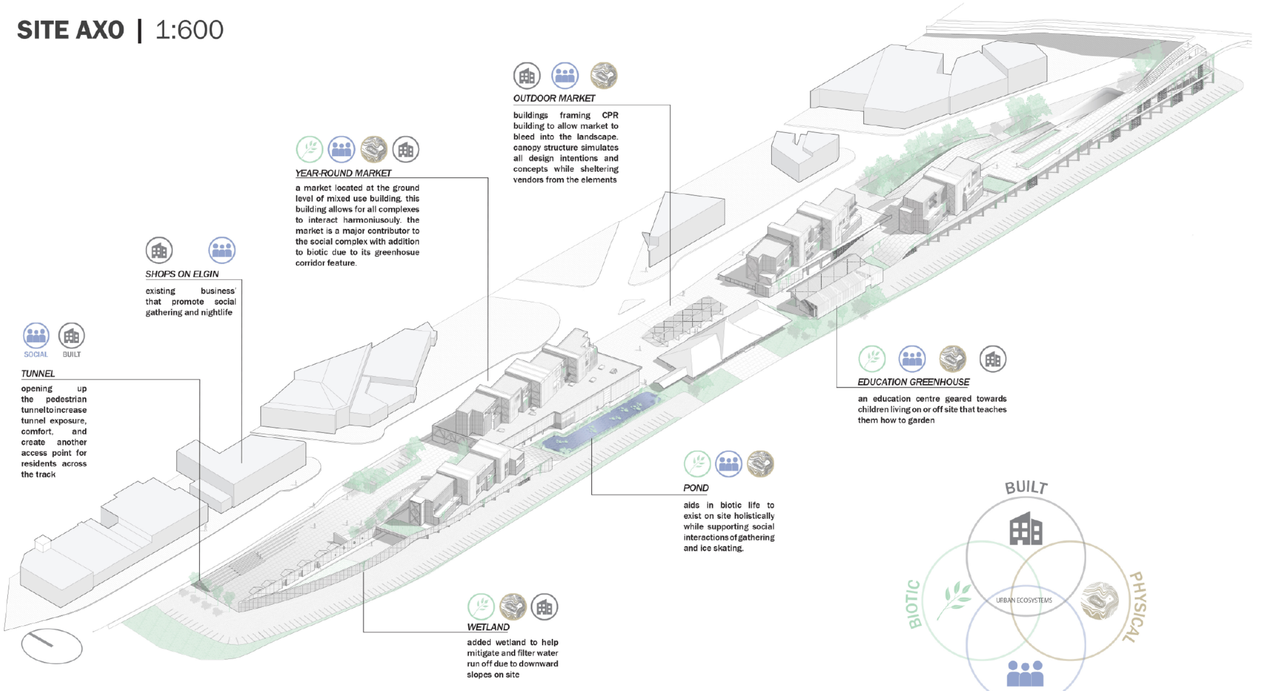
THE GREEN HOUSE EFFECT

JOSEPHINE LI | LIVINGSTON BOYD

downtown sudbury's urban development caused a divide in demographics and a lack of public greenspace. Urban development can be broken down into four complexes that need to interact in order for holistic human and urban ecosystems. Through the intervention of biotic, physical, social and built complexes, onto our site while also emphasizing on those already present, a balanced urban ecosystem can be achieved. this can be done through the integration of urban agriculture, dedicated communal spaces, and closing the divide caused by the train tracks.

SITE AXO | 1:600



OUTDOOR MARKET

buildings framing CPR building to allow market to bleed into the landscape. canopy structure simulates all design intentions and concepts while sheltering vendors from the elements

YEAR-ROUND MARKET

a market located at the ground level of mixed use building. this building allows for all complexes to interact harmoniously. the market is a major contributor to the social complex with addition to biotic due to its greenhouse corridor feature.

SHOPS ON ELGIN

existing business that promote social gathering and nightlife

SOCIAL BUILT

TUNNEL

opening up the pedestrian tunnel to increase tunnel exposure, comfort, and create another access point for residents across the track

EDUCATION GREENHOUSE

an education centre geared towards children living on or off site that teaches them how to garden

POND

aids in biotic life to exist on site holistically while supporting social interactions of gathering and ice skating.

WETLAND

added wetland to help mitigate and filter water run off due to downward slopes on site

Notable LANDMARKS

Immediately across from the East side of the site lies the **Samuelius Centre**. This centre houses many services such as the Elgin Street Mission, Star Door Soup Kitchen, and the Corner Clinic. The building receives lots of traffic through out the day, especially during typical breakfast, lunch, and dinner hours. The **Lede Hotel** is also located across the street, which appears vacant with very minimal citizen interaction with the building. At the Main and Elgin intersection situates the **Sudbury Arena** and immediately next to it is the **Shops on Elgin**. This area has a vibrant night life, especially during special events such as concerts and wolves games. Directly on the site itself is the historical **Canadian Pacific Railway** building. There are many surrounding amenities and restaurants that will serve to invite residents out of the future building and experience the growing downtown culture. Much like the rail lines that once breached divides between Canadian cities to bring Northern, the **Elgin Greenway** on this site will serve a similar unifying purpose should it come to fruition.

The Elgin Greenway Experience Noticing a jarring disparity between demographics on either side of the tracks, this is illustrated by the types of buildings, as well as their level of craft and/or maintenance. Highly maintained at the start, the eastern end of the site neighbors a lower income, lesser maintained, and what some may perceive to be less approachable area, before abruptly transitioning to another highly maintained and high income neighborhood just across the Nelson St. bridge. With the potential to foster a more inviting atmosphere reduced greyscape, and more spaces to gather and enjoy a landscaped setting, the Greenway may ease

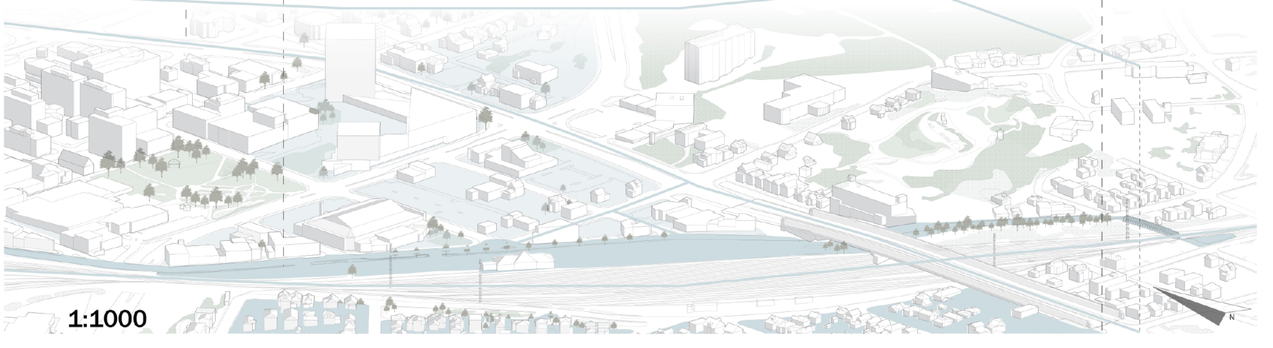
Population & DEMOGRAPHICS

There is a stark contrast in population and demographics in the surrounding neighbourhoods of the site. Downtown Sudbury residents average in the lower income bracket of roughly $40,000 per household, as opposed to $80,000 - $100,000 average household income across the tracks. Downtown is home to many renters with an average of 1.4 people per household, leading us to believe that downtown has a significant demographic single individuals. The majority of families live across the tracks.

INCOME:

Sound & TRAFFIC

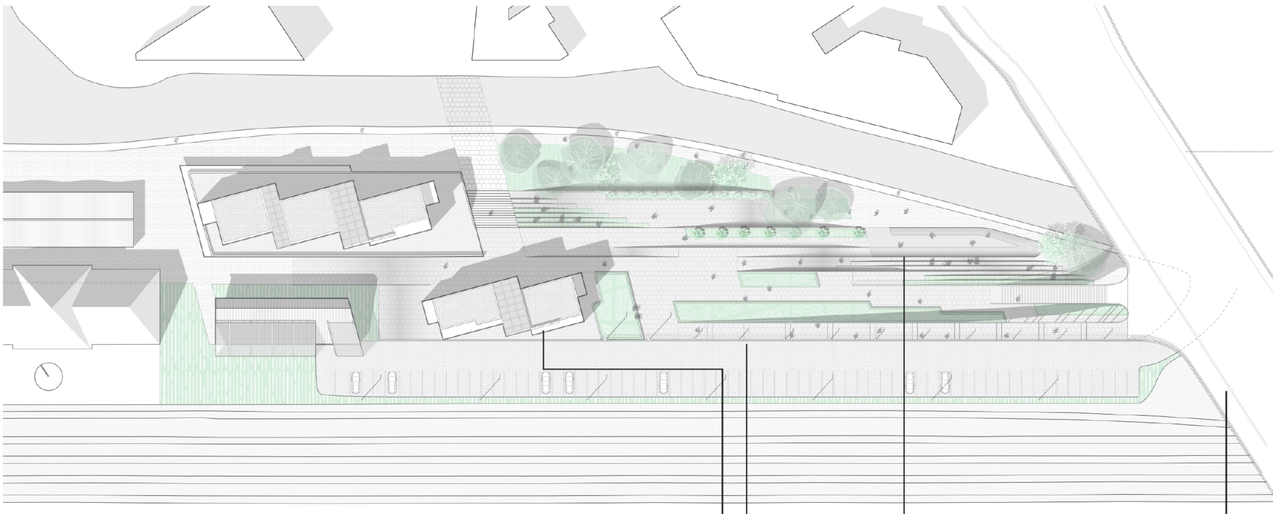
Illustrating the number of vehicles that pass these checkpoints through the day, this is not only a map of the overall traffic, but in turn, the associated walkability, approachability, and levels of noise along each of the routes adjacent to the site. Having witnessed the loud noise coming from the trains on several site visits, this seemed to propose a serious challenge that would have to be accounted for, and overcome through design.



1:1000

SITE PLAN WITH GROUND FLOOR | 1:600

DETAILED SITE PLAN | 1:300



PHYSICAL BUILT

B E R M

berming for sound mitigation from the tracks as well as creating a cross ventilation parking structure

PHYSICAL BUILT

S O U T H

building orientations to face direct south for maximum lighting

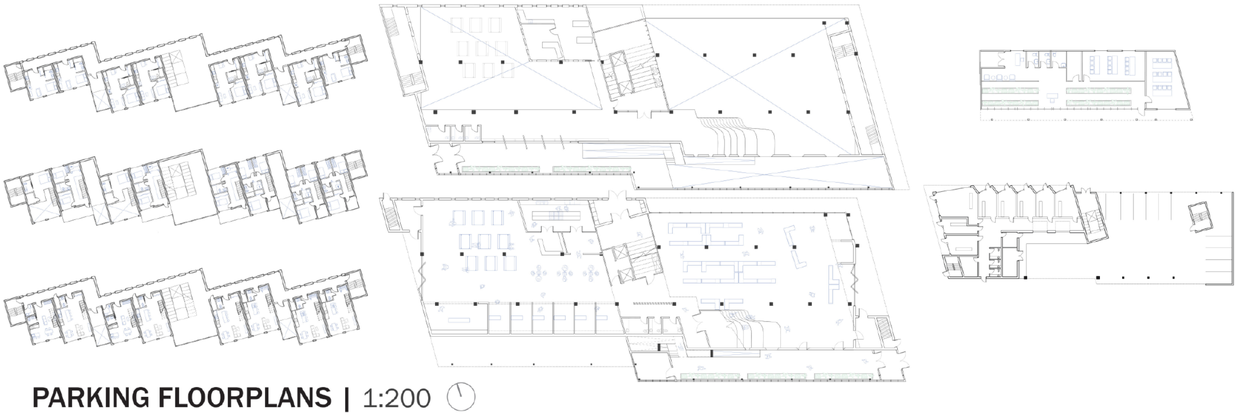
L A N D S C A P E

public space (gardens, skate park, seating areas) adjacent to existing social spaces: Samaritan centre

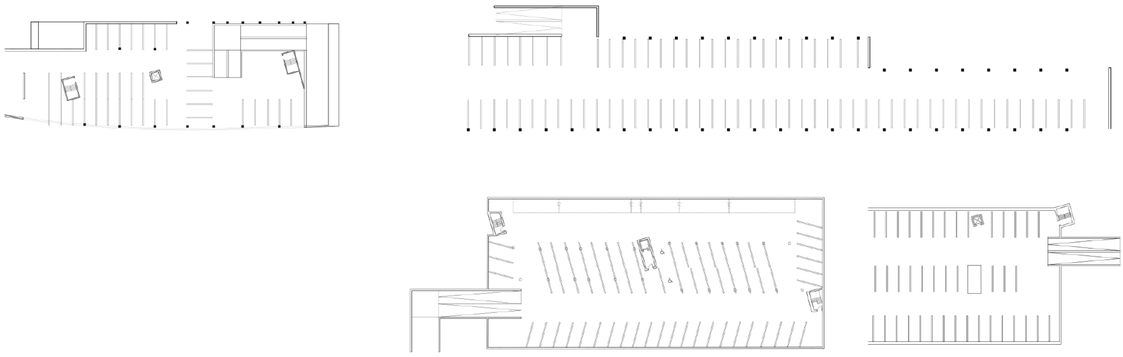
B R I D G E

berming up to the bridge of nations to open up the pedestrian entrance to the site and creating an access point for residents across the tracks

FLOORPLANS | 1:200



PARKING FLOORPLANS | 1:200



RESIDENTIAL PLANS | 1:100

MARKET BUILDING ELEVATIONS | 1:100

precedents

axel towers
FKN | Gruppe

With a concern for human scale, we wished to imitate the way that Axel towers use horizontal bands to reduce the apparent height of the buildings while creating a succession of volumes, the smallest of which is at the entrance and eases the users transition into large spaces. Horizontal bands of louvres on our North façade – where users enter – achieve the same effect, while the vestibules are compressed spaces with warmer lighting, that enhance intimacy at the transition.

kunsthaus bregenz
Peter Zumthor

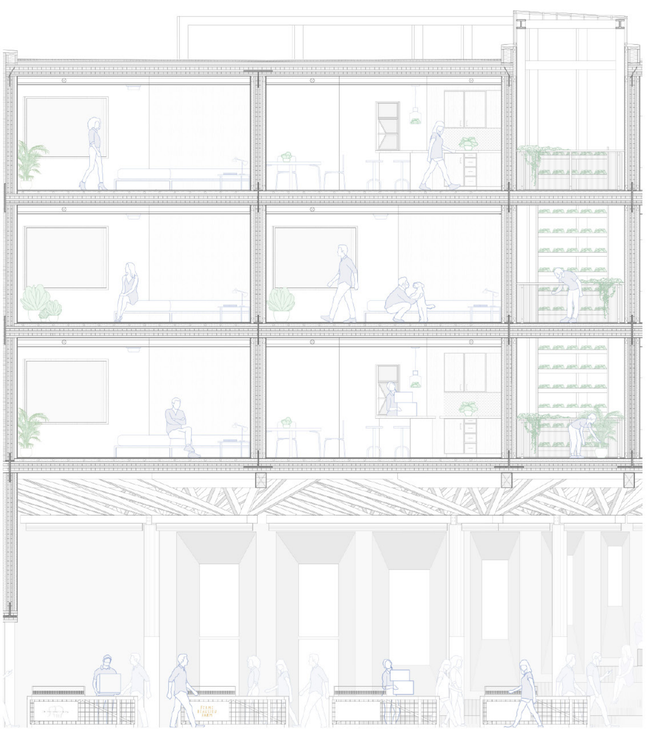
Despite its minimalism, Kunsthaus illustrates the capacity for translucency to facilitate varying ephemeral conditions. The Fresnel effect is seen reducing the transparency and increasing the brightness of the glazing as the angle of incidence relative to the observer changes with elevation. We rely on this phenomenon in the greenhouse to bring the light of the sky into the space at the far end from the observer, as well as on the greenhouses as seen from outside.

IIT Innovation Center
John Ronan Architects

The soft atmosphere produced by the IIT Innovation Centres ETFE foil cushion façade inspired the atmosphere of the greenhouse corridor, where the translucent polycarbonate double skin and dropped glazed ceiling help envelope the entire space in a similar warm glow as the evening approaches.

streetmekka viborg
EFFEKT

At Streetmekka, the translucent façade achieves an elegant yet minimalistic quality which allows for the architecture to recede while the people, art, and activity inside stand out. In our project, the façade is meant to do the same while the people, plants, and market activities are what bring the life and colour.

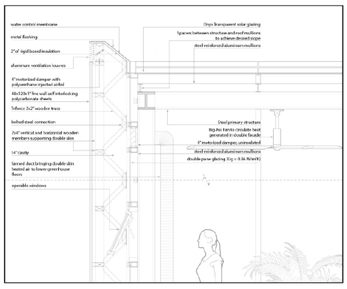


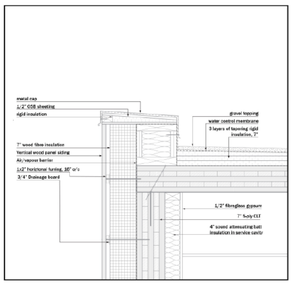
DETAILED SECTION AND ELEVATION | 1:30

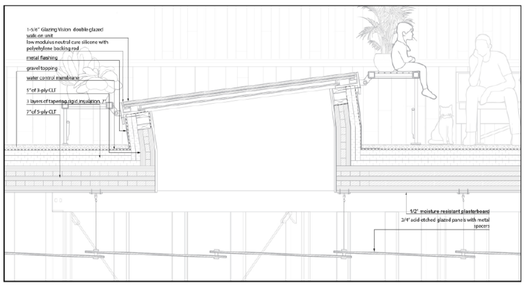
SITE ELEVATION | 1:300

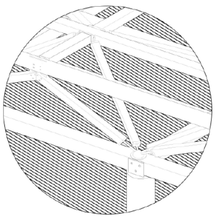
ARCHITECTURAL SECTION | 1:100

DETAILED SECTIONS

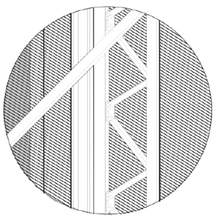








timber space frame connections



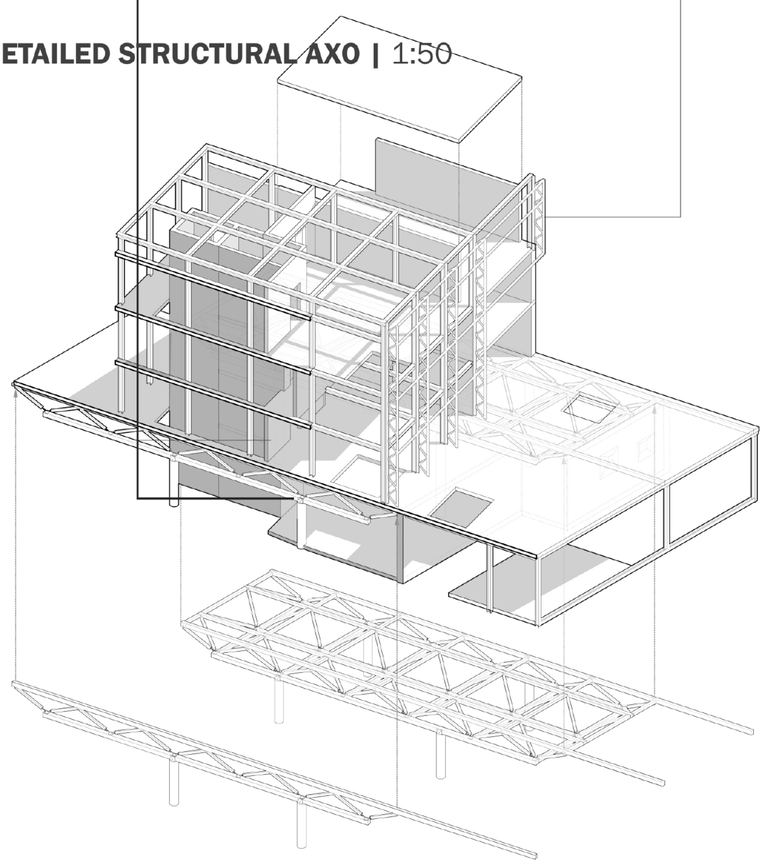
Triforce truss connection to reinforced mullions

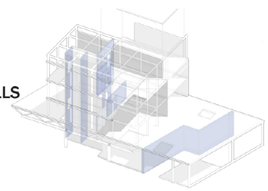
The CLT load bearing walls that divide the residential suites take the 15-degree angle that places each unit directly South. CLT floorplates divide the walls, attaching with steel plates and self-tapping screws at each corner. Supported by a series of parallel heavy timber trusses, each is linked by a **timber space frame** which allowed for a reduction of the main truss dimensions. With its countless surfaces and facets reflecting a warm light off the wood, this also connects the frame with the concept of light diffusion via different materials beyond the typical method with frosted glazing. The columns supporting the trusses continue into the parking below, spaced at one, two and three parking space widths throughout to negate the need for a transfer slab. In the greenhouses, a steel frame supports the glass envelope where wood would collect too much moisture. The double skin is held by timber **Triforce trusses** with 2x2" webs and 2x4" chords that hang off the steel reinforced aluminium mullions.

precedents

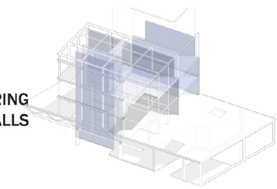
Aspen Art Museum
Shigeru Ban
Shigeru Ban Architects employs a wooden space frame at both the Aspen Art Musuem and Triangle House. Having previously looked at using substantial trusses above our market space, we hoped that switching to a space frame would not only create a more elegant appearance by facilitating smaller members, but an innovative approach to the classically steel space frame typology.

DETAILED STRUCTURAL AXO | 1:50

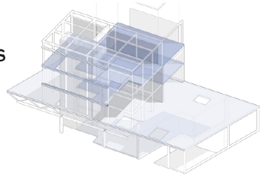




SHEAR WALLS

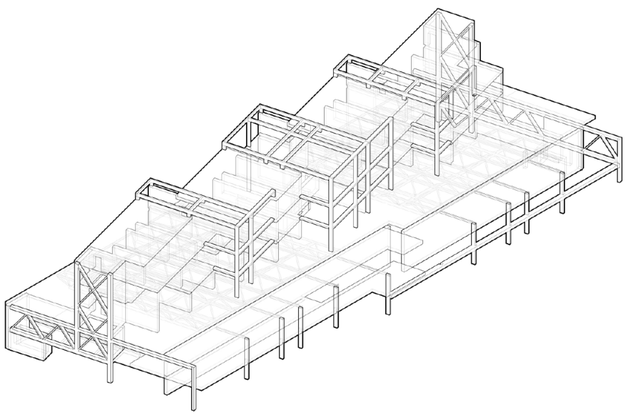


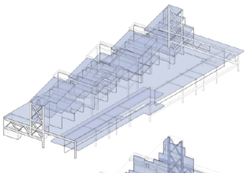
LOAD BEARING WALLS



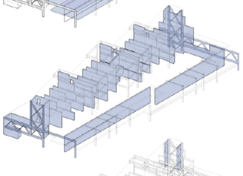
FLOOR PLATES

DETAILED STRUCTURAL AXO | 1:150





FLOOR PLATES



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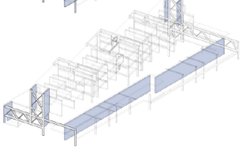
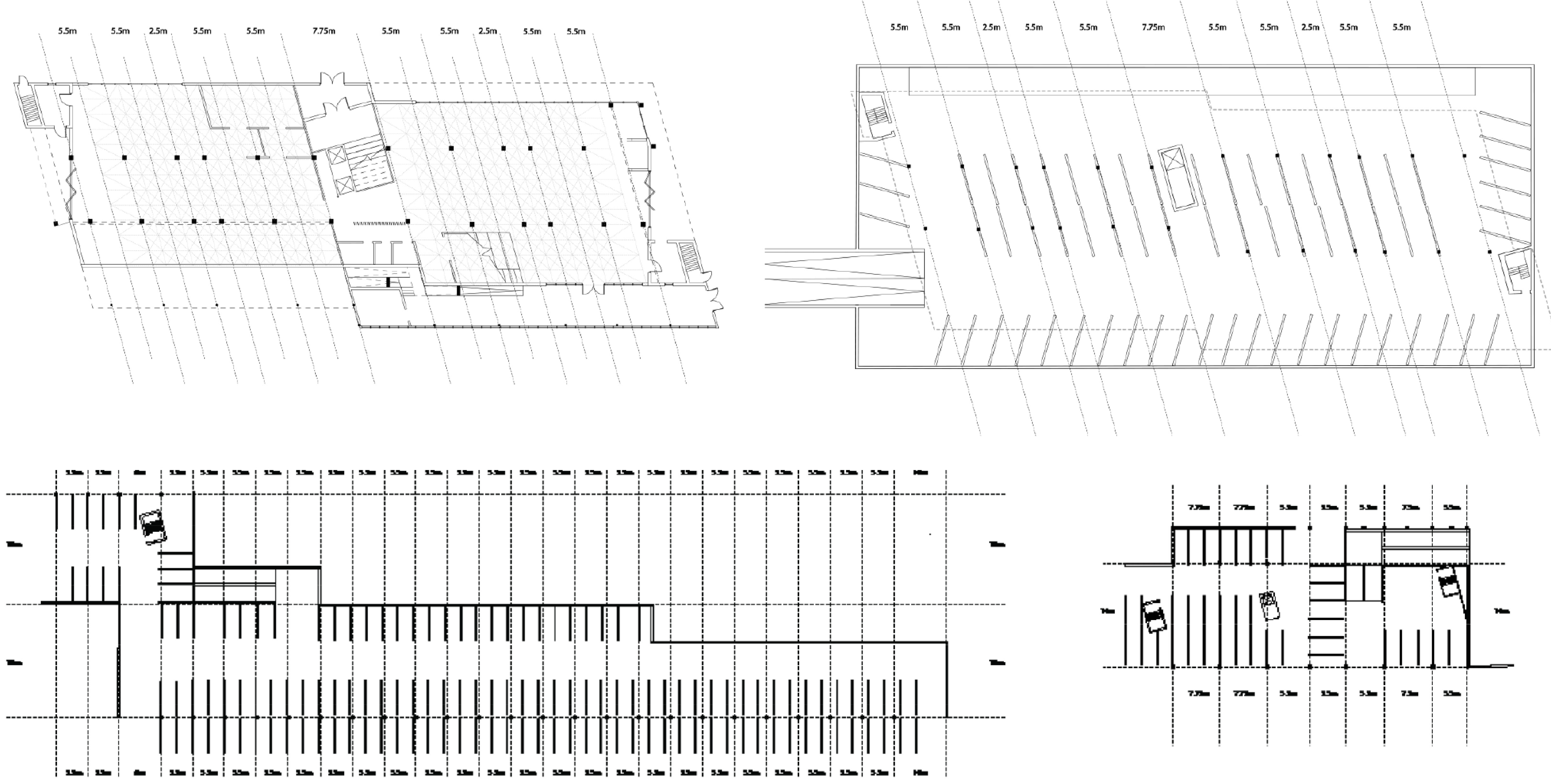
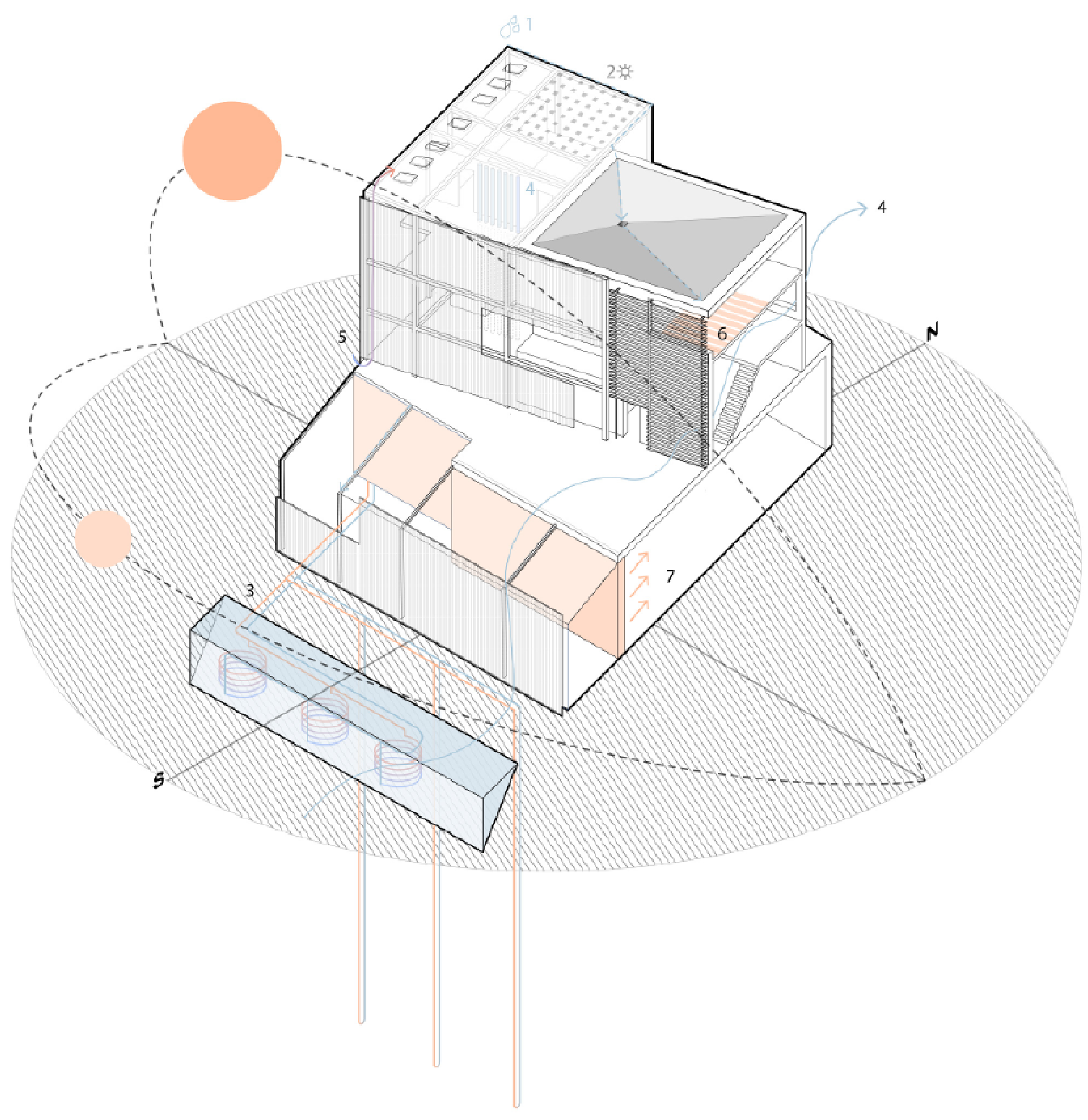
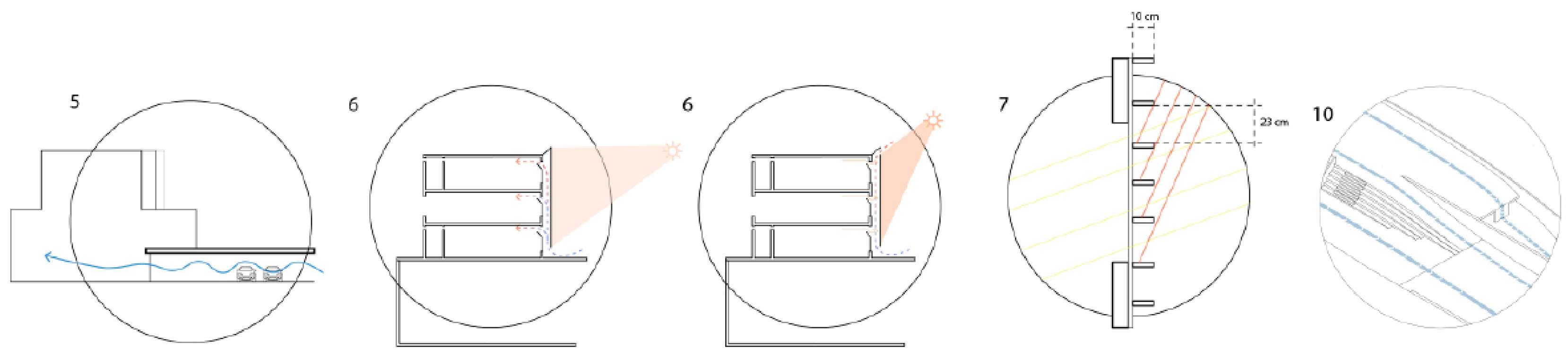


SHEAR WALLS

STRUCTURAL FLOOR PLANS | 1:100







PASSIVE

01 | Cross ventilation is achieved in loft units by an open path between operable windows on either end of the suite. Stack ventilation. The under-berm parking is open on the south and north sides, providing cross ventilation here as well.

02 | A double skin facade of sealed glass and corrugated fibreglass sheets create a stack effect when the cavity is heated, expelling hot air from the greenhouse and select dwelling units. The translucency also helps to reduce heat spots that damage plants.

03 |A combination of overhangs and horizontal louvres block direct sunlight in the summer while allowing winter sunlight in. The tall windows allow the winter sun to reach far into the unit (the thicker, lighter lines), while direct summer sunlight reaches only a few feet (thinner, darker lines).

04 | Trombe walls and high thermal mass materials along southern faces of greenhouses for passive heating.

05 | Greywater retention / passive solar energy storage in water wall, used for crop irrigation and toilets

06 | Permitted by this unique site, the design takes advantage of the opportunity for southern glazing for every residential unit in the building.

07 | Using gradual slope of landscape to directing runoff towards wetland at far West end of the site, recharging the ground water table and nearby Junction Creek

ACTIVE

01 |Slight roof slopes for rainwater redirection towards retention tanks, an underground cistern, or through a wetland to be filtered before reentering the groundwater table

02 | As both transparent and semi transparent solar glazing options are being developed (Onyx Solar Group, Brite Solar, Polysolar, Heliatek) the abundance of both types of glass between our dwellings and greenhouses provide ample opportunity for solar energy collection.

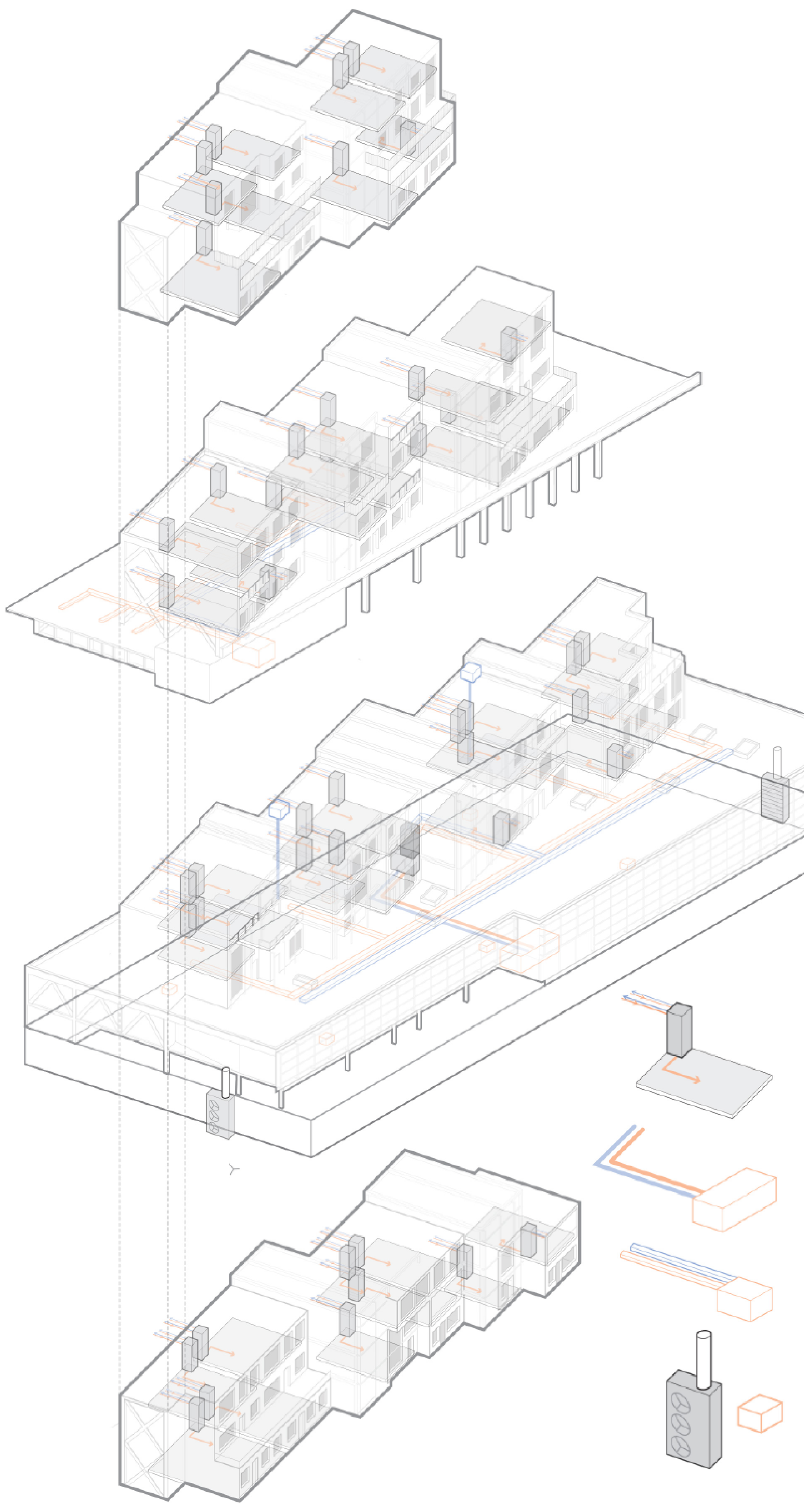
03 |Greywater retention / passive solar energy storage in water wall, used for crop irrigation and toilets

04 | 120 ft geothermal wells serve the heating needs of the market space, while a separate geothermal system utlizes the solar energy consumed by the pond to heat and cool the greenhouse corridor.

PASSIVE - ACTIVE STRATEGIES

HVAC

1. pumphouse
2. geothermal pond coils
3. geothermal wells
4. fan coil unit
5. mechanical room
6. geothermal heat pump
7. duct shaft



Localized heating and ventilation closets, served by two 3" heating ducts and two 6" ventilation ducts with 2" of insulation

Boiler room with heat pumps, connecting hot and cold air from geothermal pumps to the fan coil unit

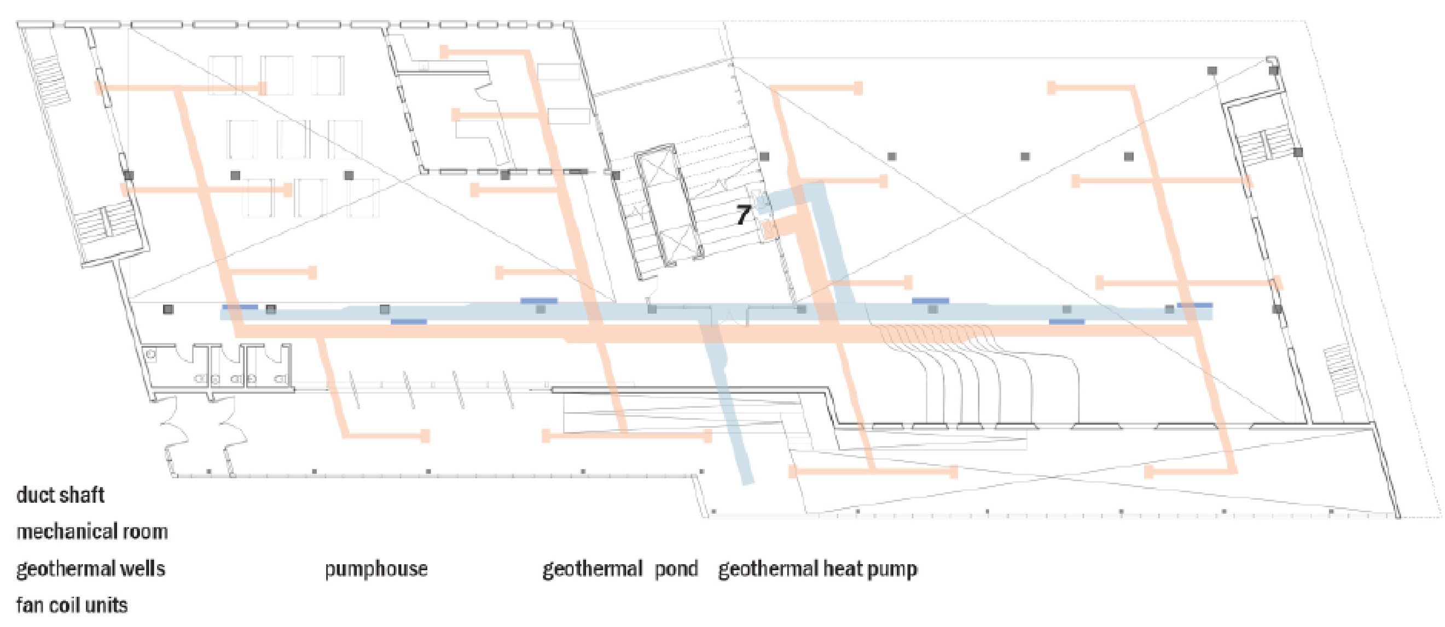
Fan coil unit room supplying cool and warm air to all common spaces via heat and ventilation ducts

Parking garage heating and ventilation. Duct shaft with fan unit on exterior side and motorized damper on interior side, exhaust pipe to the surface. Six heating units heat the space.

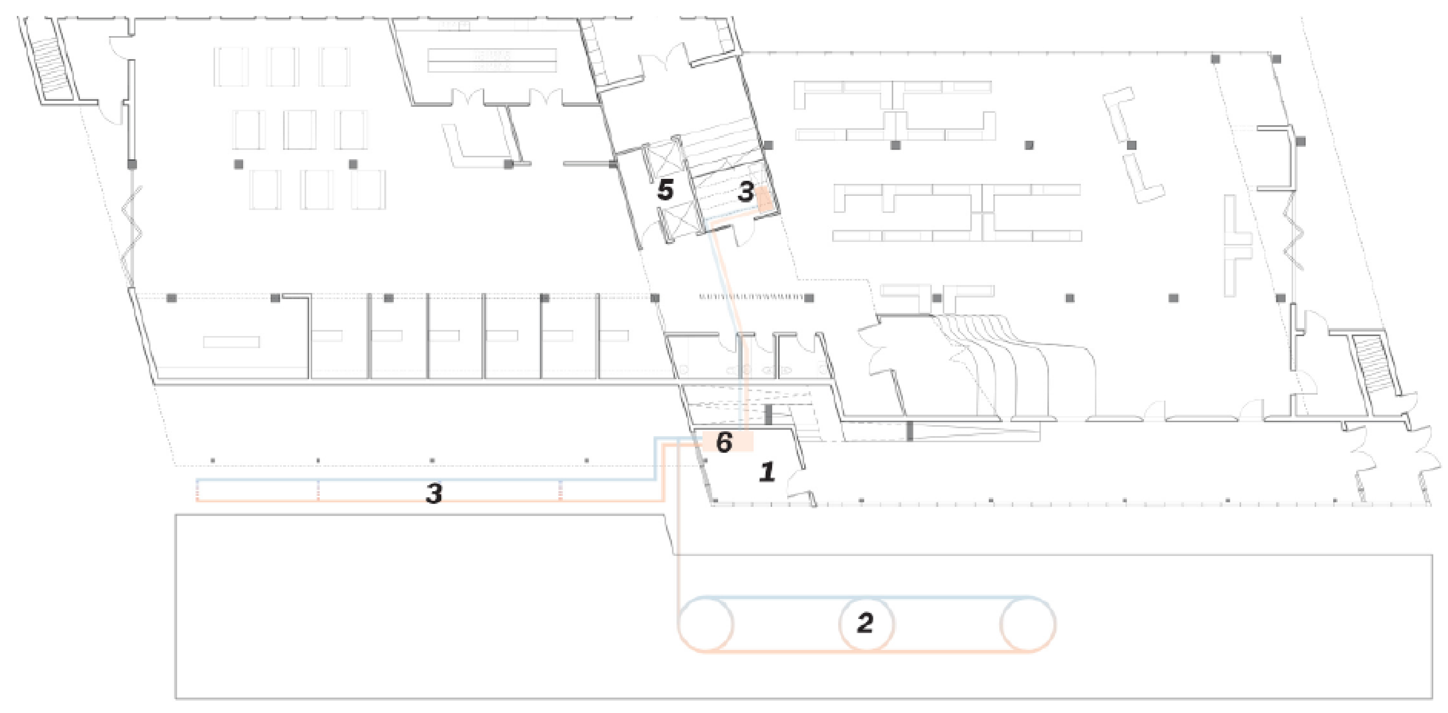
FIRST FLOOR MARKET HVAC

Total usable area between floors: 19 300 f²

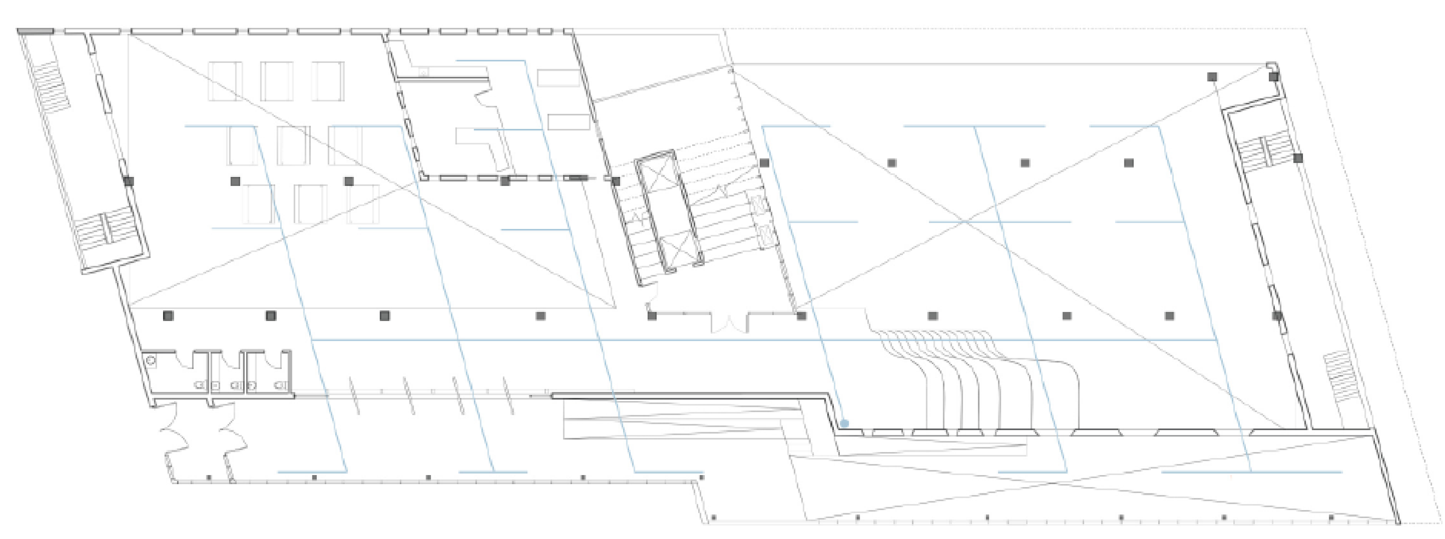
Requiring 955 350 BTUs



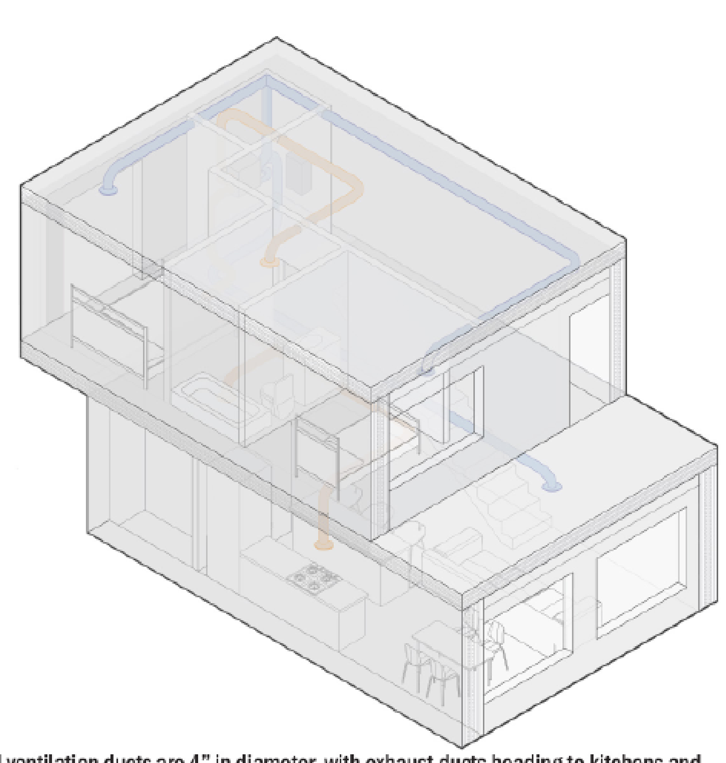
SECOND FLOOR MARKET HVAC



SRINKLERS

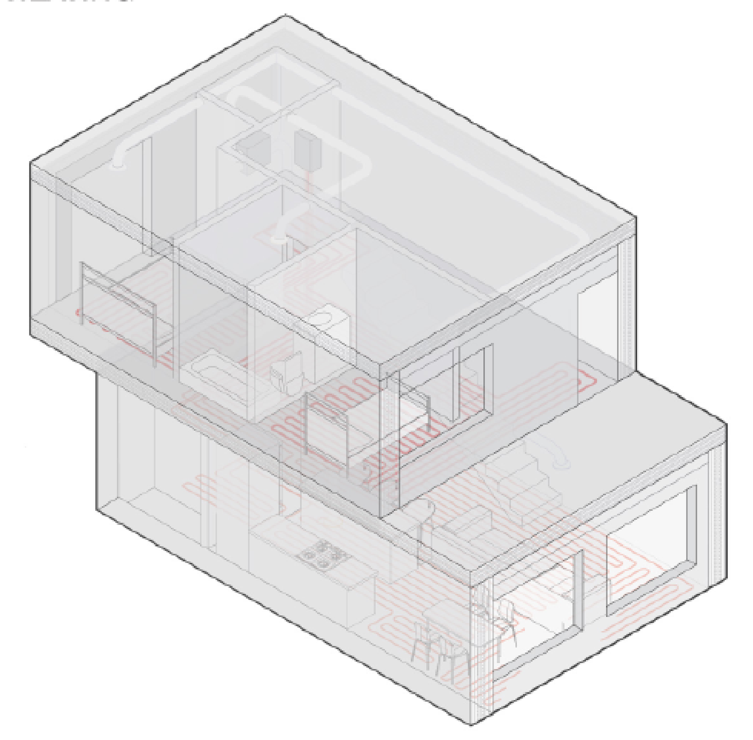


VENTILATION



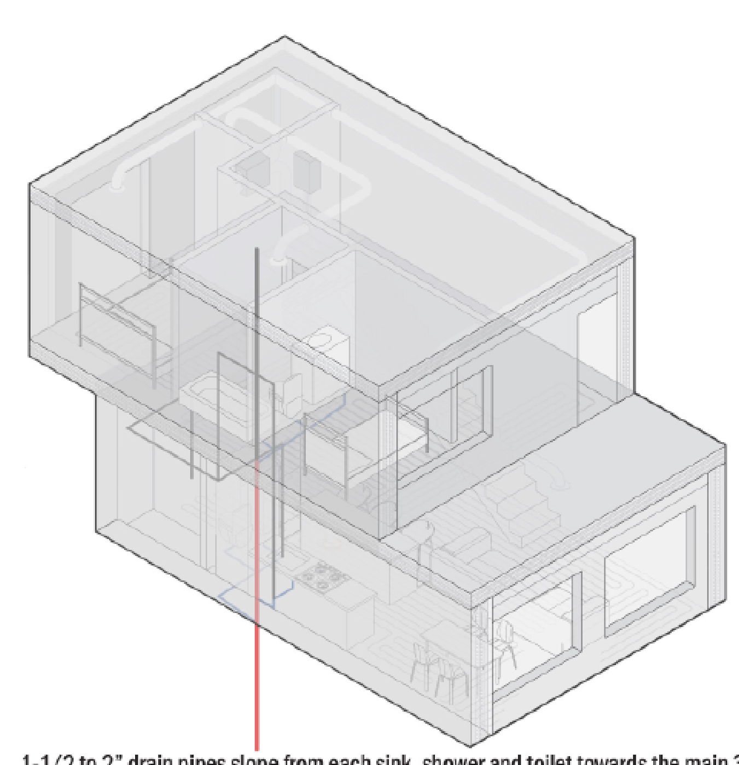
All ventilation ducts are 4" in diameter, with exhaust ducts heading to kitchens and bathrooms and supply ducts at bedrooms and living rooms where they supply air out of circular diffusers.

HEATING



The units are heated with radiant floor pipes. At ¾" diameter, these heat the space adjacent to exterior walls first, spaced at 6" O/C before spreading out and returning to the water heater's manifold.

PLUMBING



1-1/2 to 2" drain pipes slope from each sink, shower and toilet towards the main 3" drain pipe. Each branch drain is served by a branch vent, connecting to the vent stack on top of the main drain before sewer gases are exhausted at the roof.

LIGHTING
precedents

Kunsthaus Bregenz
Peter Zumthor

At Kunsthaus Bregenz, a large cavity between floors allows daylight to reach far into the spaces which are capped by a dropped translucent glass ceiling. Along with the consistent spacing of ceiling lights, these together give this appearance that the ceiling in fact opens to the sky instead of the floor above. Opting to enclose our greenhouse corridor with an insulated roof to aid heating and because its narrow width still allows south light to reach far into the space, we still wanted to maintain the illusion that there was in fact no roof. As seen in render 1, this was hopefully achieved by using a similar approach to Zumthor.

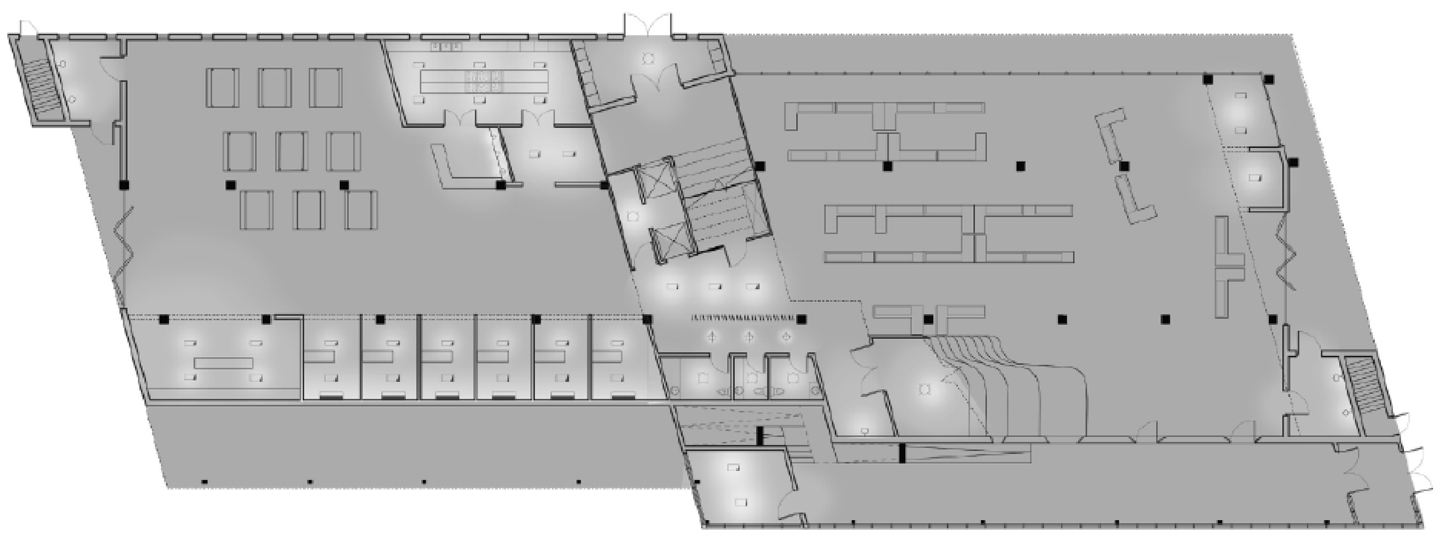
Aspen Art Musuem
Shigeru Ban

Looking again to the space frame used at the Aspen Art Museum, Shigeru Ban ensures that the frame is well lit by using skylights and stage lights that sit above the structure. (INSERT LIGHTING TEXT) Both methods were also used above our own space frame.

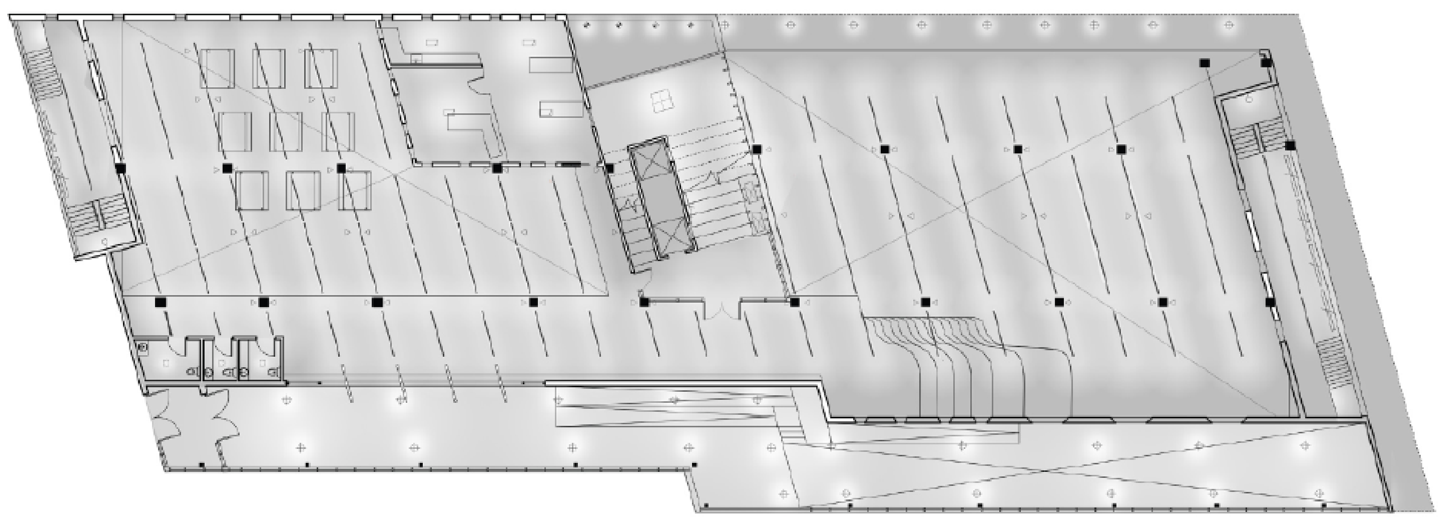
Amos Rex
JKMM

As seen in the rendering, Amos Rex features a delineation of outdoor spaces via sharp and soft lighting conditions. The seating spaces are marked by a sharp line made by lighting placed close to the ground, while other more active spaces appear to be lit with a soft glow by lights positioned high above on rooftops. Around our landscape, we use the opposite strategy, where low lying lights directly light the main paths of circulation, and the glow from the building itself and stadium-like light posts shine a soft glow on spaces where gathering and slower movement is meant to happen.

MARKET LIGHTING
first floor



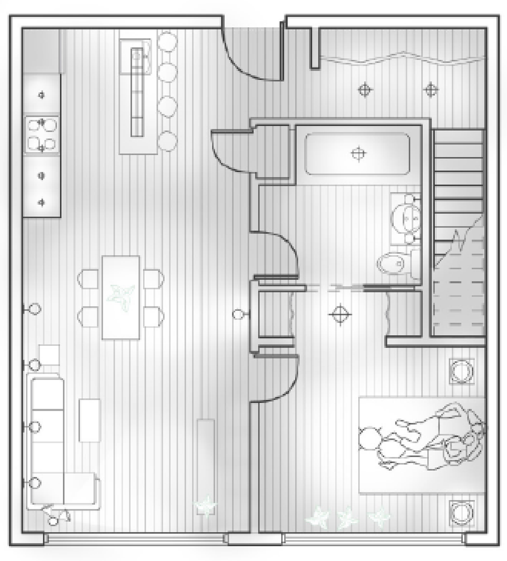
second floor

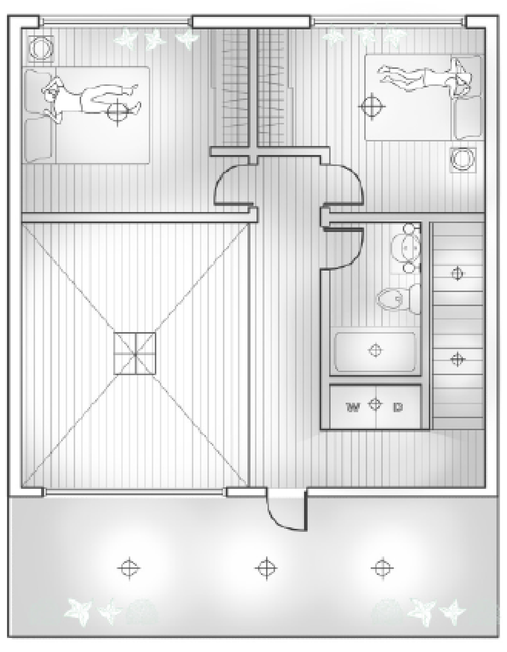


Wall wash	3000 K
Ceiling light	3000 K
Wall light	3000 K
Downlight	4000 K
Floor uplight	3000 K
LED spotlight	4000 K
Fluorescent strip light	4000 K
Pendant light	3000 K
Integrated fixture - linear	4000 K
Square recessed light	4000 K

RESIDENTIAL LIGHTING

- Pendant light
- Downlight
- Wall light
- Ceiling light
- Table lamp
- Stage light floor lamp





Hola Yeelight Ceiling light in bedrooms and market ceiling lights

LED track light above the market space frame

12W Led Acrylic Wall Lights as market sconces

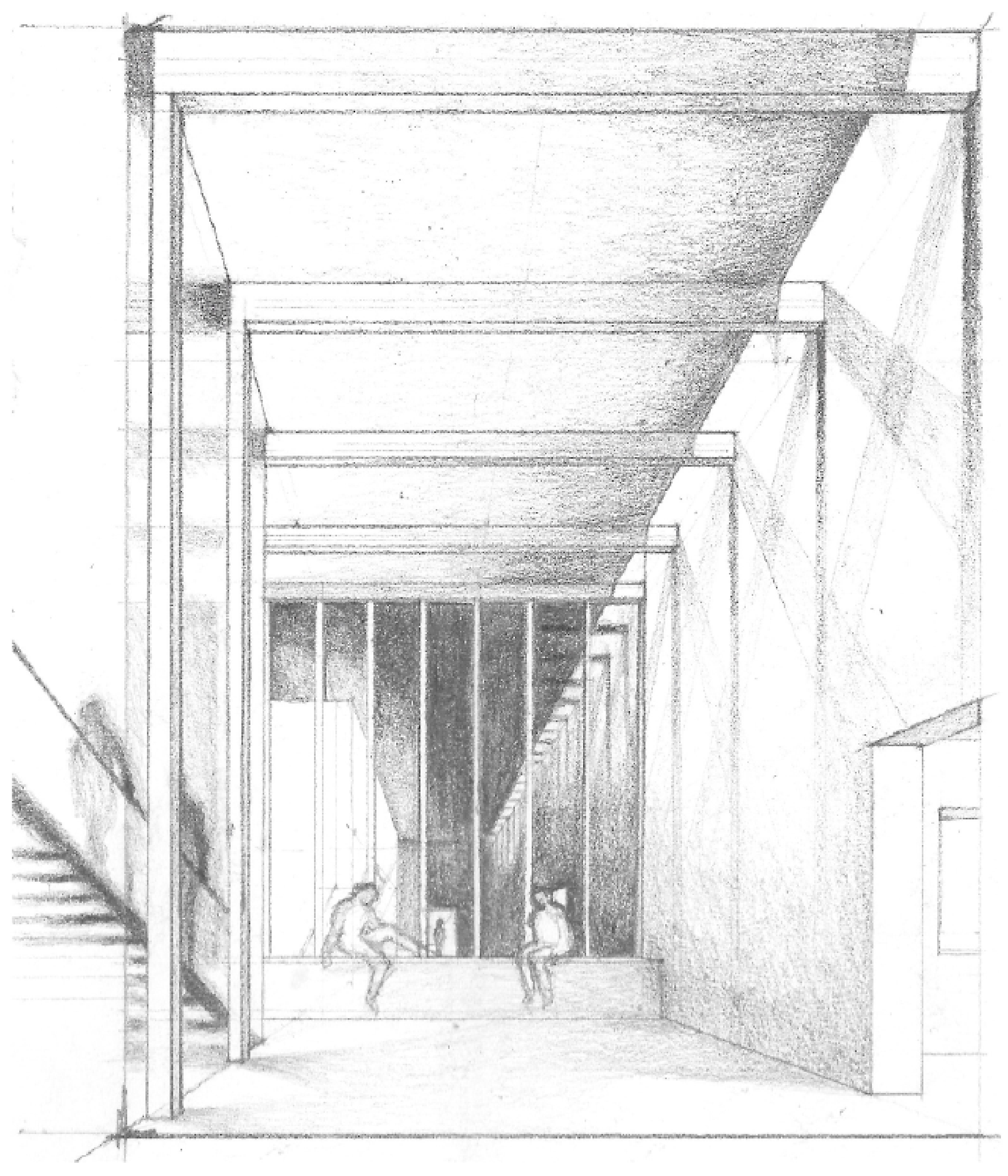
Custom polycarbonate pendant fixture in market residential entrance

LED track light as dining room pendant in dwelling units

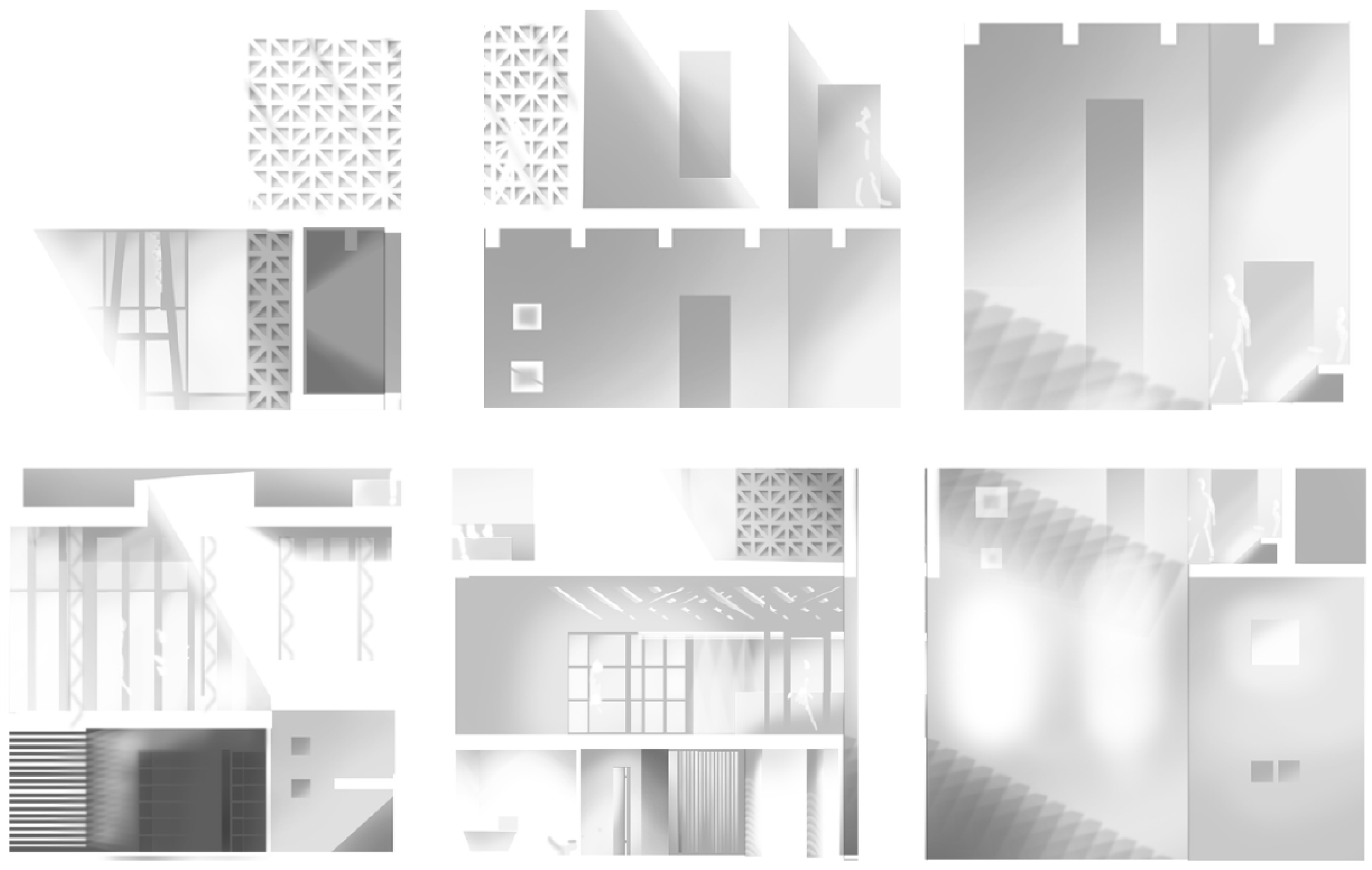
HEKTAR floor lamp in each living room

Mygdal Plant lamp as Kitchen island pendants

4000 K LED Cooper Industries Skybar strip lights



Artificial Lighting | Sketch Diagram | Desired lighting quality in residential public corridor. Where more diffused lighting can be attained using indirect lighting, layered with translucent materials such as frosted glass or polycarbonate



Lighting | Diagrams | Series of lighting vignettes of various moments throughout our building. These help capture this desired ambience using both natural and artificial lighting.

Citations

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