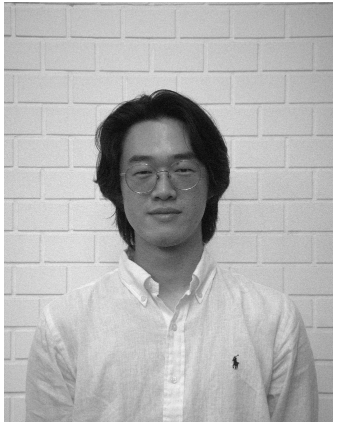
Where Flows Weave into Circulation



Ayako YANO
Kyoto Institute of Technology

Taisei SAITO
Kyoto Institute of Technology

Kaho UCHIYAMA
Kyoto Institute of Technology

Presentation No.31

Japan

How can architecture enhance the environment?

Conventional sustainable architecture has aimed to minimize environmental impact
—m**oving from negative toward zero.**
However, in an era where sustainability is critical, should architecture not go further
—**shifting from zero to positive,** actively improving the environment itself?

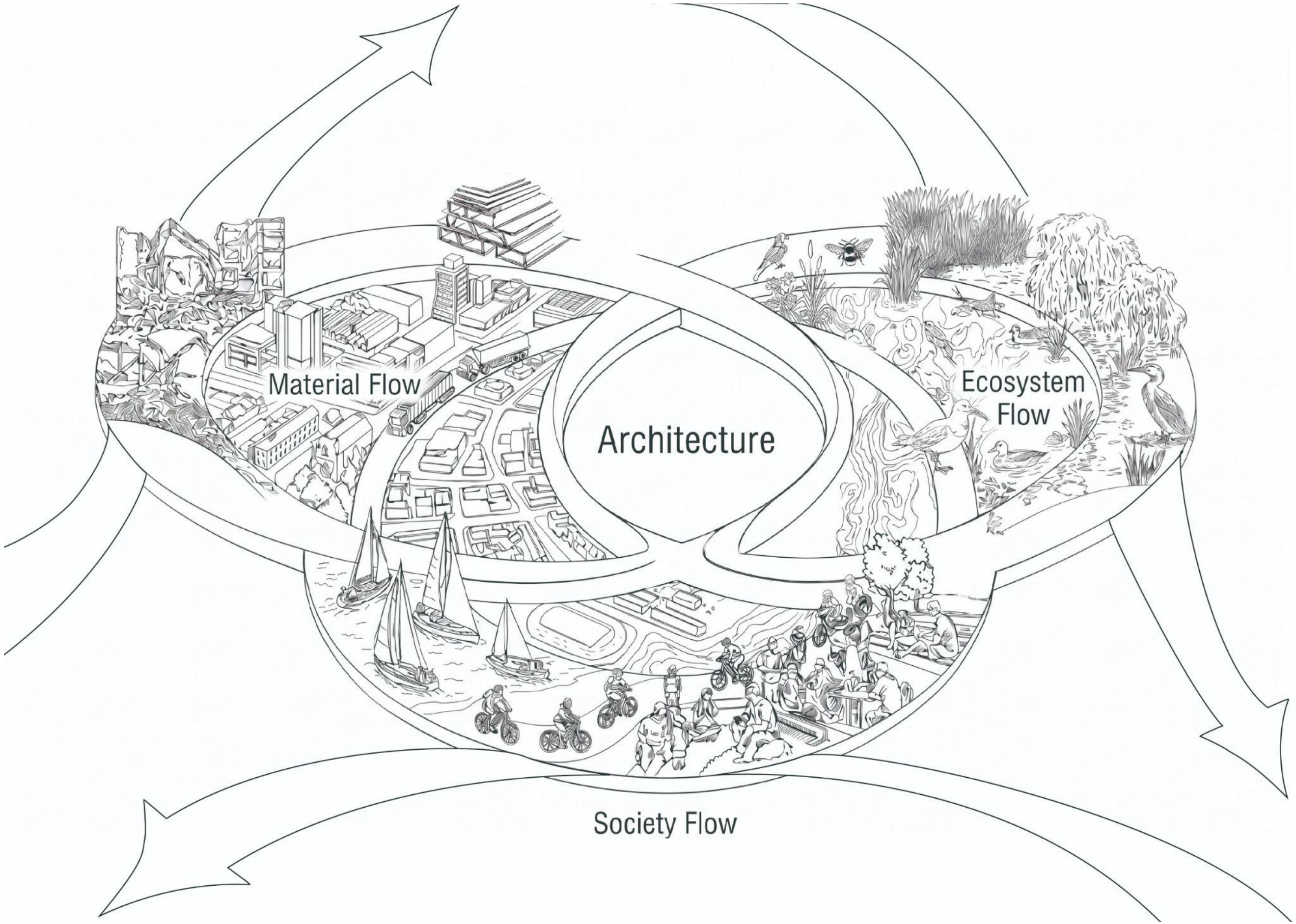
By redesigning **flows** of Material, Society, and Ecosystem.

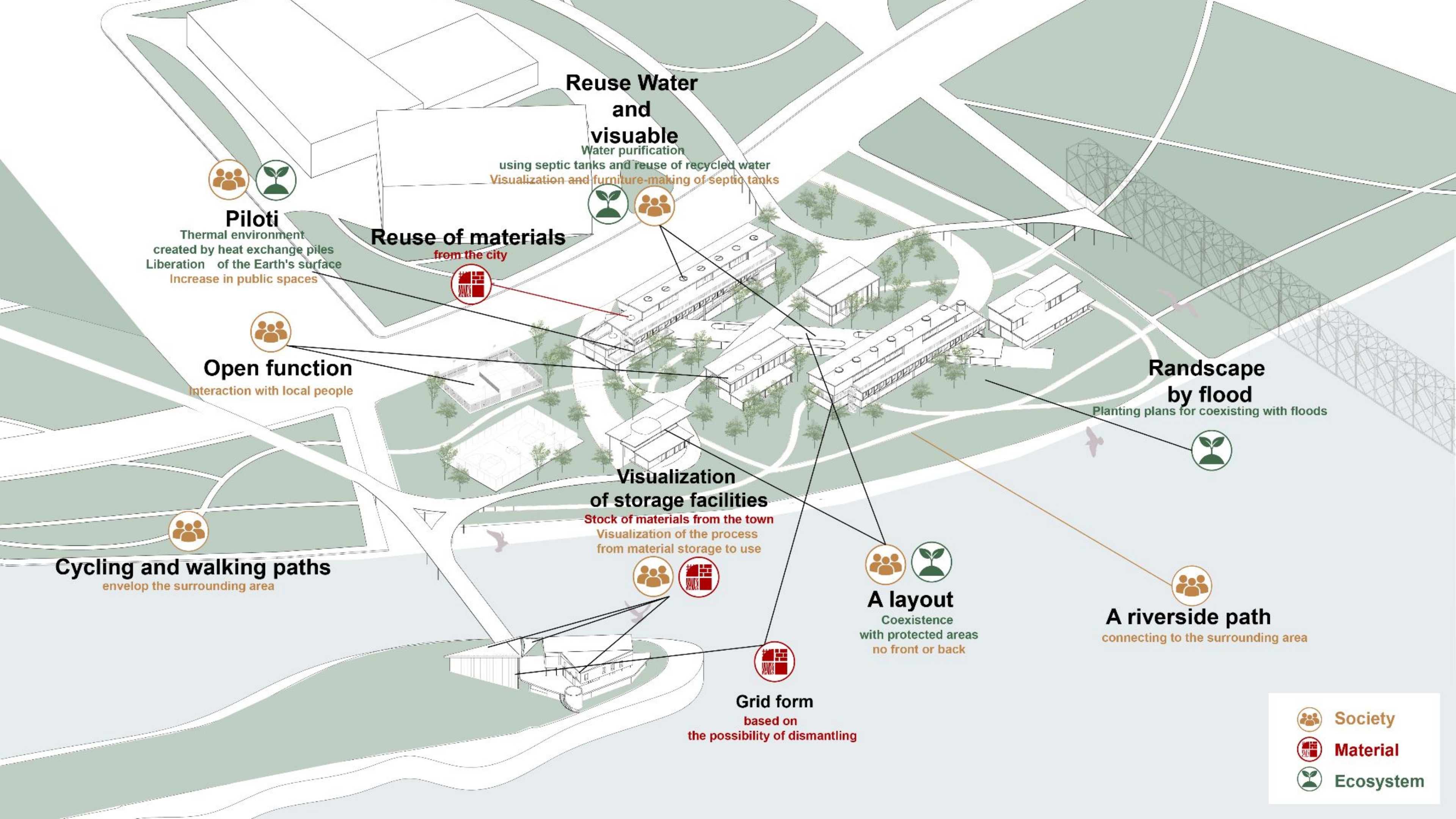
Reconnecting fragmented relationships between environment, materials, and society through architectural space and systems.

From Latent to Activated Flows for Beograd

In Belgrade, environmental and material flows are largely linear, resulting in pollution and waste.

By reconnecting and reconfiguring these flows through architecture, the project fosters a regenerative environment—not only locally, but across the city.





Reuse Water
and
visuable
Water purification
using septic tanks and reuse of recycled water
Visualization and furniture-making of septic tanks
Piloti
Thermal environment
created by heat exchange piles
Liberation of the Earth's surface
Increase in public spaces
Reuse of materials
from the city
Open function
Interaction with local people
Randscape
by flood
Planting plans for coexisting with floods
Visualization
of storage facilities
Stock of materials from the town
Visualization of the process
from material storage to use
Cycling and walking paths
envelop the surrounding area
A layout
Coexistence
with protected areas
no front or back
A riverside path
connecting to the surrounding area
Grid form
based on
the possibility of dismantling
Society
Material
Ecosystem

1-1 Material

Material Landscape of the city

Belgrade is composed of layered urban fabrics, where diverse materials exist across old and new districts.

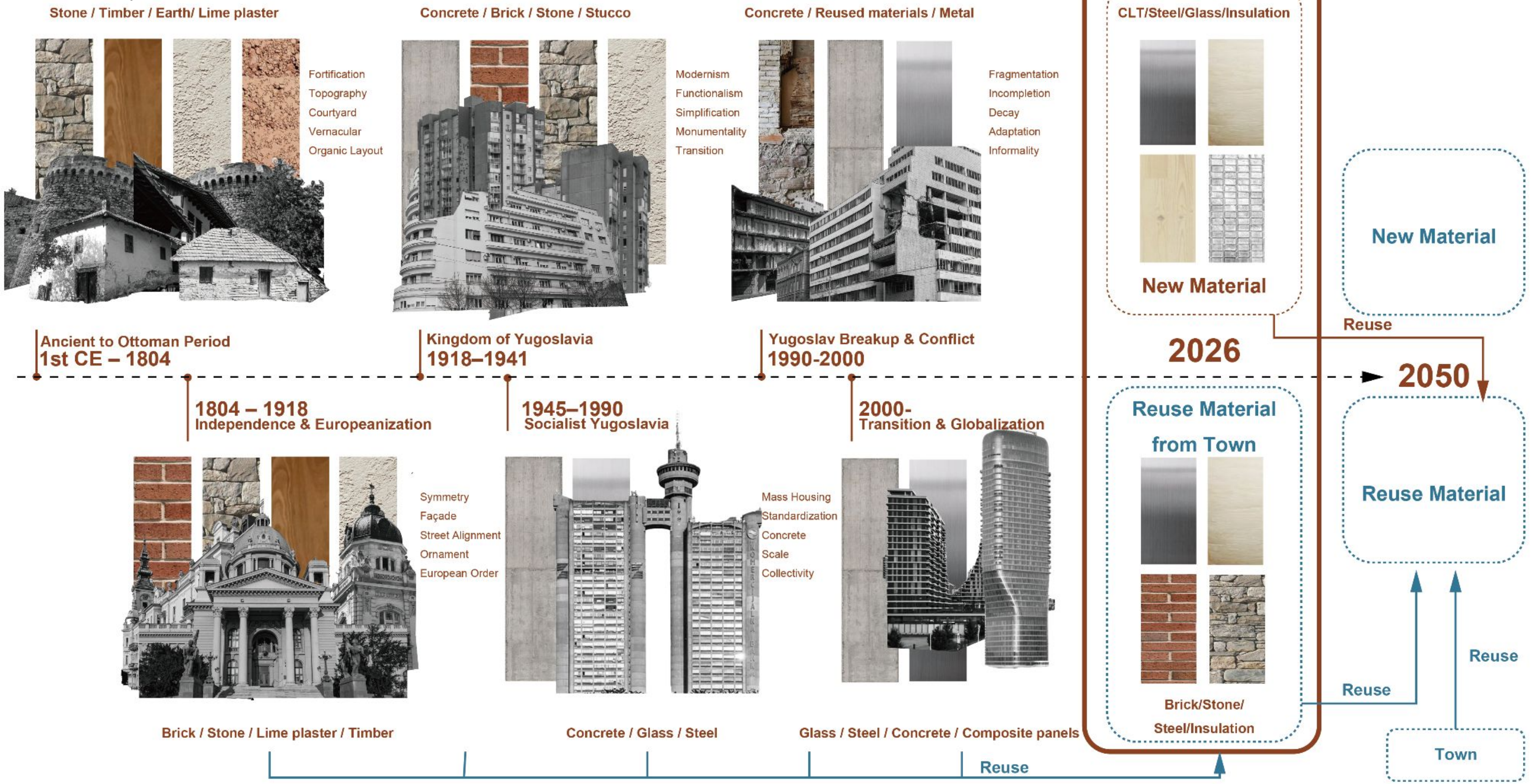
These materials form an existing resource embedded within the city.

A river and site connecting two areas

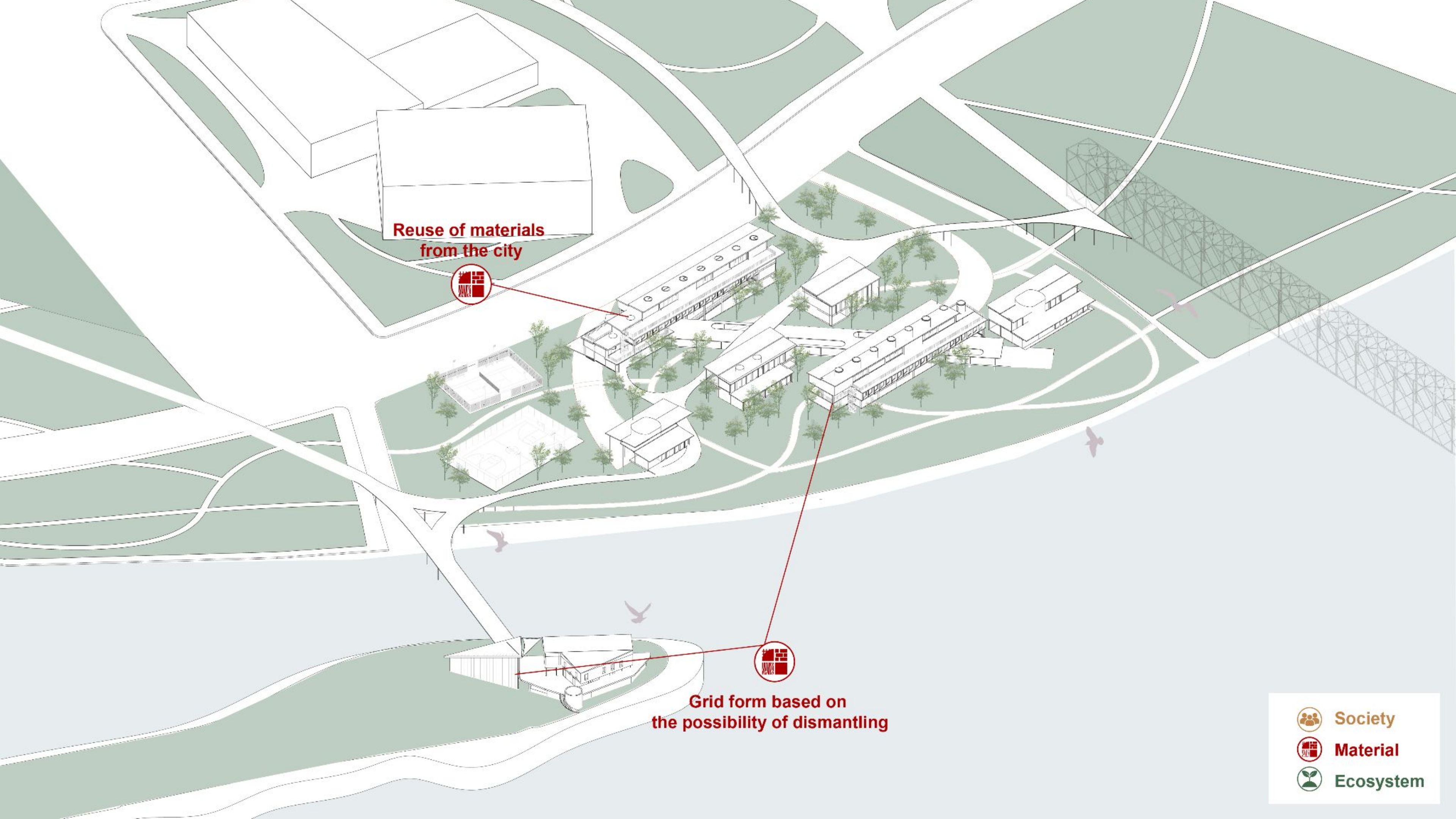
1-2 Materials as a Continuum of History

Materials used throughout the city reflect its historical transformations.

Rather than selecting from a catalog, this project identifies reusable materials from the urban context and redefines them as part of an ongoing material cycle.

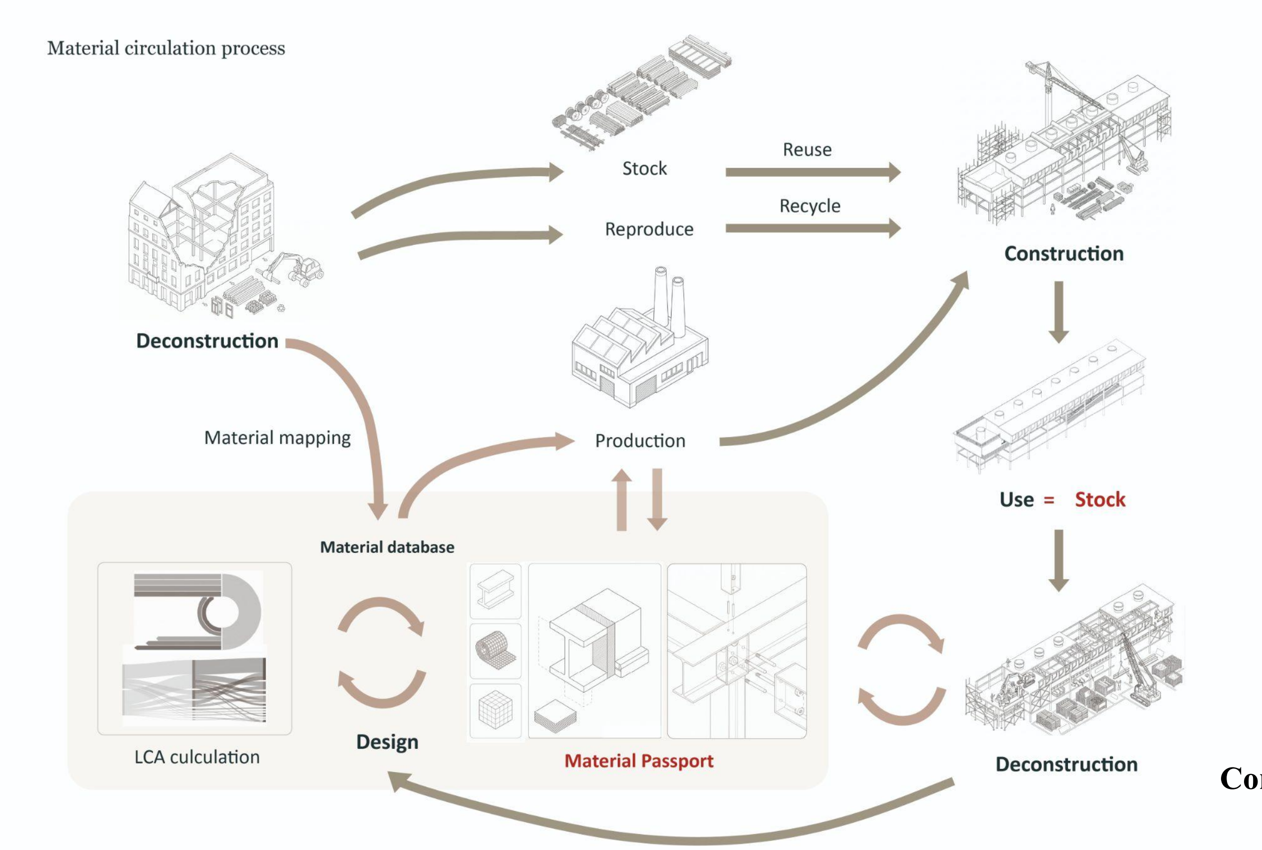


Materials and designs that carry on history


Reuse of materials
from the city
Grid form based on
the possibility of dismantling
Society
Material
Ecosystem

1-3 Material Flow and Reuse System

A material passport is assigned at the moment of construction, enabling future reuse and exchange of components.
This system allows materials—both existing and new—to circulate continuously across time.



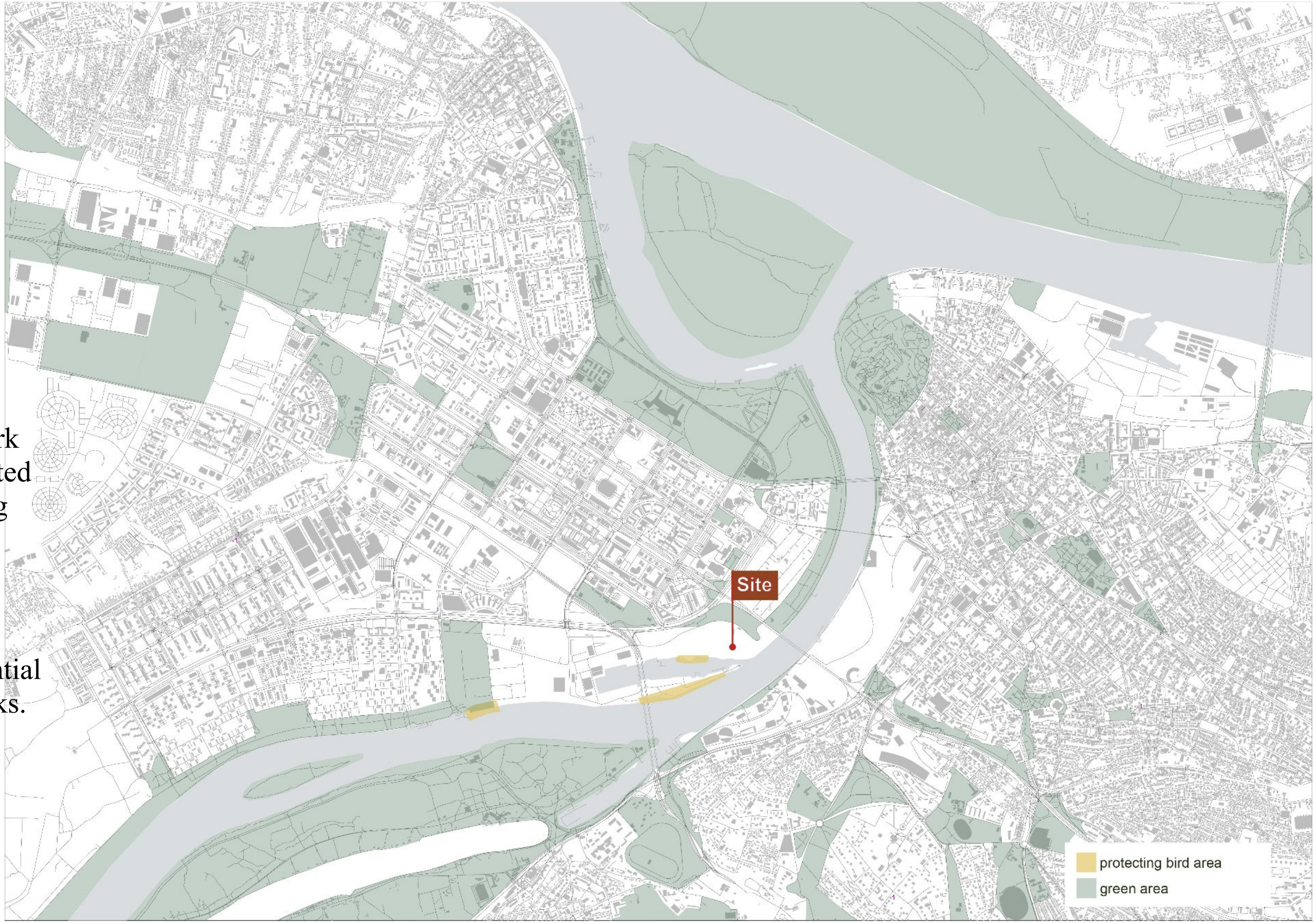
Construction methods and designs for circularity

2-1 Ecosystem

Ecological Network and Environmental Challenges

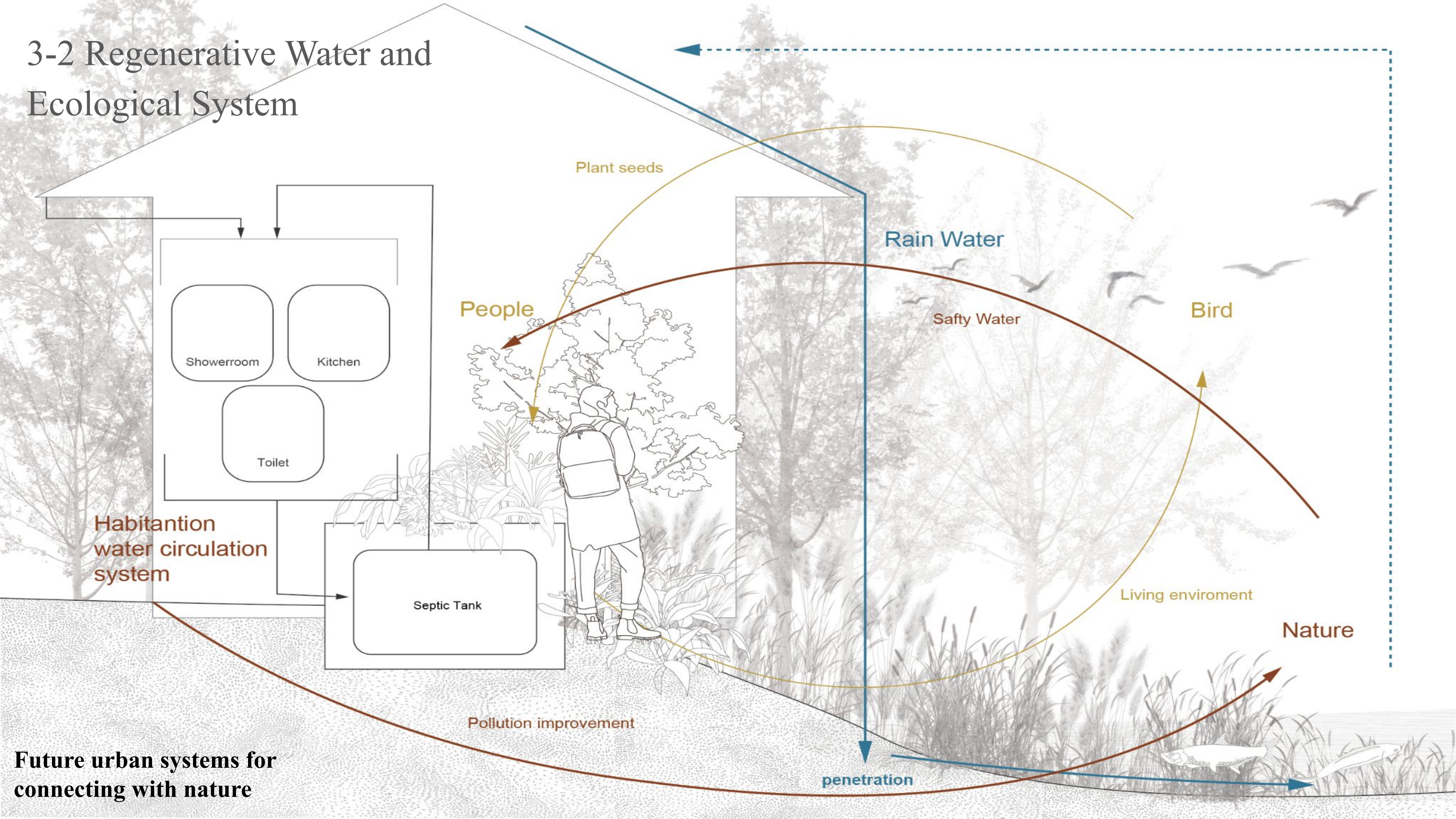
Belgrade contains a network of green spaces and protected habitats, reflecting growing environmental awareness.

However, water systems remain fragmented and polluted, limiting the potential of these ecological networks.

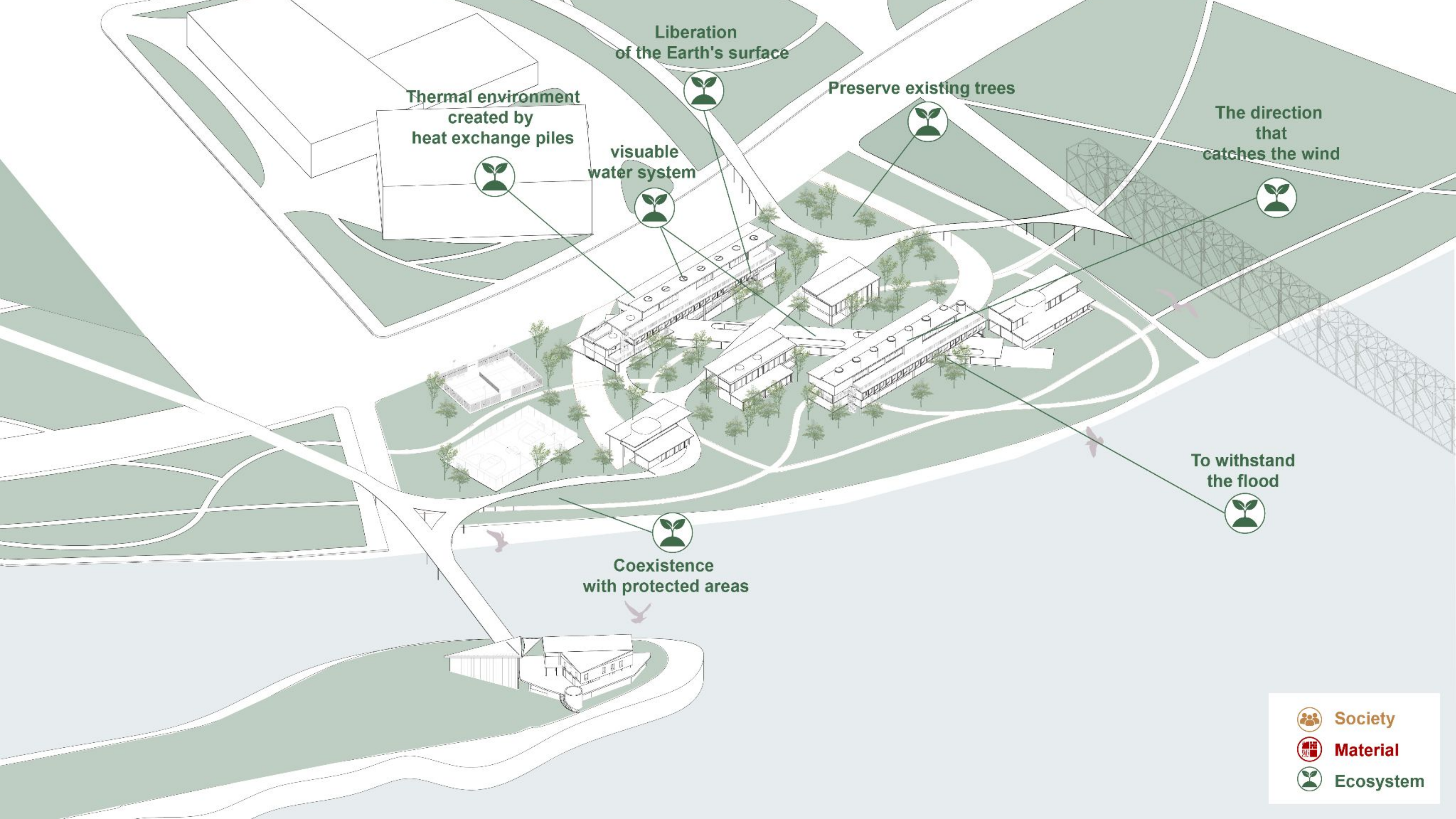


A city connected to nature

3-2 Regenerative Water and Ecological System



Future urban systems for connecting with nature

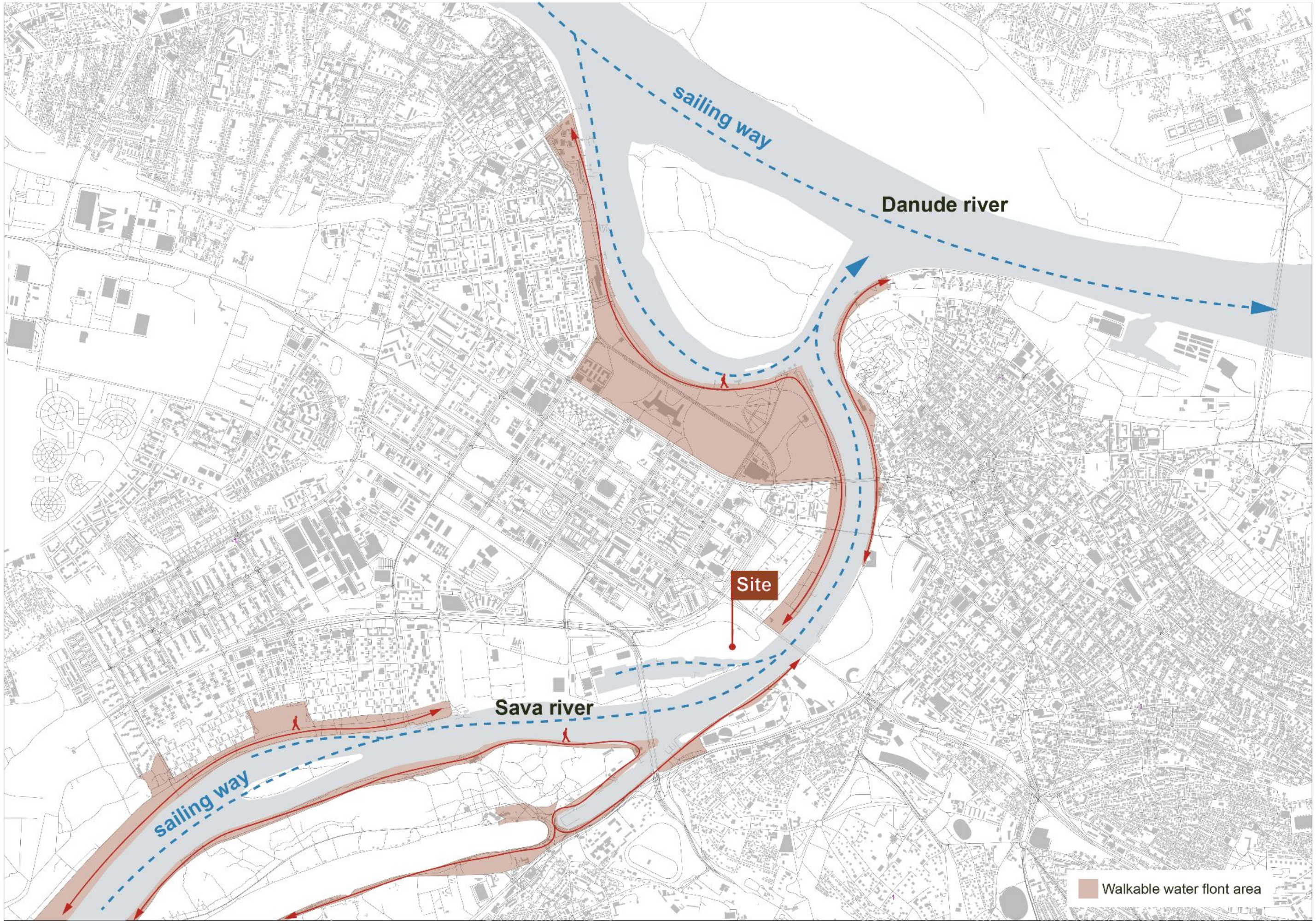

Liberation
of the Earth's surface
Thermal environment
created by
heat exchange piles
Preserve existing trees
The direction
that
catches the wind
visuable
water system
To withstand
the flood
Coexistence
with protected areas
Society
Material
Ecosystem

2-1 Society

A City Shaped by Water and Exchange

Belgrade has long developed through trade and river-based exchange, forming a network of waterfront spaces across the city.

These spaces represent an existing social relationship with water.

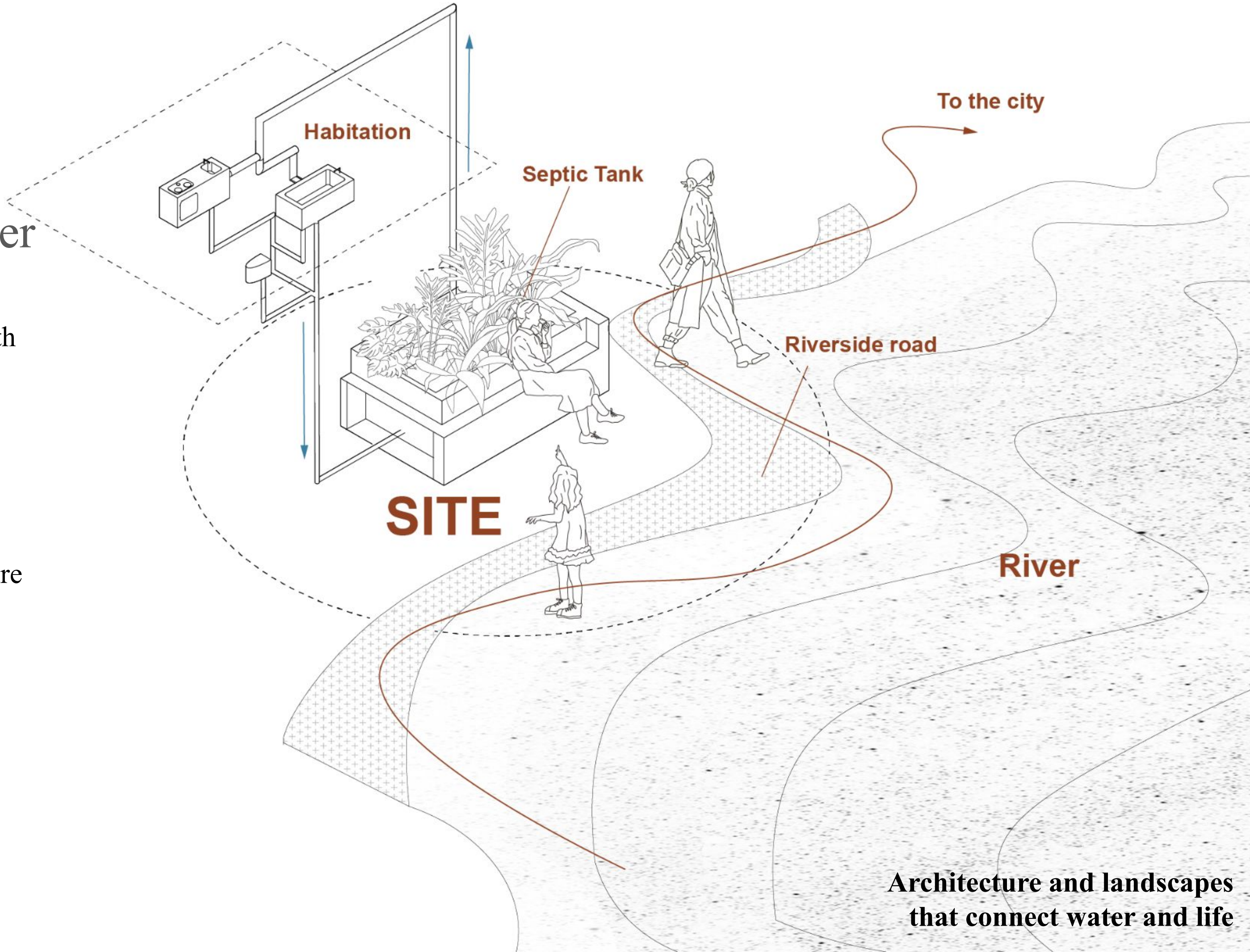


Specifications for a city connected to a river

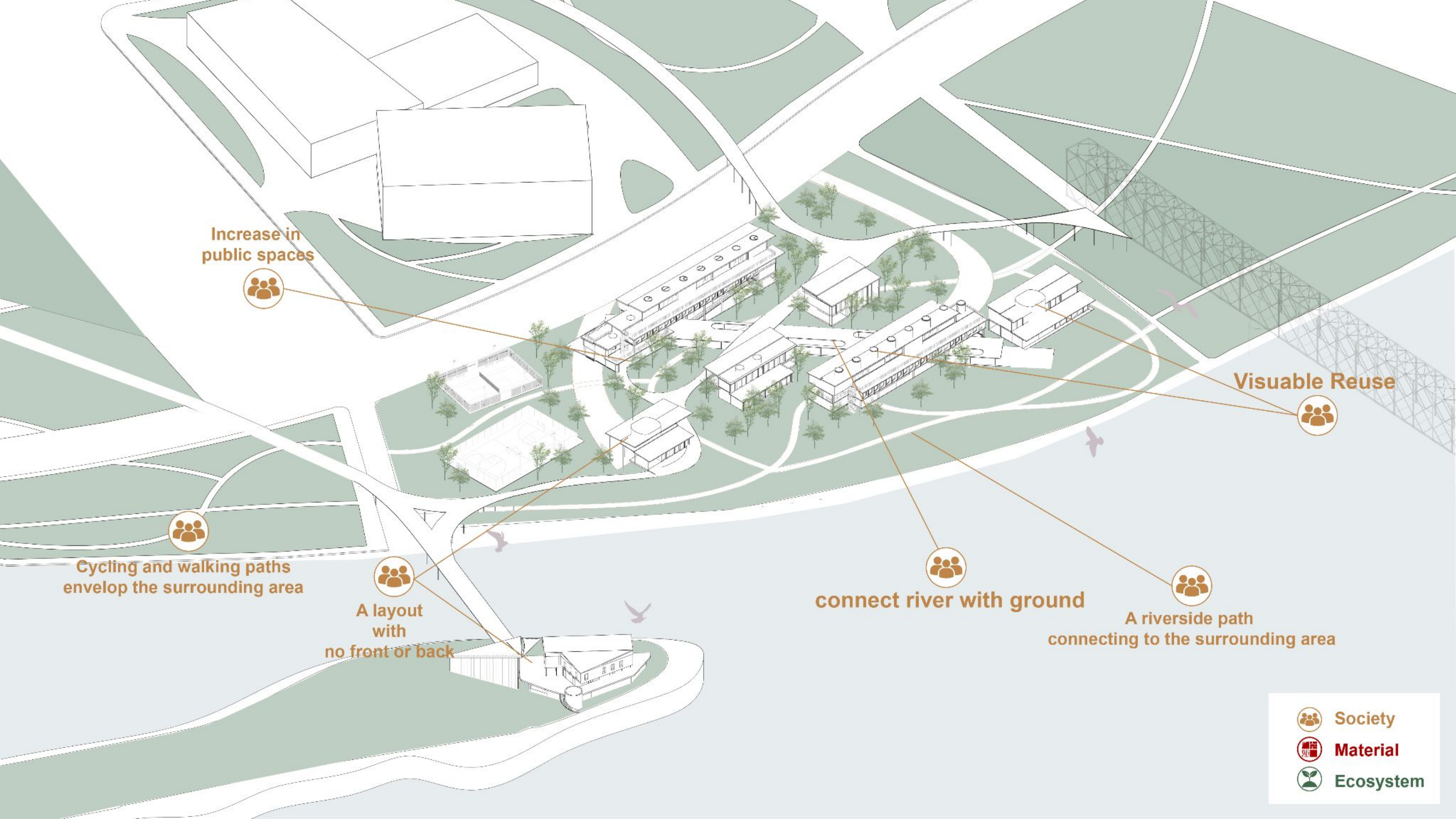
1-3 Society

Extending Everyday Interaction with Water

The project reconnects the site with surrounding waterfront spaces, creating a continuous network of movement.
Water is integrated into everyday life through visible purification systems, transforming infrastructure into shared spatial elements.



Architecture and landscapes that connect water and life


Increase in
public spaces
Visuable Reuse
Cycling and walking paths
envelop the surrounding area
A layout
with
no front or back
connect river with ground
A riverside path
connecting to the surrounding area
Society
Material
Ecosystem

8. Phased and Parallel Construction

The project proposes a phased and parallel construction process, where time-intensive elements such as steel pipe piles and landscape are implemented first.

While construction continues, the site remains partially open and active.

As a result, vegetation is already established by the time of completion, allowing environmental and social flows to emerge more rapidly.

Phase1;

Soil remediation

Restoration of the riverside vegetation

Construction of the sports facilities on the west side

Phase2;

Construction of the building clusters

Renovation of the yacht club

Phase3;

Architecture, landscape, and the ecosystem will fully align, completing the vision proposed in this project

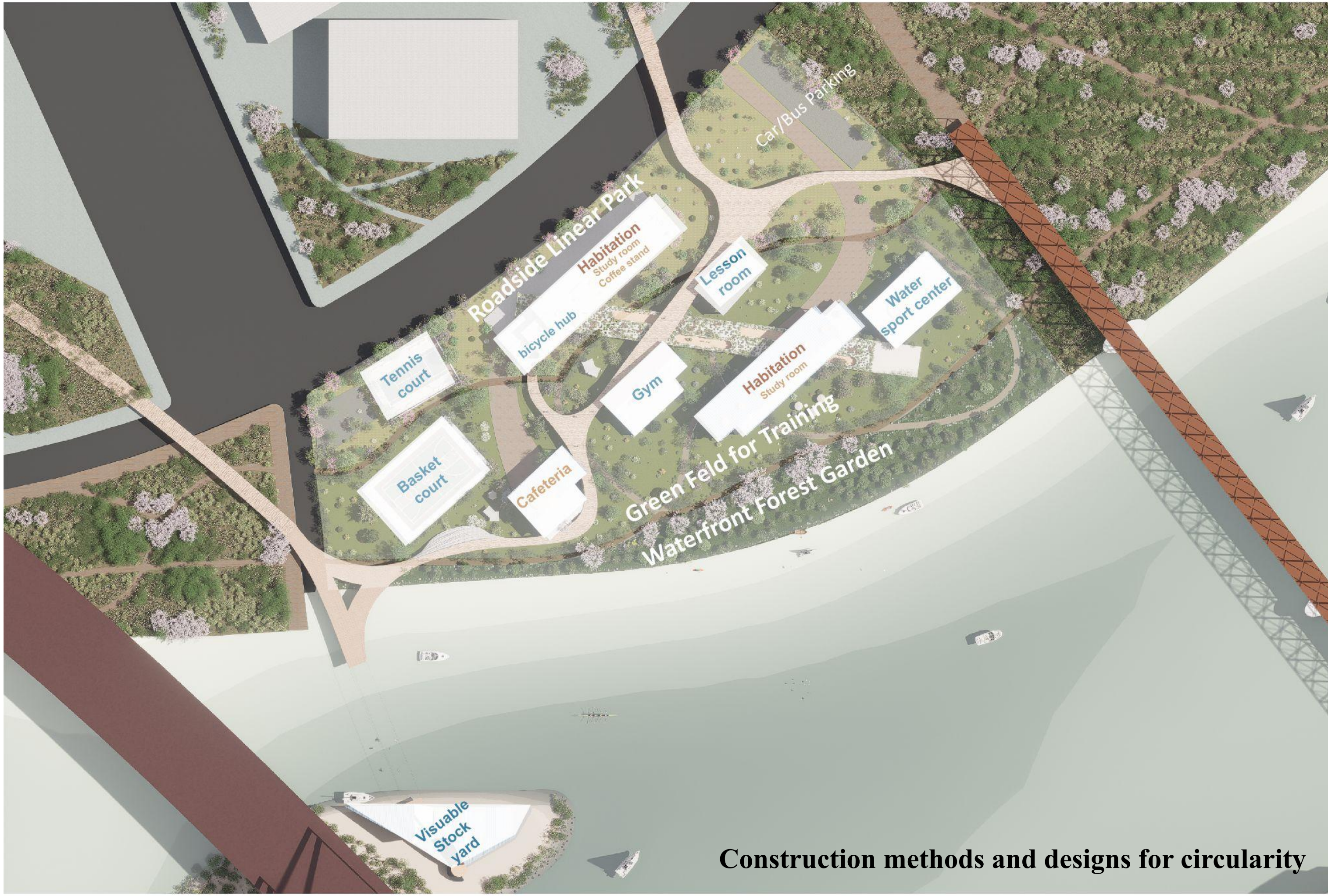
Life and culture are connected and intersect

4-3,

Master plan

4-3,

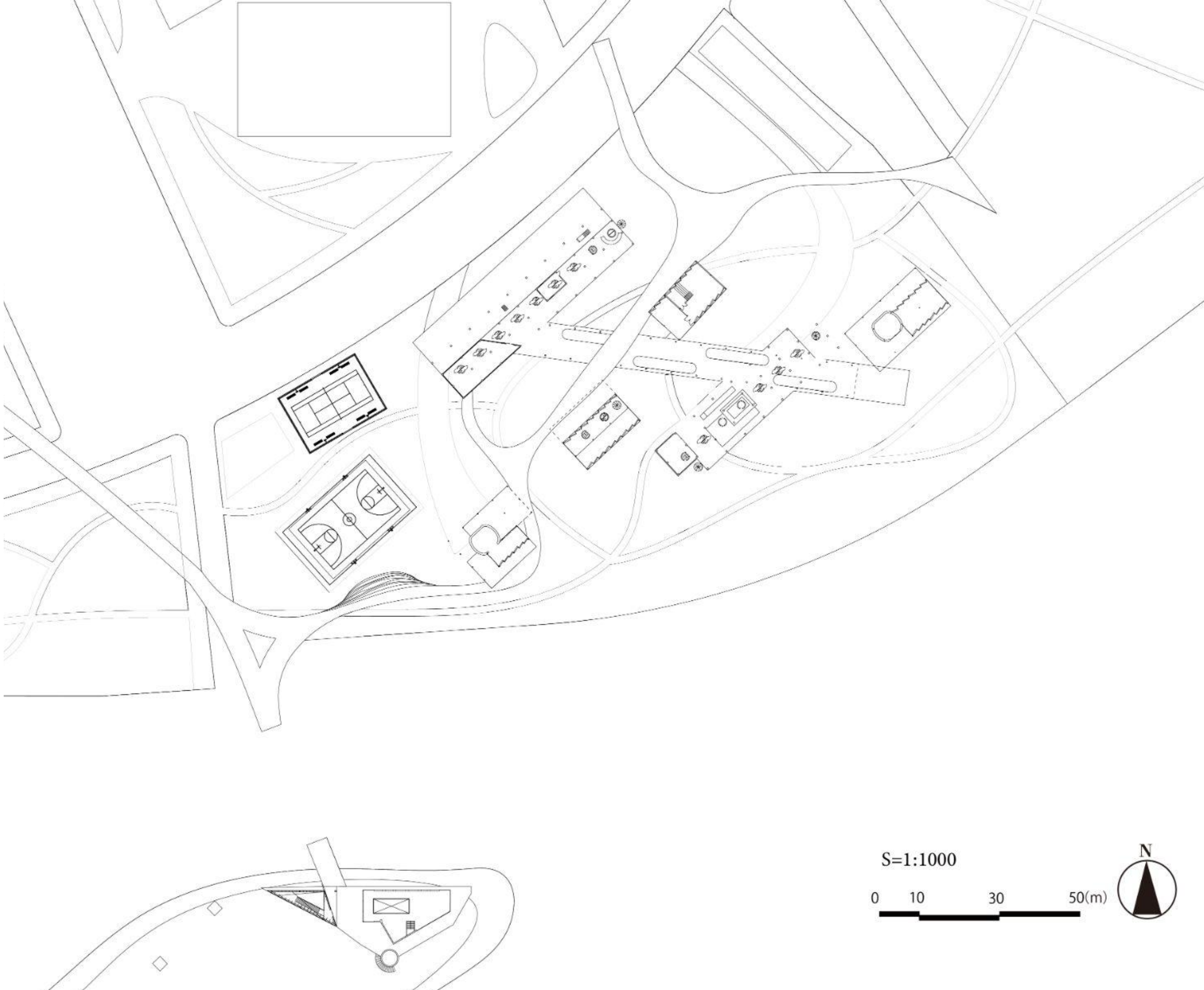
Functions



4-4

Plan_GL

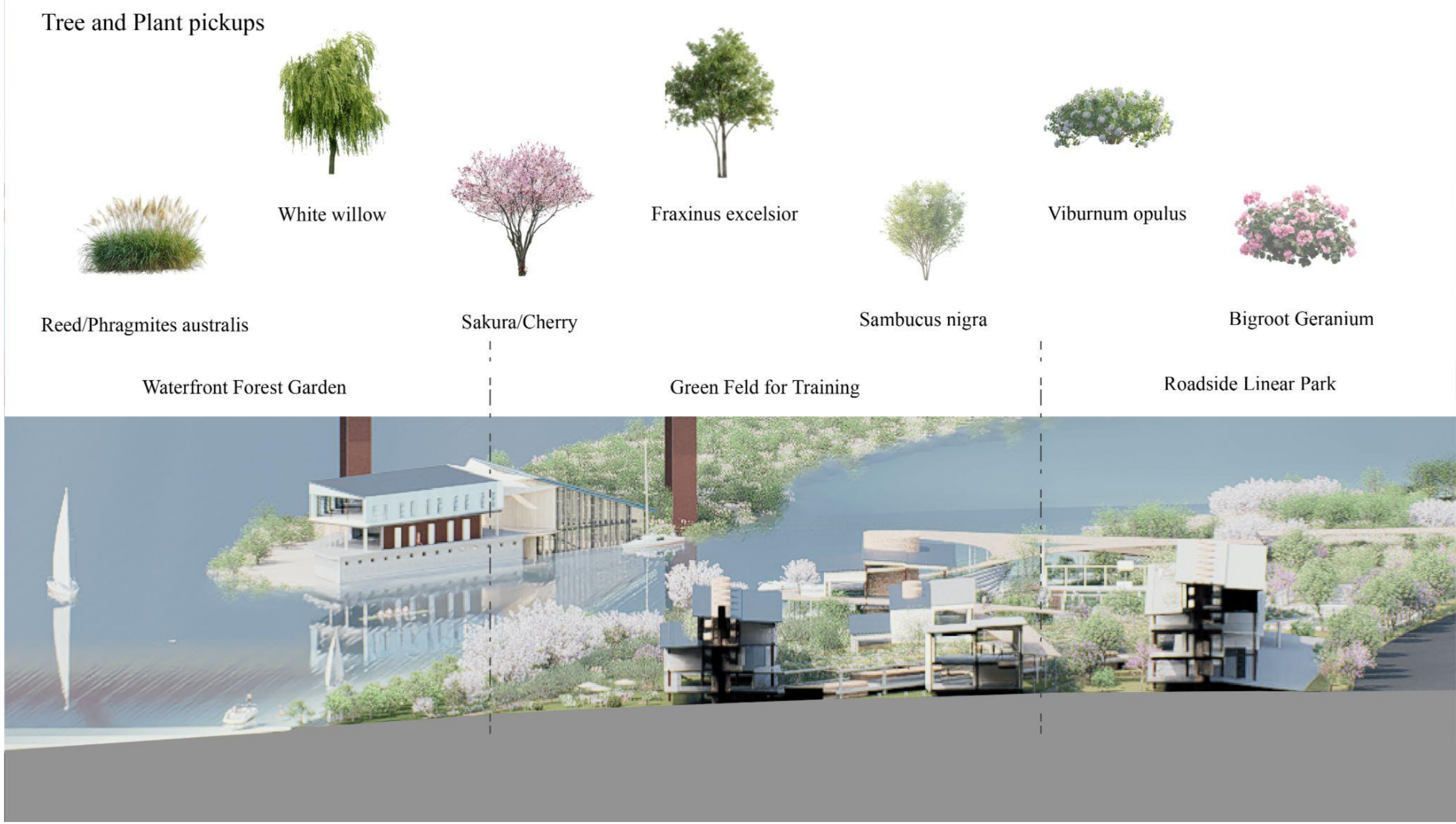
The site features a diverse network of circulation paths—including ground-level walkways, elevated deck passages, and a north-south corridor opening toward the river—each weaving together the buildings, surrounding grounds, and different elevations. This variety of movement, paired with a multi-pavilion layout that eliminates "front" or "back" facades, allows the architecture to expand naturally into its environment as an open, inviting structure.



4-5 Section

Based on research into the site's topography and the flood levels of the Sava River, the ground-level design and planting were planned by dividing the area into three zones.

Medium-sized trees suitable for riverside areas, such as white willow and European ash, were planted, and cherry trees were placed along the walking path to connect with the park on the east side of the property.



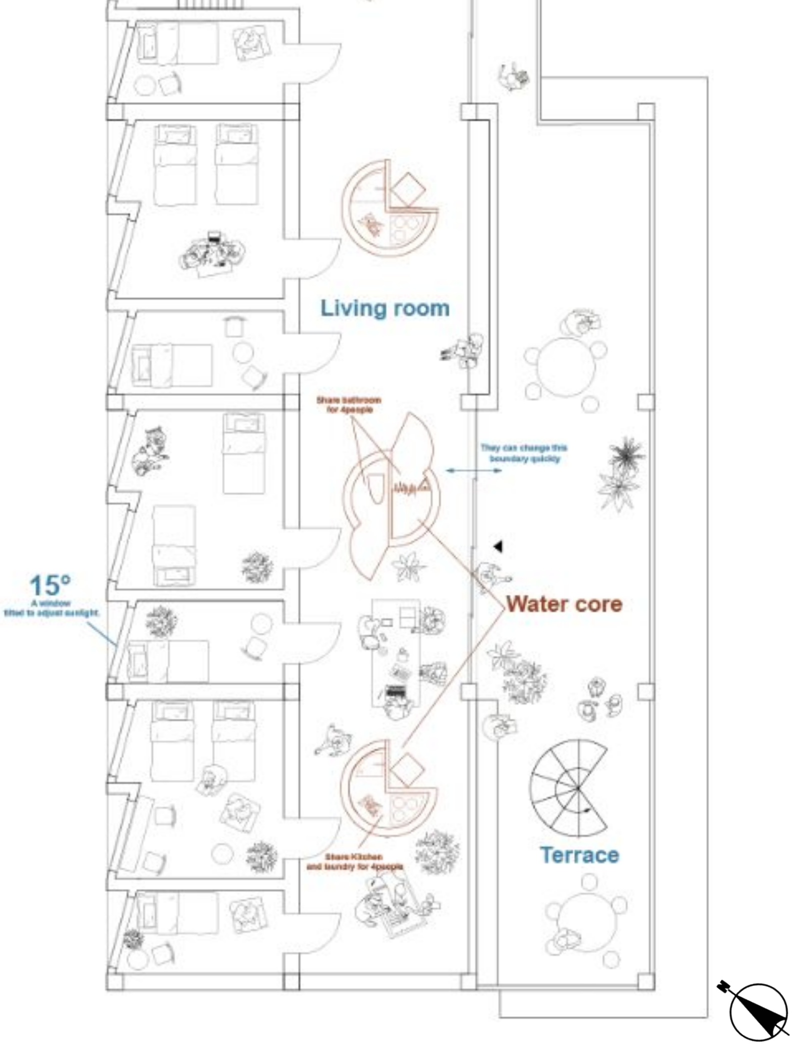
The relationship between roads and buildings changes along the slope

4-4, Athlete residence

4-4. Athlete residence

4-4. Athlete residence_Plan

A living room with large openings that connect to the outside



4-4.

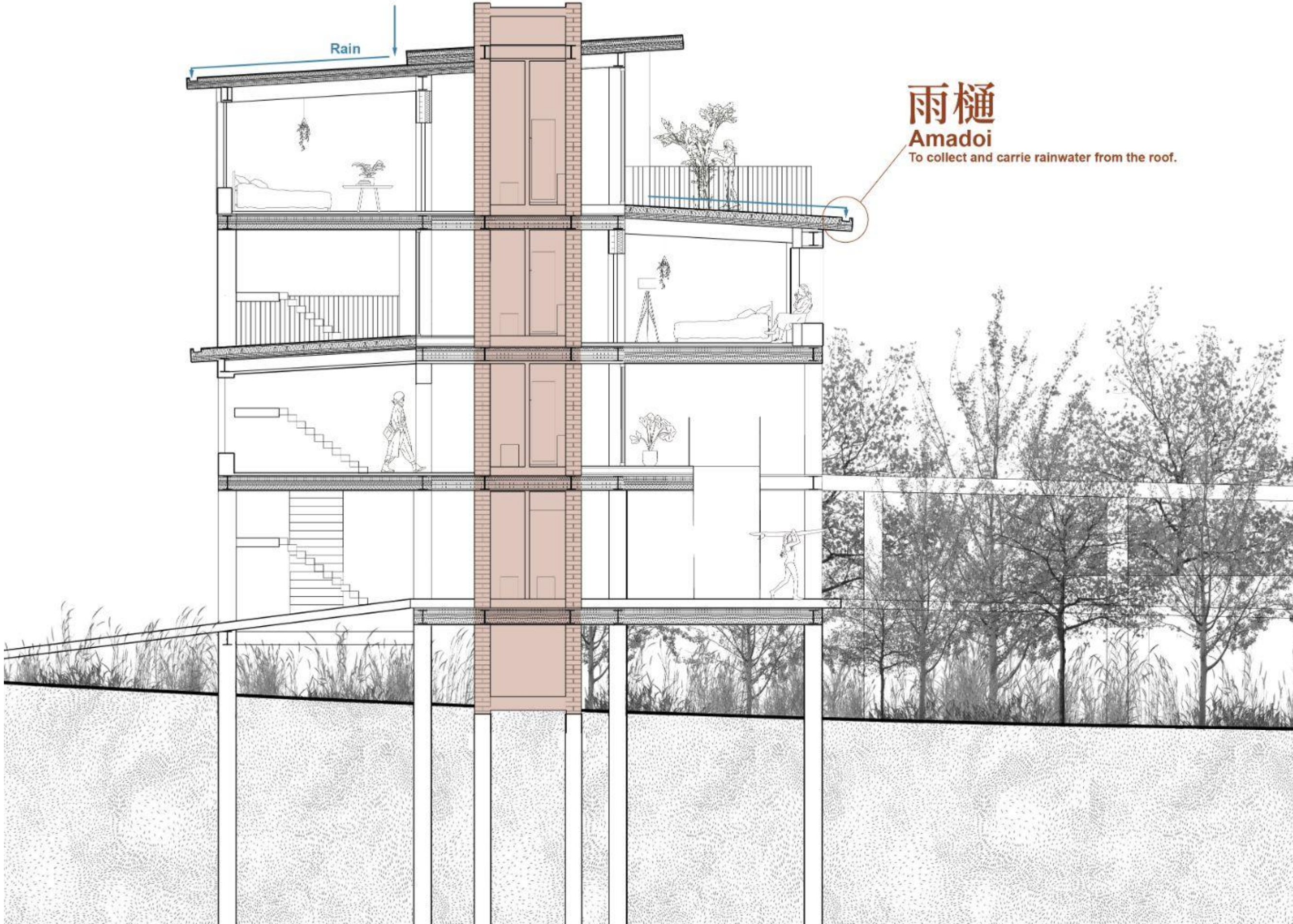
Athlete Residence

Section

The sloped roof is designed at a walkable height, functioning as both a balcony and an accessible terrace.

Continuous terraces extend from the living spaces, creating a seamless relationship between interior and exterior.

The shifts in levels generate interstitial spaces, where ramps and stairs intertwine to produce diverse spatial experiences.



The pile structure extending from the ground creates a variety of floor heights.

4-4, Athlete residence

A private room with a slanted window that lets in sunlight all day long.

A living room where the core gently divides the space.

4-5.

Corridor connecting 2 residence buildings

A semi-outdoor corridor connects the two residences. In this corridor, the septic tanks of the buildings on the property are incorporated as furniture such as benches and planters, functioning not only as a passageway but also as a place to enjoy nature.

A corridor where the wind blows through and the sun sets.

4-5.

Sports and public facilities

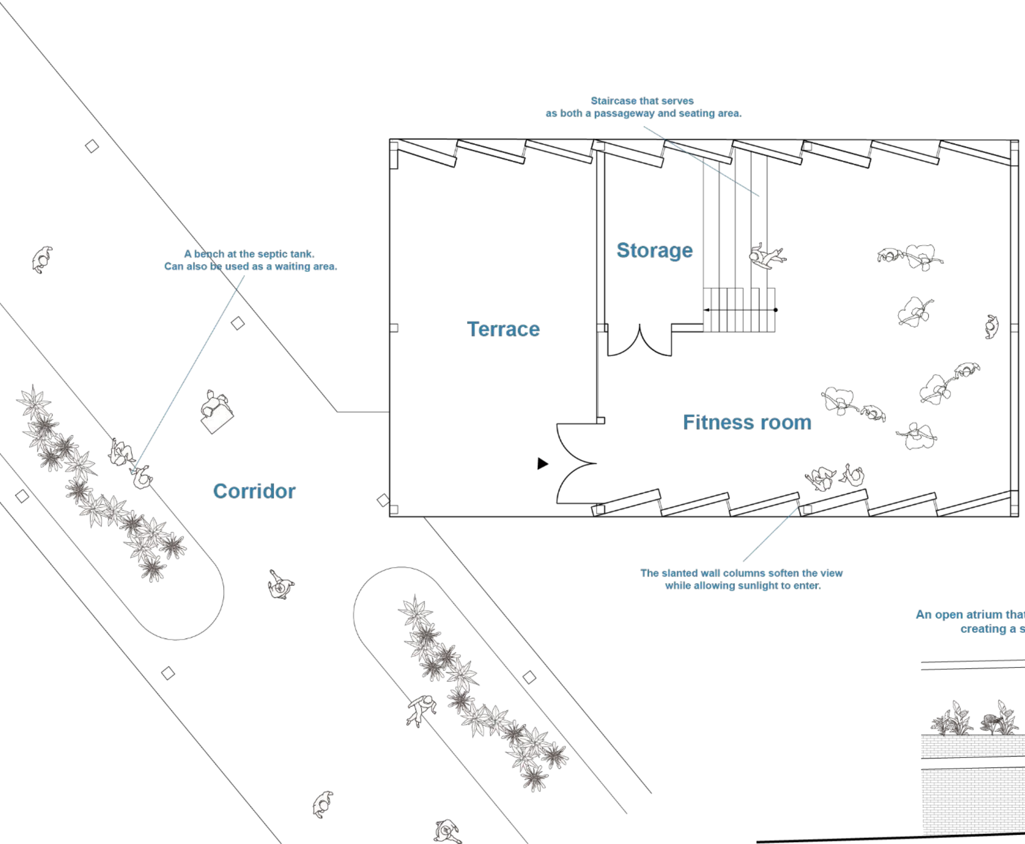
A bicycle base is designed as part of the sports program, located within the open pilotis as an accessible entrance for the public.

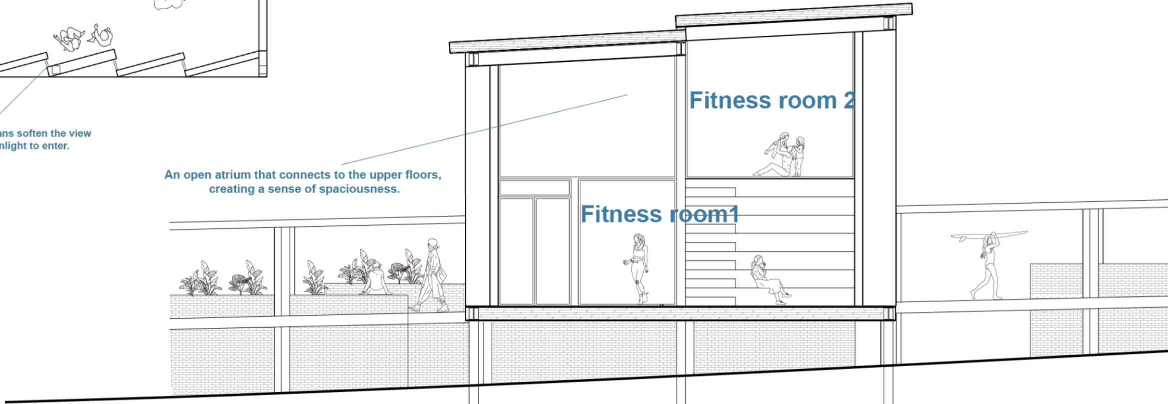
It supports the exchange and maintenance of bicycle components, while also acting as a node for material reuse at a smaller scale

Bicycle hub located under the piloti. You can ride in directly from the deck.

4-4, Sports and public facilities

4-4.Sports and public facilities

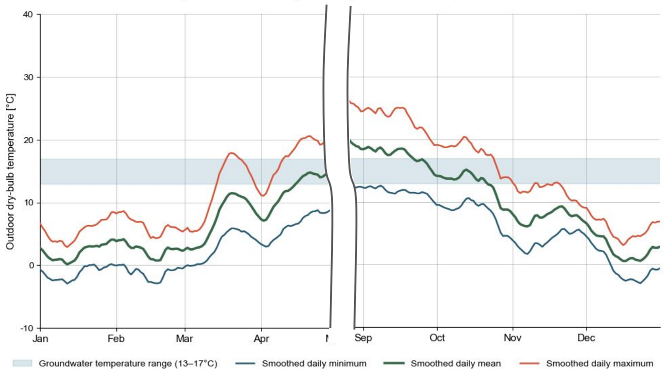




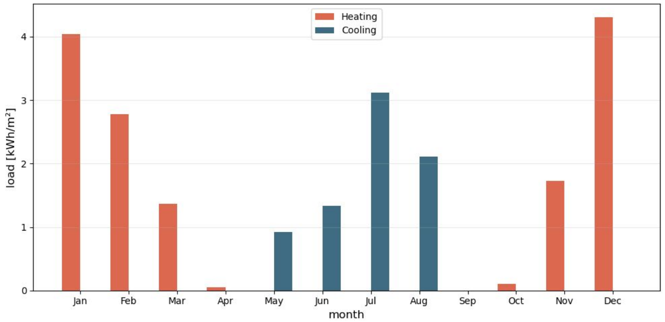
4-4, Sports and public facilities

Outdoor sports courts where you can watch the game from green area around

5-1.Sustainability Strategy : Heating Load

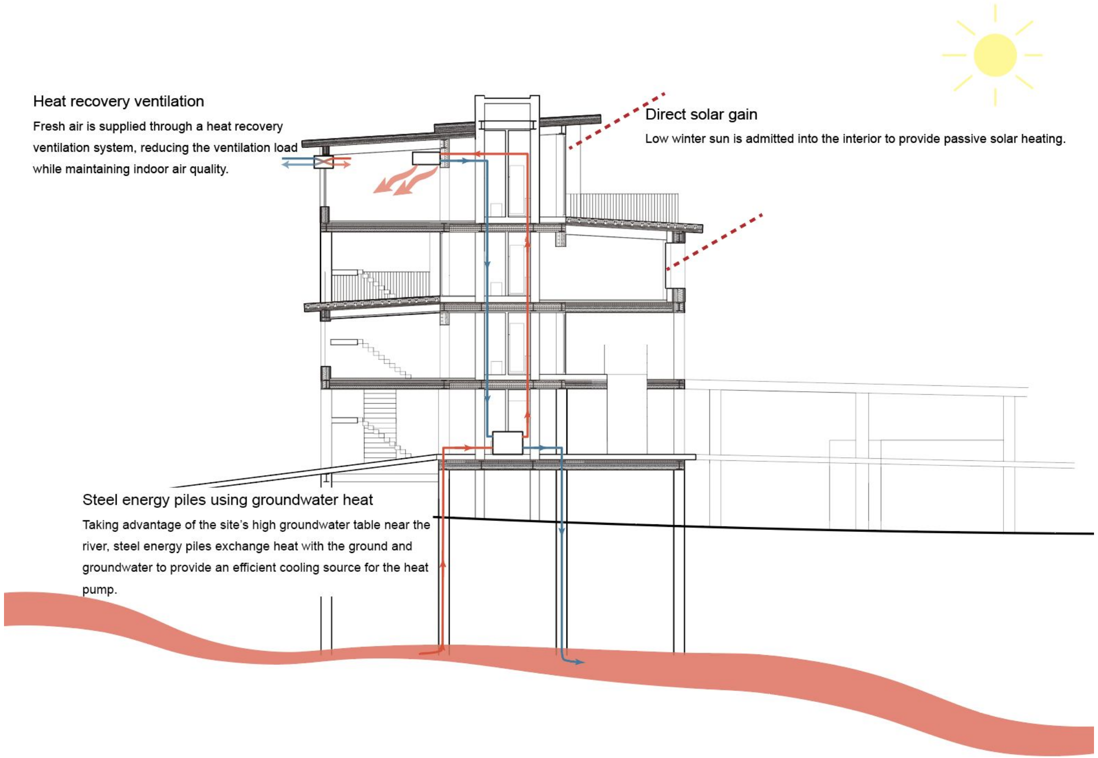


Compared with the severe winter outdoor air in Belgrade, groundwater remains thermally stable and is available in abundance. We therefore incorporated it into the active environmental system as a stable heat source for the building services.



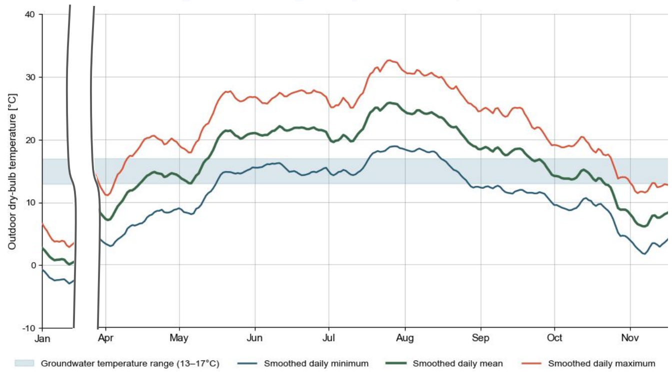
Annual energy demand for heating : 14.3kWh/m2

Heat exchange with groundwater can improve the heat pump’s COP by providing a more stable and favorable heat source.

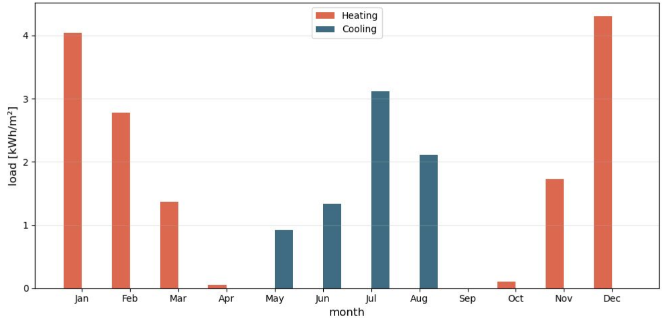


Construction methods and designs for circularity

5-2.Sustainability Strategy : Cooling Load

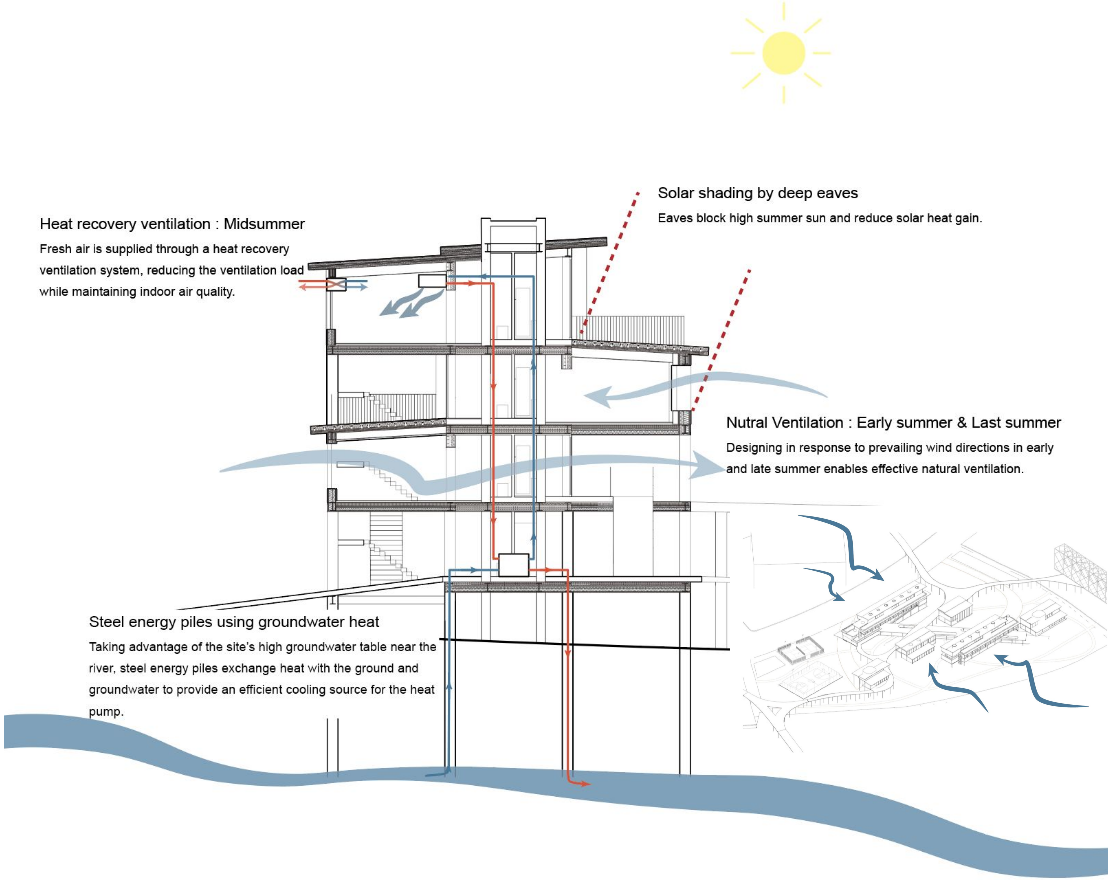


Although Belgrade experiences many relatively cool days throughout the year, there are also days when temperatures rise above 25°C. For such hot days, the building is equipped with efficient active environmental systems, while during the intermediate seasons it is designed to actively capture natural ventilation.



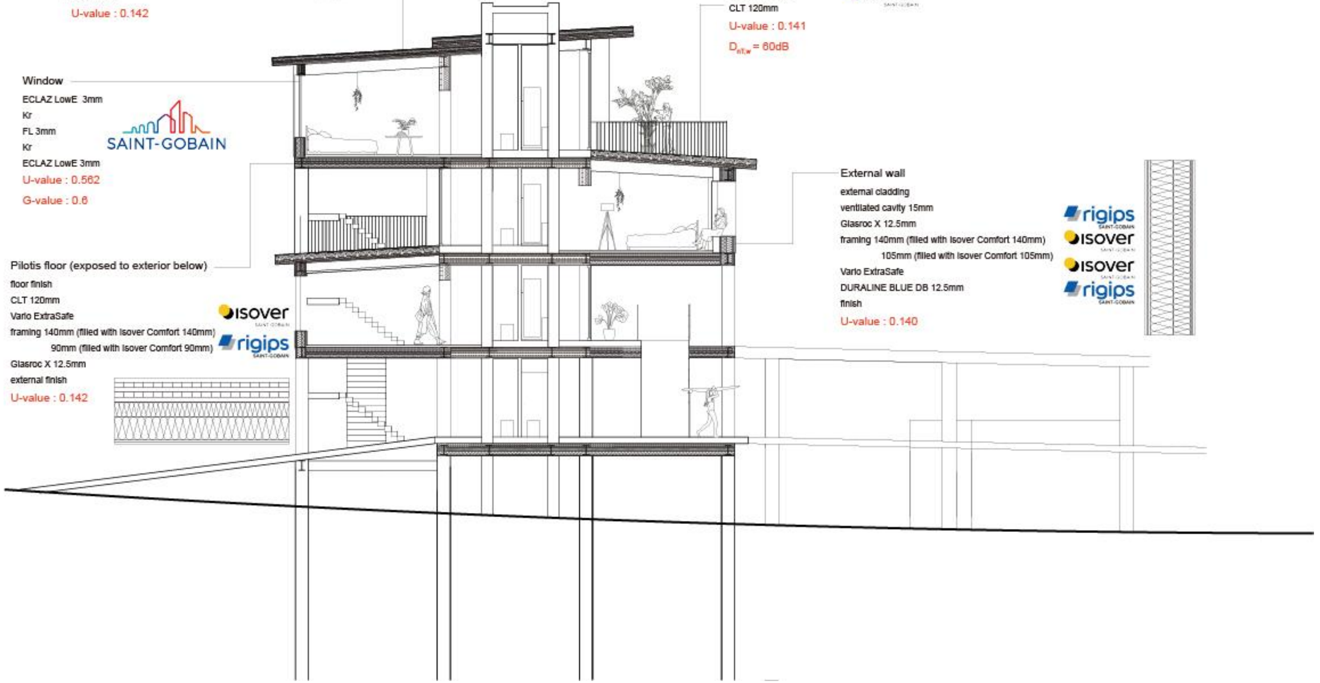
Annual energy demand for cooling : 7.4kWh/m2

Heat exchange with groundwater can improve the heat pump's COP by providing a more stable and favorable heat source.

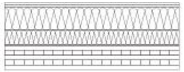


Construction methods and designs for circularity

5-3.Sustainability Strategy : Insulation

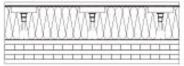


Roof
roof finish
waterproofing membrane
framing 140mm (filled with Isover Comfort 140mm)
90mm (filled with Isover Comfort 90mm)
Vario ExtraSafe
CLT 120mm
U-value : 0.142



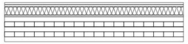
Accessible roof (walkable)
walking surface
adjustable pedestals
protection mat
double-layer waterproofing membrane
XPS insulation 200 mm
Vario ExtraSafe
CLT 120mm
U-value : 0.141
$D_{nT,w}$ = 60dB

Window
ECLAZ LowE 3mm
Kr
FL 3mm
Kr
ECLAZ LowE 3mm
U-value : 0.562
G-value : 0.6

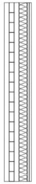


External wall
external cladding
ventilated cavity 15mm
Glasroc X 12.5mm
framing 140mm (filled with Isover Comfort 140mm)
105mm (filled with Isover Comfort 105mm)
Vario ExtraSafe
DURALINE BLUE DB 12.5mm
finish
U-value : 0.140

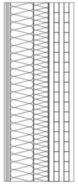
Pilotis floor (exposed to exterior below)
floor finish
CLT 120mm
Vario ExtraSafe
framing 140mm (filled with Isover Comfort 140mm)
90mm (filled with Isover Comfort 90mm)
Glasroc X 12.5mm
external finish
U-value : 0.142



Intermediate floor
floor finish
high-density dry floor panel 25mm
reinforced gypsum board 25mm
upper framing 50mm (filled with Isover Akusto 50mm)
resilient layer 10mm (rubber sheet)
CLT 120mm
$D_{nT,w}$ = 60dB



Intermediate wall
CLT 90mm
independent framing 50mm (filled with Isover Akusto 50mm)
DURALINE BLUE DB 12.5mm × 2
finish
$D_{nT,w}$ = 59dB



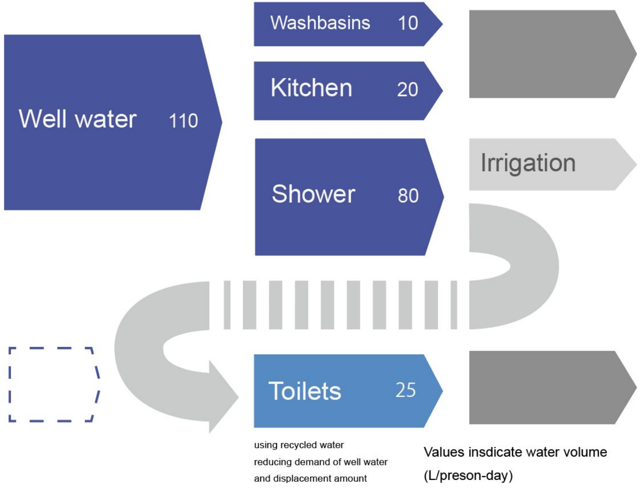
External wall (CLT version)
external cladding
ventilated cavity 15 mm
Glasroc X 12.5mm
framing 140mm (filled with Isover Comfort 140mm)
90mm (filled with Isover Comfort 90mm)
Vario ExtraSafe
CLT 120mm
U-value : 0.134

Construction methods and designs for circularity

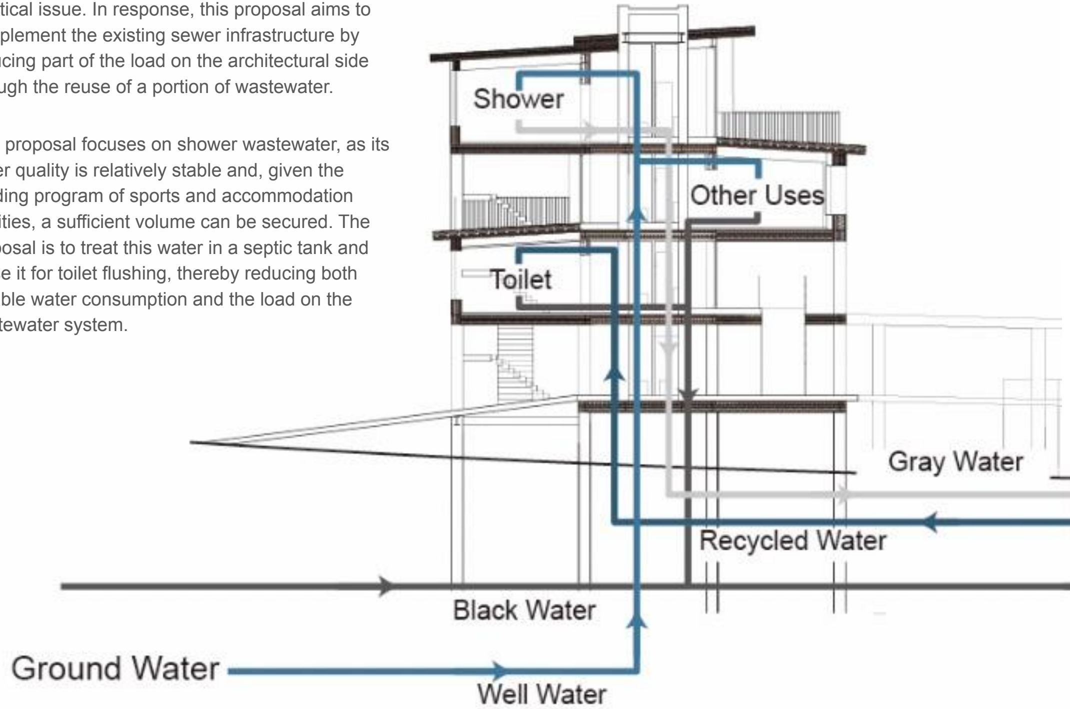
5-4.Sustainability Strategy : Water Manegement

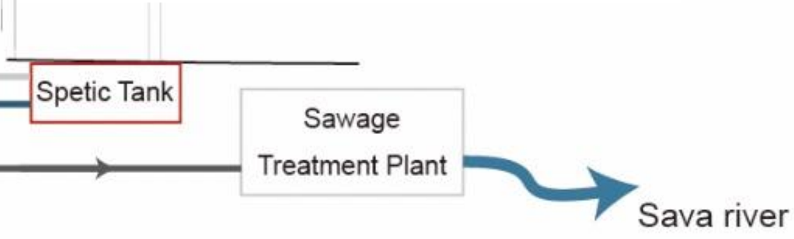
In Belgrade, the development and renewal of wastewater treatment facilities are progressing, yet reducing the burden on the river environment remains a critical issue. In response, this proposal aims to complement the existing sewer infrastructure by reducing part of the load on the architectural side through the reuse of a portion of wastewater.

This proposal focuses on shower wastewater, as its water quality is relatively stable and, given the building program of sports and accommodation facilities, a sufficient volume can be secured. The proposal is to treat this water in a septic tank and reuse it for toilet flushing, thereby reducing both potable water consumption and the load on the wastewater system.



By introducing non-potable water reuse, demand for potable water can be reduced by 20%, and the load on the wastewater system can be eased accordingly. In this proposal, reuse is limited to shower wastewater, which places a relatively low burden on the septic tank. However, in areas where sewer infrastructure is not yet fully developed, more proactive use of septic tanks should be encouraged.

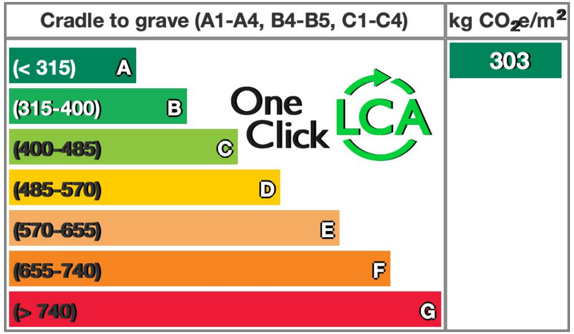


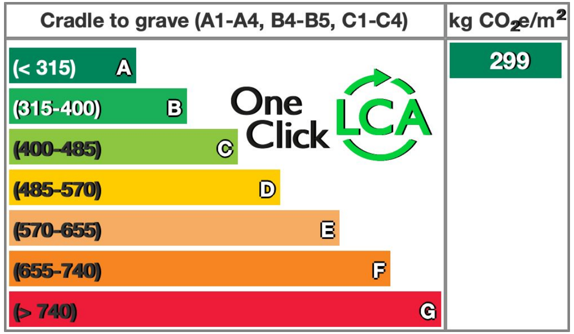


Construction methods and designs for circularity

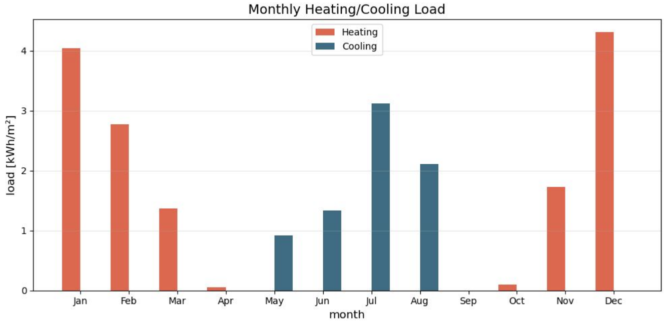
5-5.Sustainability Strategy : Key Environmental Impacts

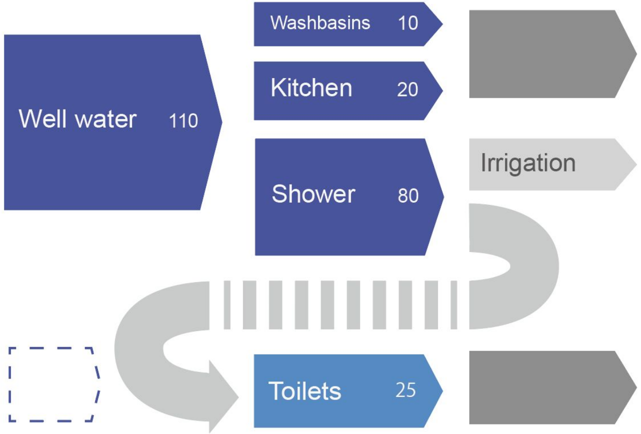
Embodied Carbon Impact at the Upfront Stage





Operational Carbon Impact





using recycled water
reducing demand of well water
and displacement amount

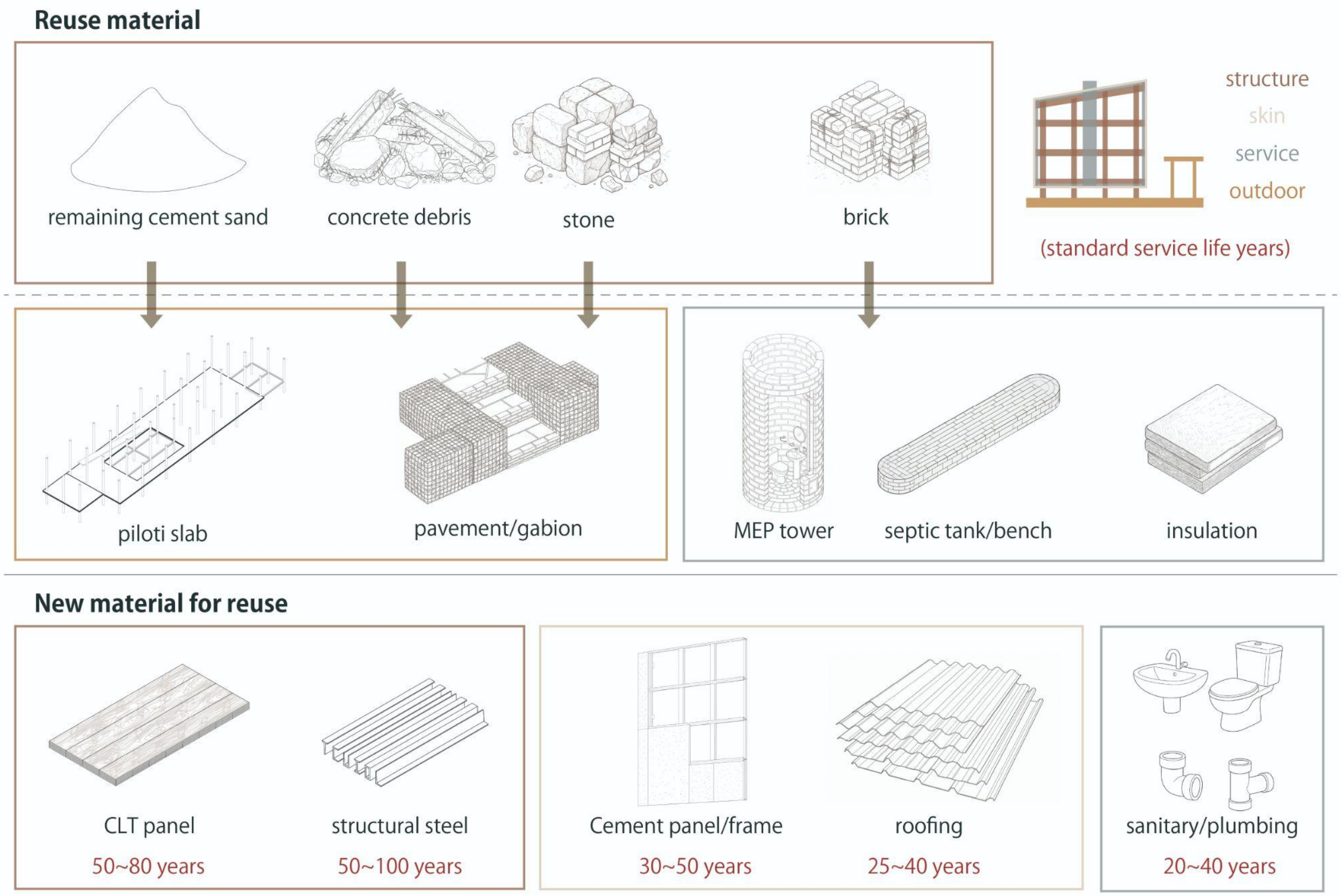
Values insdicate water volume
(L/preson-day)

6, Material reuse

This section describes the reusable materials selected for this design.

We plan to reuse a variety of materials, ranging from sand sourced from the site of an existing cement factory, to concrete rubble and debris from construction demolition sites. Bricks and insulation materials salvaged from urban architectural demolitions are also slated for reuse.

For major building materials such as CLT and cement panels, we conducted a comparative analysis of their standard lifespans, prioritizing materials that facilitate future reuse.

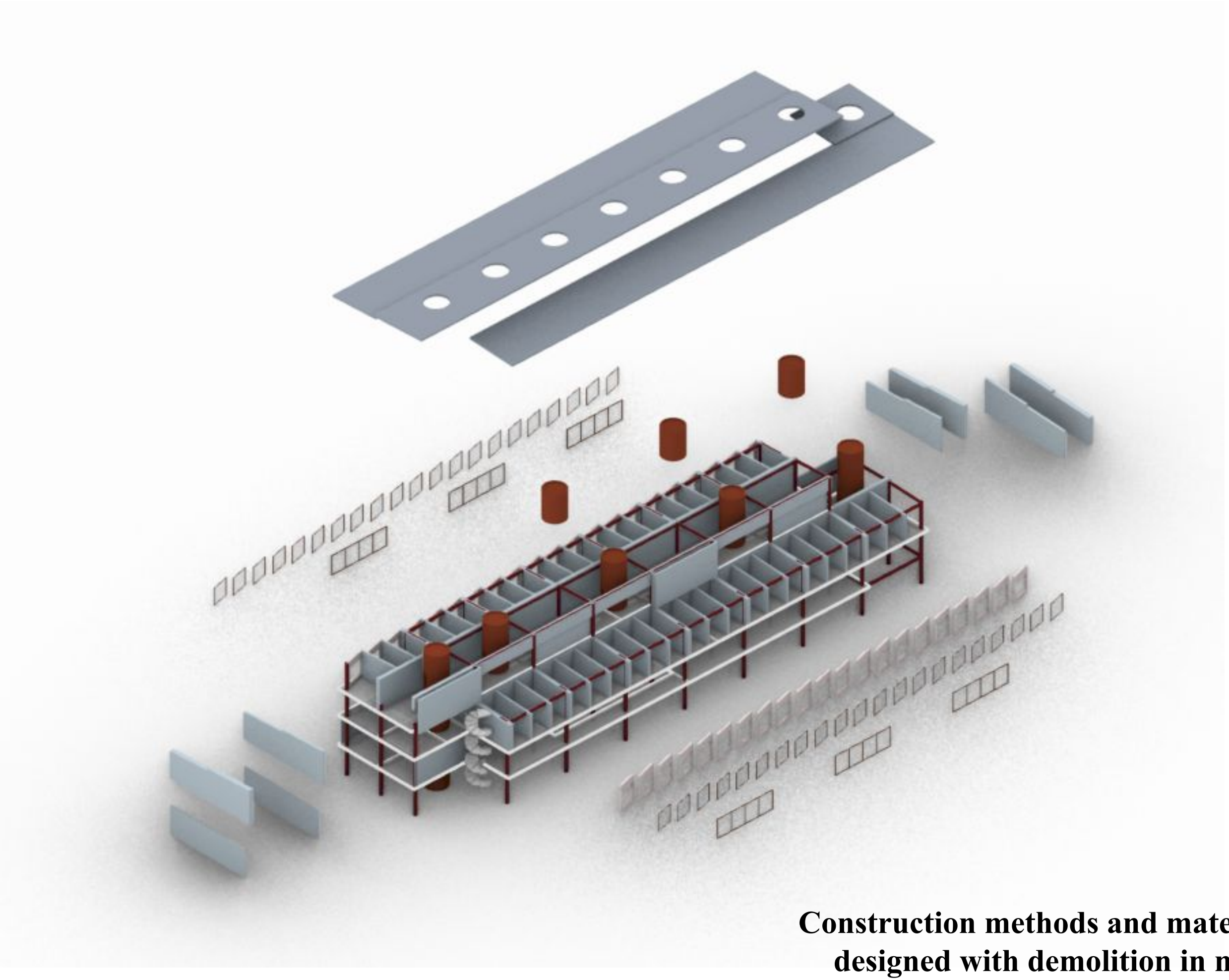


Materials selected based on their lifespan and existing urban stock.

6.Material reuse

Habitation wing especially demonstrates the optimization of disassembly and reuse. To ensure ease of dismantling while maintaining the quality of salvaged materials, prioritizing dry construction from the structure to the finishing is essential.

The structure is composed of a steel frame and CLT panels, is joined with bolts and metal hardware. By following the reverse process of construction rather than using destructive heavy machinery, the potential for high-quality material reuse is significantly increased.

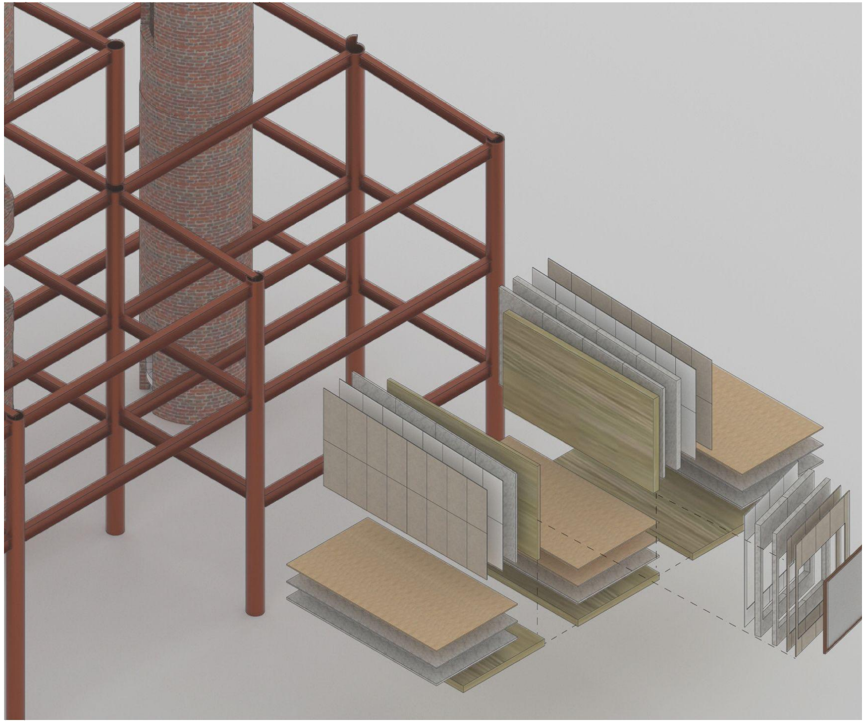


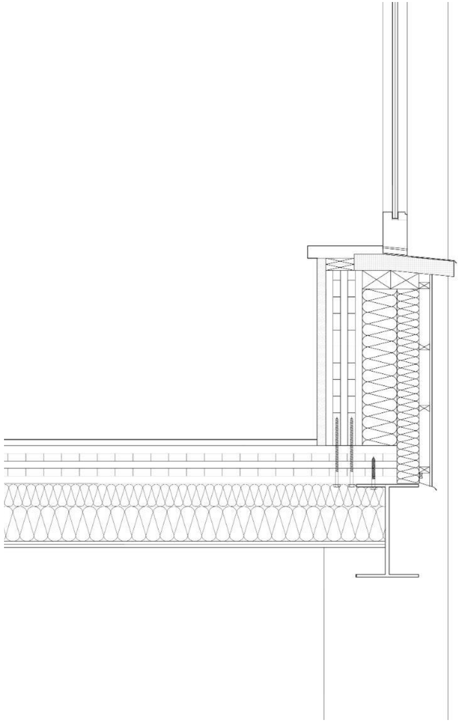
Construction methods and materials designed with demolition in mind.

6.Material reuse

The steel structural frame is constructed using standard dimensions for CLT and insulation materials, with the span determined to minimize waste.

The walls, constructed from a steel frame and CLT (Cross-Laminated Timber), are dry-type using metal connectors, which facilitates demolition and subsequent reuse.





7.Renovation

Visible Repair and Storage Hub

The project renovates a yacht club located on a river island, transforming it into a visible hub for storage and repair.

It serves as a base for storing equipment and materials for yachts and water sports, while exposing the processes of maintenance and reuse.

By aligning the axis of the existing structure with the new circulation, the former terrace is redefined as a new entrance.

Stored components are visible from the bridge, while the interior void reveals the repair of boats, making cycles of use and reuse perceptible.

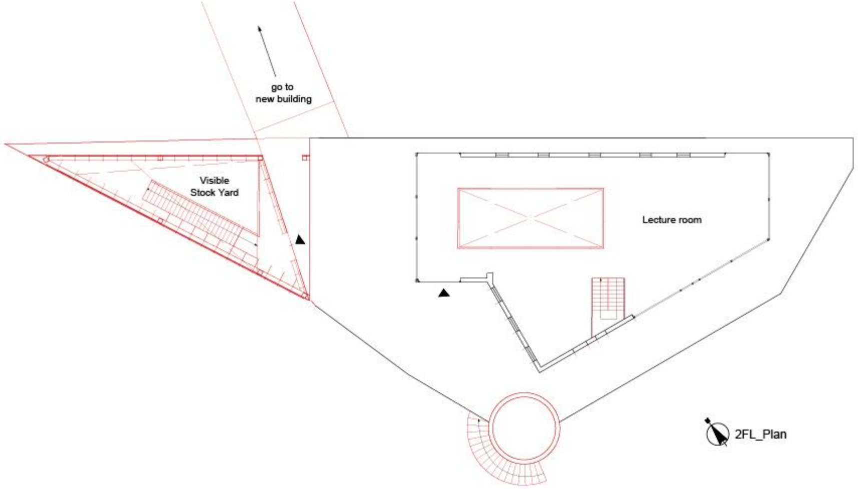
Connecting the new building site through an extension.

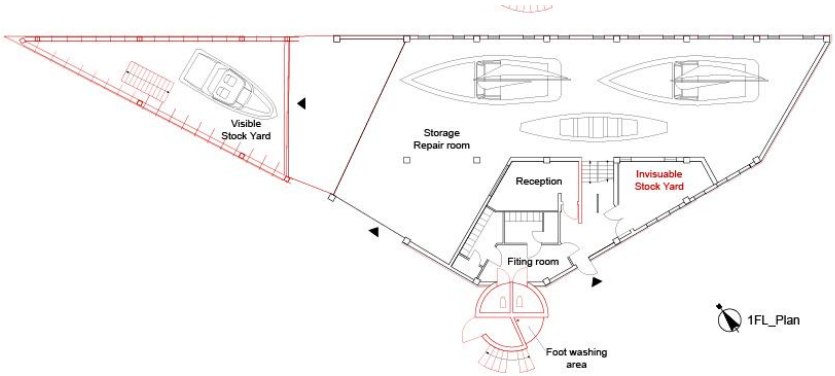
7.Renovation

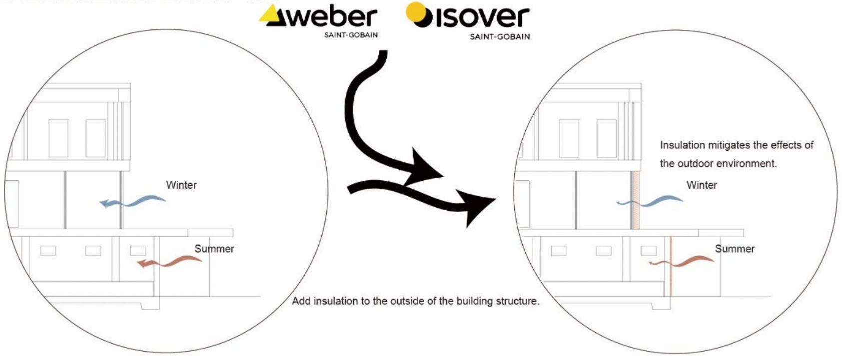
A new space between two building connects the old and new cities on opposite sides of the river as a gate.

7.Renovation

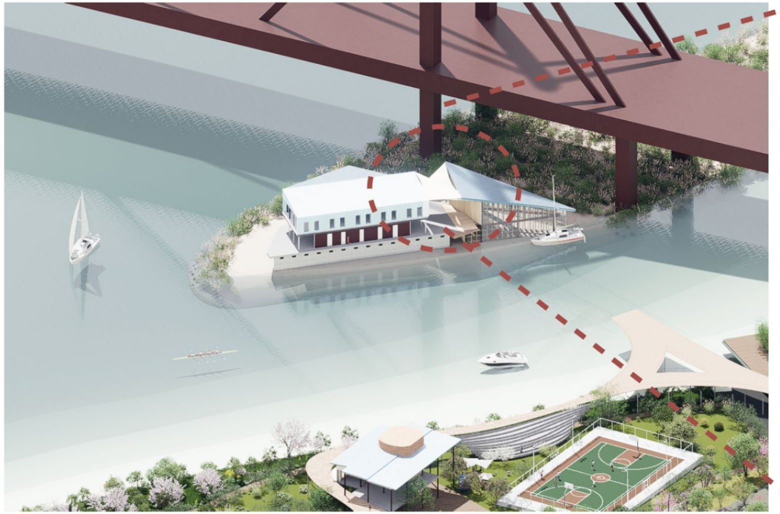
7.Renovation_Plan

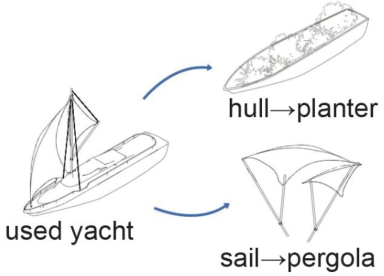






7.Renovation_Section and transportation strategy





Sails that have finished serving their original role are removed through the Visible Stock Yard and repurposed as pergolas, providing shade from the sun and creating places for people to gather.