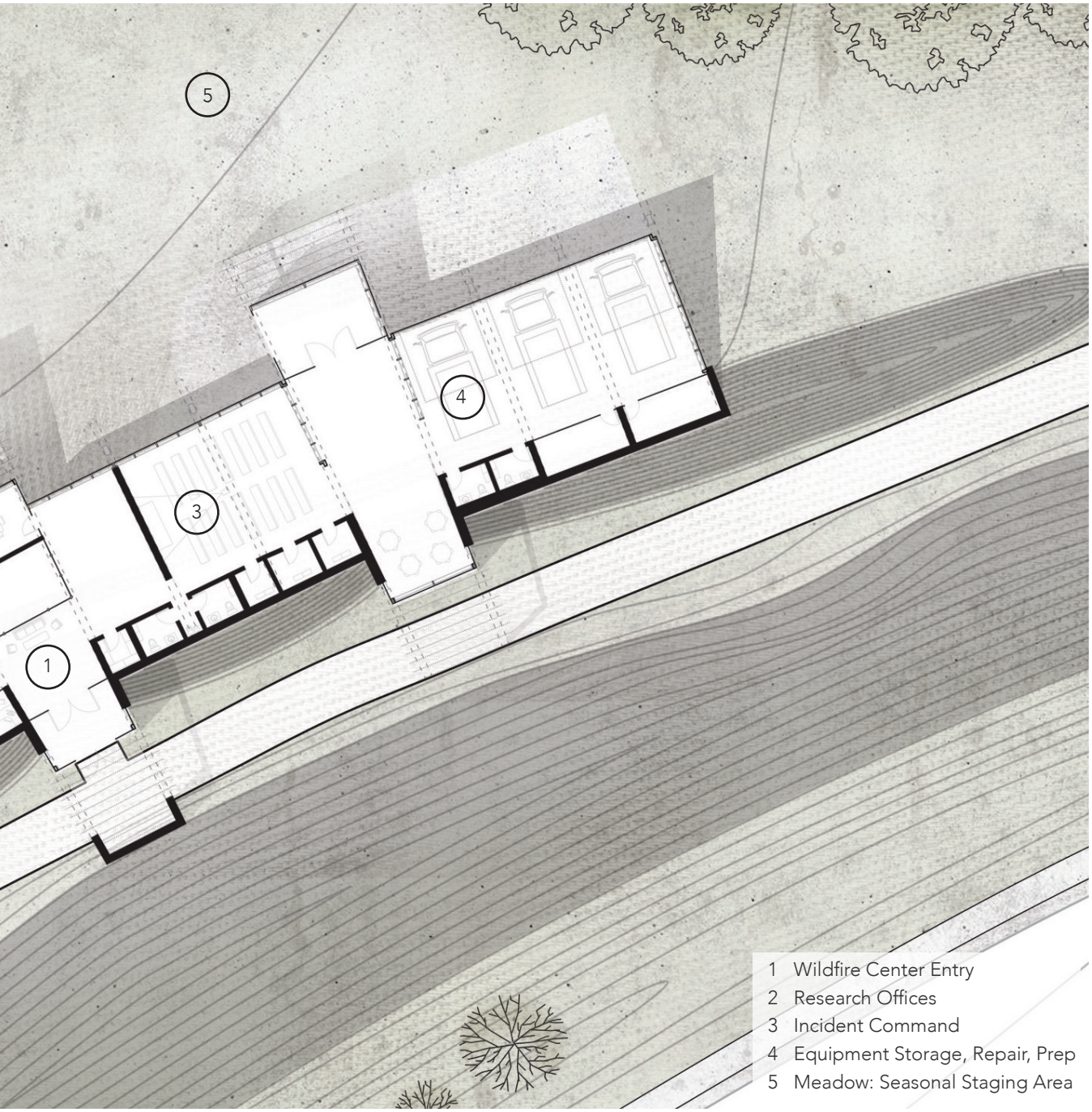


fig. 125 - Wildfire Center plan

fig. 126 - View on trail outside of Wildfire Center

fig. 127 - Meadow during the winter. Buildings can close seasonally.

TRAIL OUTSIDE THE WILDFIRE CENTER - Fig. 126 on pages: 114-115

Outside of the Wildfire Center the trail moves between the berm and the building. On a functional level the berm shelters and insulates the building. It also provides an off-trail spot to meander and relax. On an experiential level it grounds the building to the landscape and elevates the horizon line which lifts the eye up to view the surrounding mountains.

LOOKING BACK AT BOTH BUILDINGS - Fig. 127 on pages: 116-117

A view back to the meadow during the winter highlights the seasonality of this site. The use of these buildings varies throughout the year. Separating the program into multiple buildings and zones allows the Wildfire Center (left) to shut down in the winter while the Ranger Station stays open (right). The meadow and forest areas are places for the community to be outside together. Leavenworth is a popular cross country skiing destination and many trails are accessible just outside of town. Connecting these trails offers year round access to the outdoors. Winter tourist events bring large crowds to Leavenworth. The trails onsite offer an outdoor alternative for visiting tourists without needing to leave the town.

1 Green roof
2 Perch with slatted sun shade
3 Lifted roof column + beams
4 Curtain wall
5 Bypass glulam column + beams
6 Retaining wall
7 Concrete slab on grade

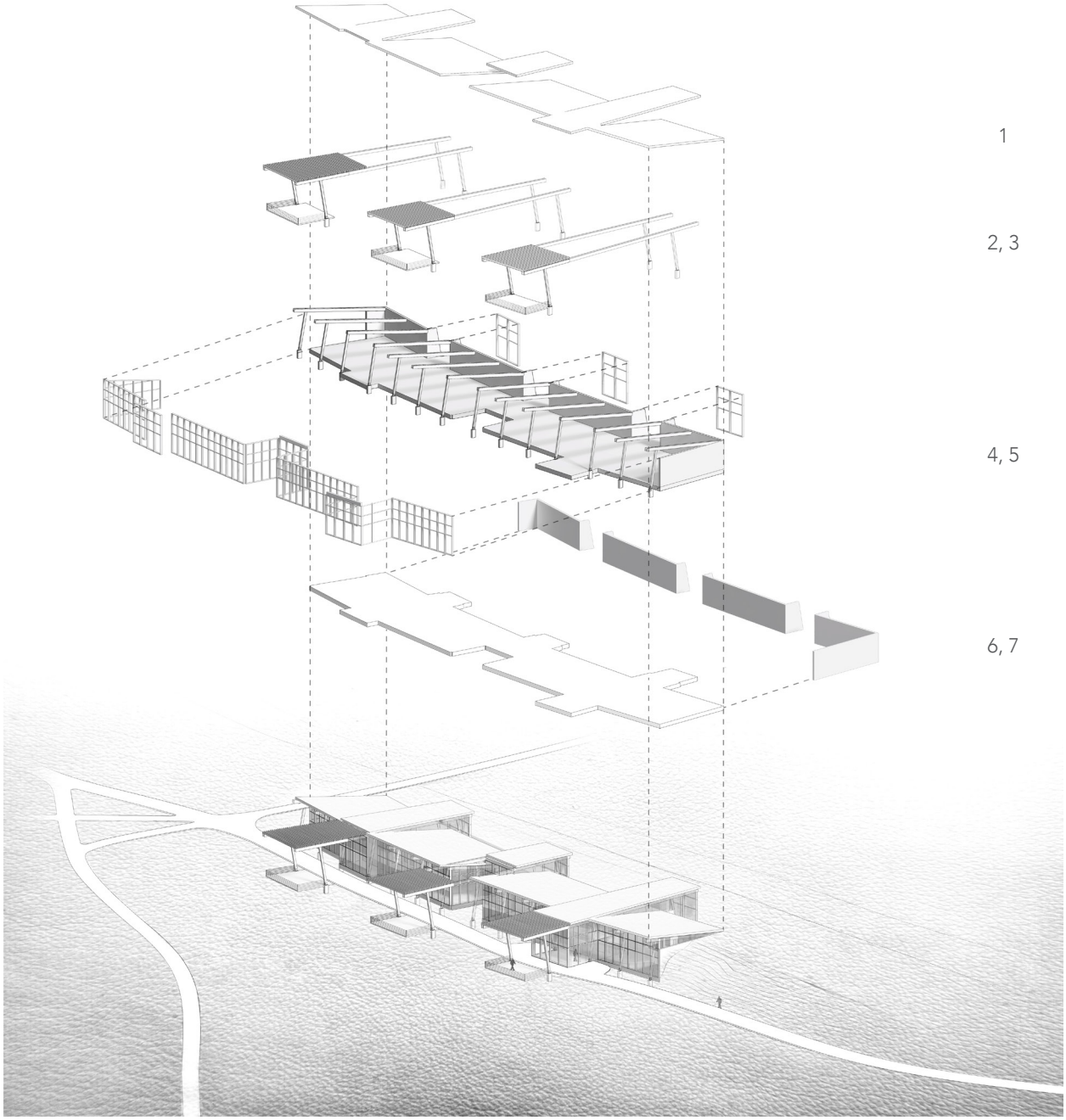
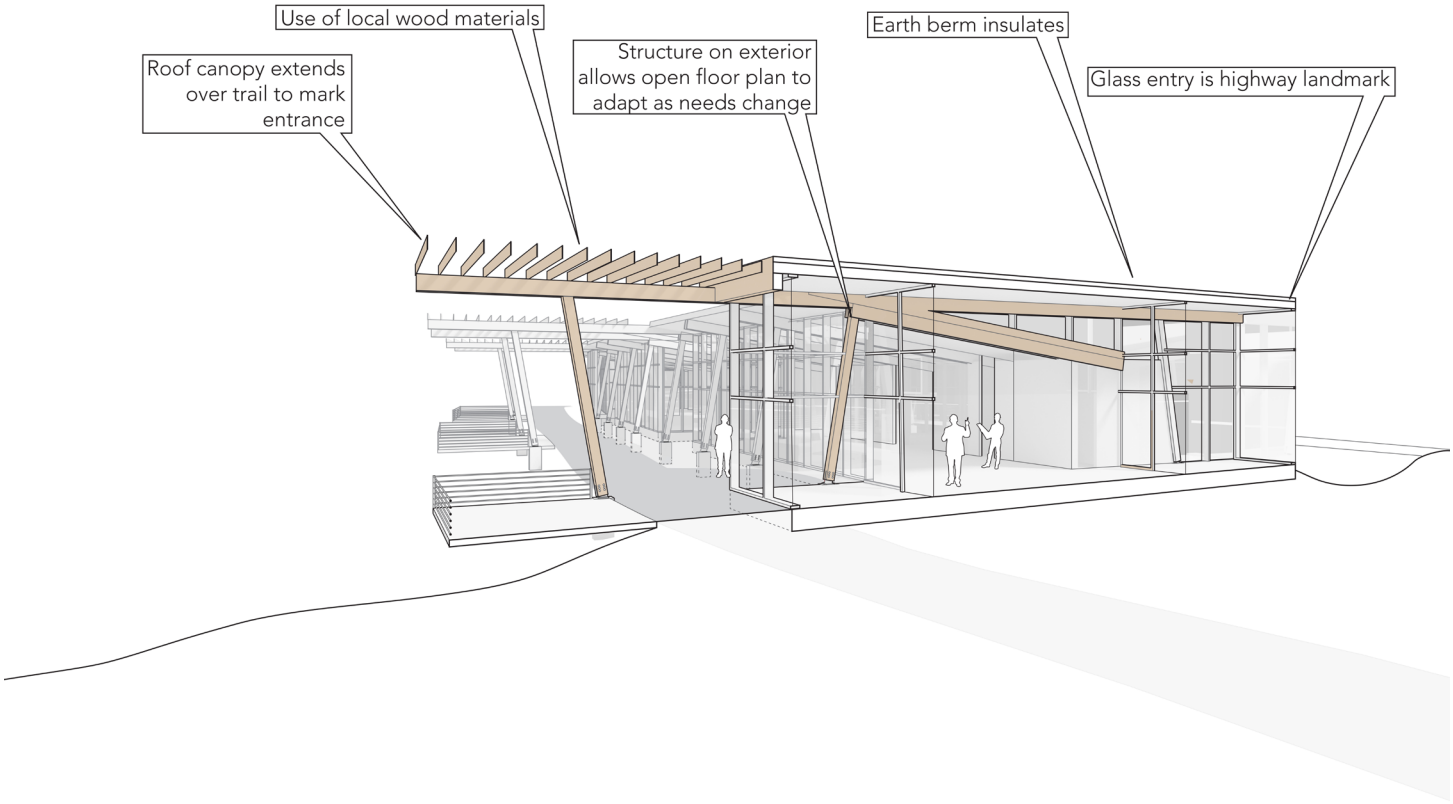


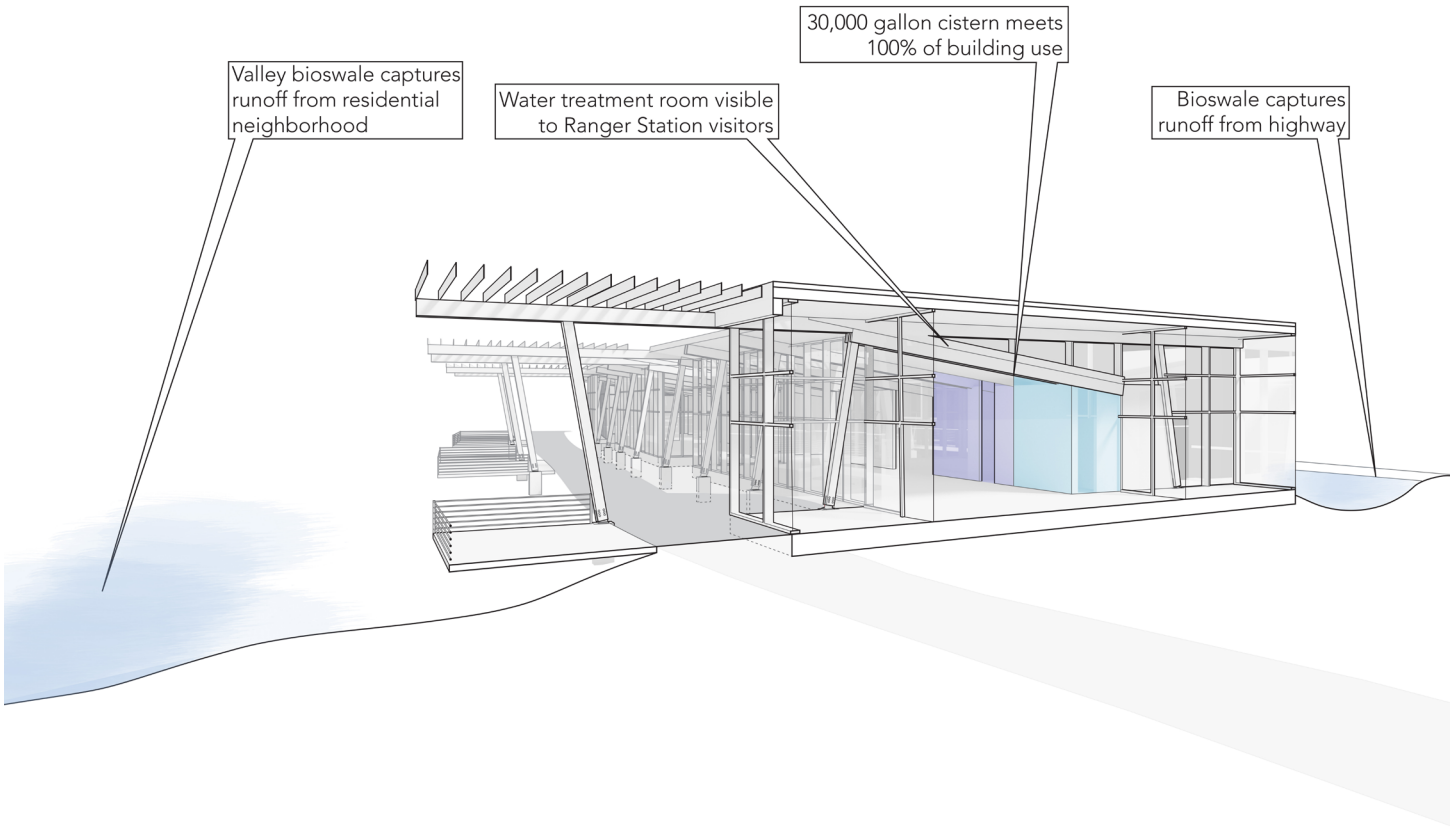
fig. 128 - Exploded axonometric showing building structure



MATERIALS + STRUCTURE

The main structural system includes glulam beams and columns in a bypass arrangement. The structure is pulled to the outside of the facade to provide an open floor plan that can adapt over time. The glassy entry on the highway side of the berm marks the building from the road. The wooden roof slats over the trail provide a canopy over the lookout perch.

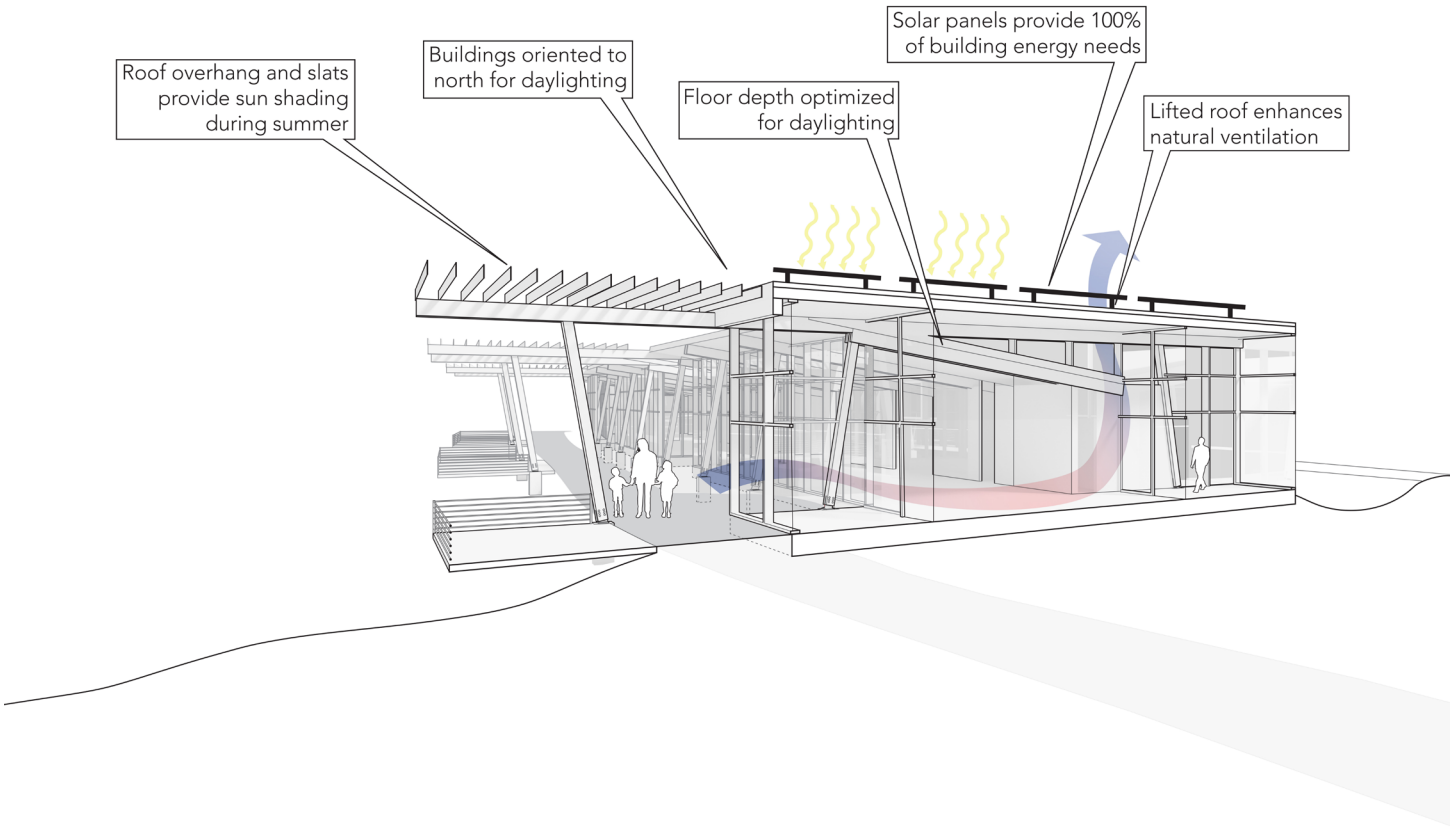
fig. 129 - Section Diagram: Materials + Structure



WATER

The valley captures runoff from the residential neighborhood and bioswales between the berm and highway capture runoff from the highway before it reaches the river. The roof directs rain and snow into a 30,000 gallon cistern to be used onsite. This more than meet the needs of both buildings, allowing the site to achieve net zero water. The water treatment system is visible from the Visitor Center so that visitors can learn about the process.

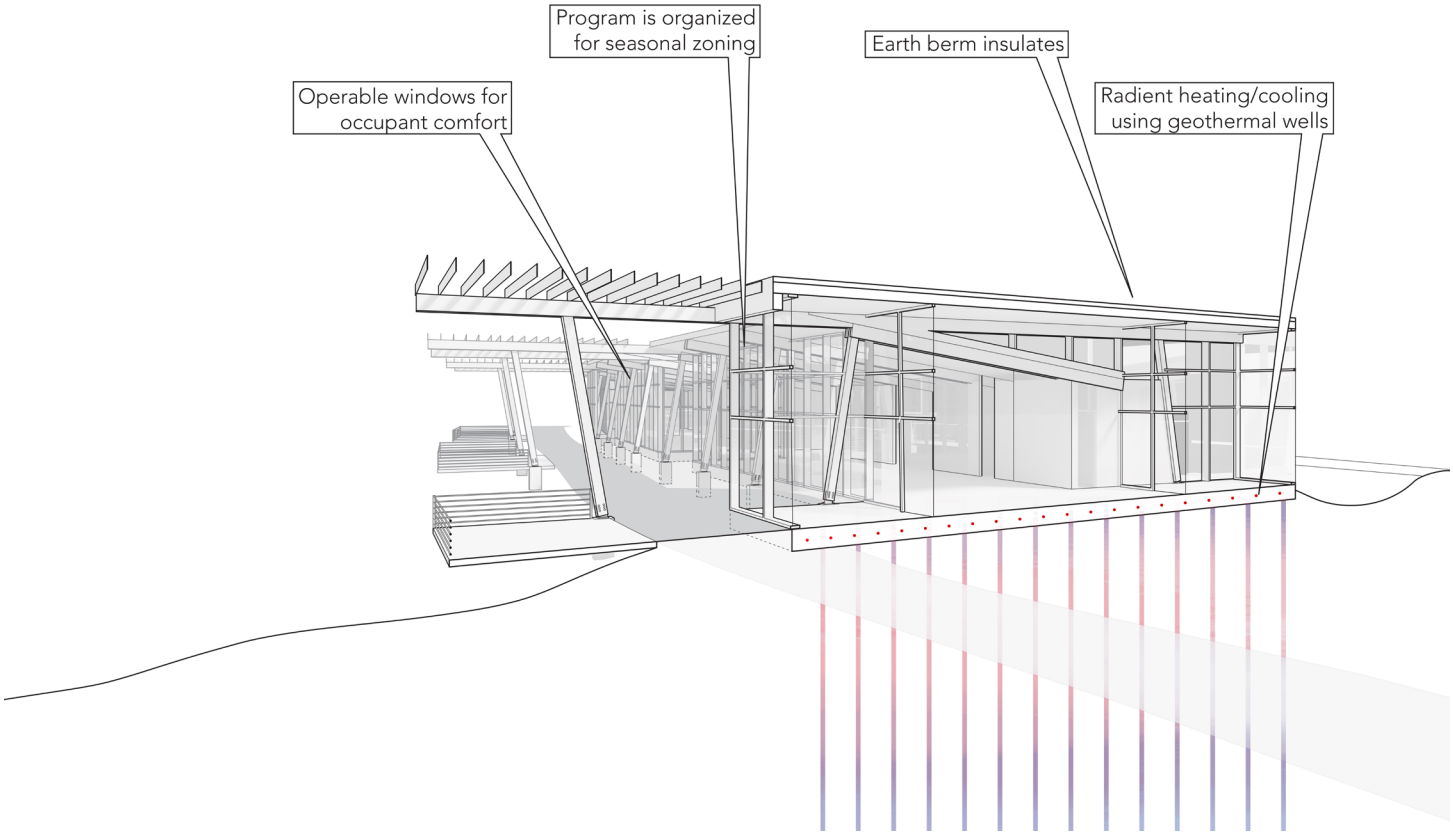
fig. 130 - Section Diagram: Water Systems



ENERGY

The floor depth to window height is optimized for daylighting to reduce energy use. Solar panels on the roof are calculated to meet 100% of the buildings' energy use on an annual basis, allowing the site to achieve net zero energy. The circulation and transition spaces through the building and berm assist in natural ventilation.

fig. 131 - Section Diagram: Energy Systems



SEASONAL ADAPTABILITY

The building is designed to flex seasonally. Program is arranged between the two buildings and within each building so that spaces are occupied seasonally and underused spaces can be shut down. Operable windows allow occupants to adjust temperature and ventilation as needed. The earth berm and green roof assist in insulating the building and geothermal radiant heating keeps temperatures consistent year round.

fig. 132 - Section Diagram: Seasonal Adaptability

8

OUT OF THE WOODS

The Wenatchee River Ranger Station and Visitor Center proposal offers a design that reduces resource consumption while enhancing visitor experiences in nature. The design proposal achieves net zero energy and water use, resulting in architecture that communicates the conservation values of the Forest Service. It is also a healthy and comfortable workplace, and is a stimulating place to visit and learn about national forests.

This thesis proposed a design approach that emphasizes the experiential qualities of being in the wilderness by highlighting connection to place, engaging visitor attention, providing sensory experiences, and provoking a sense of exploration and discovery. This thesis also advocated for high performance architecture that minimizes resource consumption and supports conservation. This thesis also has broader implications for the United States Forest Service. The USFS has 154 national forests, 20 grasslands, and tens of thousands of built facilities. Design based on visitor experiences and sustainability should be the guiding principles as this vast number of facilities are renovated and replaced. This thesis demonstrates how architecture facilities for a government agency focused on environmental sustainability can be equally sustainable.

The Wenatchee River Ranger Station and Visitor Center uses Forest Service architecture as a case study in how architecture can mediate differing views of

the wilderness. This thesis posits architecture can mediate between resource and amenity views of the wilderness by improving the experiences of visitors and by reducing the negative impacts of buildings and users on the environment. This thesis argues that civilization and wilderness are not opposed, but rather they are on a spectrum, with places being more urban or more wild. This spectrum definition of wilderness allows for a greater understanding of how humans occupy and build in nature. This attitude and approach is applicable beyond the Forest Service, to all cases where architecture acknowledges and accommodates our presence in nature while reducing resource consumption.

fig. 133 - Experience it!

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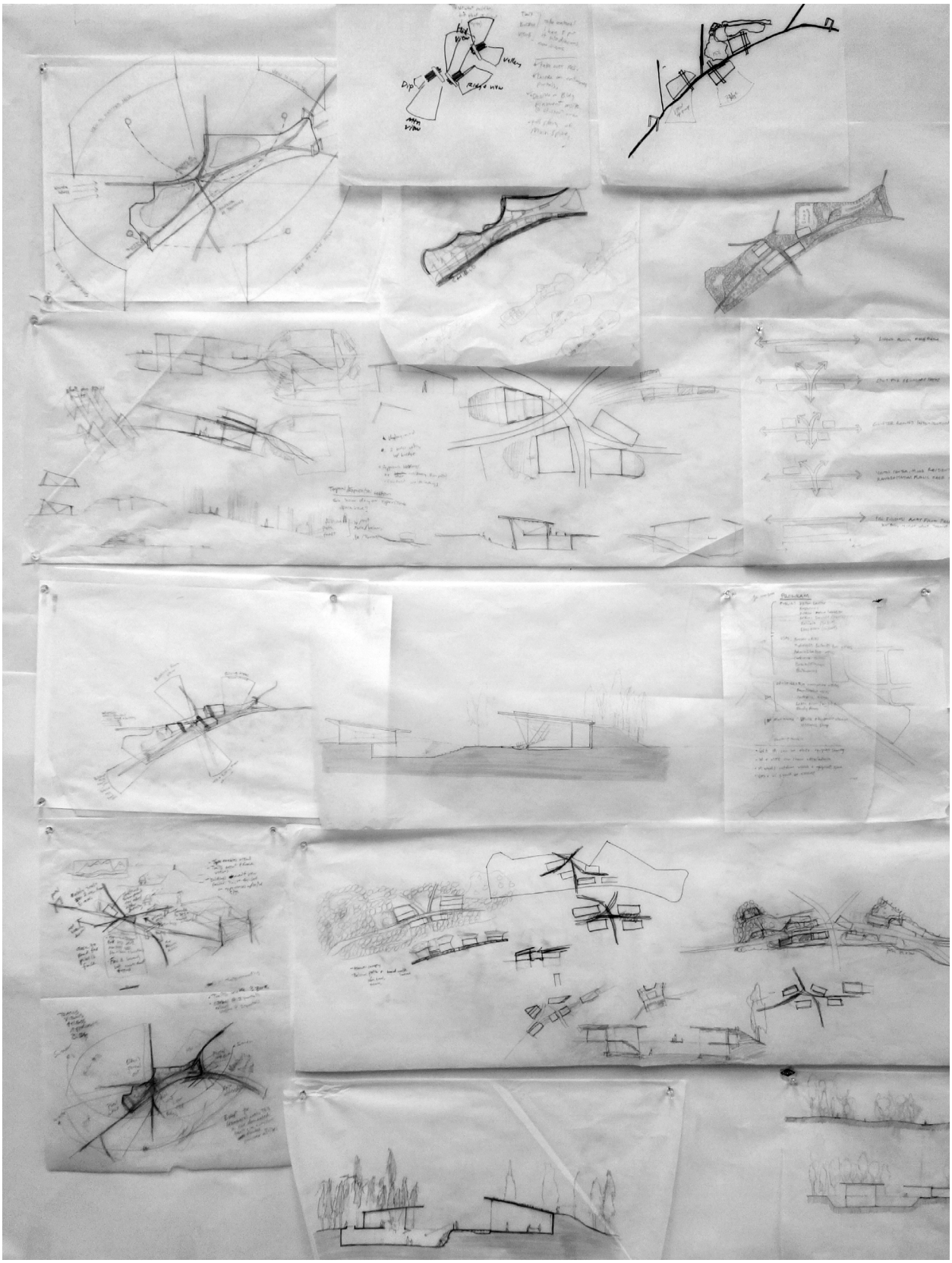

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Fig. 75 - The massing divides the ranger station into three areas based on interior program. <http://www.archdaily.com/274996/mojave-rivers-ranger-station-marcy-wong-donn-logan-architects>
Fig. 76 - All lumber is salvaged and reused or FSC certified.
<http://www.lakeflato.com/eco-conservation/dixon-water-foundation-josey-pavilion>
Fig. 77 - The two buildings frame an outdoor classroom around an existing tree. Deep porch overhangs reduce sun heat gain. <http://www.lakeflato.com/eco-conservation/dixon-water-foundation-josey-pavilion>
Fig. 78 - Multiuse rooms open to the outdoors, creating engaging classrooms. <http://www.lakeflato.com/eco-conservation/dixon-water-foundation-josey-pavilion>
Fig. 79 - Three different national forests. Each requires unique site-specific design based on local forest conditions.

Chapter 6 - Wenatchee National Forest
Fig. 80 - All public land in Washington State.

Thanks for reading!

If you want to share your feedback and continue the conversation on this topic, please connect at www.reed-kelly.com