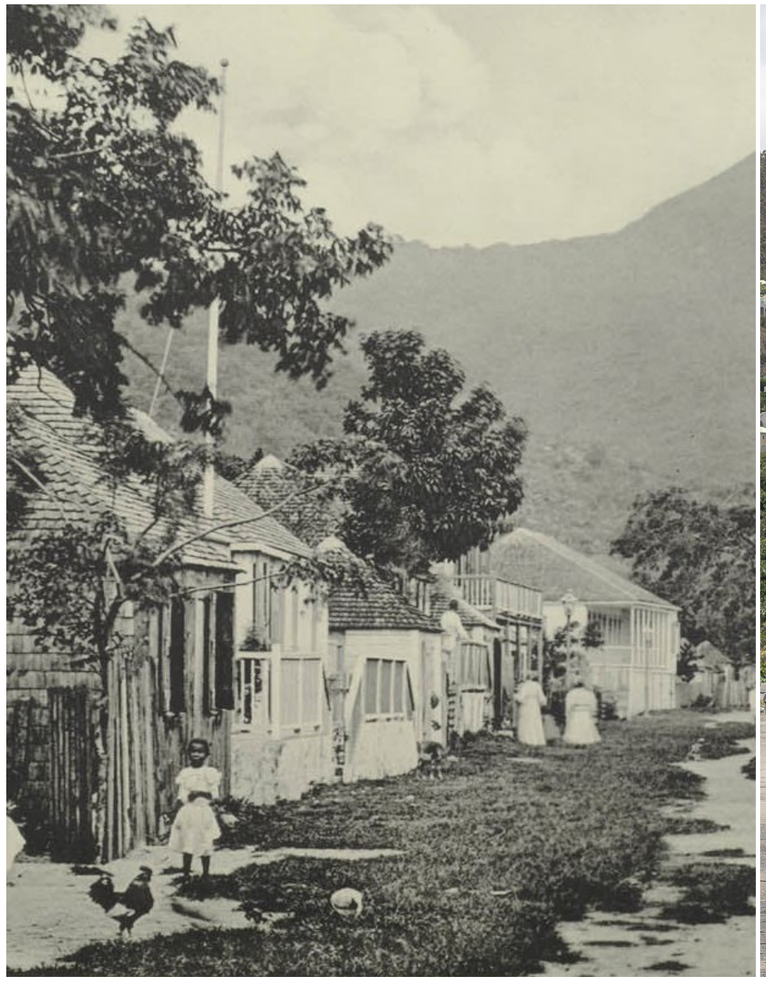
REINTRODUCING TROPICALITY TO ST MAARTEN

A RESIDENTIAL TYPOLOGY ROOTED IN THE SOIL OF THE PAST



Architectural Engineering

Tutors

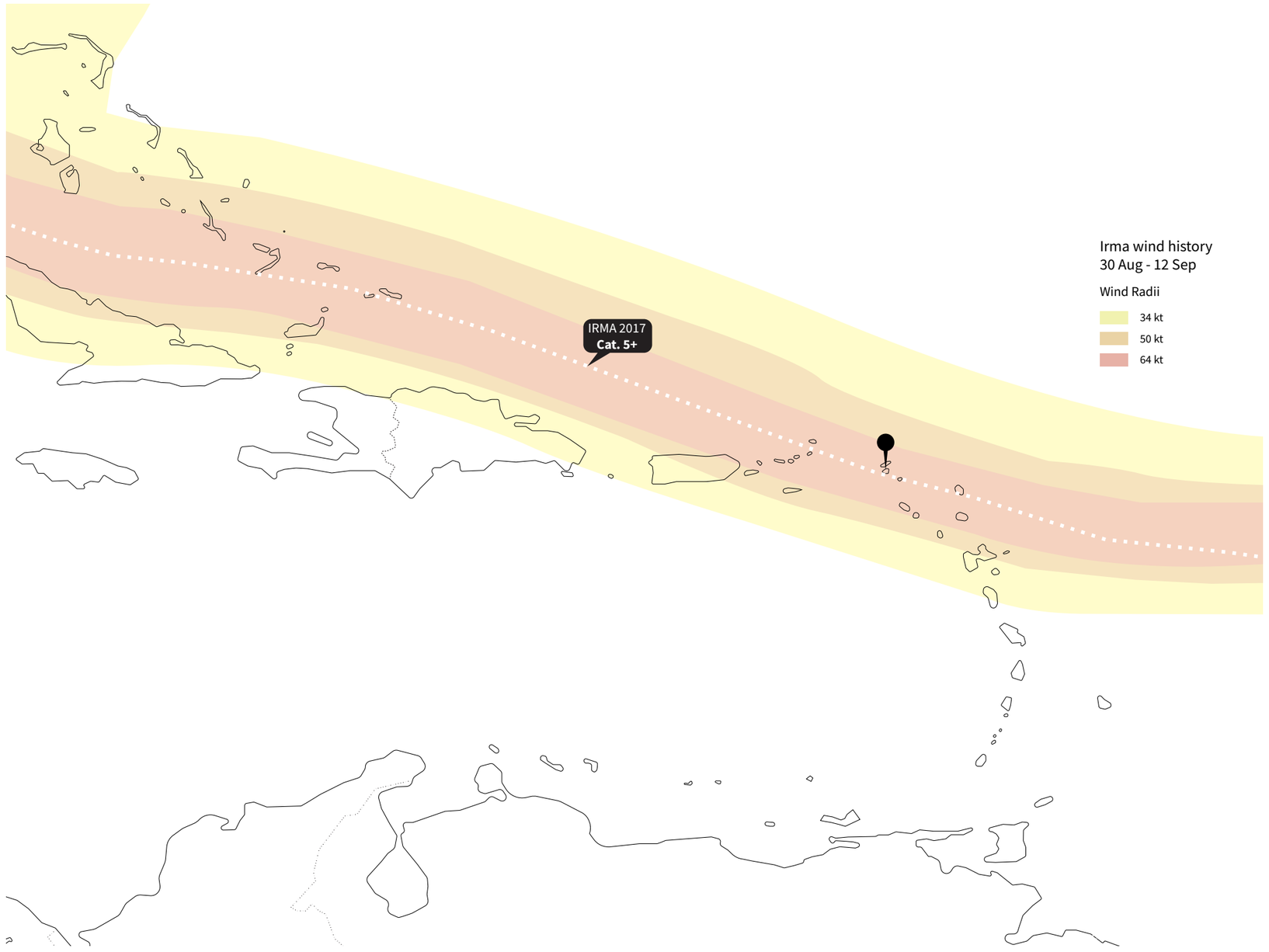
Mo Smit

Engbert van der Zaag

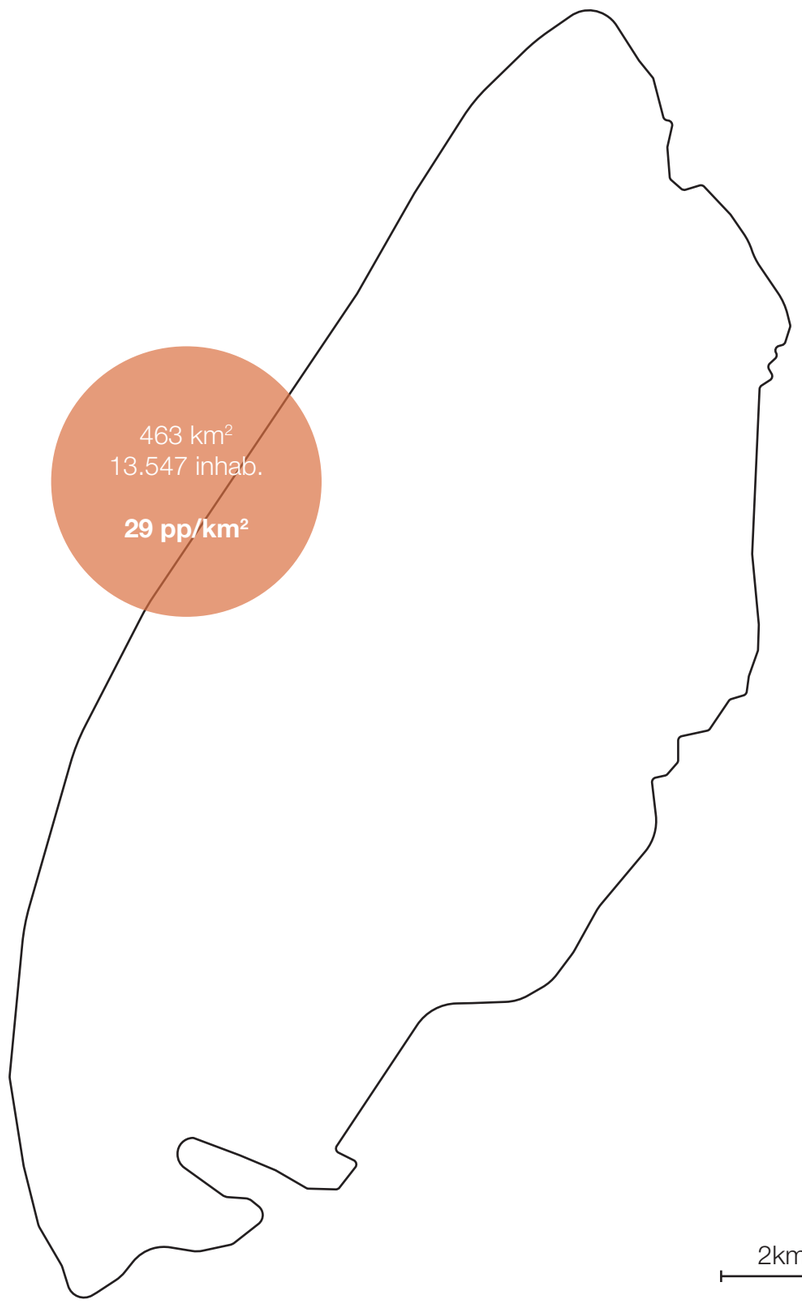
Roel van de pas

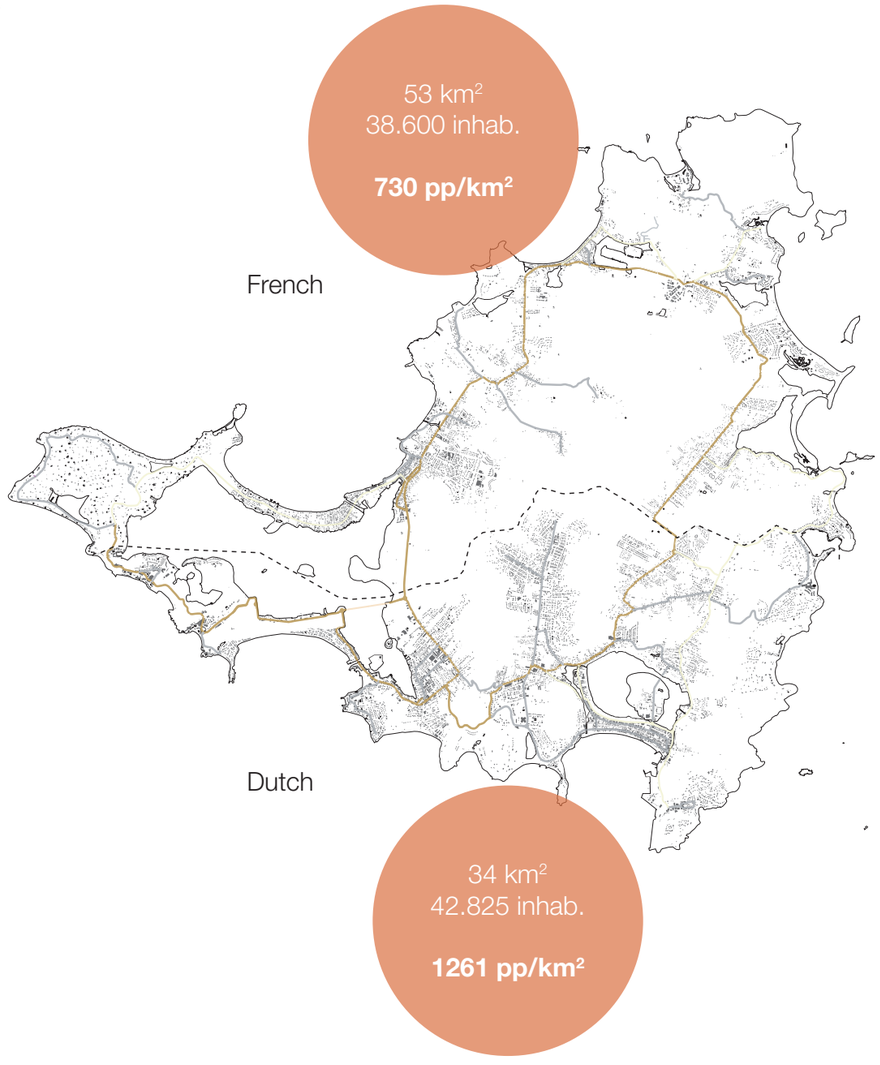
// ST. MAARTEN //

// ST. MAARTEN //


IRMA 2017
Cat. 5+
Irma wind history
30 Aug - 12 Sep
Wind Radii
34 kt
50 kt
64 kt

// TEXEL VS. ST. MAARTEN //

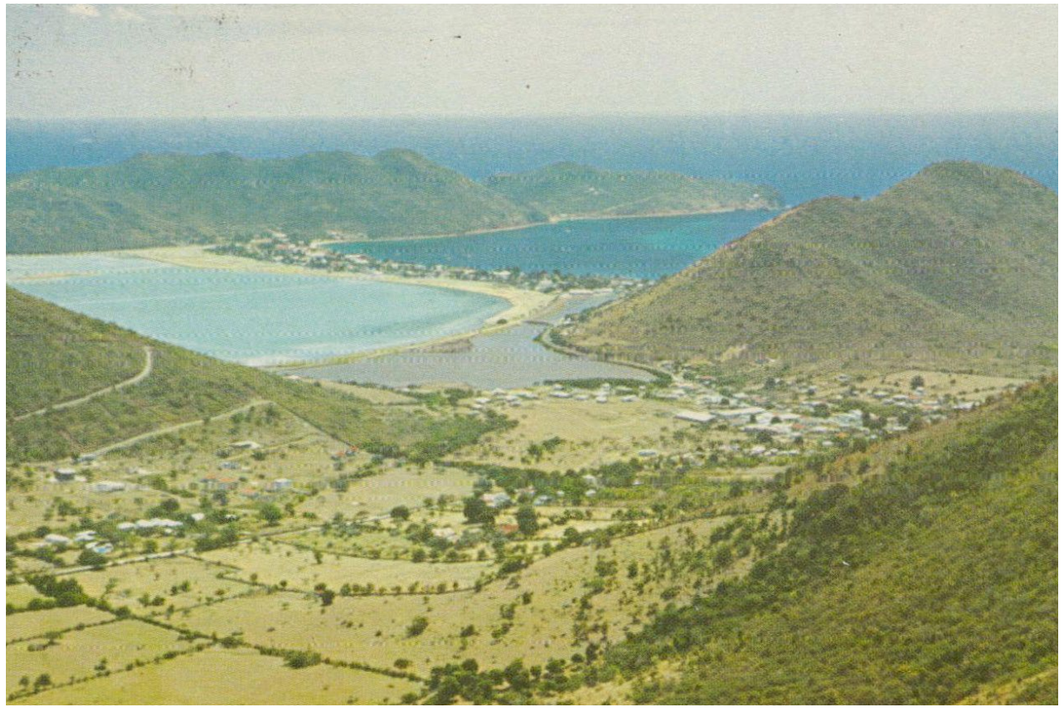




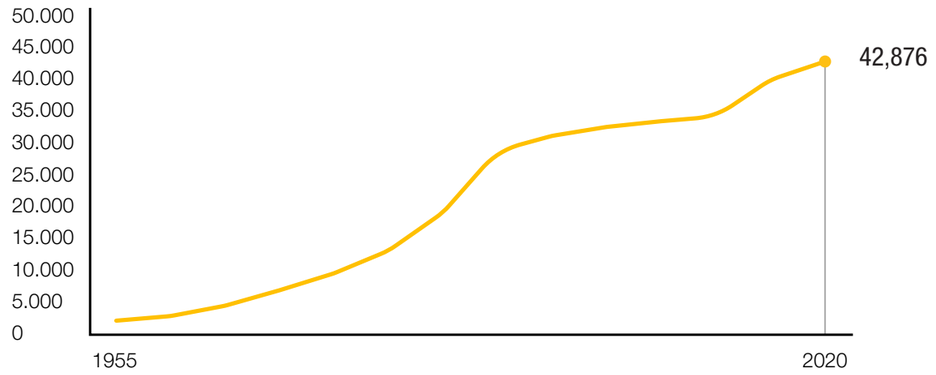
#10 most dense country in the world

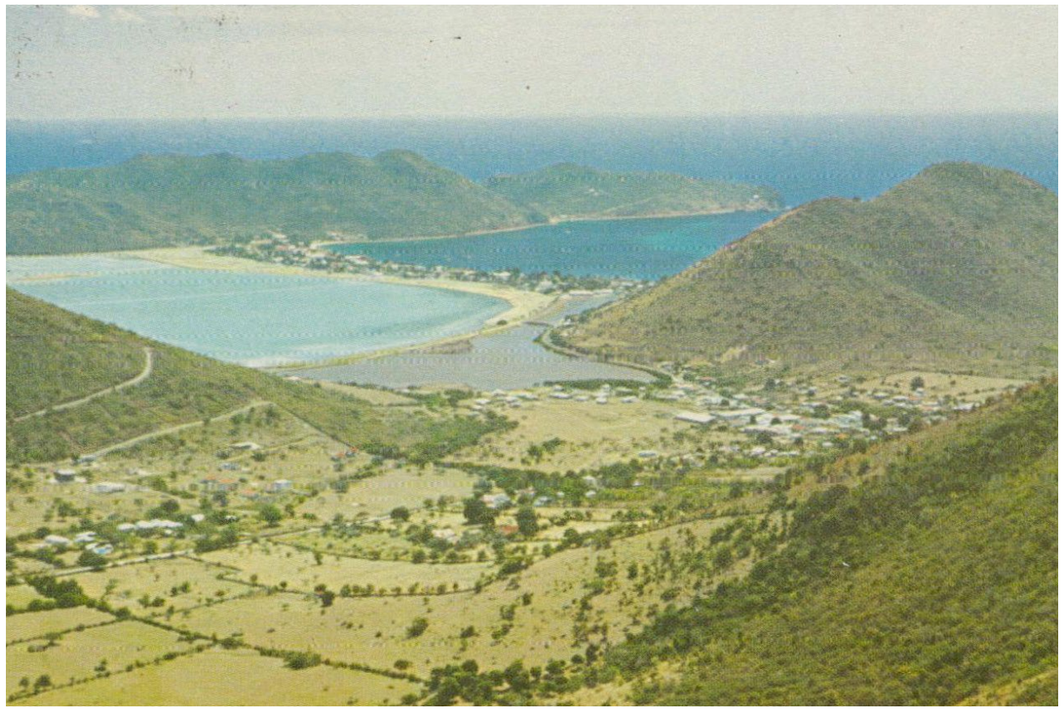
// TOURISM SECTOR //

// POPULATION GROWTH //



// POPULATION GROWTH //





Cay Bay

// ISLAND TRANSFORMATION //

Cay Bay

// **TROPICALITY** //

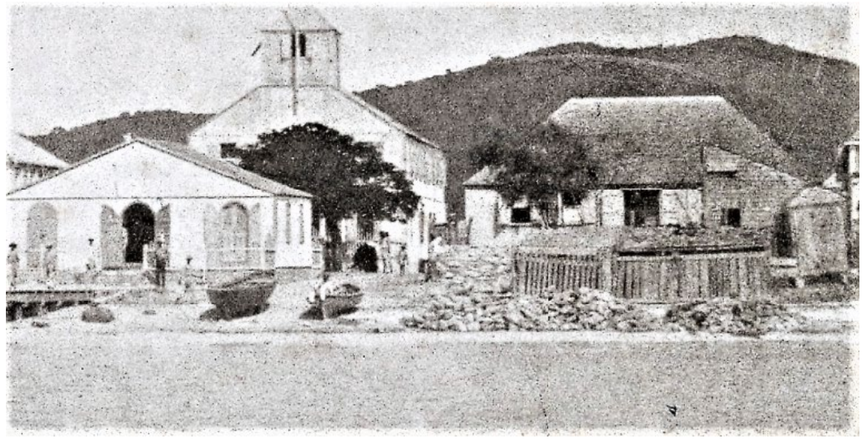
The state or condition of being tropical; the extent to which something is characteristic or reminiscent of the tropics.

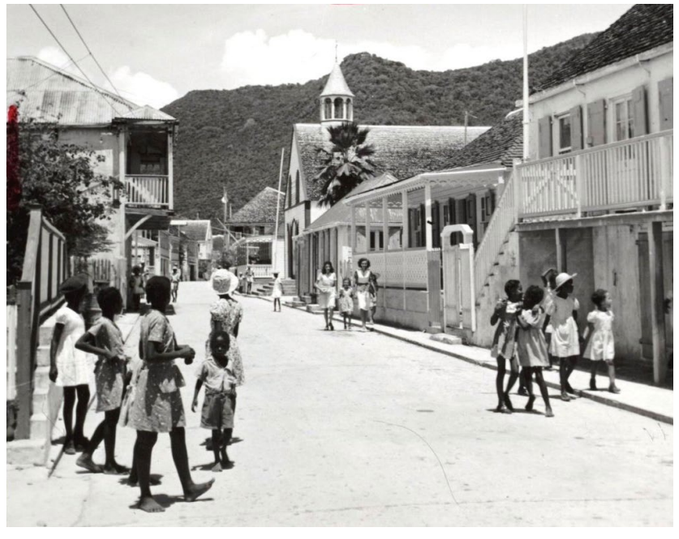
Oxford University Press

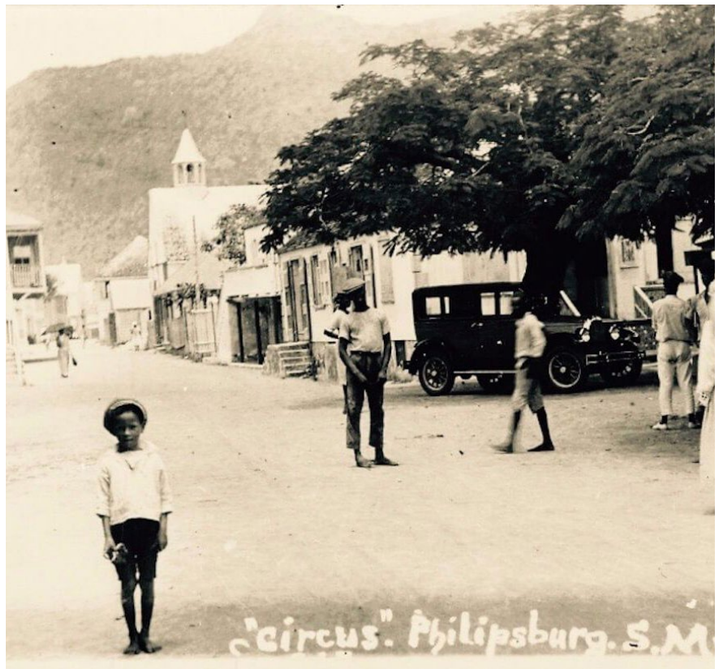
// BEFORE 1950 //

Backstreet 1897

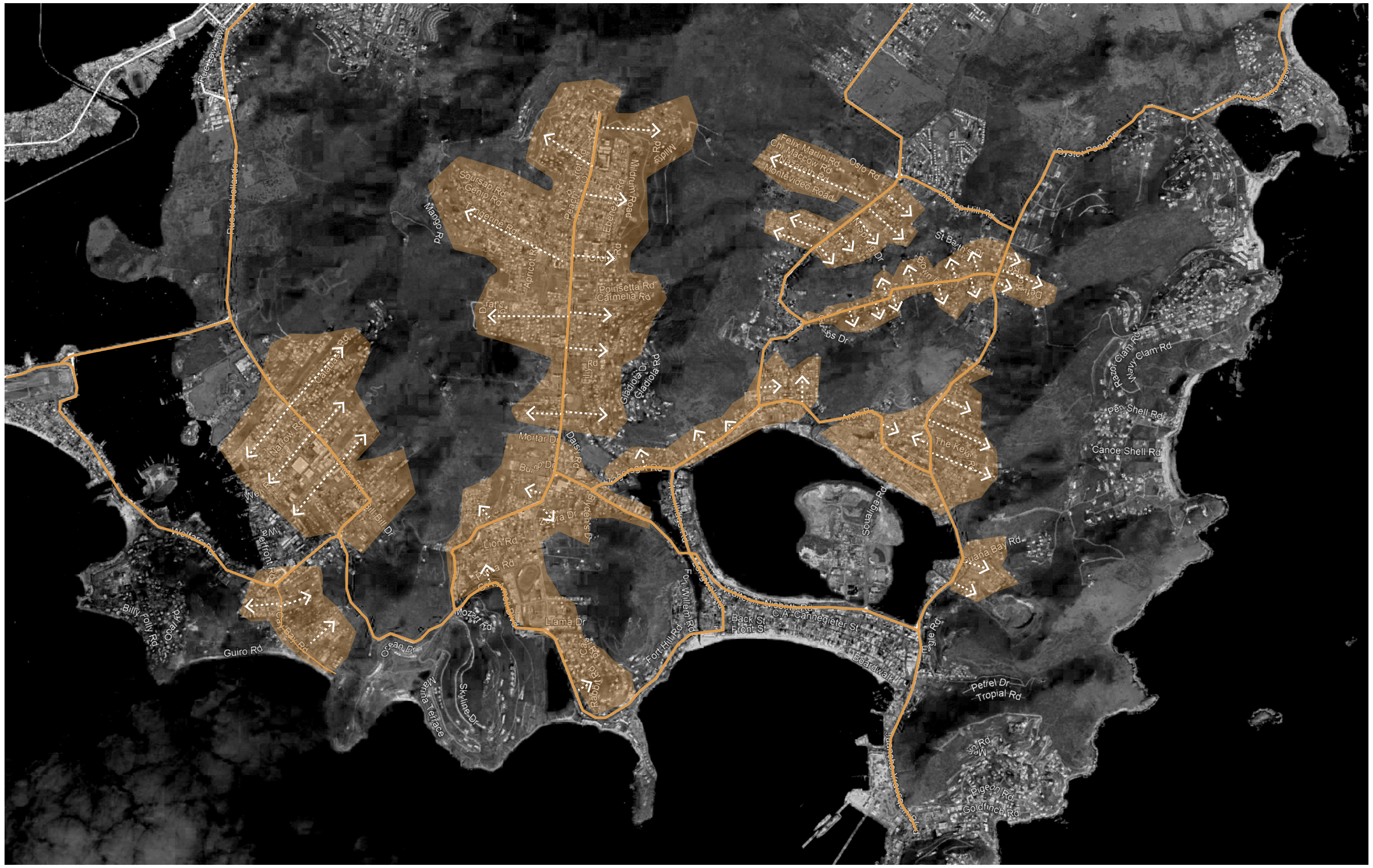
// BEFORE 1950 //



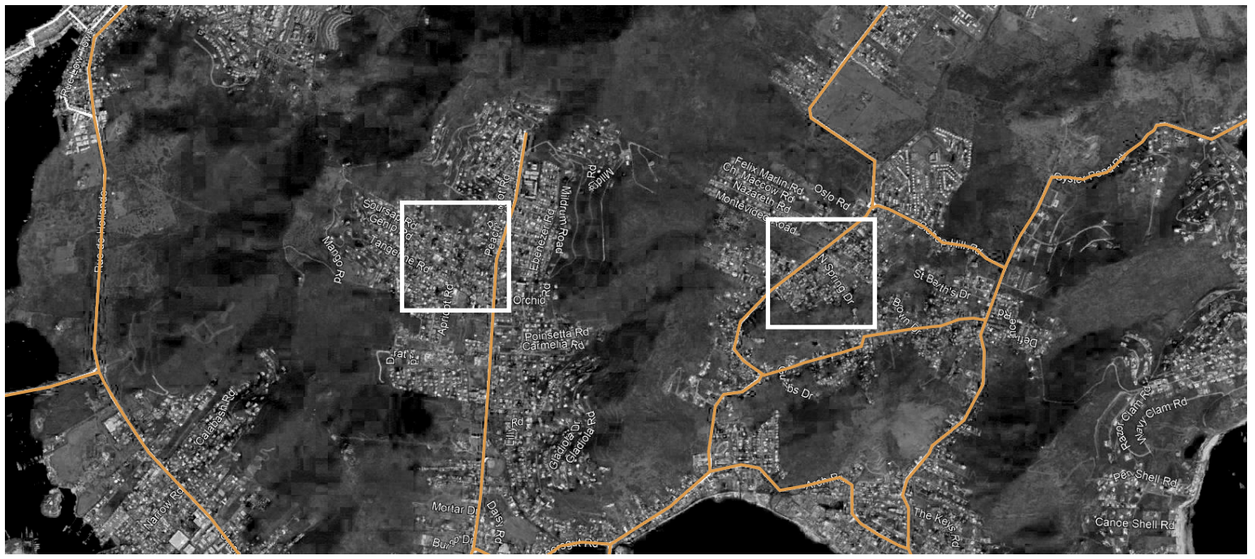




// NEIGHBORHOOD EXPANSIONS //



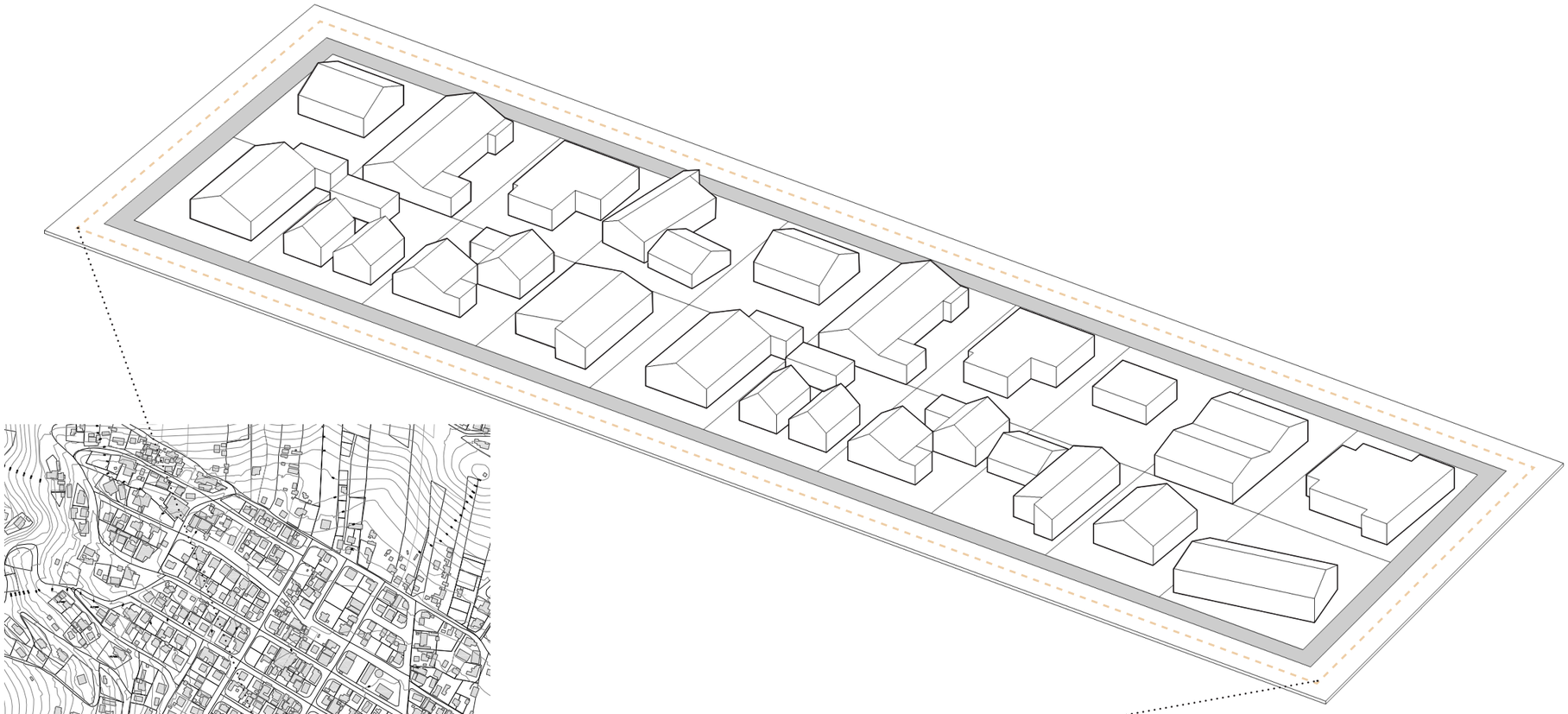
// PLANNED & INFORMAL //

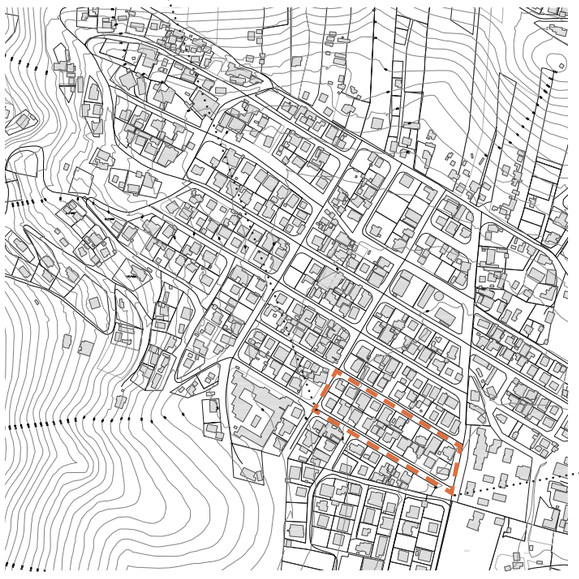


dutch cul-de-sac

dutch quarter

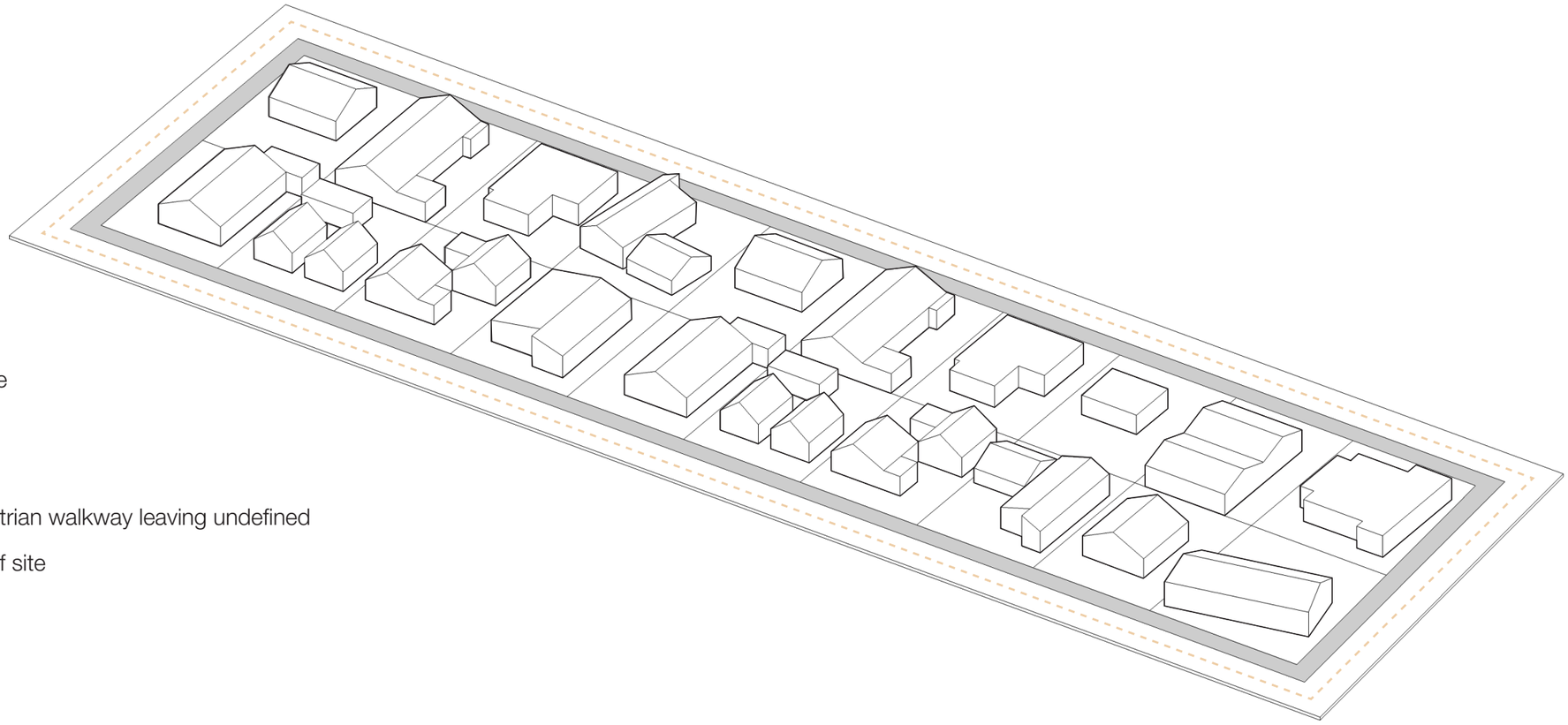
// PLANNED NEIGHBORHOODS //

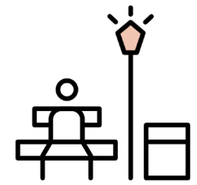




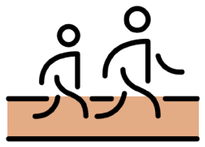
dutch cul-de-sac

// PLANNED NEIGHBORHOODS //



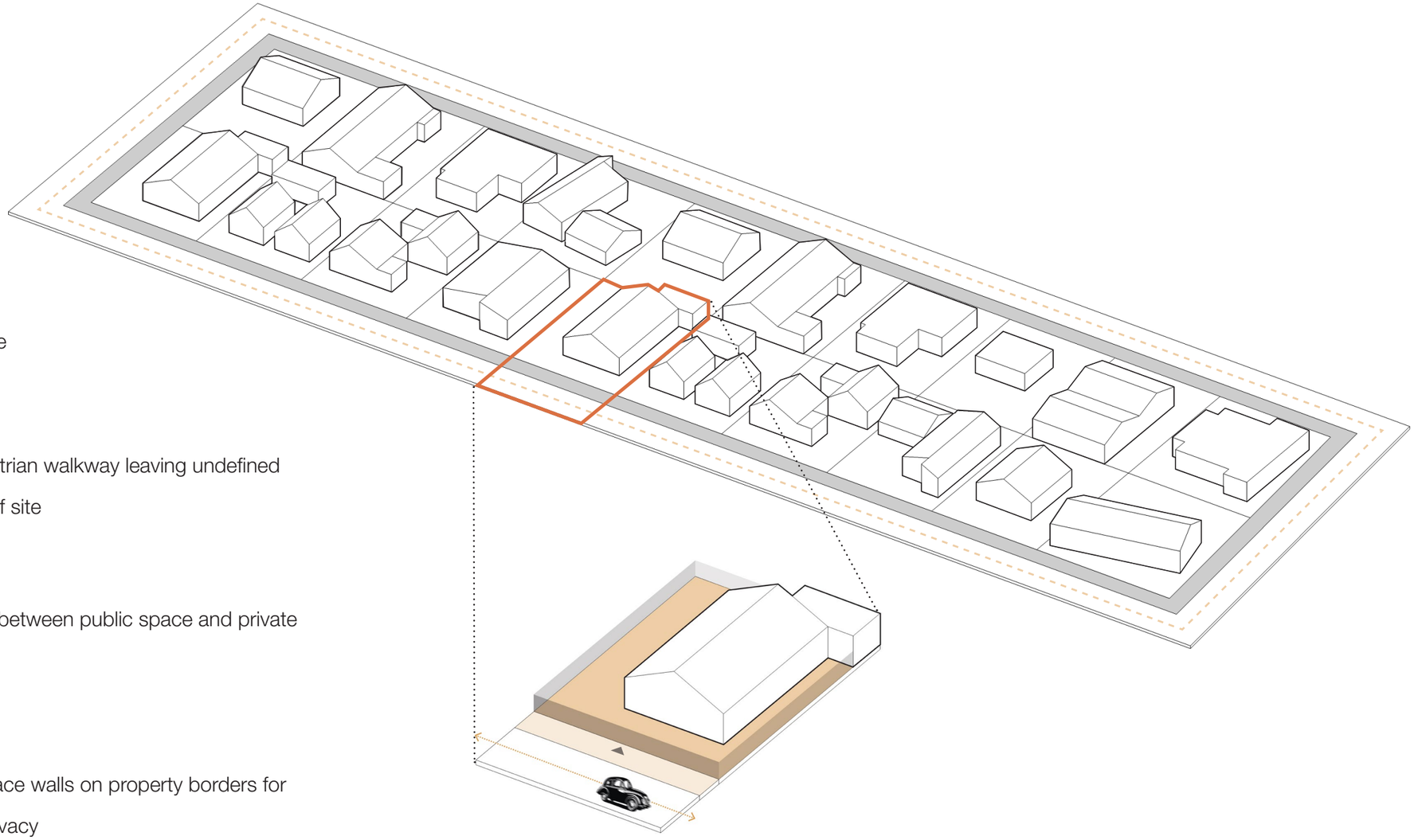


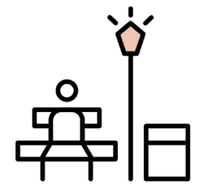
- No public space



- Often no pedestrian walkway leaving undefined space in front of site

// PLANNED NEIGHBORHOODS //





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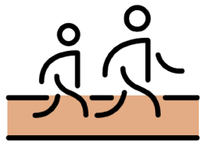
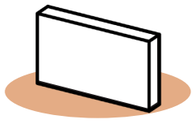


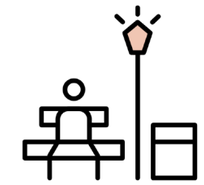
- Often no pedestrian walkway leaving undefined space in front of site

- Hard transition between public space and private property



- Necessity to place walls on property borders for security and privacy

// PLANNED NEIGHBORHOODS //



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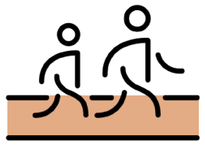

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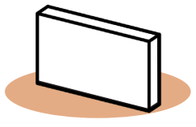

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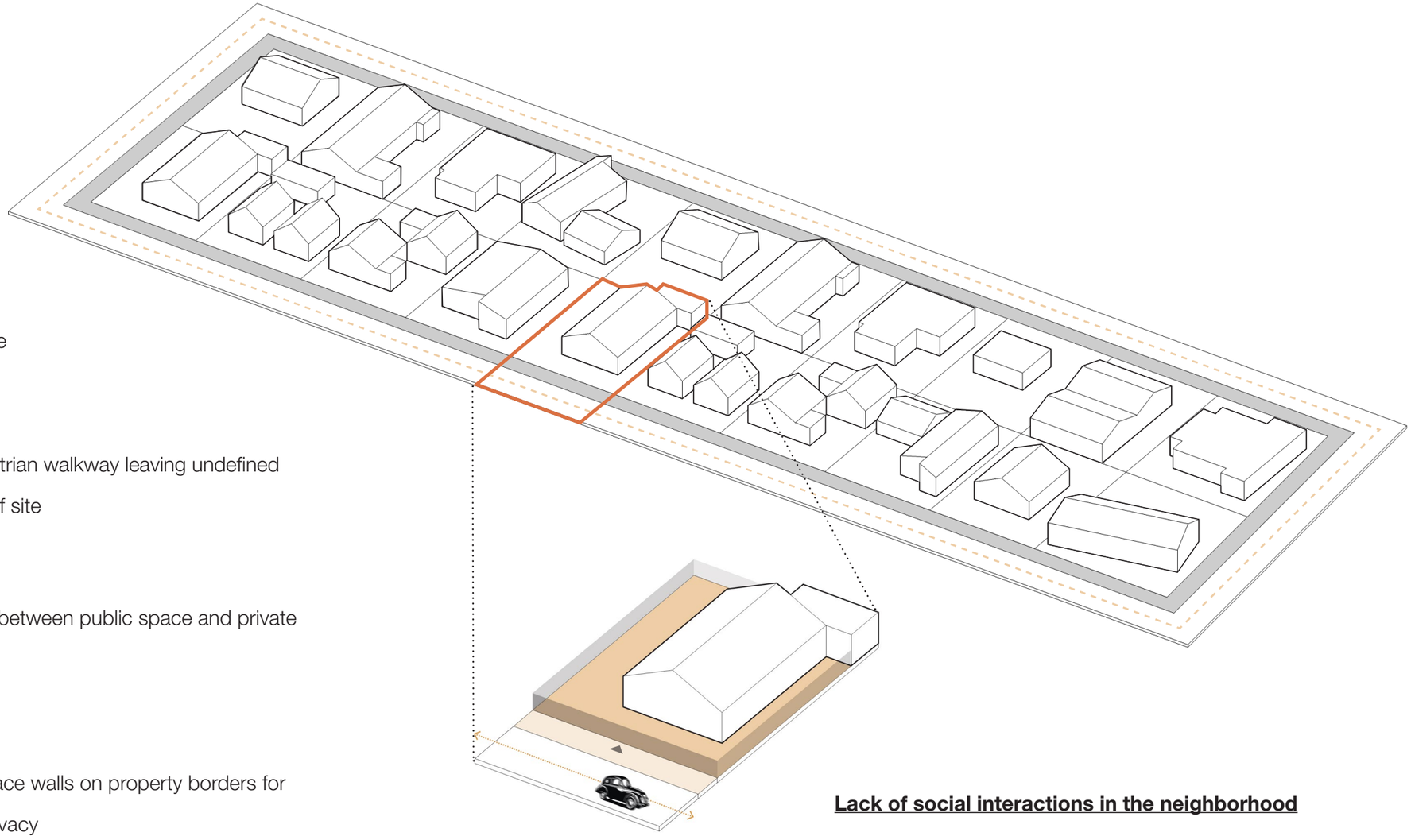


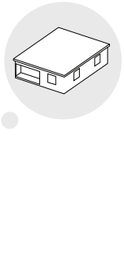
Lack of social interactions in the neighborhood

// PLANNED NEIGHBORHOODS //

// BUILDING CULTURE //

Bunkerization

PLANNING



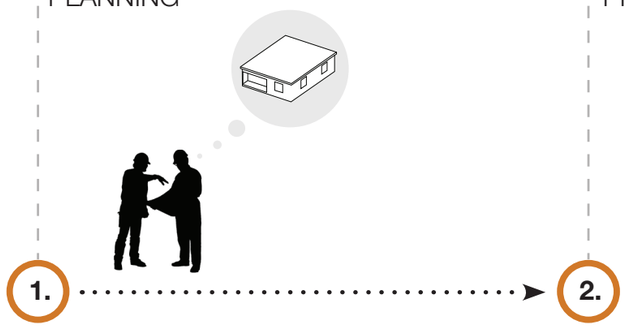
1.

the constructor and owner will plan the build of the house depending on income of the owner a architect can be hired

// BUILDING CULTURE //

Bunkerization

PLANNING



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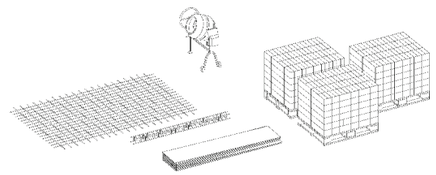

the materials mostly used are concrete and concrete brick because of their affordability, ease of use and stability

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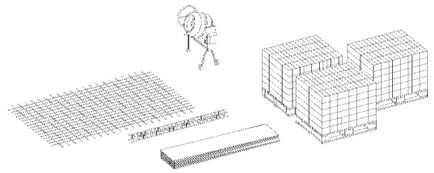
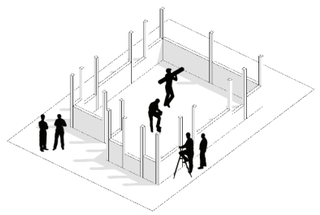


2.

the materials mostly used are concrete and concrete brick because of their strength against hurricanes

CONSTRUCTION



3.

standard construction method is with a concrete frame and brick infill

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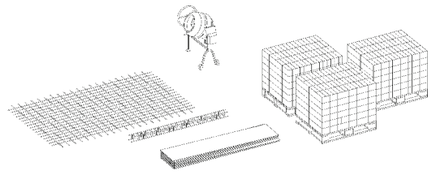

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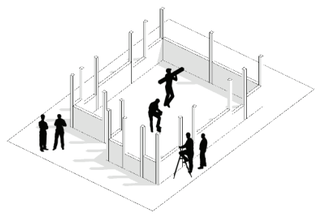
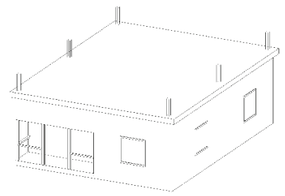


3.

construction is done with a concrete frame and brick infill

COMPLETION



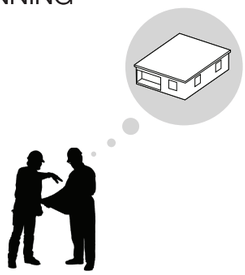
4.

the completed building is ready for its first users and often left with the rebar still visible for possible future expansions

// BUILDING CULTURE //

Bunkerization

PLANNING



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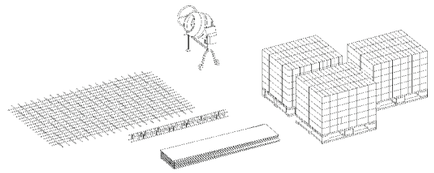

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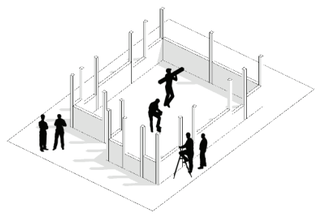

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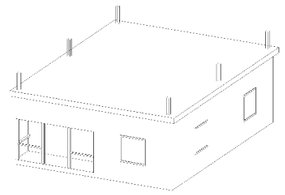

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the completed building is ready for its first users and often left with the rebar still visible for possible future expansions

// BUILDING CULTURE //

Bunkerization

// PROBLEM STATEMENT //






TECHNICAL

- current building methods use ***unsustainable materials***
- heavy & dense materials ***absorb more heat***
- small facade openings for hurricane protection means ***less cross ventilation***
- current solution for expandability leaves ***building unfinished***

SOCIAL

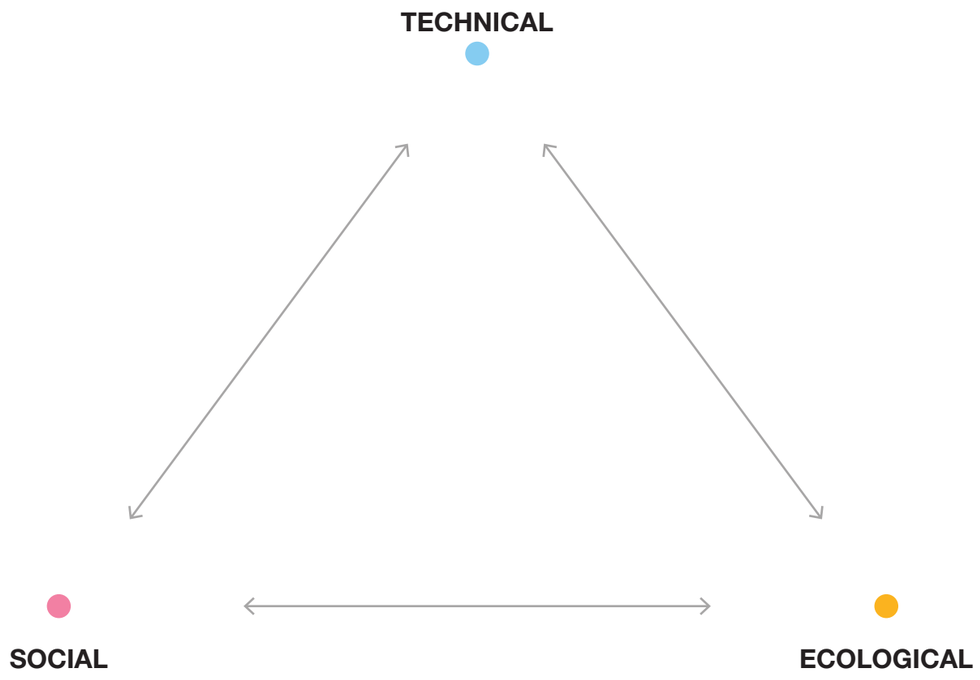
- current allotment ***disencourages social interaction***
- ***hard transition*** between public & private space
- life is lived more ***inside***
- hard borders necessary for ***privacy and security***
- ***scarcity of public space*** in neighborhoods

ECOLOGICAL

- high neighborhood density minimizes ***local vegetation***
- high electricity use results in ***burning of fossil fuels***
- current water use puts ***pressure on island sewage system***

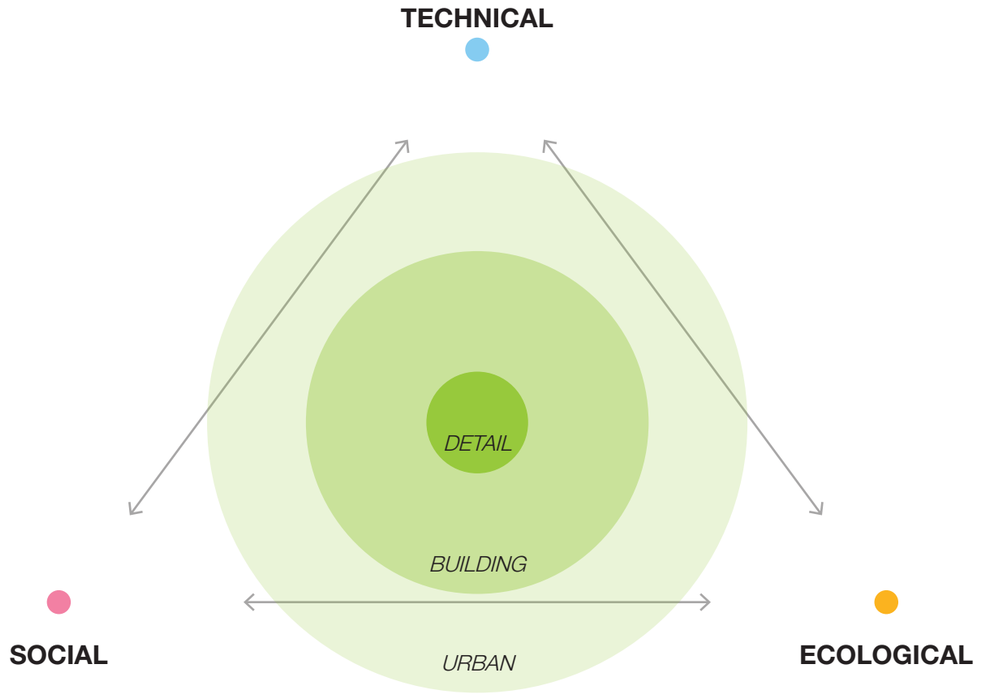
// OBJECTIVE //

CREATE A HOUSING TYPOLOGY THAT IS ADAPTED TO ST. MAARTEN'S CLIMATE AND CULTURE



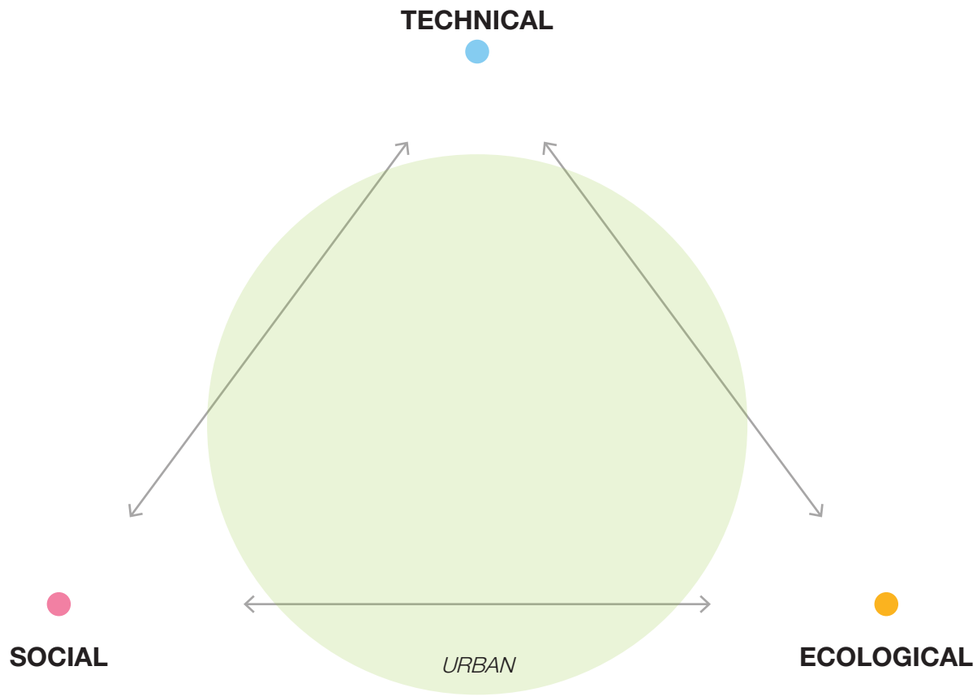
// STRATEGY //

TOWARDS TROPICALITY



// URBAN **STRATEGY** //

TOWARDS TROPICALITY



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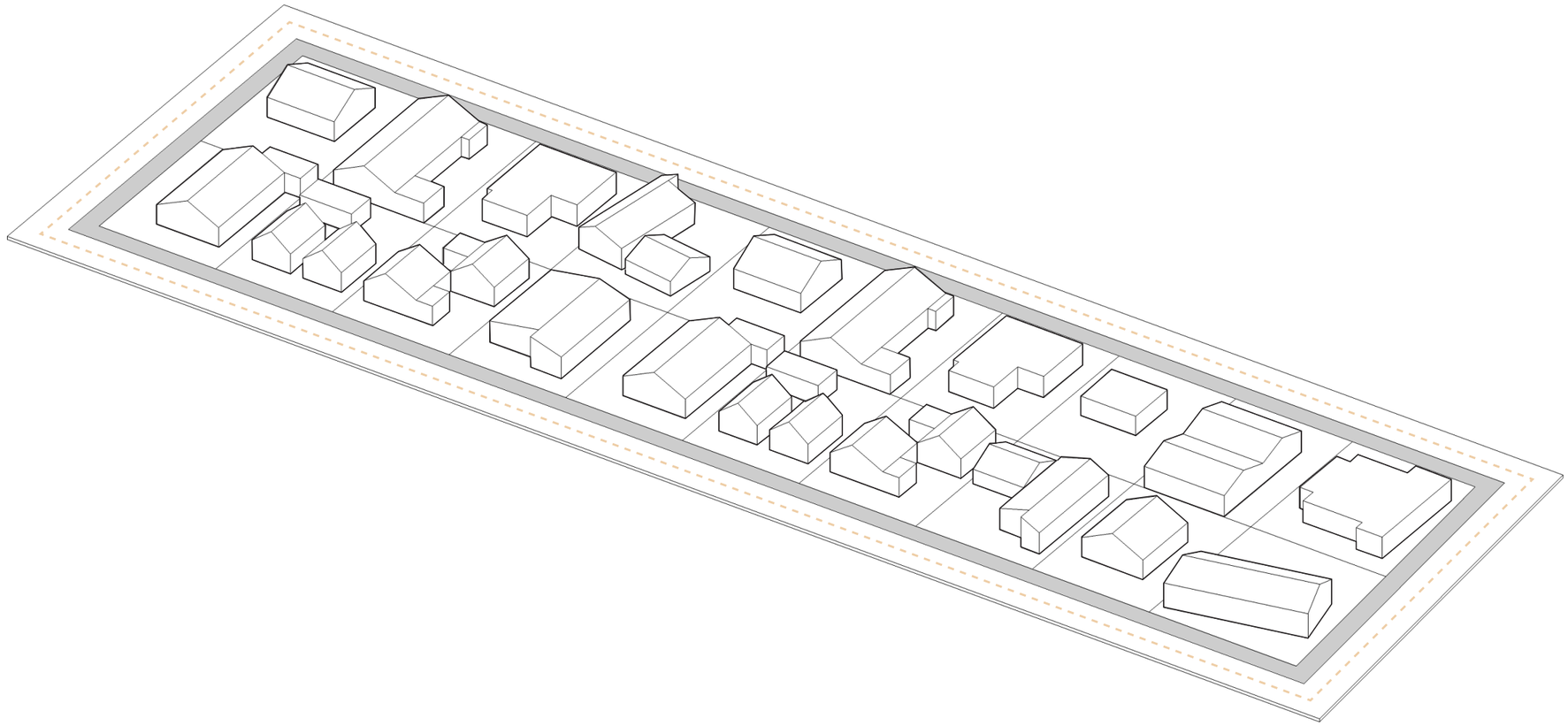

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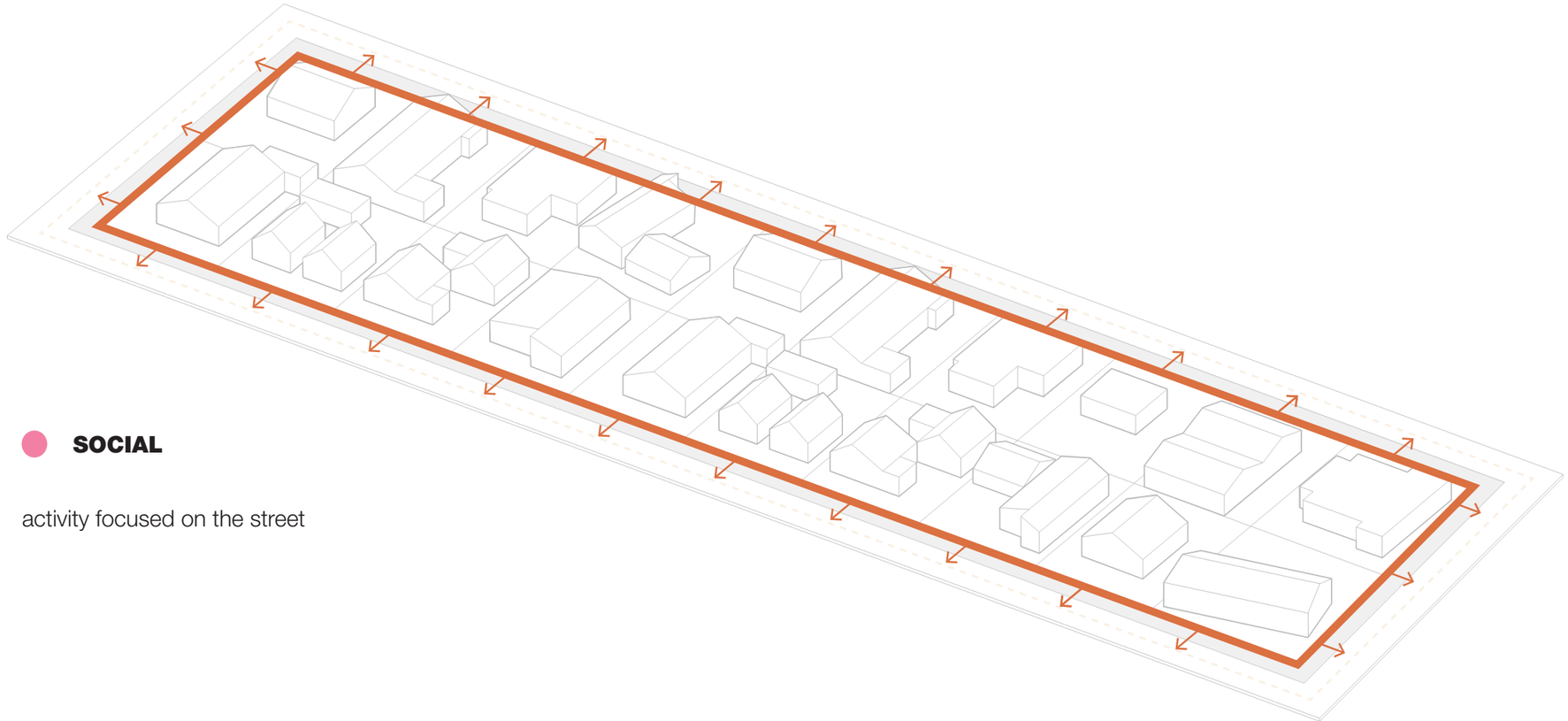
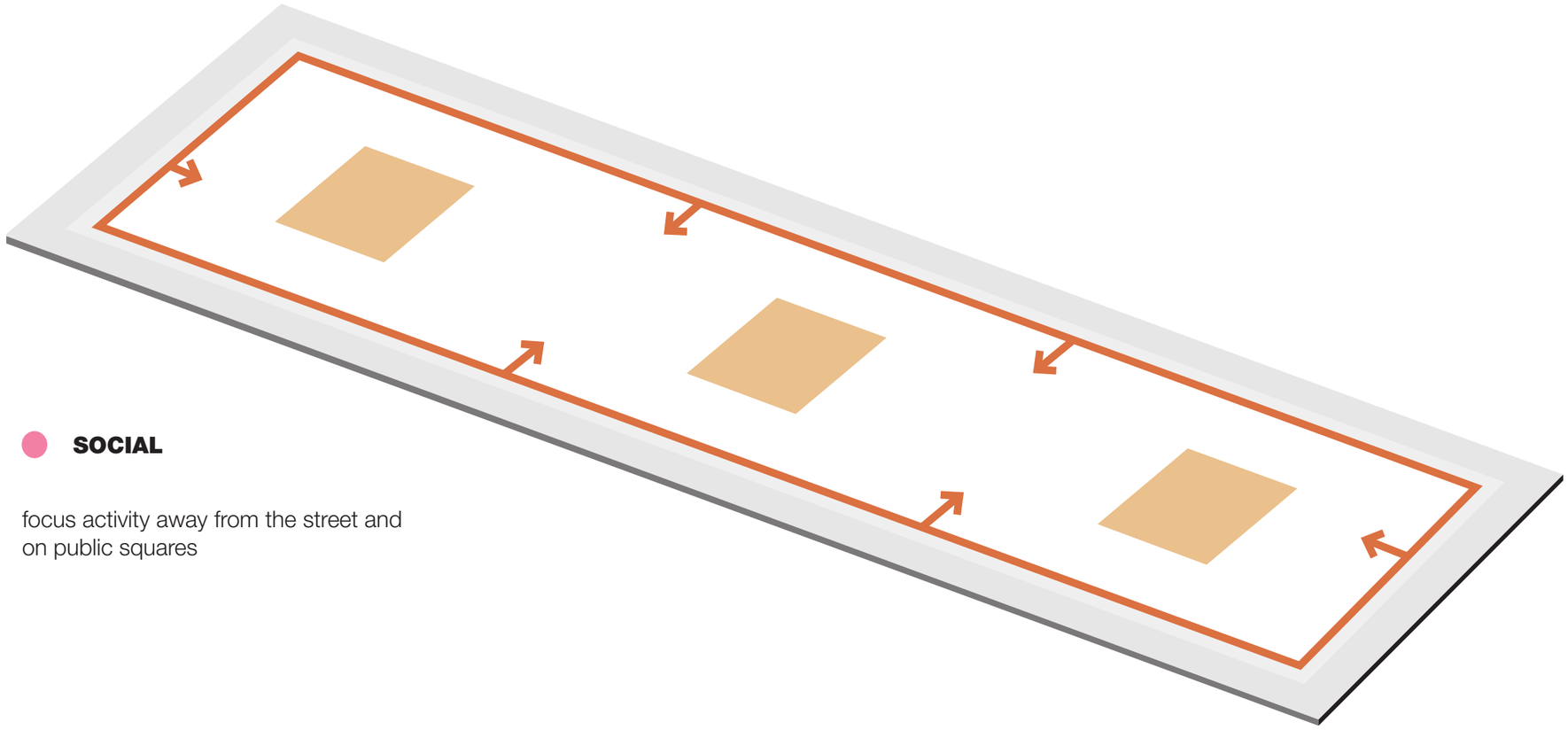


SOCIAL

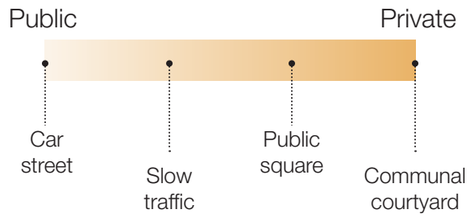
activity focused on the street

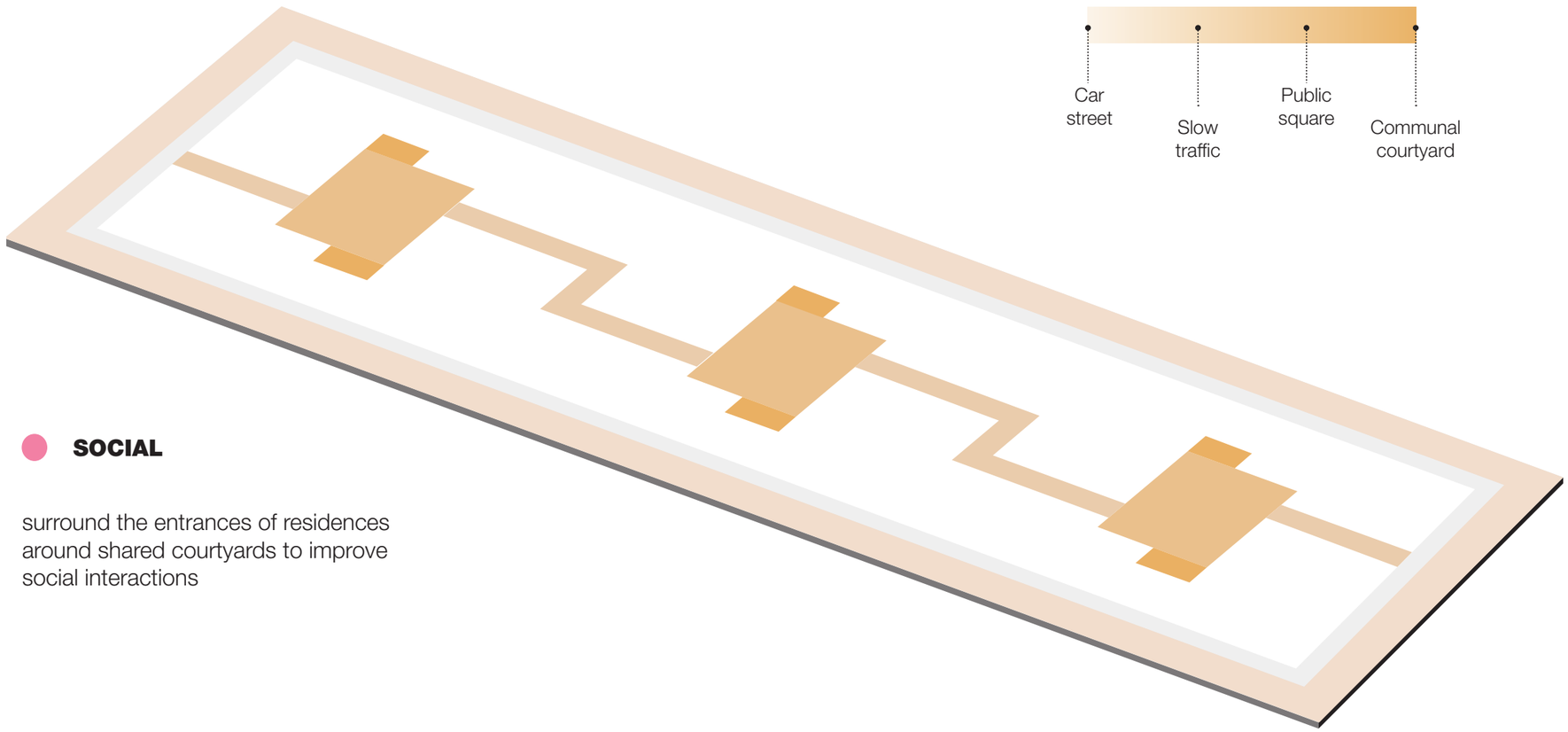


SOCIAL

focus activity away from the street and
on public squares

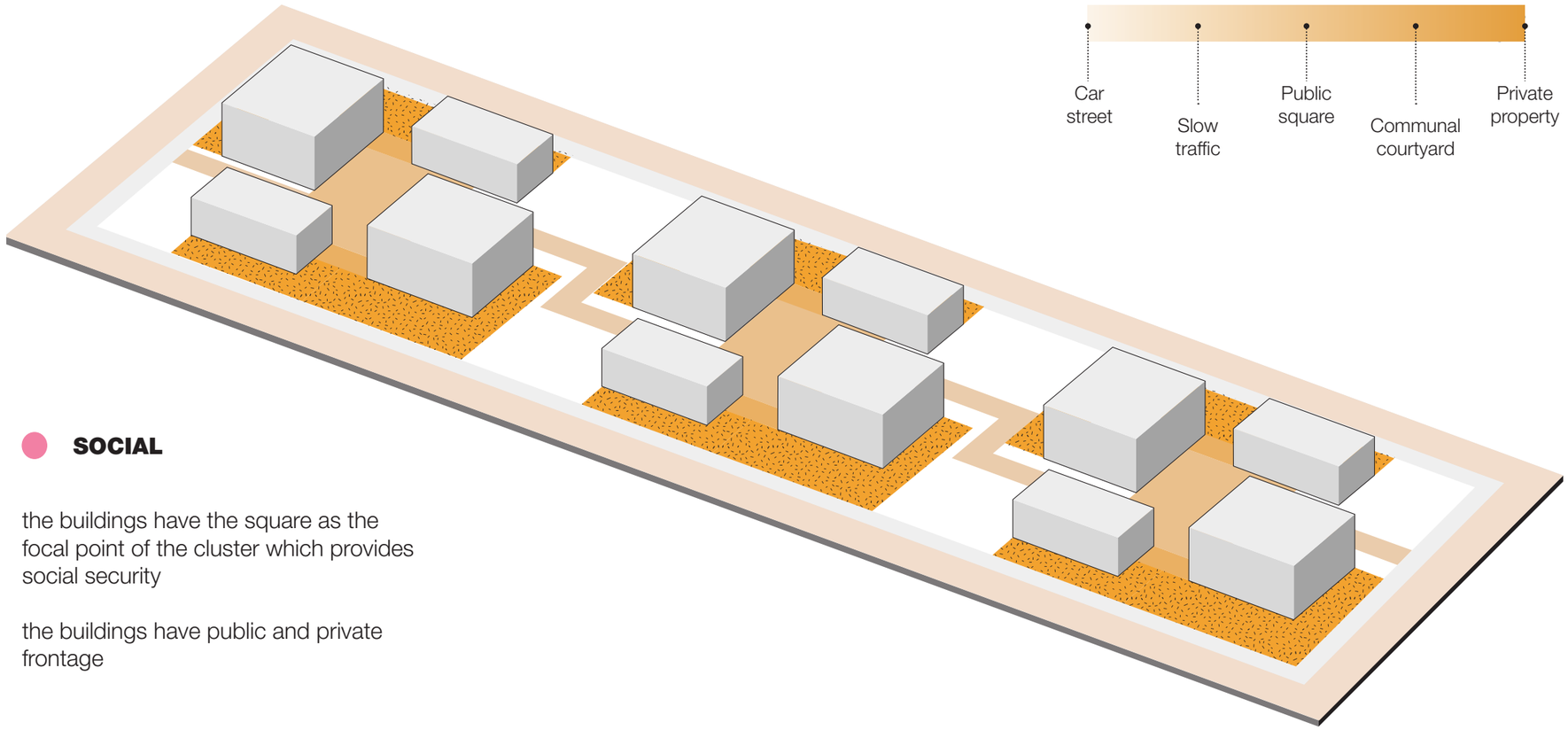
// URBAN STRATEGY //

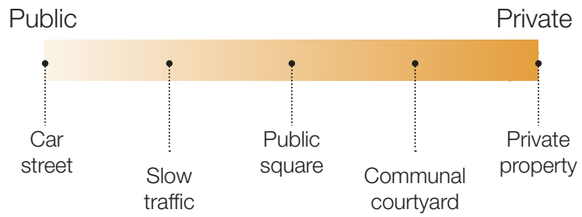




SOCIAL

surround the entrances of residences around shared courtyards to improve social interactions



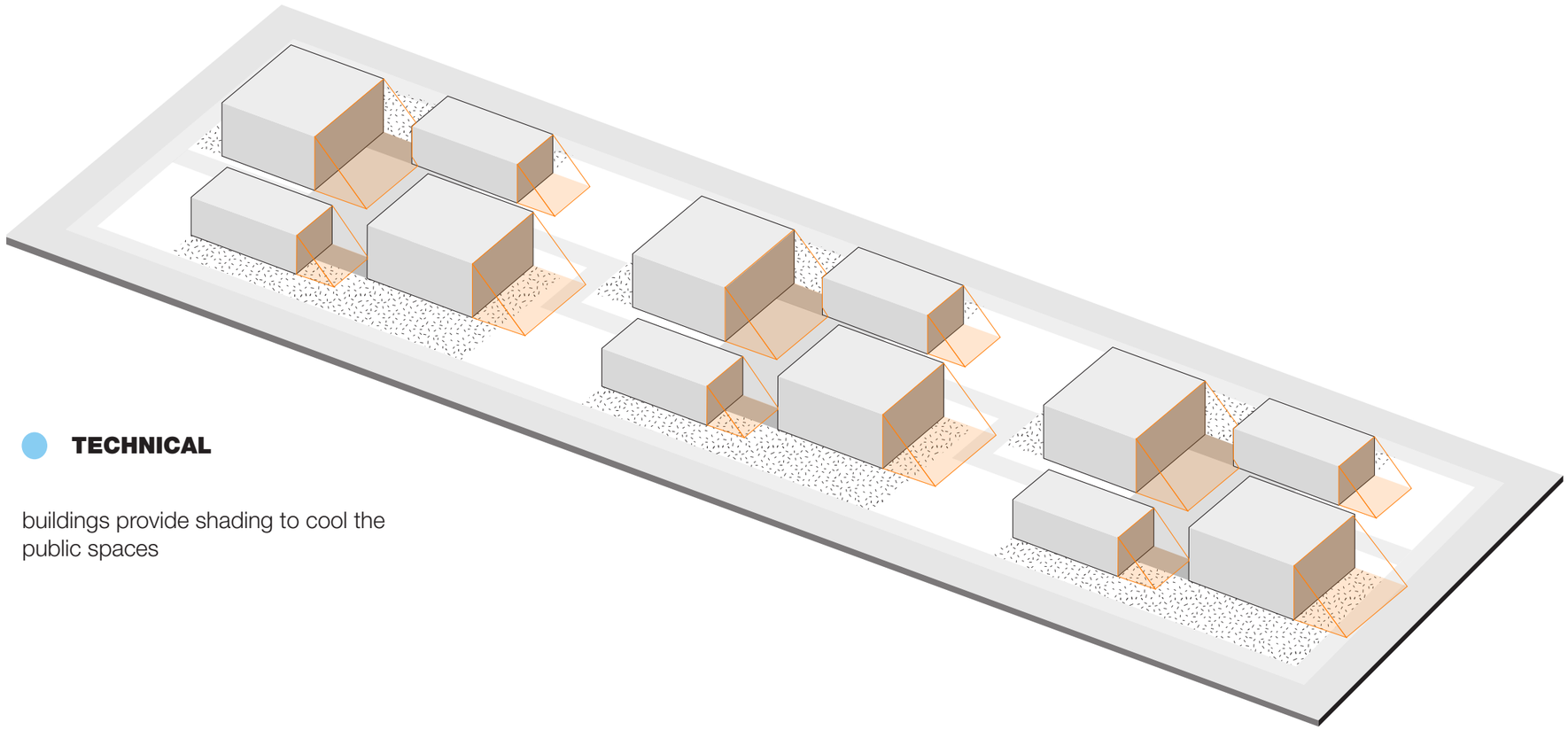


SOCIAL

the buildings have the square as the focal point of the cluster which provides social security

the buildings have public and private frontage

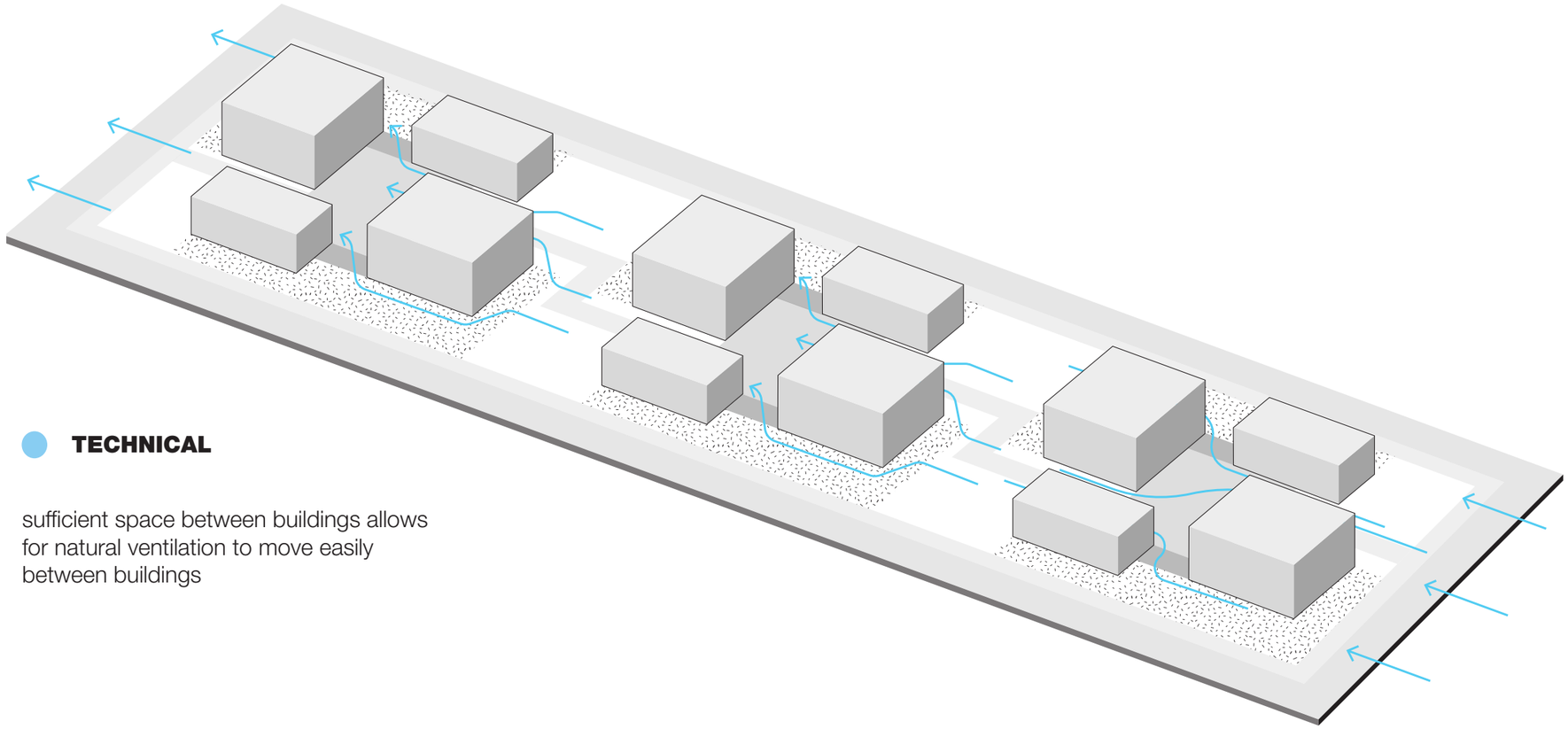
// URBAN STRATEGY //



TECHNICAL

buildings provide shading to cool the public spaces

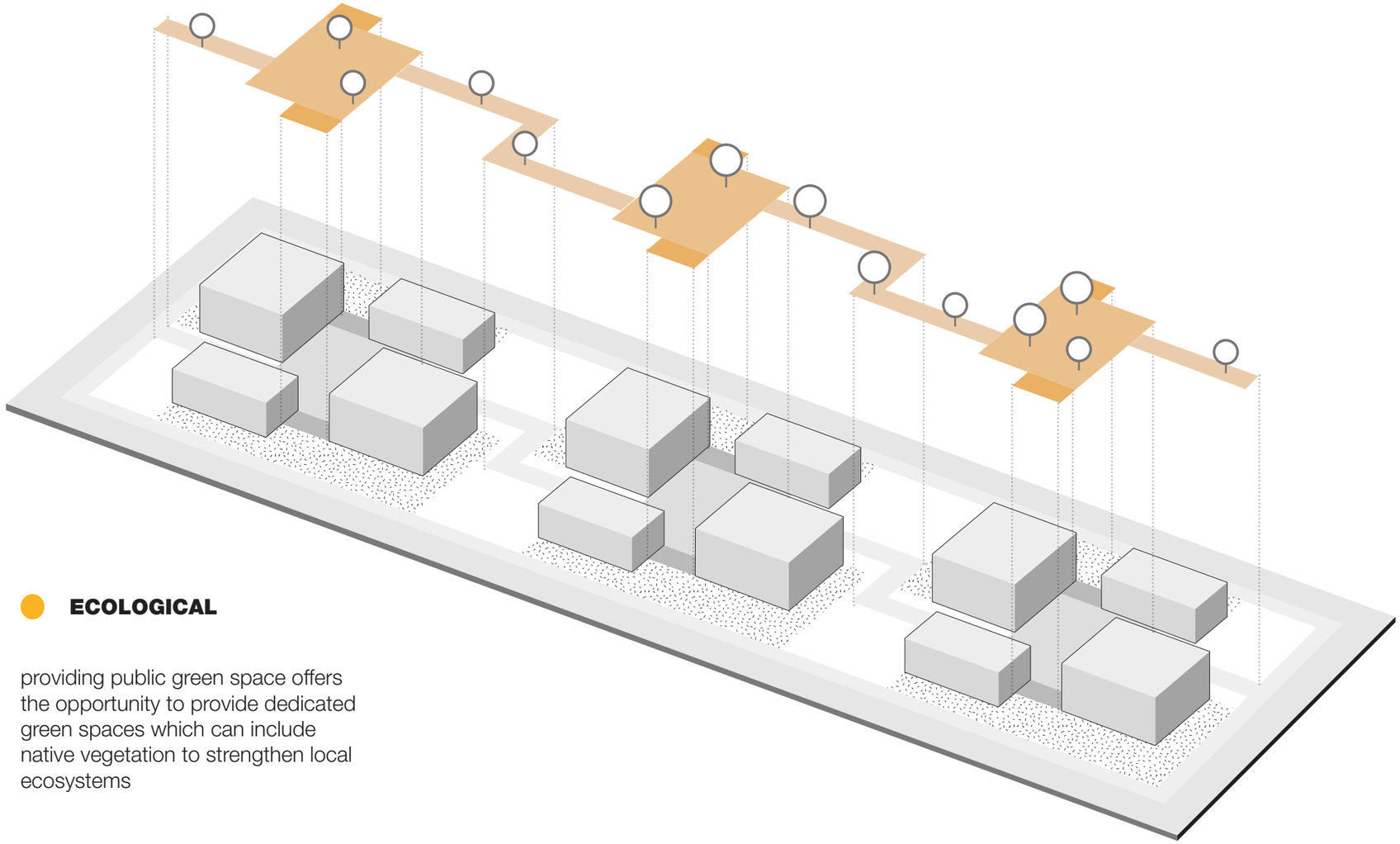
// URBAN STRATEGY //



TECHNICAL

sufficient space between buildings allows
for natural ventilation to move easily
between buildings

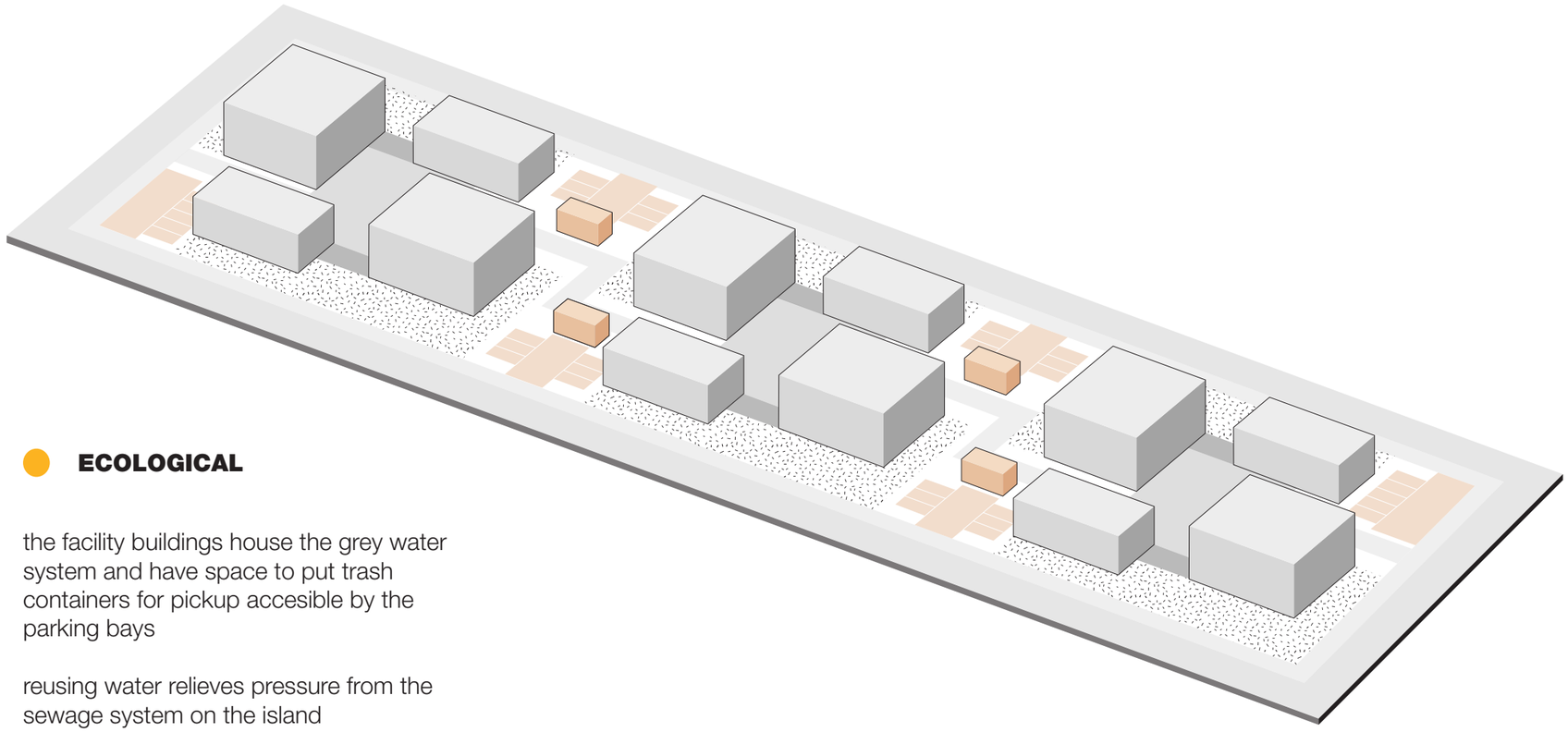
// URBAN STRATEGY //



ECOLOGICAL

providing public green space offers the opportunity to provide dedicated green spaces which can include native vegetation to strengthen local ecosystems

// URBAN STRATEGY //

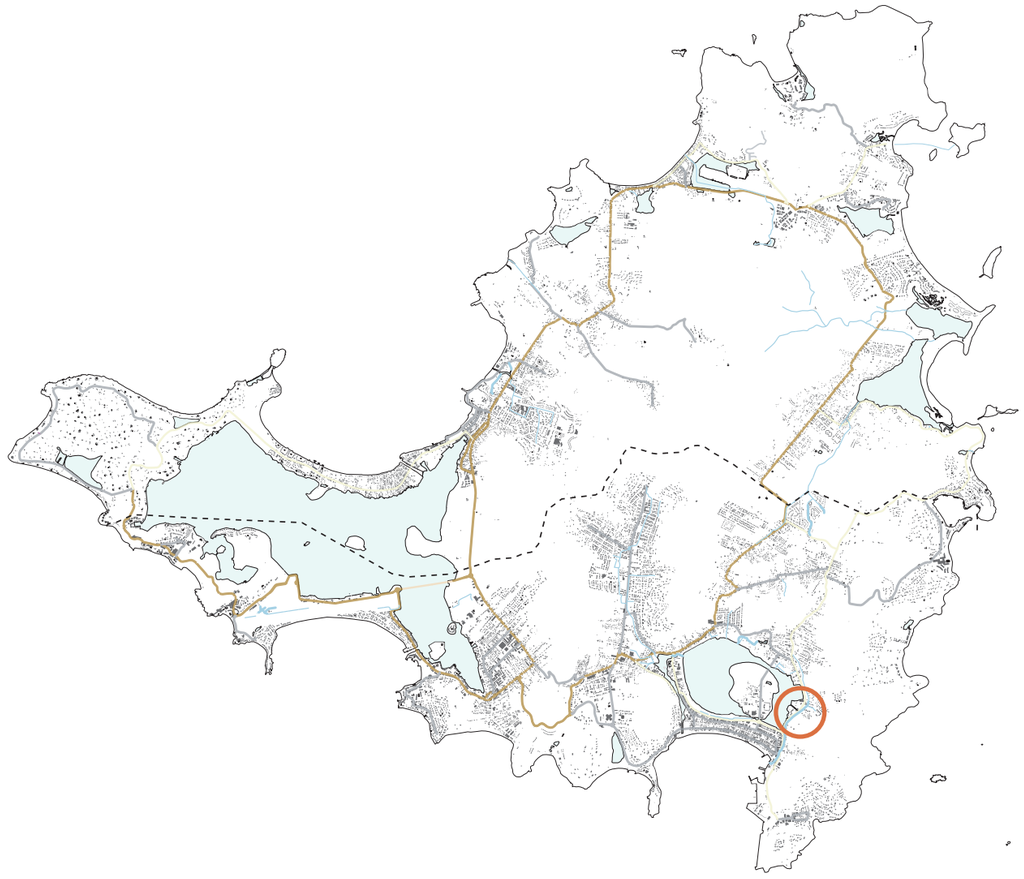


ECOLOGICAL

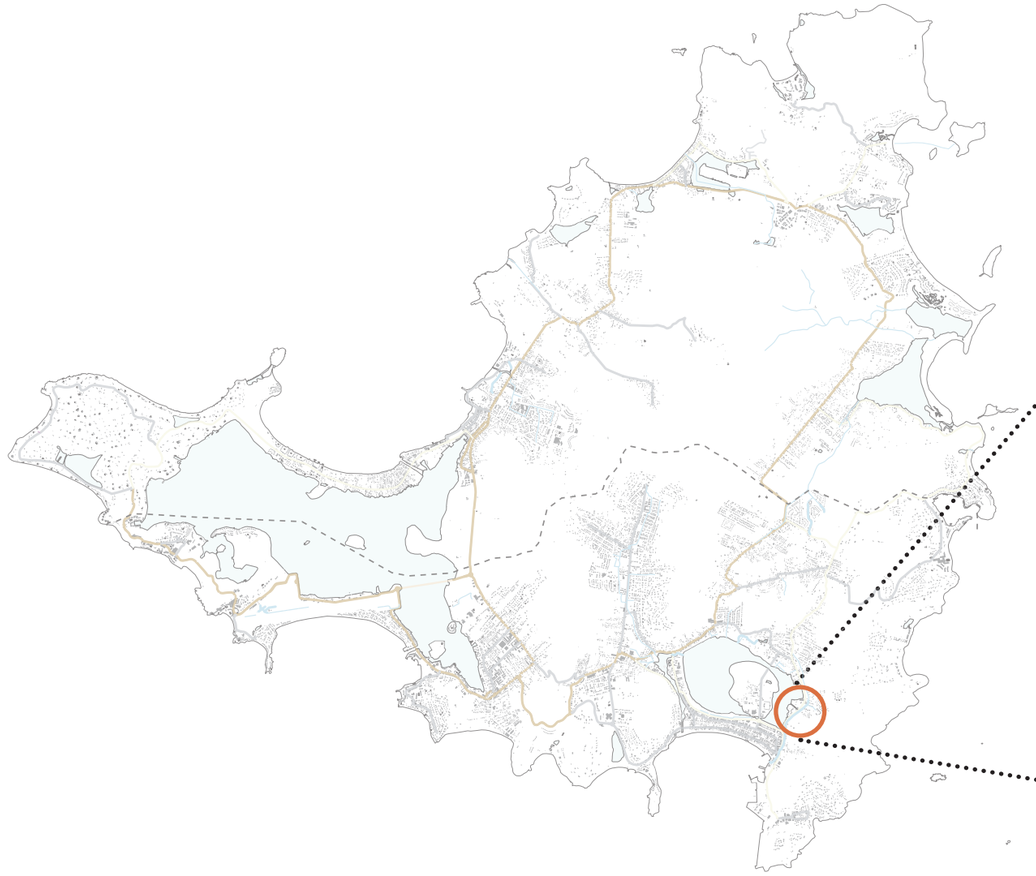
the facility buildings house the grey water system and have space to put trash containers for pickup accesible by the parking bays

reusing water relieves pressure from the sewage system on the island

// LOCATION //



// LOCATION //



- Empty plot within a relatively underdeveloped neighborhood
- Variety of services nearby
- Next to the old quarry
- 15 min walk to Philipsburg
- View over the Salt Pond

// LOCATION //

// LANDSCAPE //
Site: 5300 m² (0.5 ha)

// CONNECTIVITY //

Sucker Garden

Guana Bay

Philipsburg

Sand road to the Old quarry

// NEIGHBORHOOD FUNCTIONS //

- Mostly private residential

Commercial

Abandoned

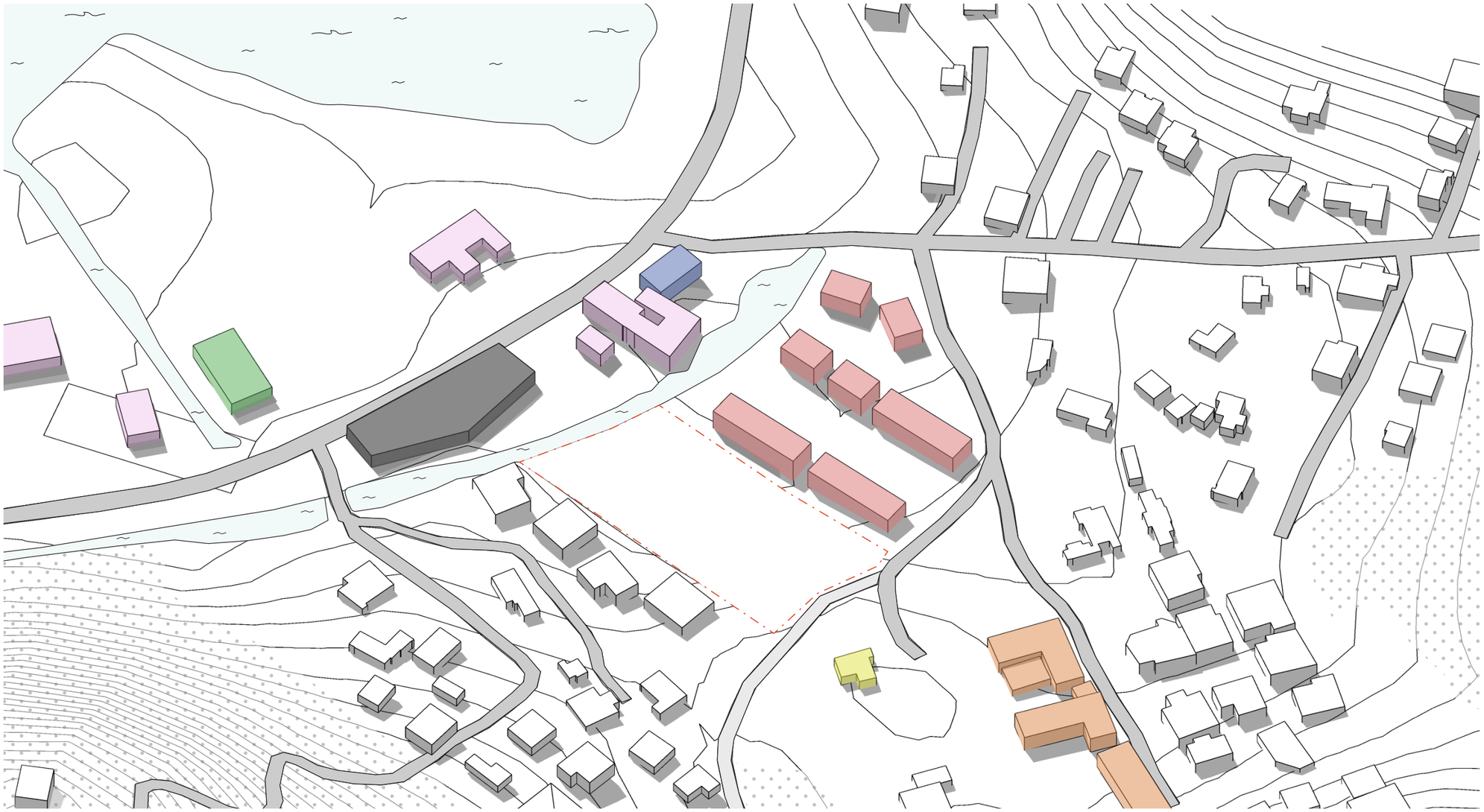
After school program

Supermarket

Social Housing

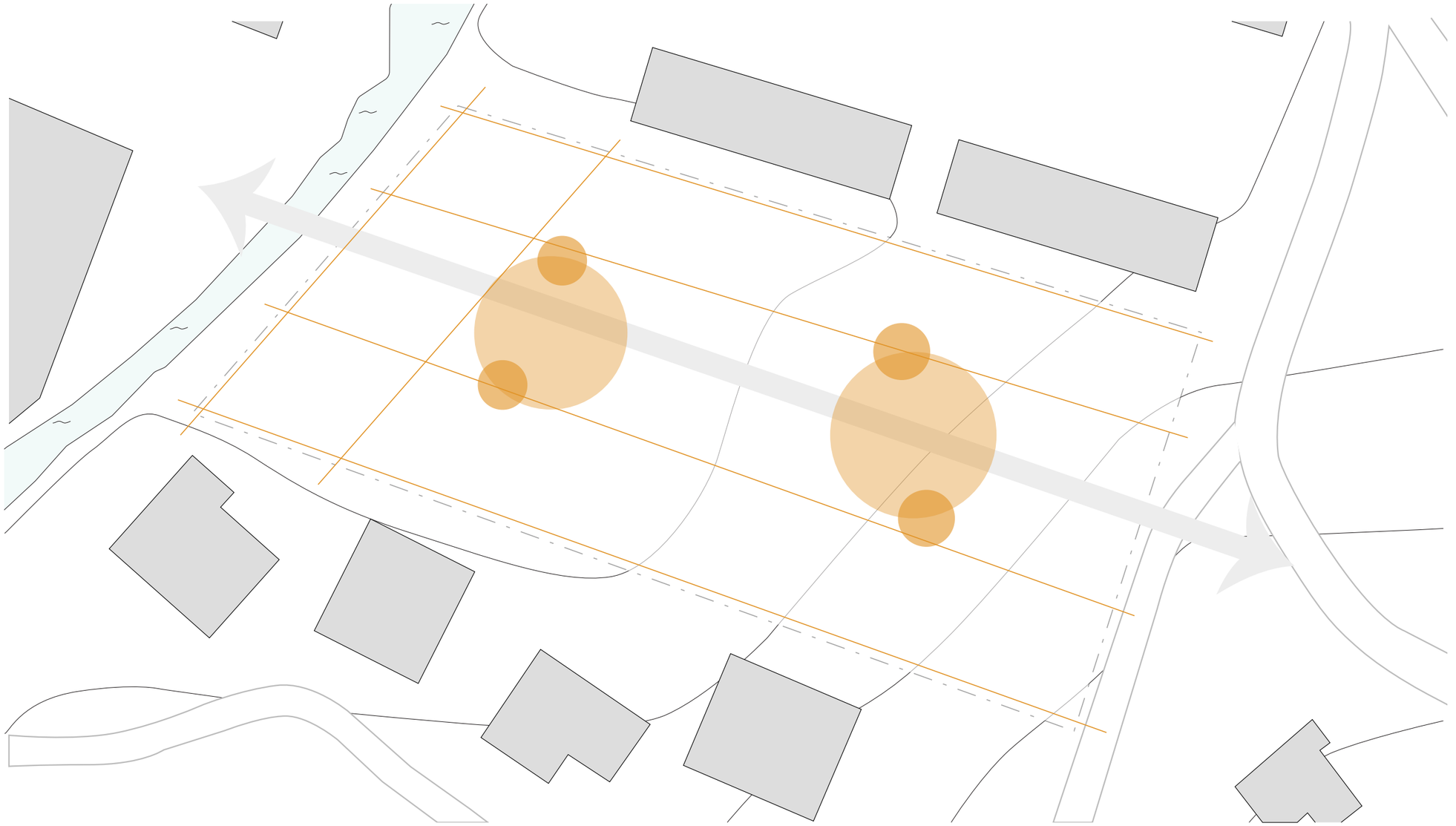
Senior Citizens centre

Primary School

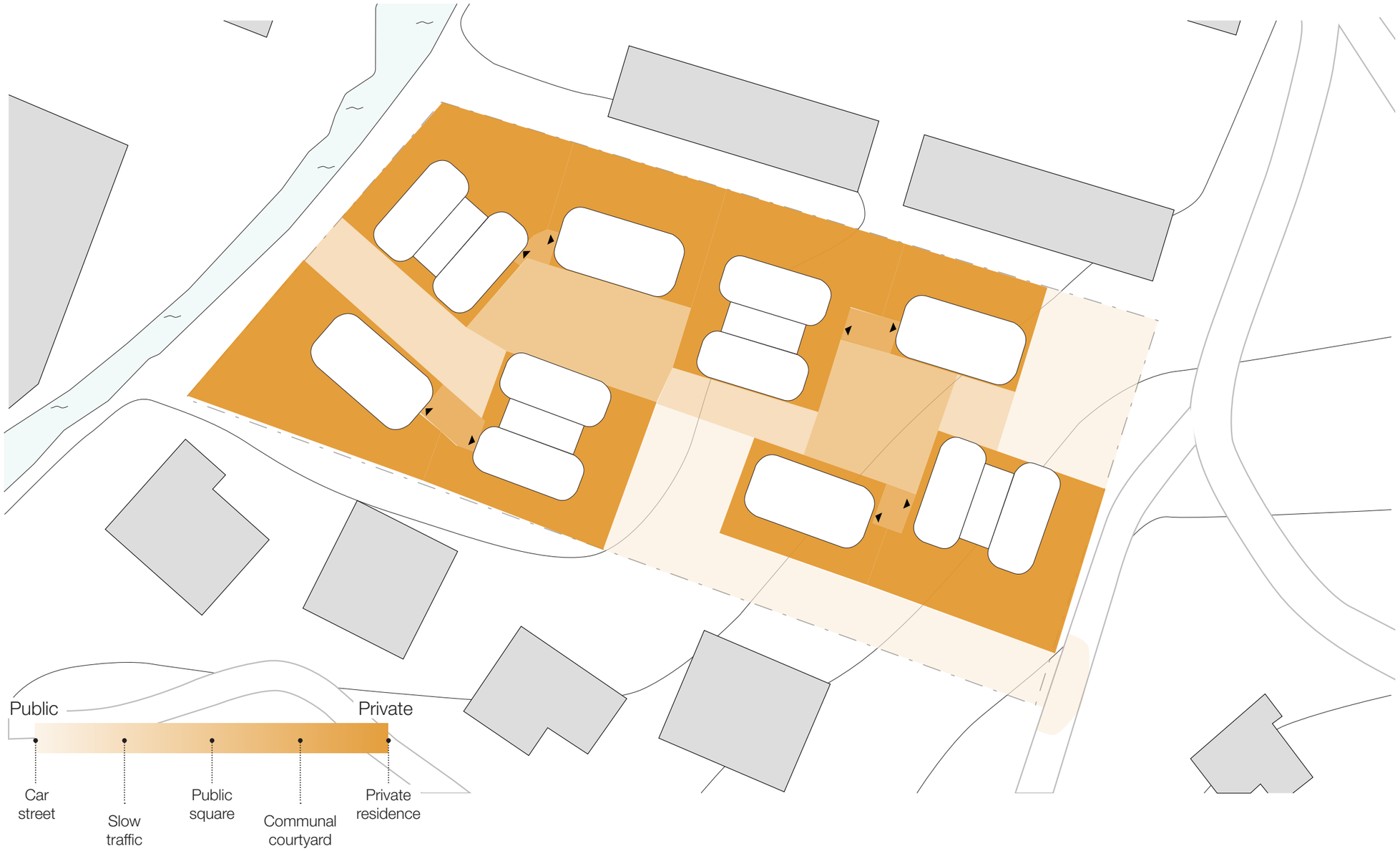


// CONTEXT //

// CONTEXT //
response

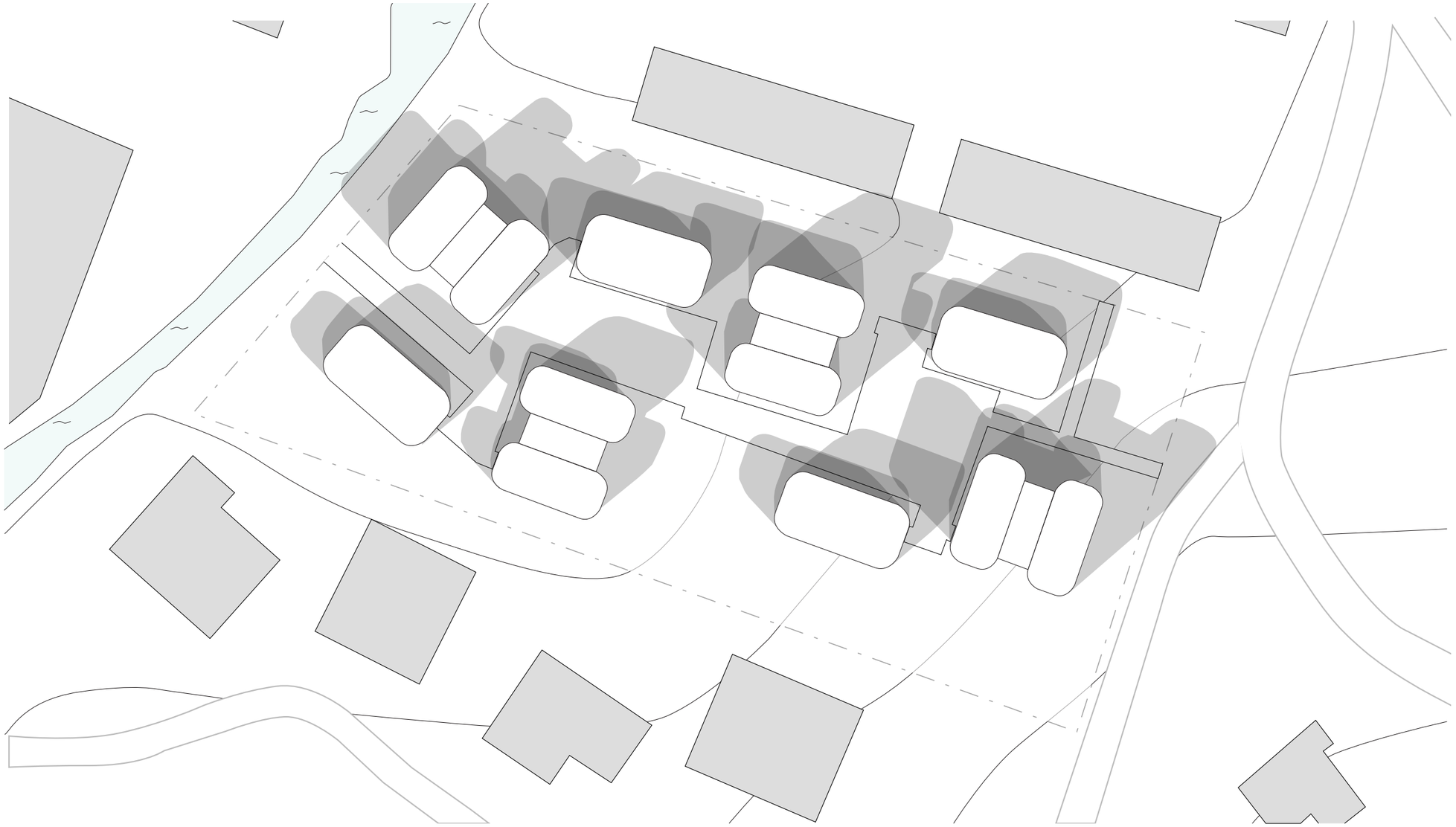


// CONTEXT //
entrances



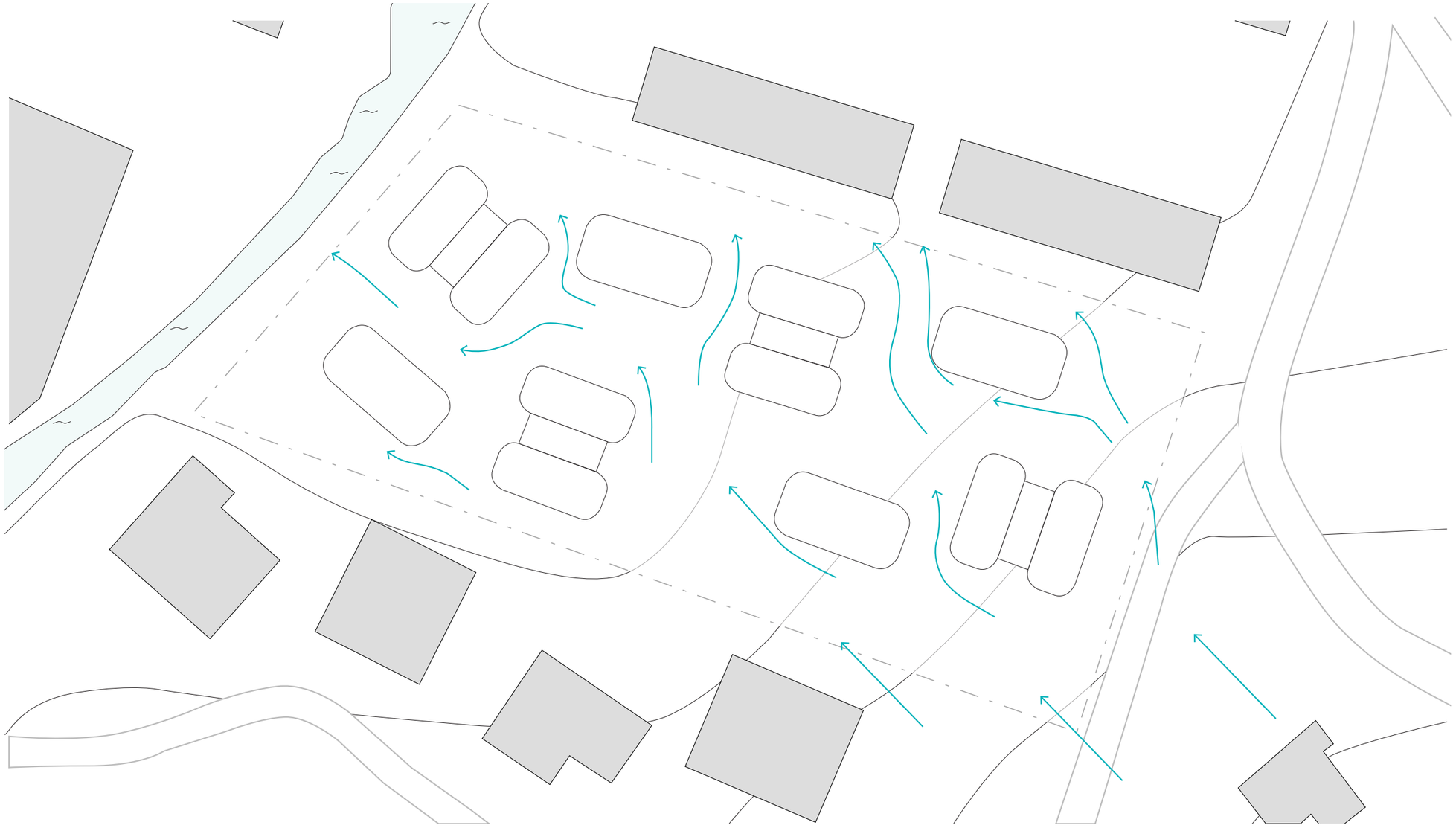
// URBAN CLIMATE //

shared shading - winter



// URBAN CLIMATE //

natural ventilation - southeast wind

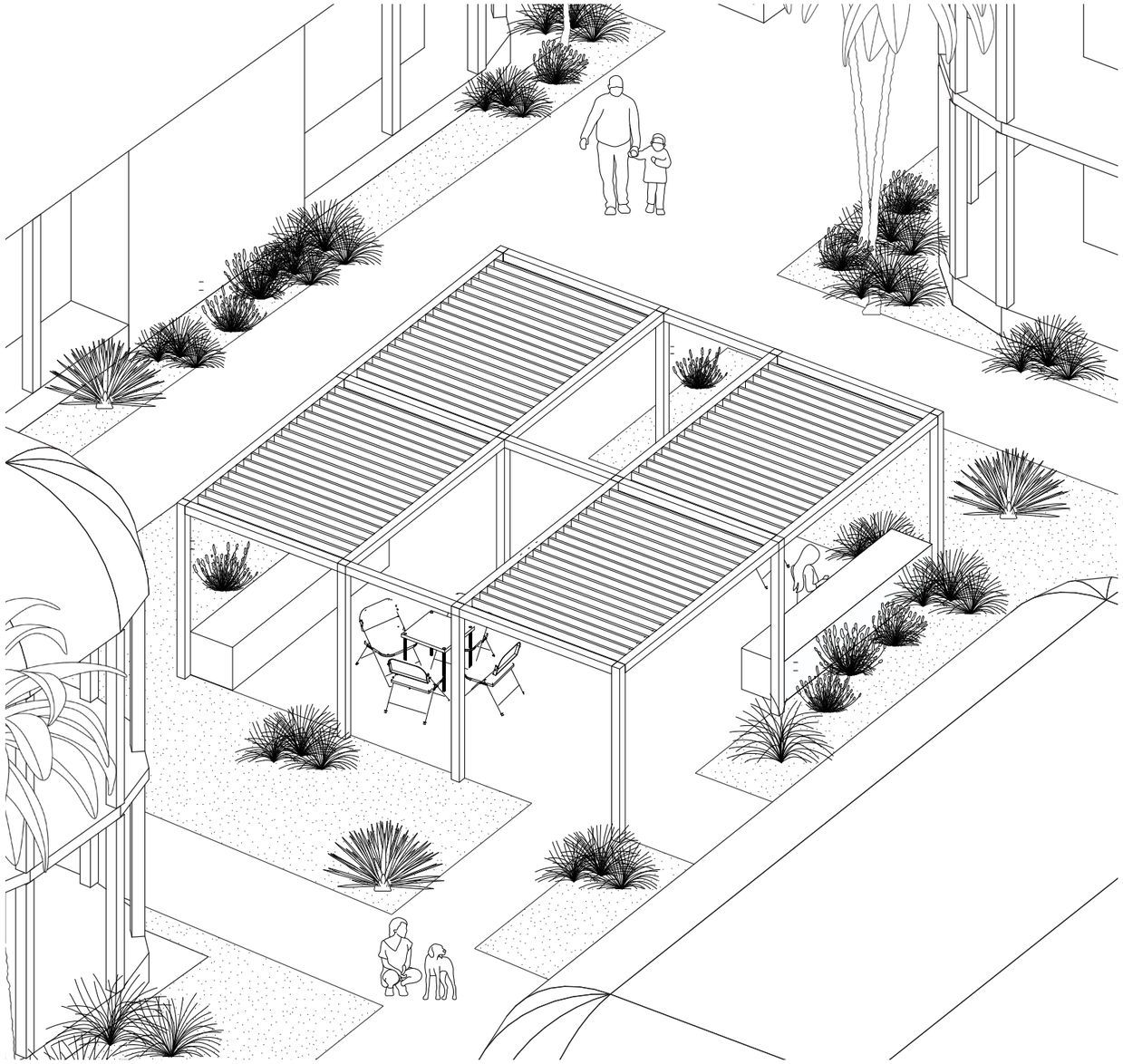


// URBAN PLAN //

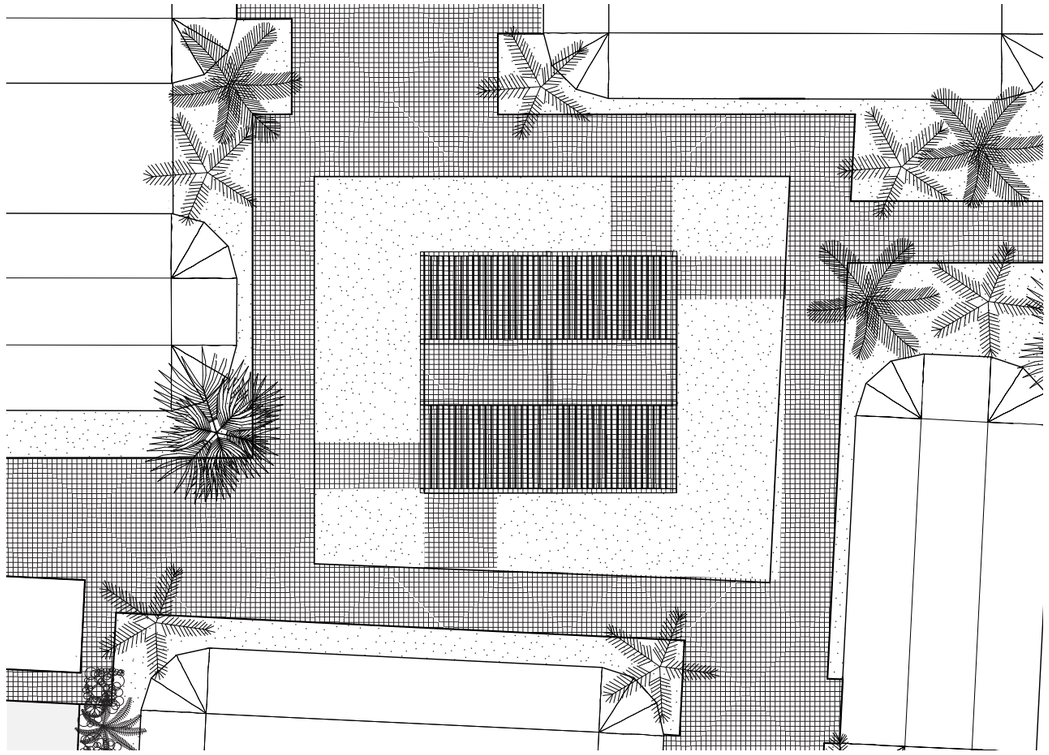
// URBAN PLAN //

// URBAN PLAN //

// CULTURAL ANCHOR //
| central squares (2)

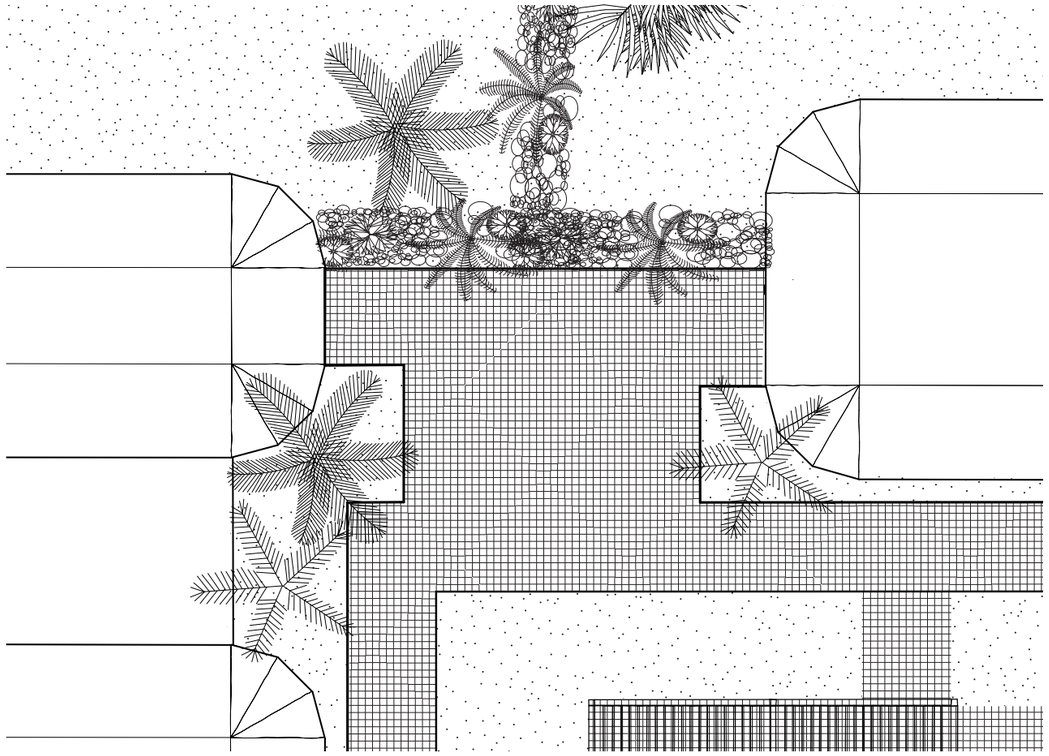


- coming together and sharing food
- expression in music (calypso, merengue, soca, zouk, reggea, etc.)
- coming together and play



// SOCIAL //
|| shared courtyard

- private entrance to homes and garden
- soft border to more private space



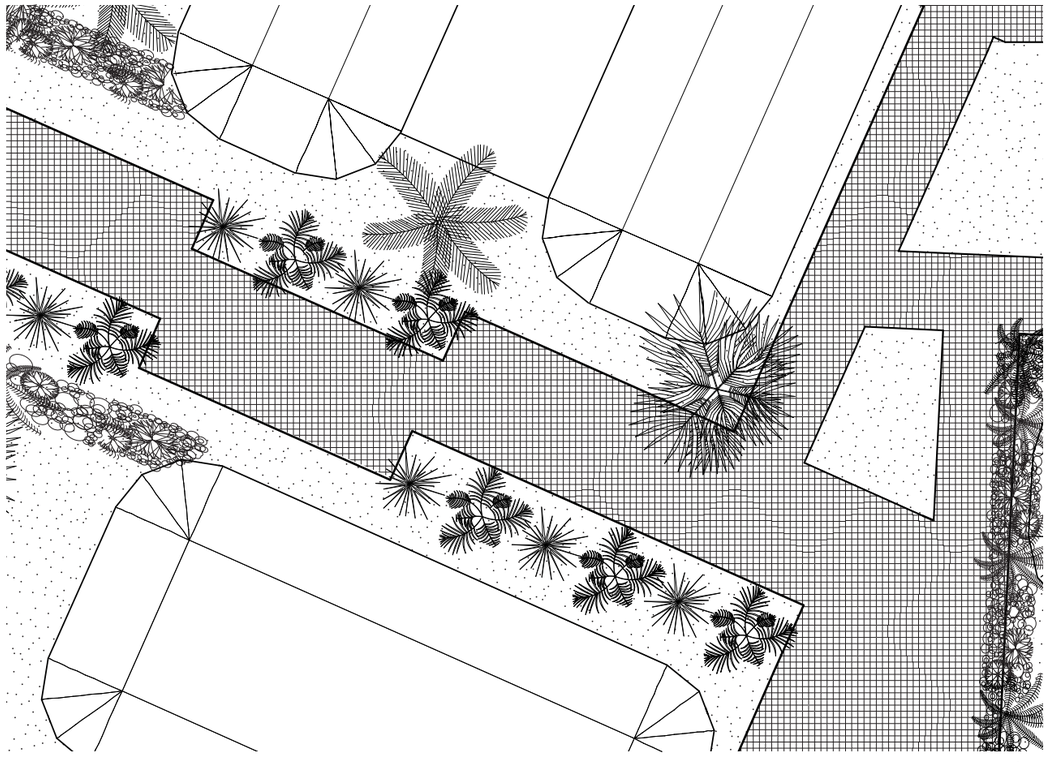
// SOCIAL //

|| shared courtyard

// ECOLOGICAL SYSTEM //

||| connection route

- connecting the development to the supermarket and public transport
- green spine with local planting



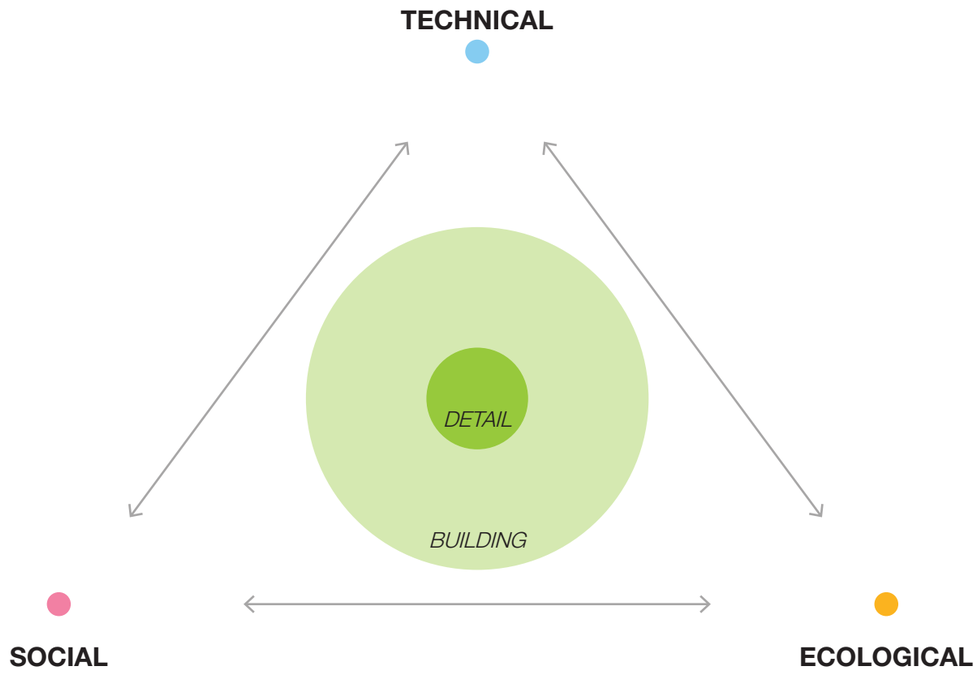
// ECOLOGICAL SYSTEM //

system buildings

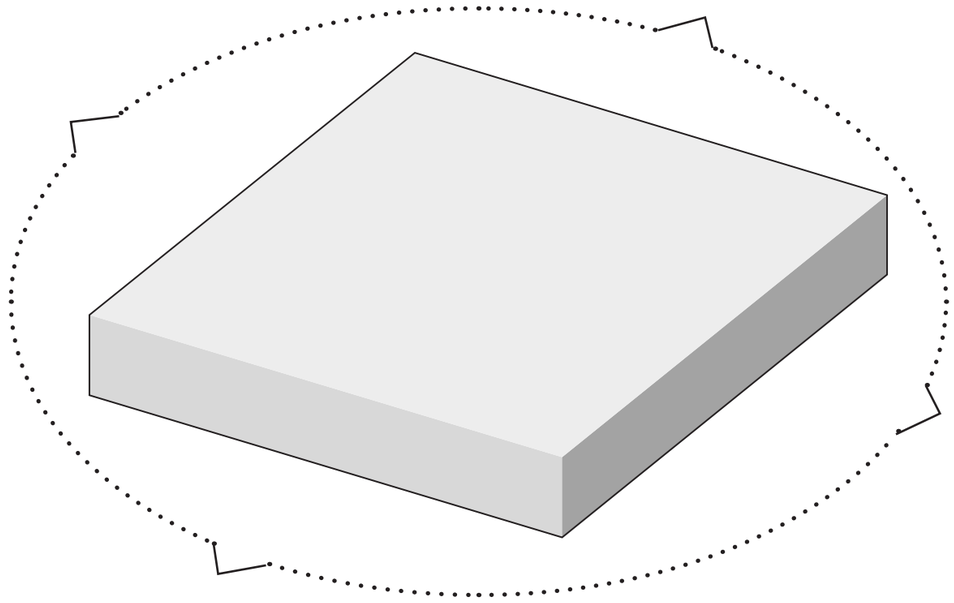
buildings house the grey water system
waste pickup points

// BUILDING **STRATEGY** //

TOWARDS TROPICALITY



// BUILDING DESIGN //
shape development



SOCIAL

privacy

security

social interaction

outdoor living

expression

TECHNICAL

hurricane resistance

climate adaptive design

expandability

adaptability

modularity

ECOLOGICAL

use of local materials

durability

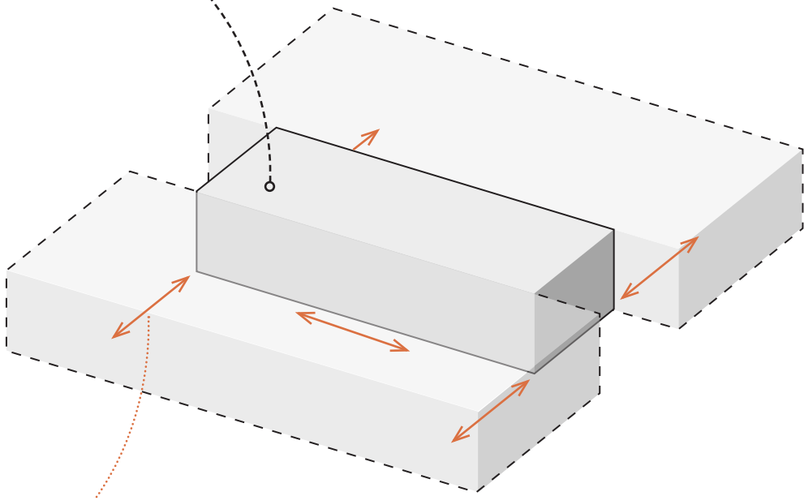
minimize use of electricity and water

reuse of materials

// BUILDING DESIGN //
shape development

essential services

kitchen, wc, storage/ laundry, vertical travel



central position

stability and flexibility

CORE

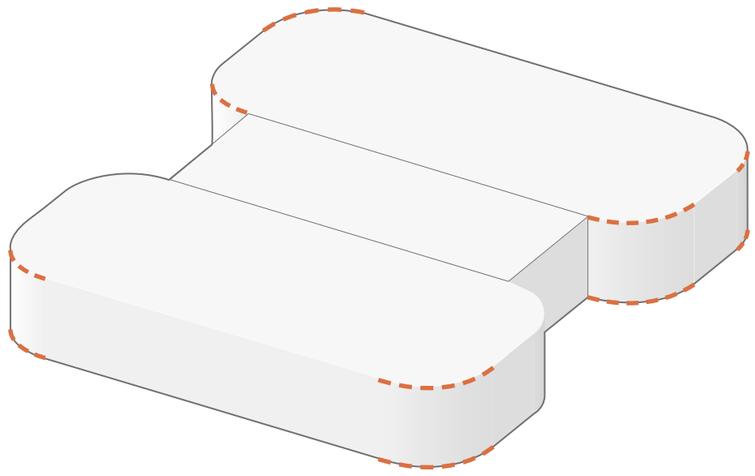
TECHNICAL

hurricane resistance

ECOLOGICAL

durability

use of local materials



CURVED SHELL

TECHNICAL

hurricane resistance

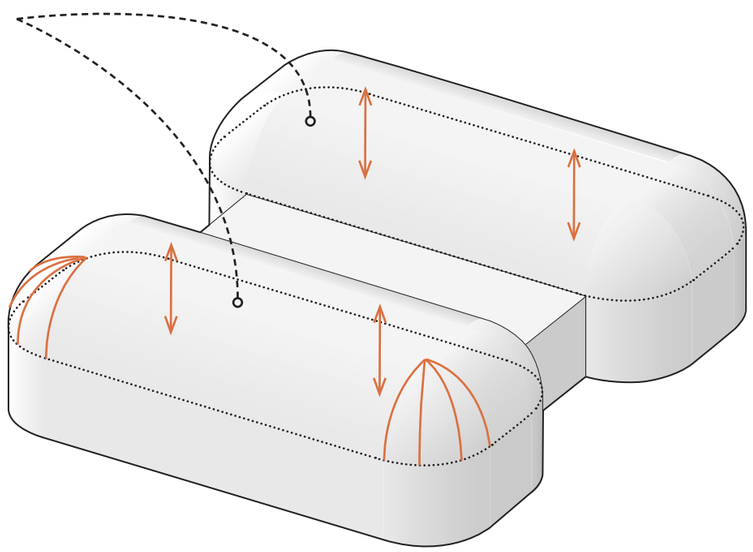
<u>drag coefficient</u>

curved edges minimize wind pressure on the building

shape development

buffer zones

hot air rises and leaves
through the ridge vents



drag coefficient

curved edges minimize wind
pressure on the building

CURVED ROOF EDGES

TECHNICAL

hurricane resistance

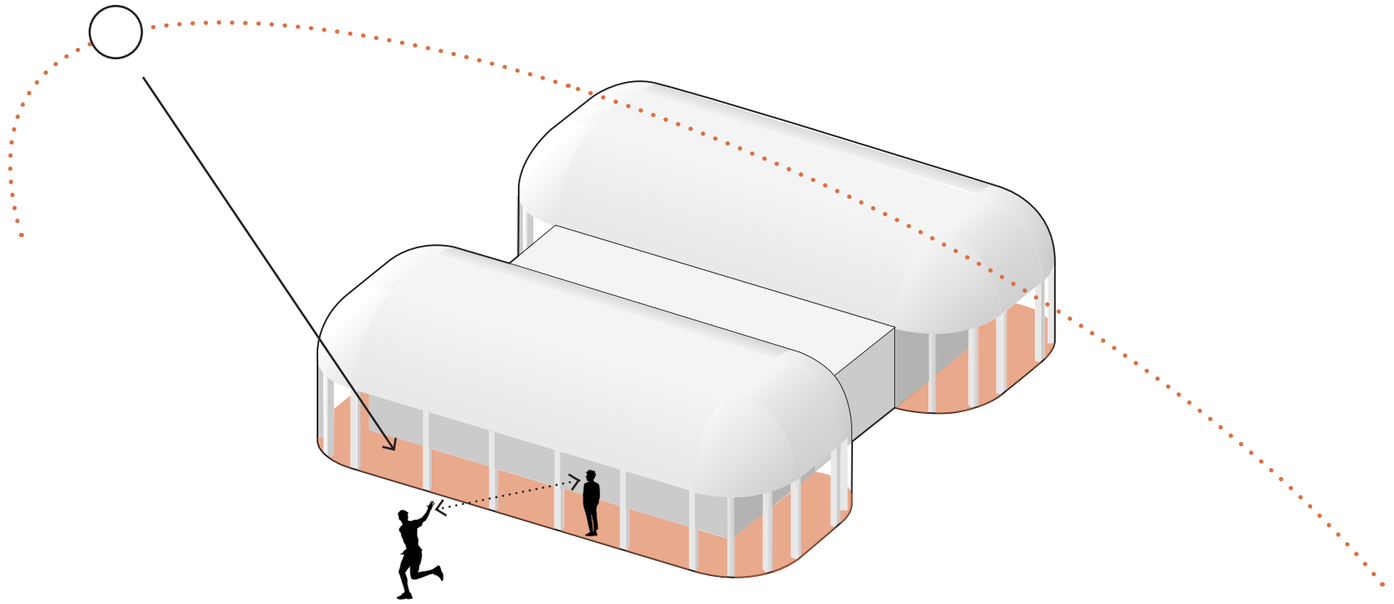
climate adaptive design

ECOLOGICAL

minimize use of electricity

to cool the building

// BUILDING DESIGN //
shape development



VERANDA SPACE

SOCIAL

privacy

social interaction

outdoor living

TECHNICAL

climate adaptive design

ECOLOGICAL

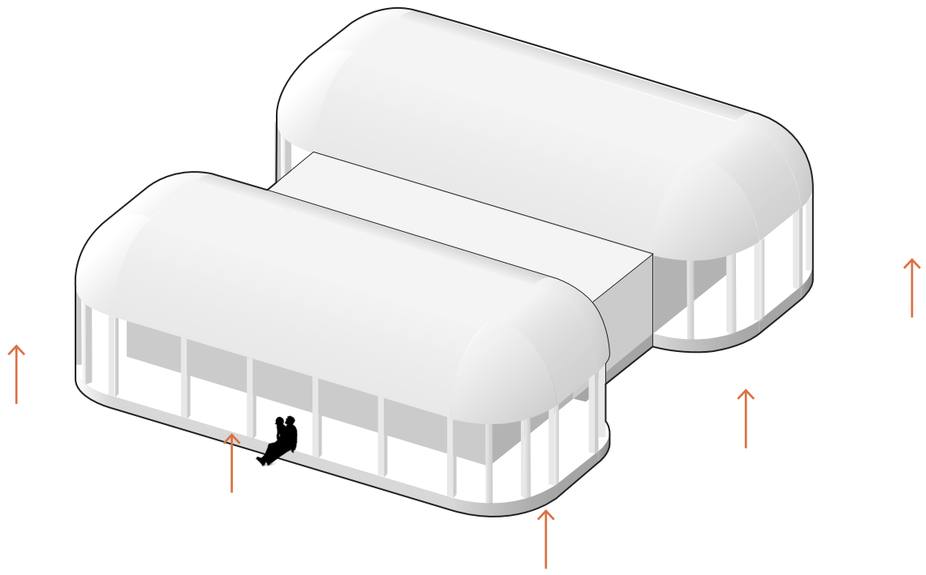
minimize use of electricity

to cool the building

<u>buffer zone</u>
the overhang protects the
indoor living spaces from
solar radiation

<u>Indoor/ outdoor</u>
the veranda creates a
outdoor living space where
you meet people and greet
your neighbor

// BUILDING DESIGN //
shape development



VERANDA SPACE

SOCIAL

privacy

interactive

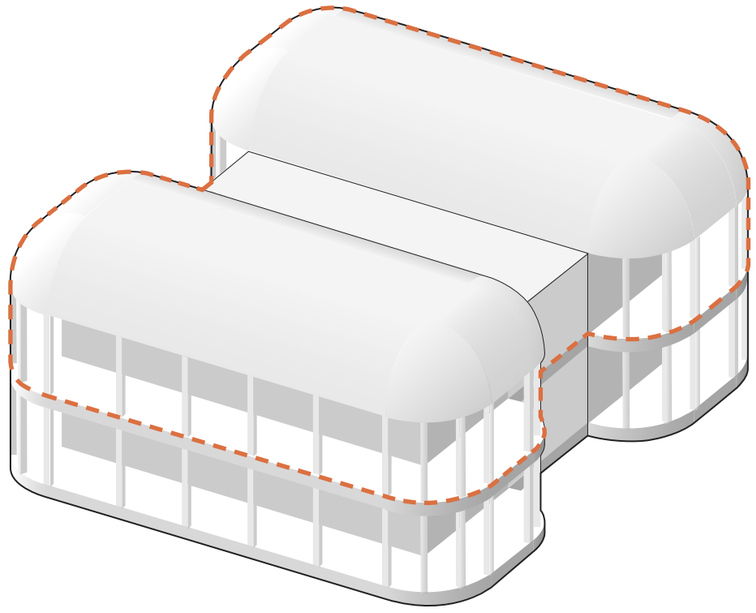
TECHNICAL

climate adaptive design

<u>height difference</u>
non-physical barrier that
creates the sense of privacy

<u>flood protection</u>
during tropical storms the
interior is protected from
flooding

// BUILDING DESIGN //
shape development



ADDITIONS

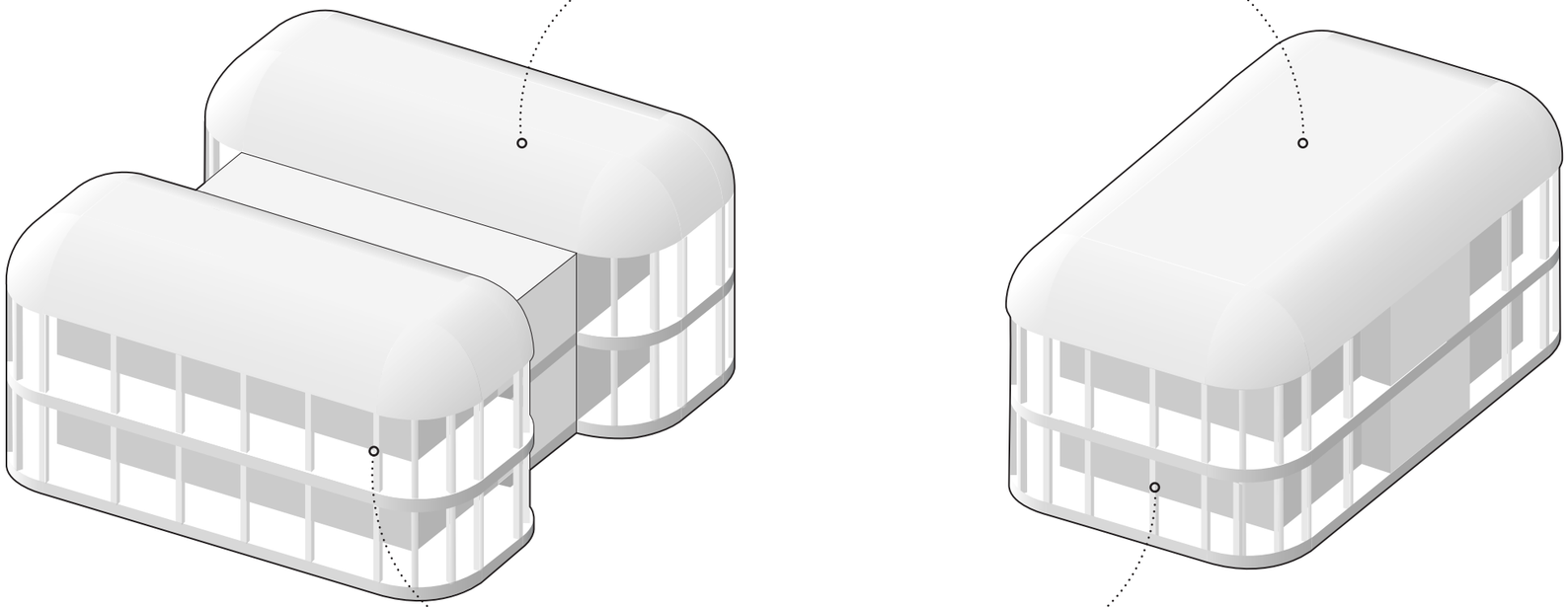
TECHNICAL

expandability

<u>additional floors</u>
in case of change of owner or
household expansion

// BUILDING DESIGN //
shape development

roof shape
influences expandability



modular building elements
the building system can be
adjusted to different sizes
and shapes

FLEXIBILITY

TECHNICAL

adaptability

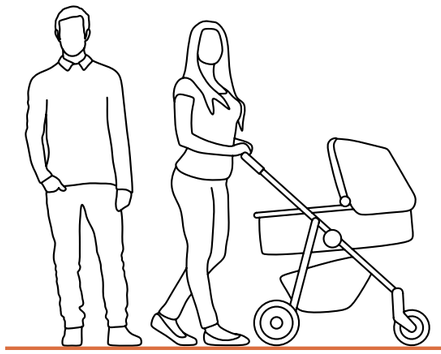
modularity

ECOLOGICAL

reuse of materials

// BUILDING SCENARIO //

target groups

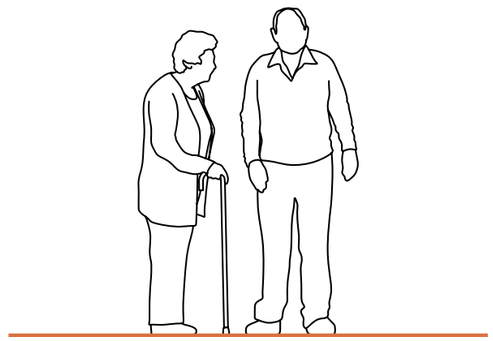


(STARTING) FAMILIES

- household of 1 or 2 parents
- 1 or more kids
- combined income ANG 120.000 - 150.000

EUR 60.000 - 80.000

- living area 150 - 250 m^2



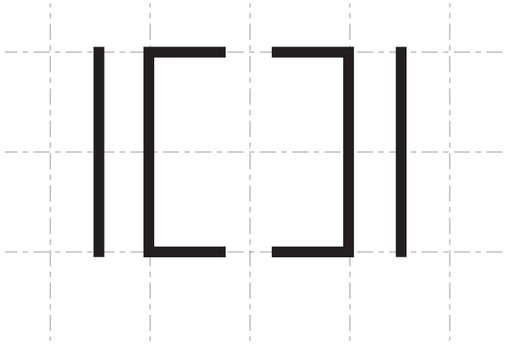
SENIORS

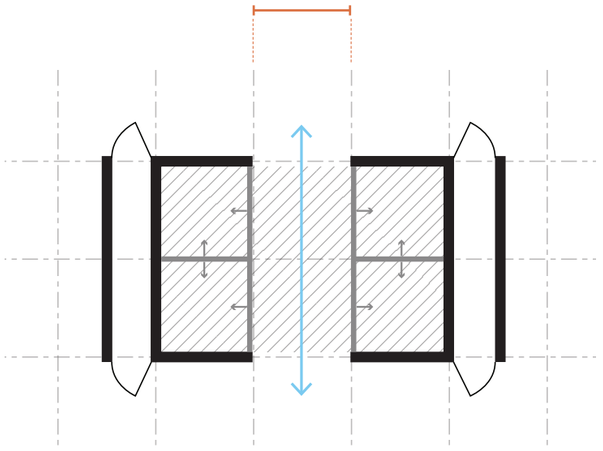
- elderly couple or single senior
- sometimes grandkid(s)
- combined income ANG 30.000 - 50.000

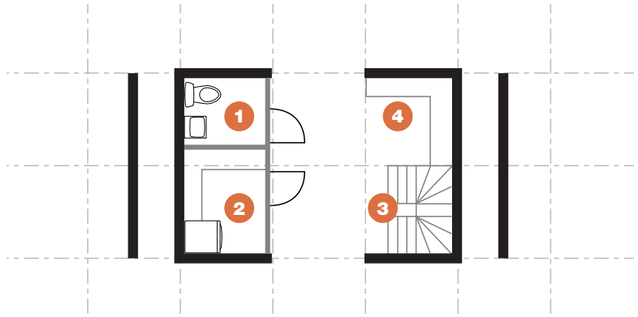
EUR 15.000 - 20.000

- living area 75 - 100 m^2

// BUILDING PROCESS //



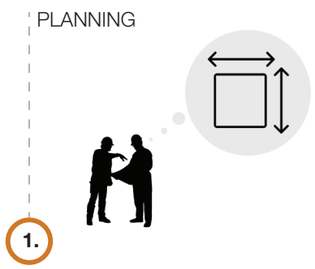




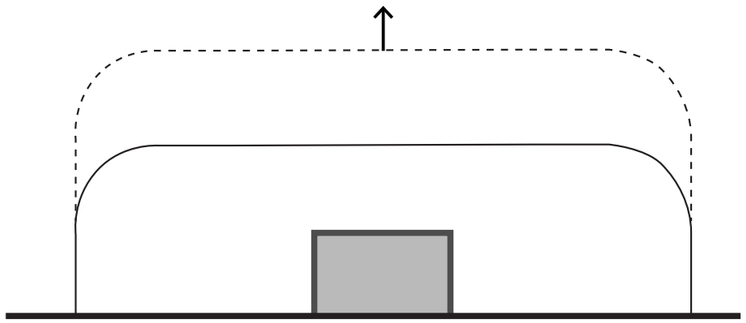
spaces

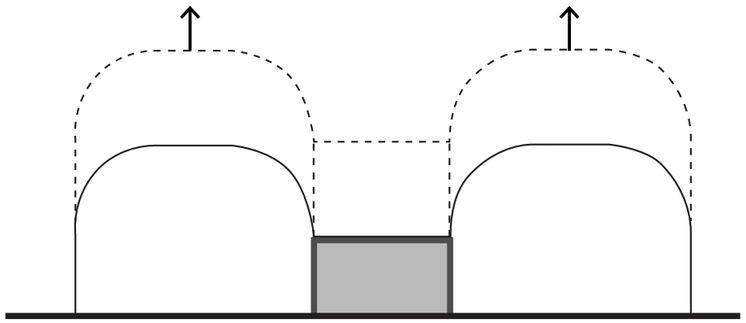
- vertical travel
- kitchen
- bathroom(s)
- storage space

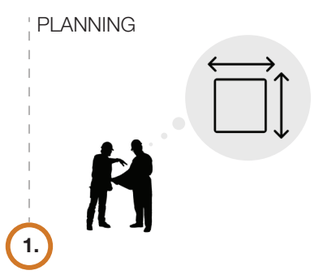
1. bathroom (3 m^2)
2. storage (5 m^2)
3. stairs
4. kitchen (5 $m^{2)}$



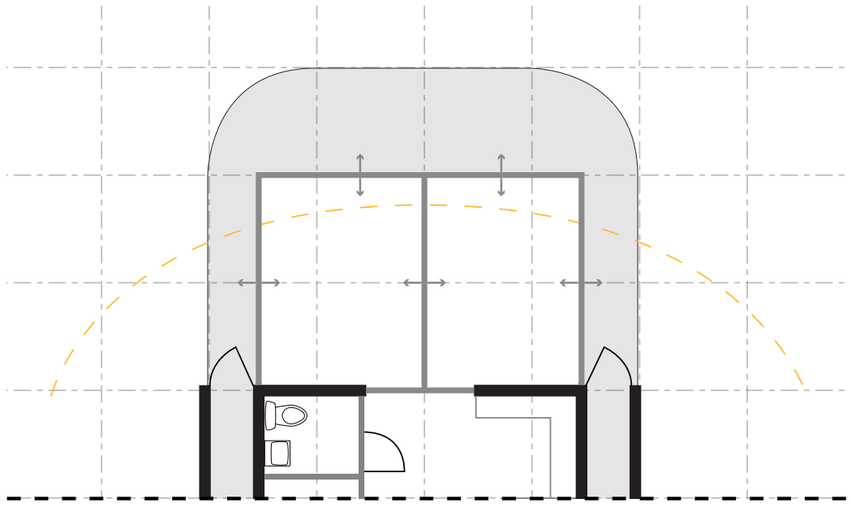
// BUILDING PROCESS //



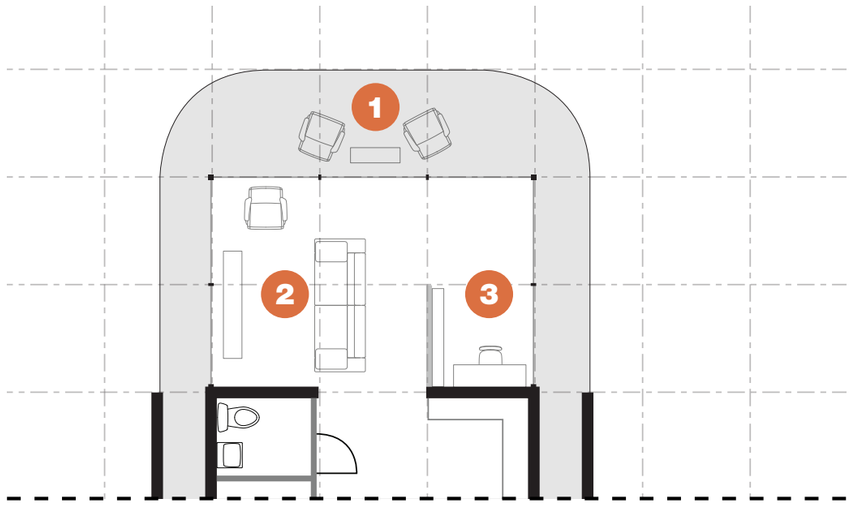




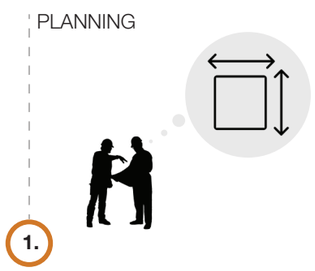
// BUILDING PROCESS //



living - **40 m²**

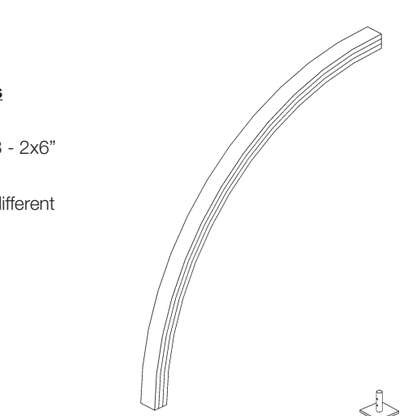


1. veranda (25 m²)
2. living (17 m²)
3. study (8 m²)



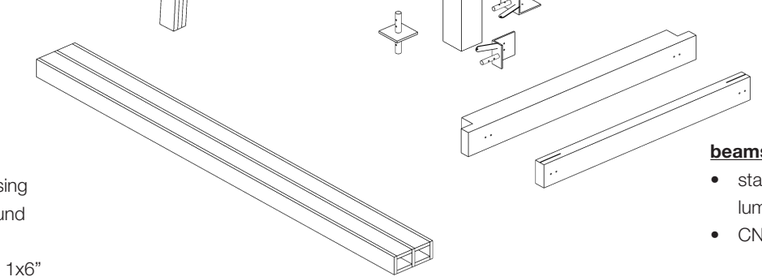
// BUILDING PROCESS //

curved roof members
- 2.1 meter radius
- prefabricated from 3 - 2x6” lumber pieces
- replicable to make different roof shapes



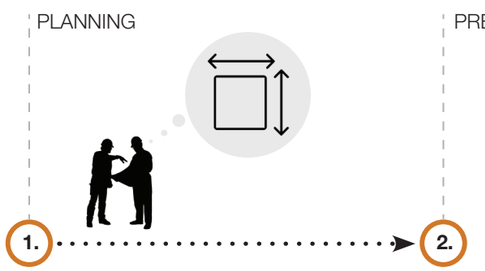
columns
- standard 8x8” lumber piece
- CNC milled for precise fittings

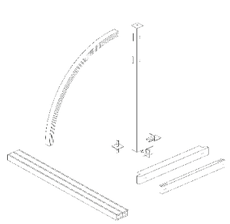
connectors
- drift pin connections
- no bolts and screws required



floor box elements
- integrated systems
- load carrying & stabilising
- possibility to instal sound insulation
- prefabricated from 7 - 1x6” lumber pieces
- spans up to 16 meters

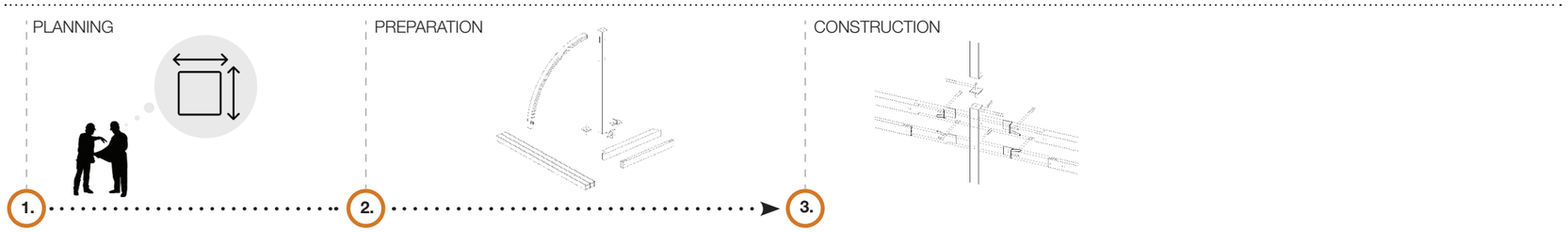
beams
- standard 8x8” and 4x8” lumber pieces
- CNC milled for precise fittings





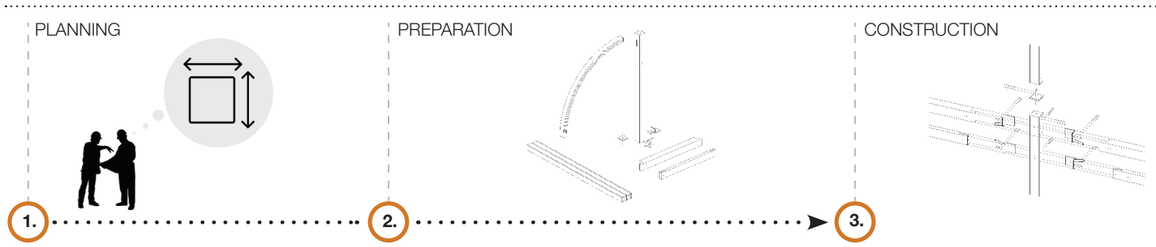
// BUILDING PROCESS //

foundation
after excavation the concrete foundation is cast on-site



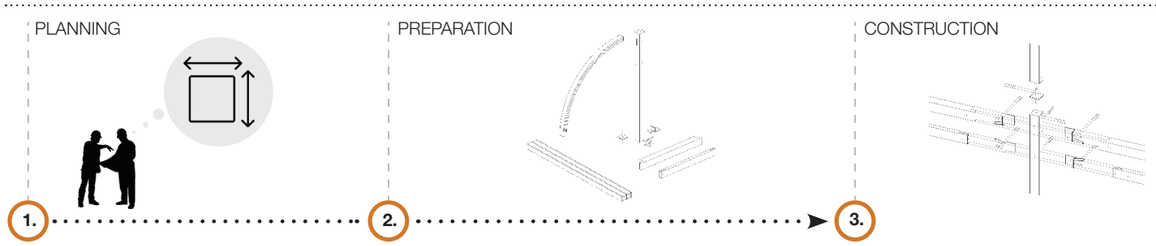
// BUILDING PROCESS //

rammed earth walls with concrete ringbeam
rammed earth walls build with excavated clay loam soil.



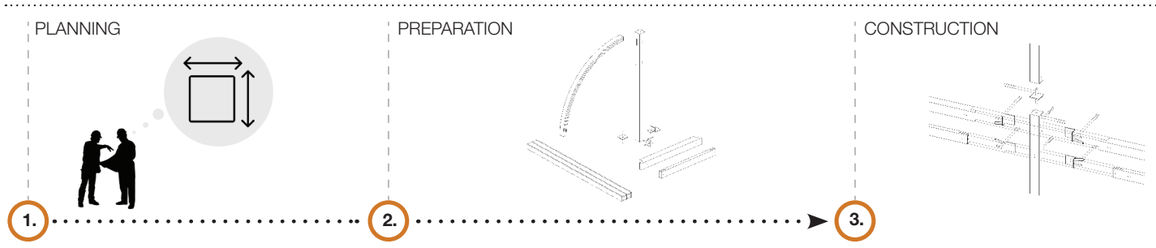
// BUILDING PROCESS //

primary structure
wood lumber columns connected by two rows of beams for stability



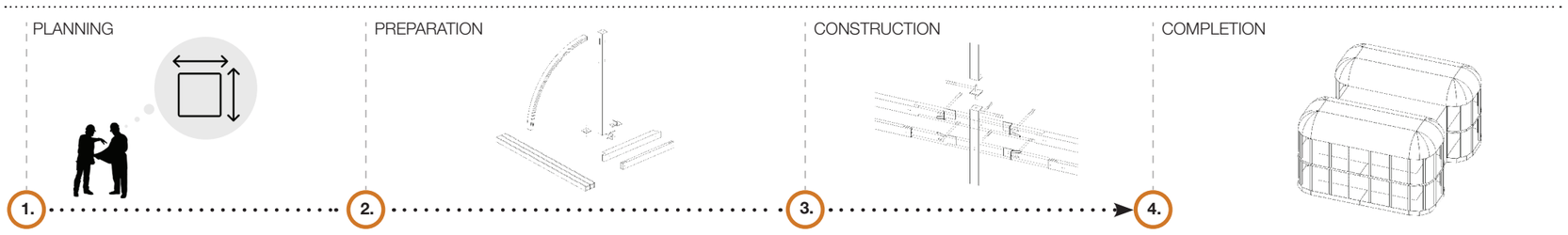
// BUILDING PROCESS //

roof structure
prefab rafters on-site and mounted to the columns whereafter
the roof finish is applied to the structure

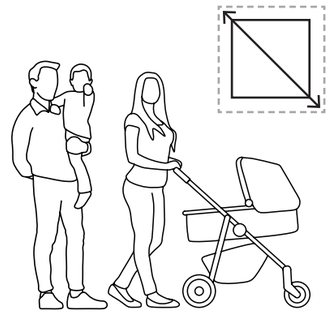


// BUILDING PROCESS //

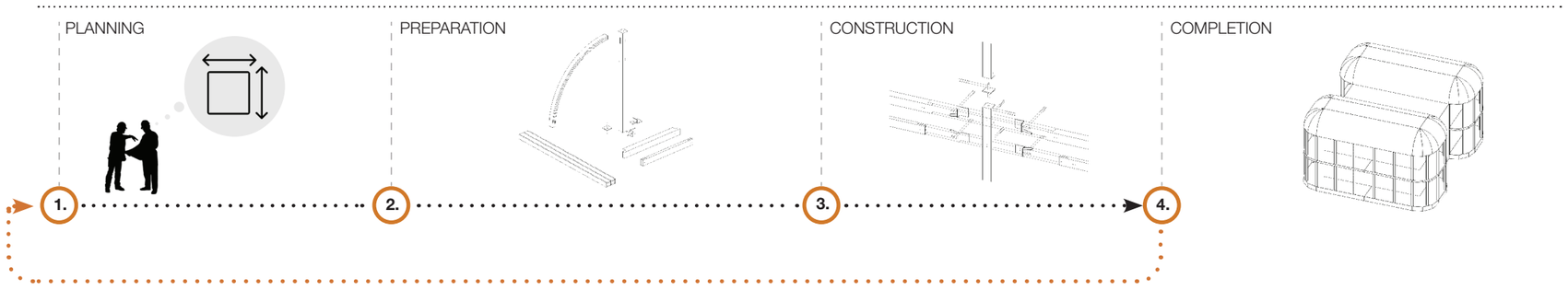
first phase completed
the secondary structure is placed onto which the facade panels are mounted which completes the first phase of construction



// BUILDING PROCESS //

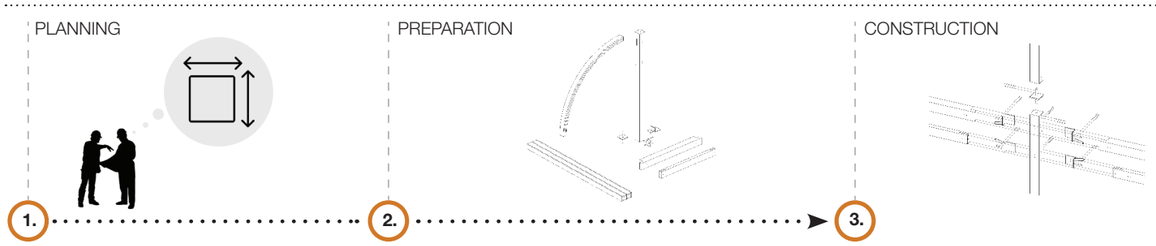


start second phase
when the family is expanding and decide to also expand their home, the process starts from the beginning



// BUILDING PROCESS //

removal of the roof
the connectors are demounted and the roof can be lifted off



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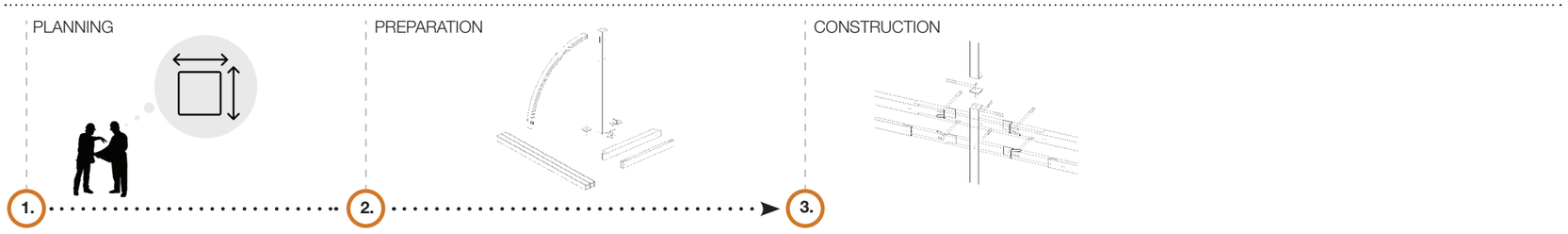
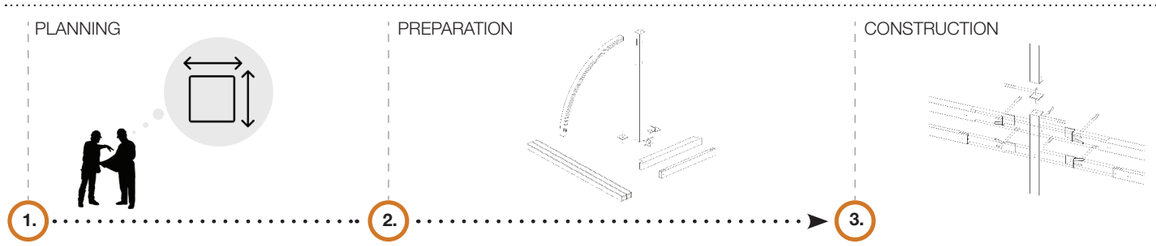


// BUILDING PROCESS //

first floor assembly
prefab wooden box elements are placed on the primary structure



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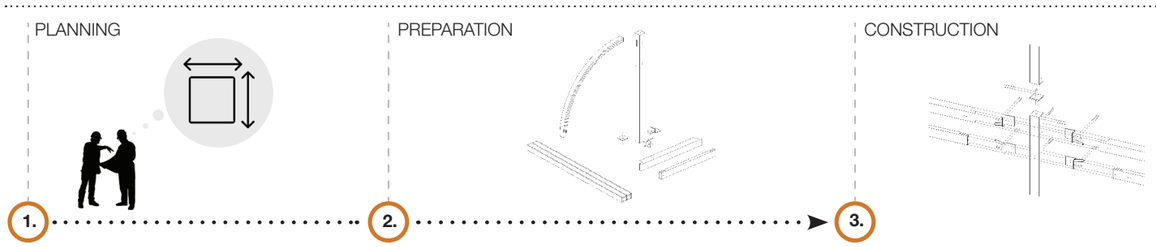

// BUILDING PROCESS //

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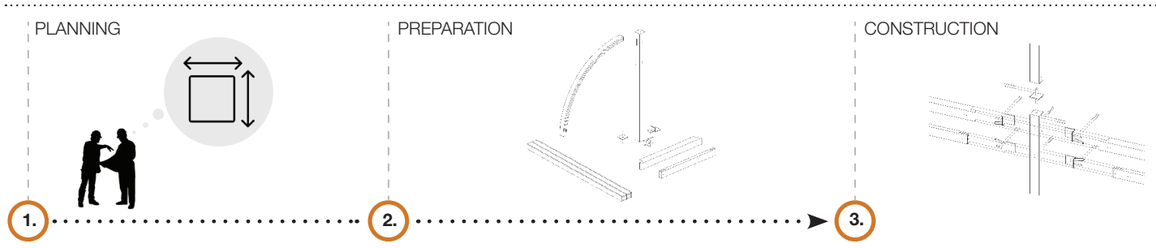
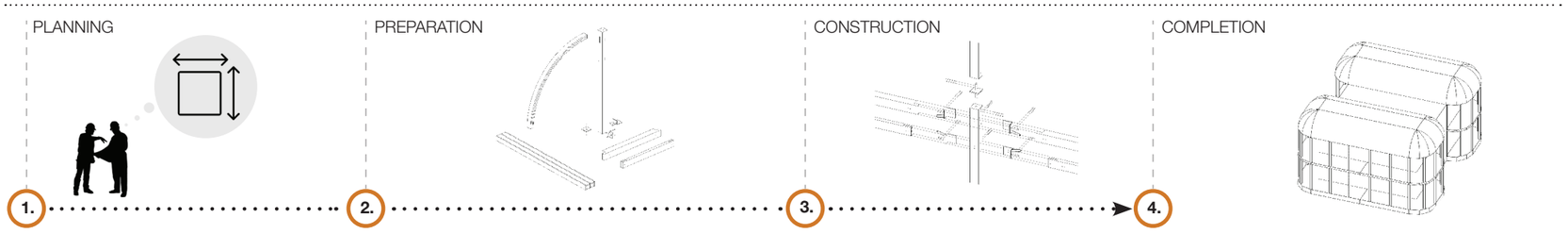
prefab rafters on-site and mounted
to the columns whereafter the roof
finish is applied to the structure



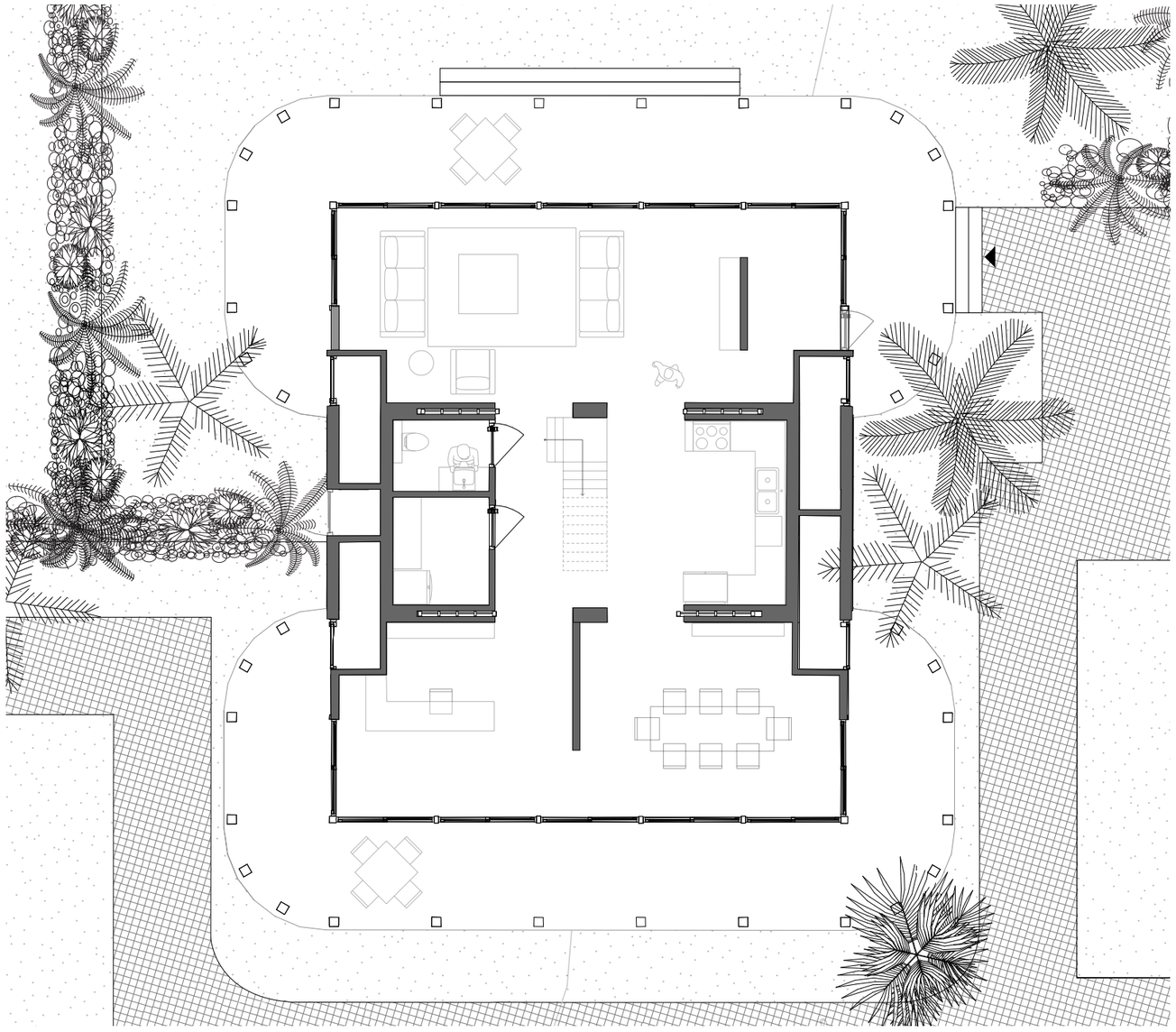
// BUILDING PROCESS //

second phase completed
the secondary structure is placed onto which the facade panels are mounted which completes the second phase of construction



// LIVING ENVIRONMENT //

ground floor plan

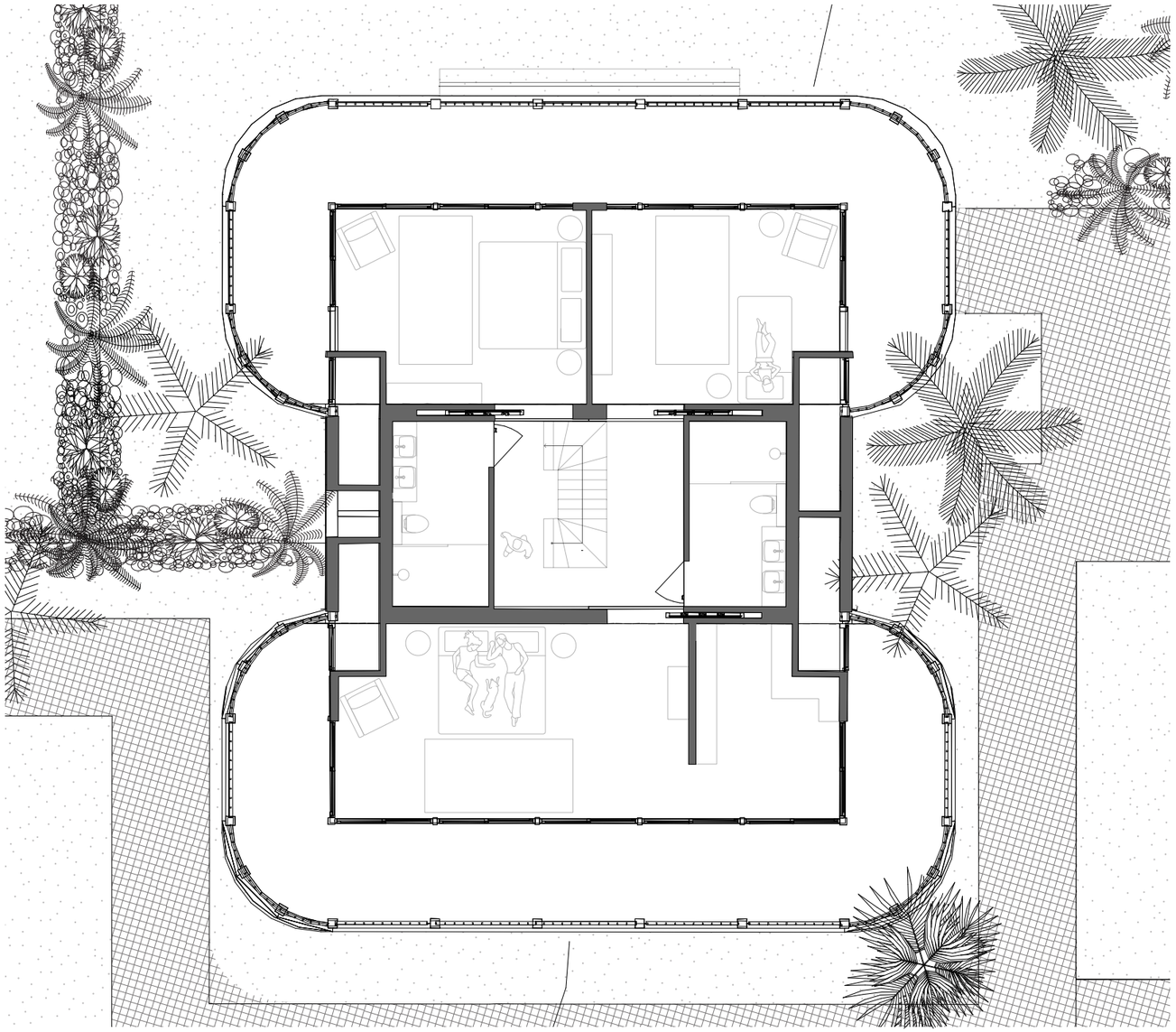


// LIVING ENVIRONMENT //

impression

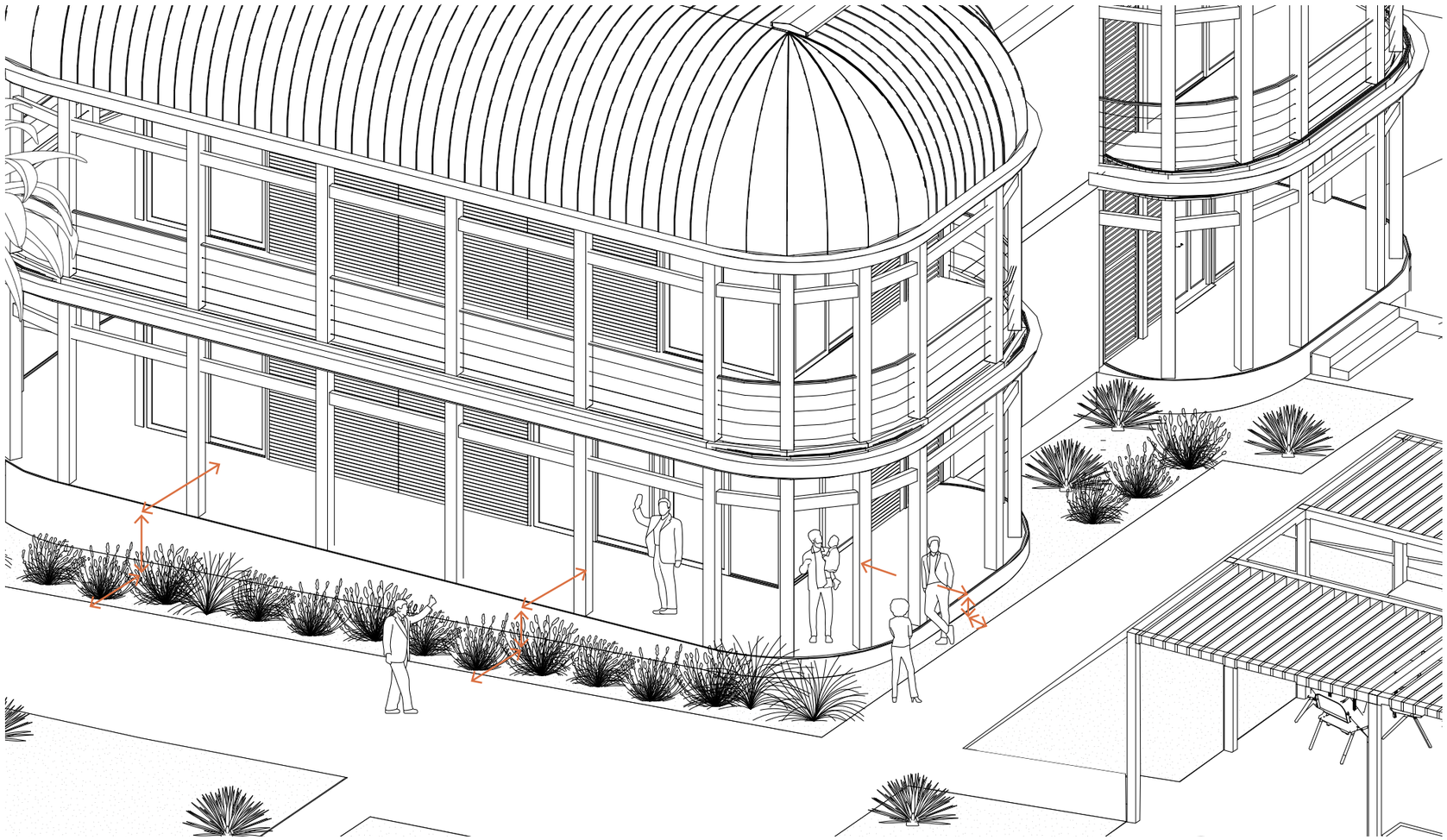
// LIVING ENVIRONMENT //

second floor plan



// LIVING ENVIRONMENT //

social interactions



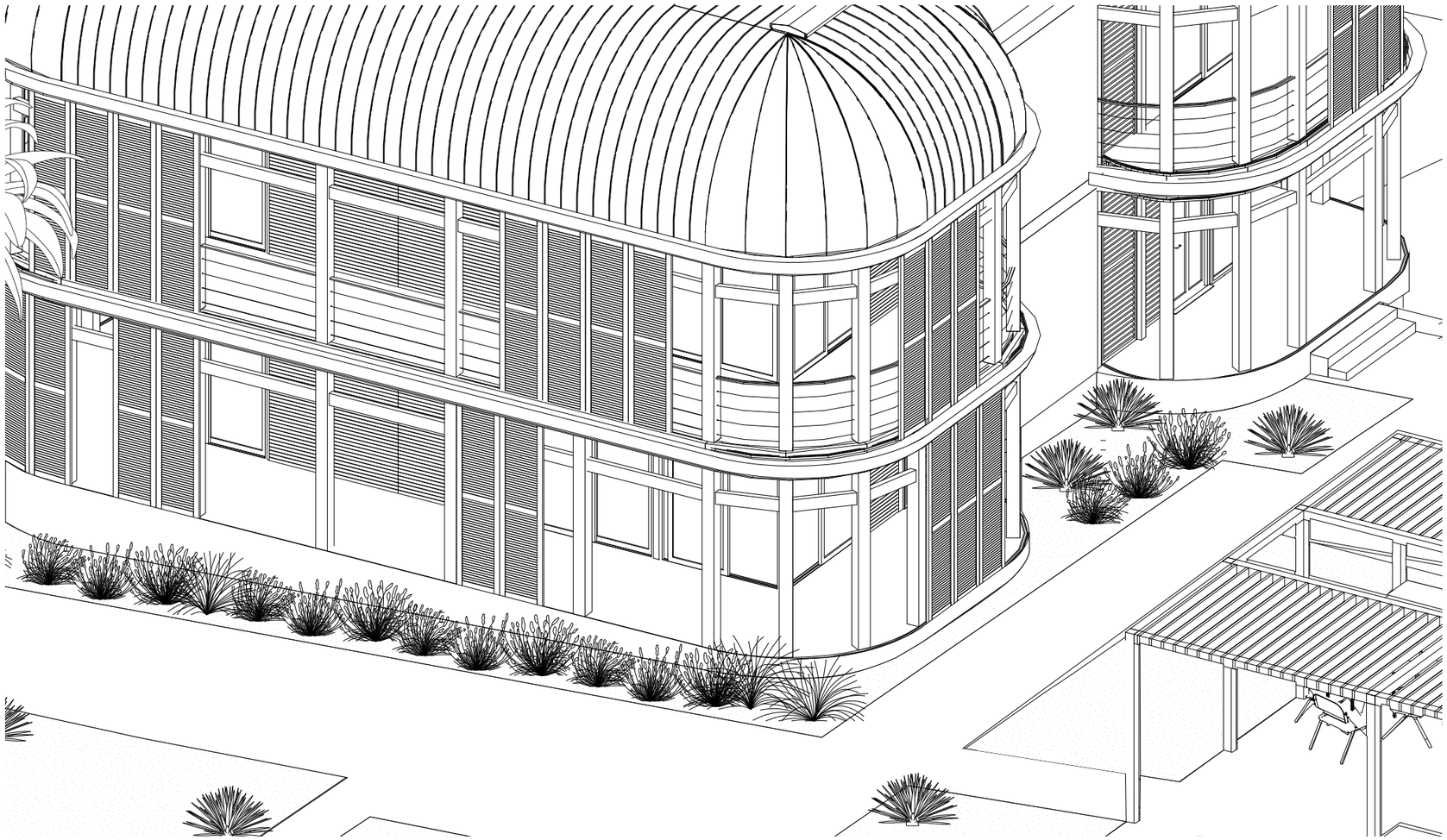
- meeting places at plinth
- soft borders
- secondary facade responds to privacy and natural light requirements

// LIVING ENVIRONMENT //

social interactions

// LIVING ENVIRONMENT //

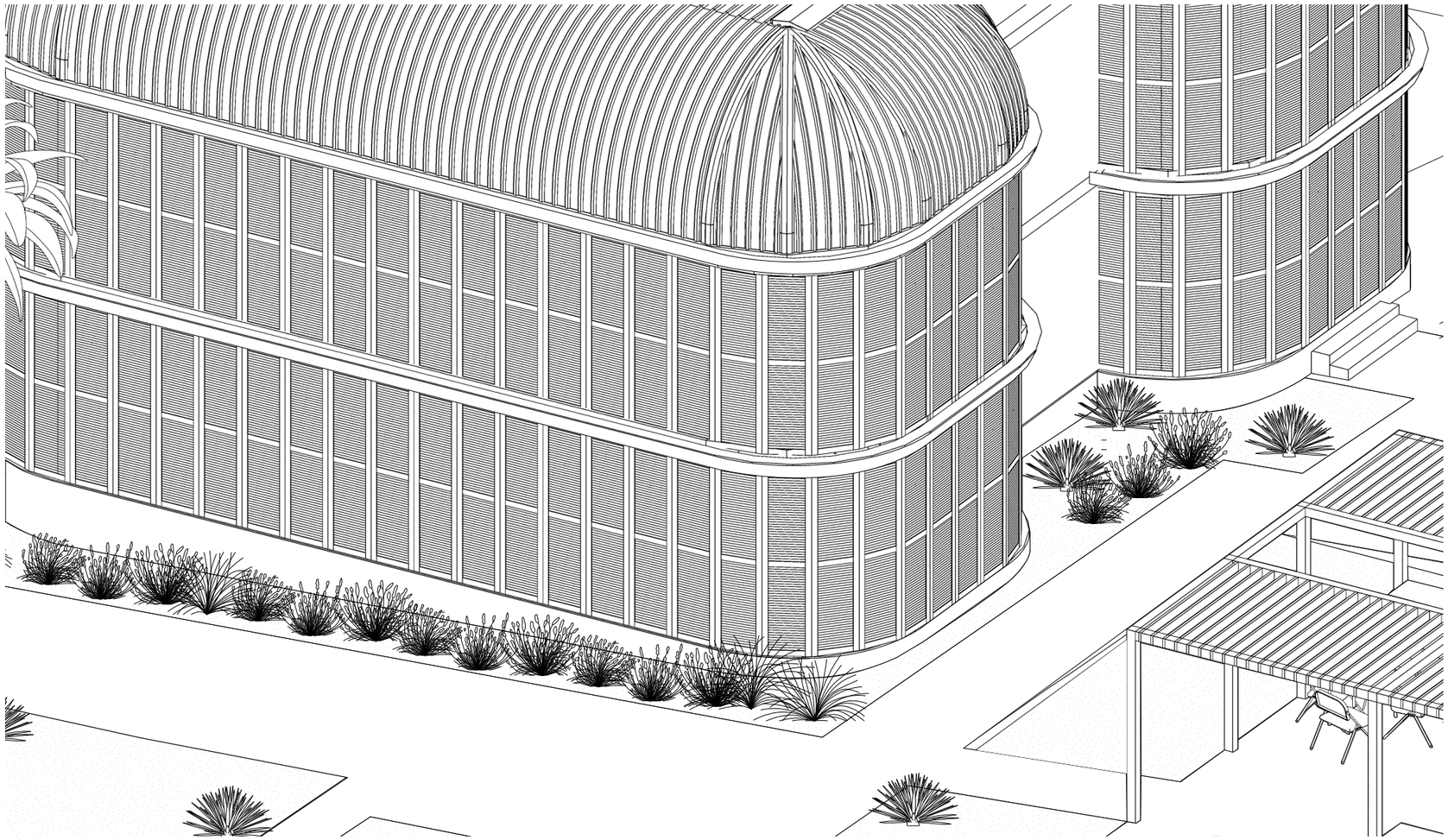
privacy



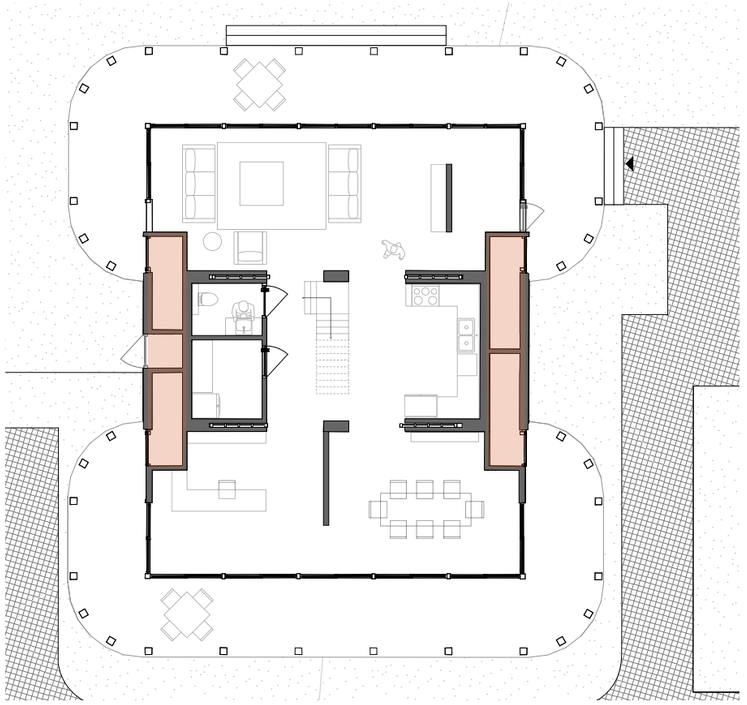
- storm panels can be used as privacy screens & sun protection with low sun angles on the veranda

// LIVING ENVIRONMENT //

storm panels

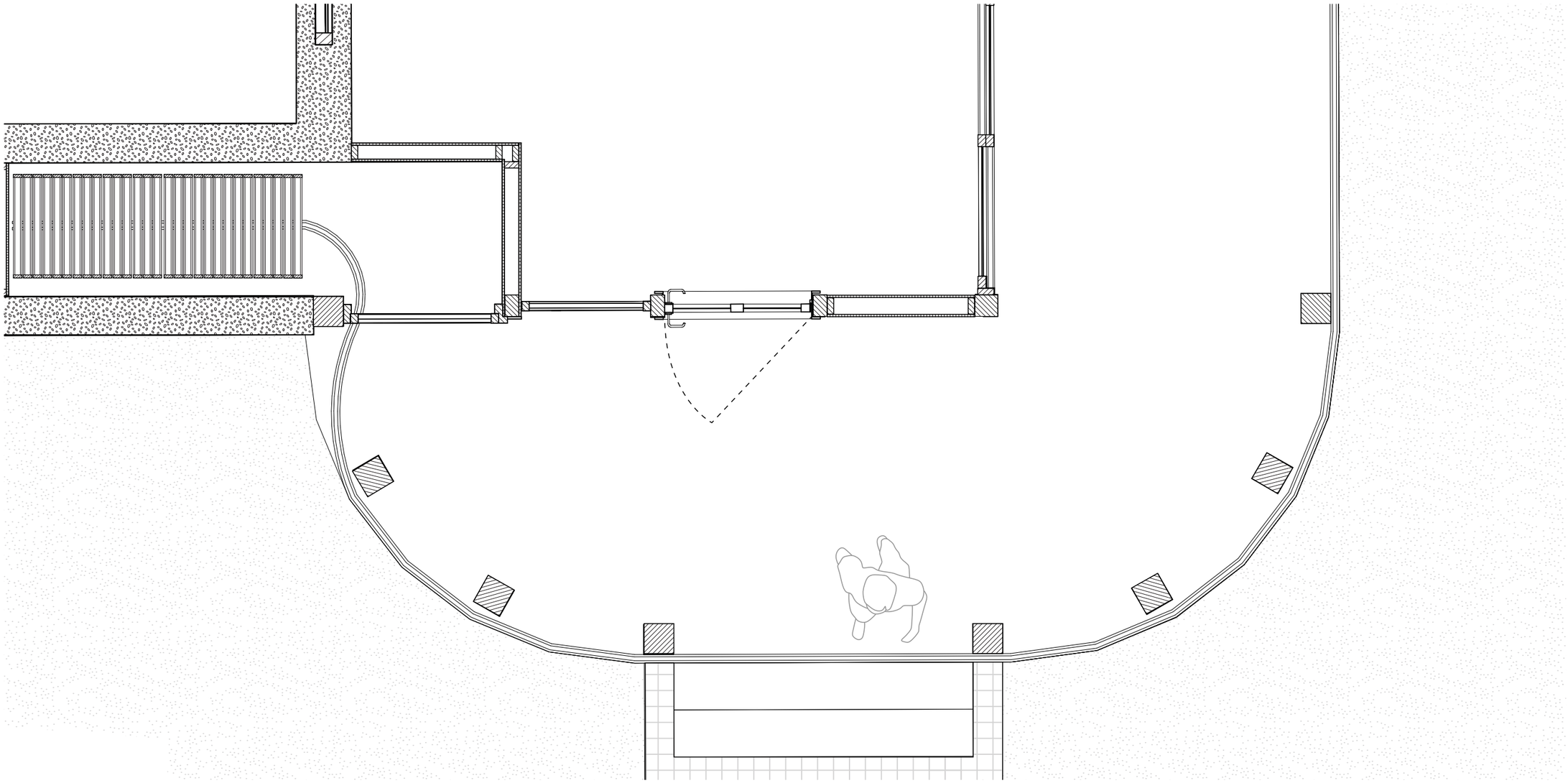


- storm panels are used in event of a hurricane to form a protective layer around the house.



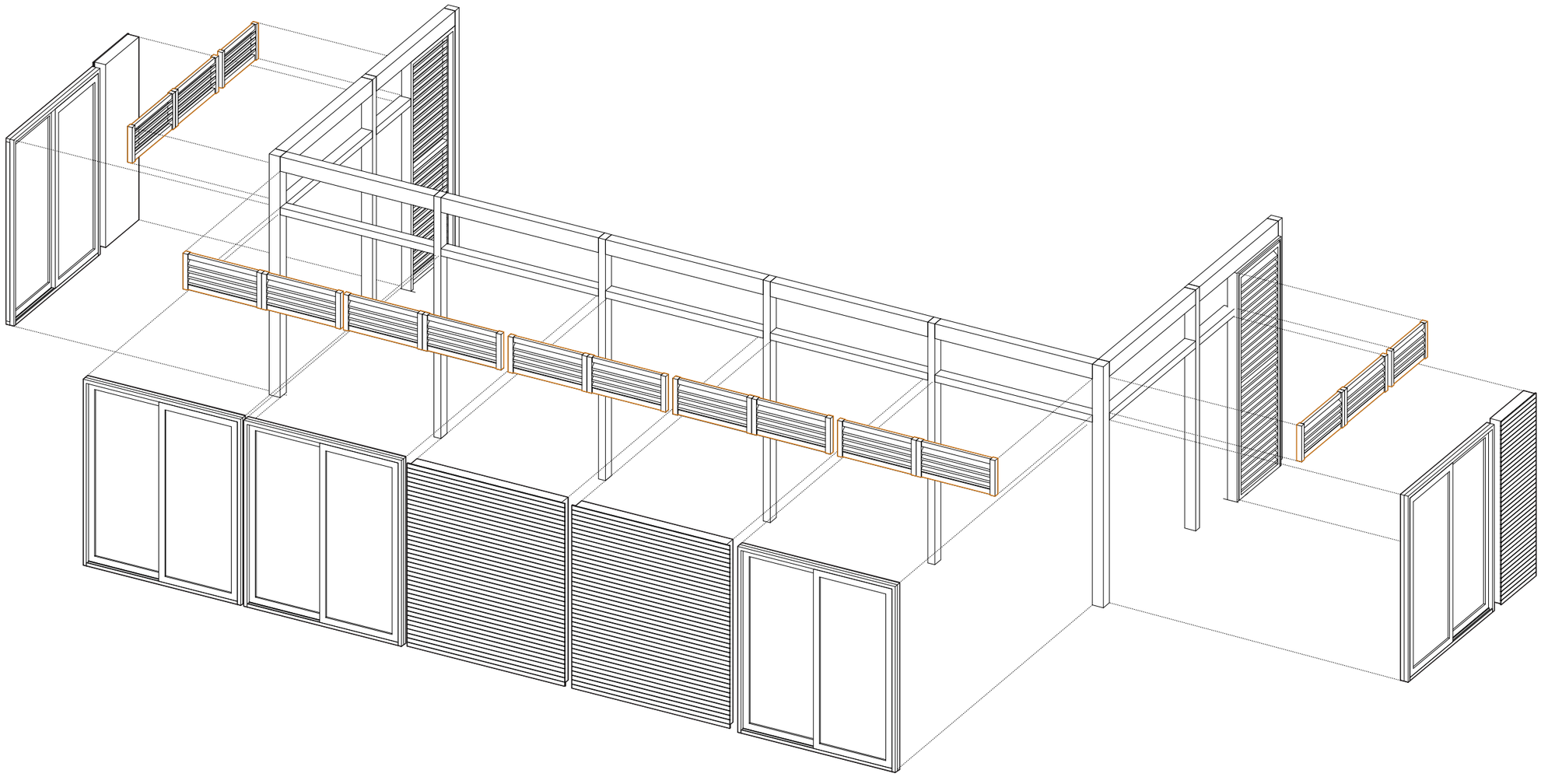
// LIVING ENVIRONMENT //

storm panels



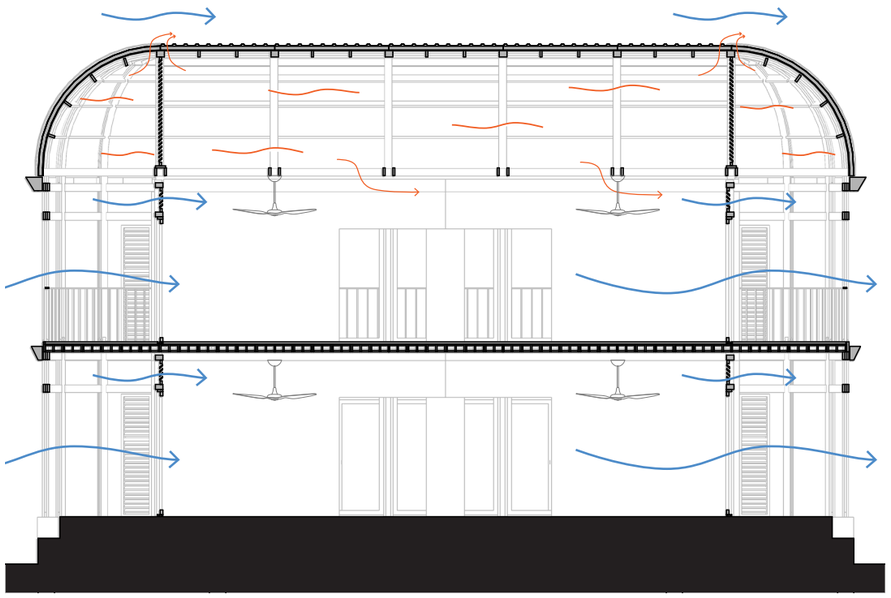
// LIVING COMFORT //

facade

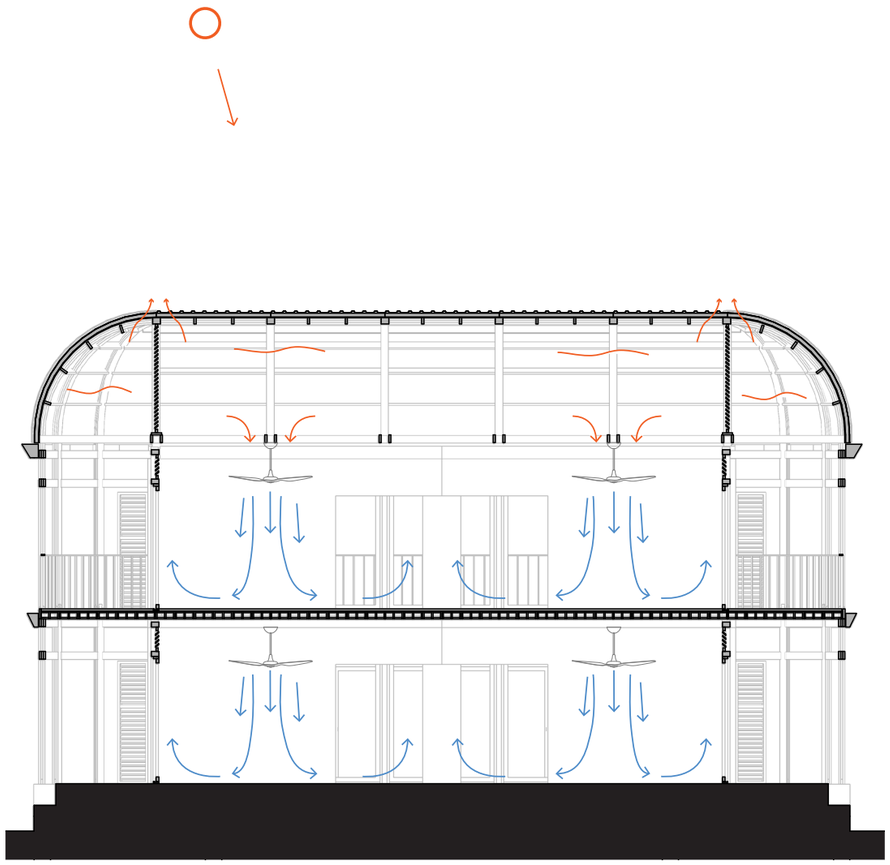


// LIVING COMFORT //

natural ventilation



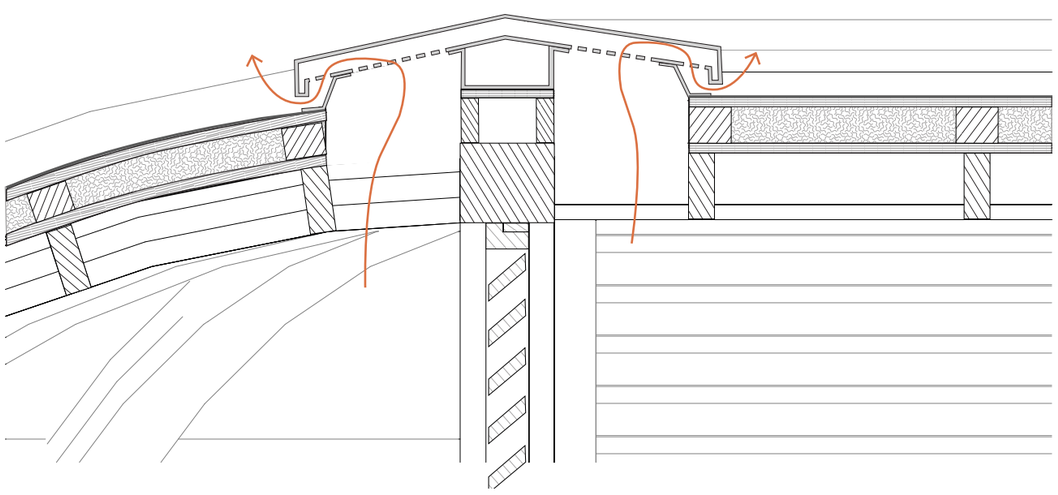
normal conditions - *windspeed 4.5 m/s*
- no mechanical cooling necessary

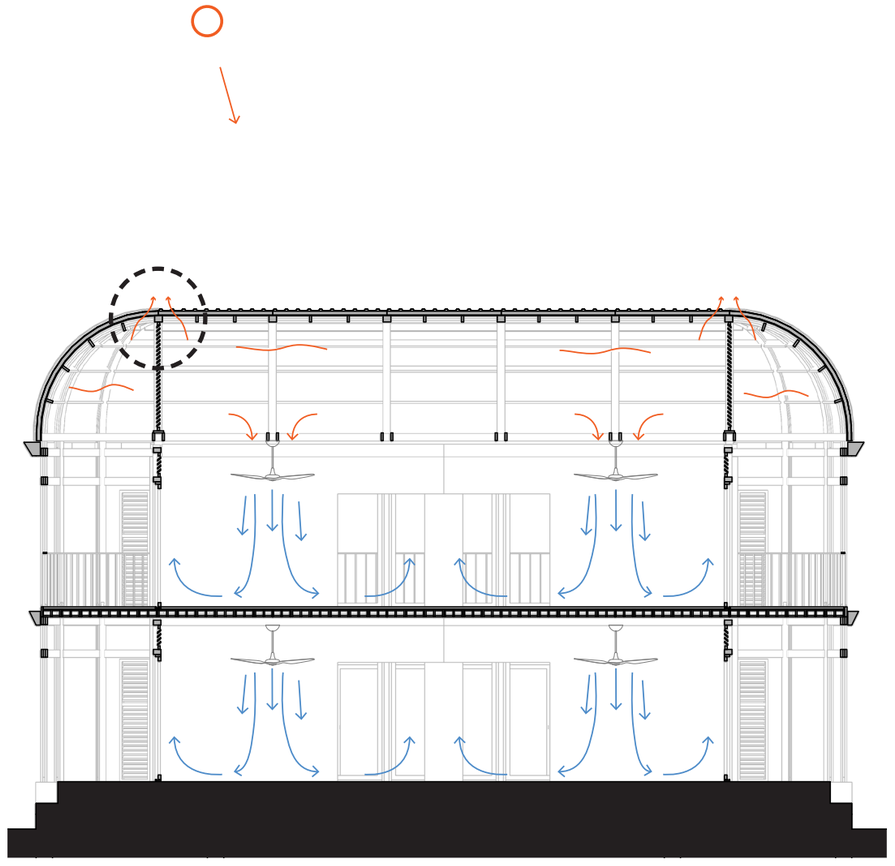


low-wind conditions - *windspeed 0-1 m/s*
- roof ventilators aid in air circulation to provide cooling

// LIVING COMFORT //

stack ventilation

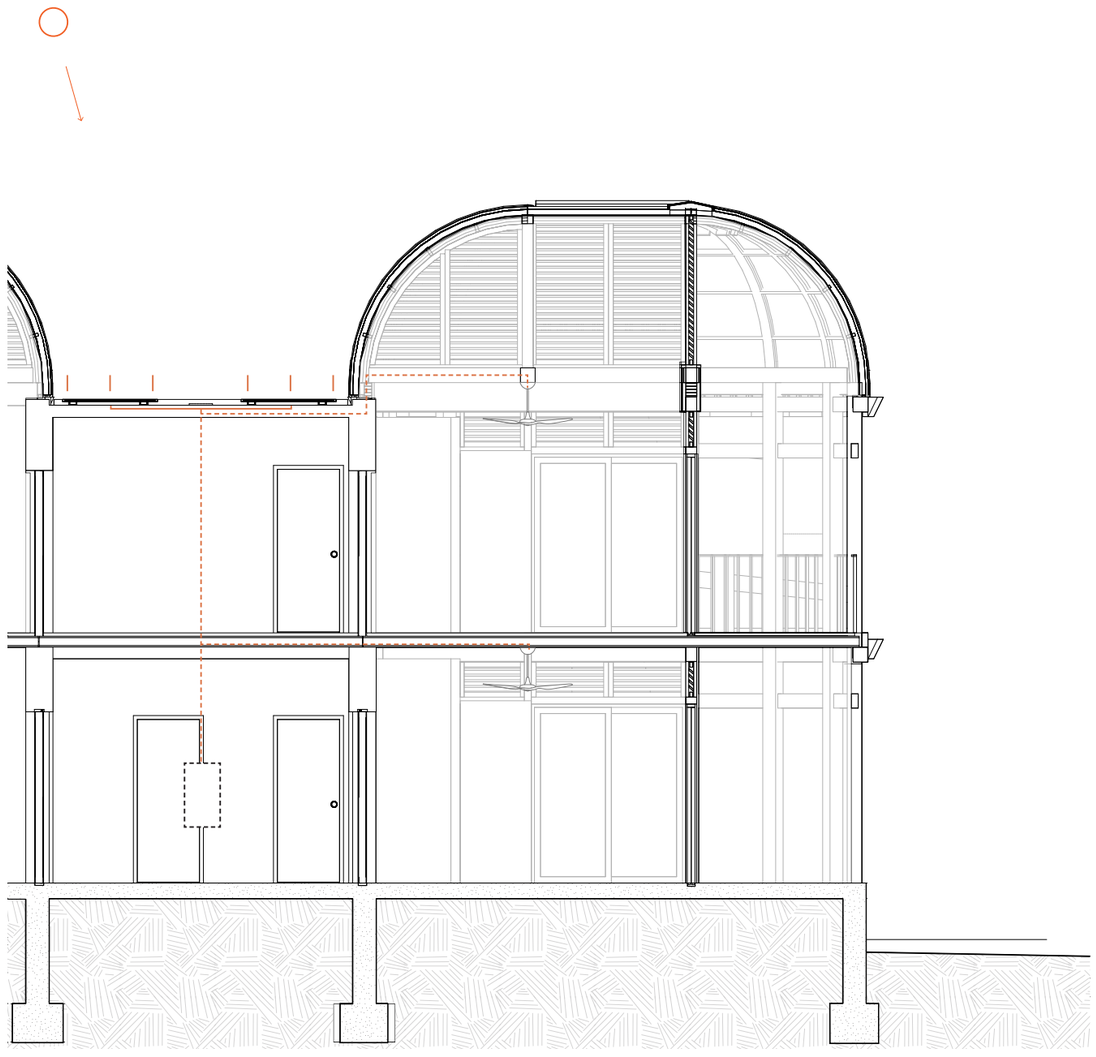




low-wind conditions - *windspeed 0-1 m/s*

- roof ventilators aid in air circulation to provide cooling

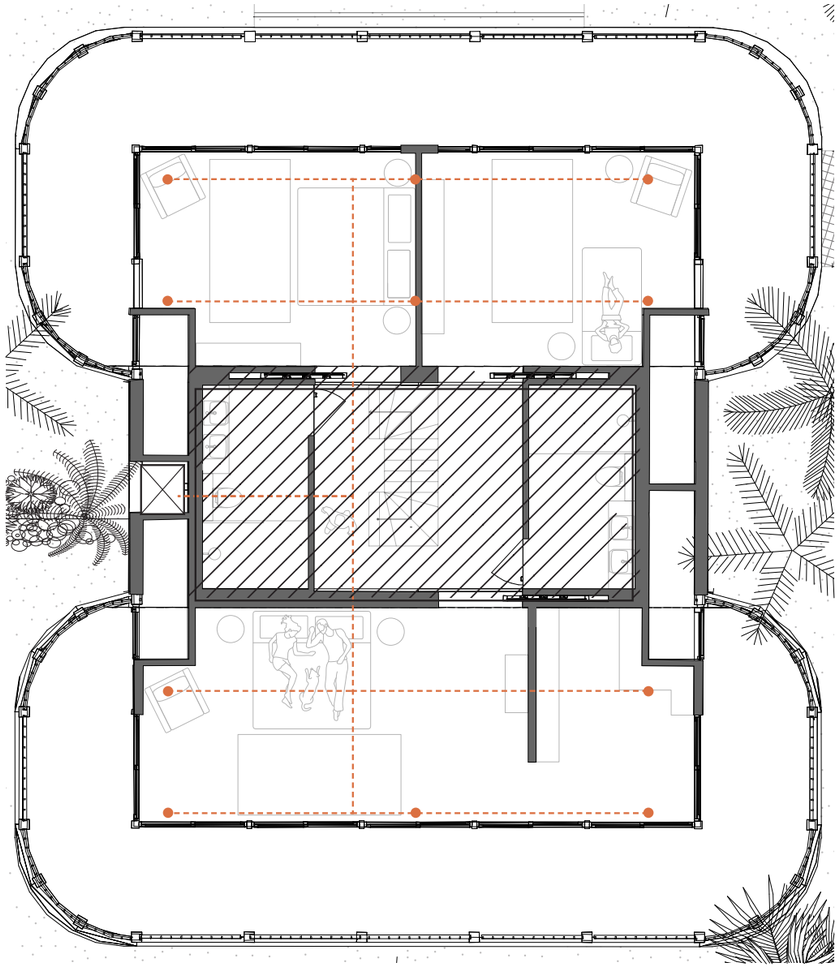
// SYSTEM INTEGRATION //
electricity



solar panels

- on the roof of the core solar panels are placed to provide electricity to the home

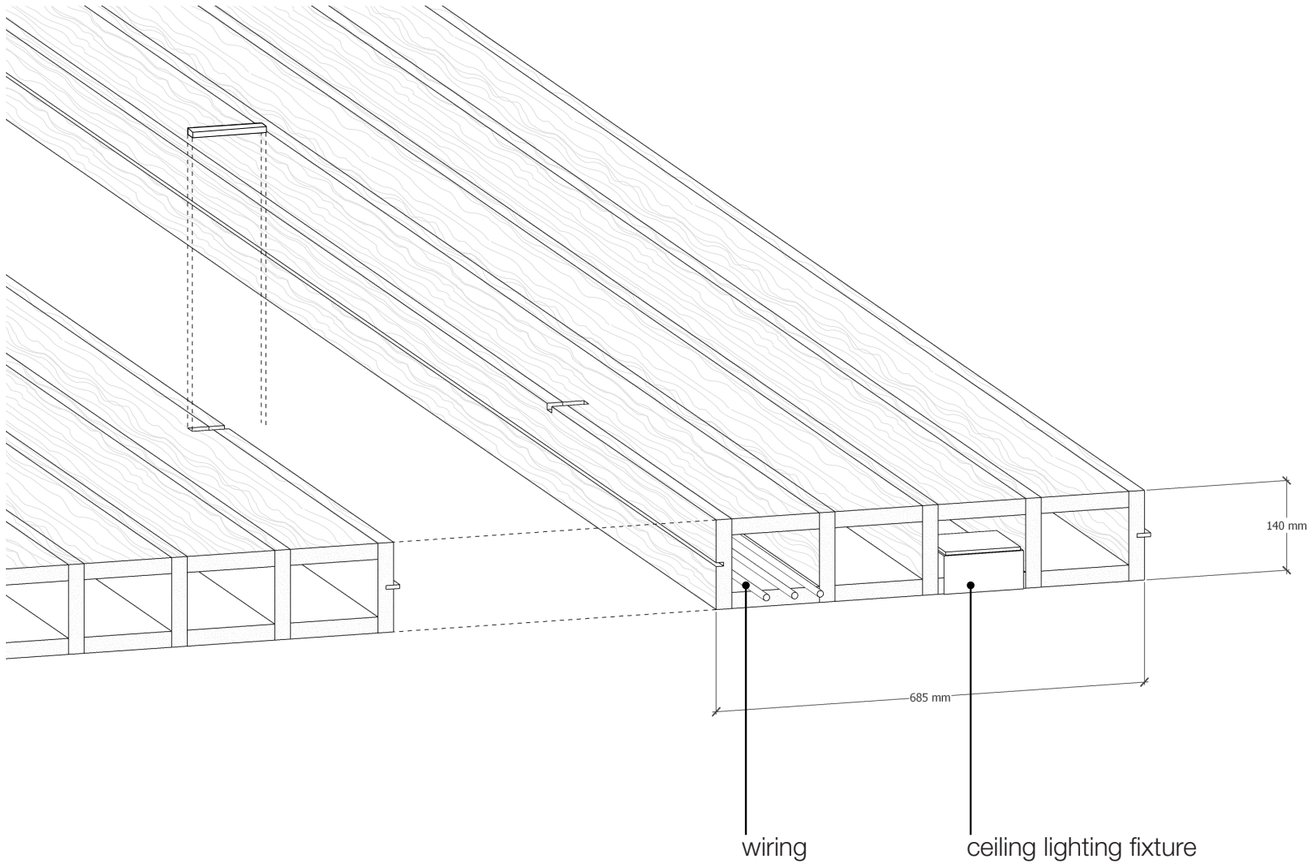
// SYSTEM INTEGRATION //
electricity

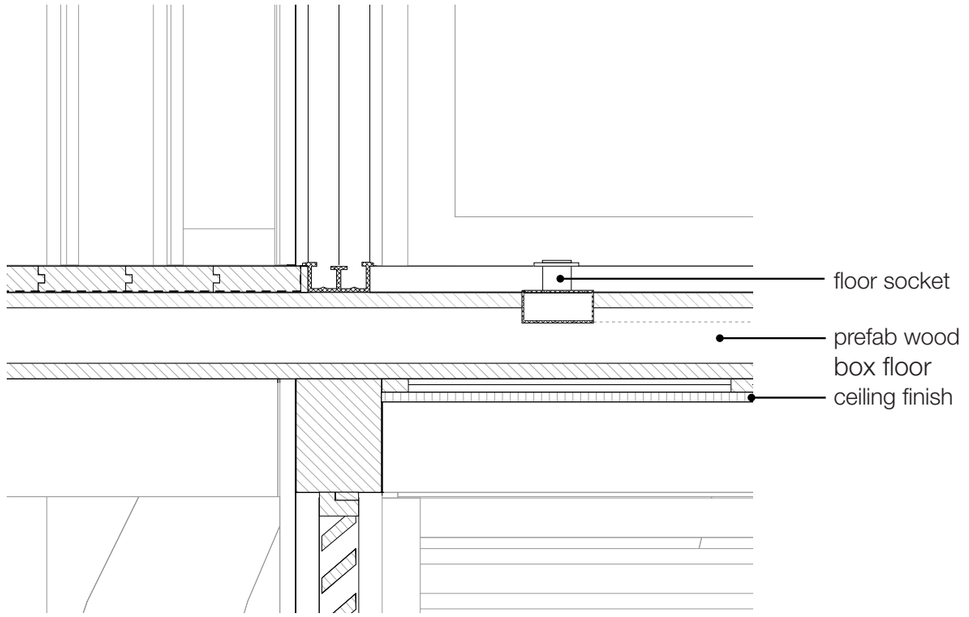


water

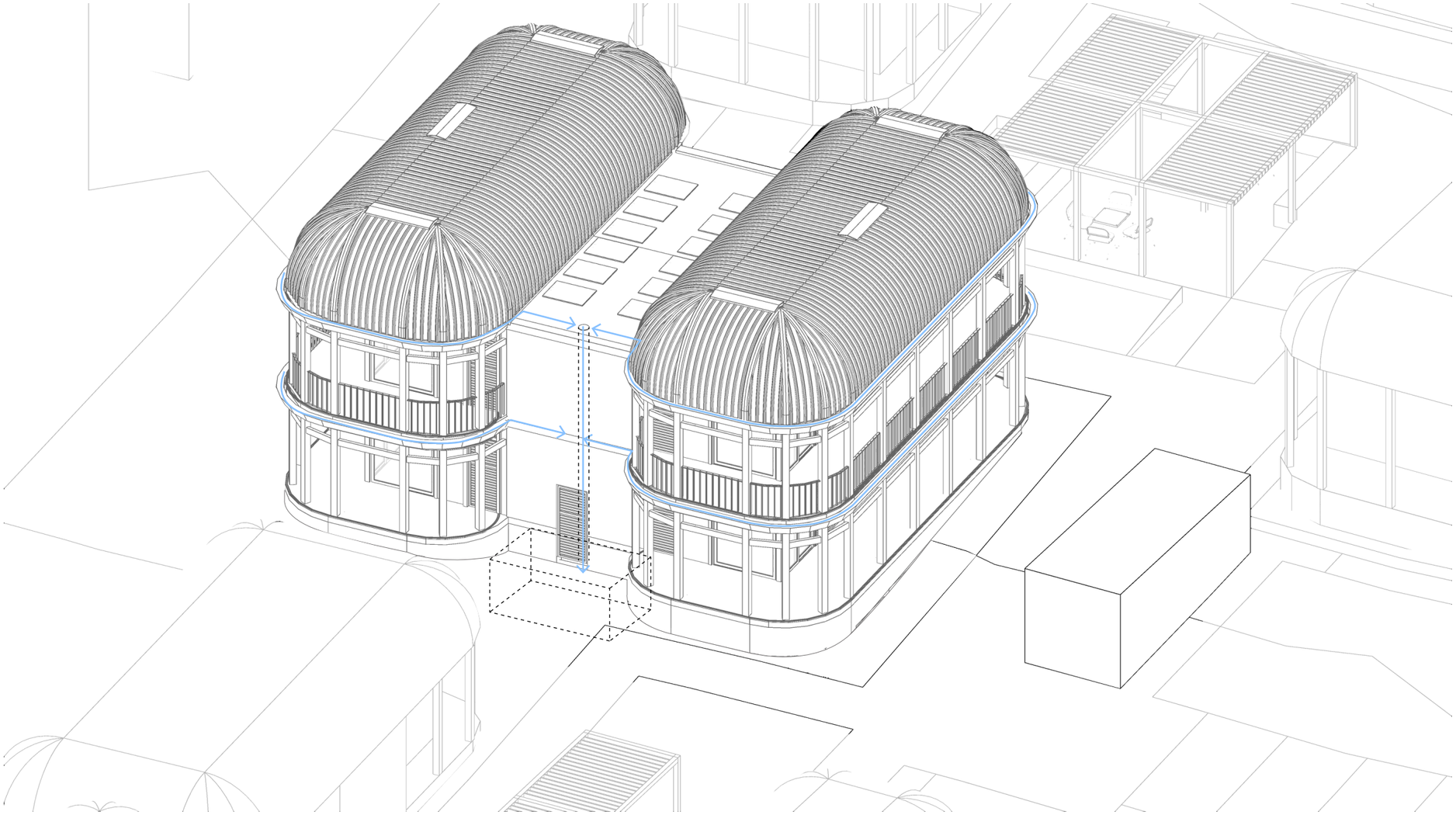
electrical

// SYSTEM INTEGRATION //
electricity



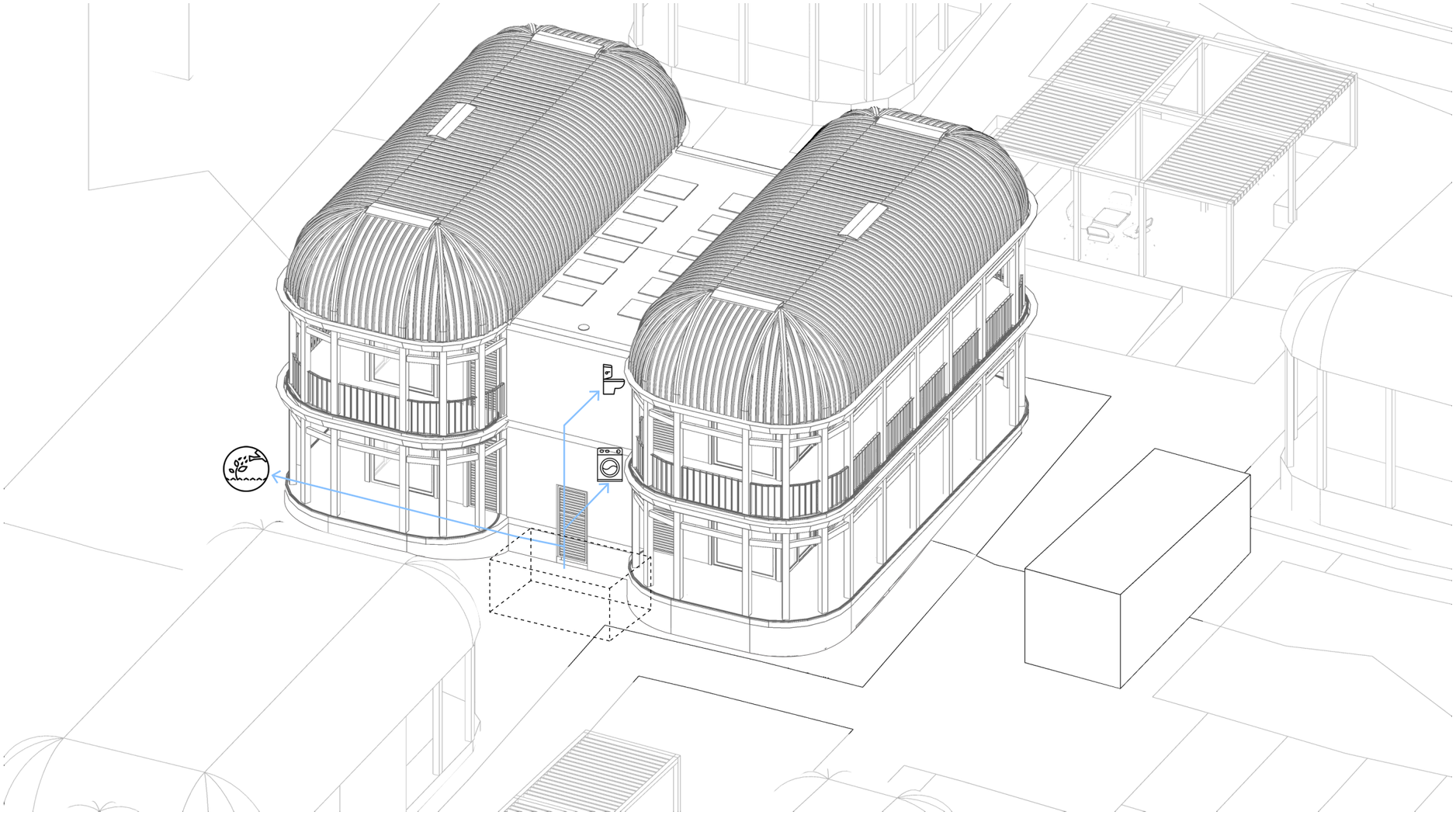


// SYSTEM INTEGRATION //
water



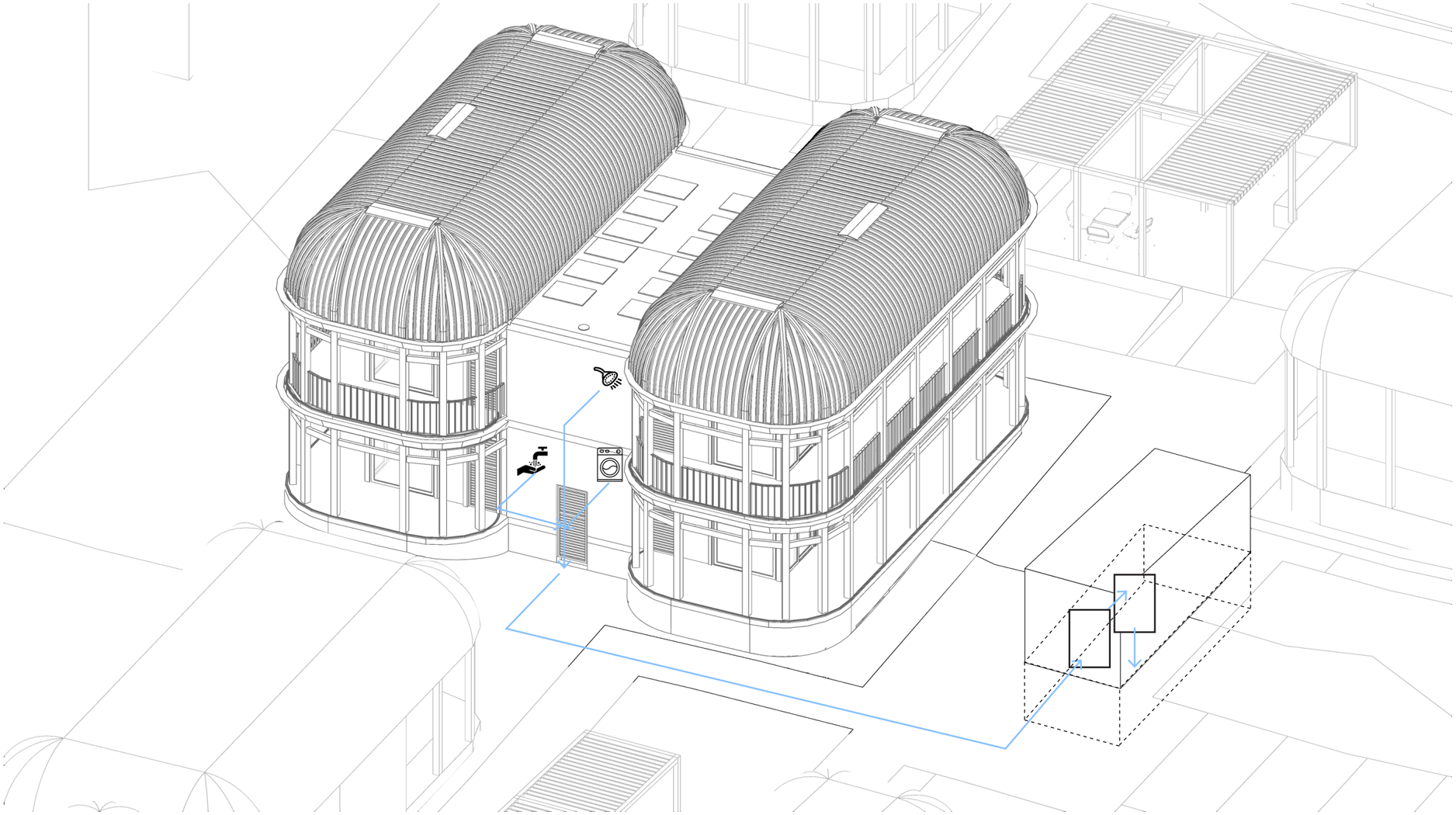
rain water collection

// SYSTEM INTEGRATION //
water



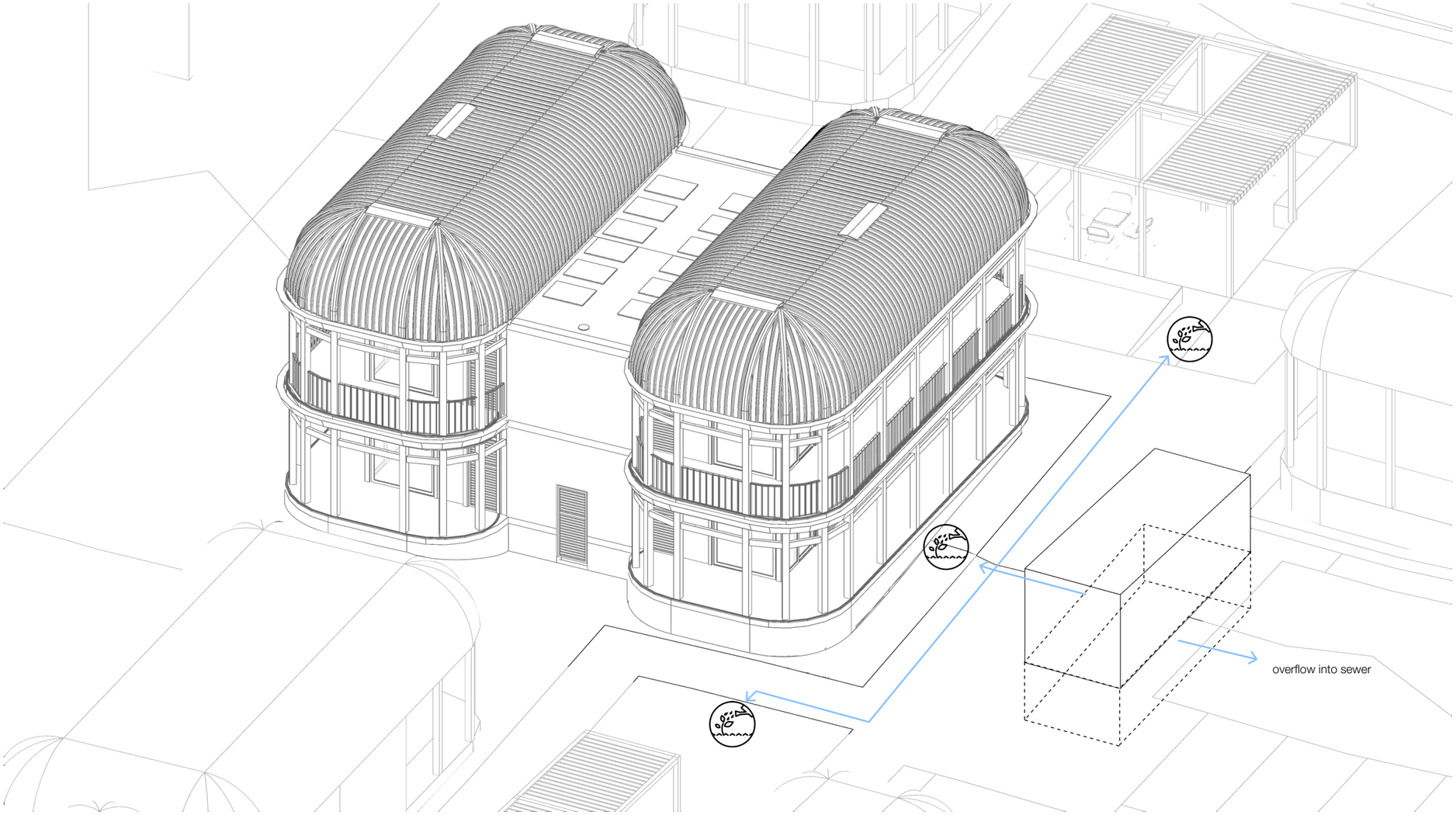
rain water use for laundry, toilet flushing and irrigation

// SYSTEM INTEGRATION //
water



grey water from wash basins, laundry and showers

// SYSTEM INTEGRATION //
water



grey water used to irrigate public spaces within development
useful during long dry periods

// BUILDING TECHNOLOGY //

materials

reused zinc sheets
- reflectivity
- durability
- standing seam plate connection for rounded corners

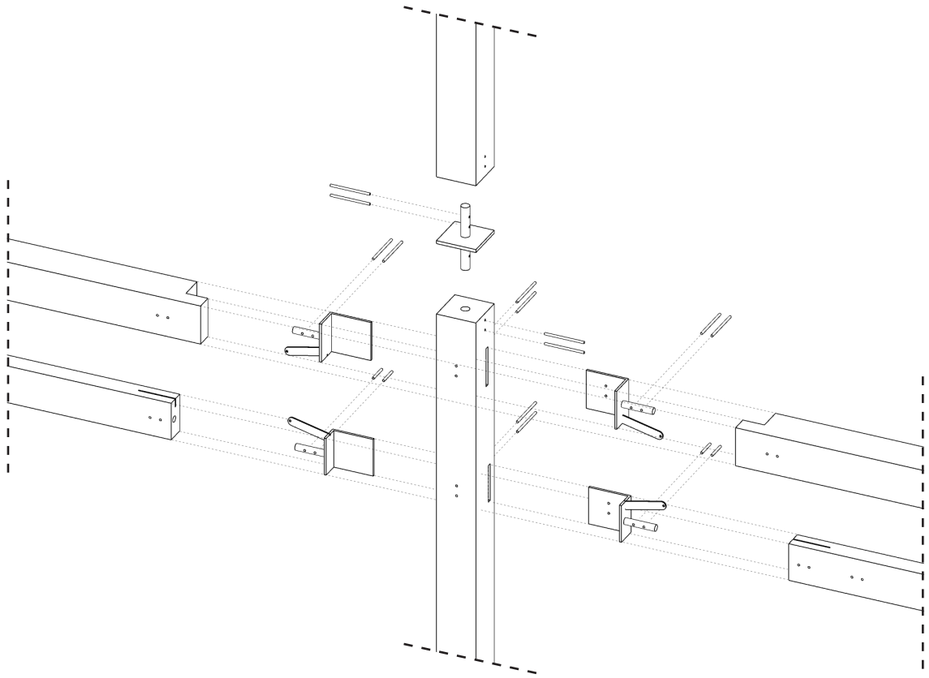
rammed earth walls
- sustainable alternative to concrete
- durability
- soil of the land visible in structure

US size dimensional lumber
- familiar materials
- light compaired to a concrete structure
- workable (connections and on-site assembly)
- renewable resource

cast on-site concrete base
- familiar way of working
- dependable in hurricane conditions
- moisture resistant

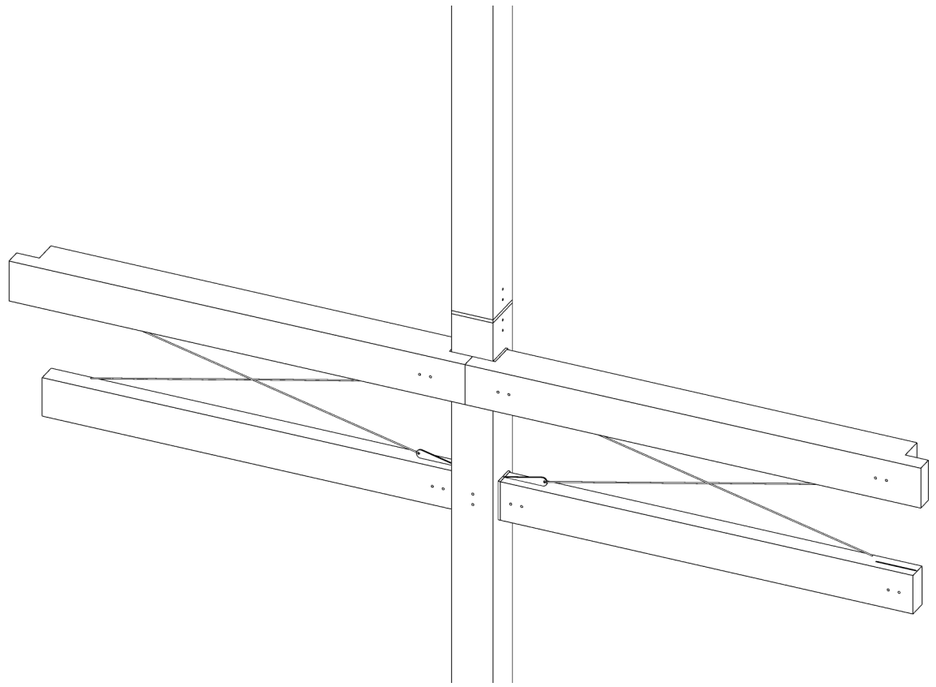
// BUILDING TECHNOLOGY //

construction



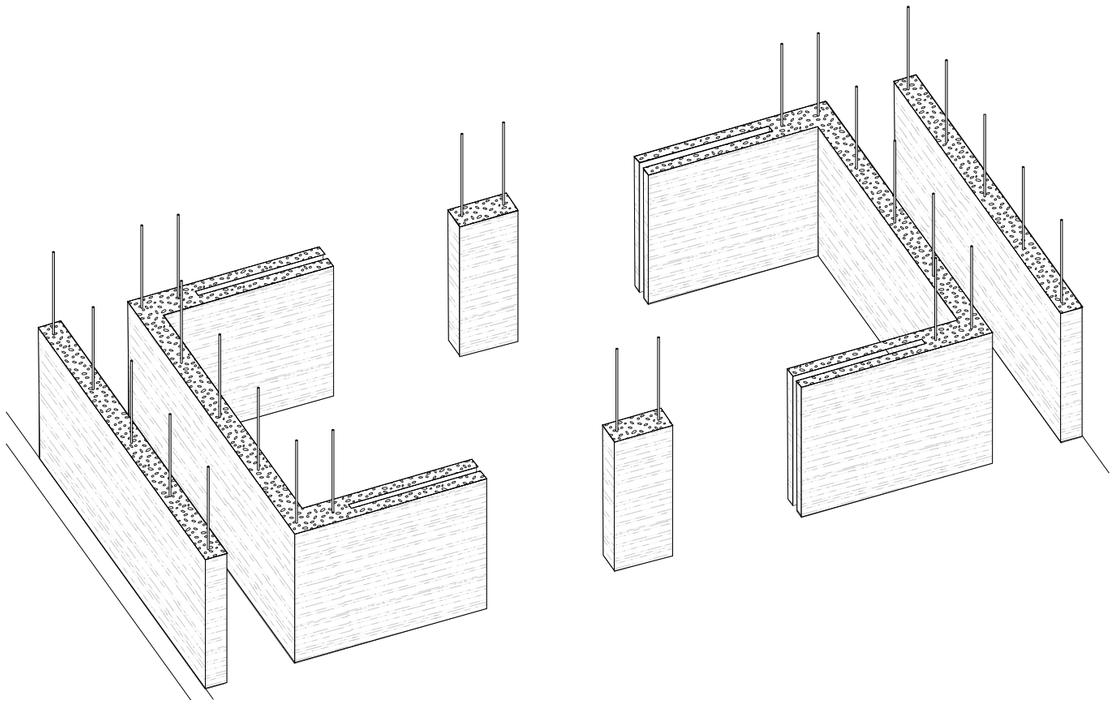
// BUILDING TECHNOLOGY //

construction

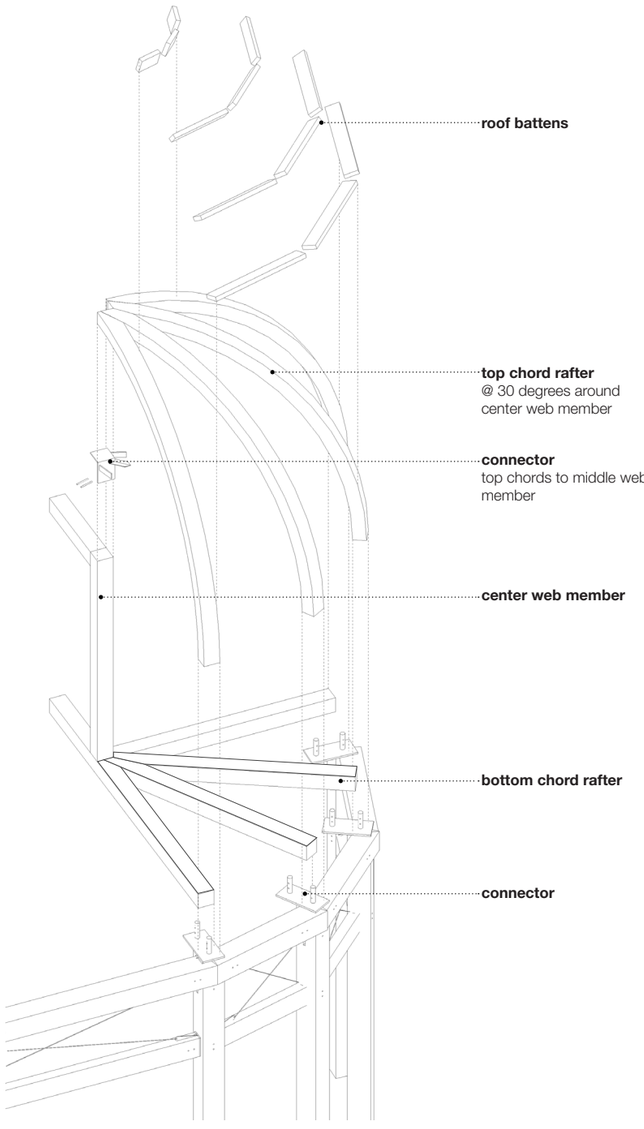


// BUILDING TECHNOLOGY //

construction

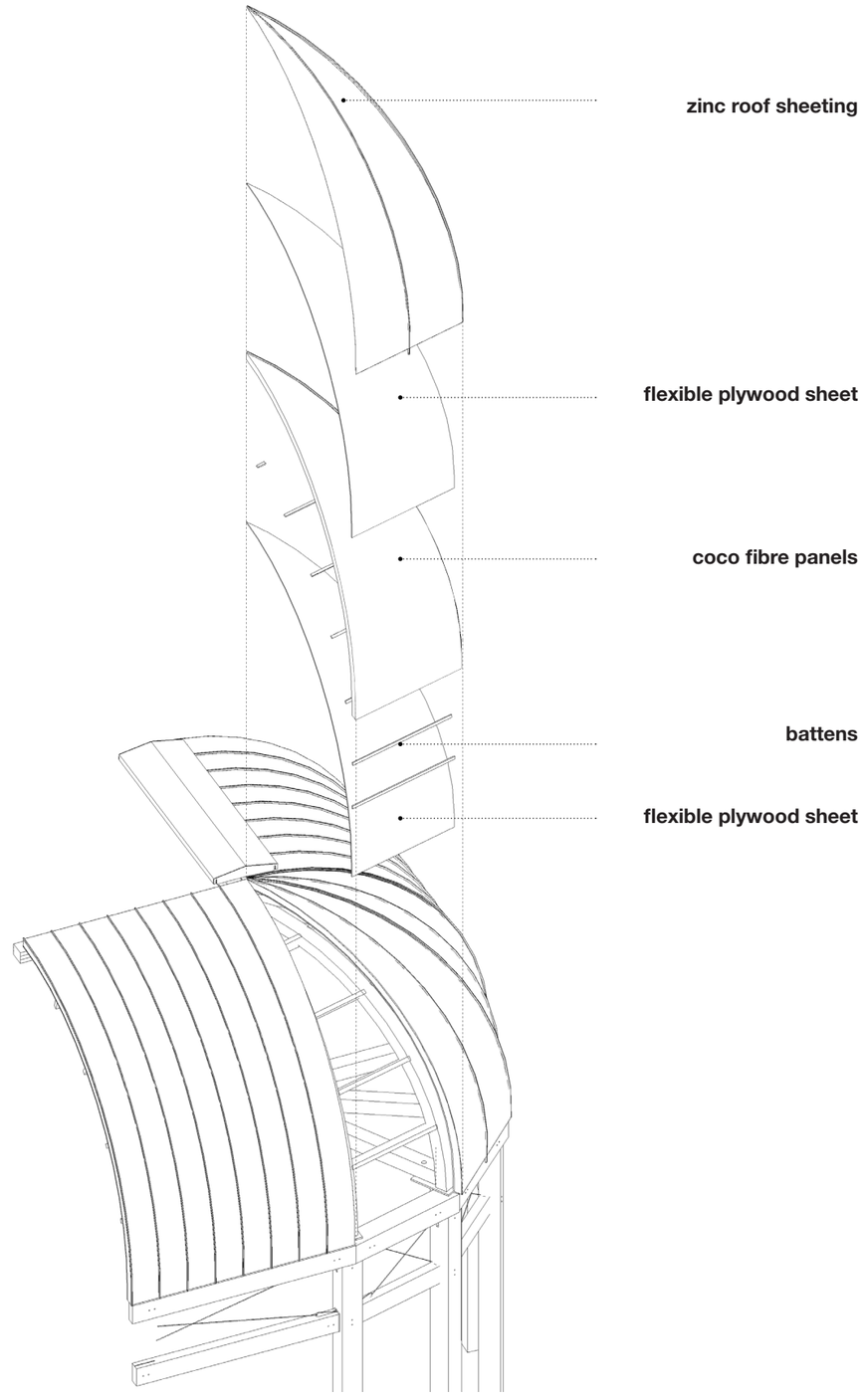


construction



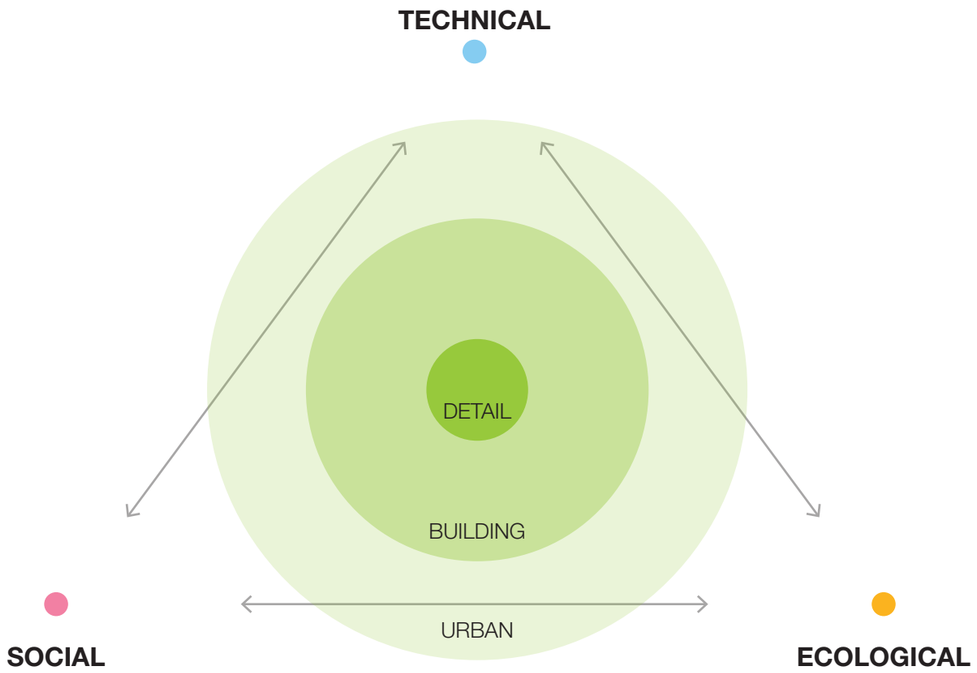
// BUILDING TECHNOLOGY //

construction



// DESIGN //

TOWARDS TROPICALITY



REINTRODUCING TROPICALITY TO ST MAARTEN

A RESIDENTIAL TYPOLOGY ROOTED IN THE SOIL OF THE PAST

REINTRODUCING TROPICALITY TO ST MAARTEN

A RESIDENTIAL TYPOLOGY ROOTED IN THE SOIL OF THE PAST

THE END