

Equestrian Architecture:

Crafting a sustainable northern community for the wellness of the
horse and human companion in Greater Sudbury, Ontario

by

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of the requirements for the degree of
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Figure 0.1: Walking through a field at PMC Performance horses in Val Caron, ON. Photograph by Danielle Provencher Designs, Oct. 2018.

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Abstract

Equestrian Architecture will create a meaningful western performance facility to improve the quality of life of an American Quarter horse in Greater Sudbury, Ontario. The interactions and connections between horses and humans, between horses alike, and between horses and their environment will be studied to curate an architecture to benefit all. The relationship between horse and human has evolved overtime, however, the architecture around them has not significantly changed. Since the 1800s, when horses were used for agriculture, the barn has remained relative unchanged. Now that these animals are used mainly for recreational purposes, a shift in the architecture is necessary to cater to the wellness of the horse and rider.

Being around horses requires humans to exercise their nonverbal communication. The experience of touch is the main way humans communicate with these animals; it is very important that the human is conscious of body language. For this reason, horseback riding is not only a physical sport but also psychological sport, and so it is beneficial to humans in many ways.

Some horses live their entire lives without ever leaving the farm, that is the place where they experience all stages of life. It is very important that the farm improves their quality of life. From Vitruvius to Le Corbusier, architects have always studied the scale of the human; this thesis needs to adapt to the scale of the horse to be able to build a comfortable architecture for them. The domesticated horse is a sensitive animal and requires care from humans to provide them food, water, and shelter especially to keep them comfortable in the harsh northern winters.

A site has been chosen in the southern side of Greater Sudbury in the small community of Wanup, ON. Building an equestrian facility in the north presents its challenges with it being such a large building complex that needs to handle the snow and wind load. The site is utilized to best handle the environmental conditions that occur in a northern climate.

The program is organized into five categories to assist with the flow of movement through the facility; the House for the Horse, the Private House for the Human, the Public House for the Human, the Shared House, and the Back of House. The horizontal and vertical relationships of these spaces to each other and the site have been studied to better the care and comfort of the horses.

This thesis looks at innovative building opportunities to better the wellness of the horse and human in the harsh Sudbury climate. The structure reflects the strong and dynamic qualities of the structure of the horse and the human. The facility re-introduces a high level of care in the craft and materiality of the building, which over time has been lost in equestrian facilities. The details in the building take influence from the highly developed connections in the equipment, such as that of the saddle and bridle. Daylighting and ventilation are maximized throughout the facility to improve the wellness of its users. The building systems work together to create an environment for the horses and riders to thrive.

This thesis creates a facility to improve the wellness of horses and humans in northern Ontario. The facility as a whole allows for the best care possible for these animals and the human companions.

Key words:

equestrian, scale, wellness, craft, communication, somatic sensations

Thesis Question

Can sustainable, durable architecture improve the **wellness** and **communication** between the **horse** and **human** companion through materiality and shaping the **environment** in which they co-exist?

Acknowledgments

I would like to sincerely thank everyone who has contributed to the craft of this thesis. To my advisor, Ted Wilson, thank you for helping me push the boundaries of these private and public spaces, and the relationships that they create. You helped me think beyond what I knew to be the typical equestrian facility to create a much more meaningful experience at these facilities. I would also like to thank my second reader, Thomas Strickland, for your genuine interest in this thesis. Your knowledge and passion for the equestrian community has really come through and helped me throughout this past year.

I would also like to thank my parents for providing me with the opportunity to grow up in the equestrian community and develop my love for these animals. It has taught me so many life skills from responsibility, independence, time management, hard work, communication, and so much more which I believe to be the reason for my many successes so far and those to come in the future.

I would also like to thank my aunt Cyndi and everyone else that has contributed to building my knowledge and experience with horses and the facilities.

A huge thank you goes out to all my close friends and family who have supported me throughout the making of this thesis and my education. You are all greatly appreciated!

Of course, I can't forget to thank my best friend who happens to have four legs, Reggie. Thank you for always keeping my mental health in check throughout my entire education. I would not have made it through this without you.

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Introduction

I have been exposed to the equestrian world for the entirety of my life which has led me to have a strong passion for the animals and the equestrian community. I have had the privilege of interacting with and riding some amazing horses, but the bond I have with my own horse is like nothing else I have ever experienced. I was 8 years old when I got my horse, who was only two years old at the time. We have created a bond that has let us accomplish many things together, including many circuit champions at horse shows, representing an Ontario youth team at the All American Quarter Horse Congress in the United States, and qualifying and showing at the AQHA Novice World Championship Show. Having my horse has never been just about the ribbons and trophies for me though, it is about the therapeutic side of our equine companions and all of the life lessons I have learned because of it.

Throughout my life I have been to many facilities in Canada and the United States, and have experienced first-hand the assets of each facility as well as their faults. Over the years I have noticed some patterns within these facilities that I have always dreamed of fixing. The most common thing that is lost in most of these facilities is reflecting the importance of nonverbal communication in these environments. The buildings themselves do not reflect this intimate level of care and communication through their materiality and the essence of the spaces. The building program also has issues that need to be addressed to improve the facilities;

1. **Horse living conditions:** I have always noticed the struggle to balance and cater to a horse's individual needs for their time outside and inside. The human needs to be there to bring the horse inside or outside and sometimes the horse is not happy with what the human decides for them. The horse should be able to decide when they want to come inside or go outside.
2. **Human residence:** Since the 1800s the residence on the property has been disconnected and often distant from the barn and the horses. This raises an issue of safety for the animals because there could be something wrong in the barn or in the fields and the person in the house would not even know.
3. **Viewing area:** There is also an absence of comfortable spaces to observe the activities happening in the arena, whether that be a parent watching their child in a riding lesson or spectators observing a competition.
4. **Kitchenette:** There is never a proper kitchenette area in the facility which is not very convenient for workers that are there all day, for children in summer camps, or even for someone who wants to make a tea or coffee.
5. **Grooming:** Most importantly, there are no separate grooming areas where you can spend extra time with your horse. The grooming areas are usually in the hallways which obstructs the flow of traffic and makes the person always feel rushed, like they need to brush, tack up and get out of the way as quickly as possible. There needs to be a space to spend quality time taking care of these horses without being interrupted.
6. **Storage:** There always seems to be a lack of storage and organization; no one seems to ever have enough space for blanket storage or they cannot fit their saddle in their locker with all of their other equipment.

7. **Materiality and structure:** Many of these buildings have an industrial feel to their materiality and structure. Horses are sensitive animals and they react to the environment around them. Everything about the environment we provide for them needs to be soothing, comfortable, and relaxing, and I feel the current material culture is not conducive to this.
8. **Passive building systems:** Equestrian facilities are always struggling with costs to keep the place running, yet no one incorporates passive building systems that we are aware of. Basic systems like ventilation, daylighting, and passive heating can be integrated to help cut down on day-to-day utility costs.

If we are aware that these are not the ideal conditions for the horse or the human why do we keep building the same facilities with the same issues? All equestrians are subconsciously or even consciously aware of the problems, yet no change has been made. The goal of this thesis is to show the equestrian community solutions to these common issues in hopes of making a long-term shift in the future of these facilities.

Equestrian Architecture will create a comfortable environment that enhances the wellness of the horses and riders. The program will be reworked and the spaces crafted to create the desired essence within the facility.



Figure 1.1: Kristina Hakala and Rite Investment.
Photograph by Danielle Provencher Designs in
Val Caron, ON, Oct. 2018.

COMMUNICATION

Reasons People Ride

Some may wonder why people still ride horses to this day. Most importantly, the domesticated horse needs humans to provide the essential care they need.¹ But being around horses also benefits humans in many ways. The following are a few examples of why people ride:

- for transportation
- to exercise the horse
- for the social aspect
- to have fun
- to stay fit
- to improve mental health
- to perfect their skills
- for the ribbons and trophies²

Horseback riding is one of the only sports that can be done at any age and can be picked up at any stage in a person's life. The sport can also be enjoyed at many different levels. From one of the earliest and most simple forms being a mode of transportation to being one of the most intimate connections between animal and human, and from leisure to competitions.³

¹ Beverly Mohan and Margaret Mohan Steinberg, *Riding: A Guide to Horsemanship* (Chicago: Follett Publishing Company, 1971), 65.

² Clay, *Riding Out of Your Mind: Equestrian Sport Psychology*, 24.

³ *The Manual of Horsemanship*, Fourteenth Edition (The Pony Club, 2013), 5.

Figure 1.2: Kristina Hakala and Rite Investment in Val Caron, ON. Photograph by Danielle Provencher Designs, Oct. 2018.



Physical & Psychological Sport

Being engaged in the physical and psychological sport benefits humans in many ways. Some only focus on the physical sport, some the psychology, and some enhance physical performance with bettering psychological performance.¹ Horseback riding forces people to learn how to control emotions and body language. The horse feeds off of body language, this means that if the rider is stressed, the horse will also become stressed. Typically, the primary communication method is the voice, but when working with horses "your body is your primary speaker."² This makes the human remember the power of body language.

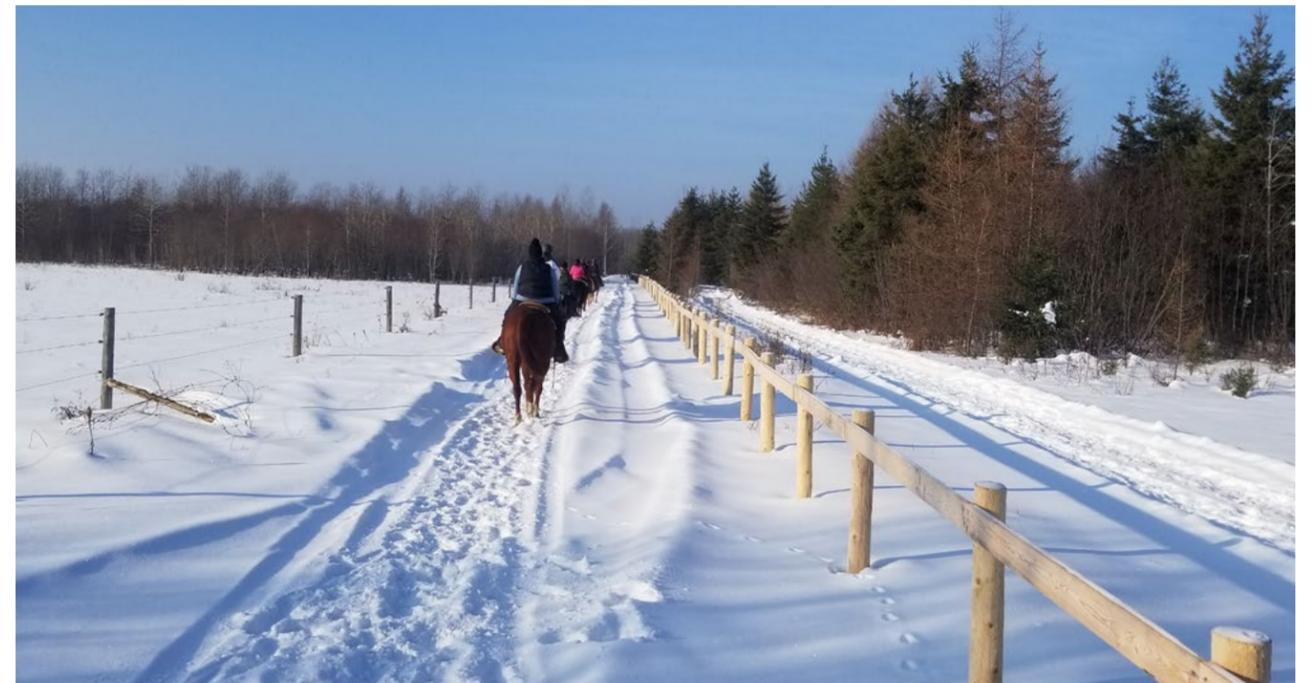
**"Mind connects to body,
body connects to horse."³**

Figure 1.3: Riding trails at PMC Performance Horses. Photograph by author, Dec. 2019.

¹ April Clay, *Riding Out of Your Mind: Equestrian Sport Psychology* (Calgary, Alberta, CA: The Writing Room, 2005), 10.

² *Ibid*, 33.

³ *Ibid*, 9.



Importance of Touch

Humans use somatic sensations (touch, temperature, vibration) to communicate with horses.¹ The sensuous experiences, with emphasis on touch and body language, within and around an equestrian facility is very important for the comfort of the horse. Horses are very sensitive animals and as a result are a reflection of the environment and those around them. When being around horses, humans must not be rough or loud-voiced; “speak quietly, handle gently but firmly, avoid sudden movements.”² Horses react to human emotions; if the rider or the person handling the horse is stressed or frustrated the horse will react to that in a negative way, whether that means the horse becomes frustrated as well or become worried about what is going on. There will be a huge change in the horse’s behaviours if the handler is calm and pleasant, the horse will become very willing to do anything that is asked of them and will have a lot of trust in the person. The ultimate goal is to build harmony and a bond where the communication looks effortless and there are no visual signs of communication.³ Without communication through touch and body language, humans and horse would not be able to bond and understand one another. People often use the phrase “having a good feel for the horse”, which refers to the ease of communication and the ability for the horse to pick up on the sensations and signals that the rider is sending.⁴

*Doing so involves a melding of both bodies, with humans and horses developing a high level of bodily control and sensitivity. It’s an empathetic physical dialogue, with the goal of having two bodies operate as a single unit.*⁵

This level of intimate care and connection between human and animal needs to be translated into the built environment which is inhabited in order to achieve the highest level of comfort.

1 Keri Brandt, “Intelligent Bodies: Embodied Subjectivity Human-Horse Communication,” 142.

2 *The Manual of Horsemanship*, 45.

3 Keri Brandt Off, “Touch Forms the Foundation of Powerful Human-Horse Relationship,” *The Conversation*, May 5, 2018.

4 Brandt, “Intelligent Bodies.” 145.

5 Brandt Off, “Touch Forms the Foundation of Powerful Human-Horse Relationship.”



Figure 1.4-1.9: The experience of touch. Photographs by Danielle Provencher Designs, Oct. 2018.

The Experience

Creating a pleasant experience with the horse is all about the bond, communication, and trust between horse and human. The following is a timeline of the experience while preparing to ride.

Figure 1.10-1.17:
The experience.
Photographs by
author, Dec. 2019.

From getting the horse in the pasture, grooming, tacking up and then finally getting on the horse, this series is about the sensuous experience to provide a calm and comfortable environment for the horse and rider.



1. Get horse from pasture.



2. Remove blanket.



5. Tack up - saddle.



6. Tack up - bridle.



3. Groom.



4. Pick hooves.



7. Use mounting block.



8. Ride!



Figure 2.1: Photograph by Kelsie Beck at Area
3 Summerama, Orangeville, ON, 2016.

THE HORSE

Life Cycle

In the life of the horse, the level of comfort on the farm is very important. Some animals will spend every single day of their lives on that property, right from birth to death, and everything in between. The domesticated horse relies on its humans to make sure it has the best possible life right from the moment it is born. As the animal grows, so does the bond between it and the caregiver. The space and place must enhance the quality of life of these animals. The farm and the property must support all of the amenities necessary to provide these animals with the best quality of life possible.



Figure 2.2:
Photograph of
Impulse to be Good,
taken by Author in
Worthington, ON.
Sept. 2016.



Figure 2.3:
Photograph of
Kristina Hakala and
Impulse to be Good,
taken by Carrie
Hotson in Lindsay,
ON. May 2019.

Scale

From Vitruvius to Le Corbusier, architects have always focused on building to the scale of the human. This thesis will not only need to build part of the program to the scale of the human, but the majority of the programmatic spaces will need to be adapted to the scale of the horse. Architecture, for Le Corbusier, was time and space, and a matter of measure.¹ To understand the human body, Le Corbusier began to measure and draw his own body in all different positions: walking, standing, sitting, etc.² With this he found with his arm in the air, he could reach to 2.2m or 7ft-3in, which meant the new standard for a ceiling height became between 7 and 8ft. In 1946, Le Corbusier came up with a system that “pins down the human body at the essential points of its occupation of space.”³ This system was later named the Modular Man and became the standardized measuring tool for the human body.⁴

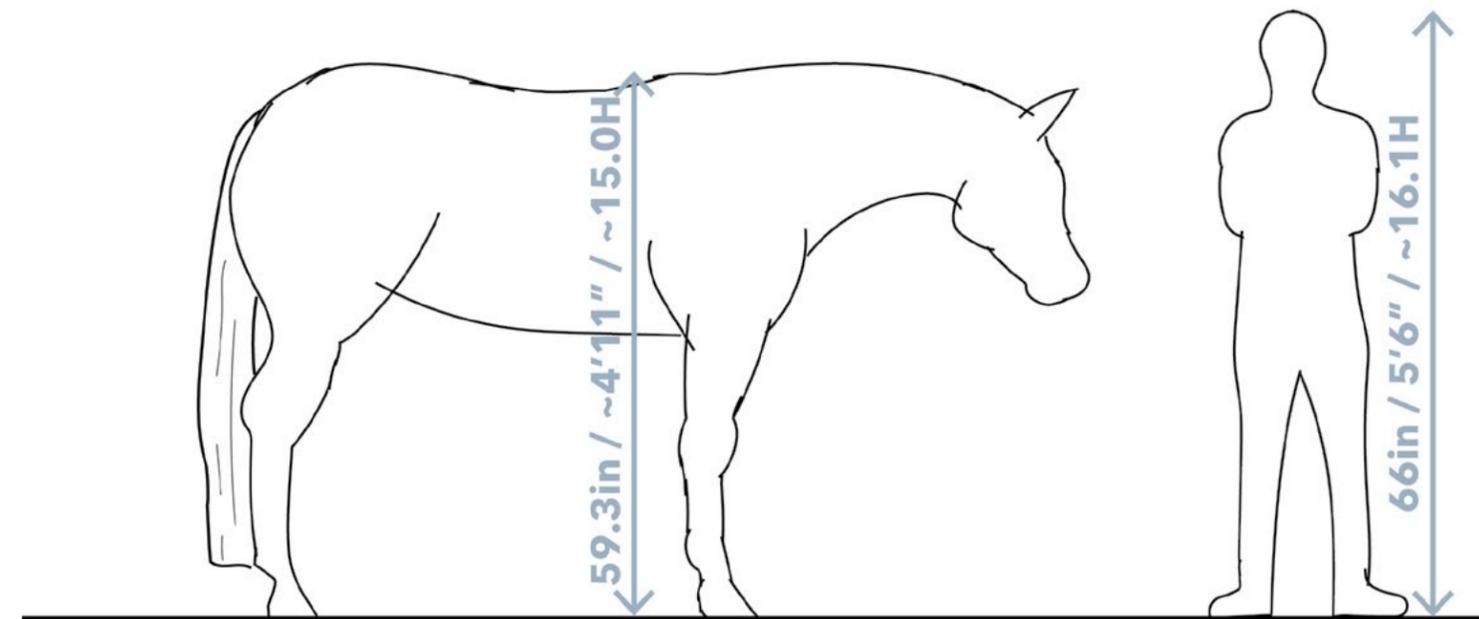
1 Le Corbusier, *The Modulor: A Harmonious Measure to the Human Scale Universally Applicable to Architecture and Mechanics* (Harvard University Press, 1954), 29.

2 Ibid.

3 Ibid, 50.

4 Ibid, 55.

Figure 2.4: Average
size of the American
Quarter Horse.



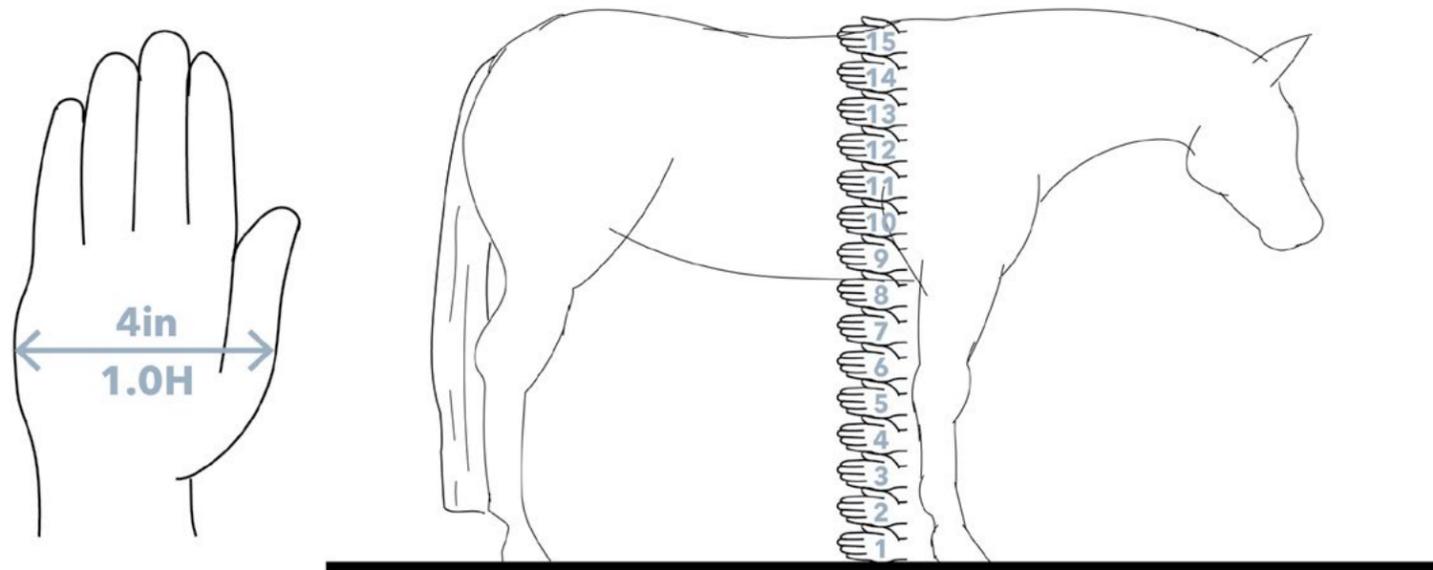
Average Size of the American Quarter Horse

1:20

In order to begin understanding the size of the horse, the architect must compare it to something familiar to everyone, that being the human body. Equestrian Architecture is a western performance facility designed mainly for the American Quarter Horse. The average height of a quarter horse is approximately 4'11" or, as equestrians would say, 15.0 Hands (H) tall. The width of the human hand, 4 inches, is used as a unit of measurement for the horse. This is just another way these two species are interwoven. After understanding the size of the animals occupying the building, a measurement system and a scale for all spaces of inhabitants can be produced.

This thesis follows the theories of Le Corbusier's Modular Man as a measuring tool, and a similar system is designed to respond to the body of the horse. The larger scale of the horse is studied in order to build an environment that it comfortable for them. As seen in Figure 2.6, the most crucial measurements of the average sized American Quarter Horse have been documented. These measurements are considering

Figure 2.5: Measuring the horse.

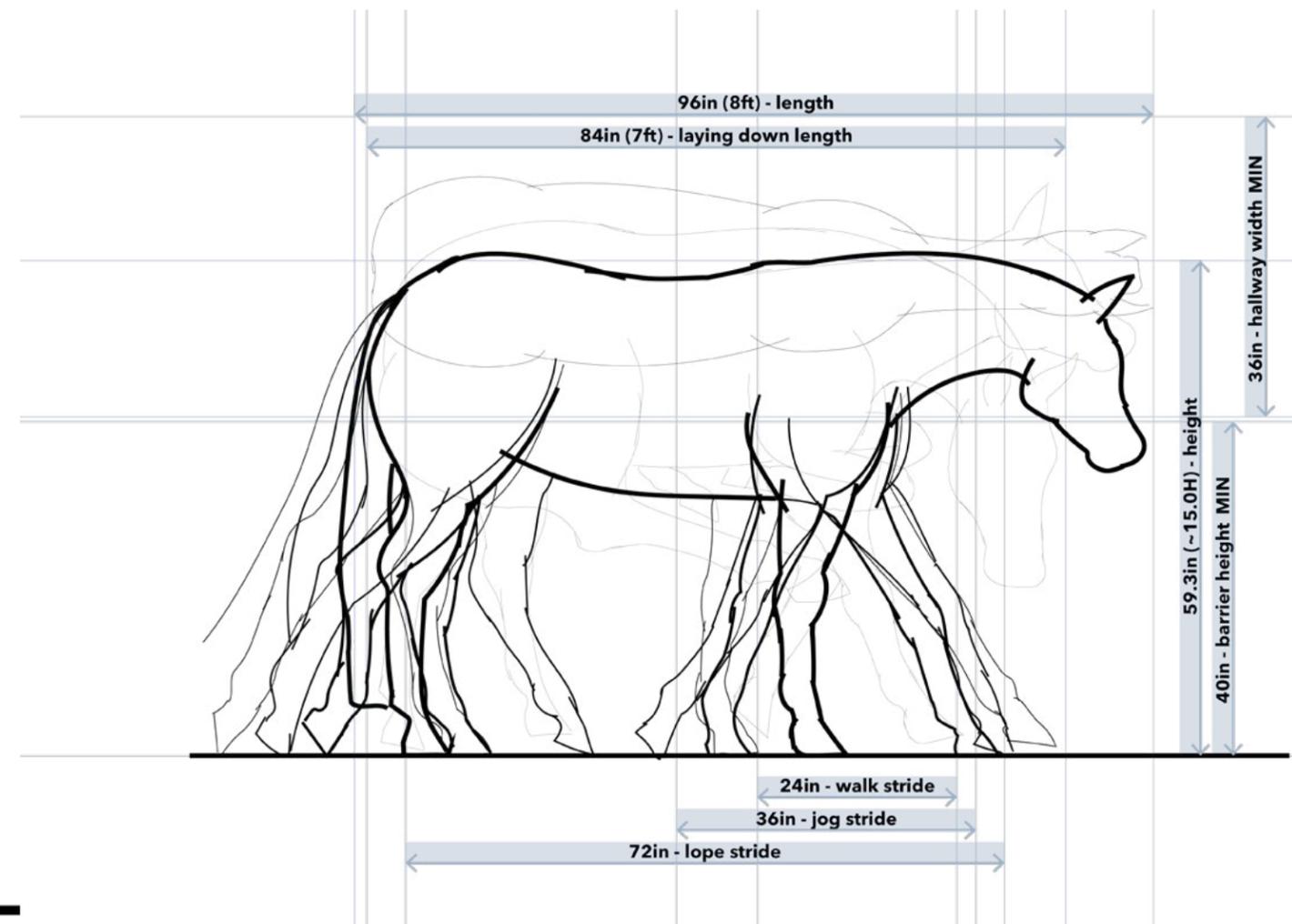


Measuring the Horse

1:20

the multiple different positions a horse will inhabit in an equestrian facility. Some of these measurements being the stride lengths of the horse, the height, length and width of a horse standing up, and those of a horse laying down, etc. This tool of measurement influences architectural elements such as barrier heights, stall dimensions, hallway widths, corridor lengths, etc. Determining the scale of the horse is of utmost importance to be able to build a healthy, and happy environment for this animal.

Figure 2.6: Scale of the horse.



Scale of the Horse

1:20

Eye Level

Another aspect of scale to consider in an equestrian facility is the eye level of the horse and the rider. This will affect the window and opening heights within the facility, especially in the indoor arena. If there is a window at the eye level of the horse, he/she may become distracted or spooked, which can become dangerous for the horse and rider, and others in the arena. There can be windows at the eye level of the human, around 8ft off ground level in a western performance facility, however there must be shades put in place to block direct sunlight from impairing the vision of the rider. Windows would ideally be on the north side of the arena at the eye level of the rider for indirect sunlight, and to allow a view outside to be aware of what is going on in the surroundings. This would allow the rider to supervise what is going on outside, whether that be in the outdoor riding arena or in the pastures for the horses, as well as keeping an eye on the weather in case the human needs to prepare for bad weather and bring the horses inside.

Figure 2.7: Eye level.



Position

The rider's body position in any discipline is very important to properly communicate with the horse. Improper body position will lead to an imbalance between horse and rider, and ultimately lead to undesirable results. The rider should sit square in the saddle with his/her shoulders and hips square to the horse. There should be a straight line from the human's shoulder, to the hip, and down to the heel. Shoulders should be back to avoid leaning forward, hips should be tilted slightly back to sit deep in the saddle, and heels should be down to keep the foot in the stirrup and be able to use the leg properly on the horse's side. There should also be a straight line from the rider's elbow, to the hand, down the rein, and to the bit in the horse's mouth. The rider's elbow should be tucked in at his/her sides, wrists should be straight, and fingers closed around the reins. The horse is a very sensitive animal and any little shift in the rider's body position will send a message to the horse. If the rider is leaning forward, it will tell the horse to increase speed. If the rider leans to the side through a turn, it will cause the horse to dive in and become unbalanced.

Figure 2.8: Correct riding position.



Movement

A western performance horse has three gates in which they travel; walk, jog, and lope. In the English events the gates are called walk, trot, canter. Each gate is unique with the horse's legs moving in different sequences for each. The walk is a four-beat gate with all four legs moving independently of each other, and it is a 2ft stride length. The jog is a two-beat gate with diagonal sets of legs moving simultaneously, and it is a 3ft stride length. The lope is a three-beat gate with the outside front leg and the inside hind leg moving at the same time and the other two moving separately, and it is a 6ft stride length. These foot patterns are tracked, created strong geometric patterns with triangles and diagonals that can be translated into the rhythm of the building structure.

Figure 2.9:
Movement of a
western performance
horse.



Jog



Walk



Lope

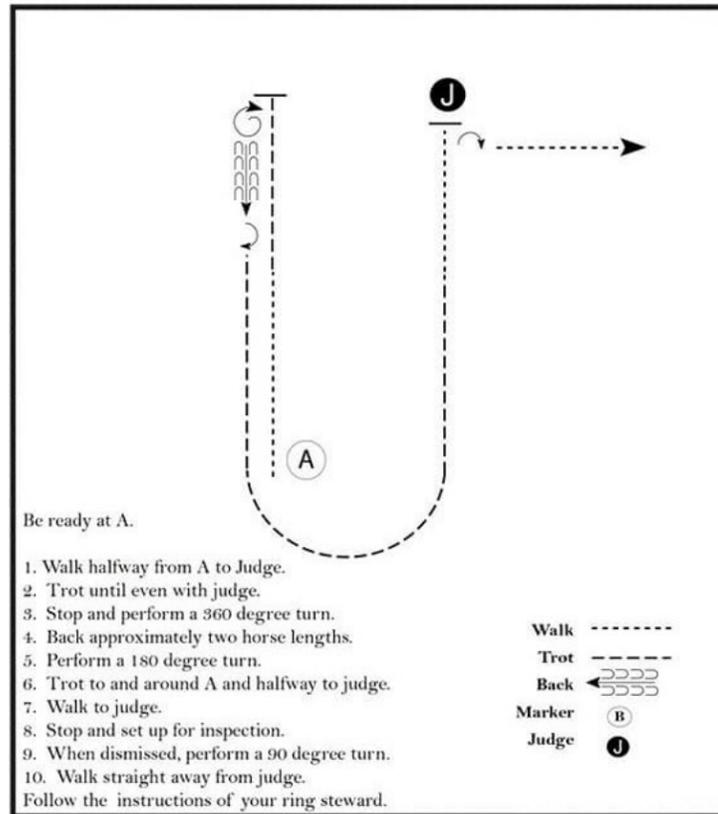
Performance Events Showmanship

Showmanship is one of the events that is done at a western performance show. The exhibitor is given a pattern that they must execute with the horse in hand. The event is judged on the ease of communication and synchronicity between horse and human. The patterns can consist of a walk, trot, back up, turn on the haunches, set up, and an inspection.

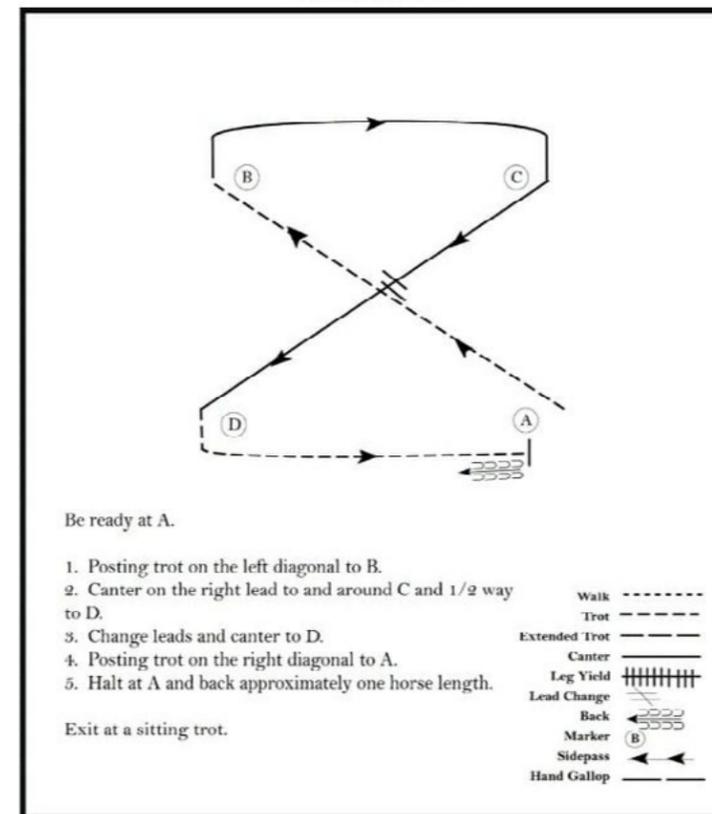
Figure 2.10 and 2.11: Photographs of Kristina Hakala and Rite Investment by Kelsie Beck at Area 3 Summerama, Orangeville, ON, 2016.



Area 3 Summerama Youth, Amateur, Select (Showmanship) Show Date: Round 1



Area 3 Summerama Youth, Amateur, Select (Equitation) Show Date: Round 2



Performance Events Equitation

Equitation is a pattern class done in English tack. The rider is judged on body position and his/her ability to subtly communicate with the horse. The horse and rider should be in sync and the pattern should appear almost effortless and graceful. The patterns include walk, sitting trot, posting trot, canter, hand gallop, lead changes, back up, turn on the haunches, and turn on the forehand.

Figure 2.12 (left): Photograph of Brianna Hotson and Just an Ultra taken by Carrie Hotson in Orangeville, ON, May 2018.

Figure 2.13 (right): Photograph of Jacqueline Blanchette and Cassis Golden Girl taken by Lone Oak Photography in Orangeville, ON, May 2017.



Performance Events Horsemanship

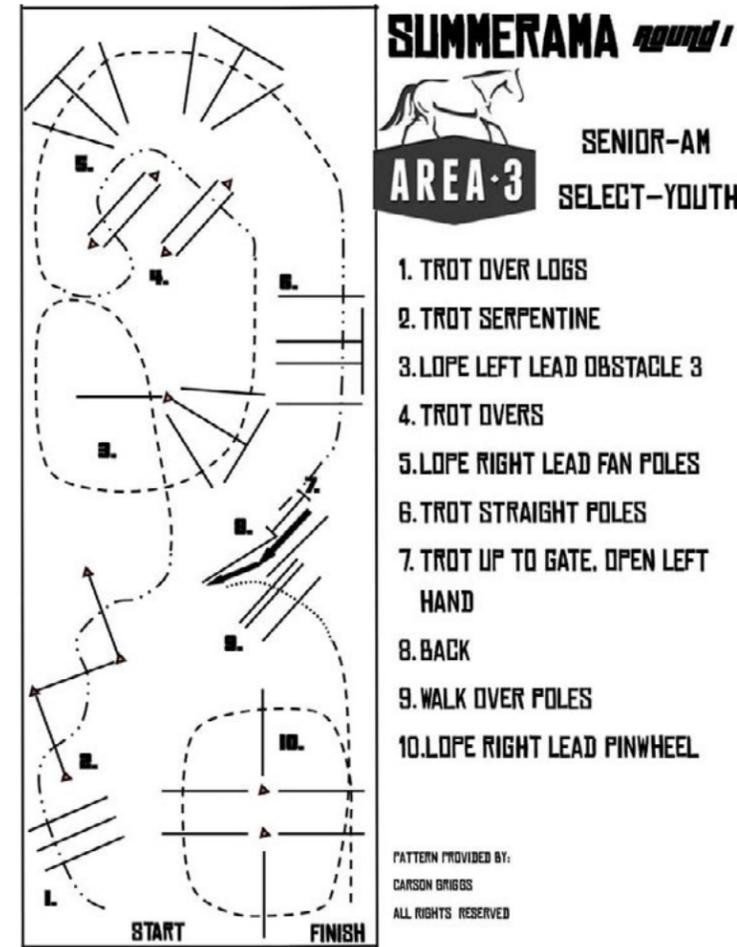
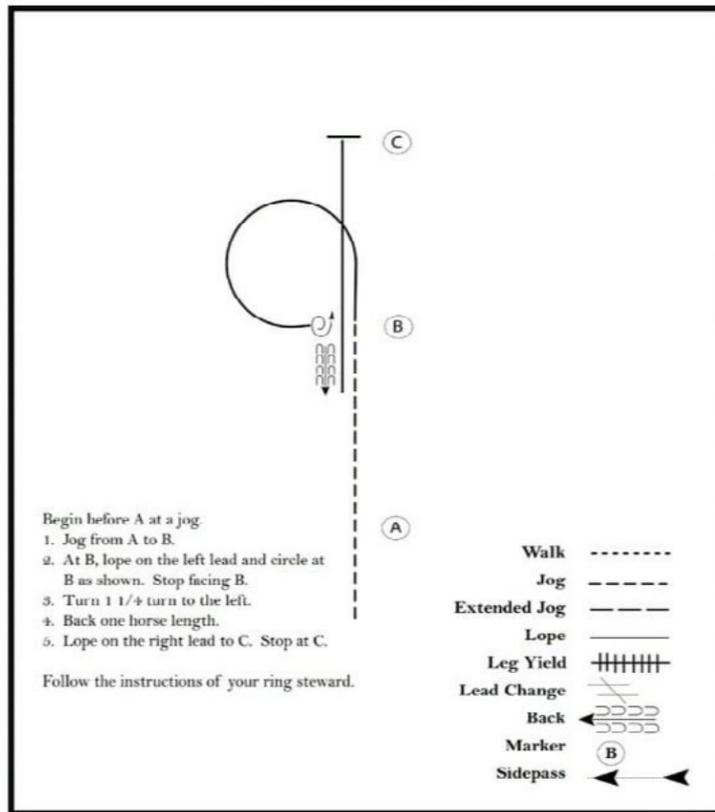
Horsemanship is similar to Equitation except it is done in western tack. The rider is judged on body position and his/her ability to execute all of the manures in the pattern. The horsemanship patterns can include walk, jog, extended jog, lope, extended lope, lead changes, back up, and turn on the haunches.

Figure 2.14 (left): Photograph of Julie Dion and Radicals Best Pass taken by Lone Oak Photography in Orangeville, ON, May 2017.

Figure 2.15 (right): Photograph of Kristina Hakala and Impulse to be Good, taken by Carrie Hotson in Lindsay, ON, May 2019.



Area 3 Summerama Youth, Amateur, Select (Horsemanship) Show Date: Round 2



Performance Events Trail

Trail is a pattern that consists of a series of obstacles and is judged by how cleanly and smoothly the horse and rider can get through the pattern. The rider must be able to control every step the horse takes, whether that is to lengthen or shorten the stride, or ask the horse to lift its legs higher. There can be walk, jog, and loping poles in many configurations, poles to back through, gates to open, walk through and then close, bridges to walk over, small boxes to turn around in, and poles to side pass over.

Figure 2.16 and 2.17: Photographs of Kristina Hakala and Rite Investment by Kelsie Beck at Area 3 Summerama, Orangeville, ON, 2016.

Equine Assisted Learning

Outside of the western performance competitions, Equine Assisted Learning is a program that builds leadership, group dynamics, team building, self development, and so much more. It can be beneficial to so many different people from children to adults, and even those with conditions such as post-traumatic stress disorder and many other disabilities. It can help humans with post-traumatic stress disorder to regain their trust and self control. It is great for people with mental disabilities to participant and be able to communicate with the horse in a nonverbal way. A series of obstacles need to be navigated in pairs or small groups working together. Horses are used for an activity like this because they are very honest and trusting creatures. They can teach humans how body language and reactions can affect those around them. If someone is angry, the horse is going to be more reactive and unsure, but if the person is calm and pleasant the horse will reflect that.¹

¹ Sawyer Photography and Videography, *PMC Performance Horses*, 2019, <https://www.youtube.com/watch?v=MF0GbJB9udE>.

Figure 2.18-2.23:
EAL event at PMC
Performance Horses.
Photographs taken by
author in Val Caron,
ON. Nov. 2018.





Figure 3-1: Barn at PMC Performance Horses.
Photograph by author, Nov. 2020

HISTORY OF THE BARN

Evolution of the Barn

The structure and relationships of spaces in a barn have greatly evolved overtime. Originally the horse and human lived under one roof, but then the human residence was separated from the barn. The shape of these buildings adapted to fit these programs and the land around it.

In the 1700s the long house or the los hoes was the simplest form of a barn house. The dwelling for the humans and livestock were under one roof with no dividing wall between them. Half of the building was the human residence and the other half of the building housed the livestock.¹

In the Netherlands in the late 1770s, a barn house type called head, neck and body was developed. The 'head' consisting of a living room of sorts and sleeping quarters. The 'neck' being the kitchen, churning room and milk cellar. The 'body' housing the barn with the threshing area down the center, stalls on one side, and wagon and equipment storage on the other side.²

By the 1800s, the living quarters for the human was no longer in the same building as the animal. The animal was now used exclusively for farming purposes. The English barn, the prairie barn and the saltbox barn were developed to suit the farm and the land. The English barn was divided into three sections; one side for animals, the middle for threshing, the other side for storing hay and other crops. The second level was used for storage of tools and smaller equipment.³ As a result of the population growth and people moving into urban areas, the prairie barn was bigger to meet the higher demands. Livestock were no longer able to roam free to find their own shelter so the barn had to be developed to accommodate more stalls.⁴ The saltbox barn was designed to handle the winds and heavy snow loads in the flat and barren lands of the prairies.⁵

1 Elric Endersby, Alexander Greenwood, and David Larkin, *Barn: The Art of a Working Building* (New York: Houghton Mifflin Company, 1992), 36-37.

2 Ibid, 39.

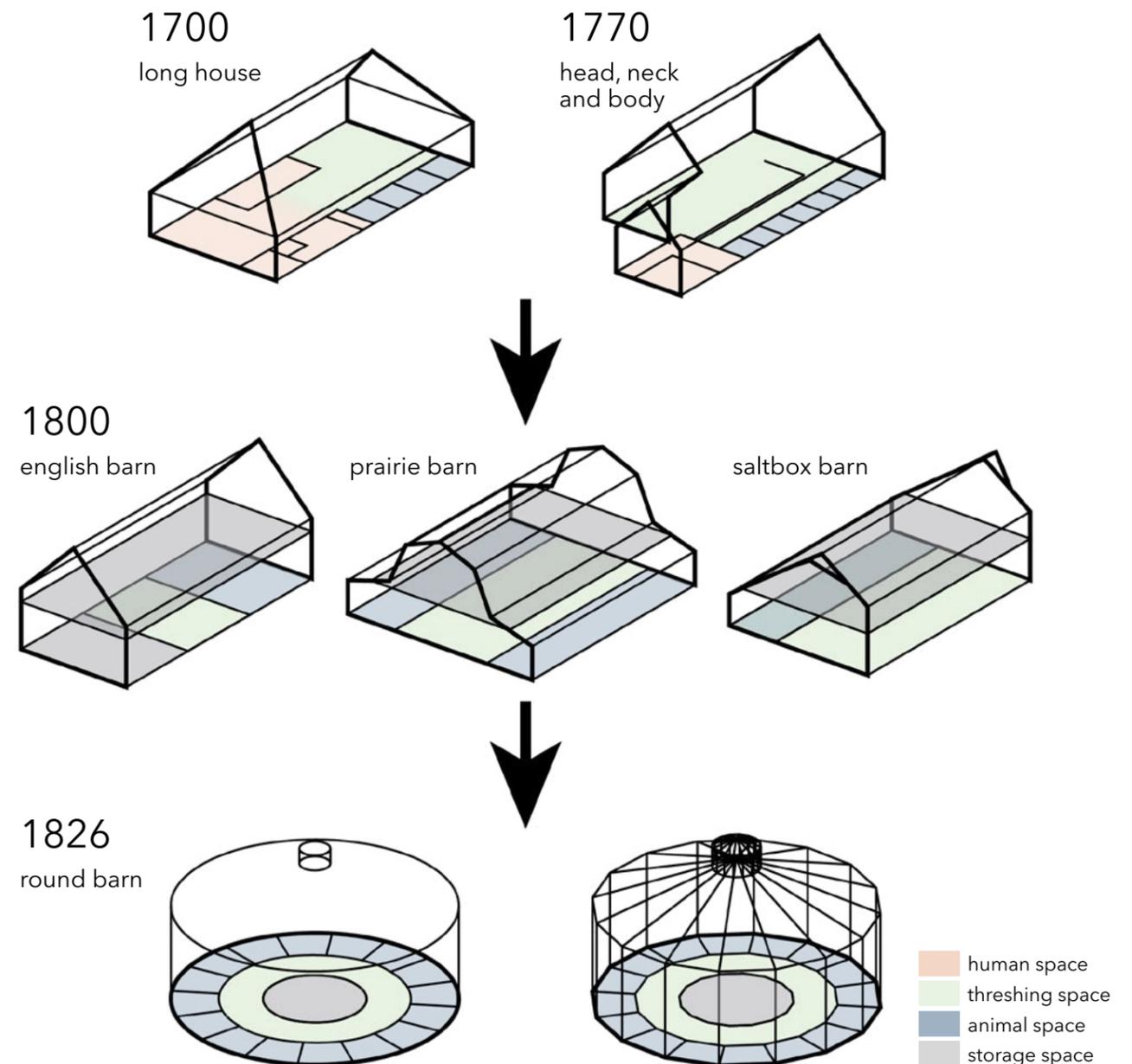
3 Susan Carol Hauser, *Barn: Form and Function of an American Icon* (Quarto Publishing Group USA Inc., 2017), 13.

4 Ibid, 47.

5 Ibid, 57.

In 1826 the first round barn was built to achieve "beauty, elegance, and ultimate efficiency."⁶ The form evolved into a series of small straight lines that appear to make a circle for the ease of construction. By the 1920s the round barn became unpractical when machines became more readily available to mass produce members that made rectangular barns much less costly and labour intensive.⁷

Figure 3.2: Evolution of the Barn. ⁶ Ibid, 76. ⁷ Ibid, 84.



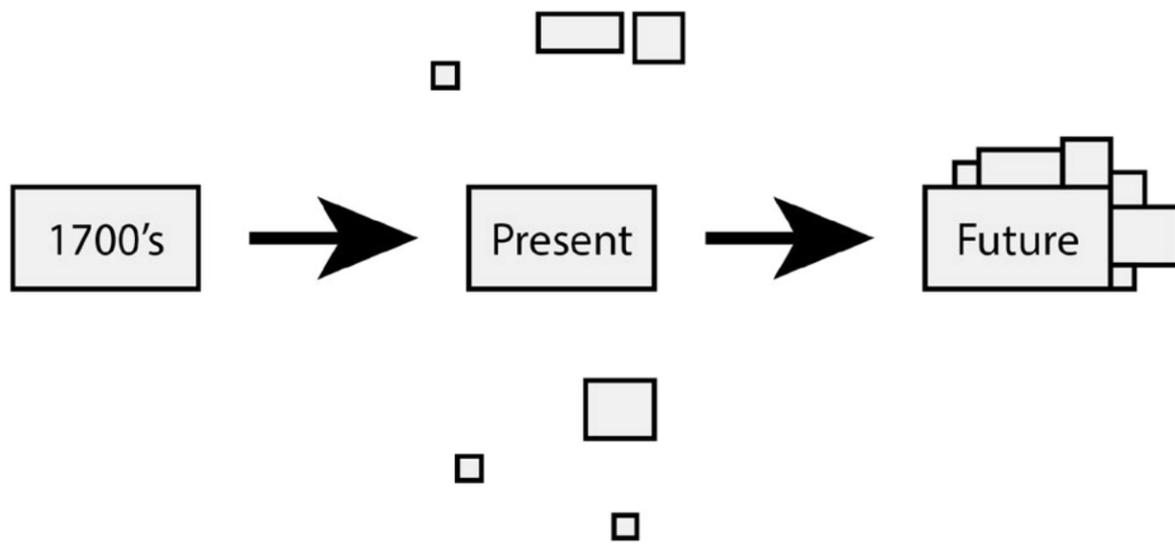
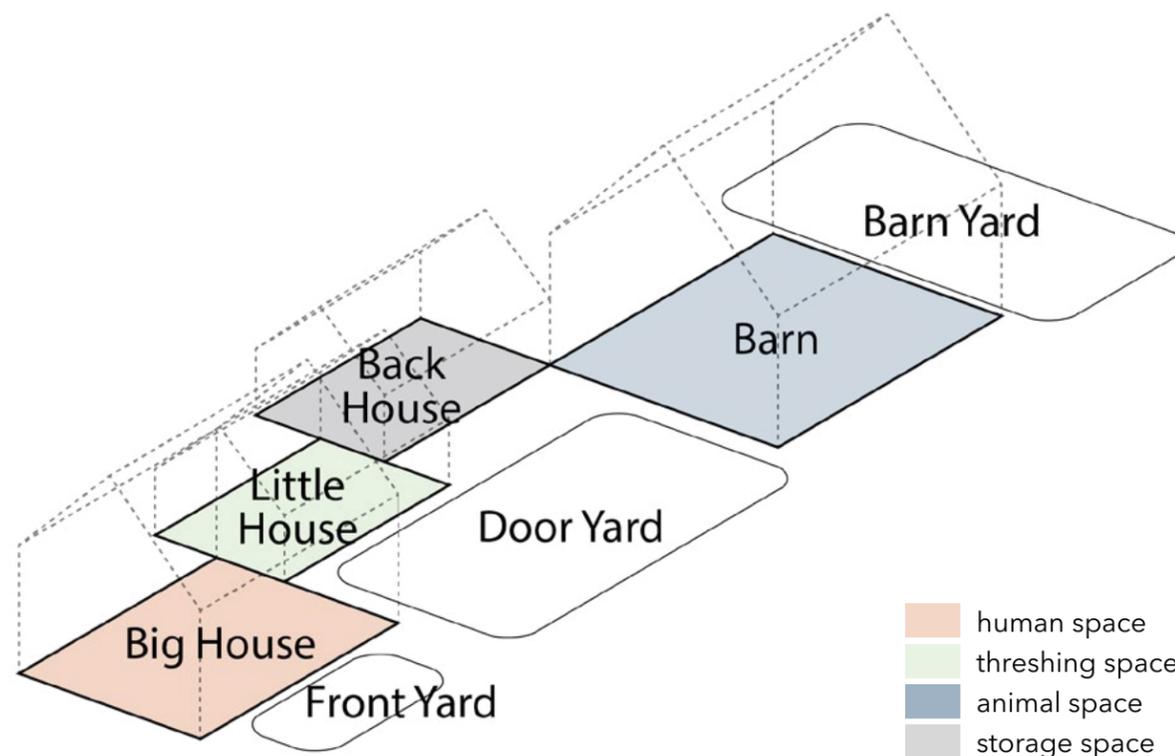


Figure 3.3: Evolution of the Supporting Spaces.

Supporting Programs

The relationship of buildings and programmatic spaces on a farm have changed overtime as well. In the 1700s, everything was under one roof, and the farmers shared the space with the animals. After the shift in agriculture from crops to mainly livestock, farmers required more space so many outbuildings were built. Since then, the way these facilities are built has not changed much even though the human-animal relationship has evolved greatly. Now humans think of these animals as companions with close, intimate connections to them, so why are the facilities not reflecting that? The goal of this thesis is to bring those spaces and interactions back under one roof to shape a better relationship with the animals and provide better living conditions for all.



Big House, Little House, Back House, Barn

In the 1850s in New England, Big house, little house, back house, barn was a building typology that became popular because of its practicality for long, harsh winters. Farmers wanted to have a more desirable passage from house to barn. However, they kept the big house and barn separated by the supporting programs of the little house and back house so there was no direct connection. The buildings were arranged to create courtyard-like conditions.¹ This thesis builds off of this concept to connect all of the spaces into one building or a series of buildings, and it shapes the buildings to create ideal outdoor spaces.

Figure 3.4: Big House, Little House, Back House, Barn.

¹ Thomas C. Hubka, *Big House, Little House, Back House, Barn*, 20th Anniversary Edition (University Press of New England, 1984), 6.

Existing Conditions

Hallways



Figure 3.5-3.7: Existing hallway conditions in Greater Sudbury, ON. Photographs by author Nov. 2020.

Stalls



Figure 3.8-3.10: Existing stall conditions in Greater Sudbury, ON. Photographs by author Nov. 2020.

Arenas



Figure 3.11-3.13: Existing arena conditions in Greater Sudbury, ON. Photographs by author Nov. 2020.

Building Connections



Figure 3.14-3.16: Existing building disconnection in Greater Sudbury, ON. Photographs by author Nov. 2020.



Figure 4.1.: Pasture field at PMC Performance
Horses. Photograph by author August 2018.

THE ENVIRONMENT

Climatic Challenge

Equine facilities in the Greater Sudbury area have been facing the misfortunes and hardships of the northern Ontario winters for many years. In the winter of 2017-2018 alone, multiple barns collapsed in the area due to a combination of snow, ice and wind loads. Many others experienced some lesser forms of damage, such as ice breakers being ripped off the roof when the snow and ice accumulation let go. One of the major problems is that snow and ice is able to accumulate on these roofs due to their low pitch. An easy building solution to help handle snow loads would be to shape the roof so snow is not able to accumulate. This thesis will craft an architectural solution to better the wellness of the horse and human to suit the harsh northern climate.

Figure 4.2-4.4:
Multiple riding arenas that collapsed due to wind and snow loads in Greater Sudbury, ON. Photographs by owners (anonymous), Feb. 2018.



Thermoregulation

With this project taking place in Sudbury and it being a northern climate, the ability these animals have to cope with extreme cold temperatures needs to be studied. Horses are able to adapt to cold weather, but must be monitored to make sure they have a sufficient heat balance. A heat or energy balance is the difference between the heat loss and the heat gain. If the horse gets too hot, they will gain weight, if they are too cold, they will lose weight.

heat or energy balance = heat loss - heat gain

heat gain > heat loss = weight gain

heat loss > heat gain = weight loss

The horse's main source of energy and heat gain is through the food they eat. A horse's skin temperature is typically 30°C.¹ If the air around them is colder, they will lose heat. This can be an opportunity to passively heat a barn if it is properly insulated.

It takes a horse 10-21 days to adapt to a temperature change so it is best to keep the indoor and outdoor temperatures close to the same all year round. They can easily adapt to the lower critical temperature (LCT) of -15°C.² Any colder than the LCT, the horses will require assistance from humans to handle the cold, such as shelters, blankets, extra feed, etc. "Maintenance energy intakes of adult horses must be increased 2.5% per Celsius degree below temperatures of -15°C or the equivalent of 2% more feed."³ Horses are able to self-regulate their energy intake (food consumption) so it is important they have free choice of hay, especially in the winter. Horses taking shelter in a three-sided shed are able to conserve 20% more body heat than if they were completely exposed to the elements.⁴

¹ Government of Ontario. "Management and Feeding of Horses in Cold Weather." Ministry of Agriculture, Food and Rural Affairs. Accessed November 8, 2020.

² Ibid.

³ Ibid.

⁴ Ibid.

Figure 4.5: Providing shelter from extreme weather conditions.

Photograph by author May 2019.





Growing (self-sufficiency)

An equestrian facility can be fairly self sufficient if the land is laid out and used properly. Grass pastures can be grown for grazing and can be a complete diet for a horse in the summer time if there is enough grass for the number of horses.¹ Hay can also be grown in the fields if growing and soil conditions are right.

If the horses are going to live on mainly grass in the summer months, they must be provided with at least one acre of grass pasture per horse. It is best to have three or four pastures to rotate the horses on in order to give the grass a couple weeks at a time to rest and regrow.² Therefore, it is ideal for one horse to have three to four acres of grass to rotate on.³ If the horses are kept on the same grass pasture all of the time, eventually they will eat all of the grass, they will trample and dig it up, and then the grass will not be able to regrow. Having a horse living on grass permanently can lead to difficulties controlling its diet, and it may become overweight. Horses do really well when turned out on grass pasture for half a day and being stabled for the other half a day where their diet can be controlled and monitored.⁴

Harvested hay is either “fed to livestock on the farm where produced, marketed off farm for feeding elsewhere, or utilized in some combination of these two alternatives.”⁵ With the slow urbanization of farms, more often farm owners purchase hay for their animals from another farmer. However, if the farm is able to grow and harvest more hay than what is needed for on property feeding, they would be able to sell the remainder for profit. Soil is the main resource needed for crop production and it is very important that the soil be maintained and tilled regularly. Tilling the living and dead roots in the field will increase organic matter, provide better aeration, creates a better seedbed, and promotes water penetration.⁶

¹ *The Manual of Horsemanship*, Fourteenth Edition (The Pony Club, 2013). 59.

² *Ibid*, 62.

³ Beverly Mohan and Margaret Mohan Steinberg, *Riding: A Guide to Horsemanship* (Chicago: Follett Publishing Company, 1971). 74.

⁴ *The Manual of Horsemanship*, 60.

⁵ R. Dwain Horrocks and John F. Vallentine, *Harvested Forages* (San Diego, California: Academic Press, 1999), 7.

⁶ *Ibid*, 12.

Figure 4.6: Grazing horses in a pasture in Val Caron, ON. Photograph by author June 2020.

Site Selection

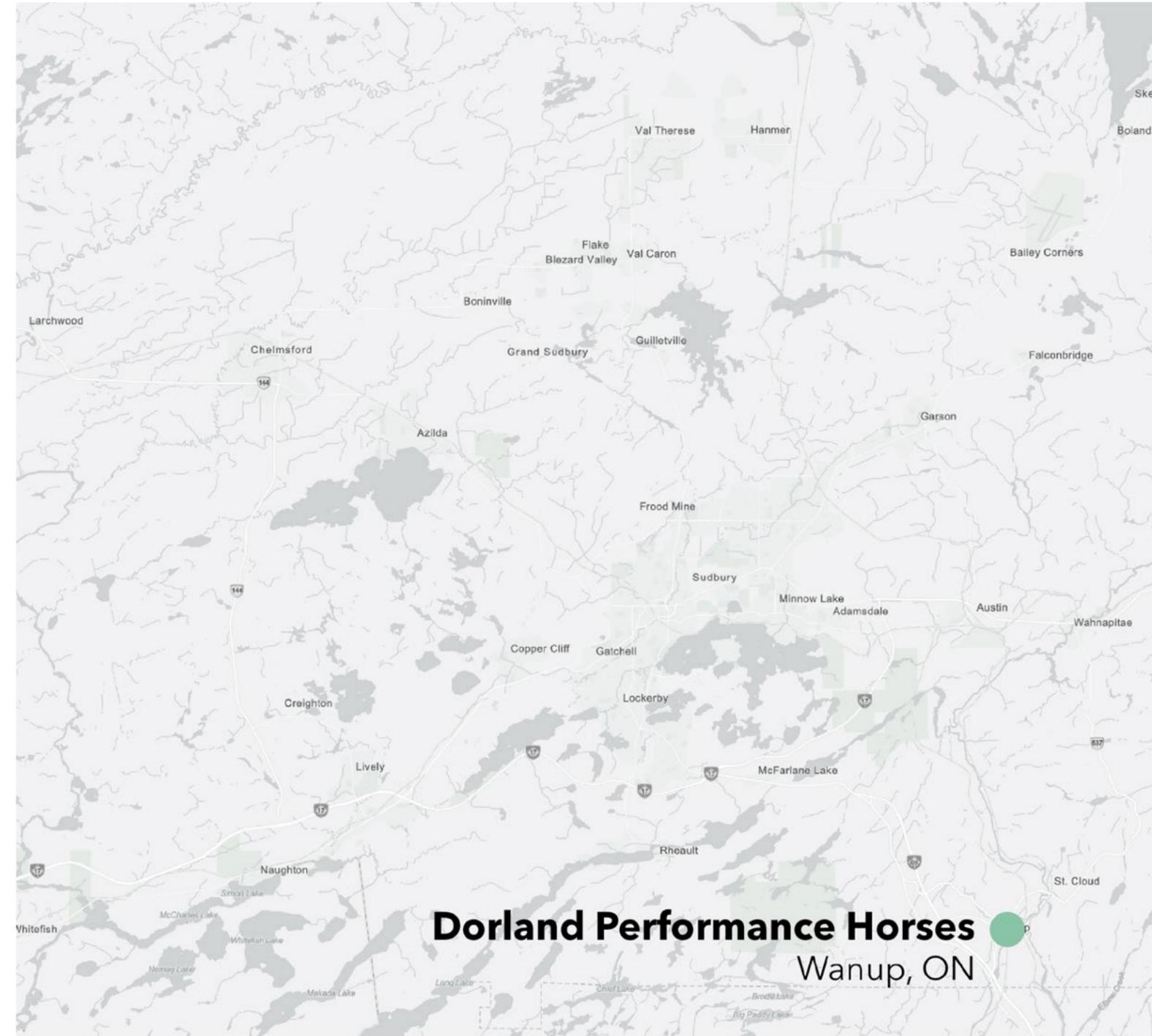
Dorland Performance Horses, Wanup, ON

A series of case studies of existing equestrian facilities were done in the Greater Sudbury area (see Appendix A - Case Studies), and with that site analysis was also done. A project site has been chosen based on a list of criteria to best suit the project and to handle the winter climate. After doing a series of case studies in Sudbury, a list of site requirements has been developed. The site must have sufficient acreage to accommodate all programmatic elements. There must be some natural protection from prevailing winds, using tree coverage and changes in topography. Growing conditions must be adequate for hay fields and grass pastures with rich soil and relatively flat land. Water must be easily accessible on the site. Flood plains and any building restrictions must be known. The property must be easily accessed from a well-maintained road. The amount of snow that typically falls in that particular area must be considered. With the list of requirements, the site that has been identified as the most suitable for Equestrian Architecture within Greater Sudbury is Dorland Performance Horses in Wanup, ON.

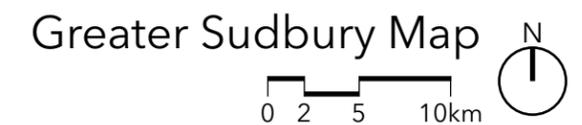
Site Requirements:

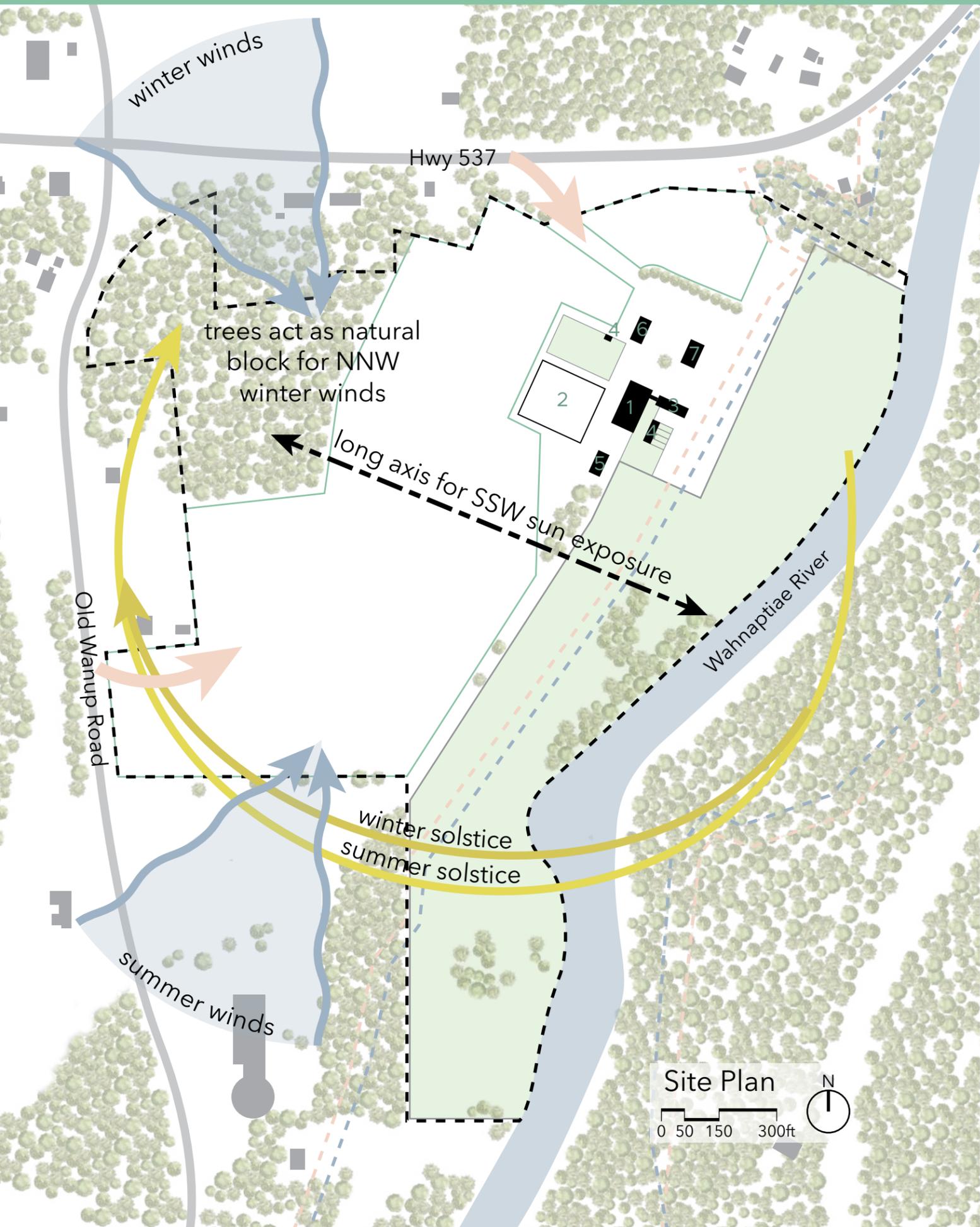
- acreage
- prevailing winds
- tree coverage
- topography
- growing conditions
- water accessibility
- flood plains
- building restrictions
- road accessibility
- snow loads

Figure 4.7: Map of case studies done of equestrian facilities in Greater Sudbury.



Dorland Performance Horses
Wanup, ON





Site Analysis

Dorland Performance Horses, Wanup

Based on the site analysis done at multiple sites, this site of Dorland Performance Horses in Wanup is most suitable for this thesis project. The site has sufficient acreage to handle the program. It has natural wind blocks to deal with the prevailing winds. The southwest summer winds are blocked by hills just to the south west of the site, and the trees on the northwest of the property block the cold winter winds. The growing conditions are ideal in these fields; the current owner/operator successfully grows more than enough hay for his horses every year. The property is easily accessed, tucked away just off a major highway, Highway 69 South, with access from two quiet rural streets. One thing to note is the flood plain along the river, with the northeast corner of the property typically flooding every Fall. Even though there are flooding conditions on the site, the site is large enough to avoid the area along the river that tends to flood with overflow from the river. With the site being in one of the lowest topographic regions in Greater Sudbury, it typically gets the least amount of snow in the region.

Figure 4.8: Site analysis diagram.

Site Plan Legend

- property line
- - - flood plain
- - - regulated area of Conservation Sudbury
- fence line
- hay field
- road access
- surrounding houses
- existing buildings
- turnout pastures
- outdoor riding arena

Existing Buildings:

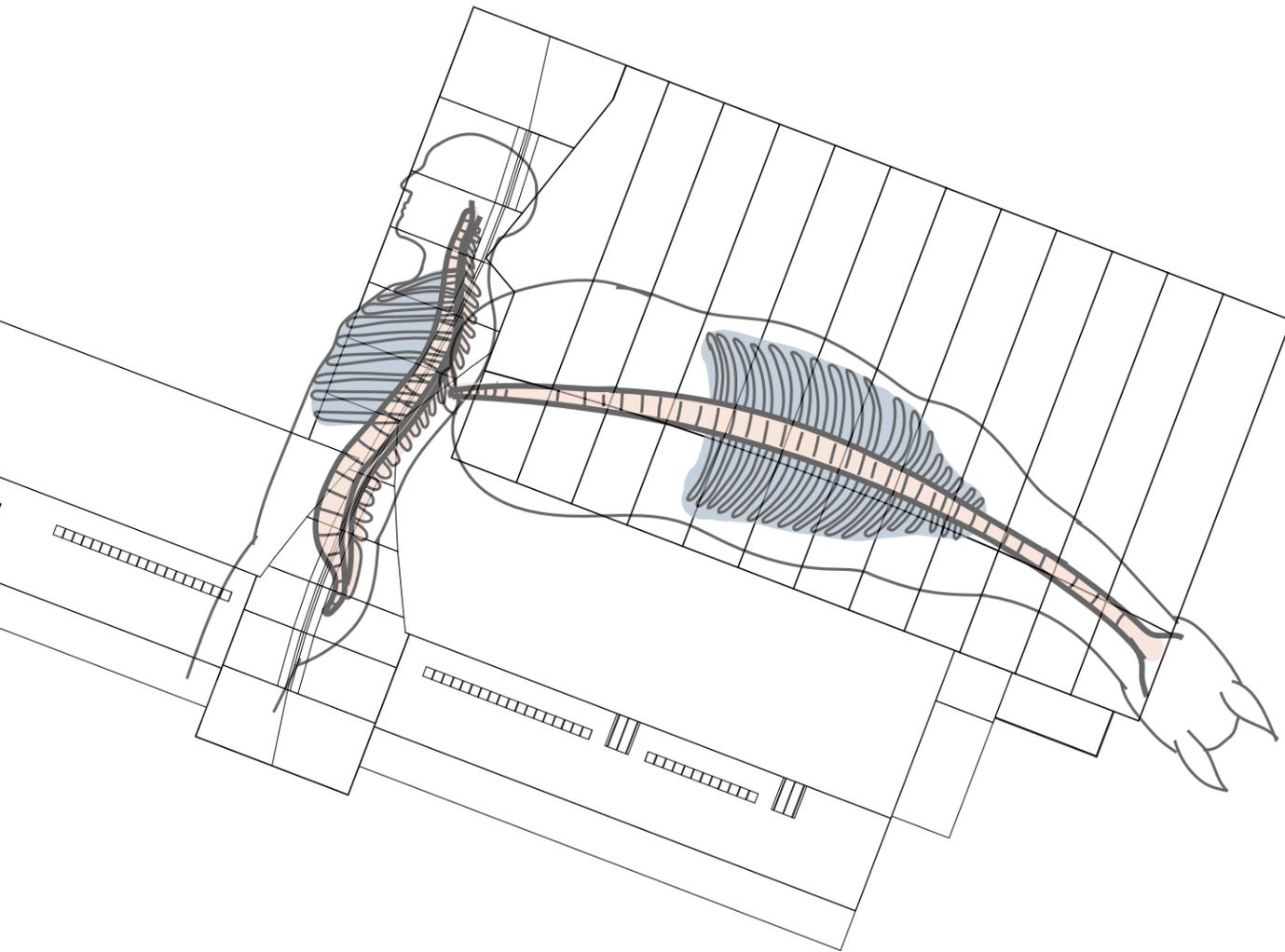
- 1 indoor riding arena
- 2 outdoor riding arena
- 3 barn with stalls
- 4 shelter in pasture
- 5 hay barn
- 6 garage
- 7 house



Figure 5.1: Entrance of *Equestrian Architecture*.

DESIGN

Design Concept



Equestrian Architecture brings the horse and the human back under one roof, creating harmony between the two. The building responds to and enhances the actions of each as separate entities and when they come together as a team.

Figure 5.2: Design concept drawing. The intersection of the horse and the human.

Program

The goal of this thesis is to design an equestrian facility that allows the horse and the human to interact, to benefit both, and the surrounding environment. In order to do this, the requirements of the barn and surrounding property must be known. In the words of equine professional Liz Newman,

A healthy and happy barn is a barn that is well designed and laid out, that horses relax in and that owners and workers look forward to going to when they wake up.¹

This thesis divides the program into five categories; the house for the horse, the public house for the human, the private house for the human, the shared house and the back of house. The house for the horse is the most important since this facility revolves around the wellbeing of the horse. It will include stalls and a couple different pasture and turnout options for the horses. The public house for the human will consist of lockers, tack rooms, lounge and viewing areas, a kitchenette, and washrooms. The private house for the human is the residential area for the owner or primary caregiver of the facility. The shared house is whether the horse and the human spend all of their time together, connecting and bonding. The back of house consists of all the supporting spaces such as feed and hay storage, shavings room, laundry, drying stall, general equipment storage, and a workshop. The arrangement and relationship between these programmatic groups can be seen in Figure 5.3.

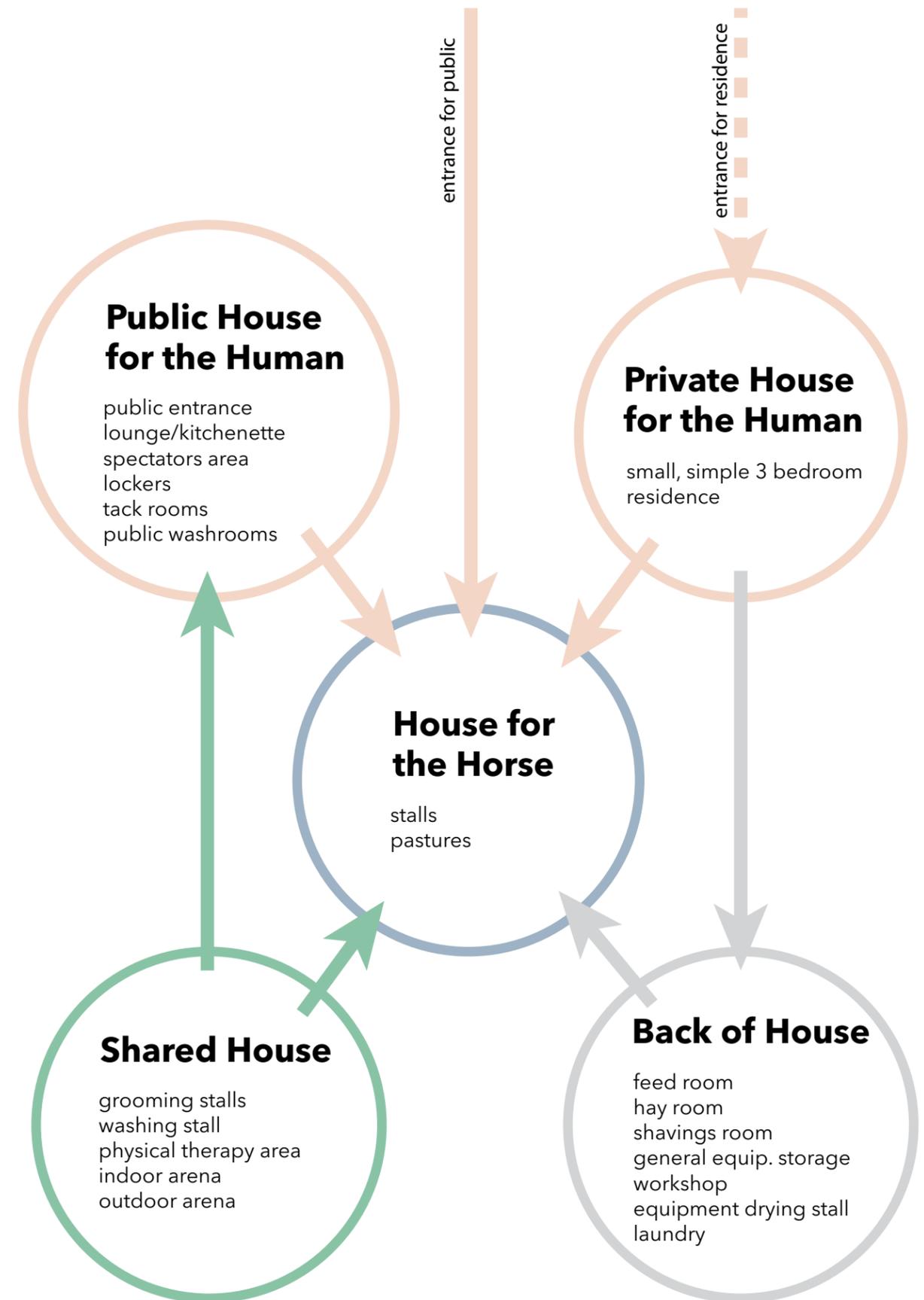


Figure 5.3: Relationship of programmatic groups.

¹ Liz Newman, "Innovations in Barn Design - Building for Health and Happiness."

Design Process

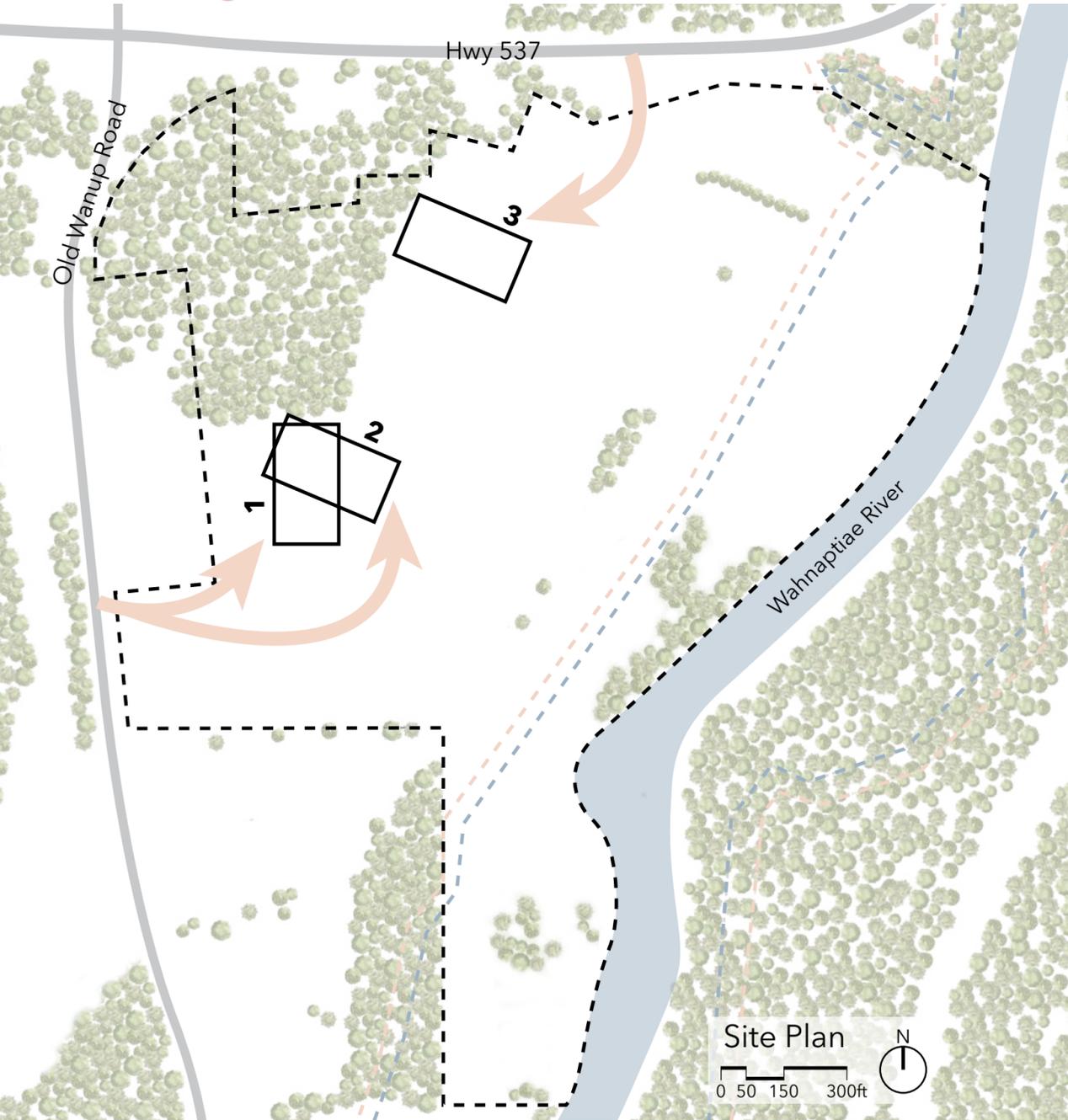
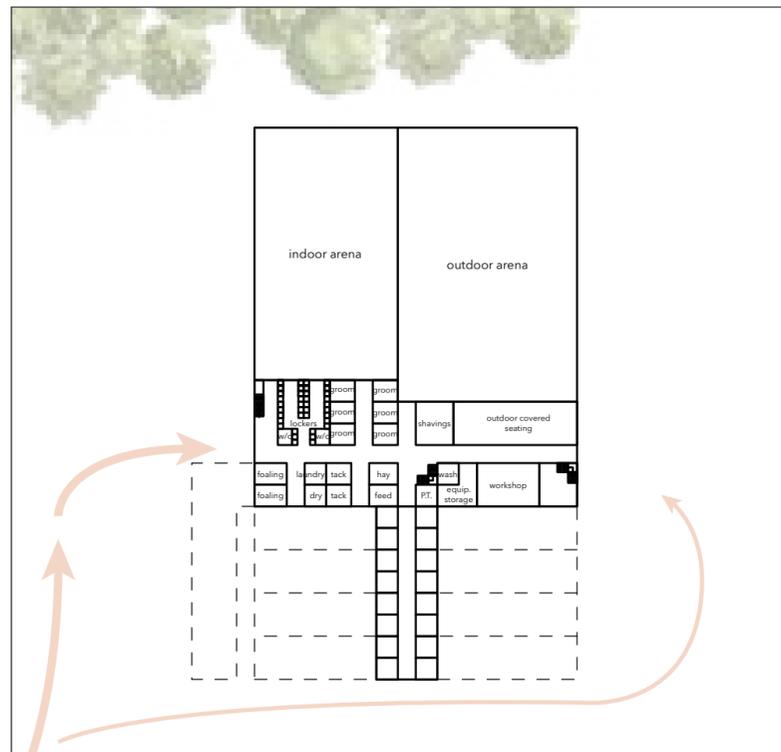
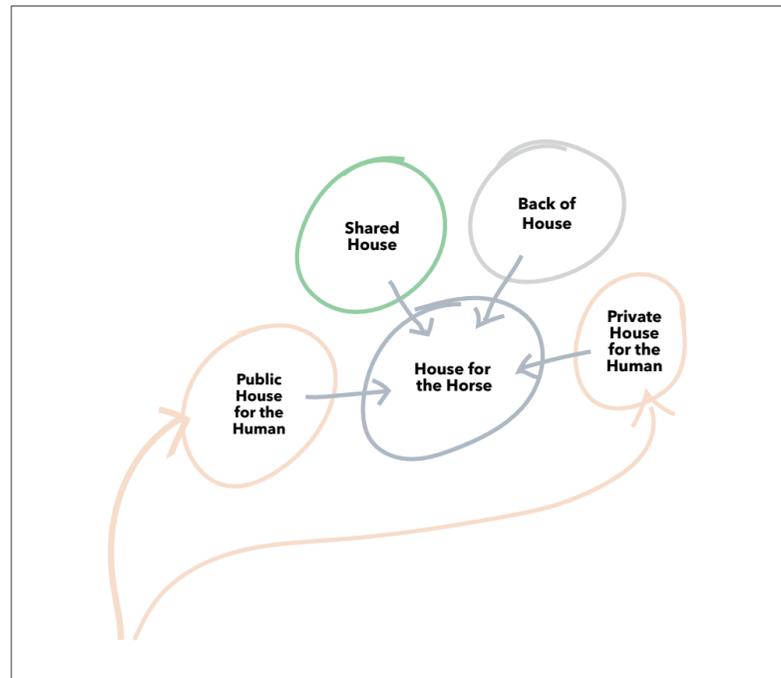
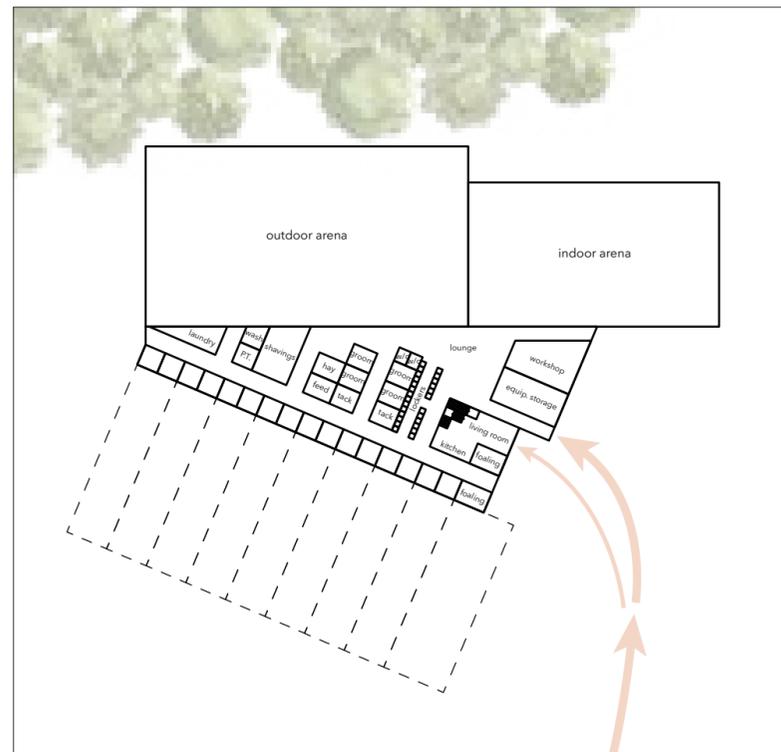
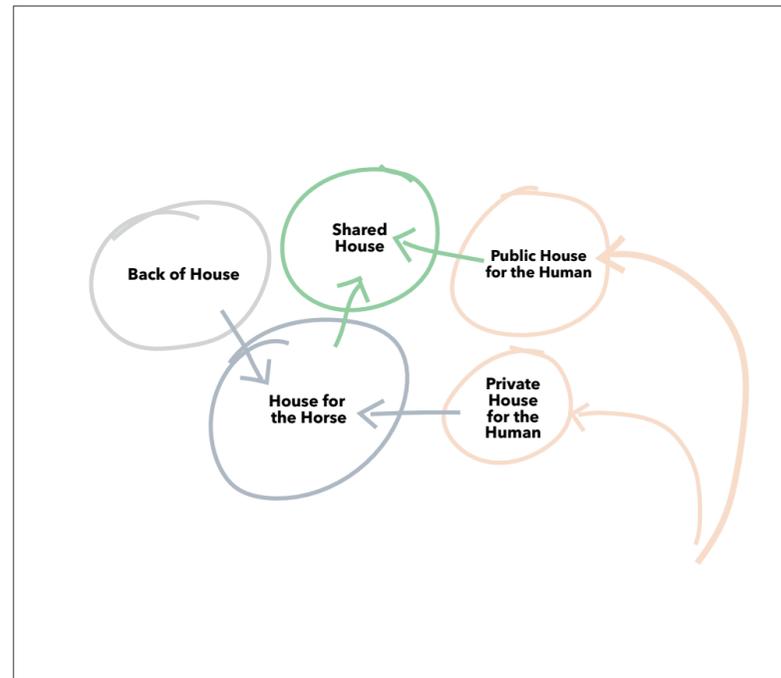


Figure 5.4: Design Process.

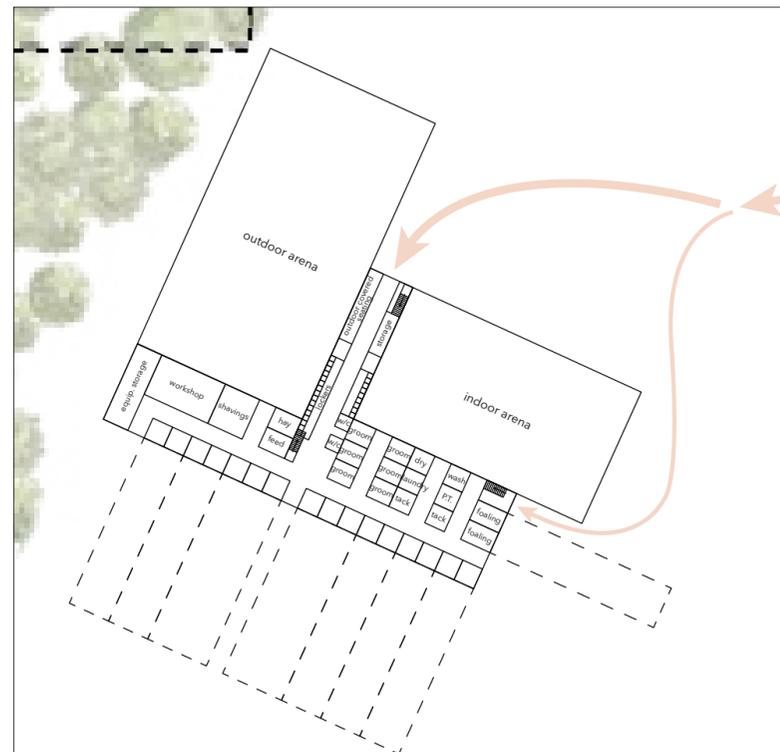
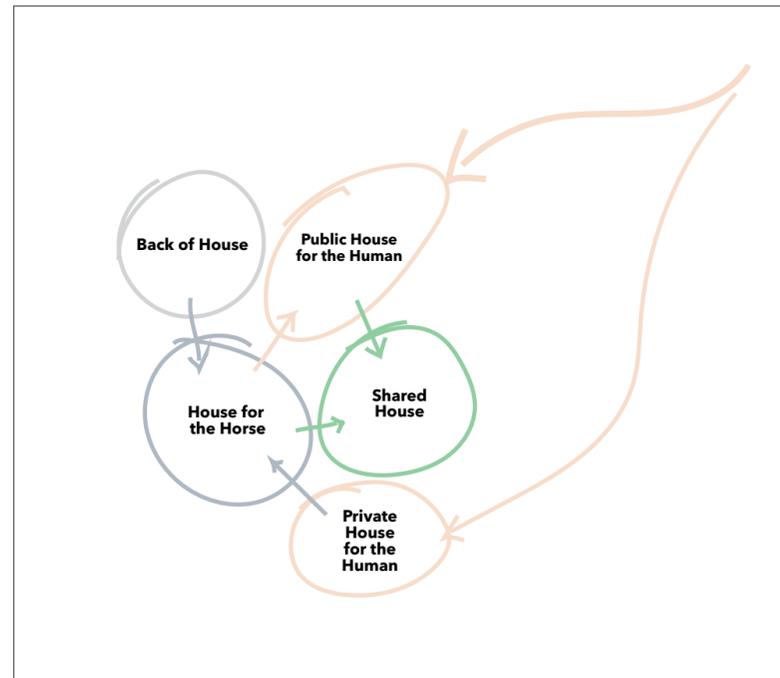
Iteration 1 1:1000



Iteration 2 1:1000



Iteration 3 1:1000



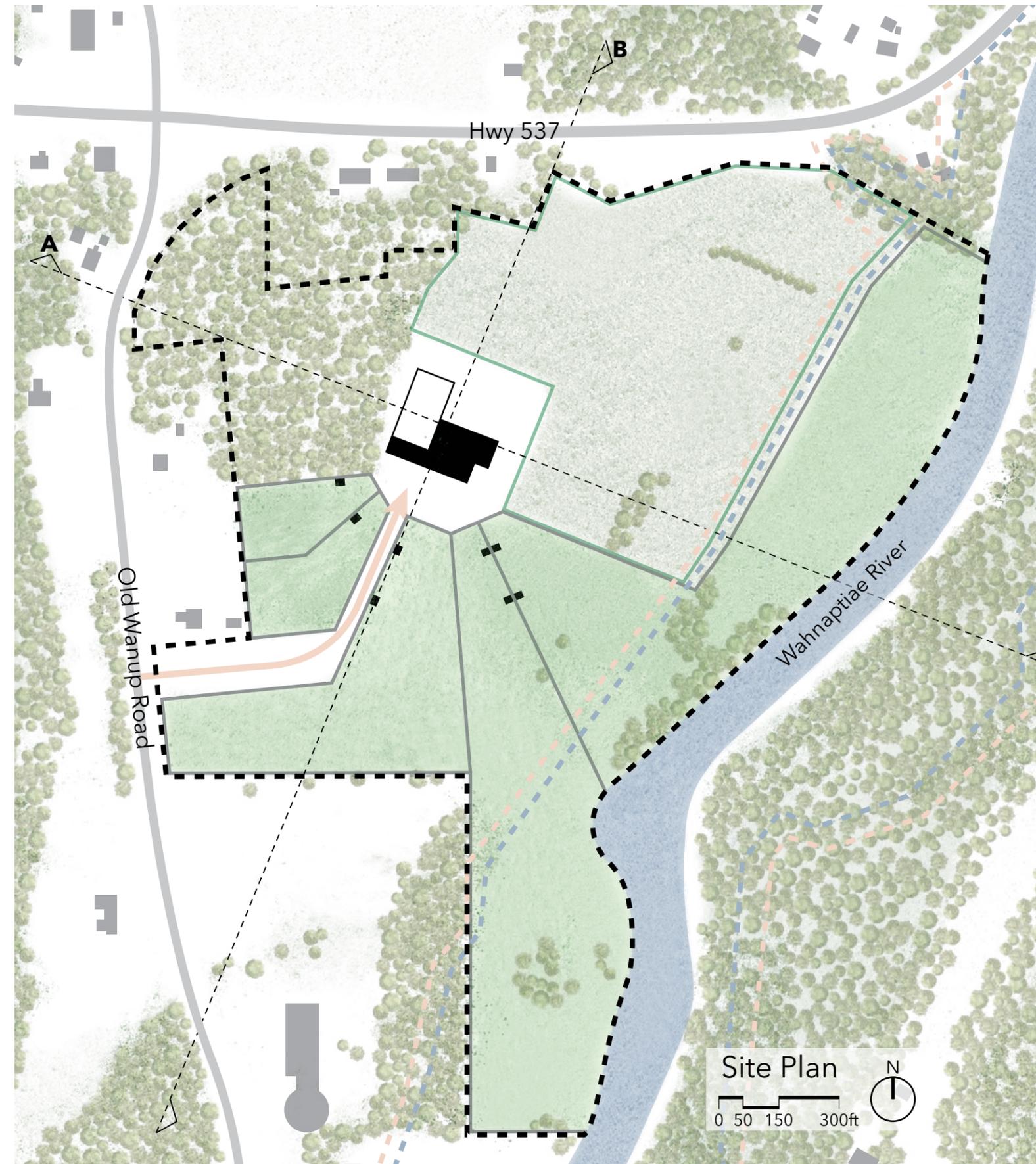
Site Plan

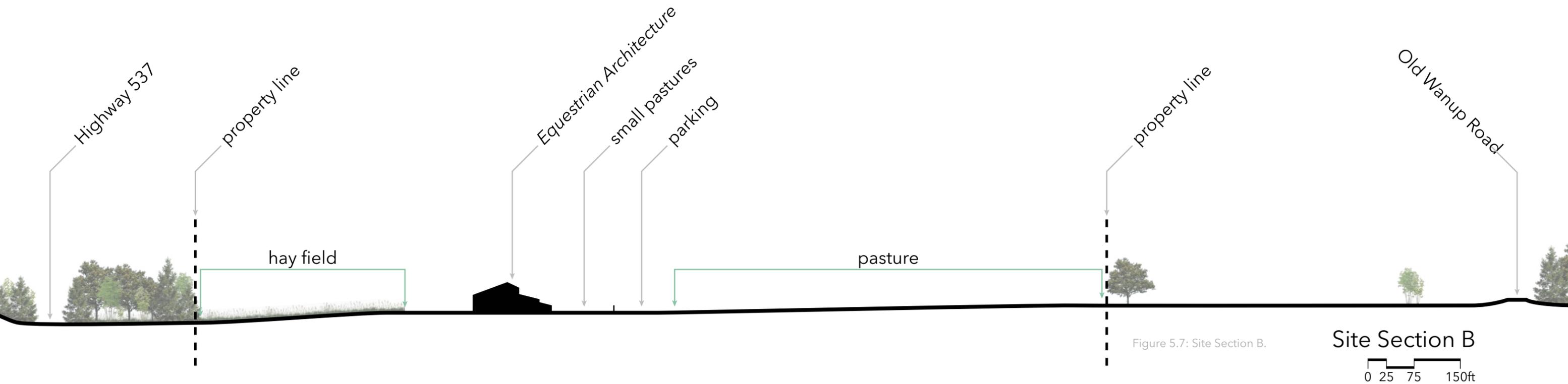
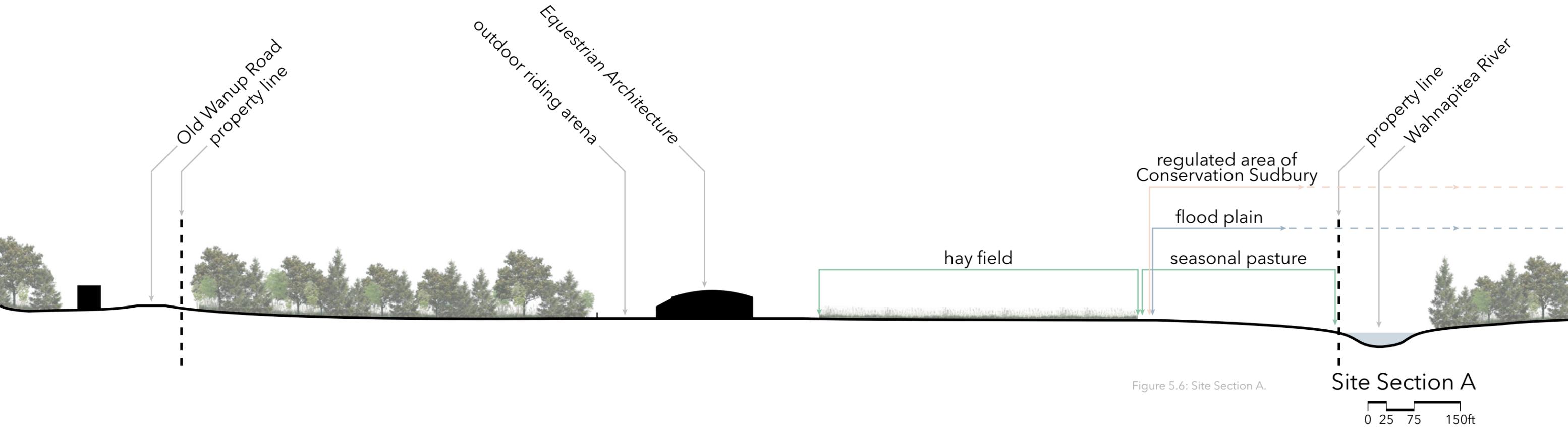
This project utilizes the site of Dorland Performance Horses in Wanup, ON. The building is positioned on the site based on wind and sun orientation. The building complex is nestled along the edge of the tall forest to help block the winter prevailing winds from the northwest. The long access of the building runs along the south-southwest axis for maximum sun exposure to take advantage of natural daylighting and passive heating. The northeast part of the site is used for growing hay for the horses on the property. The southern half of the site is used for a variety of turnout pastures for the horses. Parts of these pasture are located within the flood plain, but they will be able to be used later in the summer when the ground has dried up and the grass is thriving on that lower part of the site. Located within these pastures are three-sided shelters, approximately 16x20ft, that provided the horses with shelter from the wind, weather or sun when it is needed.

Site Plan Legend

- property line
- - - flood plain
- fence line
- hay field
- - - regulated area of Conservation Sudbury
- path of entry
- surrounding houses
- new buildings
- turnout pastures
- outdoor riding arena

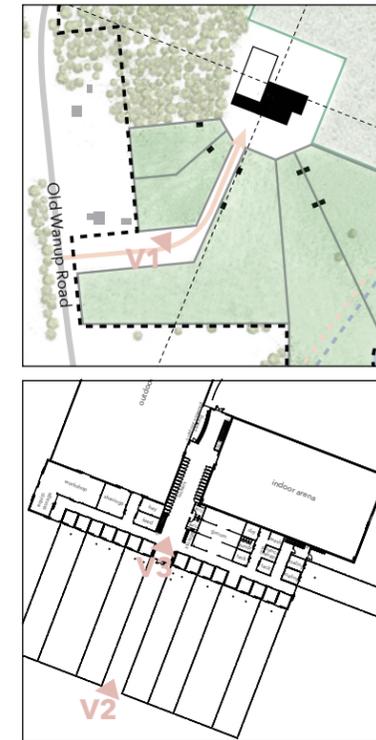
Figure 5.5: Site Plan.







V1 Figure 5.8: View coming up the driveway.



Key Plans

Arrival

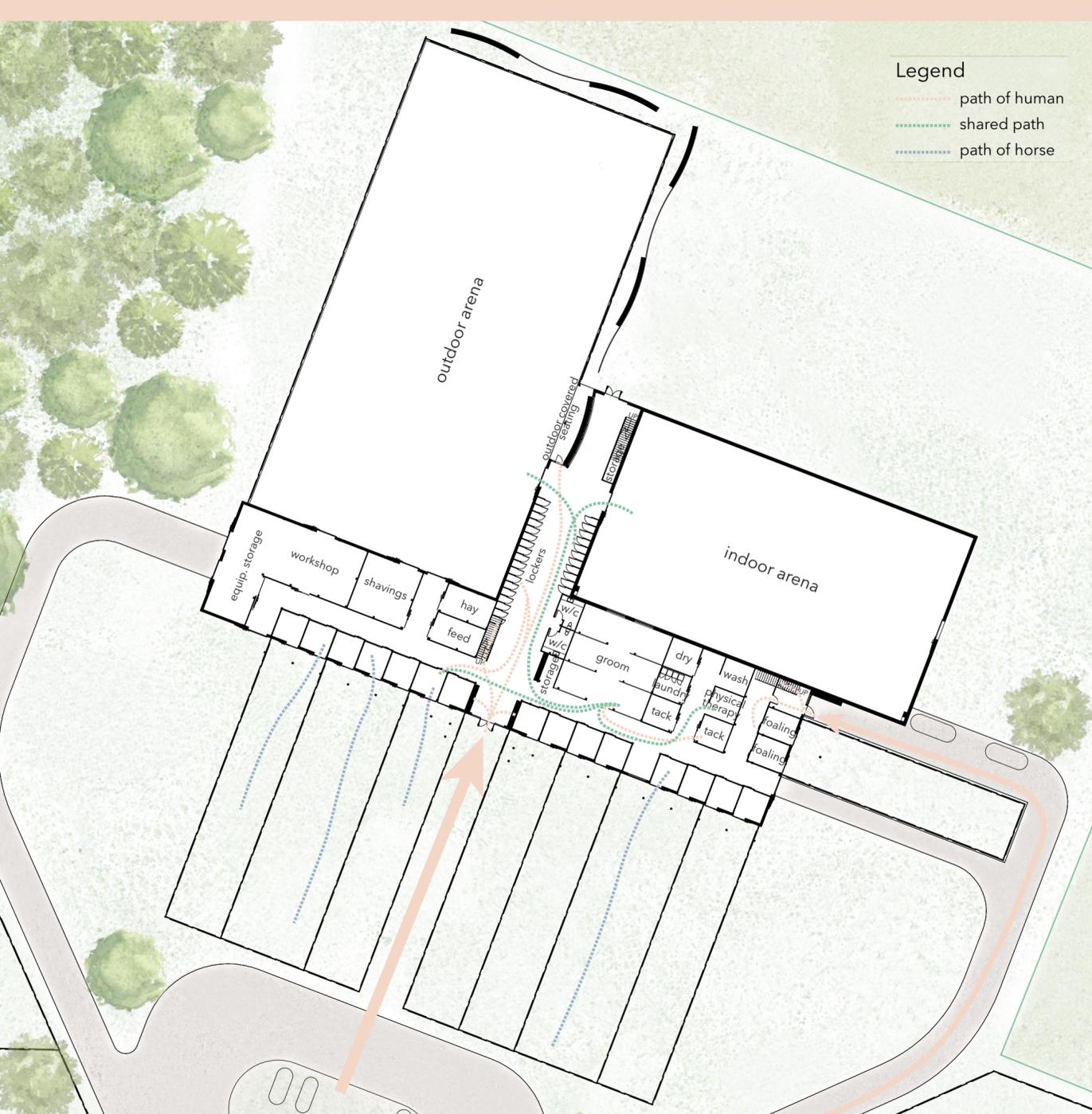
When arriving at the site from Old Wanup Road the person enters through the house for the horse. They drive up through the middle of the large pastures and park in front of the smaller pastures. This begins to prepare the user for this facility that is centered around creating an inviting home for the horse. It also provides a sense of safety with many people passing by the horses all the time and having many eyes on them. After parking the car, the user will be guided by the pathways to the entrance of the building. They will experience the living conditions of the horse on either side of them as they enter. Once the human enters the building, they immediately get a sense of direction within the facility. On either side of them there are stalls for the horses, they can see the staircase and a hint of the lounge feel upstairs, they can see an open area for grooming just off to the right, the lockers down the center hallway, and viewing areas at the far end of the center hallway. This sense of direction provides for a better experience for the user.



V2 Figure 5.9: View walking up to the entrance.



Figure 5.10: View in the entrance looking down the main corridor. **V3**



Movement

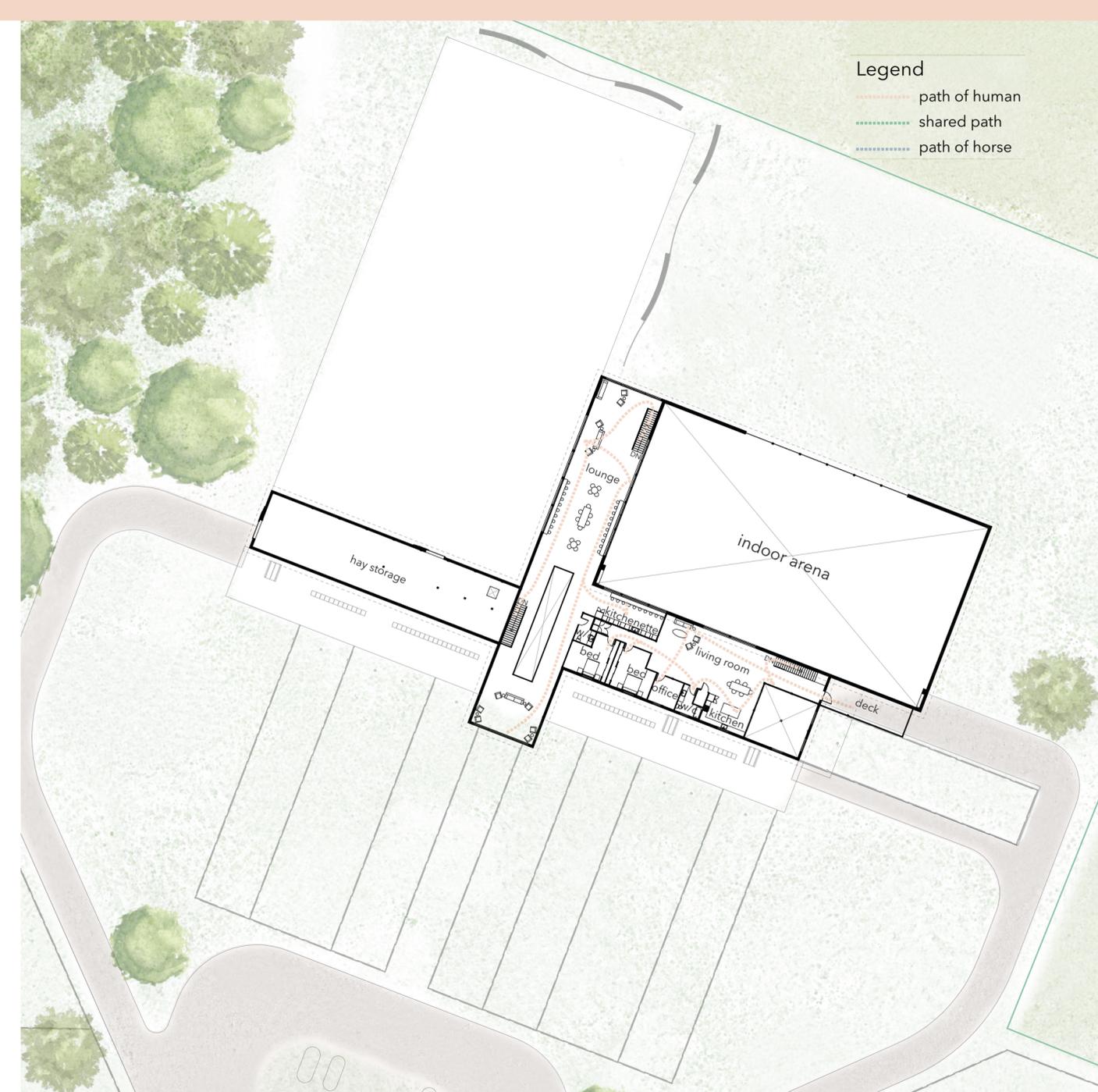
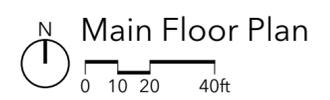
The movement of the human, the horse, and the interaction between the two were tracked through many precedents (see Appendix A). This began to show the general flow of movements through the spaces with adjacencies that worked well together, and which adjacencies broke up the flow of movement through the facility. *Equestrian Architecture* puts the horse at the forefront of the project.

The path of the horse by itself occurs only in private relaxation areas for the animal. The horse is able to freely go in and out of the stall into a small pasture that is shared with one or two other horses.

The path of someone from the public coming for a riding lesson or the boarder coming to ride can be tracked starting at the main entrance. If they are there as a spectator, they can go upstairs to the lounge, observe the event happening in the indoor or the outdoor arena, grab a coffee in the kitchenette and grab a seat. The boarder can walk in the front door and head to the lockers where they can get the supplies they need, then they can go to the horse's stall.

The stall is where the shared path begins when the human leads the horse over to the grooming stall where they

Figure 5.11: Paths of movement through the main floor.

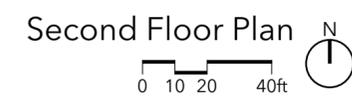


can bond and the human can care for the horse. From the grooming stall the human will go over to the tack room to grab the tack and bring it back to the grooming stall. Once the horse and rider are prepared, the team can go over to either the indoor or outdoor arena.

A good layout in a barn can reduce the labour and maximize efficiency for the workers, limiting wasted time and energy.¹ Water, feed, hay, and bedding must have close access to the stalls. Feed and bedding rooms should have direct exterior access for easy delivery of supplies. Hallways that allow tractors or ATVs into the barn can greatly speed up the daily cleaning of the stalls. Tack rooms should be adjacent to grooming stalls for quick access to equipment. A good layout also keeps horses and humans safe in the event of any emergencies such as fire.² Hallways and doorways must be wide enough and there must not be any dead-end corridors.

¹ Liz Newman, "Innovations in Barn Design - Building for Health and Happiness."
² Ibid.

Figure 5.12: Paths of movement through the second floor.



House for the Horse

The house for the horse has been designed to allow the horse to have more freedom in choosing where it feels most comfortable, instead of the human deciding when the horse goes outside and when they come inside. The living conditions for the horse include, a stall, a covered area outside the stall, and a pasture. There are also larger fields where the horse can be turned out seasonally or depending on the weather conditions and what the horse is comfortable with. Each horse has an individual stall inside the barn to ensure the horse gets regular feedings and has full shelter in bad weather. There is a door at the back of each of these stalls that opens up to a small pasture connected to two or three other stalls. These doors can be opened up and left open for the horse to freely come in and out as desired and socialize with the other horses in small, controlled groups or pairs.

Figure 5.13: House for the Horse main floor plan.



Figure 5.14: View looking out from inside a stall. **V1**



Figure 5.15: View looking at the barn from a pasture. **V2**

Private House for the Human

The Private House is placed above the grooming areas, giving a clear view of the indoor area as well as the pastures. This provides an element of safety for the horses and riders on the property since the residents will be able to keep a close eye on the place at all times.

Similar to that of the House for the Horse, there is a porch-like condition off of the human residence as well. This gives the residence a view of the pastures and a view out to the river. The living condition of the horse and human are treated equally.

Figure 5.16: Private House for the Human second floor plan.

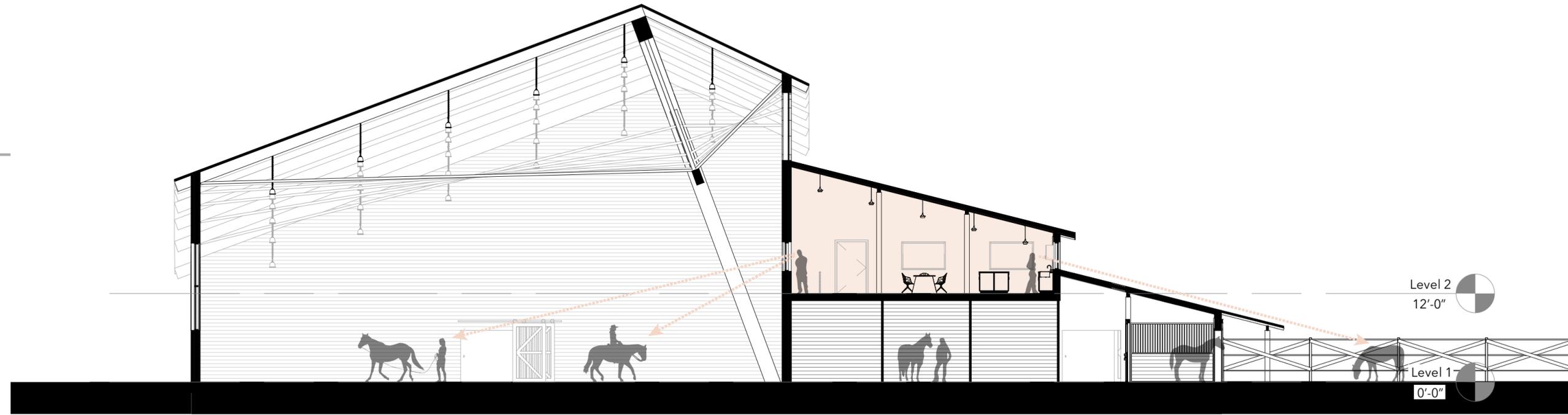
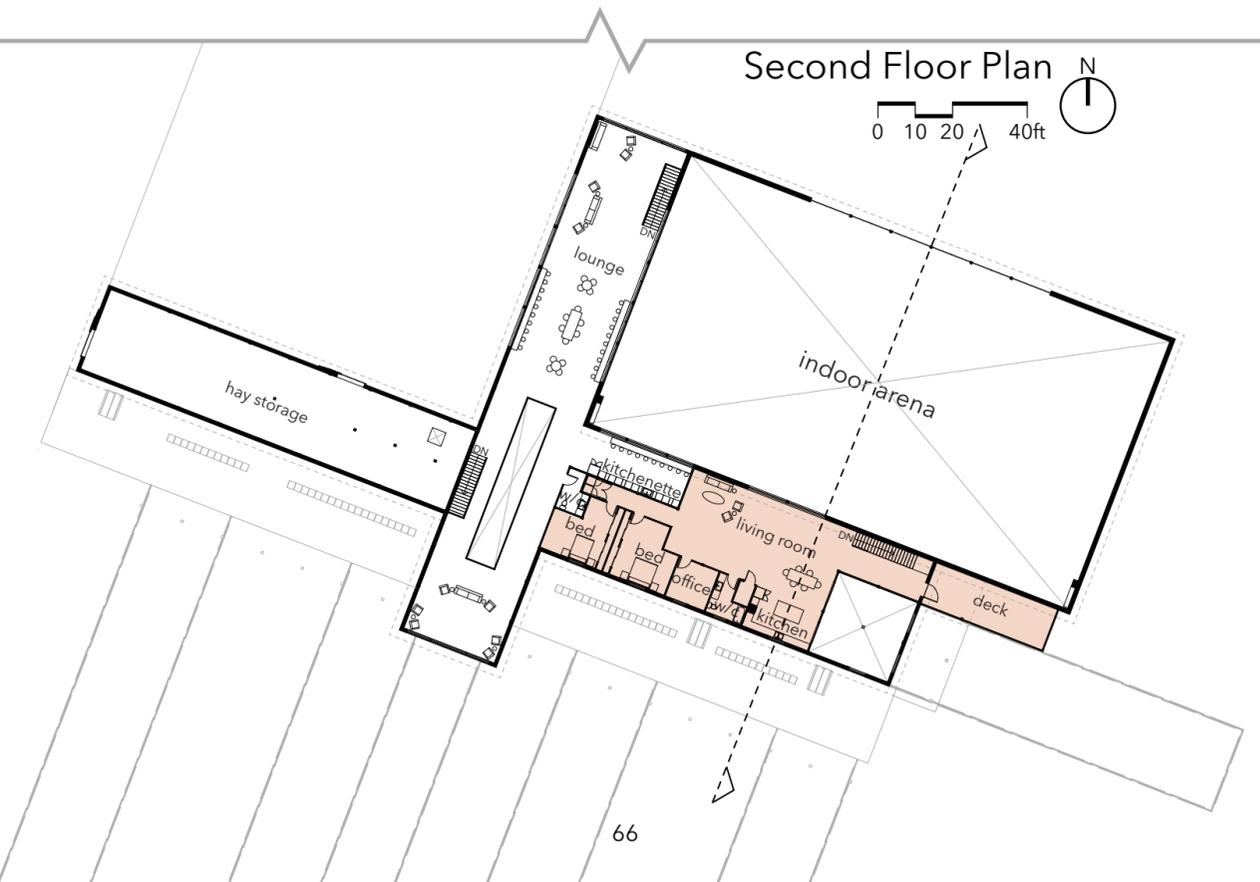


Figure 5.17: Section showing the Private House above the barn.



Figure 5.18: View in the entrance looking down the main corridor. **V1**

Public House for the Human Main Floor

The Public House for the Human inhabits the center axis running through the middle of the complex. On the main level is the public entrance where the visitor can orient themselves, small seating areas, lockers, tack rooms, two washrooms, and a covered outdoor viewing area for the outdoor arena. A series of benches provide for areas to rest at the main entrance, whether they are used to sit down and wait for someone to finish taking care of the horse, take a break, or to socialize. A small seating area in the midst of the row of stalls provides a more private social space for boarders. Two tack rooms are located adjacent to the grooming area for easy access to tack like saddles and bridles. Lockers are located in the main hallway for storage of other supplies aside from tack, such as blankets, brushes, first aid supplies, etc.

Figure 5.20: Public House for the Human main floor plan.

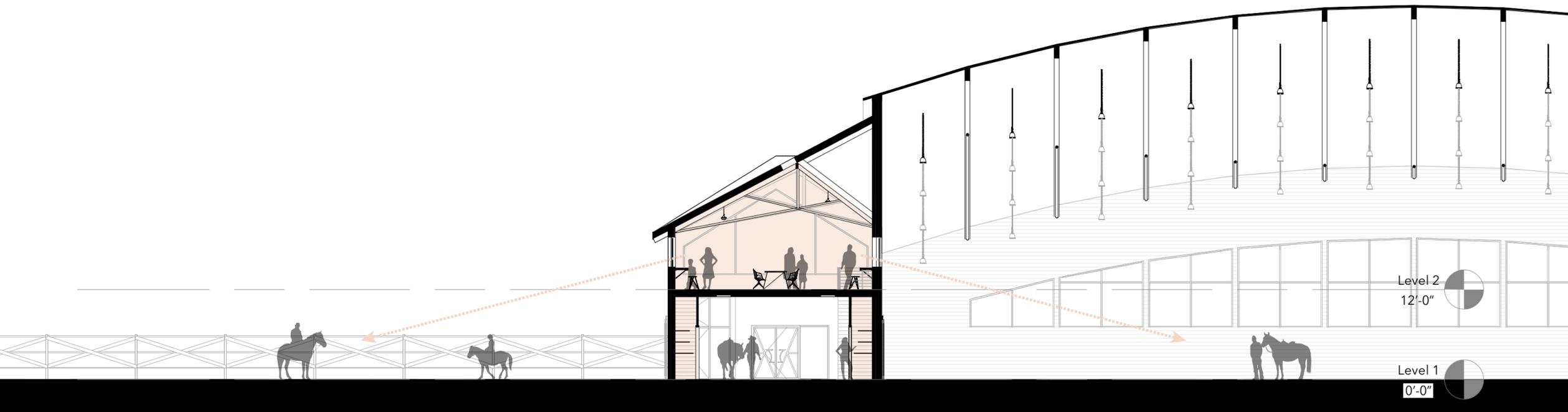
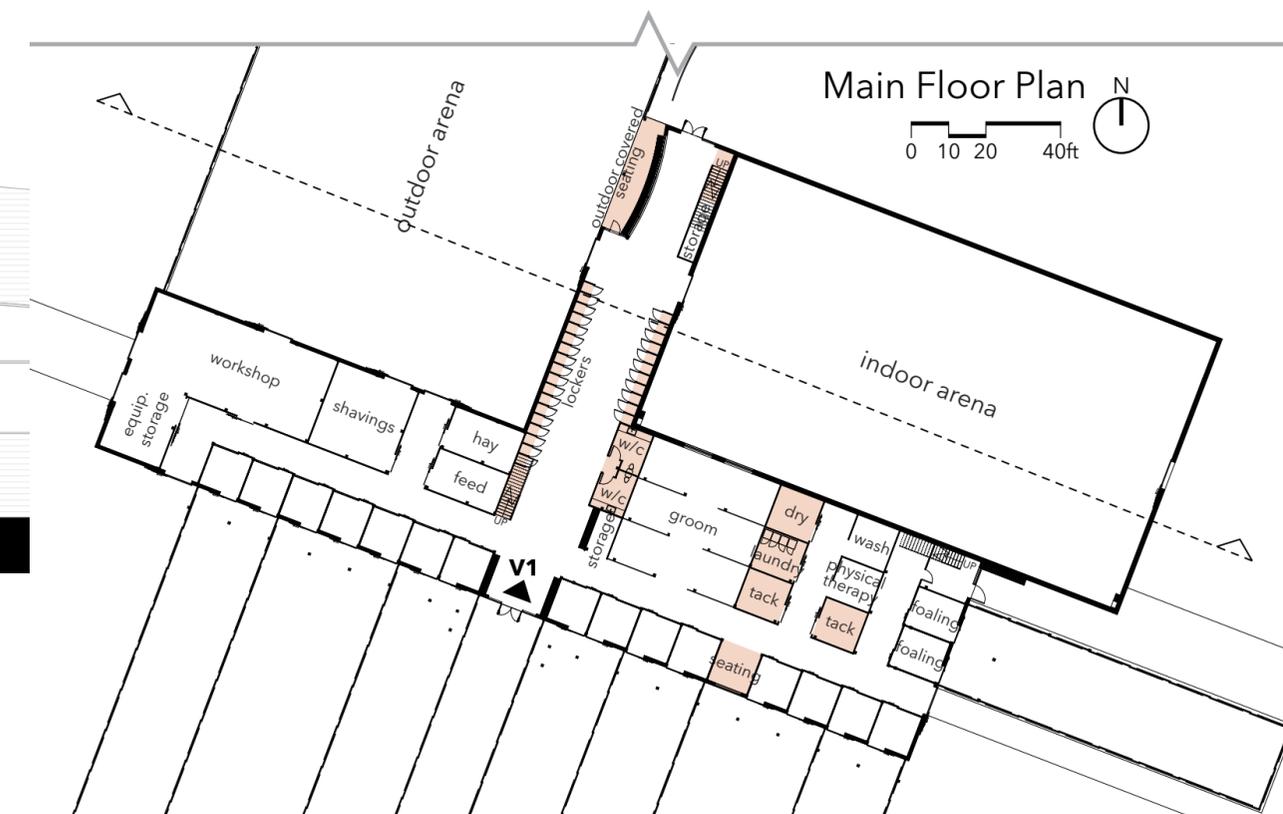


Figure 5.19: Section showing the Public House above the main corridor.

Public House Section

0 5 10 20ft



Public House for the Human Second Floor

On the second level of the Public House is the main lounge space and kitchenette. Having the lounge between the indoor and outdoor riding arenas provides a great opportunity for viewing the riding arenas from a higher perspective. This also gives parents a quiet and secluded space to bring younger children while the older siblings attend a riding lesson to ensure the horse does not get spooked or distracted. This lounge space also makes it easier to host events such as summer riding camps since it gives the children a space to do art and crafts when the horses need a break, and it provides an eating area. The kitchenette is an asset to the facility, especially for instructors, farm hands, or other people staying at the facility all day. There is also another lounge area on the southern side for a view out to the pastures.

Figure 5.21: Public House for the Human second floor plan.



Figure 5.22: View of the lounge space and kitchenette. **V1**

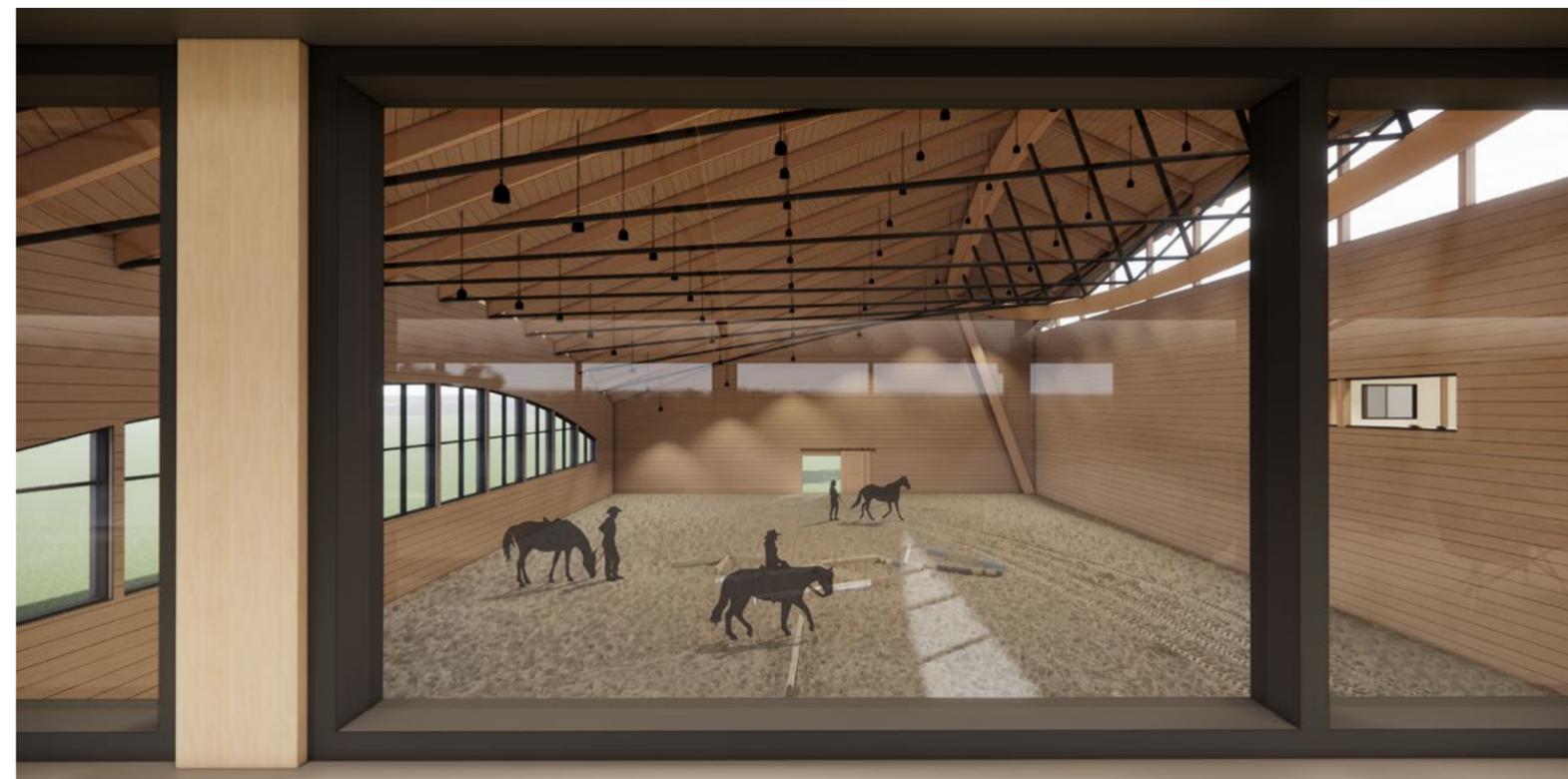
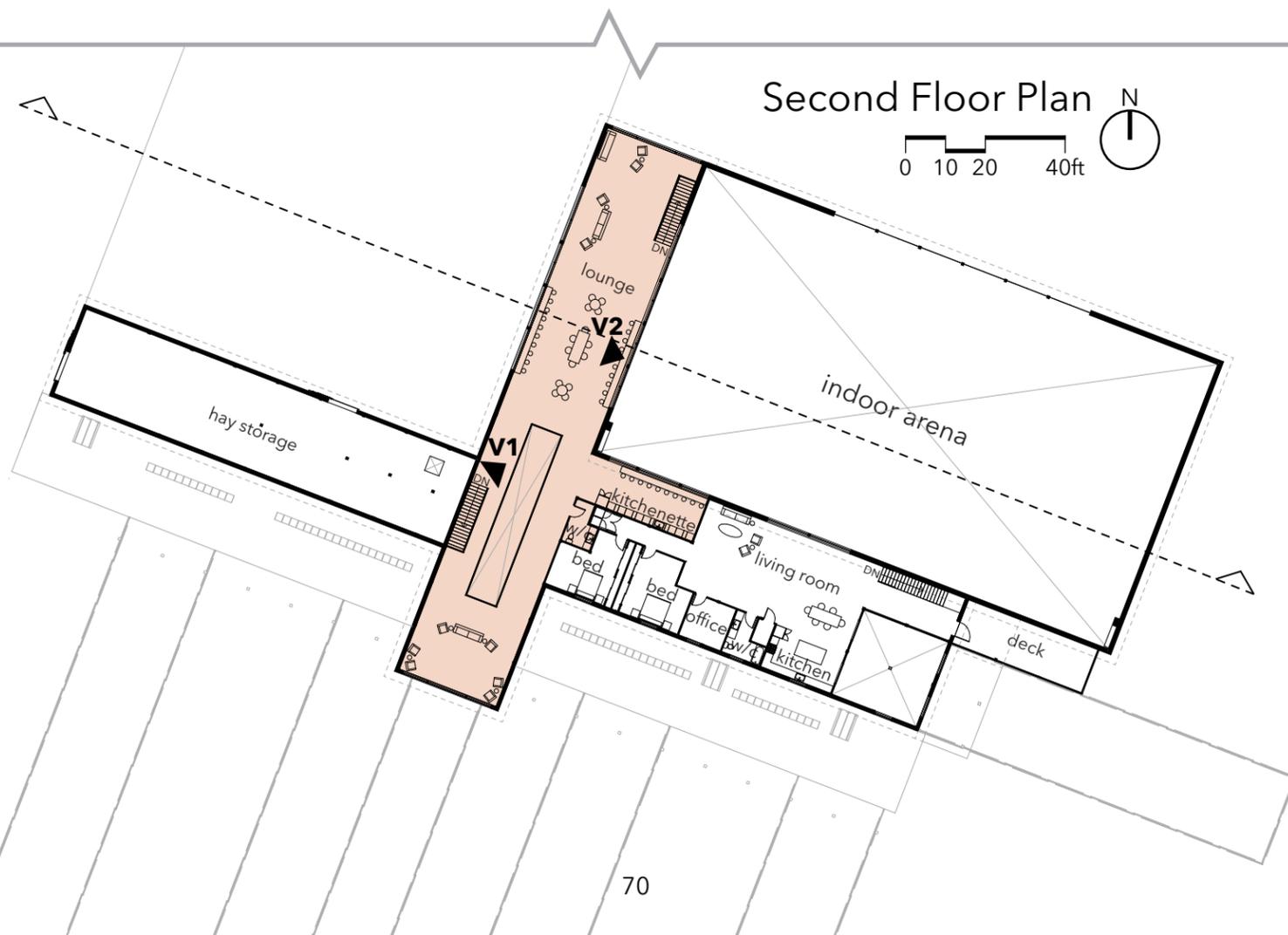


Figure 5.23: View down into the arena from the second floor lounge. **V2**



V1 Figure 5.24: View into the grooming area.



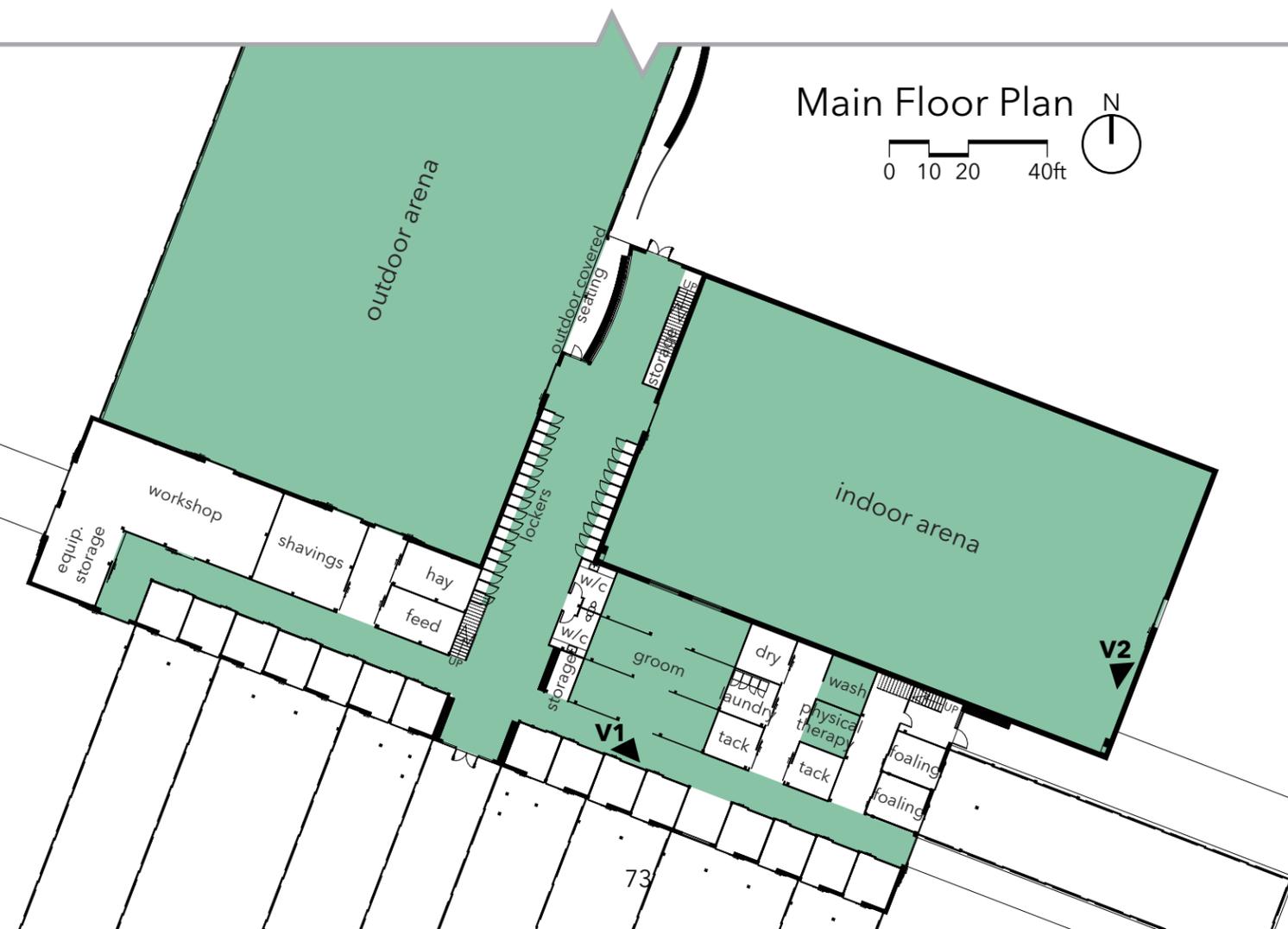
V2 Figure 5.25: View of the indoor riding arena.

Shared House

In Equestrian Architecture horses and humans have a designated grooming area that does not interrupt the regular flow of traffic through the hallways. This quiet, comfortable space is where people can take the time to care for and groom the horse. There is also a designated physical therapy stall where there can be equipment to help maintain the horse's physical health. Next to it is a wash stall with warm water to give the horse a bath in a private space where they won't be distracted.

Another major component to the Shared House is the riding arenas, one indoor and one outdoor. These two areas have a direct connection to the barn for convenience. The indoor arena is also connected to the barn in case of bad weather, the human and horse can enjoy their ride without ever having to brave the elements.

Figure 5.26: Shared House main floor plan.



Shared House Landscaping

The architecture extends beyond the building into the landscape with benches, fences, and small shelters in the pastures. The curves of the structural systems extend through the benches creating additional seating around the outdoor arena. The ideas of rhythm within the structure of the building are continued through the fence design as an extension into the landscape.

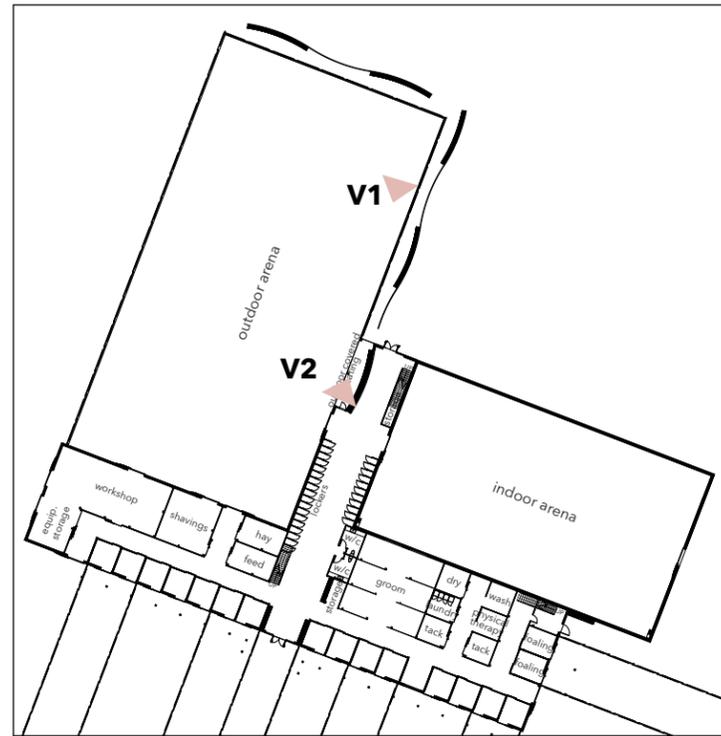


Figure 5.27: Main floor plan. **Key Plan**



Figure 5.29: View of the outdoor riding arena. **V1**



Figure 5.28: Bird's eye view of the landscaping. **Landscaping**

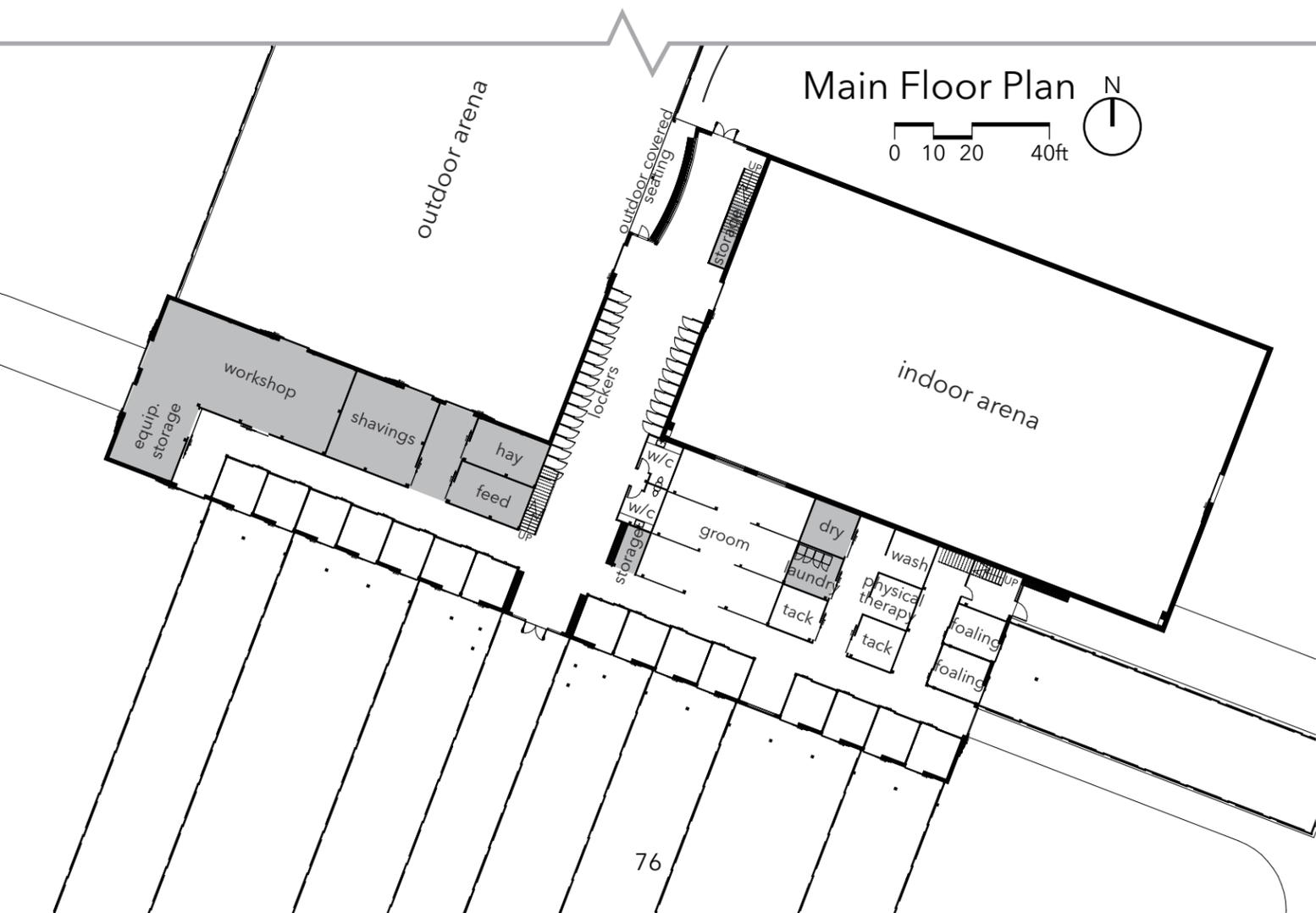


Figure 5.30: View of the outdoor riding arena. **V2**

Back of House

The Back of House consists of all of the supporting programs for the facility. This includes many things such as a laundry room and an equipment drying stall. Small storage spaces are also located around the facility such as one adjacent to the grooming area for brooms, shovels and muck buckets, and one adjacent to the indoor arena for storing trail equipment such as poles, a gate and a bridge. Larger equipment storage and workshop are located on the other edge of the facility for access with equipment such as four-wheelers and tractors.

Figure 5.31: Back of House main floor plan.



Pull through access is provided from the equipment storage to the barn hallway so a four-wheeler and trailer can have easy access for cleaning stalls. A hay room, feed room, and shavings room are located with fairly close access to all the stalls for better convenience of feeding and cleaning stalls. A large hay loft is located on the second floor for the storage of the hay that is harvested from the field at the end of each growing season. A small opening allows hay to be thrown down into the small hay room on the main floor as it is needed.

Figure 5.32: Back of House second floor plan.

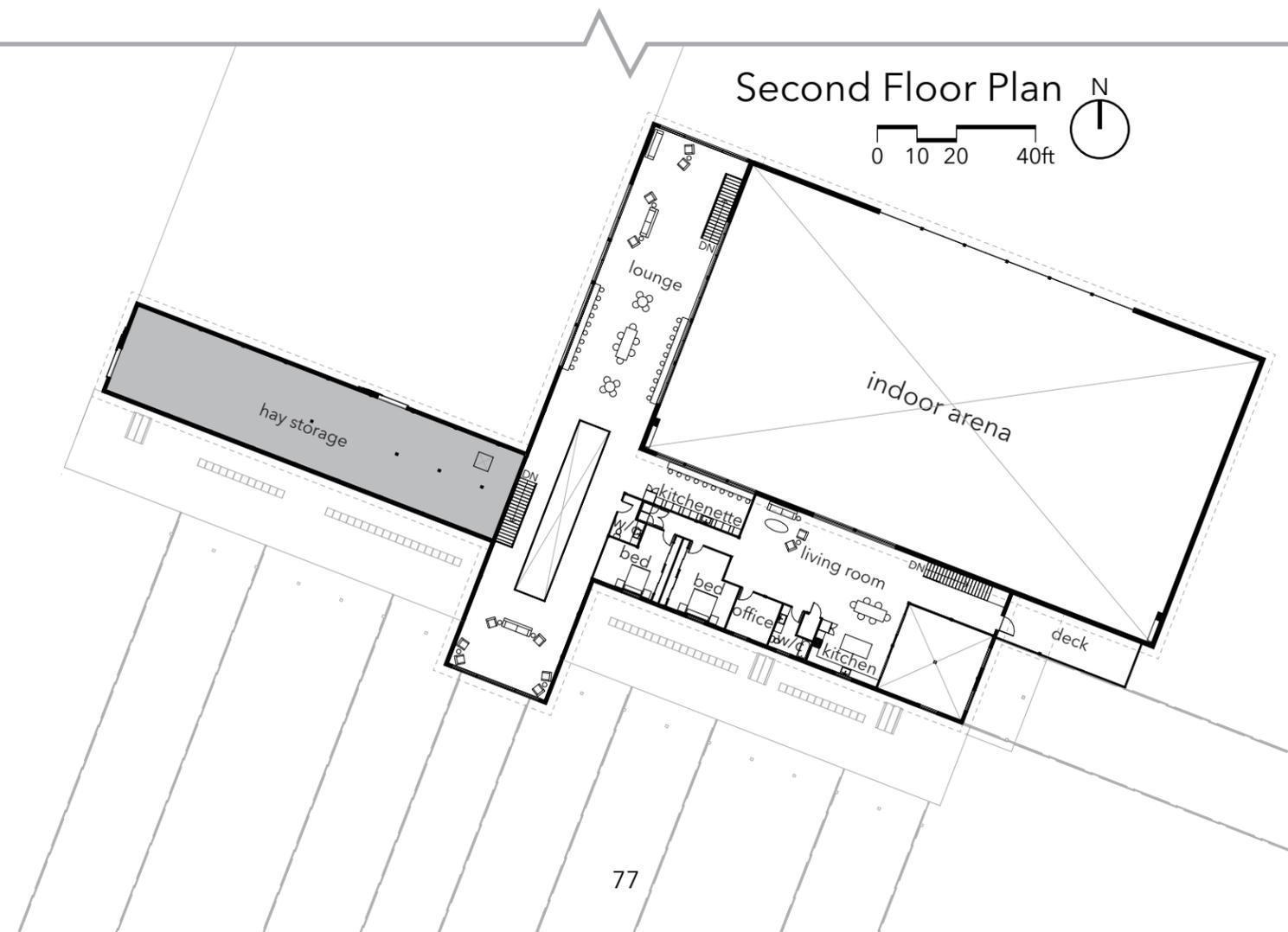




Figure 6.1: View in second floor lounge.

MATERIALITY / STRUCTURE

Materiality

The sensuous experience, with emphasis on touch, within an equestrian facility is very important for the wellness of the horse and human. The main way humans communicate with horses is through touch and body language. This level of intimate care and connection between human and animal needs to be translated into the built environment which is inhabited in order for the human and animal to achieve the highest level of comfort, with influence from architects Juhani Pallasmaa and Peter Zumthor.

Pallasmaa believes that architecture strengthens one's sense of being in the world and this is experienced through the senses.¹ He states, "architecture reflects, materializes and eternalizes ideas and images of ideal life."² Pallasmaa believes that all of the senses are extensions of the tactile sense, everything one feels is linked back to the feeling of touch.³ In order to connect to a built environment, one must feel this materiality and feel the essence of the building. Materiality is experienced at all scales from the structure of the building down to the fixtures within it.

Zumthor believes in revealing the true essence of a material through building. The architect must create a meaningful and poetic situation for these materials. Zumthor strives to design buildings that are worthy of the knowledge of the art of joinery and the craftsman, and that displays a sense of care in its construction. Zumthor begins with the physical materials and the sensuous experience the material creates. He wants the user to feel the care of craft and connections of the materials.⁴

This thesis will combine Pallasmaa and Zumthor's theories on materiality to create a meaningful equestrian facility. The importance of the materials, the sense of touch, and the care of craft will be main focuses of the architecture. Since the connection between the horse and human is so intimate, using soft and gentle touch, the architecture will reflect this through the materiality and building tectonics.

¹ Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (England: John Wiley & Sons Ltd., 2005), 41.

² *Ibid*, 71.

³ *Ibid*, 10.

⁴ Peter Zumthor, *Thinking Architecture* (Lars Muller Publishers, 1998), 12.

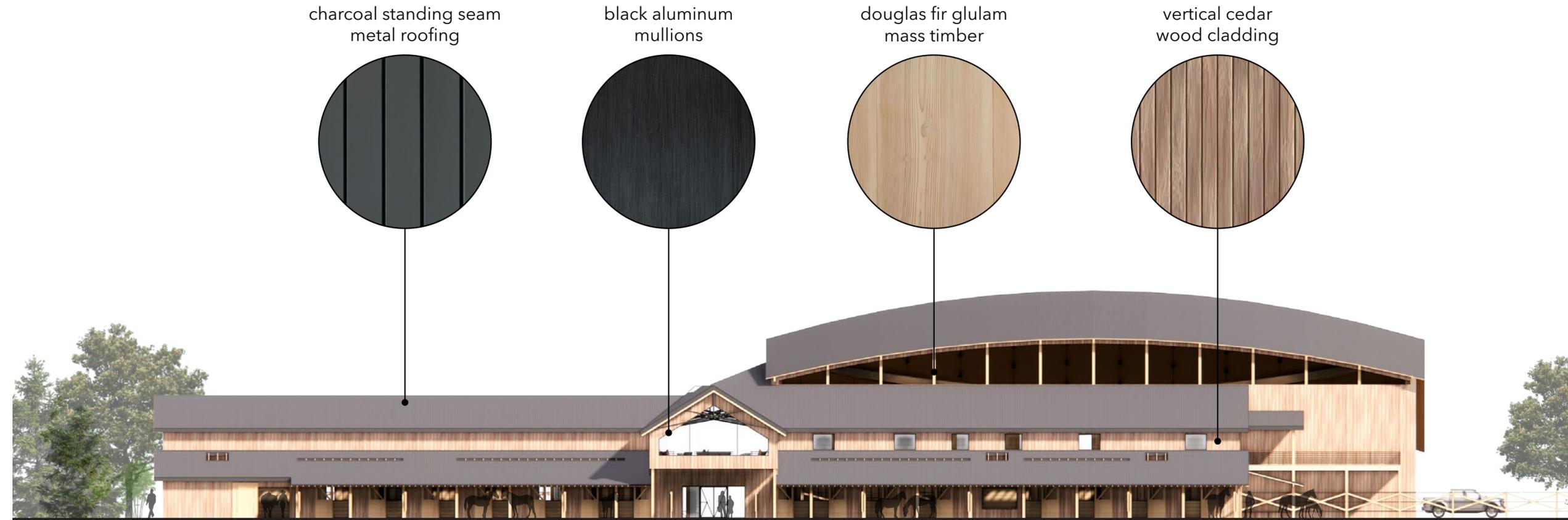


Figure 6.2: South elevation showing materiality

South Elevation



Craft

The level of care and connection between the horse and the animal will be translated into the craft of the building. A craftsman is one who is engaged in the work and is “dedicated to good work for its own sake.”¹ The skills of a craftsman are developed to a high degree overtime, which starts right from childhood, and is achieved through engagement rather than passive learning. Every good craftsman has a drive and desire for the highest quality.² If they are not interested and curious about the materials, the work will not have that sense of care

1 Richard Sennett, *The Craftsman* (New Haven & London: Yale University Press, 2008), 20.

2 *Ibid*, 97.

Figure 6.3: Careful hand crafting of joinery in barn structures. Photograph from Elric Endersby, Alexander Greenwood, and David Larkin. *Barn: The Art of a Working Building*. New York: Houghton Mifflin Company, 1992, 17.



and quality. Craft takes time, it is a slow process and cannot be rushed.³ The hand is trained to have technique and expression, which means “the hand is the window on to the mind.”⁴ Hands control thoughts through gripping and the sense of touch.⁵ During the 19th century, the craftsman started to be replaced by machinery, however, a machine will never be able to produce the care of hand craft. There is value in the variations and irregularities of hand work.⁶

Figure 6.4: Careful adjustments of joinery for a perfect fit. Photograph from Elric Endersby, Alexander Greenwood, and David Larkin. *Barn: The Art of a Working Building*. New York: Houghton Mifflin Company, 1992, 158.

3 *Ibid*, 295.

4 *Ibid*, 149.

5 *Ibid*.

6 *Ibid*, 84.



Structural Biomimicry

The material, size, shape and form of a beam can vary. It could be made of one large solid piece of wood or steel, or it can be a truss system made up of smaller members. This variety of structure is seen in the body of animals as well; the 'beams' are many different sizes, forms and orientations. The 'beam' or spine of humans is vertical with the weight bearing on two 'posts' or legs. The structure of the horse is in more of a horizontal nature; the 'beam' or spine runs horizontally.¹ The rib-cage of the animal is attached to the spine and "can be considered as a sort of simply supported beam."² The ribs are the compression members and the muscular tissue running $\pm 45^\circ$ to the ribs are the tension members.³ No matter the orientation of the beam, the 'posts' or legs still need to carry all of the load and must be perpendicular to the beam to avoid putting any longitudinal force on the beam.⁴ With the horse having four 'posts', it is generally more efficient at carrying load than an animal with only two 'posts'. The ankles of the horse must be very strong to handle all of the load.

1 J. E. Gordon, *Structures: Or Why Things Don't Fall Down* (London, England: The Penguin Group, 1978), 229.

2 Ibid, 240.

3 Ibid.

4 Ibid, 229.

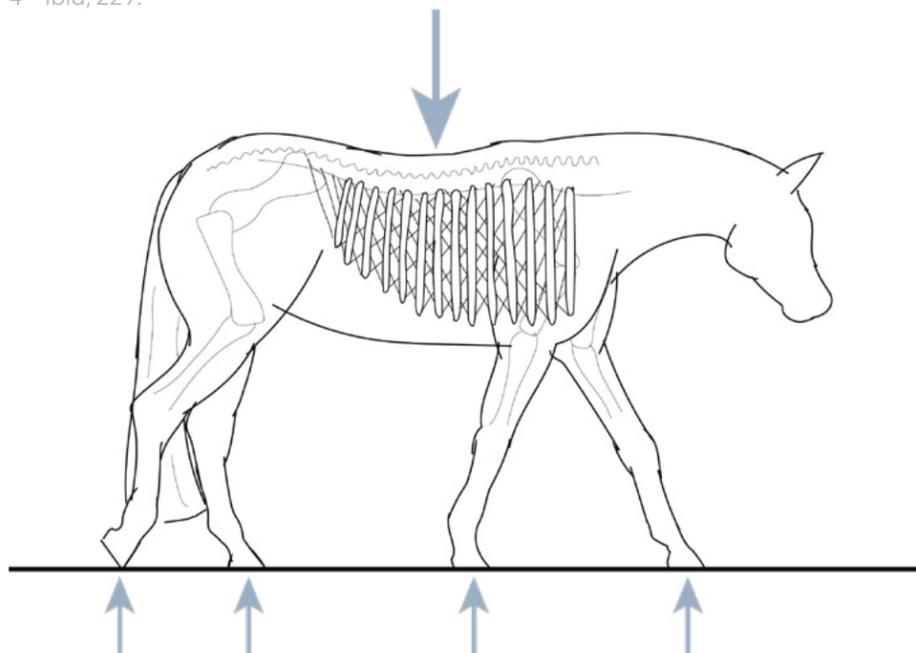
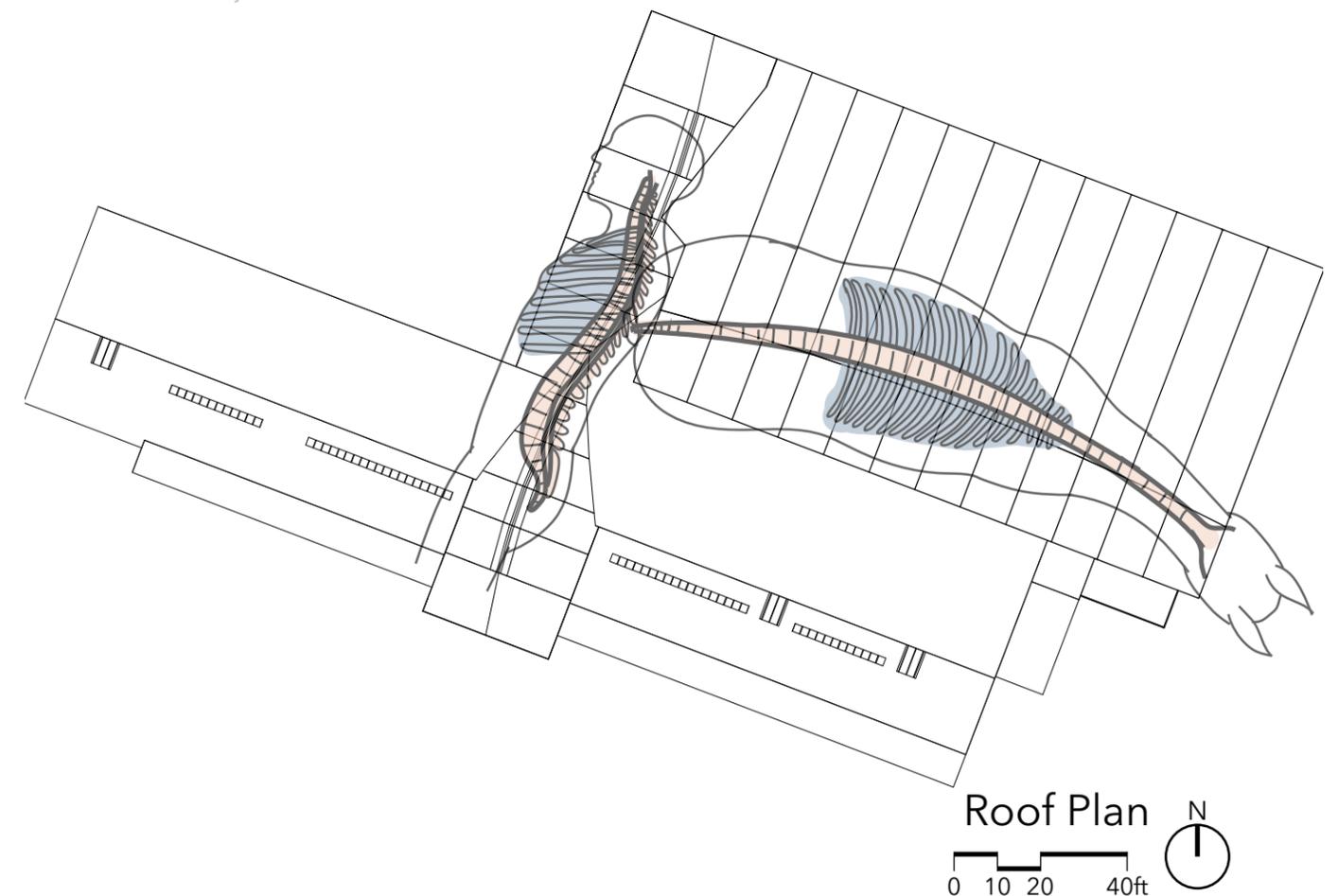


Figure 6.5: Structure of the horse.

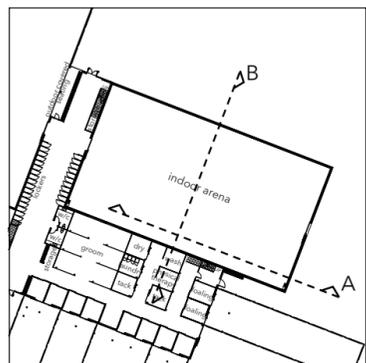
The structural systems in *Equestrian Architecture* are divided into three systems; the indoor arena, the central corridor, and the residential and remainder of the program. The indoor area and the central hall for the humans will be the two areas that house the most movement. These parts of the building structure will take influence for the structure of the horse and human, and have dynamic qualities. The arena structure will curve like that of the spine of the horse when it is being ridden in circles. The structure will also enhance the rhythm of the horse traveling in the arena. The central hall structure will follow the curvature of the human spine and encourage movement through the space. The intersection of these two spines coming together provides the perfect location where the horse and human come together and begin the bonding experience; in the grooming area.

Figure 6.6: Relationship of structural systems.



Structure Indoor Arena

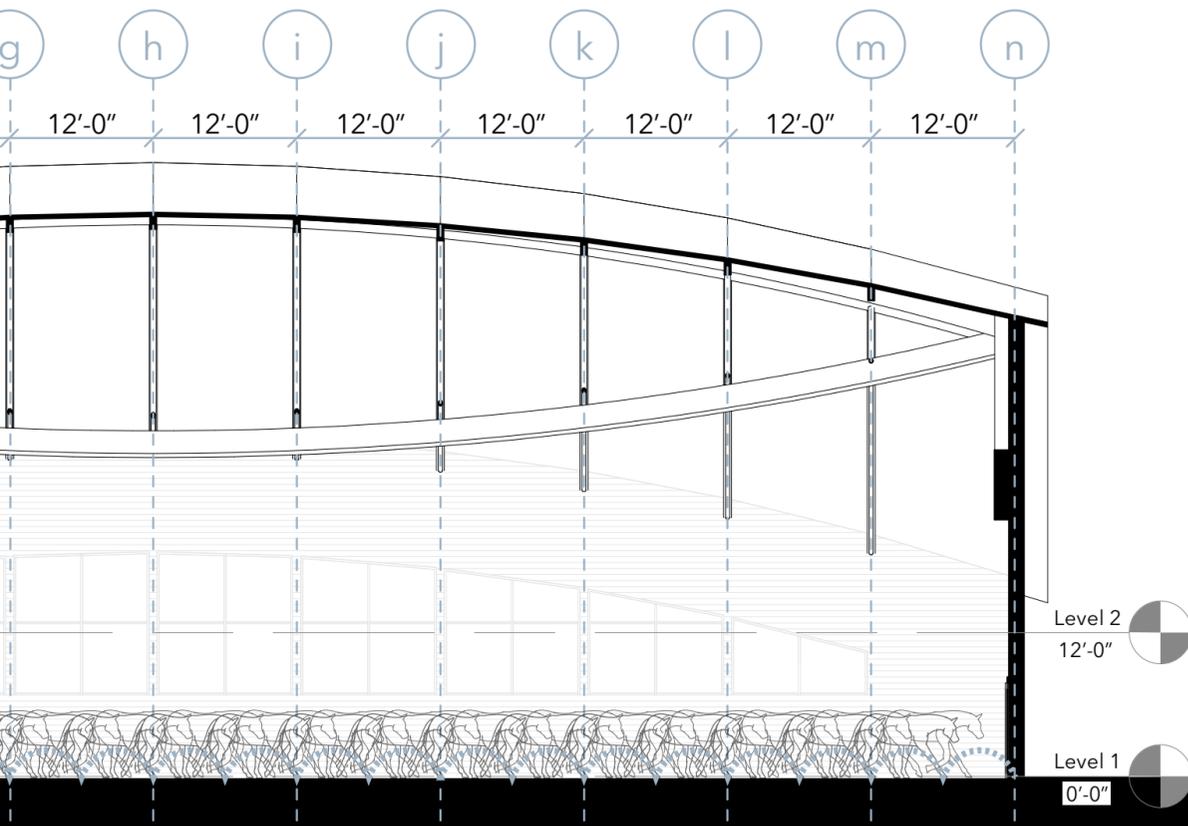
The indoor arena structure curves like that of the spine of the horse when being ridden in circles. This creates a dynamic and poetic space. The 12ft spacing of the structure will also enhance the rhythm of the horse traveling in the arena with the 6ft loping stride. The main beam mimics the spine of the horse, the wood compression members in the truss act as ribs, and the tension cables pull everything together like the tendons and ligaments.



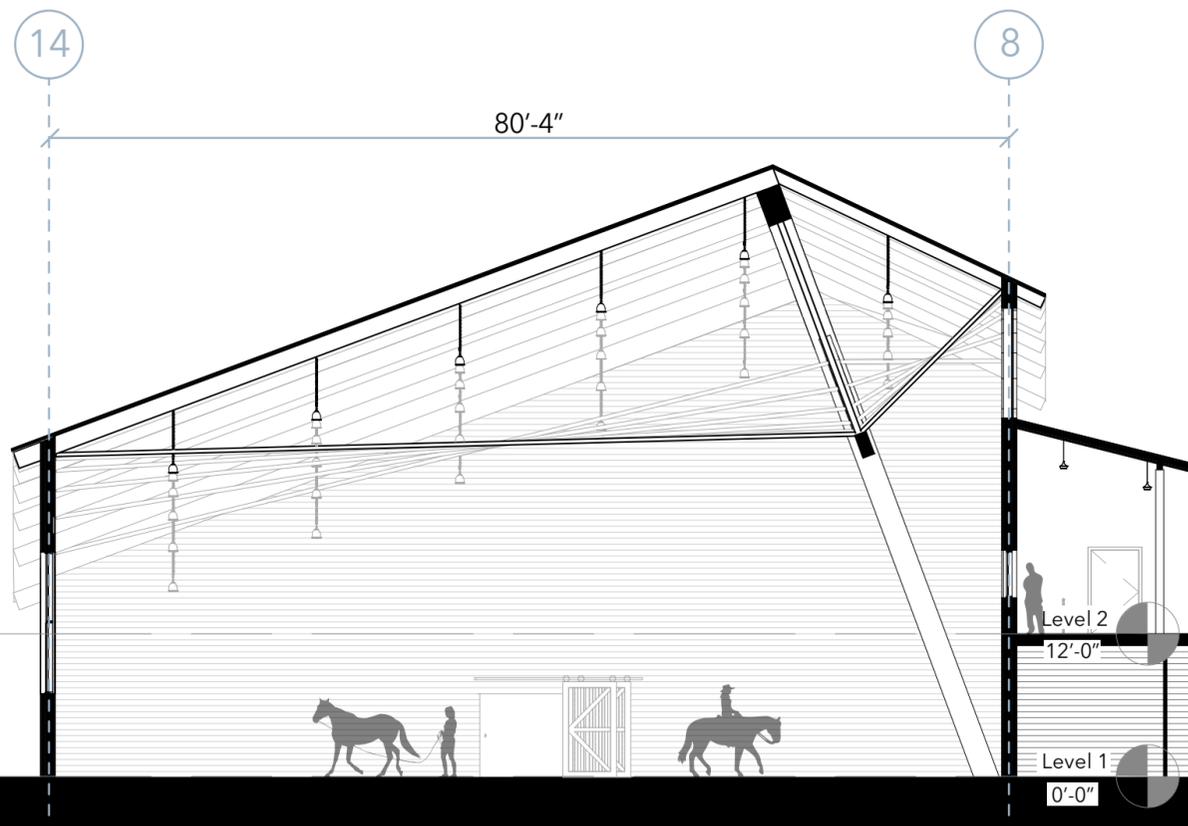
Key Plan



Figure 6.8: View of the indoor arena.



Structural Section A



Structural Section B

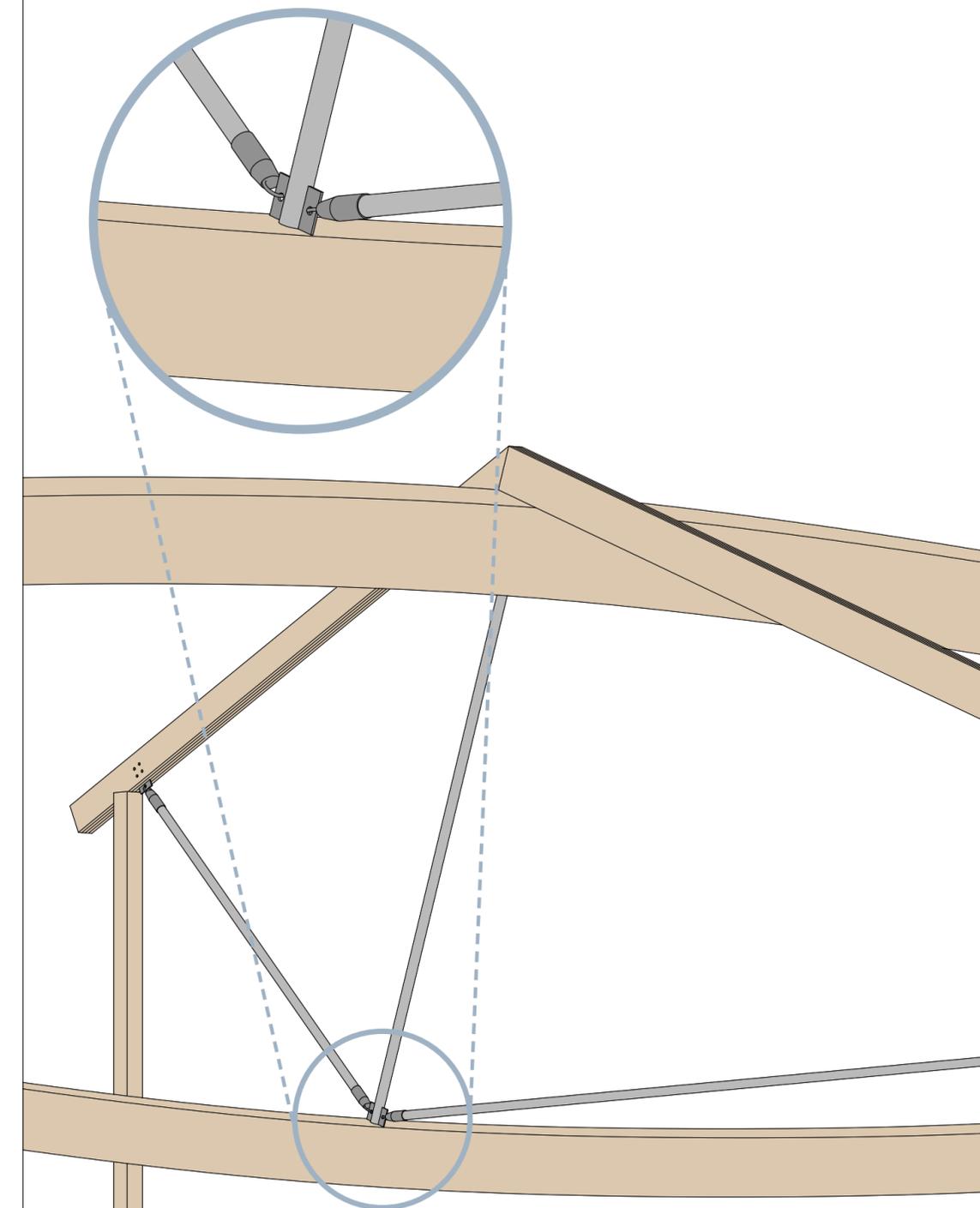


Figure 6.10: Detail structural drawing of the arena truss.

Detail Axo

Structure

Public House for the Human

The structure for the Public House will follow the curvature of the human spine and encourage movement through the space. Curving the main beam creates undulating trusses. The truss system is similar to the indoor arena, but instead of glulam beams, this truss uses standard timbers and pinches a metal plate between members to attach the tension cables.



Figure 6.11: View of the Public House lounge.

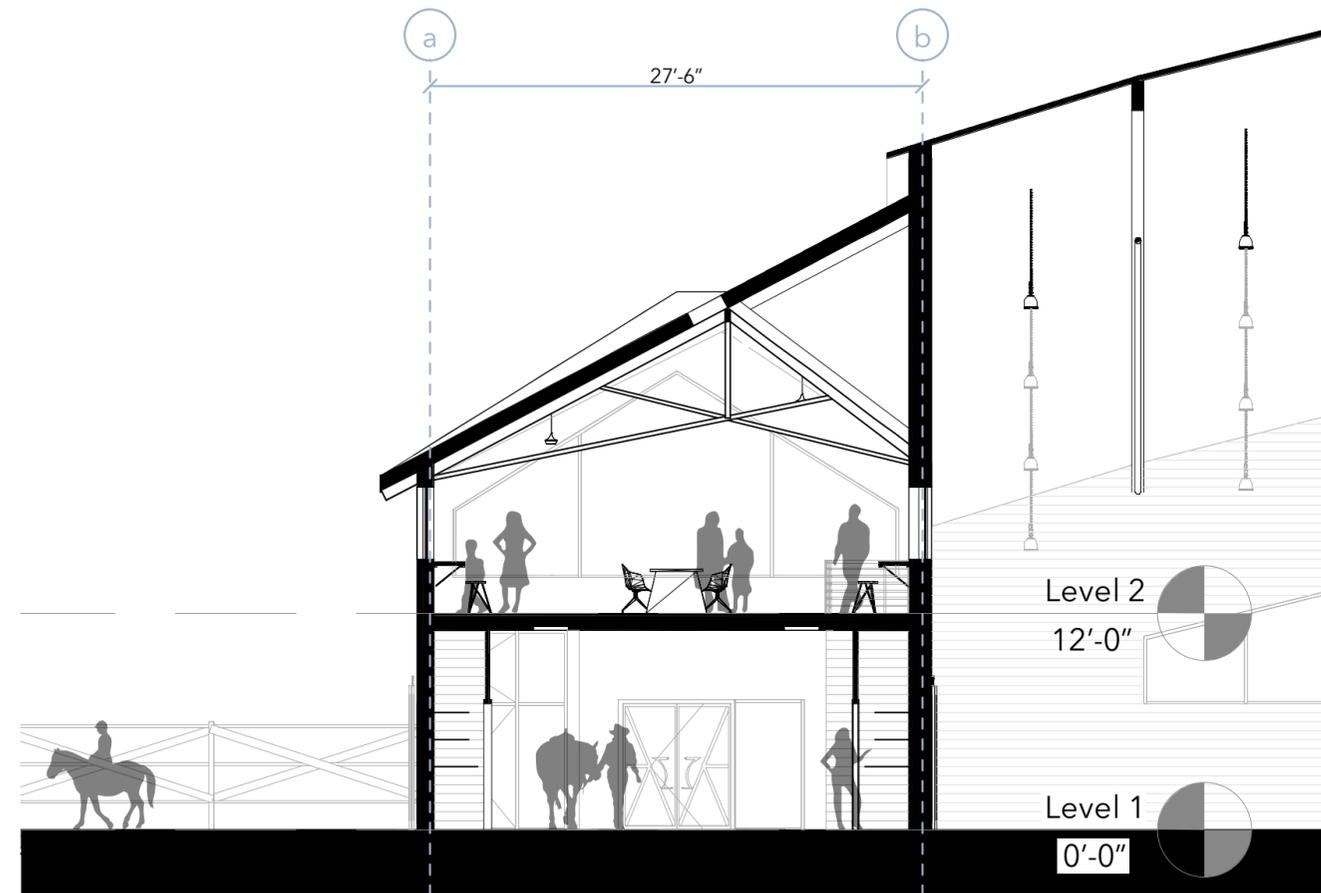


Figure 6.12: Section showing the shape of the Public House truss.

Structural Section

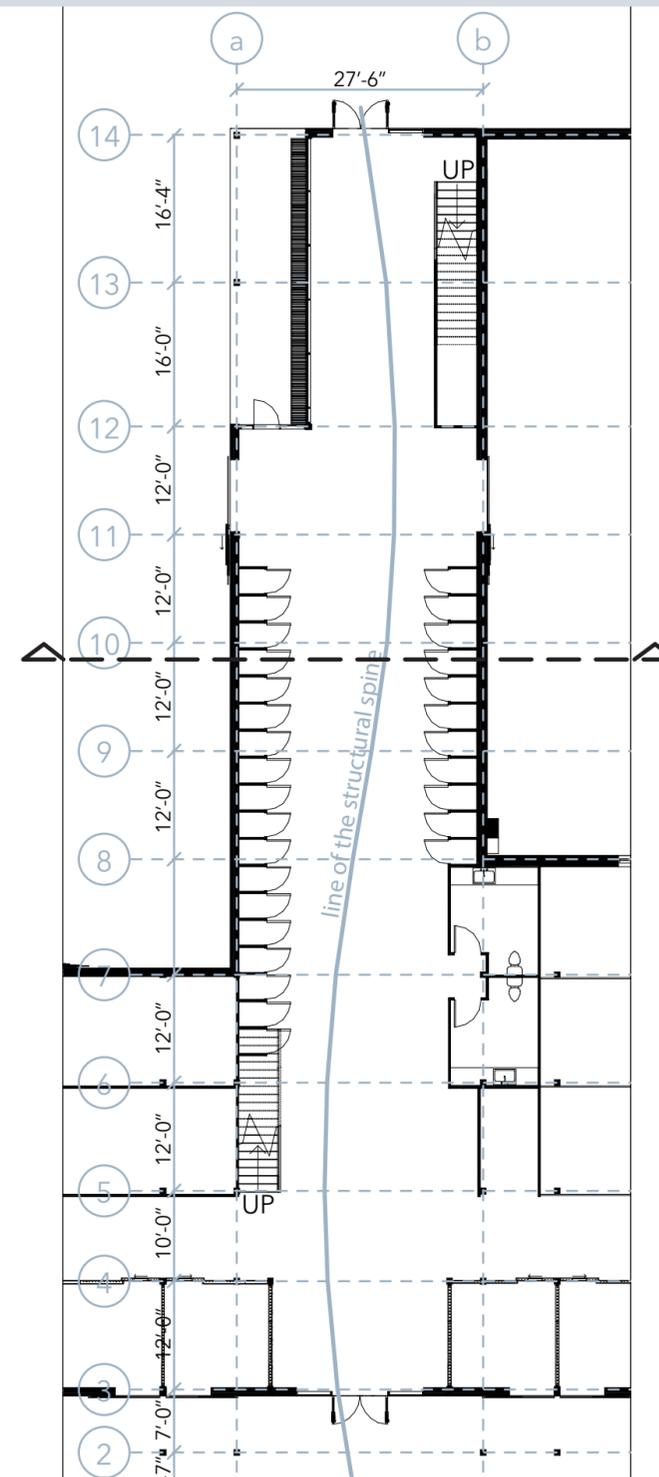
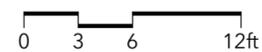


Figure 6.13: Structural plan of the Public House.

Main Floor Structural Plan

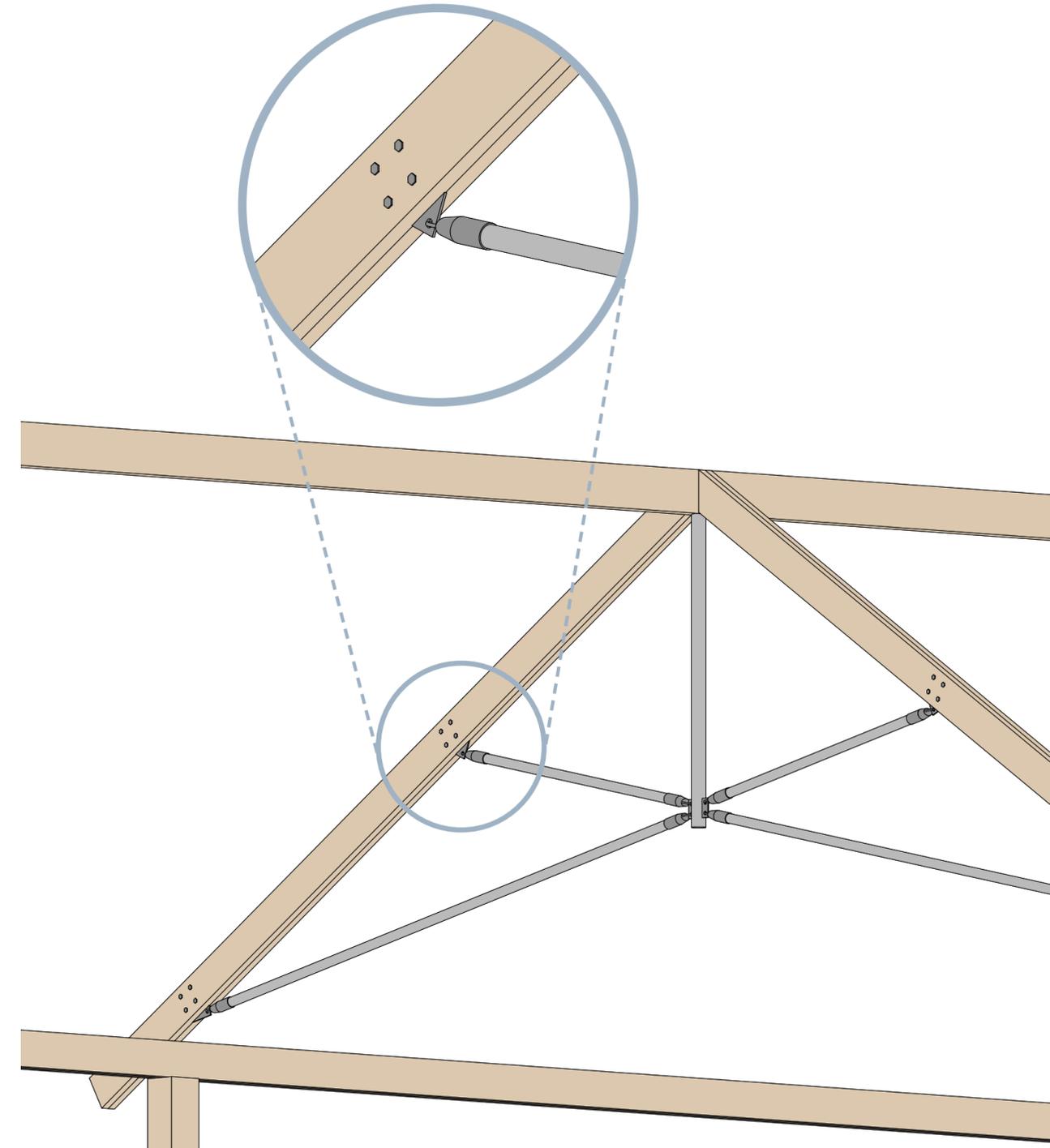
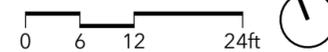


Figure 6.14: Detail structural drawing of the Public House truss.

Detail Axo



Structure

Residential & Back of House

The residential areas and the remainder of the facility use a standard mass timber post and beam system on a 12x12ft grid with a single sloped roof. The connections in this structural system brings in elements of the care of craft and wood joinery. It uses a traditional mortise and tenon joint.



Figure 6.16: View of the hallway in the House for the Horse.

Joinery

Mortise and Tenon

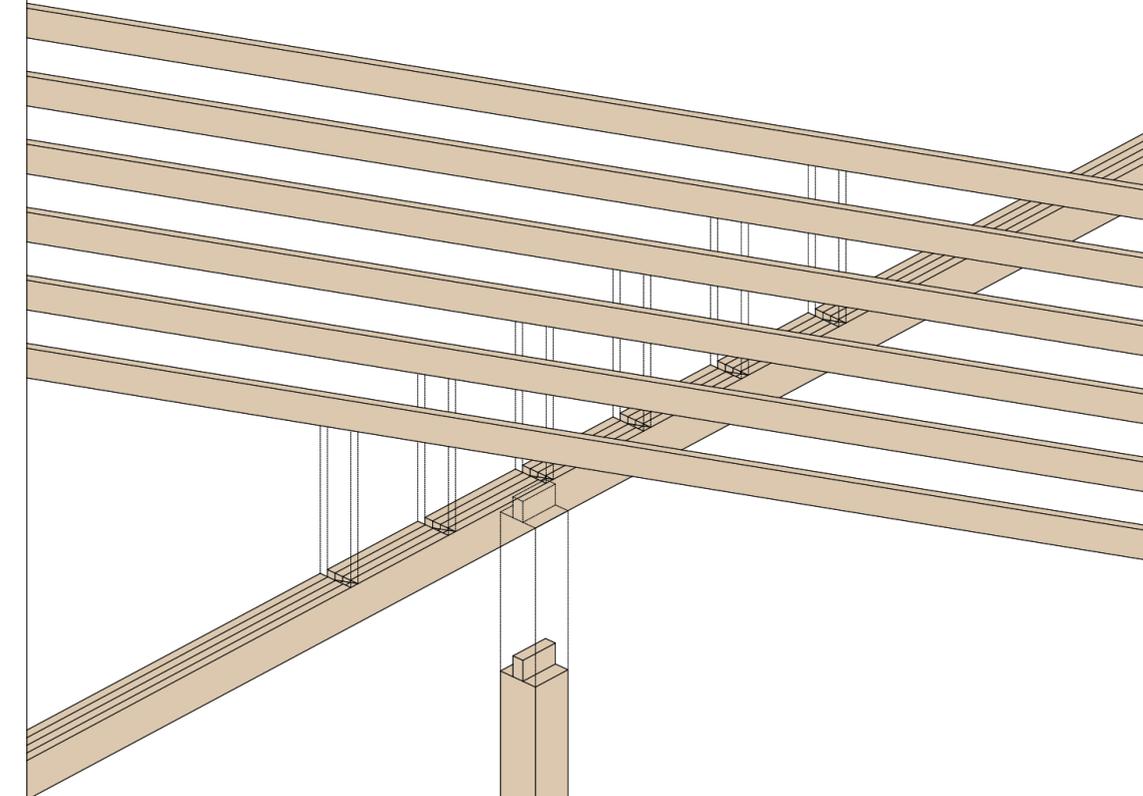


Figure 6.18: Detail structural drawing of the residential area joinery.

Detail Axo
0 0.5 1 3ft

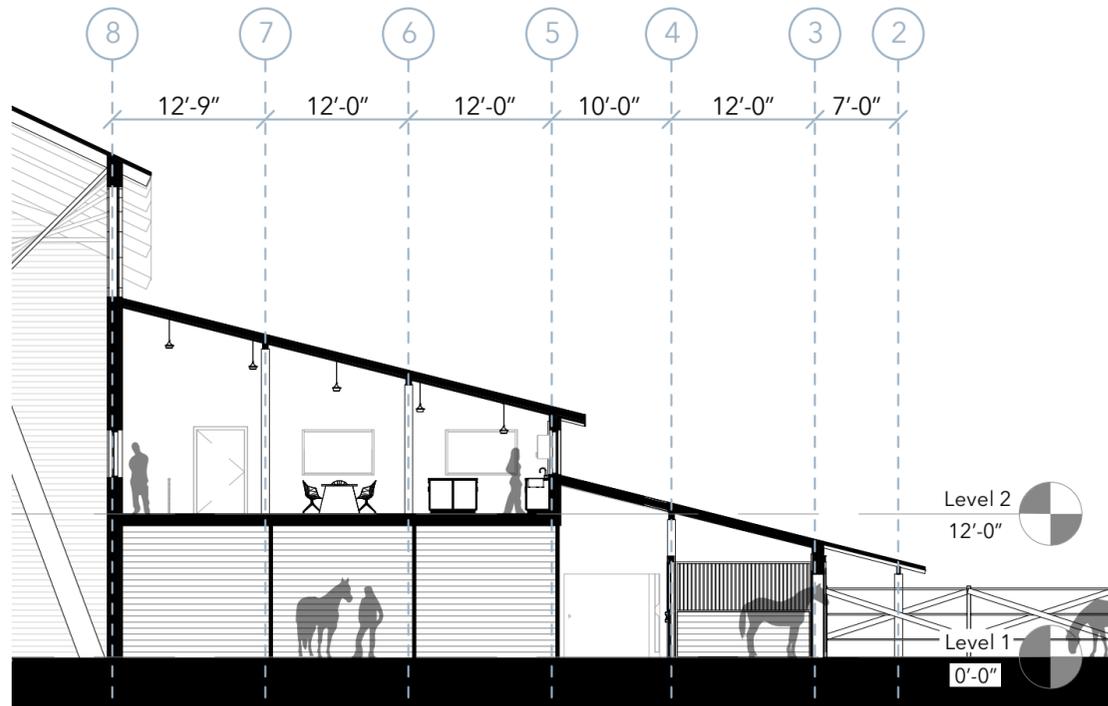


Figure 6.17: Section showing the grid of the residential area.

Structural Section

0 5 10 20ft

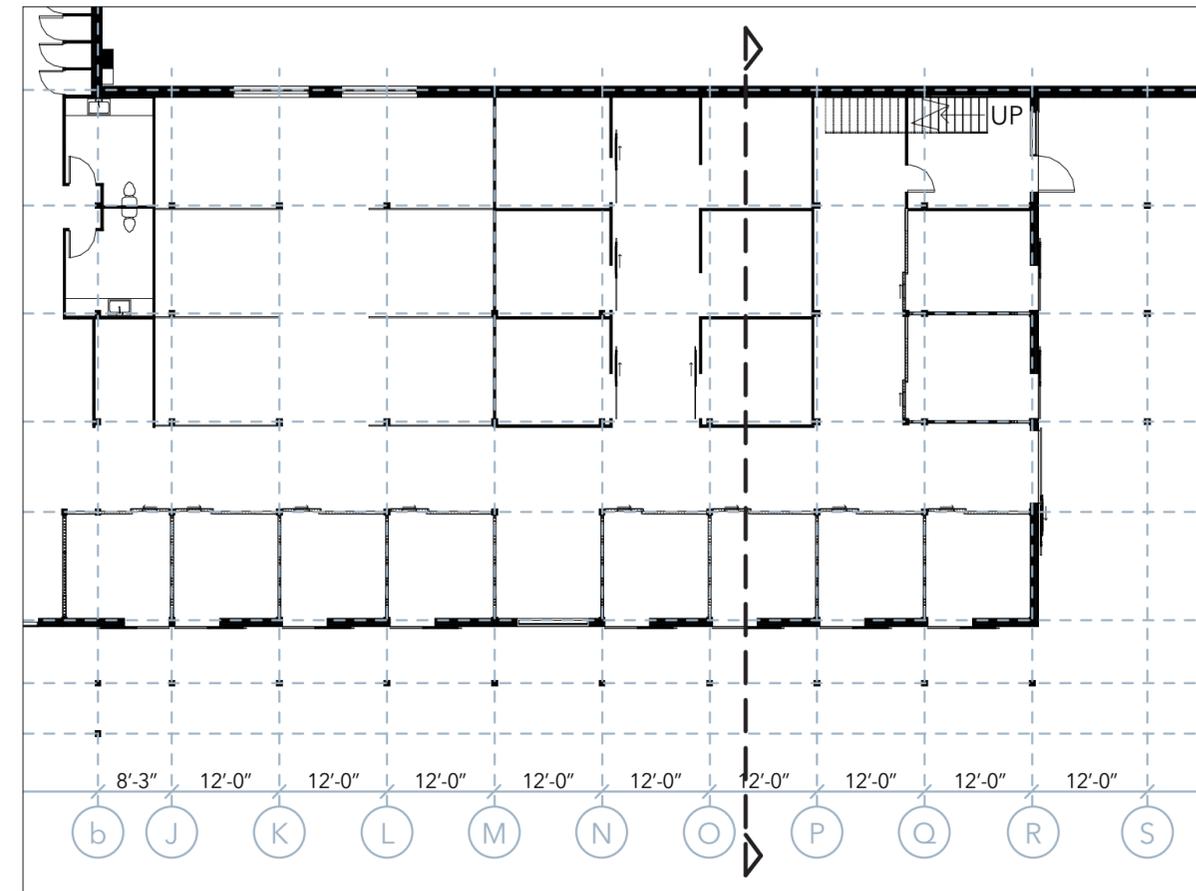


Figure 6.15: Structural plan of the residential area.

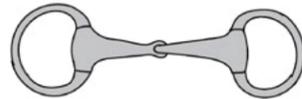
Main Floor Structural Plan

0 6 12 24ft

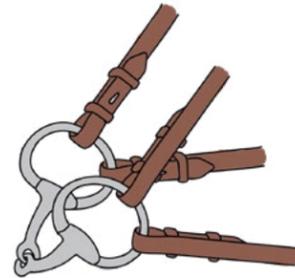
Equipment Connections

Figure 6.19-6.26: Connections in the equipment.

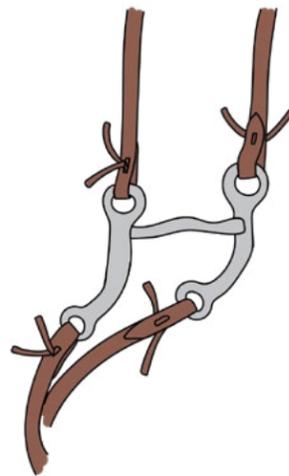
The joinery will reflect the connections used in the riding equipment for the horse and rider. Looking at interactions such as those in the bridle with connection from the horse's mouth through the reins and to the rider's hand.



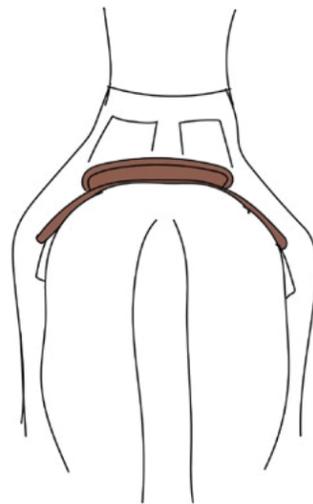
The **bit** needs to fit the width of the horse's mouth to make sure there is no discomfort and so they can properly feel the pressure through the rein for the human to communicate with them.



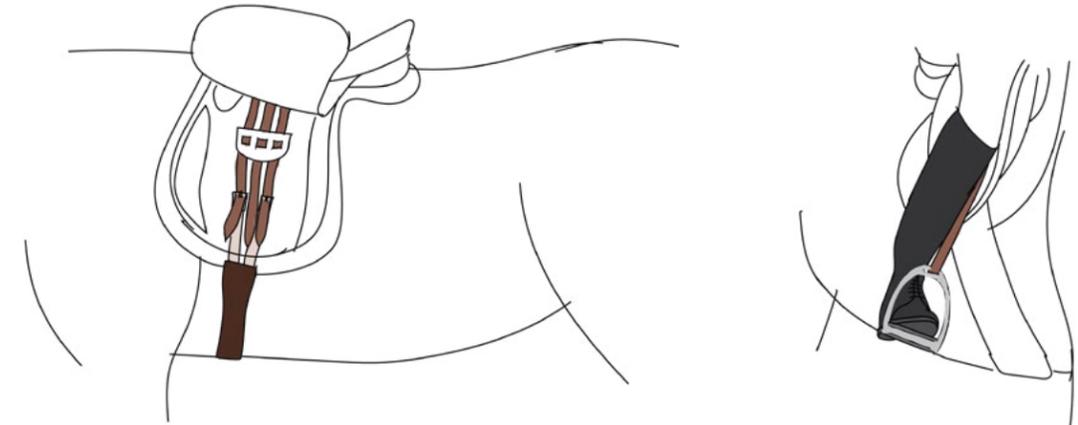
The **english style leather reins** wrap around the metal bit and secure onto itself with a hooked billet. A metal pinned connection is used with leather keepers to hold it in place.



The **western style leather reins** wrap around the metal bit as well. They are secured using a thin piece of leather that is looped through and then tied.

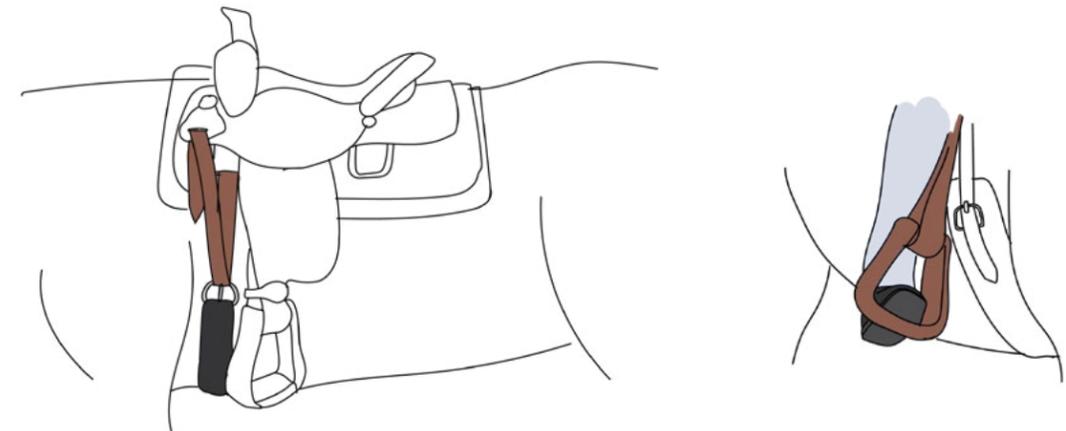


The **seat of the saddle** provides a comfortable connection between the seat of the rider and the horse's back. An ill fitting or bad quality saddle can cause pain and discomfort for the horse and rider.



The connections in an **English saddle** are similar to that of a wood framing truss system. It is made up of several smaller members. The saddle is done up with thin leather straps. The girth attaches using 2 small metal buckles with small elastic pieces allowing some give with the horse's movements.

The English stirrup consisting of a thin leather strap anchored to the seat of the saddle which holds up a thin piece of metal, often stainless steel, that holds the human foot. The English stirrup provides a rubber pad to rest the foot on for grip and comfort.



The **western saddle** is more robust and speaks more of the language of mass timber framing. The western saddle is secured onto the horse using a latigo strap and a cinch. The latigo strap is attached to the dee ring on the saddle, and it is then wrapped around through the ring on the cinch and back up to the dee ring, and continued twice around.

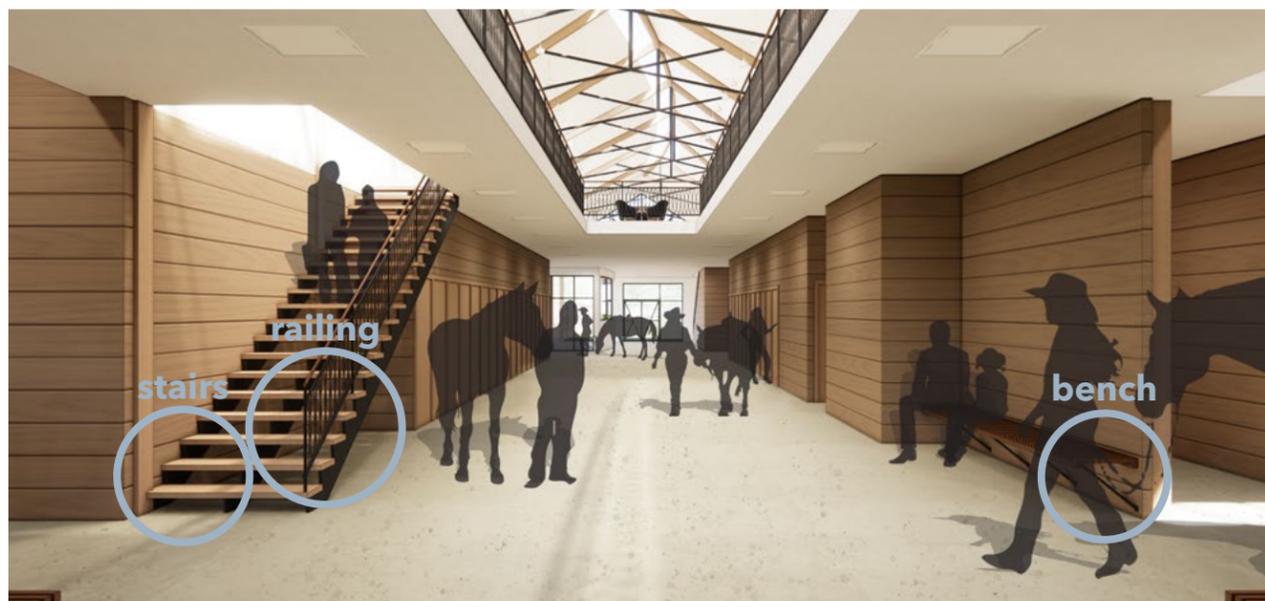
The western stirrup is a series of leather loops working together to hold the human foot. Just as humans have taken the time to carefully design these connections in the equipment to ensure the comfort of the horse and rider, the same will be done for the building connections in the equestrian facility.

Details

The details throughout the facility will reflect the connections used in the riding equipment for the horse and rider. Looking at connections such as those in the bridle, as well as the saddle, both in english and western. Six details have been chosen for the design of this thesis to enhance the experience of the place; the stall door latch, stall panels, fence, stairs, railing, and bench.

Figure 6.27 (top):
Objects detailed in
the House for the
Horse corridor.

Figure 6.28 (bottom):
Objects detailed in
the main corridor.



Stall Door Latch

The stall door latch presents an opportunity to consider the somatic senses with emphasis on touch, the scale of the horse and human, the wellness of its users, and the craft that contributes to the essence of the place. It takes influence from a connection in the western bridle called the shank hobble or the slobber strap which holds the 2 sides of the shank together.

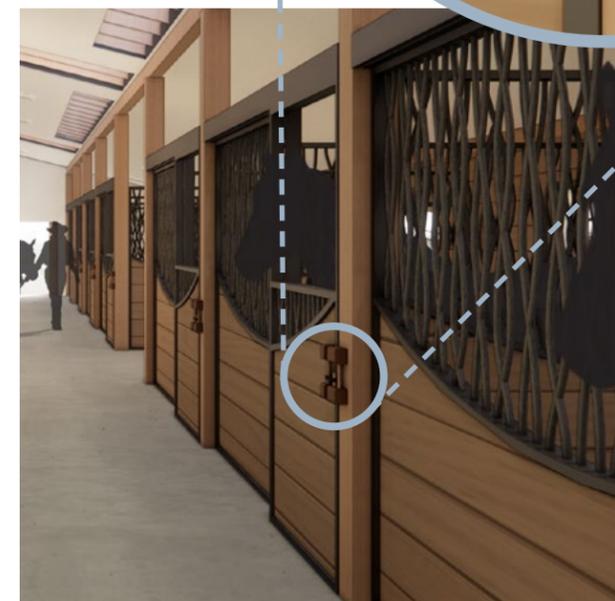


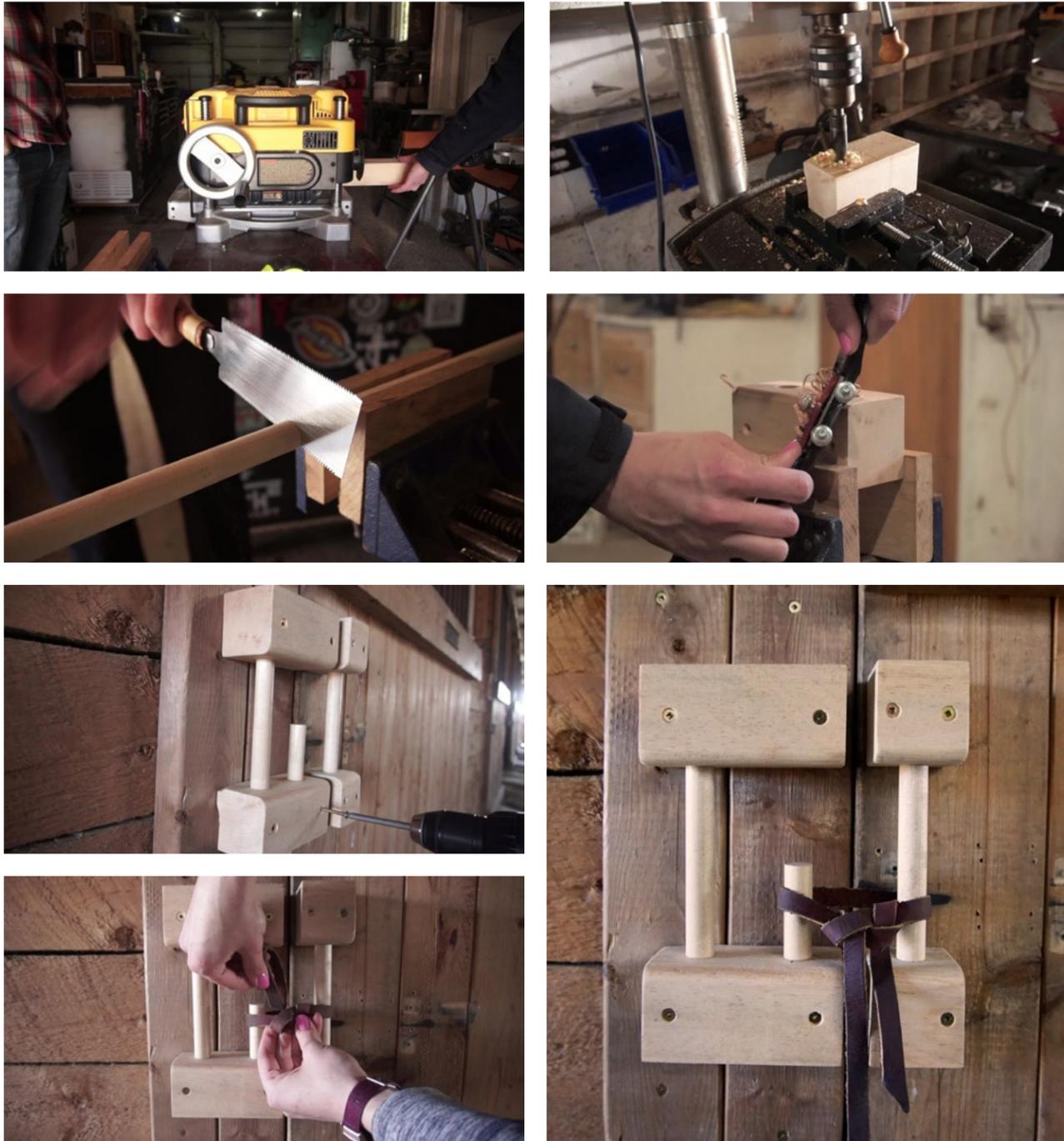
Figure 6.29: Stall latch render.

Figure 6.30: Shank hobble.

Craft of the Stall Door Latch

This is the artifact that was chosen to be built and studied further for ARCH 5326 - Fabrication 2. This latch demonstrates the care in the craft of the object and responses to the scale of the horse and human.

Figure 6.31-6.37: Craft and assembly of the stall latch.



Stall Panels

The design of the stall panels look to the ideas of rhythm within the facility. It helps break up the long line of stalls when looking down the hallway. The curve also makes the stalls feel more open and less ridged. Dropping the height of the wall also allows for better air flow through the stalls. The weaving of the bars to create a metal screen symbolizes the coming together of the horse and the human.



Figure 6.38: Stall panel render.

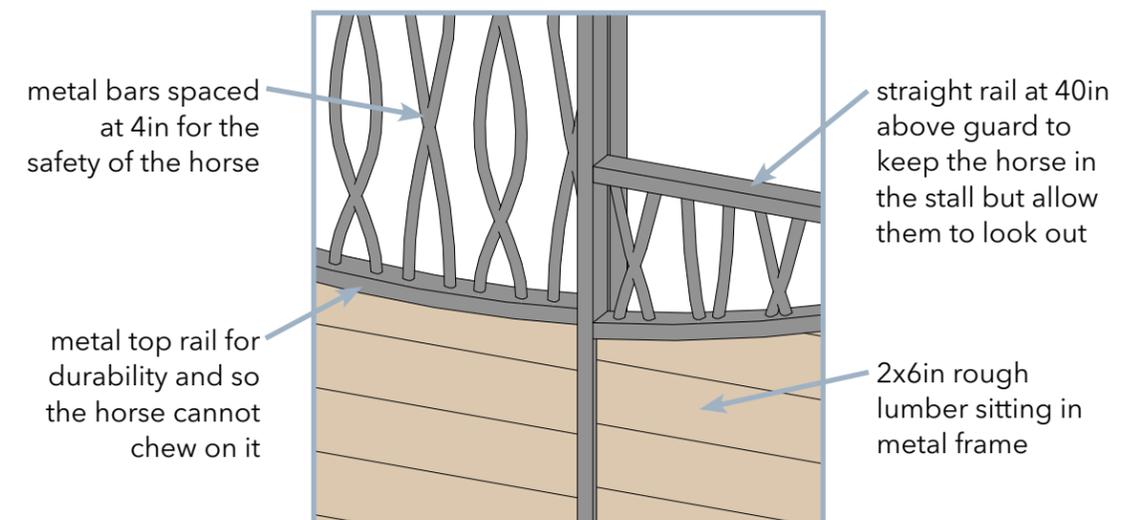


Figure 6.39: Stall panel detail drawing.

Fence

The fence design mimics the structural design throughout the facility with the use of wood and steel. The fence also continues the idea of rhythm which is created with the curve.



Figure 6.40: Fence render.

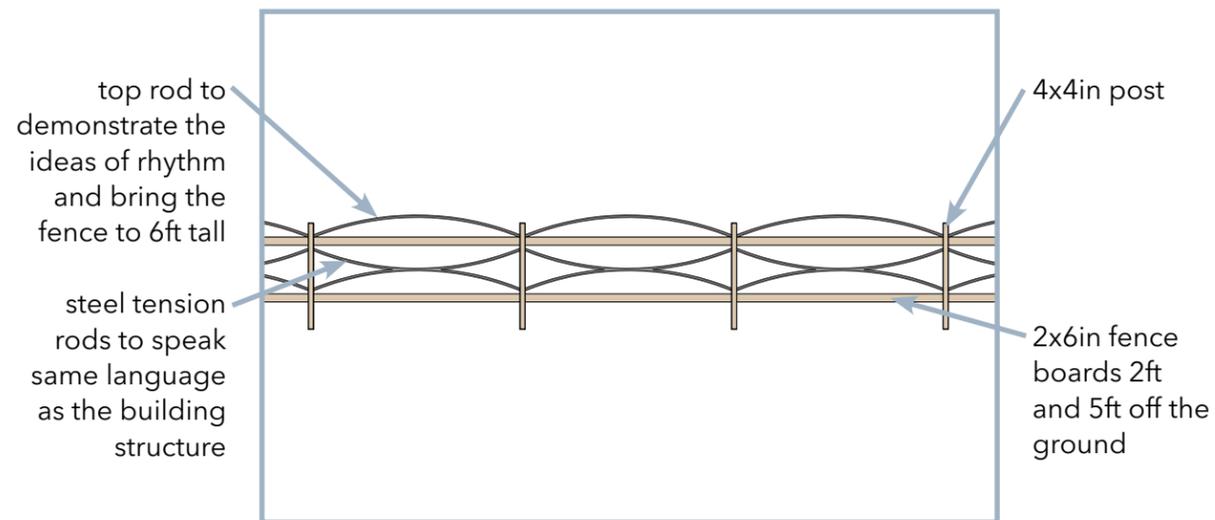


Figure 6.41: Fence detail drawing.

Stairs

The design of the stairs considers the importance of touch within the facility. The foot touches the tread so it is made out of wood which is warm, comfortable, and provides good grip. The riser is made out of steel to create the contrast between what is touched and what is not.



Figure 6.42: Stairs render.

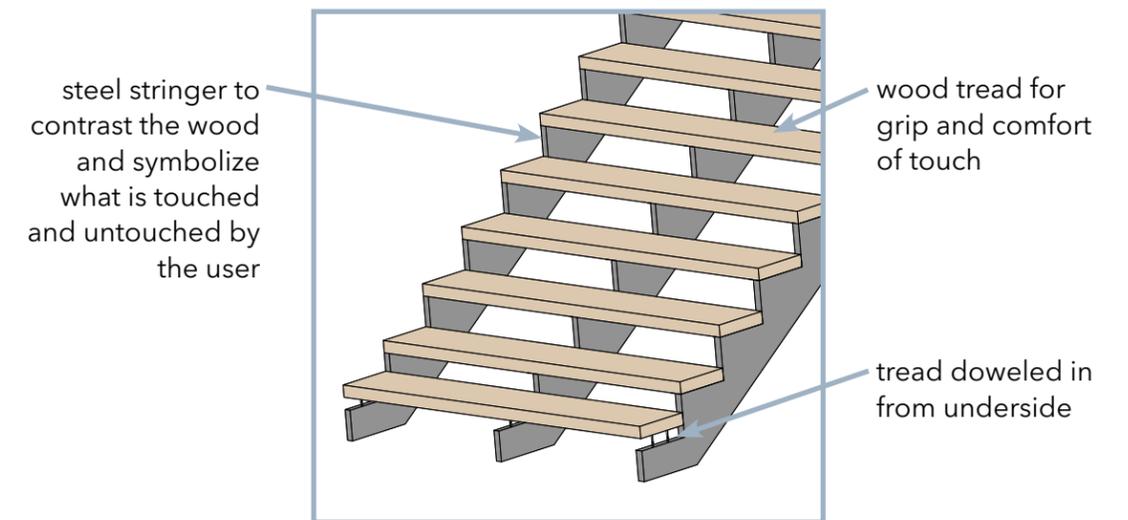


Figure 6.43: Stairs detail drawing.

Railing

The railing uses these same notions of touch. The top rail being a nice polished wood so it is comfortable for the human hand. The balusters use the notion of weaving together the horse and human, similarly to the stall design.

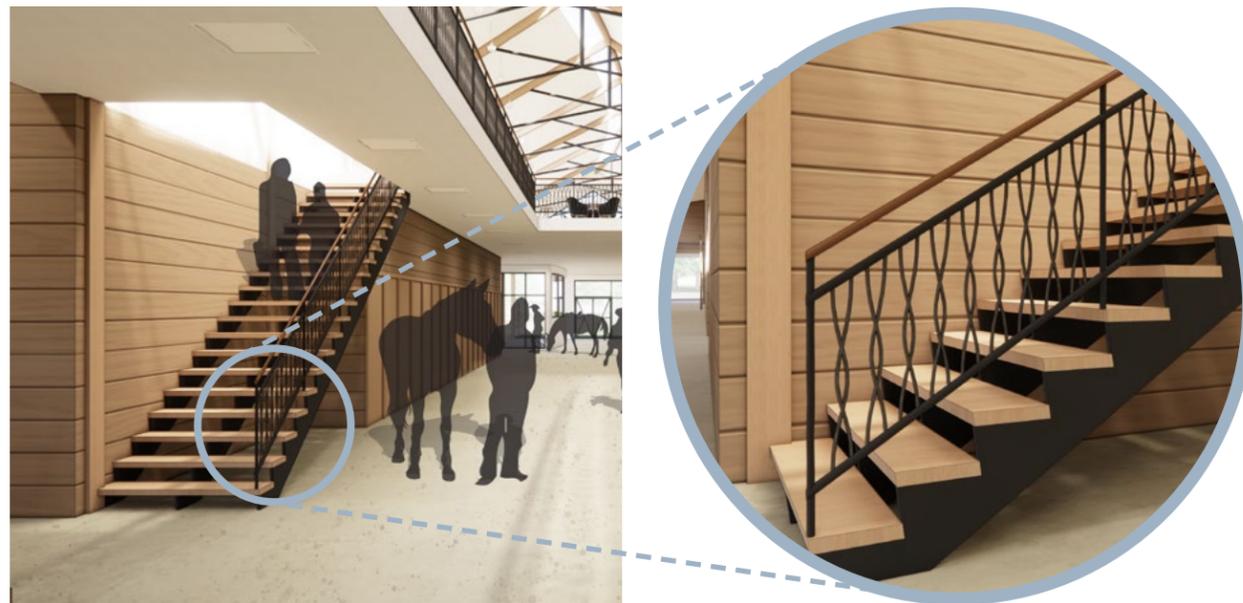


Figure 6.44: Railing render.

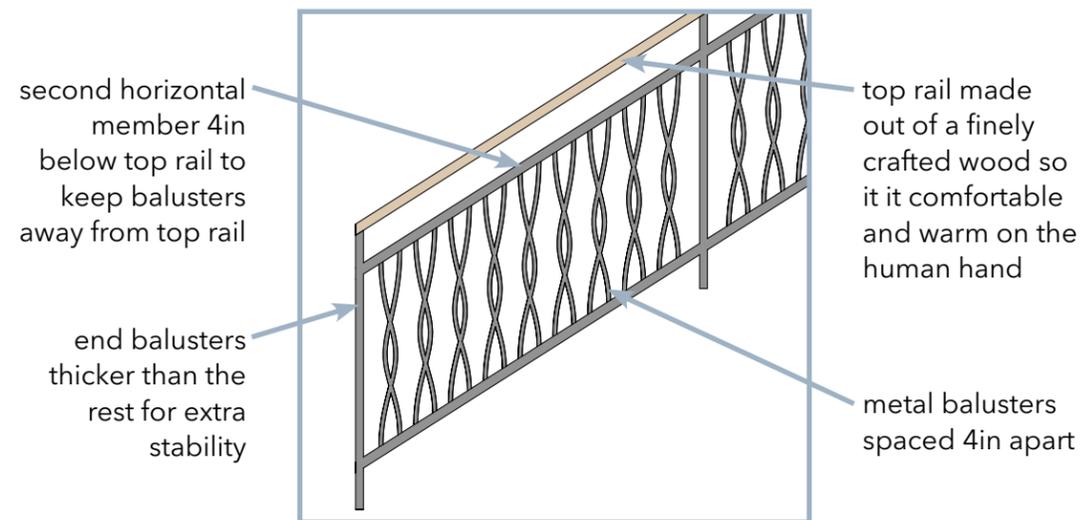


Figure 6.45: Railing detail drawing.

Bench

The bench design uses a series of 2x2s to create a warm, comfortable seat. And the steel members support them from underneath, allowing the bench to cantilever from the wall.

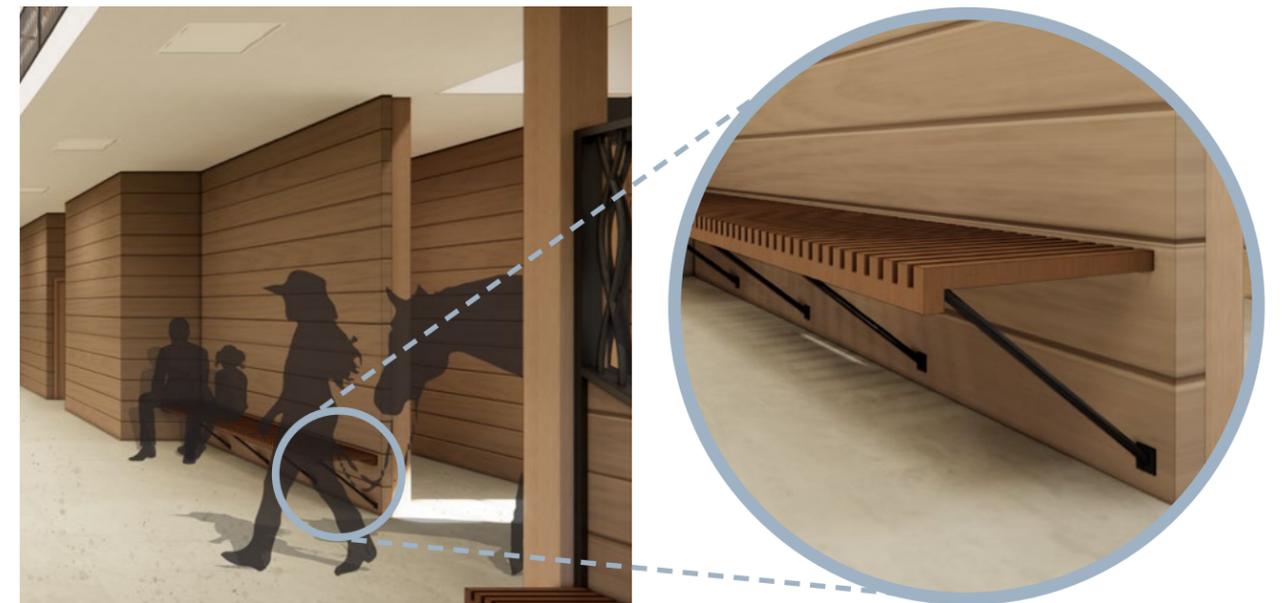


Figure 6.46: Bench render.

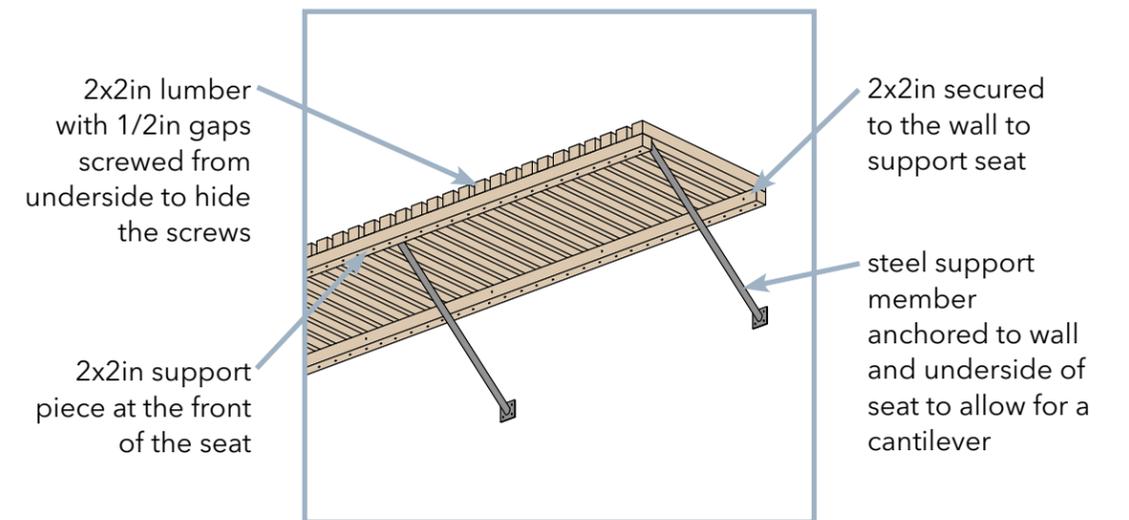


Figure 6.47: Bench detail drawing.



Figure 7.1: Center hallway of *Equestrian Architecture*.

BUILDING SYSTEMS

Daylighting

Equestrian Architecture uses as much daylight as possible, but also provides artificial light for at night. The facility also incorporates as much roof lighting as possible by using roof panels that diffuse natural daylight. Daylighting can be used wisely to help passively heat the building during winter months, as well as cut down on hydro costs of artificial lighting. Direct sunlight only comes into the arena from a very high angle so it does not blind the horses and riders, but there is lots of indirect light coming from the north side. Direct sunlight can also enter the second-floor residential spaces, grooming spaces, and the stalls for the horse during the winter solstice.

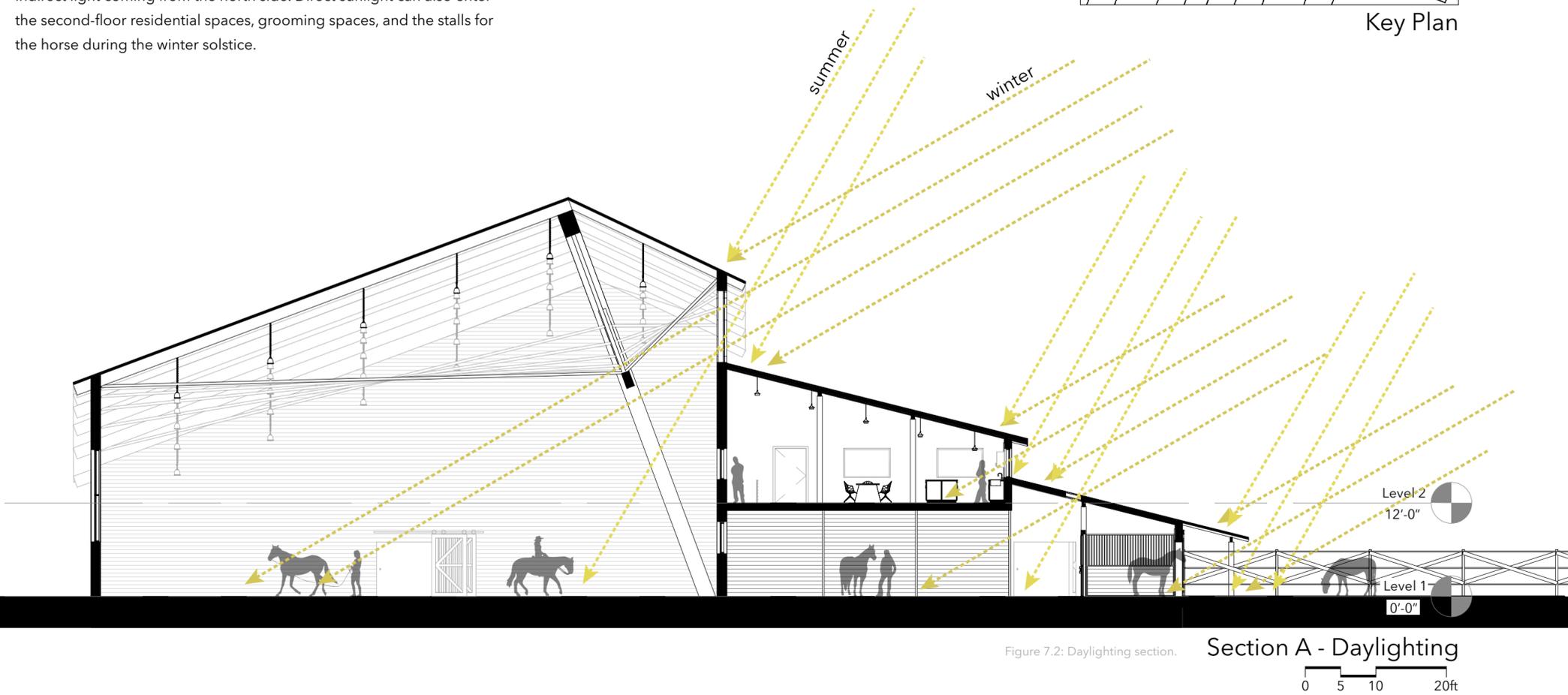
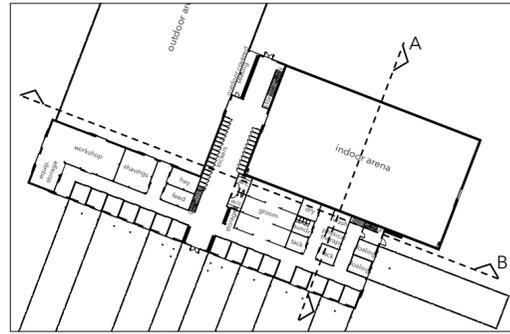


Figure 7.2: Daylighting section.

Section A - Daylighting

0 5 10 20ft



Key Plan

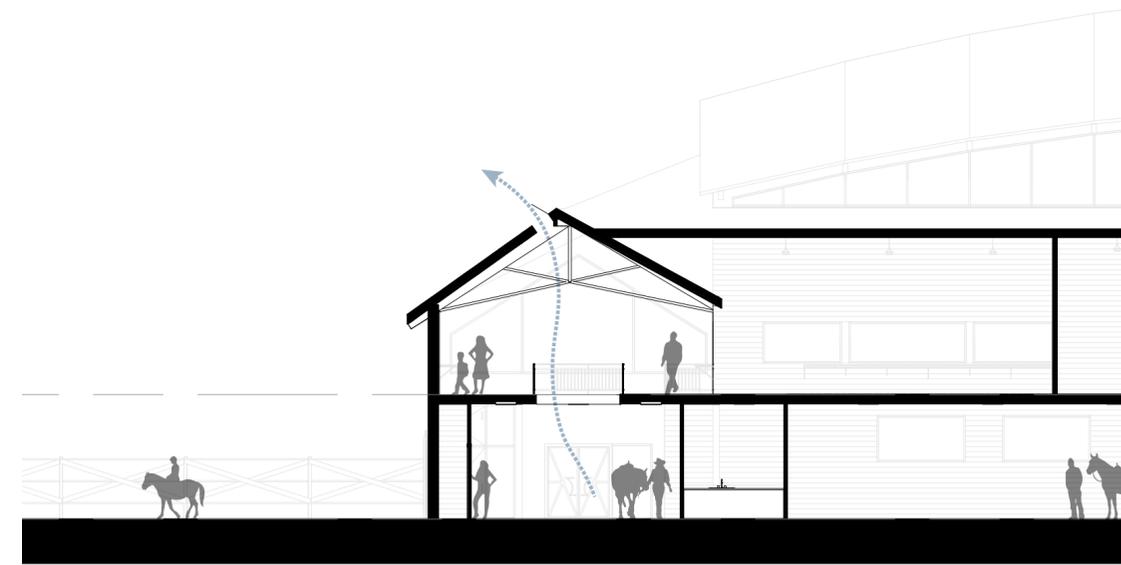


Figure 7.3: Stack ventilation section.

Section B - Stack Ventilation

0 5 10 20ft

Cross & Stack Ventilation

Ventilation is very important in an equestrian facility. "Horses are likely to be healthier and less prone to coughs, colds and allergies in an environment which has a circulation of fresh air but if draught-free."¹ Fresh air is best circulated through the facility with cross ventilation.

Stack ventilation allows hot, fowl air to rise through the building and escape out the top. Fresh air can come in through windows on the main level and push the old air upwards.

¹ Mohan and Steinberg, *Riding: A Guide to Horsemanship*, 75.

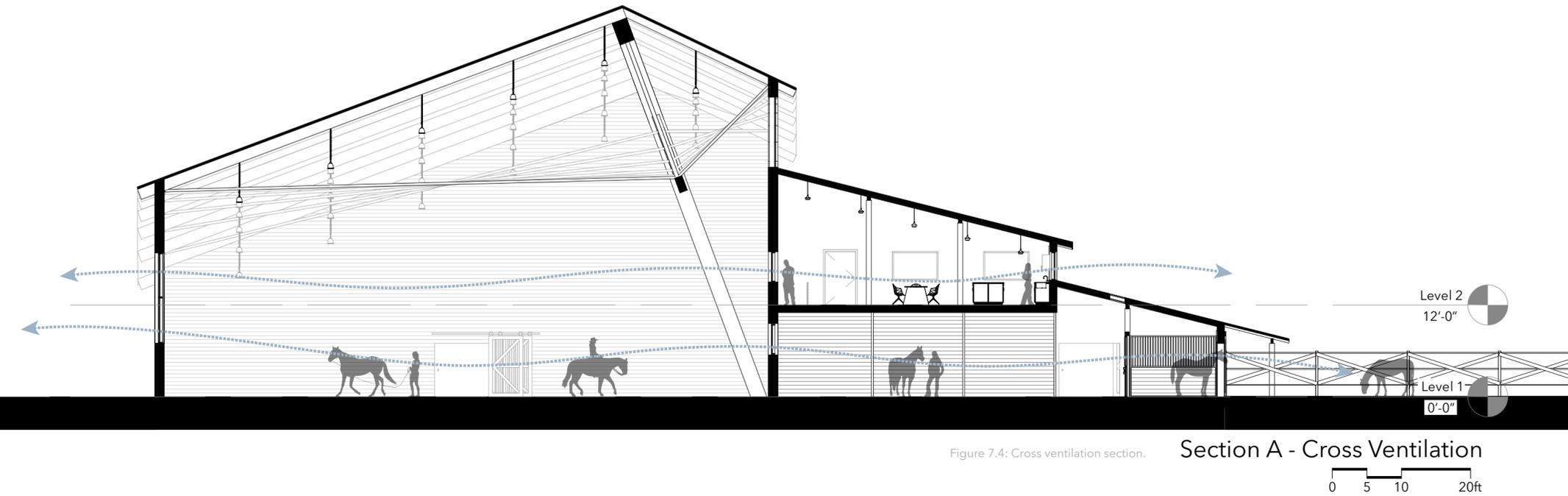


Figure 7.4: Cross ventilation section.

Section A - Cross Ventilation

0 5 10 20ft

Conclusion

The Future of Equestrian Facilities

To conclude, the goal of this thesis is to help guide the future of equestrian facilities in the north to provide better living conditions for the horses and humans, create more inviting spaces for both to interact, and to encourage these facilities to make better use of their environments. The notion of care and the importance of the sense of touch is brought back into the facility through the craft of the spaces. The issues that were identified with existing facilities have been solved;

- 1. Horse living conditions:** The horse is able to freely move from inside to outside as they please. The interior stalls are very open allowing for good airflow and circulation, and have a lot of daylighting.
- 2. Human residence:** The humans live above the horses allowing them to keep a close watch on the facility. There are views down into the riding arena, pastures, and foaling stalls.
- 3. Viewing area:** The viewing area is placed on the second level between the indoor and outdoor arenas to allow for a great vantage point for spectators.
- 4. Kitchenette:** A kitchenette is included in the upstairs lounge.

Figure 7.5: View when arriving at Equestrian Architecture.

- 5. Grooming:** A designated grooming area is provided just off the main circulation space so humans can spend quality time taking care of their horse without being disrupted.
- 6. Storage:** There are numerous personal lockers that line the hallway of the main circulation space, as well as two large tack rooms to store bulky equipment. Other storage spaces are provided throughout the facility for equipment.
- 7. Materiality and structure:** Rhythm and movement are encouraged throughout the facility using materials and structure in a poetic and dynamic way.
- 8. Passive building systems:** Basic building systems such as daylighting and ventilation are incorporated into the facility to improve the health and wellness of the users.

Equestrian Architecture improves the **wellness** and **communication** between the **horse** and **human** companion through materiality and shaping the **environment** in which they co-exist. The hope is that this thesis will show the equestrian community what the future of these facilities could be.





Figure 8.1: Pine Ridge Ranch laneway to pastures.
Photograph by author, November 2020.

APPENDIX A

CASE STUDIES

Sudbury Equestrian Case Studies

Case studies highly inform the design and layout of the architecture of this project. Highlighted on the map of Greater Sudbury are four sites that have been focused on. The terrain map (Figure 8.3) is particularly interesting because it begins to show patterns in the wind and weather based on the elevation at that site.



Figure 8.2: Map of Greater Sudbury.

Greater Sudbury Map
1:200,000

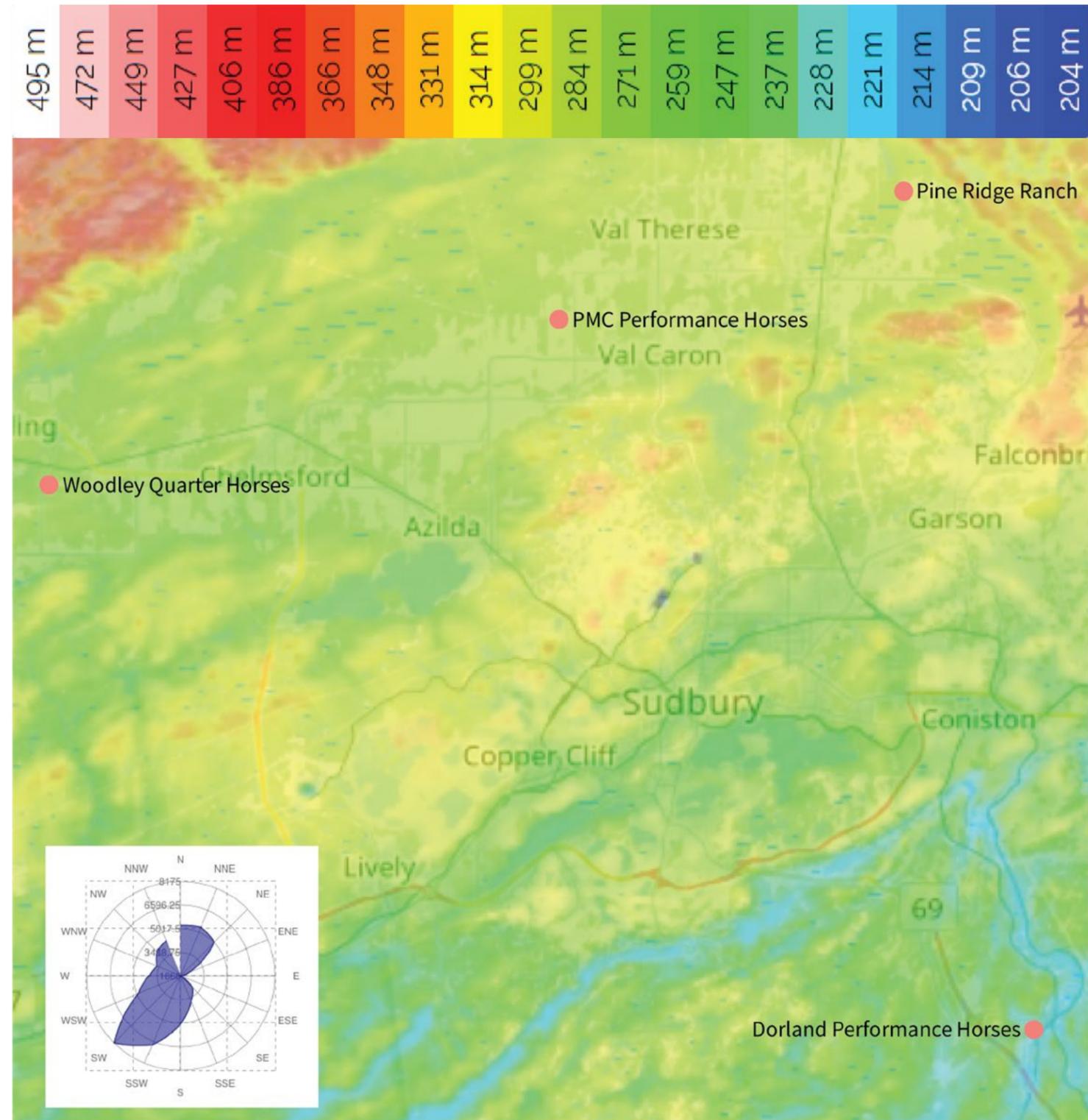


Figure 8.3: Terrain map of Greater Sudbury.

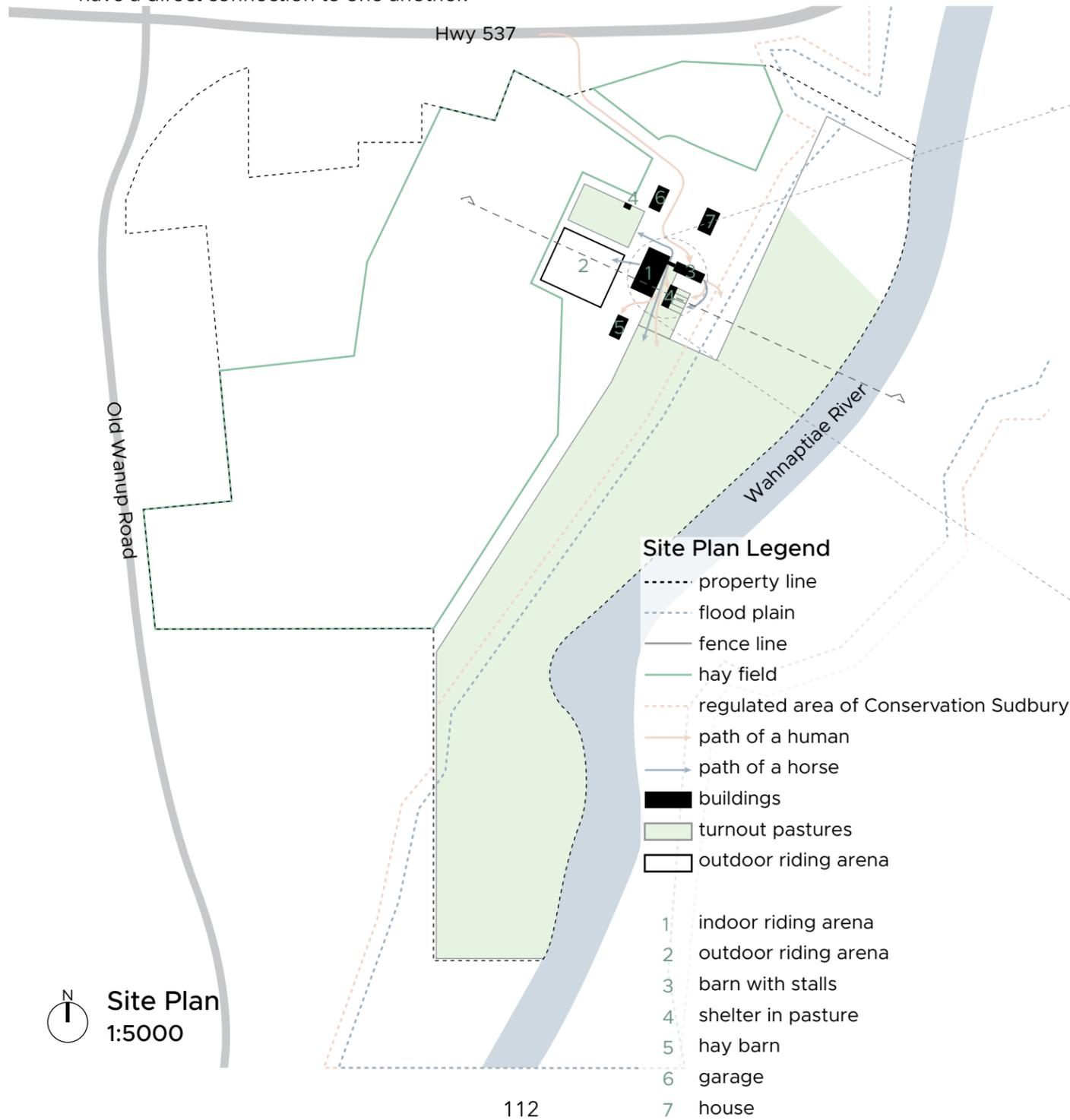
Greater Sudbury Terrain Map
1:200,000

Dorland Performance Horses

Wanup, ON

Dorland Performance Horses in Wanup has many intriguing site features such as the flat fields used to grow hay and the abundance of water available on site. The buildings on the site are in close proximity to each other, and the indoor riding arena and the barn have a direct connection to one another.

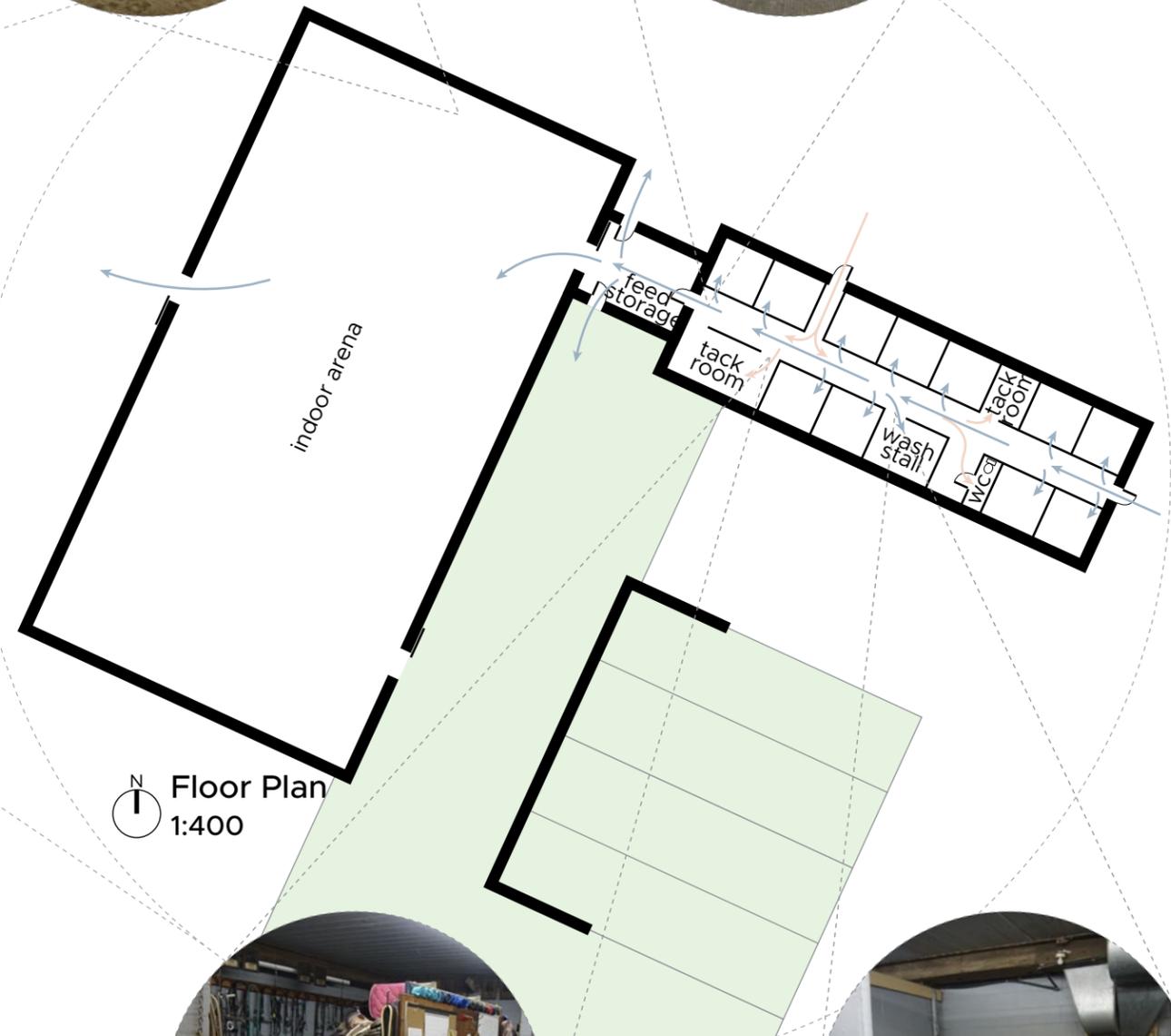
Figure 8.4-8.5:
Dorland Performance
Horses case study.



Indoor Arena
-60x120ft
-timber structure
-non-insulated
-tin roof and siding



11 Stall Barn
-approx. 12x12ft stalls
-bars on stalls to allow for air circulation



Tack Room
-open concept
-adjacent to hallway for grooming



Wash Stall
-large wash stall
-place to tie your horse
-hot water



Dorland Performance Horses

Wanup, ON

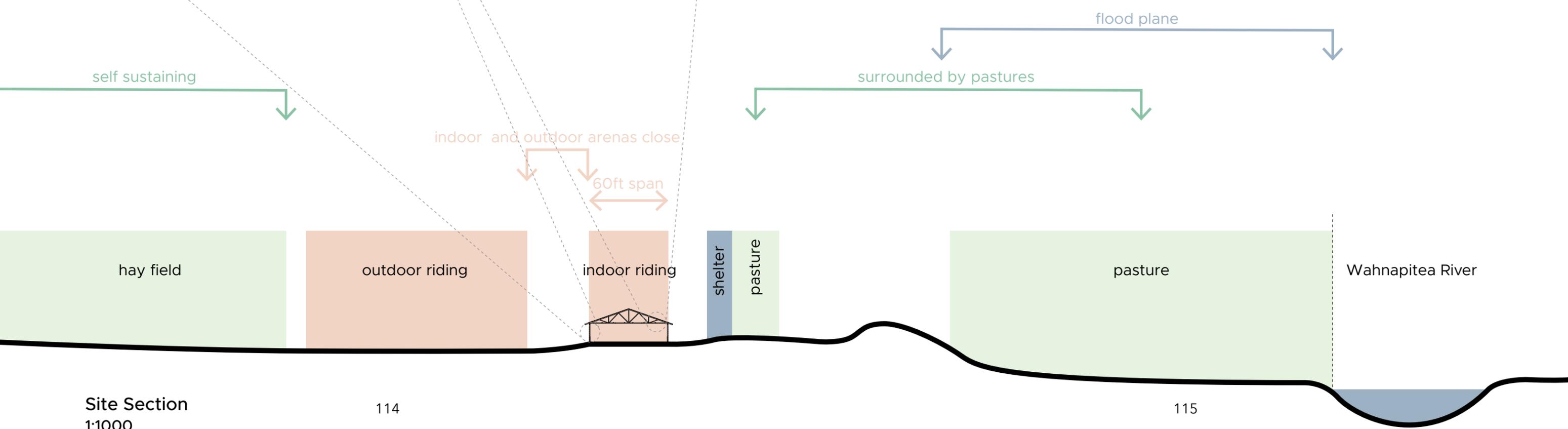
Figure 8.6: Dorland Performance Horses case study site section.

One thing to note on the site is the large flood plane along the river, as it typically causes the lower field to flood in the spring and fall. An architectural element to note is that the barn uses a structural concrete block assembly, which is different from the rest of the projects studied so far.

Large Span Timber Framing Structural System



Concrete Block Structural System



PMC Performance Horses

Val Caron, ON

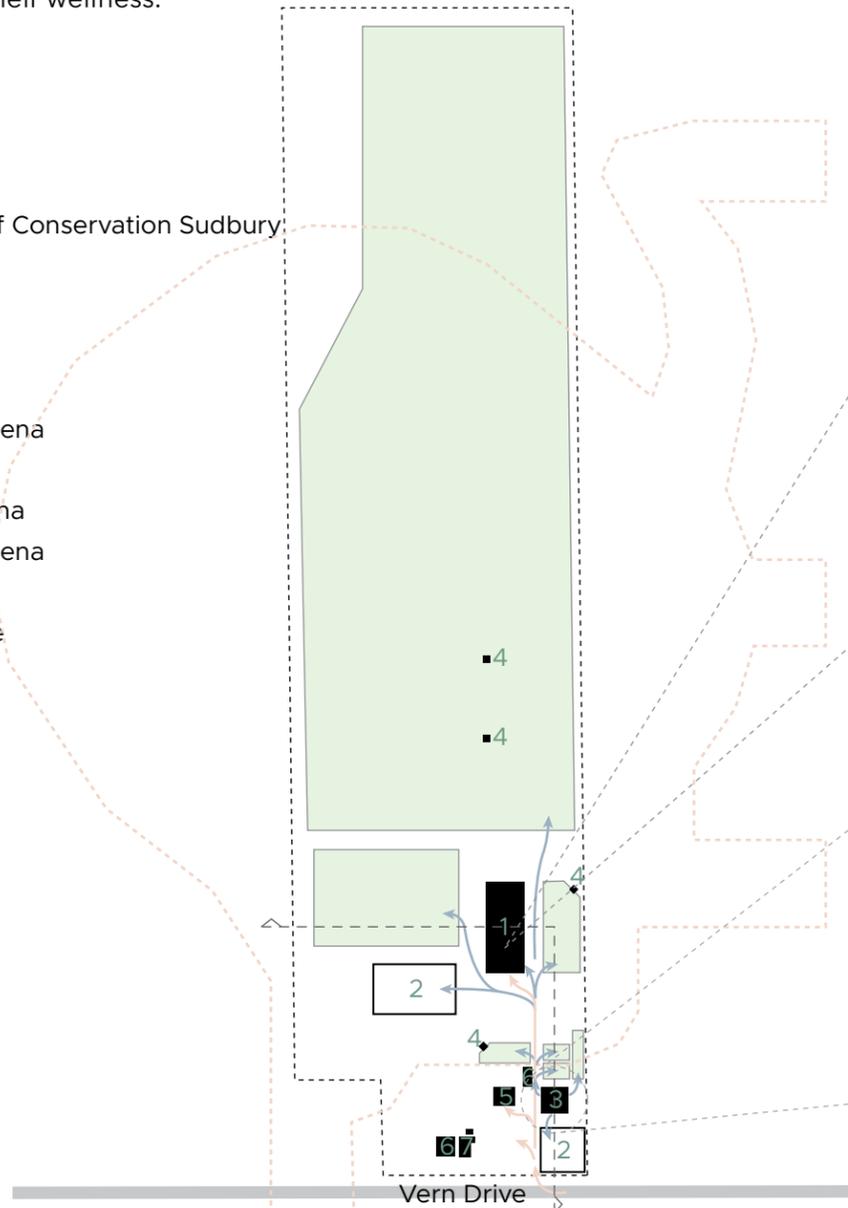
The layout of the main barn at PMC Performance Horses in Val Caron allows for a great flow of traffic with the 'T' shaped hallway, giving more than one entry point into the barn. In this barn there are some great pieces of equipment used for physical therapy of the horses to improve their wellness.

Figure 8.7-8.8: PMC Performance Horses case study.

Site Plan Legend

- property line
- fence line
- - - - - regulated area of Conservation Sudbury
- path of a human
- path of a horse
- buildings
- turnout pastures
- outdoor riding arena

- 1 indoor riding arena
- 2 outdoor riding arena
- 3 barn with stalls
- 4 shelter in pasture
- 5 dog kennel
- 6 garage
- 7 house



Site Plan 1:5000



Indoor Arena

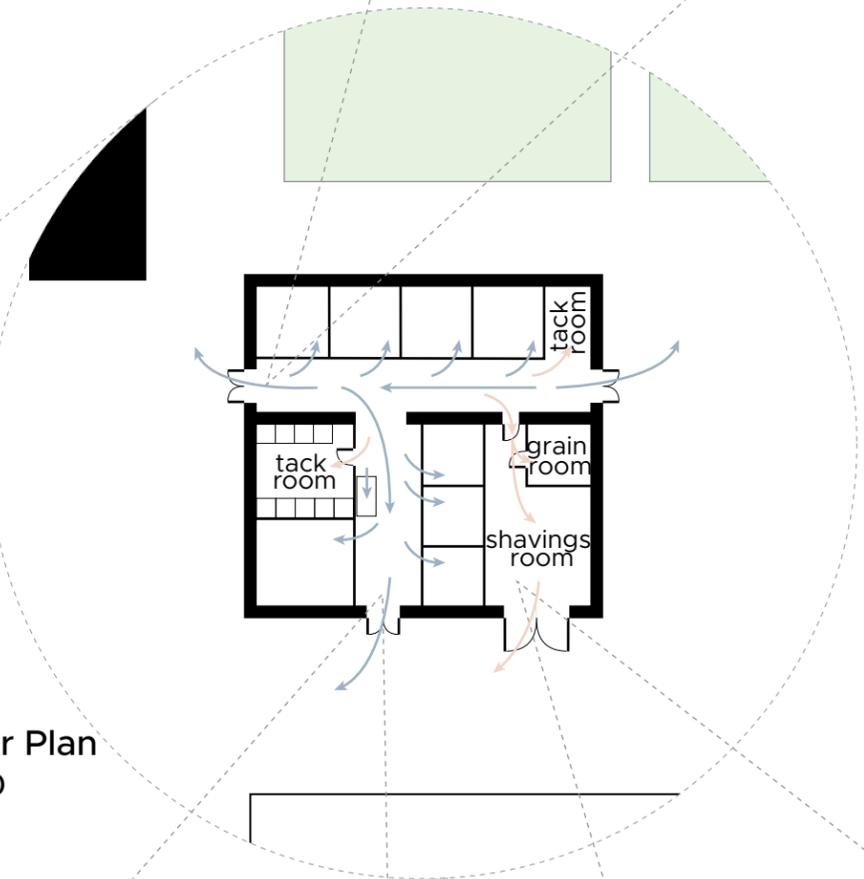
- 80x200ft
- steel structure
- non-insulated
- metal roof and siding
- daylight
- windows for airflow



8 Stall Barn

- 9x11ft stalls
- 9ft ceilings
- 9ft wide hallways
- bars on stalls to allow for air circulation
- 'T' shape hallway
- mass timber structure

Floor Plan 1:400



Physical Therapy

- TheraPlate
- infrared light
- improve circulation, relieve joint pain, reduce inflammation



Feed & Bedding

- close access to all stalls
- hay and grain all stored in one palce
- hay loft above



PMC Performance Horses

Val Caron, ON

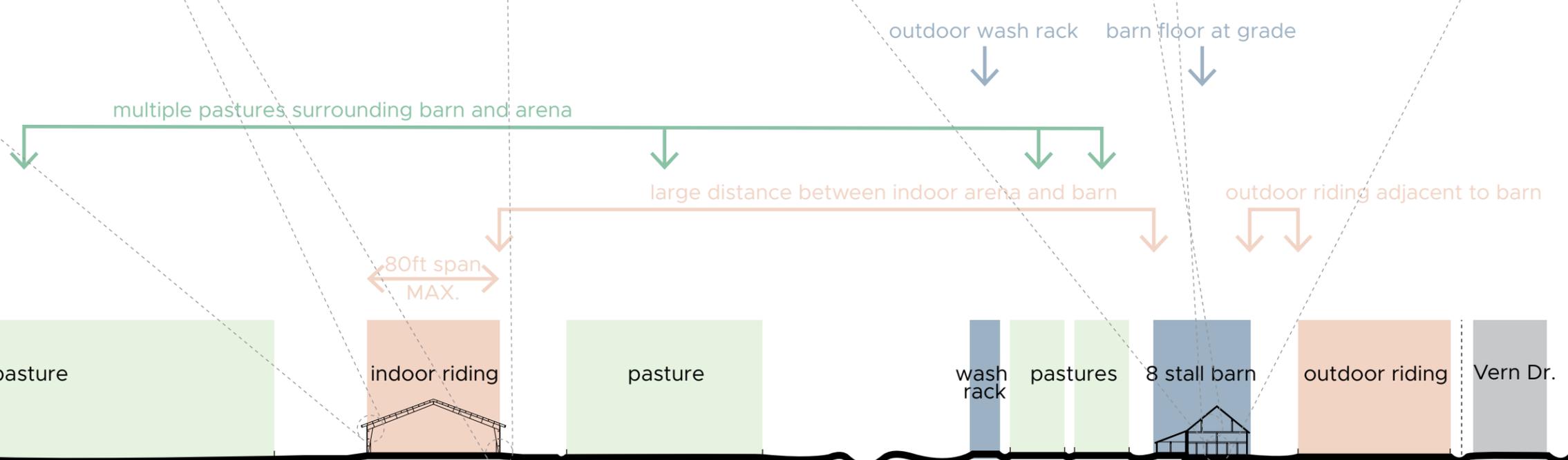
Figure 8.9: PMC Performance Horses case study site section.

However, there is a large disconnect between the barn and the arena, in both the language that the structural systems are speaking and the physical distance between the buildings, which is not conducive to the northern climate.

Large Span Steel Structural System



Mass Timber Post and Beam Structural System

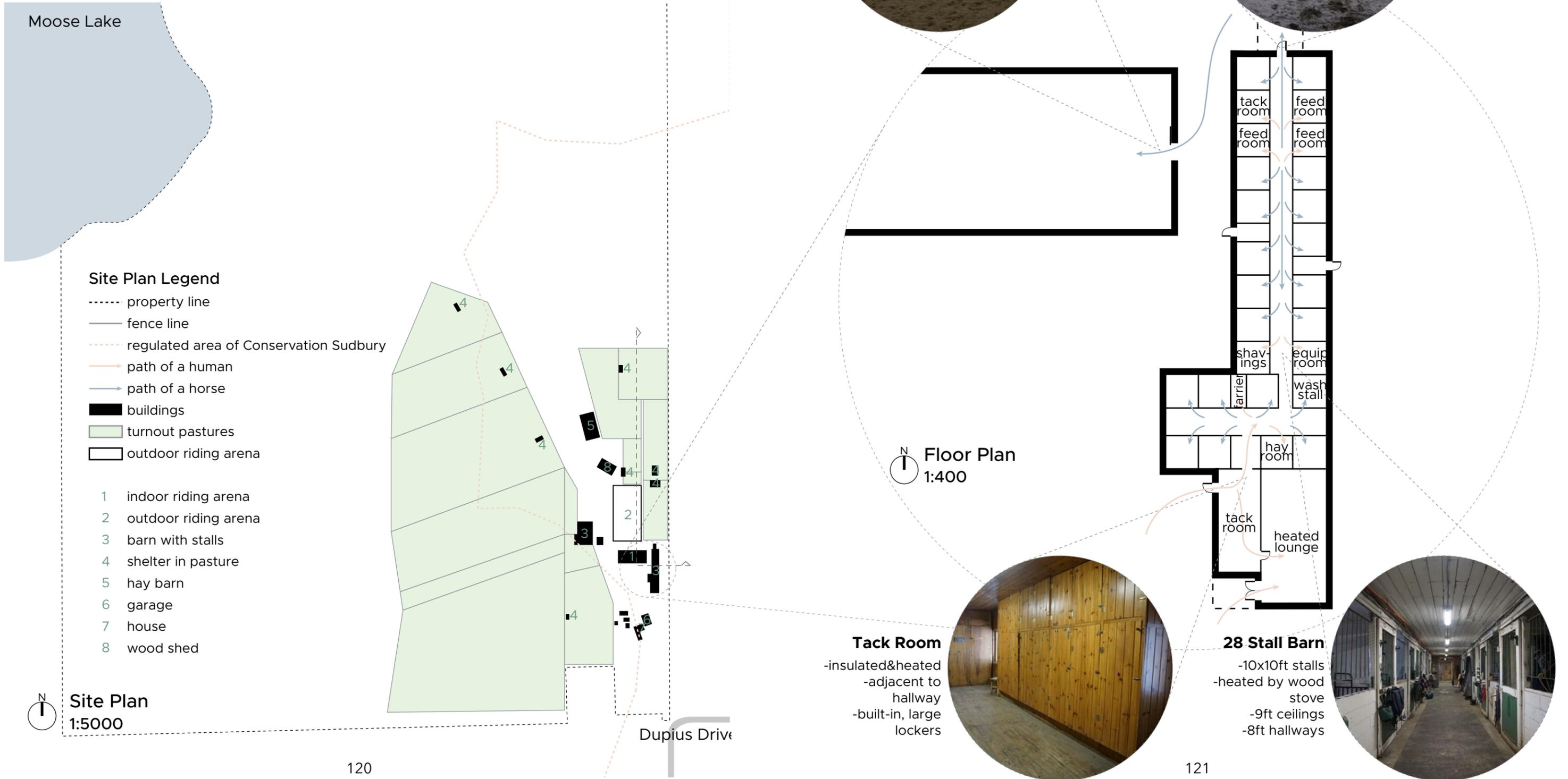


Pine Ridge Ranch

Hanmer, ON

Pine Ridge Ranch in Hanmer is a bigger facility at almost forty stalls, whereas most facilities in Greater Sudbury have around twenty stalls. The barns are surrounded by an abundance of pastures with shelters. Both the indoor and the outdoor arenas are in close proximity to the barn, however they are not directly connected.

Figure 8.10-8.11:
Pine Ridge Ranch
case study.



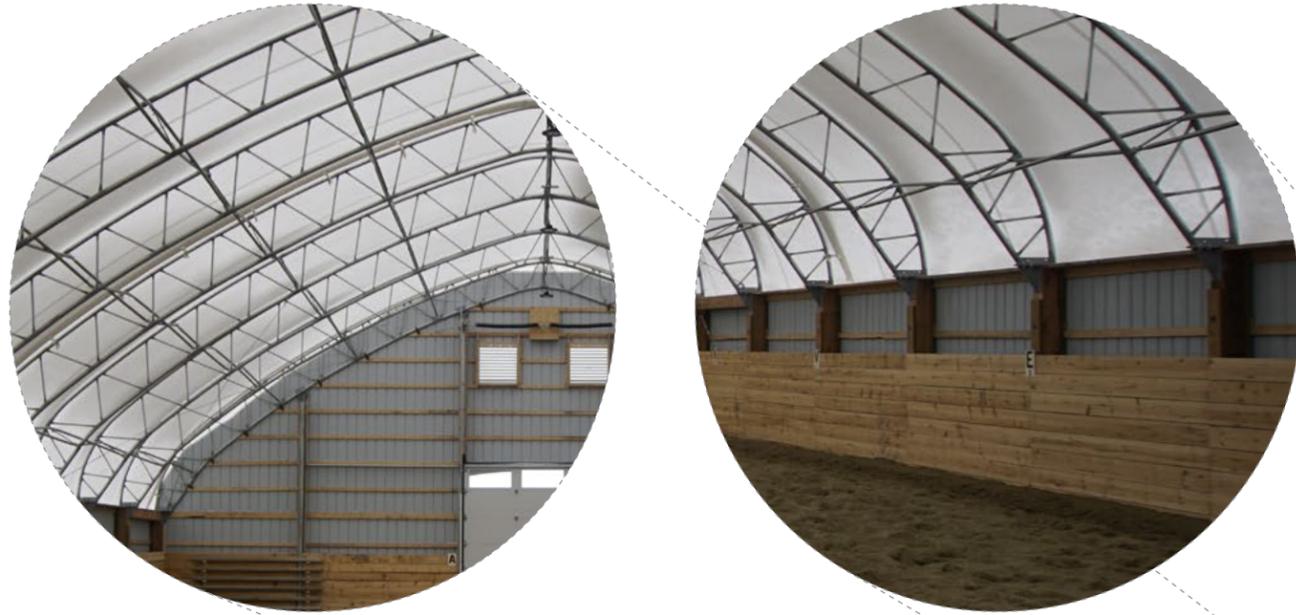
Pine Ridge Ranch

Hanmer, ON

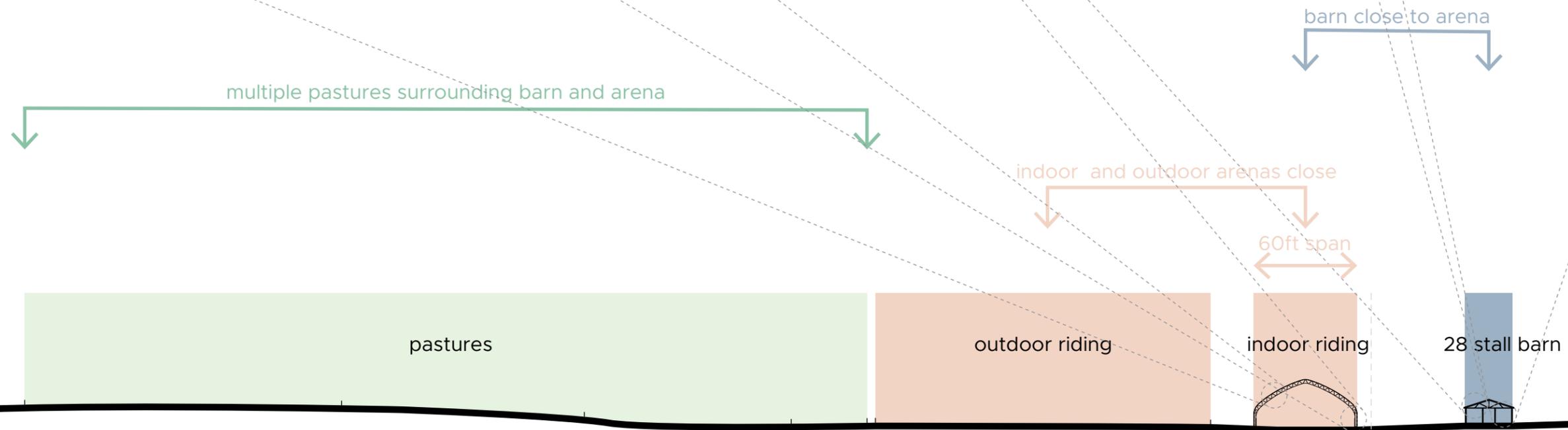
Figure 8.12: Pine Ridge Ranch case study site section.

The arena is new, finished in 2019, and is using a mass timber wall system, with a steel truss barrel roof that is covered by a canvas material. The canvas is great for shedding snow, as well as it allows for diffused daylight in the arena.

Large Span Mass Timber Columns and Steel Truss Structural System



Timber Post and Beam Structural System



Woodley Quarter Horses

Chelmsford, ON

Woodley Quarter Horses a small, private facility that has a great connection between the arena and the barn. The facility also has a great system for organizing their equipment and tack while being efficient with their use of space. The saddles and other tack are condensed into one area, and there are small personal lockers for other equipment and supplies. This is different than the usual layout of equipment storage, normally people get one locker to store all of their belongings.

Figure 8.13-8.14:
Woodley Quarter
Horses case study.



Indoor Arena

- 70x120ft
- steel structure
- steel truss and canvas roof system
- non-insulated



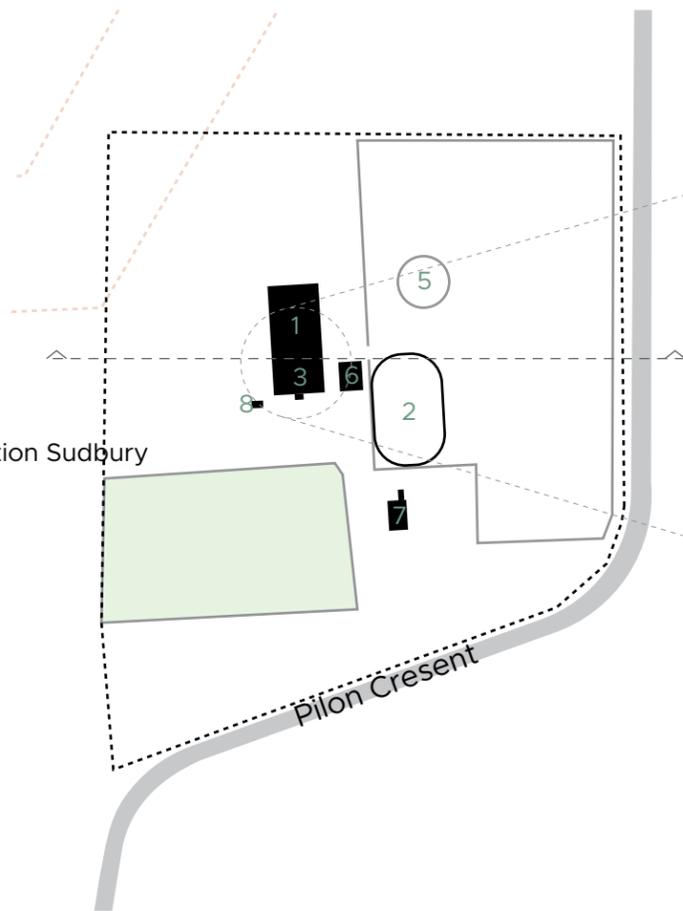
Wash Area

- indoors
- hot water
- good floor drainage

Site Plan Legend

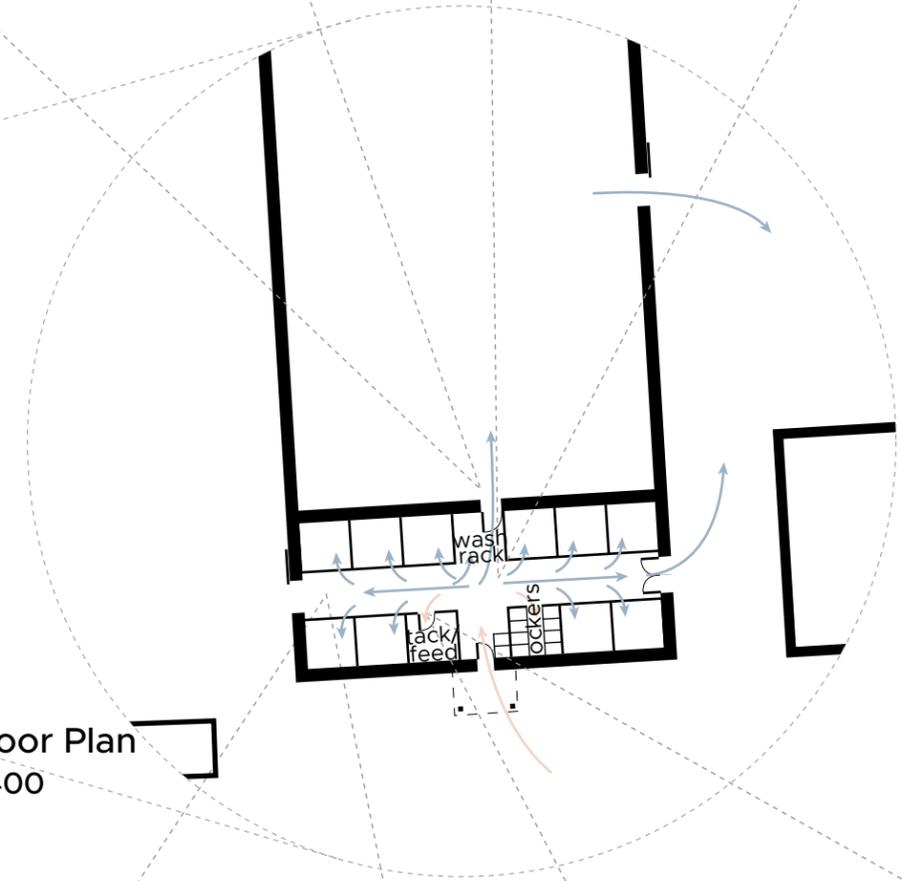
- property line
- fence line
- regulated area of Conservation Sudbury
- path of a human
- path of a horse
- buildings
- turnout pastures
- outdoor riding arena

- 1 indoor riding arena
- 2 outdoor riding arena
- 3 barn with stalls
- 4 shelter in pasture
- 5 round pen
- 6 garage
- 7 house
- 8 storage shed



Site Plan
1:3000

Floor Plan
1:400



10 Stall Barn

- 9x9.5ft stalls
- 8.5ft ceilings
- 10ft hallways



Tack Rooms

- efficient saddle organization & storage
- saddles in one room
- personal lockers in another room



Woodley Quarter Horses

Chelmsford, ON

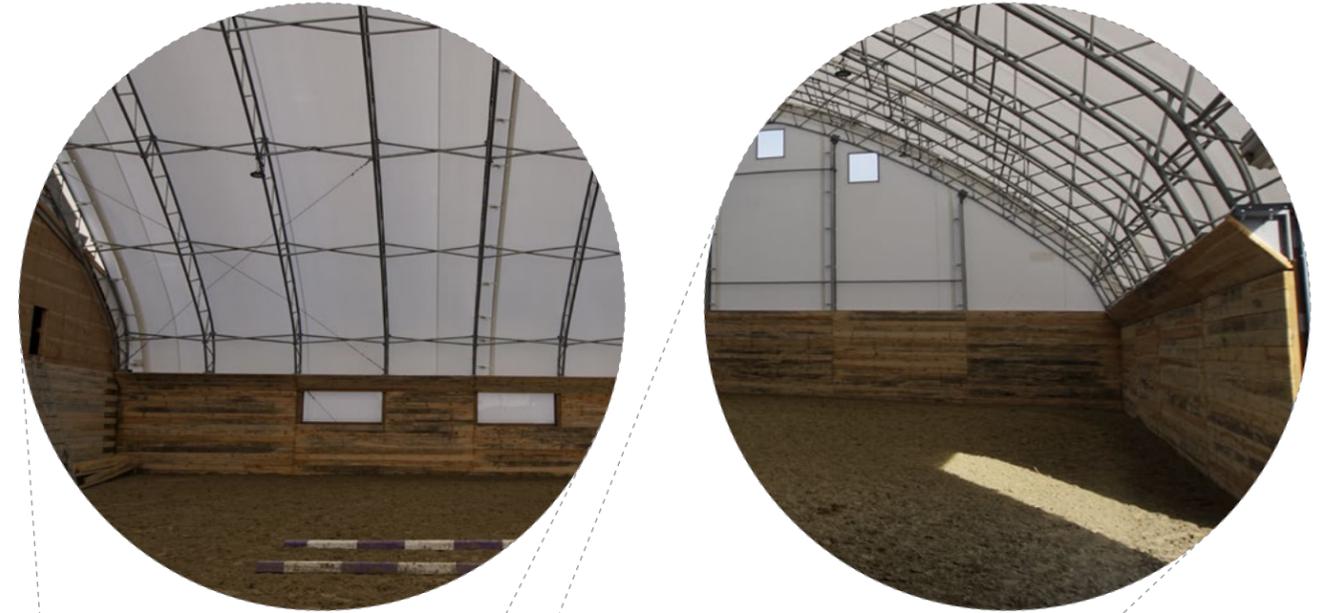
Figure 8.15: Woodley Quarter Horses case study site section.

The structural system of the barn is a mass timber post and beam system with diagonal cross bracing. The arena is the same type as Pine Ridge Ranch with the steel trusses and canvas roof.

Mass Timber Post and Beam Structural System



Large Span Mass Timber Columns and Steel Truss Structural System



one area of pastures

potential for more pastures

indoor and outdoor arenas close

70ft span

Pilon Cres.

pastures

indoor riding

outdoor riding

Pilon Cres.

Site Section
1:1000

126

127

Colorado House

Valle de Bravo, Mexico

Molo Design

This small house emphasizes its verticality in a flat landscape. On the main level is a one stall barn and above it is a small living area for the humans.¹ This project demonstrates a very direct connection between the horse and the human. It also creates a sense of safety and security for both the horse and human by having them live in such close quarters. This house focuses on the housing of the horse; the human arrives first at the barn and then proceeds upstairs to the living space for the human.

Figure 8.16-8.18:
Colorado House.
Photographs from
"Architecture of
Snow - Colorado
House," Molo Design,
accessed March 12,
2021

¹ "Architecture of Snow - Colorado House," Molo Design, accessed March 12, 2021.



High Desert Horse Barn

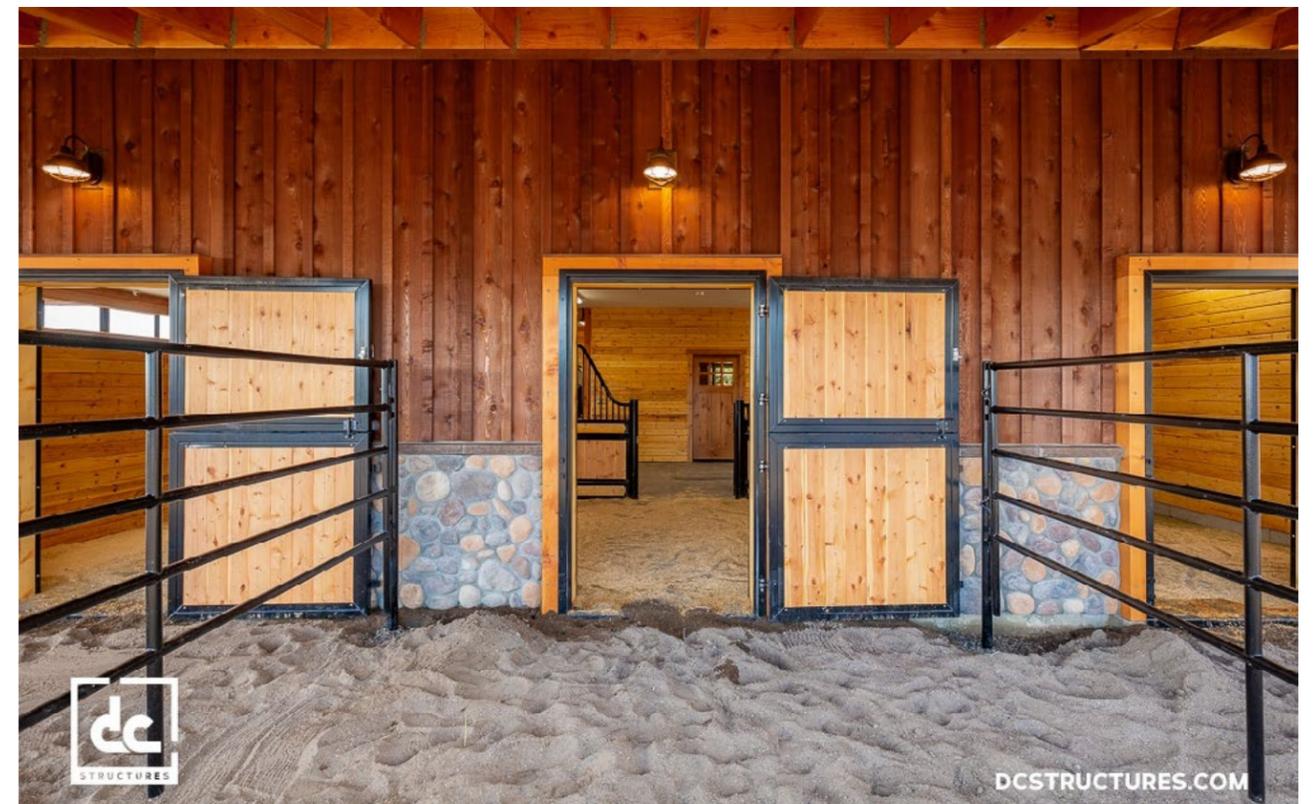
Bend, Oregon

DC Structures

This barn offers the same conditions to the horses as it does to the humans. The stalls on the main floor open up to outdoor semi covered turnout for the horses, providing them with free range of indoor, outdoor covered, or outdoor spaces. On the floor above is a space for the humans with the same sort of conditions with a balcony coming off the side of the building. There are also shared spaces on the main floor to provide area for caring for and bonding with the horses.¹

¹ "High Desert Horse Barn Kit," DC Structures, accessed March 12, 2021.

Figure 8.19-8.21:
High Desert Horse
Barn. Photographs
from "High Desert
Horse Barn Kit," DC
Structures, accessed
March 12, 2021.



El Mirador House

Valle de Bravo, Mexico

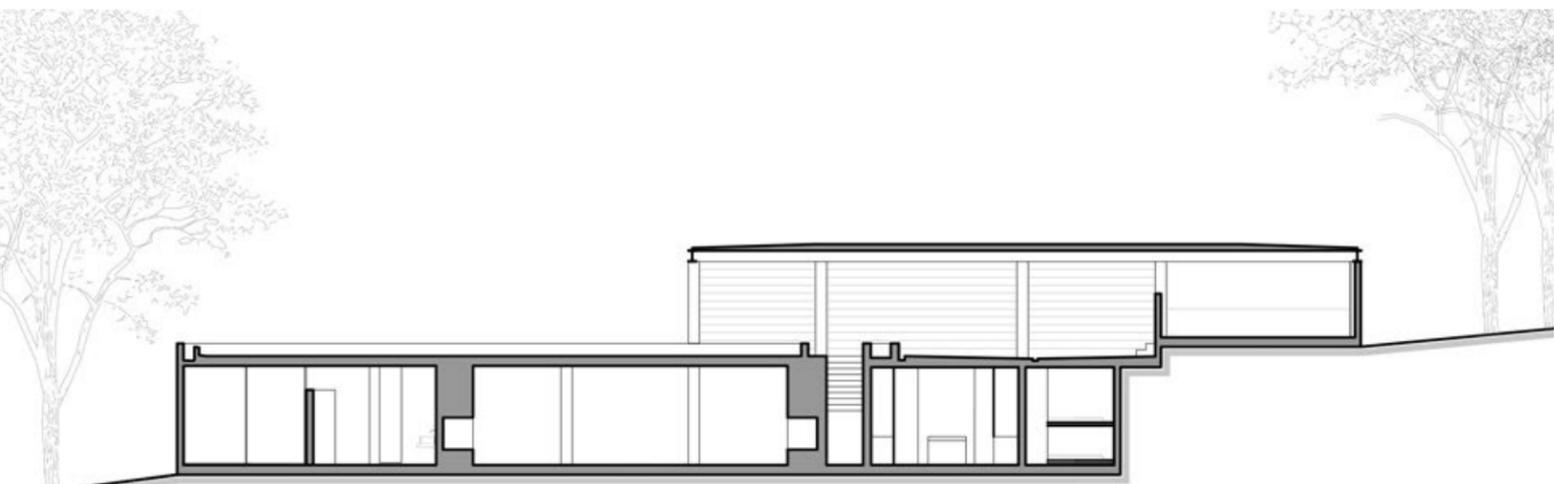
CC Arquitectos

2013

This residence begins to demonstrate a direct correlation and relationship between the human residential and equine residential areas. The house is built into the side of the mountain with the stable above. This brings the horse stalls up above the road level and brings a sense of importance to the house for the horse. The living areas for the horse and the human have very similar conditions. The rooms direct your view to one side which is open and overlooking the valley and a beautiful view.¹

¹ "Railway Sleeper Stable Tops El Mirador House in Mexico," Dezeen, January 10, 2016.

Figure 8.22-8.24:
El Mirador House.
Photographs and
Drawing from
"Railway Sleeper
Stable Tops El
Mirador House in
Mexico," Dezeen,
2016.



Ingalls Skating Rink

Yale University, New Haven, Connecticut

Eero Saarinen

1958

This arena is 85x200ft and has a sweeping dome roof known as the Yale whale. This roof system creates a “natural sense of flow and polish”¹ in the arena. The ridge beam is 290ft long and made out of reinforced concrete that symbolizes the back bone of the whale and the structure. The ceiling reaches its highest point at 75ft at the center of the arena. It uses a cable net structure giving it the double curve, which runs cable from the center beam to the outer edge of this building. The roof system is simple, yet elegant and ground breaking.²

1 “David S. Ingalls Skating Rink by Eero Saarinen,” ArchDaily, September 20, 2011, <https://www.archdaily.com/157708/ad-classics-david-s-ingalls-skating-rink-eero-saarinen>.

2 Ibid.

Figure 8.25-8.27:
Ingalls Skating Rink.
Photographs from
“David S. Ingalls
Skating Rink by Eero
Saarinen,” ArchDaily,
September 20, 2011.



Adanac Ski Patrol + Rental Facility

Sudbury, Ontario

3rdLine.Studio / Tim James

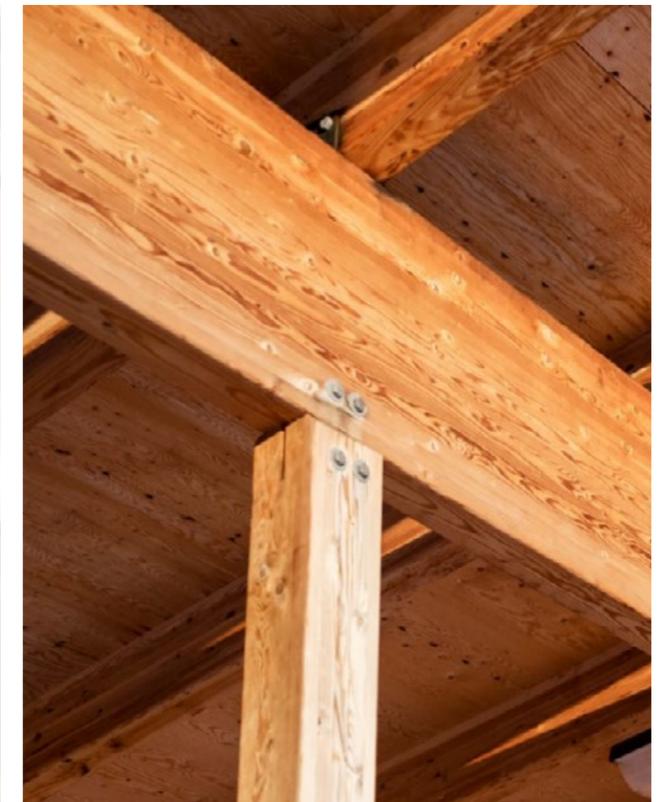
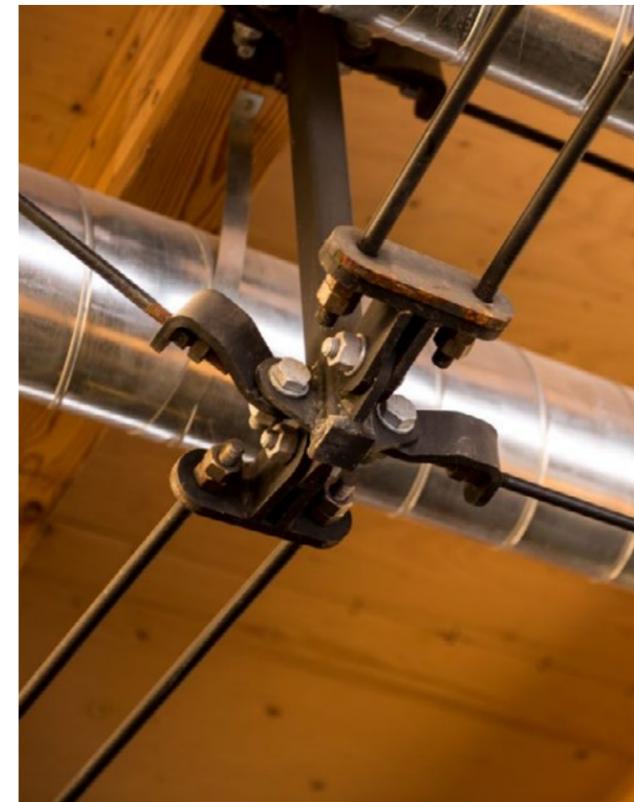
2010

The goal of this ski facility was to “provide a form/space that references the dynamic activities that take place at the ski hill.”¹ This is a very simple single sloped roof made out of a glulam beam structure. The detail on the structure with the cantilevering roof and the steel rods and cables makes reference to skiers on the hill.² This steel rod and cable system is a very simple way of supporting the glulam beams along their length. The rod acts as the compression member pushing up on the center of the beam, and the cables are in tension.

1 3rdLine.Studio, “Adanac Ski Patrol + Rental Facility,” 2010, <https://3rdline.studio/works/adanac-ski-patrol-rental-facility/>.

2 Ibid.

Figure 8.28-8.31:
Adanac Ski Patrol
+ Rental Facility.
Photographs from
3rdLine.Studio,
“Adanac Ski Patrol +
Rental Facility,” 2010.



The Pinch Library and Community Center

Shuanghe Village, Yunnan Province, China

John Lin + Olivier Ottevaere

2014

The design of this library responds to the shape of the landscape in the mountain valley village. It was built after an earthquake in September 2012 where most of the village was destroyed. The library bridges between the new memorial plaza and the rebuilt city. The roof rises to a point as tribute to the rebuild.¹ One end of the truss slowly rises as the trusses progress to the other end of the building. This makes the building feel like it is in motion and it has a poetic nature hinting at the rebuild and lifting up of the village.

¹ "The Pinch Library And Community Center / John Lin + Olivier Ottevaere," ArchDaily, August 25, 2019, <https://www.archdaily.com/499654/the-pinch-library-and-community-center-olivier-ottevaere-john-lin>

Figure 8.32-8.34: The Pinch Library and Community Center. Photographs from "The Pinch Library And Community Center / John Lin + Olivier Ottevaere," ArchDaily, August 25, 2019.



Richmond Olympic Oval

Richmond, Vancouver, Canada

Cannon Design

2010

This 100x200ft Olympic Oval in Vancouver houses many indoor and outdoor sports, shopping, and other services, creating a destination for many people. The building shape takes inspiration from the heron which is the symbol of the city of Richmond. The roof begins to take a feathered shape and the large roof overhangs create outdoor gathering spaces. The heron also inspires the three themes of the building which are flow, flight and fusion. The building sets an example for innovative sustainable design in large recreational facilities. The building achieved LEED Silver certification and uses many sustainable design strategies such as rain water collection, heat gain collection, using salvaged wood materials, using the trees that were felled on the site, low VOC finishes, and many more.¹

¹ "Richmond Olympic Oval / Cannon Design," ArchDaily, February 12, 2010, <https://www.archdaily.com/49705/winter-olympics-2010-vancouver-skating-richmond-olympic-oval-cannon-design>.

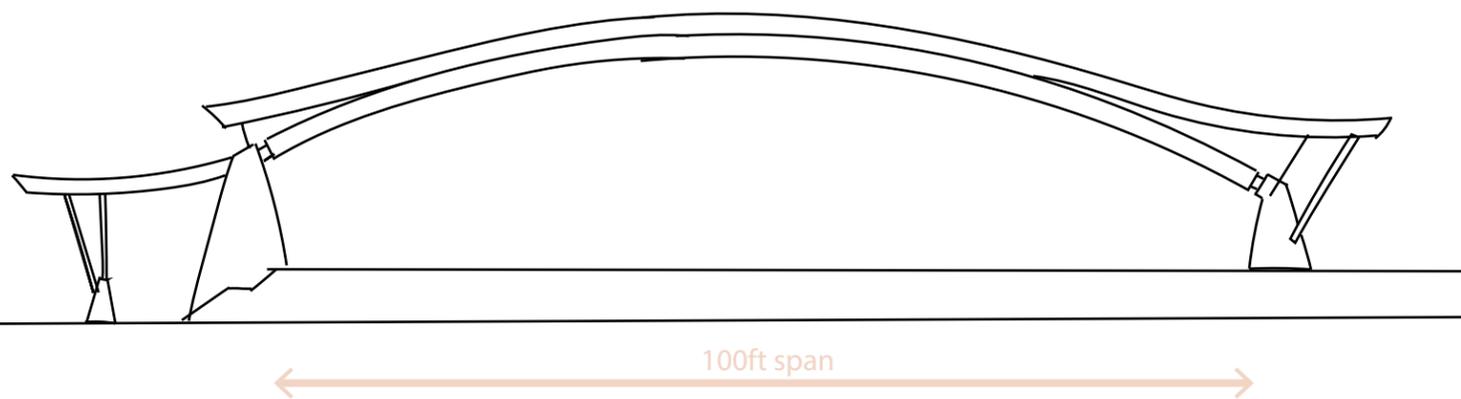
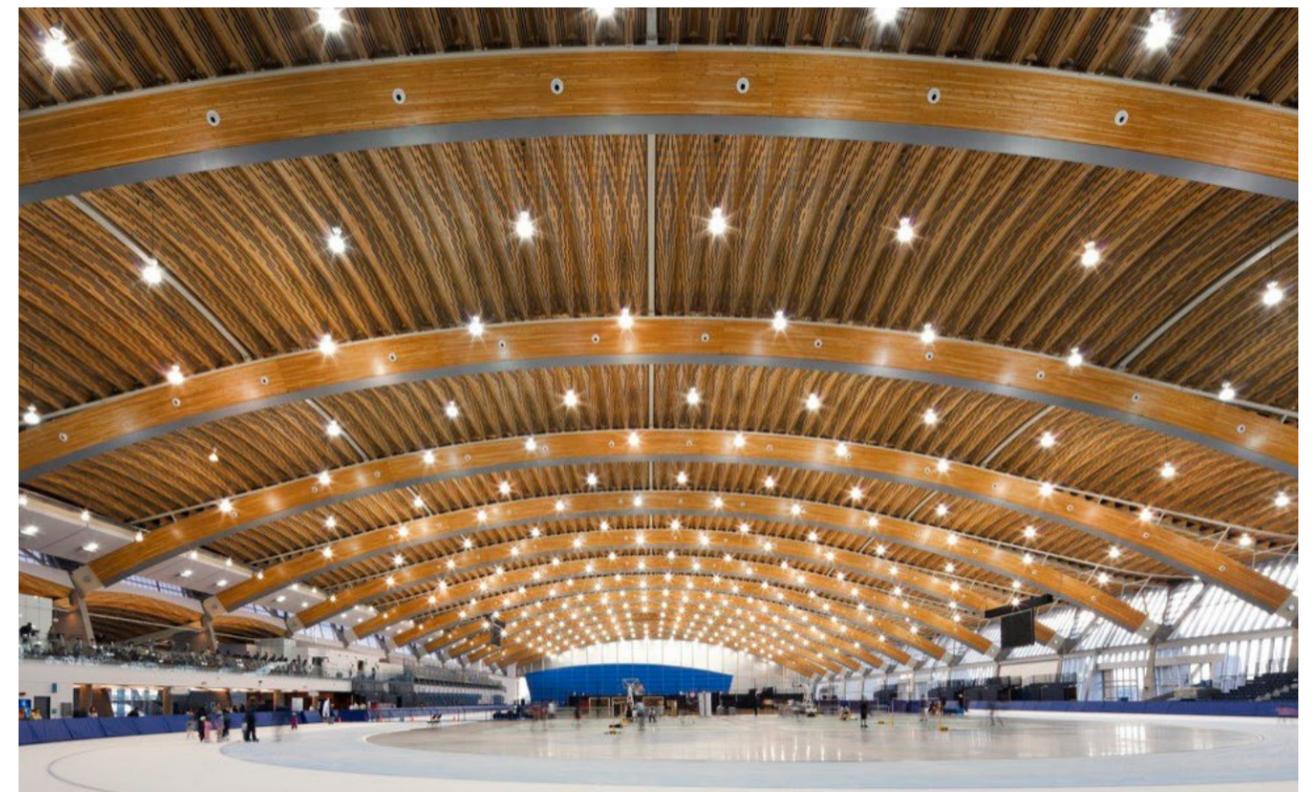
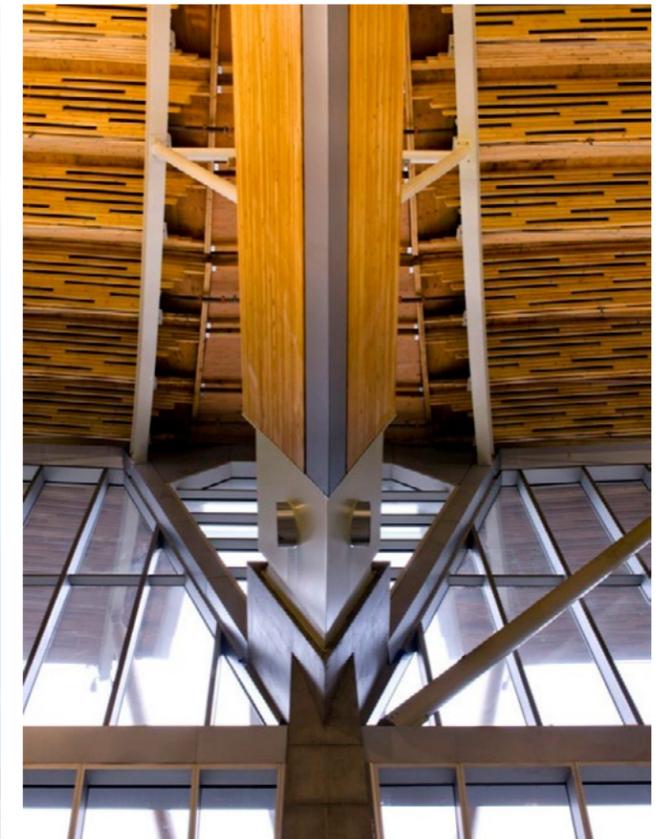
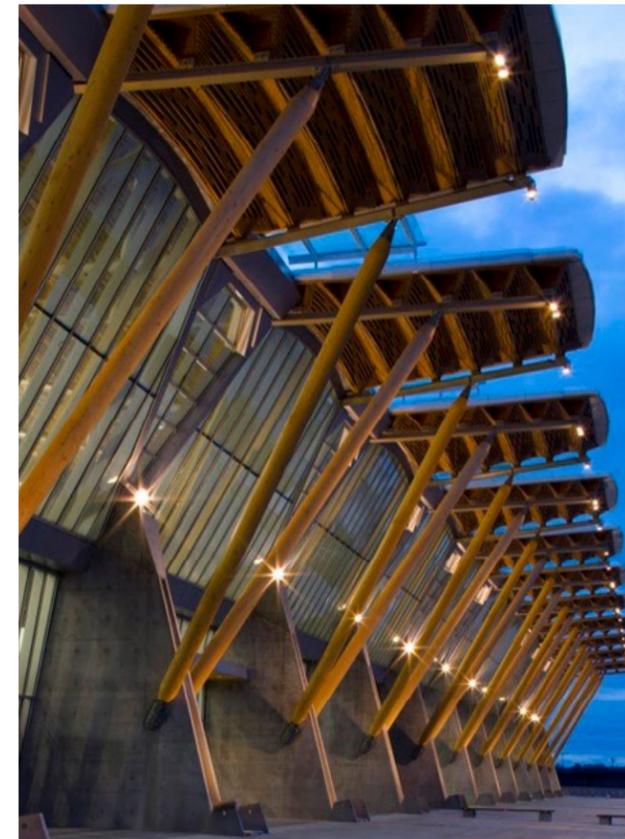


Figure 8.35 (below):
Richmond Olympic
Oval Structure.
Diagram by author
Nov 2020.

Figure 8.36-
8.38 (right side):
Richmond Olympic
Oval. Photographs
from "Richmond
Olympic Oval /
Cannon Design,"
ArchDaily, February
12, 2010.



Freeman's School Swimming Pool

Surrey, United Kingdom

Hawkins/Brown

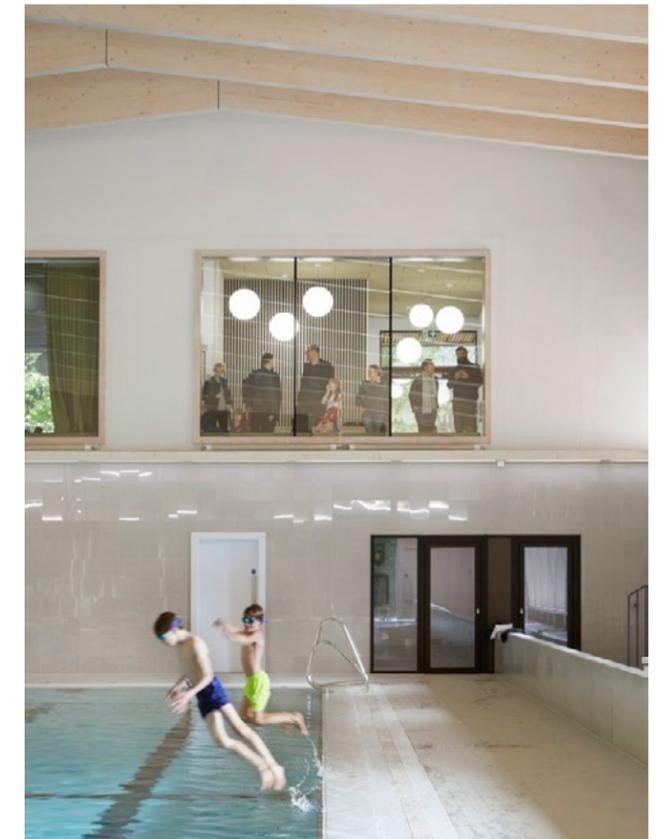
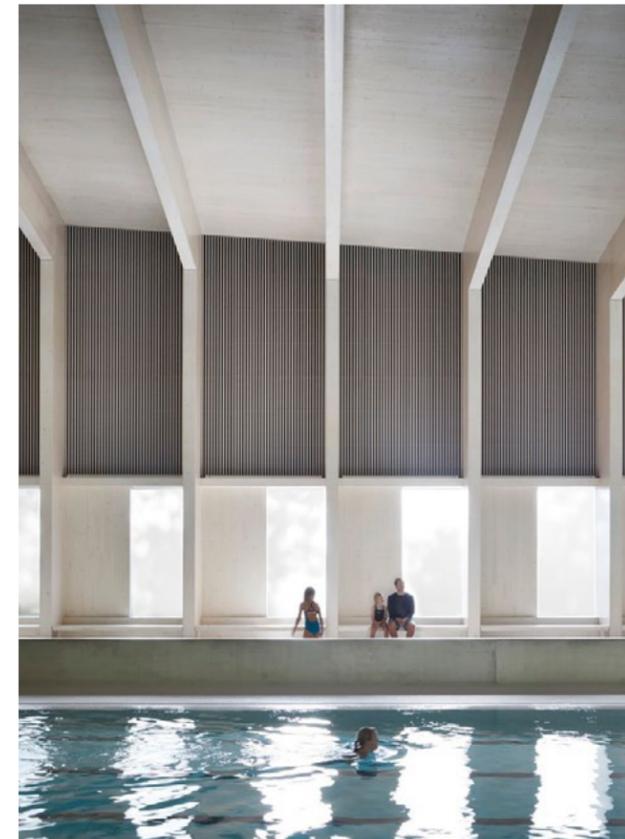
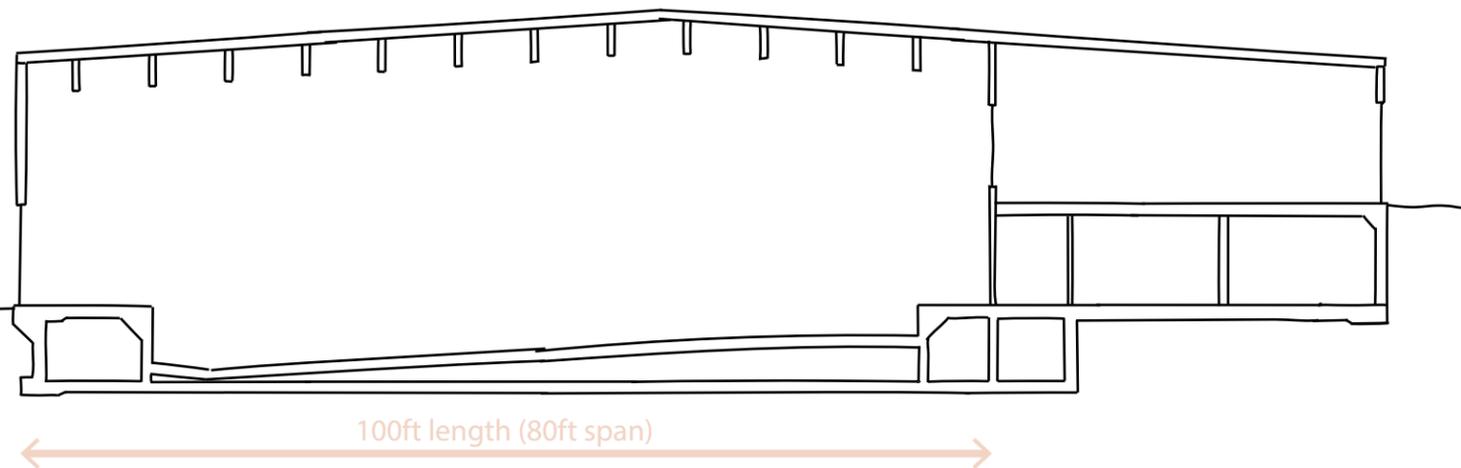
2017

This six lane swimming pool is 80x100ft which uses state-of-the-art mass timber construction. The main structural frame of the building uses glulam beams and is braced with CLT panels. With this structural system, no additional interior finishes such as drywall are required. The internal faces of the wood are stained white to create the desired experience in the space. The wood construction is "resilient, a thermal insulator and corrosion resistant."¹

Figure 8.39 (below):
Freeman's School
Swimming Pool
Structure. Diagram by
author Nov 2020.

Figure 8.40-
8.42 (right side):
Freeman's School
Swimming Pool.
Photographs from
"Freeman's School
Swimming Pool /
Hawkins\Brown,"
ArchDaily, December
18, 2017.

¹ "Freeman's School Swimming Pool / Hawkins\Brown," ArchDaily, December 18, 2017, <https://www.archdaily.com/885514/freemens-school-swimming-pool-hawkins-brown>.



Congress and Exhibition Center

Agordo, Italy

Studio Botter + Studio Bressan

2018

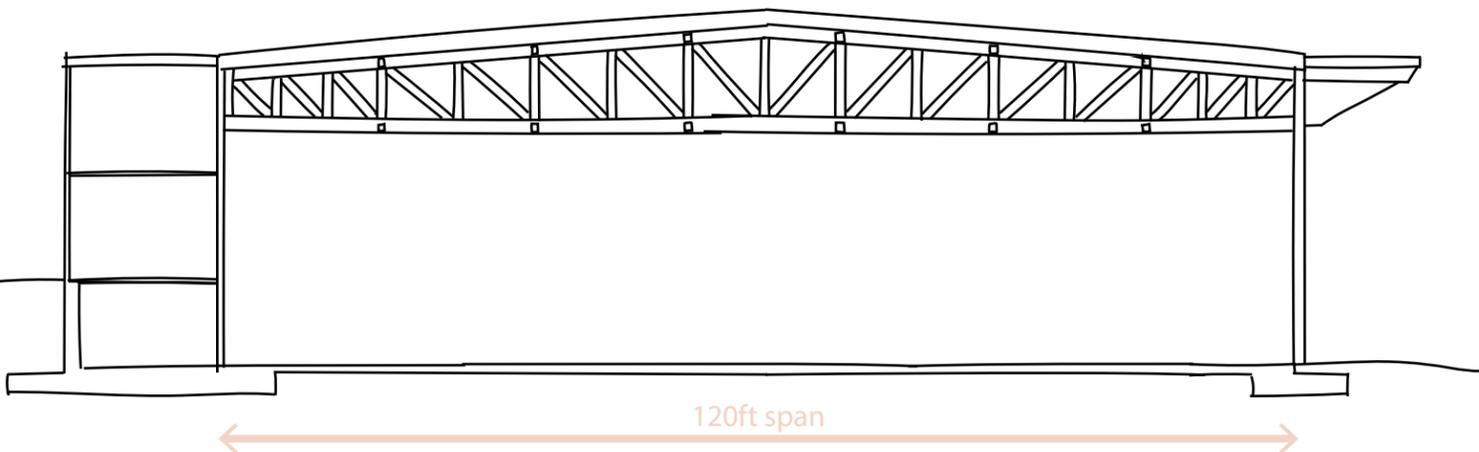
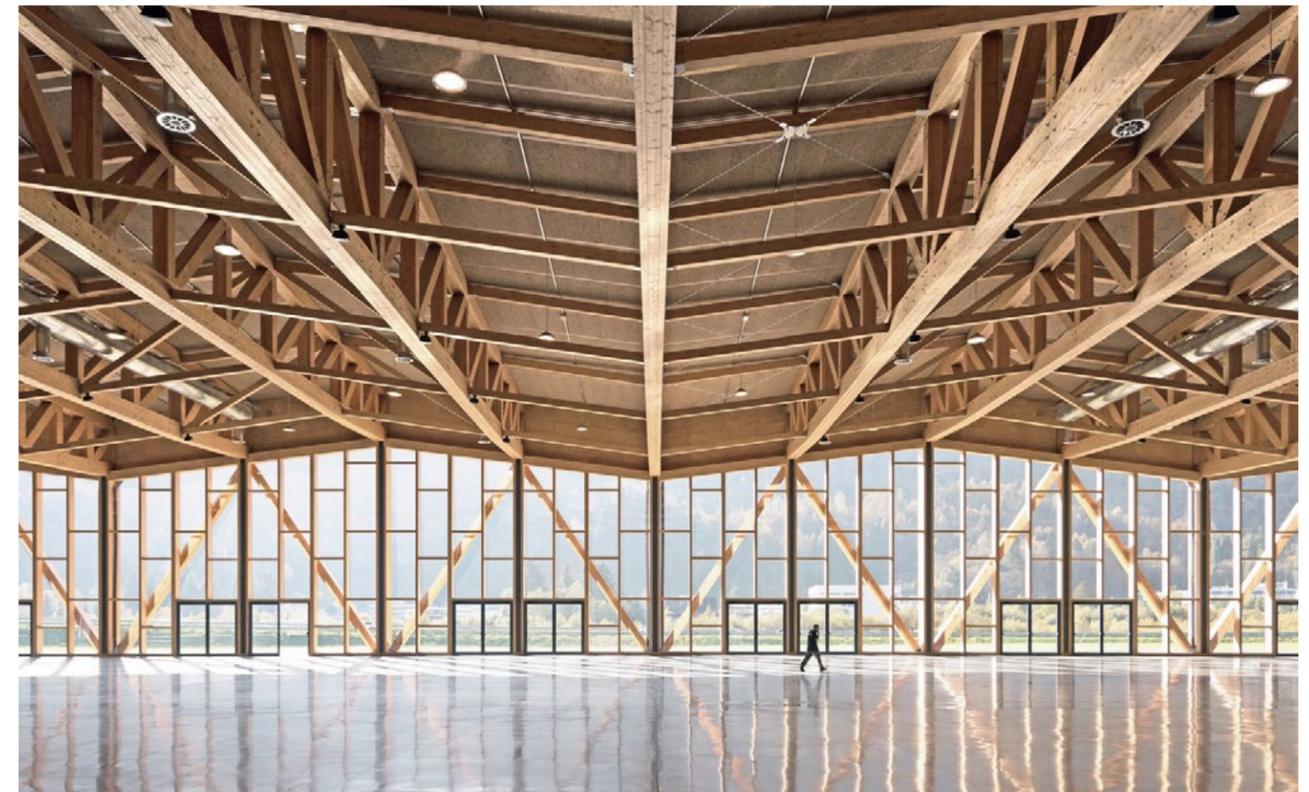
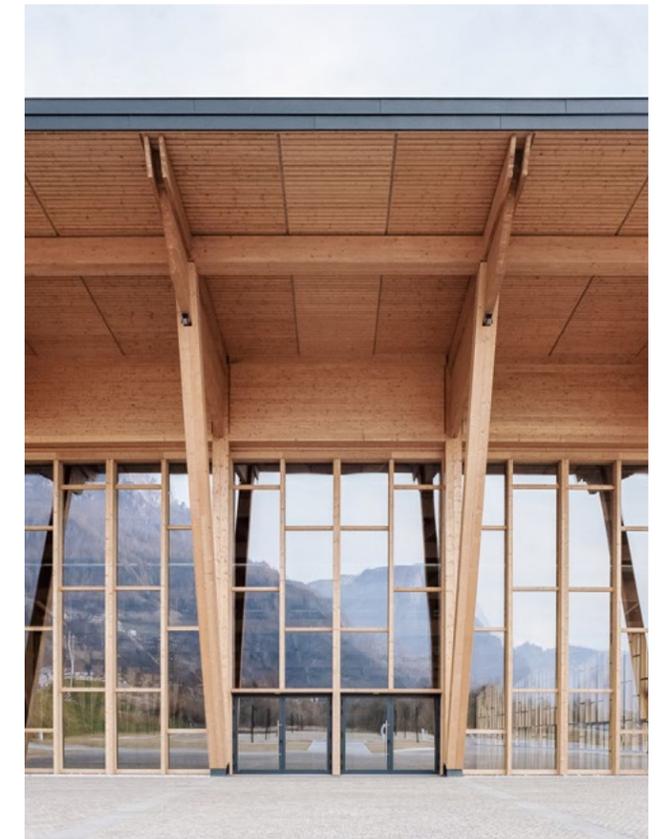
This open concept building holds many different activities such as community events, shows, and entertainment. This building achieves a 120ft span. The structure is composed of large timber framing and cross bracing. Wood was chosen to be environmentally conscious as well as to speak a similar language to the surrounding buildings.¹ The repeated pitched roofs with large roof overhangs protect the entrances and wood material from the elements, and it acts as a sun shade for the interior of the building so it does not overheat.²

1 "Congress and Exhibition Center / Studio Botter + Studio Bressan," ArchDaily, September 25, 2019, <https://www.archdaily.com/925353/congress-and-exhibition-center-studio-botter-plus-studio-bressan>.

2 "Timber Trusses Support the Congress and Exhibition Centre Roof in Italy," Dezeen, October 4, 2019, <https://www.dezeen.com/2019/10/04/congress-and-exhibition-centre-bressan-botter-italy/>.

Figure 8.43 (below): Congress and Exhibition Center Structure. Diagram by author Nov 2020.

Figure 8.44-8.46 (right side): Congress and Exhibition Center. Photographs from "Congress and Exhibition Center / Studio Botter + Studio Bressan," ArchDaily, September 25, 2019.



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- ArchDaily. "David S. Ingalls Skating Rink by Eero Saarinen," September 20, 2011. <https://www.archdaily.com/157708/ad-classics-david-s-ingalls-skating-rink-eero-saarinen>.
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