

Regenerative Ruins

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P5

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Introduction

Context: Willemstad, Curaçao
Concluding problem statement

Research

Research question
Findings
Conclusions informing strategy and design

Strategy

Context analysis
Context strategy

Design

Concept and principals
Design



Caribbean Sea

0 200
Kilometers

Curaçao, Southern Caribbean



"Yu di Kòrsou" - Literally meaning "Child of Curaçao"



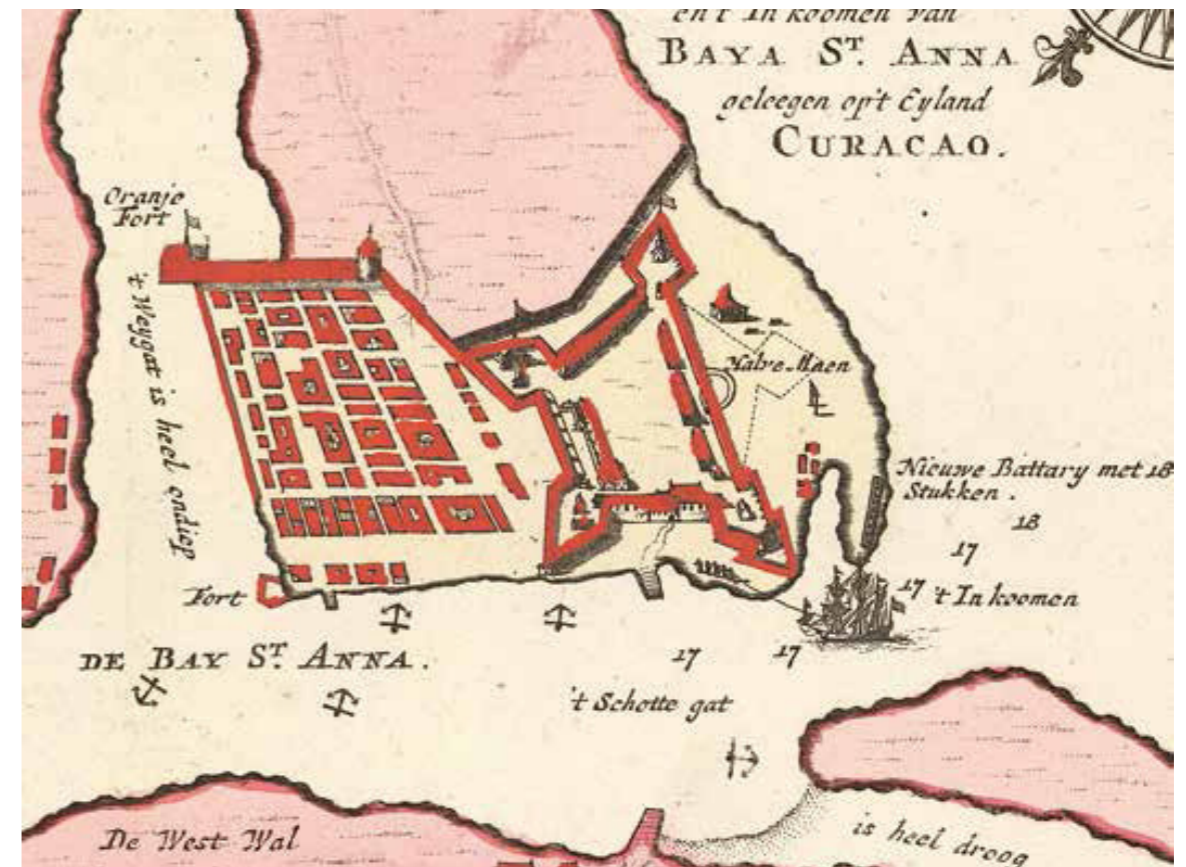
Living on the island



Curaçao a highly urbanized region



Map of Willemstad 1707



Fort Amsterdam and north city has emerged



156. Plantage op Curaçao.

'Landhuis' with surrounding plantation

Curaçao 1707:
Fort Amsterdam was built and north of it a city has emerged



Map of Willemstad 1863



Abolishment of slavery on Curaçao



Otrobanda 1863: important working class district

Willemstad, Curaçao 1863:
Otrobanda, meaning 'other side' becomes working class district after abolishment of slavery



Map of Curaçao 1950



Shell oil villages



Dilapidated city houses in Otrobanda

Willemstad, Curaçao 1950:
Arrival of Shell and oil villages leading to impoverishment of city center



Map of Willemstad 2022



Car-oriented neighbourhoods

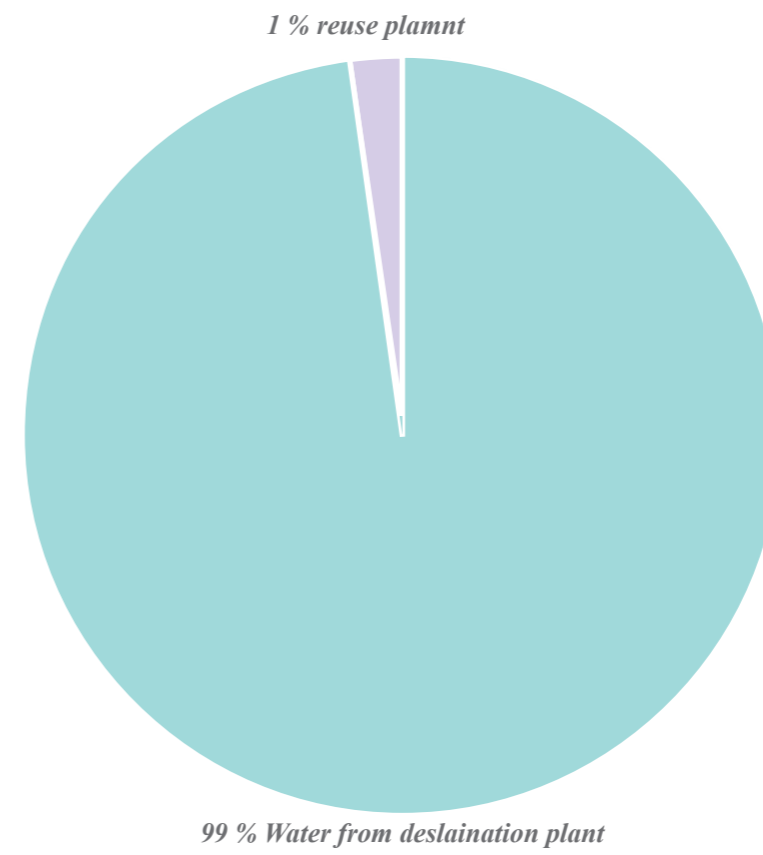


Unsustainable urbanization

Willemstad, Curaçao 2022:
Expansion periphery zone leading to depletion of natural resources

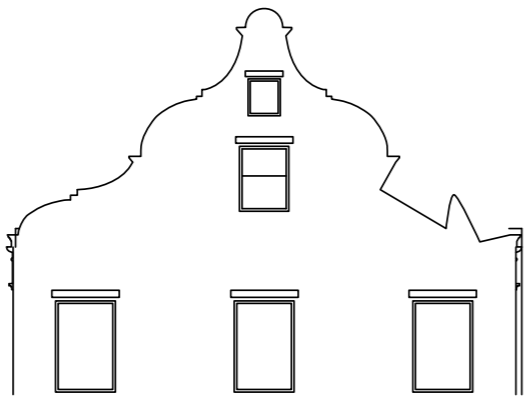


Reverse-osmosis plant Aqualectra

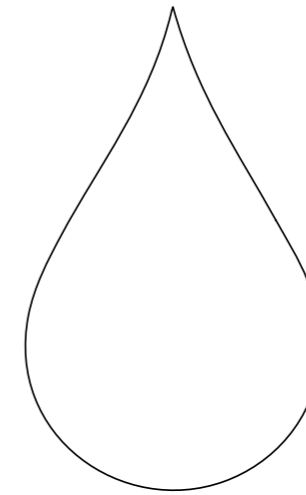


Domestic water distribution Curaçao

Pressure on natural freshwater recourses resulting in dependency on freshwater production



1. Increasing decay of city center World Heritage listed monuments



2. Increasing pressure on natural freshwater recourses

Concluding problem statements

How can a dilapidated monument be transformed into a decentralized freshwater harvesting construction and be connected to a public program to increase the communal awareness of the finite resource of freshwater?

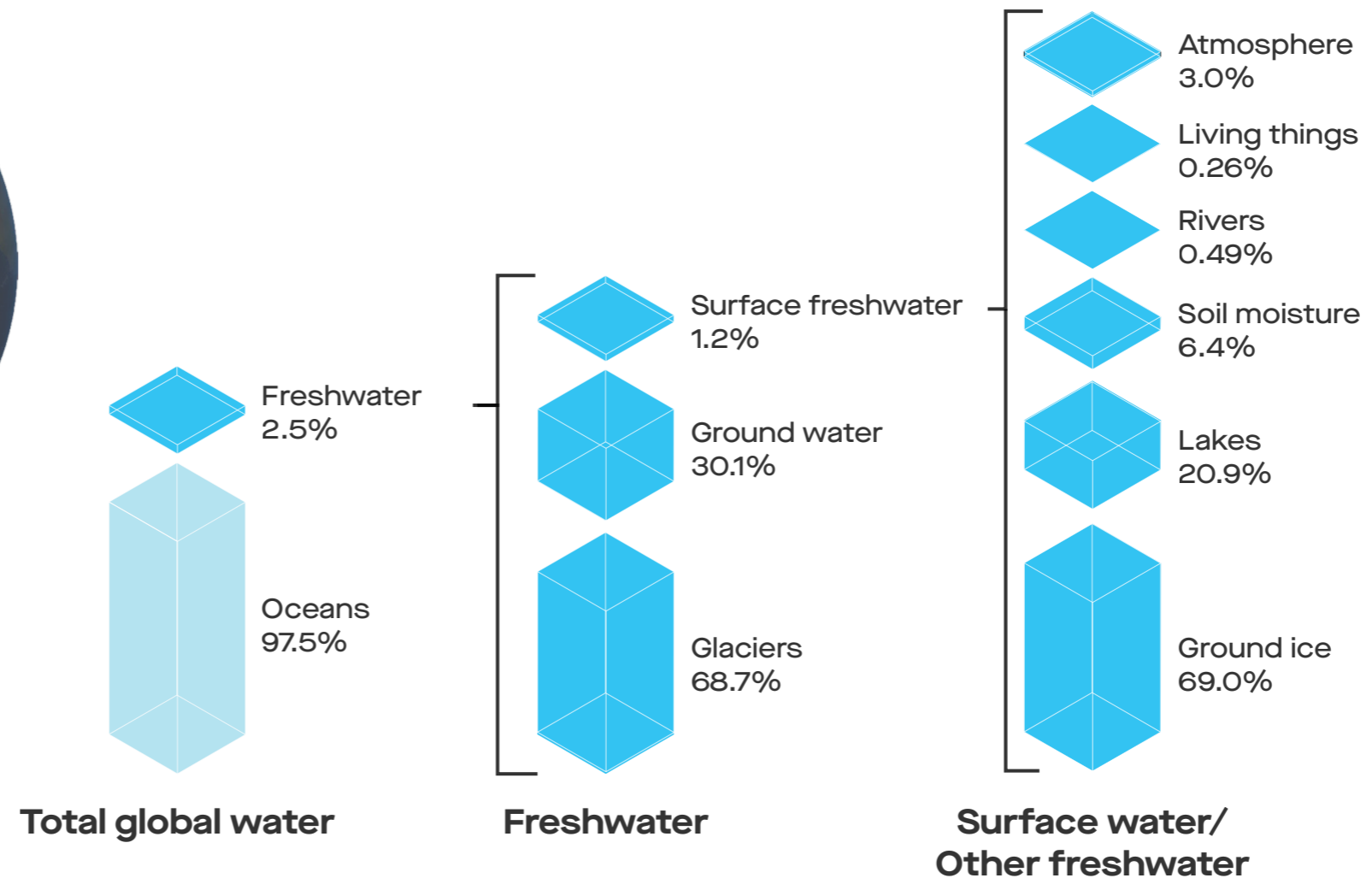
Research question: finding a combined solution for both challenges

*How can a decentralized freshwater system, be implemented on neighbourhood- and building -scale
in Willemstad, Curaçao?*

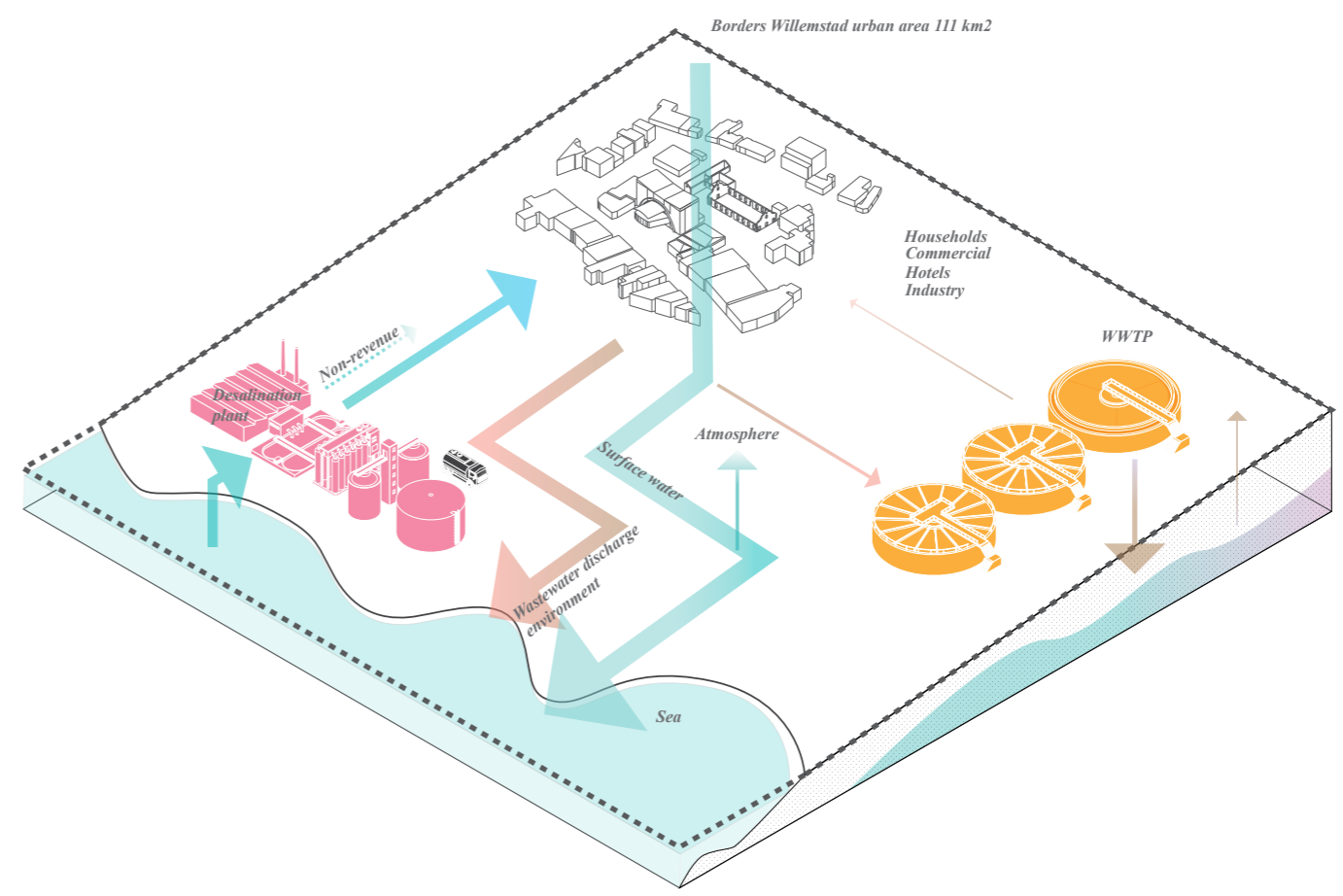
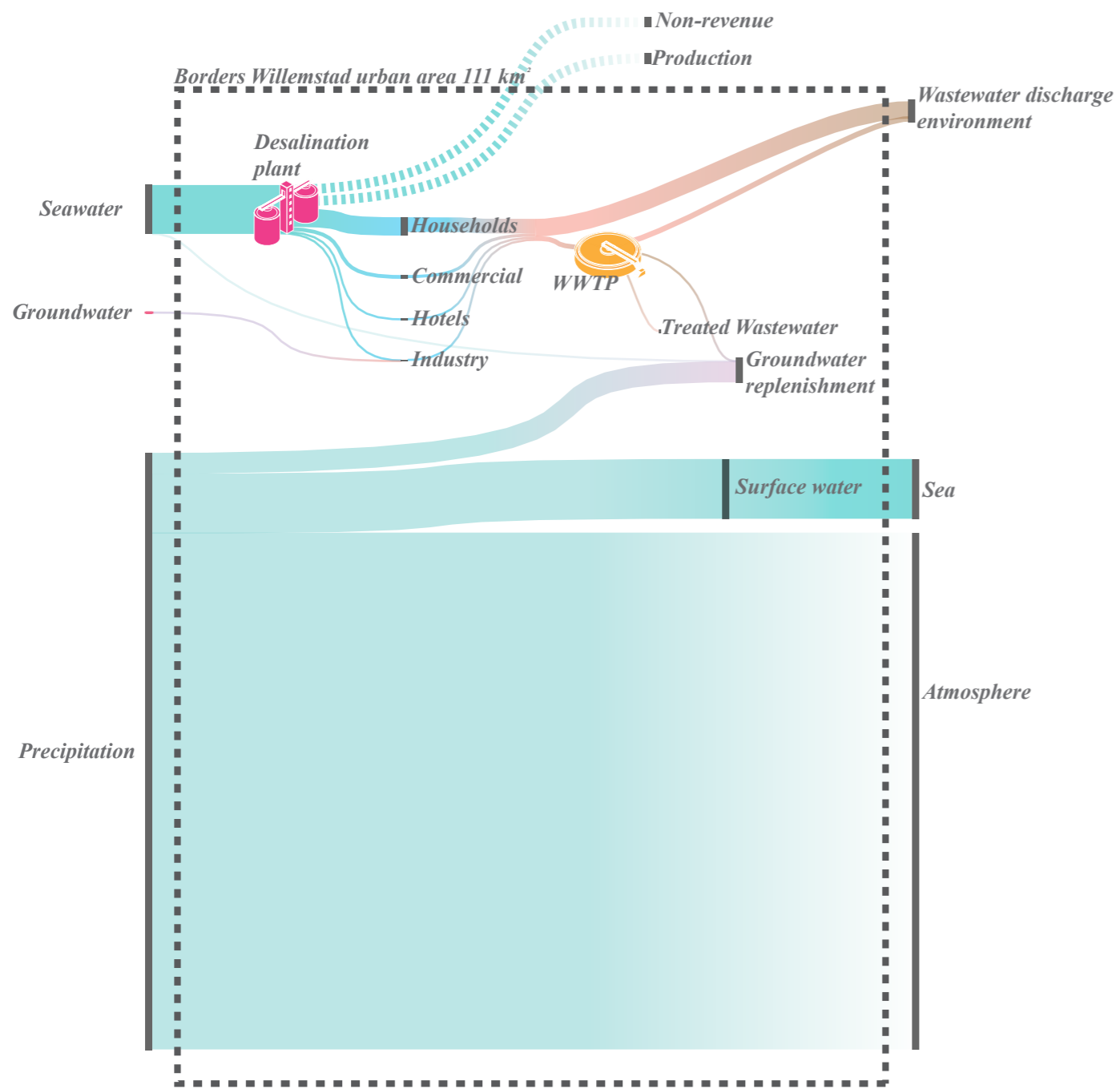
Thematic research question



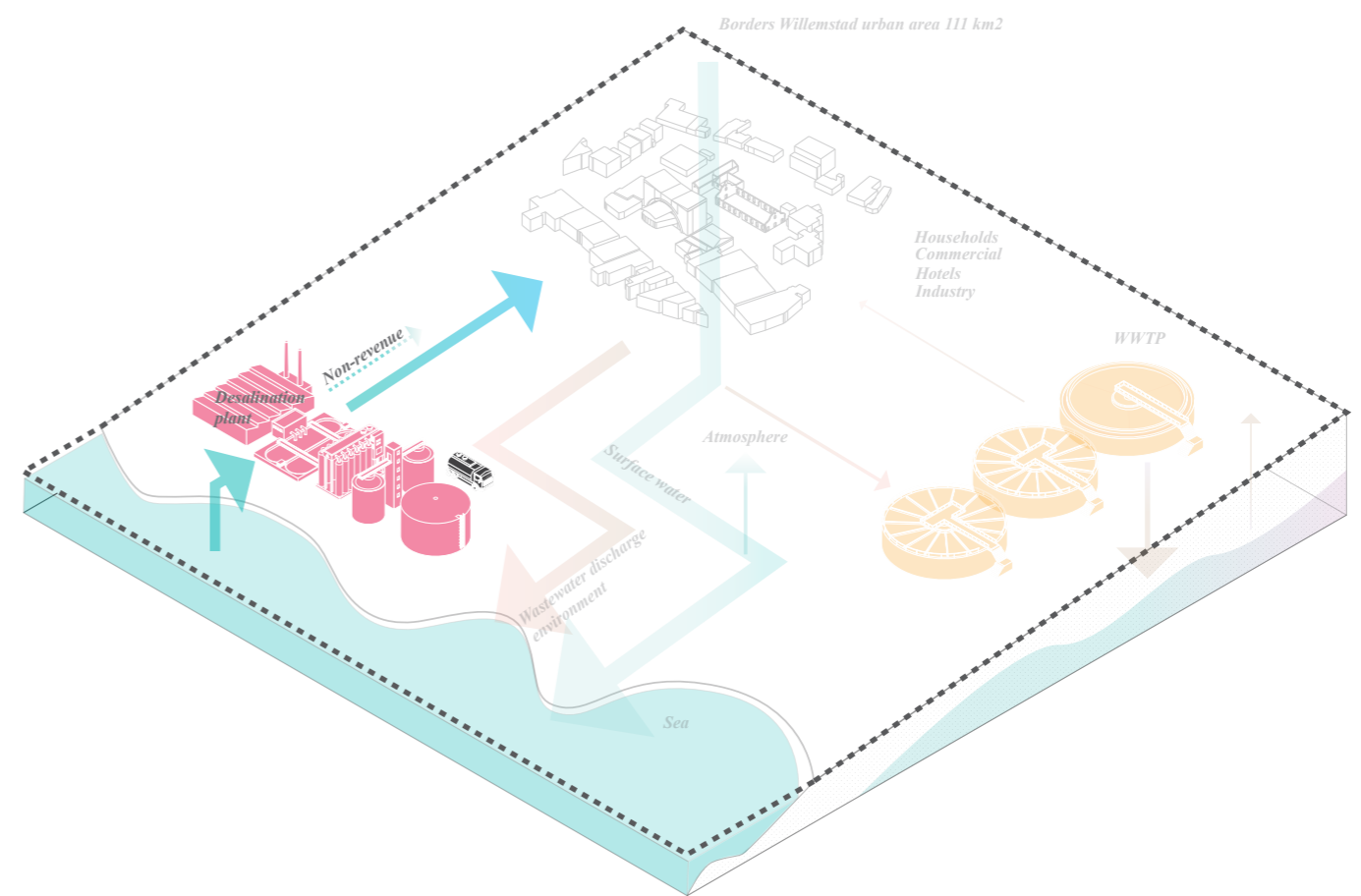
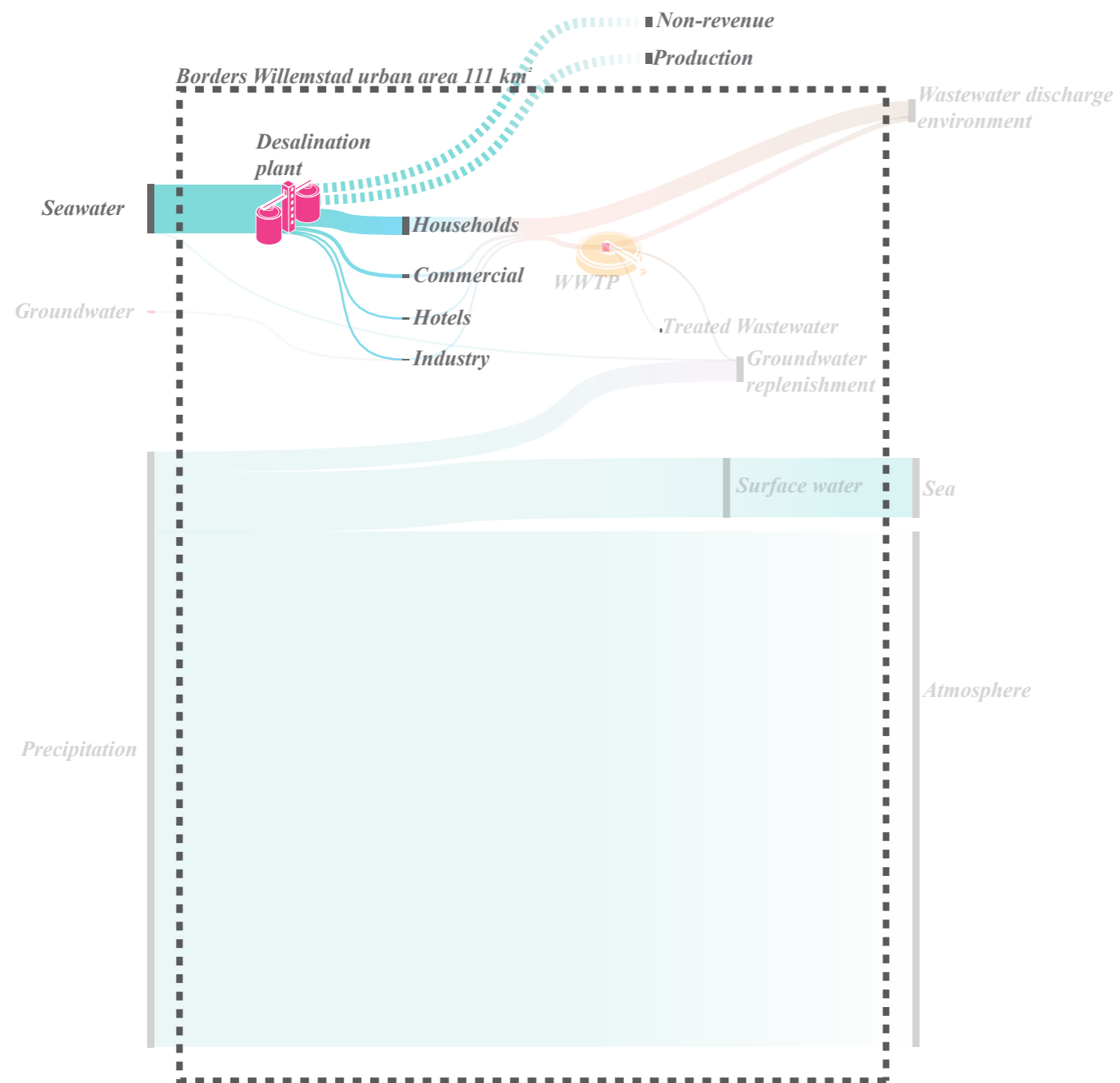
All water on earth
1.386.000.000 KM3



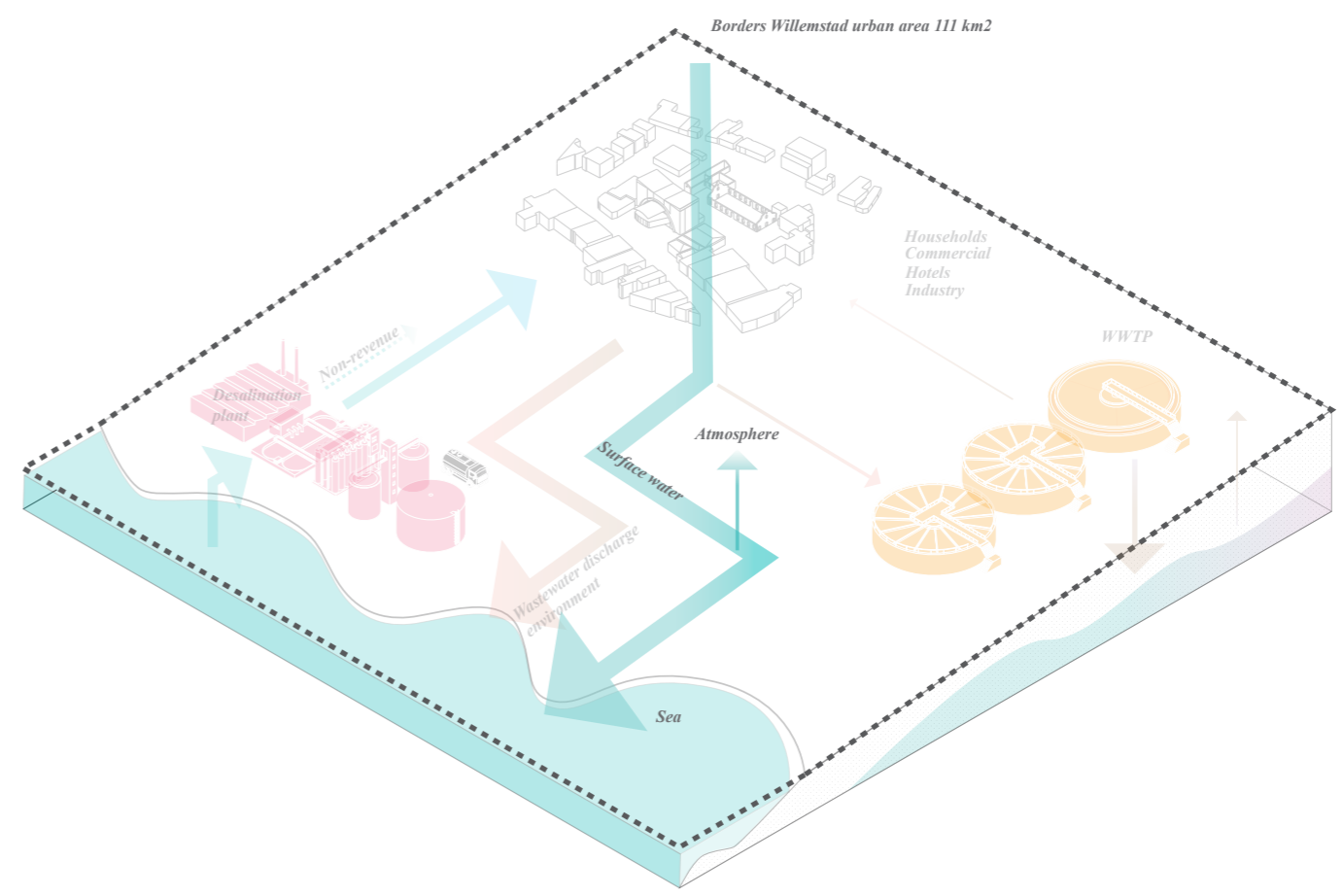
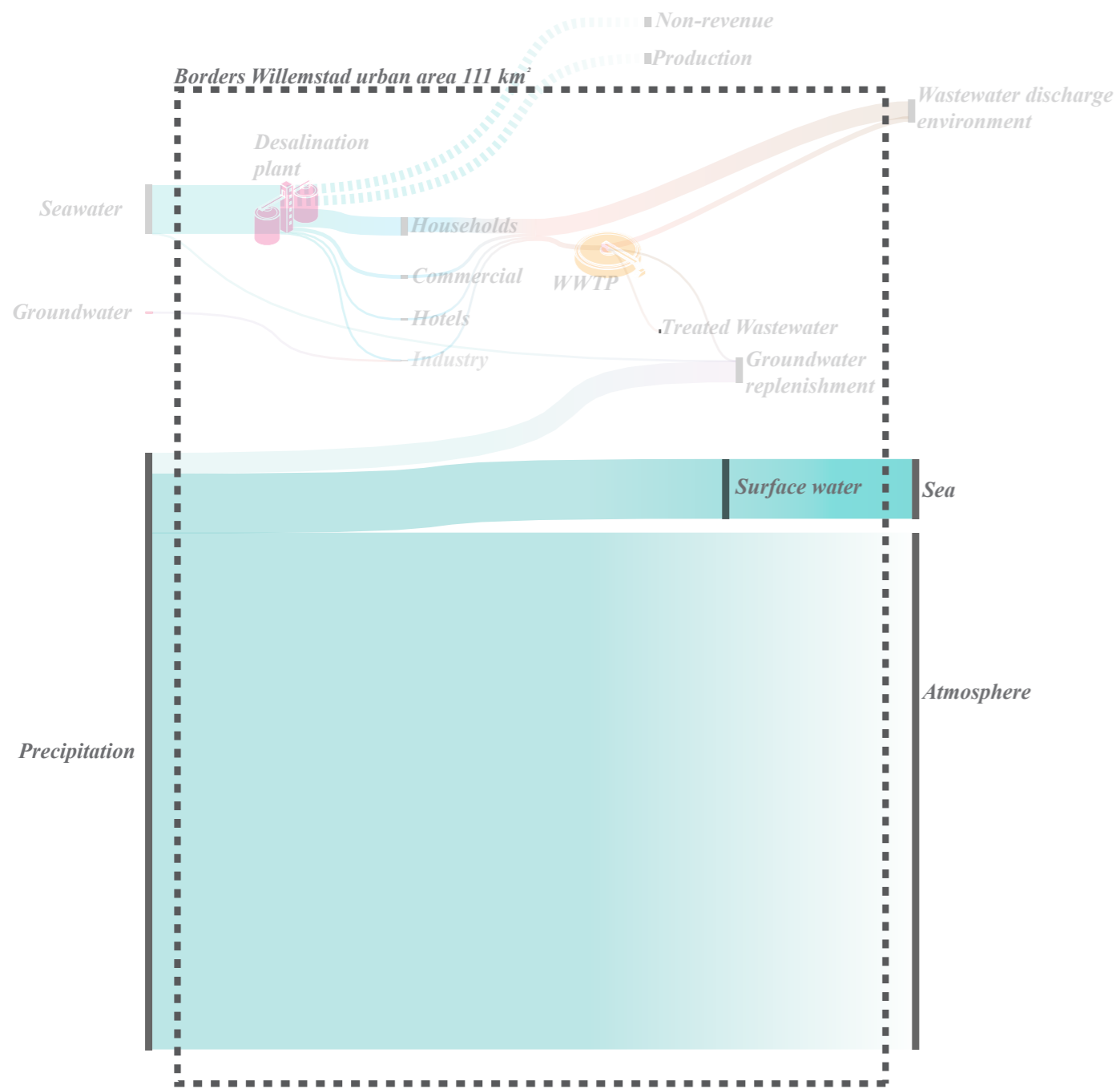
1 percent of the total water on earth is available as freshwater to humankind



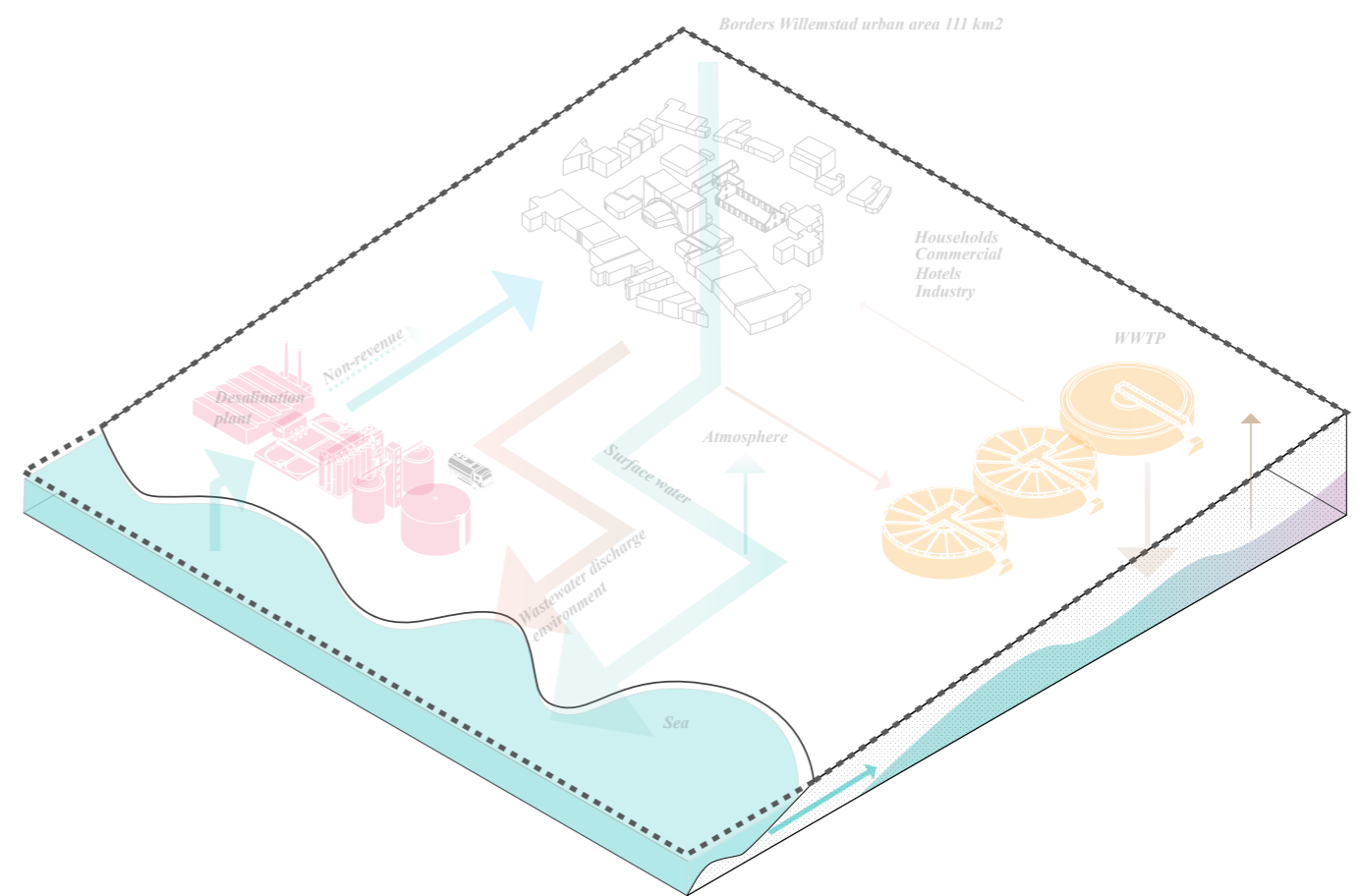
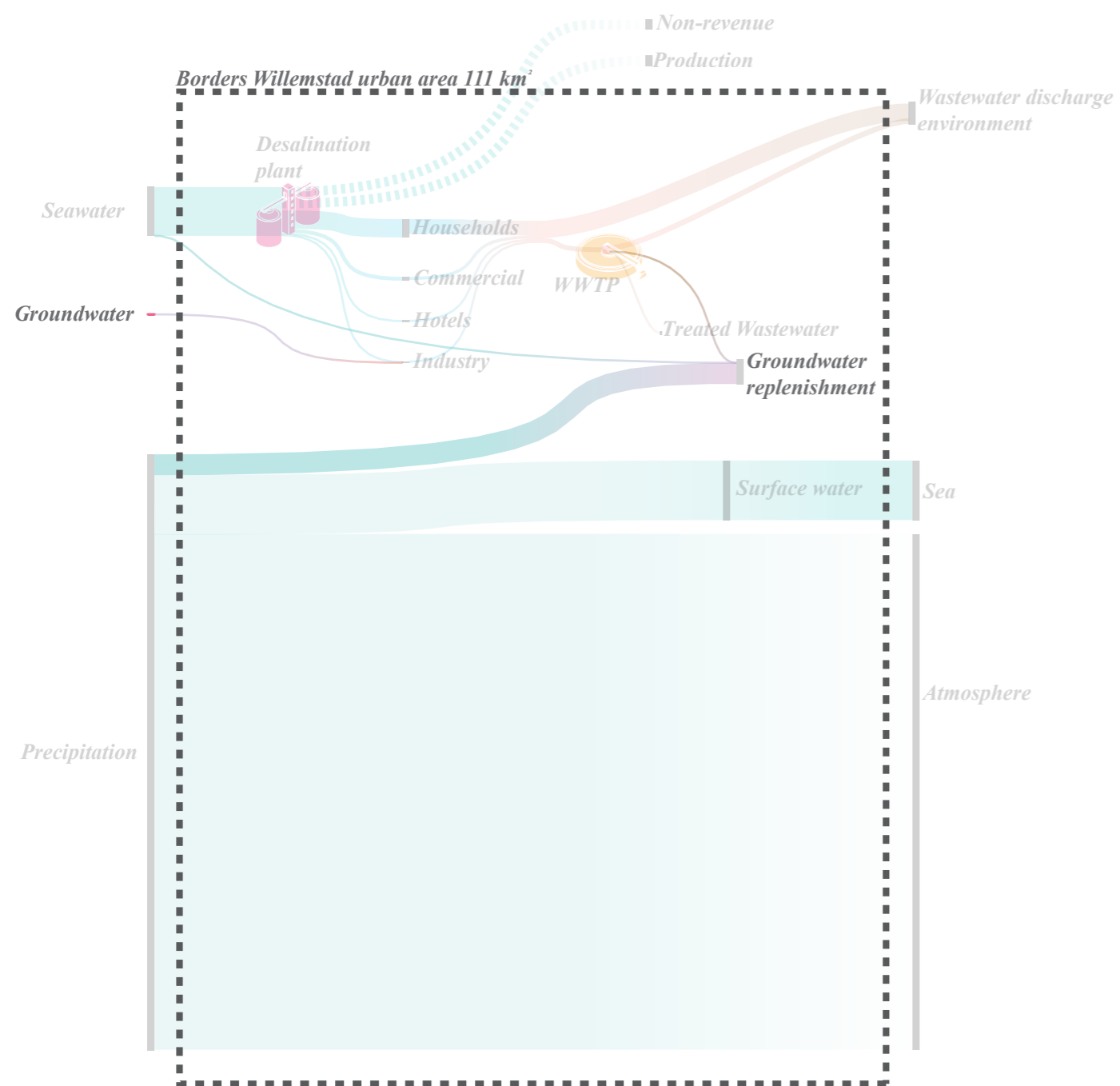
Diagrams showing water-flows in a average wet month in Willemstad



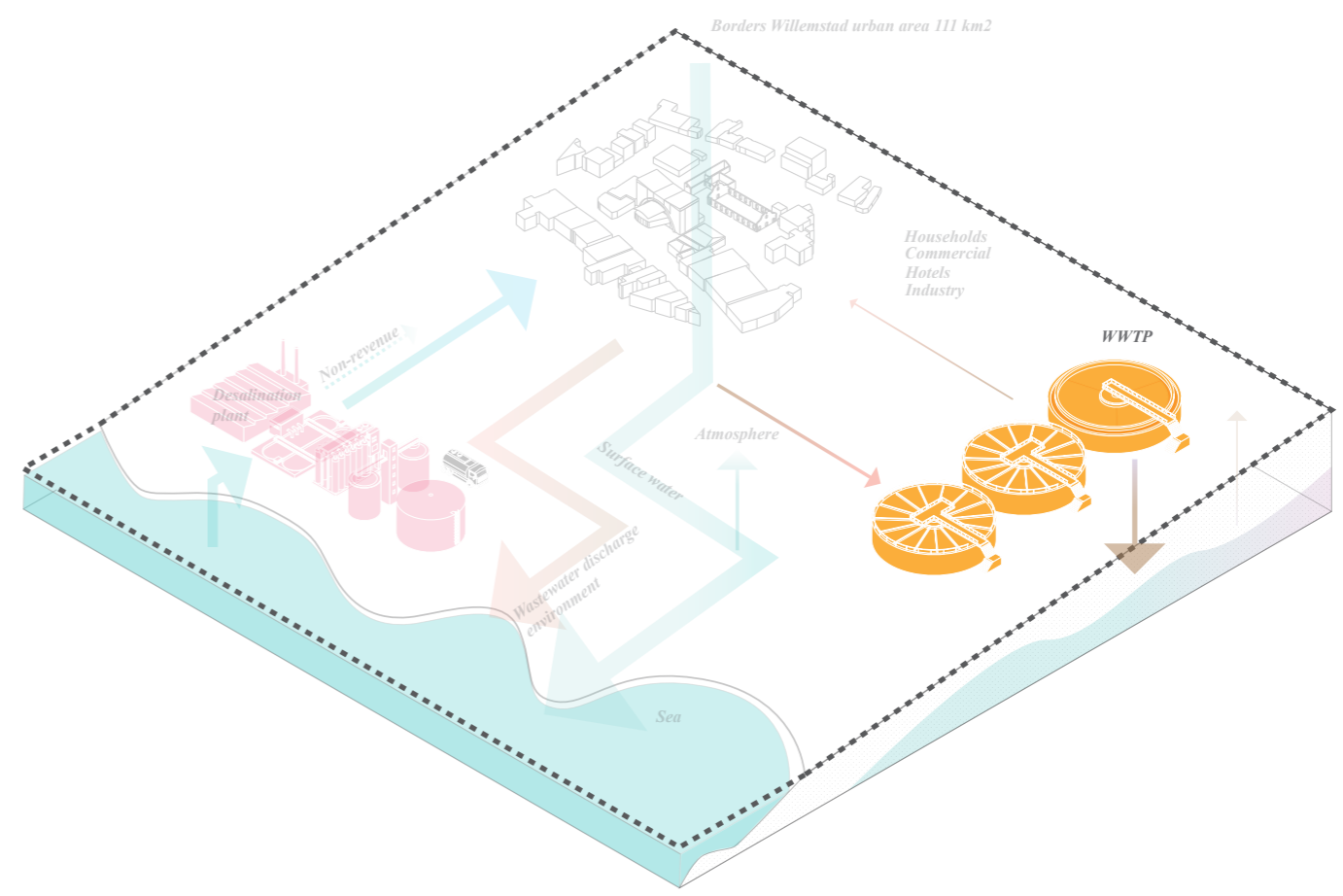
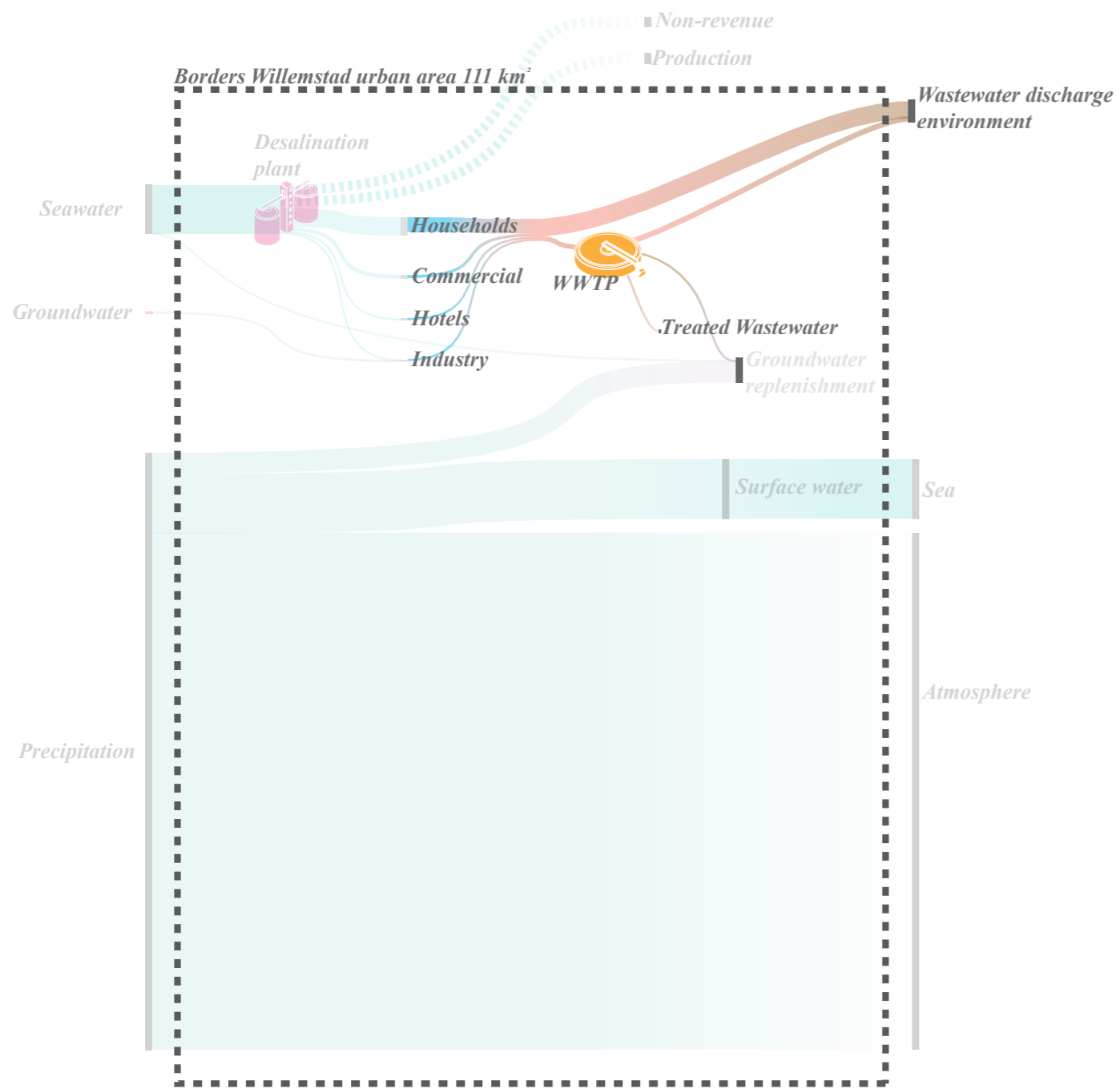
Challenges in the freshwater management of Willemstad: centralized freshwater production



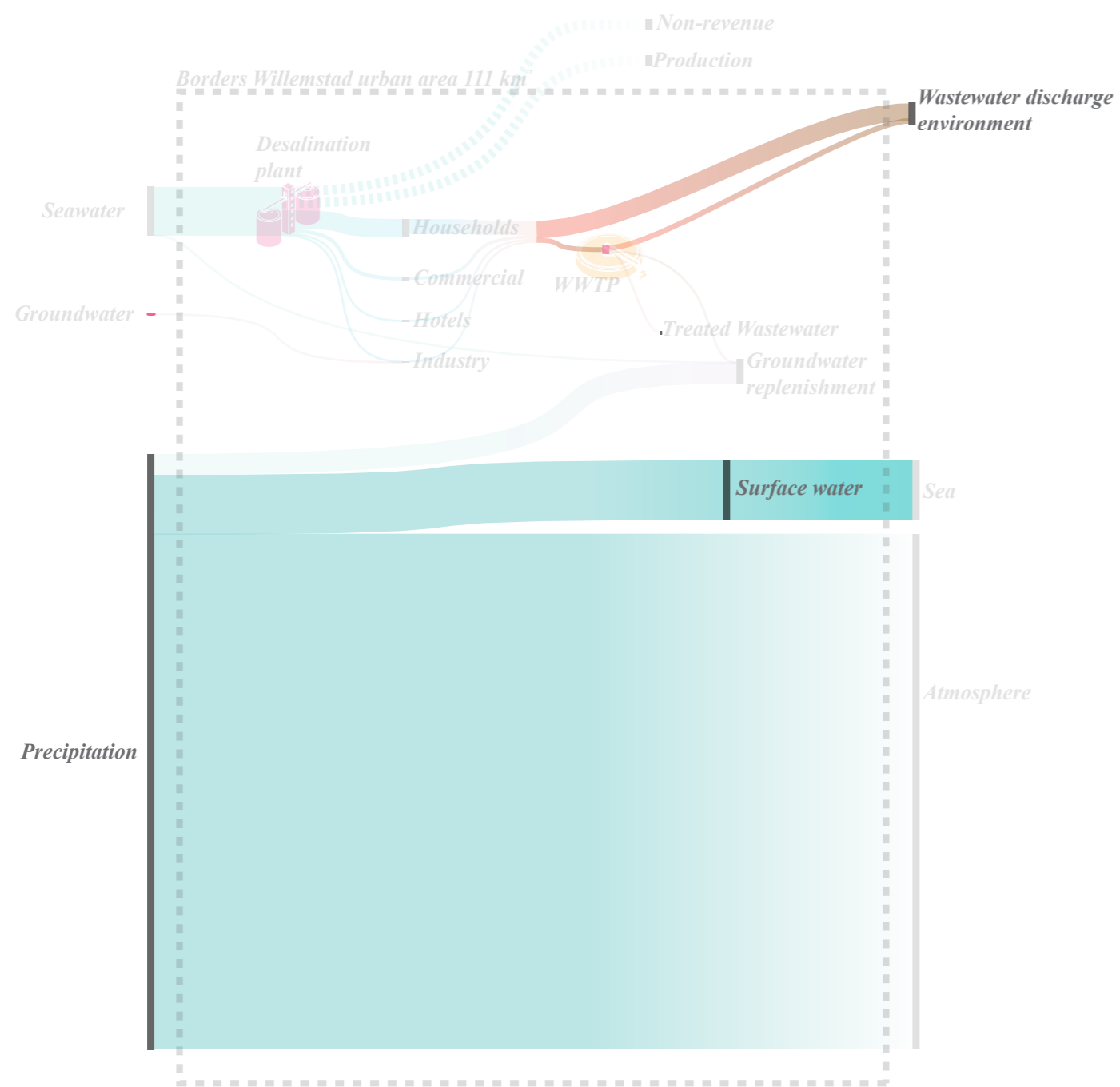
Challenges in the freshwater management of Willemstad: inadequate storm- and rainwater management



Challenges in the freshwater management of Willemstad: lack of groundwater recourses



Challenges in the freshwater management of Willemstad: lack of wastewater treatment



Rainwater

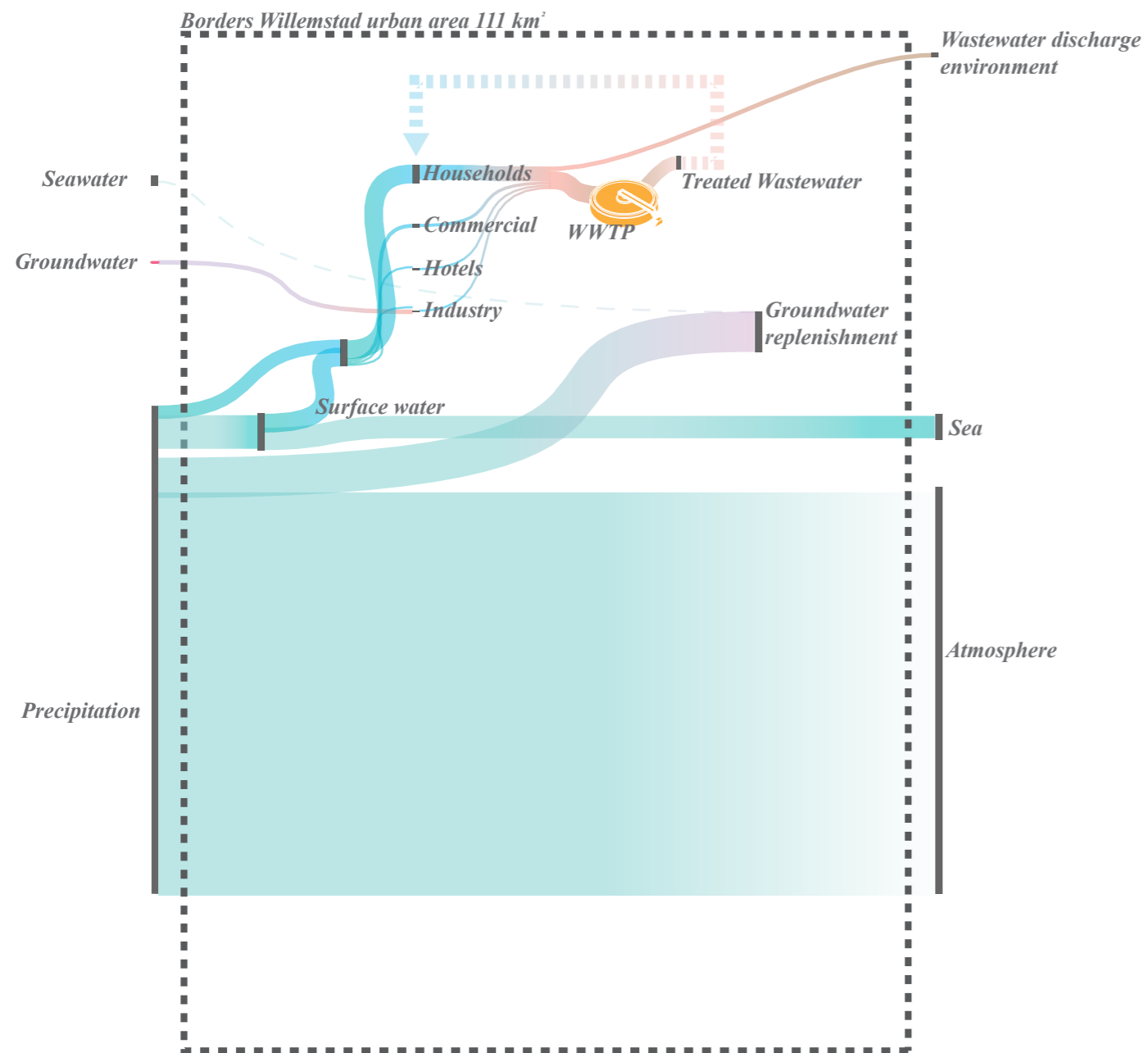


Storm-water



Wastewater

Potential sources of freshwater to create decentralized water systems



Rainwater

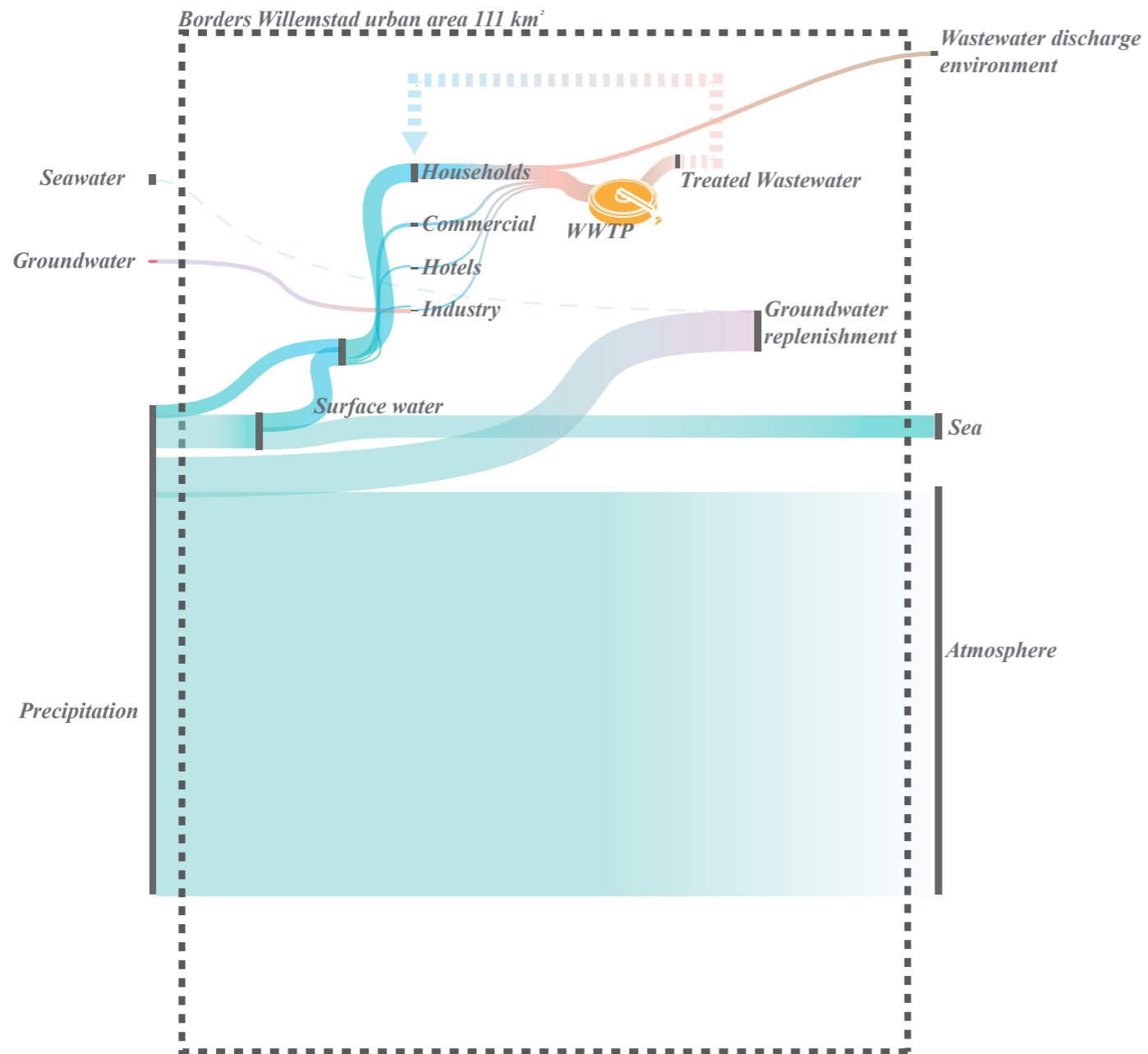


Storm-water



Wastewater

Scenario where potential sources of freshwater create decentralized water systems



How to harvest these fresh- and wastewater flows?

Water & Architecture

Catalogue #1
a look into Heritage Inspired Design Solutions in
the built-environment to manage water

Water & Architecture

Catalogue #2
a look into Nature-based Solutions in the
built-environment to manage water

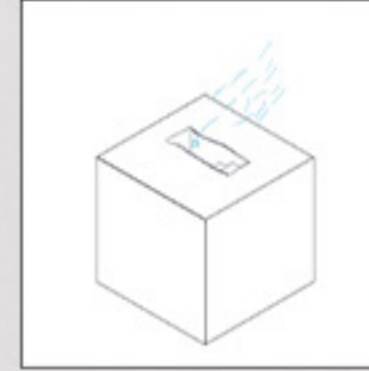
Faha



Characteristics

According to Renkema there were two types of dam systems in use. A small dam system and the large dam system. The small dam system could be found primarily on the domengronden or unfavourable grounds of plantations with irregular and steeper terrain (Renkema 1981). As mentioned before during slavery these kostgronden were in use by the enslaved as kitchen garden. After 1863 the African-Caribbean community continued this practice as subsistence / small holder farmers. Renkema describes "many small dams as no higher than a few decimetres to maximum 1 meter" constructed "on the slopes and in small nook". Henriquez (1992) describes the system in the Schottegat area (fig. 8). The small earthen dams are called faha (grāde in Papiamentu) suggesting that they have a circular shape.

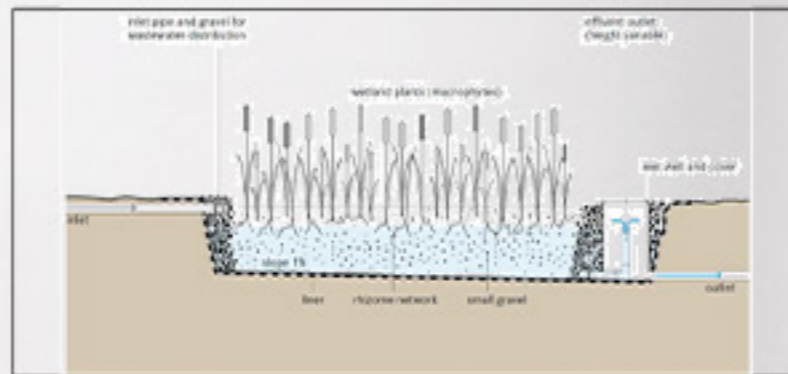
Pos di pia



Characteristics

Debrat (2009) refers to shallow hand dug water holes or pos di pia, a native Carib practice. Local resident Mary van Soest made an inventory of water supply related heritage. Soest describes a "sunken water hole" called Pos di brashan in Papiamentu, which translates as "source for prayer. Local people believe it was used by the native Caribs. It is possible that waterkulan are either seasonally overflowing karstpotten, sinkholes or dolines (geological terms), rainfed natural depressions (transformed by man) and/or manmade pools. The waterkulan are fed directly and via runoff in brooks and streams (rooken) and via dams. Waterkulan / pos di pia are usually located in forested terrain.

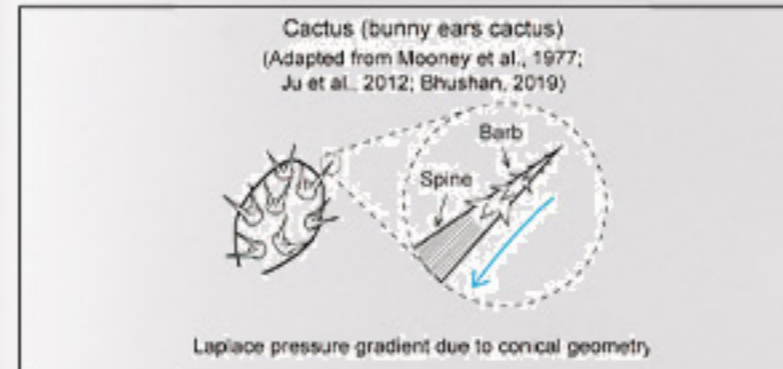
Horizontal subsurface flow constructed wetland



Characteristics

A horizontal subsurface flow constructed wetland is a large gravel and sand-filled basin that is planted with wetland vegetation. As wastewater flows horizontally through the basin, the filter material filters out particles and microorganisms degrade the organics. (Trey, et al., 2014, p. 116)

Capturing water (against gravity)



Characteristics

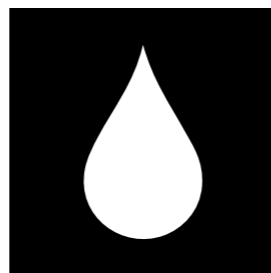
The Chihuahuan Desert cactus (*Opuntia microdasyle*) has evolved water-harvesting clusters of very fine conical spines. Its success relies on two physical phenomena: first, a gradient of Laplace pressure and, second, a gradient of surface-free energy. Laplace pressure refers to the pressure difference (between inside and outside) created within bubbles. When a droplet of water forms on the end of the conical spine, it forms asymmetrically - wider at the tip of the spine. The result is a pressure gradient that drives the droplet along the spine (even against gravity) towards the wider part of the cone. The effect is enhanced by microgrooves along the spine, which widen towards the base, creating another means by which the droplet is driven along the spine towards the base (referred to as a gradient of surface-free energy).



Implementing decentralized freshwater systems on decaying monuments in the urban context of Willemstad, Curaçao using the unused potential water streams by implementing HIDS and NBS



Economic:
Reduce cost for freshwater



Environmental:
Restore natural water buffer recourses



Social:
Create non-dependency and create awareness to the finite recourse



Cultural:
Reconnect with history and nature

Ambition



Otrobanda in the context of Willemstad



Context: Otrobanda



Breedestraat



Alleys

Impression of Otrobanda: Breedestraat in connection with various smaller alleys and garden districts



Low level houses



Use of color

Impression of Otrobanda: human-scale dense neighbourhood

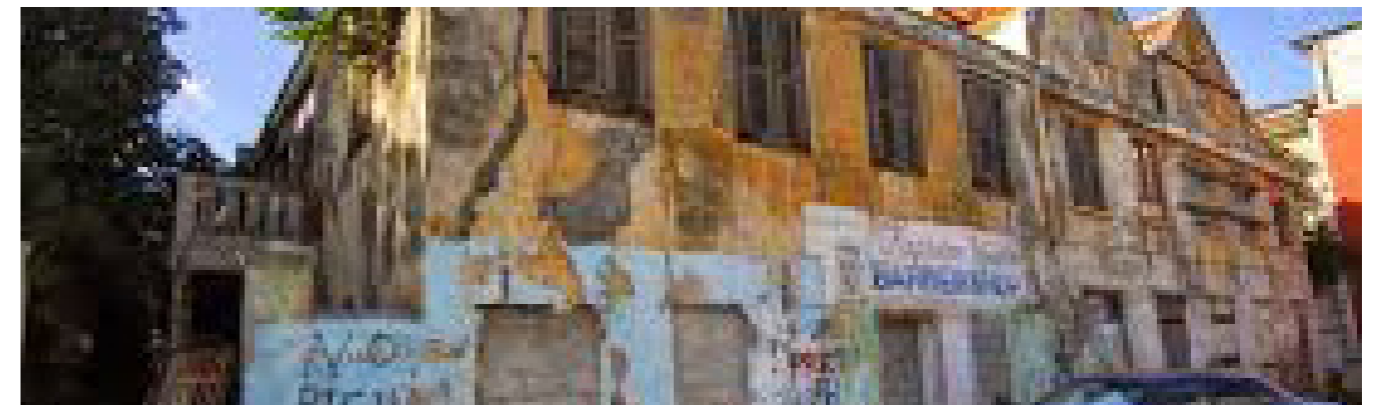


Map of Otrobanda



paradisefm.cw

**Problemen met
vervallen huizen in
Otrobanda - Paradise
FM 103.1**



Depletion of monuments

Big part of the 60% of World Heritage Listed Monuments are in depletion



Map of Otrobanda showing flood area

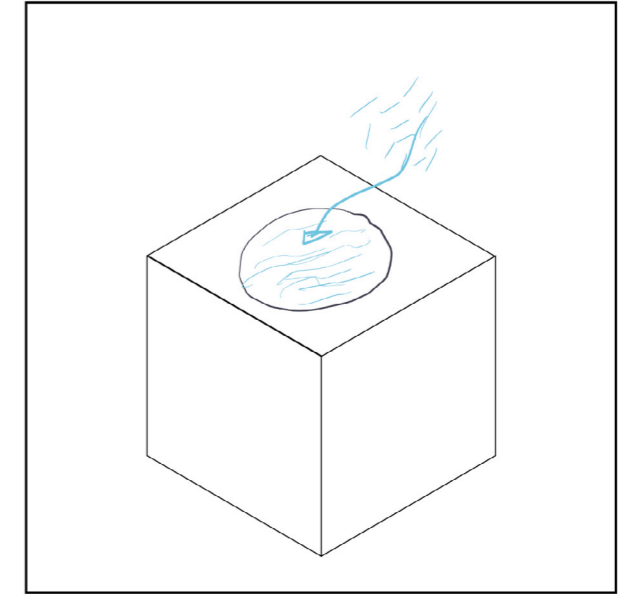


Floods

Water infrastructure leads water to sea with no buffering zones, making Otrobanda prone to floods in times of storm surges



River-system implemented in Otrobanda



Characteristics

According to Werbata's legend (fig. 1 nr. 6), a rooi is a "in the rain season filled dry bed of a brook". During rain runoff water flows downhill through the bed of the rooi. Some rooi are also fed with seepwater that flows out at the foot off porous karst formation hills, cliffs and notches. The rooien played an important part in the islands water catchment system.

Reference of heritage and nature inspired Rooi-system

Context strategy: reintroduction of man-made rooi-system in connection with freshwater harvesting monuments



Position of Frederikstraat 127 in context of Otrobanda



Orthographic shot current state of manor house envelop

FreshWater monument: Frederikstraat 127



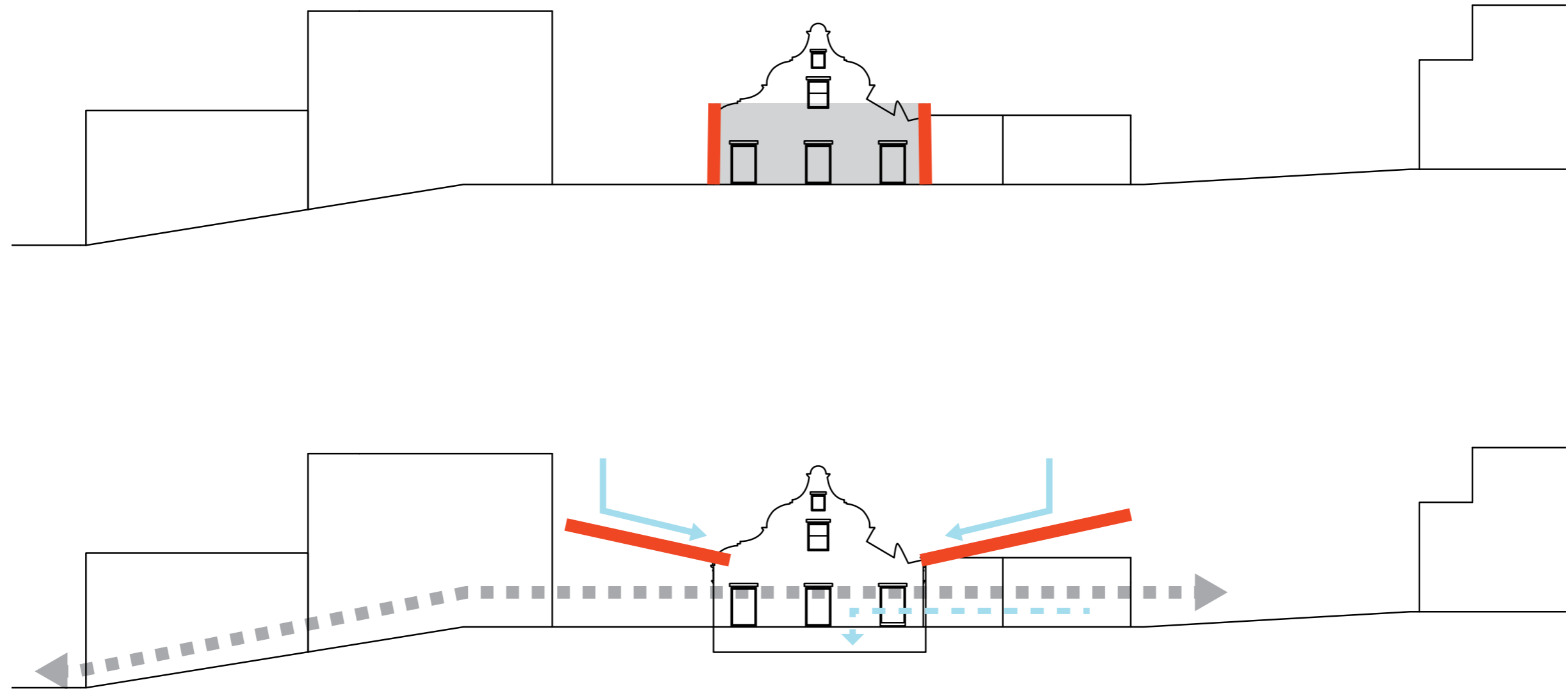
Archive picture south facade



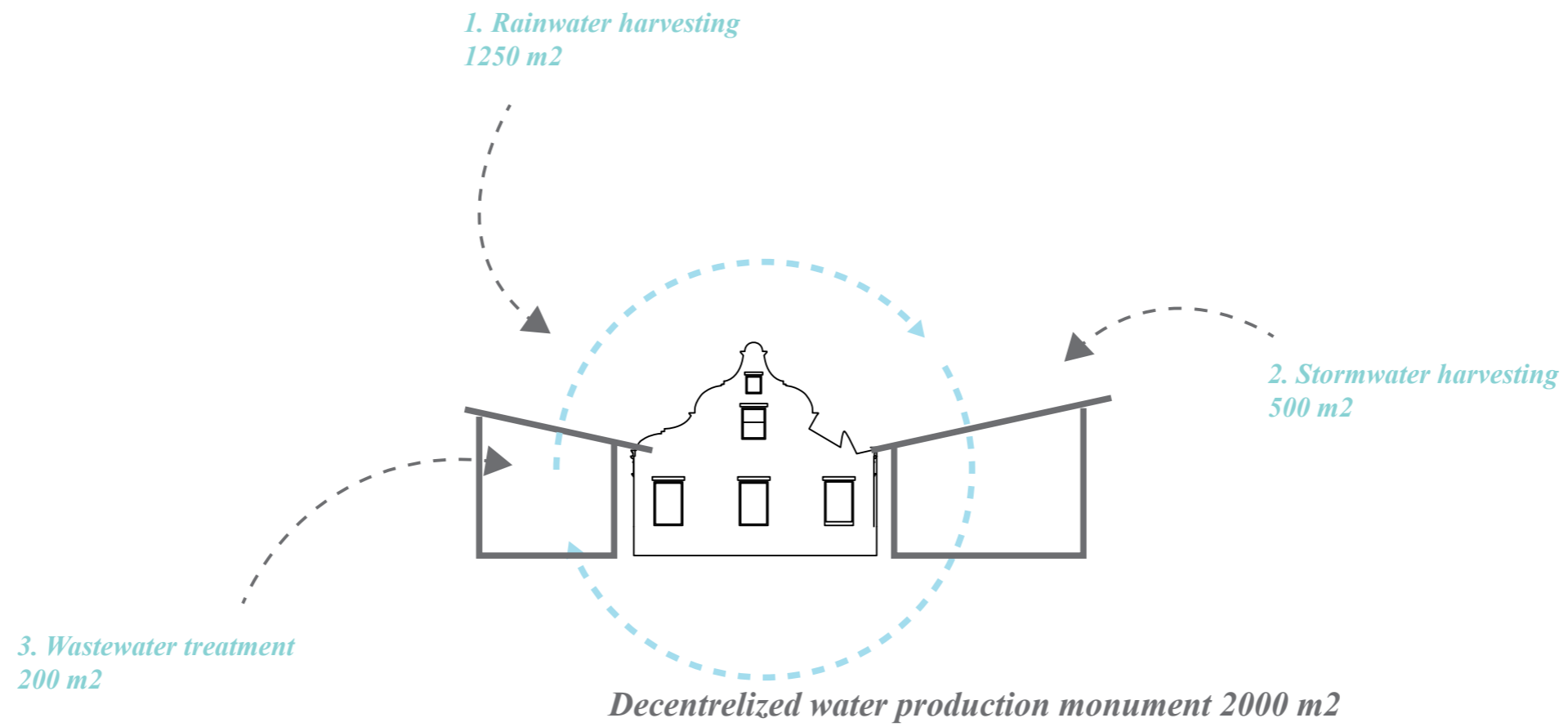
Drone shot current state of manor house envelop

Once stately manor house now a ruin

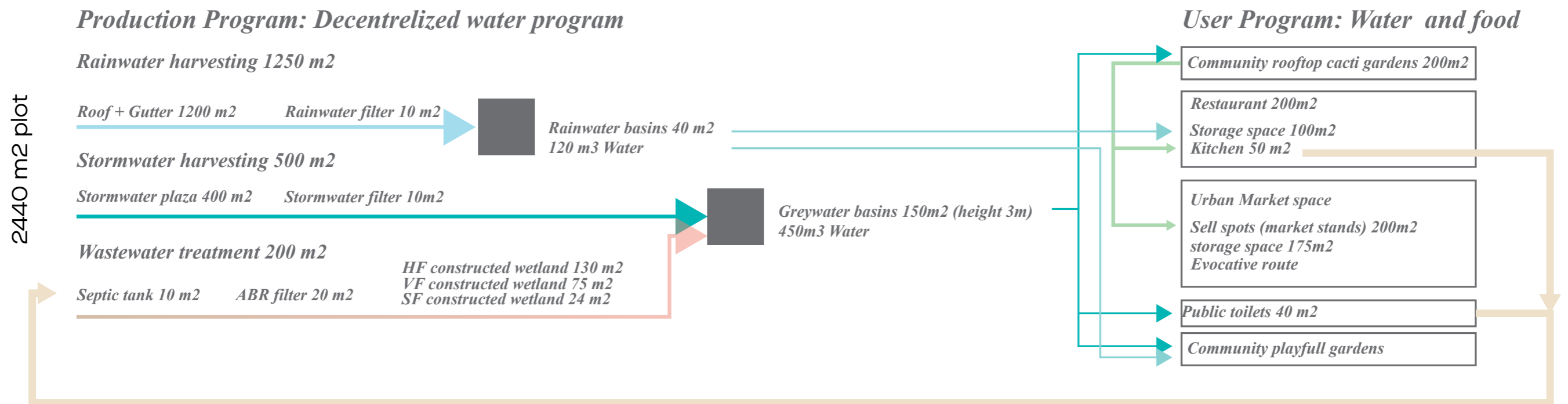
*How can **The Frederikstraat 127** be transformed into a decentralized **freshwater harvesting monument** and be connected to a public program to increase the communal awareness of the finite resource of freshwater?*



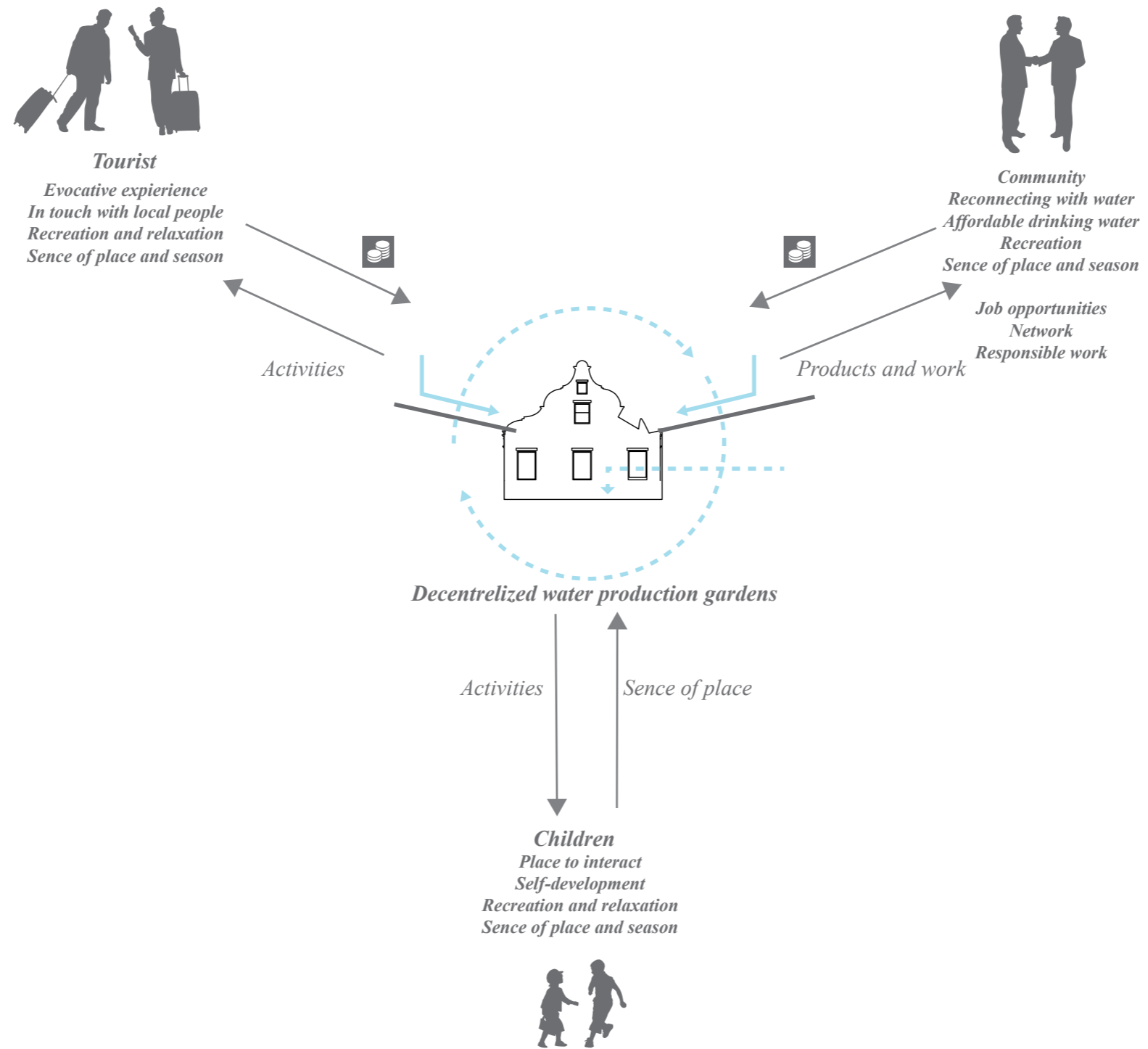
Monumental envelope becomes public courtyard while outside structure funnels water and people to central water heart



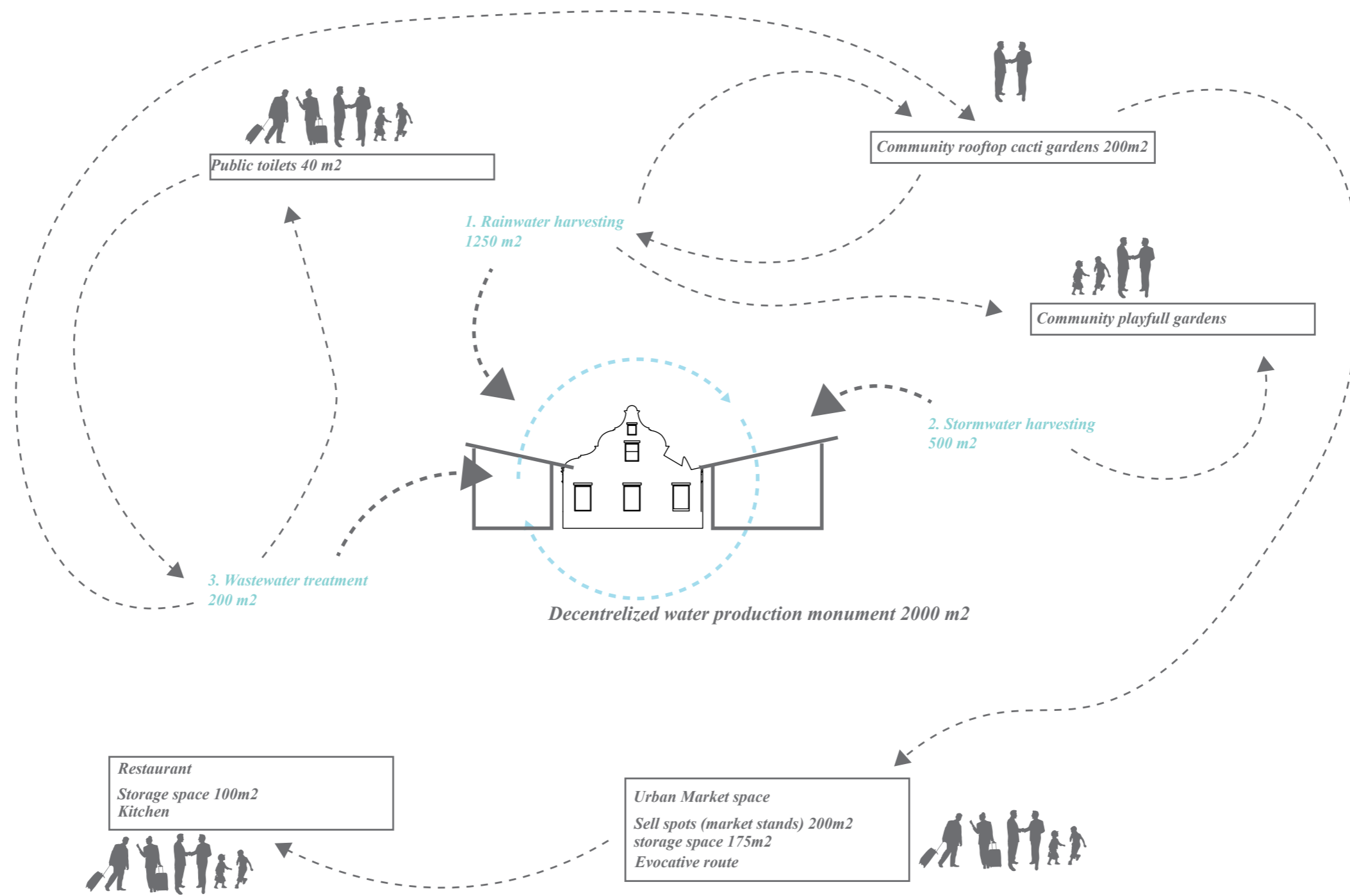
The process: Monument becomes decentralized production space with central water courtyard



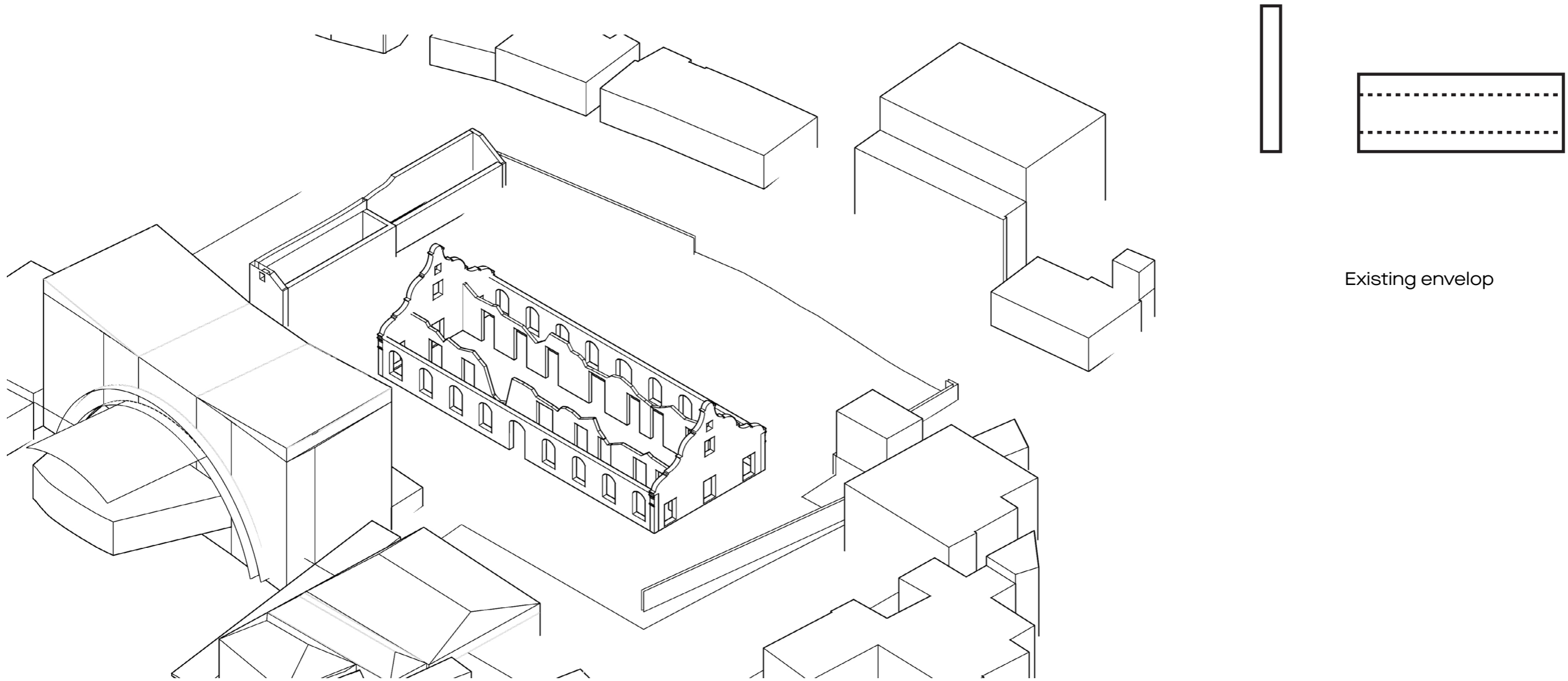
The process: program interaction



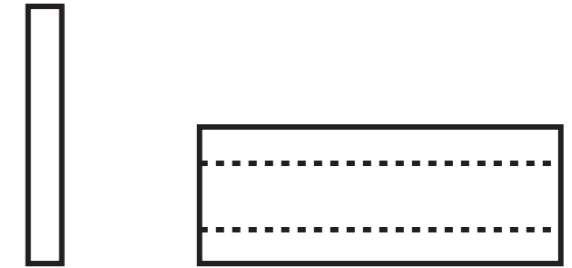
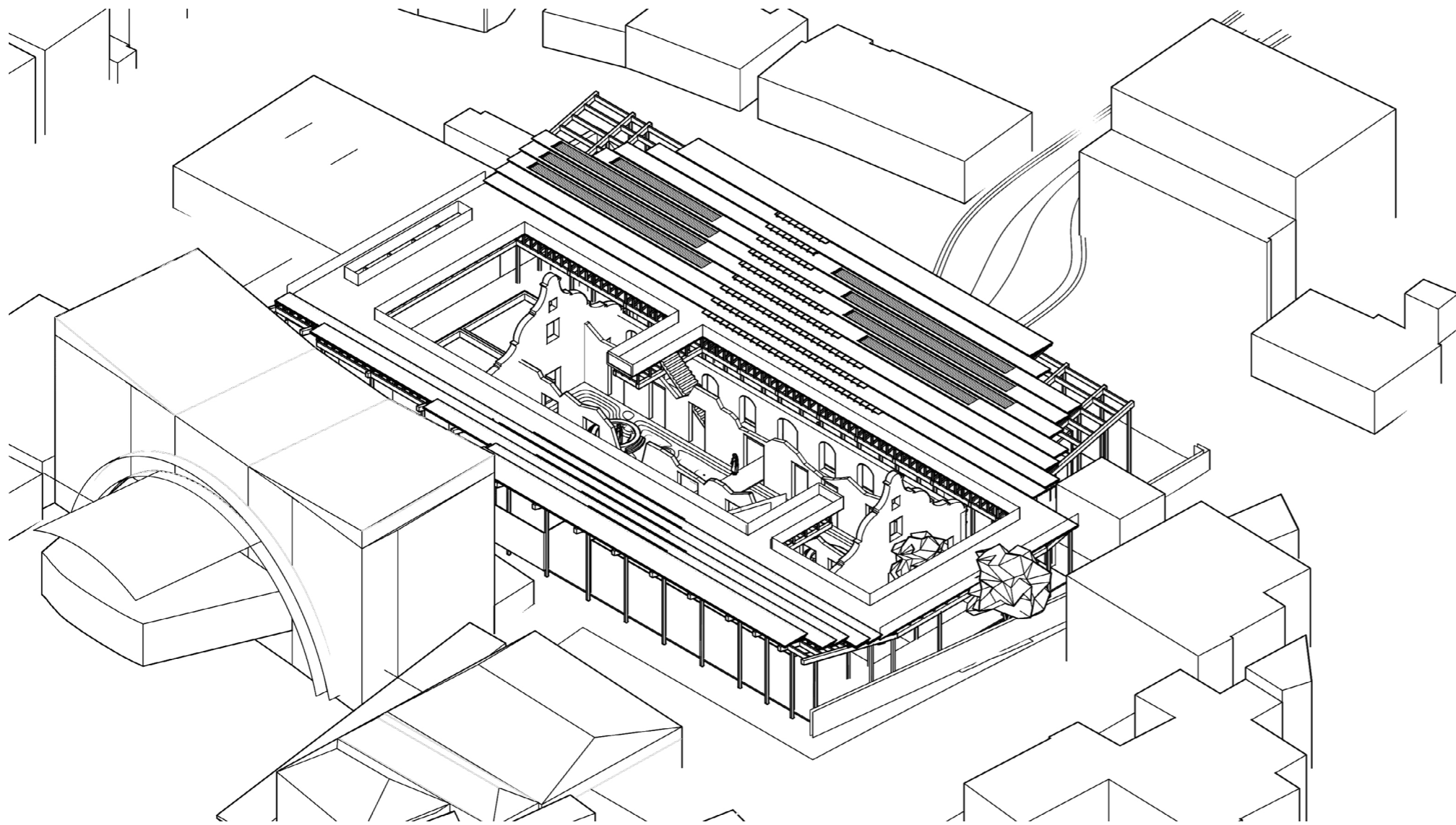
User activities



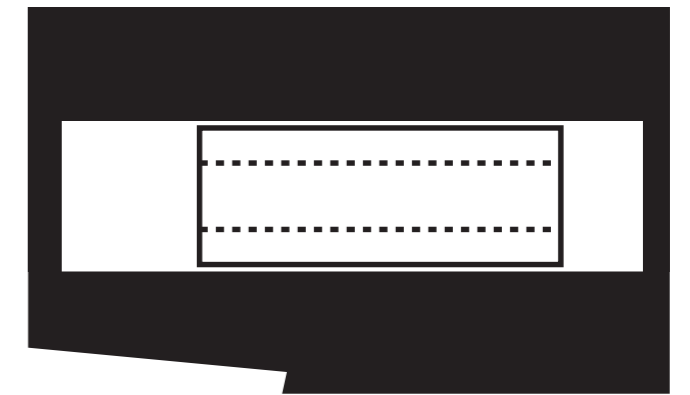
Production process + user program



Existing dilapidated structure Frederikstraat 127

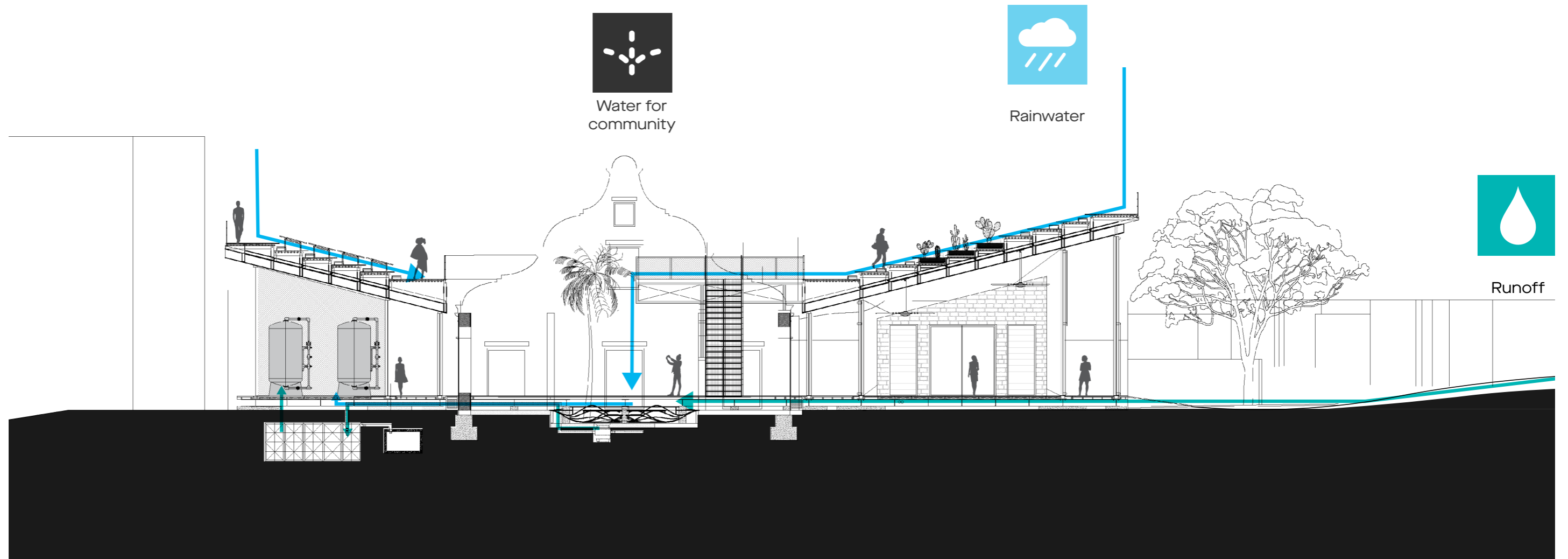


Existing envelope

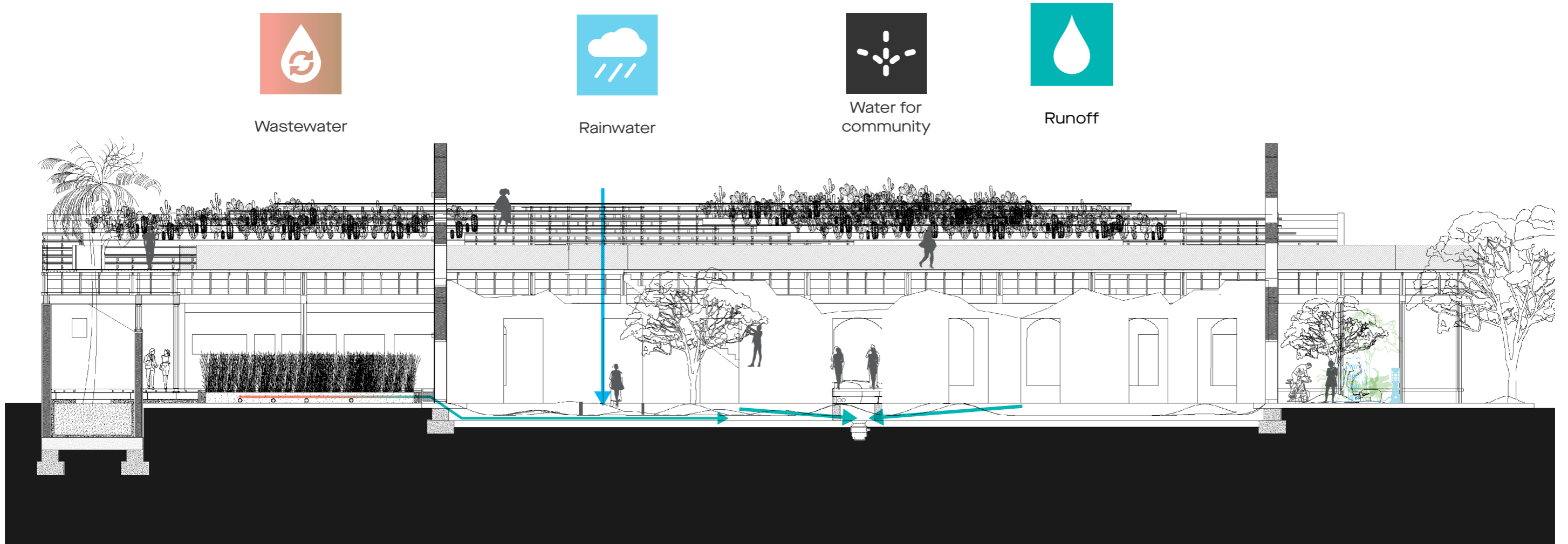


Courtyard addition

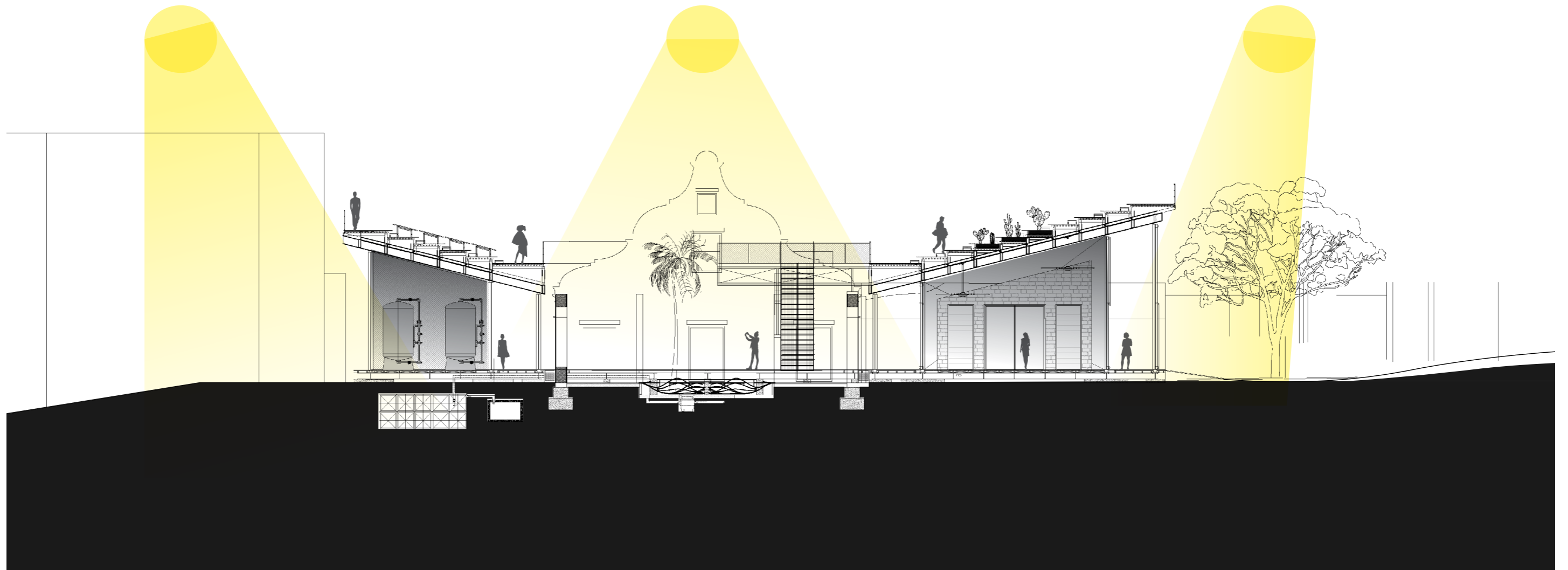
Design interventions: the invert with central freshwater courtyard



Monument becomes central freshwater courtyard



Courtyard connector of 3 water streams



Highlighting of monument structure and central courtyard. Shading public space surrounding the courtyard

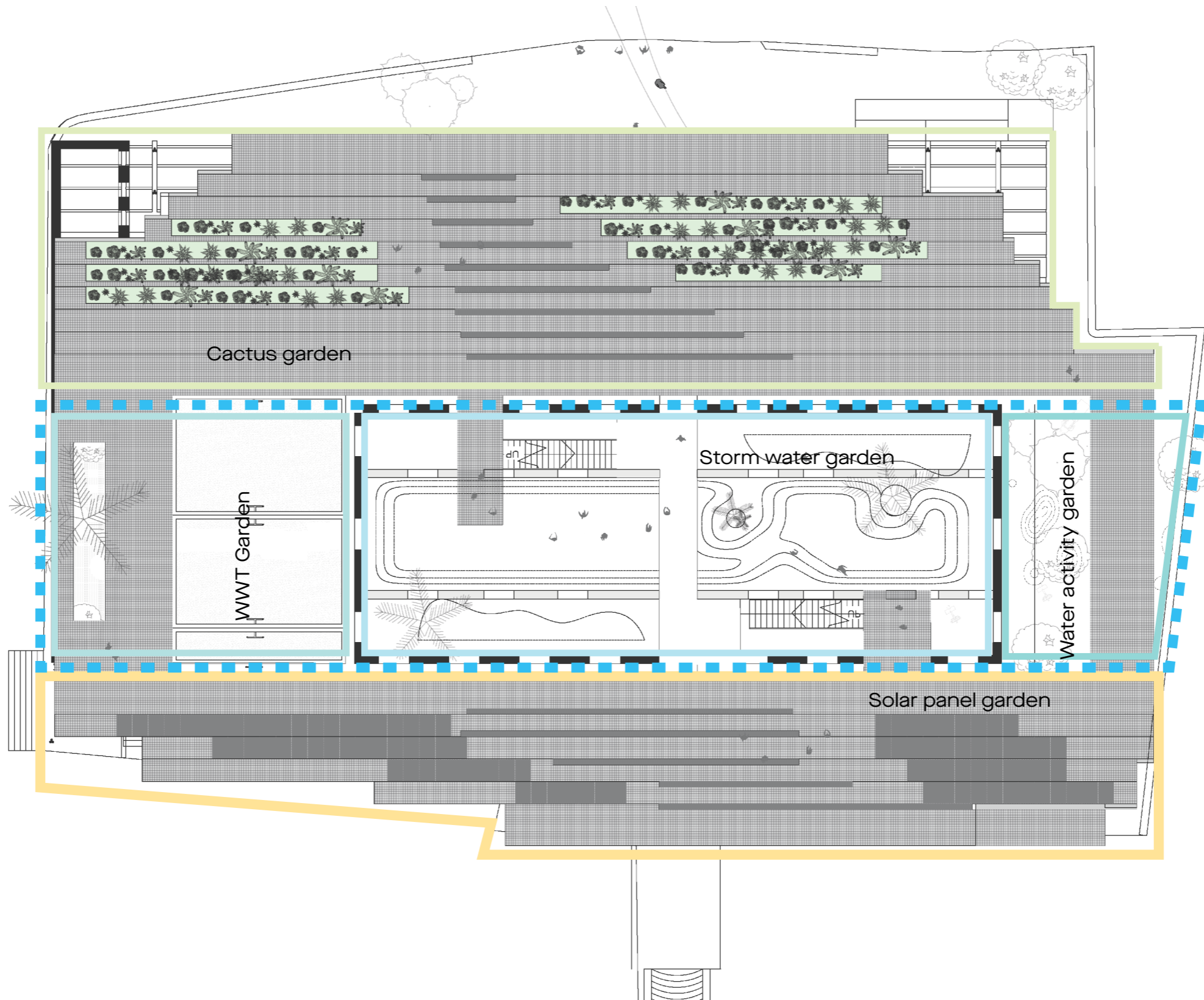


Context Frederikstraat 127 in between garden district and Breedestraat

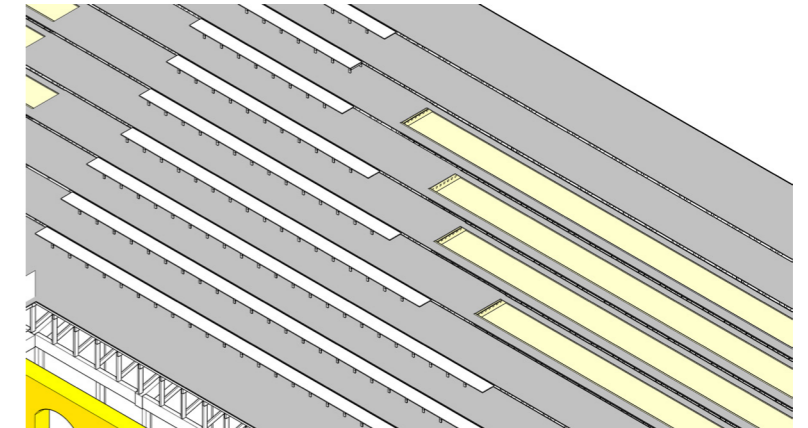
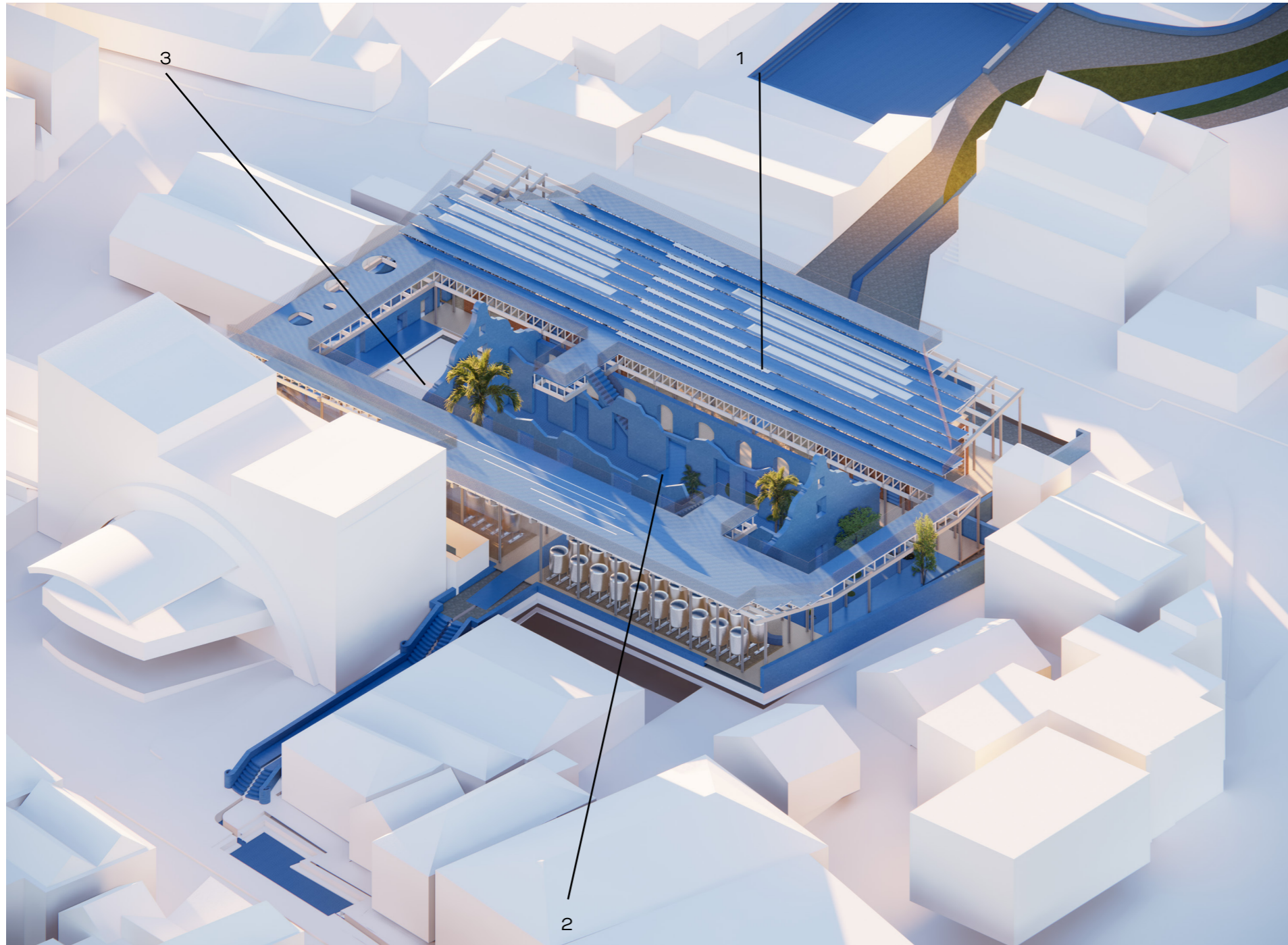


Garden district Otrobanda

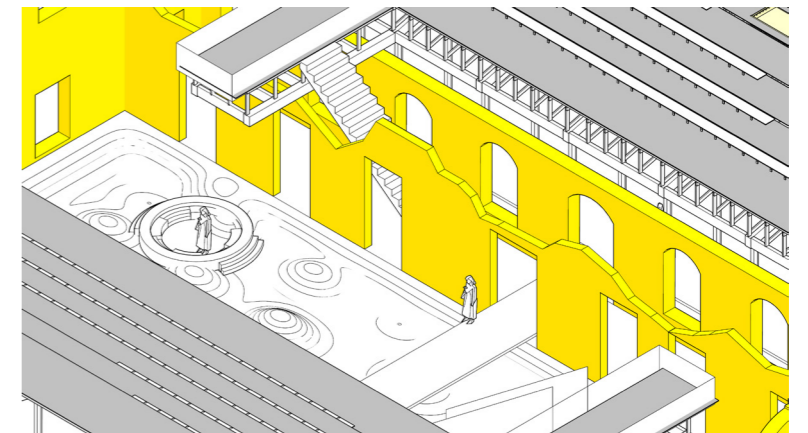
Overview site Kura/Koraal district (garden ditrict) of Otrobanda



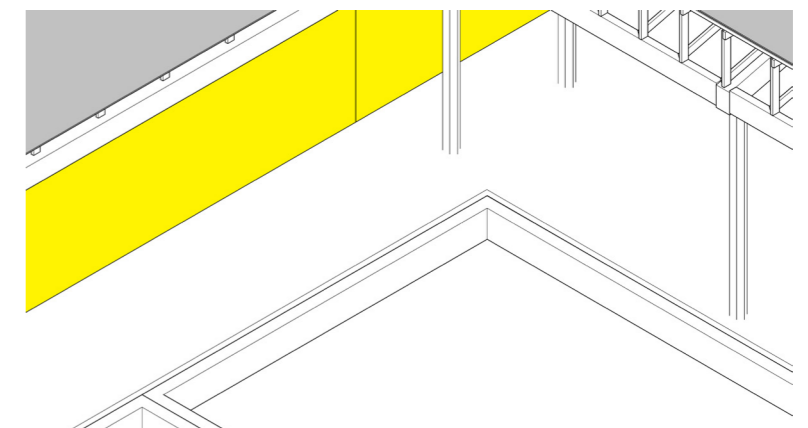
top view roof garden and ground floor gardens



1. Rainwater harvesting roof garden

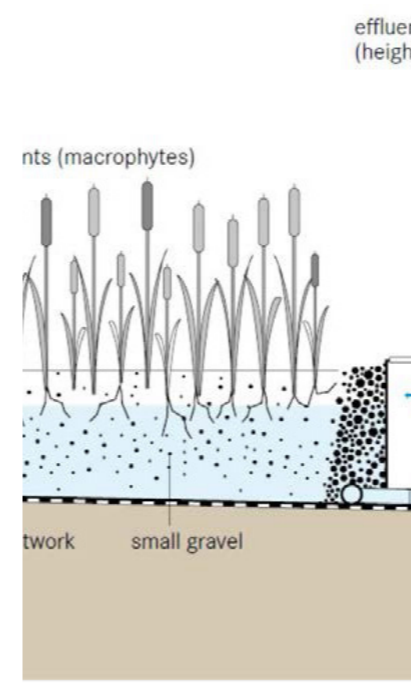


2. Storm water runoff plaza

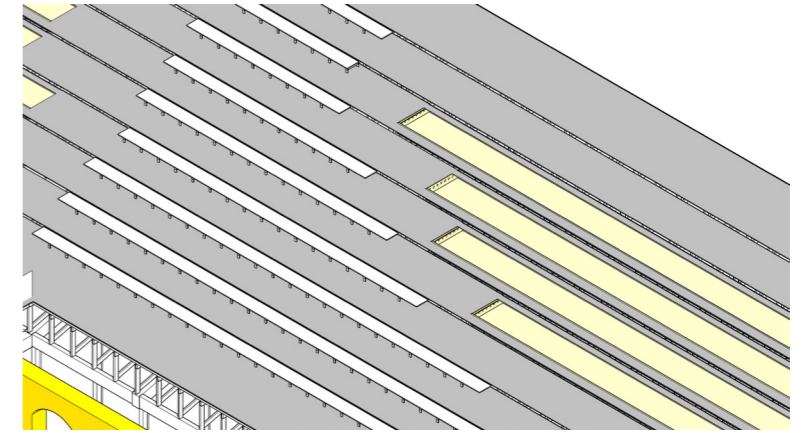
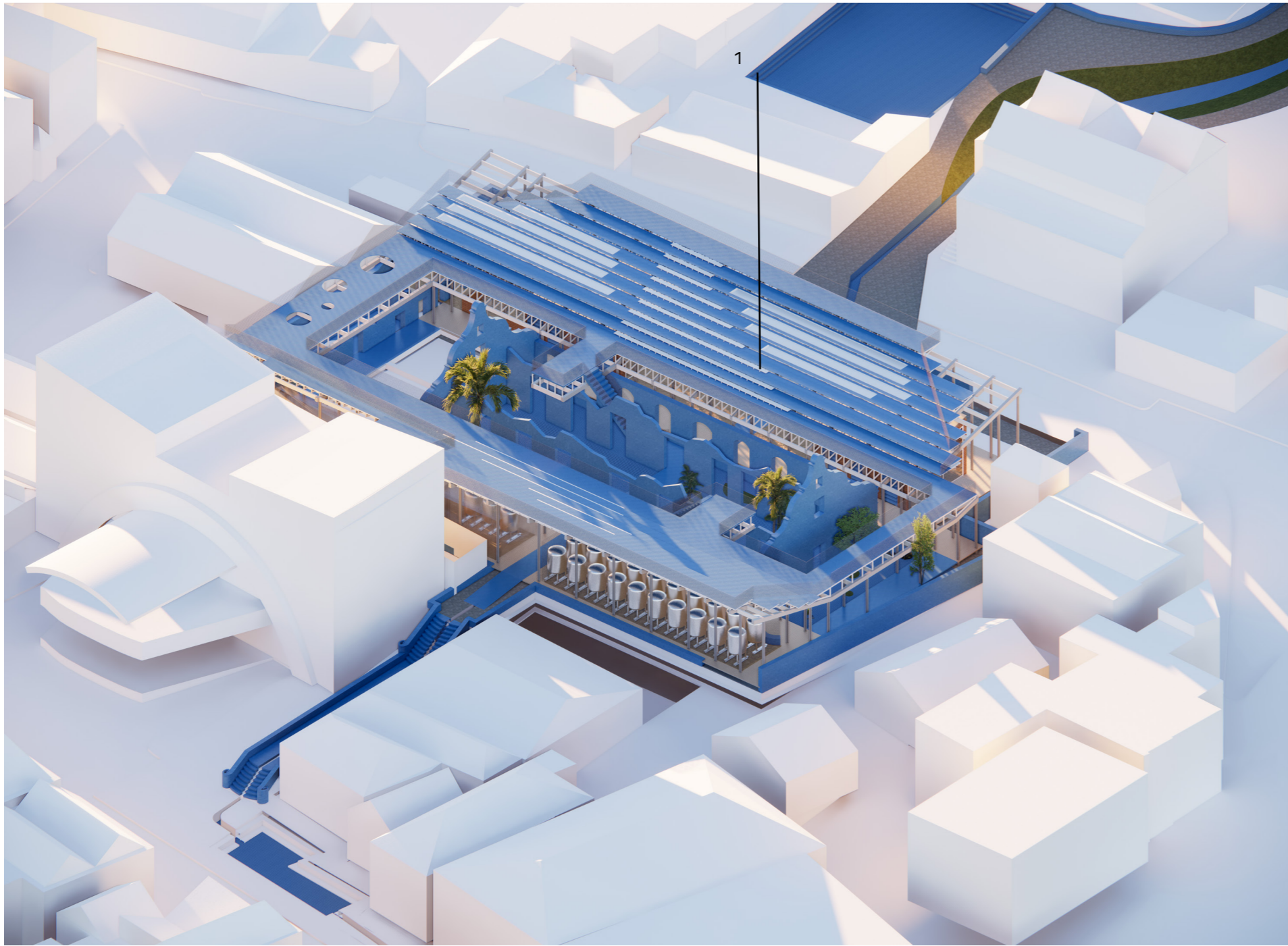


3. Wastewater treatment constructed wetland garden

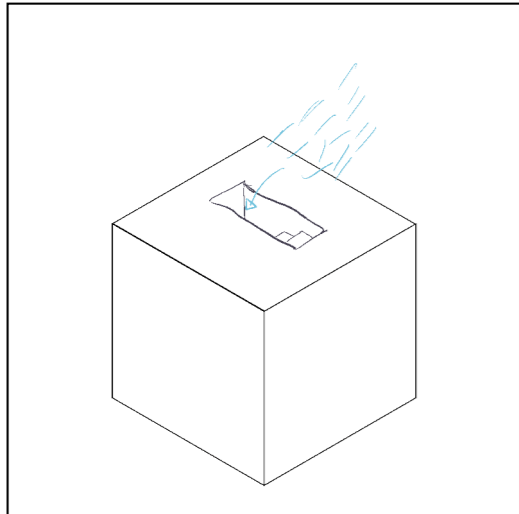
Design elements for harvesting the 3 potential (fresh)water streams



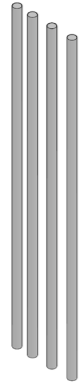
Water elements combination of heritage and nature inspired design solutions



1. Rainwater harvesting roof garden



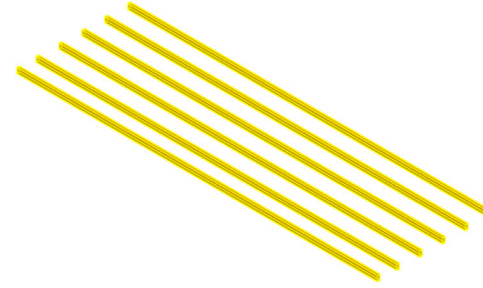
Design principal: Reference Post di daki



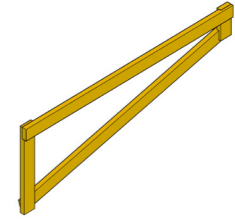
Gas and oil pipes



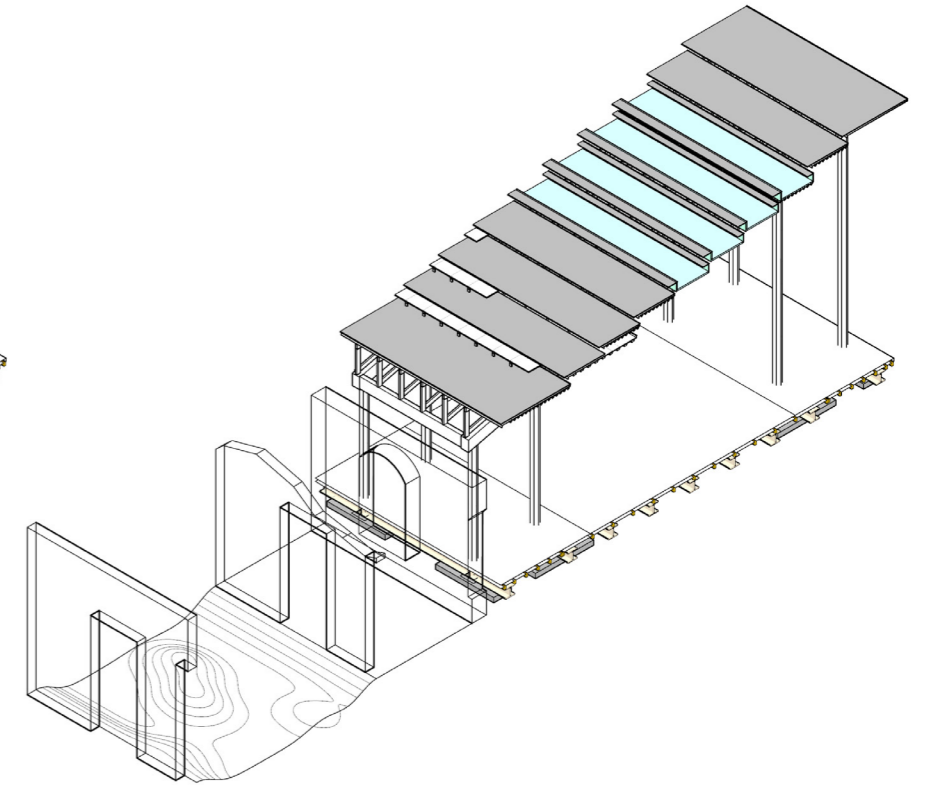
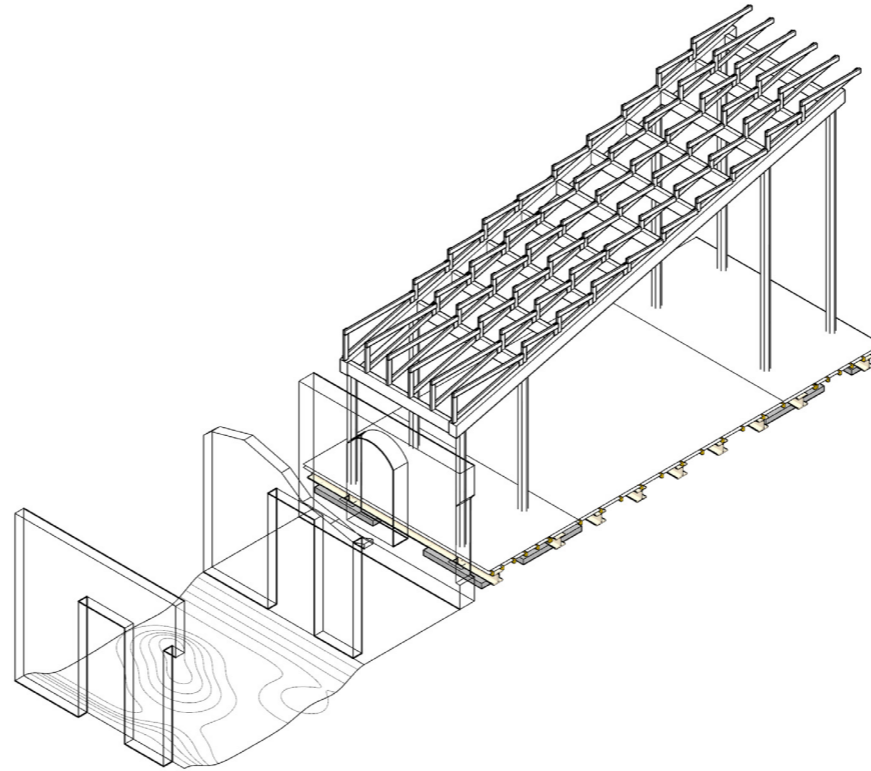
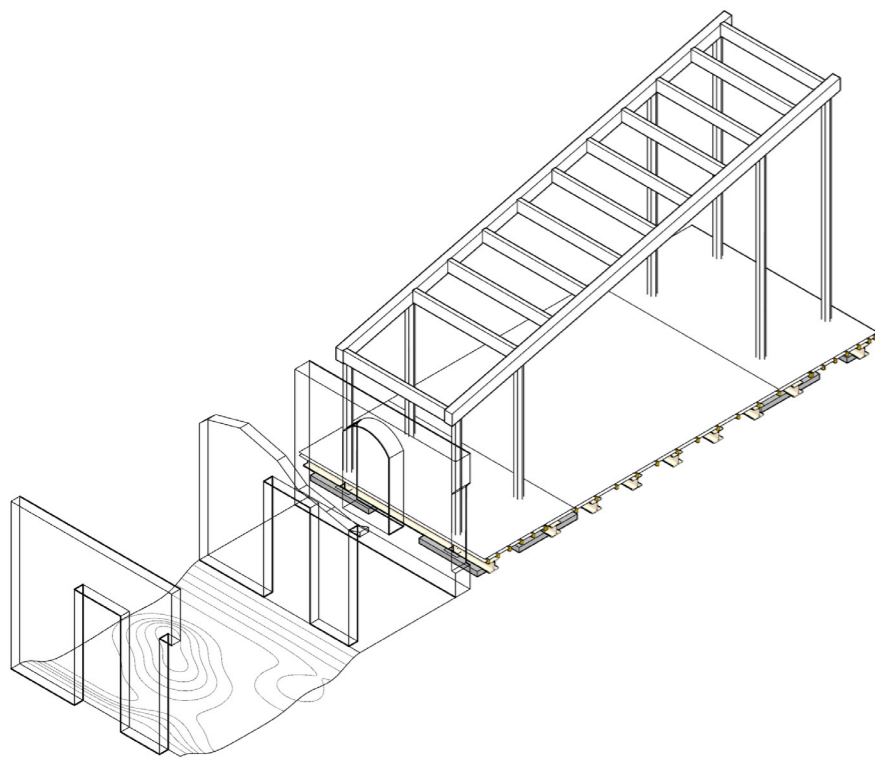
Reclaimed steel pipe (old gas pipes) column's
250×205 mm



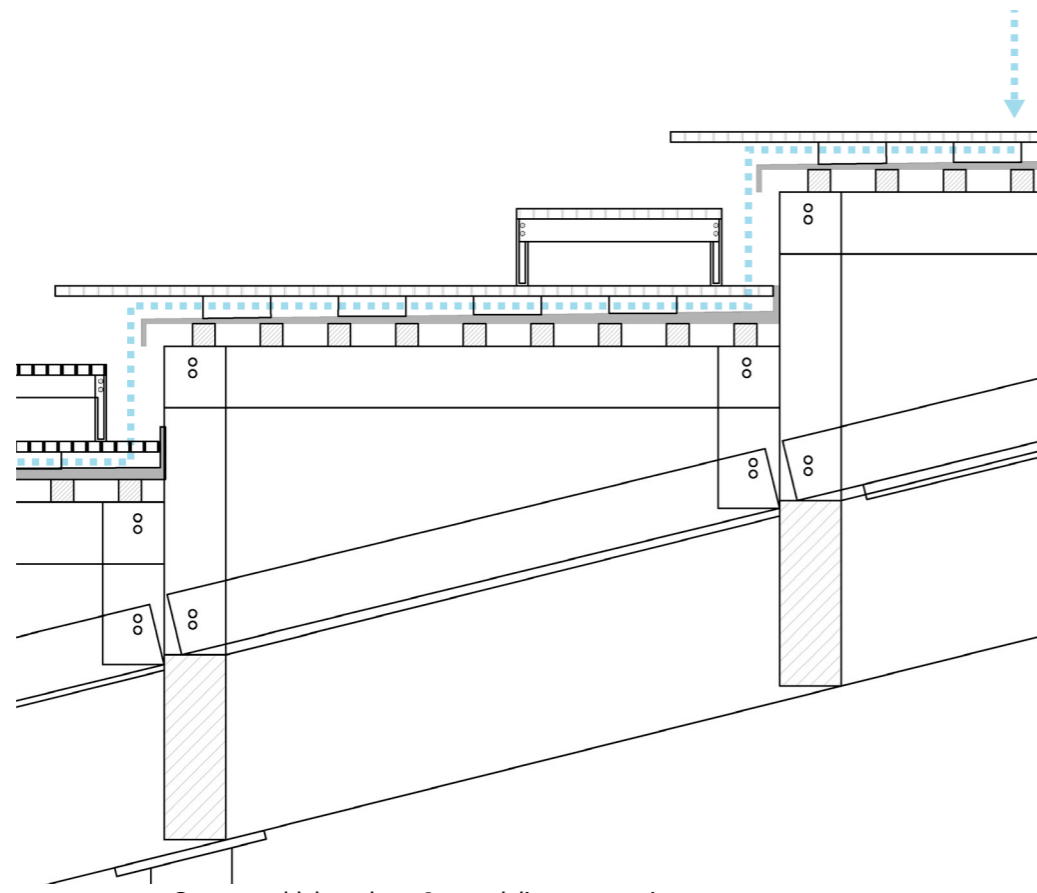
Pallet wood



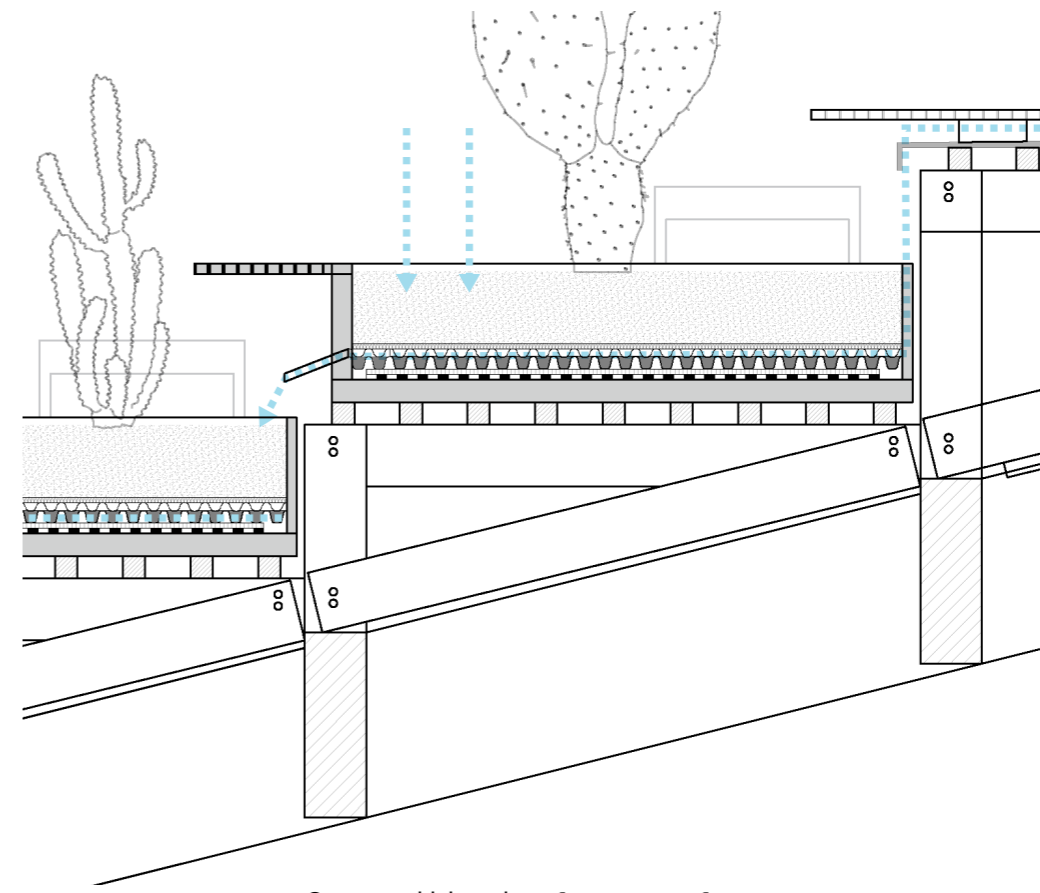
Reclaimed wooden frame made of 44×120mm
pallet wood



Staircase structure from locally resourced materials



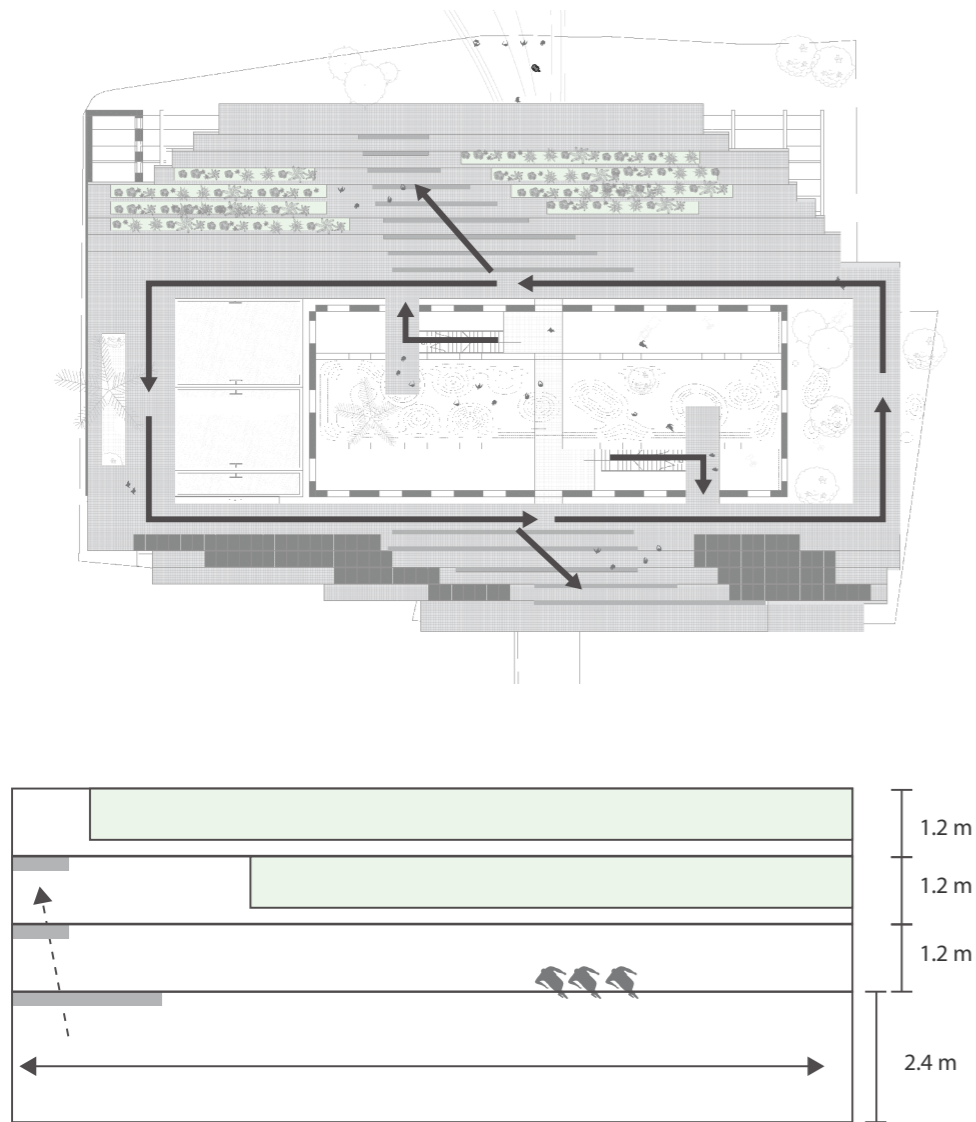
Stepped bleacher for public recreation



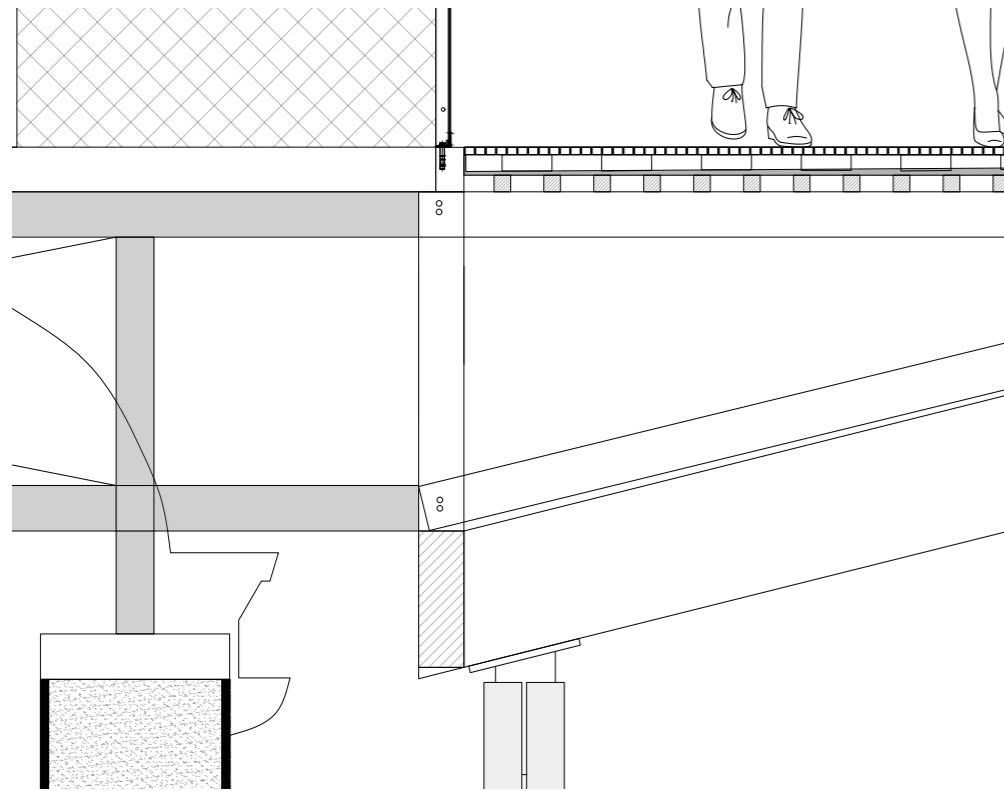
Stepped bleacher for cactus farm



View rooftop cacti garden



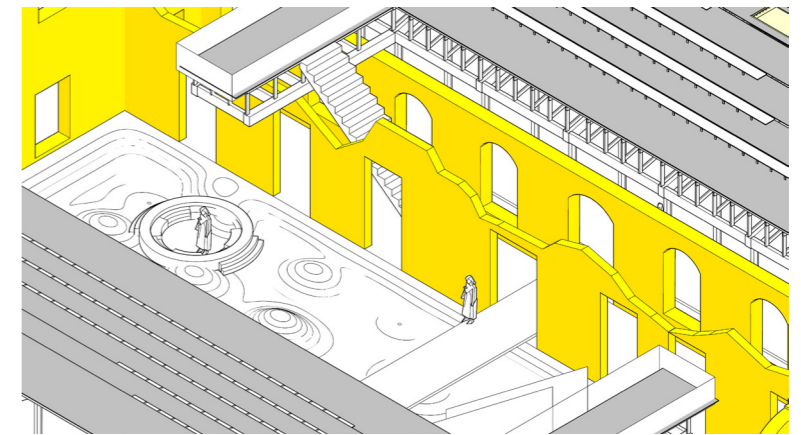
Gutter spacial definition for routing around water courtyard on top level



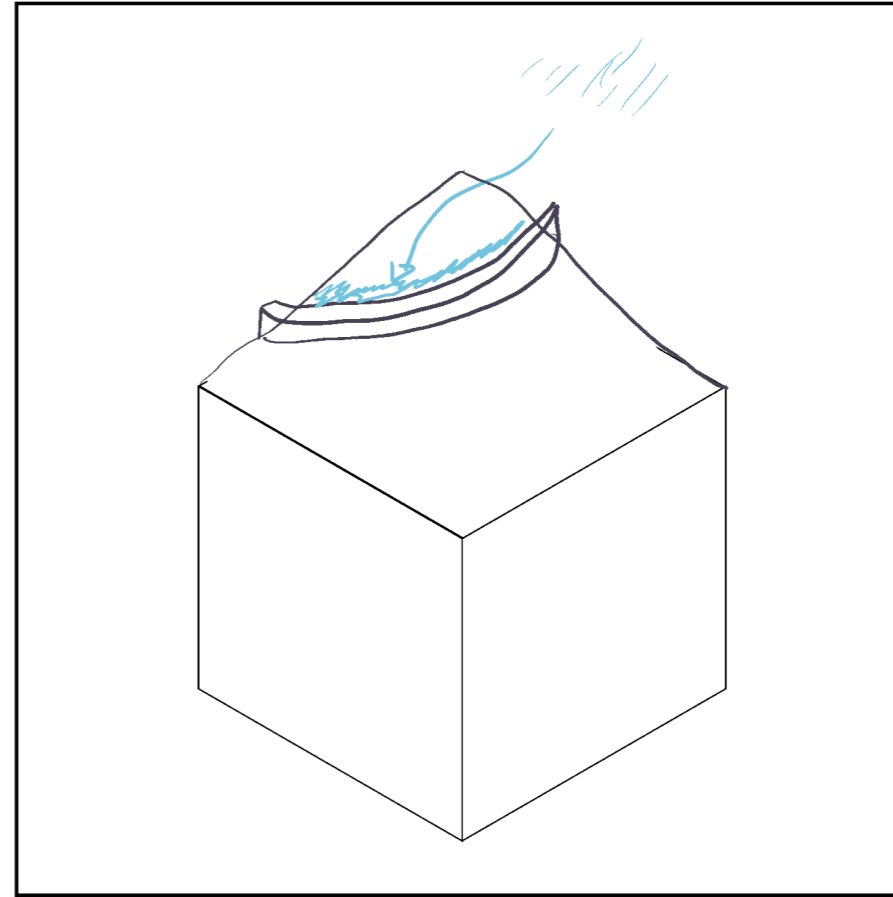
Detail: Connection Gutter new and existing structure 1:10



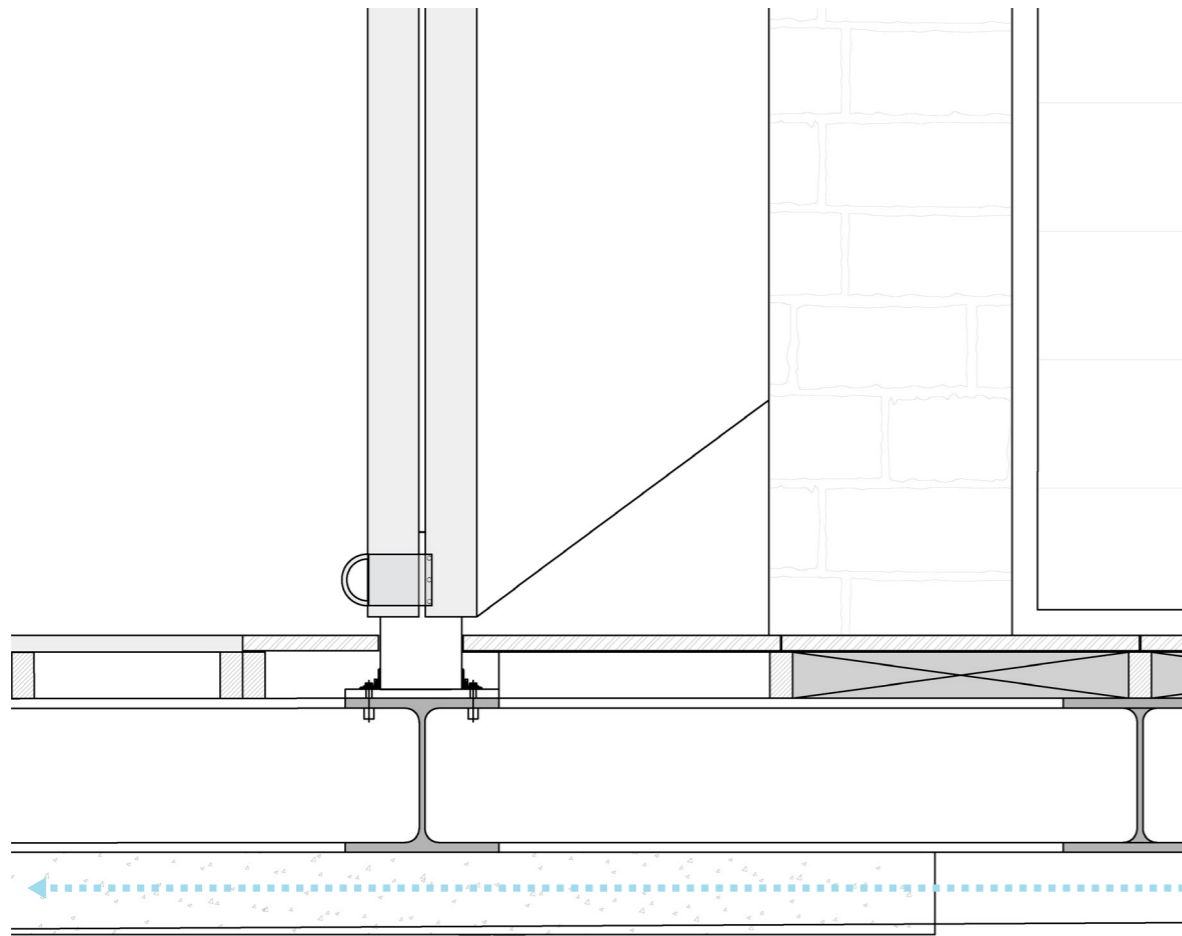
Gutter spacial definition for routing around water courtyard on ground level



2. Storm water runoff plaza

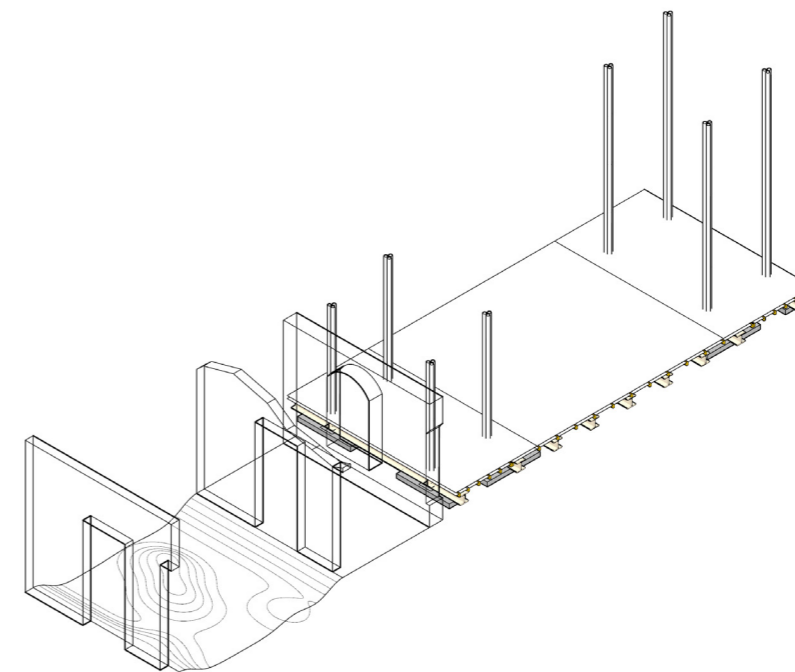
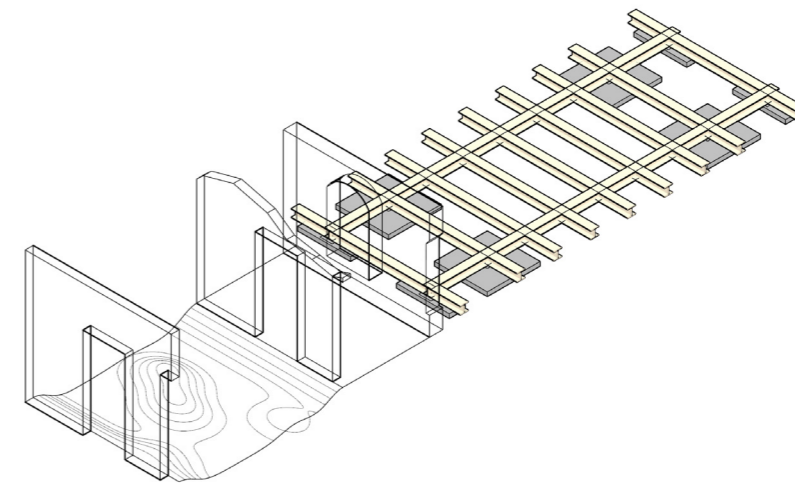
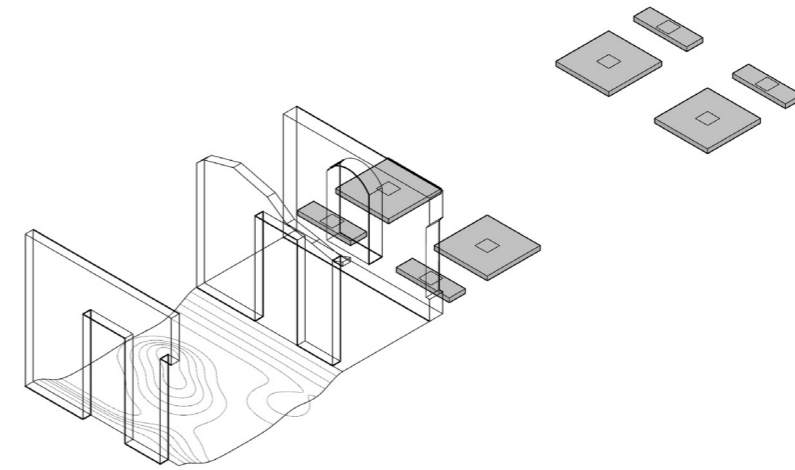


Design principal: reference heritage inspired tanki-faha system



Detail:

1. Stelcon plaat 2000×2000×140 mm
2. HEB 300 steel I profile
3. Wood frame 90×44 mm
4. Wall-bearing wooden infill bar to prevent sagging
5. Limestone flooring tiles 33×700×700 mm
6. Aluminium T-profile 20×20×2 mm
7. Wooden decking floor xxmm
8. Dry steel column-beam connection (rotting resistant)
9. Reclaimed steel pipe (old gas pipes) column's 250×205 mm



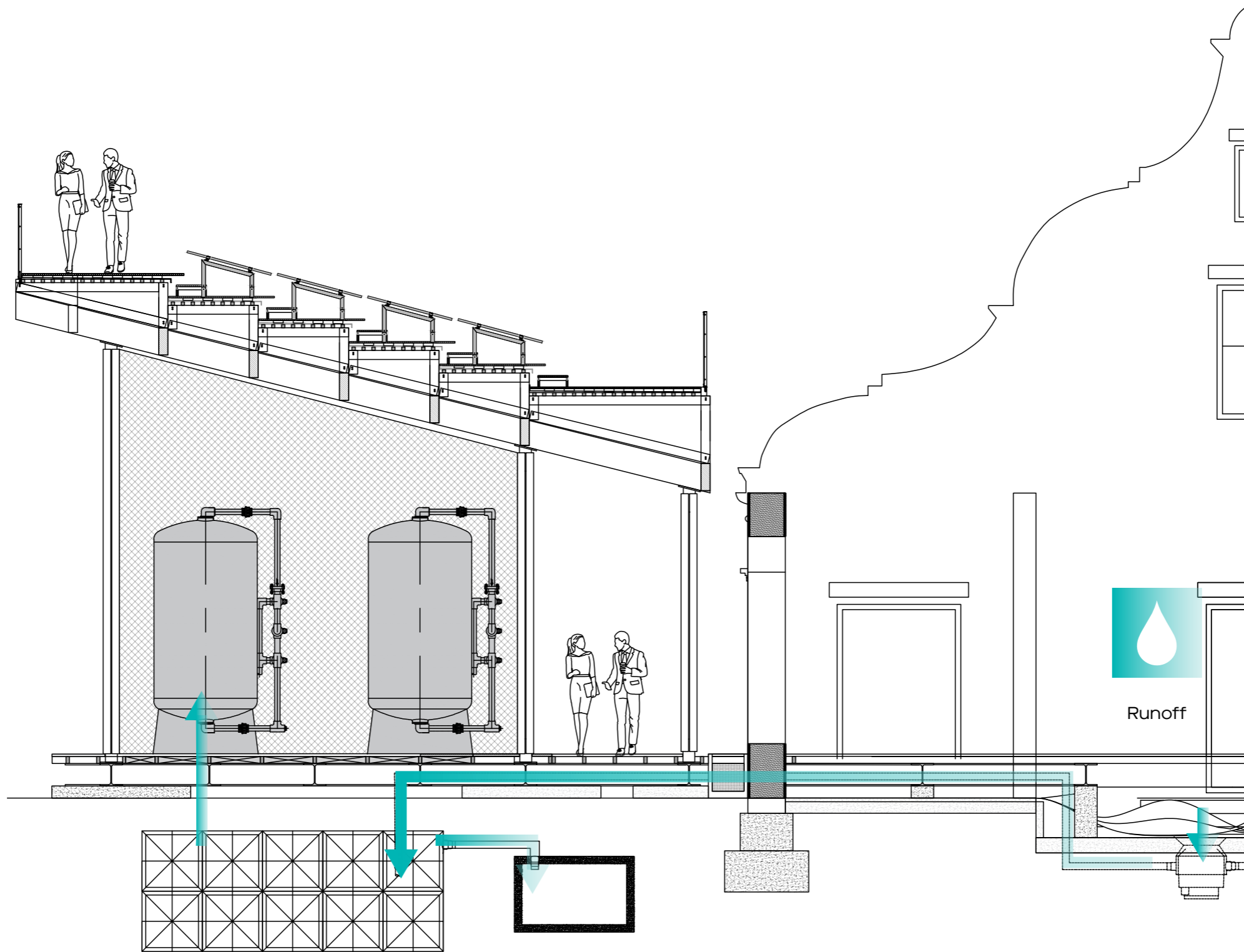
Structure creating lifted floor for storm water passage



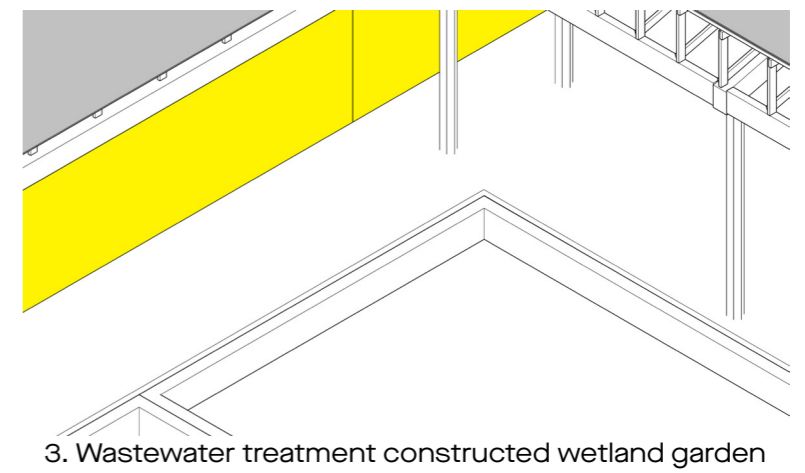
Sense of season in dry months



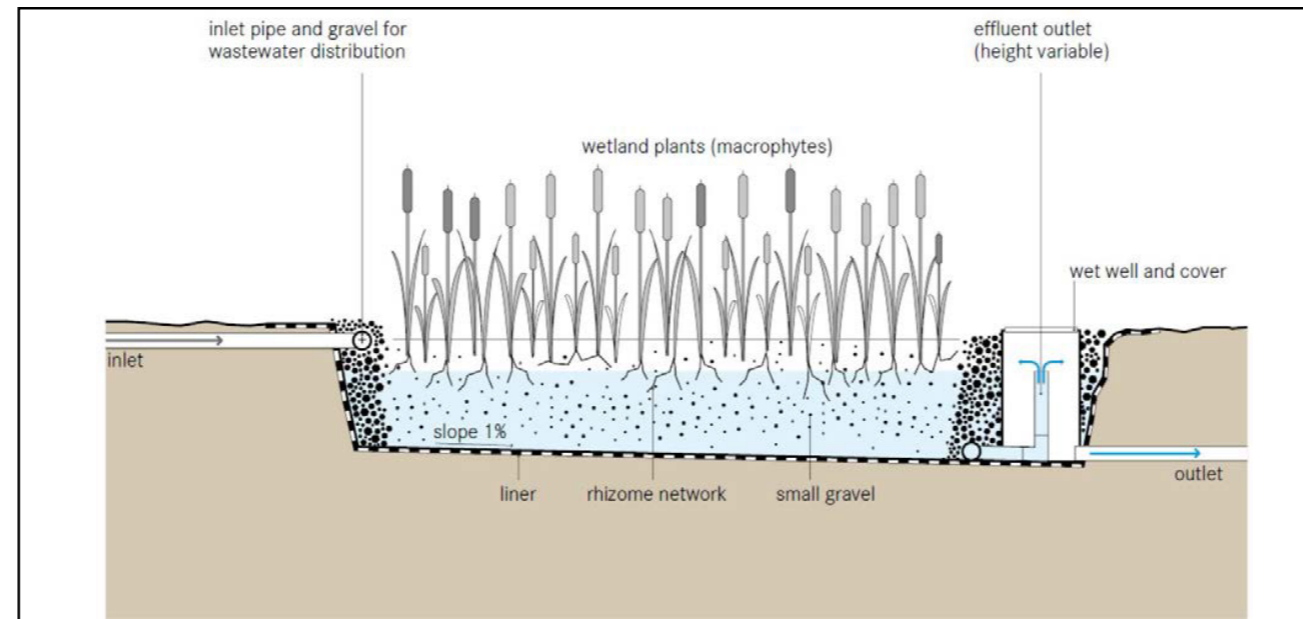
Sense of season in wet months



Evocative routing across storm water filtration and storage basin



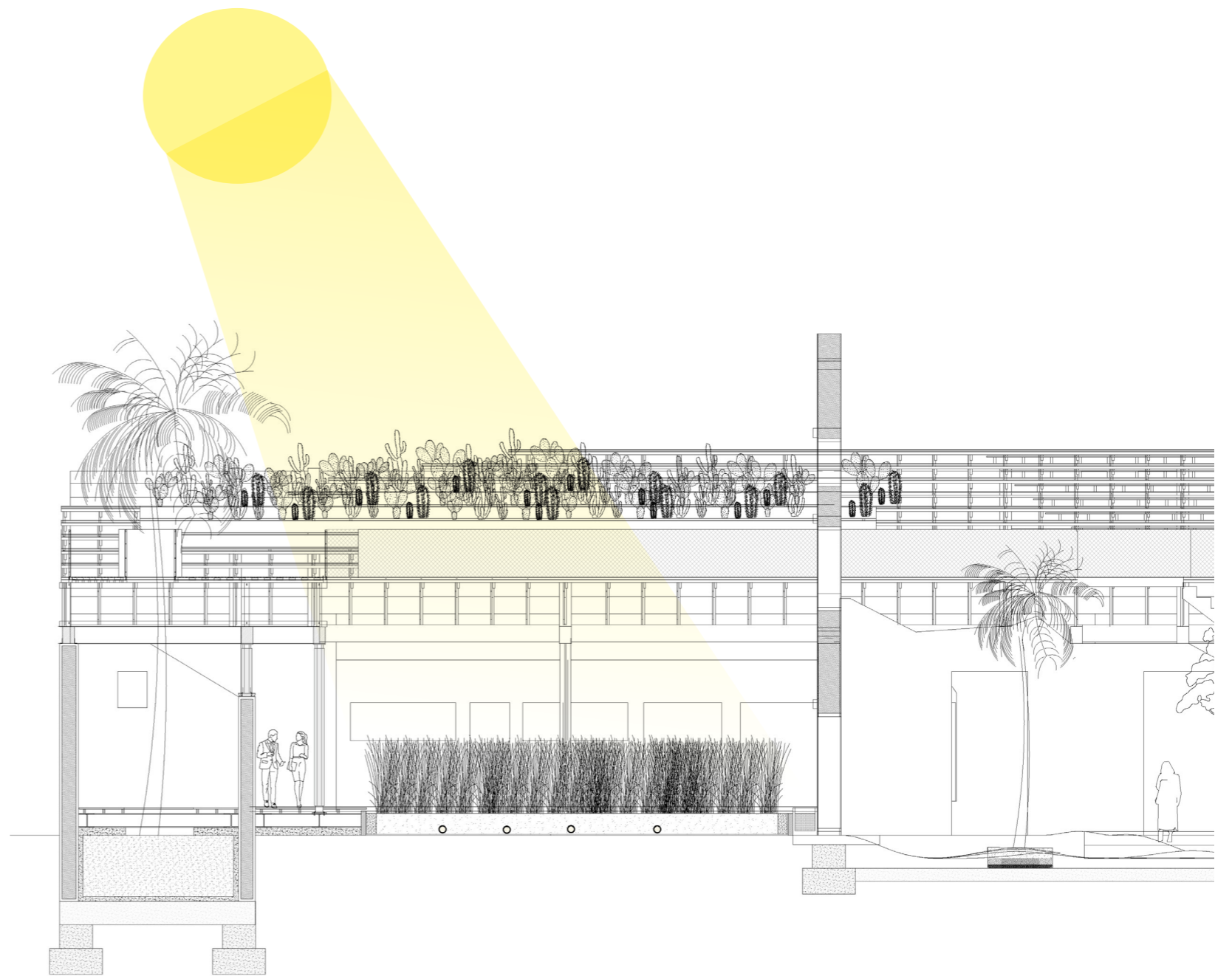
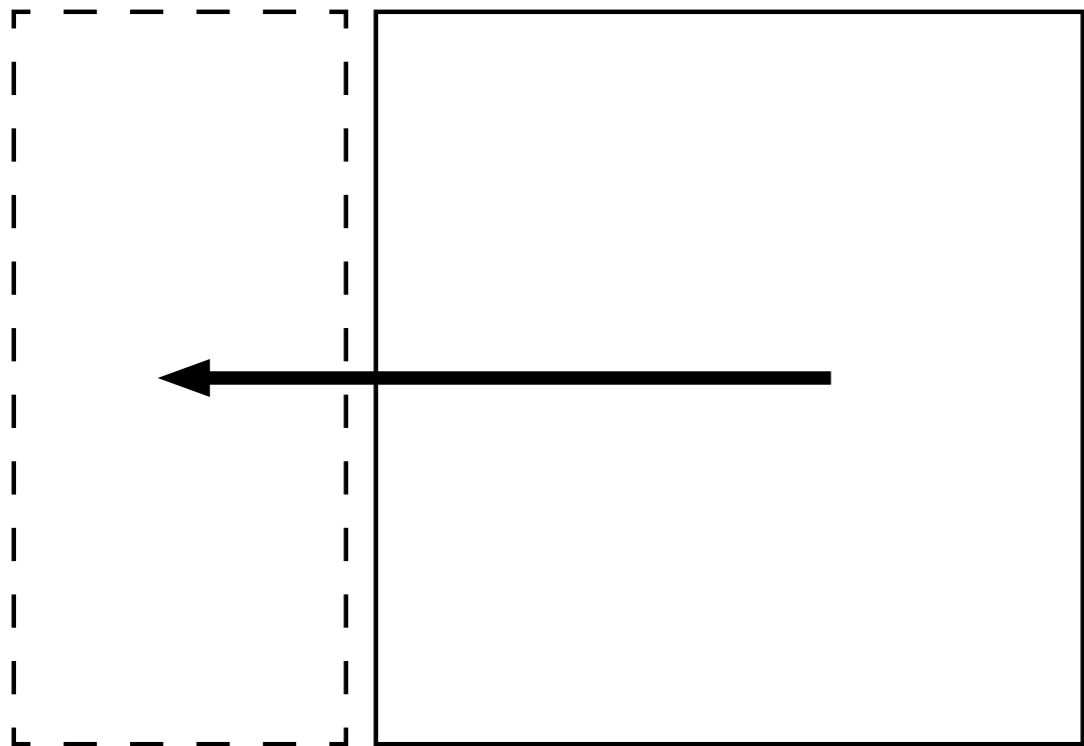
3. Wastewater treatment constructed wetland garden



Characteristics

'A horizontal subsurface flow constructed wetland is a large gravel and sand-filled basin that is planted with wetland vegetation. As wastewater flows horizontally through the basin, the filter material filters out particles and microorganisms degrade the organics.'
 (Tilley, et al., 2014, p. 116)

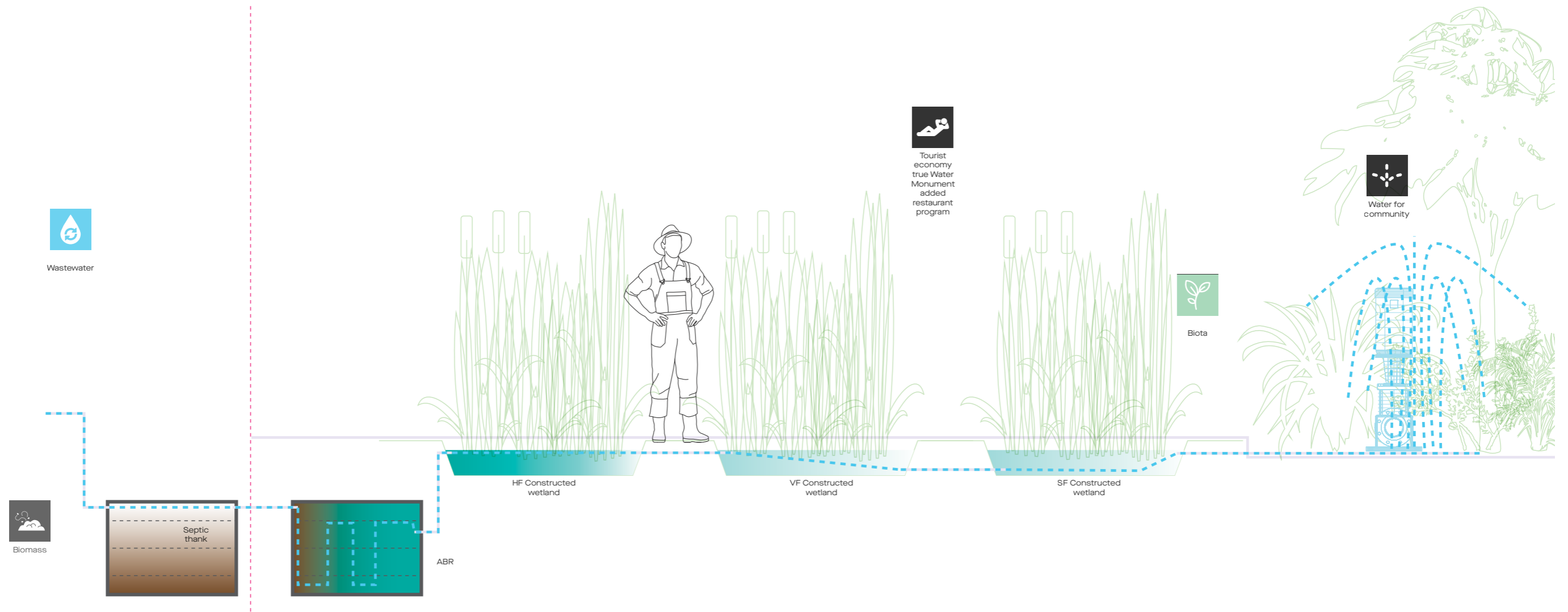
Design principal: reference of nature based constructed wetland treatment garden



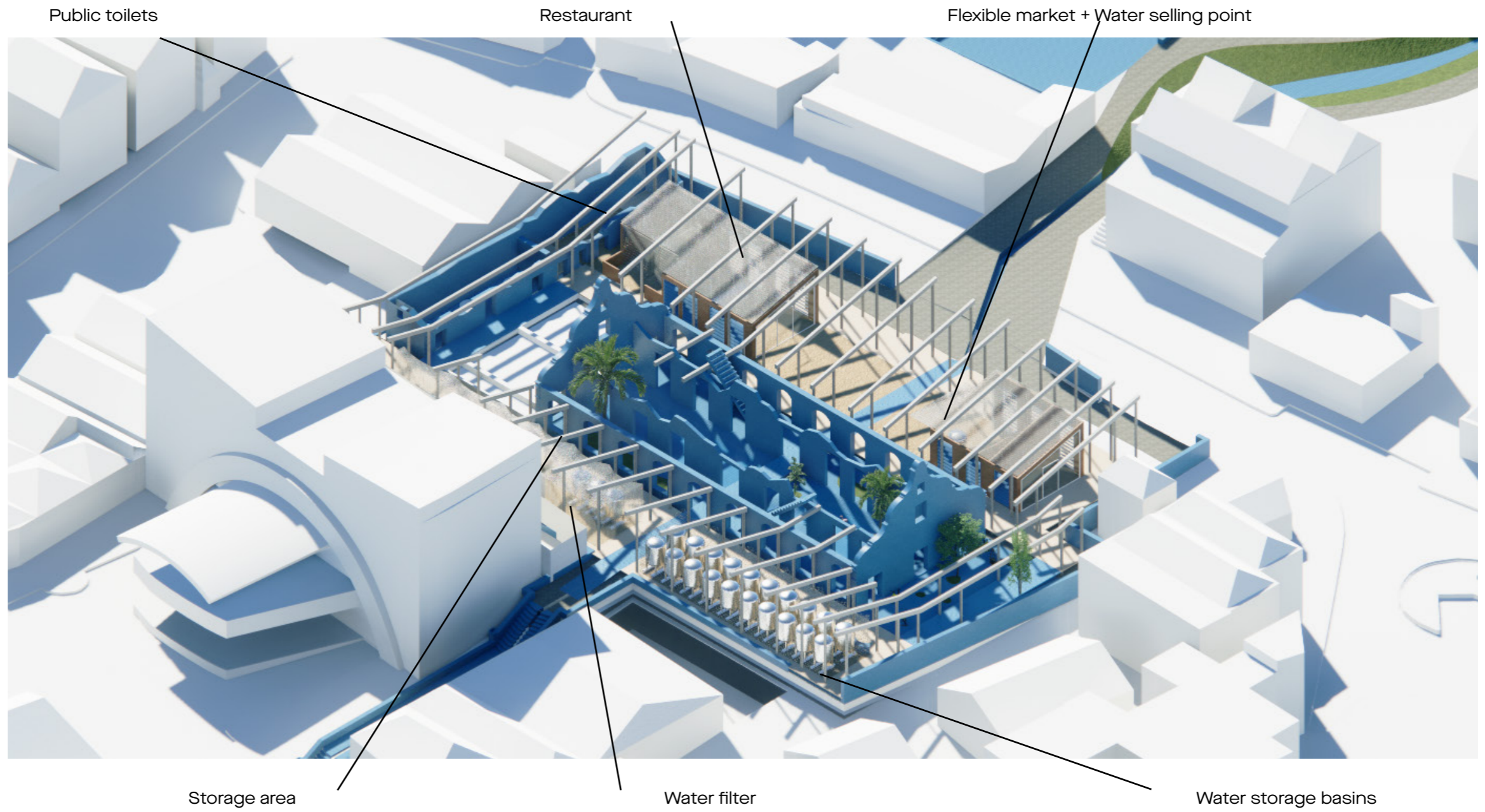
Constructed wetland as extension of courtyard for sun lighting



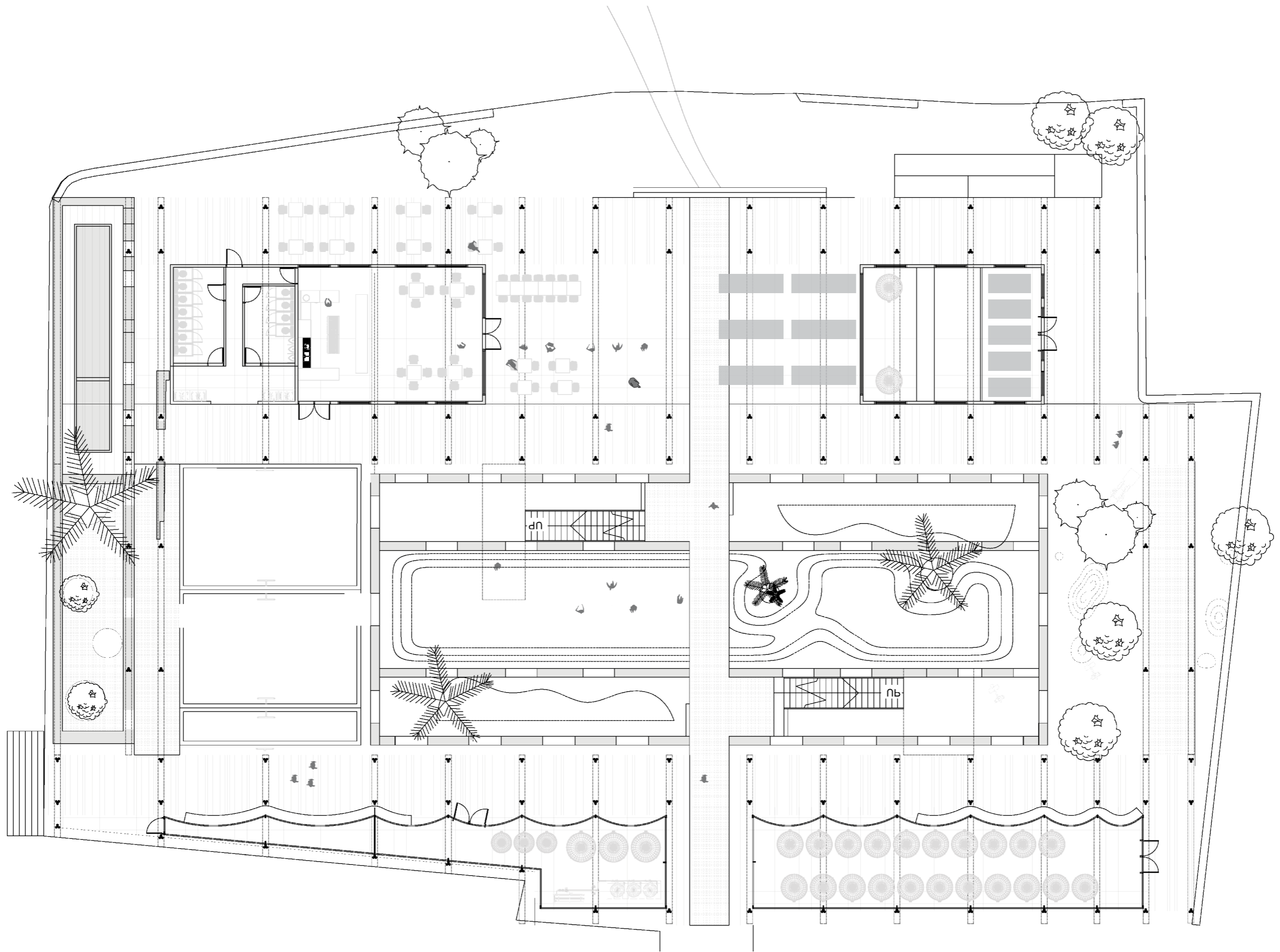
View on constructed wetland garden and exposed traditional manor house facade



Usage of harvested freshwater



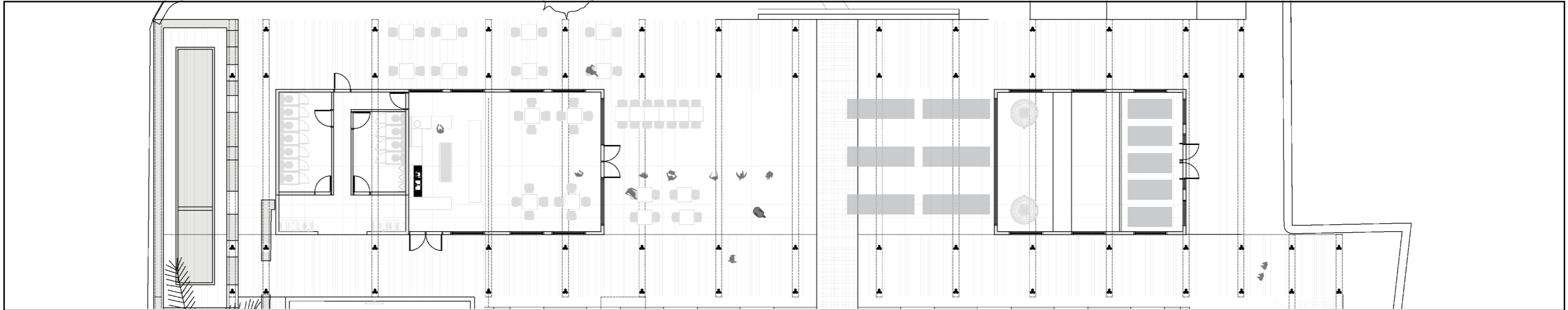
Visitors experience of added structures surrounding courtyard



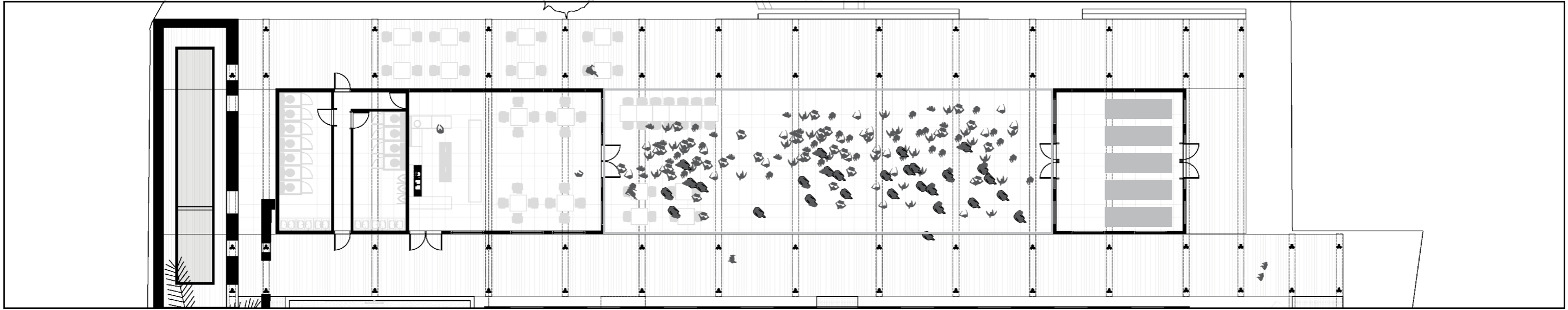
New ground floor plan: separation technical area and user areas



View basins as evocative routing

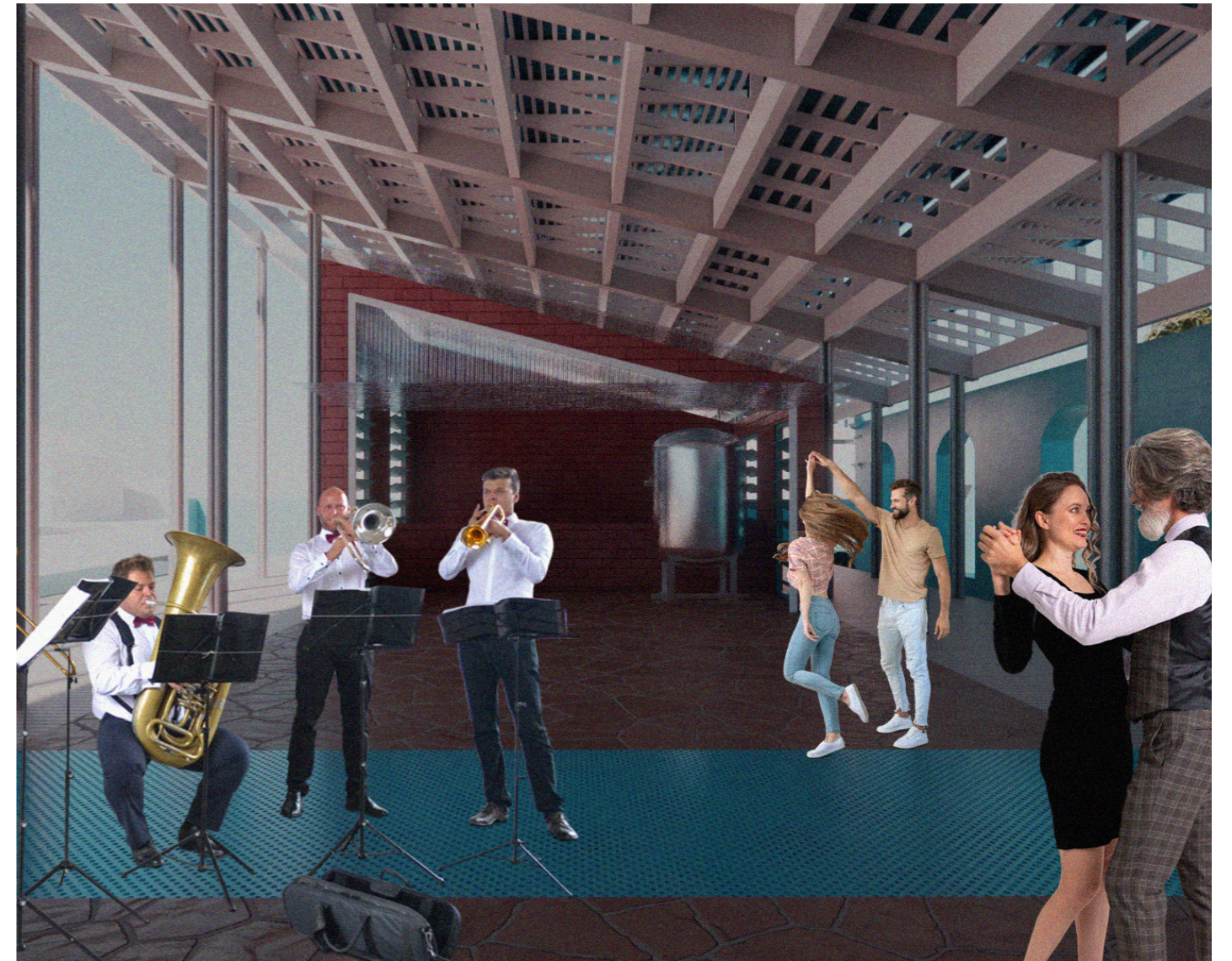


Floor plan market day

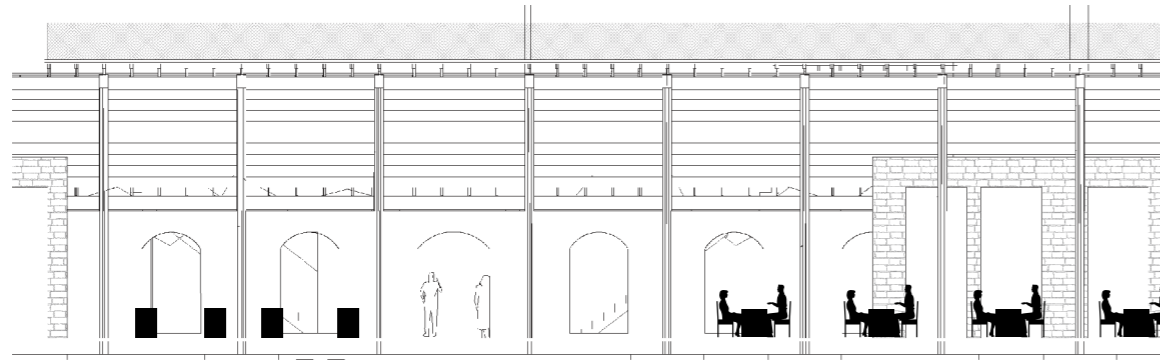


Floor plan festivities

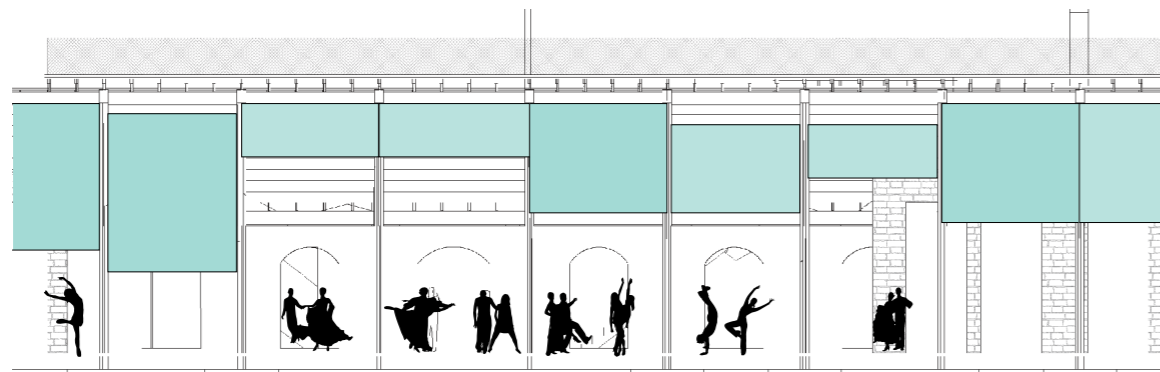
Open structure inviting flexible use



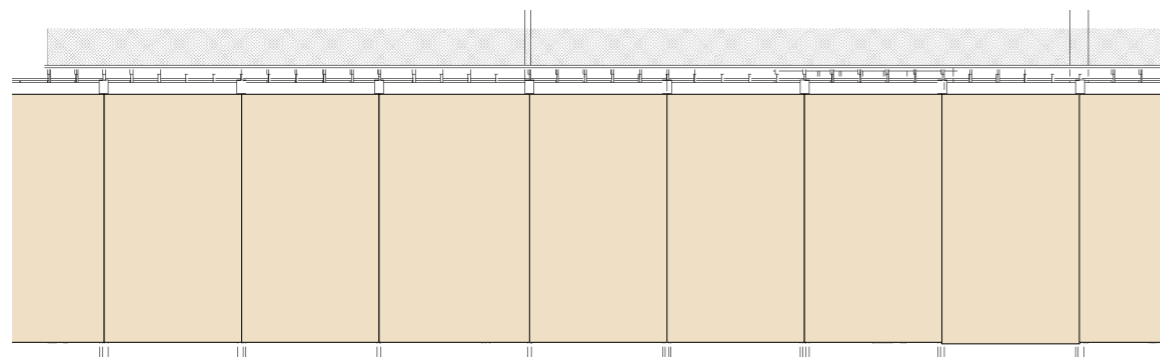
Impression of festivity and market space



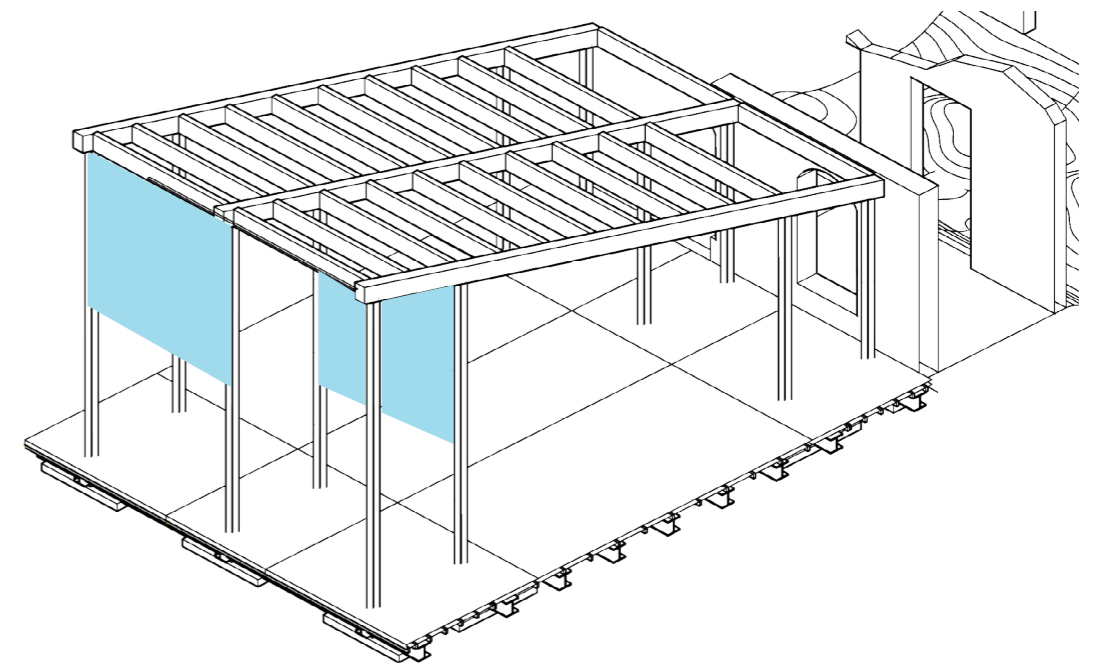
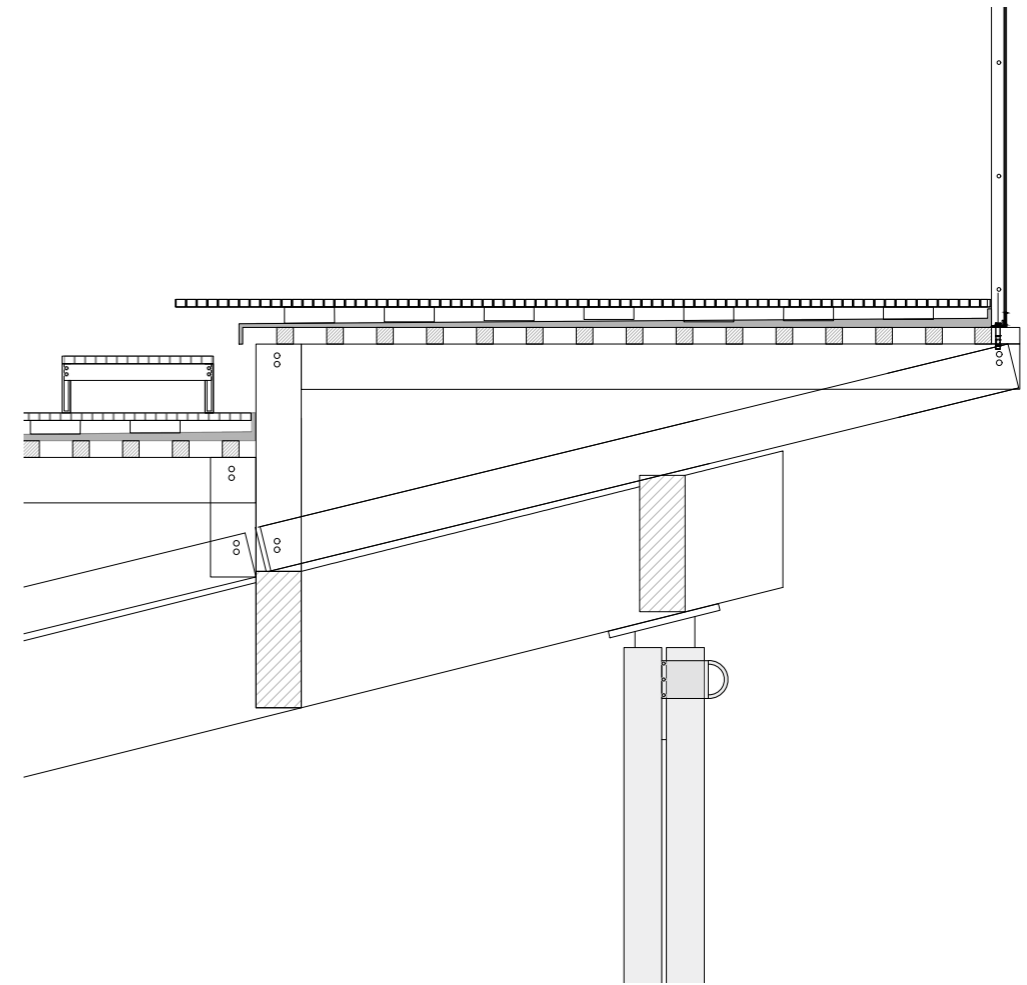
1. Open facade structure

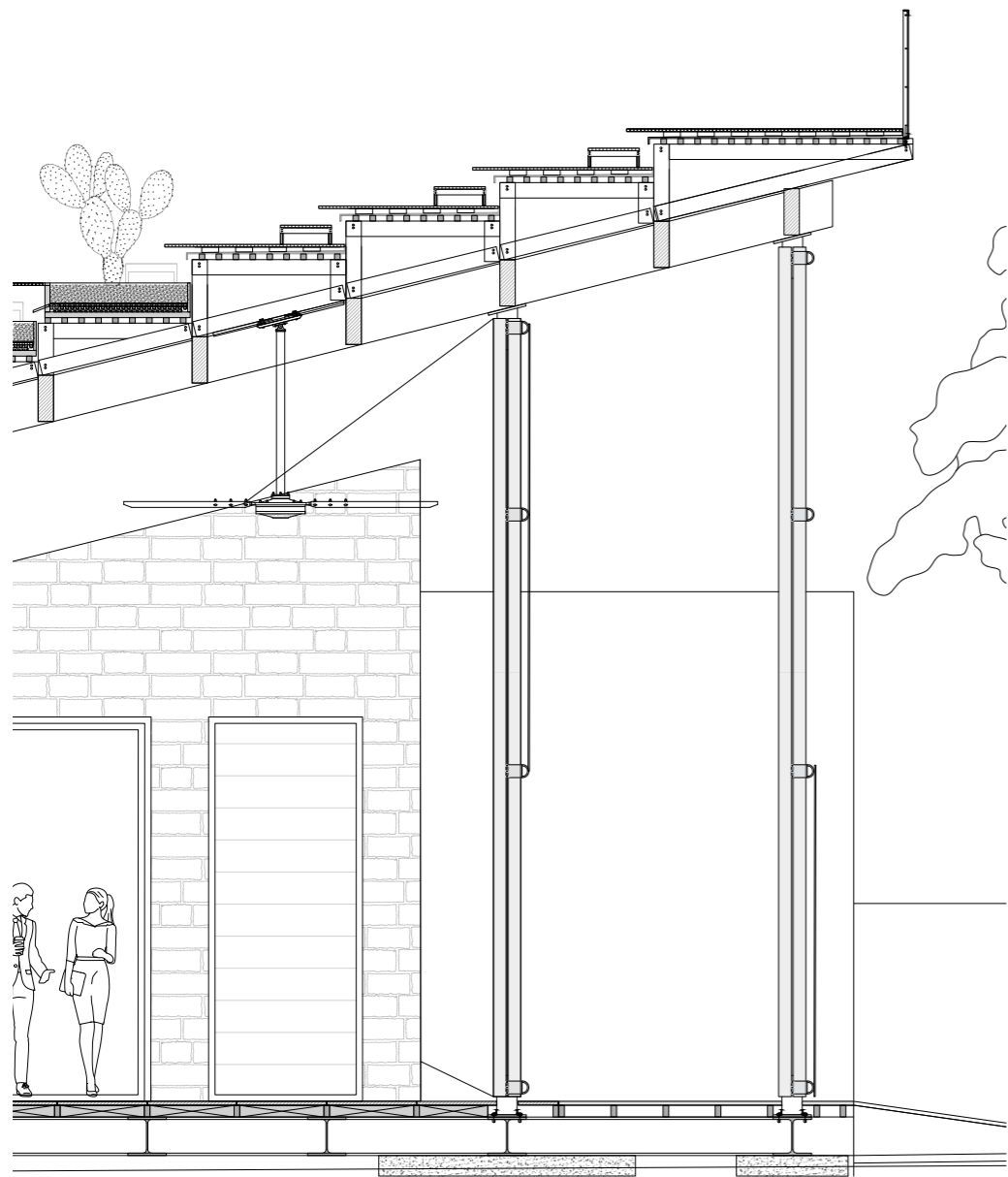


2. Sun shading on a festive day



4. Shelter timber facade panels for resistance of storm and hurricane

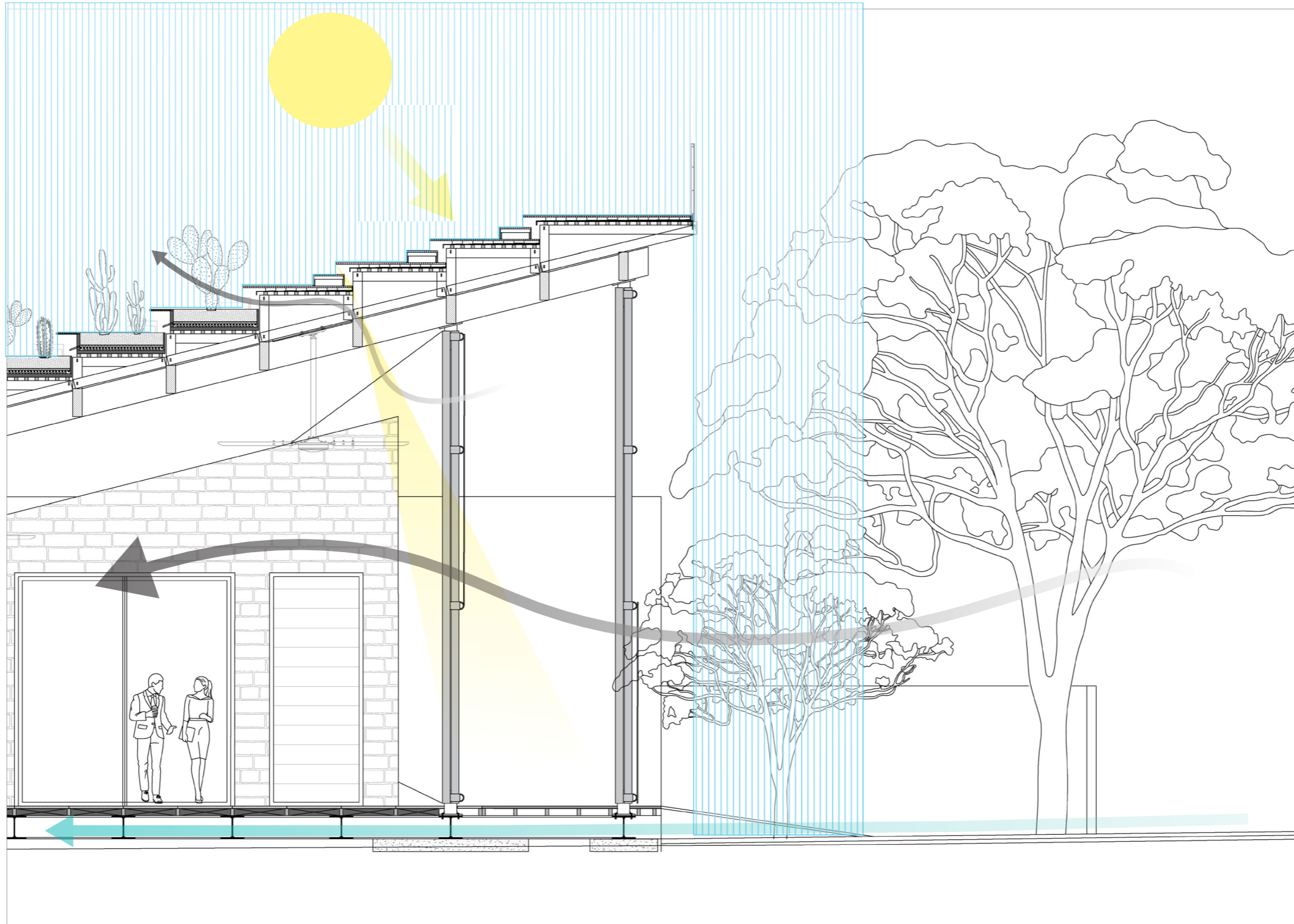




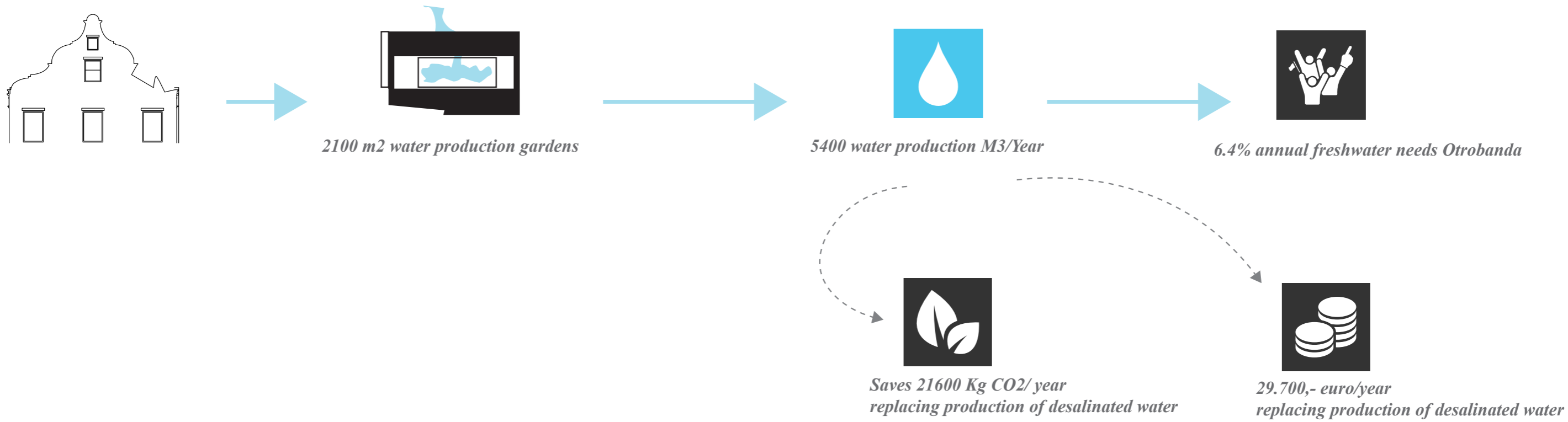
Section and facade detail showing usage of local reclaimed materials

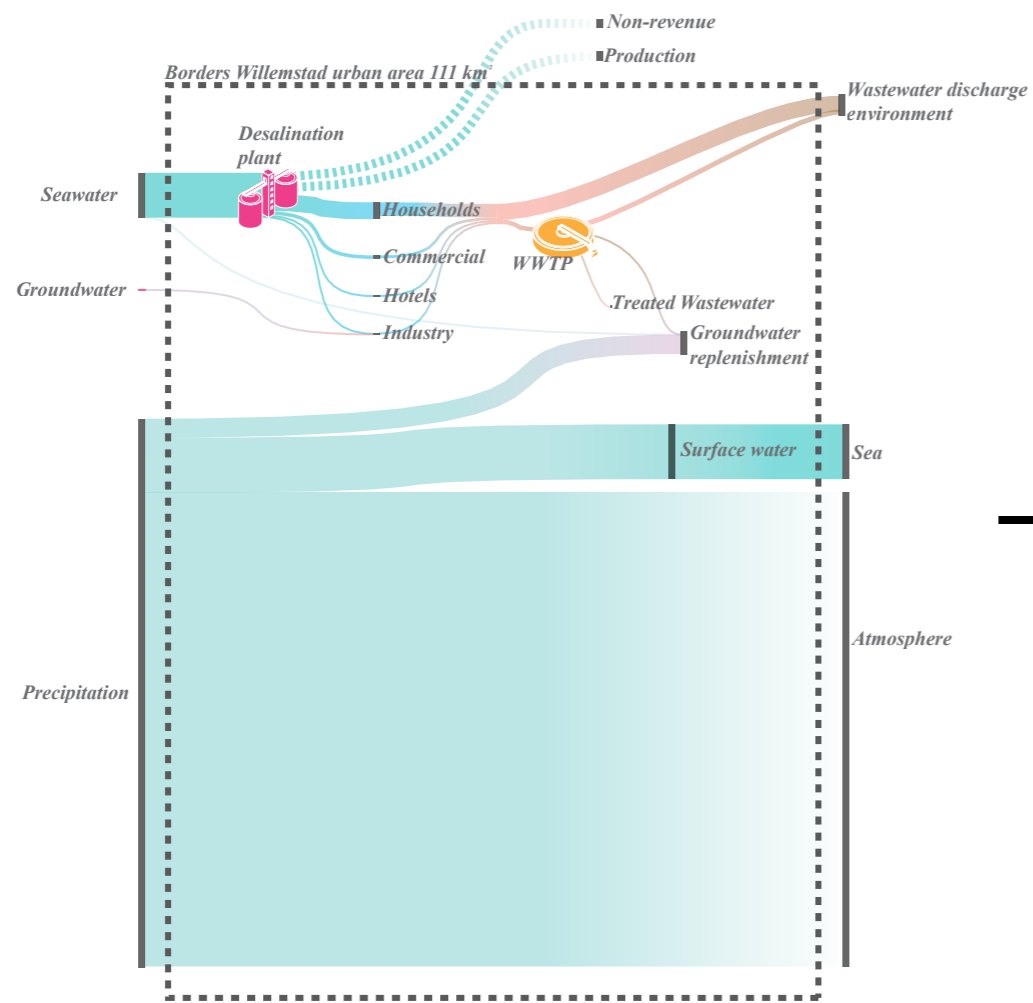


Material choice: Using locally found materials

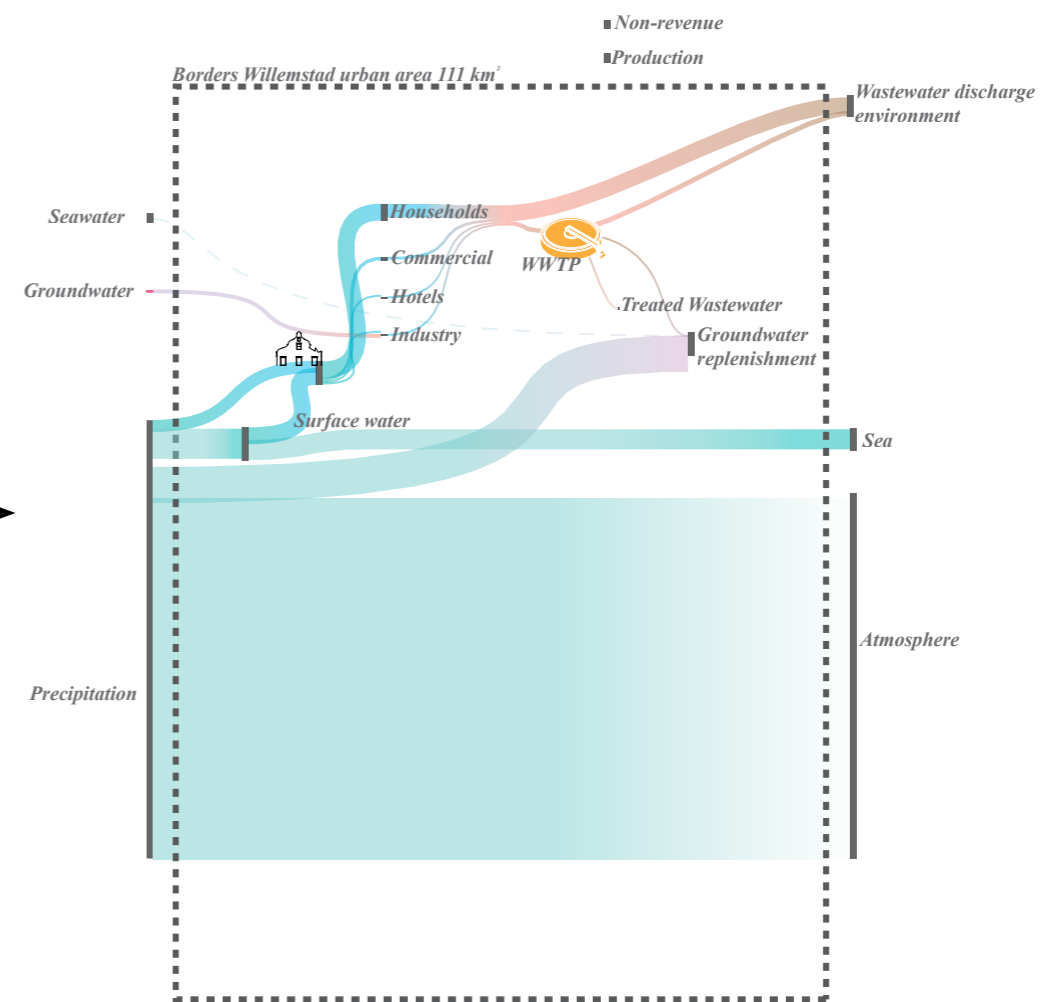


Climate strategy following reference to gallery for sun and rain protection



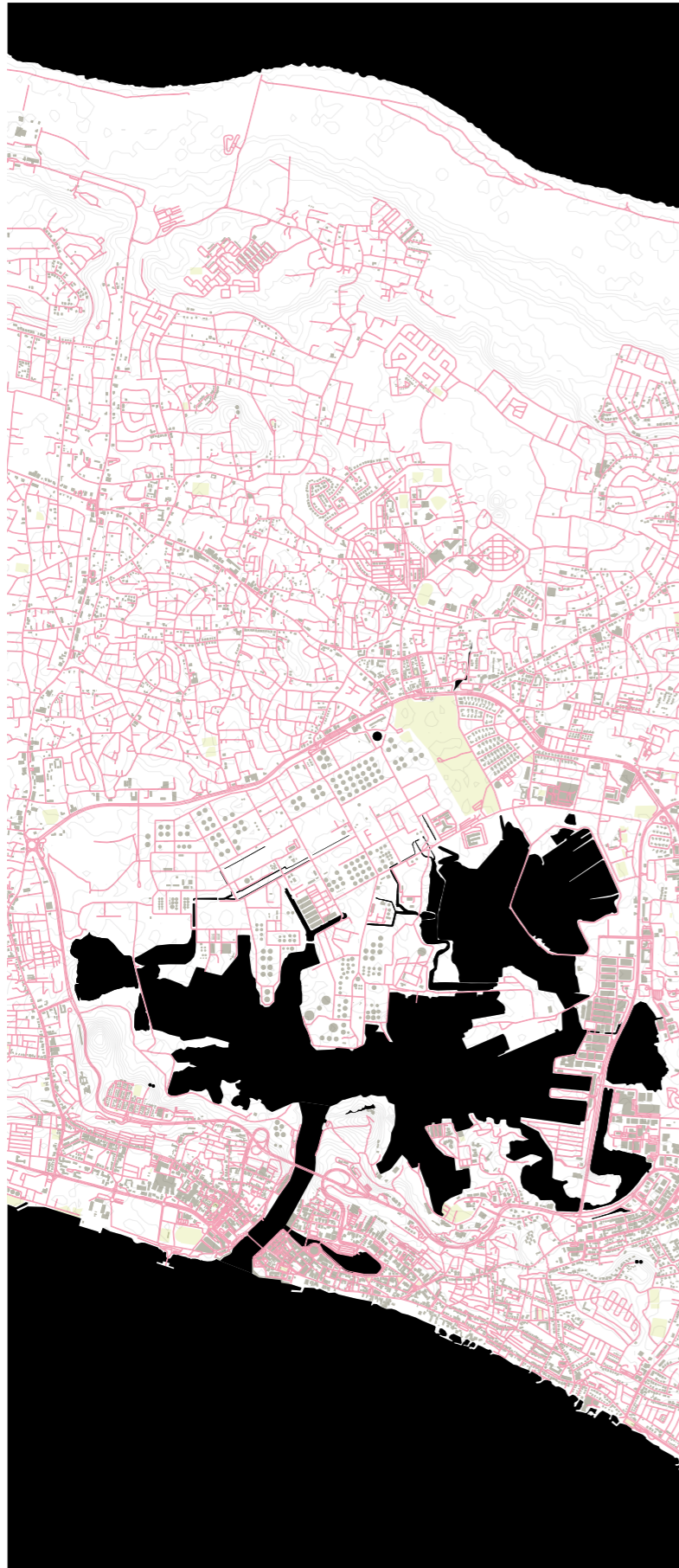


Willemstad 2022

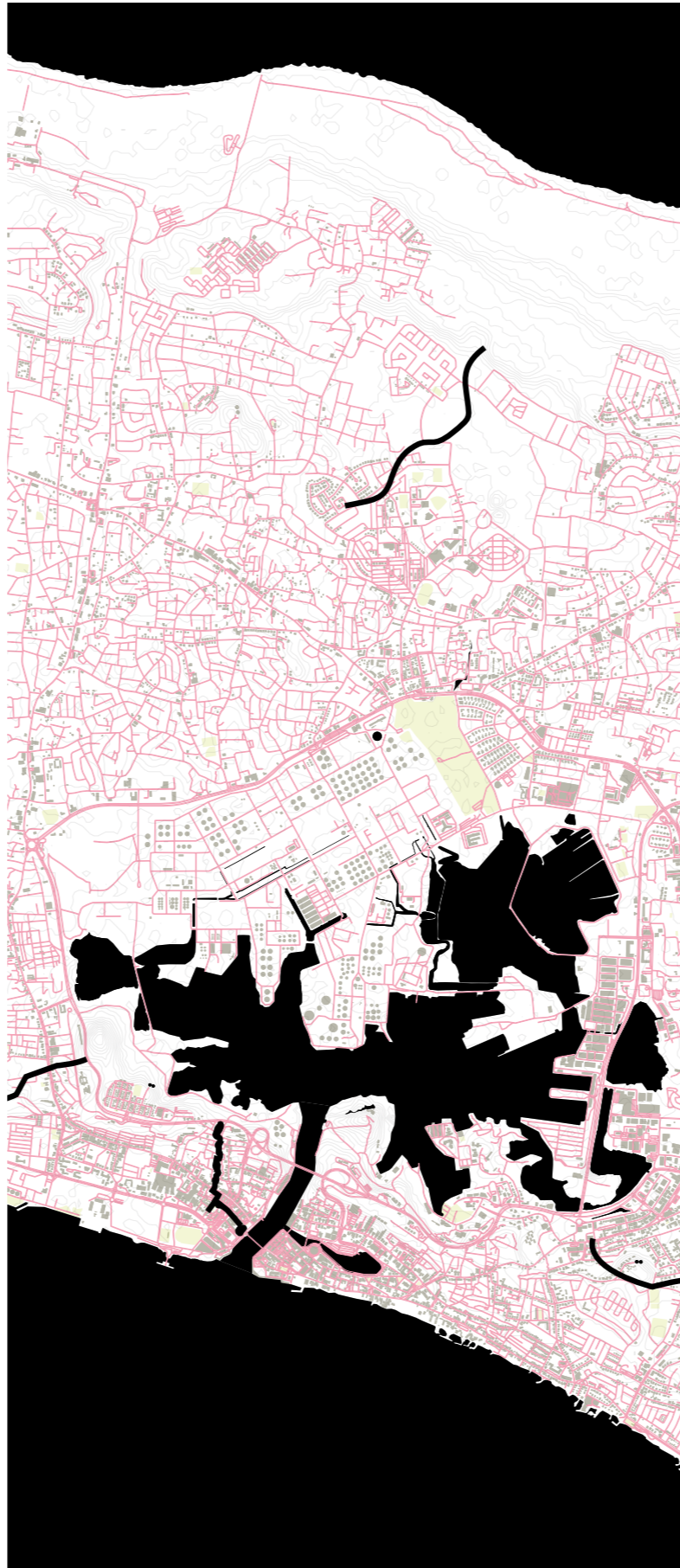


Willemstad 2050

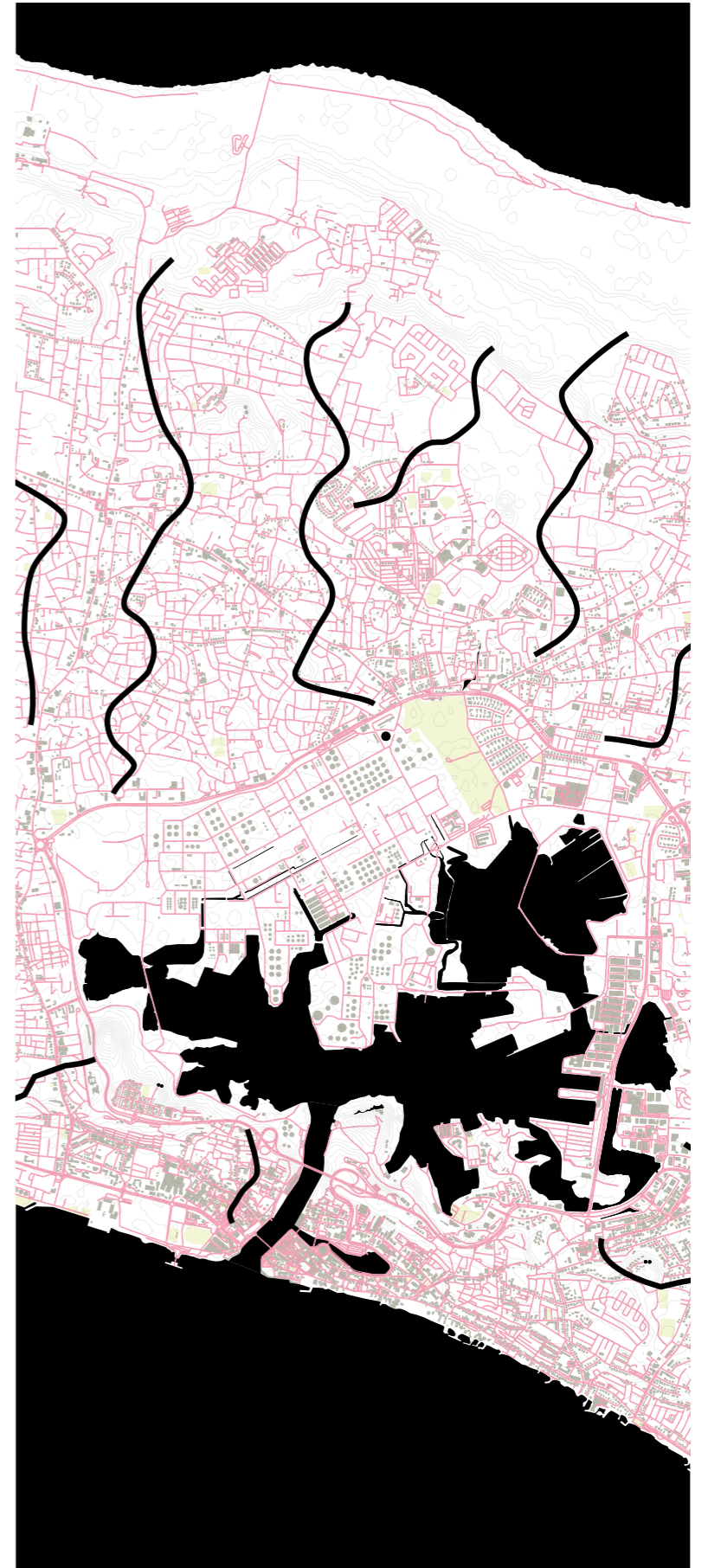
From centralized to decentralized freshwater harvesting production by using decaying monuments



Willemstad 2022

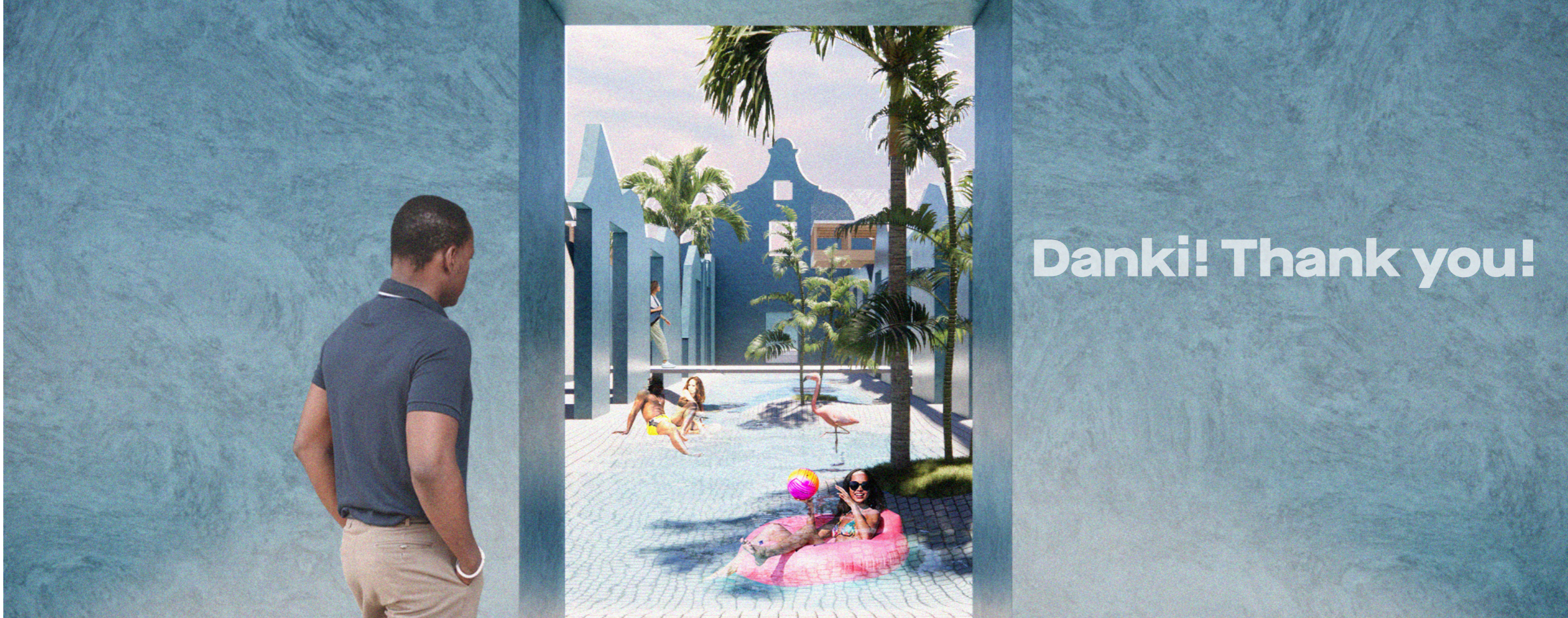


Willemstad 2030



Willemstad 2050

Utopian vision of decentralized water system in Willemstad creating a post desalination era



Danki! Thank you!