Post -arium

by

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Bachelor of Arts in Architecture
University of California, Los Angeles, 2015

Submitted to the
Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of

Master of Architecture at the Massachusetts Institute of Technology
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Note:
This document is best viewed as a spread (two-page display).

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Abstract

Post -arium is a search for a new form and tectonics, an exploration of new standards and other ways to produce comfort. If -arium is a suffix denoting a location in which things are kept, often alluding to architecture as containers of comfort sustained by carbon forms, in Post -arium, we question comfort: on whose and what terms are we basing it on? In the face of temperature change, we need a new kind of comfort; ask for new standards, idea, strategies and form; probing further what is comfort or discomfort, how we can achieve it, and who can achieve it. Post -arium looks at the flow of energy (often felt as heat) between the "source" and "sink" states, and further using this as a methodology to explore its possible forms. Here, we discuss issues relating to flooding and modes of living in Jakarta, Indonesia, through the lens of Post-arium. As a low-lying delta, surrounding cities send water through the rivers and canals of the city, before all the water drains out to Jakarta Bay. Specifically, the site in discussion is Waduk Pluit, a crucial end point of the water routes in North Jakarta, a small reservoir with a water gate that pumps out to the sea. Like many other bodies of water in Jakarta, informal settlements have developed around the edges of the reservoir. The gap between the high-rise lifestyle of the *rusunawa* (rental housing flats for low-income residents) and these informal settlements calls for a hybrid between urban living and its need for densification, with models of housing that aligns with the cultural desires of the residents. Post -arium looks to bring into the site the strategies for density that are sensible to the cultural aspirations and environmental reality, and thus challenges the notion of comfort thermally and culturally.

Thesis Advisor Mariana Ibañez
Associate Professor of Architecture, MIT

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I thank God for placing me where I was, am, and will be, and for all the people I have met along the way:

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Hans, to whom I lean on for many things,

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Thank you!

Contents

Post -arium
THE SCAFFOLD

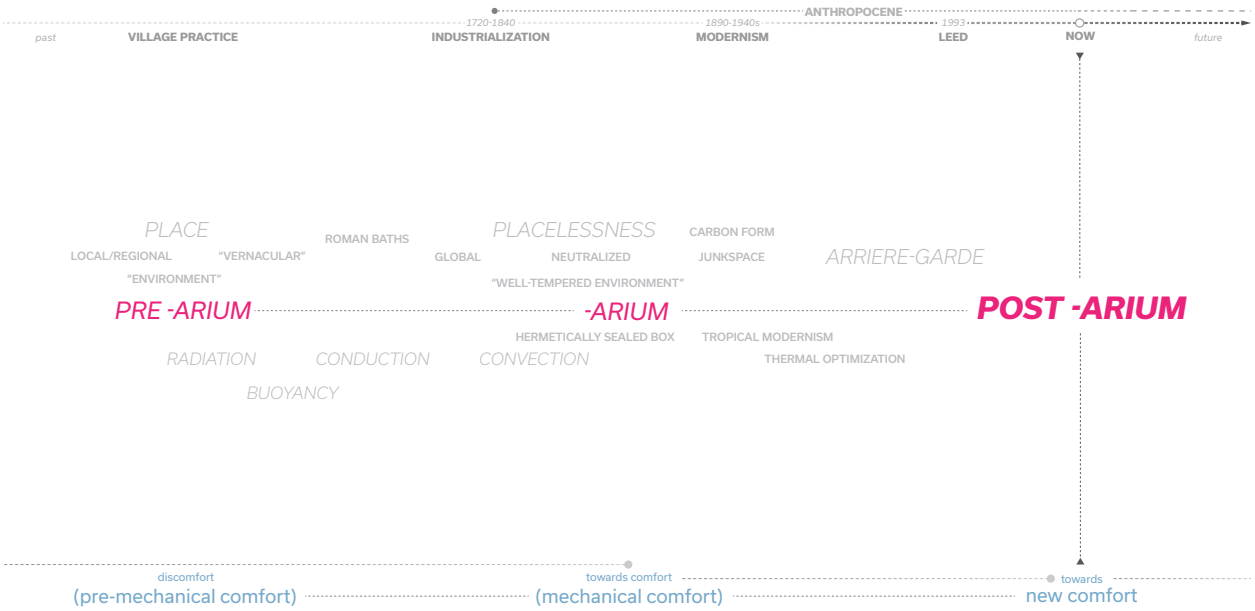
The ways we think about comfort

If -arium is a suffix denoting a location in which things are kept, often denoting artificial environments, and looking at architecture as a container of comfort sustained by emitting carbon footprints, In *Post -arium,* we question comfort. When we talk about comfort, on whose and what terms are we basing it on? A little area on a standardized psychrometric chart denotes the comfort we aspire to achieve, and outside of it is regarded as discomfort.

The events of modernization and universalization of architecture, such as the invention of mechanical air conditioning and the ASHRAE standard, brings upon architecture itself a fetish of comfort. Specifically, it forms itself around the fulfilment of standardized thermal comfort. It seals, insulates, holds its breath, and exhales only through mechanical equipment. Architecture becomes containers of thermal comfort, -aria of mechanically cooled air, and manifestations of carbon form. Why have the building envelope evolved into layers of sealing and insulating, subject to the regime of comfort? Architecture needs a new form, tectonics, and ways of thinking that is unafraid of discomfort.

To quote Daniel Barber: "Comfort is very difficult to disrupt."[1] But in the face of temperature change, we need a new kind of comfort; ask for new standards, idea, strategies and form; probing further what is comfort or discomfort, how we can achieve it and who can achieve it. This thesis, is about finding what comes next after -arium, after exposing architecture's addiction of comfort, finding the post -arium. *Post -arium* is a search for a new form, an exploration of new standards and other ways to produce comfort.

[1] Barber, Daniel. "After Comfort," Log 47, Overcoming Carbon Form (Fall 2019), pp. 45-50.



The Post -arium timeline:
from pre -arium to post -arium

Pre -arium, -arium, post -arium

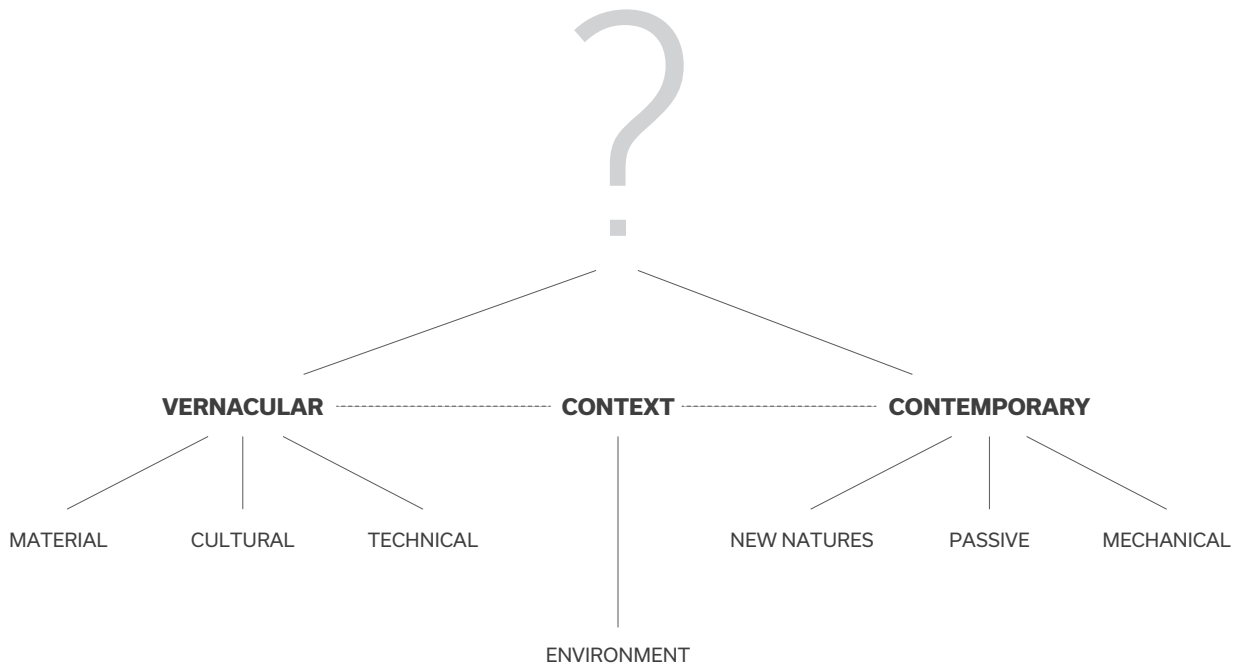
If we look at a longer timeline and how we have dealt with discomfort, it goes from pre -arium and makes its way to -arium. The question of comfort is central, but the ways to achieve it have evolved:

Pre -arium navigates discomfort using village knowledge and the notion of the "vernacular," locality, place and sense of source. Pre -arium is the era where discomfort exists, but tries to eradicate discomfort as much as possible. Embedded in the locality of its practices, the pre -arium has a sense of regionalism. Pre -arium roots its practices to the culture of a particular place, returning it to a source.

On the other hand, -arium is a neutralized box, with its envelope developed to contain the mechanically well-tempered environment. -Arium nurtures placelessness[2] of the box, due to the machine and its compliance to globalization. If thermal comfort has a form, we would call it -arium. -Arium is the fine tuning of comfort and the very thing that develops comfort-fetish in architecture. -Arium transforms the envelope into a poché, with layers of sealants and insulations such that the conditioned air does not leak.[3] -Arium fulfils its optimum temperature standards through the brute force of carbon lifestyle. Thus, in the context of -arium, comfort is a manifestation of carbon. Being subject to the machine and cheap energy, architecture is complicit in commodifying comfort as a carbon form.

[2] Frampton's reference to Heidegger in "Towards a Critical Regionalism: Six Points for an Architecture of Resistance"

[3] Bhatia, Neeraj. "The Post-Junkspace Globe: Towards Weather and in Architecture," -arium: Weather + Architecture. Ostfildern: Hatje Cantz, 2010. Print.


?
VERNACULAR
CONTEXT
CONTEMPORARY
MATERIAL
CULTURAL
TECHNICAL
ENVIRONMENT
NEW NATURES
PASSIVE
MECHANICAL

Should architecture seek for what is "green"? When trapped in solving for efficiency, architecture uses the adjectives "green," "sustainable" as its prefix, yet it maintains the regime of comfort as the status quo. Should architecture go back to regionalism and village practices, to the pre -arium? No, architecture should seek for the new forms, tectonics and logic of the post -arium.

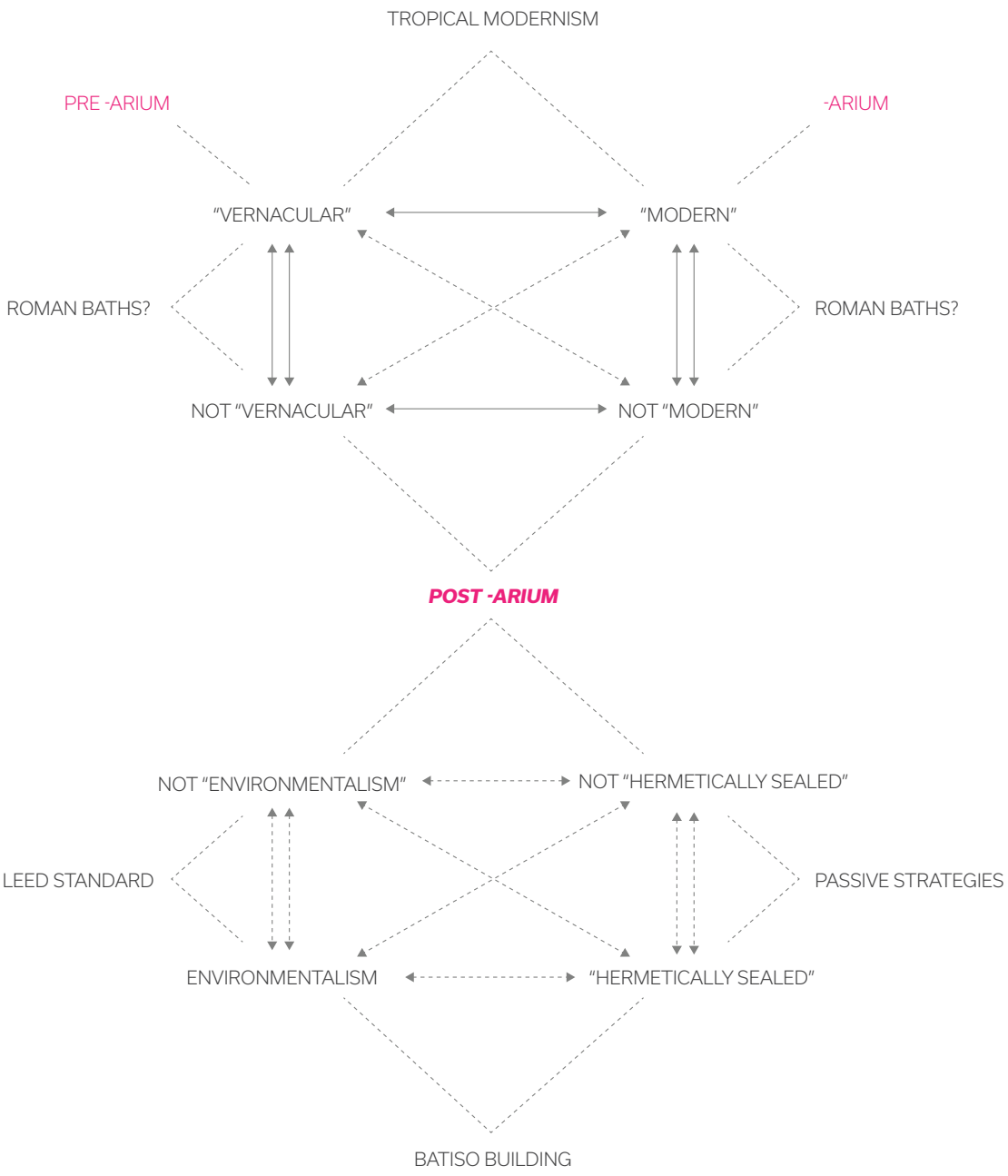
Form, tectonics and materials of the post -arium

The two eras have their forms, we understand the pre -arium as something that emerged from there vernacular and very local; and modernism encouraged sealed boxes with mechanically cooled air detached from its environment and context, but what is the form, tectonics, and materials of the post -arium?

We could look to the vernacular and its genius. But, post -arium is not neo pre -arium. It is not nostalgic about the old ways of reaching comfort. Post -arium is not a sadistic nostalgia about living in an uncomfortable world. We could also look into the contemporary methods of thermal thinking, but post -arium should not place too much devotion in technology as a salvation from the comfort addiction.

Post -arium assumes the *arriere-garde*[4] –resist the nostalgic looking back of the vernacular, nor place too much devotion in technology as a salvation from the comfort problem. Post -arium recalls the paradox proposed by Ricoeur of "how to become modern and to return to sources." [4] thus it looks at the vernacular, the contemporary, and the context; which is the environment, and its broader meaning.

[4]Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance", in The Anti-Aesthetic. Essays on Postmodern Culture (1983) edited by Hal Foster, Bay Press, Seattle.


TROPICAL MODERNISM
PRE -ARIUM
-ARIUM
"VERNACULAR"
"MODERN"
ROMAN BATHS?
ROMAN BATHS?
NOT "VERNACULAR"
NOT "MODERN"
POST -ARIUM
NOT "ENVIRONMENTALISM"
NOT "HERMETICALLY SEALED"
LEED STANDARD
PASSIVE STRATEGIES
ENVIRONMENTALISM
"HERMETICALLY SEALED"
BATISO BUILDING

Post -arium in the extended field

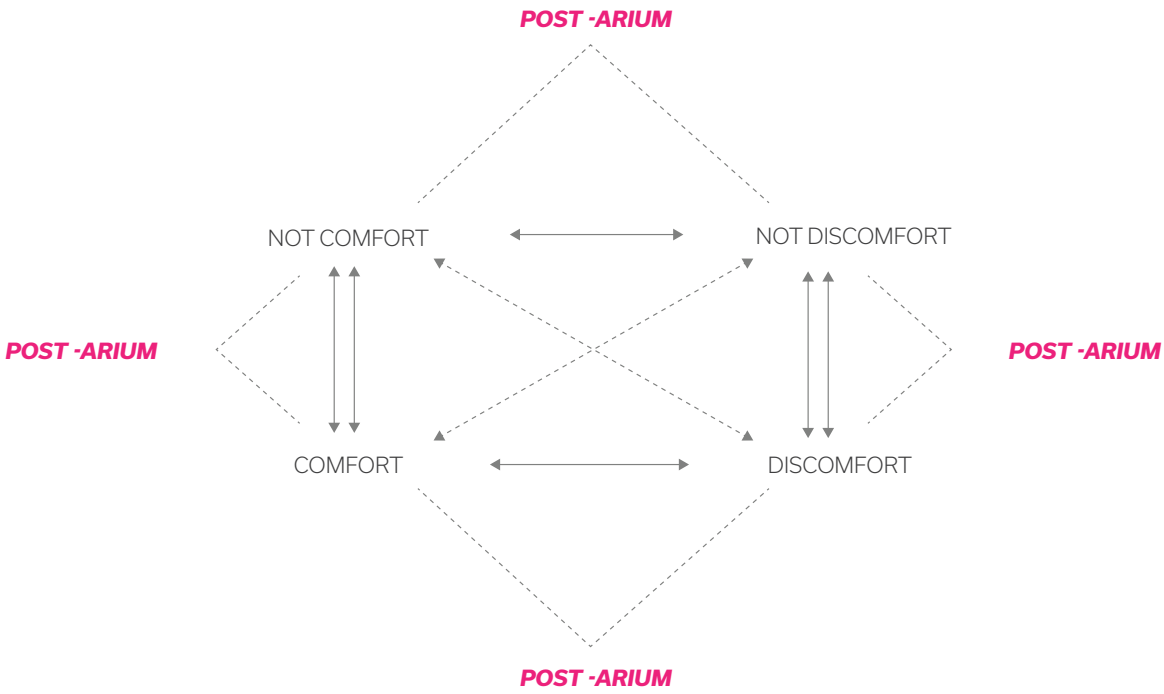
Post -arium is located on an extended field of its negations; it's not about repeating the vernacular nor the modern. It is also not about environmentalism nor the "hermetically sealed."[5]

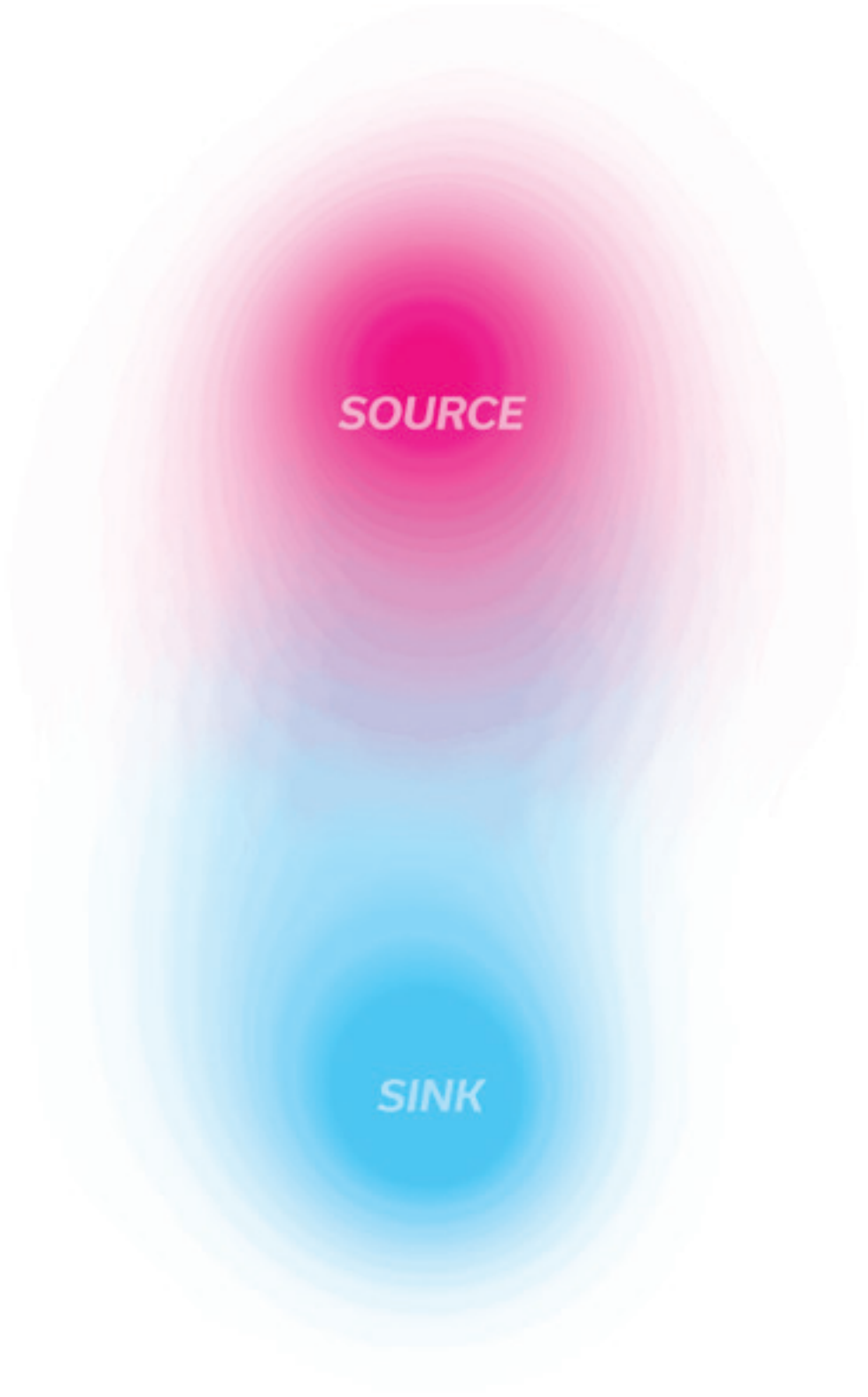
Post -arium attempts to find a new kind of comfort, perhaps something that reach towards thermal texture,[6] refuses to depend on the stability of thermal comfort, but exploits the potential of mobility and motion in thermodynamics.

Post -arium looks into new models and new attitudes towards environmental issues in relationship to space making practices.

[5] Banham, Reyner. The Architecture of the Well-Tempered Environment. 2nd ed. Chicago: University of Chicago Press, 1984. Print.

[6] Craig, Salmaan. Beyond Thermal Monotony. (from Abalos, I., Snetkiewicz, R., & Ortega, L. (2015). Abalos Sentkiewicz: Essays on thermodynamics, architecture and beauty. New York: Actar D.)




SOURCE
SINK

Sources and sinks

The concept of "source and sink"[7] as a system of energy transfer is simple. But, understanding this as design exercise can be complex and compelling. Post -arium aims to understand the flow of energy (often felt as heat) between these two states, and further use this as a guideline and methodology to explore its possible forms, tectonics and materials.

[7]Abalos Iñaki, et al. Abalos + Sentkiewicz: Essays on Thermodynamics, Architecture and Beauty. Actar D, 2015, pp. 236.

The Site

INDONESIA

└ JAKARTA

└ WADUK PLUIT

└ RUSUNAWA MUARA BARU

(1)

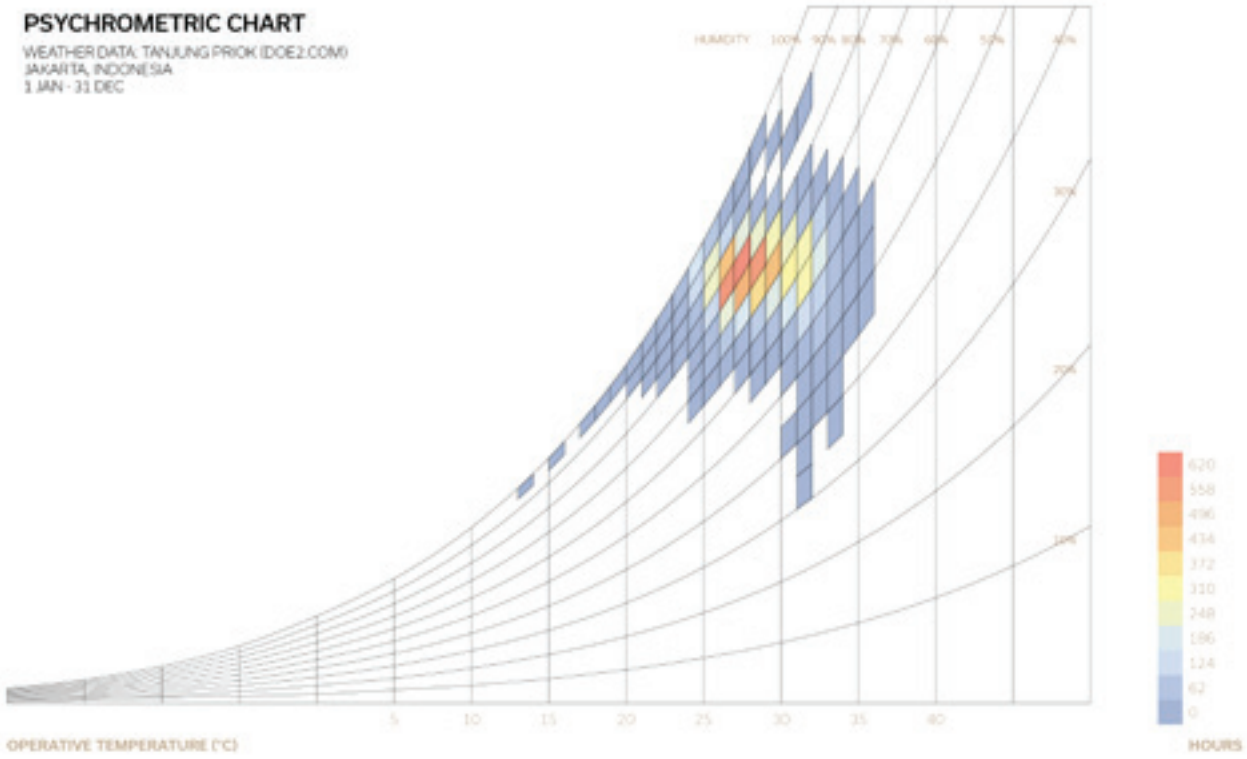
(2)

Leaving Jakarta Behind?

Indonesia has over 17 thousand islands, and each region have their own specific vernacular styles. Each of them intertwine form, culture, and environmental knowledge. We'll zoom in to the Island of Java, where Jakarta, the capital city, is currently located. Due to overcrowding, overcapacity, and its prone-ness to environmental hazards such subsidence, flood and sea level rise, the capital has plans to move to Borneo. An architecture competition was held, winners were announced, land and forests have been surveyed to start building underlying infrastructures, before the governmental facilities can first move to occupy the new capital as early as 2024. But what about Jakarta and its inherent environmental problems?

(1) https://iradiofm.com/antisipasi-banjir-musim-hujan/

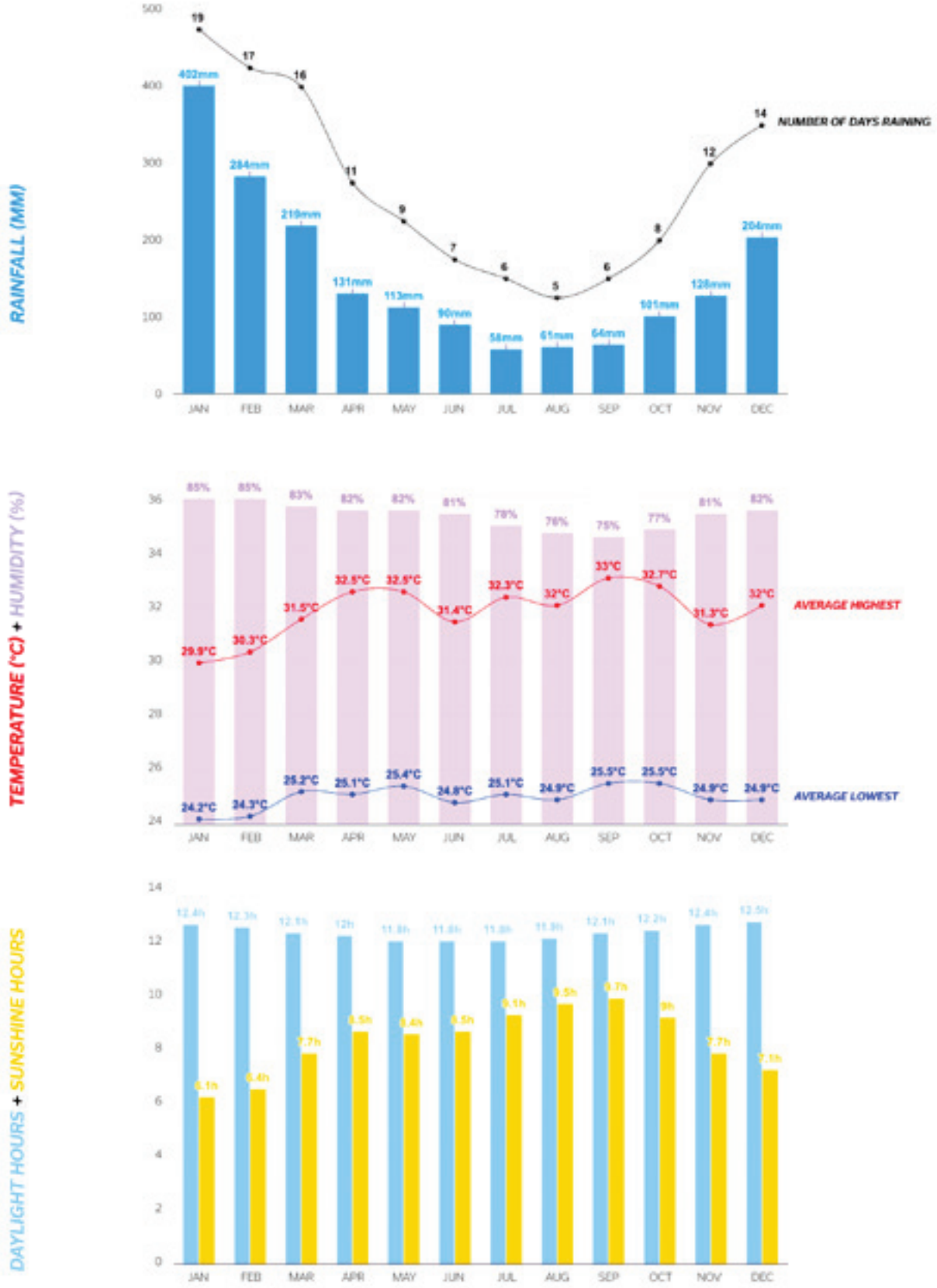
(2) https://de51gn.com/sibarani-sofian-architect-of-indonesias-new-capital-discusses-its-urban-potential-and-why-jakarta-needs-to-urgently-rejuvenate-itself/


PSYCHROMETRIC CHART
WEATHER DATA: TANJUNG PRIOK (DOE2.COM)
JAKARTA, INDONESIA
1 JAN - 31 DEC
HUMIDITY
OPERATIVE TEMPERATURE (°C)
HOURS

Jakarta's Climate

We look at Jakarta and understand its climate with high humidity and heavy rain months that brings annual flooding, and its abundant sunshine as well as its saturated soil conditions and its risk of land subsidence. Having the knowledge of this context, we can deploy the "source and sink" framework to understand the possible architectural strategies.

Jakarta's psychrometric chart:
Generated from Ladybug,
Weather data from doe2.com



Jakarta's climate data

(adapted from https://www.weather-atlas.com/en/indonesia/jakarta-climate)

Warmest month: ***September (highest average high temperature 33°C)***
The coldest month: ***January (lowest average low temperature 24.2°C)***

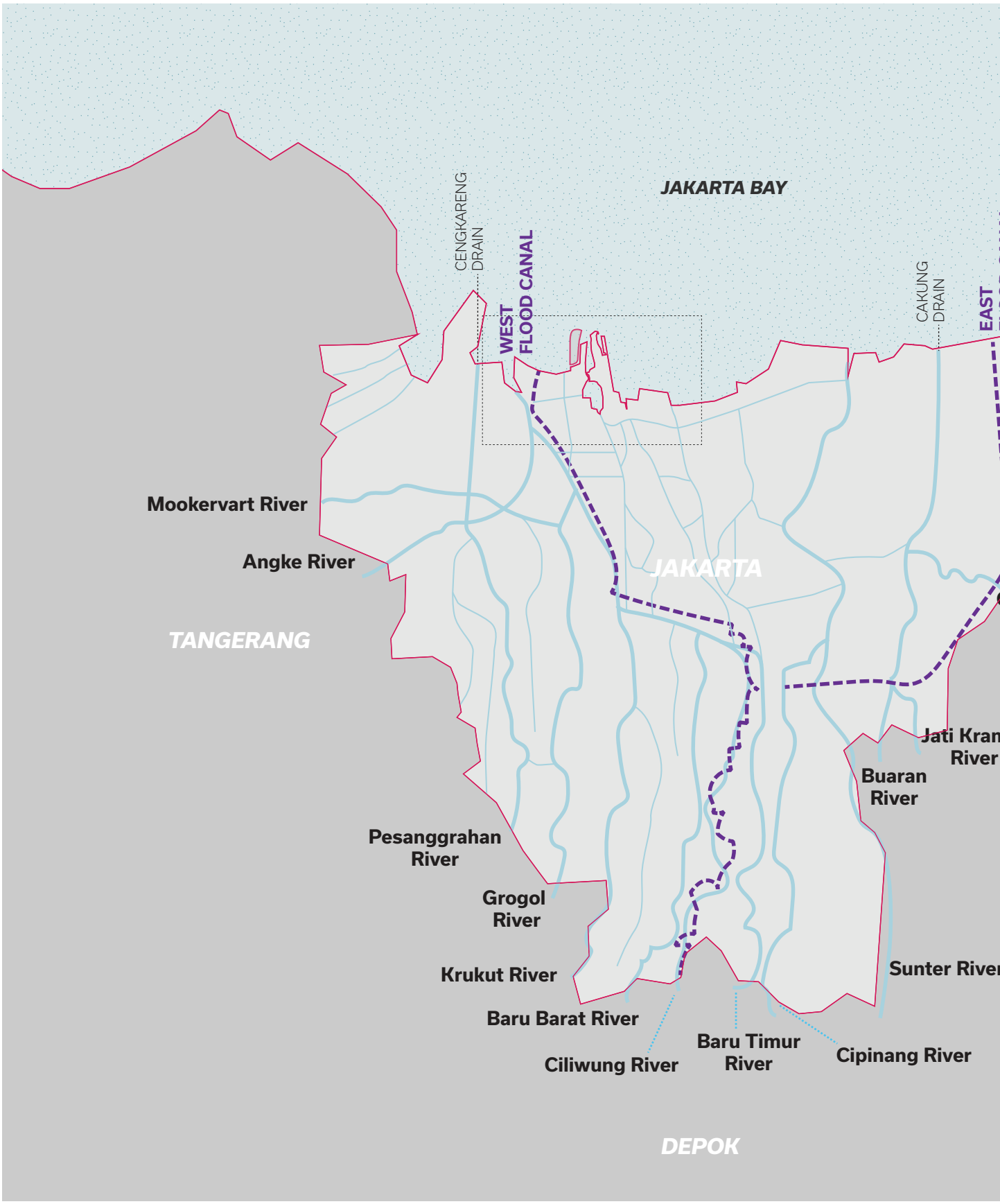
Highest humidity: ***January and February (humidity 85%)***
Lowest humidity: ***September (humidity 75%)***

Most rainy days: ***January (19 days)***
Least rainy days: ***August (5 days)***

Month with longest days: ***December (average daylight: 12.5h)***
Months with shortest days: ***May, June and July (average daylight: 11.8h)***

Month with most sunshine: ***September (average sunshine: 9.7h)***
Month with least sunshine: ***January (average sunshine: 6.1h)***

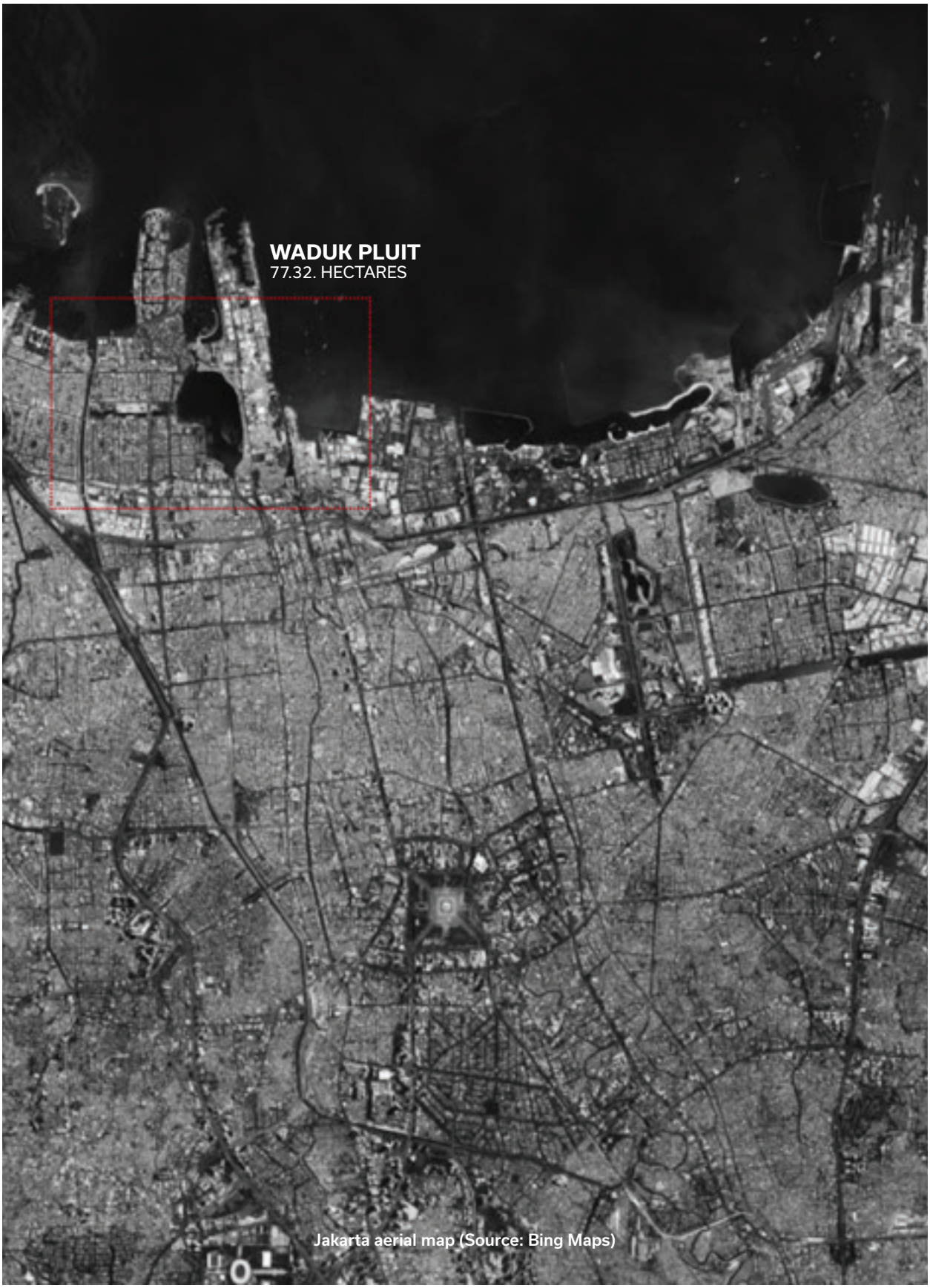
Due to its geographical location in a low lying delta, land subsidence, sea level rise, and loss of water retention areas caused by overcrowding, ***Jakarta is prone to flooding during heavy rainfall months.***


JAKARTA BAY
CENGKARENG DRAIN
WEST FLOOD CANAL
CAKUNG DRAIN
EAST
Mookervart River
Angke River
JAKARTA
TANGERANG
Jati Kran River
Buaran River
Pesanggrahan River
Grogol River
Krukut River
Sunter River
Baru Barat River
Baru Timur River
Ciliwung River
Cipinang River
DEPOK

Riverways of Jakarta
Adapted from:
Jakarta: Design Research and Hypercomplexity. Meredith Miller, Adam Bobbette, Etienne Turpin. 2012.
Peta 13 Sungai Jabodetabek (http://poskobanjirdsda.jakarta.go.id/Pages/noPentingEdukasi.aspx)

Jakarta floods

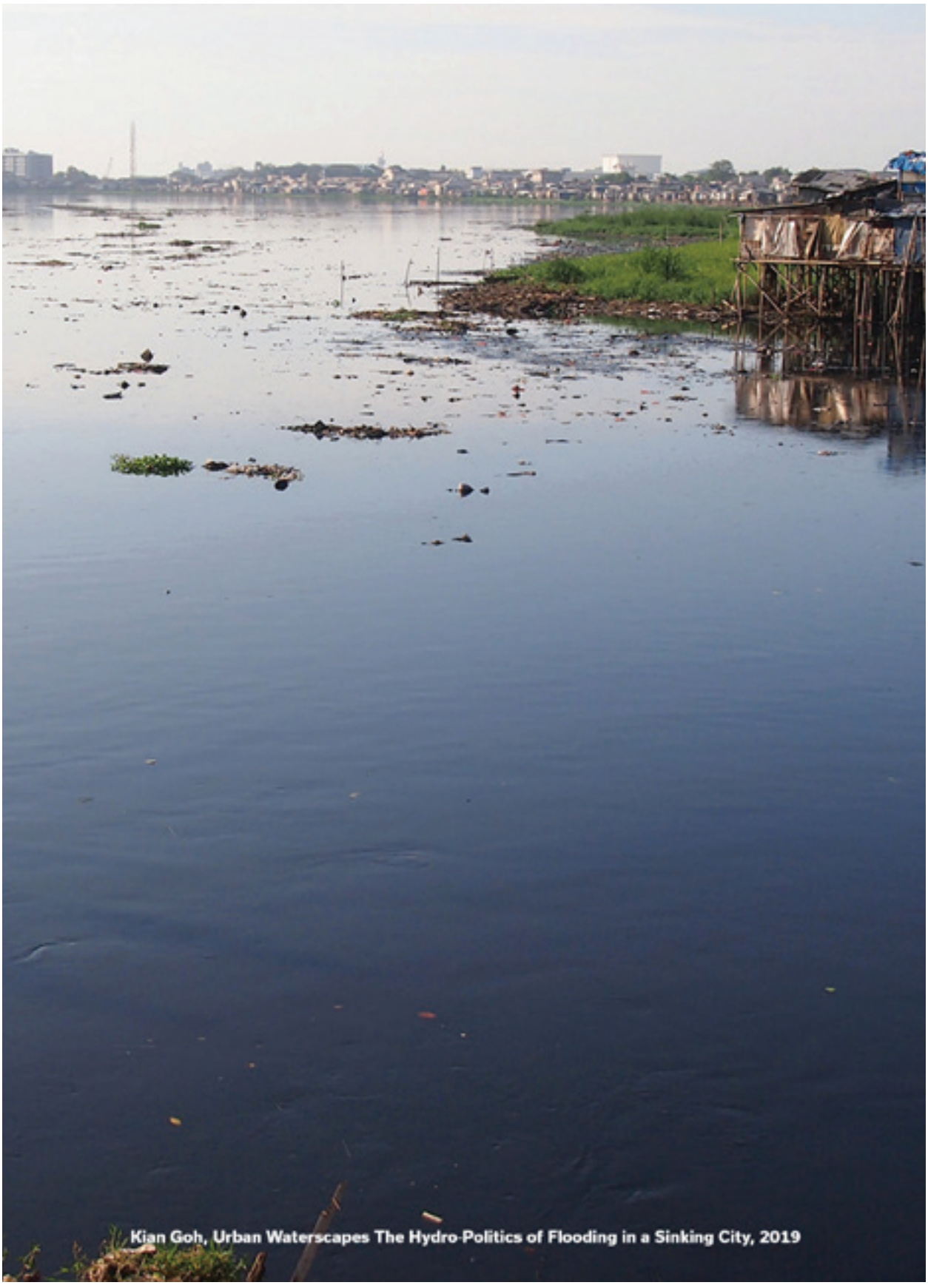
Jakarta is a low-lying delta. The cities that surrounds it sends water to the canals of the city, before all the water drains out to Jakarta bay. Especially during heavy rainfall months, Jakarta expects high volumes of water disproportionate to its canal system. The issue of flooding is a complicated one, which interlinks infrastructures, maintenance, master planning, grassroot initiatives, and many others; but the uncertain and contested nature of land tenure-ship and the flourishing of informal settlements along the riverbank complicates this issue.



Jakarta aerial map (Source: Bing Maps)

Jakarta: Design Research and Hypercomplexity. Meredith Miller, Adam Bobbette, Etienne Turpin. 2012.

Jakarta: Design Research and Hypercomplexity. Meredith Miller, Adam Bobbette, Etienne Turpin. 2012.



Kian Goh, Urban Waterscapes The Hydro-Politics of Flooding in a Sinking City, 2019

Taman Waduk Pluit
Rusunawa Muara Baru

Jakarta's Water Infrastructure Complexity
To widen the canals and for maintenance, informal settlers are often displaced and relocated to low income housing projects.

Specifically, our site is on the north side of Jakarta, the area by Waduk Pluit, a small yet crucial water reservoir with a water gate that pumps out water to the sea. This water pump is what prevents Jakarta from sea water flooding, as they regulate the water level balance between the sea and the reservoir.

Like many other bodies of water in Jakarta, informal settlements have developed around the water edges. For example during a maintenance and green space project of Taman Waduk Pluit (highlighted in yellow), hundreds of families had to relocate. Some moved into the low-income housings high-rise flats on the northeast side of the dam (highlighted in blue). Some are displaced to an area of Jakarta foreign to them, and the media reported that this caused them to leave their jobs behind.

Exterior views of the existing housing complex
(Google Street View)

High rise housings for low-income residents

Rumah Susun Sederhana Sewa (*Rusunawa*), literally translates as "rented simple stacked housing," are subsidized rental unit houses available to rent for citizens with low income (monthly wage of 2.5 to 4.5 million IDR, approximately 170 to 320 USD) or in accordance with provisions specified by the Indonesian Ministry of Housing. [3] Although some *Rusunawa* are publically rented out, some are built specifically to accomodate relocated residents living in informal settlements, or settlers living by the water edges during maintenance or public works.

Rusunawa are often built as high rise flats. In existing low-income housings, the corridor and atrium are often improvised by the residents to accomodate their communal lifestyle. There are disjunctions between the high-rise lifestyle and informality of village practices. This gap calls for a hybrid between urban living and its need for densification, with other cultural models of housing, that support cultural desires of the residents relocated to *Rusunawa*.

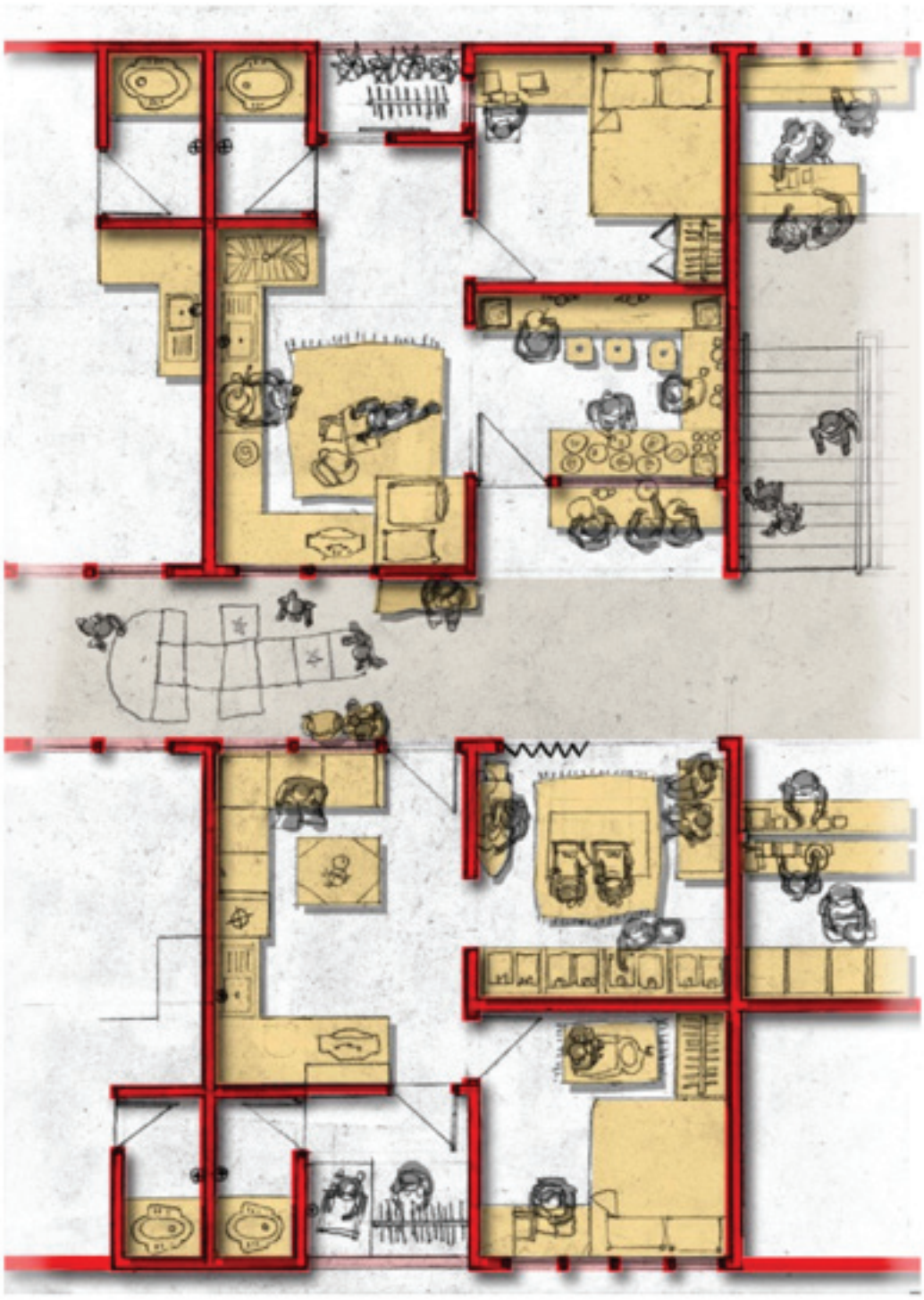
[3] Maharani, Dian. "Prerequisites to live in Jakarta's Rusunawa" (In Indonesian) *KOMPAS.com*

Central atrium at Rusunawa Cilincing

(https://www.liputan6.com/news/read/4098224/foto-menengok-kehidupan-warga-di-rusun-cilincing?page=1)

Make-cozy corridors at Rusunawa Cilincing

(https://www.liputan6.com/news/read/4098224/foto-menengok-kehidupan-warga-di-rusun-cilincing?page=1)



Plan sketch from a design charette at Bukit Duri Village, near Ciliwung River.
(https://medium.com/forumkampungkota/membangun-bukit-duri-dc5567a6b625)

A grassroot organization involved citizens living in flood prone riverbanks with high risks of relocations, in other parts of Jakarta. [4] Involving residents in the design process reveals their aspiration of this hybrid between village life and high-rise lifestyle; the soft edge versus the hard edge; high rise buildings and the dispersed nature of low rise dwellings; and hard edge in relation to soft edge. With these dualities in mind, the framework of sources and sinks is again deployed. We can begin to see how different scales can be paralleled, and how environment encompass across all scales.

[4] *Membangun Bukit Duri, membangun kota: Reposisi Kampung Dalam Konteks Urban* (https://medium.com/forumkampungkota/membangun-bukit-duri-dc5567a6b625)

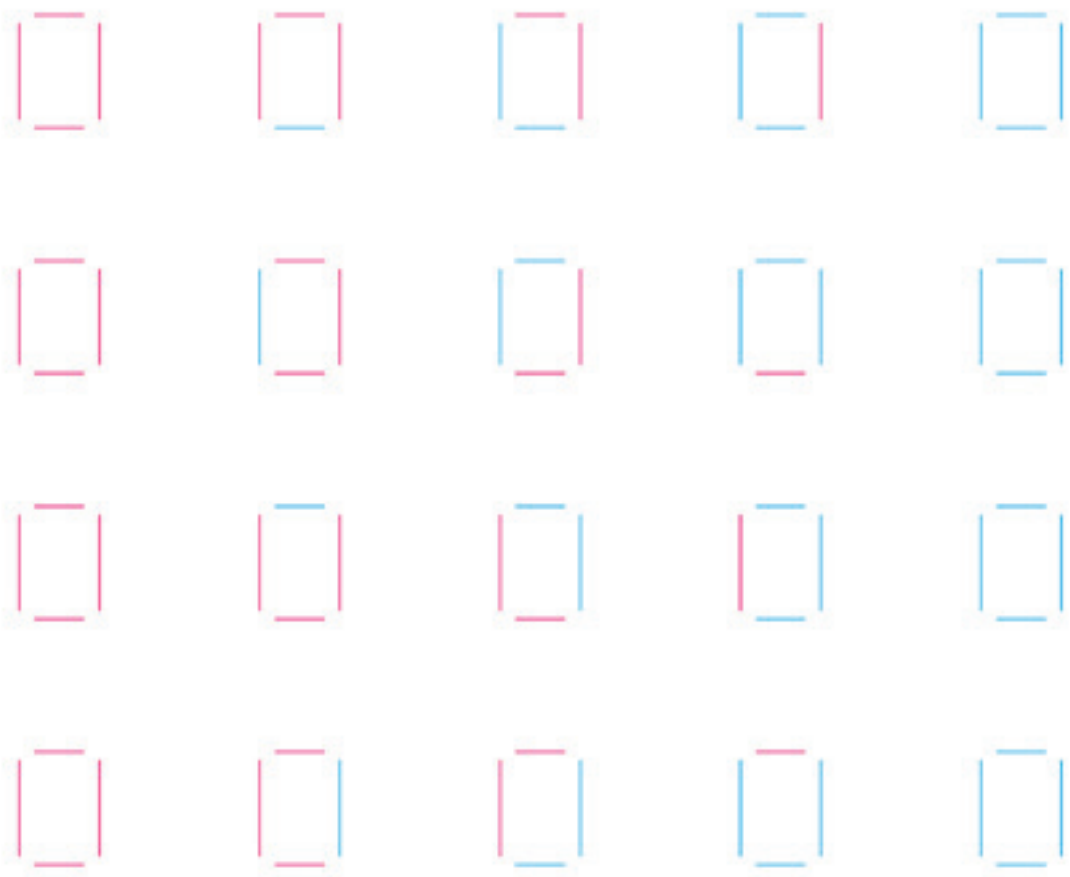
Diagram: List of dualities in the post -arium

Designing with sources and sinks

In thinking of the climate of Jakarta, the framework of sources and sinks, the dualities offered thus far; the project begin the initial probing of design possibilities by operating on the scale of an elevation. Through a series of images, the aim is to understand on a very basic level all the permutations in terms of sources and sinks. The project begins the initial provocation to map different building practices to these scenarios.

This images adds the layer of lifestyle and program; paralleling different activities and models of the "vernacular", the make shifting of current high-rise housing, introducing their lifestyle, food making, clothes drying, social encounters, et cetera, and how thinking of all these as sources and sinks map onto the elevation mixed sensations and energy dissipations.

Through these images I'm trying to understand the juxtapositions of village practices and urban life. For example: in the building scale, in cooking, selling, and informal encounters, in food making and processing and how contemporary architecture can support this cultural activity. This exercise is simply trying to find opportunities rather than trying to problem solve for these programs to take place, and these images are trying to understand and speculate the hybrid as an opportunity for innovation between village practices and urbanity, and rethink new measures of comfort in these juxtapositions.



Source/Sink Permutations:
Permutation diagram of possible arrangements of sources and sinks, on a four-sided space that can be read as an elevation or a plan









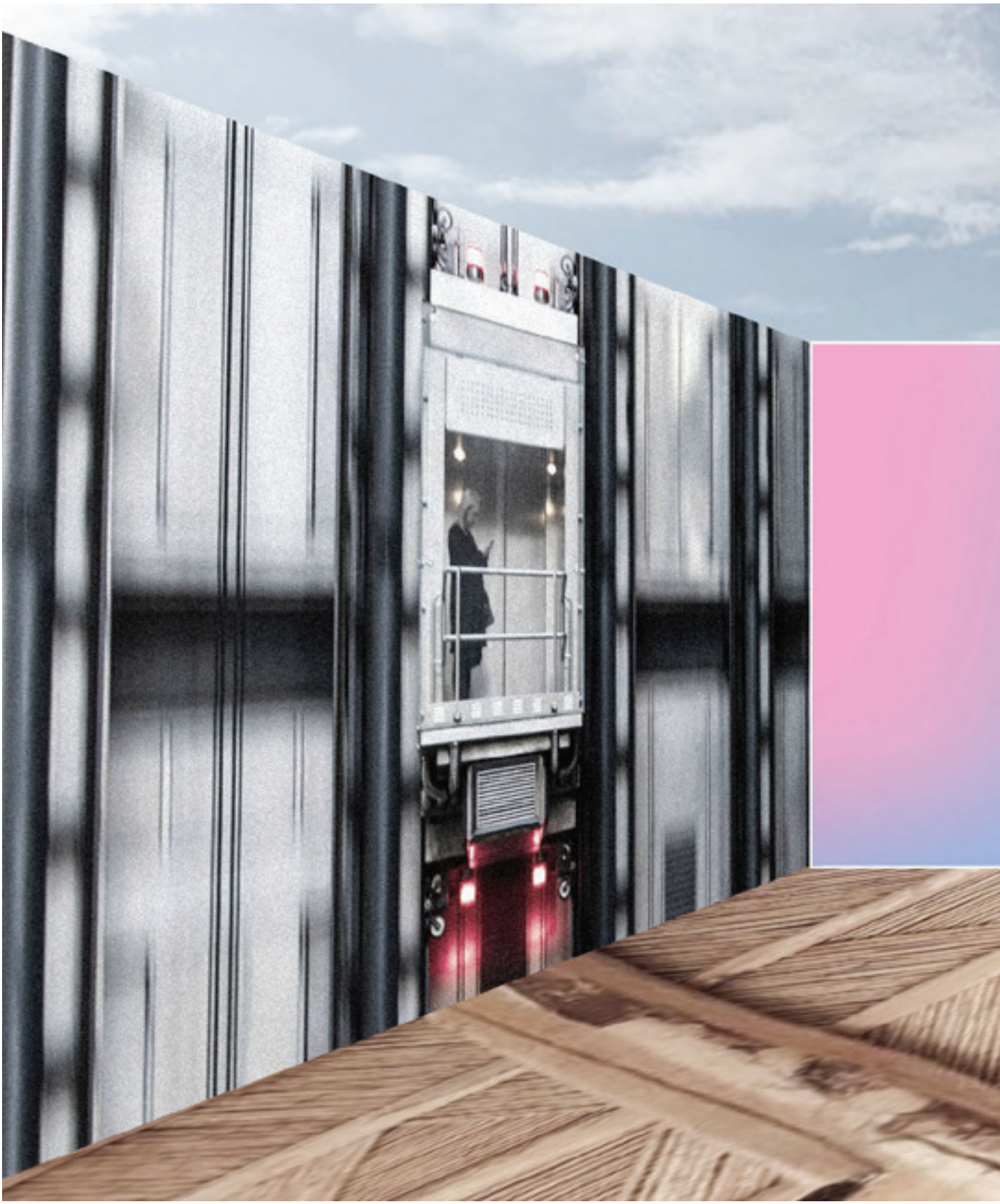


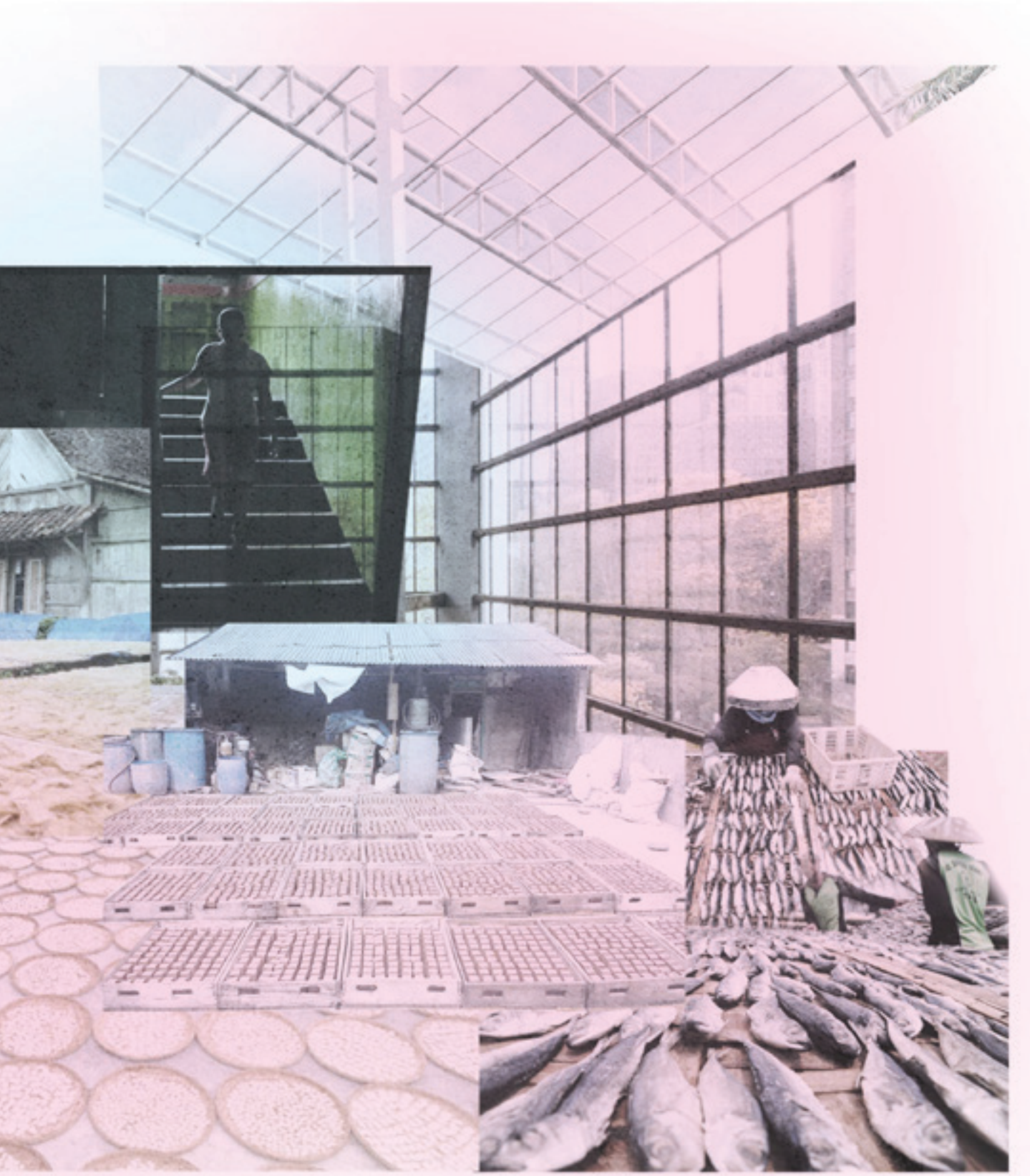







Source/Sink Seeing Machine:
Permutations of sources and sinks, and the mapping of energy dissipation on the elevation that changes with different combinations.
(Original format: GIF)





Site Plan:

Existing low-income housing flats

Informal houses

Two phases

Living on the water edge of Waduk Pluit are roughly 17 thousand people. With maintenance and dredging, it is most likely that they will have to find other modes of settling. This issue is a delicate one, and although we are looking beyond just the existing high-rise building, the idea is to not assume tabula rasa to begin with, but to operate with sensibility and compassion, bringing to the site what is needed, avoid displacement or perhaps build this in phases.

We will investigate the site in two modes: first, looking at the existing housing and find opportunities to bring in aspirations of village-ness; and second, looking at the edge condition and how to create density and urban infrastructure, proposing a new mid-rise typology. Both with the post -arium thinking of energy sink, and energy source.

Phase 01

RETROFITTING RUSUNAWA MUARA BARU

Densify; minimize relocations;
find new comfort and cultural opportunities

The objective of the first phase is to approach is to operate with the post -arium mindset at the scale of the room and building tectonics. While this housing should not just be containers of living, the retrofit will densify, explore ways to find new comfort thermally and culturally, while at the same time we achieve all these, we minimize relocations.

The existing housing

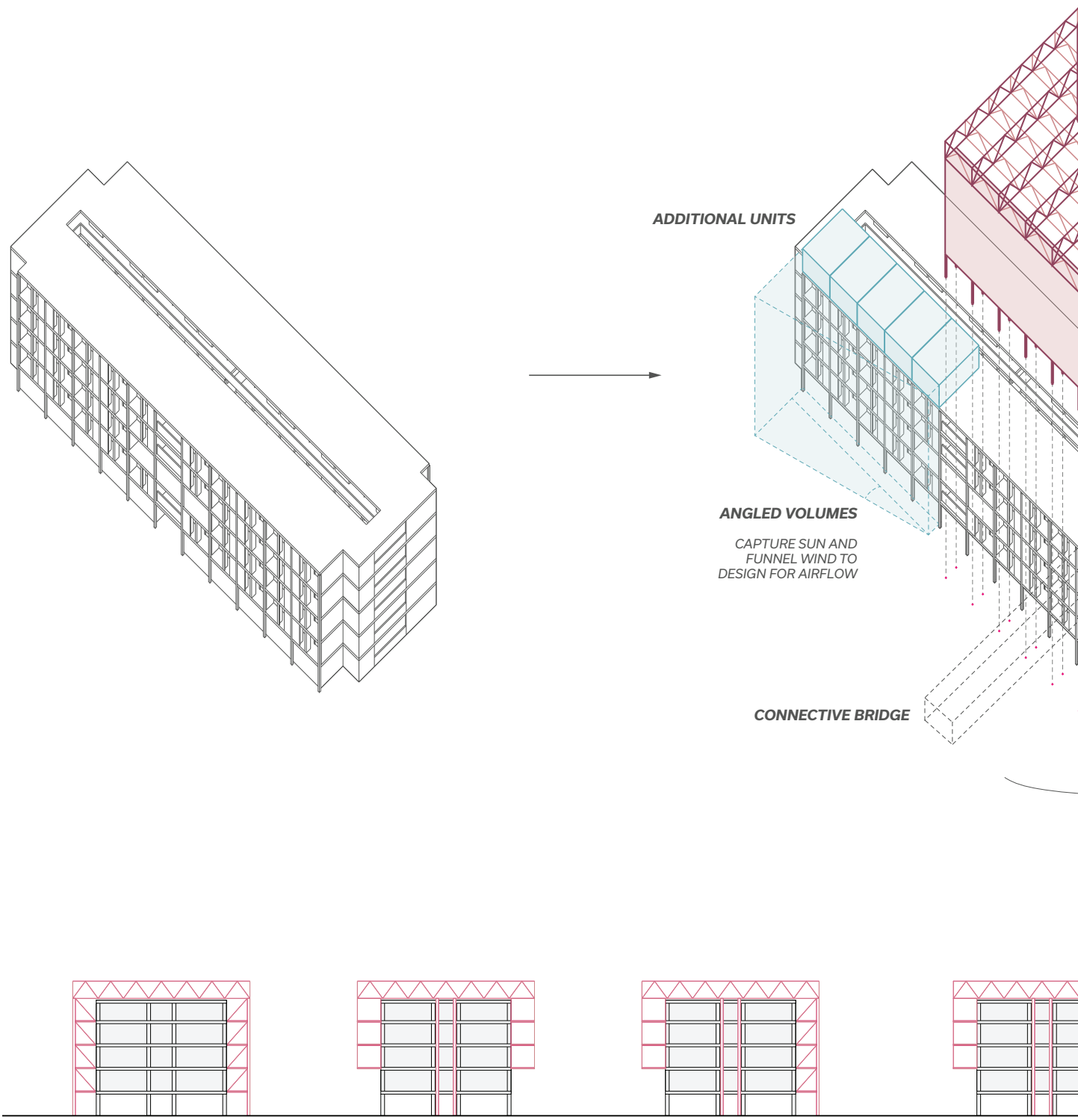
The current housing model was built in 2014, and are currently occupied by residents who were relocated during the greening of the west side of the reservoir. In this complex, there are 12 buildings, with 80 units per building, and totals to 960 units. This capacity is not enough to accommodate all the relocated residents, as some of them are displaced to East Jakarta.

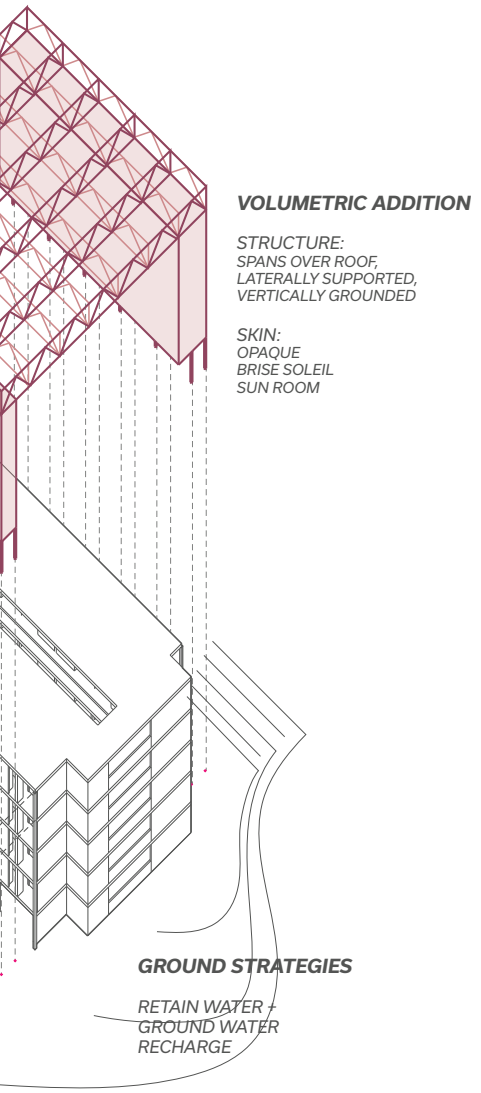
Each building is a typical single-loaded corridor with central atrium, and each unit comprises of 2 bedrooms and 1 bathroom. The problem with this model is that its rigidity does not allow for space sharing, such as selling and other communal activities, which is common in the residents' lifestyle. The bottom floor is reserved for kiosks and commercial spaces, but some relocated residents who didn't get housing units established temporary rooms.

Central atium and makeshift shops at Rusunawa Muara Baru
(Beginilah Kondisi Rusunawa Muara Baru, Berita Satu, May 14, 2016)

Occupying available common spaces: selling, playing, living

(Beginilah Kondisi Rusunawa Muara Baru, Berita Satu, May 14, 2016)


ADDITIONAL UNITS
ANGLED VOLUMES
CAPTURE SUN AND
FUNNEL WIND TO
DESIGN FOR AIRFLOW
CONNECTIVE BRIDGE

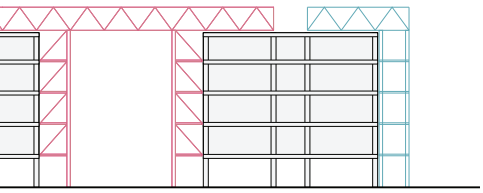


The retrofit works in multiple steps:

By means of addition, volumes are added over and wrapping the existing building. The volumes create additional units, communal area, and extensions of living spaces. They respond to environmental cues (in terms of orientation and façade treatment), making the strategies global, but also local and specific, to each building location. Connective bridges create network within the 10 buildings to encourage villageness, and frame the ground below.

By means of subtraction, the ground is activated for water strategies and public courtyards. The walls along the central corridor are also subtracted, to sculpt the vertical air flow, designing for buoyancy.

Structurally, the reftrofit works like a cap fitted to the building, but independent from it, while borrowing some lateral support as platforms meet the existing floorplates.

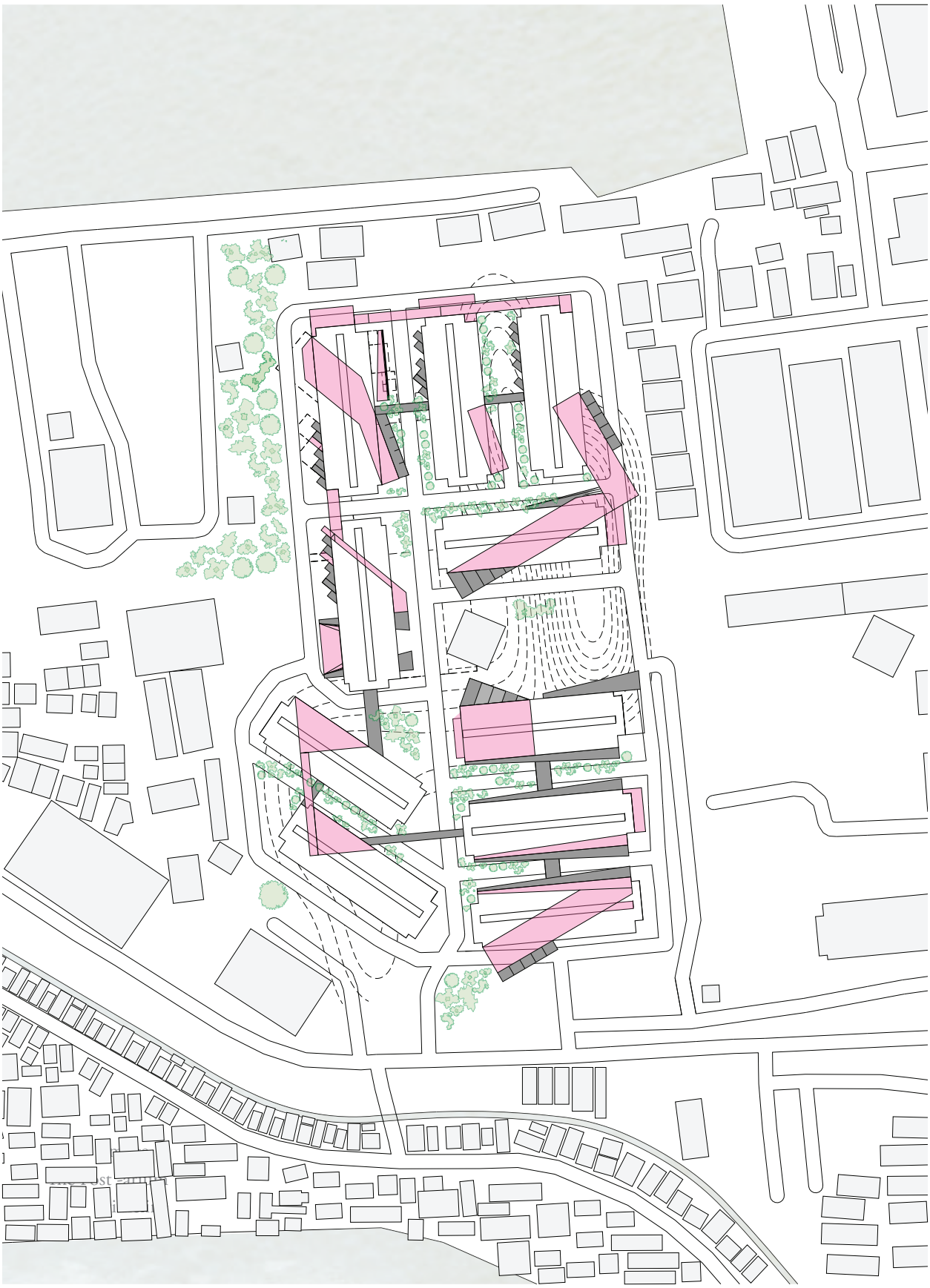


Above: **Diagram of retrofit strategies**
Left: **Structure diagrams**

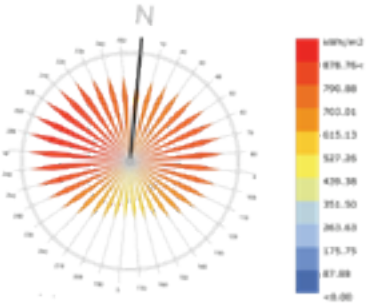
Before and after the retrofit

As seen on this roof plan, the buildings are individual to each other regardless of source and sink. Without any intervention, the building turns into itself, and does not interact with neighboring buildings. Activities are internal to each unit, although the lifestyle tendency for space sharing is apparent.

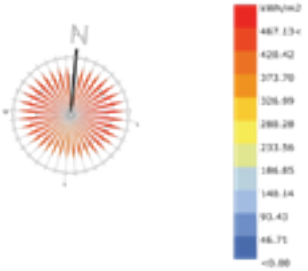
With the retrofit strategy, the volumetric addition responds to wind and sun orientations; Buildings are connected and respond to each other as they frame courtyards, funnel winds, or capture sunlight. In that, they become energy source and energy sink for each other.



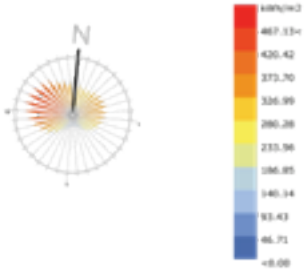
Radiation



total (kWh/m2)

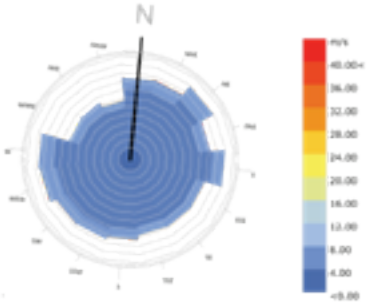


diffuse (kWh/m2)

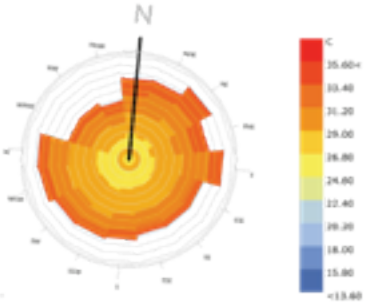


direct (kWh/m2)

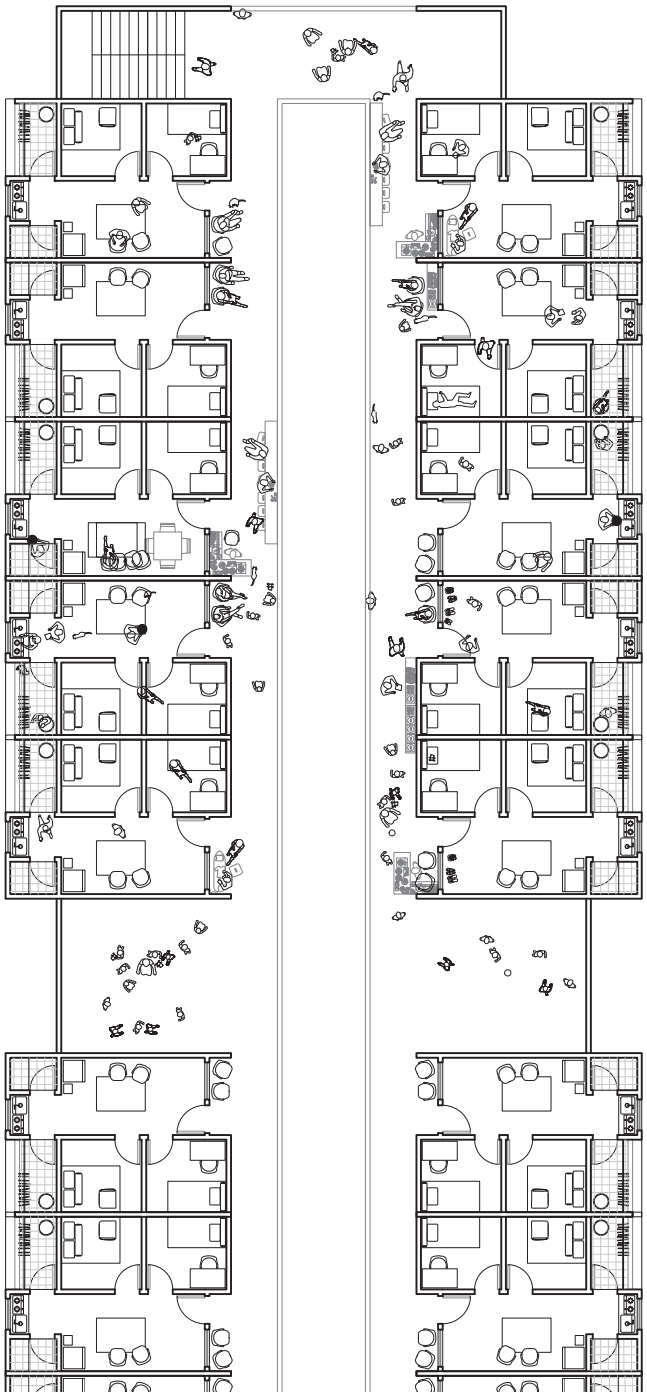
Wind

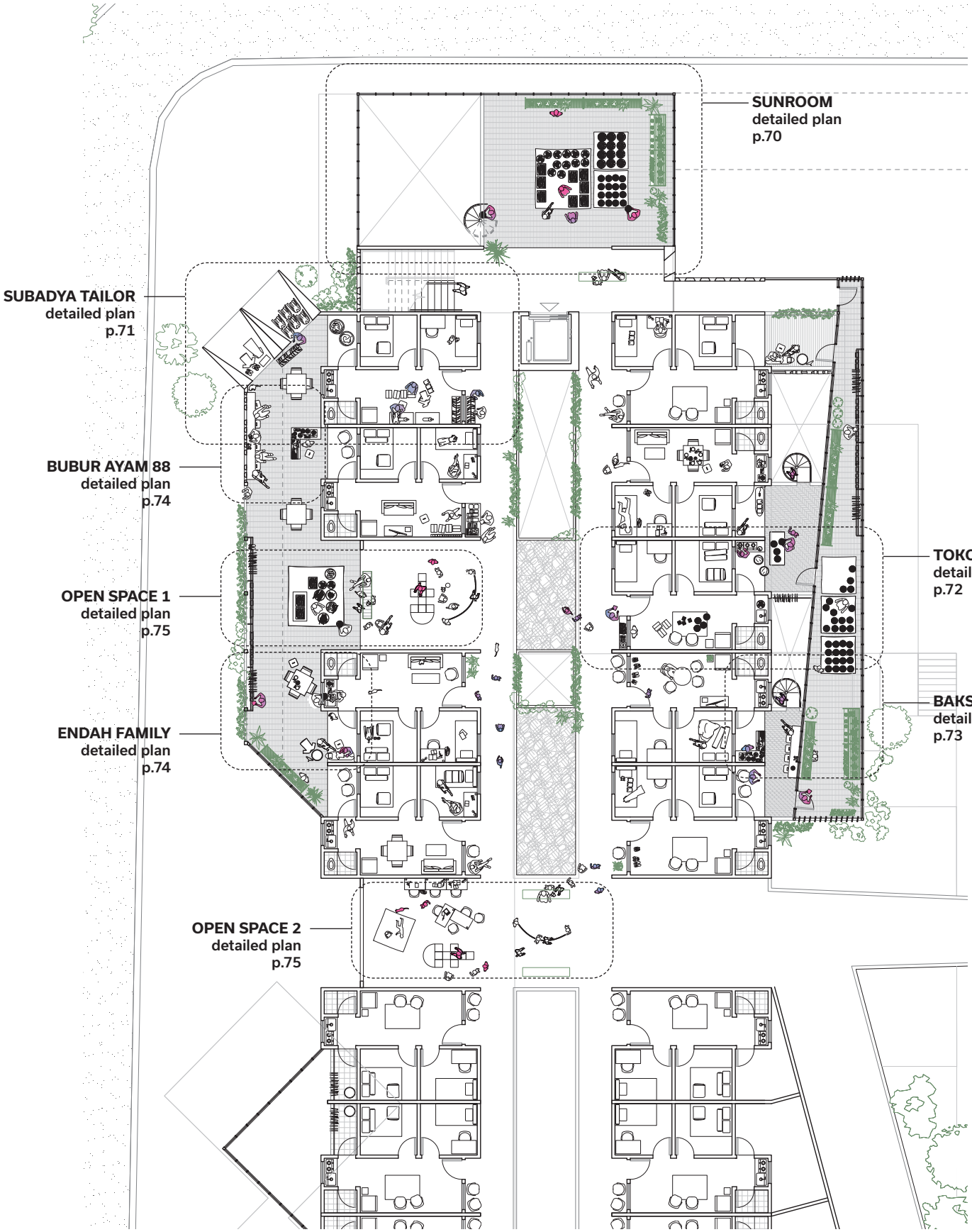


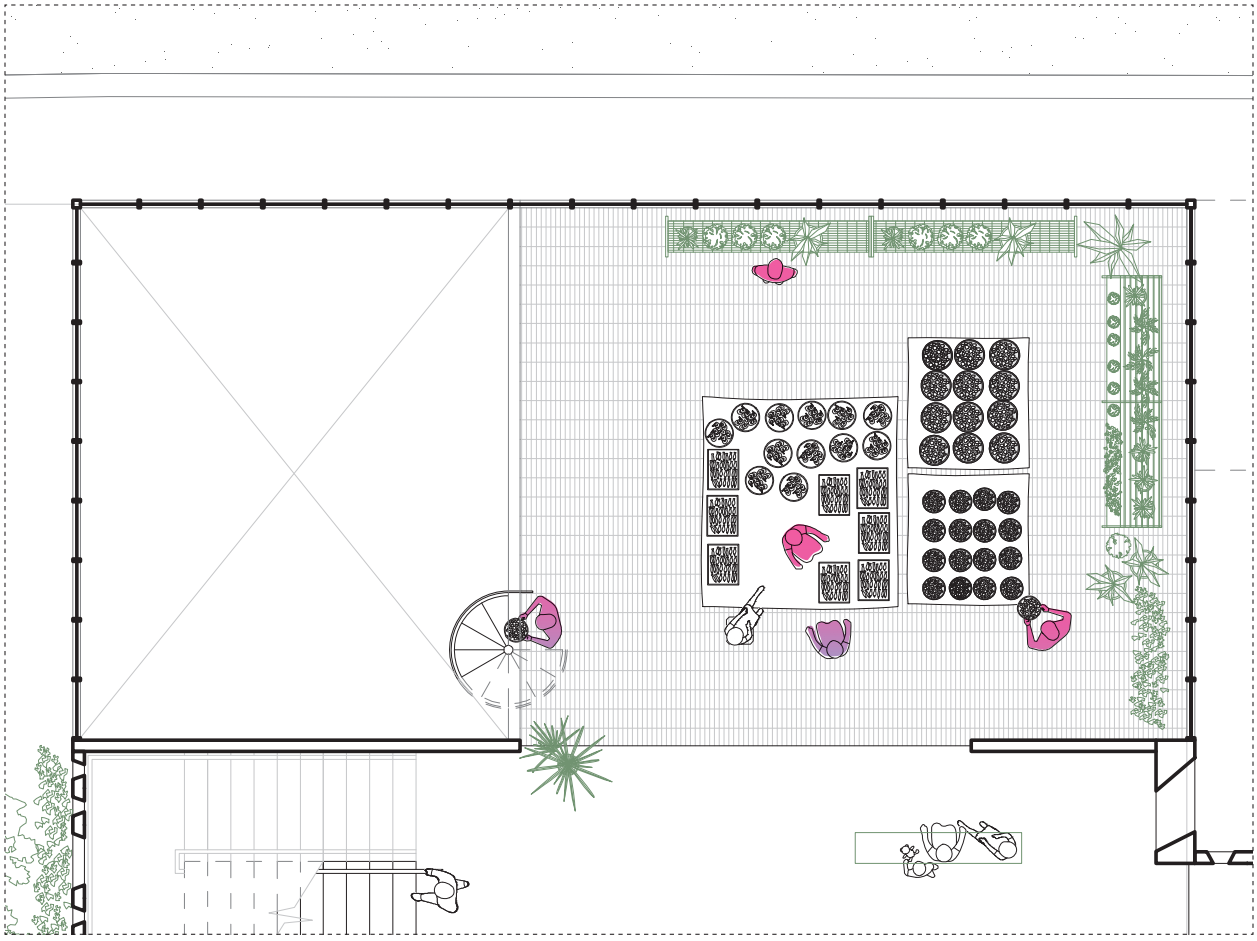
speed (m/s)



dry bulb temperature (°c)

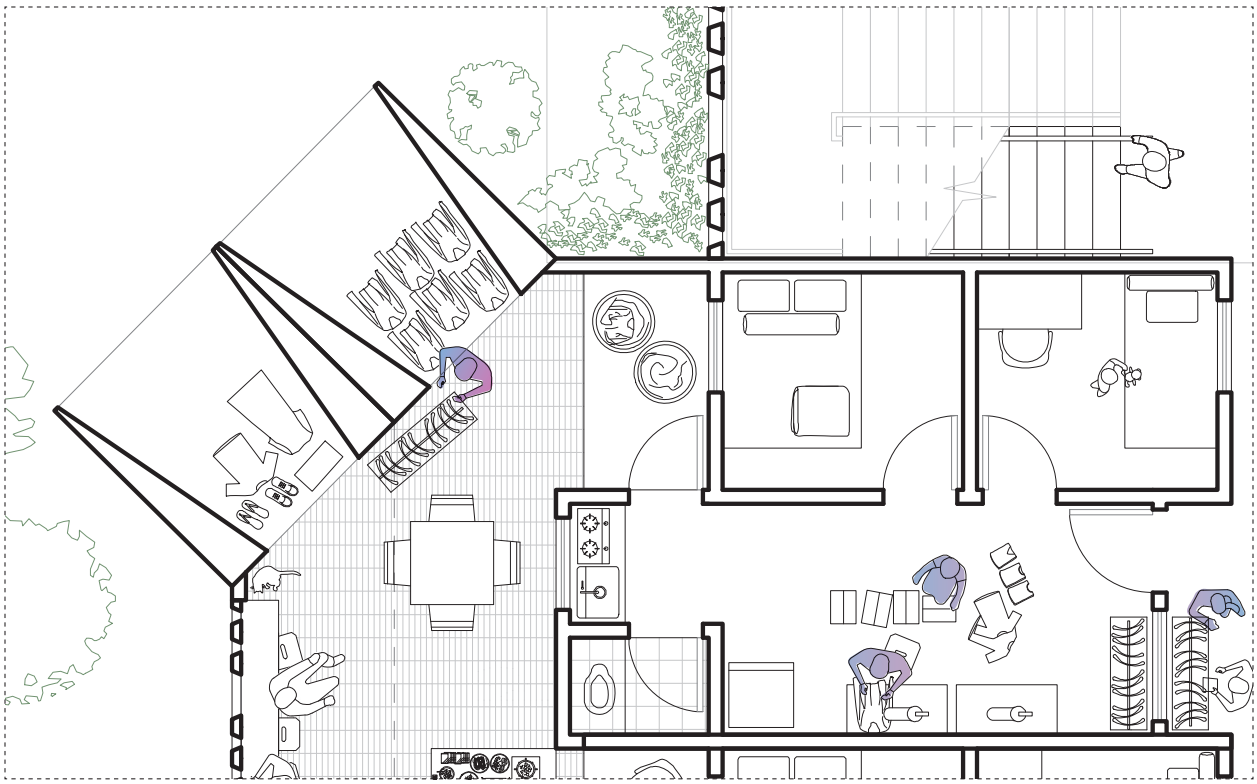



SUNROOM
detailed plan
p.70
SUBADYA TAILOR
detailed plan
p.71
BUBUR AYAM 88
detailed plan
p.74
OPEN SPACE 1
detailed plan
p.75
ENDAH FAMILY
detailed plan
p.74
TOKO KERUPUK
detailed plan
p.72
BAKSO MAHMUD
detailed plan
p.73
OPEN SPACE 2
detailed plan
p.75



SUNROOM
detailed plan

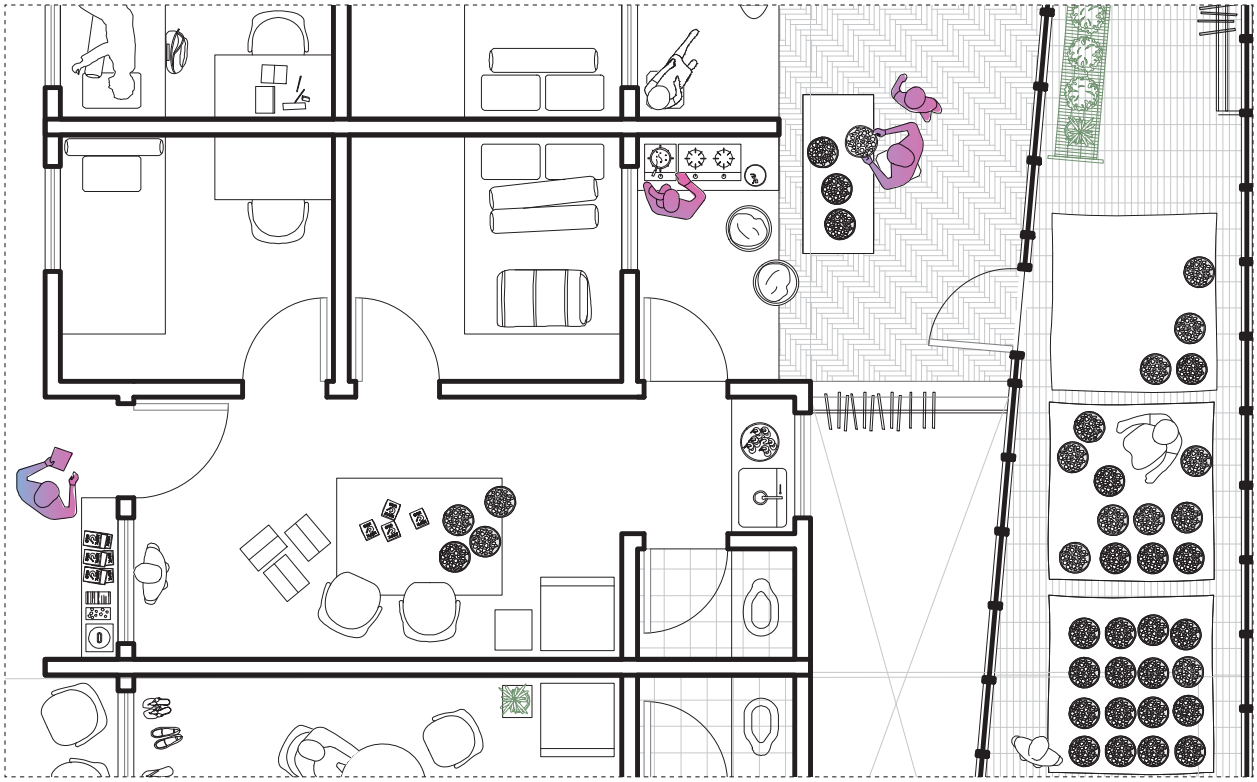
The sunroom can be used for clothes drying, small farming, or food preservation, particularly to process hauls from nearby fisheries.



SUBADYA TAILOR
detailed plan

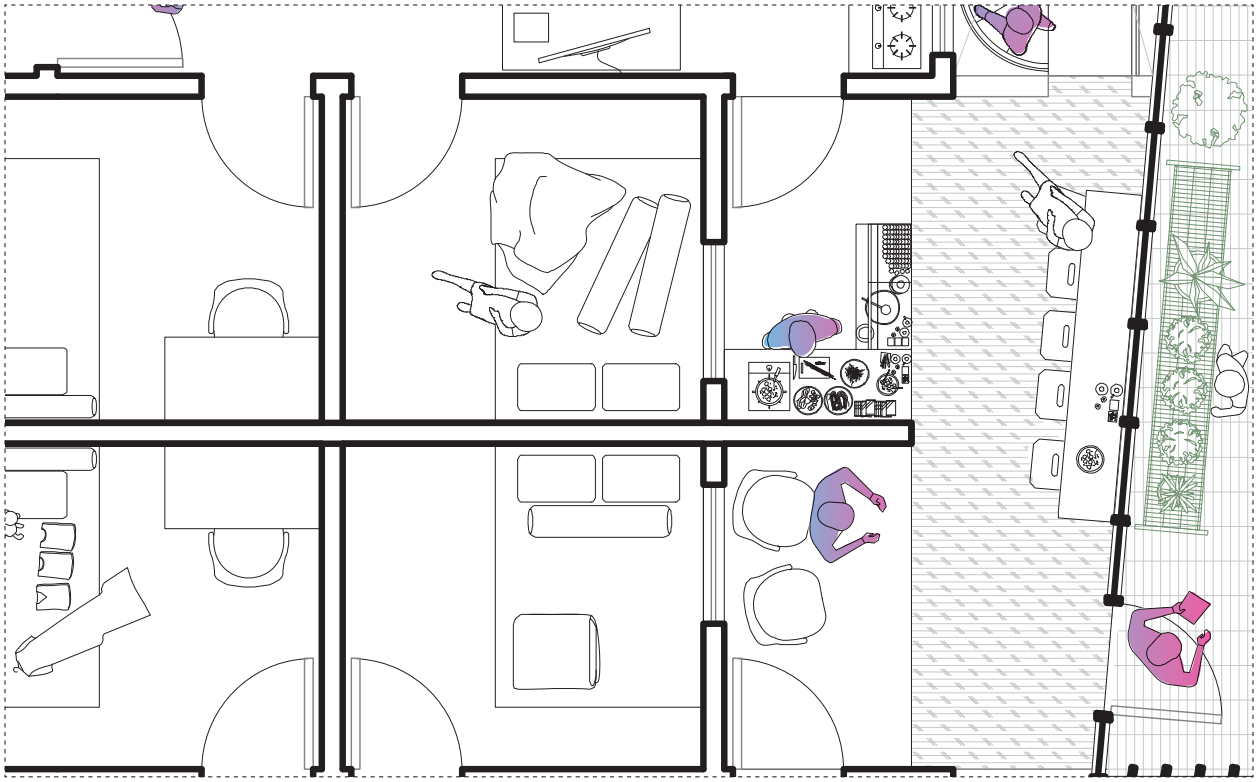
The volumetric addition adds asymmetry to the building, and creates opportunity for difference in air pressure, such that air flow is encouraged. The funneling effect behaves volumetrically and on surface levels. funnel in wind to the newly added patio and into the adjacent units as well.

Because of the additional space, less private activities such as dining, and chores can be brought outside. As the result, the living room can be freed up for working space or setting up a small shop. This enables work-life settings and home industries. For example, the Subadya family can set up a tailoring and garment business, producing and selling it at the same time.



TOKO KERUPUK UDG
(UDG Shrimp Crackers Shop)

Because of the high heat and increased wind speed, the long sunroom is dehumidified and can be used for food procesing that requires drying. This family uses the sunroom to dry their homemade shrimp crackers, producing and selling it at their small shop in the front door.

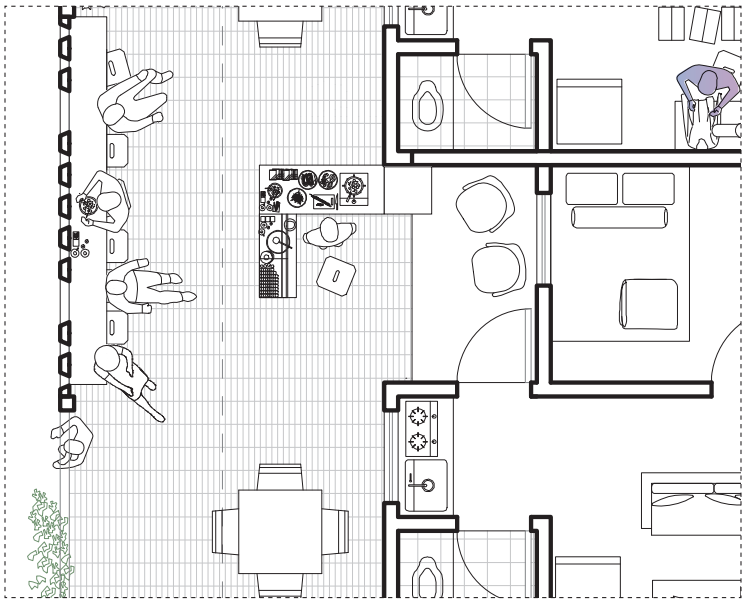


BAKSO MAHMUD
(Mahmud Meatball Soup)

The private atrium hosts vertical circulation to specific units making it like a back door. It also pushes air up to improve circulation, and maintain natural light to the living spaces. the volumes enable a backyard situation, where they can work or extend their living activities. The Mahmud family sells meatballs in their backyard.

ENDAH FAMILY

The Endah family has 4 children. So, their living room is used as a family room by day, and bedroom by night. Their family uses the additional space for dining, laundry, and ironing.

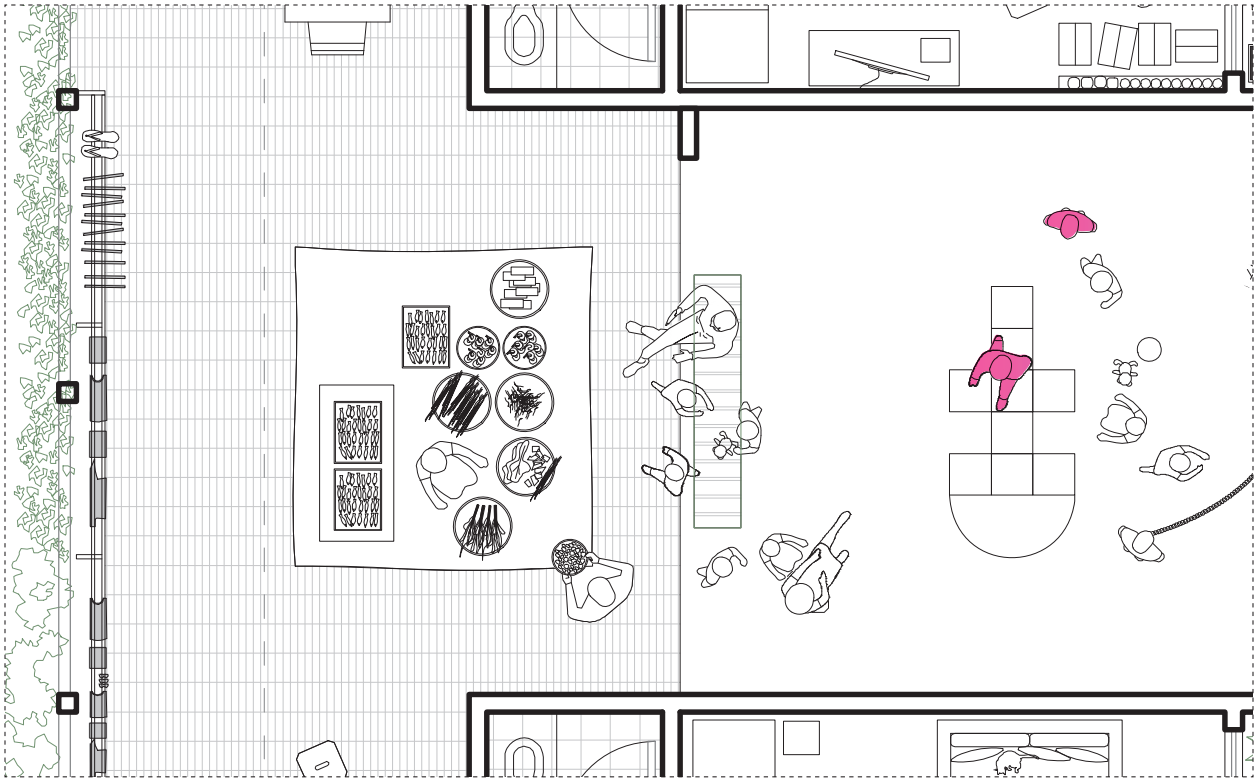


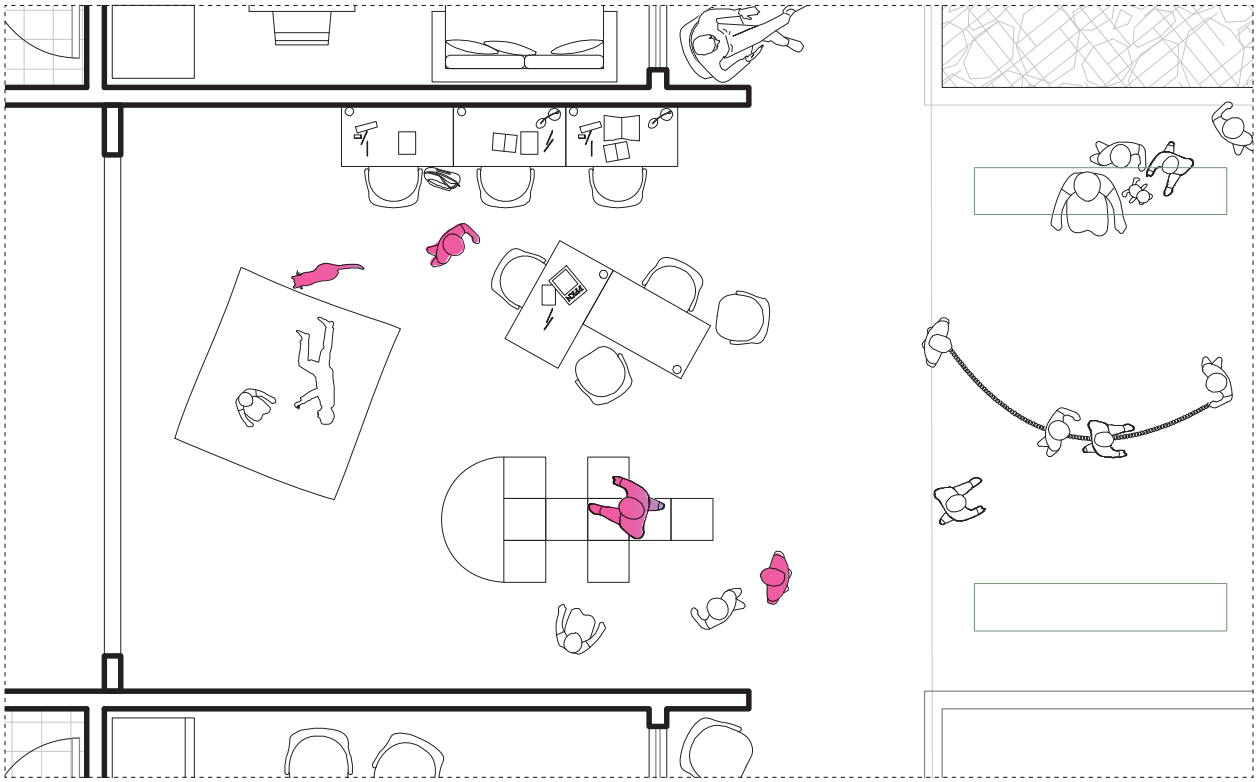
BUBUR AYAM 88
(88 Chicken Porridge)

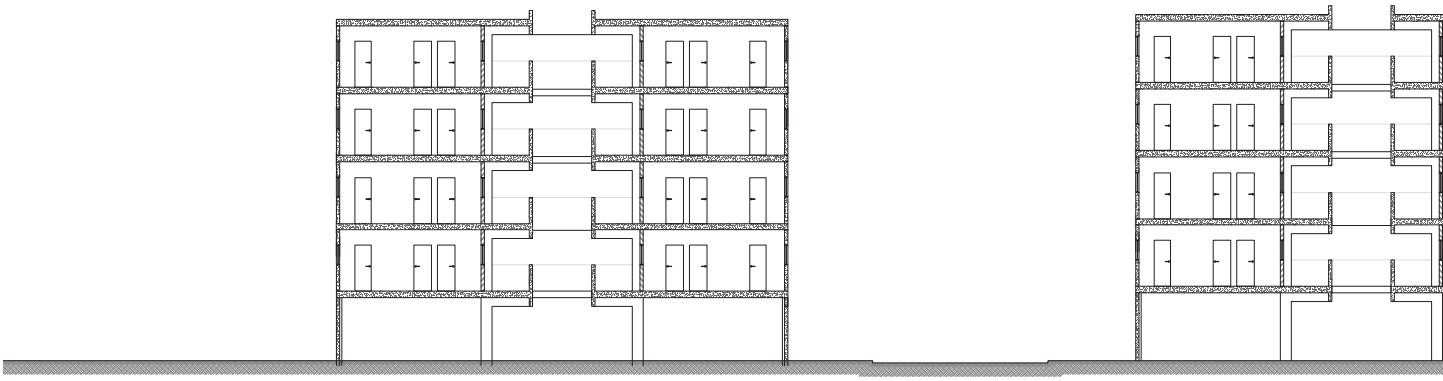
Enjoy your breakfast by the brise soleil that funnels the wind breeze to the dining area and adjacent living units.

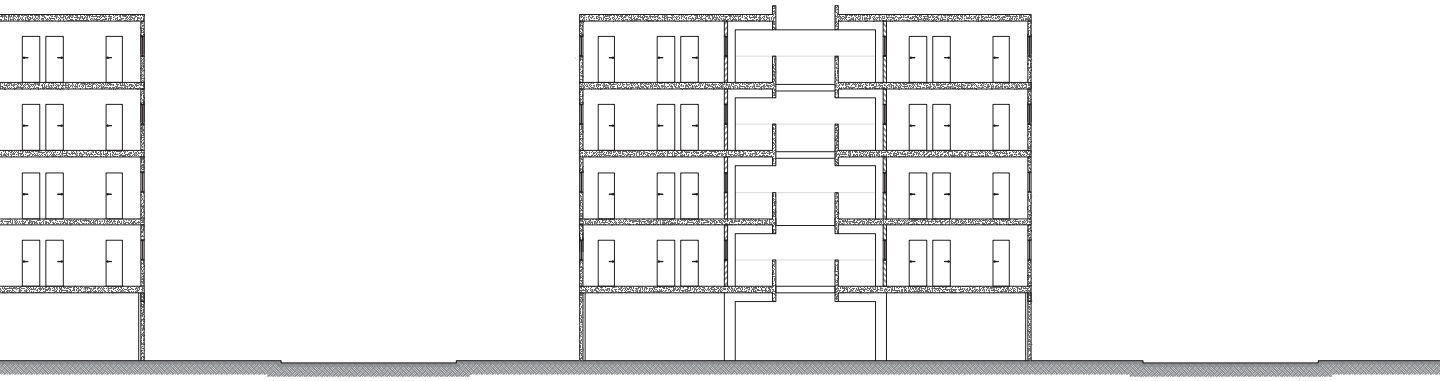
OPEN SPACE 1: **MORNING MARKET**
OPEN SPACE 2: **STUDY AND PLAY AREA**

(Opposite page) On larger spaces, residents can open a vegetable market, communal clothes drying, or babysitting, or play and study areas for children.





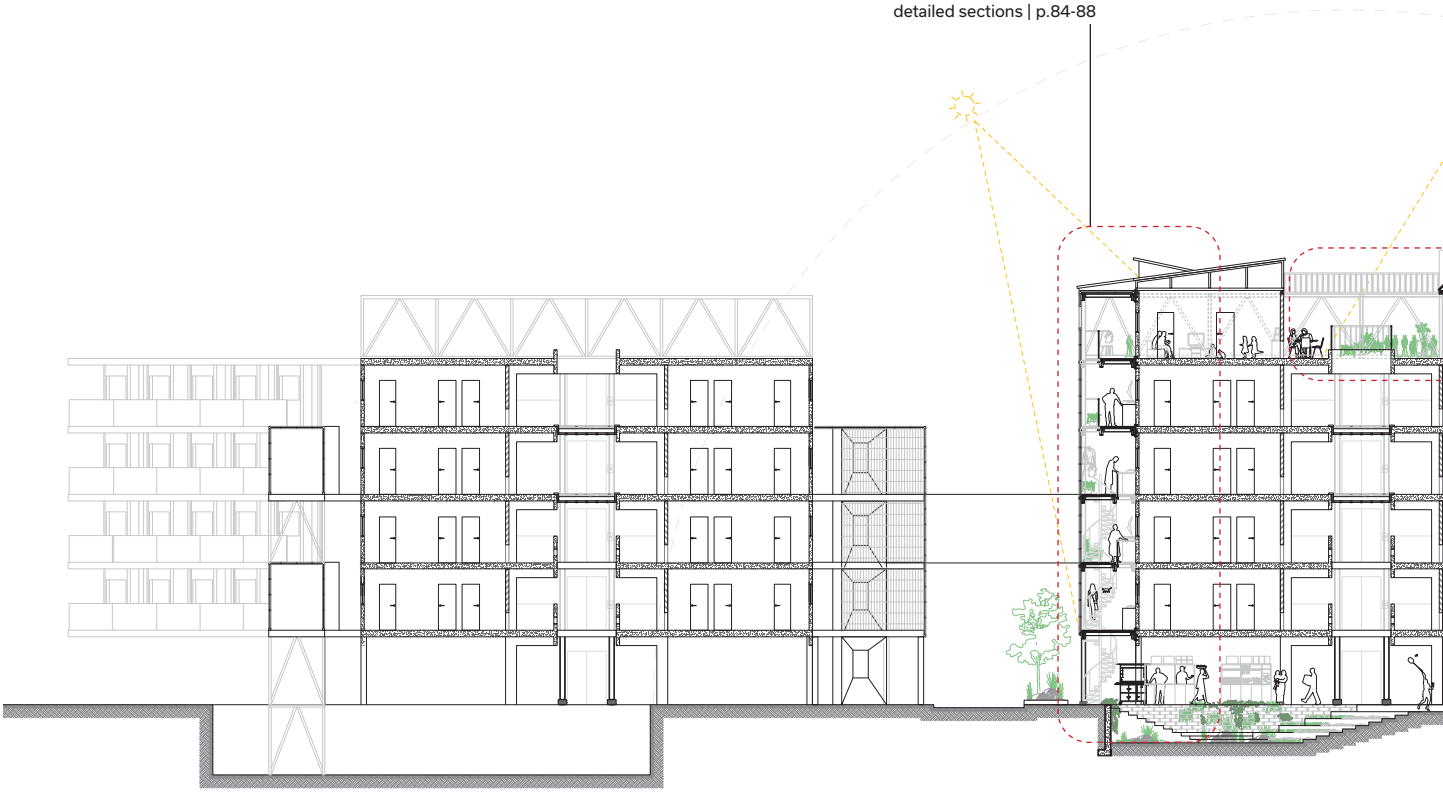


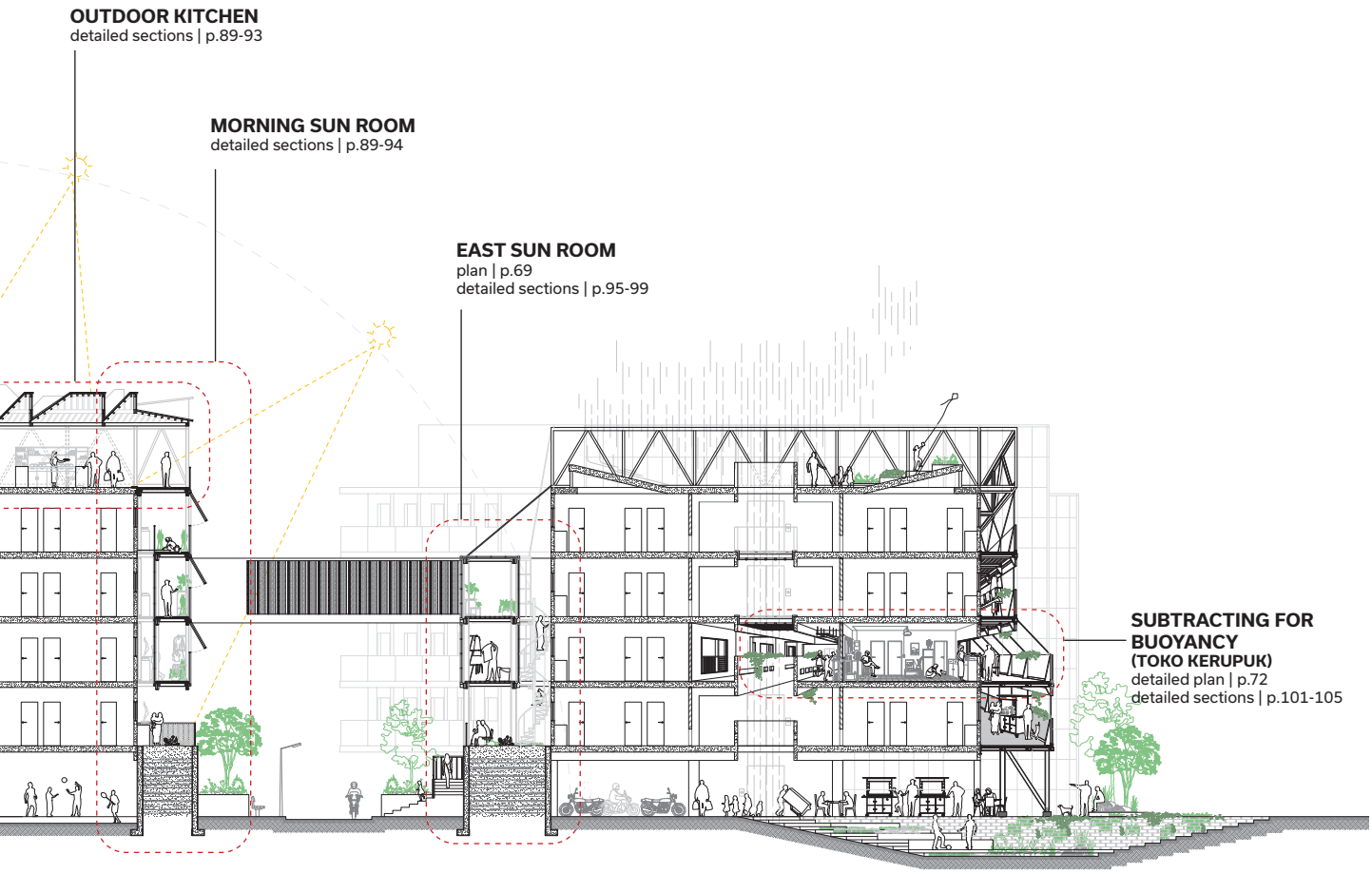


SECTION
before the retrofit

Sectionally, the existing housing is separated from each other, except for the ground circulation for cars and pedestrians.

EAST SUN ROOM, ADDITIONAL UNITS
detailed sections | p.84-88



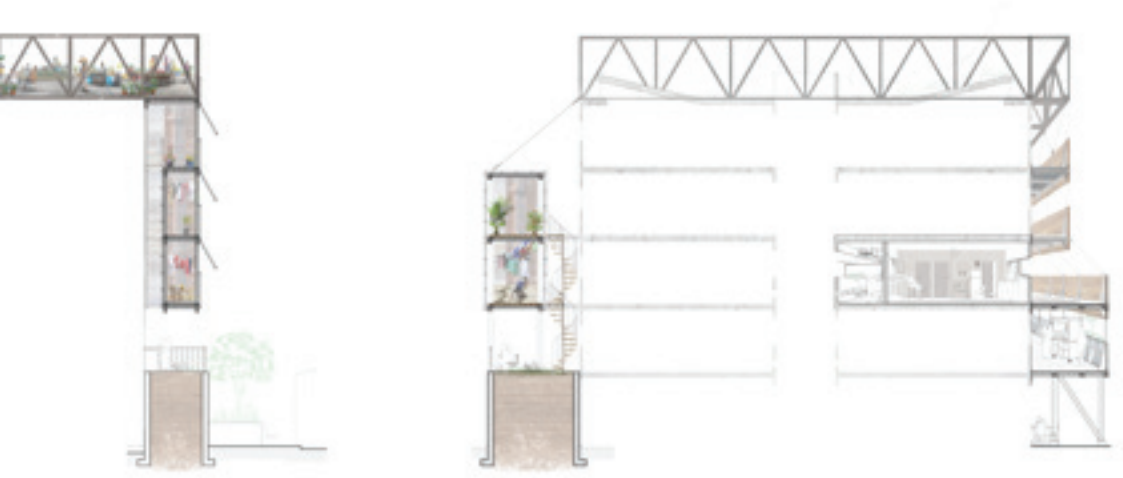


SECTION
after the retrofit

With the alteration, the building becomes one continuous building, with local uniqueness. The ground is also activated as an open space or water retention.

SECTION
buoyancy

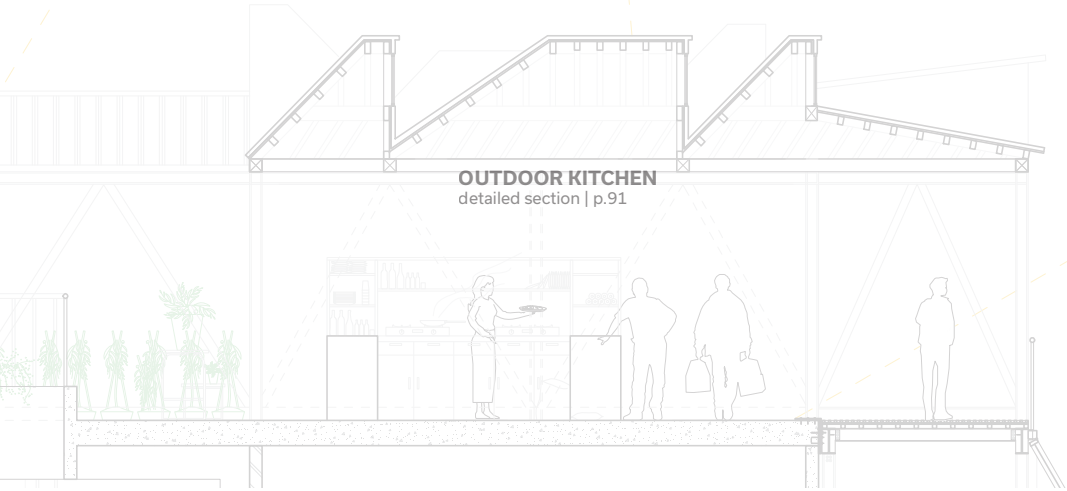
Modest apertures, low to high, are introduced in the existing balconies and walls to sculpt the air flow. Activities that are sources of heat are grouped together above and outside the living areas, such that the temperature difference encourage air to rise quicker.



SECTION
material, tectonics and culture

The sources and sinks are also viewed in relation to the cultural aspirations the programs supported by the retrofit addition. Materiality supports the assembly of spaces as sources and sinks.


ADDITIONAL UNITS
detailed section
EAST SUN ROOM
detailed section
OPEN SPACE:
commercial area
GARDEN:
water absorption,
water retaining



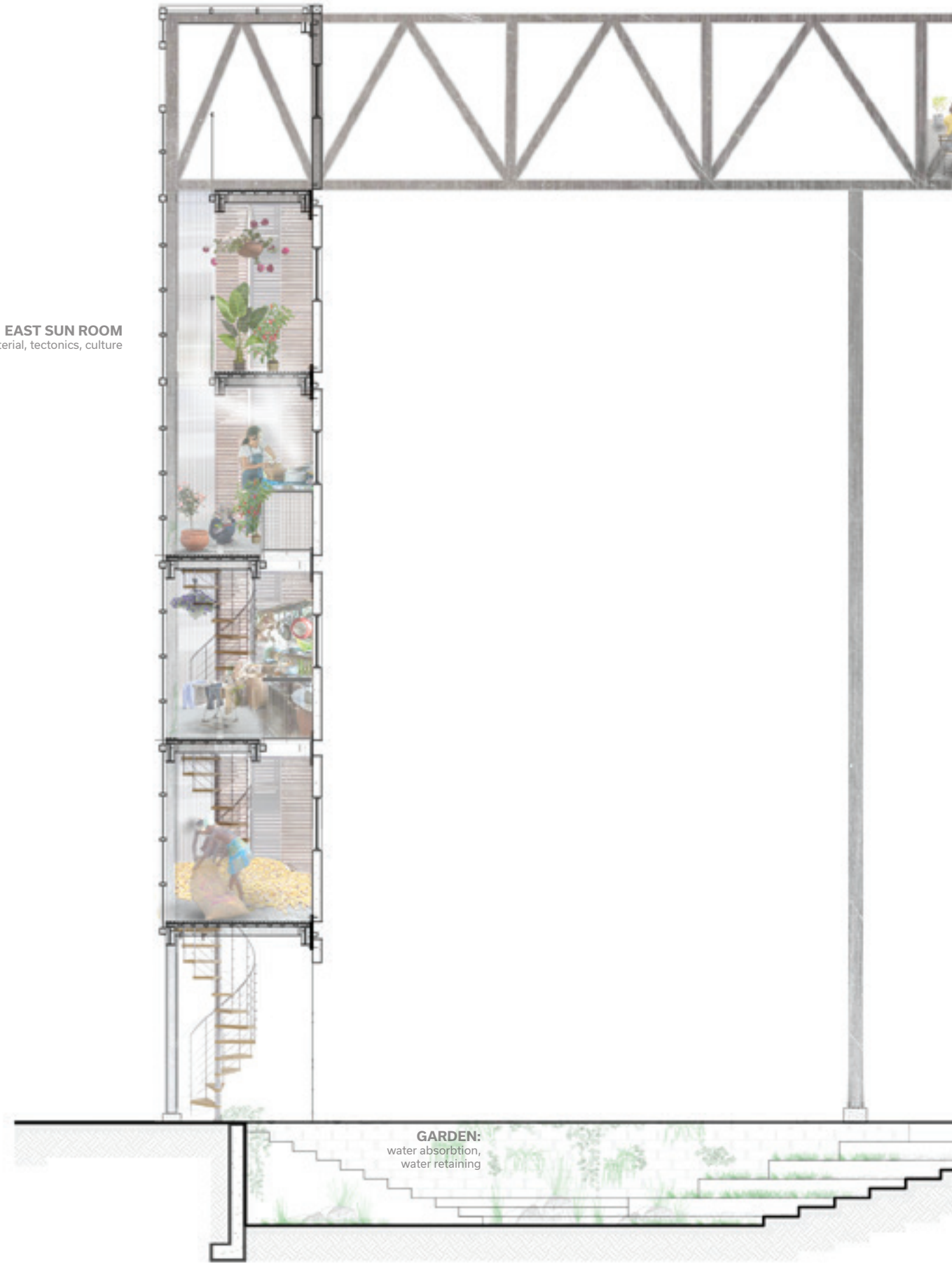
ADDITIONAL UNITS

On the top of the building, a maximum of 12 additional units can be added. These units will have separate kitchens across from the living spaces. The kitchens are moved outside and above the building so that it becomes a heat source, to which will buoyancy naturally flow to.

The first floor hosts commercial spaces, and the ground is carved for a water retaining and absorption area.

The structure is fitted to the building from the top with a space truss that spans across the building width. Floors can be hung with a steel tension bar, secured with lateral attachments, and finally anchored by steel columns. With this system, they become semi-independent.

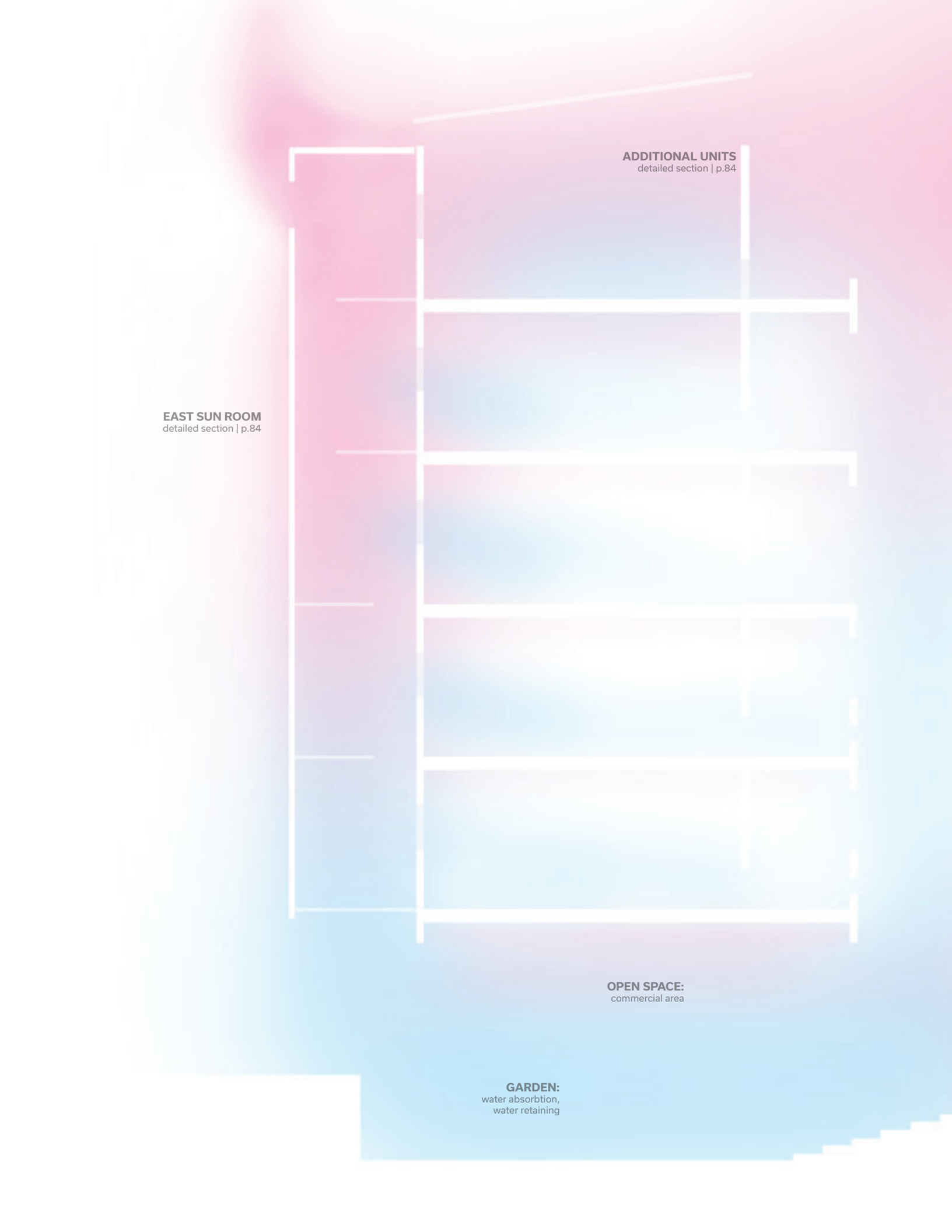
EAST SUN ROOM
material, tectonics, culture

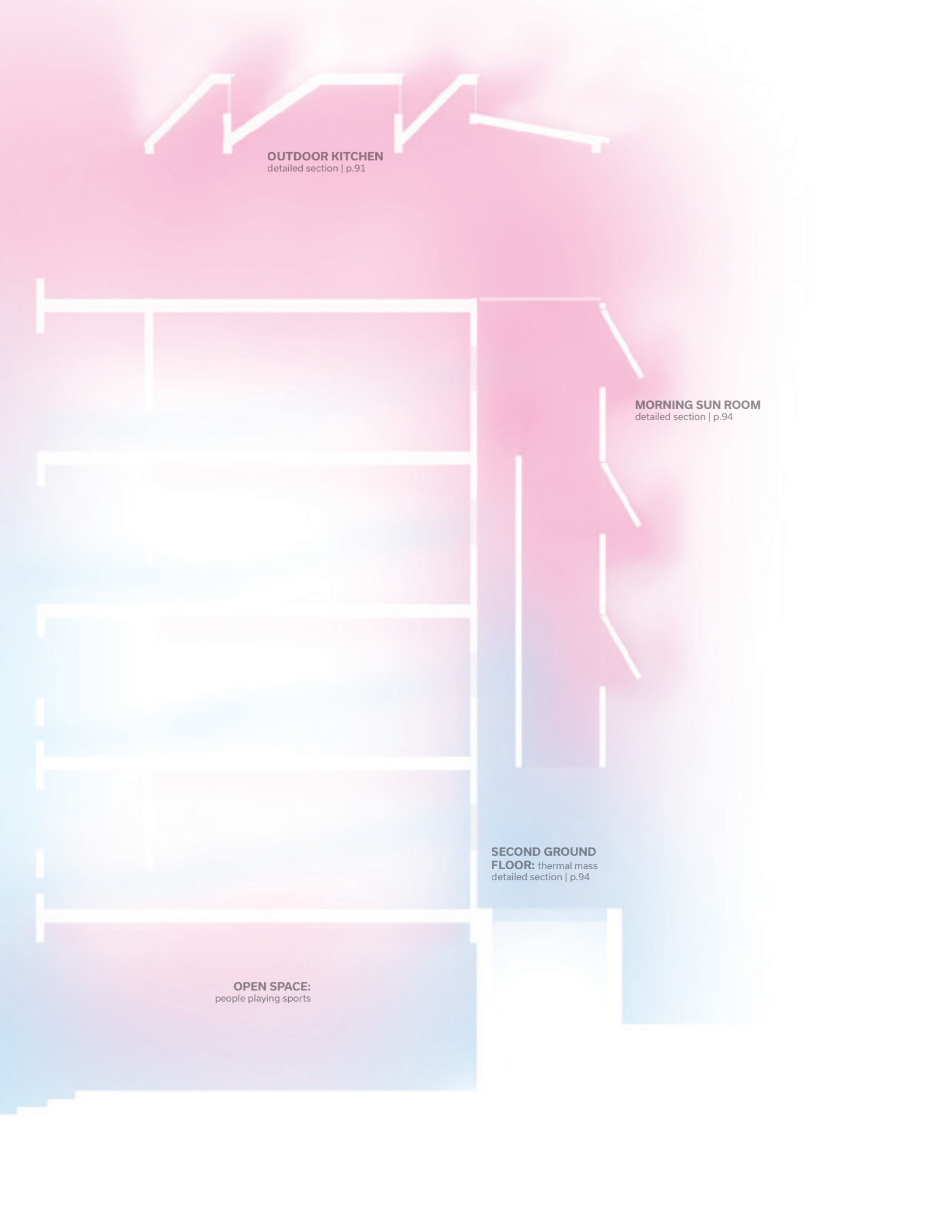


GARDEN:
water absorbtion,
water retaining

EAST SUN ROOM

The sun rooms are sources that intensifies energy transfer in the building, but are also used to host activities such as farming and food preparing. In the East Sun Room of this building, the kitchen are moved into a patio and greenhouse that acts like a thermal chimney to flush interior air. The commercial and water retention areas on the ground floor act as sinks, which will accentuate temperature difference with the sun rooms, and will encourage air flow through buoyancy.


ADDITIONAL UNITS
detailed section | p.84
EAST SUN ROOM
detailed section | p.84
OPEN SPACE:
commercial area
GARDEN:
water absorbtion,
water retaining


OUTDOOR KITCHEN
detailed section | p.91
MORNING SUN ROOM
detailed section | p.94
SECOND GROUND FLOOR: thermal mass
detailed section | p.94
OPEN SPACE:
people playing sports

ADDITIONAL UNITS
detailed section | p.80

OUTDOOR KITCHEN

By separating the kitchen (viewed as a heat source) from the additional living units, the building benefits from the curation of heat such that buoyancy is encourage through the middle atrium.


OUTDOOR KITCHEN
material, tectonics, culture | p.94
MORNING SUN ROOM
material, tectonics, culture | p.94
SECOND GROUND FLOOR

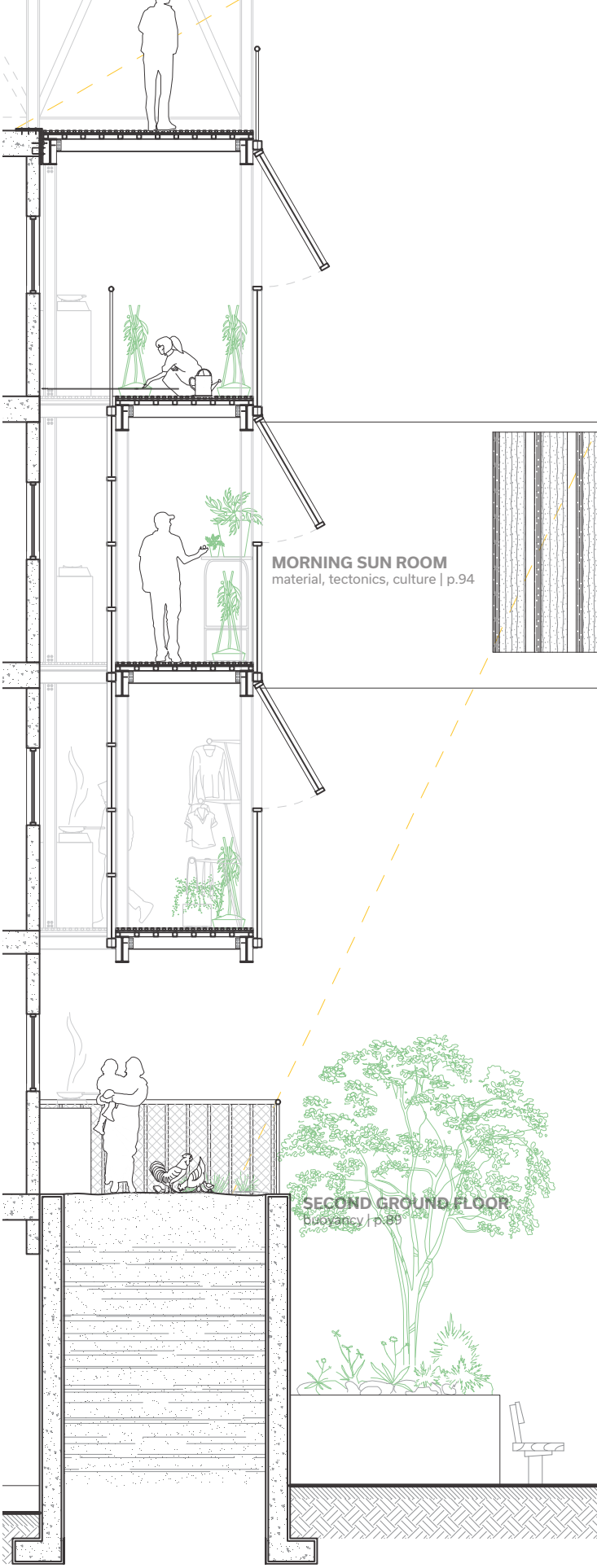
OUTDOOR KITCHEN
detailed section | p.91

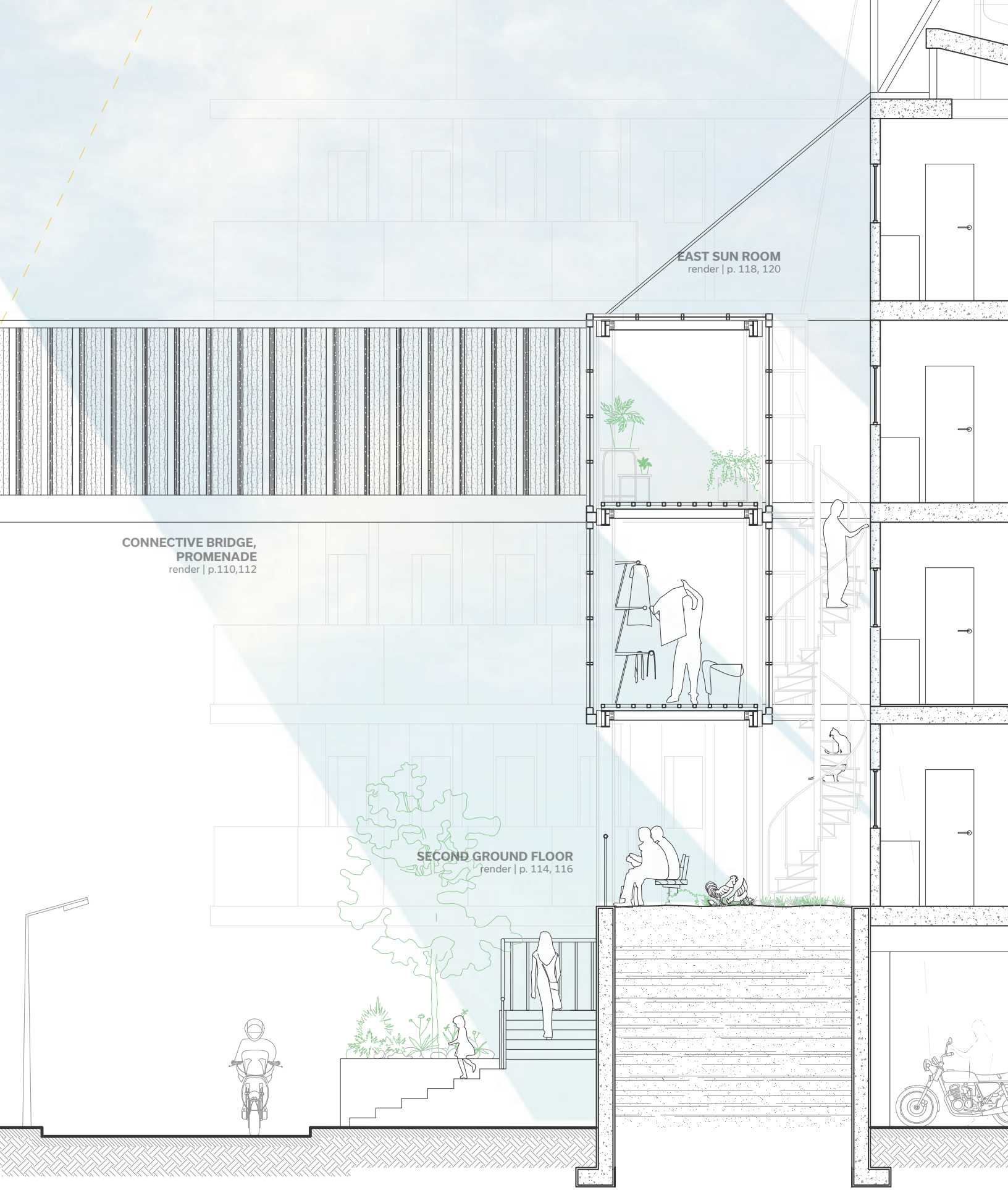
MORNING SUN ROOM
detailed section | p.91

SECOND GROUND FLOOR
detailed section | p.94

SUN ROOMS

The sun rooms are activated by the time of day. The sun room on the left is west-facing, so it will be hotter in the morning, from 9 AM - 12 PM. The east facing ones are activated after noon, from 12PM - 3 PM.




EAST SUN ROOM
render | p. 118, 120
CONNECTIVE BRIDGE,
PROMENADE
render | p.110,112
SECOND GROUND FLOOR
render | p. 114, 116

EAST SUN ROOM
render | p. 118

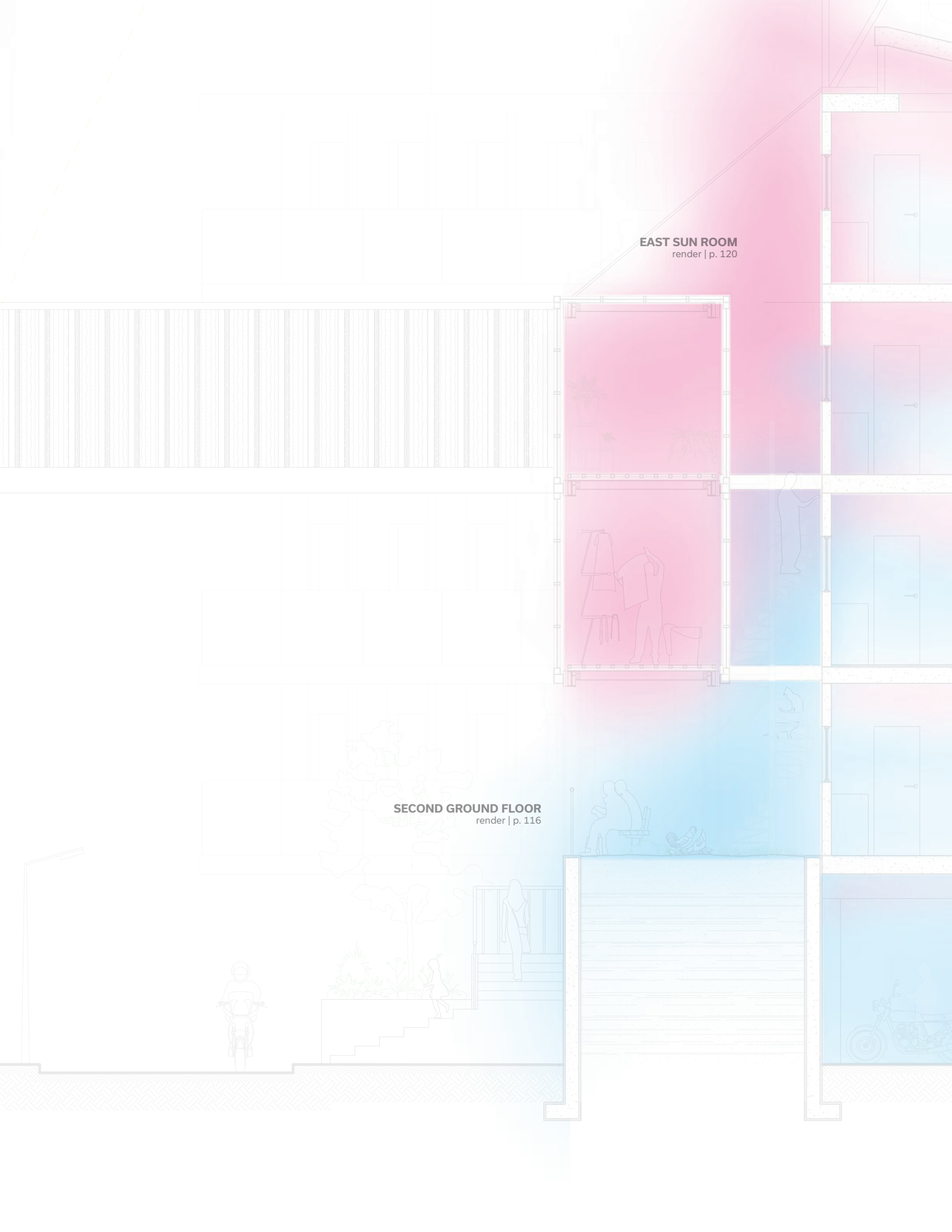
SECOND GROUND FLOOR
render | p. 114

SUN ROOMS

In the sun rooms, the fins at each end of the funnel, increases the wind speed, to dissipate evaporated water, and dehumidify the room. Similar to the east facing ones, the patios host activities that are sources of heat, such as cooking and ironing. The residents can use it to dry fish, and other food products, from nearby fisheries. They can also be used as greenhouses.

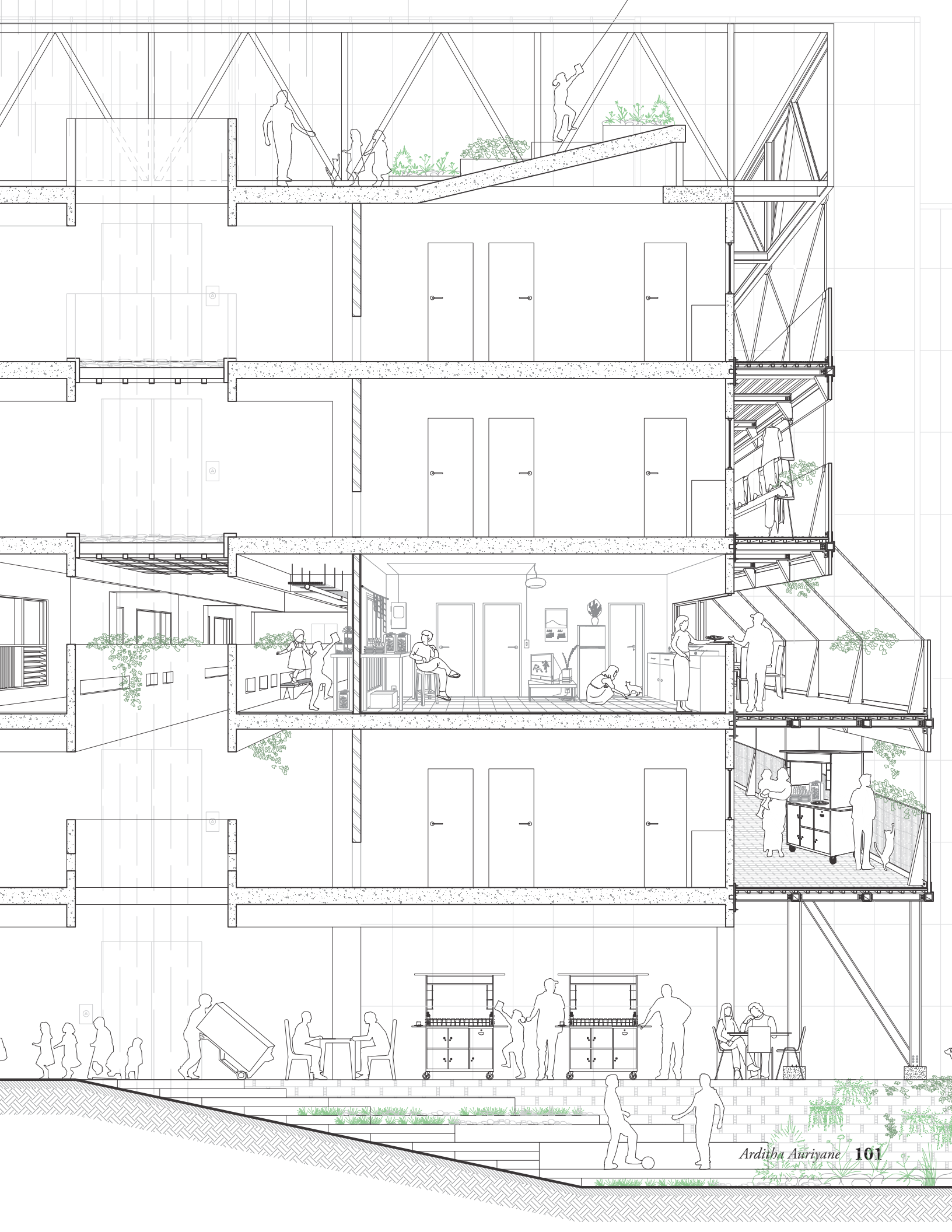
THERMAL MASS FRONT YARD

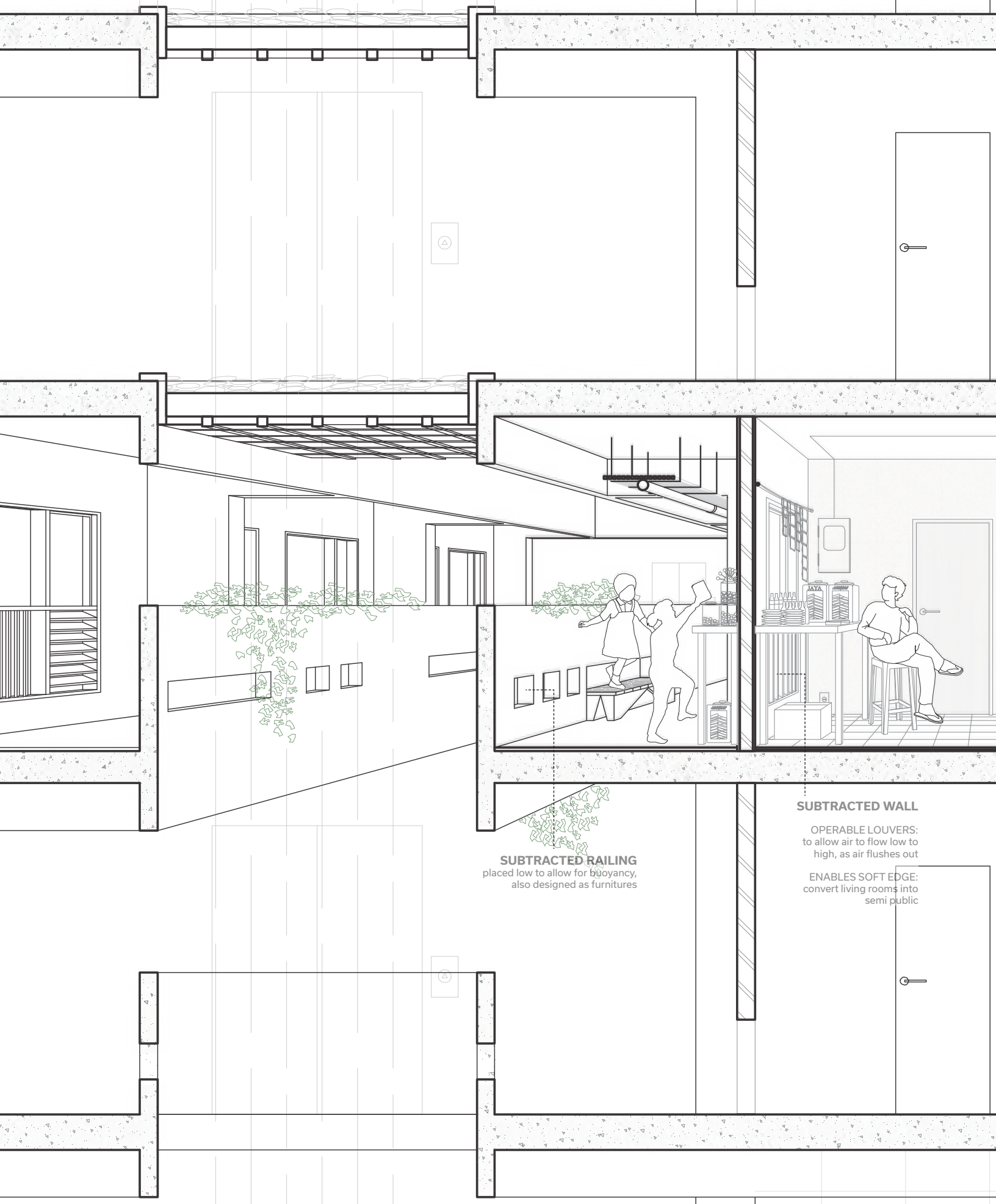
Yet, the heat of the sun room is balanced with the thermal mass from the ground, which create extremes that will encourage air to rise quicker. This thermal mass also serves as a second ground floor, an alternate entry point of the second floor units, giving the residents a front yard and a village feel despite living in a high rise building.


EAST SUN ROOM
render | p. 120
SECOND GROUND FLOOR
render | p. 116

SUBTRACTING FOR BUOYANCY

In some of the existing units, the balconies and interior walls are altered to allow for modest apertures in each room, low to high, following the buoyancy flow. These operable walls also enables soft edges that connects the living room as an extension of social activities, towards both the existing corridor and the additional space provided by the retrofit.



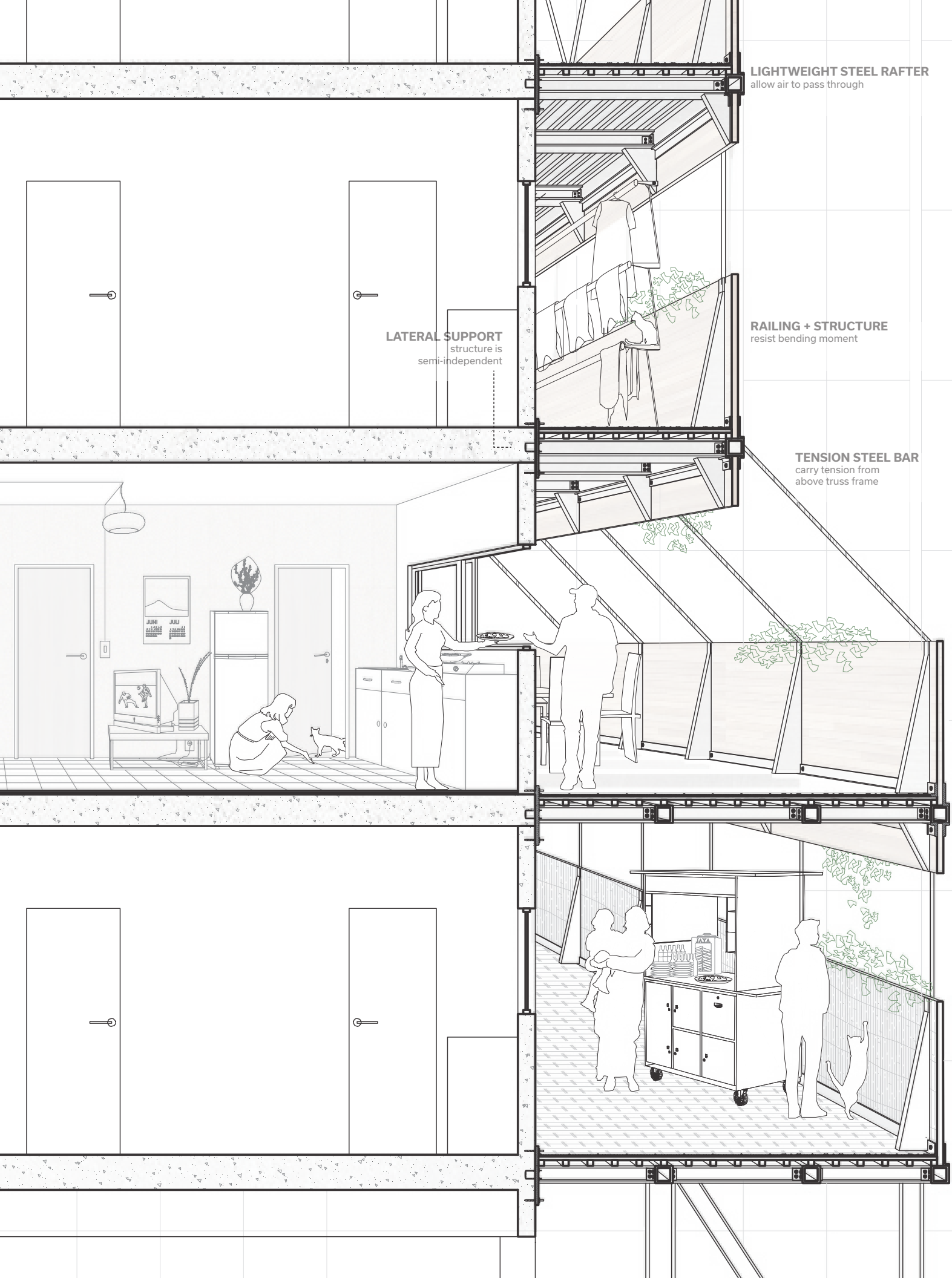


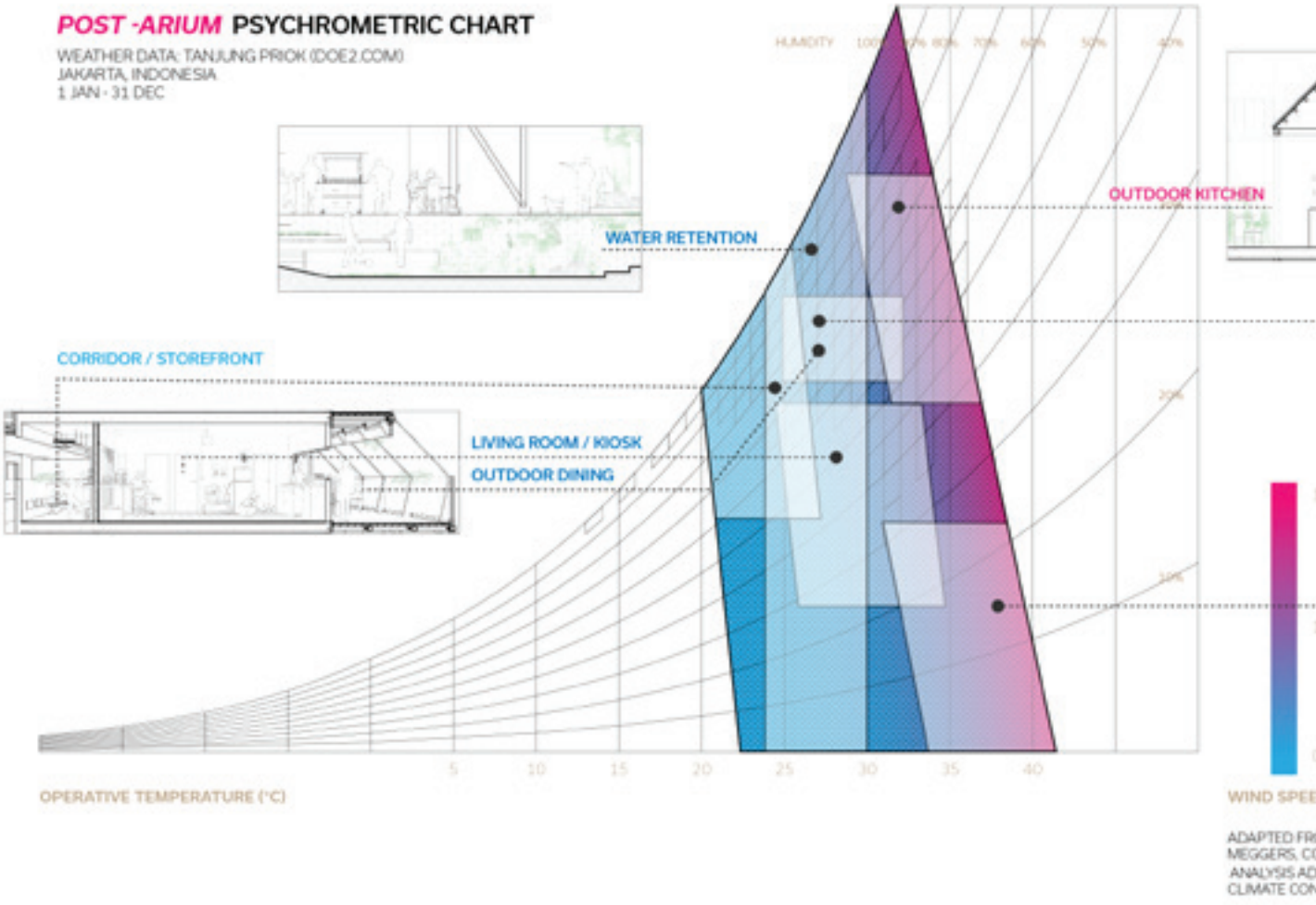
SUBTRACTED RAILING
placed low to allow for buoyancy,
also designed as furnitures

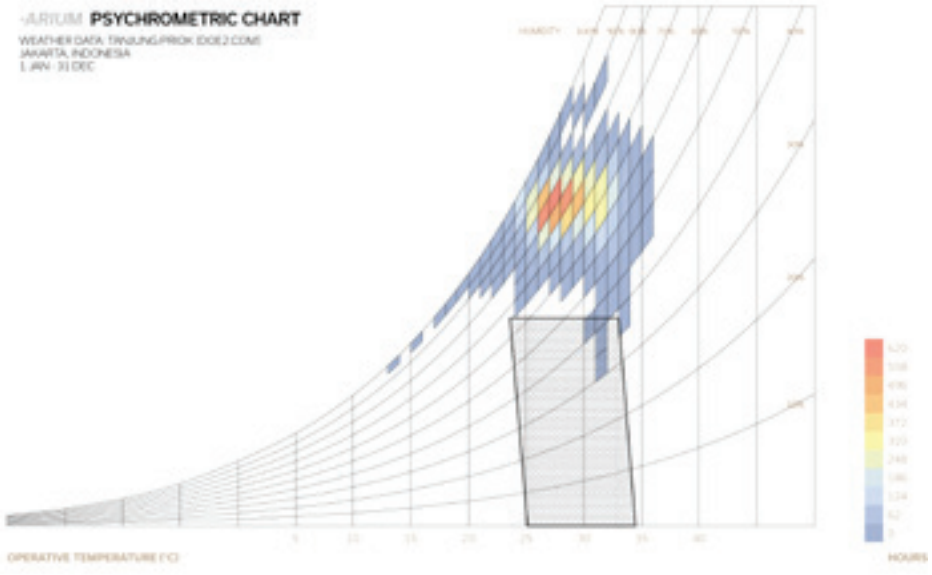
SUBTRACTED WALL

OPERABLE LOUVERS:
to allow air to flow low to
high, as air flushes out

ENABLES SOFT EDGE:
convert living rooms into
semi public


LIGHTWEIGHT STEEL RAFTER
allow air to pass through
RAILING + STRUCTURE
resist bending moment
LATERAL SUPPORT
structure is
semi-independent
TENSION STEEL BAR
carry tension from
above truss frame
JUNI
JULI


POST -ARIUM PSYCHROMETRIC CHART
WEATHER DATA: TANJUNG PRIOK (DOE2.COM)
JAKARTA, INDONESIA
1 JAN - 31 DEC
HUMIDITY
OUTDOOR KITCHEN
WATER RETENTION
CORRIDOR / STOREFRONT
LIVING ROOM / KIOSK
OUTDOOR DINING
5
10
15
20
25
30
35
40
OPERATIVE TEMPERATURE (°C)
WIND SPEE
ADAPTED FR
MEGGERS, C
ANALYSIS AD
CLIMATE CO



Post, multi, new comfort

In the hot and humid Jakarta, post -arium extends the thermal comfort area; from a small standardized comfort range that is dependent on altering the air temperature. Into an expanded area where humidity and temperature is taken advantage of by allowing for wind speed and buoyancy. These areas are the new, post, and multi comfort, adapted to by adjusting activities, clothing, and curating the sources and sinks in the architecture.

Understanding comfort in the post –arium is to account for the collection of variables: cross and stack ventilation, funneling air to capture natural ventilation, designing for buoyancy, accentuating heat sources, and placing them outside and above the building. At the same time, post -arium realizes that passive strategies are actually active.By pairing these combinations with programs that might benefit from unstandardized comfort, different from what is offered by standardized mechanical system, post -arium does not solve for efficiency. Comfort, in its thermal and cultural sense, is reimagined in the post -arium.

Materiality supports microclimates, within the volumetric additions.The framing of the ground below, creates village-ness, and in all support cultural and climactic endeavors.

Beyond what is materially seen,
there is a **dynamic interplay,** between
sources and sinks.

Understanding these implications in the energy realm, is what drives the understanding of spaces, and design decisions of the post -arium. What is constantly addressed is the sensibility to the cultural context and environmental reality, that challenges the notion of comfort thermally and culturally.

Phase 02
A NEW TYPOLOGY

Scale of operation: urban sources and sinks

The second mode of operation is to address the water edge paired with finding sensible ways of densification. While the retrofit looks at post –arium at the scale of the room and building tectonics of an existing building, this second phase will look at massing strategies, and how the water edge can participate in the cycle of sources and sinks.

The new typology will densify. Yet, the pitfall of densification is that it is easier to assume the arium mentality and create containers of living, that relentlessly extrudes up. However, post -arium aims for intentional awareness of the environmental reality. With the post -arium mindset, the new typology will find new comfort, in terms of thermal experience and cultural opportunities, look at the urban scale of energy sinks and sources, and provide sensible waterfront infrastructure.

EXISTING CONDITION

17,000
DWELLERS

UP TO
4250
FAMILIES

PROPOSED TYPOLOGY

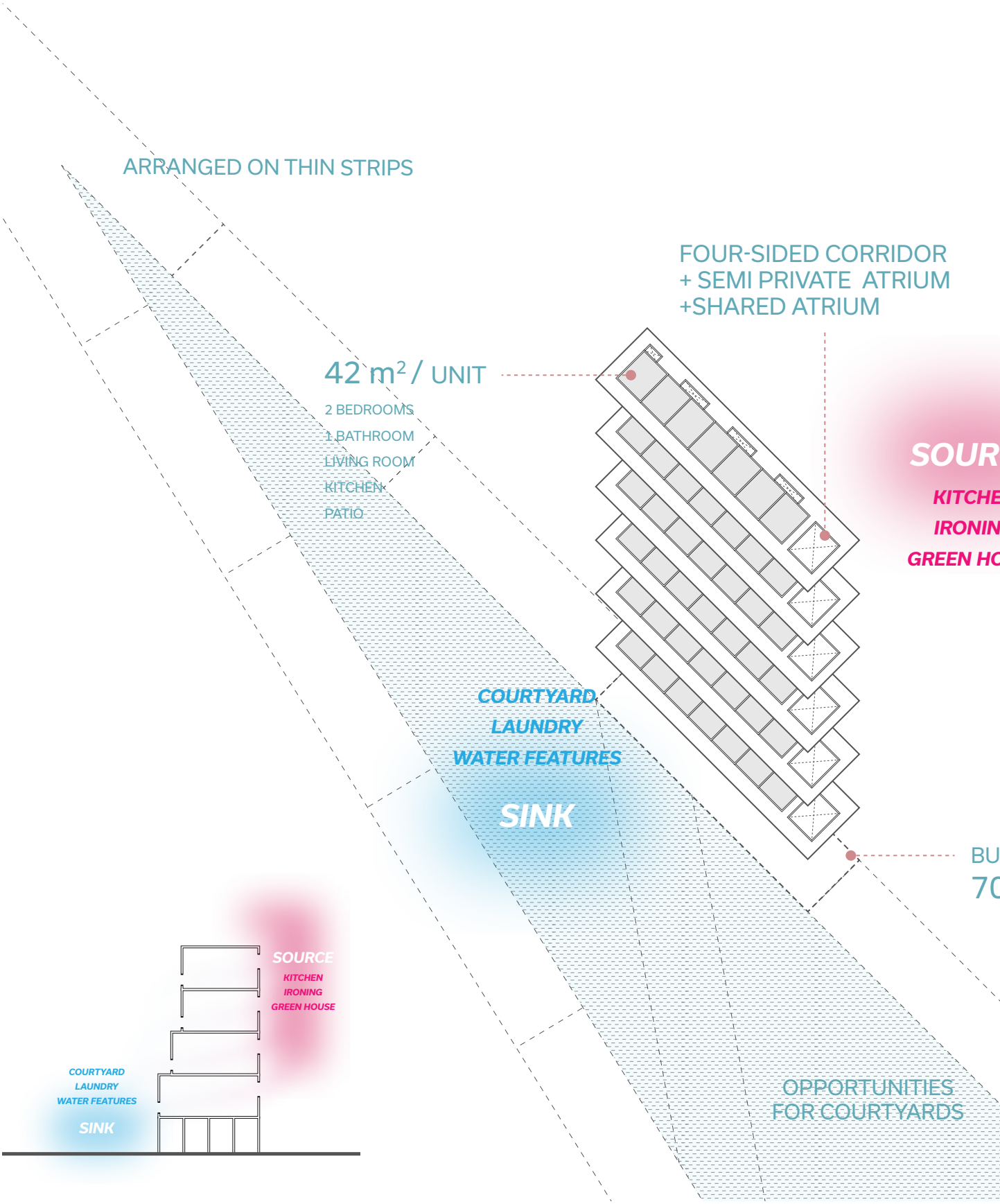
17,000
DWELLERS

UP TO
3620
FAMILIES

Densification plan

Currently living on the water edge are 17 thousand people, and that would constitute roughly 4250 nuclear families of 4. The current water edge is very dense and packed, and these housings are highly sensitive to the water level on the reservoir. Densification is needed to provide for safe, resilient, housing.

From the 4250 families, the new arrangement can provide 3620, for the same number of people. Although this is under the unit count, the project adds open space, and multigenerational families are given the option to live together in larger units.


ARRANGED ON THIN STRIPS
FOUR-SIDED CORRIDOR
+ SEMI PRIVATE ATRIUM
+SHARED ATRIUM
42 m² / UNIT
2 BEDROOMS
1 BATHROOM
LIVING ROOM
KITCHEN
PATIO
SOUR
KITCHE
IRONIN
GREEN HO
COURTYARD
LAUNDRY
WATER FEATURES
SINK
BU
70
SOURCE
KITCHEN
IRONING
GREEN HOUSE
COURTYARD
LAUNDRY
WATER FEATURES
SINK
OPPORTUNITIES
FOR COURTYARDS

CE
EN
G
OUSE

ILDING FOOTPRINT
06 m²

90
PROPOSED
TYPICAL BUILDINGS

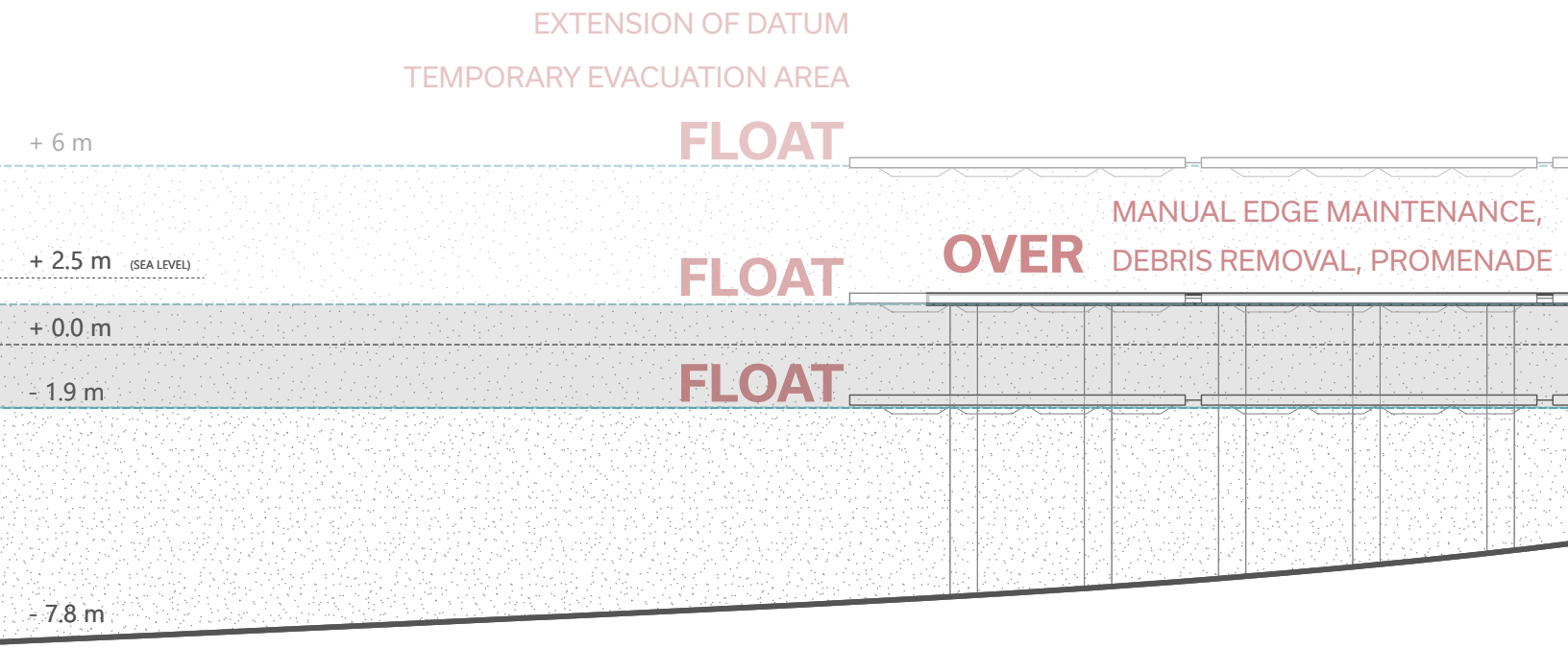
X

36
UNITS
PER TYPICAL 6-LEVEL BUILDING

TOTAL
UP TO
3240
UNITS

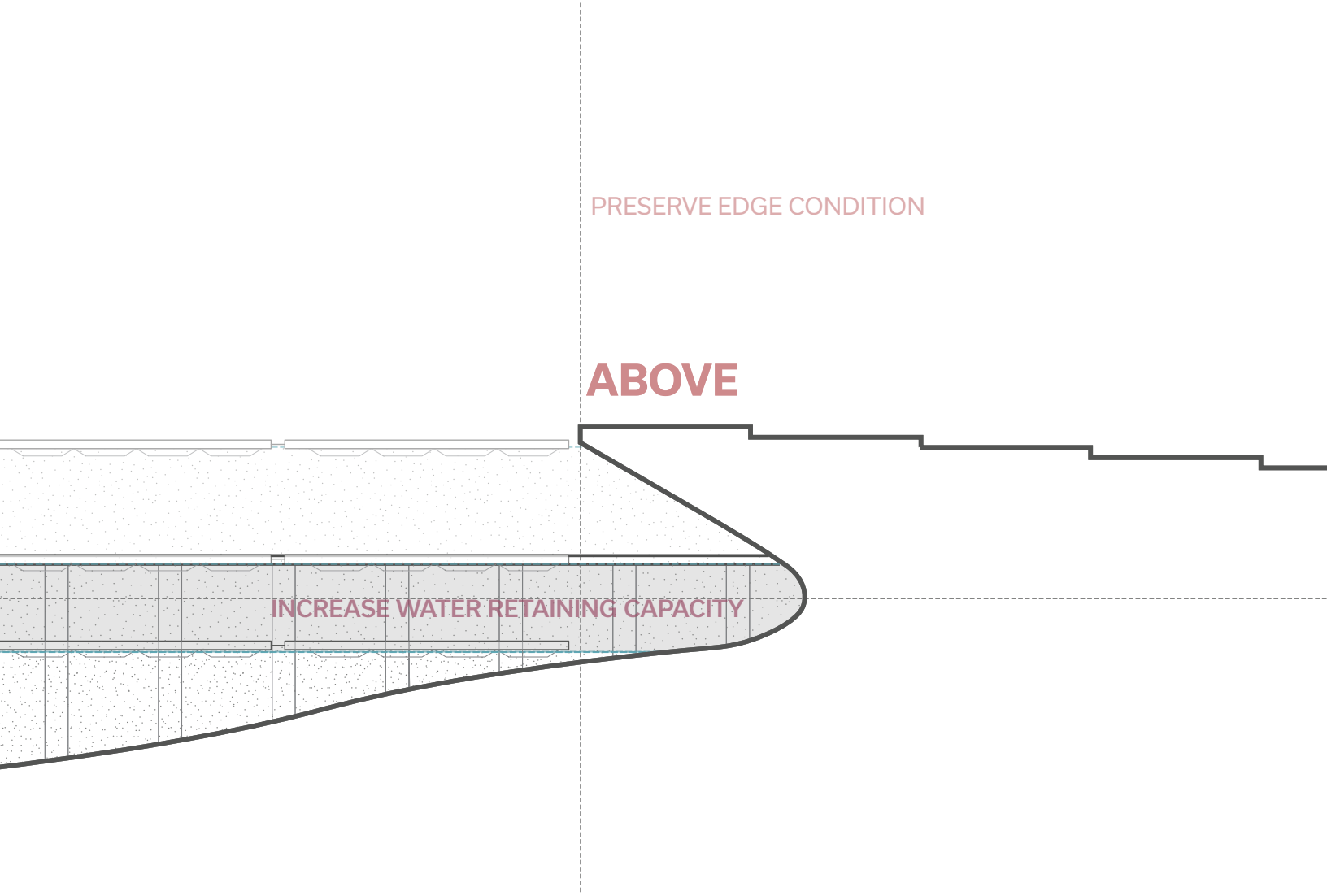
Proposed typology

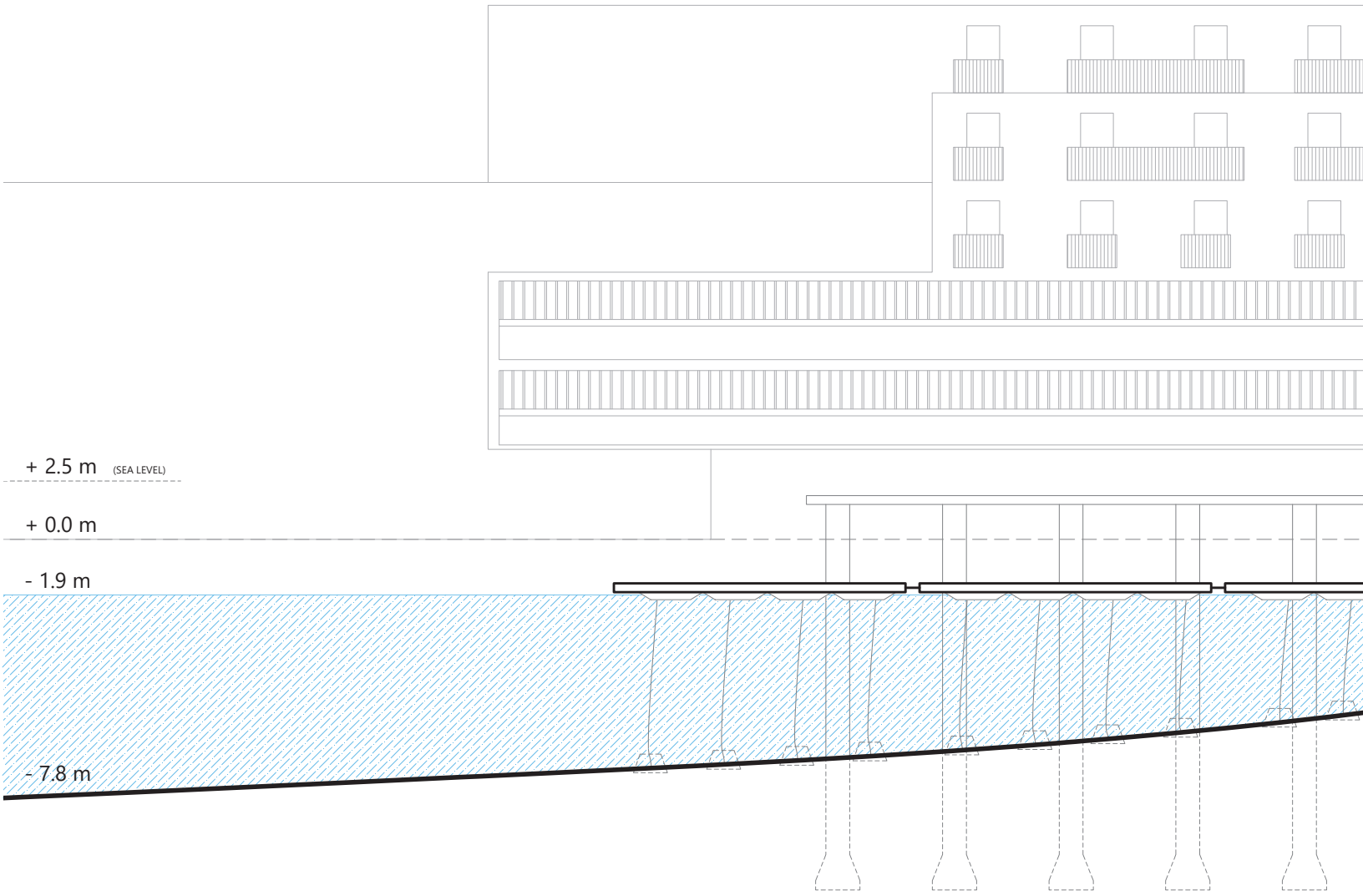
The proposed typology is a new single load type which provides four-sided corridor, creating semiprivate and shared atriums. The building is arranged on thin strips to take advantage of the thin site sliver, while its alignments can create opportunities for courtyards and energy sinks. The "source" can be translated into programs such as kitchen, greenhouse, and sunrooms; the "sink" as courtyards, laundry areas, and water features. Sectionally, the floor cascades to allow for natural light. The wall openings are crossed and vertically positioned for buoyancy to pass through the living units, and the heat source intensifies this energy transfer.


EXTENSION OF DATUM
TEMPORARY EVACUATION AREA
+ 6 m
FLOAT
MANUAL EDGE MAINTENANCE,
OVER
DEBRIS REMOVAL, PROMENADE
+ 2.5 m (SEA LEVEL)
FLOAT
+ 0.0 m
- 1.9 m
FLOAT
- 7.8 m

Waterfront infrastructure as an initial sink

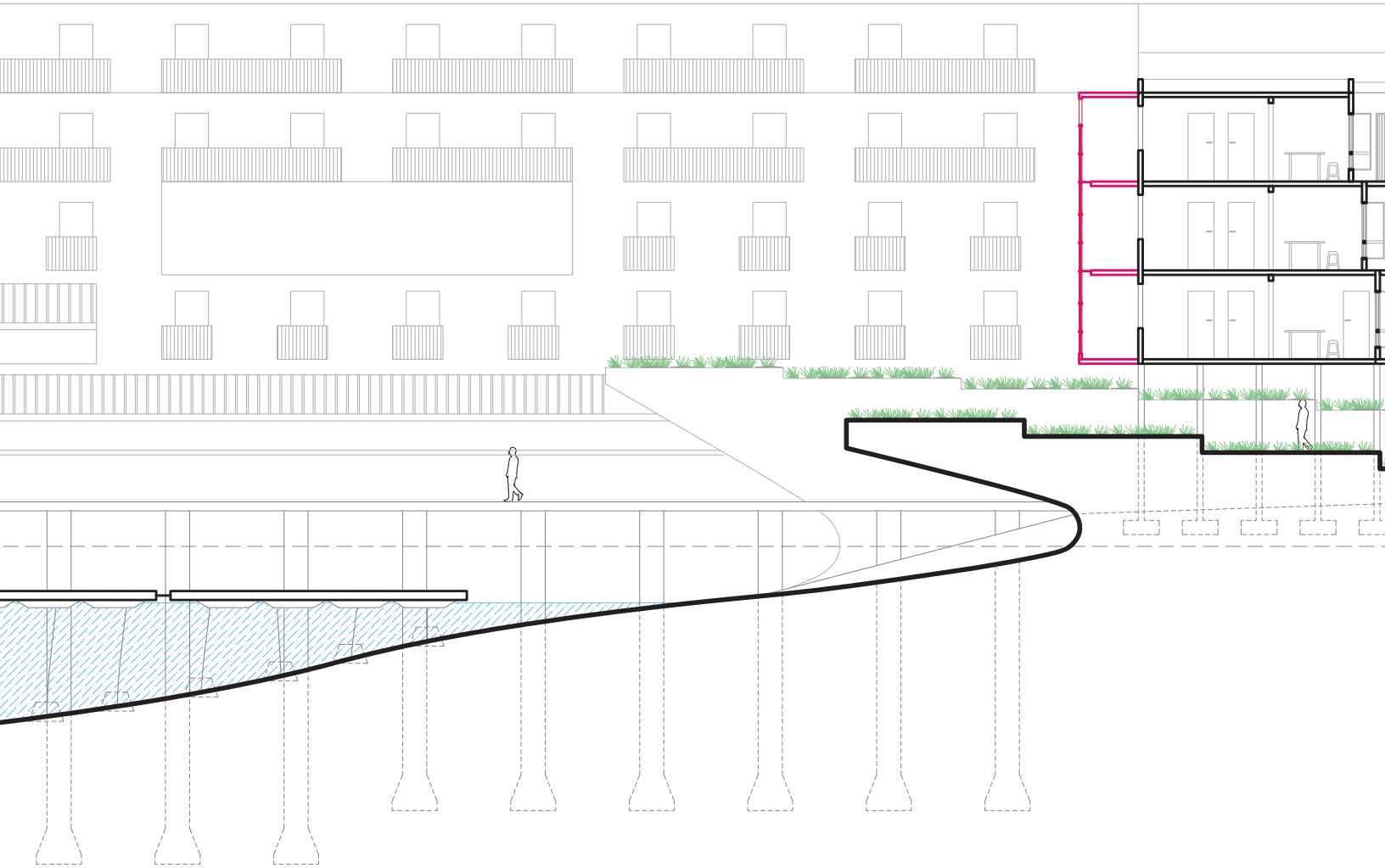
The water features can be part of the infrastructure. In general, the attitude toward the water edge is to stay afloat, over, and above it. Over the water to create promenade and public space, and float with the water for manual edge maintenance and debris removal to keep the edges clean. Above it, to preserve the edge condition, and increase the water retaining capacity by carving a concave edge As the water rises during flooding the floating platforms extends land and can become evacuation areas.

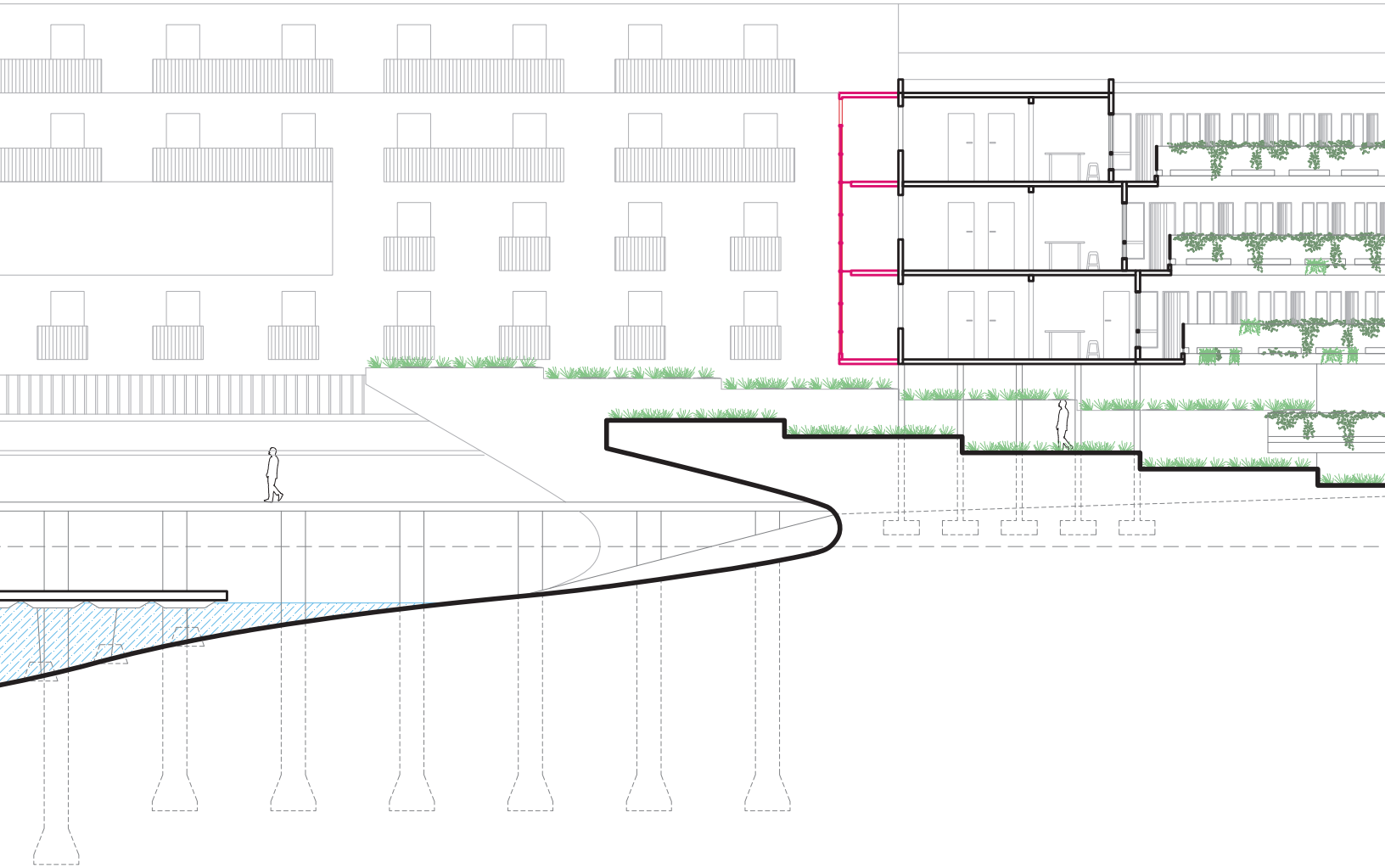


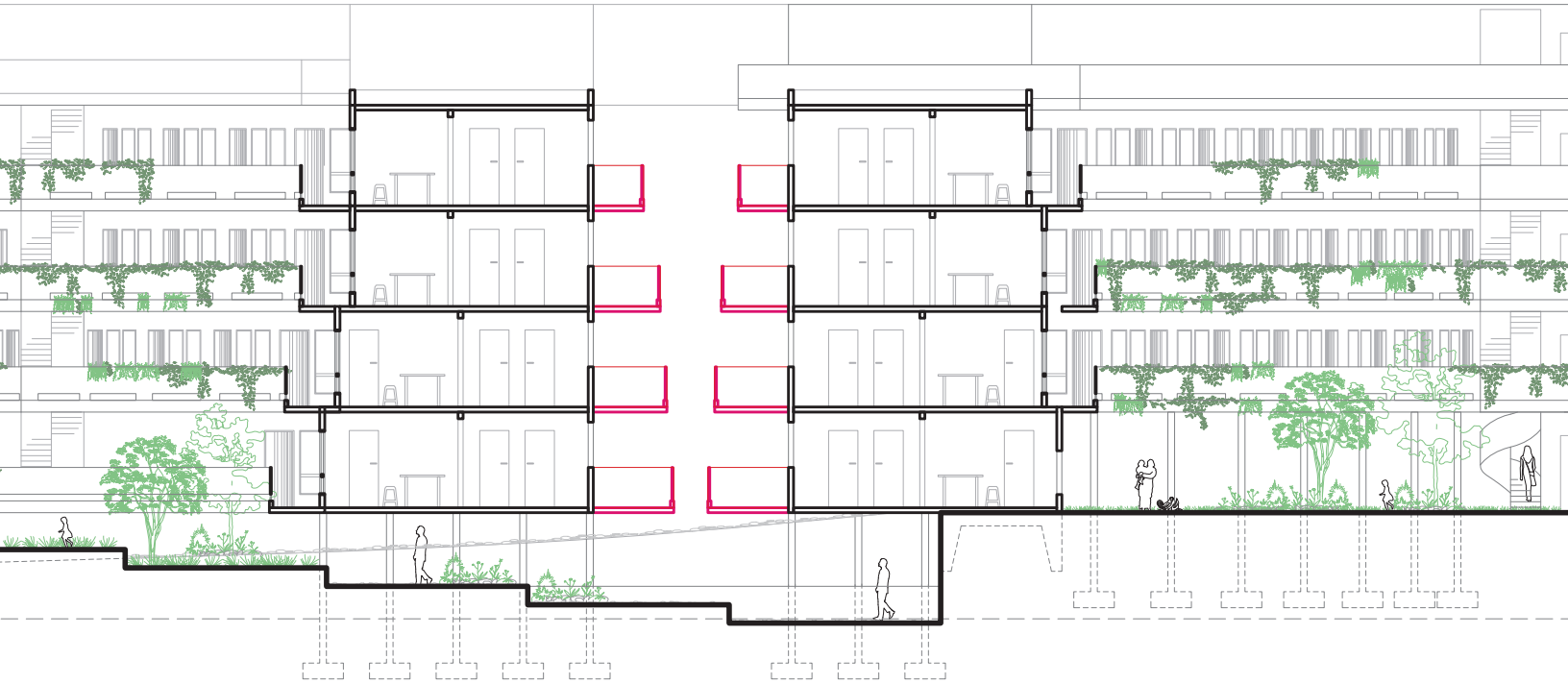

+ 2.5 m (SEA LEVEL)
+ 0.0 m
- 1.9 m
- 7.8 m

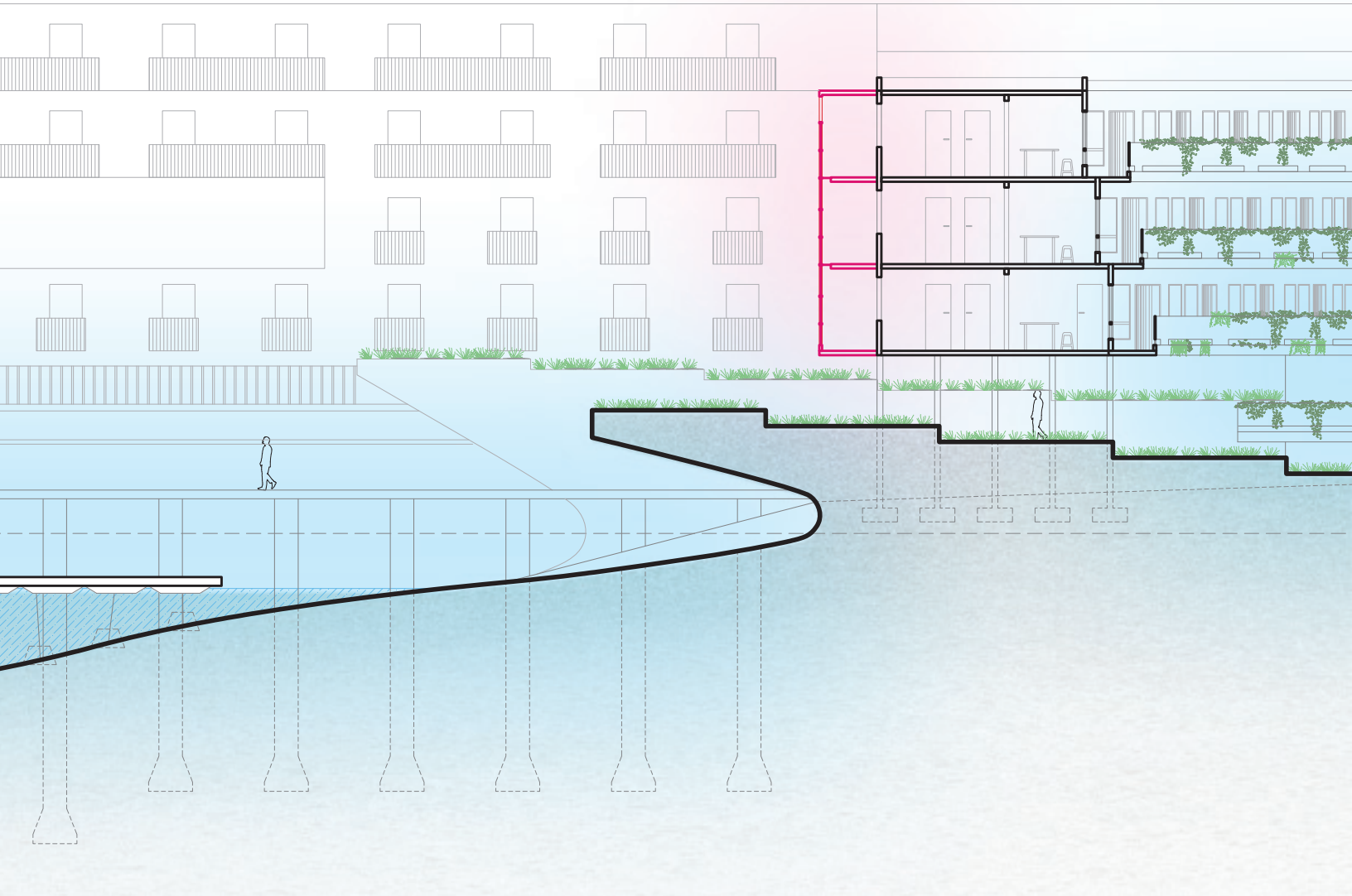
SECTION CUT THROUGH SOURCES AND SINKS

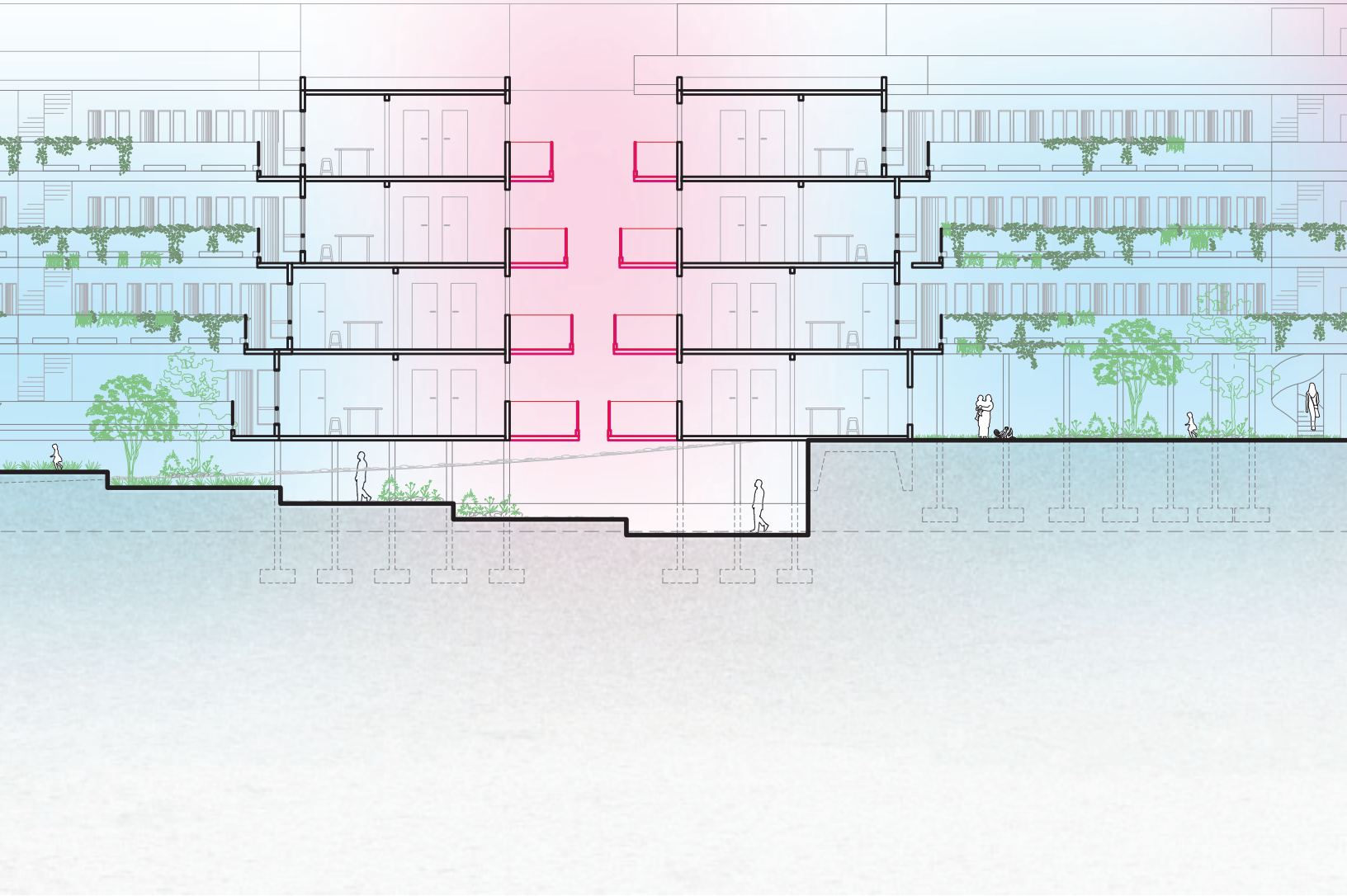
With edge condition of the water as the initial sink, the building unfolds into a series of sources and sinks. As the bar buildings intersect, the framed courtyard becomes a sink and source, alternatingly. These curation of sources and sinks support cultural activities and create juxtapositions of thermal sensations, constantly pushing the boundaries of comfort and discomfort that is specific to activities instead of pushing for thermal stability.

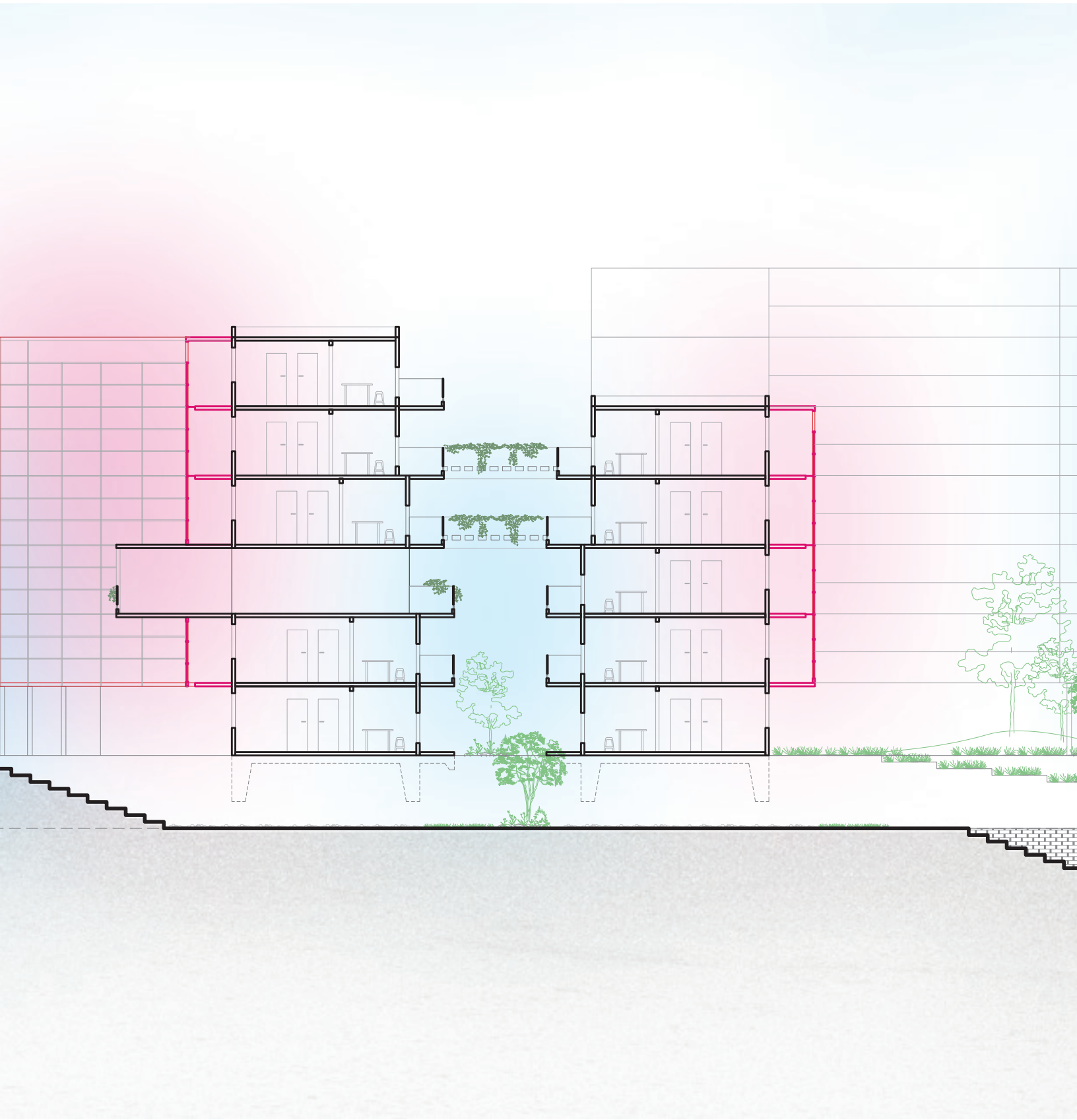


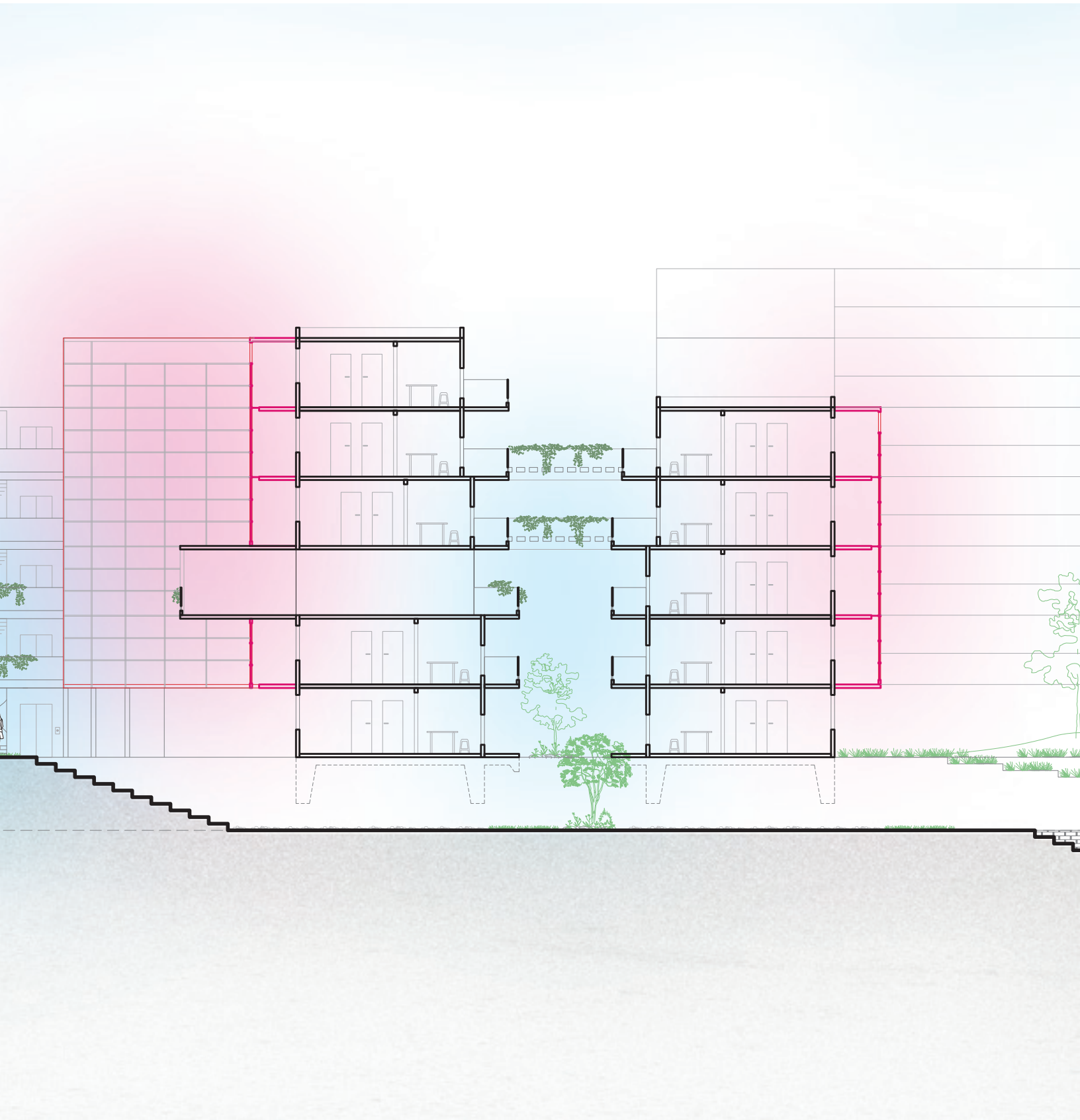


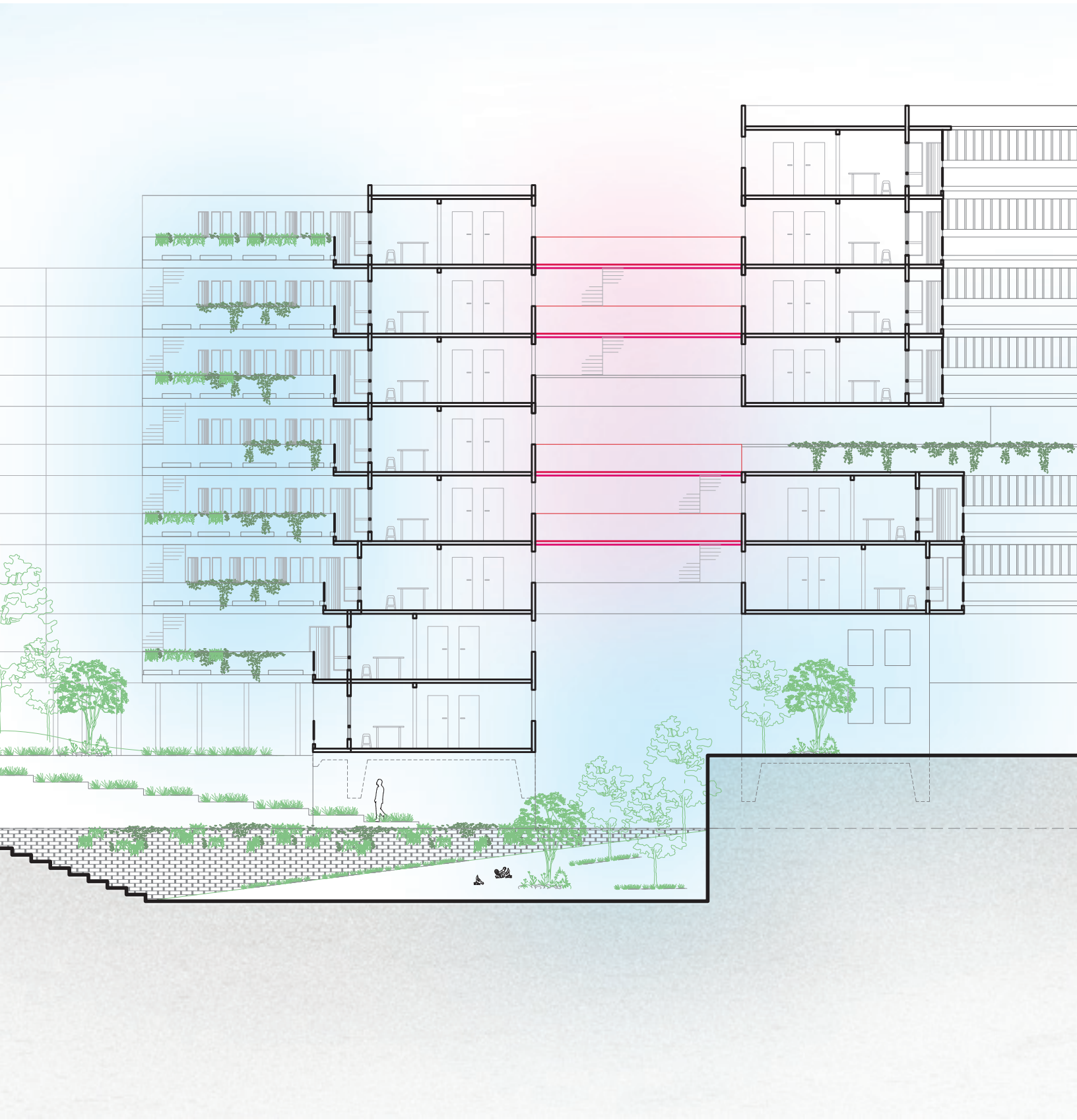


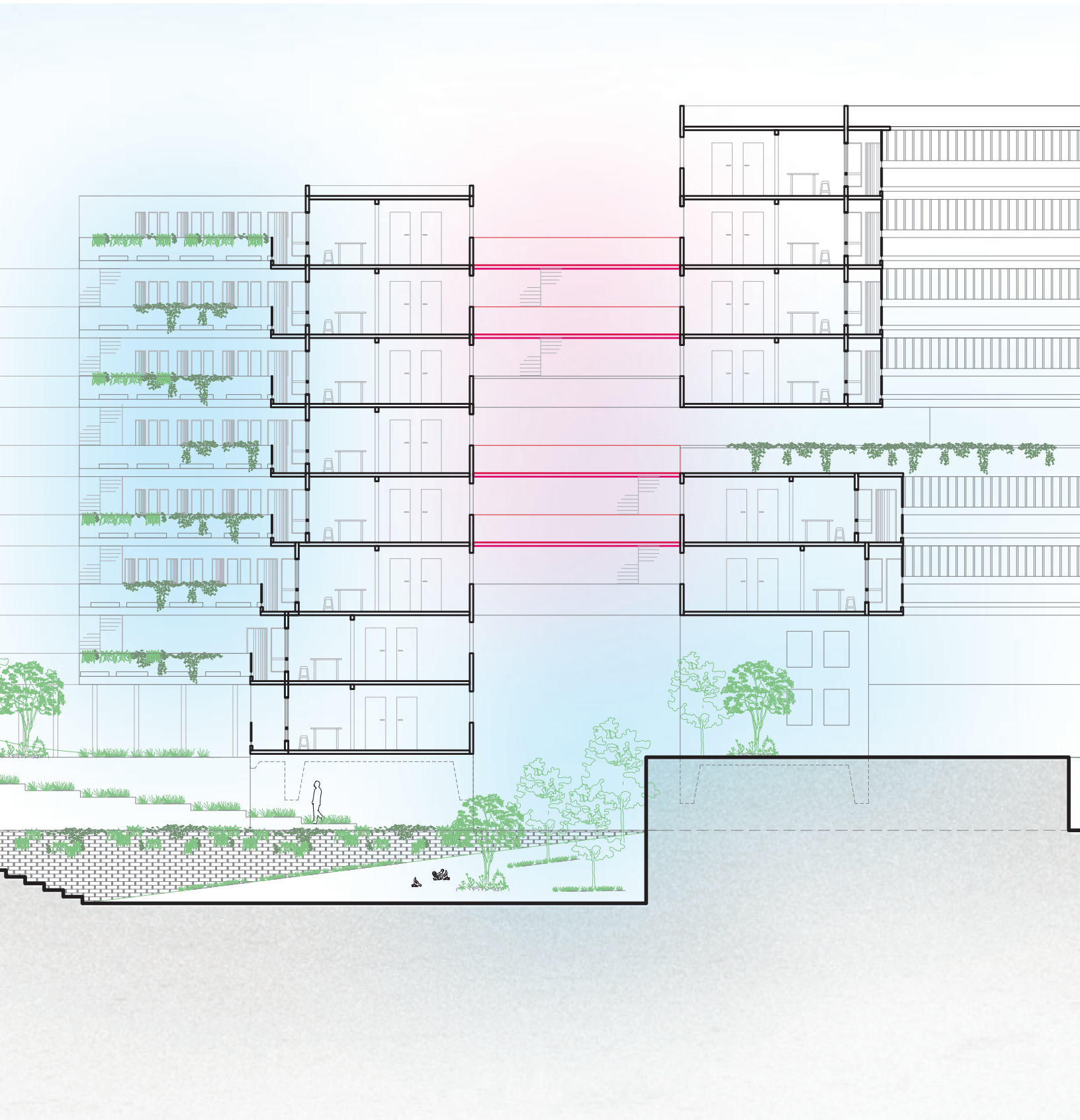


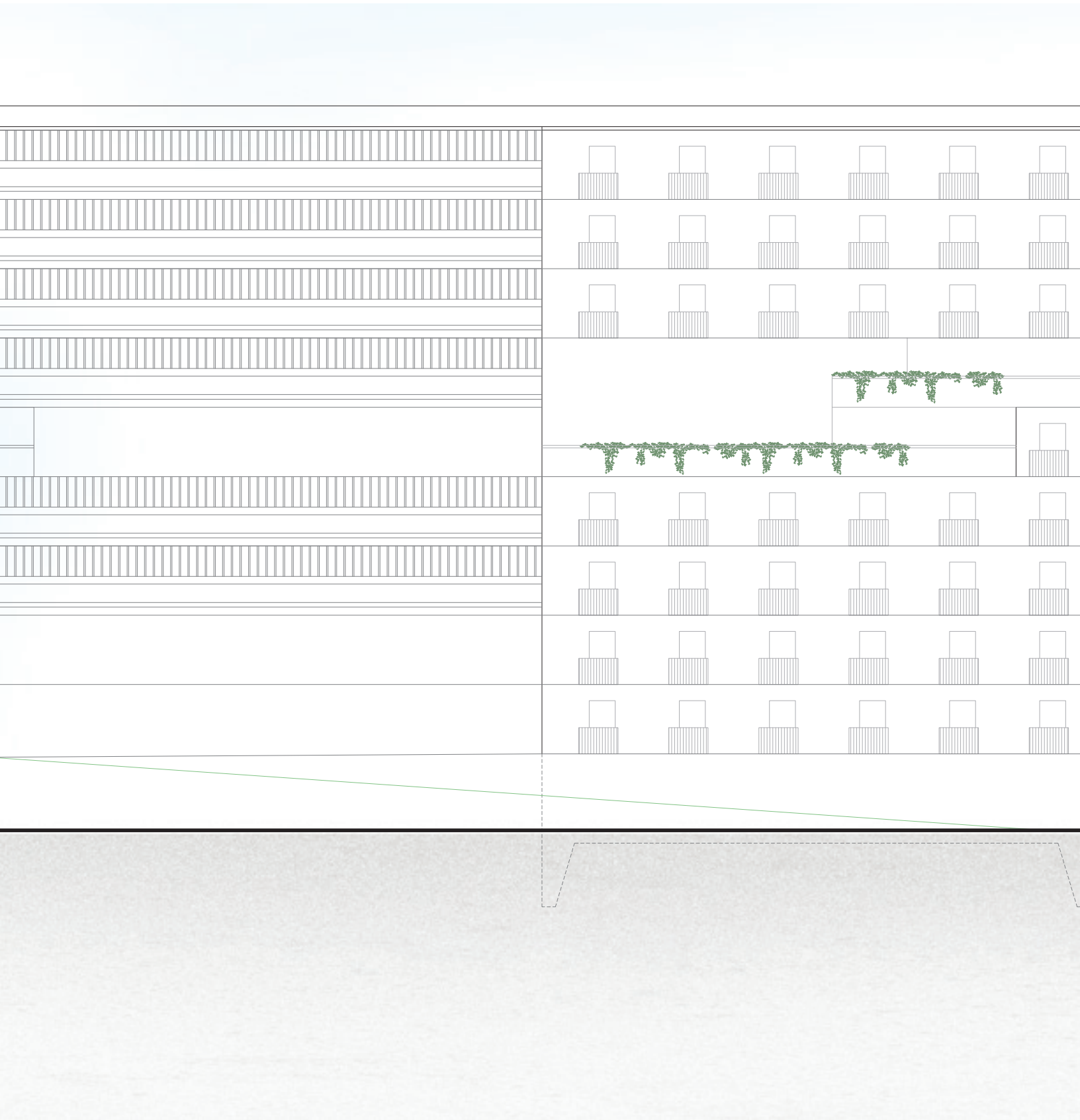








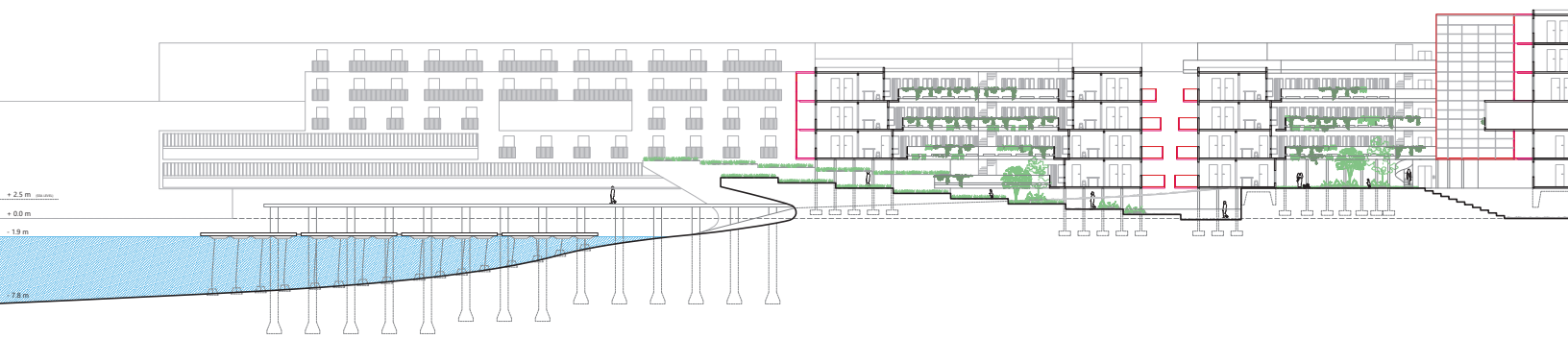


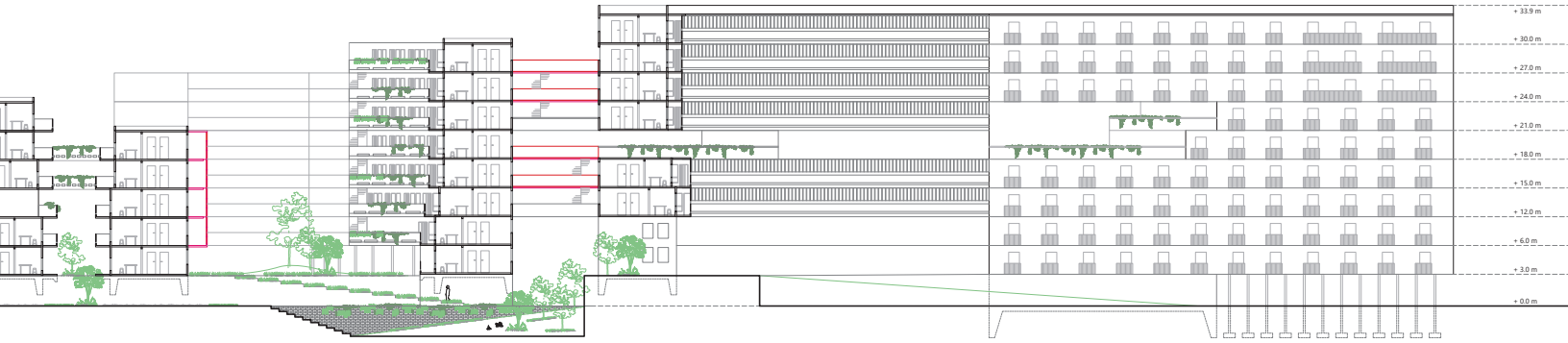


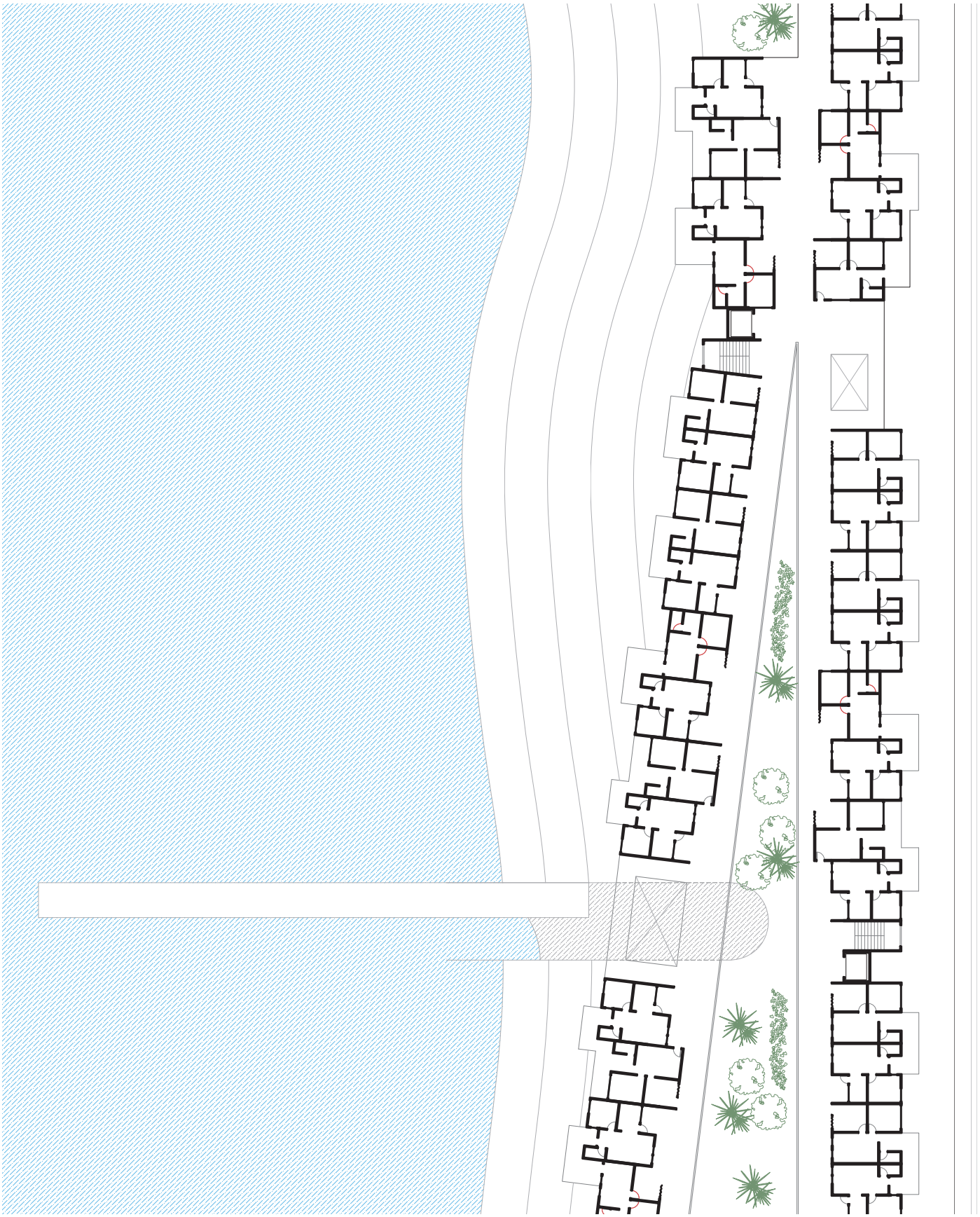
Curation of sources and sinks

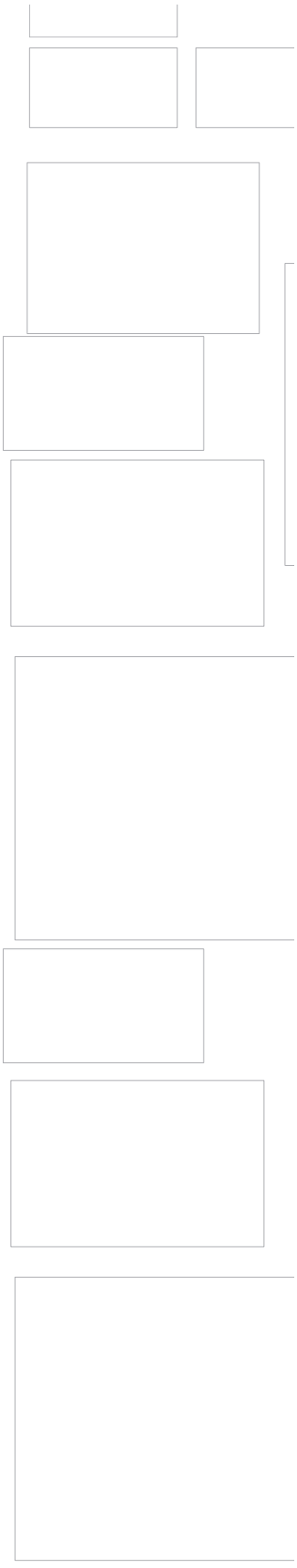
The bar buildings are cut strips, but they feel continuous. Turning the complex into one big building, with its faces and massing as a curation of sources and sinks. The courtyards can also become an extension of larger water edge infrastructure.

Site plan:
Massing strategy


+ 2.5 m
+ 0.0 m
- 1.9 m
- 7.8 m


+ 33.9 m
+ 30.0 m
+ 27.0 m
+ 24.0 m
+ 21.0 m
+ 18.0 m
+ 15.0 m
+ 12.0 m
+ 6.0 m
+ 3.0 m
+ 0.0 m

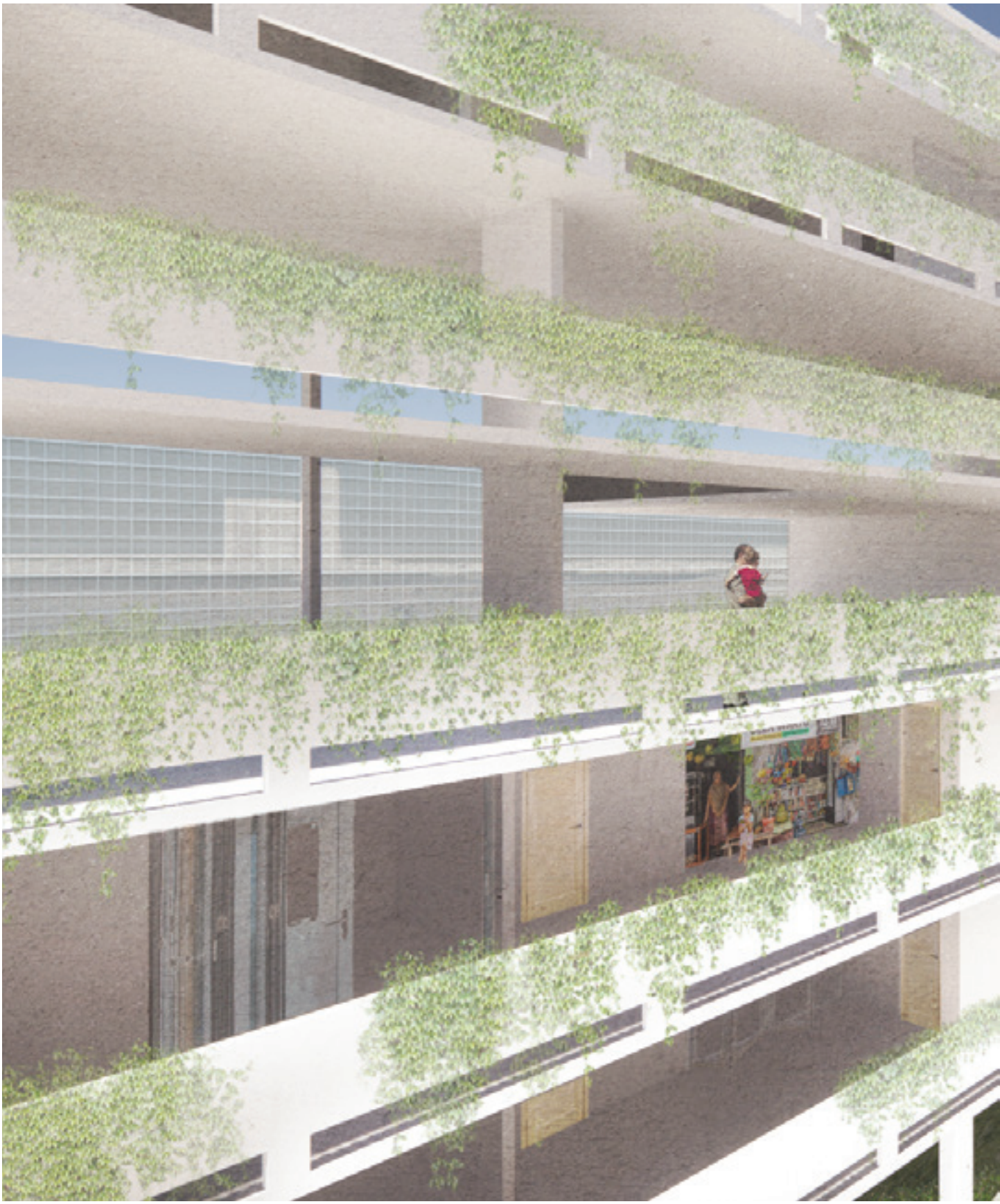


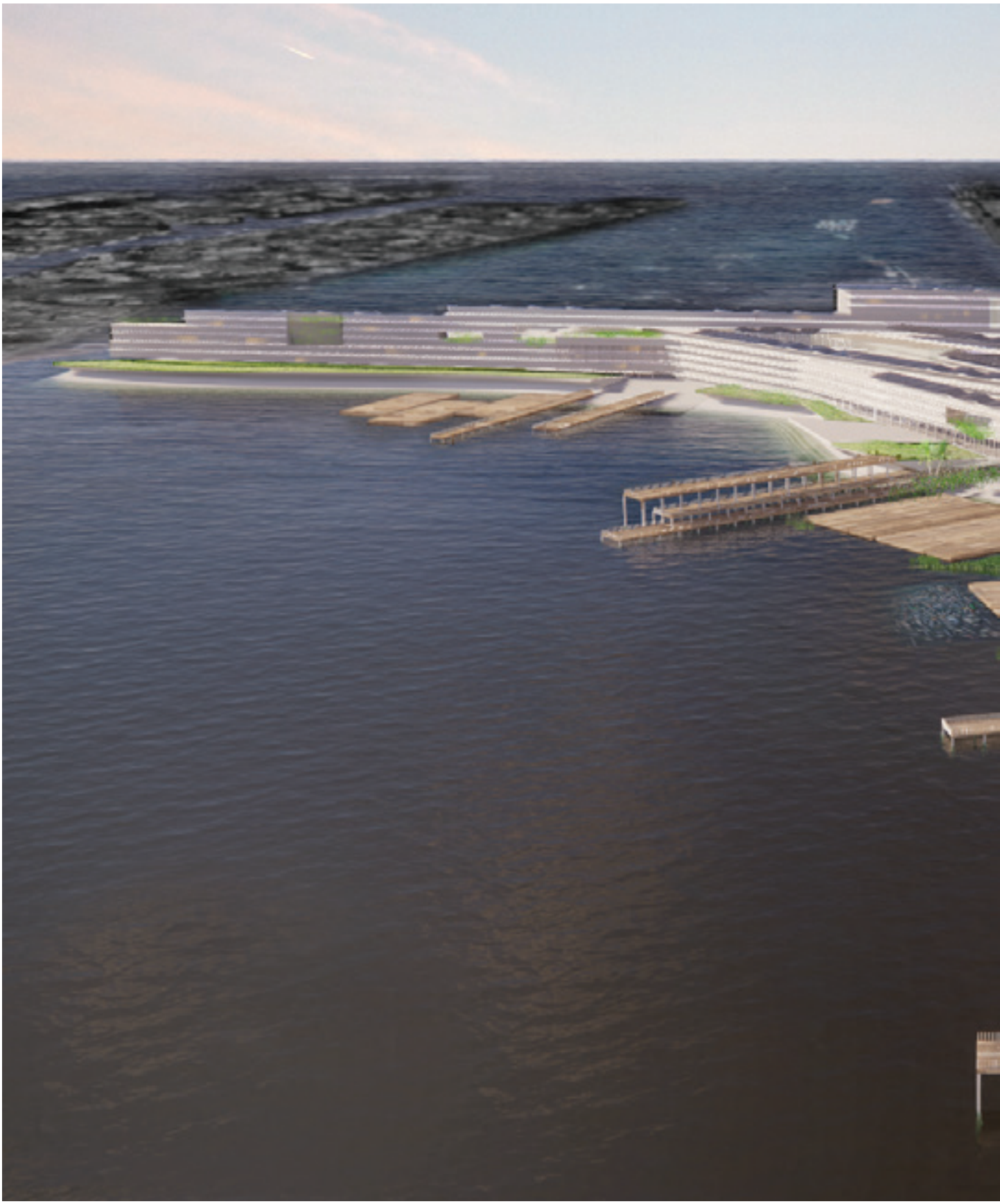


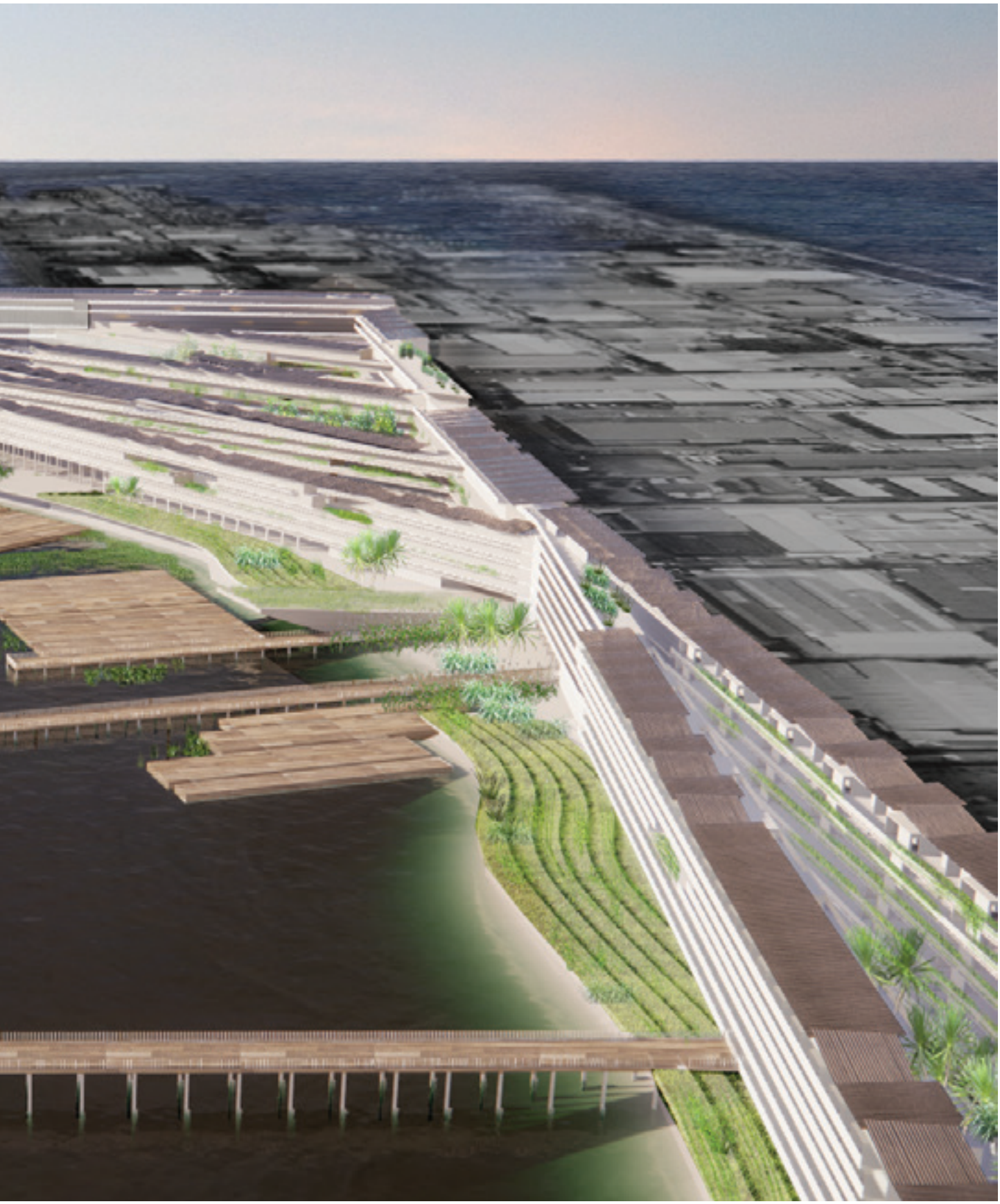
Soft edge quality

In addition to courtyards, the units are arranged for soft edges, allowing for storefront to be established as part of their house. This is enabled by the staggering of units, allowing for a less rigid double loaded corridor. Double-loaded corridors diverge into single-load corridors, while maintaining this soft edge quality. So, this new midrise typology offers a taste of low rise in the middle of high rises. This is the attitude of post -arium; although globally it densifies, it finds opportunites to be local and specific to environmental forces and cultural needs.

Floor plan:
Double-load diverge into single-loads, framing the courtyard.







Both the retrofit and the new typology
assumes the ***attitude of post -arium;***
by constantly addressing the dualities of
urban and ***village practices;***
density of ***high-rise buildings,*** and the
dispersed nature of ***low-rise*** dwellings;
hard edge in relation to ***soft edge;***

and ***challenging the specificity of comfort***
by finding local opportunities to face
environment realities,
to find new comfort.

Architecture should not solve for comfort through energy efficiency.

For post –arium, what's important is to tether to the cultural aspect and local notions, while benefiting from technical advancement and knowledge.

Post -arium form is ***post comfort;***
it does not solve for comfort but looks to find strategies that is sensible to the cultural context and environmental reality,
and in that, it challenges the notion of comfort thermally and culturally.

Post -arium rejects a singular definition of comfort, and presents the ***multi comfort*** and ***new comfort.***

Bibliography

Abalos, Iñaki, et al. *Abalos + Sentkiewicz: Essays on Thermodynamics, Architecture and Beauty.* Actar D, 2015.

Banham, Reyner. *The Architecture of the Well-Tempered Environment.* 2nd ed. Chicago: University of Chicago Press, 1984. Print.

Barber, Daniel. "After Comfort," *Log*, Fall 2019, No.47. Overcoming Carbon Form (Fall 2019), pp. 14-23

"Beginilah Kondisi Rusunawa Muara Baru." 16 May 2016, www.youtube.com/watch?v=DzC7cFMj7Fs.

Frampton, Kenneth. "Towards a Critical Regionalism: Six Points for an Architecture of Resistance", in *The Anti-Aesthetic. Essays on Postmodern Culture* (1983) edited by Hal Foster, Bay Press, Seattle.

Goh, Kian. "Urban Waterscapes: The Hydro-Politics of Flooding in a Sinking City." 2019, doi:https://doi.org/10.1111/1468-2427.12756.

Miller, Meredith, et al. *Jakarta: Design Research and Hypercomplexity.* 2012.

Peta 13 Sungai Jabodetabek (http://poskobanjirdsda.jakarta.go.id/Pages/noPentingEdukasi.aspx)

Liputan6.com. *FOTO: Menengok Kehidupan Warga Di Rusun Cilincing.* 29 Oct. 2019, www.liputan6.com/news/read/4098224/foto-menengok-kehidupan-warga-di-rusun-cilincing?page=1.

Maharani, Dian. "Ini Cara Dan Syarat Tinggal Di Rusunawa Jakarta." *KOMPAS.com,* Kompas.com, 26 June 2019, megapolitan.kompas.com/read/2019/06/26/08472341/ini-cara-dan-syarat-tinggal-di-rusunawa-jakarta.

Mayer, H. , J., and Neeraj Bhatia. *-arium: Weather + Architecture*. Ostfildern: Hatje Cantz, 2010. Print.

Suryani, Sri. *Membangun Bukit Duri, Membangun Kota*. 13 Oct. 2016, medium.com/forumkampungkota/membangun-bukit-duri-dc5567a6b625.

Teitelbaum, Eric, et al. "Design with Comfort: Expanding the Psychrometric Chart with Radiation and Convection Dimensions." Energy and Buildings, vol. 209, 2020, p. 109591., doi:10.1016/j.enbuild.2019.109591.

"Thinking Outside the Comfort Box." Psycho about Psychro, comfortch.art/.

Appendix:
Reading List

Adam Bobbette, Meredith Miller, Etienne Turpin, "Jakarta: Design Research and the Futures of Hypercomplexity," MONU 17: Next Urbanisms. (November 2013): 56-63.

Barber, Daniel A. *Modern Architecture and Climate: Design before Air Conditioning*. Princeton University Press, 2020. JSTOR, www.jstor.org/stable/j.ctvr0qrd5.

Barber, Daniel A. *A House in the Sun Modern Architecture and Solar Energy in the Cold War.* Oxford University Press, 2016.

Dawson, Barry, and John Gillow. T*he Traditional Architecture of Indonesia*. Thames and Hudson, 1994.

Diller, Elizabeth, and Ricardo Scofidio. *Blur: The Making of Nothing*. New York: Harry N. Abrams, 2002. Print.

Gould, Kira, and Lance Hosey. *What are Comfort and Delight?* Ecotone LLC, 2007.

Heschong, Lisa. *Thermal delight in architecture.* Cambridge, Mass.: MIT Press, 1979. Print.

Iturbe, Elisa. "Architecture and the Death of Carbon Modernity," *Log*, Fall 2019, No.47. Overcoming Carbon Form (Fall 2019), pp. 14-23

Jarzombek, Mark. *Architecture of First Societies: a Global Perspective*. Wiley, 2013.

Ju, Seo Ryeung. *Southeast Asian Houses: Expanding Tradition*. Seoul Selection, 2017.

Miller, Meredith, et al. "Urban Temporalities: Jakarta after the New Order (Abidin Kusno in conversation with Meredith Miller & Etienne Turpin)," Scapegoat: Architecture, Landscape, Politics, Economy, Issue 05 (Summer/Fall 2013): 180-205.

Kallipoliti, Lydia. "Feedback Man," *Log,* Fall 2008, No. 13/14, Aftershocks: Generation(s) since 1968 (Fall 2008), pp. 115-118

Kindangen, Jefrey I., Rogi, Octavianus H.A., and Verry Lahamendu. *Why Is the Attic Ventilation Disappearing from the Current Urban Houses in the Humid Tropics?* ISTEcS 2019 Equity, Equality, And Justice In Urban Housing Development. Volume 2019.

Lauber, Wolfgang. *Tropical Architecture: Sustainable and Humane Building in Africa, Latin America and South-East Asia.* Prestel, 2006.

Moe, Kiel. *Thermally active surfaces in architecture*. New York: Princeton Architectural Press, 2010. Print.

Ralph, Knowles. *Sun Rhythm Form.* MIT Press Ltd, 1985.

Schindler, S. (2014). *Architecture vs. Housing: The Case of Sugar Hill*. Retrieved January 15, 2021, from https://urbanomnibus.net/2014/09/architecture-vs-housing-the-case-of-sugar-hill/

Simone, A. (2014). *Jakarta, Drawing the City Near.* Minnesota: University OF MINNESOTA Press.

Suhendri and M D Koerniawan. *Investigation of Indonesian Traditional Houses through CFD Simulation.* IOP Conf. Series: Materials Science and Engineering 180. 2017

Tilley, Lisa, et al. *"Urban Evictions, Public Housing and the Gendered Rationalisation of Kampung Life in Jakarta."* Asia Pacific Viewpoint, vol. 60, no. 1, 2019, doi:https://doi.org/10.1111/apv.12209.

Zaera-Polo, Alejandro. "The Politics of the Envelope," *Log*, Fall 2008, No. 13/14, Aftershocks: Generation(s) since 1968 (Fall 2008), pp. 193-207

Appendix:

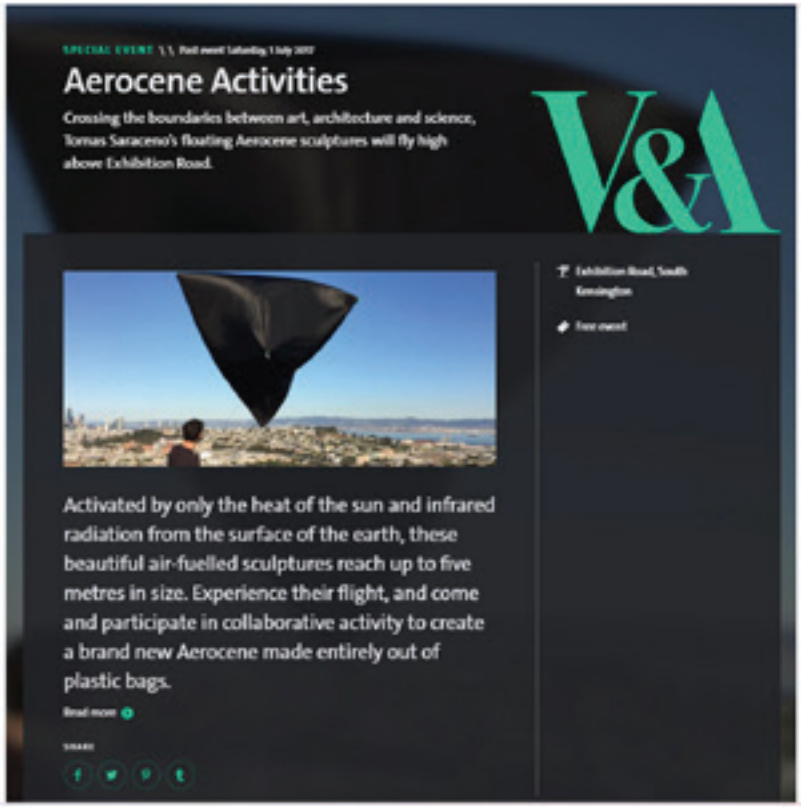
Precedents Worksheets

AEROCENE

"Aerocene is an interdisciplinary artistic community that seeks to devise new modes of sensitivity, reactivating a common imaginary towards an ethical collaboration with the environment and the atmosphere, free from carbon emissions. As an ever growing research and experimental practice, Aerocene is open-source and collaborative. It consists of a dedicated and diverse global community of practitioners who collaborate to promote and enact environmental awareness and atmospheric sensing experiments, imagining new infrastructures of planetary mobility and ethics.
By collaboratively developing, testing and launching aerosolar sculptures, Aerocene seeks to open up the imagination towards an emergent cloudscape, un-tethering a new era of planetary attunement, restoring the thermodynamic balance of the Earth, free from borders, free from fossil fuels."[1]

"AEROCENE MANIFESTO:
While fossil fuel enterprises attempt to colonize other planets, the very same interface between us, the Sun and the atmosphere – the air – continues to be compromised. Carbon emissions fill the air, invisible radio waves develop in a hegemonic algorithm of finance, particulate matter floats inside our lungs. Can you imagine how would breathing feel in a post fossil fuel economy, and what is our response-ability? How do we challenge geopolitical borders in an age of climate inequality?"[2]

(1) https://aerocene.org/about_2020/
(2) https://aerocene.org/wp-content/uploads/2020/04/AC20_AeroceneManifesto_WebVersion_EN_Languages.pdf



AEROCENE BACKPACK

2

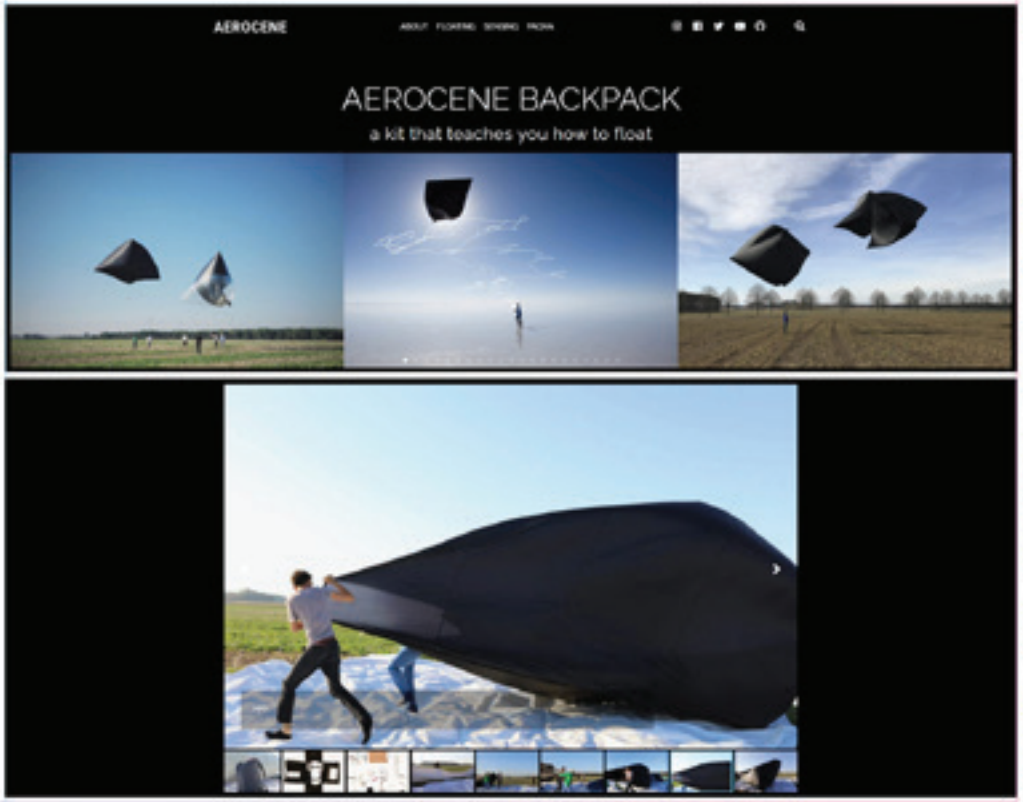
"The Aerocene Backpack is a portable floating kit, which enables anyone to launch their own aerosolar sculpture and start sensing the ocean of air, lifted only by the sun,without the use of fossil fuels, helium, hydrogen, solar panels, or batteries.

With only heat provided by the sun, the enclosed aerosolar sculpture lifts several sensors contained within the SensAIR device that captures atmospheric data such as temperature, humidity, pressure and air quality.

The Backpack is designed to engage participants in thinking-through-making activity, stimulating imagination and creativity, and imparts information about solar balloon flight, thermodynamic physics, meteorological science, and art practices.

A poetic tool for imagining a renewed era without fossil fuels, the Aerocene Backpack is a sculpture that is intended to be borrowed or built autonomously, and is always evolving through an ongoing, collective process of construction through an open-source approach."

(1)https://aerocene.org/floating/
(2) https://aerocene.org/a-brief-note-ballooning-and-aerosolar/



AEROSOLAR *(FROM AEROCENE)*

3



*Aerosolar
Adjective. Noun.

Of the Sun and the winds.

The capacity to harness the energy of the Sun in ways that make moving with, and relating to, the ocean of air self-sustaining.

An envelope's ability to gain buoyancy; a contained body of air heated by direct solar radiation, achieving lower density than the air outside of it to float in equilibrium with the atmosphere.

The desire for futurity expressed in the rejecton of fossil fuels and the extractive practices and relations of the industrial-colonial model, embodied in the will to sense and collaborate with the atmosphere and all immersed in its elemental milieu.

An ethical principle of an ecology of practices cultivated by the Aerocene Community, developed through the Archimedes principle established in c. 250 BCE by Archimedes of Syracuse, fundamental to the fluid dynamics of the laws of physics.

An aerosolar sculpture, capable of moving on air, only with the power of the sun." [1]

(1) https://aerocene.org/about_2020/
(2) https://aerocene.org/wp-content/uploads/2020/04/ACSC_AerosolarManifesto_WebVersion_EN_Language.pdf

MASDAR CITY, ABU DHABI
FOSTER+PARTNERS

#4

*Foster + Partners to create the world's first zero carbon, zero waste city in Abu Dhabi. The first project as a result of the Masdar Initiative is a new 6 million square meter sustainable development that uses the traditional planning principals of a walled city, together with existing technologies to achieve a zero carbon and zero waste community

The principle of the Masdar development is **a dense walled city ... that relies on the creation of a large photovoltaic power plant,** which later becomes the site for the cities second phase, allowing for urban growth yet avoiding low density sprawl.

Rooted in a zero carbon ambition, the city itself is car free. With a maximum distance of 200m to the nearest transport link and amenities, the compact network of streets encourages walking and is complemented by a personalised rapid transport system. The shaded walkways and narrow streets will create a pedestrian friendly environment in the context of Abu Dhabi's extreme climate.

It also articulates the tightly planned, compact nature of traditional walled cities. With expansion carefully planned, the surrounding land will contain wind, photovoltaic farms, research fields and plantations, so that the city will be entirely self-sustaining.*[1]

(1) https://www.dezeen.com/2007/09/08/abu-dhabi-eco-city-by-foster-partners/#:~:text=Architects%20Foster%20%26%20Partners%20have%20announced,of%20cars%20under%20walled%20city.
(2) https://www.fosterandpartners.com/projects/masdar-city/
(3) https://wwf.panda.org/wwf_news/press_releases/?121101/WWF-Abu-Dhabi-unveil-plan-for-worlds-first-carbon-neutral-waste-free-car-free-city

MASDAR CITY, ABU DHABI
on WWF

"Masdar City will be the world's first zero-carbon, zero-waste, car-free city. Through the "One Planet Living™" programme, a global initiative launched by WWF and environmental consultancy BioRegional, WWF will work with Masdar to ensure the city meets standards of sustainability which include specific targets for the city's ecological footprint.

ZERO CARBON
100 per cent of energy supplied by renewable energy – Photovoltaics, concentrated solar power, wind, waste to energy and other technologies
ZERO WASTE
99 per cent diversion of waste from landfill (includes waste reduction measures, re-use of waste wherever possible, recycling, composting, waste to energy)
SUSTAINABLE TRANSPORT
Zero carbon emissions from transport within the city; implementation of measures to reduce the carbon cost of journeys to the city boundaries (through facilitating and encouraging the use of public transport, vehicle sharing, supporting low emissions vehicle initiatives)
SUSTAINABLE MATERIALS
Specifying high recycled materials content within building products; tracking and encouraging the reduction of embodied energy within material sand throughout the construction process; specifying the use of sustainable materials such as Forest Stewardship Council certified timber, bamboo and other products
SUSTAINABLE FOOD
Retail outlets to meet targets for supplying organic food and sustainable and or fair trade products
SUSTAINABLE WATER
Per capita water consumption to be at least 50 per cent less than the national average; all waste water to be re-used
HABITATS AND WILDLIFE
All valuable species to be conserved or relocated with positive mitigation targets
CULTURE AND HERITAGE
Architecture to integrate local values
EQUITY AND FAIR TRADE
Fair wages and working conditions for all workers (including construction) as defined by international labour standards
HEALTH AND HAPPINESS
Facilities and events for every demographic group[1]

(1) http://wwf.panda.org/wwf_news/press_releases/?121105/WWF-Abu-Dhabi-unveil-plan-for-worlds-first-carbon-neutral-waste-free-car-free-city

MASDAR CITY, ABU DHABI
CRITIQUE

#6

"It will also deliberately link itself to the past, with narrow streets, small squares where water plays, natural air conditioning from wind towers, and an infinity of shades and light. It is, in short, an "ecotopia", a very real oasis in the unsustainable world of energy-guzzling skyscrapers now thrusting up throughout the emirates.

But Masdar does not impress Nayla. "This is unreal," she says. "It is not for us. Why can't they build mass housing for the poor? It is attractive only for the elite, the business people. Who else will live there? Who are they building Masdar for?"[3]

"As of this year — when Masdar was originally scheduled for completion — managers have given up on the original goal of building the world's first planned zero-carbon city.

Masdar City is nowhere close to zeroing out its greenhouse gas emissions now, even at a fraction of its planned footprint. And it will not reach that goal even if the development ever gets fully built, the authorities admitted.

"We are not going to try to shoehorn renewable energy into the city just to justify a definition created within a boundary," said Chris Wan, the design manager for Masdar City."[3]

(1) https://www.theguardian.com/environment/2008/jan/28/carbonemissions.climatechange
(2) https://grist.org/climate-energy/the-worlds-first-zero-carbon-city-is-a-big-failure/
(3) https://www.bloomberg.com/news/articles/2020-02-14/the-reality-of-abu-dhabi-s-unfinished-utopia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Masdar's zero-carbon dream could become world's first green ghost town

people / data
text
technology
products
materials
events
policy
organizations

THERME VALS

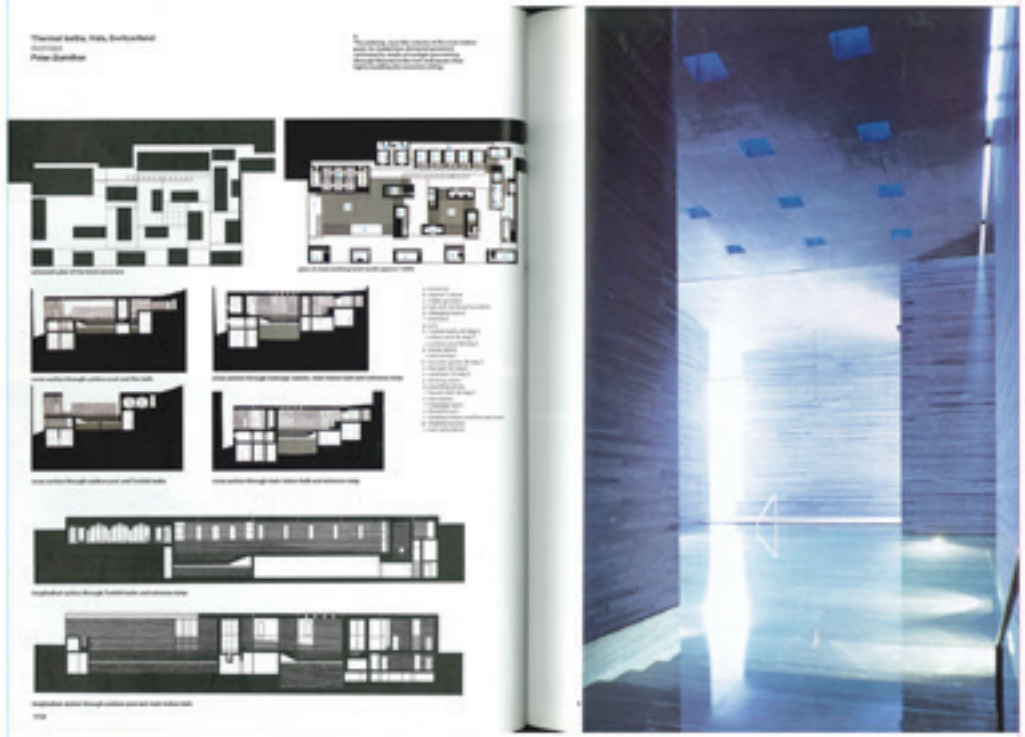
#7

"Mountain, stone, water – building in the stone, building with the stone, into the mountain, building out of the mountain, being inside the mountain – how can the implications and the sensuality of the association of these words be interpreted, architecturally?" Peter Zumthor

"The gaps between these lower panels form thresholds and channels for excess water. They delineate the inhabited shafts - each with its tiny specific chamber - from the general pool precinct. Inside one apparently solid shaft is a chilly 10 degrees Celsius plunge pool, inside another an aromatic 30 degrees C bath with petals; both are entered at right angles and surround the bather immediately in stone.

You step down directly into the hottest pool (42 degrees C), then rest on submerged shelves as small waves drop noisily into a deep perimeter trough. The 35 degrees C pool is beneath the point of entry, but turns back through a small chasm to reposition the more adventurous bather in a high chamber lit from below. Across the plan, another body of water moves out against a tall external window; in summer, the lower panel falls away to allow swimmers direct connection into the big outdoor pool." [1]

(1) https://www.archdaily.com/13358/the-therme-vals



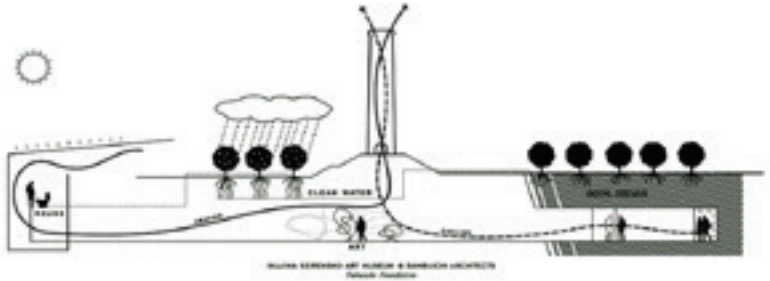
HIROSHI SAMBUICHI

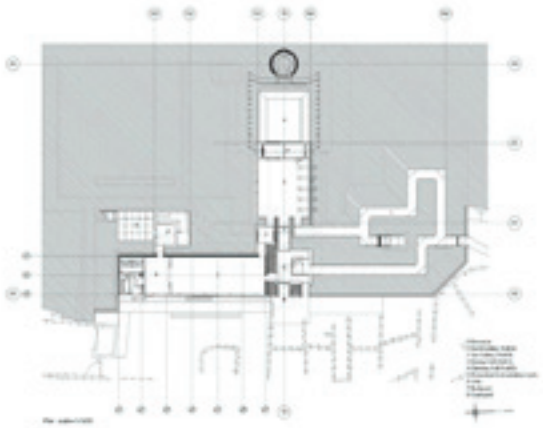
#8

Inujima Seirensho Art Museum

"Breathing new life into the ruins of a former copper refinery, Inujima Seirensho Art Museum was built around the idea of "using what exists to create what is to be". Exhibited here are works created by Yukinori Yanagi who used Yukio Mishima as a motif, a vocal critique of Japan's modernization, together with the remodeled architecture designed by Hiroshi Sambuichi. By using the existing smokestacks and karami bricks from the refinery as well as solar, geothermal, and other natural energies, the architectural design minimizes the construction's environmental impact. The building also employs a sophisticated water purification system that makes use of the power of plants. The project truly embraces the concept of a recycling-based society through its focus on industrial heritage, architecture, art, and the environment."

(1) https://benesse-artsite.jp/en/art/seirensho.html





HIROSHI SAMBUICHI

#9

Naoshima Hall

"Naoshima Hall was created in the Honmura district of Naoshima, as a place to reaffirm the values of the island and to encourage local residents to actively reflect on their past and put this wisdom to use in new ways. It is a public hall, but at the same time, it also represents the credo of Benesse Art Site Naoshima of "Using what exists, to create what is to be." This idea has always probed the relationship between nature and human beings through the lens of art and architecture.

While researching geographical details throughout the village, Sambuichi came to understand how, for generations, the villagers have lived harmoniously within their natural environment. From the directions of the winds, to how the area's water resources were deployed (including the flow of water from reservoirs into the rice fields located below; the system of waterways and canals flowing throughout the village; and the locations in which wells were drilled), local residents and the architect have put the area's natural endowments to work."

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HIROSHI SAMBUICHI

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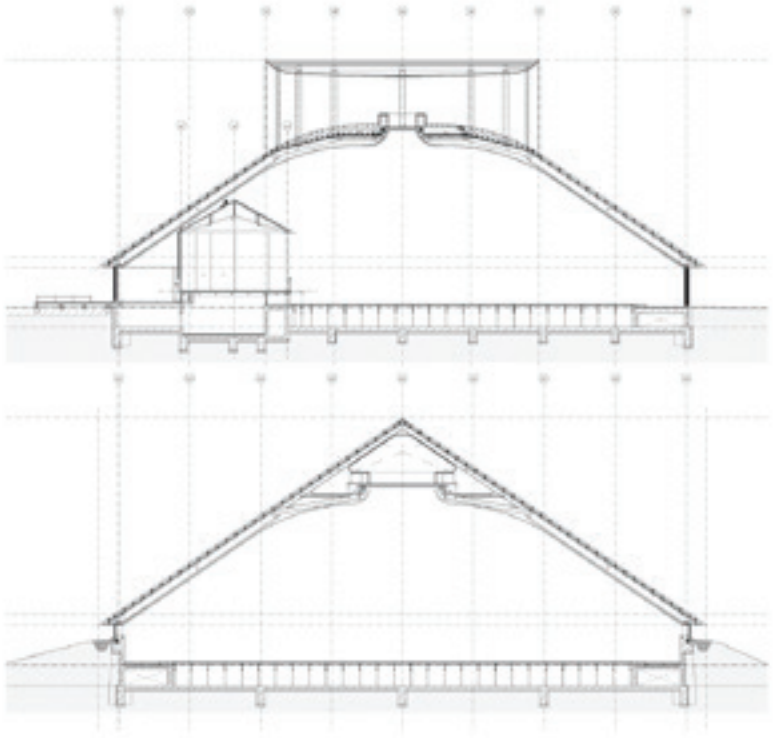
Naoshima Hall

"It was Sambuichi's wish to celebrate the town-building process itself as a precious message from the area's ancestors, and after many attempts, he discovered the angles, shapes and structure his building should take to harness the natural energy of the site without requiring artificial energy. In the main hall, he designed an aperture through the Irimoya hip-and-gable roof so that the predominant southerly winds blowing in Honmura could flow through it. As long as the winds continue to blow across the island, the building will be served by a natural ventilation system, circulating air inside the hall. Sambuichi also recognized the value of the local well water, the temperature of which stays cool all year long, and circulates it up to the roof surfaces of the community center during summer to cool its interior spaces. Nowadays, the wells that once supported the everyday lives of the island's residents are not used much. It is hoped that people will once again recognize their value."



CHENNAI ICE HOUSE

11

"The Ice House. A pink, part-circular, wedding cake-like building on the Chennai sea front. It hasn't stored ice for well over a century. But that's how this extraordinary building is still generally known.

It was built in 1842 - one of three ice houses in India established by the Boston-based 'ice king' Frederic Tudor, and the only one of the three to survive. And yes, it really did store ice, transported all the way from New England.

Tudor hit on the idea of harvesting ice from the freshwater lakes of New England (it was after all free), using sawdust for insulation, and then sending the ice out from Boston where ships often travelled empty to the Caribbean and further afield. Yes, a lot of the ice melted - but enough made the journey, and was sufficiently prized, to earn a profit. A decent profit to judge by the splendour of this building.

The poet and essayist Henry David Thoreau saw ice being harvested for Tudor at Walden Pond in the winter of 1846-7. 'The sweltering inhabitants of Charleston and New Orleans, of Madras and Bombay and Calcutta, drink at my well', Thoreau wrote. 'This pure Walden water is mingled with the sacred water of the Ganges."[1][2]

(1) https://www.andrewsmith.net/blog/a-term-in-chennai-the-ice-house/#.X0S1Xk

(2) https://tamanu.wordpress.com/2017/05/01/lost-landmarks-of-chennai-the-curious-case-of-ice-houses/

WEATHERMART

Yushiro Okamoto | M.Arch Thesis 2012

"The challenge of this thesis is to rethink the notion of what's inside and outside, and what is temporary and permanent, through air and mass. Architecture has ultimately been about defining what is inside or controlled, and I was very interested in how that boundary could change according to where on earth it's placed, from summer to winter, and time of the day. "Supermarket" was an interesting material to think about such contradictory agendas.

A supermarket should be designed thermo-dynamically, reorganizing the climatic relationships between different atmospheres it houses. Such gradational spectrum of heat and moisture begin to become part of a greater external spectrum of nature as it starts to expose its boundaries."[1]

2.4 Food Migration

Weathermart is effected by the seasonal climate changes. Typically, buildings regulate the internal temperature by facade system or HVAC systems. However, in Weathermart, the thermal properties of each chambers change month to month, season to season. So programs need to shift from one room to another according to seasons. In this case, the foods and produce migrate from chamber to chamber finding its ideal climate.

Produce placed in supermarkets are ever changing. They are sold and being replaced daily. If they are there for too long, they're also replaced. It continues the subtraction and addition one after another. When food needs to change its location, it can be moved in this manner. They will be replaced little by little and finally, changing its location.

During summer, a part of supermarket becomes more active with vegetables and fruits, like a farmers market. During winter, fishes and meat comes out of the enclosed active chambers to be more exposed to the main flow of people. Then it becomes a fisherman's market during winter.

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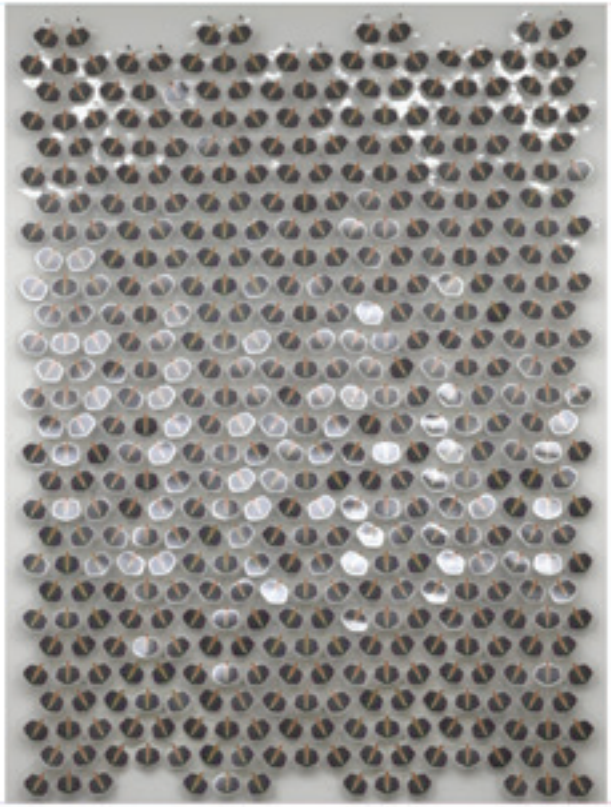
(1) Okamoto, Yushiro. Weathermart. MIT DSpace. 2012.

GROW *(Prototype)*
Samuel Cabot Cochran, Benjamin Wheeler Howes, SMIT
Sustainably Minded Interactive Technology, LLC

13

"GROW is a hybrid wind and solar energy delivery device that uses film photovoltaics with piezoelectric generators; it converts sunlight into electricity while also transforming mechanical energy into electrical energy. Its organic and dynamic form replicates climbing ivy, and its "leaves" are flexible photovoltaic panels. The leaves catch sunshine to generate solar power; their fluttering generates wind power. Due to its light weight, this device can be easily mounted on vertical surfaces such as building façades to produce energy. The designers use recycled and reclaimed materials wherever possible, and, GROW's lifespan and sustainable methods will minimize its environmental footprint."



BIOWALL (PROTOTYPE)

Rachel Wingfield, Mathias Gmachl, Loop, pH

14

"Biowall is a woven scaffold that becomes a partition when colonized by living plants. In their attempt to create a modular building system based on structures found in nature, the designers looked at several geometries, such as Penrose tiles (pairs of shapes that tile a plane so that no section of the pattern is repeated) and Synetic structures (airy, lacelike basketries of thin arcs over which pressure is evenly distributed). They opted for a weave of twelve small circles made of one-millimeter fiberglass rods around which the plants could grow and creep. "The construction is based on the principle of self-similarity, translating a biological construction from the nanoscale to the macroscale. It can be seen in our natural environment in the formation of bubbles, living cells, and water molecules," the designers have explained."

RECEPTIVE SKINS: THE BREATHING WALL

Chrisoula Kapelonis | City Science - Media Lab

15

"In architecture, the building skin is the primary interface for mediating the environment of the external with the internal. But today, **this mediation is mechanical, deterministic, and static**—often seeing the human as a generalizable and problematic input. With advances in material science however, there is great potential to disrupt these traditional manufactured environments of architecture and turn them into **responsive mediated environments**. What this thesis aims to explore is this idea of the receptive skin—a sensate and dynamic multi-material interface for environmental mediation. This suggests that by departing from the view that buildings are static artifacts, we may instead begin to see buildings as organic, living entities.

Through the development of a working prototype, this project explores how such an interface may manifest itself, through dynamic material composites, instead of mechanical and electronic means. The final prototype is a "proof of concept," a built example of this novel design methodology, which unites material performance with sensate technologies, as a way to enable **new interactions between building and environment."**

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MARSBOREAL GREENHOUSE

BEAVER+SAEXE Team
Responsive Environments - Media Lab

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"Less dependency from Earth supplies, better psychological and physical conditions for the astronauts, higher safety, and lower energy and resources consumption are the main requirements for such missions, and must be matched and experimented from the very beginning of human deep space exploration. To address this same need for higher feasibility and sustainability, this research explores a novel design for **a greenhouse module that can supply 100% of the food required for a crew of four astronauts on an extended mission** to Mars, while also providing physical and mental health benefits for the crew members.

The module accomplishes this by maximizing space and minimizing mass with a novel spiral system within an inflatable, cylindrical shell designed to protect astronauts from harmful radiation. Crops, which supply the food for the crew, grow in modular hydroponic trays that descend from the top floor of the module along six spiral tracks. **The lighting, temperature, nutrient supply, track length, and vertical separation of each spiral is matched to plants growth patterns** and needs, thereby maximizing volume for growth, optimizing growing conditions, and providing isolation in case of disease."

(1) https://www.media.mit.edu/projects/marsboreal-greenhouse/overview/

MEDIATED ATMOSPHERE

Nan Zhao | Responsive Environments - Media Lab

17

"The sensorial qualities of a space—the atmosphere—shaped by the composition of light, sound, objects, and people—have a remarkable influence on our experiences and behavior.

We envision workspaces that can self-regulate on the basis of an occupant's activities and affect in a closed-loop fashion. We imagine a workspace that, when asked, can instantly trade the engaging focus of a library with the liberating sensation of a stroll through the forest—a workspace that can replicate the invigorating tension of a control room or the restorative qualities of a beloved childhood hideaway.

The responsive controller relies on **ubiquitous, nonintrusive sensing of the occupant's activity, work habits, and physiological or behavioral reaction to environmental changes.** Building on data from realistic work scenarios, we create personalized occupant response models for accurate control. ... As a result, the workspace might suggest the **atmosphere** of a local coffee shop or an artifact-strewn artist's living room when it is time to spark creativity, and the atmosphere of a study when it is time to maintain focus. **The workspace might integrate brief nature escapes into our workday, supporting us in our effort to balance our schedule and physiological needs**"

(1) https://www.media.mit.edu/projects/mediated-atmospheres/overview/

TERMITE MOUND

18

"The mounds are built around large central "chimneys" that reach from gallery – the underground vault where the bulk of the colony lives – to the top of the mound. **While the interior of the mound features large structural walls, the exterior is far thinner, with walls that, while impermeable to wind, allow for the exchange of gases.**

During the day, Mahadevan explained, as **sunlight warms the mound's outer walls, the air inside warms, causing it to rise**. "What you get is a convection cell, ... the warm air can't move through the walls quickly enough, but it has to go somewhere, and the only possibility is for it to go down into the interior through the central chimney. **At night, as the exterior cools, the airflow reverses, and it pulls the air up** from the central part of the mound."

The result ... is that while CO^2 concentrations during the day can reach up to 4 or 5 percent in the center of the mound, airflow at night pulls the gas to the exterior walls, where it can **escape by diffusing through the walls.** "But what's remarkable here is how the termites are using transients. The temperature outside the mound is oscillating, and they have developed a method to harness that to ventilate their mounds."[1]

(1) https://news.harvard.edu/gazette/story/2015/09/how-termites-ventilate/
(2) https://news.harvard.edu/gazette/story/2013/12/termites-as-architects/
(3) https://www.pbs.org/wnet/nature/the-animal-house-the-incredible-termite-mound/1121/
(4) https://news.harvard.edu/gazette/story/2013/12/how-do-tiny-termites-make-such-massive-mounds/
(5) https://www.asahi.edu/kiki/kumae/termite/?cgid=termite0#unit-links

MATERIALECOLOGY

Neri Oxman | Media Lab

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"The main idea promoted by this project," Oxman says, "**is our ability not only to analyze natural (and biological) tissues but to reconstruct them in larger scales.**" Three microscale biological tissues (a leaf section, a butterfly wing, and a scorpion paw) were reconstructed using a digital protocol. The tissues were closely analyzed and then reconstructed in three-dimensional macroscale prototypes out of wood, through the use of a very fine mill controlled by a computer."

"Over the past decades, architects have been studying the possibility of creating dynamic buildings that adapt to changing environmental conditions and levels of occupancy. With this task in mind, Oxman coined the term **"material ecology"** and advocates for **products and buildings to be designed as living, interactive entities—environmentally informed, computationally grown, digitally manufactured, and biologically augmented.**

The surface of Cartesian Wax is thickened locally when more structural support is needed, and modulates its transparency according to the light conditions of the environment. "The work is inspired by Descartes's Cartesian Wax thesis," explains Oxman, "which relates to the construction of self knowledge and the way it is informed by and reports on an individual's experience of the physical world."[2]

(1) https://www.moma.org/collection/works/115941
(2) https://www.moma.org/collection/works/115952

Neri Oxman, Massachusetts Institute of Technology, Cambridge, MA
Subterrain, from the Materialecology project
2007

(1)

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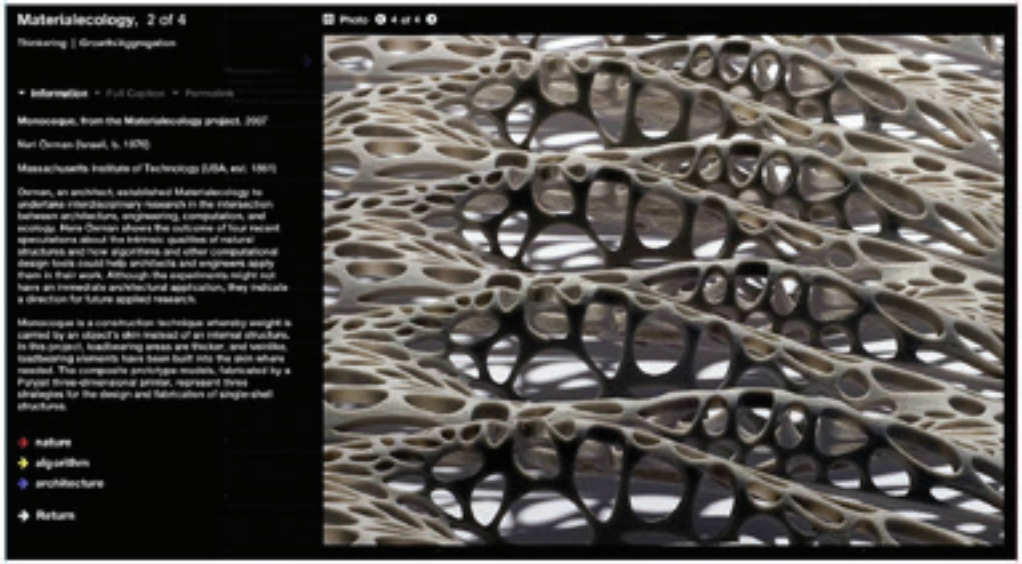
MATERIALECOLOGY - MONOCOQUE

Neri Oxman | Media Lab

20

"Monocoque is a construction technique whereby **weight is carried by an object's skin instead of an internal structure.**"(1)



(1) https://www.moma.org/interactives/exhibitions/2008/elasticmind/ [07]

PLUMEN
Nicholas Roope

21

"Some people find their shape and the quality of their light unpleasant, and some question their environmental advantage, but **low-energy lightbulbs are a necessary innovation.** Their presence in our lives, explain the Plumen's designer, "should be seen as an advantage to be celebrated by drawing, sculpting, or scrawling in the air with light. **The bulbs should not be viewed as an afterthought but instead as a centerpiece**. Then people might begin to buy these bulbs through genuine desire rather than mere moral obligation." Production of the Plumen began in 2011, and the bulbs are sold in Europe and the United States." [1]

(1) https://www.moma.org/collection/works/131865

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Nicolas Roope
PLUMEN low-energy lightbulb (Prototype)
2007

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MATALI CRASSET

22

*"Q: Seven years into an already established career, the French government awarded you a scholarship to pursue your "Autogenous Design" project. **What is autogeneous design?** Can you give us some examples of the object or products that were produced as a result of this project?*
A: My autogeneous lamp is a research project. It's a one-off piece. It's a reflection on energy. **"What if objects were autonomous and were able to produce their own energy? What if they, at last, became autarchic?"** In my design for the autogeneous lamp, there is only the lampshade left: the only element retained is the symbol of the lamp. But can the memory of the original object suffice? One has to draw on existing forms in order to rethink them. The new form of the lamp represents a memory of a previous use that has been diverted by another intention. From a symbolic point of view, a lamp represents a point of transition, a place where energy is consumed and transformed into something else - light. The lamp is switched on by turning the lampshade upside down. In this way, the on/off switch is rematerialised by a gesture or action, and the form remains respectful of its use.

Q: What is your design philosophy? How would you categorise your output?
A: I don't want to change anything, only propose things to those who are interested. I think more in local terms than in global ones." [1]

(1) https://www.designindaba.com/articles/creative-work/matali-crasset

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matali crasset
Splight table lamp (Prototype)
2005

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THE AEC PAVILION
Pneumatics

"Designed by American architect Victor Lundy in collaboration with American engineer Walter Bird of Birdair, Inc., the pneumatic Atomic Energy Commission (AEC) Pavilion premiered in Buenos Aires, Argentina in 1960.

This double skin system featured different air pressures for both the inner and outer layers, whereas the space in between was engineered to enhance thermal performance (i.e. keep the sun out, reduce the need for cooling systems, and aid human comfort in the interior). The pavilion was also designed with safety in mind: the air space between the inner and outer skins was compartmentalized into eight discrete chambers. If one of the skins incurred any damage, it would be contained to only that discrete section, resulting in a "relaxation" of the select area, rather than total structural failure or collapse.

It could be said that the structural instabilities—that is, the political, economic, social and environmental anxieties—of the first wave of pneumatics, are likewise plaguing contemporary society. As a result, the perceived (if not romanticized) instability of inflatables as instant, temporary, and disposable objects suggest a renewed desire to seek out alternative modes of expression. ... A more mundane, yet sustaining identity for pneumatics has been their capacity to endure, and at times entertain. ... Lundy demanded more architectural innovation out of this emergent building type."[1]

(1) https://www.flux.com/architecture/structural-instability-1957#/environmental-and-mapping/
(2) http://evolve-studio.com/2013/10/11/frances-dallegret-and-reyner-banham-a-home-is-not-a-house-1965/

SYMBIOSIS

Jelte van Abbema

24

Growing everchanging letters with bacteria by altering their environment and the shape of their culture

LIGHTWEEDS

Simon Heijdens

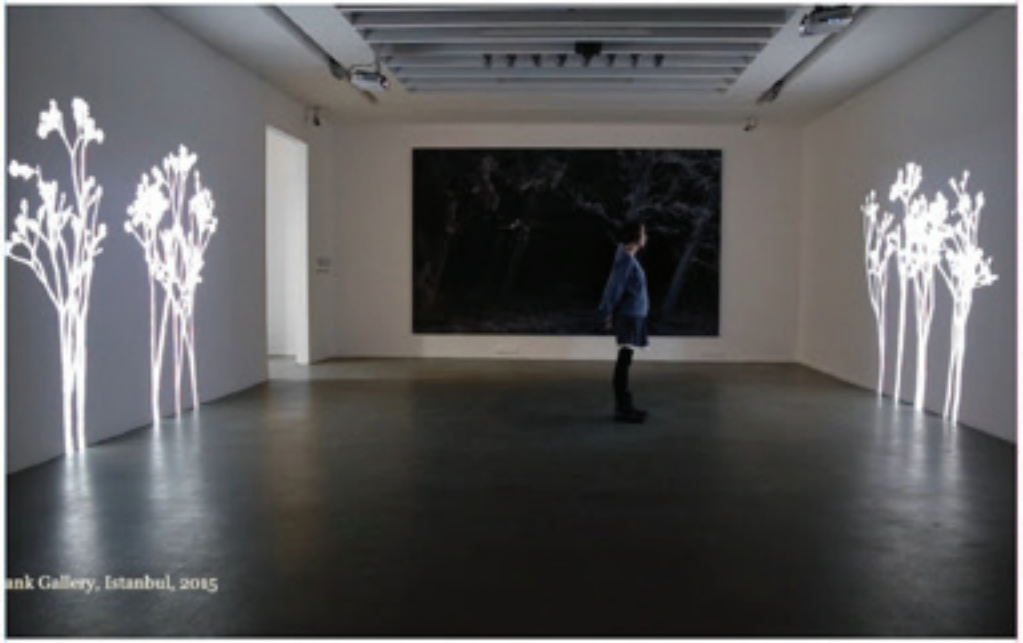
25

Lightweeds* (2004, ongoing) is a projected living digital ecosystems responsive to actual nature.[1]

"A digital seed that contains the genetical data of a plant species, brought alive by the live data feed from sensors placed outside the building. The plants grow along actual rain and sunlight, and sway in the wind, ever evolving as the weather develops throughout the days and seasons.

When people pass, the plants tremble and eventually loose their seeds which pollinate in the direction of passage. Like footsteps in the sand, the evolving location and density of plants reveal which way the building is used.

A living digital organism through which the perpetual built environment regains an unplanned evolving natural flux."[2]



ank Gallery, Istanbul, 2015

(1) http://simonheijdens.com/index.php?/home/Biography
(2) https://vimeo.com/21107445
(3) https://www.iconeme.org/installation/works/12/253

SILK PAVILION II

Neri Oxman and The Mediated Matter group | Media Lab

26

"What are radically sustainable methods for knitting, making and building in the age of the Anthropocene? How can humankind and members of other species such as silkworms collaborate in the construction of objects, products, and buildings? Can we extract silk without boiling cocoons? Standing six meters tall and five meters wide, Silk Pavilion II offers insights into these questions by combining kinetic manufacturing with biological construction, uniting the built and the grown, fusing technology and biology."(1)

(1) https://www.media.mit.edu/projects/silk-pavilion-ii/overview/

SYNTHETIC APIARY

Neri Oxman and The Mediated Matter group | Media Lab

27

"The Synthetic Apiary proposes a new kind of environment, bridging urban and organismic scales by exploring one of the most important organisms for both the human species and our planet: bees. We explore the cohabitation of humans and other species through the creation of a controlled atmosphere and associated behavioral paradigms. ... Many animal communities in nature present collective behaviors known as "swarming," prioritizing group survival over individuals, and constantly working to achieve a common goal. Often, swarms of organisms are skilled builders; for example, ants can create extremely complex networks by tunneling, and wasps can generate intricate paper nests with materials sourced from local areas."[1]

"The Synthetic Apiary takes up an entire room and offers precise control of light, humidity and temperature to replicate the ideal environment for bees to survive and produce honey. The colony is provided with synthetic pollen and sugar water, and its health is constantly monitored.

The apiary's perpetual warmth tricks the insects into thinking it's spring throughout the year, meaning the colony remains active and producing honey. Outside of the apiary, hives of honey bees typically reduce in number as the weather cools, with the remaining insects surviving on honey stored during summer. The team has described the experiment as "the first demonstration of sustainable life in a completely synthetic environment."[2]

(1) https://www.media.mit.edu/projects/synthetic-apiary/overview/
(2) https://www.dezeen.com/2016/10/26/neri-oxman-synthetic-apiary-mit-mediated-matter-bees-beehive-design-technology/

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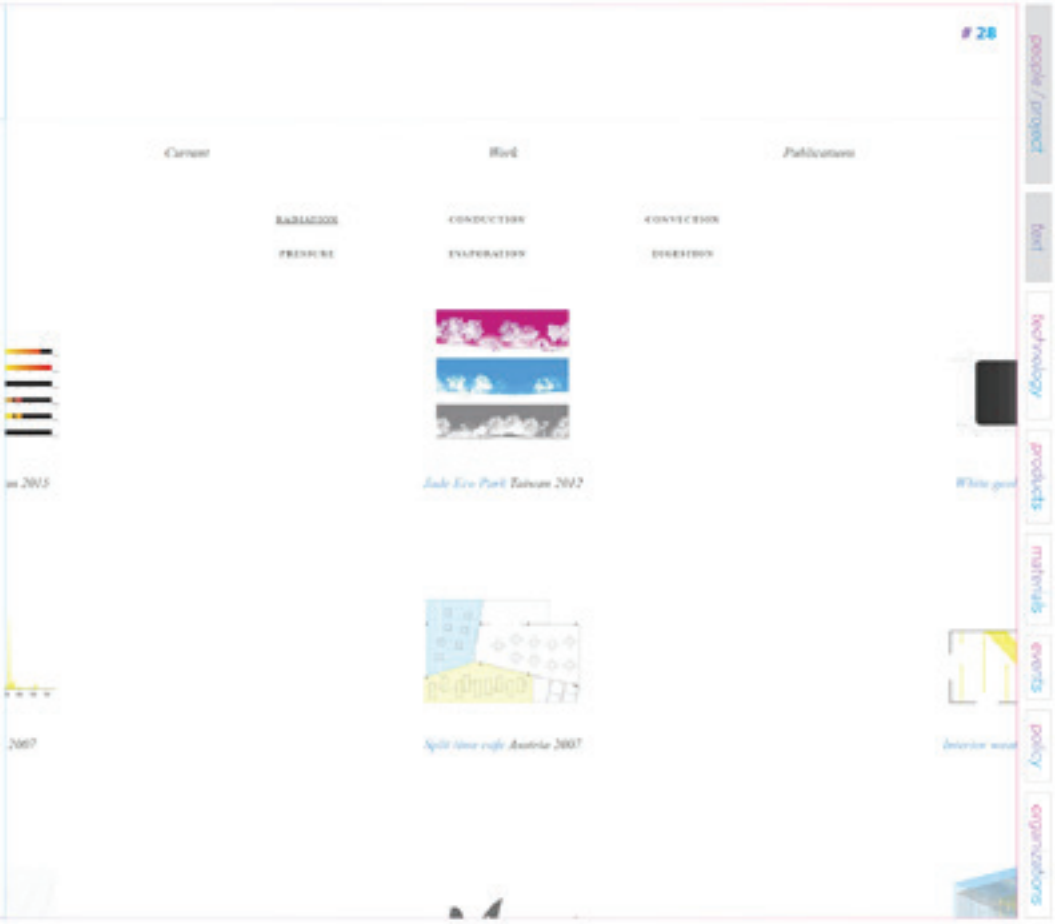
PHILIPPE RAHM

"It is no longer a case of building images and functions, but of opening climates and interpretations, working on space, on the air and its movements, on the phenomena of conduction, perspiration, convection as transitory, fluctuating meteorological conditions that become the new paradigms of contemporary architecture; moving from metric composition to thermal composition, from structural thinking to climatic thinking, from narrative thinking to meteorological thinking."

"Space becomes electromagnetic, chemical, sensorial atmosphere with thermal, olfactory and cutaneous dimensions in which we are immersed and which, by the act of inhabiting, we in turn compose with the breath, perspiration, and thermal radiation of our bodies"

"Architecture should no longer builds spaces, but rather create temperatures and atmosphere."[10]

(1) Rahm, Philippe. Thermodynamic Architecture. ACADIA 08 - Silicon + Skin: Biological Processes and Computation. p.46-47



DIGESTIBLE GULF STREAM

Philippe Rahm

KEYWORDS: CONVECTION, DIGESTION

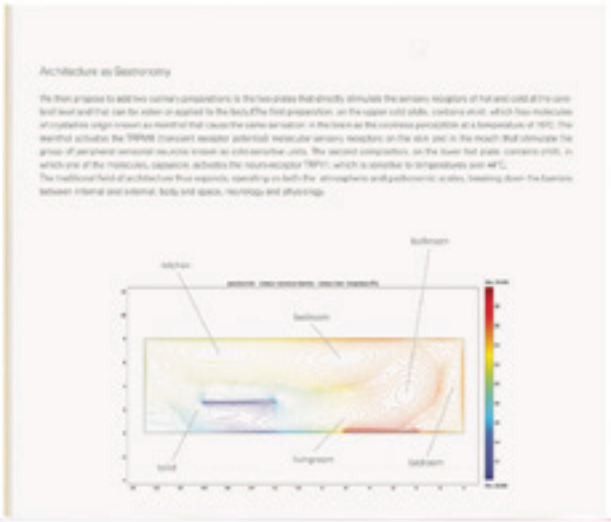
29

"Like a miniature Gulf Stream, their position creates a movement of air using the natural phenomenon of **convection**, in which rising hot air cools on contact with the upper cool sheet and, falling, is then reheated on contact with the hot sheet, thus creating a **constant thermal flow,** akin to an invisible landscape. What interests us here is not the creation of homogeneous, established spaces, but of a **plastic, climatic dynamic,** the activation of forces and polarities that generate a landscape of heat. In this case **the architecture is literally structured on a current of air, opening up a fluid, airy, atmospheric space.** This architecture is based on the construction of meteorology. The inhabitant may move around in this **invisible landscape between 12°C and 28°C, temperatures at the two extremities of the concept of comfort,** and freely choose a climate according to his or her activity, clothing, dietary, sporting or social wishes.

We have five ways of cooling down, which act on different scales:
1. reducing the air temperature in the room, for example by air conditioning (atmospheric solution);
2. **drinking (physiological solution)**
3. taking off clothes (social solution)
4. resting (physical solution)
5. stimulating a sense of coolness with the mind (neurological solution)

We then propose to add two culinary preparations to the two plates that directly stimulate the sensory receptors of hot and cold at the cerebral level and that can be eaten or applied to the body. The first preparation, on the upper cold plate, contains mint, ... The second composition, on the lower hot plate, contains chilli"[1]

(1) Rahm, Philippe. Thermodynamic Architecture. ACADIA 08 - Silicon + Skin : Biological Processes and Computation. p.46-47



Architecture as Gastronomy

INTERIOR GULF STREAM

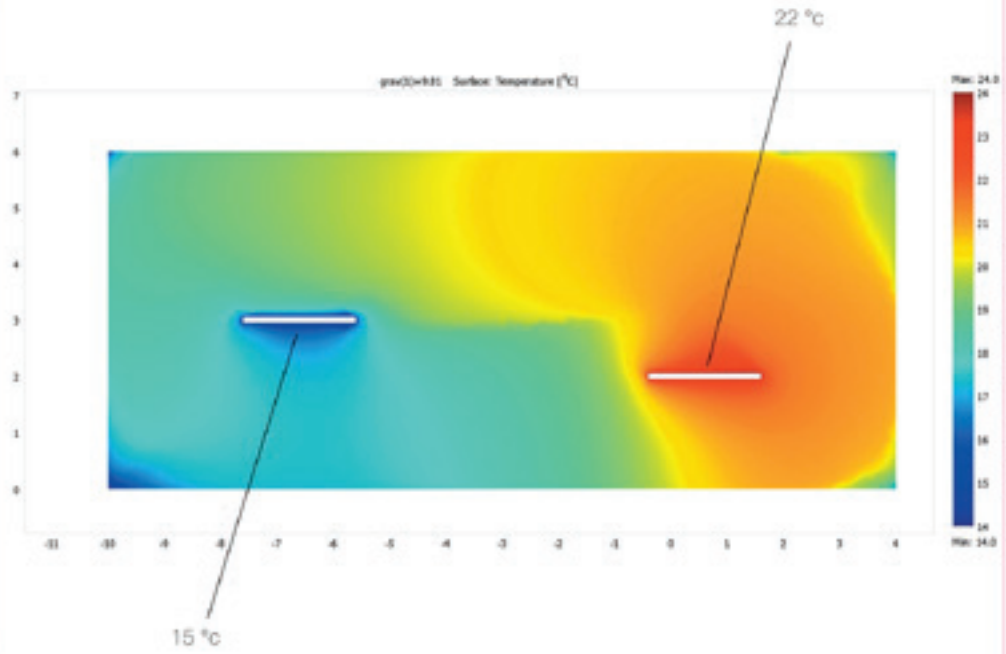
Philippe Rahm

KEYWORDS: CONVECTION

30

"**Modernity led to uniform, consistent spaces in which the temperature is regulated around 21 degrees.** The aim here is to restore diversity to the relation that the body maintains with space, with its temperature, to allow **seasonal movement within the house,** migrations from downstairs to upstairs, from cold to warm, winter and summer, dressed and undressed. For people to feel **comfortable in a heated room there must be equilibrium in the exchange of heat occurring via convection between their bodies and the surrounding air.** This equilibrium is of course relative to clothing, from nudity in the bathroom, to the thermal protection of blankets, to light clothing worn in the living room.

Instead of warming all the space at the good temperature around 20°C, we propose to create in the house two sources of heat, like two different thermal poles creating a thermodynamic tension inside the all house: one pole is cold at 15°C and situated in the upper layers of air of the house. The opposite pole is warm, at 22°C situated in the lower layers of the space. **A movement of air will be generated** by this difference of temperatures and positions in the space. ... The project process is thus reversed: a **indoor climate is first produced and after, functions are freely chosen anywhere in the space related to the thermal quality required depending of activities, clothes, personal desires.**"[1]



(1) Rahm, Philippe. Thermodynamic Architecture. ACADIA 08 - Silicon + Skin: Biological Processes and Computation. p.46-47

CONVECTIVE APARTMENTS

Philippe Rahm

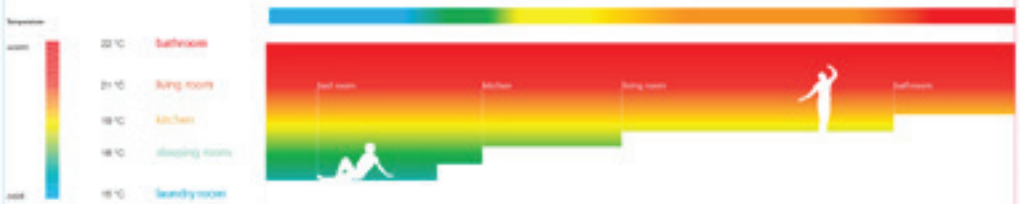
KEYWORDS: CONVECTION

31

"The design of this condominium building is based on the natural law of **Archimedes that makes the warm air rises while theand cold air fallsdrop.** Very often in an apartment, **a real difference of temperature could can be measured between the floor and the ceiling, a difference that could sometimes even be of 10 °C sometime.**

Depending on our physical activities and the thickness of the our clothes we wear, the temperature of a room doesn't have to be at the same level everywhere inin every room of the apartment. Because If we are protected by the a blanket in the bed, the temperature of the bedroom could be reduced to 16° Celsius. In the kitchen, because if we are dressed up and physically active, we could have a temperature of the space at 18°C. The living room is often heated at 20°Celsius because we are dressed up but without moving, staying motionless in on the sofa. The bathroom is the warmest space of the apartment because here we are naked. in it. Keeping these precise temperatures in these specific areas could economize a lot of energy by reducing the level of the temperature to the our exact needs. ... The apartment become likewould become **a thermal landscape**, with his different altitude of heat ,temperatures, where the inhabitant could freely wander inside around like in a natural landscape, looking for specific thermal qualities related to the seasons or the moment of the day."[1]

(1) http://www.ph-lapparatm.com/data/projects/convectiveapartments/index.html



SECTION_APARTMENT
FUNCTIONS RELATED TO THERMAL ZONES

TADEUSZ KANTOR MUSEUM

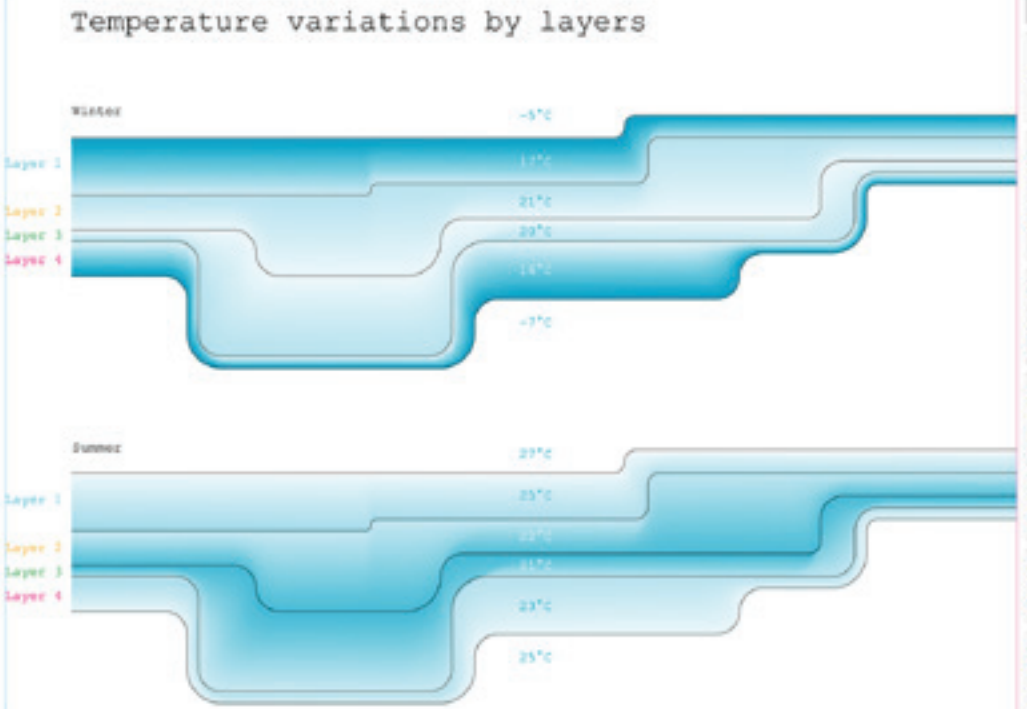
Philippe Rahm

KEYWORDS: CONDUCTION

32

"This project for a museum in Poland is **literally an increase of the thickness of the small spacing of some millimetres between the glass panes of a window with double or triple glazing, until it becomes a liveable space of some meters.** Precisely like the construction manner of the contemporary windows which adds several panes of glass (single, double and triple pane) to improve the insulation by decreasing the coefficient of the thermal transmission K (W/m2.K) (single pane: K =5,6, double: K = 3, triple: K = 2), our project adds layers to improve the thermal coefficient gradually, one layer after another, offering a variety of temperatures and luminosities. **Against the homogeneity of the modern climate, we propose a diversity of atmospheres, light and temperatures open to transhumance. According to the type of activity, according to the season, we will rather choose one layer than another, hotter or more in north, more constant in its temperature or more luminous.** Architecture finds here, in its own language and in the energy needs related to sustainable development, the means to create interpretable spaces, extraordinary, freely opened to the future behaviours and functions." [1]

(1) http://www.philipperahm.com/data/projects/musee-pologne/index.html



people / practice
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products
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WINDTRAP

Philippe Rahm

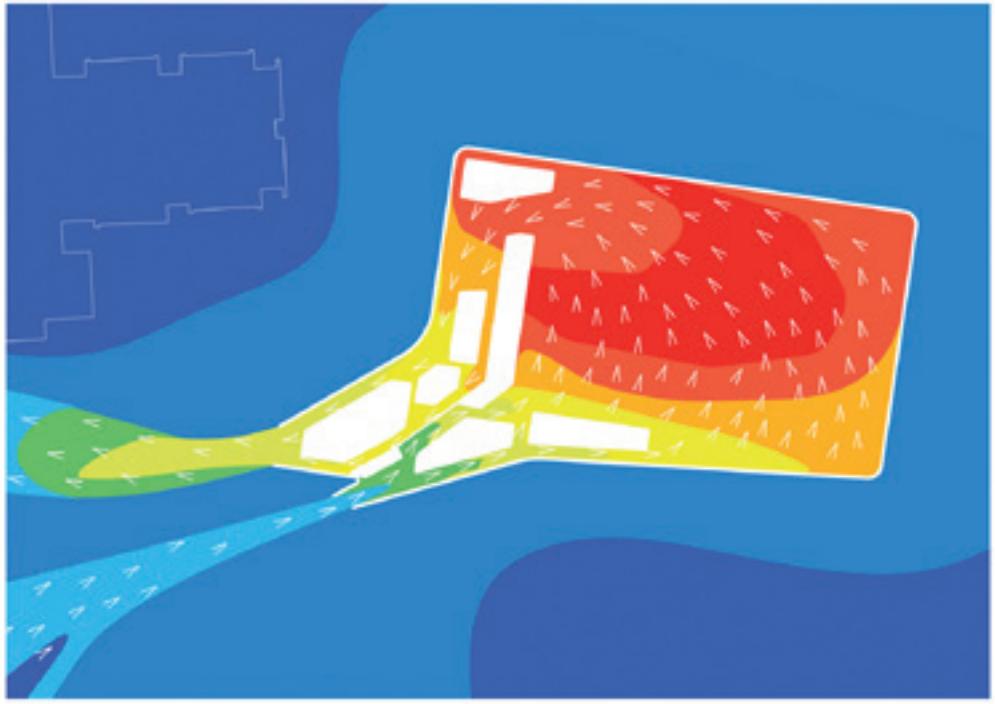
KEYWORDS: PRESSURE

33

"Our project for a new sports hall in Slovenia is an **architecture as weather,** placed in the site as a wooden object slipped in the course of the wind. **It captures the warm scent from the south and rejects the stale air to the north, after removing its heat**. The sports hall emerges as a slight inflection in the natural movement of wind. Technically, this building, **perfectly isolated, uses a system of double flow ventilation, which warms the incoming air with the warmth of the exhaust air, by an exchange between large conductive metal surfaces. In the winter, this allows the exhaust air to give its heat to the cold incoming air.**

The project spatially expands the double flow heat exchange air renewal system, which is normally the size of a machine, to the size of the entire building. So, all the rooms of the building participate in the exchange of heat, depending on recommended temperatures related to the functions: from the hottest at 22 ° C for the showers and changing rooms, to the coldest at 12 ° C for storage room. The toilets and corridors form the chemically-sealed boundary between the incoming fresh air and the returning hot air, and are where the heat exchange to the metal walls happens, warmer at the north of the building and colder at the south of the building."[1]

(1) http://www.philipperahm.com/data/projects/sundihop/index.html



MERGOSCIA HOUSE

Philippe Rahm

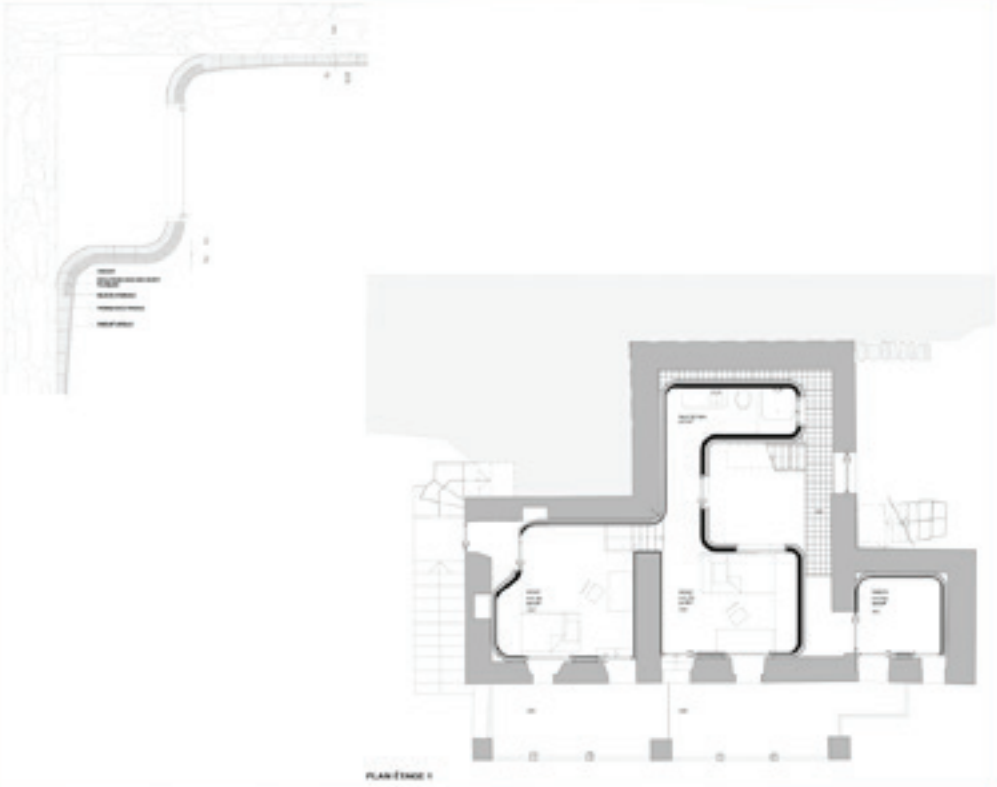
KEYWORDS: PRESSURE

34

"The project questions the coefficient of thermal ductibility, U, of a facade that is achieved with a depth of thermal insulation. **Our project proposes a new layer of thermal insulation that is offset from the existing stone façade in order to define intermediary spaces with a slightly lower thermal coefficient which is more sensitive to the exterior climate.** Now more variable, the renovated architecture makes a sensual dialogue with the seasons, weather movements, exposure to sunlight and the physical quality of the soil. **Next, a chimney of sorts continuously grows up and down as a secret and irrational passage. Less controlled but still thermally tempered, it develops itself within the entire house, making a set of open climate situations,** with the coldest and wettest at the bottom and warmest and driest at the top.

It is in these spaces that the fruits of the garden, as well as objects and clothes, are conserved, **according to their requirements of moisture content and temperature**. Mint leaves dry at the top, canned vegetables, stored away from the daylight, syrup, broth, and apples at the bottom...We go through this intermediary space more sensitive to the variations in weather and geology. We consider these intermediary spaces a new landscape, not quite inside nor entirely outside, **more natural yet totally artificial,** which opens itself to the perfectly isolated interior spaces. In this way, they are like new windows added to the existing ones, creating a temperate climate landscape where one passes through to move between floors." [1]

(1) http://www.philipperahm.com/data/projects/thermalconductivity/index.html



PLAN ÉTAGE 1

VAPOR APARTMENTS

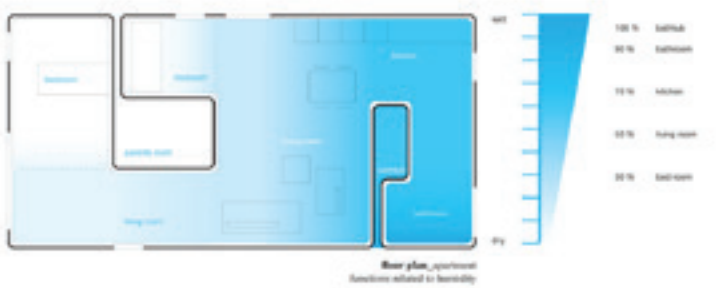
Philippe Rahm

KEYWORDS: PRESSURE

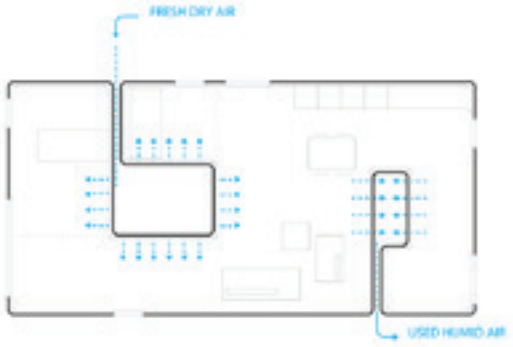
35

"The design of this building is based on the route of vapor throughout the house. Indeed, **the new double-flux system of air renewal ventilation** of the building (one of the most efficient ecological solution today for decrease the energy consumed in the building) requires a precise one-way route of the course of the air in the house. T**he air renewal starts in the driest part of the house and finishes in the most humid part of the house,** because we don't want to bring back humidity in the dry area of the house. There is a slow stream of air, running in the entire building, exhausting the humidity in the air in one way, starting from the dry area (the bedroom) and becoming always more wet in the route though the house to the wet area (the bathroom). This route of this air is determined by the use of the space and the vapor produced by the body in relation with the physical activity performed there. **One man produces 40 grams of vapor during one hour when he is sleeping, 150 grams of vapor when he is awake, 1500 grams when he cooks, 2400 grams of vapor when he takes a shower.** The aim of this project is to compose the plan of the apartment on the **cartography of the indoor humidity** in order to create a more sensual relationship to the space. ... **Instead of just answering with a technical solution to the problem of the humidity in the air, we want to transform this problem in a poetic way into a sensual landscape** ... stretched between a miniature desert and an indoor tropical jungle, between a dry area at 30% of relative humidity and a wet region at 90% of relative humidity where the inhabitants could freely wander."[1]

(1) http://www.philipperahm.com/data/projects/vaporapartments/index.html



floor plan_apartment
functions related to humidity



floor plan_apartment
air flow related to the double flux air renewal with heat exchanger

ENVIRONMENT-BUBBLE

Reyner Banham, Francois Dallegret (1965)

"Banham's original concept of "environmental management," whereby architecture asserts itself in the most minimal means possible, is reminiscent of Marc-Antoine Laugier's primitive hut. In his Essai sur l'architecture (1753) Laugier argues for a return to simplicity as a means to achieve architectural perfection. He writes, "From now on it is easy to distinguish between the parts which are essential to the composition of an architectural order and those which have been introduced by necessity or have been added by caprice." For Laugier, what forms the essential in architecture is limited to the column, entablature, and pediment. By way of a back-to-nature philosophy, architecture was to provide only the basic requirements for shelter.

Over two hundred years later, Banham was asking similar questions about primitive enclosures, but with an emphasis on the relationship between architecture and technology, or what he refers to as "shelter performance." What the pneumatic afforded, as demonstrated by the original Environment-Bubble, was the eradication of Laugier's tripartite organization of architecture. In lieu of columns, beams, and a roof, Banham and Dallegret's bubble offered a paradigm shift whereby a barely there membrane could provide all of the structural and environmental properties of a hut. Here, the bubble subverts the hut as an architectural ideal—a "new nature" defined through the deployment of contemporary materials and mechanical systems. Although not necessarily a solution, the pneumatic emerged in the 1960s as an archetype for architectural experimentation."[1][2]

(1) https://www.flux.com/architecture/structural-instability/1967/03/environment-and-bagpipes/
(2) https://www.fac.centre.fr/_en/art-and-architecture-collection/dallegret-francois-s-home-not-house-10?tx_fluidfac%5Bcontroller%5D=Item

36

François Dallegret
Un-house. Transportable standard-of-living package. The Environment-Bubble., 1965

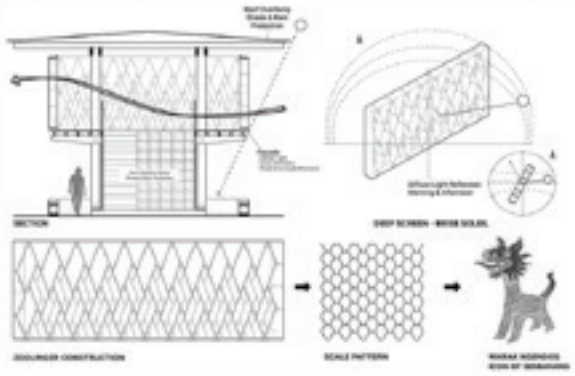
Drawing
Encre de Chine sur film translucide et gélatine sur acétate transparent
76 x 76 cm
1/6
005.12.05

MICROLIBRARY WARAK KAYU

SHAU | Semarang, Indonesia (2020)

"Microlibrary Warak Kayu represents SHAU's **passive climate design,** material and typology experimentation for the tropical context. The building is elevated, like a traditional **'rumah panggung' (house on stilts)** because it does not only function as library but adds value by becoming a community center. The **brise soleil is based on the 'Zollinger Bauweise'** a construction which forms a reciprocal system, resulting in a distinctive slightly shifted diamond pattern. This pattern happens to resemble a local mythical creature 'Warak Ngendog' and its dragon-like skin. Hence the name Warak Kayu – meaning Wooden Warak. The building is made entirely from FSC certified wood."[1]

(1) http://www.shau.nl/en/project/64



SESSAT AGUNG

Andramatin, 2017

38

"Sessat Agung is a cultural community center in Tulang Bawang Barat's Islamic Center, in **Lampung**. Architecturally it's a simple **stage-house** that's made out of wood, with a contemporary twist. It has a box massing treatment below, and nine gable roofs. In its ceiling, there are the names of the eleven ancient villages in Tulang Bawang Barat, written in Kaganga script. Before anything was built, the site was a swamp, surrounded by rubber plantations. The swamp has now been replaced with a large pool surrounding the two buildings, mosque and Sessat Agung. Water has become an important factor to both of the buildings. Aside from adding aesthetic value, the **water keeps a cool air flow,** and reflects the beautiful view across the pond. As the As-Sobur Mosque's counterpart, the Sessat Agung is spread out horizontally to express human being's relationship with one another, or in Islam known as habluminannas."[1]

(1) reference reference reference reference reference
(2) reference reference reference reference reference reference reference

CREMATORIUM IN THUN

TEDA ARQUITECTES, MACCARI CARRERA ARCHITECTS

39

"Soul Building
Moving between life and death
Life is understood as a path, a sequence of stages, of moments in which there is a definite time. In the building the visitor walks between life-tree-water and death-chimney-smoke"[1]

(1) https://divisare.com/projects/137724-teda-arquitectes-maccari-carrera-architects-crematorium-in-thun

CREMATORIUM SIESEGEM

KAAN Architecten

40

"Next, to the ceremony spaces, the technical aspects of the building are also a fundamental part of the design. The architects endeavor to disclose, rather than hide the cremation process, creating an unusual yet effective polarity between the mechanics and the serenity. The soft sandy yellow color of the furniture is echoed by the ovens and the chimney that stretches up through a glazed opening in the roof. A sense of dignity and intimacy infuses the building."[1]

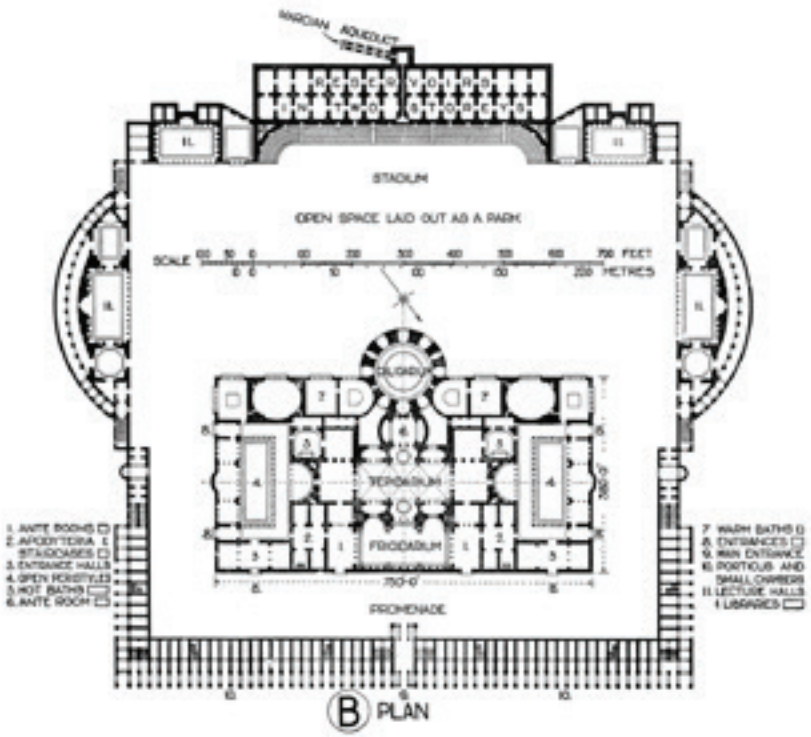
(1) https://www.archdaily.com/1635757/crematorium-siesegem-kaan-architecten

ROMAN THERMAL BATHS

"The baths followed the "great Imperial baths" blueprint for Roman baths. Besides being used for bathing, the complex also offered facilities for taking walks, reading/studying, exercise and body care. The main building stood in the centre with no connections to the surrounding walls, which housed the cisterns, two symmetrical libraries (south), two large exedras (east and west) and tabernae (shops) to the north. The surviving library measures 38 by 22 meters. Between the outer wall and the central complex were gardens (xystus).

The axis of the baths was laid out in a northeast to southwest fashion to make use of the sun's heat. The caldarium faced southwest, the frigidarium northeast. Overall, the bath area was arranged along a single linear axis.

The tunnels served to heat the baths and as sewers for the outflow of water. They were also used to store the fuel for the furnaces – which are estimated to have burned around 10 tons of wood per day. Storage capacity had been estimated at more than 2,000 tons of wood."[1] [2]



(1) https://www.ancient.eu/image/11173/plan-of-the-baths-of-caracalla/
(2) https://en.wikipedia.org/wiki/Baths_of_Caracalla#cite_note-Bodel-1

ROMAN THERMAL BATHS:
HYPOCAUST

"Hypocaust, in building construction, open space below a floor that is heated by gases from a fire or furnace below and that allows the passage of hot air to heat the room above. This type of heating was developed by the Romans, who used it not only in the warm and hot rooms of the baths but also almost universally in private houses in the northern provinces.

Many examples of such hypocausts exist in villa and house foundations in Roman centres in Germany and England. The usual custom was to lead the hot air from a hypocaust into a single vertical flue in the wall of the room to be heated, through which the hot air and smoke escaped into the open air. Where greater warmth was desired, several flues would lead up from the hypocaust in the side walls of the room; at times these wall flues consisted of hollow oblong tiles set close together entirely around the room.

The usual construction of a basement hypocaust consisted of a layer of tiles laid continuously in a bed of concrete for the bottom surface. Piers approximately 8 inches (20 cm) square and about 2 feet apart were used as the supports for the hypocaust's internal space. The floor above was made of concrete or of large square tiles supporting a bed of concrete, on which the finished floor of marble or mosaic tessera was laid."[1]

(1) https://www.britannica.com/technology/hypocaust

ROMAN THERMAL BATHS:
TEPIDARIUM

43

"The tepidarium was the warm (tepidus) bathroom of the Roman baths heated by a hypocaust or underfloor heating system. The speciality of a tepidarium is the pleasant feeling of constant radiant heat which directly affects the human body from the walls and floor."[1]

(1) https://en.wikipedia.org/wiki/Tepidarium

ROMAN THERMAL BATHS:
CALDARIUM

44

"This was the hottest room in a Roman bath. At the Baths of Caracalla, the room was 115 feet wide and crowned with a concrete dome.

The hot water and steamy air were designed to open your pores, and water and air temperatures may have risen well above 100 degrees Fahrenheit, with a sticky 100 percent humidity to exaggerate the effect. At the Baths of Caracalla, the caldarium consisted of a large hall that contained a large pool a little over three feet deep. If you had slaves attending you, they might use a pouring dish called a patara to refresh you with cool water.

This room and its waters, like the tepidarium, were heated by the hypocaust, the system's furnace. The hypocaust, below ground and stoked by slaves, heated a tank of water transported by pipe to the appropriate pool.

The furnace heated the air drawn underneath the floor of the caldarium to heat its tiles. You would have probably worn sandals or wooden clogs so as not to scorch your feet. Hot air then rose up through hollowed-out bricks that lined the walls before exiting through chimneys." [1]

(1) https://www.pbs.org/wgbh/nova/lostempires/roman/caldarium.html

ROMAN THERMAL BATHS:
FRIGIDARIUM

45

"A frigidarium is a large cold pool at the Roman baths. When entering the bath house, one would go through the apodyterium, where they would store their clothes. After the caldarium and the tepidarium, which were used to open the pores of the skin, the frigidarium would be reached. The cold water would close the pores, however, hot water will open them. There would be a small pool of cold water or sometimes a large swimming pool (though this, differently from the piscina natatoria, was usually covered). The water could be also kept cold by using snow." [1]

(1) https://en.wikipedia.org/wiki/Frigidarium

ECOLOGY WITHOUT NATURE

Rethinking Environmental Aesthetics

Timothy Morton

46

"In Ecology without Nature, Timothy Morton argues that **the chief stumbling block to environmental thinking is the image of nature itself.** Ecological writers propose a new worldview, but their very zeal to preserve the natural world leads them away from the "nature" they revere. The problem is a symptom of the ecological catastrophe in which we are living. Morton sets out a seeming paradox: **to have a properly ecological view, we must relinquish the idea of nature once and for all."**

"The mesh is about intimacy across distances ... we realize we are caught in the mesh, we are no longer able to imagine an outside, an exterior, a perch from which we might observe the vast array of interdependencies and interconnections that comprise Earth systems."[2]

"Environmentalism is a set of cultural and political responses to a crisis in human's relationship with their surroundings ... they struggle against pollution, ... risks of nuclear technologies and weaponry ... fight for animal rights and vegetarianism ... oppose globalization and the patenting of life-forms. Environmentalism is broad and inconsistent."[3]

(1) https://www.hup.harvard.edu/catalog.php?isbn=9780674035812
(2) Barnett, Joshua Trey. The Ecological Awareness of an Anthropocene Philosophe. Environmental Communication: 2008, Vol. 1,1 Issue 1 p083-101. 19p.
(3) Morton, Timothy. Ecology Without Nature: Rethinking Environmental Aesthetics. p.1

PETRICHOR

47

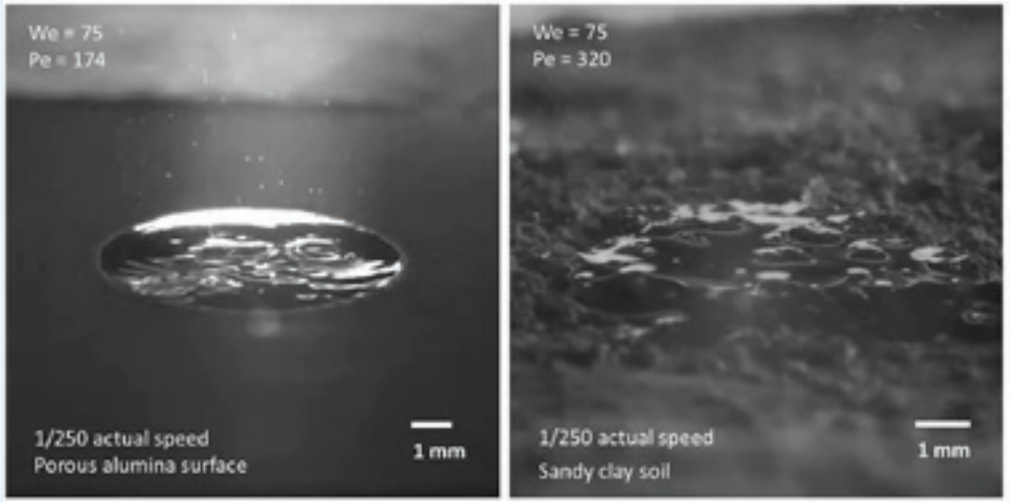
The smell of rain

"Bacteria, plants and even lightning can all play a role in the pleasant smell we experience after a thunderstorm; that of clean air and wet earth.

Known as petrichor, the scent has long been chased by scientists and even perfumers for its enduring appeal.

"So when you're saying you smell damp soil, actually what you're smelling is a molecule being made by a certain type of bacteria."

That molecule, geosmin, is produced by Streptomyces. Present in most healthy soils, these bacteria are also used to create commercial antibiotics. Drops of water hitting the ground cause geosmin to be released into the air, making it much more abundant after a rain shower.[1] [2]



(1) https://www.bbc.com/news/science-environment-44834298
(2) Samfist Can Release Aerosols, High Speed Video Shows, https://www.youtube.com/watch?v=9gpAuMDKmw

MONUMENTAL ARCHITECTURE:
a thermodynamic explanation of symbolic behaviour

Bruce G. Trigger

Abstract

While human beings cope with the production and distribution of goods by trying to achieve maximum efficiencies in energy expenditures, **the basic way they symbolize power is through the conspicuous consumption of energy,** control of which is the fundamental measure of power. Conspicuous consumption occurs in the form of monumental construction, supporting large numbers of energy consumers, production of high energy-consuming luxury goods, and an emphasis on non-useful movement (processions, needlessly large rooms, etc.). By expanding the concept of energy-use to cover conspicuous consumption as well as efficiency of production, it can be seen as a basic factor in shaping the political as well as the economic behaviour of human beings and can explain why, as systems of inequality evolve, monumental architecture becomes an increasingly prominent feature of the archaeological record. This enlarged concept would also broaden a materialist perspective on human behaviour to take account of many significant aspects of the ideational components of such behaviour that appear in the archaeological record.

(1) Trigger, Bruce G. Monumental architecture: a thermodynamic explanation of symbolic behaviour. https://www.jstor.org/stable/23487...

BEYOND THERMAL MONOTONY

Salmaan Craig

49

"And it's not the temperature that counts, but **the degree of difference. In other words, the rate of exchange.** Before entering the pool, the body core is cool - indeed, it is cooling. On entering the pool, the skin temperature spikes.

The brain is a difference engine, calculates that the thermal contrast is good. The body core temperature will soon rise to where it ought to be.

The monkey, a hedonist, plays on this. He adjusts his immersion to sustain the difference, to extend the pleasure. Below the water line, it's hot and viscous; aboe its cold, hsarp and steamy. Thermal texture. Thermal bliss.

Our thermal receptors are change-seeking. Make architecture that puts them and us on alert; **away from thermal monotony, thermal indiference; toward thermal texture."**

(1) Craig, Salmaan. Beyond Thermal Monotony. (from Abalos, I., Sentkiewicz, R., & Ortega, L. (2013). Abalos Sentkiewicz: Essays on thermodynamics, architecture and beauty. New York: Actar D.)

EFFECT OF BUILDING INTERFACE FORM ON THERMAL COMFORT IN GYMNASIUMS IN HOT AND HUMID CLIMATES

Xiaodan Huang, Xiaoli Ma, Qingyuan Zhang

50

"On the one hand, the influence of the top interface form of gymnasium on thermal comfort was mainly dominated by the mean radiant temperature, and thermal comfort could be improved by controlling the radiation. **The radiation from the top of the buildings could be decreased by constructing double roofs where the air layer is sandwiched**, similar to the top interface form of SCUT Gym. Shading components, grass-covered roofs, and insulation materials could also be used. However, **horizontal skylights should be avoided in this case, where heat is absorbed directly.** The influence of the side interface form of gymnasiums on **thermal comfort was mainly dominated by air velocity, and thermal comfort could be improved by promoting natural ventilation on the side interface form to reduce indoor heat.** Controlling the open areas of side interfaces and setting up overhanging eaves and window blinds on the side interfaces could improve the effect of natural ventilation by means of wind pressure and thermal pressure ventilation, similar to the side interface forms of SCUT Gym and WL Gym."[1]

"The Occupational Safety and Health Administration makes recommendations for a workplace to be maintained between **68 and 76 degrees Fahrenheit,** with a **humidity level between 20 to 60 percent.** The gym is not a typical workplace, however. OSHA's regulatory language regarding gym temperature is vague and recommends only that it be measured by the clients' level of comfort. The International Fitness Association suggests that areas **near pools be kept between 70 and 80 degrees and to maintain aerobics, cardio, weight-training and Pilates rooms at approximately 65 to 68 degrees. Yoga classes can be closer to 80 degrees and humidity levels for all areas should be around 40 to 60 percent. ... Sauna rooms are kept at 160 degrees and whirlpool baths around 102 degrees."**

(1) https://www.sciencedirect.com/science/article/pii/S2095263513000754
(2) https://www.livestrong.com/article/450991-gym-temperature-humidity-requirements/

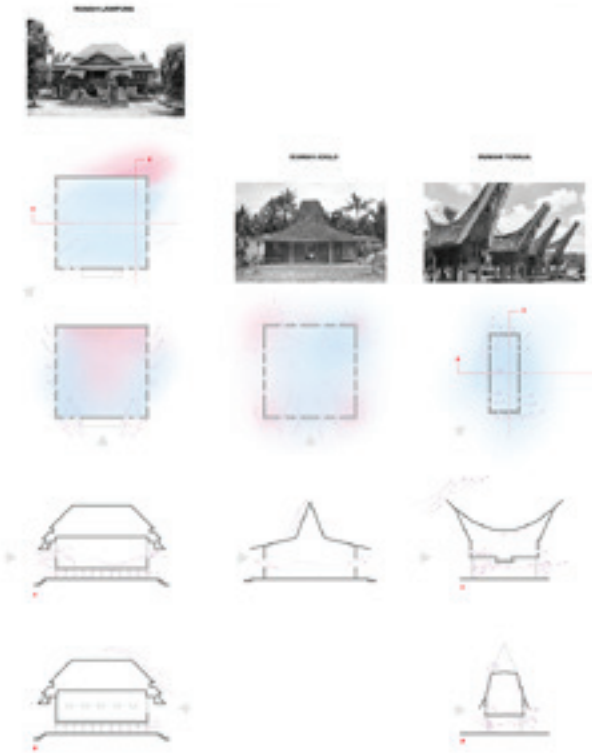
SOUTH EAST ASIAN "VERNACULAR"

Ju and Kim in their book writes about the three crucial aspects of Southeast Asian housing, which are the roofs, walls, and piles. These three aspects play a role in altering the climate within the houses.

Roofs in Southeast Asian houses represent more than functional roles. The bigger the roof, the higher up in social stature. However, the steep angles of these roofs, along with materials that do not absorb water, allow rainwater to fall to the ground quickly. Underneath these roofs are also equipped with a small gap with the wall to allow ventilation.

Walls in these traditional houses typically have windows that span from top to bottom. Materials that are used include waved palm and split bamboo. Separators within the house are just screens that allow 'bare minimum of privacy.' These houses maximize and prioritize ventilation.

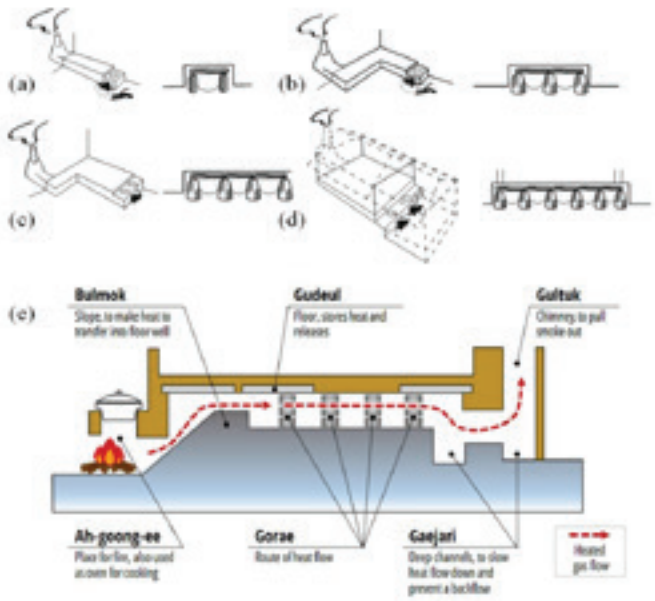
Piles not only elevate, but the floors of these pile-built houses are made with a material that allow currents of cool air being drawn upwards to provide ventilation.



KOREAN ONDOL

"Ondol in Korean traditional architecture, is underfloor heating similar to a Kang bed-stove that uses direct heat transfer from wood smoke to heat the underside of a thick masonry floor. In modern usage it refers to any type of underfloor heating, or to a hotel or a sleeping room in Korean (as opposed to Western) style.

The main components of the traditional ondol are an agungi (firebox or stove) accessible from an adjoining room (typically kitchen or master bedroom), a raised masonry floor underlain by horizontal smoke passages, and a vertical, freestanding chimney on the opposite exterior wall providing a draft. The heated floor, supported by stone piers or baffles to distribute the smoke, is covered by stone slabs, clay and an impervious layer such as oiled paper."[1]



(1) https://en.wikipedia.org/wiki/Ondol

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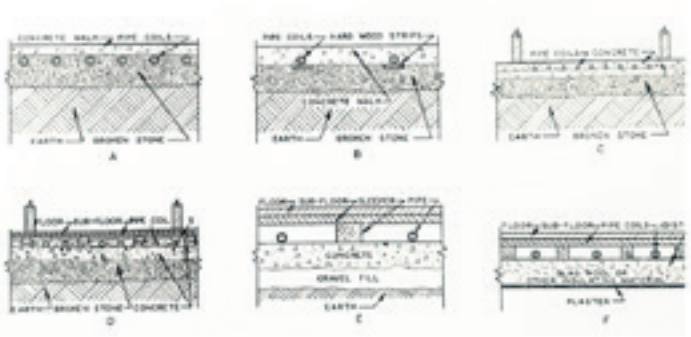
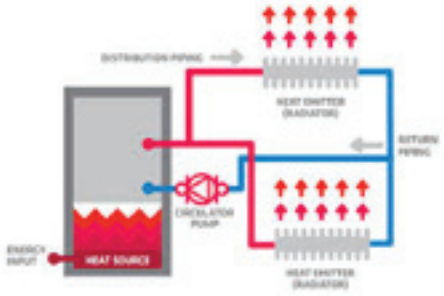
BATISO BUILDING
Batiso buildings are "constant temperature buildings" with emphasis on high performance building envelope. It relies on cast-in-place concrete for thermal mass, with hydronics system to control radiant temperatures of floors and ceilings, for cold to moderate climates.

HYDRONICS

54

Hydronics are 1950s post-war development of surface heating systems, as opposed to air-based convection conditioning systems. Ultimately, hydronics becomes less popular in America due to its difficulties in preventing leak. Hydronics are more commonly in European buildings.



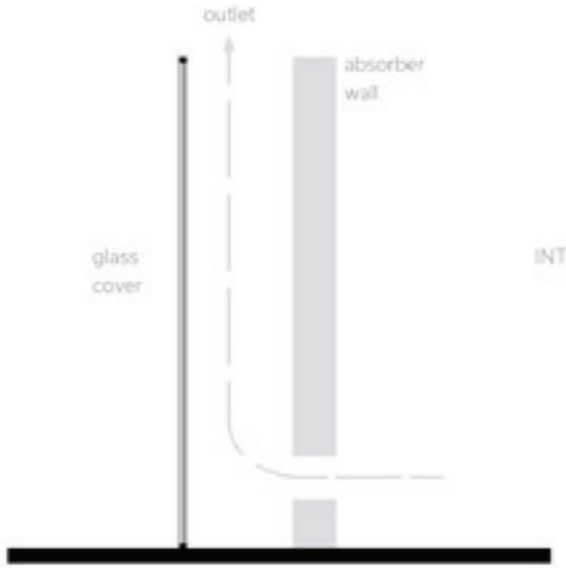


(1) Moe, Kiel. Thermally active surfaces in architecture. New York: Princeton Architectural Press, 2010. Print.

THERMAL CHIMNEY

#55

"A thermal chimney is a vertical shaft that utilizes solar radiation to enhance the natural ventilation in buildings. This is achieved as a result of the fact that the solar energy causes a temperature rise as well as a density drop in the air inside the thermal chimney. The drop in air density causes air within the thermal chimney to rise and be expelled out of the top of the chimney. The air which leaves the thermal chimney is typically replaced with outside air that is first drawn through the building to provide natural cooling. This building feature is typically composed of an absorber wall, an air gap and a glass cover with high solar transmissivity and is designed to maximize solar gain in order to increase the chimney effect and thus the air flow generated by the chimney."



EARTH TUBES

56

"An earth tube is a long, underground metal or plastic pipe through which air is drawn. As air travels through the pipe, it gives up or receives some of its heat to/from the surrounding soil and enters the room as conditioned air during the cooling and heating period."[1]

(1) https://www.sciencedirect.com/science/article/pii/S0378778803001204
(2) https://www.aivc.org/sites/default/files/airbase_7723.pdf

THERMAL CHIMNEY + EARTH TUBES

The different zones assigned to thermal strategies, such as the thermal chimney or the earth duct, have their own distinct temperatures. This project will look into making these zones occupiable in size and desirable for certain human activities, regardless of their comfort level. This way these zones will not just be zones to make the indoor temperature comfortable, but also a meaningful space that challenges the notion of comfort. Their difference in temperature will create different kinds of suitable activities, which might be an interesting challenge to the notion of comfort (see diagram 1).

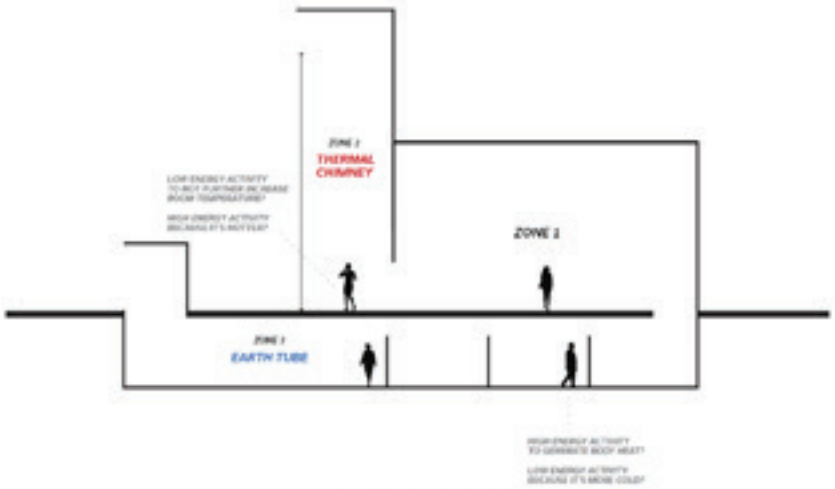


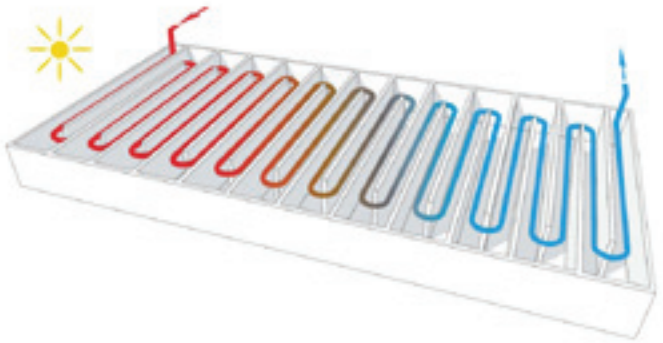
Diagram 1: Occupiable zones

FOG COLLECTOR

THERMAL LABYRINTH

59

"Ventilation is essential to maintaining a healthy indoor environment. However, during the summer and winter seasons, the temperature of the outdoor air can be so extreme that providing adequate ventilation requires a significant amount of energy. Consequently, an energy-efficient ventilation system is important for minimizing energy consumption. **The thermal labyrinth is a ventilation system that pulls in outdoor air through an underground labyrinth-shaped concrete structure that is part of the building itself. Through heat exchange with the ground, this system can pre-cool and pre-heat the outdoor air in the summer and winter seasons, respectively.** The goal of this study was to evaluate the energy performance of the thermal labyrinth ventilation system (TLVS) used in the Ewha Campus Center building recently built in Seoul, South Korea. By using the TLVS, the peak loads for the cooling and dehumidification and the heating and humidification of the outdoor air were found to be reduced by 47.6% and 41.2%, respectively. The annual energy need for conditioning outdoor air was reduced by 31.3%, and a payback period of 12.1 years was calculated."[1][2]



(1) https://www.sciencedirect.com/science/article/pii/S0378778813003254 - text=The%20thermal%20labyrinth%20is%20a,and%20dehumidification%20and%20the%20heating

(2) https://www.designingbuildings.co.uk/wiki/Thermal_labyrinths

people / project
text
technology
products
materials
events
policy
organizations

ECOSTRESS
CALIFORNIA WILDFIRES

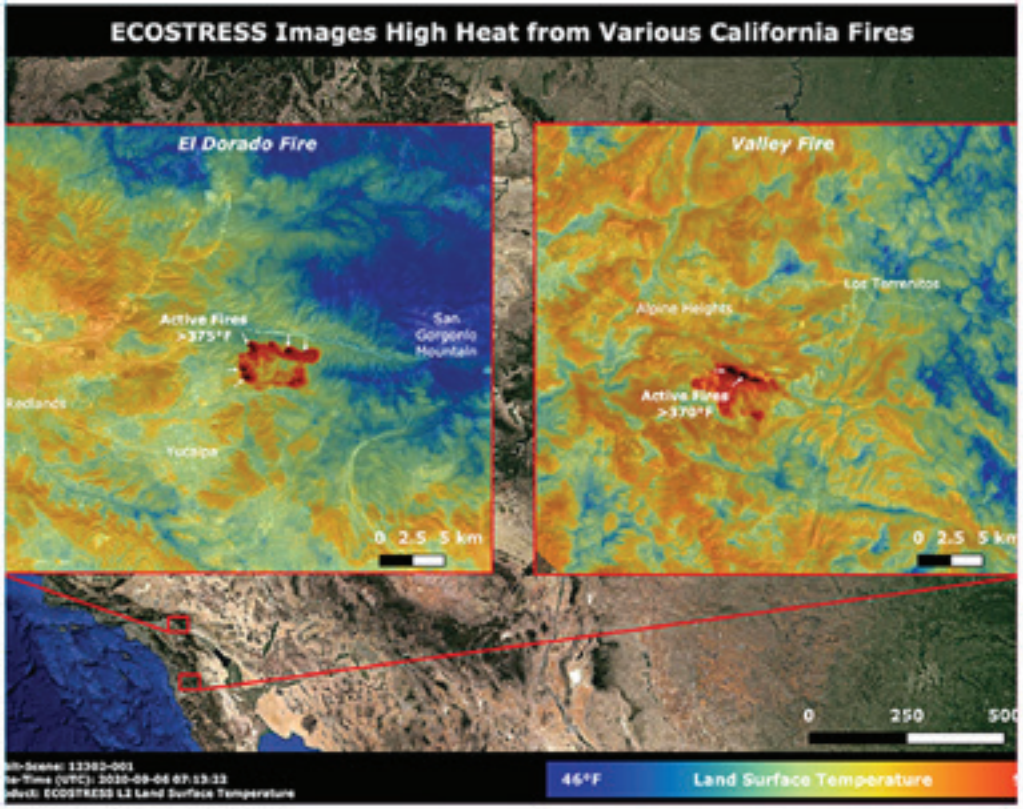
"ECOSTRESS is addressing three overarching science questions:

- How is the terrestrial biosphere responding to changes in water availability?
- How do changes in diurnal vegetation water stress impact the global carbon cycle?
- Can agricultural vulnerability be reduced through advanced monitoring of agricultural water consumptive use and improved drought estimation?

The ECOSTRESS mission is answering these questions by accurately measuring the temperature of plants. Plants regulate their temperature by releasing water through tiny pores on their leaves called stomata. If they have sufficient water they can maintain their temperature, but if there is insufficient water, their temperatures rise and this temperature rise can be measured with ECOSTRESS. The images acquired by ECOSTRESS are the most detailed temperature images of the surface ever acquired from space and can be used to measure the temperature of an individual farmers field.

One of the core products that will be produced by ECOSTRESS team is the Evaporative Stress Index (ESI). ESI is a leading drought indicator - it can indicate that plants are stressed and that a drought is likely to occur providing the option for decision makers to take action."

(1) https://ecostress.jpl.nasa.gov/



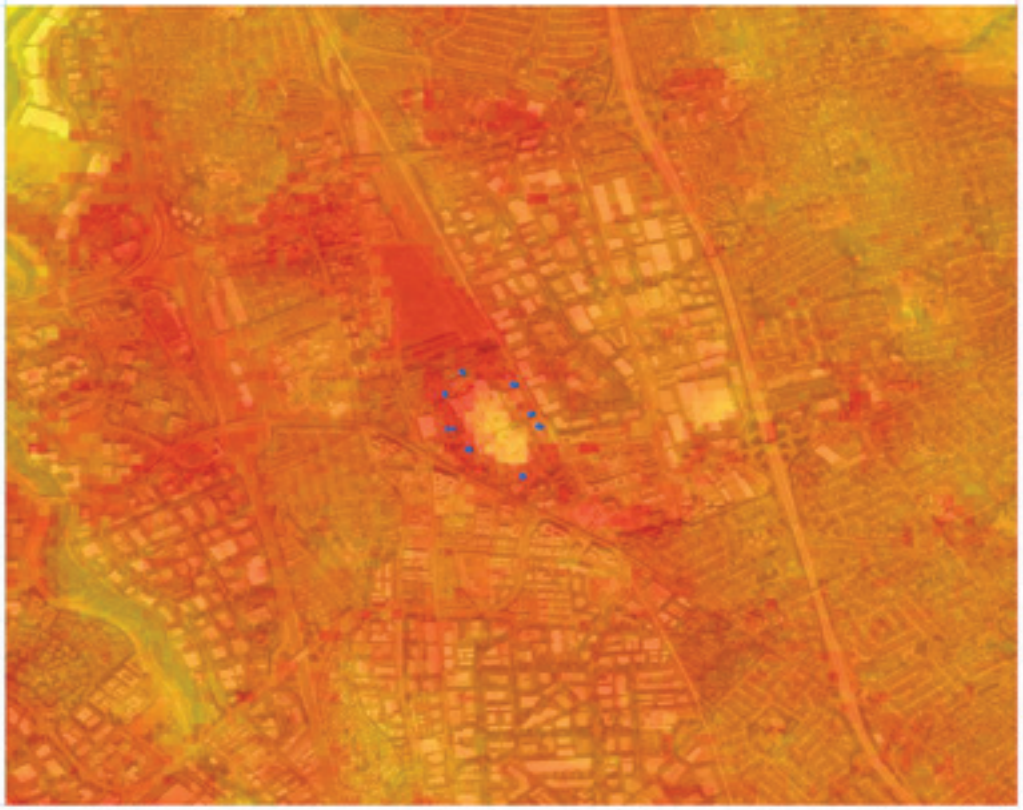
ECOSTRESS
COVID-19 AND SURFACE TEMPERATURE

61

"Potter is asking questions like, if automobiles are parked and concentrated in giant lots, do you change the reflectance of the surface and the overall heat flux? Even shiny car windows may be enough to reflect sunlight, Potter said.

Potter and his team want to know how the entire Bay Area's urban heat flux has changed during the pandemic, and how that change has contributed to a more or less healthy environment for the millions of people living in it. Understanding potential changes in the thermal heat flux is a key indicator of how COVID-19 has altered the Bay Area's environmental footprint, Potter said.

This image shows the ECOSTRESS land surface temperature variations measured on May 22, 2020, during the full lockdown period over an area centered on the Great Mall in Milpitas. The blue dots represent ground truth measurements on May 22 in large vacant parking lots. The darkish reddish shades show the highest temperatures on dark asphalt parking lots and roadways, and the yellow-greenish shades indicate lower temperatures in parklands and semi-vegetated areas. Bright white rooftops are in the middle shades."[1]



(1) https://www.nasa.gov/feature/jpl/2020-how-projects-explore-connections-between-environment-and-covid-19

SERVER ROOM SPECIFICATIONS

*Spatial Specifications

- **Room should have no windows.**
- **Ensure space is large enough for future growth**
- **Ceiling should be at least nine feet**
- **Should have drop ceiling return to exhaust heat**

Equipment Specifications

- Computer racks should have a **clearance** of at least 42 inches.
- All racks should have proper grounding and seismic bracing.
- Computing equipment should have a maximum electrical intensity of 300 watts/sqf.
- Server room should contain **fire, smoke, water and humidity monitors.**

Cooling Specifications

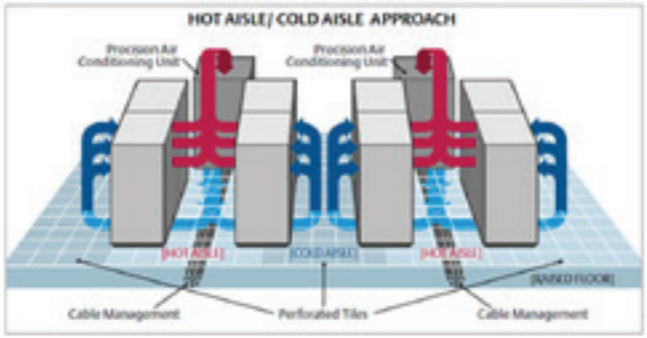
- Racks should be arranged in a **hot-aisle/ cold-aisle configuration.**
- Use cooling equipment with variable speed fans.
- Plan for redundancy, do not rely on building cooling for back-up.
- Under floor cooling systems require a raised floor with a minimum height of 24 inches, with the ability to hold the weight of server racks and equipment.

Electrical Systems Specifications

- Computer equipment and HVAC should have separate power panels.
- There should be no heat-generating support equipment.
- Electrical systems should have an isolated ground, grounding grid and dedicated neutral.
- Separate back-up power should be available for data center.
- The electrical system should have a shunt trip for purposes of emergency shutdown.[1,3]

* ... not just precision cooling but also temperature monitoring. Heat kills equipment and wherever there is air conditioning installed within a server environment ... Should the air conditioning cooling a high-density server rack fail, the high amount of power being drawn (10-30kW) could lead a sudden and critical rise in temperature with server CPU failure within minutes with the potential for fire to break out.[2,3]

(1) https://www.network.intel.com/checklist-for-designing-a-new-server-room/#gs.gBuDq
(2) https://www.serverroomenvironments.co.uk/blog/design-guide-checklist-server-room-facilities
(3) https://www.emerson.com/prhoddetail/precision-ac-server-room-cooling-system-ILA3000675?Q=DRH



WEATHERIZING YOUR HOME

energy.gov

63

"Weatherization Topics:

Home Energy Audits
A home energy audit, also known as a home energy assessment, can help you understand the whole picture of your home's energy use.

Air Sealing Your Home
Reducing air leakage in your home saves money and energy.

Insulation
Insulation saves homeowners money and improves comfort.

Moisture Control
Controlling moisture can make your home more energy efficient, less costly to heat and cool, and more comfortable.

Ventilation
Controlled ventilation keeps energy-efficient homes healthy and comfortable."

(1) https://www.energy.gov/energysaver/weatherize

VENTILATION

energy.gov

64

"ASHRAE has determined that a home's living area should be ventilated at a CFM rate determined by adding 3% of the conditioned space floor area to 7.5 times the number of bedrooms plus one ... as published by ASHRAE 62.2 in 2013. In a tight home, mechanical ventilation is necessary to achieve this ventilation rate.

NATURAL VENTILATION

Natural ventilation is the uncontrolled air movement in and out of the cracks and small holes in a home. In the past, this air leakage usually diluted air pollutants enough to maintain adequate indoor air quality. Today, we are sealing those cracks and holes to make our homes more energy-efficient, and after a home is properly air sealed, ventilation is necessary to maintain a healthy and comfortable indoor environment. Opening windows and doors also provides natural ventilation, but many people keep their homes closed up because they use central heating and cooling systems year-round.

Natural ventilation is unpredictable and uncontrollable—you can't rely on it to ventilate a house uniformly. Natural ventilation depends on a home's airtightness, outdoor temperatures, wind, and other factors. During mild weather, some homes may lack sufficient natural ventilation for pollutant removal. During windy or extreme weather, a home that hasn't been air sealed properly will be drafty, uncomfortable, and expensive to heat and cool.

SPOT VENTILATION

Spot ventilation can improve the effectiveness of natural and whole-house ventilation by removing indoor air pollution and/or moisture at its source. Spot ventilation includes the use of localized exhaust fans, such as those used above kitchen ranges and in bathrooms. ASHRAE recommends intermittent or continuous ventilation rates for bathrooms of 50 or 20 cubic feet per minute and kitchens of 100 or 25 cubic feet per minute, respectively.

WHOLE-HOUSE VENTILATION

The decision to use whole-house ventilation is typically motivated by concerns that natural ventilation won't provide adequate air quality, even with source control by spot ventilation. Whole-house ventilation systems provide controlled, uniform ventilation throughout a house. These systems use one or more fans and duct systems to exhaust stale air and/or supply fresh air to the house.

There are four types of systems:
Exhaust ventilation systems work by depressurizing the building and are relatively simple and inexpensive to install.
Supply ventilation systems work by pressurizing the building, and are also relatively simple and inexpensive to install.
Balanced ventilation systems, if properly designed and installed, neither pressurize nor depressurize a house. Rather, they introduce and exhaust approximately equal quantities of fresh outside air and polluted inside air.
Energy recovery ventilation systems provide controlled ventilation while minimizing energy loss. They reduce the costs of heating ventilated air in the winter by transferring heat from the warm inside air being exhausted to the fresh (but cold) supply air. In the summer, the inside air cools the warmer supply air to reduce ventilation cooling costs.

Ventilation for cooling is the least expensive and most energy-efficient way to cool buildings. Ventilation works best when combined with techniques to avoid heat buildup in your home. In some climates, natural ventilation is sufficient to keep the house comfortable, although it usually needs to be supplemented with spot ventilation, ceiling fans, window fans, and—in larger homes—whole-house fans.

Ventilation is not an effective cooling strategy in hot, humid climates where temperature swings between day and night are small. In these climates, however, natural ventilation of your attic (often required by building codes) will help to reduce your use of air conditioning, and attic fans may also help keep cooling costs down."[1]

(1) https://www.energy.gov/energysaver/weatherize/ventilation

TROMBE WALL

Lorem ipsum | Lorem ipsum

65

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(1) reference reference reference reference reference

(2) reference reference reference reference reference reference reference

INSULATION

energy.gov

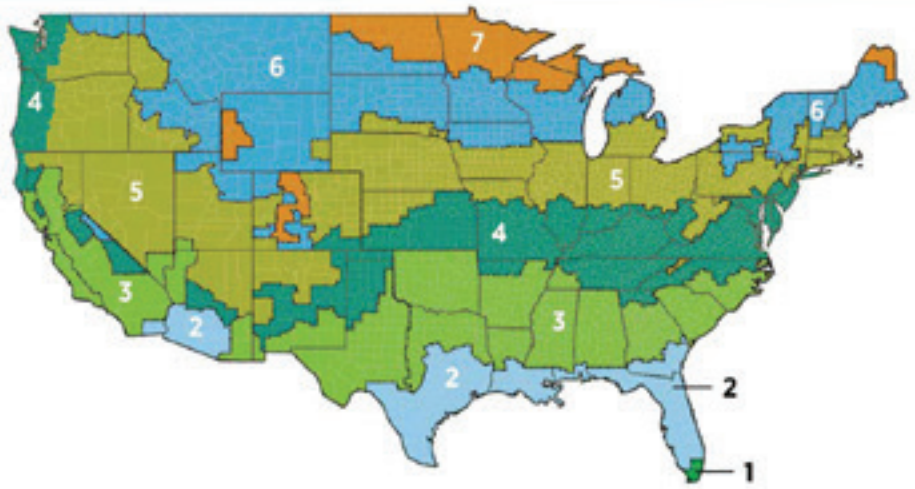
"To understand how insulation works it helps to understand heat flow, which involves three basic mechanisms – **conduction, convection, and radiation.** Conduction is the way heat moves through materials, such as when a spoon placed in a hot cup of coffee conducts heat through its handle to your hand. Convection is the way heat circulates through liquids and gases, and is why lighter, warmer air rises, and cooler, denser air sinks in your home. Radiant heat travels in a straight line and heats anything solid in its path that absorbs its energy.

Most common insulation materials work by slowing conductive heat flow and–to a lesser extent–convective heat flow. Radiant barriers and reflective insulation systems work by reducing radiant heat gain. To be effective, the reflective surface must face an air space.

Regardless of the mechanism, **heat flows from warmer to cooler until there is no longer a temperature difference**. In your home, this means that in winter, heat flows directly from all heated living spaces to adjacent unheated attics, garages, basements, and even to the outdoors. Heat flow can also move indirectly through interior ceilings, walls, and floors–wherever there is a difference in temperature. During the cooling season, heat flows from the outdoors to the interior of a house.

To maintain comfort, the heat lost in the winter must be replaced by your heating system and the heat gained in the summer must be removed by your cooling system. Properly insulating your home will decrease this heat flow by providing an effective resistance to the flow of heat." [1]

(1) https://www.energy.gov/energysaver/weatherize/insulation



	ADD INSULATION TO ATTIC		
Zone	**Uninsulated Attic**	**Existing 3-4 inches of insulation**	**Floor**
1	R30 to R49	R25 to R30	R13
2	R30 to R60	R25 to R38	R13 to R19
3	R30 to R60	R25 to R38	R19 to R25
4	R38 to R60	R38	R25 to R30
5	R49 to R60	R38 to R49	R25 to R30

THE REEDS PERFORMANCE STUDY ON TRADITIONAL ARCHITECTURE AS BUILDING MATERIAL IN WAE REBO VILLAGE

Indri L. Juwono, Dalhar Susanto

"Imperata cylindrica as a traditional material used on the roof of Wae Rebo building is still feasible to be used as construction material, because source on Mules Island produces fine reeds, with low humidity but still has a good tensile strength value, between 43.09 x 104 N/m2 to 32.63 x 104 N/m2 when dried. The drying process decrease the humidity from 17,82% until 9,31% and stable. The water content at extraction comes from the reeds body itself which then evaporates in the drying process is aerated or heated and create a dry and strength reeds, once its humidity come On the extraction phase until the storage of dried reeds the lower humidity of the reeds then the tensile strength decreases.

Reeds have increased tensile strength from dry-only storage phases to constructed use in buildings, with heating treatment from the stove in the building every day, and increased humidity after being constructed on the roof and influenced by daily weather., so the trend of decreasing the value of tensile strength is steeper than the decreasing trend in the maintenance period. Age of older reeds roofs has lower tensile strength values than younger ones."[1]

[1] Juwono, Indri & Susanto, Dalhar. (2018). The Reeds Performance Study on Traditional Architecture as Building Material in Wae Rebo Village. E3S Web of Conferences. 67. 04003. 10.1051/e3sconf/20186704003.

THE FUTURE STARTS HERE

Exhibition at V&A, 2018

68

"The world of tomorrow is shaped by the designs and technologies emerging today. From smart appliances to satellites, this exhibition brings together more than 100 objects either newly released or in development that point towards where society might be headed.

1. Self - What makes us human?

2. Public - Are cities still fro everyone? Does democracy still work?

3. Planet

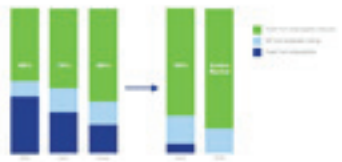
Should the planet be a design project? Human activity has altered our planet to the extent that some scientists have declared a new geological epoch, the 'Anthropocene', or 'age of humans'. Now that we know our behaviour has unintentionally designed the Earth, **can we use technology to reverse the effects?** Some designers are working on possible solutions to **clean, repair or give back to the planet. Others are looking beyond the Earth for solutions in the stars** - designing satellites that scope asteroids for mining new geological resources, and solutions for inhabiting Mars. But if Mars is the answer, what is the question? Can we still save our planet or shall we leave?"

4. Afterlife - Who wants to live forever?[1]

(1) https://www.vam.ac.uk/articles/about-the-future-starts-here-exhibition

THE 2030 COMMITMENT
AIA

"The mission of the AIA 2030 Commitment is to support the 2030 Challenge and transform the practice of architecture in a way that is holistic, firm-wide, project based, and data-driven. By prioritizing energy performance, participating firms can more easily work toward carbon neutral buildings, developments and major renovations by 2030" [1]



[1] https://www.aia.org/resources/ 202043-the-2030-commitment
[2] http://aia2030.org/ (archive)
[3] http://content.aia.org/sites/default/files/2020-09/AIA_2030_DataReleaseJune_2019_0.pdf

DESIGN AND THE ELASTIC MIND

Exhibition at MoMA, 2008

70

" ... One of design's most fundamental tasks is **to stand between revolutions and life, and to help people deal with change.** Designers have coped with these displacements by contributing thoughtful concepts that can provide guidance and ease as science and technology evolve. Several of them—the Mosaic graphic user's interface for the Internet, for instance—have truly changed the world. Design and the Elastic Mind is a survey of the latest developments in the field. It focuses on designers' ability to grasp momentous changes in technology, science, and social mores, changes that will demand or reflect major adjustments in human behavior, and convert them into objects and systems that people understand and use.

The exhibition will highlight examples of successful translation of disruptive innovation, examples based on ongoing research, as well as reflections on the future responsibilities of design. Of particular interest will be the exploration of the relationship between design and science and the approach to scale. The exhibition will include objects, projects, and concepts offered by teams of designers, scientists, and engineers from all over the world, ranging from the nanoscale to the cosmological scale. The objects range from nanodevices to vehicles, from appliances to interfaces, and from pragmatic solutions for everyday use to provocative ideas meant to influence our future choices."

(1) https://www.moma.org/calendar/exhibitions/147

(2) https://www.moma.org/interactives/exhibitions/2008/elasticmind/

ENERGY
Exhibition at MoMA, Fall 2019

"Energy is the indispensable fuel of life for all species. For humans, it has become almost an addiction. The search for new sources of energy and the exploitation of existing ones have driven progress, formed and informed cultures, transfigured landscapes, and ignited wars. Throughout the 20th century, everything from objects to buildings and entire cities was conceived to maximize immediate output and productivity. Modern architecture and design were powered by electricity, and linked to energy production and distribution. In order to secure energy, we have deforested, drilled, mined, extracted, removed mountaintops, and terraformed the planet.

In the 21st century, many designers have become aware of their role and responsibility in these disruptive activities, and have adjusted their practices accordingly. If in the past design led us to devour energy at an ever-growing rate, design can now help us conserve it and behave more responsibly. The objects presented here engage with energy in its myriad forms—from thermal and kinetic to electrical and even reproductive. They represent its sourcing, deployment, consumption, and preservation. They showcase the technological advancements of the past decades, while proposing alternatives for a future in which resources might not be as readily available."[1]

(1) https://www.moma.org/calendar/exhibitions/5103

MoMA

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In conjunction with Energy, The Museum of Modern Art commissioned The Embodied Energy Pilot Project at Columbia University's Graduate School of Architecture, Planning and Preservation to create a series of visualizations about embodied energy—what it is and how it relates to the Museum's new building.

EXPO '70
PROGRESS AND HARMONY FOR MANKIND
Japan World Exposition, Osaka

"The physical plan of Expo glorifies the **paradox between tradition and modernism.** [Japanese contemporary artists] share the international concern for understanding the **complexity of technological society and what it has done to our environment**, ... delve into historical tradition as well as modern technological collaborations between artists and scientists.

Japan's head architect, Kenzo Tange, envisions Expo as a city of the future, stressing **modern advances** such as computerized traffic control, and human coordination of artists, designers, and planners **providing comfort and pleasure in our complex environment.**"[1]

"Four Pillars (Sub-Themes):
1. Have a richer life and achieve better health.
Origin and mystery of life, healthcare, psychology, childbirth and child-rearing, hobbies, etc.
2. Utilize nature in more prosperous ways.
Farm-raising, growing plants, bringing land into cultivation, energies, seabed resources, weather conditions, etc.
3. Design a better everyday life.
Clothes, foods, residential houses, means of transport, pollution prevention, clocks, etc.
4. Mutually understand each other more deeply.
Language, mass media and journalism, communication, education, family, art, cultural exchange, etc."[2]

(1) Hindenwall, Judith. 'Expo '70: Japan's world fair at Osaka.' American Artist, April 1970, Vol. 34, p.27.
(2) Zhongjie Lin , Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan

EXPO '70 *(CRITIQUE)*
PROGRESS AND HARMONY FOR MANKIND
Japan World Exposition, Osaka

Dystopic, won over by consumerism?[2]

"process of transformation and renewal is born not out of human desire, but provoked by entraties of capital"[1]

"planning of the future as a mere extension of technology"[1]

"Why does this papier-mâché city that dreams about the future remind me so much of things that are already prone to decay, the things of the past, or rather, that which exudes the impression of ruins? ... It is because the reality of the everyday and the rawness of the present have been completely stripped away, and therefore all images of the future momentarily fade, turning into the past"[3]

"I cannot think of any other ideas than the following two, for redeveloping former Expo site. ... The first is to eternally leave all the pavilions, all the Expo '70 facilities, they are, in order to show posterity just how ugly material civilization today been. I want to show them how rain, wind, and other natural forces will have eaten into, undermined, and ravaged the exposition site, turning it into a sickly ruin eventually vanishing it altogether. In this way, I can also show posterity that just postulated in thermodynamics, entropy will gradually, yet surely, increase and will eventually vanish, future humankind, too, is destined to eventually vanish, matter how wonderful it may be. The second idea is to vanish all the pavilions entirely, all the facilities of Expo '70 ... In this approach, 3,300,000 square meters of the exposition site will be transformed back into an unsullied piece of land covered by green bamboo groves, where young bamboo shoots will sprout"[4]

(1) Vandenwall, Judith. Expo '70: Japan's world fair at Osaka. American Artist, April 1970, Vol. 34, p.22
(2) Zhongjie Lin , Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan
(3) Ishiki, Hiroyo. Expo '70 as the Ruins of Culture (1970)
(4) Kuroda, Matsuzawa. Master Mesh Version: A Proposal for Redevelopment of the Former Expo Site (1970)

LIVING UPON NATURE

The 46th Nisshin Kogyo Architectural Design Competition 2019

"We are currently asked about how to define "Nature".

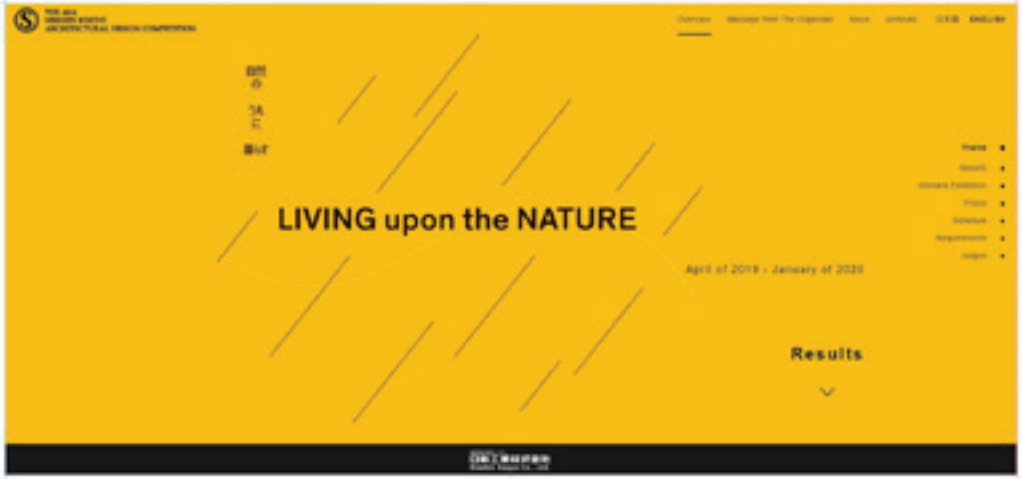
For instance, "Anthropocene" means a new stratum formed by the activity of mankind which has a significant influence on the global environment, such as massive emissions of carbon dioxide and large-scale reclamation. It has been advocated as a geological time after the Holocene. How should we live on such an unstable Earth which is susceptible to human influence?

The phrase "Living upon the Nature" might seem somewhat a strange expression. Rather than an image like a comfortable villa in nature, the meaning can be taken as **living on the history of Earth** or may be considered as **living based on the large context of global environment.** Looking forward to seeing architectures and cities that suggest rich relationship between Earth and humans.
- Ryue Nishizawa

We are living in this century in a world where **human and nature are subsumed into each other, neither by artificial existence in nature nor human beings completely controlling nature.** In my opinion, the architecture leading our era is vividly constructed by stating the way such world is.
- Akihisa Hirata

Think carefully of the word "up on" of "LIVING **upon** the NATURE". If the word was **"in"**, life blending in with the rich forest may be imaginable, or if the word was **"with"** the term **"symbiosis"** may come to mind. **"Up on" seems to encompass the life of the city, assuming the existence of nature.**
- Yasutaka Yoshimura

(1) https://www.kashimaenglish.co.jp/company/2019/index_EN.html



ACADIA 08
Silicon + Skin › Biological Processes and Computation

"ACADIA 08, Silicon + Skin: Biological Processes and Computation, assembles researchers, scholars and practitioners to formulate an interdisciplinary discourse by fostering design work and research that lies at the intersection between design, biology, and computation. More specifically, the conference identifies and examines current trends in digital design technologies developed and applied in the framework of biologically inspired processes and digitally assisted sustainable design."[1]

1. Concepts of Nature and Technology
As the relationship between nature and technology become more blurred, design can facilitate a new understanding of the world. Natural processes can provide designers with new models and strategies for design.

3. Differentiated Systems, Landscapes, and Cities
The study of complex systems has led architects and urban designers to rethink the way in which large-scale systems such as landscapes and urban environments can perform more ecologically. Concepts such as system feedback, interaction, and evolution are essential for an emergent system to grow and adapt over time.

4 Approaches to Environmental Performance and Analysis
As architecture has attempted to integrate environmental performance into the design process, new techniques and strategies are required to deal with the complexity of nonlinear systems such as flow of thermal energy.

6. Materials and Craft Inspired by Nature
In nature, as has been said many times, shape is cheaper than material. The biological world places little emphasis on excessive form or expensive materials and designers have begun to integrate these ideas into their design process.

(1) https://cnan.mackenzie.br/wp-content/uploads/2018/05/Publications_ACADIA-intro.pdf

PROTOCOLS

76

"The **1987 Montreal Protocol**, which curbed the use of chloro-fluorocarbons and other substances that were depleting the ozone layer, virtually ensured full participation by stating that trade would be banned with any country that didn't sign.

Three decades later, global leaders are working to confront a much more complicated challenge—climate change. Nearly 200 countries agreed to the **1997 Kyoto Protocol**, which acknowledged that poorer countries need help transitioning away from fossil fuels, but the agreement has not achieved the intended outcome.

Today, the **2015 Paris climate accord**, with each nation determining contributions toward the goal of reduced emissions, is the next big test—and perhaps the ultimate test—of planet-wide cooperation. At the same time, the United Nations Sustainable Development Goals, a 17-goal blueprint addressing everything from poverty to better planned cities, will be scrutinized at the World Urban Forum 10 in Abu Dhabi next month, where the Lincoln Institute will have a delegation." [1]

[1] https://www.lincolninst.edu/publications/articles/2020-01-land-matters-podcast-what-makes-planet-wide-pacts-successful-sustainable-development-goals

LEED

"We believe green buildings are the foundation of something bigger: helping people, and the communities and cities they reside in—safely, healthily and sustainably thrive. The heart of our green building community's efforts must go well beyond construction and efficiency, and the materials that make up our buildings. We must dig deeper and focus on what matters most within those buildings: human beings.

Every single human being on the planet should have safe and healthy places to live, work, learn and play. Leading long and healthy lives is not a privilege—it's a right for everyone. Shouldn't the places where we spend 90% of our time support our health and wellbeing? Improved health and productivity benefits are playing a larger role than ever before in driving companies to invest in green building."

LEED was created to accomplish the following:

- **Define "green building" by establishing a common standard of measurement**
- **Promote integrated, whole-building design practices**
- **Recognize environmental leadership in the building industry**
- **Stimulate green competition**
- **Raise consumer awareness of green building benefits**
- **Transform the building market**