



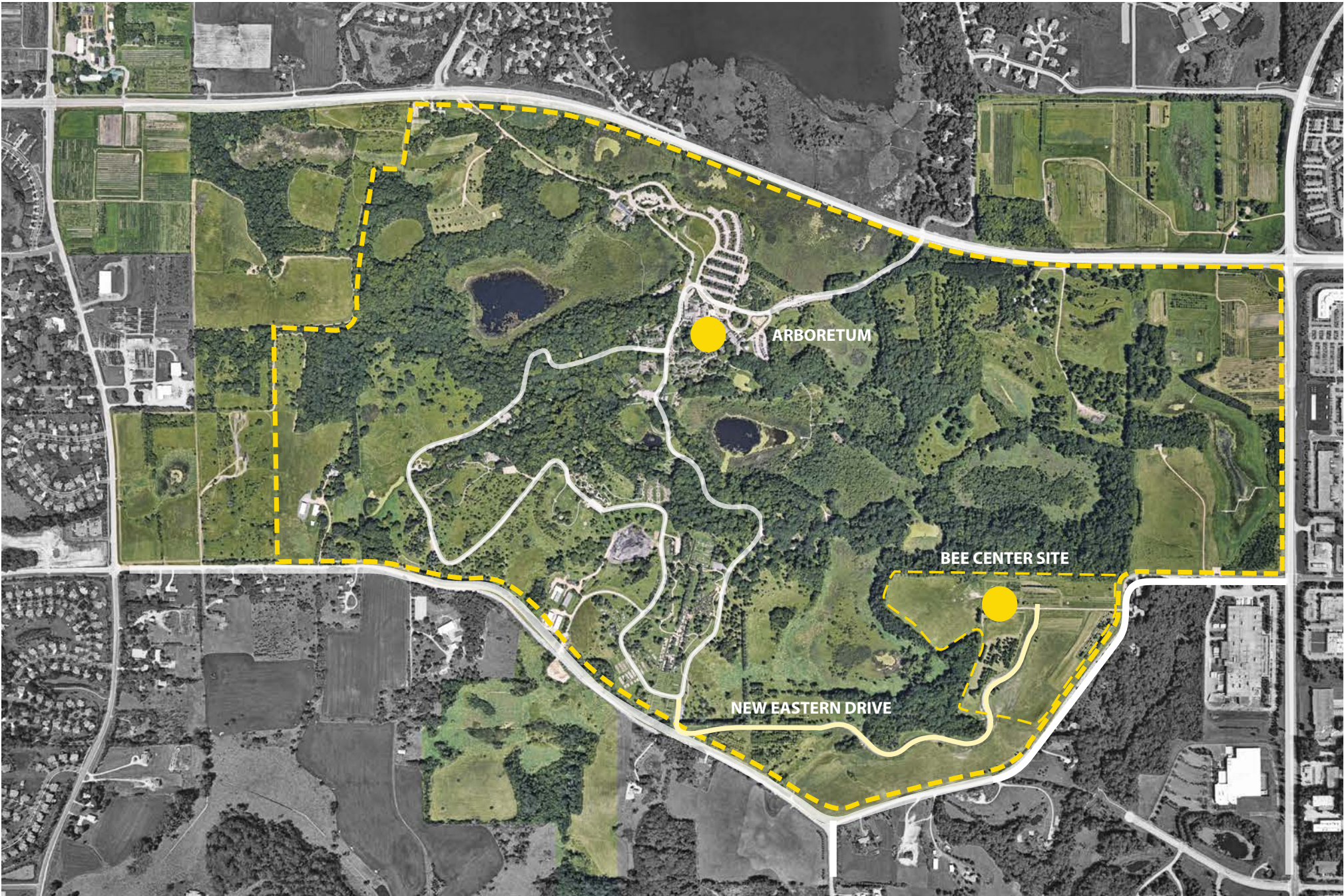
DEMONSTRATION POLLINATOR GARDENS SURROUND THE BEE CENTER

The Tashjian Bee and Pollinator Discovery Center is a multi-functional public education facility that provides learning opportunities for children and adults about the lives of bees and other pollinators, their agricultural and ecological importance, and the essential, fascinating and delicious ways our human lives intersect with theirs.

Program: Along with their importance to flowering plants, honey bees and other pollinators play a crucial role in the production of the food we eat. However, the health of pollinators is in danger from pesticide use, lack of forage, destruction of nest habitats, and colony collapse disorder. Serving as the outreach arm of the University of Minnesota’s Bee and Pollinator Research Lab, this new 6,700 square-foot center contains exhibit space, a multi-purpose learning lab, a demonstration apiary, and a honey extraction room.

Design: Located on a previously abandoned historic farm site at the Minnesota Landscape Arboretum, the Bee Center is the first building of a new campus focusing on sustainable farm to table education. The architect developed a master plan for this new campus with the 120-year-old Red Barn as its heart and future event center. The practical beauty of traditional farm buildings inspired the Bee Center’s simple forms, its siting, material selections, and its passive design strategies. The Bee Center’s exposed glulam truss framing is a contemporary response to the wood framing of the Red Barn’s hay loft. The design connects each interior program space to demonstration pollinator gardens, beehives and future food production plots.

The Bee Center strives to serve as exemplar of its program’s urgent call for human conversation and best practices in our natural environment. Located in an Arboretum that is visited by hundreds of thousands in all seasons, the Bee Center invites visitors to deepen their understanding of, and connection to, the natural world around them.



SITE CONTEXT OF THE MINNESOTA LANDSCAPE ARBORETUM

The Tashjian Bee and Pollinator Discovery Center facility provides a venue for outreach to the community on the alarming decline in the health of honeybees, Monarch butterflies, and other native pollinator populations. It supports public bee keeping with its honey extraction room. The design team facilitated a series of community listening sessions which engaged Arboretum staff, trustees, as well as neighbors potentially impacted by new patterns of use proposed on the Arboretum grounds. Results included encouraging the architects to pursue a Midwest agrarian aesthetic relating harmoniously to the site's legacy Red Barn. The center' warm wood spaces, expansive views and traditional forms are inviting to visitors of all ages and backgrounds and the exhibits and programming encourage all to sense the world from the vantage point of the small pollinators. A learning lab provides space for community events such as weddings and family reunions as well as structured learning activities. The center ties into and expands the trail and road system of the 1100 acre arboretum encouraging physical activity and providing a rich experience of nature for visitors of all mobility capabilities. The electric arboretum trolley provides transportation connecting the Bee Center to other amenities on the larger site.

MANDATORY METRICS

Community Engagement:	Involve: Stakeholders were involved throughout most of the process
Walk Score:	5

ENCOURAGED METRICS

From a survey of building users or other method, estimate percentage of building occupants who commute via alternative transportation (biking, walking, mass transit, etc.):	70%
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NATIVE, POLLINATOR-FRIENDLY PLANT SPECIES FILL THE BEE CENTER'S DEMONSTRATION POLLINATOR GARDENS

Many elements of traditional farming prior to the use of large petroleum powered machinery, chemical fertilizers, and pesticides were inherently gentle to natural ecosystems while supporting healthy human life. An emotional attachment to the memory of such farms persists. Located on the remains of a classic Minnesota farmstead, the Bee Center taps into this legacy to reestablish the farm site with community-based programming to teach and promote farm-to-table methods for growing, preparing, and preserving food.

Pollinator and wildlife friendly landscapes as well as sustainable food production plots will surround the building. Demonstration gardens showcase native perennial species adjacent to non-native annuals for live-observation of pollinator preference. Sourced within 200 miles of the site, these native plants reflect a diverse palette, rich in pollen and resin production for the ultimate foraging and nesting habitat. A garden with exposed sandy soils interprets the value of over-wintering habitat for ground-nesting bees while a collection of depressed stones capture water and exhibit micro-habitats critical to supporting complete bee life-cycles. A University-developed bee lawn offers visiting homeowners an alternative to traditional turf and interpretive signage throughout the site serves as a shopping list for those interested in starting pollinator-friendly gardens in their own backyards.

MANDATORY METRICS	
Percentage of the site area designed to support vegetation (landscape or green roof):	64%
Percentage of site area supporting vegetation before project began:	96%
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals:	50%
Additional information: Before the project began, the fallow farm site was dominated by invasive species including reed canary grass and aggressive brome grass. As predominately a monoculture, the site supported little biodiversity. Transitioning the site back to a suite of native species actually enhanced biodiversity and offered increased habitat capacity.	



LANDSCAPE DESIGN AND SITE CONTEXT

The agricultural legacy of the site informs the Bee Center’s approach to water management; stormwater collects on the clean metal roof or permeable site paving, flows through visible and traditional gutters and downspouts, and is absorbed and infiltrated by the site’s extensive soft landscaping and natural prairie. A new onsite sewage system developed, funded, and monitored by a University of Minnesota research grant eliminates long inefficient connections to the regional system and recharges the aquifer. The highest performing low-flow fixtures allowable by code are specified. And the limited irrigation used for the demonstration gardens’ native plantings are drawn from on-site wetlands rather than the aquifer.

MANDATORY METRICS

Predicted annual consumption of potable water excluding process water (such as cooling towers):	39%
Is potable water used for irrigation?:	Yes
Predicted peak month consumption of potable water for outdoor (irrigation) purposes:	0.05 gal/sf

ENCOURAGED METRICS

Percent of rainwater that can be managed on site from a maximum anticipated 24-hour, 2-year storm:	100%
Percent of Total Suspended Solids (TSS) removed from stormwater runoff?:	97%

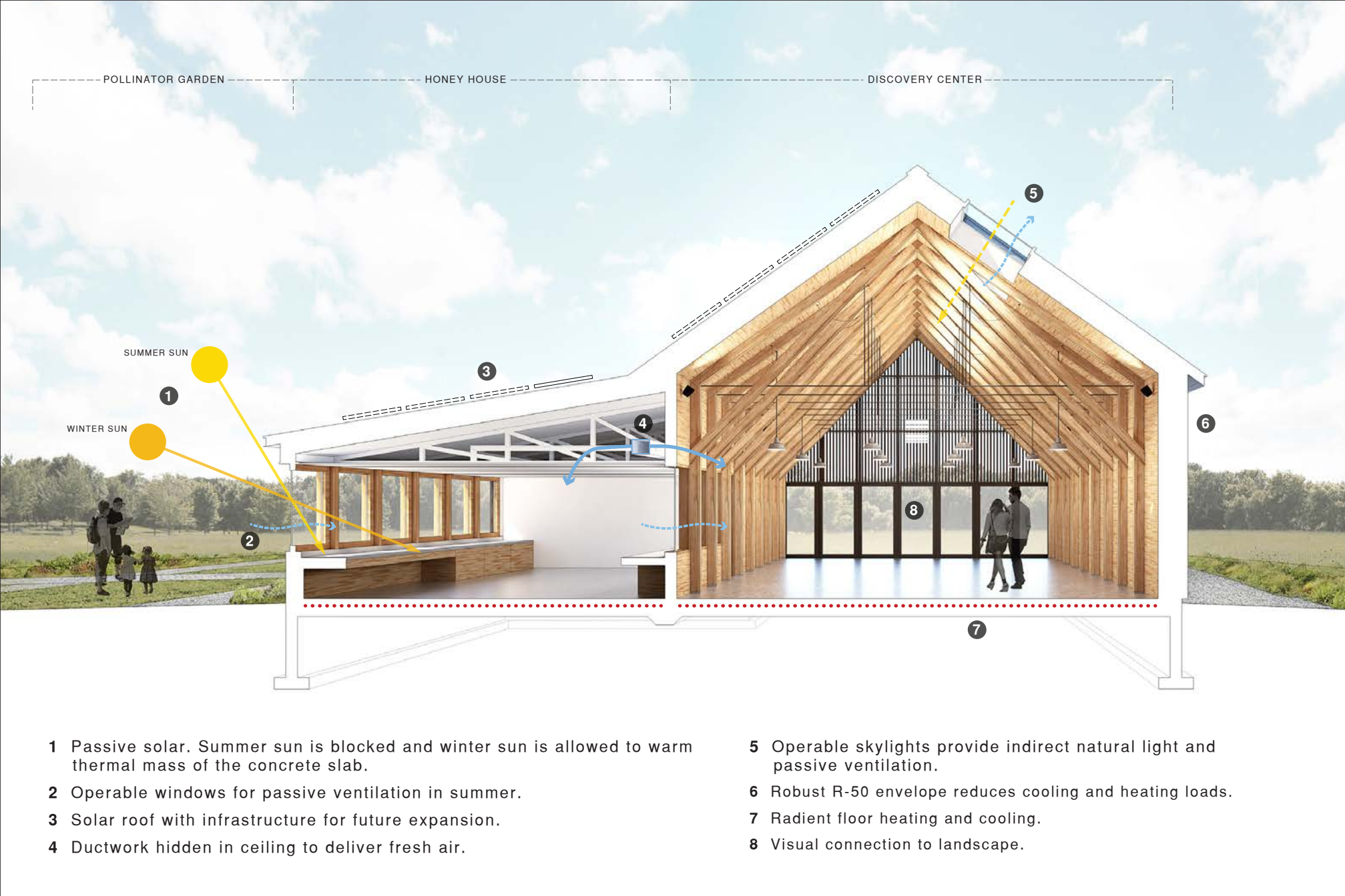


THE DISCOVERY SPACE FRAMES ITS EXHIBITS WITHIN THE CONTEXT OF THE BEAUTIFUL LANDSCAPE ARBORETUM

Traditional agricultural architecture was function based, economical, and efficient by necessity. The design of the Tashjian Bee and Discovery Center adapts these basic values, creating simple orthogonal gable roofed forms that use basic wood framing technology and that are relatively easy to build. Early explorations of more complex “contemporary styled” forms were distilled through continuous editing that sought to eliminate unnecessary elements. Instead, the articulation of structure, daylight, and curated site connectivity provides clarity, utility, and drama in the project’s three main spaces. A single south-facing skylight set in an articulated wood ceiling animates an entry that frames the working apiaries beyond. Simple wood trusses are allowed to penetrate an angular daylit volume in the classroom. And the rhythm of exposed glulam trusses and north-facing skylights in the vaulted Discover Space culminates in a wall of glazing opening to the natural prairie beyond.

A well-crafted, ordinary, and modest pallet seeks extraordinary economy and beauty. Modified SIPs panels were chosen for structural and insulation efficiency. Polished concrete heated and cooled floors and provide structure, enclosure, finish, and conditioning. And shou-sugi-ban charred Accoya siding provides a natural, beautiful, durable, and low maintenance wood exterior.

MANDATORY METRICS	
Cost per square foot:	\$432/sf
ENCOURAGED METRICS	
Percent estimated annual operating cost reductin from a code-baseline building:	51%



SECTION THROUGH THE DISCOVERY SPACE AND HONEY HOUSE

The Bee Center combines passive design strategies with a robust envelope, radiant systems, a geothermal field, and photovoltaics to deliver thermal comfort and energy performance in a challenging Minnesota climate with cold, harsh winters and hot, humid summers.

Passive design: The project is oriented to optimize solar control. South glazing uses optimized external shading to block summer sun and allow direct winter sun to warm the thermal mass of the concrete floor. The building section encourages natural ventilation with operable windows serving as inlets to capture shoulder season breezes from the South East before harnessing the stack effect and exiting operable skylights on the north face of the gabled roof.

Envelope: Superinsulated walls (R52) and roof (R72), triple pane double low-e glazing, and continuous air barrier dramatically reduce heat loss and gain through the building skin.

Systems: A radiant concrete floor slab is tied to a 15 Ton ground-source heat pump with twelve 300 ft deep boreholes to provide superior efficiency and thermal comfort. Staff has commented that visiting school children often prefer to sit on the floor!

Renewable energy: The project is designed to be net-zero with the future expansion of the roof-mounted 1-kW photovoltaic array.

MANDATORY METRICS

Predicted consumed energy use intensity (Site EUI):	22 kBtu/sf/yr
Predicted Net EUI:	21.6 kBtu/sf/yr
Predicted net carbon emissions:	11.68 lb/sf/yr
Predicted percent reduction from national average EUI for building type	71%
Predicted Lighting Power Density (LPD)	0.78 W/sf



THE ENTRY FRAMES VIEWS DIRECTLY OUT TO THE DEMONSTRATION APIARY

The building is approached by an expansion of the trail and road system of the 1100 acre arboretum encouraging outdoor physical activity and providing a rich experience of nature for visitors of all mobility capabilities. The design connects each interior program space to demonstration pollinator gardens, beehives and future food production plots while the building's large glass west façade brings the whole arboretum site into the building. Daylighting and natural ventilation modeling guided the shape, selection and location of all windows. The wood paneled ceilings of the public spaces are perforated and lined with acoustic insulation promoting a quiet environment. The heated and cooled floor slab is both energy efficient and comfortable. School kids love sitting on the warm floor for demonstrations on cold winter days.

The design team integrated early design analysis in the design process from the outset, leveraging energy and daylight modeling to shape spaces that frame the connections between visitor, educational content, and the outside world. Visitors can take in the changing of the seasons while feeling the warmth of direct sunlight moving through the space. Simultaneously, shading, orientation, and skylights create even daylighting for exhibits, with 83% of the spaces being fully daylit.

MANDATORY METRICS

Percentage of floor area or percentage of occupant work stations with direct views of the outdoors	100%
Percentage of floor area or percentage of occupant work stations within 30' of operable windows	100%
Percentage of floor area or percentage of occupant work stations achieving adequate light levels without the use of artificial lighting, by simulation or by direct measurement of the finished building, at a typical single point in time:	83%



WOOD WAS CHOSEN AS A NATURAL, DURABLE, AND BEAUTIFUL MATERIAL THAT RELATES TO THE SITE CONTEXT OF THE ADJACENT HISTORIC RED BARN

Inspired by its context and program, the Tashjian Bee and Pollinator Center celebrates the use of wood as its structure and predominant finish material. The project is a contemporary response to the vernacular construction of the adjacent Red Barn. Unlike the barn's single-width wooden enclosure that is visible on both sides, the Bee Center optimizes the selection of wood products for its interior and exterior.

Interior: Plywood panels cover the walls and ceilings of the project's public spaces and serve as a backdrop to the project's exposed wooden trusses. The panels and trusses are unstained and mechanically fastened to minimize off-gassing and ease disassembly.

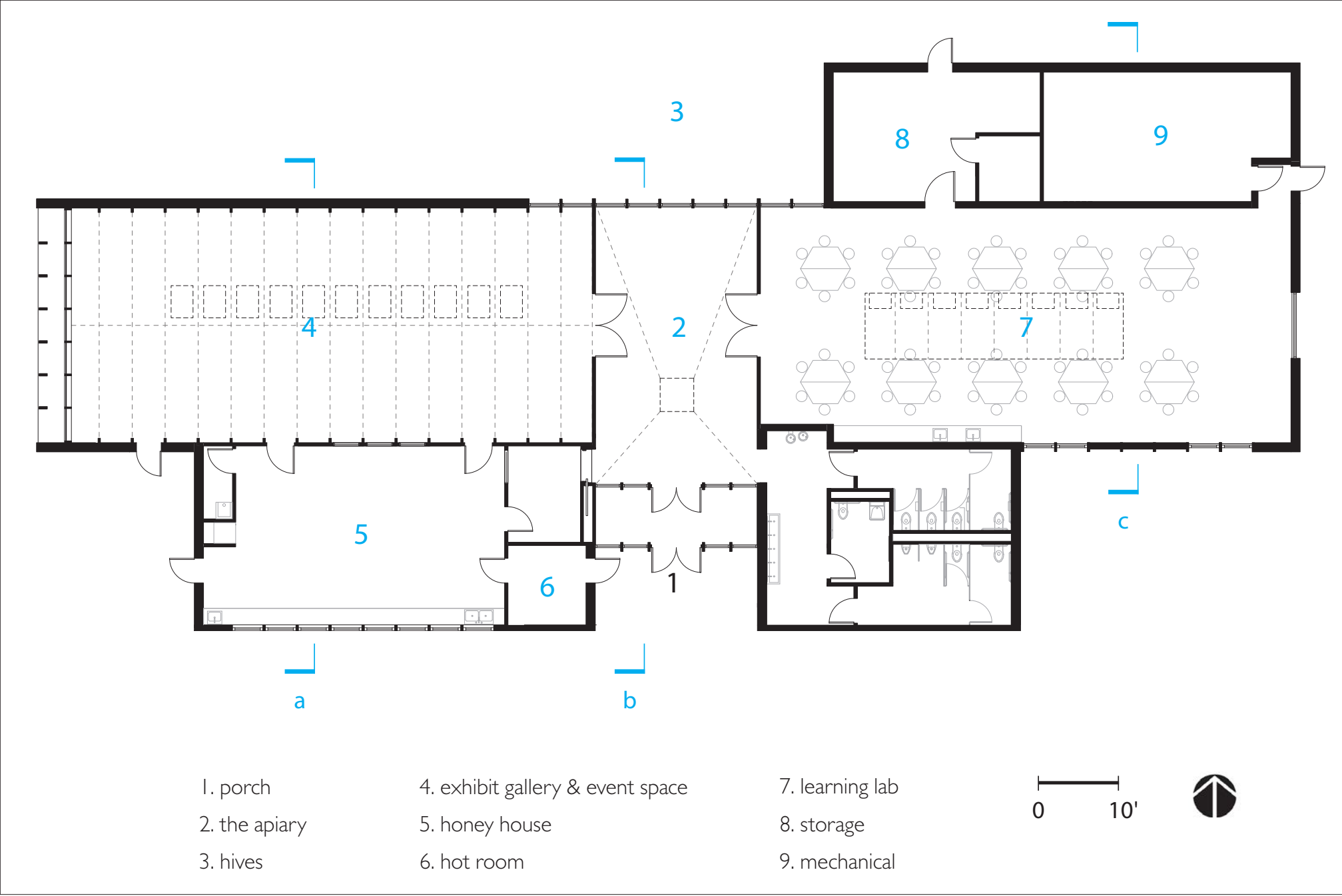
Exterior: The exterior wood finish combines contemporary wood technology with an ancient finishing process. The exterior is clad in Accoya, a Cradle to Cradle Gold certified modified timber product that uses acetylation to improve the dimensional stability, durability, and longevity of wood. The Accoya was then charred using the traditional Japanese process of “shou-sugi-ban”. This exterior finish protects and preserves the wood. It also helps preserve pollinators - the natural charred finish replaces exterior varnish that has been found harmful to bees.

MANDATORY METRICS

Estimated carbon emissions:	142 CO2/sf
Estimated carbon emissions associated with building construction:	142 CO2/sf

ENCOURAGED METRICS

Percentage (by weight) of construction waste diverted from landfill:	78%
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THE BEE CENTER'S FLOOR PLAN GIVES FOUR FLEXIBLE LEARNING ENVIRONMENTS CLEAR HEIRARCHY AND CONNECTIONS TO THE OUTDOORS

The design's simple floor plan provides structure to and invites movement between four flexible learning environments. The Discovery Space, Entry, and Classroom all open directly into one another. Each space also has a direct visual connection to the surrounding landscape. There are no partition walls in the project as flexible furniture and exhibits meet its programmatic needs. Already, the project provides experiential learning opportunities to buses of school children and adults, hosts community events, private rentals, and supports large lectures. Much like the adjacent 120 year old Red Barn will become an event center in the near future, this project's approach to providing a well organized spine to beautiful, daylit, flexible interior spaces can support a variety of public or private uses in the next 100 years.

MANDATORY METRICS

Percentage of project floor area, if any, that represents adapting existing buildings:	0%
Anticipated number of days the project can maintain function without utility power:	2 days

ENCOURAGED METRICS

Percentage of power needs supportable by onsite power generation:	2%
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THE DESIGN OF THE ENGAGING, INTERACTIVE EXHIBITS ARE SYMPATHETIC TO THE PROJECT'S ARCHITECTURE

The project team collaborated on a year of post occupancy research and have presented it at conferences and events. They analyzed real world performance through three interrelated lenses: people, space, and systems.

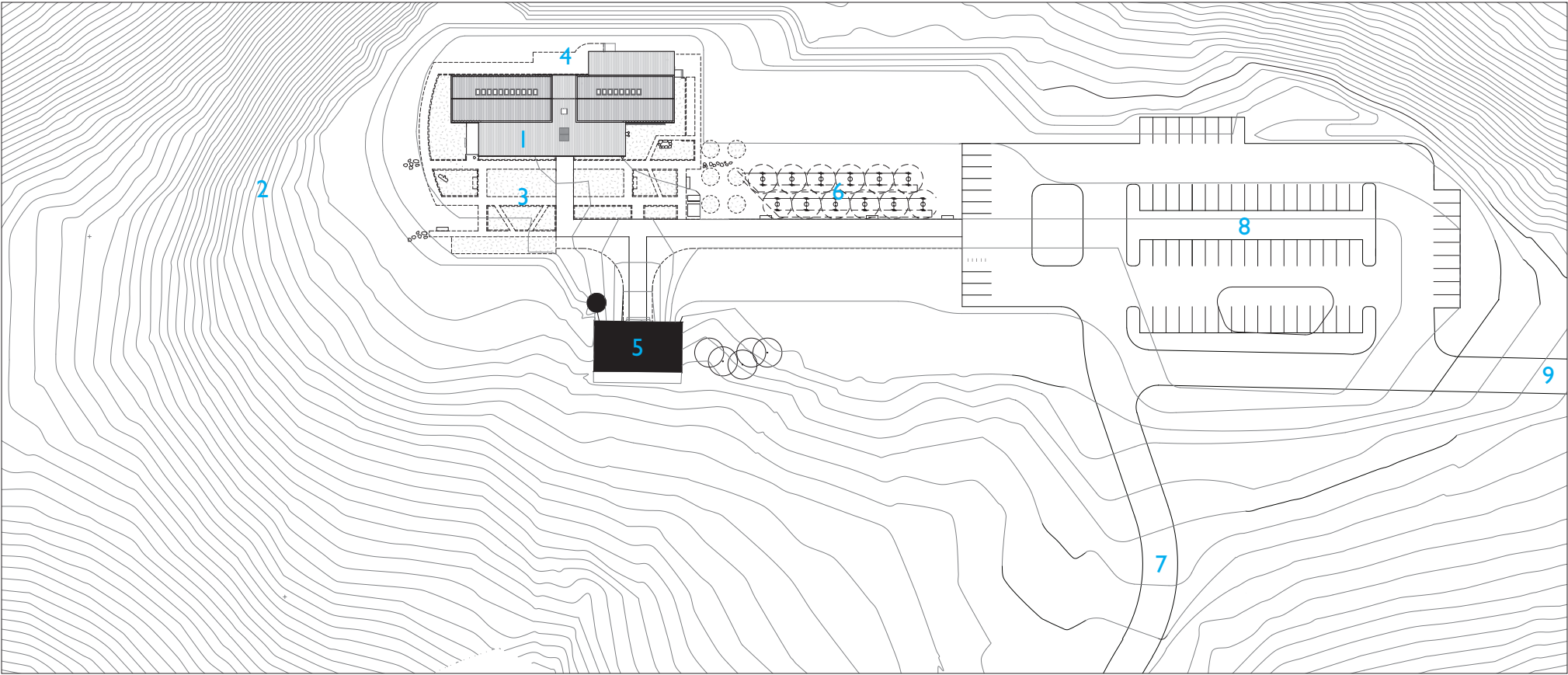
People and the perception of thermal comfort: The project's transient user groups and one full time employee is a challenge for typical post occupancy surveys. Research centered on adapting survey questions focus on radiant thermal comfort and develop a delivery method that can engage and collect feedback from a variety of visitors.

Space and thermal comfort tracking: The research team installed a wireless sensor network throughout the Discovery Space and Classroom to capture and record a grid of temperature, mean radiant temperature, and humidity analysis points.

Systems Optimization and energy performance: The building is not currently achieving its proposed building EUI. Three simple control changes to align performance with design intent have been identified to reduce energy consumption by 15 kBtu/sf/yr including operating the dedicated outdoor air handling unit on an occupancy schedule, changing the systems setpoints to 68 deg F and 76 deg F in winter and summer, and creating a buffer tank set up with a dead band and hot water reset.

MANDATORY METRICS

Has a post-occupancy evaluation, including surveys of occupant comfort, been performed?	Yes
Summarize the results of the post-occupancy evaluation: Post-occupancy surveys are actively being developed to fit this project's unique user group. Traditional post-occupancy evaluations demand a reasonable set of responses by occupants who regularly use the building to generate statistically-relevant analysis and results. This project has one full time employee, three volunteer staff, and hosts a variety of student groups, adult education events, and self-guided visitors. We have developed an online survey and tested its deployment to the small staff and adult education visitors, but the number of responses is still quite small. We are in the process of shifting away from quantitative surveys towards testing small group interviews focused on a qualitative understanding of occupant comfort for the Bee Center. The anecdotal, qualitative feedback we have received is promising. The full time staff member has reported satisfaction with her environment including daylight, views, acoustics, and thermal comfort. She even said that children often prefer to sit on the radiant floor during winter programming. We are hopeful that the continuing lessons learned from developing an approach to post-occupancy for the Bee Center can be applied to the many small-scale public projects that can benefit from engaging with users well after a project is complete.	

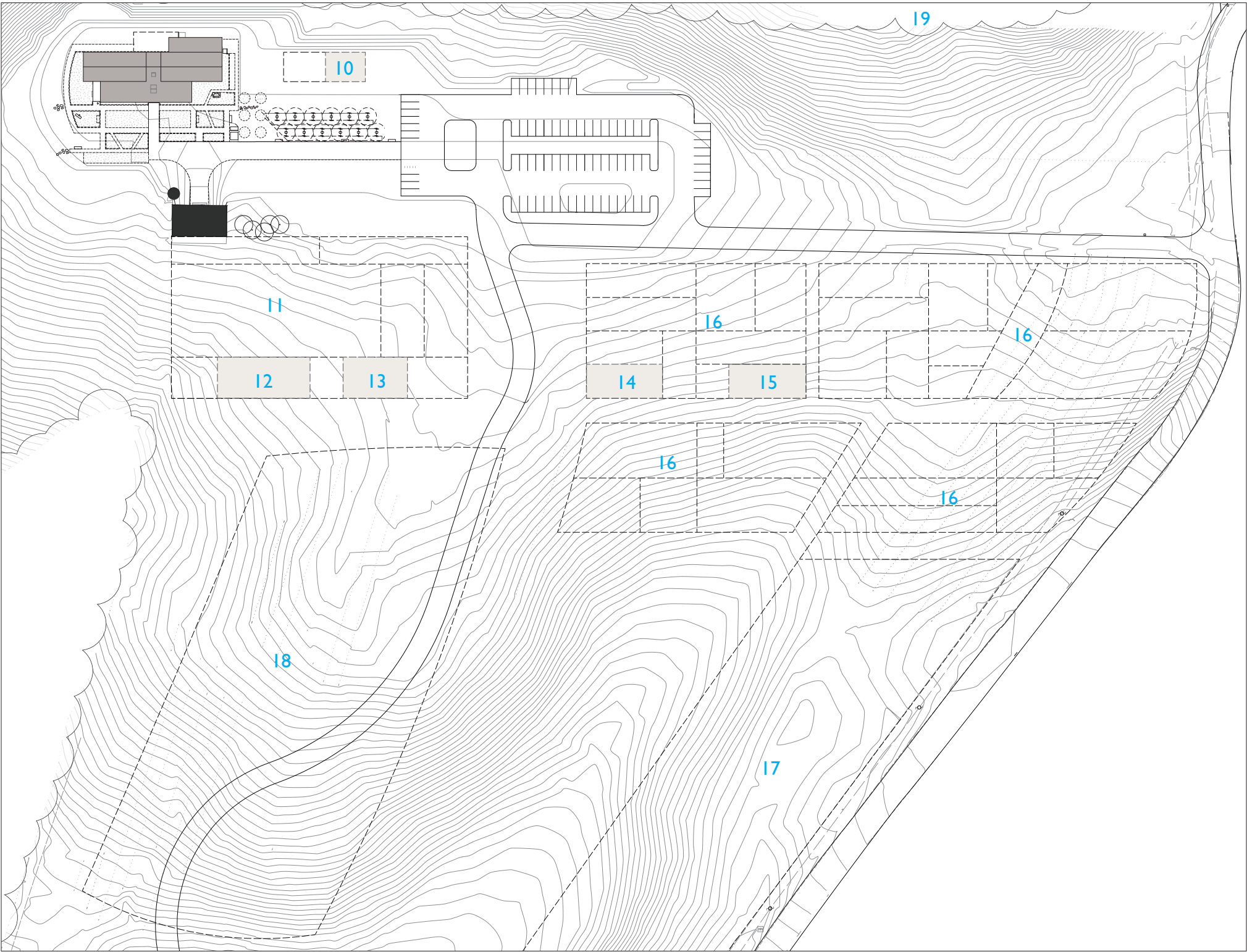


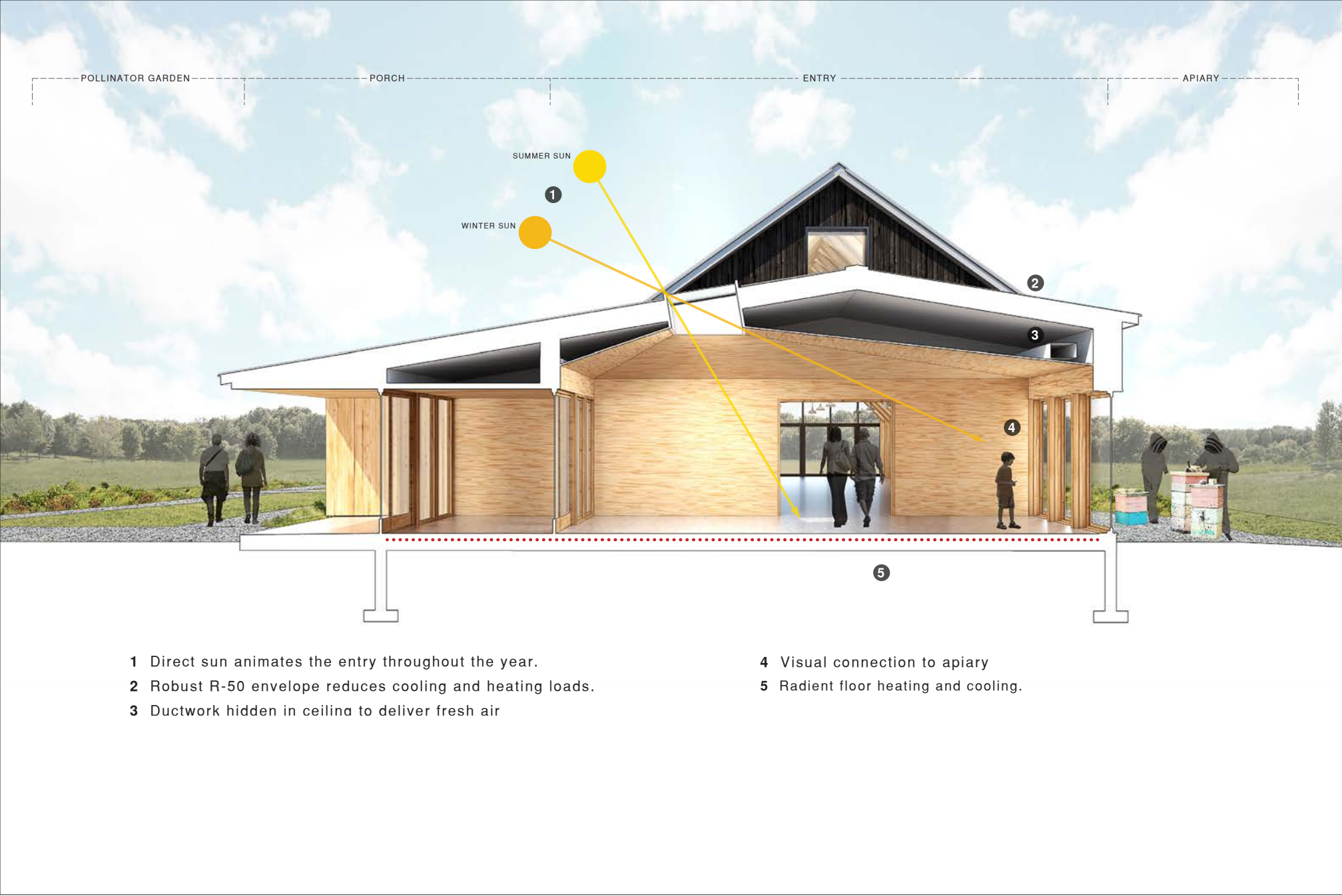
Tashjian Bee and Pollinator Center Site Plan

- 1 Tashjian Bee and Pollinator Center
- 2 wildflower meadow
- 3 pollinator gardens
- 4 apiary
- 5 historic red barn
- 6 geothermal well field
- 7 arboretum drive
- 8 parking
- 9 entry

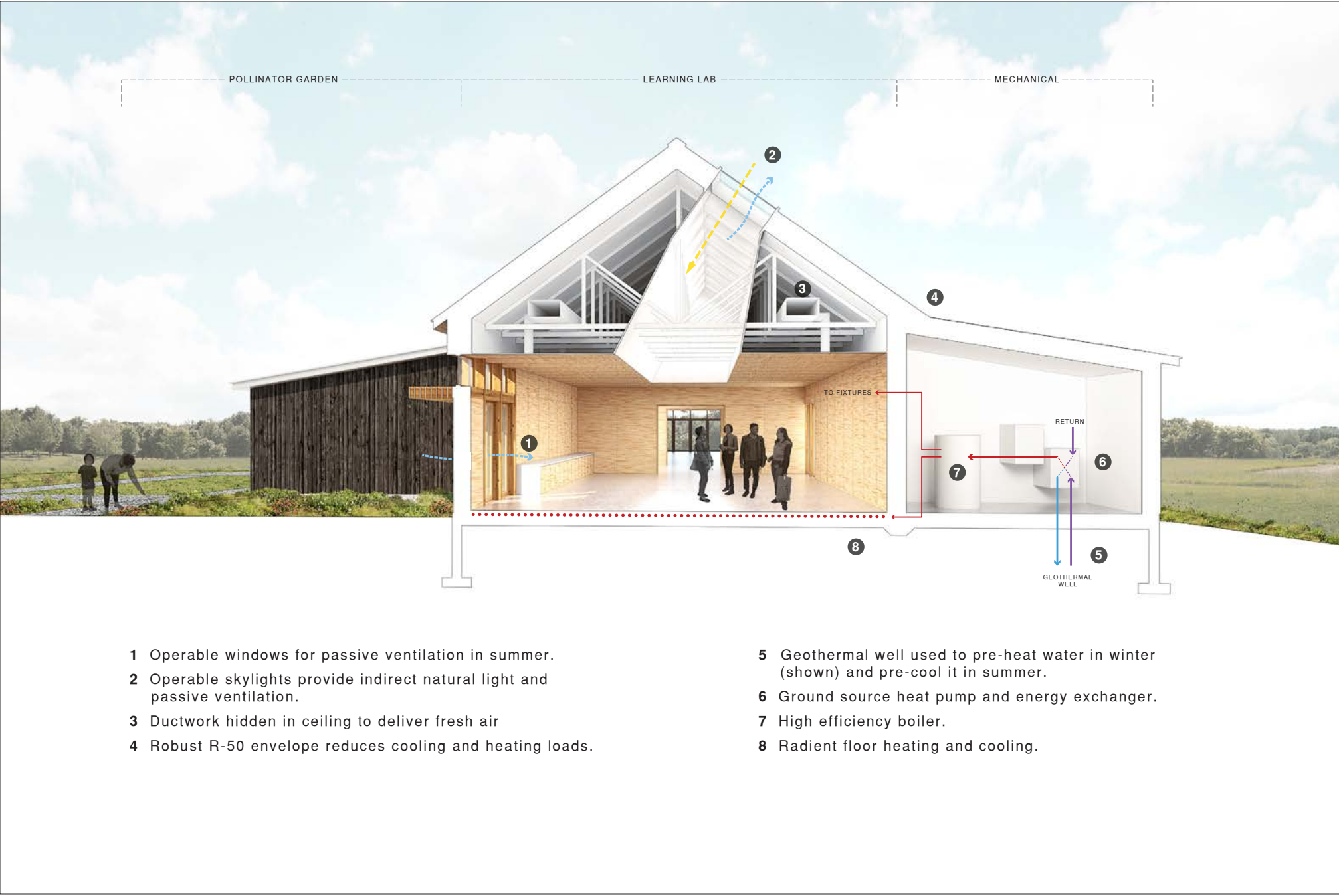
Future Phases of Master Plan

- 10 outdoor classroom
- 11 event lawn
- 12 master gardener university extension program
- 13 garden shed
- 14 learning kitchen & dining
- 15 garden shed
- 16 demonstration gardens
- 17 meadows & fields
- 18 orchard
- 19 stormwater filtration pond





SECTION THROUGH THE ENTRY AND APIARY



SECTION THROUGH THE CLASSROOM AND MECHANICAL ROOM