ABSTRACT

Title of Thesis:	CO-HABITAT: HARMONIOUS COEXISTENCE AND WILDLIFE REHABILITATION
	Emily Kelly, Master of Architecture, 2023
Thesis Directed By:	Professor Joseph Williams, School of Architecture, Planning, and Preservation

In a world dominated by the human existence, it is important to acknowledge and respect the natural world by designing for more than just humans. Through seamless integration of the building and landscape, Co-Habitat will create an ecosystem where humans and non-humans can coexist harmoniously. The ultimate goal is to achieve mutualistic symbiosis, in which every species benefits from the ecological relationship network. As a new home for a wildlife rehabilitation organization, the complex will support their mission to mitigate damage to the environment caused by human activities. In addition to meeting program needs, the facility aspires to provide a method of safe observation. This unique aspect of the visitor experience will offer enjoyment as well as education for the public. The project will enhance the organization's positive impact by channeling principles of meaningful placemaking and incorporating strategies of regenerative design. Co-Habitat challenges the typically anthropocentric focus of buildings and proposes a synergistic approach, in which the built environment forms an inclusive habitat for all beings.

CO-HABITAT: HARMONIOUS COEXISTENCE AND WILDLIFE
REHABILITATION

by

Emily Kelly

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Architecture
2023

Advisory Committee:
 Professor Joseph Williams, Chair
 Professor James Tilghman, Instructor
 Professor Michael Ezban
 Professor Juan Burke

Acknowledgements

Thank you to my committee for their invaluable guidance, and thank you to my

family for their unwavering support.

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Chapter 1: Environmental Crisis

Global Biodiversity

Recently, the WWF's 2022 Living Planet Report demonstrated that 50% of the world's wildlife has vanished since 1970. This drastic decline in biodiversity across the globe affects more than just the animals and environments that are directly at risk. Biodiversity refers to the variety of organisms that make up the natural world that work together in ecosystems in order to support food, water, shelter, and thereby life itself.[1] As humans consume resources faster than nature can replenish them, the increasing pressure leads to an upset in the delicate balance of the planet's biosphere. As a result, the environment becomes damaged and can no longer support all life. On the bright side, Earth is resilient, meaning if we take the proper measures to mitigate the negative impacts caused by humans, nature will be able to recover and the balance will be restored.
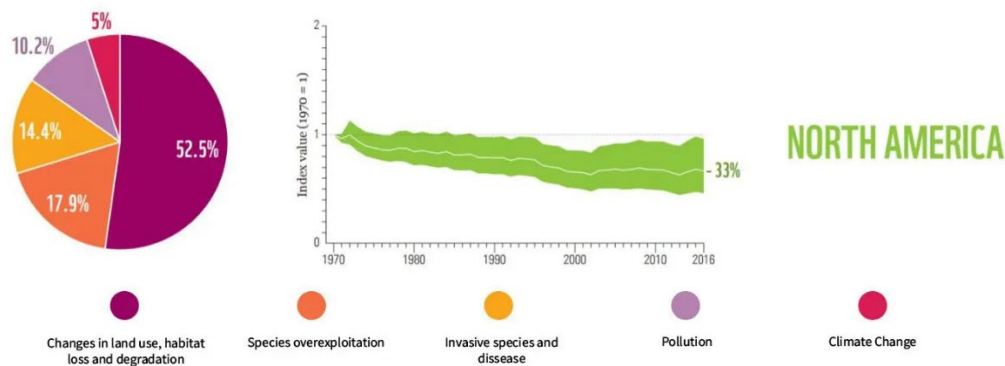
Figure 1: Biodiversity Loss and its Causes in North America

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[1] "What Is Biodiversity?," WWF (World Wildlife Fund), accessed March 19, 2023, https://www.worldwildlife.org/pages/what-is-biodiversity#:~:text=Biodiversity%20is%20all%20the%20different,maintain%20balance%20and%20support%20life.

In environmentalism, there are two movements that deal with how humans interact with the environment, known as preservation and conservation. Preservation involves completely protecting the environment from human activities, while conservation allows the responsible use of natural resources but minimizes the damage. When preserving the environment, the land cannot be touched and there is no human interference.[2] When conserving the environment, there is recognition of the impact humans have already had and an attempt to mitigate it.[3] In preservationism, humans must be hands-off with the environment in order to allow nature to take its course. However, there is no acknowledgement of the damage that has already been done, and no attempt to resolve it. Therefore, conservation is a more realistic approach and will be the primary driver behind this thesis.
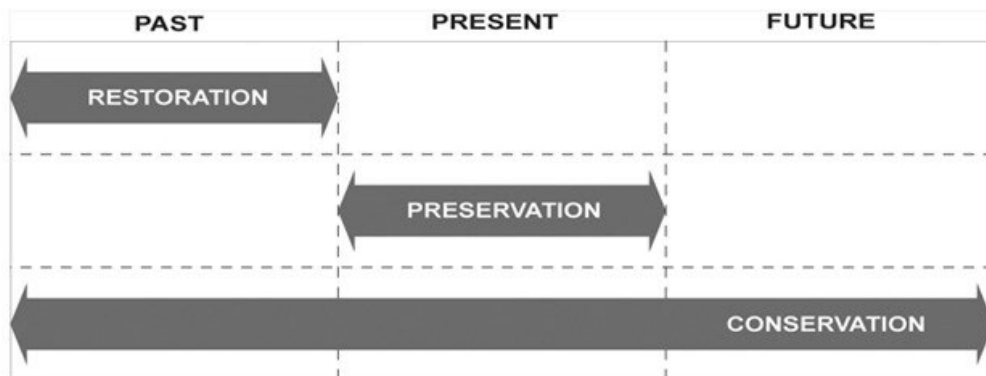
Figure 2: Preservation vs. Conservation

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[2] "Preservation," National Geographic, accessed March 18, 2023, https://education.nationalgeographic.org/resource/preservation/.
[3] "Conserving Earth," National Geographic, accessed March 18, 2023, https://education.nationalgeographic.org/resource/conserving-earth/.

There are many examples of environmental conservation at work, such as the Sustainable Rivers Program, which is a collaborative effort between the U.S. Army Corps of Engineers and The Nature Conservancy. The purpose of this project is to restore natural flow patterns to rivers that have previously been altered by human interventions such as dams.[4] At the Bill Williams River National Wildlife Refuge, the Alamo Dam was built in 1969 to manage the effects of extreme weather patterns in the surrounding region, which experiences alternating seasons of droughts and floods. Unfortunately, a lack of knowledge about the ecosystem and poor management of the dam led to significantly negative impacts on the woodland habitat downstream. In 2002, the Sustainable Rivers Project studied the river and the ecosystems it was meant to support in order to understand the natural flow patterns as well as the effects of the dam. Since the dam has already drastically altered the ecosystem, removing it could potentially cause further disruption rather than restoring pre-dam conditions. Instead, the operation schedule of the dam was updated to better manage the extreme weather patterns. As a result of this effort, the critical ecological functions of the Bill Williams River National Wildlife Refuge have been restored and it is now home to the only extensive community of native forest along the lower Colorado River watershed.[5]

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[4] "Sustainable Rivers Program," The Nature Conservancy, May 15, 2020, https://www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/land-and-water-stories/sustainable-rivers-project/.
[5] "Bill Williams River," The Nature Conservancy, accessed July 8, 2023, https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/the-bill-williams-river/.

Figure 3: Bill Williams River National Wildlife Refuge

The Sustainable Rivers Program took a conservationist approach by recognizing the damage done by human interference, and implementing an intervention that benefits all species. While humans can continue to operate the dam and manage extreme weather patterns, the ecosystem can also thrive and support the other species that depend upon it. If this project had used a preservationist approach, the ecosystem would have been left as is and no human interference would be allowed. Without human efforts to restore the natural environment, the damage done would not be fixed and the Bill Williams River National Wildlife Refuge would have continued to deteriorate and may have never recovered.

Chapter 2: Crisis Response

Second Chance Wildlife Center

       As a wildlife rehabilitation organization, Second Chance Wildlife Center aims to mitigate damage to the environment caused by human activities. They rescue injured and orphaned wildlife, rehabilitate them back to health, and then return them to their natural environment. Their meaningful work is an excellent example of environmental conservationism, and their success is proof of the effectiveness of this approach. Due to Maryland wildlife rehabilitation laws, they exclusively treat animals which classify as native wildlife, including many species of birds, mammals, amphibians, and reptiles. According to their most recent annual report, the organization admitted almost 3,000 patients across over 100 different species in 2021.[6] The most common reasons for patient admission include displacement from a nest, attack by a pet, strike by a vehicle, or collision with a window. Note that each of these reasons can be traced back to human activities.

Figure 4A: SCWC Patient (Baby Rabbit); Figure 4B: SCWC Patient (Duckling)

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[6] "2021 Annual Report," Second Chance Wildlife Center, June 2022, https://www.scwc.org/wp-content/uploads/2022/07/2021_ANNUAL_REPORT_FINAL_June_2022.pdf.

In working toward their mission, Second Chance Wildlife Center depends upon the compassion of everyday citizens to bring distressed animals in for medical treatment and attentive care. The facility is run by staff members, interns, and volunteers who dedicate many hours of their time to the cause. They often work between 12 and 14 hours per day during the busiest spring and summer seasons. In addition to working hands-on and on-site, they also must attend conferences and seminars in order to keep up with the latest advancements made in the field of wildlife care and management, as well as to network with other rehabilitators and organizations with similar purposes.[7] These hard-working people rely on the Second Chance Wildlife Center facility to support their everyday dedication to the mission of the organization. However, the existing facility is lacking in more ways than one.

Figure 5A: Staff Performing Surgery; Figure 5B: Volunteer Feeding a Patient

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[7] "Second Chance Wildlife Center," LinkedIn, accessed July 8, 2023, https://www.linkedin.com/in/second-chance-wildlife-center-maryland-04818aaa.

Existing Facility

Second Chance Wildlife Center is currently located in an old farmhouse in a residential neighborhood of Gaithersburg, Maryland. As a single family home, the building was never meant to host such an operation. While the staff have done their best to make it work, it has never truly fit the needs of the organization. The layout is problematic because staff members must pass through the examination room to reach the kitchen where food and medications are stored. Plus, since the rooms for animal care cannot be separated from general foot traffic, noise frequently disrupts the patients which causes distress and makes it harder for them to recover. Additionally, the rooms themselves do not meet the needs of the animals, which requires creative solutions. For example, waterfowl and aquatic reptiles reside in a room without running water, forcing staff to transport them to and from a bathroom down the hall. Additionally, any rabies-vector species must be quarantined, so the only place for the bats is a walk-in closet. Lastly, there is an overall lack of space that makes it difficult for Second Chance to keep up with the number incoming patients.[8]

Figure 6: SCWC Current Facility (Exterior); Figure 6B: Intake Room

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[8] Caralee Adams, "Second Chances," MoCo360, April 10, 2020, https://moco360.media/2020/04/10/second-chances/3/.

By providing a new facility for Second Chance Wildlife Center, Co-Habitat will support the organization's conservationist efforts. In taking a conservationist approach, the project will utilize specific, actionable strategies that work to reduce the negative impact that humans cause on the environment, and even push for an actively positive impact. First and foremost, the new facility will meet the program needs of Second Chance Wildlife Center. This includes spaces for the purpose of wildlife rehabilitation that serve both humans and animals. Secondarily, the new facility will enhance the organization's positive impact through several design strategies, including environmental stewardship through regenerative design, building and site integration through landscape architecture, habitat establishment through the phenomenology of home and dwelling, and a visitor experience through meaningful place-making. Finally, the aforementioned design strategies will work in combination with one another to question the anthropocentric purpose of buildings, and encourage open-minded thinking about designing for more than just humans.

Figure 7: Conceptual Housing Complex in the Forest

Chapter 3: Environmental Design Strategies

Environmental Stewardship through Regenerative Design

Humans have caused a global environmental crisis, and are thereby responsible for resolving it. As a complex issue, global biodiversity requires a multi-faceted resolution. In order to develop a plan, humans must first decide on an approach that will serve as a foundation for the actions that follow. In the past, humans have utilized strategies of sustainability, which is based on the idea that humans should live a sustainable lifestyle. This means that humans must consume natural resources at a reasonable rate – one that allows the environment to recover and continue providing them. This approach is problematic because it maintains the one-way relationship in which the planet produces resources and humans consume them. Alternatively, regenerative design goes beyond the surface-level efforts of sustainability. In fact, it dives deeper using actionable strategies that produce a net positive impact.[9] Ultimately, it encompasses all that sustainability is and builds upon it. A regenerative project is characterized by multiple interrelated systems that work together as part of a greater entity. This includes the building and its mechanical systems, as well as the natural systems of the surrounding site. The goal is to design a

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[9] Dias, Bruno Duarte. "Beyond Sustainability – Biophilic and Regenerative Design in Architecture." *European Scientific Journal*, March 2015, 147–58. https://www.academia.edu/42321954/BEYOND_SUSTAINABILITY_BIOPHILIC_AND_RE GENERATIVE_DESIGN_IN_ARCHITECTURE.

cohesive environment, in which the building and site are fully integrated, and there is a sense of place for both humans and animals.[10]

One example of regenerative design in action is the KOI Café located in Hanoi, Vietnam. In this case, an existing three-story building has been renovated to accommodate the Koi fish themed restaurant. In order to minimize its environmental impact, the construction process maintained as much of the old building as possible and incorporated repurposed materials when available. Where there was need for additional materials, they were selected based on local availability and utilized conservatively.[11]

Figure 8A: KOI Café Exterior; Figure 8B: KOI Café Floor Plans

The café features an aquarium system that has both aesthetic and functional qualities. There is a pond on the first floor, which visitors must use stepping stones to

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[10] Bal, Wojciech. "The Role of Integration of Architecture and Landscape in Shaping Contemporary Urban Spaces." *Materials Science and Engineering* 471 (2019). https://doi.org/10.1088/1757-899x/471/7/072020.

[11] Rayen Sagredo, "Koi Cafe / Farming Architects," ArchDaily, December 28, 2019, https://www.archdaily.com/884951/koi-cafe-farming-architects.

cross in order to access the seating area. Living Koi carp occupy the pond, which is fed by a waterfall that cascades from the second floor directly above. The waterfall replenishes the pond with clean water and oxygenates the habitat for the fish. Waste from the Koi carp is flushed to the third floor where it gets pumped into a garden of trees and vegetables. The vegetation provides shade and insulation to the rooms below, which moderates the temperature and reduces the need for electricity to achieve thermal comfort. Vegetables grown here can be harvested for use in the café and any organic waste can be composted and returned to the soil. Bacteria in the garden soil convert the ammonia from the excrement into nitrates, which nutrifies the soil and feeds the plants. Through this process and with the help of the vegetation's roots, the water gets filtered and purified before flowing back down the waterfall into the pond. As a closed-loop system, this cycle conserves water and eliminates the need to fertilize the plants.[12]
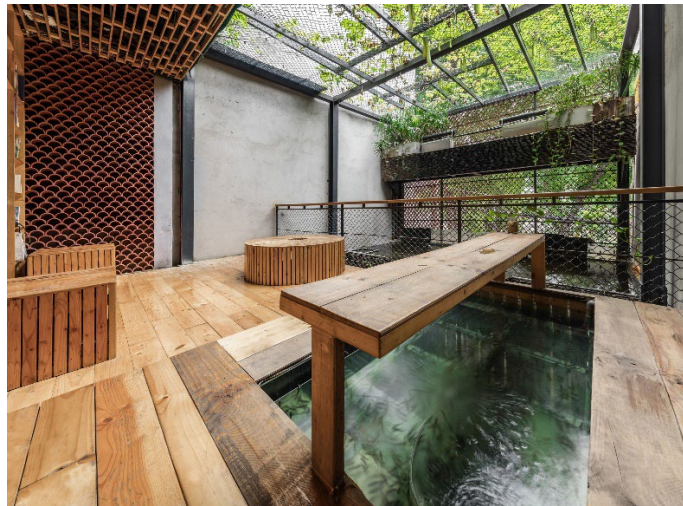
Figure 9A: KOI Café First Level; Figure 9B: KOI Café Second Level

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[12] India Block, "Hanoi Cafe Features Koi Carp Ponds and an Aquaponics Vegetable Patch," Dezeen, January 15, 2019, https://www.dezeen.com/2017/11/02/koi-cafe-farming-architects-hanoi-vietnam-fish-pond-indoor-waterfall-farm-aquaponics-trees-vegeatables-tiles/#/.

This project is regenerative because it involves a self-sustaining system that produces resources rather than solely consuming them. While this example is small in size and simple in process, regenerative design can be implemented at any scale or complexity.

Building and Site Integration through Landscape Design

Architecture is defined as "the art and technique of designing and building."[13] The open-ended nature of this definition leaves room for interpretation in terms of what is being designed and built. However, architects often apply the term exclusively to man-made structures that enclose conditioned space, leaving out the surrounding site. In order to design a cohesive environment, it is crucial to integrate the building and the site as interconnected elements of a combined system. This means that they must be designed in tandem with one another from the beginning of the design process. The designer must start by conducting a thorough analysis of the site, then develop a list of program that includes both indoor and outdoor spaces. Then, they need to evaluate which spaces might correlate to each other and whether there are any incompatibilities. Once the relationships between indoor and outdoor spaces have been established, the designer can begin to plan their placement on the

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[13] Collins, Peter. "Architecture." Encyclopædia Britannica, April 7, 2023.
       https://www.britannica.com/topic/architecture.

site. At this point, it is paramount to work in plan and section in order to ensure seamless integration of the building and the landscape.[14]

One example of a project that seamlessly integrates the building and the landscape is the Panda House Observation Center in Denmark by Bjarke Ingels Group. The circular enclosure takes the form of a yin and yang symbol, with two separate interlocking areas that mirror one another's shape and slope. Each area features a lifted side and a lowered side, which forms an undulating landscape and creates a rhythm of upper and lower levels. The pandas are free to roam within the enclosure, which closely resembles their natural habitat with patches of bamboo dispersed throughout. Visitors can circulate around the perimeter along a path which follows the topography and provides views of the pandas from all angles. Each level provides an immersive experience in which visitors feel close to the pandas.[15]

Figure 10A: Panda in Exhibit; Figure 10B: Observation Outlook

[14] Boul, Bruce. "Where Do Landscape and Architecture Design Intersect?" HMC Architects, August 20, 2019. https://hmcarchitects.com/news/where-do-landscape-and-architecture-design-intersect-2019-08-20/.

[15] Pintos, Paula. "Panda House Observation Center." ArchDaily. Accessed May 3, 2023. https://www.archdaily.com/927643/panda-house-big/5dbc492b3312fd1433000f2d-panda-house-big-diagram?next_project=no.

Bjarke Ingels Group employs several strategies of building and site integration at the Panda House Observation Center. First, the ground plane is sculpted elegantly with smooth transitions between upper and lower levels, as well as strong interconnections between indoor and outdoor spaces. Second, the width and curve of the expanse of lightly-framed glass creates an illusion that there is no barrier between humans and animals. This effect is emphasized by the continuation of the ceiling plane, gesturing toward the landscape beyond and the animals that reside there.

Chapter 4: Experiential Design Strategies

Habitat Establishment through Phenomenology of Home and Dwelling

For this project to establish habitat, it is important to explore the phenomenology of home and dwelling. In simple terms, home is defined as "the place where a person lives[16]," while dwelling means "to live in a particular place[17]." By these definitions, humans and animals may dwell, but only humans dwell in homes. Furthermore, most of the discussion about the phenomenology of home and dwelling is focused on how humans experience the world and establish homes. To be fair, humans have a long and complicated relationship with the concept of home. It began as a practical solution to a need for shelter from danger and the elements, but it has since evolved to encompass a much more complex and personal meaning. In the centuries leading up to the Industrial Revolution, home had become a place for families to live and work as a self-sustaining unit. The mechanization of tasks resulted in a tradition of work outside the home, which led to the idea of home as a private space that is separate from the public realm. Soon after, home developed into a symbol of social status and became attached to personal identity. Although each economic class lived in vastly different homes, trends that began with the wealthy trickled down to the less privileged. Later, as the desire for privacy entered the home, the idea grew in complexity and started to delineate rooms as spaces for specific functions. At first, rooms remained interconnected but soon became separated with

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[16] "Home," Encyclopædia Britannica, accessed June 5, 2023, https://www.britannica.com/dictionary/home.
[17] "Dwell," Encyclopædia Britannica, accessed June 5, 2023, https://www.britannica.com/dictionary/dwell.

walls, doors, and corridors. Each type of room required specialized furniture, which further differentiated rooms from one another. With the modern invention of glass and the development of windows, the aesthetic qualities of light and shadow could be appreciated. Curtains were added to control heat and light while maintaining the privacy of the home. Commercialization of furniture and curtains created opportunities for personalization of the home. Today, the human definition of home continues to evolve with the dynamics of culture and can be hard to pinpoint. Put simply, home is a retreat from the world to find safety and privacy. It is a nostalgic place to keep personal belongings and spend time with loved ones. Home is an intimate space of comfort and familiarity.[18]

Of course, this qualifies the human definition of home and excludes a non-human perspective. It also demonstrates the typically anthropocentric purpose of buildings which lacks the open-minded thinking required to design for more than just humans. Perhaps there is a wider definition of home that includes humans and animals without appropriating the aspects of home that are unique to the human experience. In returning to the fundamental idea of home and dwelling, it is commonly accepted that humans occupy space and manipulate the surrounding environment in order to establish spaces in which to dwell. In doing so, humans create places and build homes.[19] This phenomenon is not exclusive to the human species, as all other animals occupy space and manipulate the surrounding

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[18] Judith Flanders, *Making of Home: The 500-Year Story of How Our Houses Became Our Homes* (St Martin's Press, 2016).
[19] Janet Donohoe, "The Place of Home," *Environmental Philosophy* 8, no. 1 (2011): 25–40, https://doi.org/https://www.jstor.org/stable/26168058.

environment in order to establish spaces in which to dwell. Why then does the definition of home include only humans? This thesis postulates that animals also create places and build homes, and therefore expands the definition of home to include both humans and animals.

At the Bellbird House, Bower Architecture successfully demonstrates the establishment of habitat for both humans and animals. The project is situated in a suburban bush setting in the Bellbird Area of Blackburn, Australia. The surrounding environment connects to the Blackburn Bush Corridor, which provides critical habitat for native wildlife and vegetation. Due to its ecological significance, it has been protected as a National Trust since the 1960s and has experienced limited development.[20]

Figure 11: Bellbird House Among the Trees

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[20] Hana Abdel, "Bellbird House / Bower Architecture," ArchDaily, April 28, 2023, https://www.archdaily.com/1000077/bellbird-house-bower-architecture?ad_source=search&ad_medium=projects_tab.

In order to match the setting and reduce the carbon footprint, the house features a broad palette of natural and recycled materials. The locally-sourced limestone cladding and sustainably-produced black-oiled band-sawn Accoya wood finishes celebrate the aesthetic qualities of nature while functioning as protection from the elements. Large windows provide passive daylighting as well as views of the trees, further emphasizing a connection to nature. The windows are shaded with vertical louvers to prevent overheating the interior and to protect birds from colliding with the glass. In order to create a comfortable micro-climate within the home without disrupting the natural surroundings, there is a substantial amount of insulation throughout. As for the landscape around the house, the layout of the floor plan was designed to accommodate all of the previously existing established native trees. There is also a garden that features an abundance of native plants that provide habitat for local wildlife. Lastly, a pond was added to encourage waterfowl and other aquatic species to visit the site as well.[21]

Figure 12A: Bellbird House – Connection to Nature; Figure 12B: Floor Plan

[21] Hana Abdel, "Bellbird House / Bower Architecture," ArchDaily, April 28, 2023, https://www.archdaily.com/1000077/bellbird-house-bower-architecture?ad_source=search&ad_medium=projects_tab.

Overall, the design and construction of the Bellbird House respects and responds to the natural surroundings in several ways. First, it minimizes disruption to the environment by using natural materials and building around the existing trees, which preserves the habitat that was already present on the site. The project also actively encourages wildlife inhabitation by planting a flourishing garden and installing a tranquil pond, both of which further welcome animals to the site. As a result of these actions, the Bellbird House effectively establishes habitat where humans and animals can live together harmoniously.

Visitor Experience through Meaningful Place-making

In the mid-19th century, increasing urbanization led to the development of the 'concrete jungle,' which refers to harsh urban environments that are constructed of concrete or other human-made materials. The tightly-knit urban fabric of tall buildings and narrow roads prevents the light and warmth of the sun from reaching the ground level. These spaces lack the comforting qualities of greenery, wood, and other natural elements. As a result, they are not considered attractive or inviting, and they do not feel safe. People pass through these spaces by necessity, not by choice. No one arrives here to stay, because there is nothing to do or see. As a response to this phenomenon, place-making was conceptualized in the 1960s to design places, which refers to spaces that are dynamic and vibrant. These spaces come in a diverse variety of forms, each with its own sense of identity. Unlike the concrete jungle, places are welcoming and inclusive with ample sunlight and greenery. They are spaces where people choose to go because there is something to do or see. Since the

1970s, urban planners have relied upon principles of place-making to rejuvenate spaces and create places. The foundation of place-making is a fundamental understanding of the surrounding community. In order to create a genuine place, each project must build upon the existing identity of the neighborhood. This process involves collaboration between designers and community members, which leads to meaningful and lasting progress.[22]

At the Cottonwood Canyon Experience Center, SIGNAL Architecture and Research has implemented strategies of place-making in order to create a place rather than just a building. The Center is located on a remote site in a recently established Oregon State Park, so it required some creativity to draw in visitors. The building is clad with a combination of juniper and metal siding, materials which are traditional for the area due to their resistance to damage from rot and insects. They are locally-sourced, low-maintenance, and durable which reduces the environmental impact of the building's construction. Although the footprint is modest, the interior spaces are flexible with an open floor plan and large doors that allow the building to accommodate a variety of needs. It offers classroom spaces, activity areas, meeting rooms, a library, and interpretive displays. With such a wide range of potential functions, the Center is inviting and engaging for visitors ranging from grade school children to researchers from private institutions.[23]

[22] Jill Sweeney et al., "Assembling Placemaking: Making and Remaking Place in a Regenerating City," *Cultural Geographies* 25, no. 4 (2018): 571–87, https://doi.org/10.1177/1474474018778560.
[23] Pilar Caballero, "Cottonwood Canyon Experience Center / Signal: Architecture + Research," ArchDaily, April 23, 2020, https://www.archdaily.com/937979/cottonwood-canyon-experience-center-signal-architecture-plus-research?ad_source=search&ad_medium=projects_tab.

Figure 13A: The Center Exterior; Figure 13B: The Center Interior

Overall, the Cottonwood Canyon Experience Center provides a place that generates interest in the park which attracts a diverse spectrum of visitors. It offers many options in terms of entertainment and activities, as well as opportunities for education and research. It facilitates the human connection to nature with warmly lit interiors and shaded exterior spaces. Additionally, the Center responds to the surrounding environment through the use of natural and traditional materials. As a whole, the Cottonwood Canyon Experience Center provides a safe and welcoming destination for community members to enjoy the park through experiencing and learning about nature.

Second Chance Wildlife Center does not currently allow visitors because wildlife rehabilitation laws prevent the exhibition of patients. However, the organization often rehabilitates animals that ultimately cannot return to the wild. For example, at a nearby wildlife rehabilitation facility, there is a one-eyed Great Horned Owl named Wink who lives on site long term. With only one eye, this bird would not

be able to effectively hunt for food, and therefore she cannot be returned to the wild. However, she is otherwise physically completely healthy and does not need to be euthanized. Second Chance frequently encounters animals like Wink, but the sad truth is that most of these animals are euthanized because there is nowhere for them to go. Fortunately, this provides an opportunity for Co-Habitat to add a wildlife sanctuary to the facility which would allow the organization to include a visitor experience. Although the organization would need to delegate resources to this new feature, it would be worth their while due to the potential to bring visitors who may want to volunteer or even donate to the cause. It also enhances their mission by providing a new way for visitors to engage with wildlife, which could be both enjoyable and educational.

Figure 14: Wink the One-Eyed Owl

Chapter 5: Site

Site Selection Criteria

The ideal location for Co-Habitat will meet a particular set of site selection criteria. The site options will first be compared in terms of total space, measured in square miles. The location must also be accessible for patrons to bring the injured and orphaned wildlife. This can be measured by evaluating the distance of the site from the nearest city center, as well as the quality of local road networks. It may also be useful to understand the demographics of the nearest city in terms of population as well as population density.

For the site to support the big picture of harmonious coexistence, it must act as an adequate habitat for the local wildlife. The most important aspect of this is the availability of resources such as food, water, and shelter. Another essential component of this is the connectivity with other areas of suitable habitat.

It is critical that the site has an aspect of privacy in order to allow the organization to work in peace, as well as to encourage the presence of wildlife. Ideally, there will be a site buffer which can be measured in terms of completeness. In all, the site for this project will be selected based on which option best fulfills the above criteria.
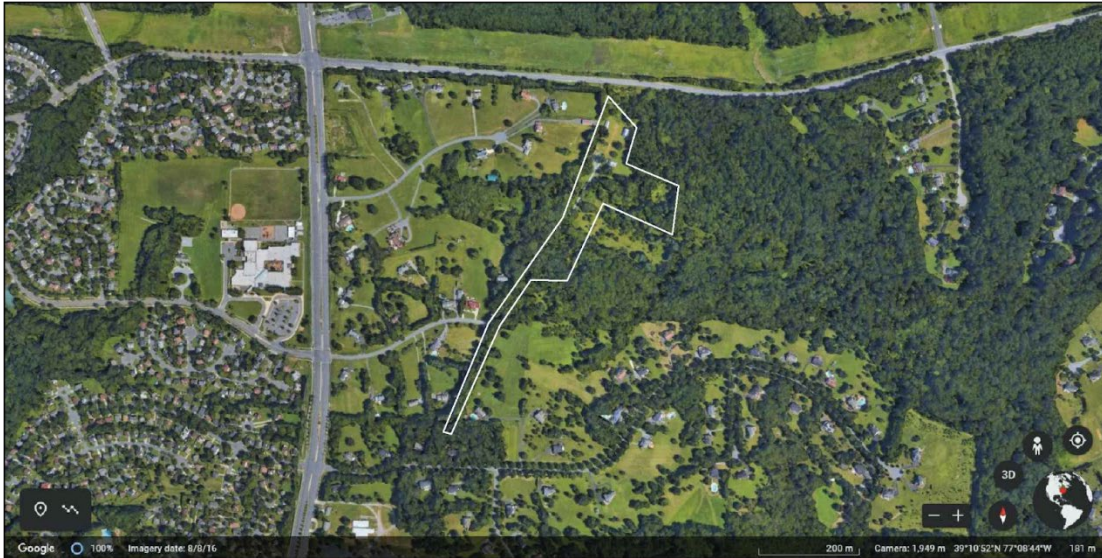
Figure 15: Site A Boundary Overlayed on an Image from Google Earth

Site A

Site A is located within a residential neighborhood in the suburbs of Gaithersburg, Maryland. Gaithersburg is moderately populated with 69,101 people, which adds up to 7,034 people per square mile. The city center is 5.7 miles away, giving the site a degree of remoteness. The lot size totals a spacious 9.76 acres and is primarily wooded with 78% of the area covered by vegetation. It can be accessed via gravel road at the back of a cul-de-sac, which gives the organization the necessary privacy to do their work. The site is buffered along 96% of its perimeter, which is long due to its abnormal shape at 5,328 feet. The site borders on Rock Creek Park, giving it connectivity to nearby habitat and providing freshwater within 0.2 miles.

Figure 16: Site B Boundary Overlayed on an Image from Google Earth

Site B

Site B is located in a rural area of Clarksburg, Maryland and is surrounded by agricultural land as well as a small residential area. Clarksburg is lightly populated with 26,234 people, which adds up to 7,034 people per square mile. The city center is 4.5 miles away, giving the site a degree of remoteness. The lot size totals to a moderate 4.84 acres and is somewhat wooded with 61% of the area covered by vegetation. It can be accessed via paved road and is located across the street from an equestrian center. The site is buffered along 77% of its perimeter, which is normal length due to its simple shape at 2,035 feet. There are several parks within close proximity to the site, giving it connectivity to nearby habitat and providing access to freshwater within 0.02 miles.

Site Selection Matrix

Criteria:	Site A (current)	Site B (future)
Lot size	9.76 acres (++)	4.84 acres (+)
Distance to city center	5.7 mi. (++)	4.5 mi. (+)
Road access	Yes (+)	Yes (++)
Urbanization level	Suburban (+)	Rural (++)
Surrounding zoning	Residential (+)	Agricultural, residential (++)
Human population	69,101 people (/)	26,234 people (/)
Human pop. density	7,034 people per sq. mi. (+)	2,634 people per sq. mi. (++)
Vegetative cover	78% (++)	61% (+)
Water availability	0.2 mi. (+)	0.02 mi. (++)
Habitat Connectivity	0 mi. (++)	0 mi. (++)
Site perimeter	5,328 ft (/)	2,035 ft (/)
Site perimeter buffer	96% (++)	77% (+)
Total Score	**15**	**16**

Scoring System Key:

(++) Great = 2

(+) Good = 1

(/) Neutral = 0

(-) Bad = -1

Site Selection = Site B

In terms of program, the client requires spaces that accommodate animal needs, human needs, and animal-human interactions. The site is approximately rectangular in shape, and takes up 210,830 square feet in area – 71,874 square feet of which is protected conservation area – leaving 138,956 square feet of buildable land.[24]
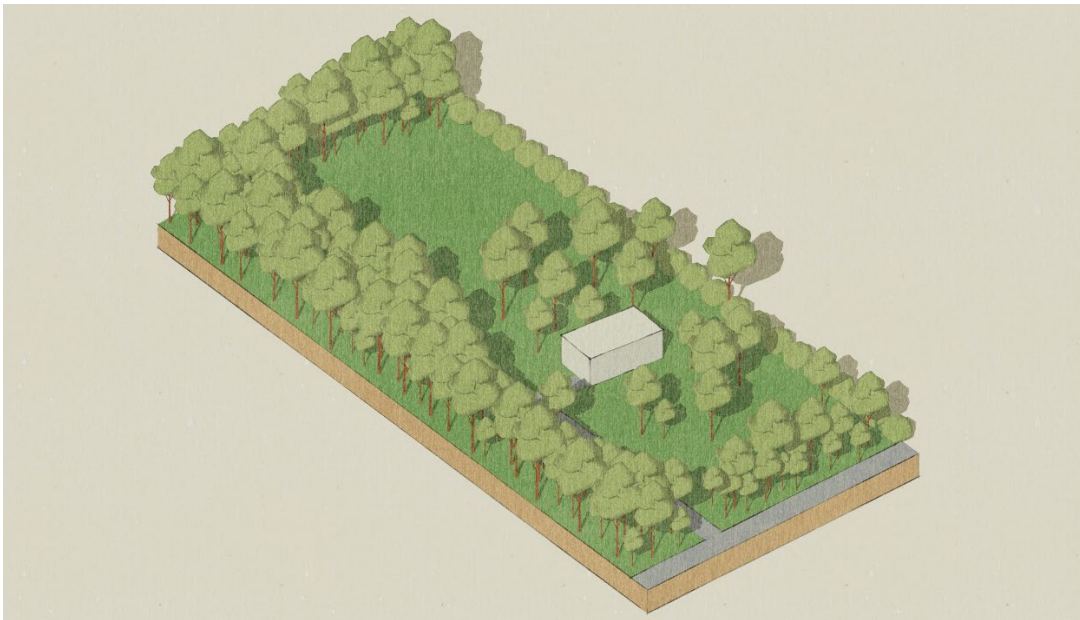
Figure 17: Site Axon

Site Documentation and Analysis

The existing conditions of the site provide ample opportunities for designing and building Co-Habitat. The location is ideal due to the distance from the city center

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[24] "Forest Conservation Easements," Montgomery Planning (Maryland National Capital Park and Planning Commission, December 8, 2022), https://montgomeryplanning.org/planning/environment/forest-conservation-and-trees/conservation-easements/#easement-map.

– it is far enough to avoid urban activity while still being accessible. The shape of the site is fairly regular, and there is certainly enough space for the project. The surrounding context is relatively quiet, with a sparse residential neighborhood to the West behind the thick of the forest conservation area, and a single family home to the North which is separated by a row of hedges. While there is no neighbor to the South, there is an equestrian center across the street to the East, which has potential for collaboration and sharing of resources.

Figure 18: Site Plan 1" = 500'

The border of the site is almost entirely occupied by vegetation, which provides an appropriate level of privacy as well as a buffer for noise. The rest of the site is mostly characterized by open grassy space with some trees dispersed throughout the East half.
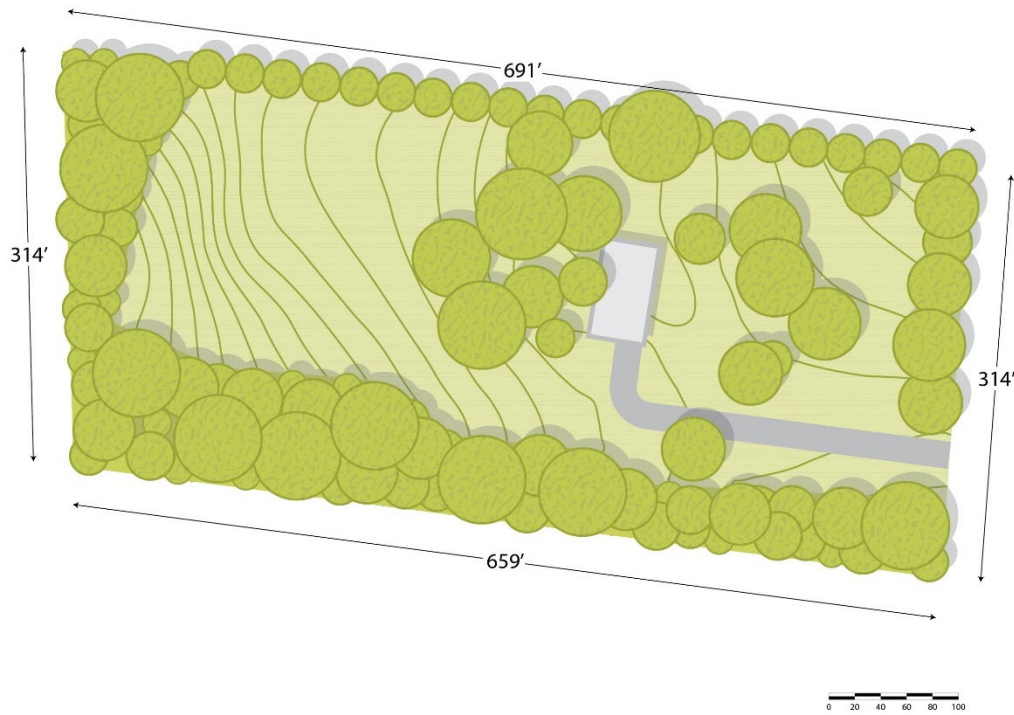
Figure 19: Site Plan 1" = 100'

Building and Site Integration

The overall goal of this proposal involves seamless integration of the building and the site, by way of combining principles of architecture with those of landscape architecture. The building footprint will take up only a small portion of the site area, leaving ample room for outdoor program and site features. Manipulation of the site shall be limited to the buildable area, and may involve moving, removing, and planting of vegetation, as well as alterations to the topography. Disturbance will be minimized and strategic, and any negative impacts will be balanced out by positive ones. A portion of the site will be dedicated to a garden for the purpose of food production. The building itself will contribute to the natural environment by

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interacting with the landscape and providing habitat for local wildlife. The complex

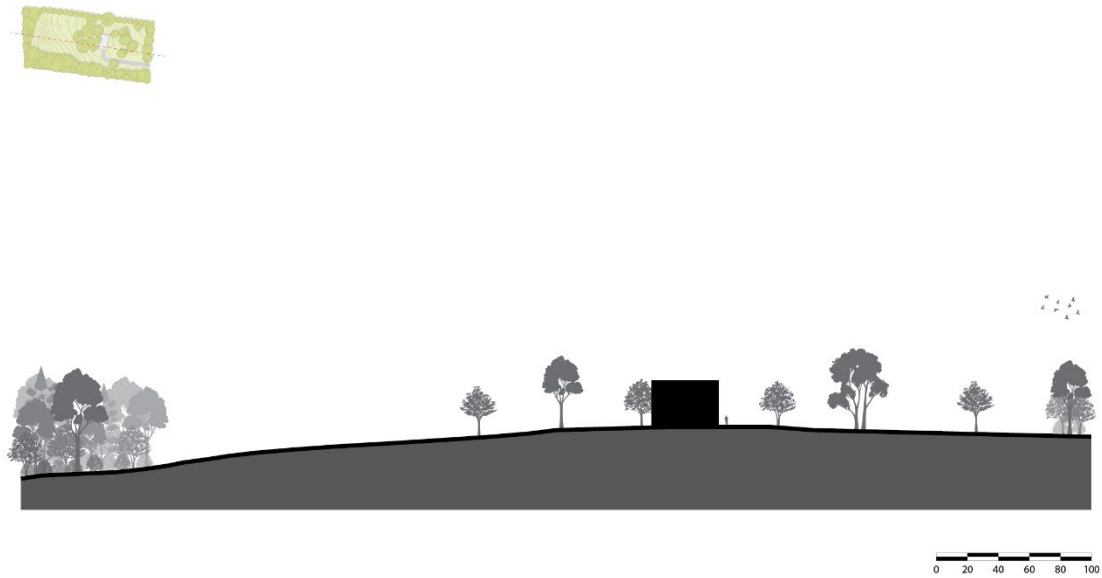will be welcoming to all species and will allow for them to coexist harmoniously.

Figure 20: Site Section 1" = 100'

Chapter 6: Precedent Analysis

Canine and Feline Hotel

Located in Parada, Portugal, the Canine and Feline Hotel by Raulino Silva Arquitecto was completed in 2019. It primarily serves as temporary accommodation for pets while their human companions travel. The building consists of three interconnected masses, one for each element of the program. The largest one holds the primary program which is the accommodation for dogs. The long rectilinear volume contains two stories that are connected by a spiral staircase. The upper level features 41 dog kennels, which are stacked side-by-side against the long outer walls. There is a connecting central corridor with a long skylight centered over the space, which floats above a planter of the same dimensions. The lower floor is characterized by a spacious multi-functional room, as well as several human services areas. The large room links the higher terrain of the site's entrance to the lower ground of the outdoor playground for the animals. The two smaller masses are characterized by approximately square dimensions, and each contain a secondary program. One provides the accommodation for cats with kennels around the interior perimeter, while the other is primarily composed of administrative offices for human use.[25]

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[25] India Block, "Raulino Silva Arquitecto Designs a Hotel for Cats and Dogs in Portugal," Dezeen, November 5, 2020, https://www.dezeen.com/2020/10/11/raulino-silva-arquitecto-designs-a-hotel-for-cats-and-dogs-in-portugal/.
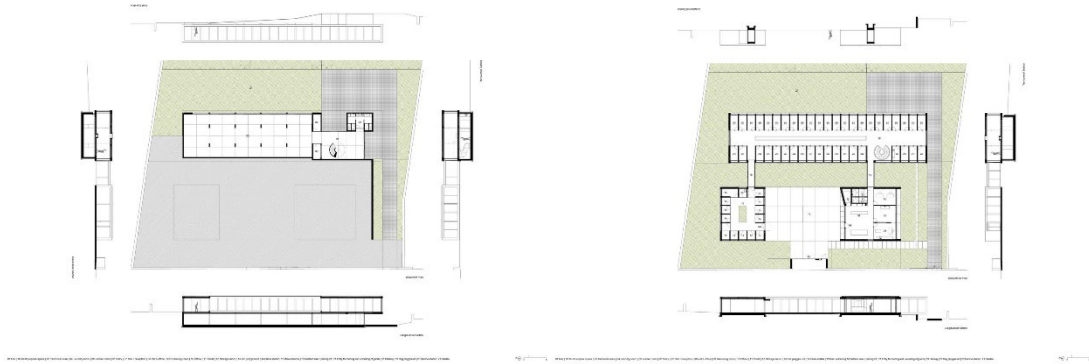
Figure 21A: Lower Level Plan; Figure 21B: Upper Level Plan

Overall, the building is beautifully crafted with stark white walls and
extensive spans of glass. However, it seems as though the facility would not be ideal
in terms of function. The kennels are small and transparent, which prevents the
animals from finding peace and privacy. The glass allows an inordinate amount of
harsh sunlight, which causes thermal and visual discomfort. Based on this analysis,
the design of the Canine and Feline Hotel prioritizes aesthetics and human enjoyment
over function and animal comfort. This thesis will explore a different approach, in
which animals and humans are considered equally while designing the facility.

Figure 22A: Hotel Exterior; Figure 22B: Hotel Interior

Program Analysis

Although the Canine and Feline Hotel takes a different approach than that of

Co-Habitat, the similarity in function between the two projects makes this precedent

relevant to this thesis. Both projects include program oriented for humans and

animals, as well as shared spaces between the two. The Canine and Feline Hotel

separates the program by species, with one volume each for humans, dogs, and cats.

While humans may access the spaces designated for animals, there is very little
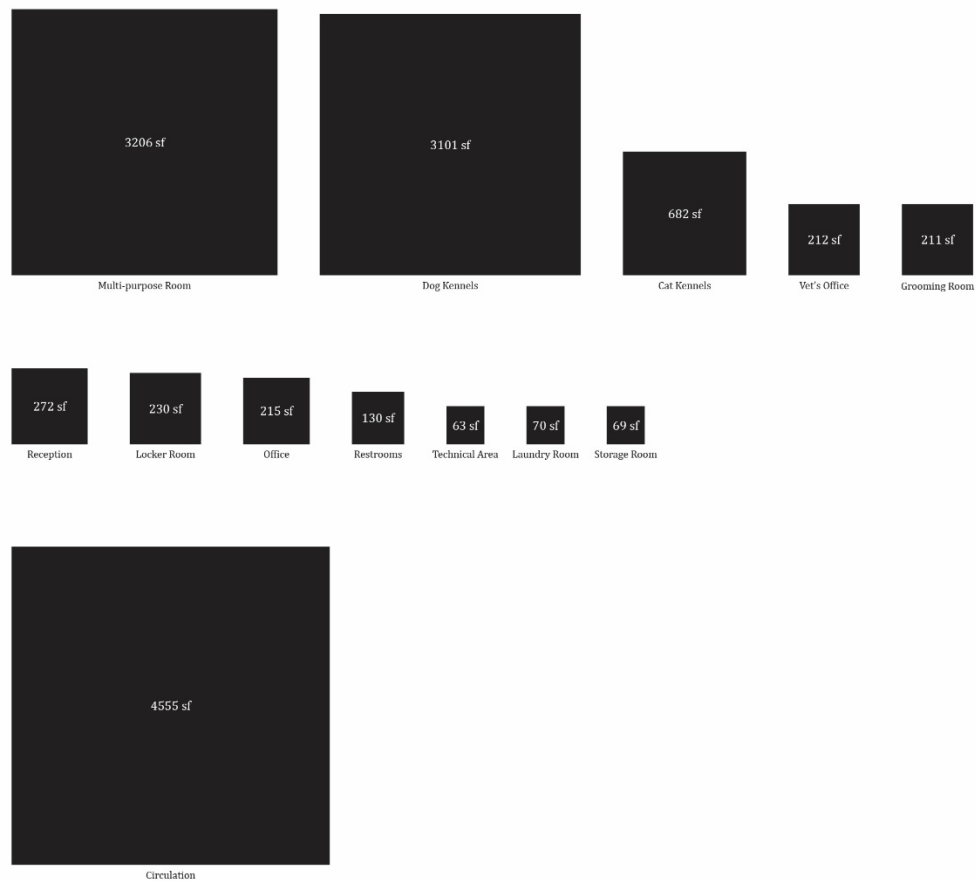
integration between different parts of the program.

Figure 23: Precedent Program Analysis

The preceding diagram represents the area of each program at a relative scale. The majority of the total area is dedicated to animal enclosures and multi-purpose rooms, while a smaller portion hosts the exclusively human program. While the total area sums up to over 13,000 square feet, the building's footprint only takes up around 5,000 square feet. The latter amount equals the buildable area on the site, meaning the scale of this precedent is similar to that of Co-Habitat.

Site Exploration

By placing the precedent's program on the site at the same relative scale, this thesis can begin to sense the size of the site compared to that of the precedent's program. From this study, it seems as though there will be ample room for the program of Co-Habitat.

Figure 24: Precedent Program on Site
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Chapter 7: Program and Enhancements

Program Criteria

In terms of program, the client requires spaces that accommodate animal needs, human needs, and animal-human interactions. The primary purpose of the facility is the rehabilitation of wildlife, which involves patient intake, medical evaluation and treatment, laboratory testing, and surgery. This area of the program would benefit from as much storage as possible for equipment and medications, including cabinets that can be locked.

The next priority in the program includes human support spaces such as a kitchen for food storage and preparation, a laundry room, a conference room, staff offices, and a break room. These areas must be separate but located in close proximity to the wildlife rehabilitation program, and they can only be accessed by qualified staff members. This section of the program would also benefit from maximal storage options.

Although wildlife rehabilitation patients may not be publicly exhibited, there are some animals that are healthy but unable to return to nature. This poses an opportunity to keep some of those animals on site and continue to care for them. The resources needed to support such an operation would be worth spending for several reasons. The animals could be observed by visitors for the purpose of public

education and enjoyment. The experience could also inspire visitors to volunteer with the organization, or to make monetary and material donations.

In order to incorporate a visitor experience, there must be program with which visitors can engage. This would include a viewing area into the wildlife sanctuary, an outdoor patio or pavilion for gathering, an exhibit space for interactive educational activities, and a gift shop – the proceeds of which would benefit the organization. There will also be a front entrance with an entry vestibule that leads to a reception area for those who are arriving with wildlife patients for admission.

The following table outlines the spaces that compose each of the four main areas of program, which include wildlife rehabilitation, human support, visitor experience, and exterior.

Program List

Space	Comments	Area (s.f.)
Wildlife Rehab:	Located furthest from the entrance; secure access	Total = 2200
Entry Vestibule	Helps prevent animal escape	50
Lobby / Reception	Includes waiting area	200
Patient Intake	For brief evaluation and intake paperwork	100
Med Eval & Treat	For full evaluation and non-surgical treatment	100
Laboratory	For testing	100
Surgery	Medically equipped, sanitary	100
Storage	Includes locking cabinets for medication	150
Animal Enclosures	Separated categorically	1400
Human Support:	Close proximity to wildlife rehabilitation; secure access	Total = 1300
Kitchen	For food preparation and storage	150
Laundry	Two washers and two dryers	100
Conference	Accommodates 12 people	300
Staff Offices	Four offices	450
Staff Break Room	Includes kitchenette for human use	150
Storage	Maximal	150
Visitor Experience:	Accessible to public; easy access	Total = 2000
Animal Enclosures	Healed animals that cannot be released	1000
Viewing Area	Safe observation	300
Exhibit	For interactive educational activities	500
Gift Shop	Proceeds benefit the organization	200
Exterior:	Publicly accessible; interacts with landscape	Total = 2000
Animal Enclosures	Healed animals that cannot be released	1000
Patio / Pavilion	For visitors to gather	700
Garden	For growing food	300

By placing Co-Habitat's program on the site at the same relative scale, this thesis can continue to sense the size of the site compared to that of the project's program. As expected, there is ample room on the site for the program of Co-Habitat.

Figure 25: Co-Habitat Program on Site

Blocking and Stacking Exploration

The next step in the study of Co-Habitat's program explores a variety of approaches to placing the program on the site.
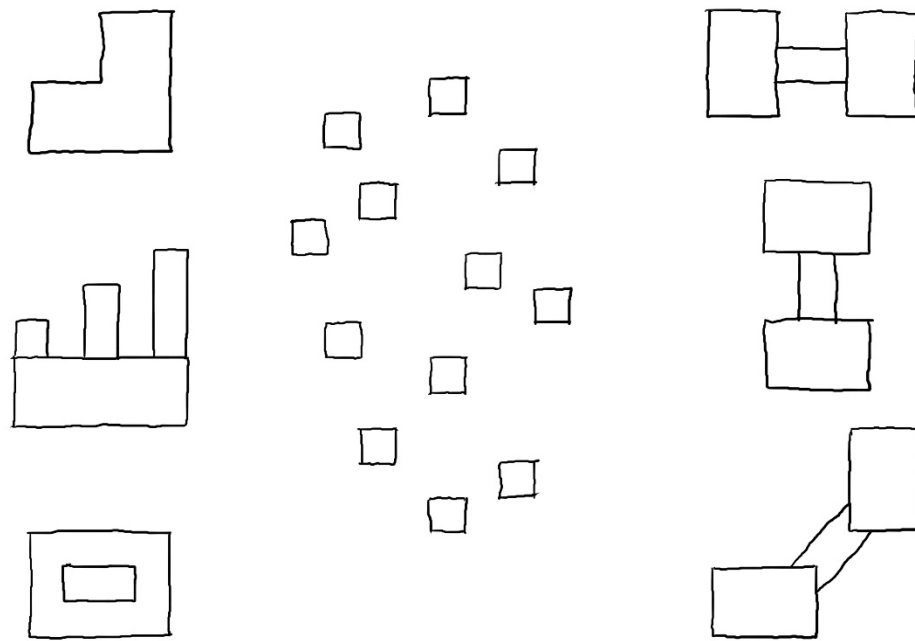
Figure 26: Site Approaches (left to right: Consolidated, Dispersed, Connected)

In this study, there are three main strategies to placing the program on the site. The first strategy consolidates the program into one volume. The main advantage of this approach is the potential for connectivity between different areas of program. Although the building could take a variety of shapes, this approach may require significant site alterations. The second strategy disperses the program across the site. While this approach could allow more conservation of the site's resources, it involves less potential for connectivity between different areas of program. The third strategy splits the program into separate volumes while maintaining a connection between them. This approach could potentially include connectivity between different areas of

program while also allowing more conservation of the site's resources. Realistically, the approach to placing Co-Habitat's program on the site will involve a hybrid strategy that combines the advantages of each. The following diagrams demonstrate a few examples of these strategies in action.

Figure 27: Site Approach A – Consolidated
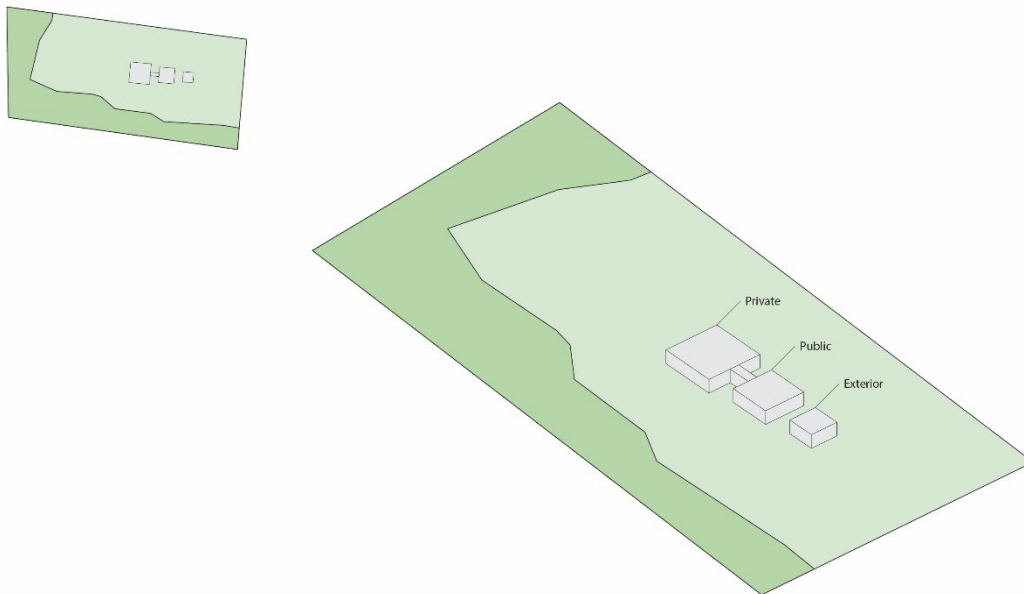
Figure 28: Site Approach B – Dispersed

Figure 29: Site Approach C – Connected

Chapter 8: Design Solution

Co-Habitat

The proposed scheme is composed of a combination of interior and exterior program elements. The interior program is consolidated into a singular building which is positioned close to the front of the site for best access and visibility. The exterior program consists of several site features that are dispersed across the property for maximum engagement of the landscape.

Figure 30: Site Axon

The building spans almost the width of the property, acting as a gateway to the rest of the site. Vehicular access is bound to the zone between the building and the road to prevent cars from disturbing the wildlife. The paved surfaces are permeable

and planted, which allows stormwater to percolate at a natural rate and prevents soil erosion. Site features include interventions that establish wildlife habitat as well as exterior program elements of the visitor experience.
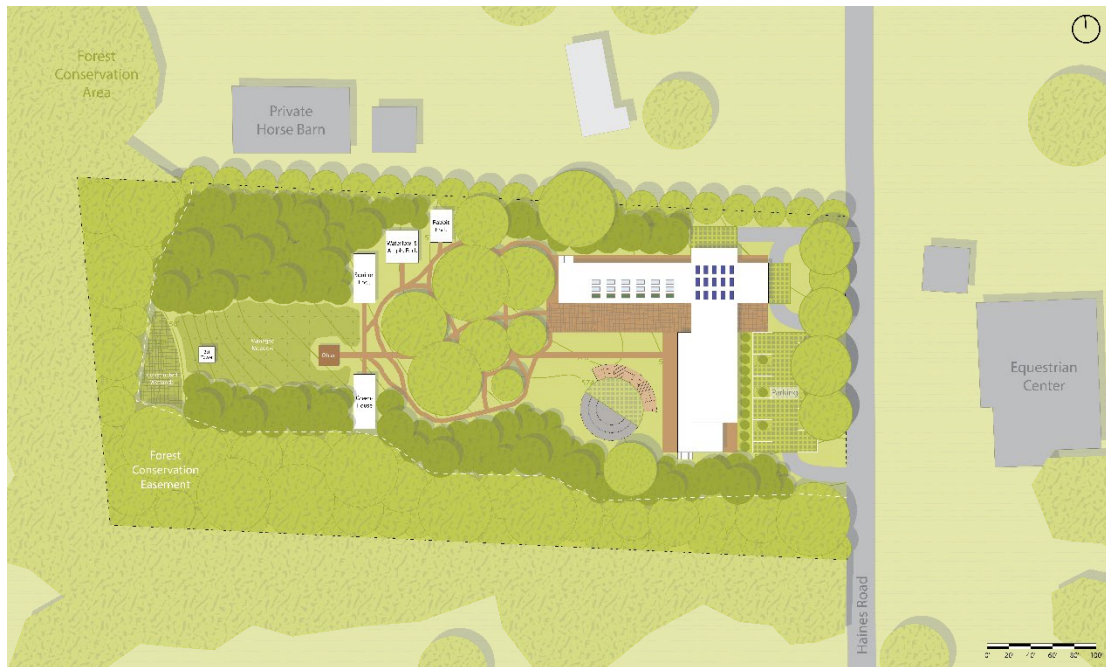

Figure 31: Site Plan

There are several interventions that establish wildlife habitat on the site. There is a rooftop garden that is planted to invite pollinator insects and birds. The meadow is managed by planting native vegetation and removing harmful non-native vegetation, effectively restoring the natural ecosystem which further attracts pollinator insects and birds. The wetlands are constructed by planting riparian vegetation, which also improves stormwater management on the site by providing a catchment area to slow runoff along the steep slope. The bat tower is a human-built bat house that provides habitat for bats that live local to the site. It is nested within the

meadow and in close proximity to the constructed wetlands to ensure the bats have access to food sources. Lastly, the reforestation zones area places where trees are planted to enhance the forest conservation area that surrounds the site. Although the zones are modest in size relative to the greater ecosystem, they do add substantial woodland edge habitat to the site, which is ideal for wildlife that prefer this transitional zone, such as White-Tailed Deer.

The visitor experience includes several exterior program elements that are dispersed across the site. There is a terraced public amphitheater for gathering and demonstrations that has a circular shape which contrasts with that of the building. The wildlife sanctuary consists of enclosures that house animals that have been rehabilitated but cannot return to their natural habitat. The enclosures are consolidated to one zone, and are each spacious enough for visitors to enter and interact with the wildlife under staff supervision. There is an observation area from which visitors can look toward the bat tower from a safe distance. There is a greenhouse where food is grown and harvested for the wildlife patients that are cared for at the facility. Visitors can enter the greenhouse and observe this part of the animal care process. Lastly, there is a network of pathways that connects all of these site features. One primary path runs along an axis that aligns from the center of the lobby to the bat tower, while the other pathways take organic shapes in order to weave around the existing trees. The pathways end at the observation area which allows the rest of the site to be preserved as undisturbed wildlife habitat.
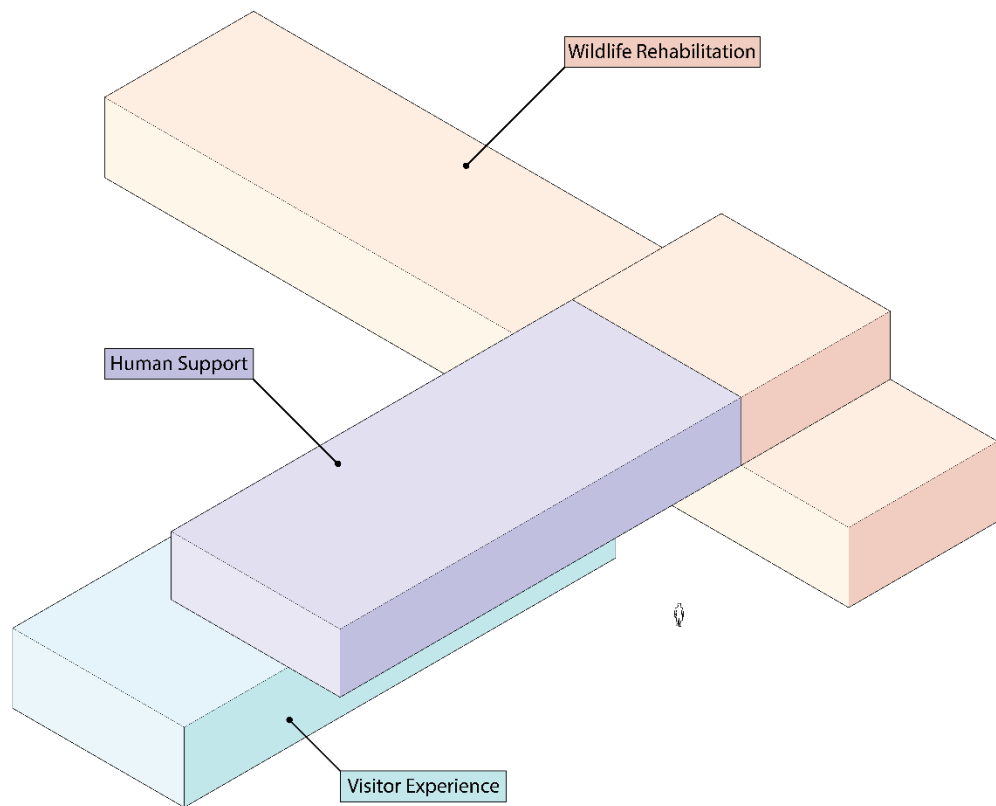
Figure 32: Building Massing & Program Zones

The building is composed of three bar-shaped volumes that are stacked and

shifted, creating interesting moments of overlap as well as opportunities for usable

space on the roof surfaces. The three primary zones of program are organized to

maximize each one's individual function and to promote logical interactions between

one another. The Wildlife Rehabilitation program is consolidated into a long and

narrow bar for efficiency of animal care. The Visitor Experience consists of an open

and spacious volume for maximum visitor engagement. The Human Support spaces are stacked above and act as a bridge across the two other areas of program, supporting each one and creating a connection between them.

Figure 33: East Elevation

The perpendicular arrangement of the volumes establishes hierarchy through the width of the front facades. Material qualities of the building enclosure reflect which areas are public or private, by incorporating transparency to indicate public access and utilizing opacity to protect private program.

Figure 34A: Level 1 Floor Plan; Figure 34B: Level 2 Floor Plan

The first floor consists of two wings, one for Wildlife Rehabilitation and one for the Visitor Experience. They are separated by a pass-through that allows visitors and wildlife alike to access all areas of the site. The second floor bridges across the two lower volumes and provides additional spaces for the more private areas of Wildlife Rehabilitation program, and also contains the Human Support spaces.

The priorities of the Wildlife Rehabilitation wing are the function of the organization and efficiency of animal care. The result is a compact arrangement of rooms that are organized to facilitate the flow of patients from arrival to release. For example, the recovery wing consists of six rooms stacked along a single-loaded corridor that provides a buffer between the public space and the private program.

Figure 35: North Elevation

There are two entries to the Wildlife Rehabilitation wing, each with its own intake and treatment areas and both lead to the same recovery area. There is one entry at the front for citizens and one at the side for animal services, allowing them discretion when bringing wildlife patients that are larger, more dangerous, or more severely injured.

Figure 36: Section A

There is a logical sequence of spaces that begins with entry, leads into intake and treatment, and ends with recovery. Each recovery room has individual access from the corridor and directly leads to an independent exterior enclosure that faces the thick vegetation along the North border of the site. Certain program is stacked above for extra privacy, including the surgery room and quiet recovery area.

Figure 37: Section B

The priorities of the Visitor Experience wing are public access and visitor engagement. The result is an open and spacious volume with a variety of education opportunities. It includes a lobby that doubles as an exhibit space, and a wide corridor that leads to a pair of classrooms for educational activities and a library for additional learning opportunities.

Figure 38: West Elevation

The West elevation demonstrates the use of transparency and opacity to
provide cues as to which spaces are public and which are private. The Visitor
Experience wing is characterized by highly transparent enclosure and large open
spaces within. This view also shows the way the second floor bridges across the two
lower volumes and frames the pass-through between them.

Figure 39: Section C

The lobby acts as a threshold to the site features and the transparency of the enclosure makes the site features visible from within, drawing the visitor toward the landscape. The lobby doubles as an exhibit space, allowing for flexible programming. The Human Support spaces are stacked above and shifted to create a roof terrace that overlooks the site and a covered walkway for the entrance.

Figure 40: South Elevation

The South elevation features a vegetative green wall to shade and insulate the interior spaces within, which receive natura daylight from the East and West directions. This view also demonstrates the translucent corridor of the Wildlife Rehabilitation wing, allowing visitors a glimpse of the process without compromising its privacy.

The Visitor Experience can be understood as a sequence through the program elements.

Figure 41: Front Entrance

The visitor approaches the building from the front of the site. Cued by the transparency of the enclosure, the visitor enters the lobby of the Visitor Experience.
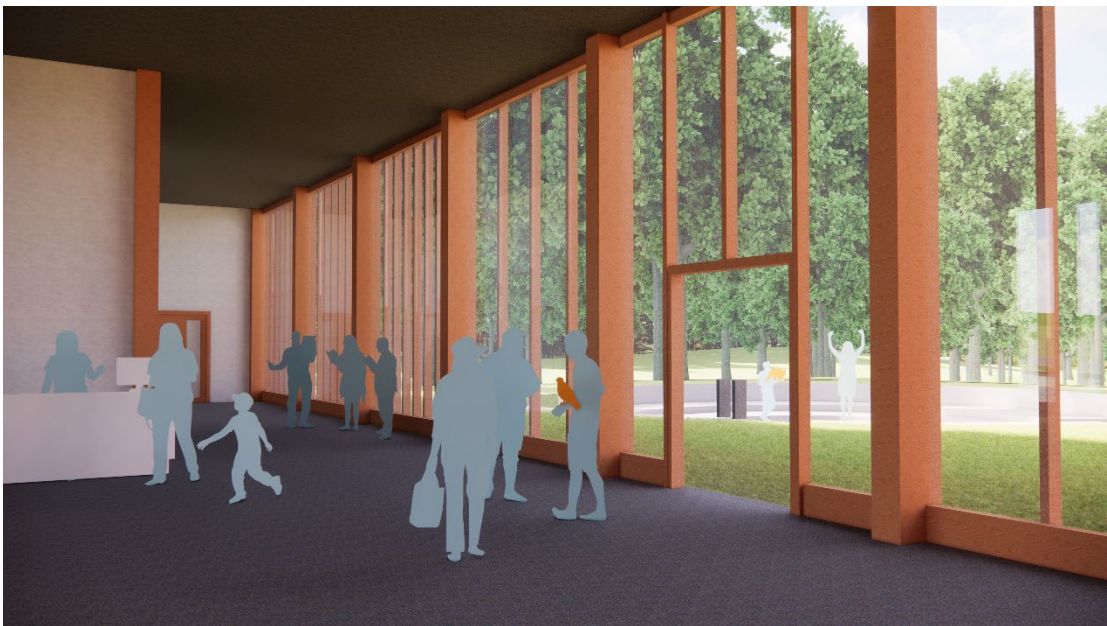

Figure 42: Visitor Lobby

The visitor is received by the lobby which doubles as an exhibit space, where there will be opportunities for education and engagement. The site features are visible from here, drawing the visitor toward the landscape.

Figure 43: Wildlife Sanctuary

The visitor comes across the wildlife sanctuary enclosures, where recovered wildlife love long term when they can't be released. The visitor can enter the enclosures in order to interact with the wildlife that live there.

Figure 44: Bat Tower & Observation Area

The visitor continues toward the bat tower, which provides habitat for wild bats that live local to the site. The observation area provides opportunities for the visitor to view them from a safe distance.

Figure 45: Garden Greenhouse

The visitor then passes the garden greenhouse where staff grow food for the wildlife they care for. Visitors can enter the greenhouse to learn more about this part of the animal care process.

Figure 46: Public Amphitheater

On the way back to the Visitor Experience Center, the visitor encounters the public gathering space, where there may be a demonstration to enjoy.

In closing, Co-Habitat promotes a world where humans and animals coexist harmoniously in a few ways. First, Co-Habitat supports the mission of Second Chance Wildlife Center by providing a new and improved facility. Co-Habitat also enhances the impact of Second Chance Wildlife Center through environmental stewardship, habitat establishment, and the addition of a mutually beneficial visitor experience.

Throughout the process of developing this thesis, I have realized a few things that will impact how I approach design opportunities moving forward. First, I realized that the framework established by this thesis document acts as a structure off which to build, rather than a set of limitations. The framework forms a solid foundation which guides the design process but also allows the course to adjust as needed. This leads to my second realization that design truly is an iterative process. Each time a design change is made, it must be reflected in all types of drawings. During this process, it is inevitable to notice the impact of each change and essential to adjust accordingly. Finally, I realized that small changes can have a big impact on the overall project. A seemingly minor adjustment can make or break a project, which is why each design change must be thoroughly tested and followed through.

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