

Mochik Ranch

Masterplanning & Architectural Design

A Development Package for The Sewa U'usim Community Partnership
in Service to the Pascua Yaqui Tribe

Prepared by: University of Arizona Masters of Architecture Studio 510E | July 12 2022



Yoeme Pueblo | Rio Yaqui | Sonora | circa 1927

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Photos Courtesy of Simmons Buntin, CAPLA

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Introduction: Horses that Heal

The Pascua Yaqui (or as they refer to themselves, the Yoeme, translated as "the people"), are indigenous to the lands of Sonora Mexico and Southern Arizona. Their ancestral homelands were located along the Rio Yaqui, and in part because of a desire to control this fertile land, the Yoeme have been subjected to forced migration, extermination, land grabbing, and repression of their culture by Spain, Mexico, and the United States. Today, nearly half of all the Yaqui people living in the state of Arizona reside in the greater Tucson area, refugees and immigrants or their descendants. At present there are four principal centers of Yaqui population in Tucson - Barrio Libre in South Tucson, Old Pascua in Tucson, Yoem Pueblo Marana, and New Pascua, 15 acres of federal trust reservation land.

The Yaqui communities in Tucson are well-established and have maintained their independence and cultural identity in spite of the challenges they have faced. Because of their dispersed settlement patterns in Southern Arizona, and because each of these settlements is encapsulated within a greater western settlement, maintaining cultural and traditional connections to one another, to the land, and to their ancestral heritage is a continual challenge. Additionally, few Yaqui own agricultural lands in Arizona, and border issues have made access to their ancestral pueblos along the Rio Yaqui difficult. To provide a spiritual and social amenity - a place where tribal members can retreat, connect - and to secure cultural, traditional and self-actualizing agricultural and land resources for the tribe, the Pascua Yaqui Tribe purchased the 6,500-acre Mochik Ranch property in 1999. Mochik Ranch is a large multi-purpose ranch set in the drylands west of the Tucson metro area, located 11 miles northwest of New Pascua along a traditional route that links the Old Pascua and New Pascua.

Over the last several years, the Tribe's Health Services Division has made significant investments in the property. The ranch is operated by the Sewa U'usim Community Partnership, an arm of the Tribe's health department "grounded on the principles of providing a comprehensive array of quality care tailored to the diverse needs, individual preferences, cultural uniqueness, spirituality, and strengths of the Hiaki child and family." Central to the therapeutic functions at Mochik Ranch are equine therapy, horsemanship, and life skills programs. During their operation of the ranch, activities at the site have evolved to also include hands-on life skills and job skills options through planting and harvesting of traditional Sonora wheat, a greenhouse and hoop house for growing heirloom vegetables and cultural herbs and plants, and an aquaponics facility with the potential to raise tilapia and Yaqui Catfish.



Gathering on site to discuss the placement of a traditional adobe oven.



Equine therapy is central to the Ranch's function.



Water tank adorned with Deer Dancer.

Team

In 2019, a series of strategic planning sessions concluded that Mochik Ranch would be developed as a place for *promoting community wellness and cultural preservation, with emphasis on long-term sustainability*. To implement this plan, Tribal Health Services and the Sewa U'usim Community Partnership engaged Claudia Nelson, Director for The University of Arizona Native Peoples Technical Assistance Office (NPTAO) and Trent Teegerstrom, Associate Director for CALS Tribal Extension Programs and Ag Economics Extension Specialist, to explore all the land and use issues for this parcel including infrastructure, grazing, cultural preservation and equine therapy. In the fall of 2020, Laura Carr and Bo Yang from the College of Architecture, Planning and Landscape Architecture at the University of Arizona, were invited to meet with the team to discuss the possibilities for this property to be explored through interdisciplinary studio work.



Through this team effort and collaboration, advisors, consultants, students, and specialists have worked together in assisting Mochik Ranch under the leadership of the Sewa U'usim Community Partnership to realize the development of the ranch.

Timeline

Within the College of Architecture, Landscape Architecture, and Planning, there does not currently exist an interdisciplinary design studio or elective design studio outside of the students' required coursework to do a project of this nature. Additionally, the ranch is run by therapists, currently learning how to operate a ranch and take on development responsibilities. This presented a rather dynamic design environment in which all parties had to remain flexible and adaptable, and the project had to be broken up into manageable phases. To make this accommodation, the work for Mochik Ranch was distributed over three successive graduate studios beginning in Spring 2021 and concluding in Spring 2022. The work contained herein is from the Spring 2022 MArch 510E studio, and builds upon two previous semesters of work not included here.

2021 Spring

Team: MArch Studio ARC 510E | Laura Carr, Senior Lecturer, SOA
MLA Studio LAR 511 | Bo Yang, Professor, SLA

Outcomes:

- Establish design scope
- Explore range of services and programs available at the ranch
- Initiate a conversation of Cultural Specificity and how that might manifest in the built environment
- Explore concepts for articulating these ideas, values and expressions

2021 Fall

Team: MLA Studio LAR 611 | Bo Yang, Professor, SLA

Outcomes:

- Address watershed management
- Address herd and livestock bio-security and infrastructure
- Formalize site design; establish roads, building sites, agricultural zones

2022 Spring

Team: MArch Studio ARC 510E | Laura Carr, Senior Lecturer, SOA

Outcomes:

- Master Planning: phase two
- Life Skills + Agricultural Center design development

Ranch Performance Goals



Culture

Foster an environment that supports **cultural preservation** by applying traditional and technical knowledge to increase greenhouse programs and production, cultivation of traditional food crops, culturally significant plants and resources. Enable **knowledge transfer** across generations through making and sharing.



Wellbeing

Expand the **therapy programs** to new audiences within the Pascua Yaqui Tribe, such as displaced children, individuals with special needs, adults receiving behavioral services, elders, and veterans.



Resilience

Support an **integrated learning environment** of Agriculture and Applied Sciences Programs. Provide **hands-on experiences** of nature and agriculture to teach science, math, engineering, and technology (STEM).



Resource

Design the infrastructure needed to support these functions by creating a 20-acre master plan and construct the Mochik Ranch Life Skills Center and Agricultural Center. Create a **sense of place** that reflects culturally specific **tribal ownership** while also integrating with the forces of the site.

User Groups



Yoeme Elders

Yoeme elders are the keepers of wisdom. They transfer knowledge to younger generations through oral and making traditions. Program spaces must facilitate this cultural knowledge transfer.



Therapists

Sewa U'usim employs equine therapists, art therapists and traditional therapists to help children and families. Private spaces for therapy sessions is critical, as are public spaces for teaching and making.



Yoeme Families

Yoeme families use this facility for therapy, art, making cultural goods, hands-on learning, and community events. Due to the remoteness of the site and the distance between the ranch and reservation, spaces must be included for comfort, waiting, and wellbeing of the families that take part in the ranch's programs.



Ranch Staff (Agriculture, Equine, Maintenance)

Staff grow and harvest food crops for the Tribe. As Yoeme culture is rooted in agriculture and ecology, these individuals play an important role in hands-on education and stewardship of the land. They require spaces for planning, production and education.

Design Values

Design for Equitable Communities: the hummingbird brings power blessings and protection for all people everywhere.

Equity is essential to the health of any cooperative exchange between traditional wisdom and a modern world. The facility and site designs are intended to extend their reach to include and represent all Yoeme people, providing opportunity for community engagement and education towards a resilient future.

Economy: the preservation of culture is a long term investment.

Designs feature elements included for their value in preserving culture and tradition including: the cultivation, harvesting and processing of Sonoran Wheat done in the traditional ways; growing Carrizo for construction of and yearly maintenance of traditional ramadas; inclusion of outdoor kitchens and meditation gardens; using low tech systems and building typologies for ease of maintenance and construction.

Design for Integration: the flower represent the blessings of the Enchanted World towards the Spirit of the Deer.

The Flower World is honored with concepts rooted in purpose; programs designed for engagement; architecture that reflects connection to place; moments of culturally specific expression; resource mindfulness that places the highest value on social + economic + environmentally responsive designs.

Ecosystems: the cottonwood is an indicator of the health of the entire ecosystem and is sacred to the Yaqui.

Plans feature native vegetation and wildlife intermixed with traditional crops and livestock. Bio-secure boundaries are strategically placed to protect agricultural functions and the natural desert from disease, pollutants and habitat degradation.

Water: the Rio Yaqui is the source of life.

The current ranch site is subject to flooding. The master plan design replaces levees and diversions with bioswales, retention and detention basins as well as active water harvesting systems. Natural areas are protected from agricultural run-off by these features.

Design for Resources: stewardship is a spiritual practice.

Indigenous communities value ephemerality over permanence. The acts of repairing, replenishing, reusing, re-purposing and interacting with the built environment is an expression of that. This is most commonly seen in caring for the ramada - each year the old Carrizo is removed and re-applied.

Well-being: the Yaqui are outdoor people.

The Yaqui believe that the health of the land ties directly to the health of the people. The ranch function leverages this - creating a variety of social, cultural, economic, psychological and physical experiences that take place in the landscape.

Energy: take only what you need.

Proposed designs aim to lower energy consumption by being site-, climate-, and form-responsive first, then aim to utilize passive strategies, and last, supplement with renewable energy sources whenever possible.

Design for Change: the Pascua Yaqui were never conquered.

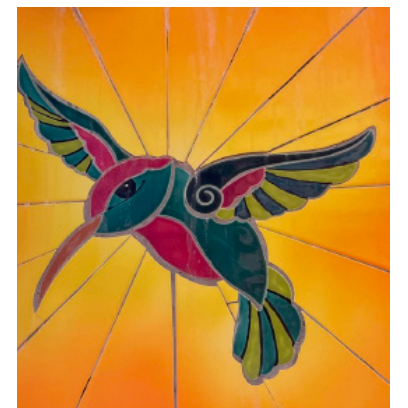
Efforts such as raising Tilapia as part of an aquaponics gardening system, establishing a Yaqui Catfish hatchery, growing traditional crops, and facilitating 4-H programs and STEM classes all enhance the resilience of the Yaqui of Arizona.

Discovery: culture is a living practice.

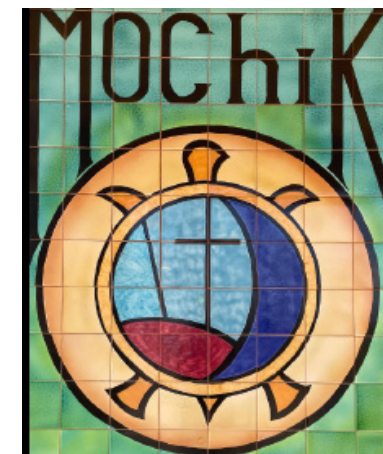
Projects feature culturally specific elements such as cottonwood trees, water, ramadas, art, maker spaces, and outdoor kitchens to engage youth in their culture as they experience the ranch.



Pascua masks are used at the Pascua, or Easter, storytelling ceremonies.



The hummingbird is a spiritual bird that comes from the "Sewa Ania" Flower World and is a messenger with powerful blessing and



The Mochik symbolizes perseverance and strength to the Yoeme. In this image, Mochik is inscribed with a cross, indicating the acceptance of Catholicism into the traditional belief system.



Carrizo, or Giant Reed, harvested from the banks of the Rio Yaqui used to make baskets, mats, sandals, as well as ramadas and shelters.

Site | Location + Existing Conditions



Existing Site Plan



Yaqui Country Context Map - NTS



Greater Tucson Vicinity Map - NTS



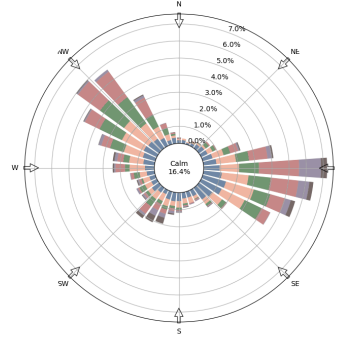
- 1 Hoop House, Aquaponics Greenhouse And In-Earth Garden Demonstration Lab
- 2 Administration + Therapy Offices, Staff Parking, Staging Yard
- 3 Utility Yard - Main Power, Well, Water Tanks, Hay Storage, Equipment Storage
- 4 Pastures, Tack And Staging
- 5 Therapy Round Pen + Entrance To The Horse Trail
- 6 Feast House + Feast Circle, Visitor Parking
- 7 Horses + Livestock, Group Therapy Pens
- 8 Sonoran Wheat Fields
- 9 Dusty Flats Residential Area, Ranch Manager Residence
- 10 Perennial Clay Pond



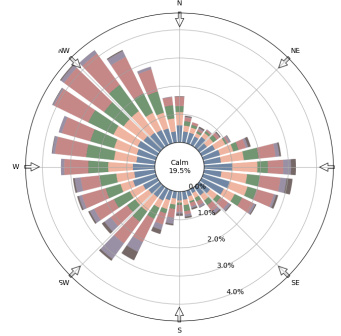
Site Forces

Wind

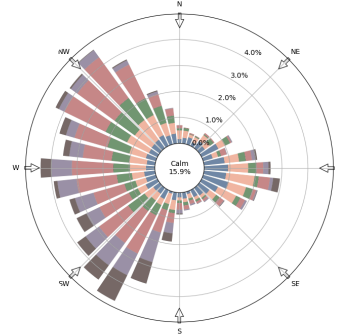
Winter | January



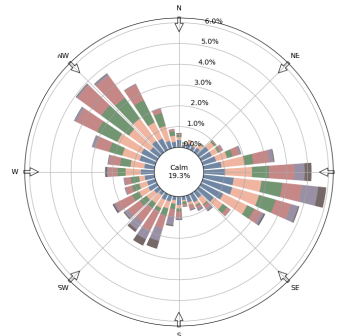
Summer | July



Spring | April

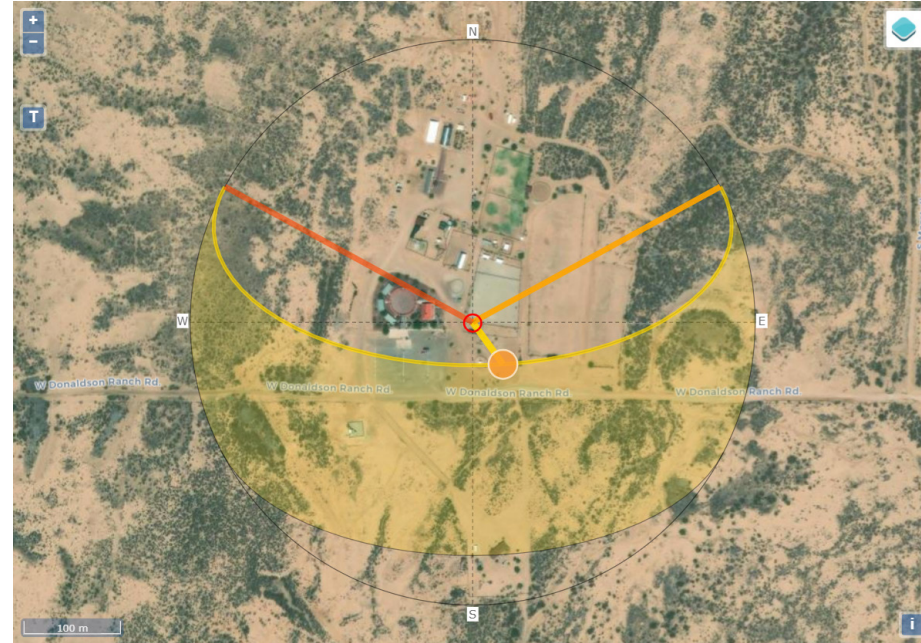


Fall | October

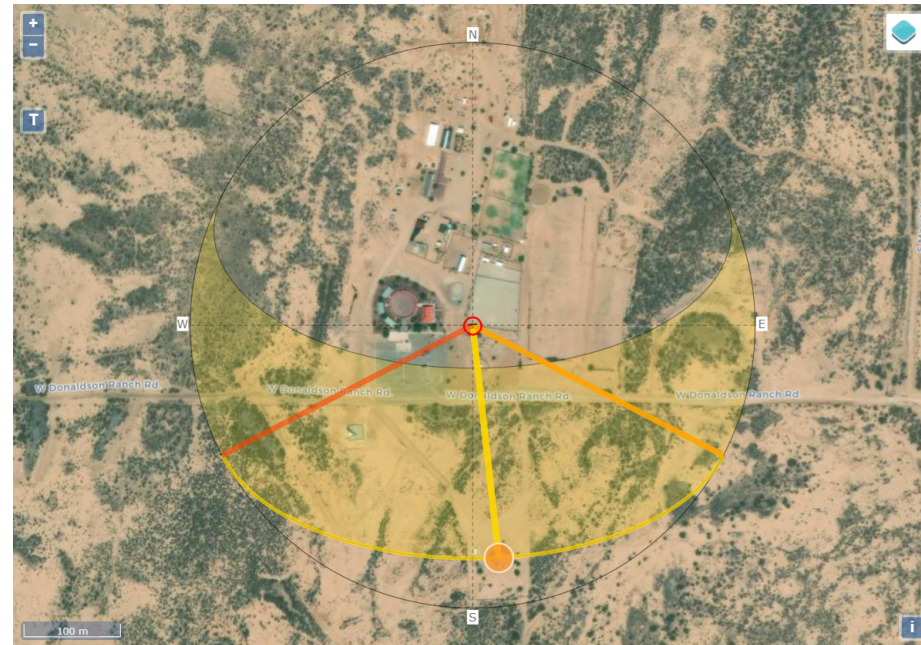


Sun

Summer Equinox | June 21



Winter Equinox | December 21



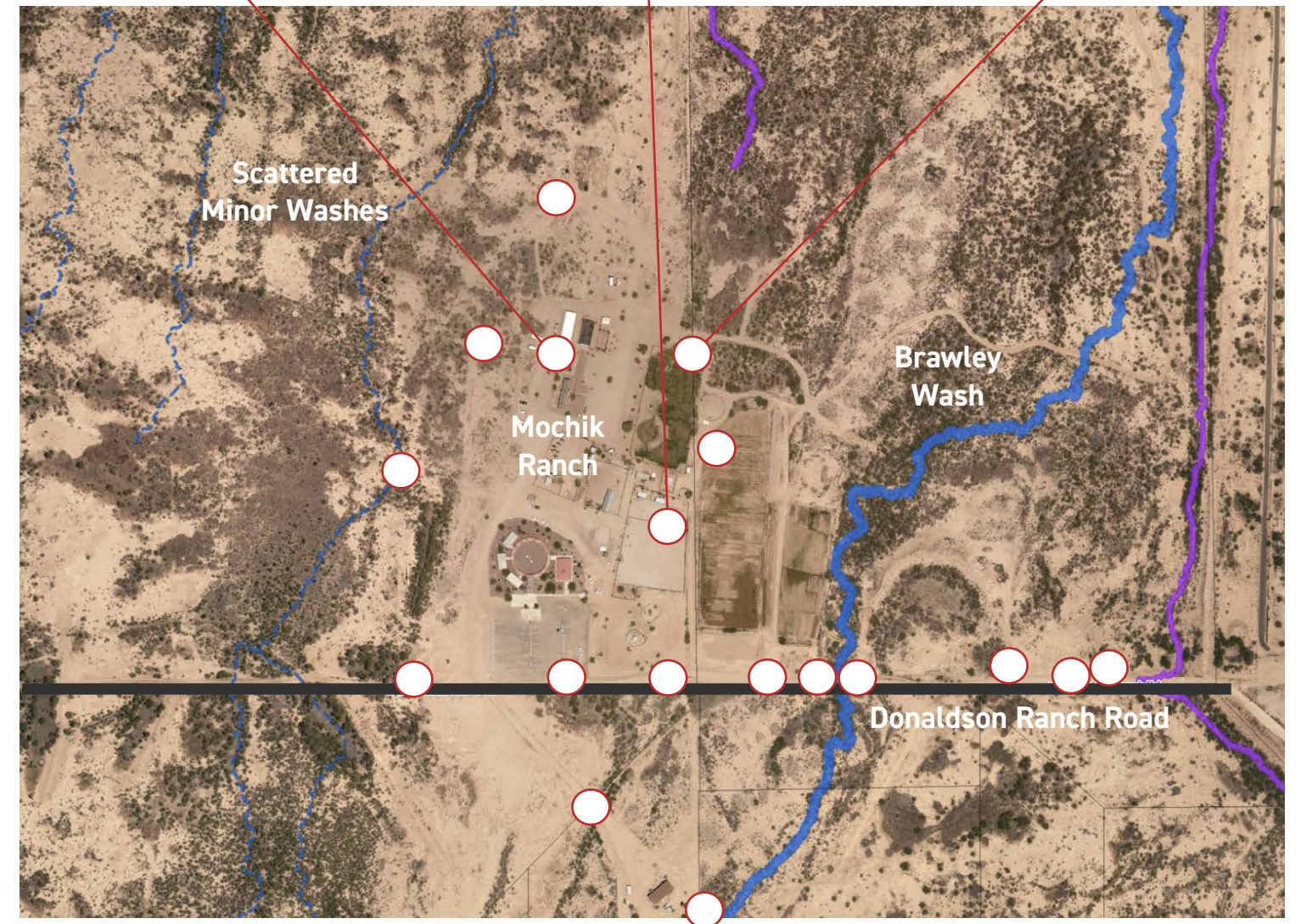
Sources

Sun Data: <https://www.timeanddate.com/sun/@32.17706,-111.24147?month=12&year=2022>

Wind Data: https://mesonet.agron.iastate.edu/sites/locate.php?network=AZ_ASOS

Water

Flooding from July 2021



Wash Proximity | Points of Accumulation

○ Points of Accumulation

Created by Studio LAR611

The area of Mochik Ranch has been designated as a Federal Emergency Management Agency (FEMA) special flood hazard zone AO-2, which means that it is at risk of 2-foot flooding depths during the 100-year flood.

Site Master Plan Proposals (Phase I) | Fall 2021

In the Fall of 2021, Masters of Landscape Architecture Studio LAR 611 completed three masterplans for the ranch. In December of 2021, a series of planning sessions were held and the 'best of' features were selected from these plans. Those concepts are summarized here.



VEHICULAR CIRCULATION STRATEGY

LAR 611 TEAM 1 | POTUCEK, SIEGEL, WALLACE

- Major arterial road + small access roads = creates vehicular circulation that minimizes traffic yet provides access to key areas.
- Therapy roundpens are dispersed for privacy yet close to equine area.
- North to south orientation of equine space arrangement eases daily function of ranch activities, and creates space to relocate the small animals away from the utility yard.
- Northern wheat field can be reduced in size in order to create one large pasture area.

Site Map | Landscape Design



ENTRY ROAD DESIGN

LAR 611 TEAM 4 | LHOSE, WISSLER

- Curved entry road slows traffic and creates space for additional bioswales to south side of Donaldson Ranch Road within the property boundary and where flooding is most severe.
- Tree-lined road enhances entry experience and promotes slower driving speeds.
- Car pullout at entrance provides views of Tucson mountains and sets the tone of the ranch before entering the ranch.

Site Map | Landscape Design

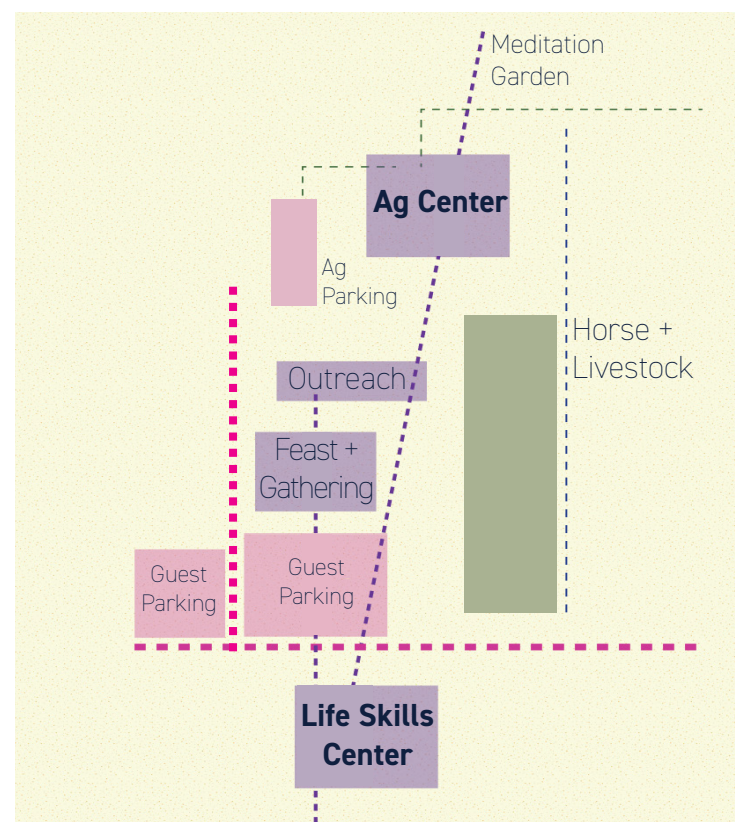


EQUINE + MEDITATION + BIOSWALE

LAR 611 TEAM 2 | GALINDO, SHU, HOWELL

- Equine Arrangement: A large, rectangular covered arena is to be located next to the Mare Motel and playground.
- The pasture is re-conceived as a paddock adjacent to the Mare Motel.
- A meditation garden is included at the north end of site.
- The basin and bioswale design promotes re-vegetation of the land in areas that will provide privacy, shade, and wind protection, and prevent agriculture runoff to infiltrate the natural desert areas.

Site Map | Landscape Design



- equine
- staff
- visitor
- vehicular

Site Diagram | Circulation and Relationships



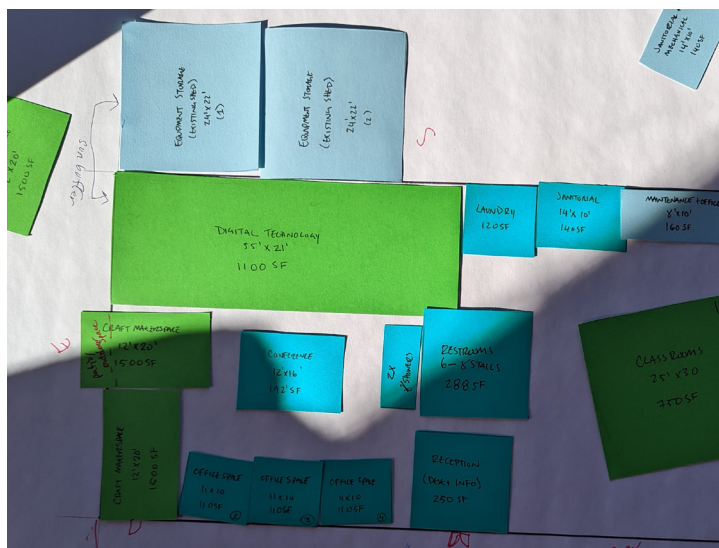
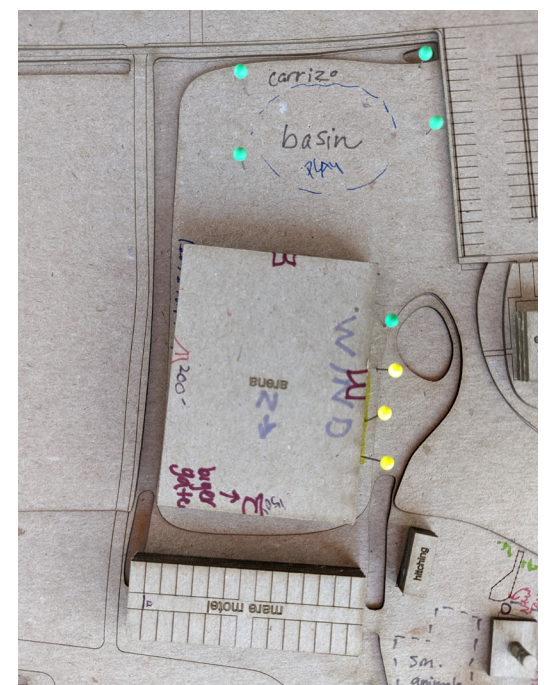
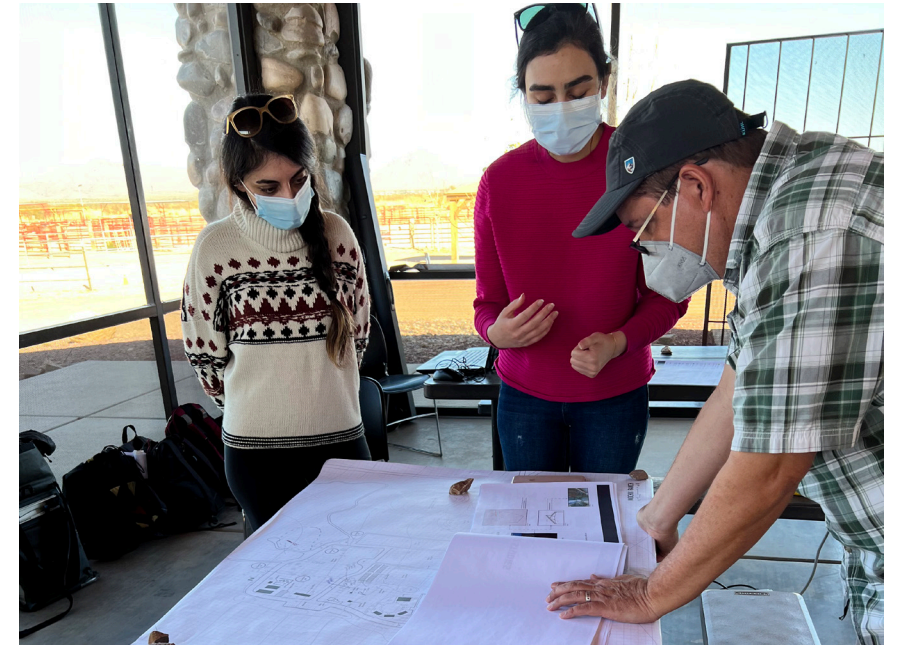
Design Charrette | Spring 2022

The studio facilitated a design charrette at the Ranch where the users were able to guide a series of exercises that helped create community buy-in and trust in the client-designer relationship.

The existing ranch presents in a rather piecemeal fashion in terms of the placement, orientation, and use of existing buildings. With an integrated design approach taking into account both the existing site resources and the programmatic needs of the client, the ranch aspires to have a sense of Place through a unifying concept. Thus, the charrette began with an assessment of the 'best of' from previous proposals and then segued into a collaborative mapping exercise where ranch staff were able to manipulate a site model and make written or drawn comments.

Included in this exercise was a presentation of precedent studies relevant to the typological and programmatic approach of this rural ranch site. This exercise helped guide the architectural expectations of staff, and assured them of the studio's commitment to projects that were not ostentatious, but instead offered their users a sense of ownership and belonging.

The charrette then zoomed in on the programmatic needs and spatial arrangement of the first two projects to be developed: a Life Skills Center, and an Agricultural Center. Through this process, both the client and designers reached a collective understanding of the intentions for these projects.





Site Map | Mochik Ranch

1 New Agricultural Complex

To incorporate existing Hoop House, Aquaponics Greenhouse and In-Earth Garden Demonstration Lab

2 New Life Skills Complex

- 3** Existing Utility Yard - contains main power, well, existing water tank, hay storage, equipment storage
- 4** New Outreach and Welcome Area
- 5** New Therapy Round Pens
- 6** Existing Feast House + Feast Circle
- 7** New Mare Motel
- 8** New Covered Arena
- 9** New Playground

All buildings on the ranch need to comply with a set of design criteria unique to this client. The ranch is in a rural location, with few resources nearby for sourcing specialty parts or expertise in the maintenance and upkeep of the buildings. Thus, maintenance requirements and technological strategies are critical components of the building programs. The ranch needs to provide for a rich diversity of user experiences; at the same time, structures need to be correctly sized and oriented to use passive design strategies and minimize life-cycle costs.

Yoeme people are outdoor people. Each project has been optimized in relation to its conditioning requirements and orientation, such that much of the program might comfortably exist at least partially outside of enclosed structures. This allows for a stronger connection to the land and ecology of the site, and allows the building construction and operational costs to be reduced.

Life Skills Center

Cultural Maker Spaces

- 25-40 occupants; flexible use
- Welding, metal working and woodworking, hand and power tools; pottery wheels, sinks, storage racks; electric pottery kiln
- Eye and handwash stations
- Desktop computer stations, large and small format printers
- Drawing, painting, embroidery
- Indoor and outdoor work areas; ample storage

Classroom

- Projectors, desktop computer stations
- Kitchenettes, ample storage directly accessible from the classroom
- Indoor and outdoor learning areas

Offices

- 12 full time staff members/ shared offices with 1 private office
- Break room with dining area, kitchenette and storage
- Reception and waiting area with visibility to the entry of ranch

Conference Room + Community Room

- Accommodate 20 people

Restrooms

- 2 showers, 2 industrial washers

Equipment Storage and Maintenance

- Tools locked indoors, covered equipment storage with space to work on and maintain ranch equipment
- Office space for ranch maintenance staff

Agricultural Center

Demonstration Kitchen

- Accommodate minimum 25 people
- Traditional and contemporary kitchens
- Indoor and outdoor preparation and dining space

Demonstration Greenhouse

- Use existing greenhouse, re-program for educational purposes

Production Greenhouses

- Two 100' greenhouses and/or unconditioned hoop houses

Moth Habitat

- Breeding, hatching, and feeding space for sphinx moths

Catfish Hatchery

- Breeding, hatching, and feeding space for Yaqui catfish
- May be connected with existing tilapia aquaponics system

Classroom

- Accommodate minimum 25 people

Processing and Packing

- Processing food crops (from greenhouses and Sonoran wheat fields) for use on the reservation and sale at casinos

Storage

- Both dry storage for supplies and cold storage for food crops

Restrooms

- Potential for composting toilets and greywater reuse

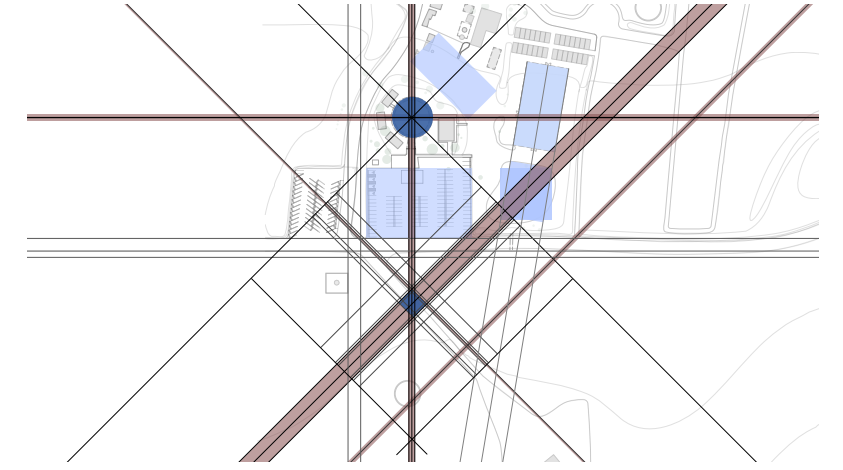
Connection

Life Skills Center

Project Narrative

This project is organized via axial relationships with existing and planned buildings on the site, and through framing views of the Tucson Mountains to the northeast of the ranch. The initial form and orientation of the building was discovered through a geometric analysis of these relationships with the landscape and the current site structures in order to allow the new Life Skills Center to belong to the site.

Mochik Ranch hosts 360 degree views of multiple mountain ranges. The Tucson Mountains are located closest to the ranch and hold a spiritual significance to the Yoeme, the Tohono O'odham, and tribes indigenous to this area. Orienting the main sight lines of the Life Skills Center towards these mountains allows the users of the center to connect directly with their land.



Main Entry Approach over Boardwalk



Section through Maker Studio



Section through Classroom

Expression and Discovery

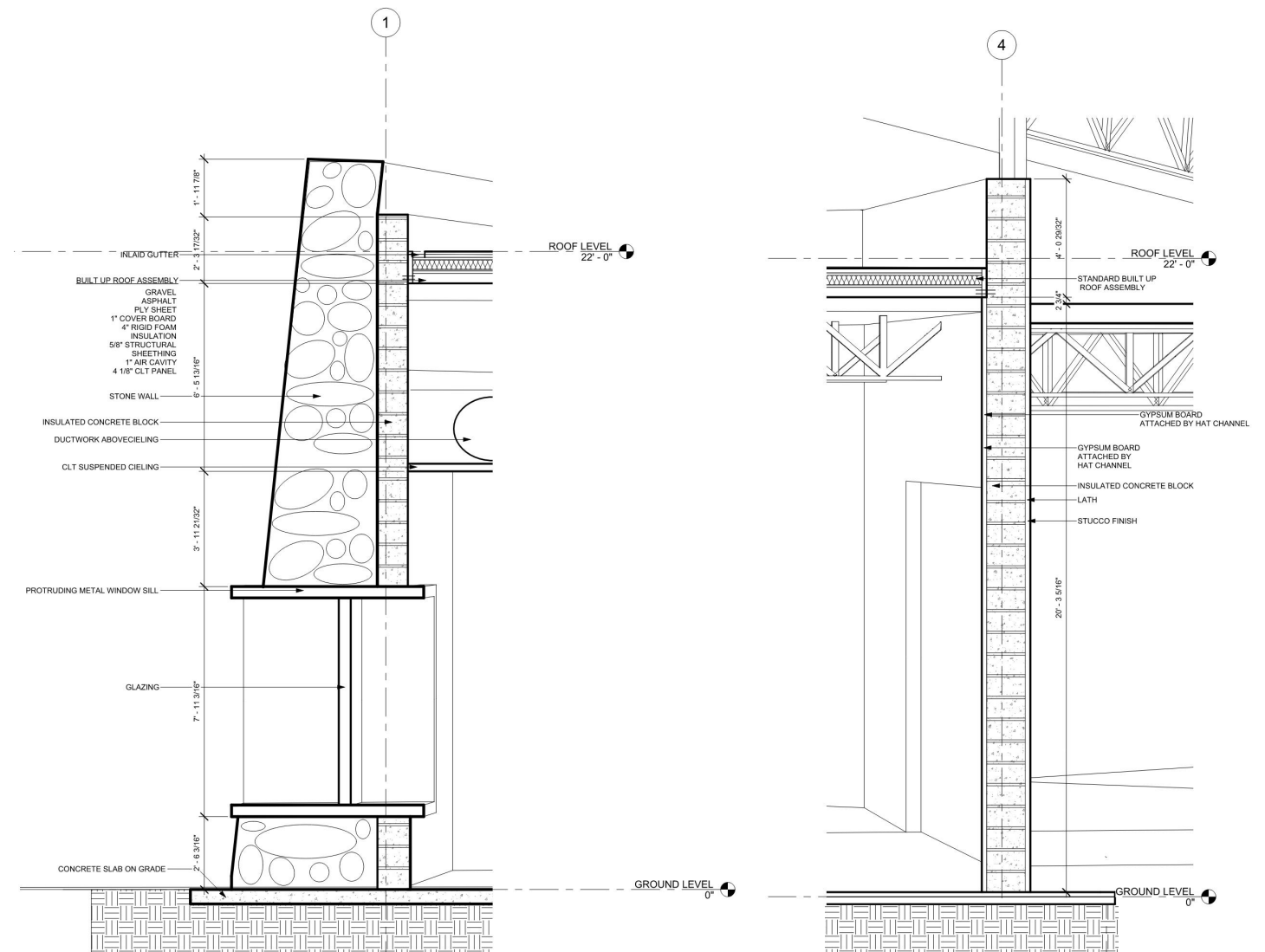
Axial corridors open into grand spaces supported by exposed trusses. These spaces allow for large groups to attend meetings, classes, and art-making activities. They also allow generous wall space for exhibiting Yoeme art, which is an essential part of cultural identity. Conditioned spaces open to exterior covered spaces where the architectural language of the exposed trusses continues. These patios frame long views out to the mountains and back into the heart of Mochik Ranch. Spatial compression and release offers users a sense of discovery and wonder as they make their way through the architecture.



Classroom Patio



Sculpture Trail



North Wall Section

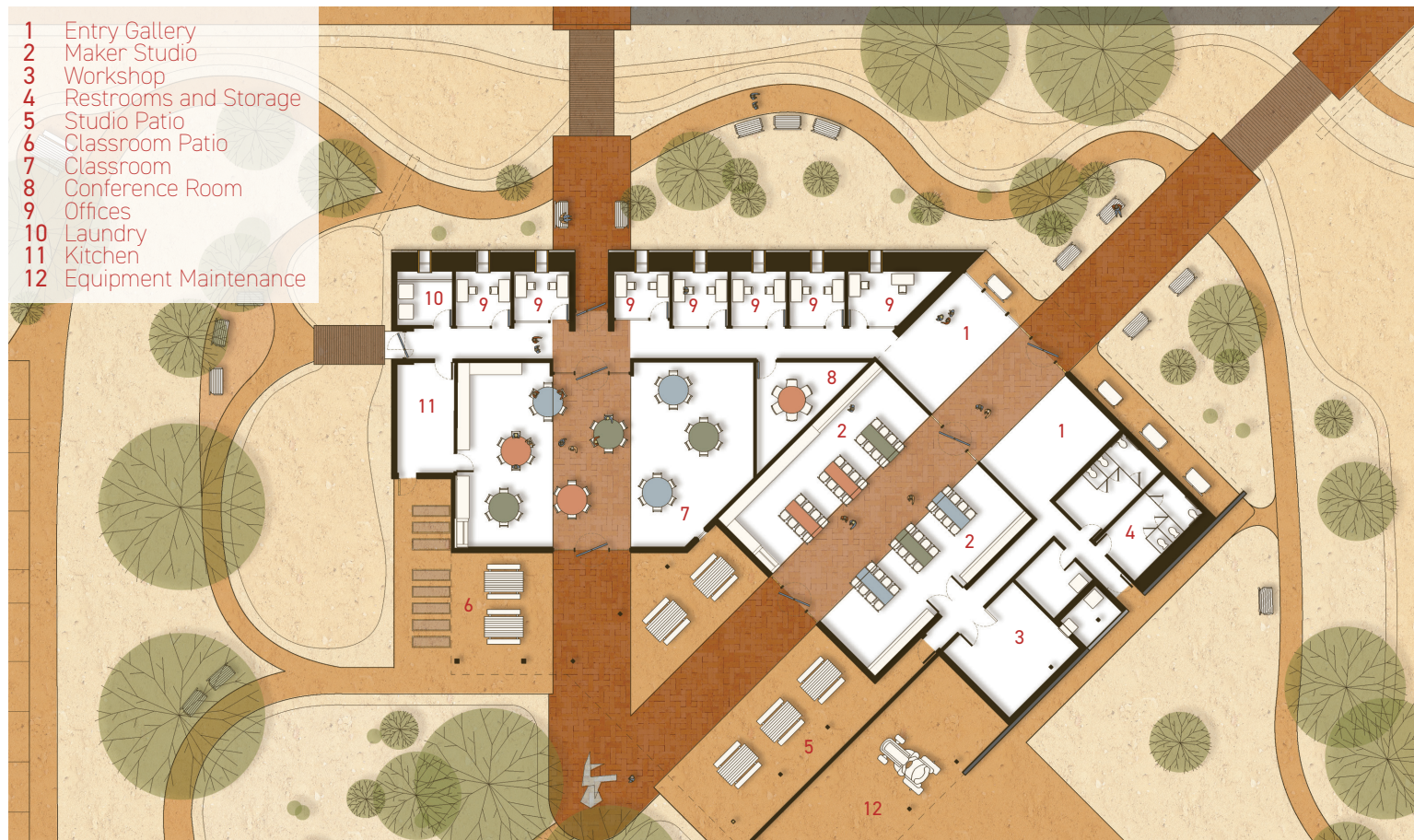
South Wall Section



Maker Studio

Axes and Convergence

The act of art-making is central to the expression of Yoeme identity. Thus, the maker studio and classroom are at the center of the Life Skills Center. An array of glazed openings and corridor pivot doors pulls users through the building. Both volumes orient towards a central point, where axes that project out into the landscape of Mochik Ranch and the Tucson Mountains converge. This nexus is a hub of covered outdoor learning and making, which evokes the experience of the traditional Yoeme ramada. The Yoeme are an outdoors people, and require a connection to the earth and to unenclosed space. The Life Skills building acts as a conditioned threshold between the ranch and the protected outdoor patios.



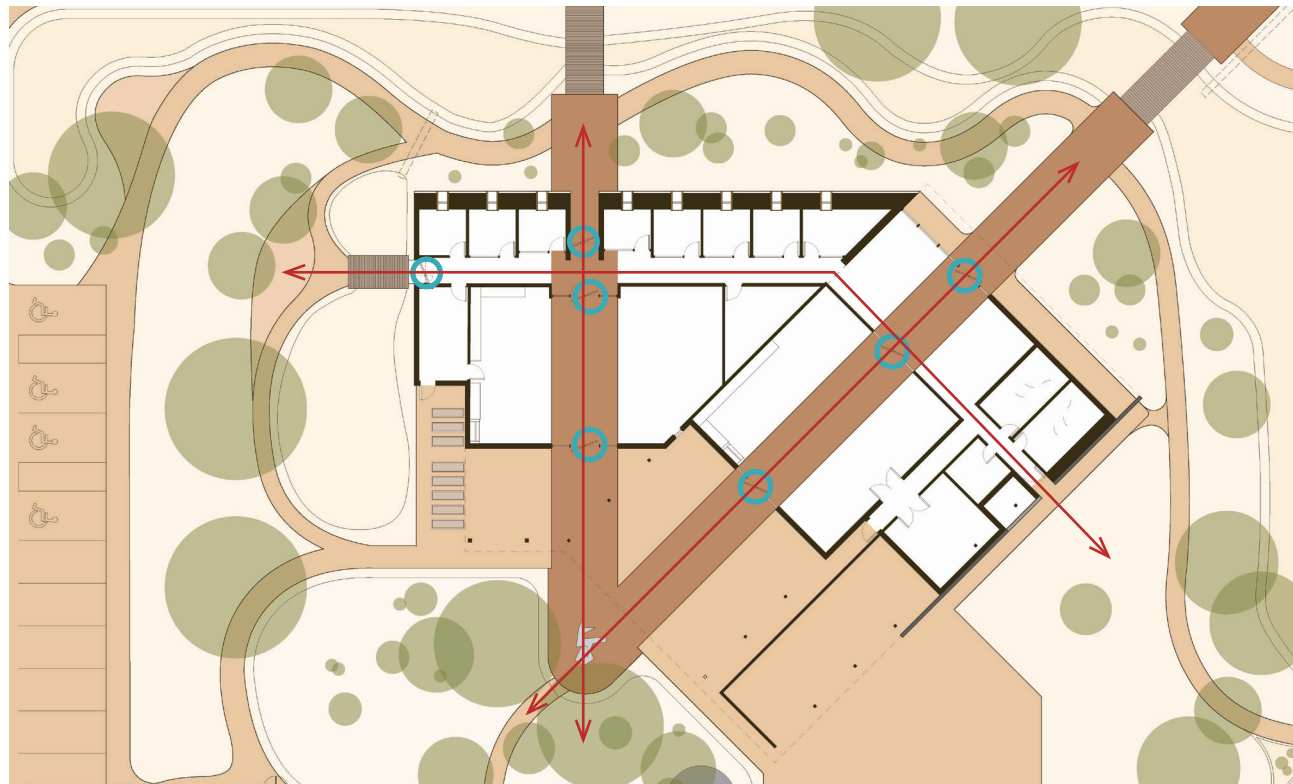
Plan

0' 16' 32'



Site Map | Axial Alignments



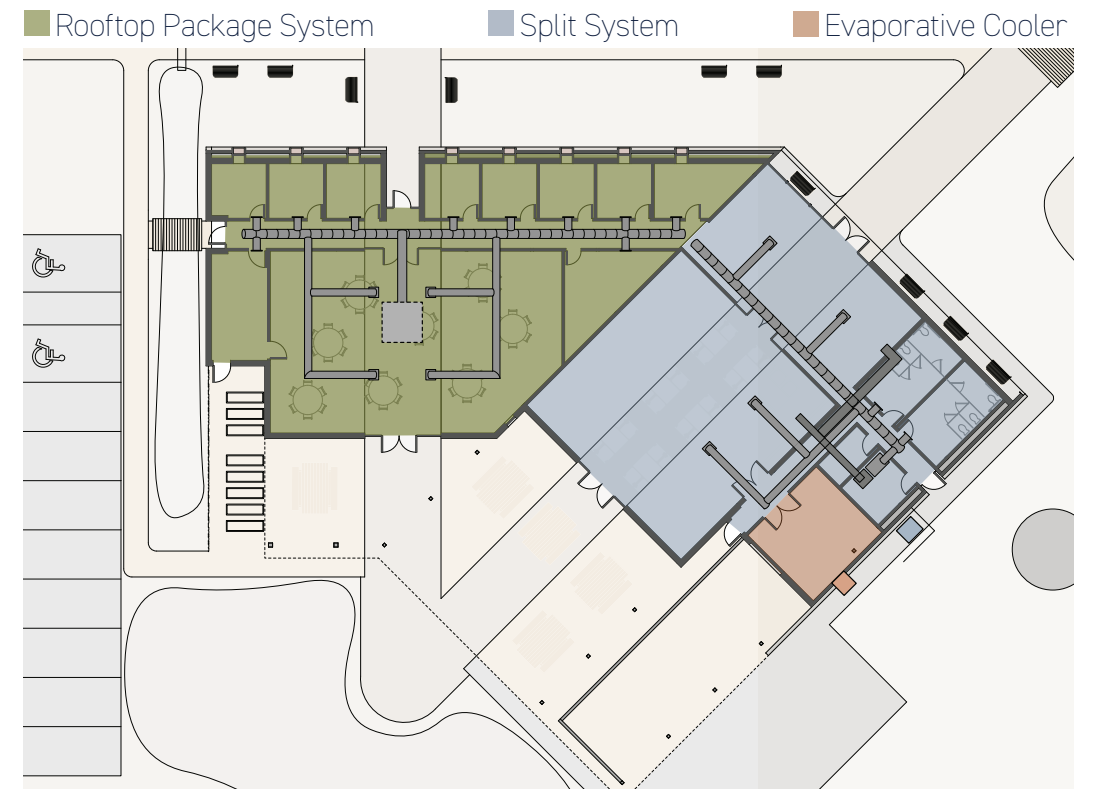


Plan | Natural Ventilation

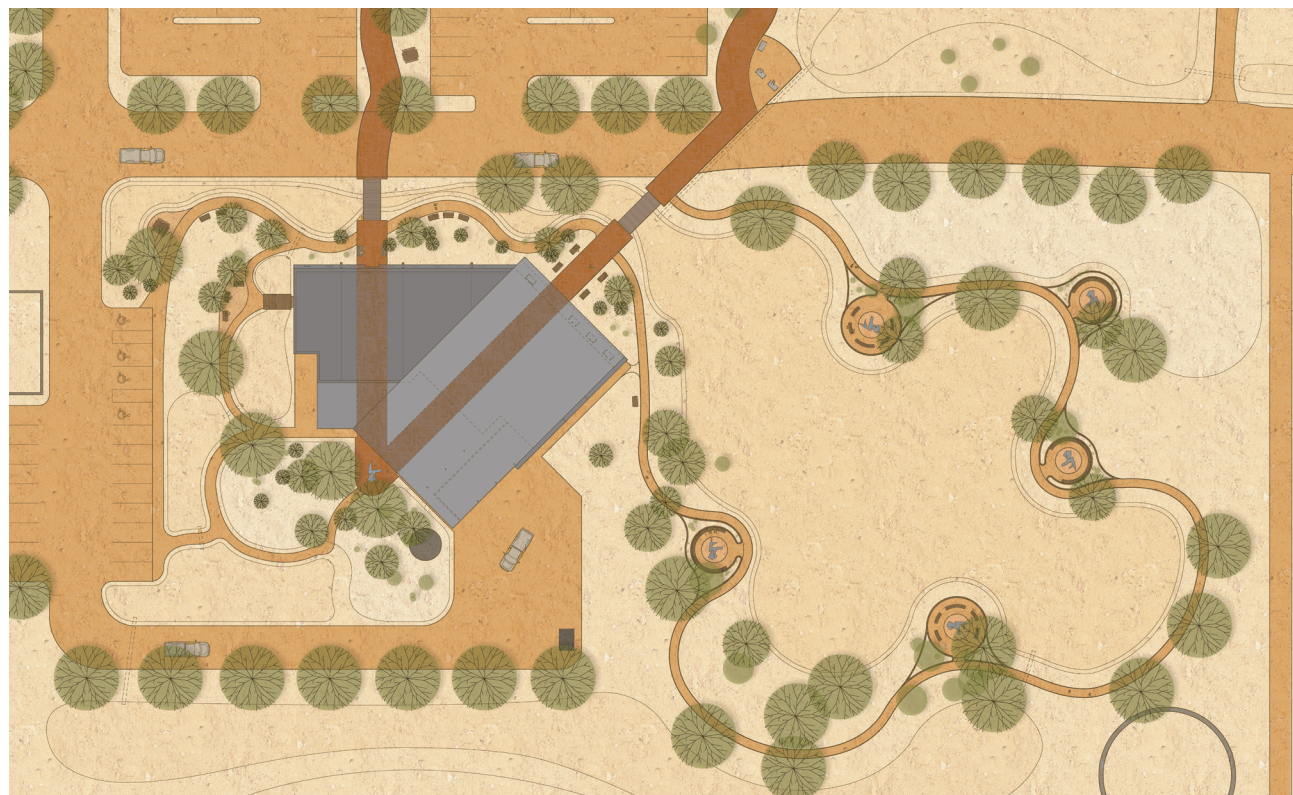


Passive Ventilation

Pivot doors centered on the arterial circulation routes enable passive cooling and ventilation. The pivot doors in combination with the pressure differential along the narrow corridors allows for outside air to naturally ventilate spaces and exhaust stale interior air. These doors also bring the sounds and smells of nature deep into the interior spaces, which helps enable an experience of the architecture as being *in* nature rather than *apart* from nature.



Plan | Active Ventilation



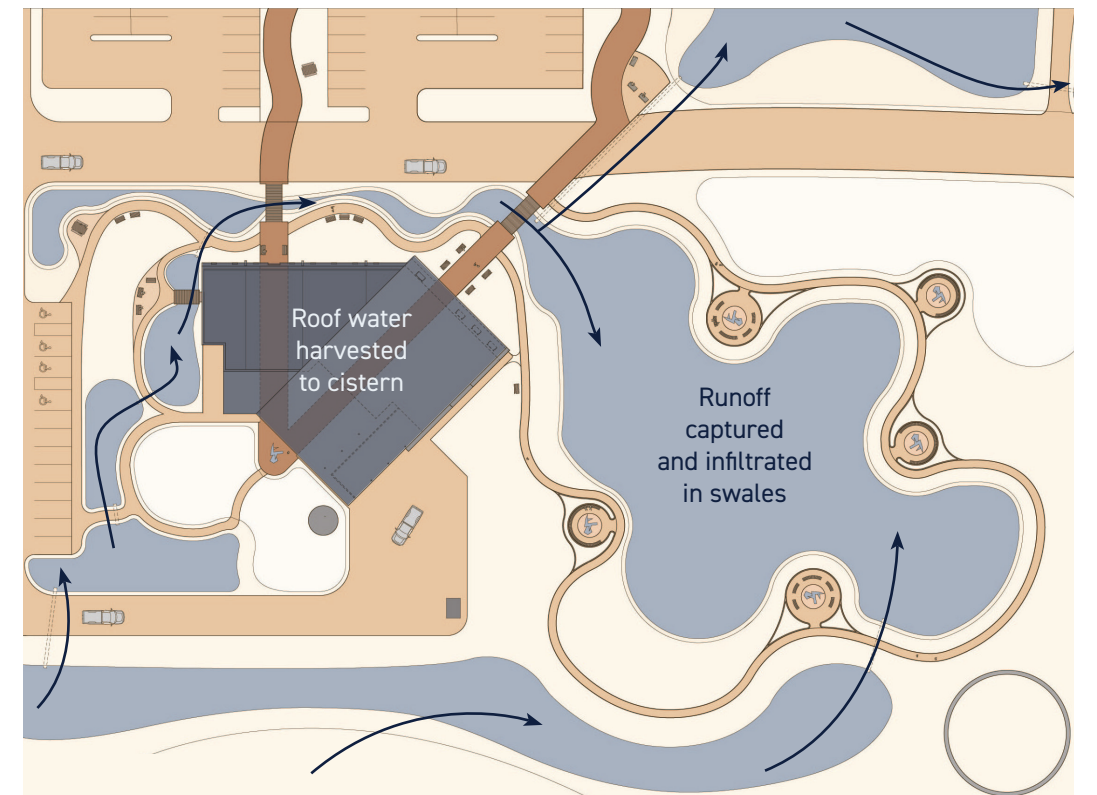
Plan | Landscape Design



Water Harvesting

The Life Skills Center harvests rainwater through both active and passive systems. Water is a scarce resource on the site, yet nearly all of the programmatic functions of the ranch require it. The design was conceptualized with an oversized roof, not only to shade the exterior patio spaces from the desert sun, but also to maximize the water collection surface. The east roof captures rainwater and transports it to a large underground cistern buried within the south berm.

Passive harvesting swales and basins capture the sheet flow that moves northwards across the ranch. As the first line of defense highest up in the ranch's watershed, the Life Skills Center has the most impact on flood mitigation.



Plan | Rain Harvesting



Expression

Life Skills Center

Project Narrative

The Life Skills Center invites members of the Yoeme community to express their cultural creativity through spaces that share color, light, shade, and texture. The enclosed conditioned spaces and the covered exterior spaces are equal in scale, which mirrors the formal relationship of a Yoeme house to its ramada. The architectural wisdom of traditional Yoeme structures provides improved health and wellbeing through greater thermal comfort and higher air quality within the enclosed space. This project applies these principles to contemporary architectural demands.

Though the program requires conditioned space as an escape from the Sonoran Desert, the shade under the ramada tempers this distinction between interior and exterior. The double roof strategy places thermal mass below radiating roof planes, where temperatures can stabilize across wide diurnal and seasonal changes.

NATURE

HERITAGE

HEALING

COMMUNITY

CULTURAL
CREATIVITY

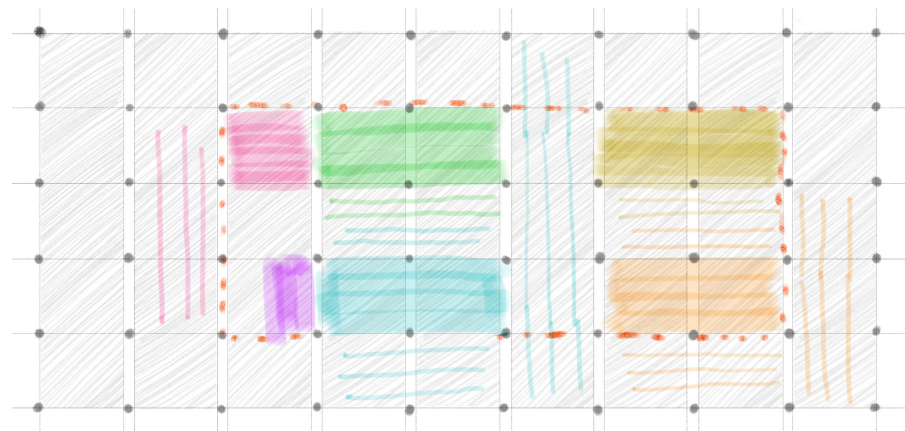
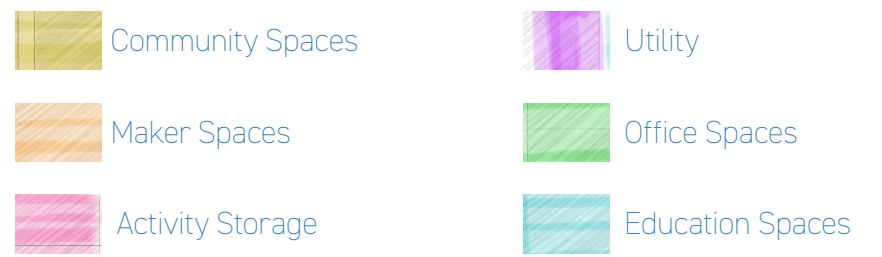
LEARNING

COLOR

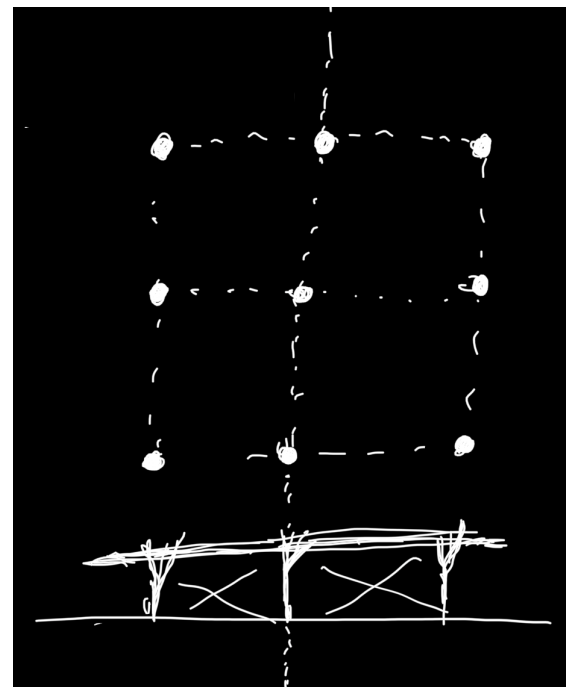
LIGHT



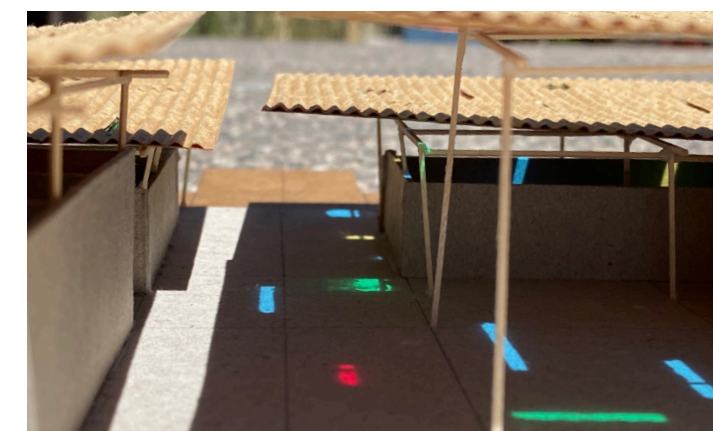
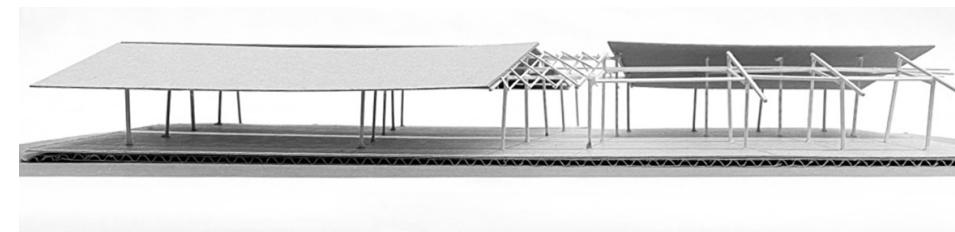
In Central Courtyard



Programmatic Parti



Yoeme Ramada Sketch



Model Iterations

Placemaking through Ornamentation

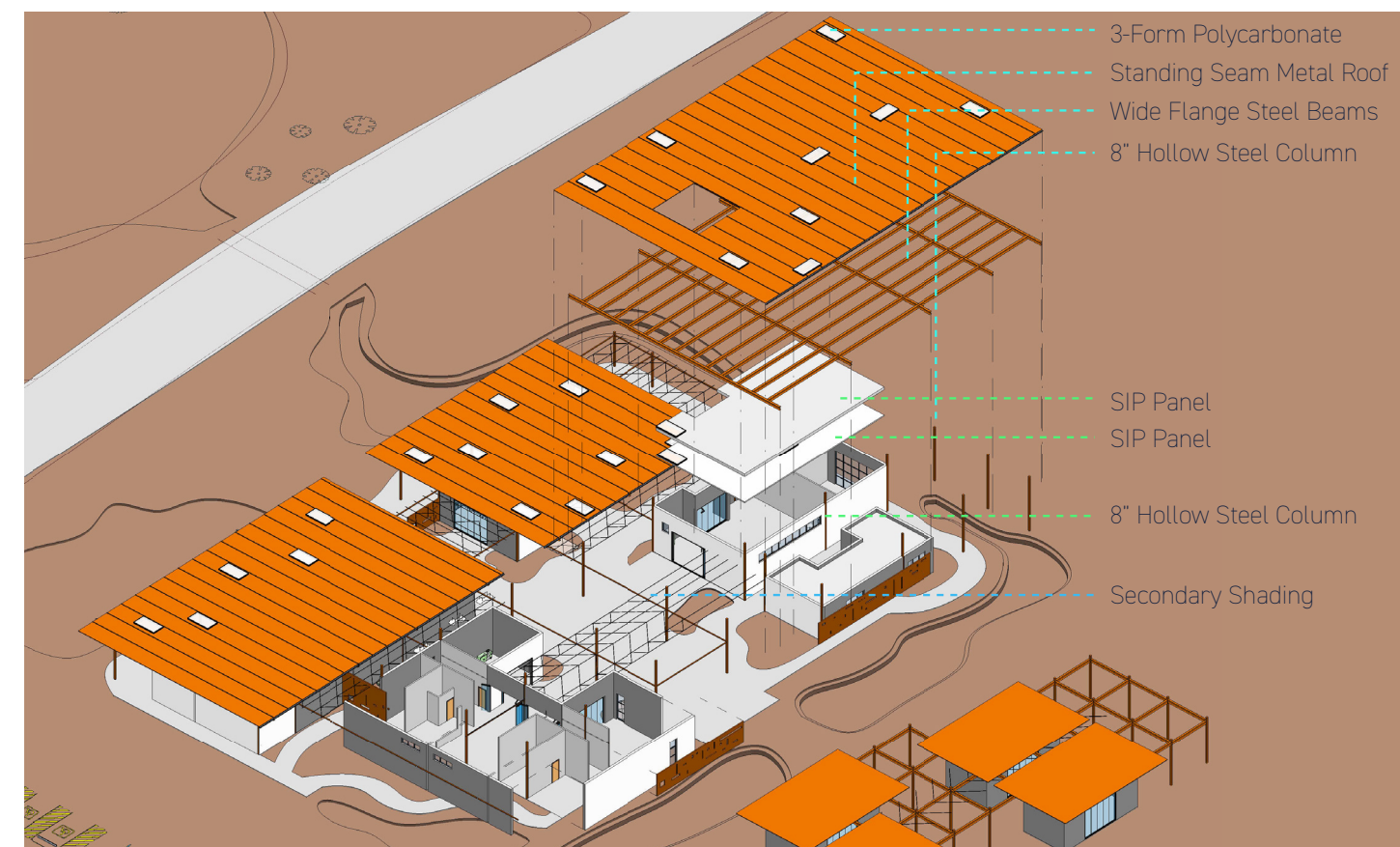
The Life Skills Center was designed to empower the Yoeme community to explore, create, and connect with fellow members of the tribe. The building itself allows for the community to shape the way in which it is used and how it will express the cultural identity of the tribe for all generations. It achieves this through a careful integration of culturally-specific design criteria, such as the shaded exterior spaces, the strong visual and aural connection across programs, and the large scale of intergenerational learning and making spaces.

Structural Logic

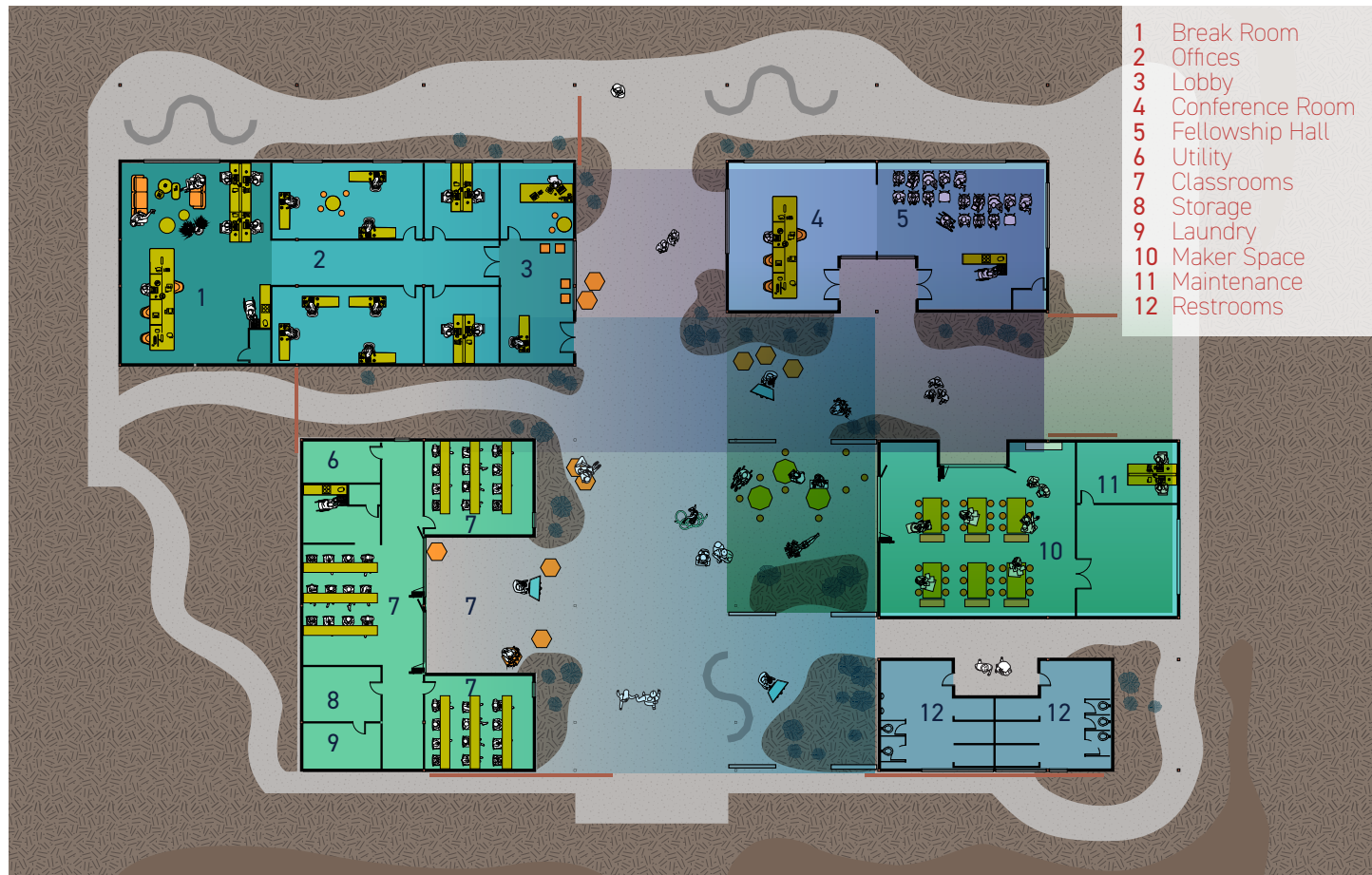
The iterative models were generated from the architectural language of the ramada. Through this process, the ramada evolved into a form that allowed light to enter the interior spaces. The scale of the structural members has been reduced in order to reference the scale of traditional Yoeme architecture. The separation of ramada and conditioned space below creates environmental performance advantages and a sense of spatial unity throughout the Life Skills Center.



Conference Room



Axonometric Structural Diagram



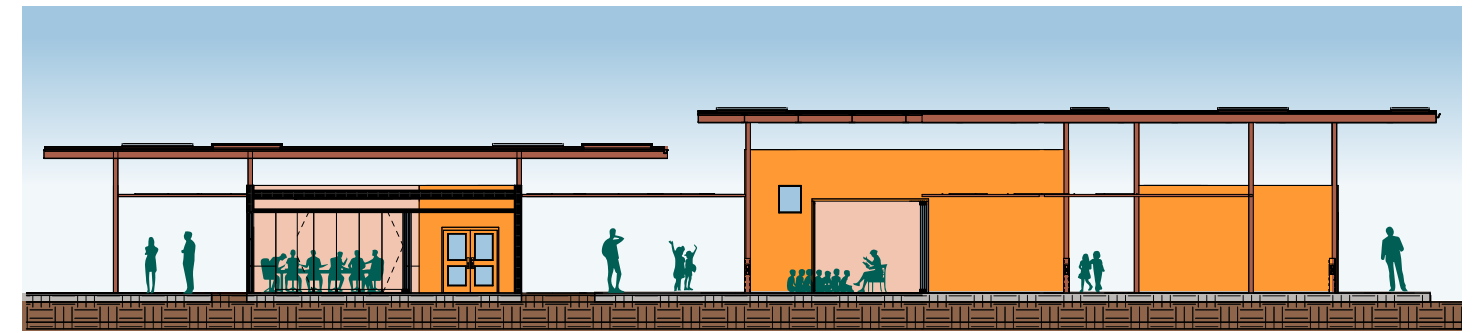
Plan | Program Blending

Program Blending

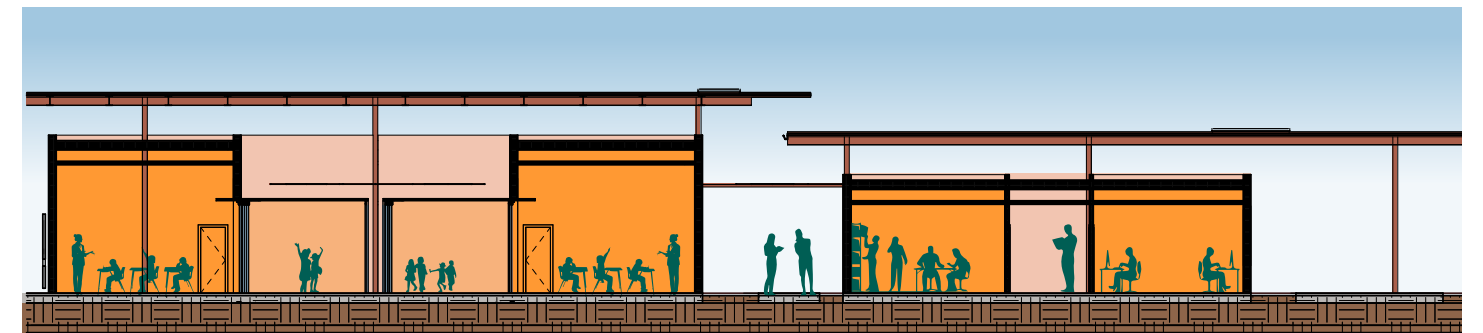
The blending of program through intermediate spaces allows for unplanned and unstructured interactions between Tribal Elders, youth, and ranch staff. This leads to the creative exchange of ideas within the entire Life Skills Center.



Classroom Courtyard



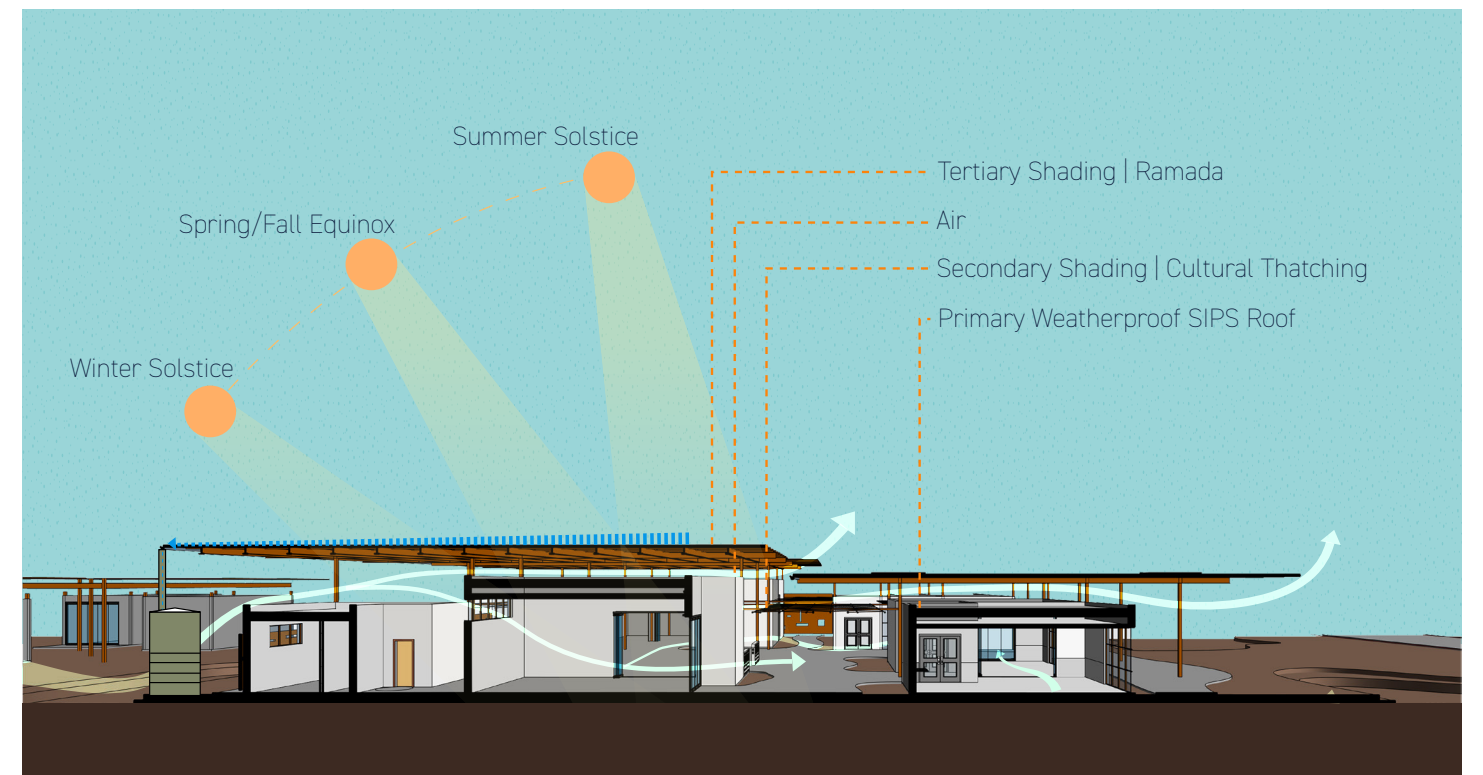
Section through Conference Room and Makerspace



Section through Classroom and Office

Environmental Performance

The double roof references the formal aspects of the Yoeme ramada, but it also allows the structures to make use of passive design principles. The lighter steel roofs above prevent unwanted solar radiation from reaching the conditioned volumes below for a majority of the year. The metal roofs act as heat conductors via the physics of buoyancy, and as they draw cooler air up from the shaded concrete slabs below, fresh air is circulated.

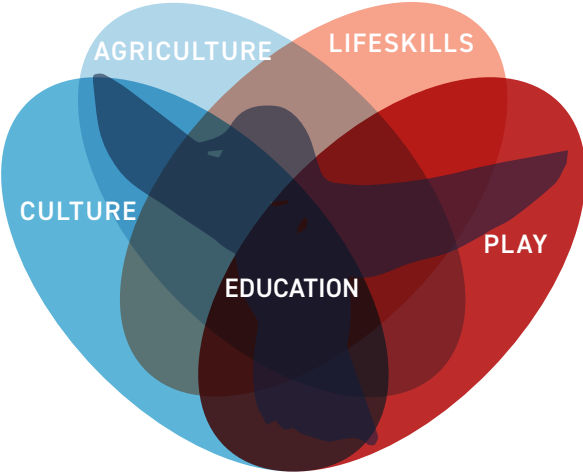


Perspective Section | Environmental Performance

Vernacular Life Skills Center

Project Narrative

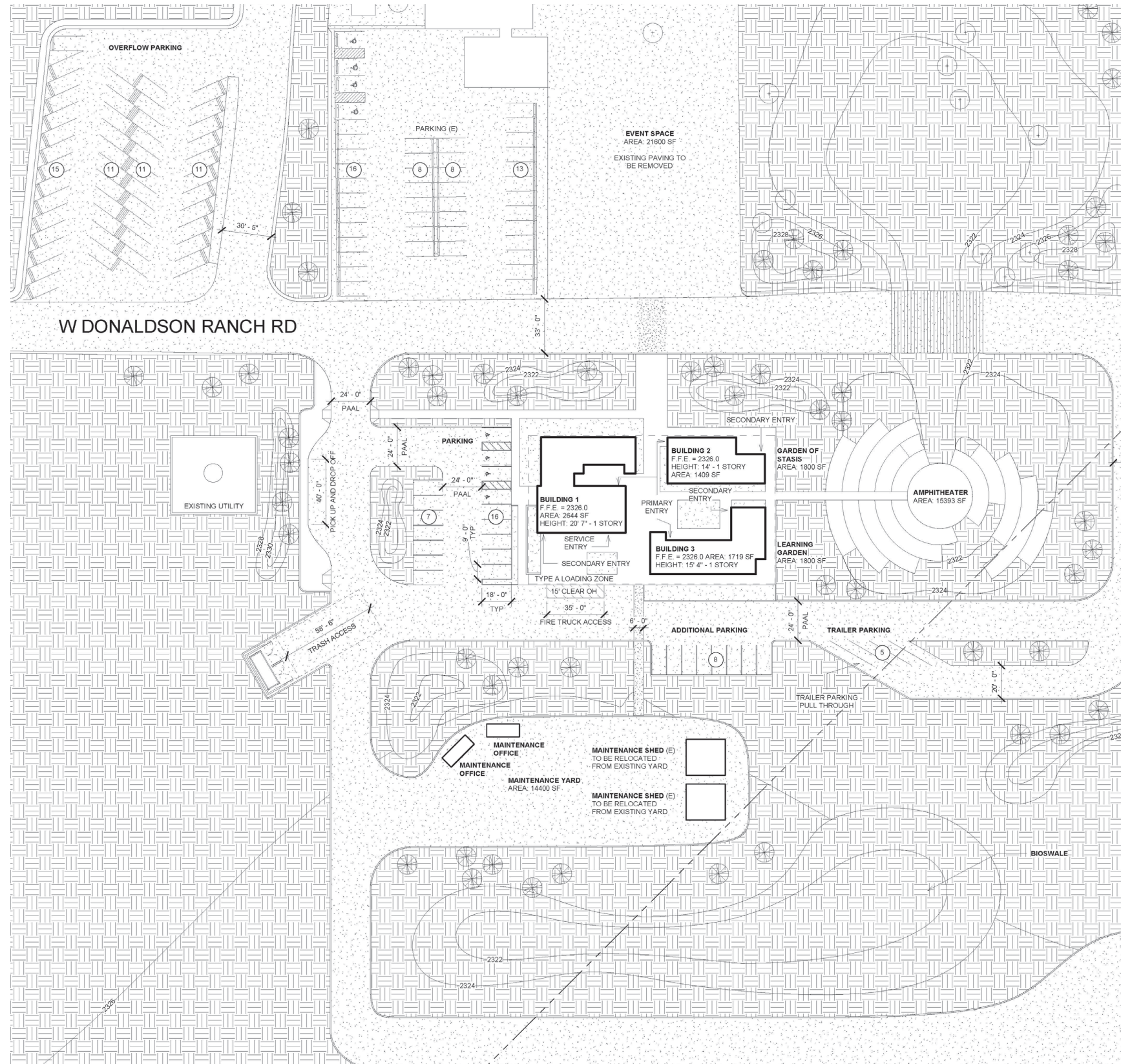
This project explores the traditional architectural typologies and symbols of Yoeme life. It aims to create a culturally-specific home-like environment for its users. This enables individuals to self-actualize through therapy programs, creative endeavors in the makerspaces, and knowledge transfer in the classrooms. It aims to integrate the symbolically-rich existence of the Yoeme into the existing architectural language of the ranch, which primarily consists of metal pre-fabricated structures. The low-slope roof with generous eaves is not only reminiscent of equestrian architecture, it also mirrors the vernacular housing stock on the Pascua Yaqui Reservation. By giving its users a "home away from home," the Life Skills Center encourages each youth to find their own unique expression through art, making, sharing, and learning.



Approach from Amphitheater

Site Integration

The Life Skills Center anchors the southern boundary of the ranch. The proposed design considers each of the other elements on the ranch, and aims to connect them via sight lines, orientation, circulation, and function. The idea is that an integrated site does not happen piecemeal, but rather must be planned via emphasizing the overlapping connections between each element in the architectural landscape.



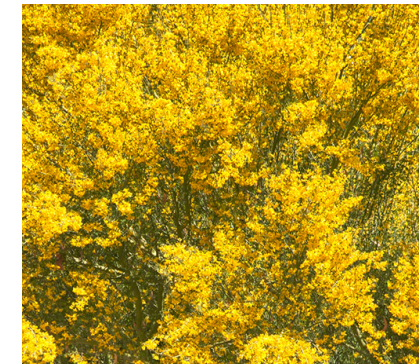
Architectural Site Plan



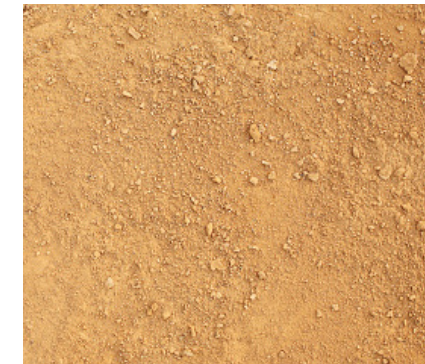
Site Map

Design Inspiration

The Yoeme are intimately connected to the ecology of the Sonoran Desert. Thus, the project takes inspiration from both the natural and architectural landscape of the tribe.

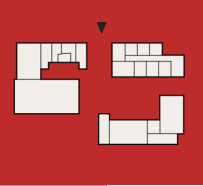
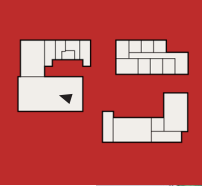


Nature



Architecture





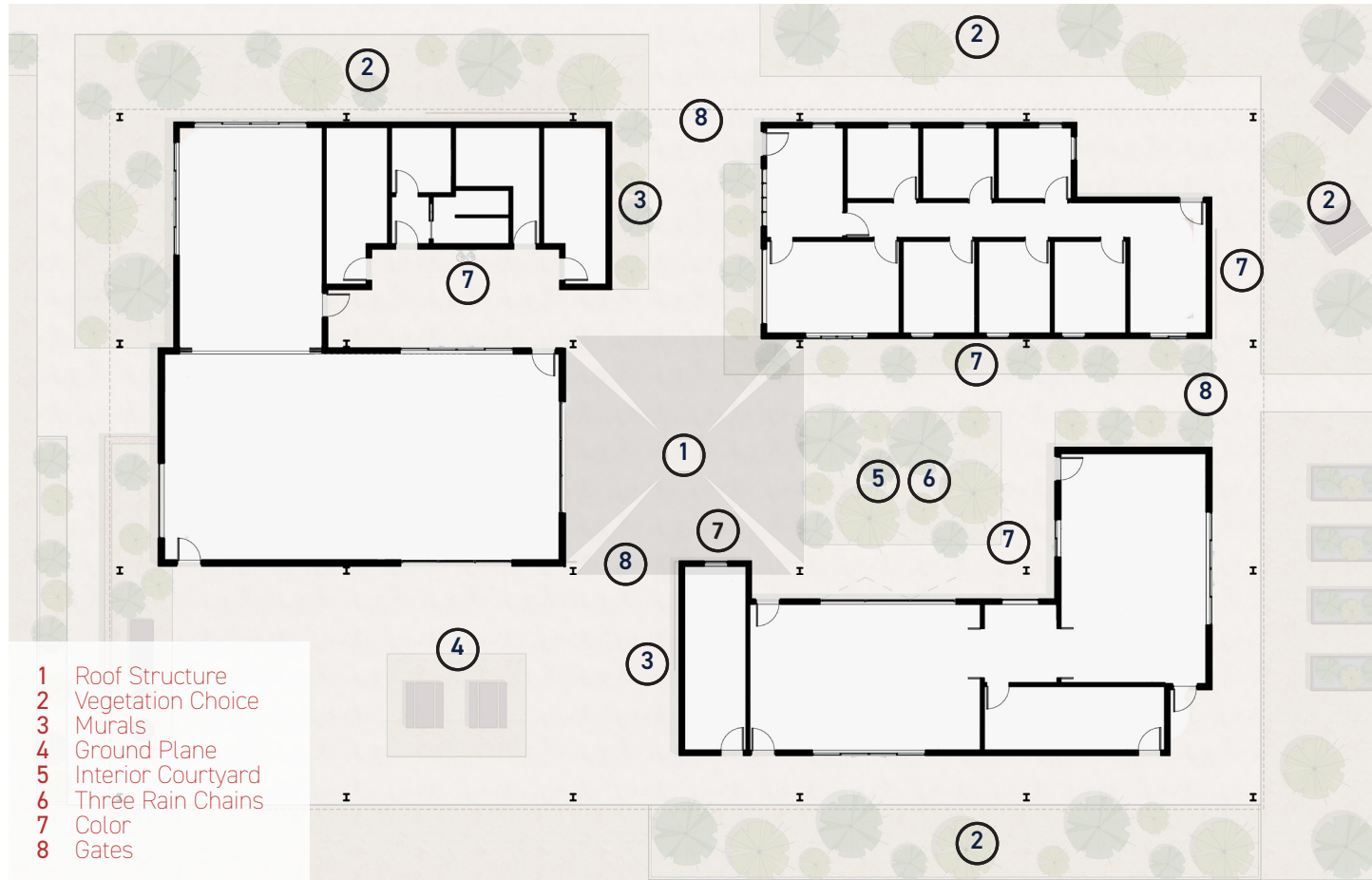
Makerspace



Entry & Skylight

Embedded Symbolism

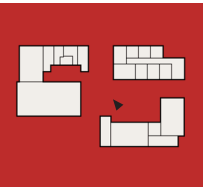
Incorporating symbolism within a cultural project is critical to celebrating the identity of the community that it serves. Through discussions with tribal members, a number of symbols were identified as omnipresent within the tribe's day-to-day life. These have been integrated into the building through structural elements, material treatments, and more.



Plan | Symbolism



Yaqui Cross in the Roof Structure

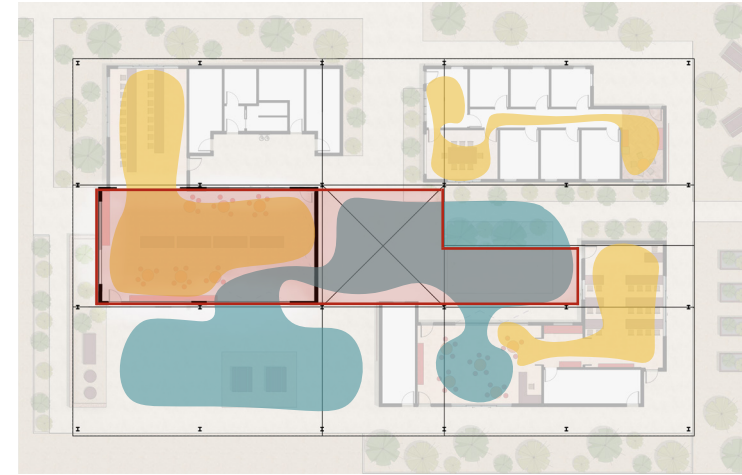


Learning Administration Support Outdoor



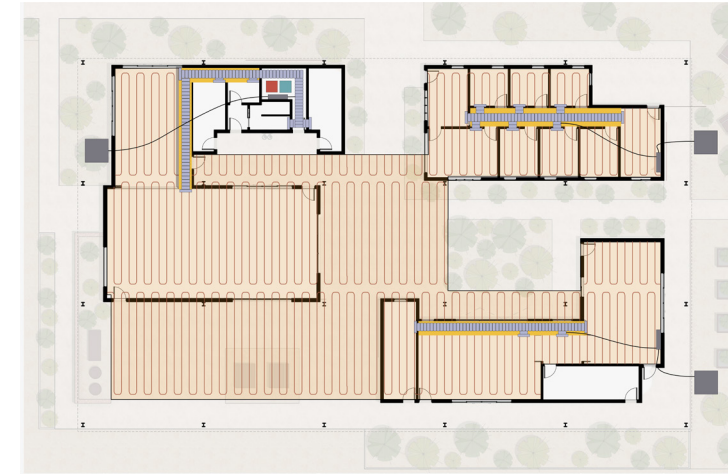
Plan | Use

Exterior Flexibility Interior Flexibility Daylighting



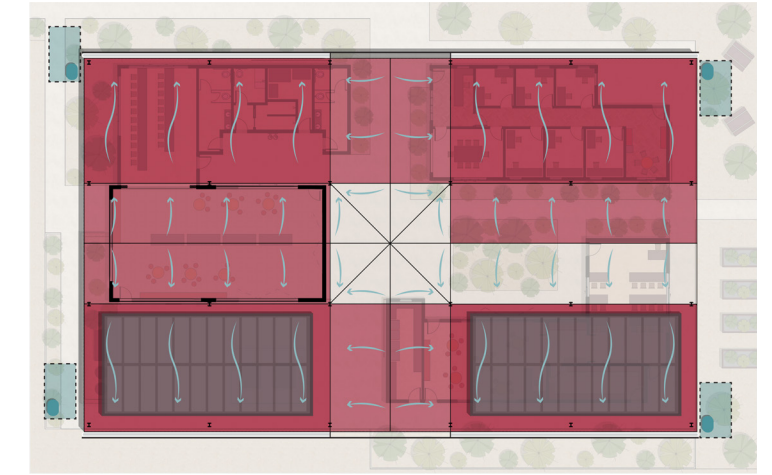
Plan | Daylighting and Flexible Use

Ducted Mini-Split Radiant Heating and Cooling



Plan | Thermal Comfort

Rainwater Cistern Steel Roof Photovoltaic Array

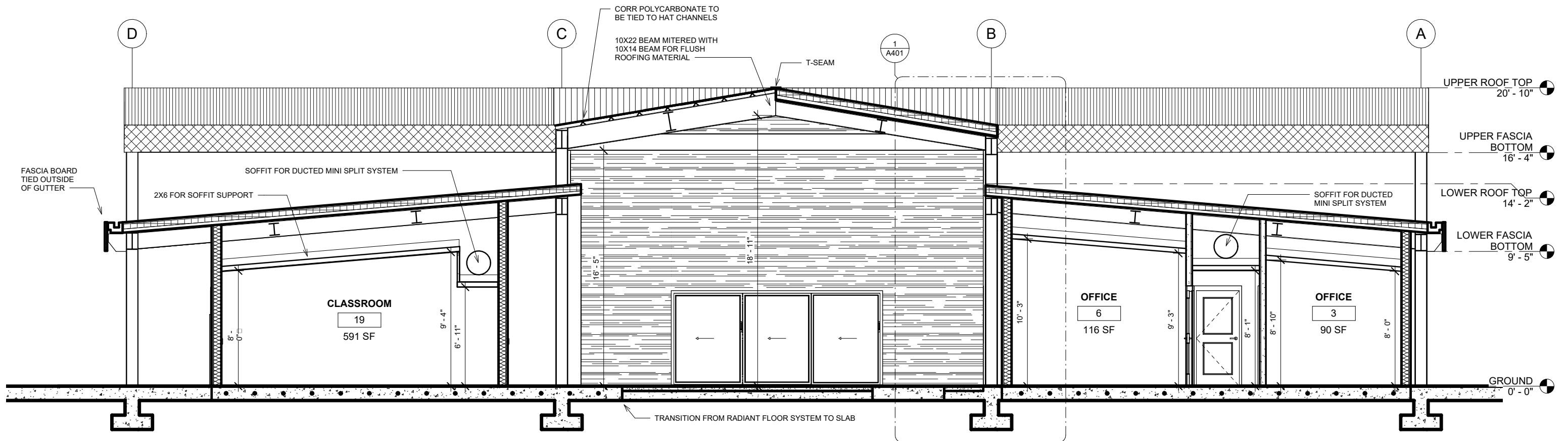


Plan | Solar and Water Harvest

Biophilia and Wellbeing

Passive daylighting strategies allow for an abundance of natural lighting, and the interior courtyards blend the distinction between inside and outside. The biophilic impact of sheltered courtyards filled with plants, natural materials in conditioned spaces, and long views into protected shared spaces allows the users a sense of comfort, and a safe space to learn, share, create, and connect.

Given that doors and windows are intended to be open for use, a radiant heating and cooling floor slab is an ideal thermal system. It is more efficient to cool and heat mass than air and with insulated exterior roofs, it will be easier to maintain thermal comfort. A ducted mini split system will be used for each building. This will help with the circulation of fresh air in the summer and can be adjusted dependent on the occupancy in each of the buildings. Corrugated polycarbonate is used as a material for certain parts of the roof, to allow natural daylight into the courtyard.



Section Facing West

Resiliency

Agricultural Center

Project Narrative

Each season in the Sonoran Desert presents a unique set of environmental variables, from temperature to rainfall to solar angles. This project is based on the variables of seasonal change; it positions itself as an instrument that reads and reacts to unique climactic conditions throughout the year. Opacity / transparency, interior / exterior space, are positioned to make best use of passive heating, solar shading, and natural ventilation. The seasonal cycle of change is further embedded in the project through the reality of programmatic change at Mochik Ranch. Simple volumes are efficient to build and adapt as the Agricultural Center's programmatic needs change in the future.



Section Facing West



Monsoon



Fall



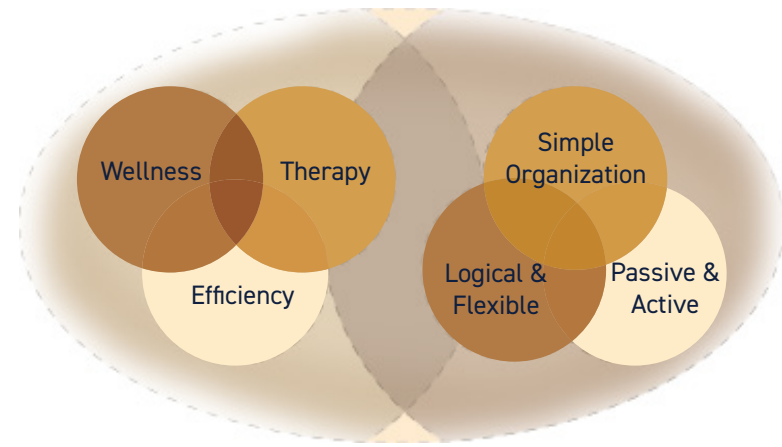
Winter



Spring

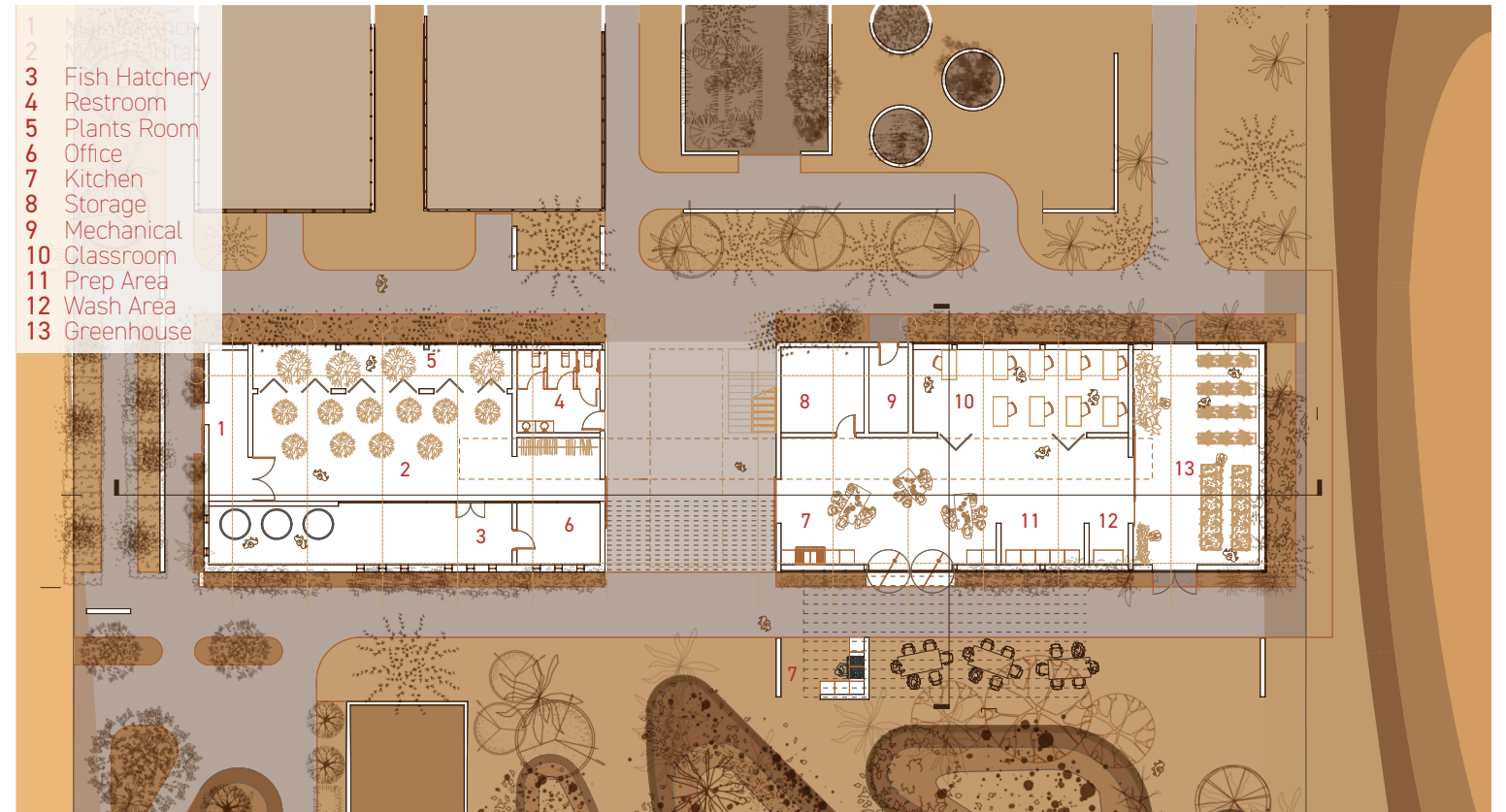


Summer

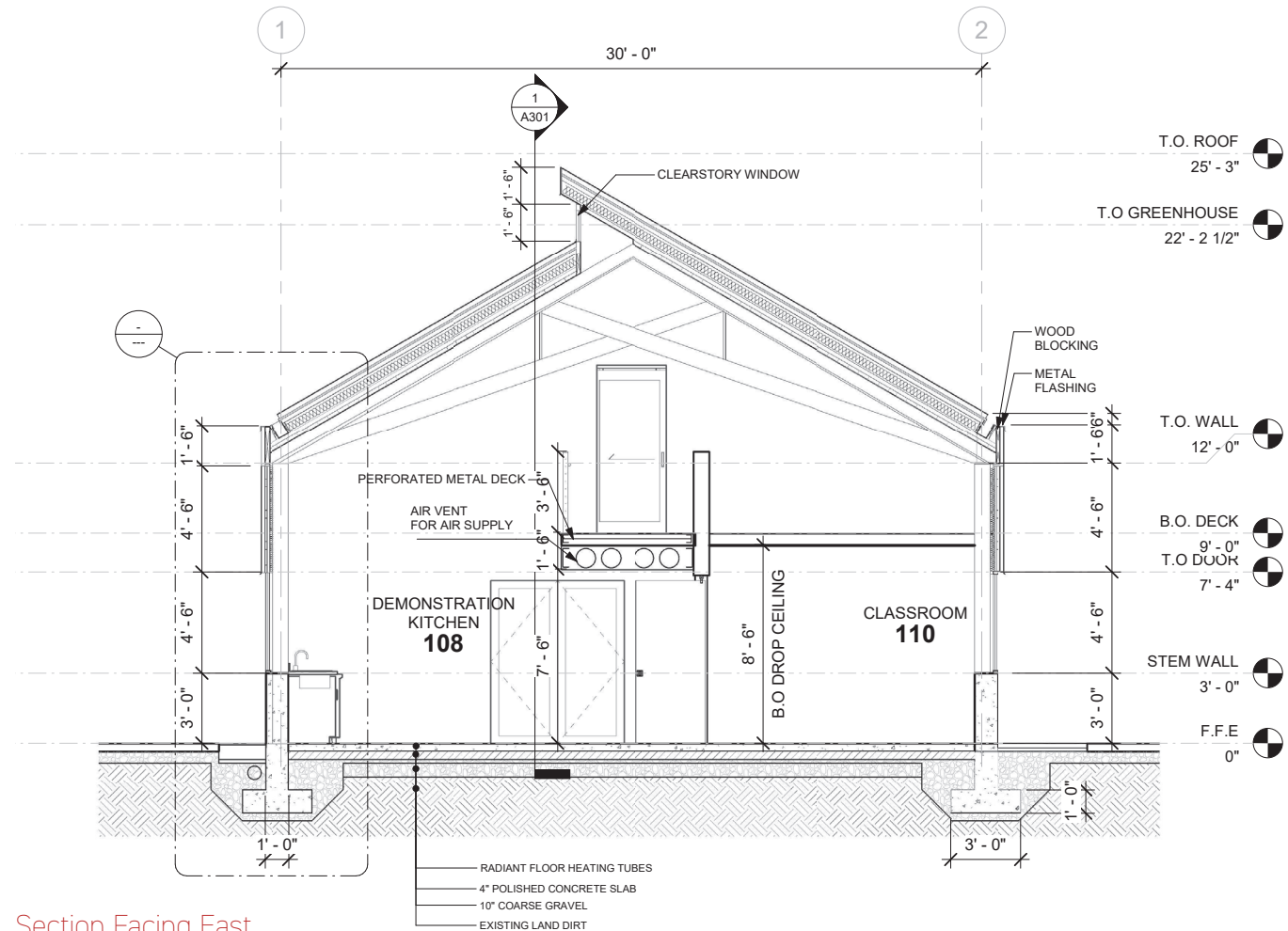


Bioclimatic Design

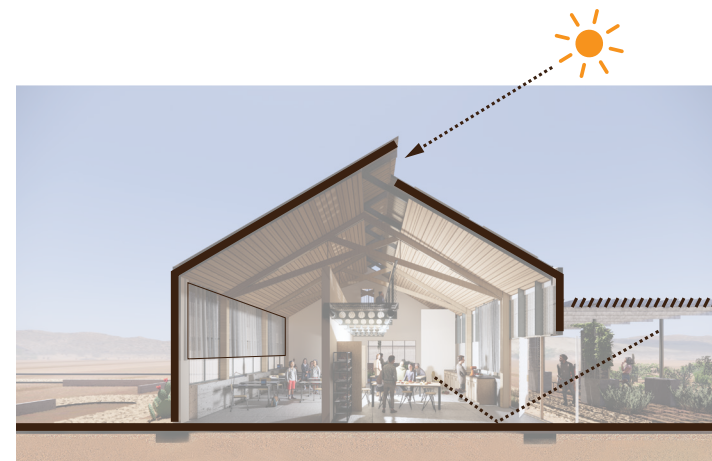
The Agricultural Center uses bioclimatic design methods to enhance user thermal comfort throughout all seasons in the Sonoran Desert. Much like the seasons themselves, the bioclimatic strategies change throughout the year. The architecture offers multiple nodes of interaction -- from a suspended catwalk, to a covered outdoor kitchen, to a central patio -- that offer users a diversity of spaces, each of which has an optimal period of the year for their use. This low-tech and lost-cost method of thermal comfort is preferable to a thermal control strategy that relies upon complex mechanical systems, due to the remote nature of the ranch and the lack of services and skilled repair trades.



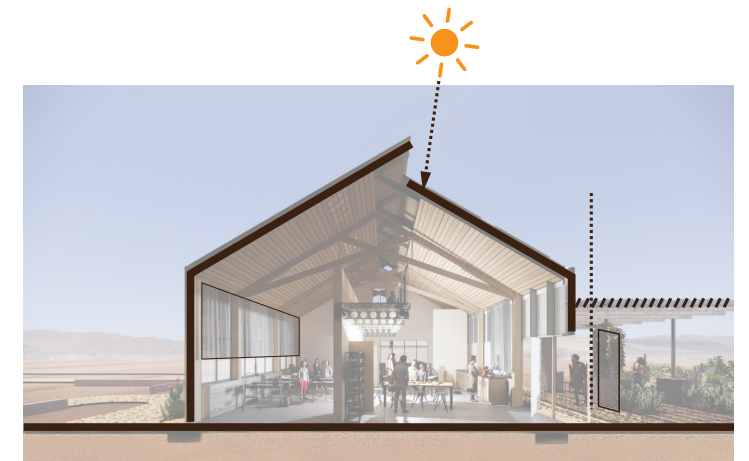
Plan



Section Facing East



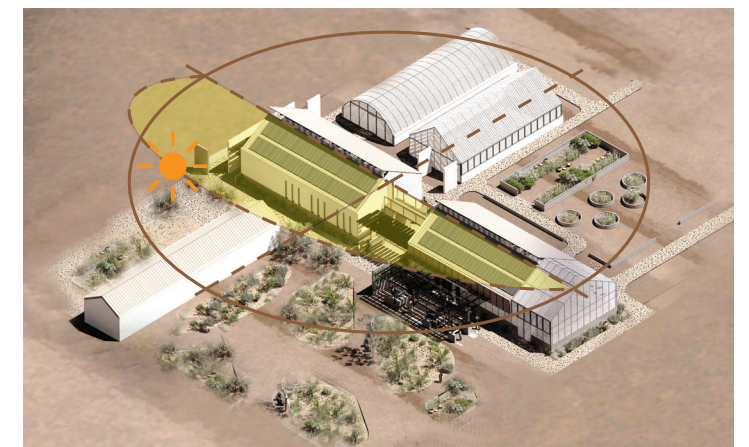
Section Facing West | Winter Solstice



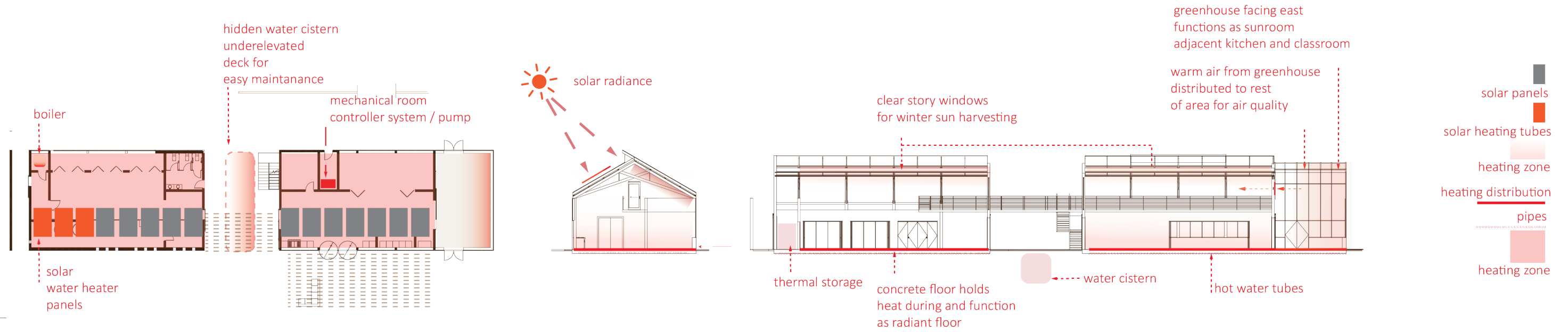
Section Facing West | Summer Solstice



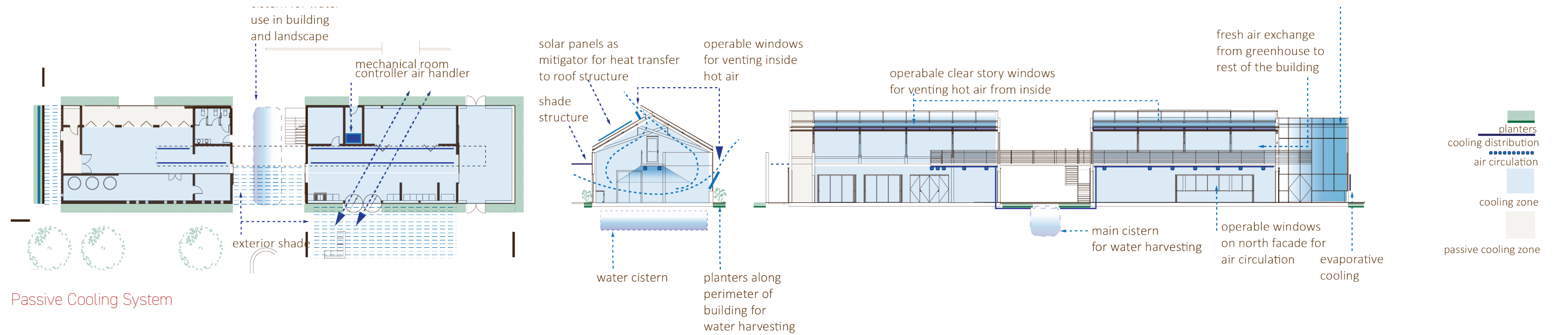
Axonometric | Summer Solstice Solar Arc



Axonometric | Winter Solstice Solar Arc



Passive Heating System



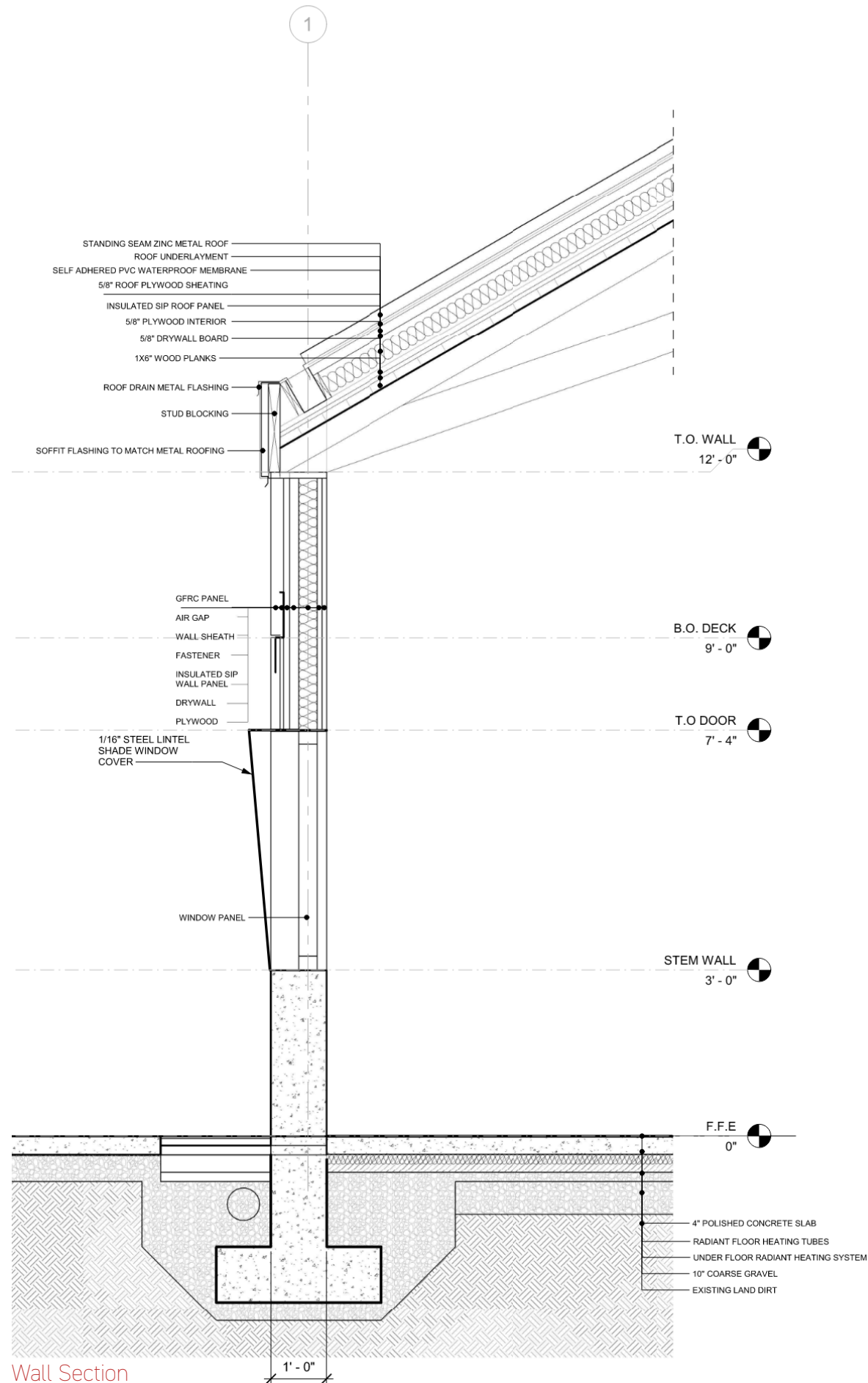
Passive Cooling System

Systems Design

Active and passive systems work together to make use of scarce water on the site, as well as harness the abundant solar energy while mitigating the effect of summer solar gain. Each system first relies upon passive systems in order to use as little energy as possible, and then relies upon on-site renewable solar energy to generate the majority of the electrical energy required to run these systems and the Agricultural Center at large. Not only does this climate-responsive design make best use of resources and save the tribe money in utility costs, it also reflects the Yoeme cultural values of resiliency and harmony with nature.

Social Space

The natural expression of wood, metal, concrete, and polycarbonate on the interior create a human-scaled space rich with visual, haptic, and thermal delight. The shallow dimension of the volumes allow smaller members to clear-span the structure, creating open spaces with visual and aural connection. Unplanned social interactions arise easily in this interior space, where quiet observation is as natural as extroverted conversation. Combining a mixture of program uses into the open volumes ensures that boundaries between learning, making, and socializing are fluid.



Wall Section



Teaching Kitchen



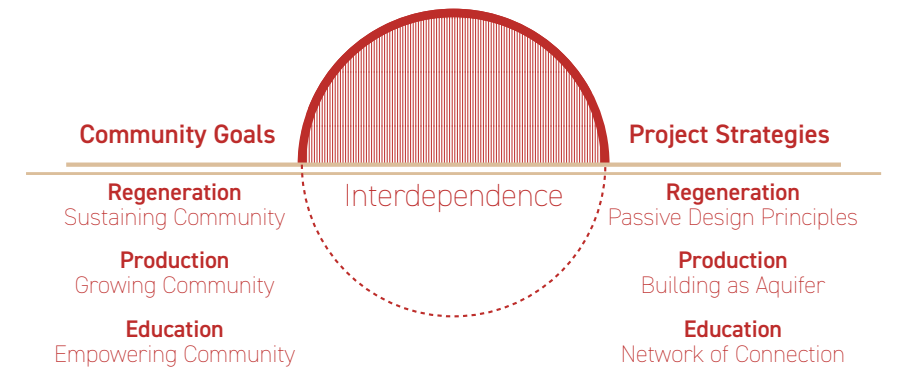
Greenhouse Approach

Interdependence

Agricultural Center

Project Narrative

The Agricultural Center at Mochik Ranch is predicated on the concept of interdependence, which is a central tenant of Yoeme spirituality and culture. Just as the Yoeme are culturally interdependent on the ecology of the Sonoran Desert, the Agricultural Center aims to create a network of relationships between architecture, agriculture, production, and education. The project goal was to use architecture to facilitate agricultural production and cultural ownership through an interdependent deployment of climactic forces and culturally-significant building materials.



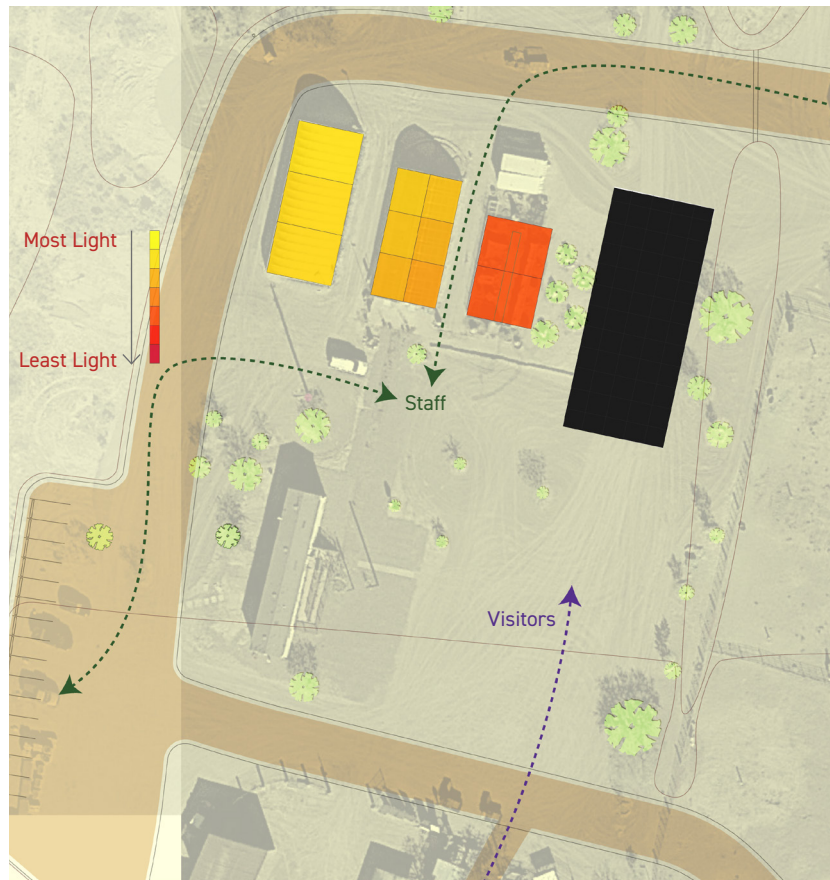
Approach over Rain Garden

Site Forces

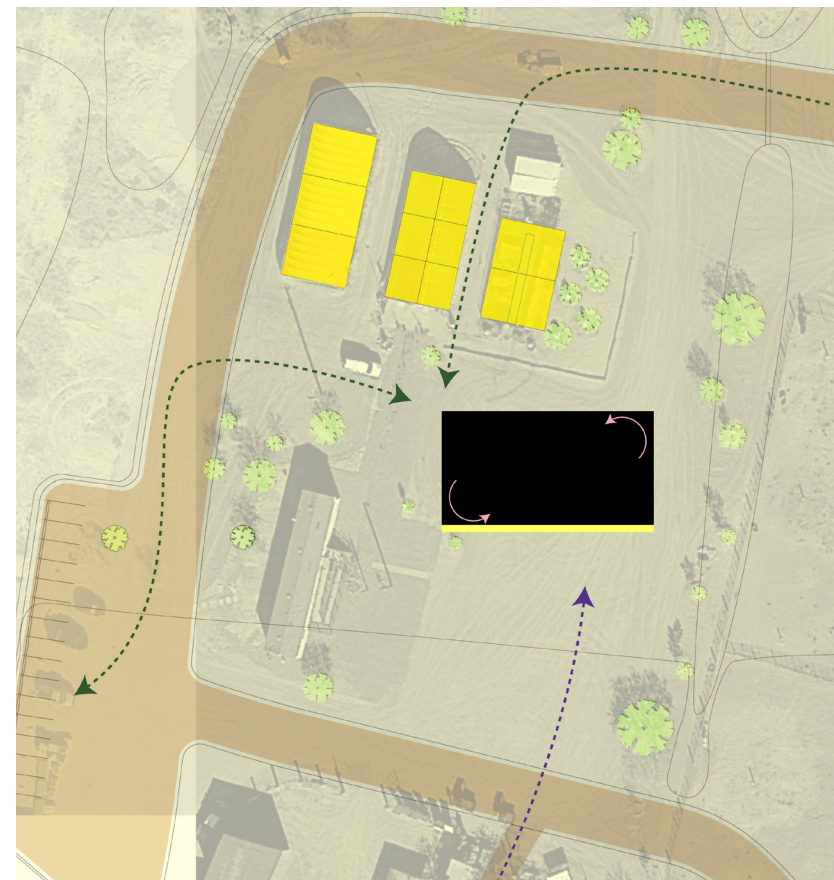
The Agricultural Center is to be located on a site that is already in use. However, the existing buildings and infrastructure sit to the edge of a large open area, with minimal vegetation and no definitive organization. Thus, the first step taken in the design of the project was to establish the organizing forces of the site.

The Center's location, orientation, massing, and site improvements were designed with solar, wind, water, circulation, and existing infrastructure in mind. The Yoeme cultural values of stewardship and interdependence determined the criteria of environmental performance and optimization of existing infrastructure.

The project is sited in proper relation to the existing growing areas to allow perennial solar access. It is then rotated and pulled apart to optimize direct solar gain and natural daylighting. Program blocks are divided further to provide circulation across the site, and to create sheltered exterior spaces adjacent to the conditioned buildings. The project uses roofs to collect rainwater for irrigation of food crops, as well as diverting gray water into wild landscaped areas for wind buffering.



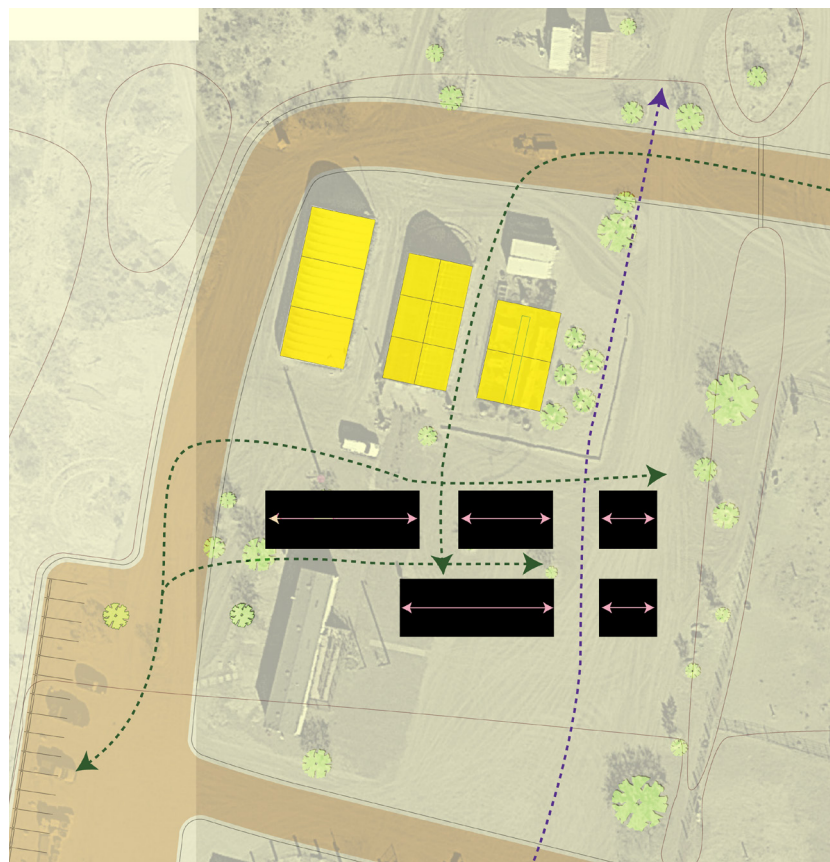
1 Situating Building For Adequate Daylight To Existing Growing Area



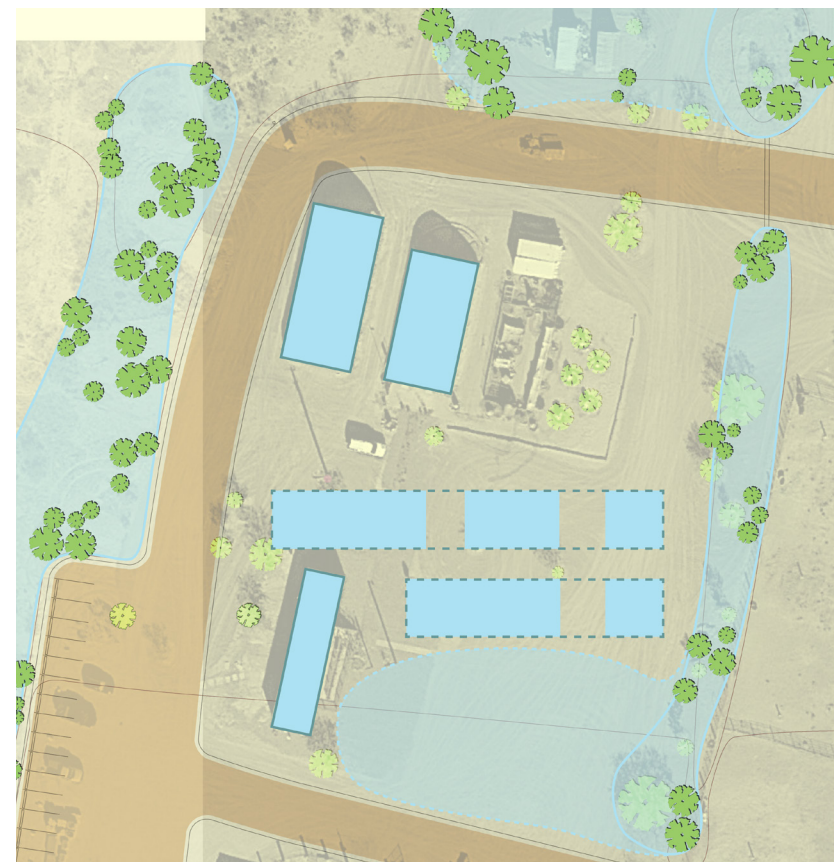
2 Rotating Building Mass to True South for Winter Solar Gain



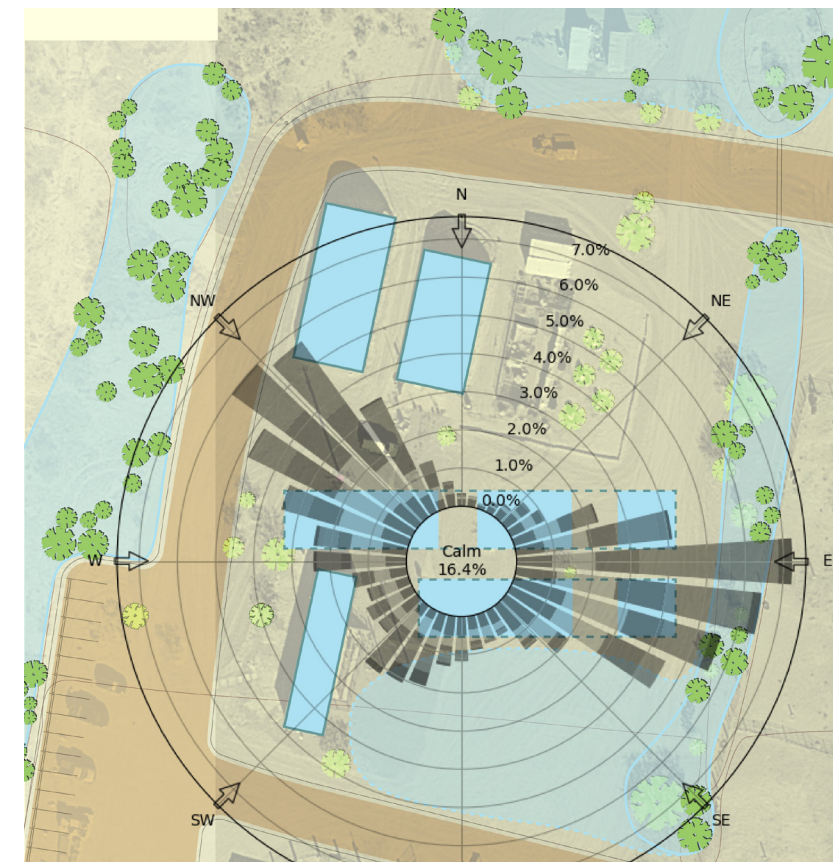
3 Separating Masses for Daylighting and Thermal Performance



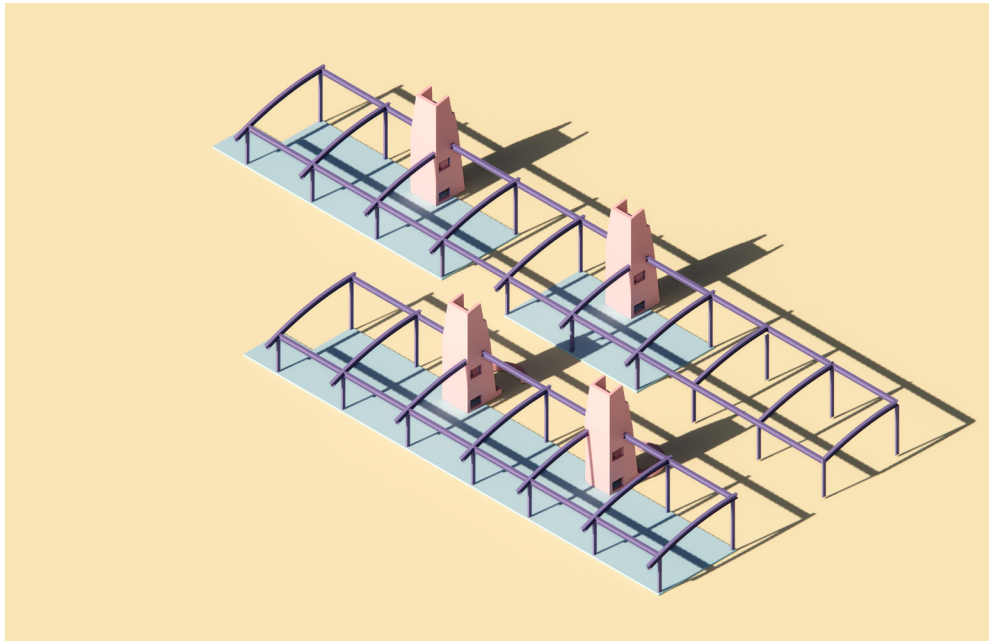
4 Continuing Overall Ranch Circulation Through Agricultural Site



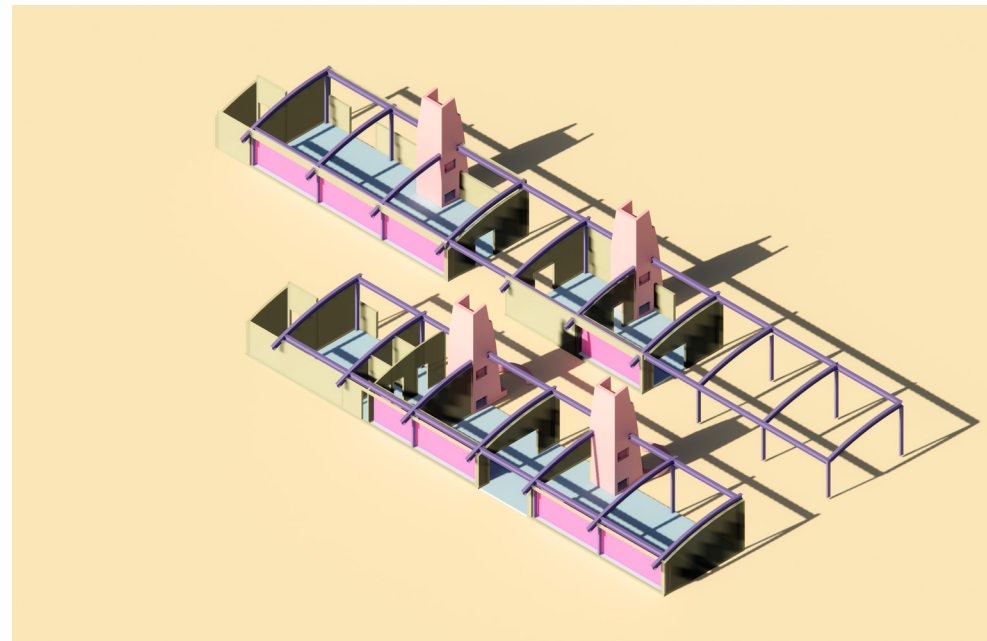
5 Rainwater Harvested from Building Roofs and in Wild-Vegetated Bioswale Buffers



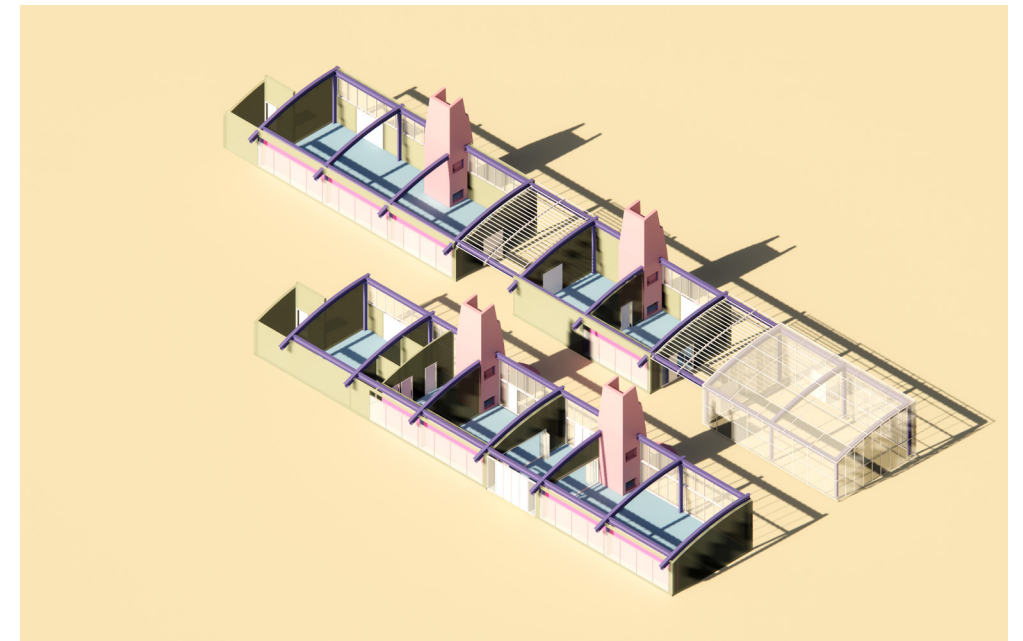
6 Vegetation Grown with Harvested Rainwater Oriented to Block High East-West Winds



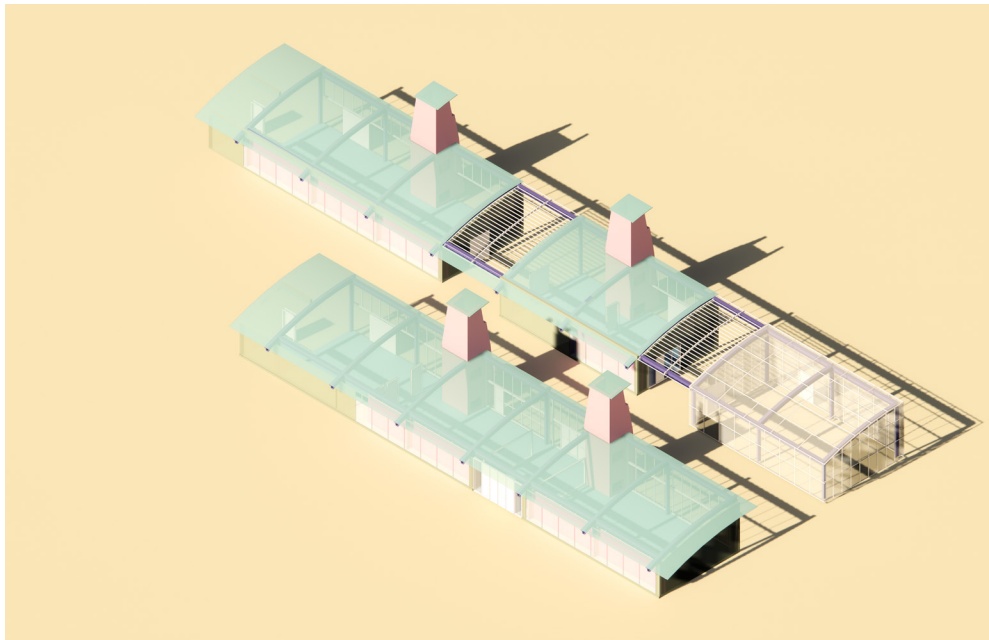
1 Cast Concrete Floor Slabs & Cooling Towers | Structural Steel Frame



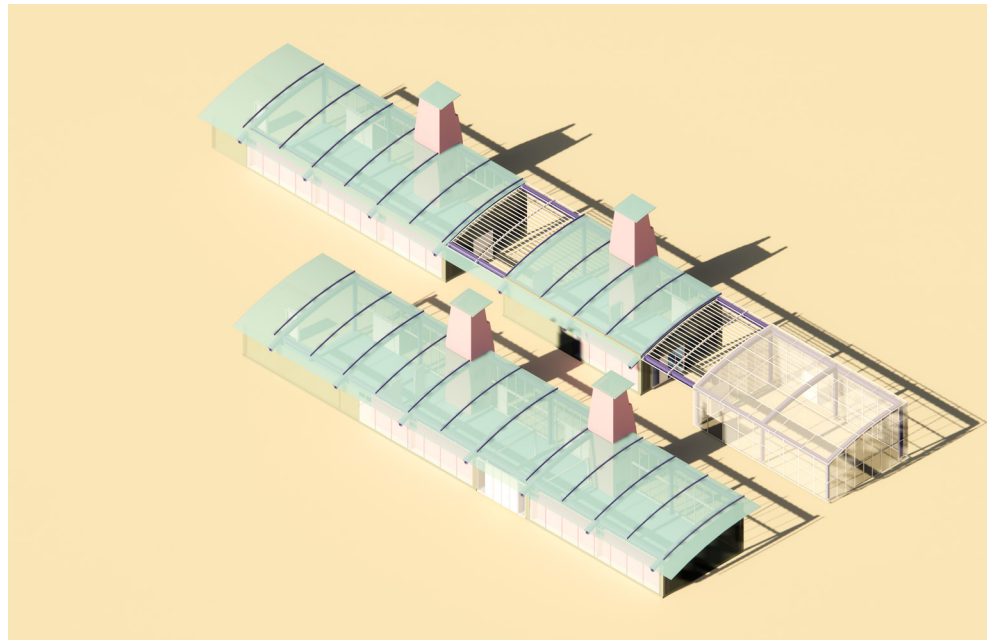
2 Unfired Adobe Trombe Walls | Stud Frame Insulated Walls



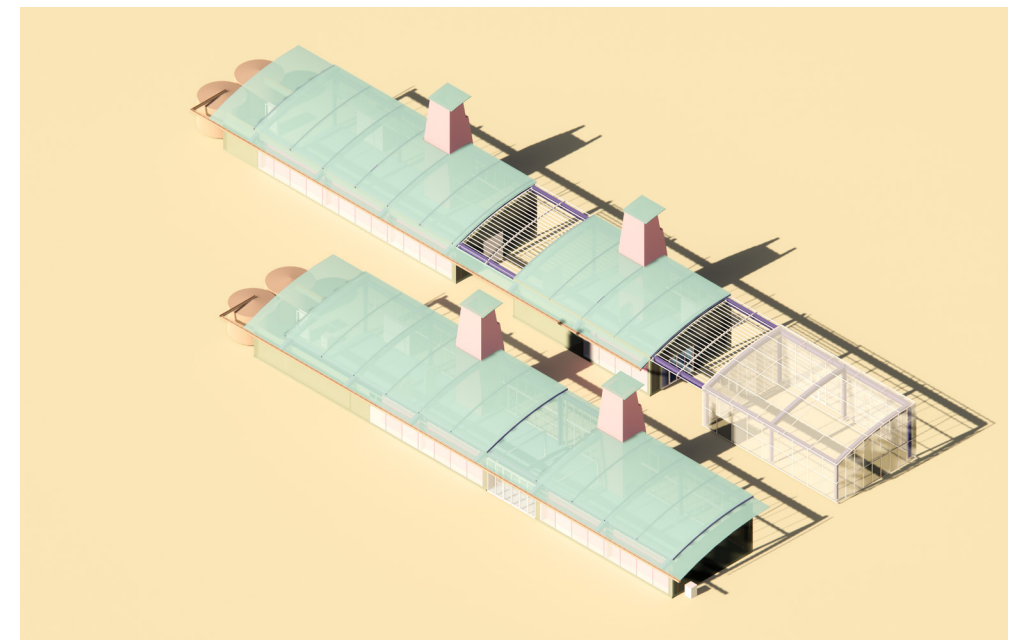
3 Curtain Wall Glazing



4 Insulated Metal Roof



5 Secondary Roof Structure



6 Vented Secondary Metal Roof | Rainwater Harvest



Structural Section Model

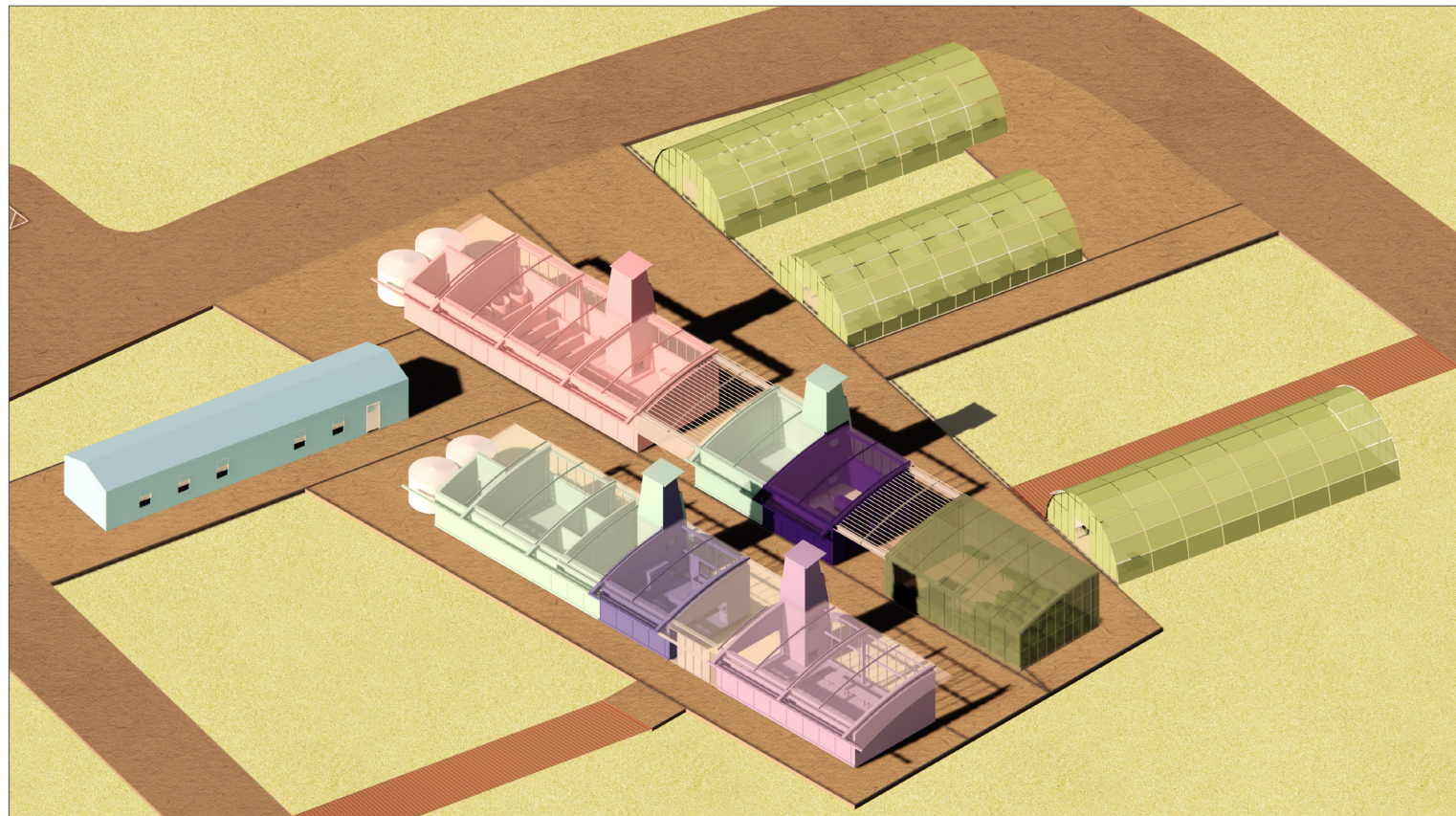
Structural Design

The ease of constructibility of the Agricultural Center was a primary goal of this project. The structure was conceived as a pre-fabricated structural steel frame anchored to slabs on grade, from which opaque and transparent roof and walls could be hung. This allows for less specialized trade crews, and a faster time to dry-in. Both volumes are identical in section, which essentially halves the engineering required for the construction. Significant economic savings are a result, not only in engineering costs, but also in material fabrication, as both the steel frame structural bays and the concrete tower cores are repeated elements throughout the project.

The formal strategy is a nod to the agricultural vernacular of long lean quonset huts and hoop houses, which already exist at Mochik Ranch.

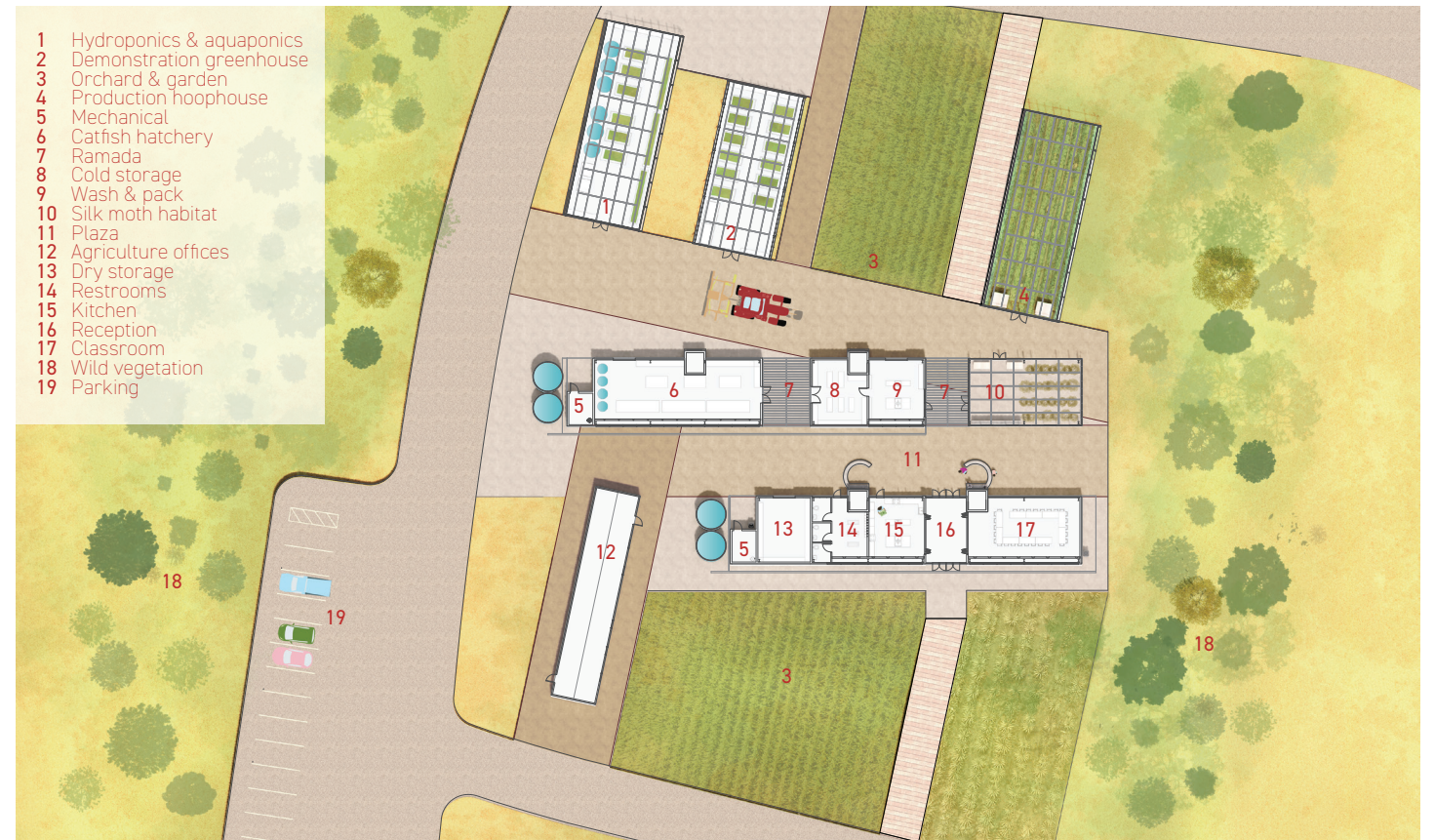


Structural Section Model



Plant Moth Fish Process Cook Learn Admin Support

Axonometric | Use

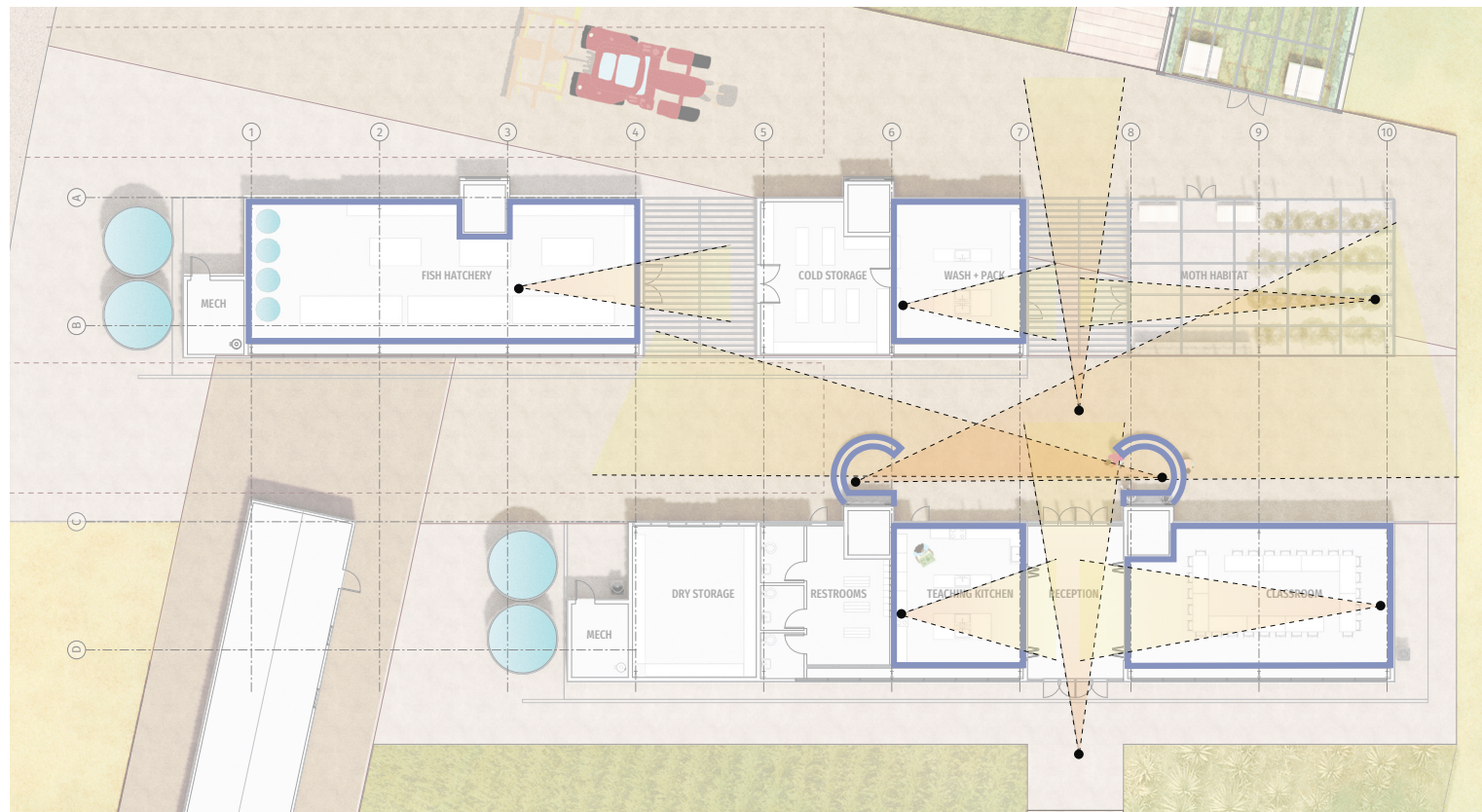


Site Plan

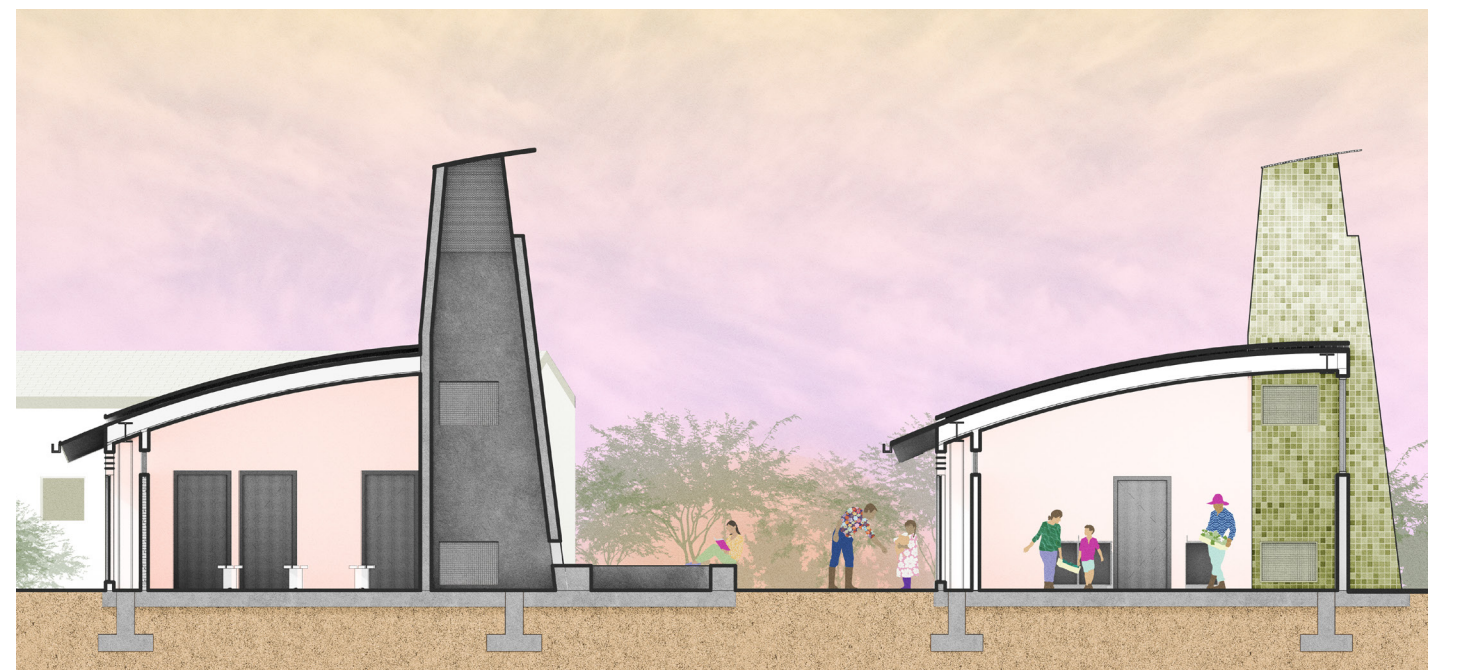
0 25 50

Wellbeing

The Center was designed according to published research on health and wellbeing in the built environment. Biophilic principles of prospect and refuge were designed into both floor plan and section of the buildings. Daylighting, air exchange, volumetric proportion, and material choices were optimized to published metrics of wellbeing. Overall site utility was also considered; an organized and well-planned site is one that more readily allows its users comfort and ease.



Plan | Prospect and Refuge

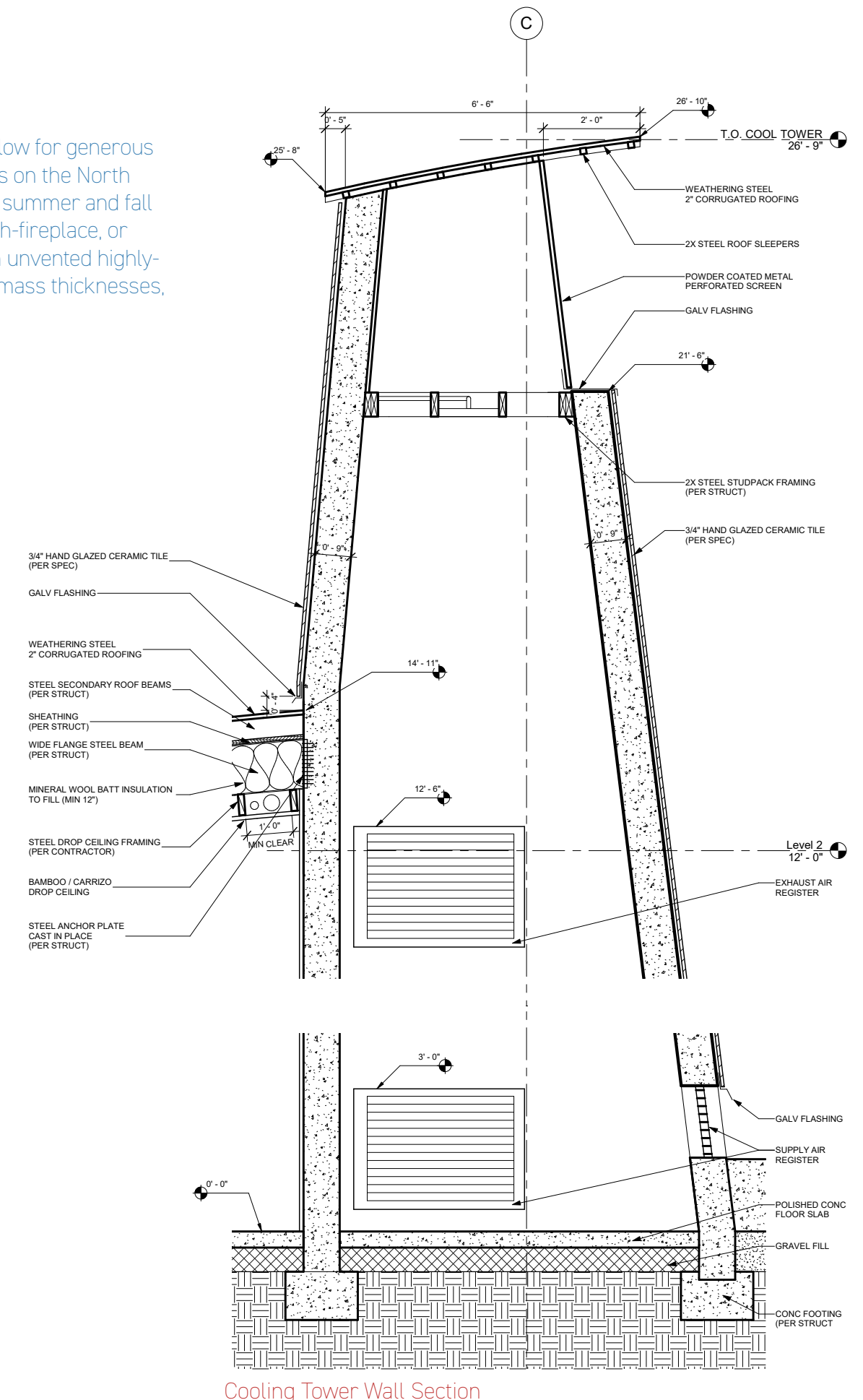
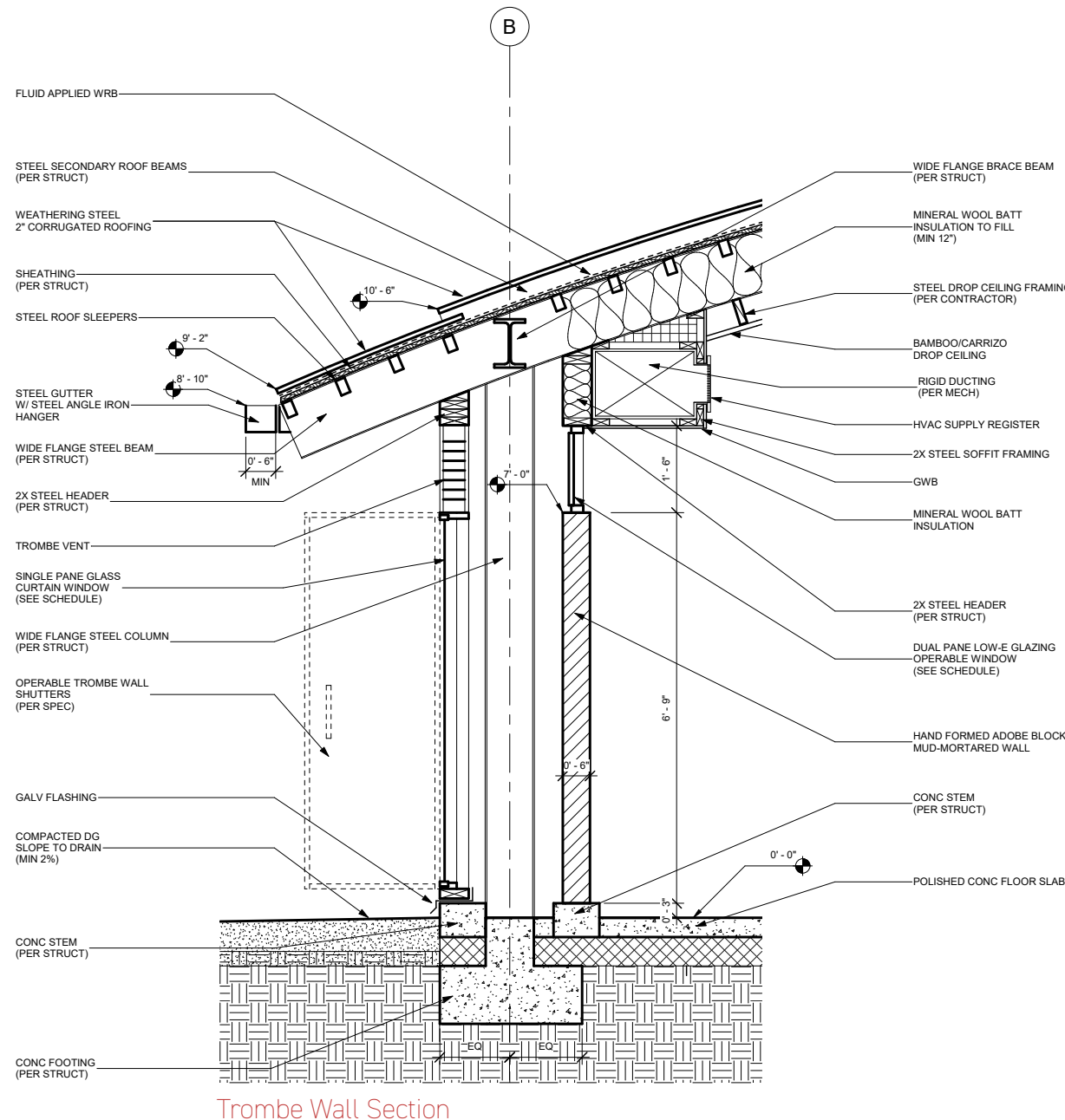
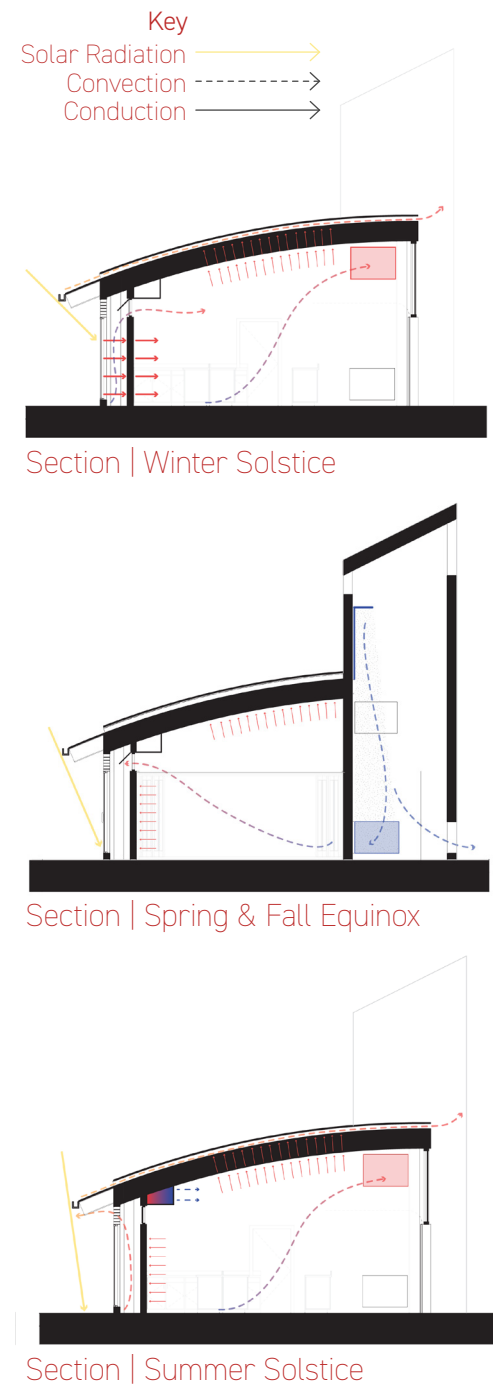


Section Facing West

0 1 2 3 4 5 10

Integrated Passive Design

The architecture is optimized for passive strategies of heating, cooling, ventilation, and daylighting. Shallow volumes with high North-facing glazing allow for generous daylighting, and an unfired adobe trombe wall along the South aids in both passive heating and cooling throughout the year. The cast concrete towers on the North elevation act as structural cores for the pre-fabricated steel structure, as well as ventilation stacks for both air intake and exhaust. In the hot and dry summer and fall months, the evaporative cooling can be directed to the exterior plaza spaces between buildings, which have the social and thermal function of a coolth-fireplace, or "coolthplace." The double roof structure uses only a minimal amount more material than a conventional single roof, which allows for the benefits of an unvented highly-insulated primary roof with a vented cavity above. Thermodynamic flows from internal and external loads were computed with software to optimize mass thicknesses, ventilation opening sizes, glazing sizes and locations, and mechanical systems sizing and location.





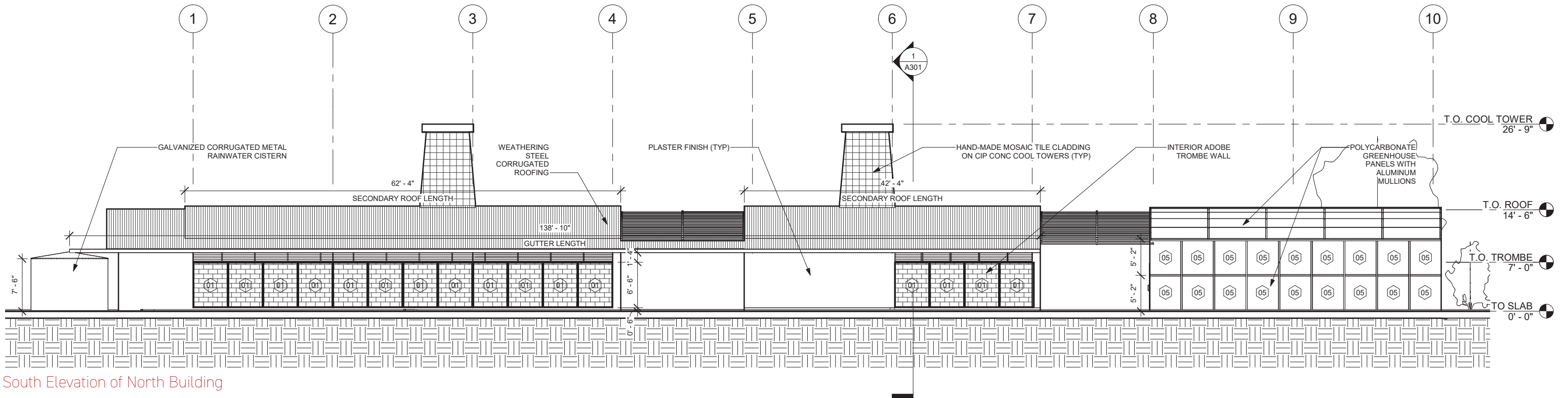
Community Gathering in Plaza Between Buildings



Class in Teaching Kitchen

Material Strategy

Traditional building materials are culturally significant to the Yoeme, and their use in the architecture of the Agricultural Center creates a sense of Tribal identity and ownership. Adobe walls and carrizo roofs define Yoeme dwellings, but these natural materials are fragile and require continual maintenance. Instead of using these materials as load-bearing or exterior elements, this project places these materials inside the structure, into closer contact with the users, and under the shelter of an efficient and durable skin.



South Elevation of North Building

Stewardship

Agricultural Center

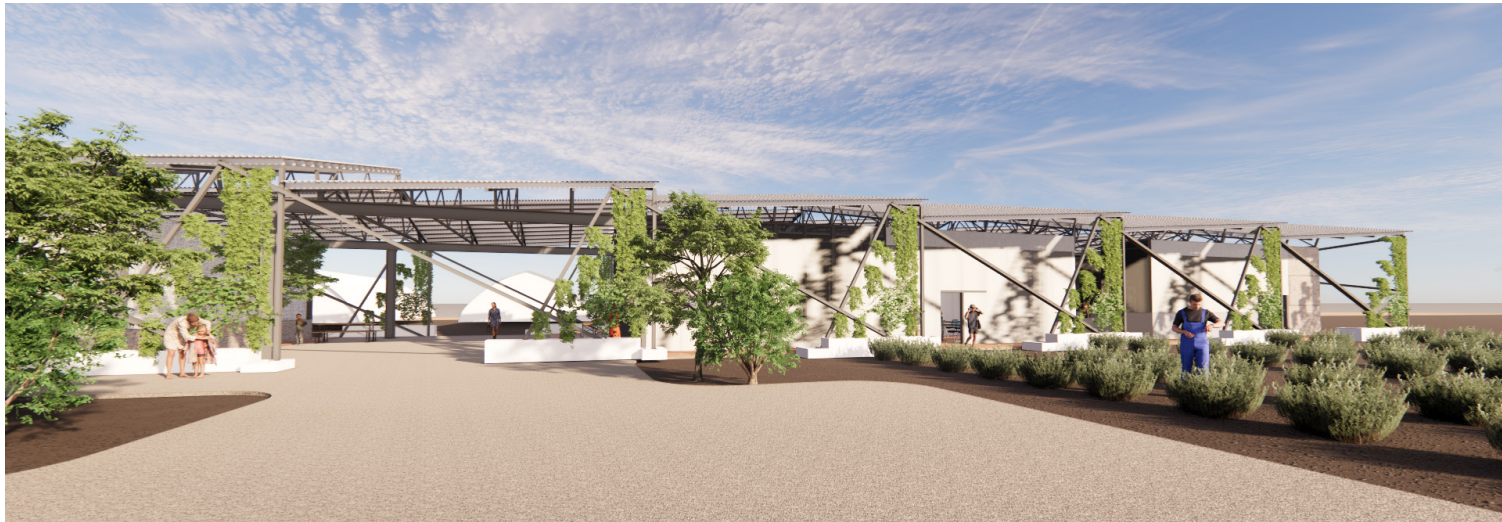
Project Narrative

The Agriculture Center Expansion is designed to strengthen and emphasize connections. This project unites the site's existing infrastructure under an overarching roof composed of structural members that serve multiple roles. Not only do these members rely upon each other for stability; without each playing its part, the finished project would function inadequately. For instance, the outer columns both collect water and supporting shading vines on trellises.

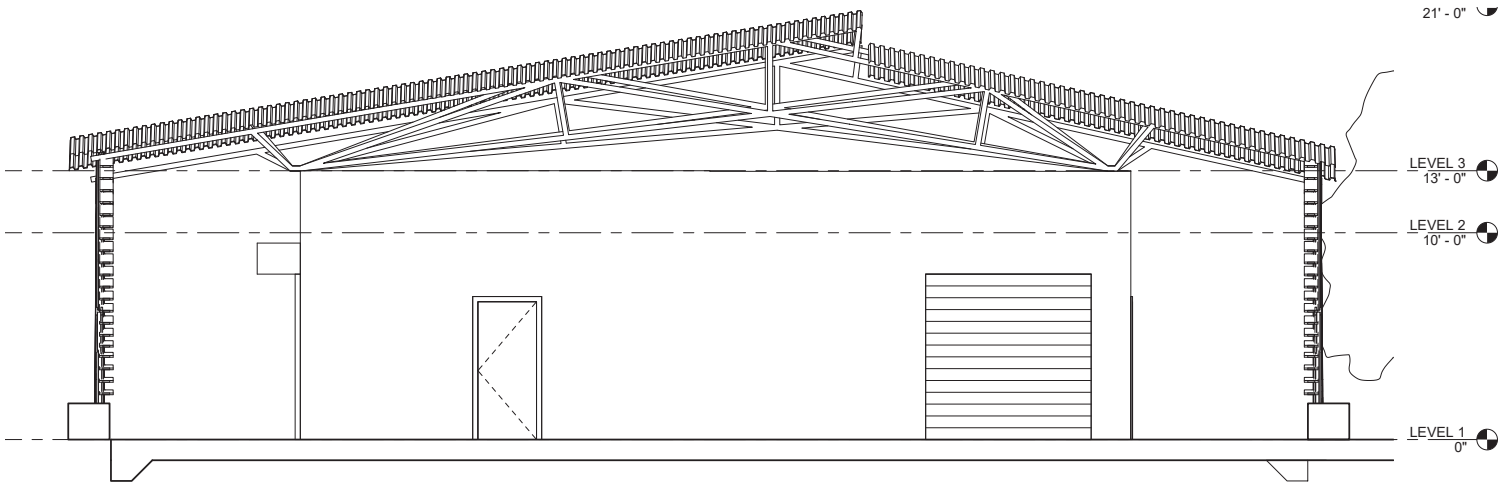
With the Pascua Yaqui Tribe's young average age and excitement for the site's potential and growth, it is important to focus on the versatility of this site. Thus, there is a lightness to the structure and the materials used. The modularity of the center's structural pattern can be replicated and repeated, allowing for future expansion. These choices emphasize adaptability and the flexibility to grow with the Tribe.



Event in Covered Patio



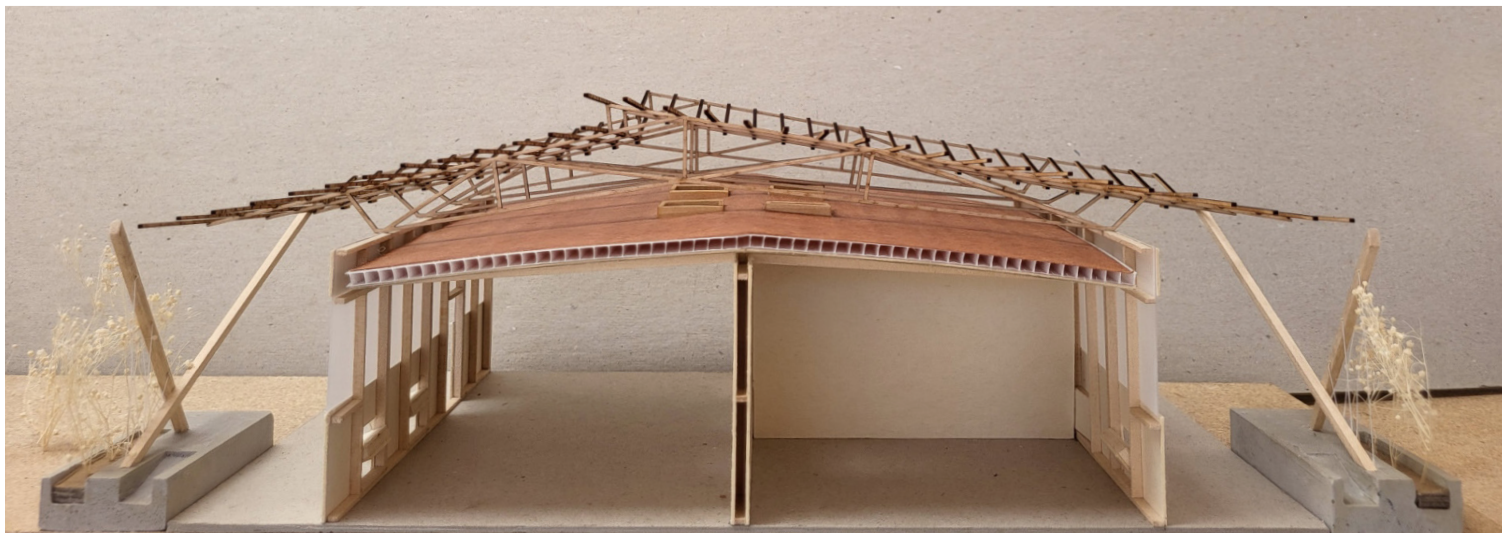
Agricultural Center Approach



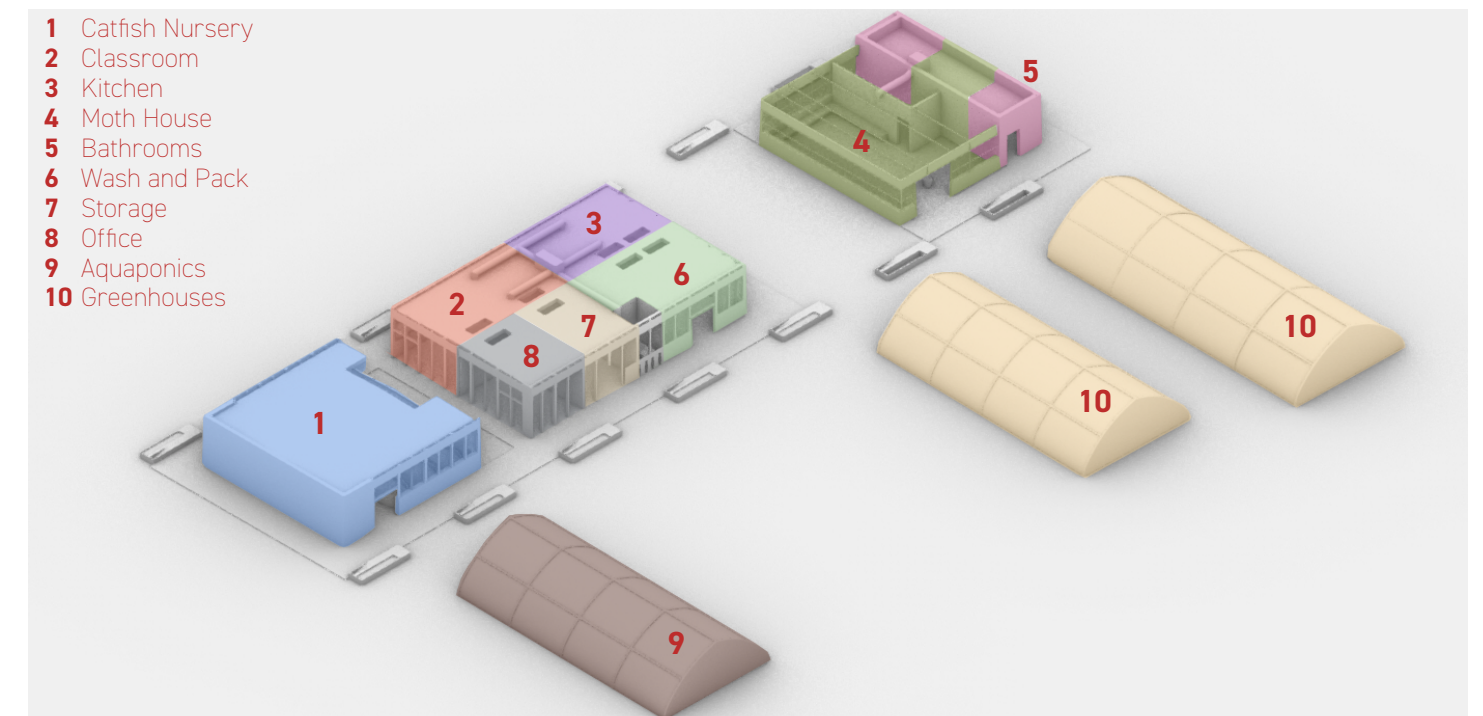
West Elevation

Materiality

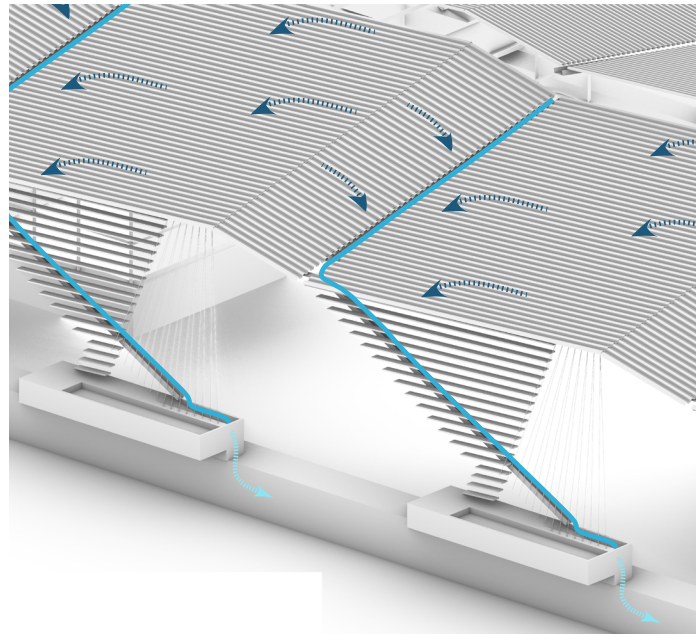
The steel superstructure is a repeating pattern across each structural bay. This allows for both a visually complex composition and efficient fabrication and installation. The conditioned volumes below utilize framed walls that host polycarbonate for visual connection and daylighting. The floors are made of thermal mass to regulate temperature variability.



Section Model



Axonometric | Use



Roof Harvesting Rain Water



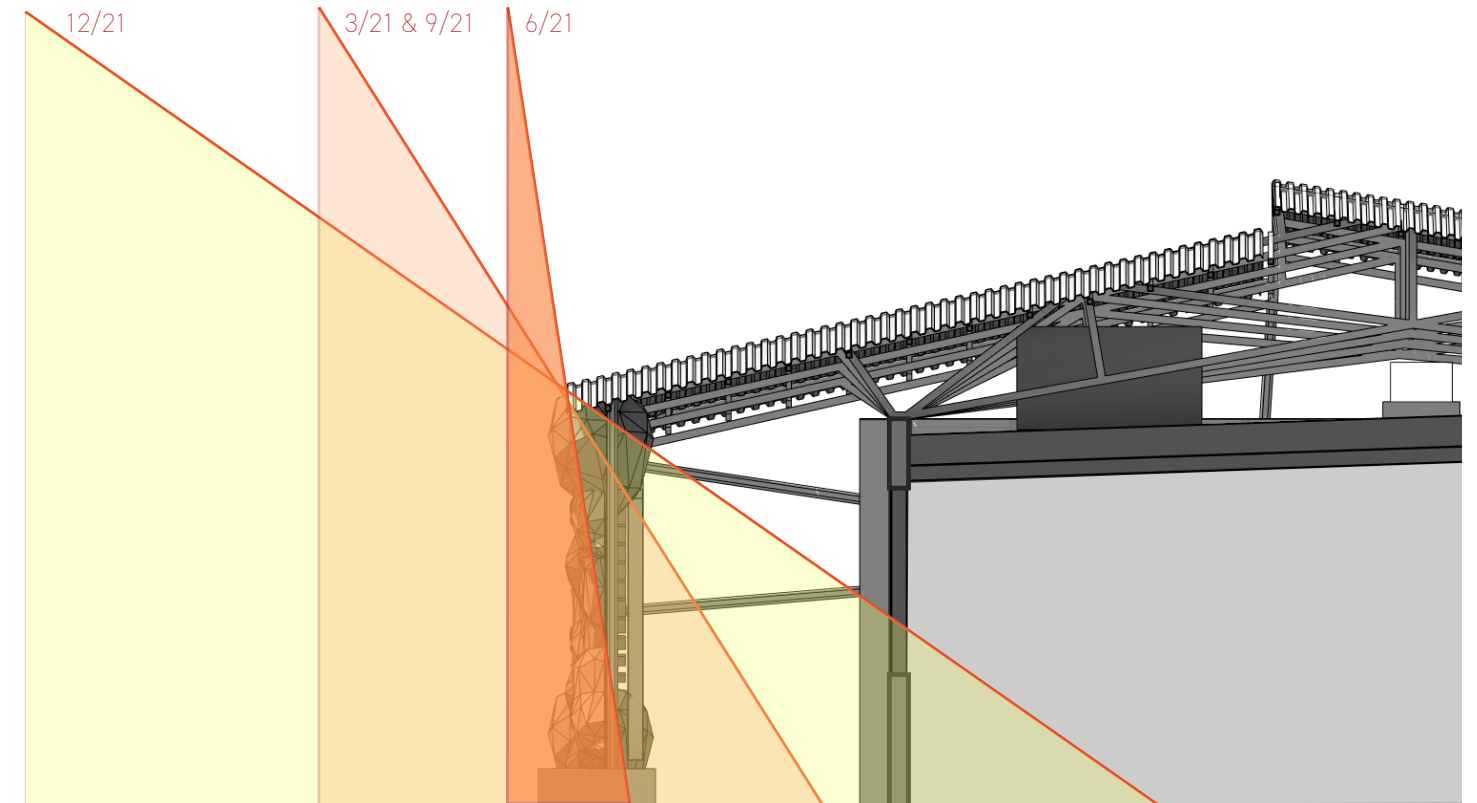
Circulation Corridor behind Trellises

Water Handling

Considering an average annual rainfall of 11," the roof has enough surface area to collect 80,000 gallons annually. The rain water is directed from the upper roof surface down through integral gutters that bring the water harvesting into direct view of the Center's users. This water is directed first into planters that grow vines, shading the southern facade of the structure in summer. The planters then overflow into drains that direct the water to underground cisterns. The two cisterns, each 5' x 8' x 100' in dimension, have a total holding capacity of 60,000 gallons.



Plan | Water Recycling

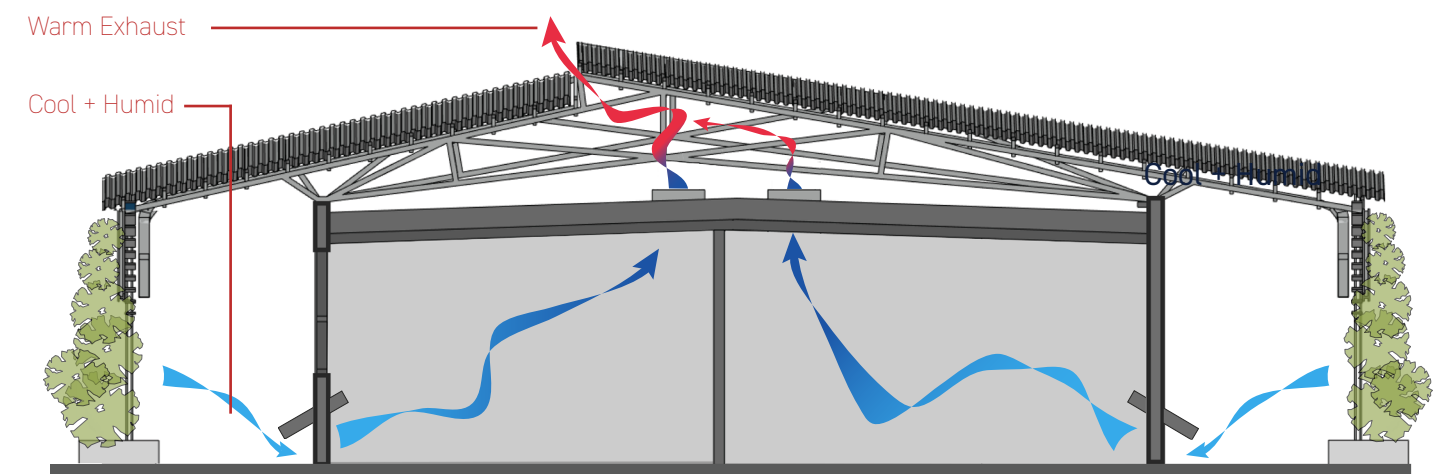


Section Facing West | Solar Angles

Solar Design

The building is oriented with the longest elevations to the North and South, which ensures minimal summertime heating in the Sonoran Desert. The secondary metal roof is equipped with generous overhangs to the South and North, which provides the contemporary equivalent of a porch. This allows diffuse reflected daylight to reach into the interior spaces, while only allowing direct solar gain during the winter months. The secondary metal roof also aids in stack effect, which is facilitated by operable louvers adjacent to the shading vines, and operable shaded skylights in the roof of the conditioned volumes.

The deep overhangs create an exterior circulation corridor, which reduces conditioned space that would be needed for interior circulation. The users are brought into direct contact with the double roof strategy by literally inhabiting it whenever they circulate throughout the Center.



Section Facing West | Stack Effect Ventilation and Cooling