ARCHITECTURE STUDENT CONTEST

21st INTERNATIONAL EDITION, BELGRADE 2026

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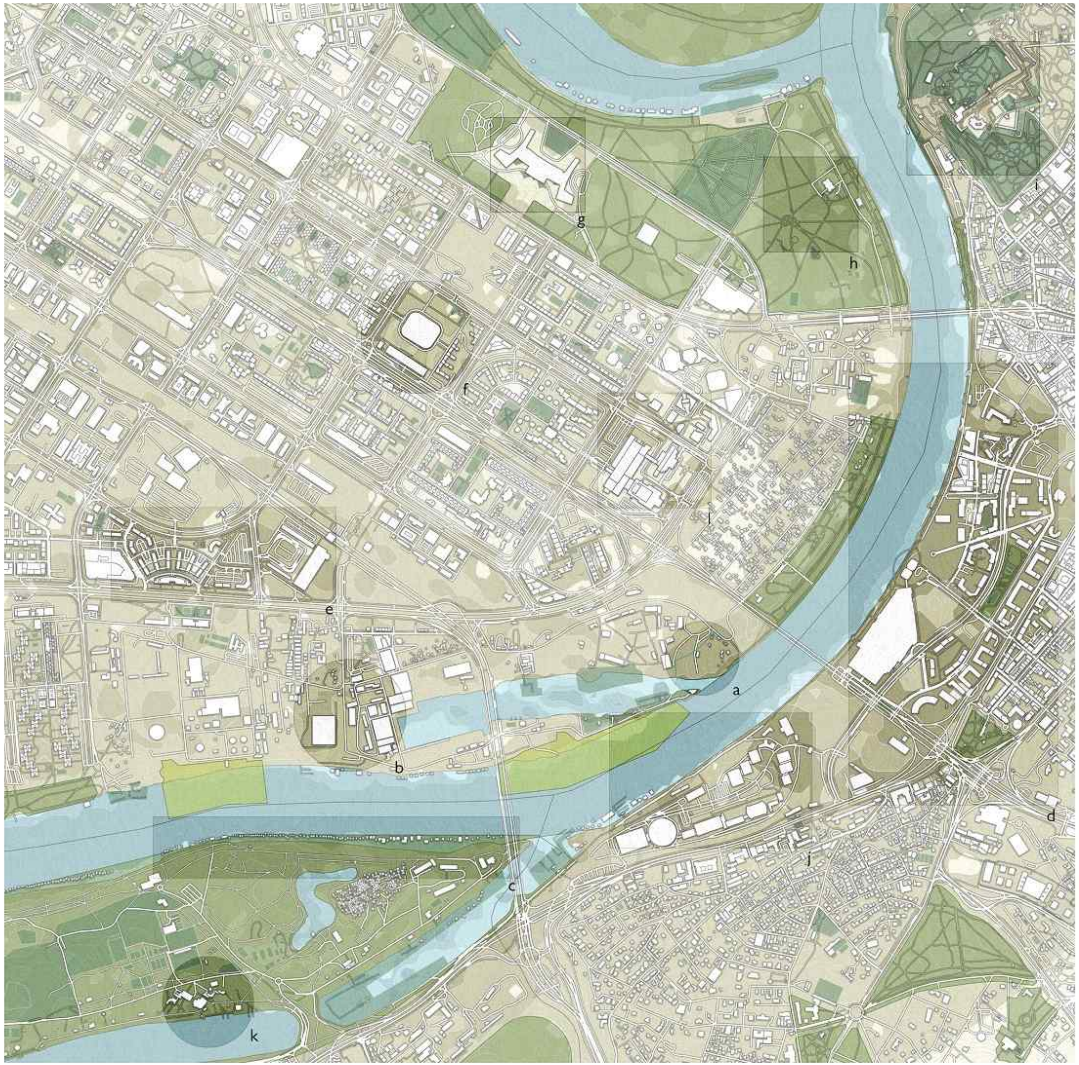
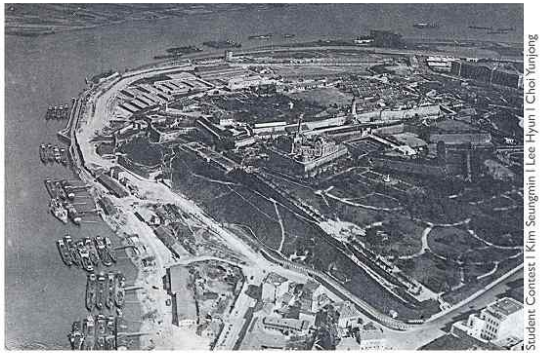
Sponge





Belgrade and its industrial sites along the waterfront in 1936

Belgrade (Serbia), 1680s

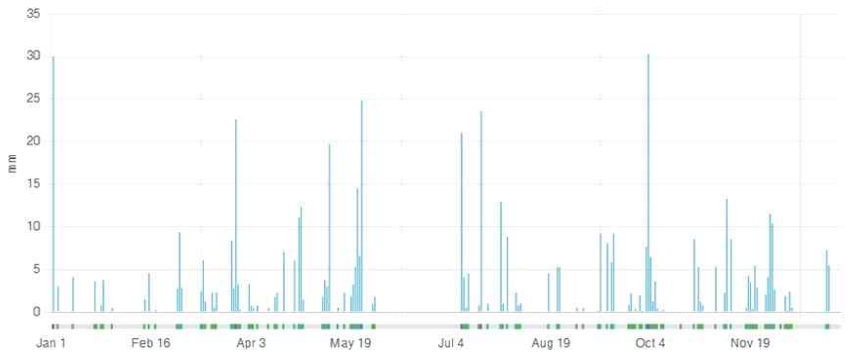
a. Project Site
b. NBGD Hall, Sports Center
c. Splavovi, Ada Ciganlija
d. Waterfront
e. Dom zdravlja Jedro and Belgrade Bus station
f. Belgrade Arena, Sports Center
g. Palace of Serbia
h. Museum of contemporary art, Ushce Park
i. Beograde Fortress and Kalemegdan
j. Beograde Fair Hall, Conference Center
k. Bicycle Center, Ada Ciganlija
l. Sava Centar, Conference Center

Our site, and Sava river

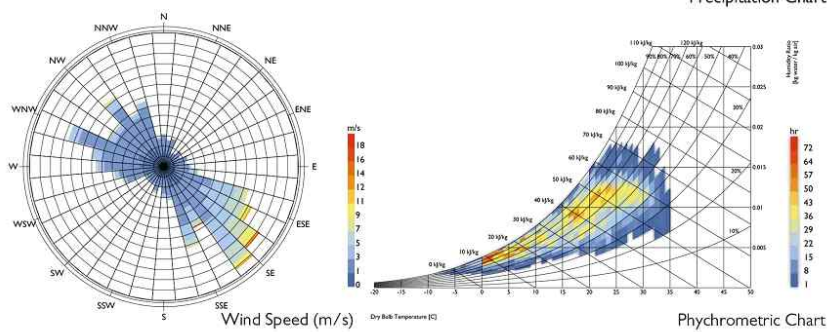
Climate Issues near Sava river

Sava and Danube rivers' confluence

flooding occurred in Obrenovac, Serbia in May 2014

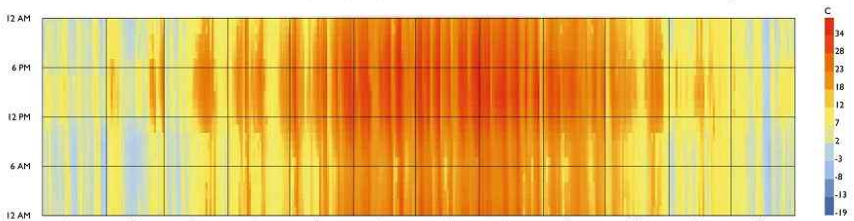


Precipitation Chart

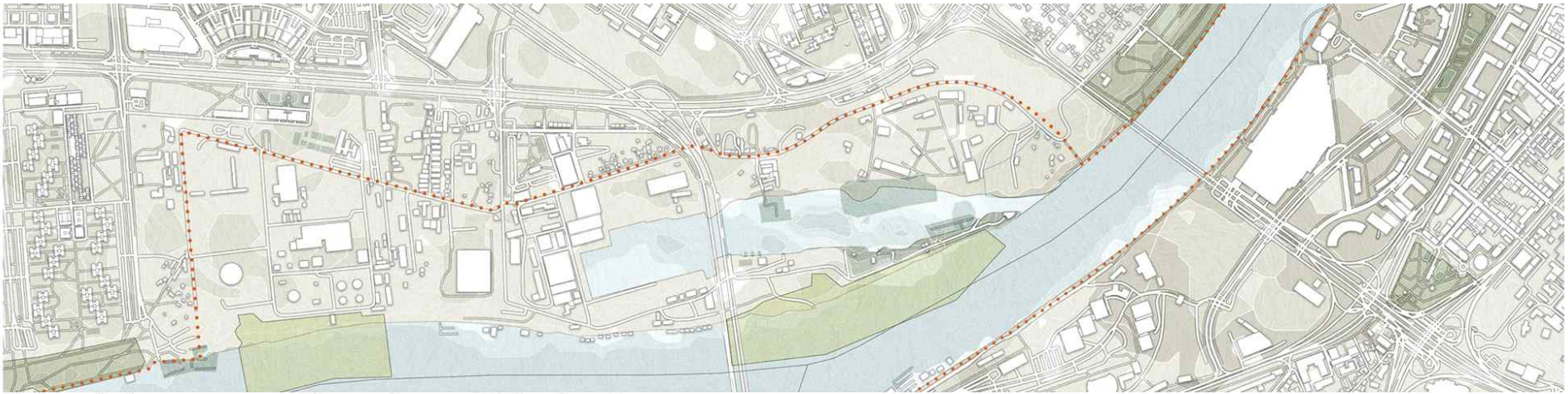


Wind Speed (m/s)

Phychrometric Chart



Dry Bulb Temperature (C)



Beyond the protected boundary, within the river ...

post war period

Following World War II, the riverbank absorbed a massive influx of people fleeing the countryside, with makeshift shelters and informal settlements lining the water's edge The river became a refuge for those displaced by war, its banks claimed by necessity.

modernism period

From 1948, the socialist state launched one of the most ambitious urban construction projects in post-war Europe on the left bank of the Sava, transforming the riverbank into an industrial and infrastructural backbone. Our site was part of this movement until today.

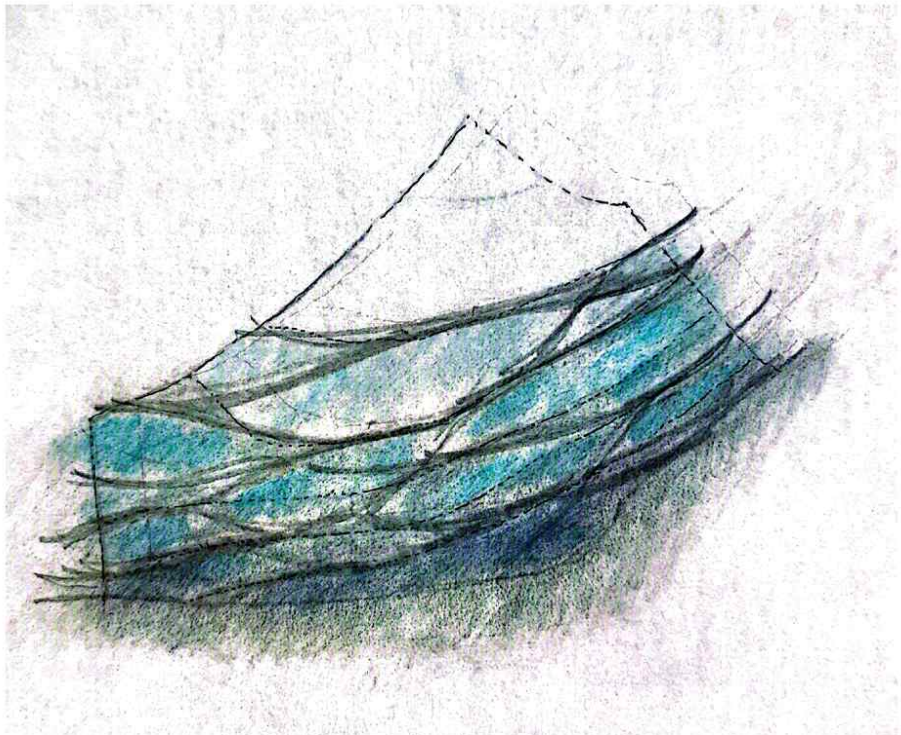
contemporary period

Today, the riverbank is undergoing a third transformation — away from industry and toward nature, sport, and collective life

... a part of a bigger context

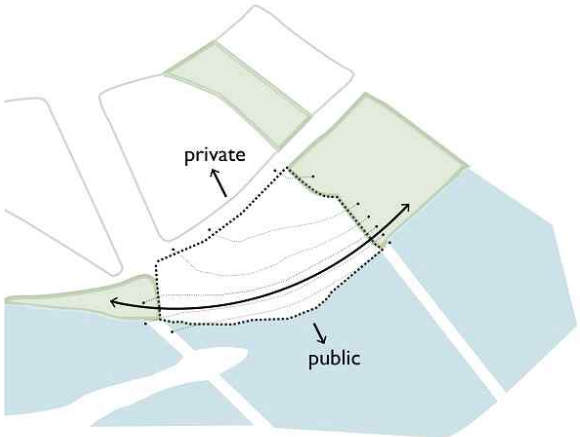
Sponge

What will we Sponge?



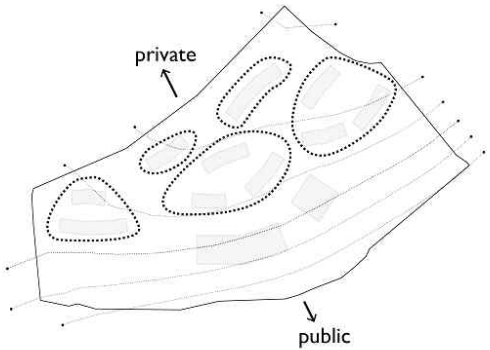
Horizontally flowing contour lines, and Sava rising against them...
Where the two meet, the project begins

Masterplan Design Strategies



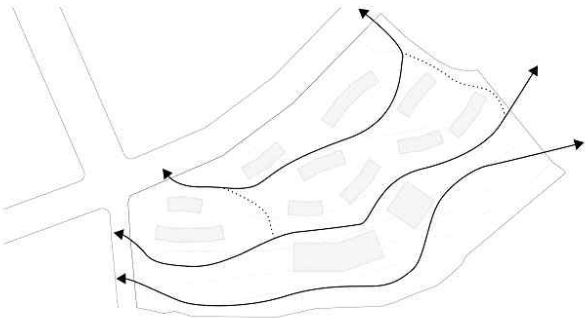
a public main access along the Sava river bank

being more public is to be friendly towards the river while being more private is to be safer from the river



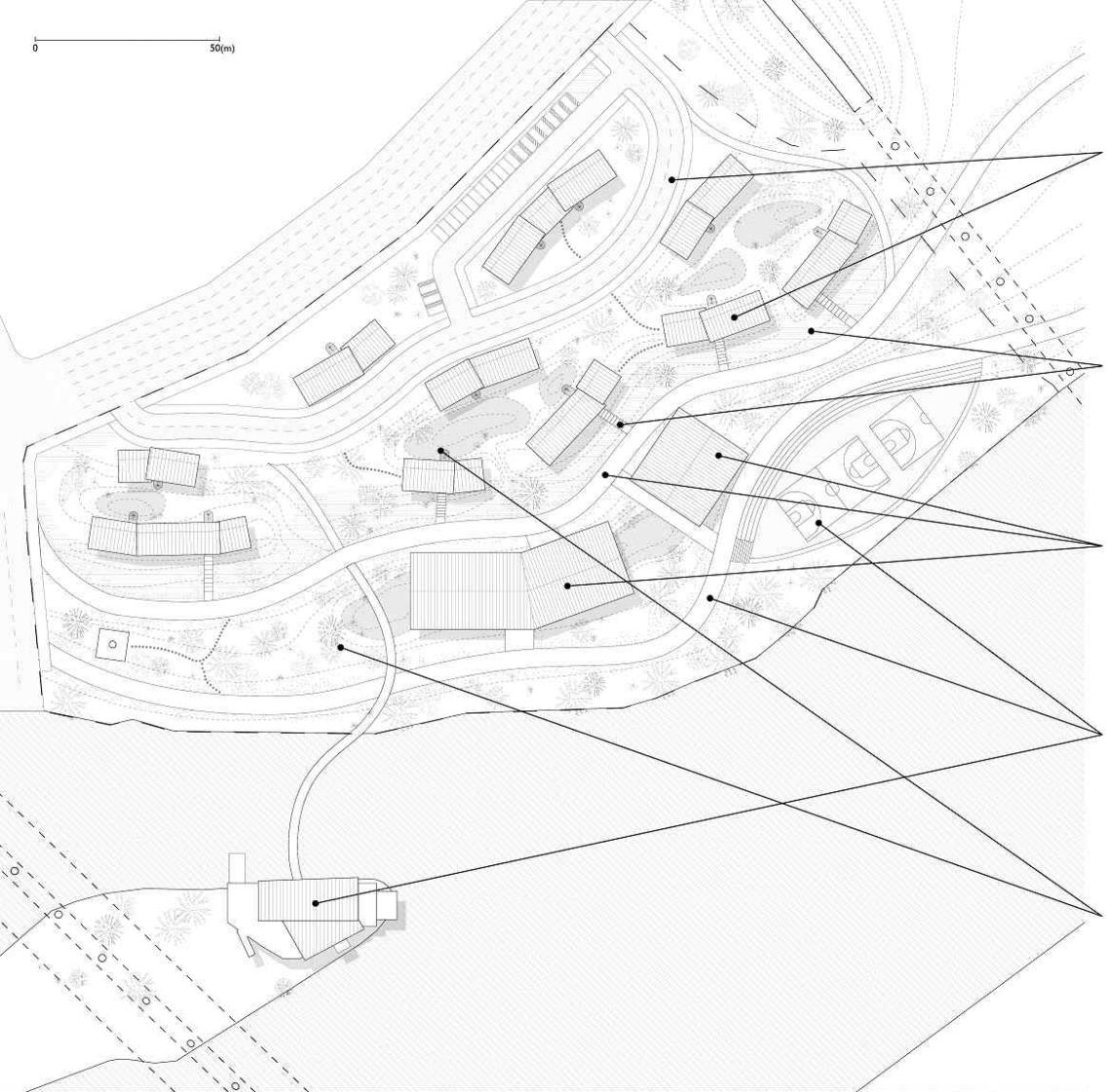
programs are placed in vertically along the contour lines

private programs like accommodations are placed north,
while public programs like a community center are placed south near the river

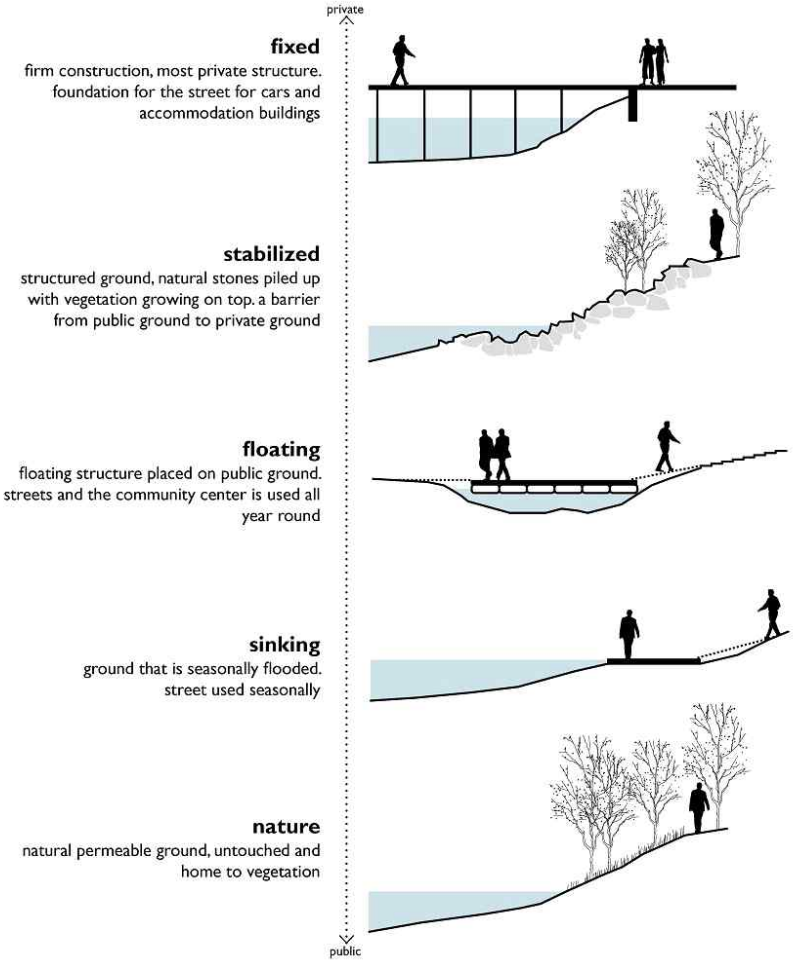


streets are placed following the contour lines

streets connect all buildings across the site



Masterplan Design Strategies



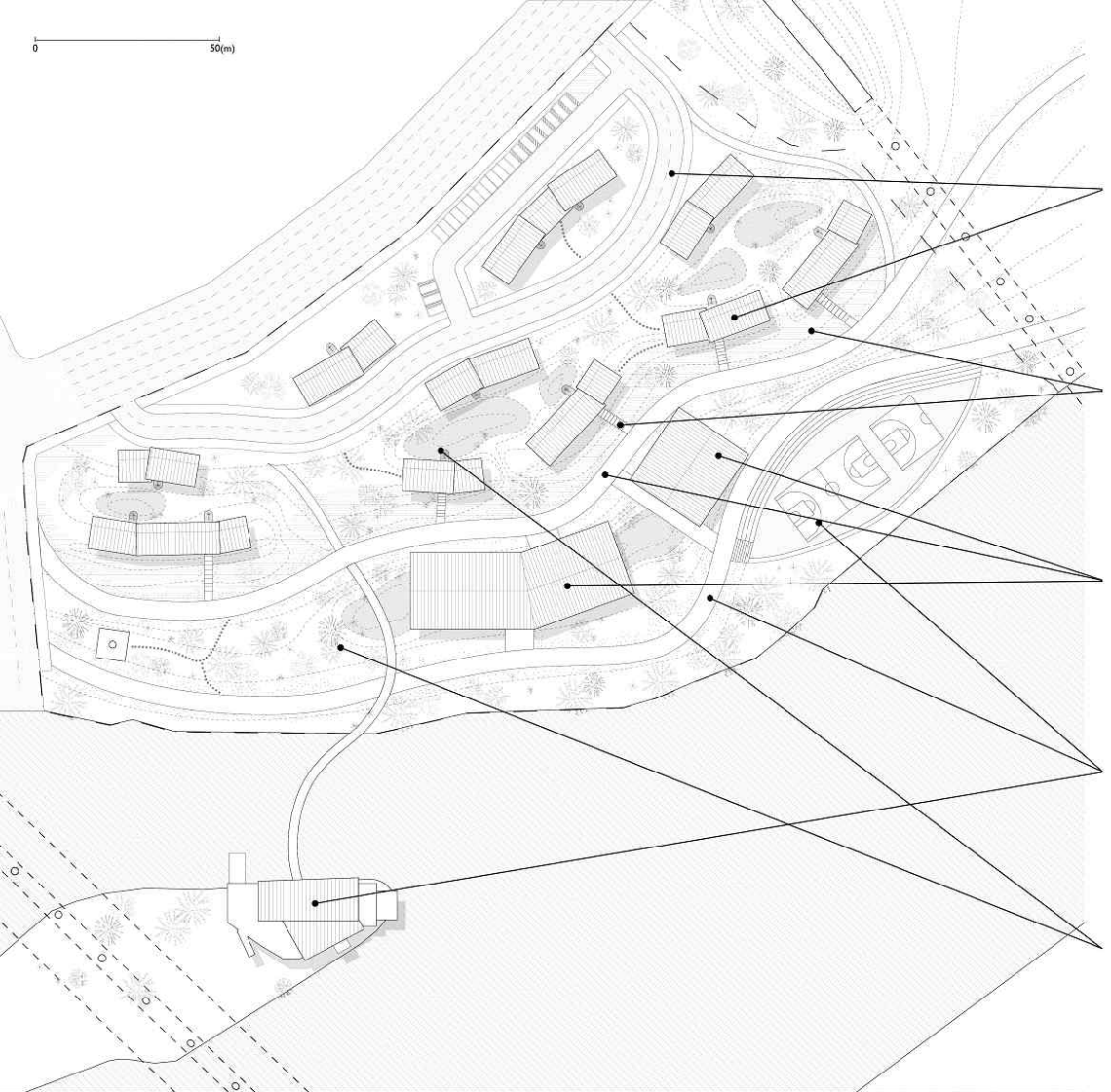
fixed
firm construction, most private structure. foundation for the street for cars and accommodation buildings

stabilized
structured ground, natural stones piled up with vegetation growing on top. a barrier from public ground to private ground

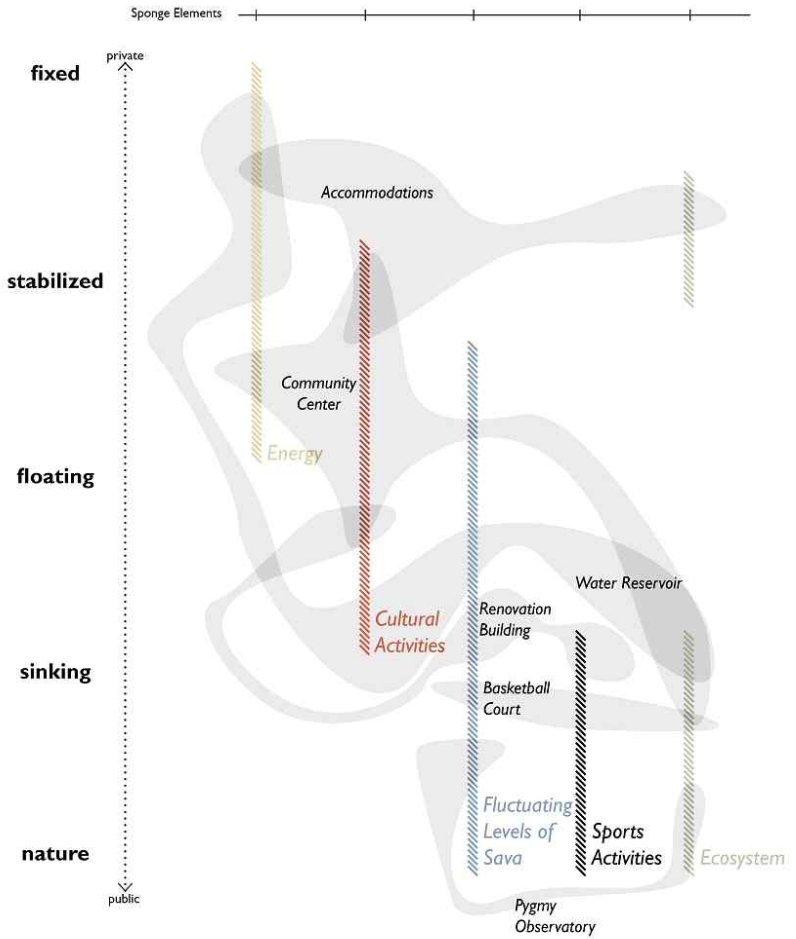
floating
floating structure placed on public ground. streets and the community center is used all year round

sinking
ground that is seasonally flooded. street used seasonally

nature
natural permeable ground, untouched and home to vegetation

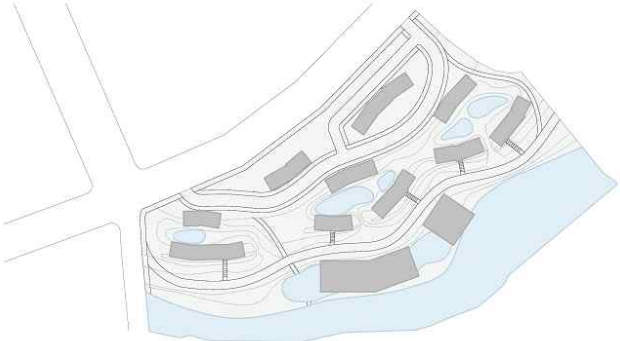


How we Sponge

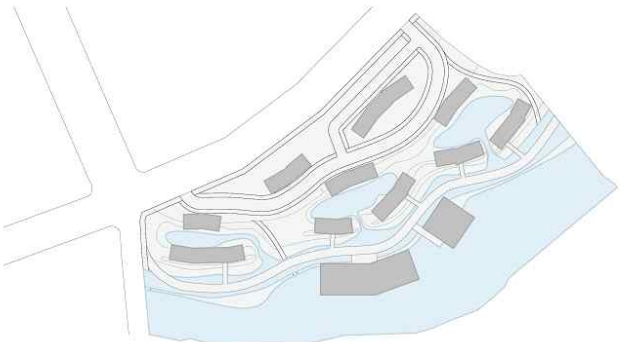


Seasonal Designs

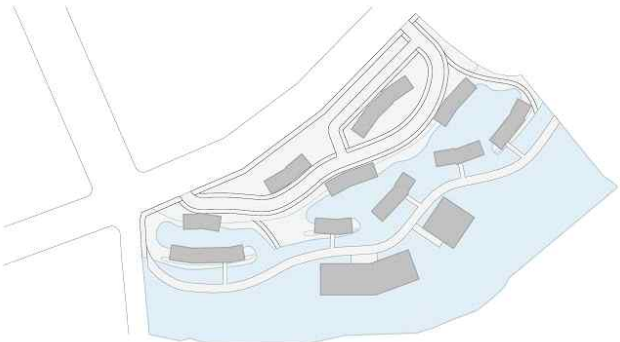
usual days
fluctuation of the river is minimum.
no floods and floating events.



September to December
floods due to rainy seasons.
floating events may happen for the community center.
sinking events may happen for the streets.



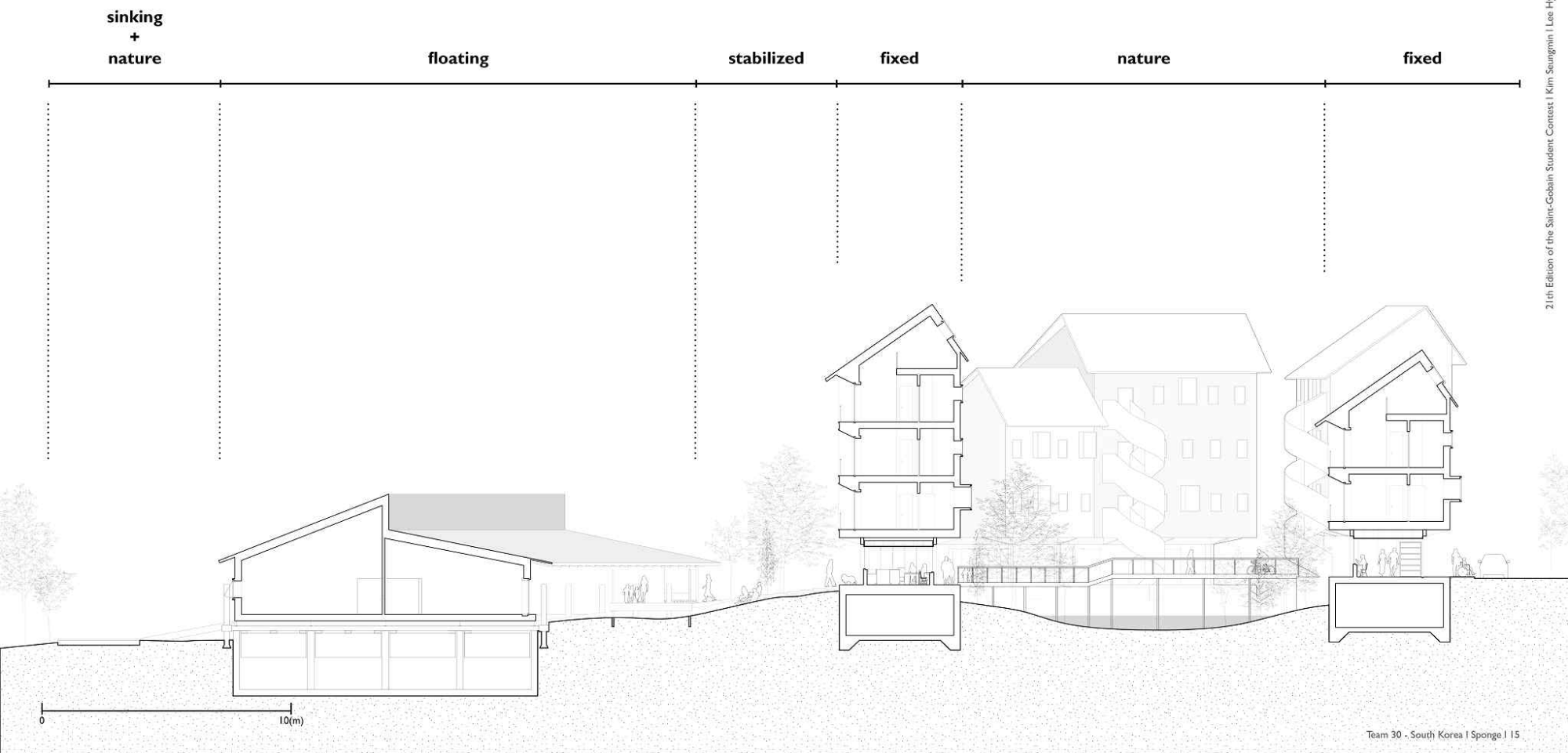
April to June
floods due to rainy seasons and melting snows.
floating events happen for the community center and streets.
sinking events happen for streets.



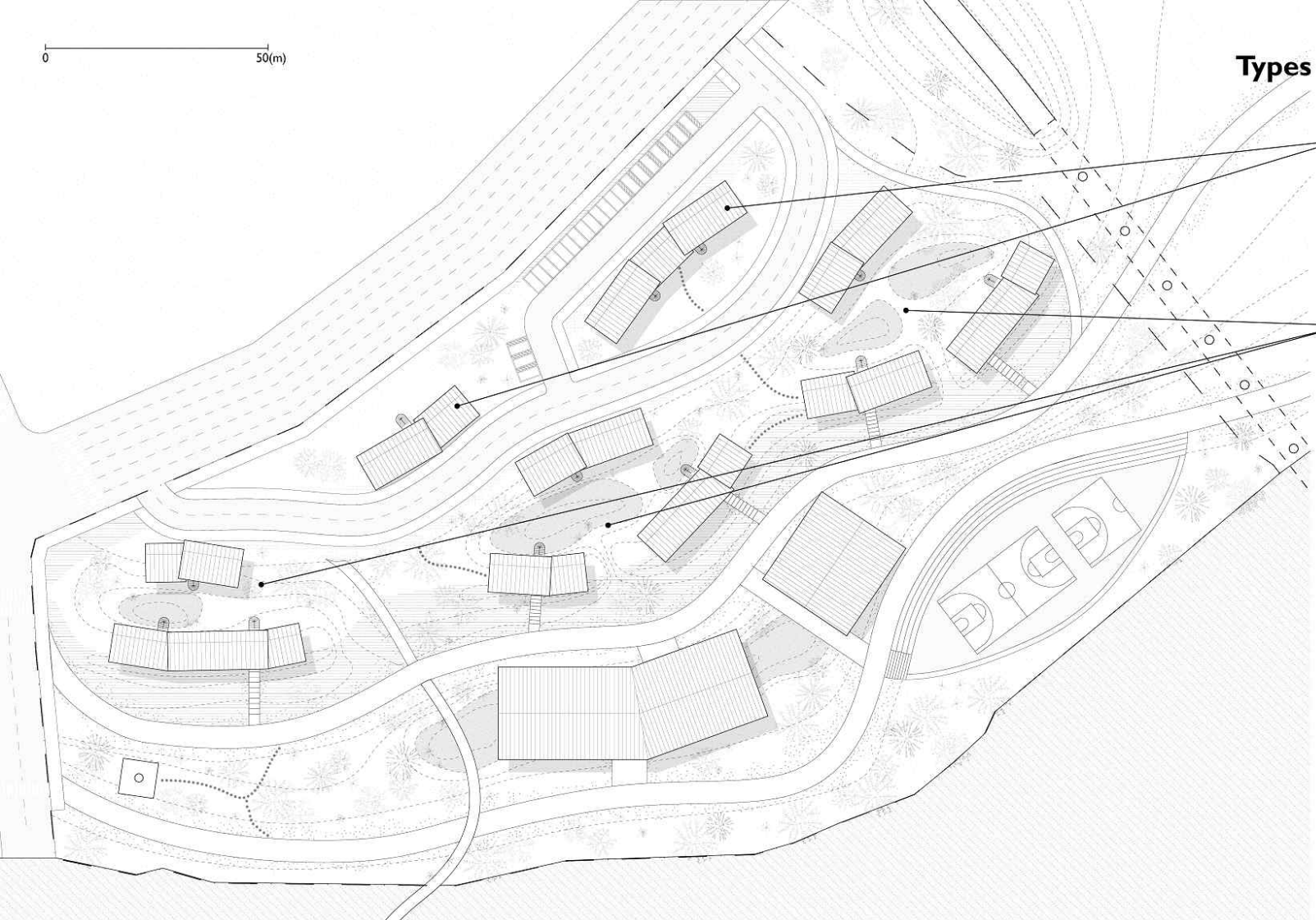
Maximum Water Level
major flood events.
floating events happen for the community center and streets.
sinking events happen for streets.
ground level of accommodation buildings are still safe.

New Construction

Site Design Strategies



The most protected.



Types of Accommodations

Accessible Accommocations

Placed at the most private, protected area of the site.

Easy accessibility by cars.

Cluster of Accommodations

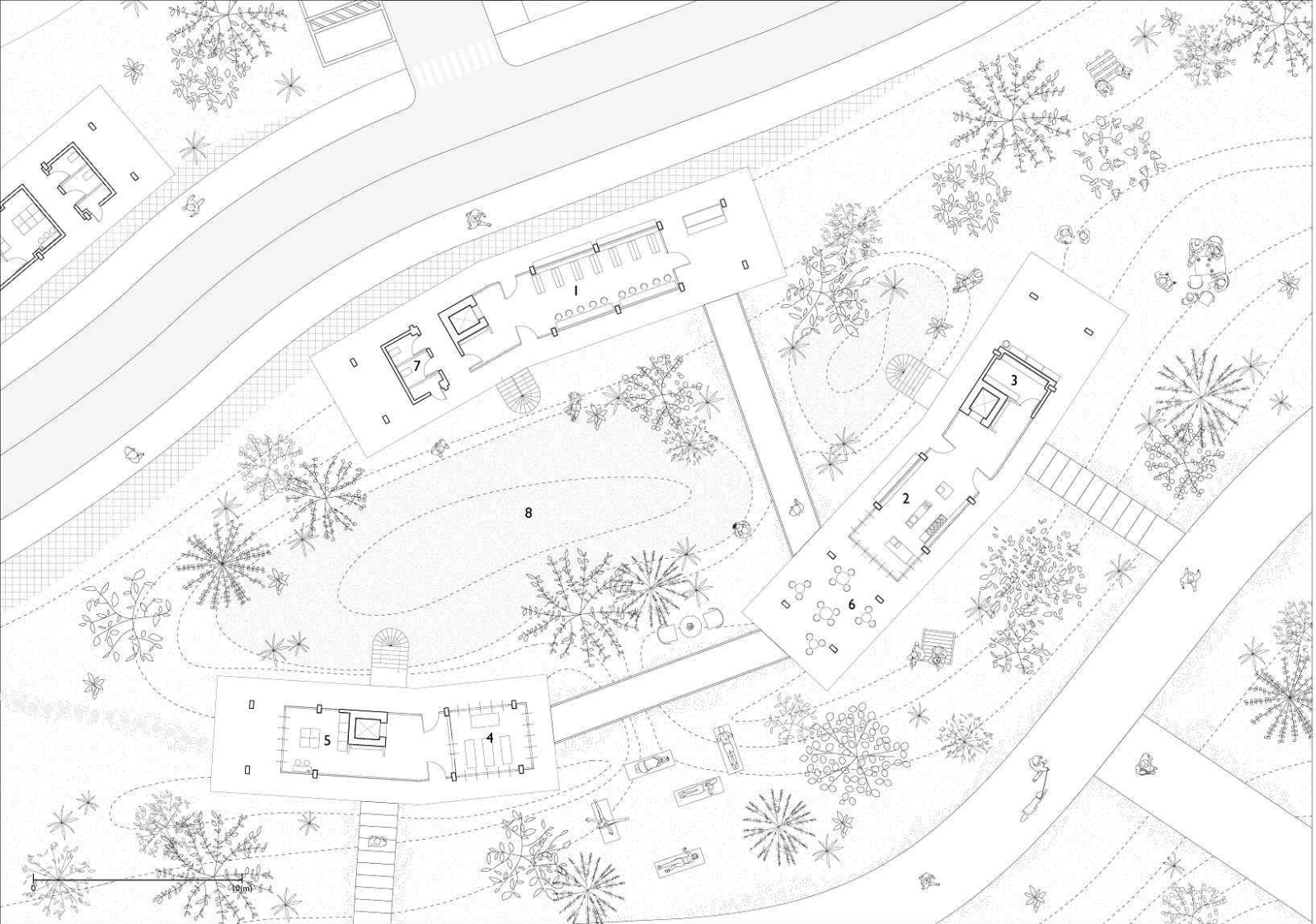
A resovoir, surround by accommodations is the basic formula.

Accommodations interact more with the river, and draws energy from the water by using heat pumps.

A natural environment for pygmies and native species is created in the middle of the clusters.

Connection between Ground Levels

Connection between Ground Levels

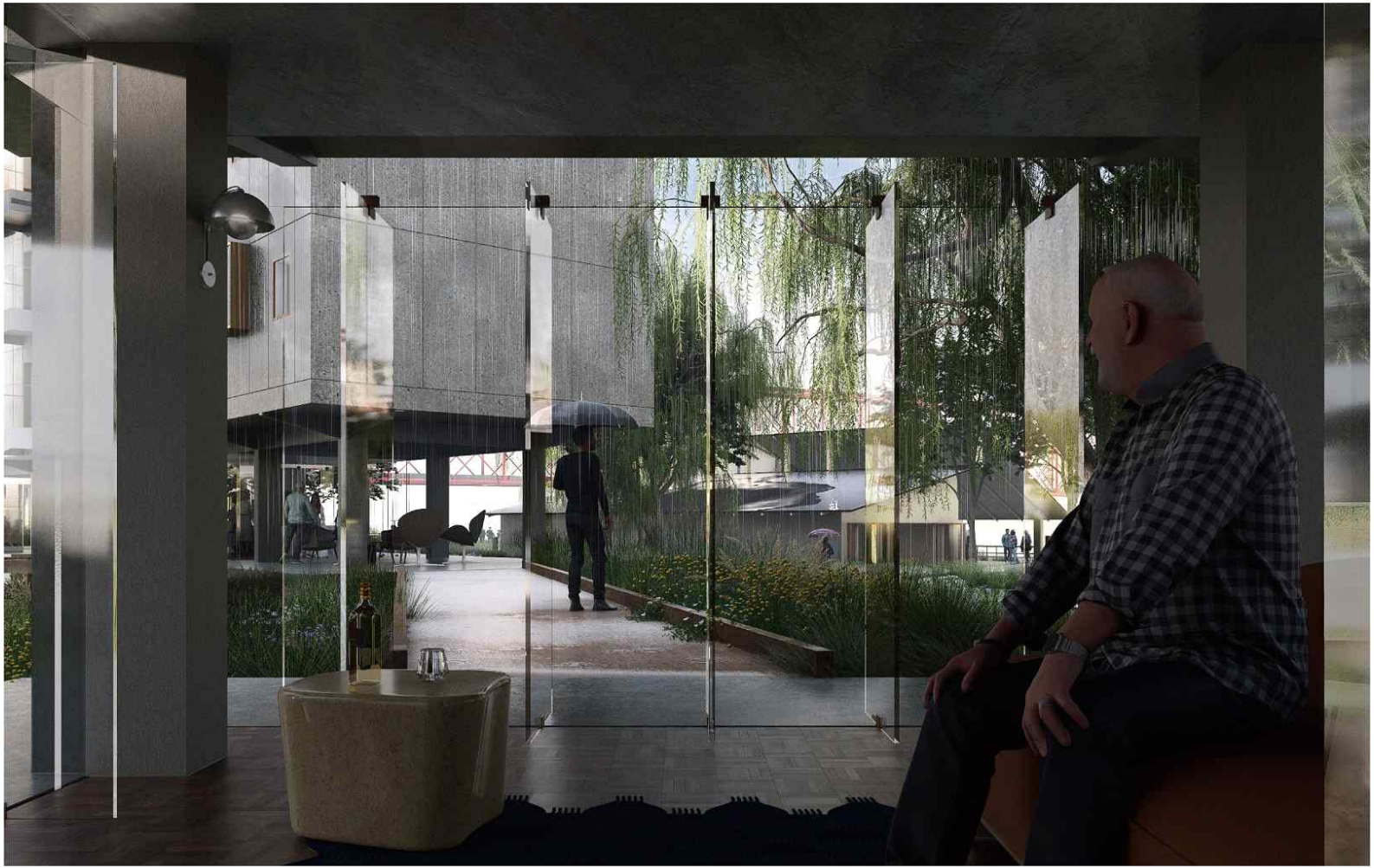


Ground floor plan

1. Student Lounge
2. Shared Kitchen
3. Post Office
4. Small Hall
5. Laundry
6. Outdoor Tables
7. W.C
8. Retension Basin

0 10(m)

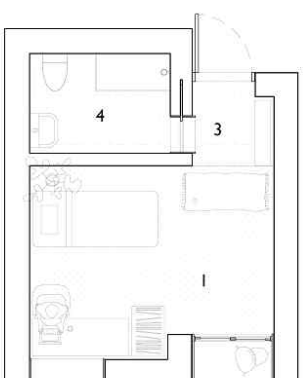
Connection between Ground Levels



About the living area

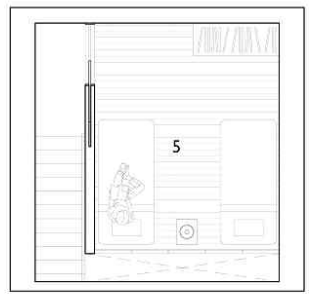
Unit Types

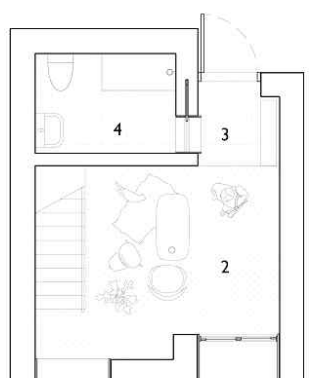
single unit
62 units



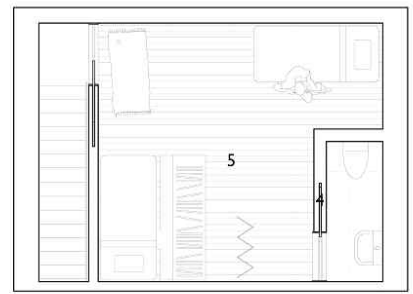
double unit
40 units

single unit. accessible room
6 units



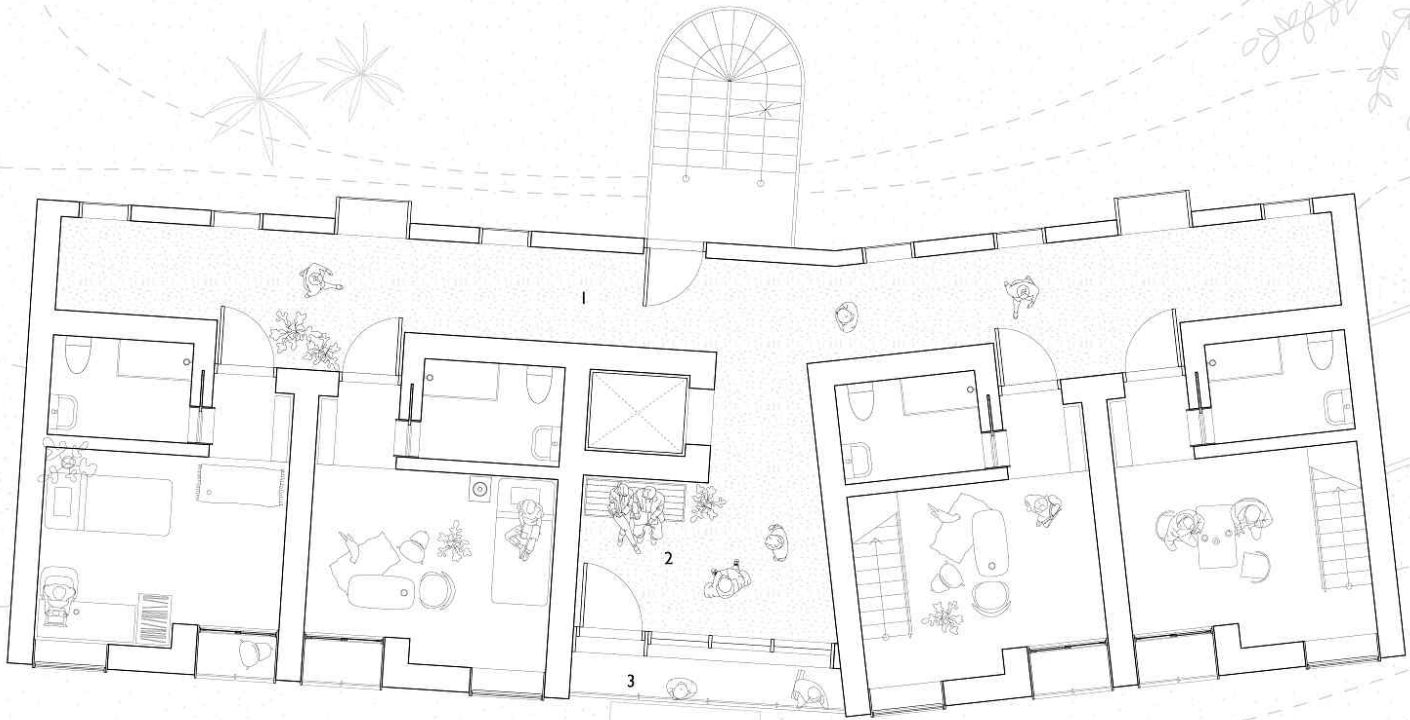


double unit. accessible room
8 units



1. Living+Bedroom
2. Living room
3. Porch
4. W.C
5. Bedroom

Unit Composition of one Building



0 5 (m)

1. Hallway
2. Common Lounge
3. Terrace

Unit Composition of one Cluster

First floor plan

1. Units
2. Common Lounge

Unit Composition of one Cluster

Second floor plan

1. Units
2. Common Lounge

Unit Composition of one Cluster

Third floor plan

1. Units

Composition of one Cluster

0 10(m)

Heating and Cooling

0 10(m)

summer solstice 68.7°

winter solstice 21.7°

Solar PV
Solar PV serves as the primary energy source, directly powering both the heat pump and everyday electrical loads during daylight hours. A roof pitch of 33° directly matches Serbia's optimal solar angle, achieving a performance coefficient of 1.0 and maximizing annual PV generation with no efficiency loss. This alignment is especially advantageous in winter, when the lower sun elevation is met at the most favorable angle, compensating for reduced daylight hours during the period of highest heating demand.

Inverter
During daylight hours, PV panels directly power both the heat pump and the building's everyday electrical loads — lighting, personal devices, and shared appliances. Surplus generation is stored in the battery for use during evening and nighttime hours when PV output is unavailable. On an annual average basis, the PV system generates sufficient electricity to cover the combined demand of the heat pump and daily living loads.

Radient Cooling System
During summer, chilled water circulates through pipes embedded in the floor or ceiling surfaces, absorbing heat from the interior by radiation and convection. The extracted heat is then transferred to the reservoir via a heat pump connected to submerged collectors, using the reservoir's stable cool temperature as a natural heat sink.

Stores surplus daytime PV electricity for use at night or during overcast conditions, reducing grid dependency during evening peak hours.

BMS(Battery Management System)
Prevents overcharge, over-discharge, and overheating, and coordinates with the inverter to control charging cycles.

Battery

Buffer Tank

Plate heat exhanger

Heat pump(lake collectors)
In the summer, it rejects heat into the reservoir and returns as chilled water, keeping the indoor air cool.

Summer

Inverter
During winter, when solar irradiance drops and heating demand rises, the public grid supplements the deficit. The operational hierarchy is clear: PV as the main source, battery as the short-term buffer, and the grid as the seasonal backup.

Radient Heating System
During winter, the system operates in reverse. The heat pump draws low-grade thermal energy stored in the reservoir and upgrades it through the refrigeration cycle, delivering warm water through the same embedded pipe network to gently heat the interior spaces.

Plate heat exhanger
Transfers thermal energy between the heat pump circuit and the reservoir water without direct fluid mixing, maintaining system efficiency and preventing contamination between the two loops.

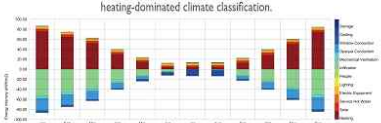
Battery

Buffer Tank

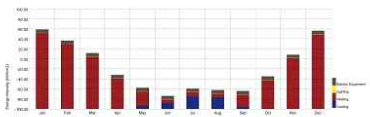
Heat pump(lake collectors)
return temperature is around 5-6 degrees higher than ground sourcees with little ground works in comparison with horizontal ground collectors

Winter

The monthly energy balance was simulated using Honeybee with the thermal zone defined under the ASHRAE 2019 MidriseApartment, Apartment program type and Climate Zone 5,Mass construction set, reflecting Serbia's heating-dominated climate classification.



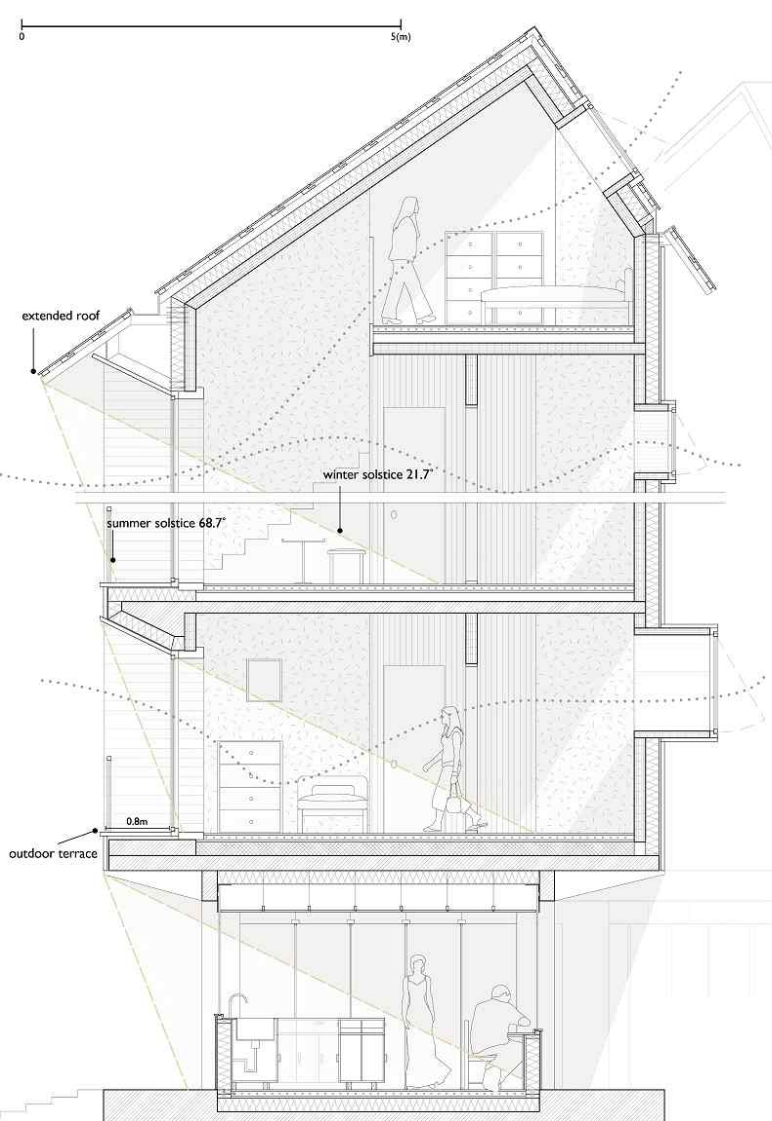
Results confirm a heating-dominated profile peaking at ~80 kWh/m² in January, with infiltration and envelope conduction as the dominant heat loss drivers — directly informing the airtightness and thermal bridge control strategy at the ground-to-CLT transition.



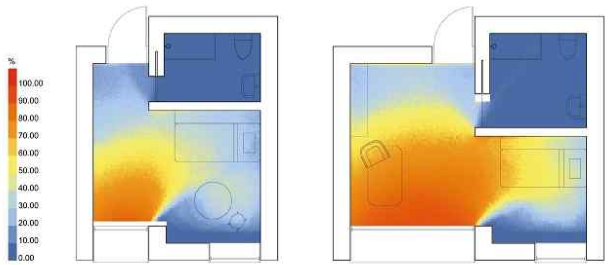
High heating demand : 42,000 kWh/year
Heat pump electricity demand : 24,200 kWh/year
(heating + cooling + hot water)
Daily living electricity demand : 10,800 kWh/year
(lighting, appliances, ventilation)
Total electricity demand : 35,000 kWh/year

Solar PV energy production : 41,700 kWh/year

Daylight



Annual daylight performance was simulated using Honeybee (v1.9) with a Radiance-based grid sensor array across all occupied areas.

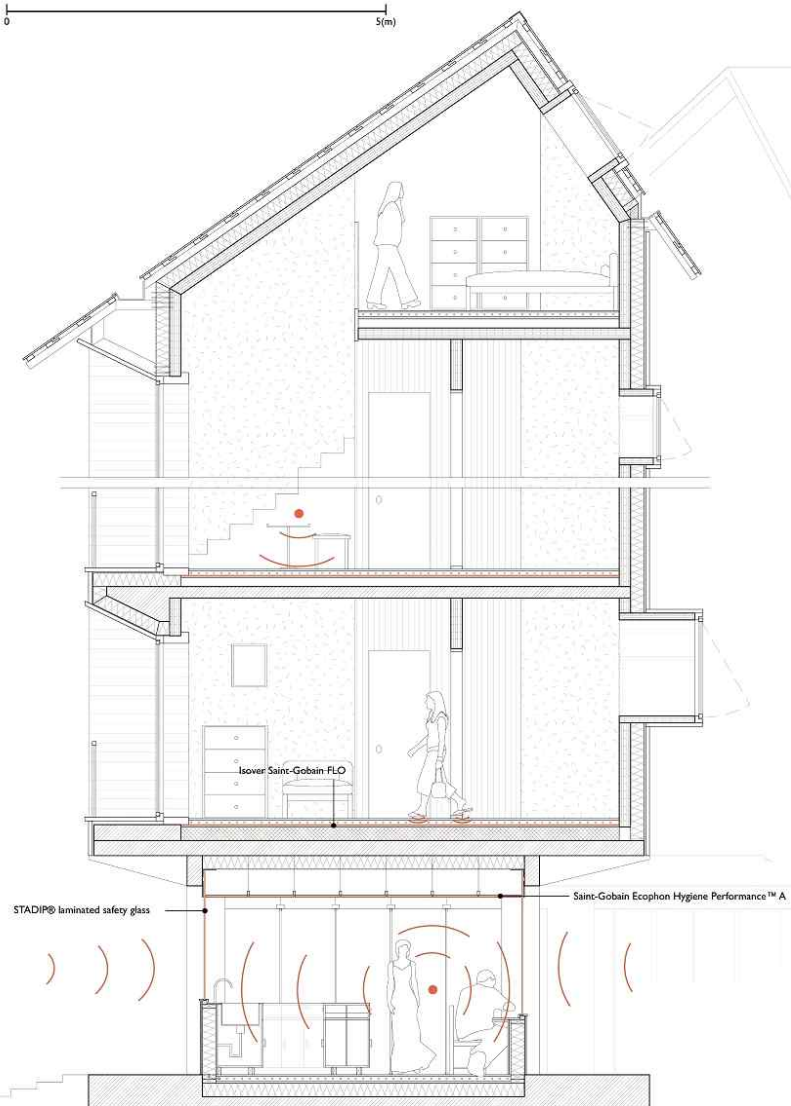


Winter solstice sun penetration depth : 6.1 m
Summer solstice sun penetration depth : 0.67 m
Spatial average DA (300 lux) : 54.1%
Spatial average UDI (100–2000 lux,) : 70.2%

These results are grounded in the sectional depth strategy. At winter solstice (21.7°), direct sunlight clears the 0.9m outdoor terrace edge and penetrates 6.1m into the living space — effectively reaching the full room depth and contributing to passive solar heating during the peak demand season. At summer solstice (68.7°), the 0.6m roof overhang limits direct sun penetration to just 0.67m from the facade, reducing unwanted solar gain to approximately 11% of the winter condition. This geometrically calibrated section, rather than simply maximizing glazing area, produces the measured balance between daylight autonomy and thermal comfort throughout the year.

Accoustic Comfort

In an athlete dormitory, acoustic comfort is essential to recover, focus, and rest. The project integrates acoustic solutions layered across floor, facade, and ceiling.



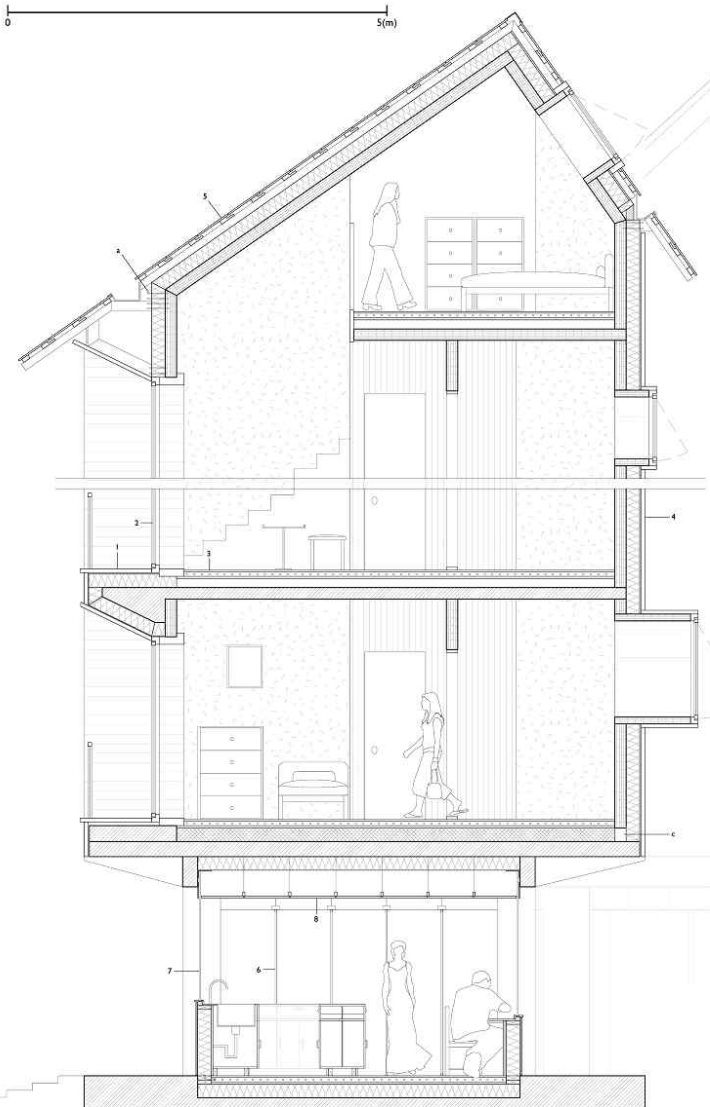
STADIP® 44.2 laminated safety glass :
Sound reduction index : Rw ≈ 43 dB (combined IGU)
EN ISO 12543 compliant

Saint-Gobain Ecophon Hygiene Performance™ A :
Sound absorption coefficient : αw = 0.90 (Class A)
Humidity resistance : up to RH 95%

Isover Saint-Gobain FLO 30 :
Impact sound improvement : ΔLw ≈ 28 dB
Dynamic stiffness : s' ≤ 10 MN/m³

Athlete housing demands a heightened sensitivity to impact noise. Competing athletes follow divergent training schedules — early risers and late returners sharing the same floor plate — making inter-floor sound transmission a direct threat to rest and recovery. The **Isover FLO 30** floating floor decouples the finish floor from the structural slab, delivering ΔLw ≈ 28 dB where the **human cost of noise is highest.** The concrete ground floor and shared kitchen create an inherently humid environment. With humidity resistance up to RH 95%, **Ecophon Hygiene Performance™ A delivers Class A sound absorption without compromising durability.** The ground floor's fully glazed facade maximizes openness but also acoustic exposure. **STADIP® 44.2** maintains visual transparency while reducing external noise to Rw ≈ 43 dB, keeping **shared spaces acoustically protected without sacrificing openness.**

Detail Section



1.

1. Dark-stained thermally modified timber window frame
2. Slope-forming polymer-modified cement screed
3. Saint-Gobain Weber Bituver waterproofing membrane system
4. Isover Flora hydrophilic stone wool vegetation roof substrate board
5. Reinforced concrete slab (C30/37) with 40% recycled aggregate

2.

Insulating glazing unit:
6 mm PLANITHERM® XN toughened glass
+ 16 mm argon cavity
+Saint-Gobain PLANICLEAR® 6mm clear float glass
(low-iron soda-lime silicate clear float glass, 6mm, λ = EN 572-2)

3.

1. Engineered timber flooring panels 20 mm (600 x 2400 mm)
2. 60 mm Saint-Gobain Weberfloor® heating screed
3. PE damp-proof membrane 200 micron
4. 30 mm Isover Saint-Gobain FLO 30 rigid glass mineral wool floating floor acoustic insulation board
5. 120 mm Isover Saint-Gobain Forte 12 glass mineral wool friction-fit insulation roll
6. 150 mm reinforced recycled aggregate concrete slab (C30/37)

4.

1. 50 mm expanded cork façade panel adhered with Saint-Gobain Weber® reinforced lime mortar
2. 180 mm Isover Flora hydrophilic stone wool vegetation roof substrate board (hydrophilic mineral fibre board for extensive/semi-intensive green roof systems — balanced hydroaccumulation and drainage, λD = 0.037 W/m·K)
3. 150 mm 5-ply cross-laminated timber structural panel

a.

STS fixing screws — Heco Topix-plus
Ø8 mm × 320 mm stainless steel A2, @ 400 mm centres
fixed through insulation layer into CLT structural wall panel

b.

Perforated soffit panel with Ø10 mm ventilation holes
@ 100 mm centres, stainless steel insect mesh backing

c.

Schöck Isokorb® structural thermal break element

5.

1. Schweizer Solrif® photovoltaic in-roof module system (frameless PV module with Solrif aluminium frame profiles, interlocking double-fold edge system)
2. Solrif® mounting clamp system fixed to 120×30 mm timber mounting battens
3. Ventilated rear cavity formed by vertical timber counter-battens
4. Breathable waterproof sarking membrane compliant with ZVDH / SIA 232/1
5. 180 mm Isover Saint-Gobain Forte 18 glass mineral wool friction-fit insulation roll (high-elasticity glass fibre clamping felt for pitched roof, attic and interior wall thermal insulation—friction-fit between rafters, no mechanical fixing required, λ = 0.034 W/m·K, Euroclass A1)
6. 150 mm 5-ply cross-laminated timber (CLT) structural roof panel

6.

Folding door unit:
Saint-Gobain PLANICLEAR® 4mm clear float glass
+ 1.52 STADIP® laminated safety glass
in thermally broken aluminium sliding frame
+ Saint-Gobain PLANICLEAR® 4mm clear float glass

7.

Insulating glazing unit:
6 mm PLANITHERM® XN toughened glass
+ 16 mm argon cavity
+ 44.2 STADIP® laminated safety glass
in thermally broken aluminium sliding frame
(2300 x 2000 mm)

8.

1. 20mm Saint-Gobain Ecophon Hygiene Performance™ A high-density glass wool acoustic ceiling tile with Akutex™ HS surface
2. 100mm Isover Saint-Gobain Rio Plus Alu 100 aluminium foil-faced glass wool thermal insulation and vapour barrier roll
3. 180 mm reinforced recycled aggregate concrete slab (C30/37)

Planitherm®
Glass that makes a difference

Schweizer

weber
SAINT-GOBAIN

isover
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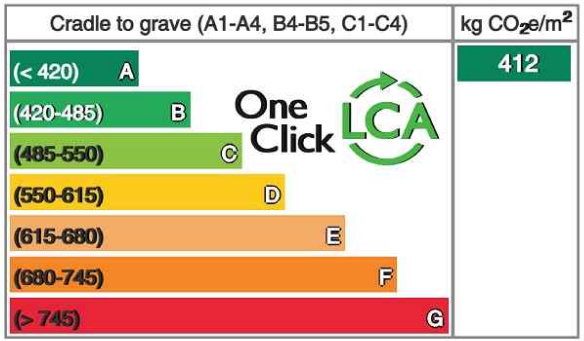
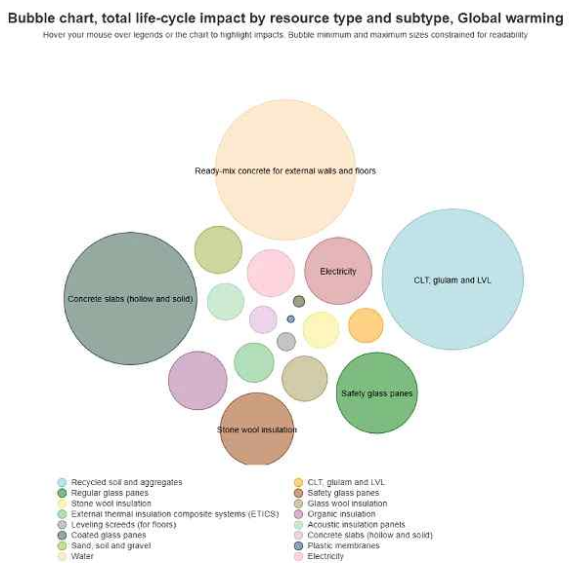
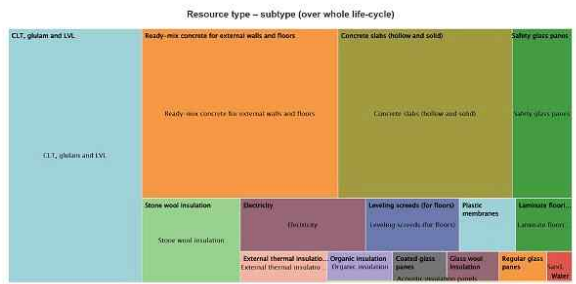
One Click LCA

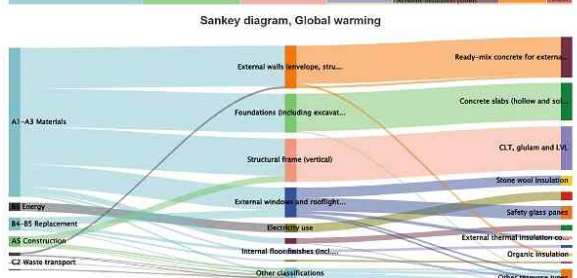


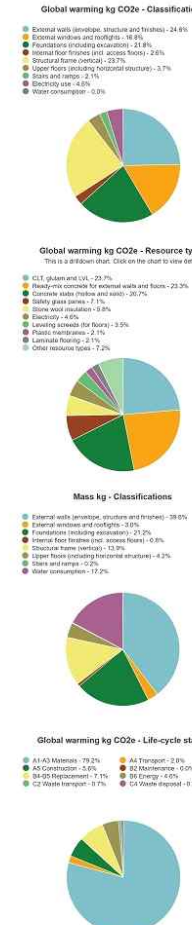
Total emissions : ~525 Tonnes CO2e
Emissions per m² : 412 kg CO2e/m²
Annual carbon intensity : 8.24 kg CO2e/m²/year
Level of emissions : Grade A — below 420 kg CO2e/m² threshold

The cradle-to-grave assessment confirms a Grade A carbon rating at 412 kg CO2e/m², sitting below the 420 threshold through a combination of structural and material decisions. A1-A3 embodied carbon dominates at 79.2% — typical for timber-concrete hybrid structures — with CLT and ready-mix concrete each contributing approximately 23% of total emissions. The use of 40% recycled aggregate concrete across foundations and structural slabs directly reduces the highest-impact material category. At the operational stage, B6 Energy accounts for just 4.6% of total lifecycle carbon — a direct consequence of the rooftop PV system covering annual electricity demand across both the athlete housing and community center. B4-B5 replacement at 7.1% is driven primarily by glazing replacement cycles, an expected cost of the high-performance facade strategy over a 50-year lifespan.









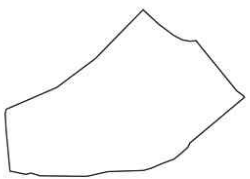
Reservoir surrounded by Accommodations

Water Cycle

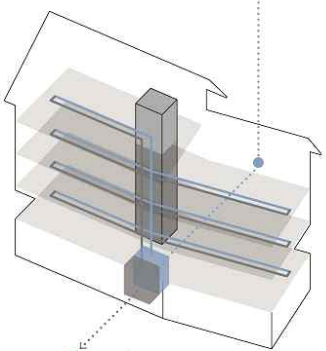
Municipal Water Supply

Београдски водовод и канализација

PUC Belgrade Waterworks and Sewerage

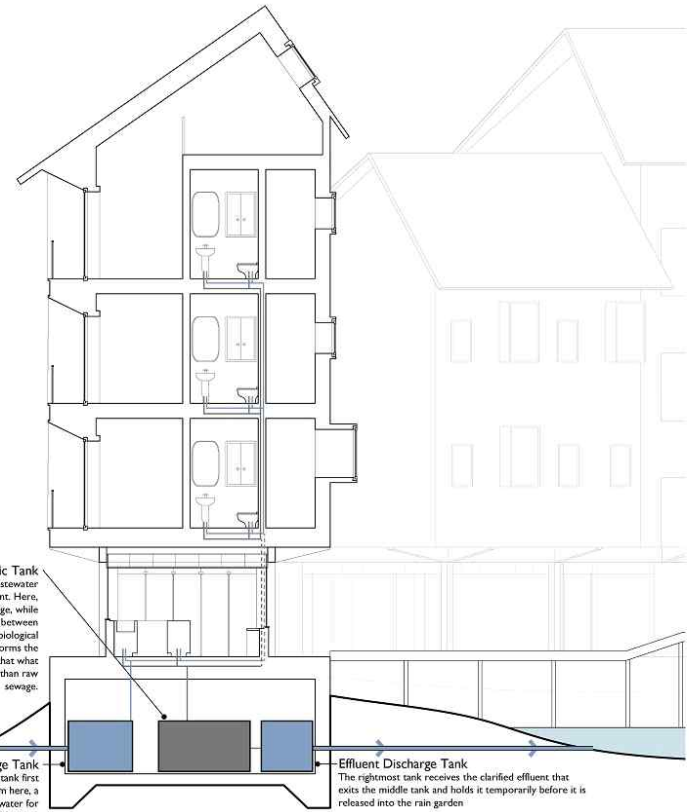


our site



sava river

Domestic Water System



Septic Tank
Once water is used throughout the building, it exits as wastewater and flows down into the middle tank for initial treatment. Here, heavier solids sink to the bottom and accumulate as sludge, while lighter materials float to the surface. The remaining liquid in between — called effluent — undergoes a degree of anaerobic biological breakdown before moving on. This tank essentially performs the first stage of filtration, separating solids from liquid so that what passes forward is partially clarified wastewater rather than raw sewage.

Underground Water Storage Tank
Municipal water, already treated and pressurized by the city, enters this tank first and is stored before being redistributed throughout the building. From here, a pump drives the water upward to supply each floor with potable water for drinking, washing, and bathing.

Effluent Discharge Tank
The rightmost tank receives the clarified effluent that exits the middle tank and holds it temporarily before it is released into the rain garden

This effluent is discharged into the on-site reservoir, where plants and soil bacteria absorb the remaining pollutants and clean the water naturally. From the reservoir, the treated water flows into the rain garden at the edge of the dormitory cluster, where its final journey across the site begins. Rather than relying on mechanical treatment, the rest of the process is driven entirely by the shape of the land. The natural slope of the site carries the water downhill through layer after layer of planted ground — each one filtering it a little further — until it reaches the Sava River in a condition far cleaner than when it left the building. The landscape itself becomes the treatment system, closing the water cycle between the city, the site, and the river.

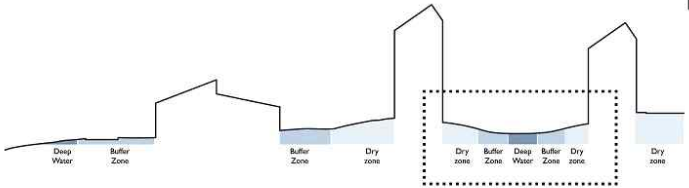
Ecosystem of the Wetland

0 10(m)

Vegetation Classification

Zone	Levels	Hydrological Condition	Vegetation Classification
Deep Water :	from ground level to +1 m	Constant Saturation	Phragmites australis, Typha latifolia, Schoenoplectus lacustris, Sparganium erectum
Buffer Zone :	from +1m to +1.5m	Fluctuating	Iris pseudacorus, Iris sibirica, Carex acutiformis, Lythrum salicaria, Alisma plantago-aquatica
Dry zone :	from +1.5m	Bank/Dry to Moist	Salix alba, Alnus glutinosa, Cornus sanguinea, Viburnum opulus, Calamagrostis epigejos

Zoning of the whole site




Common reed
Phragmites australis


Broadleaf cattail
Typha latifolia


Lakeshore bulrush
Schoenoplectus lacustris


Branched bur-reed
Sparganium erectum


Yellow flag iris
Iris pseudacorus


Siberian iris
Iris sibirica


Lesser pond sedge
Carex acutiformis


Purple loosestrife
Lythrum salicaria


Common water-plantain
Alisma plantago-aquatica


White willow
Salix alba


Black alder
Alnus glutinosa


Bloodtwig dogwood
Cornus sanguinea


Guelder rose
Viburnum opulus


Wood small-reed
Calamagrostis epigejos


Pygmy
Polihierax semitorquatus

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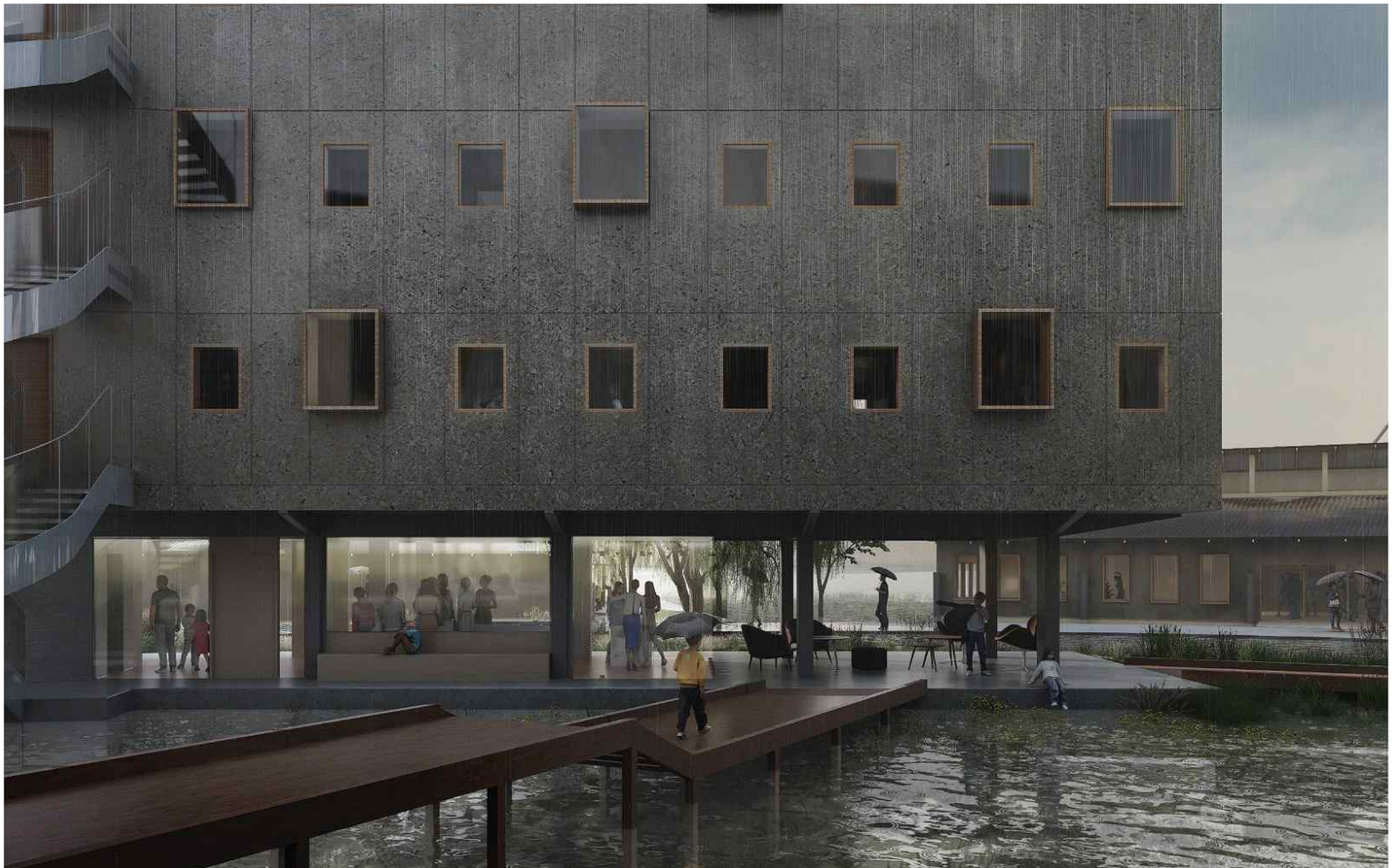
usual days

September to December



Maximum Water Level

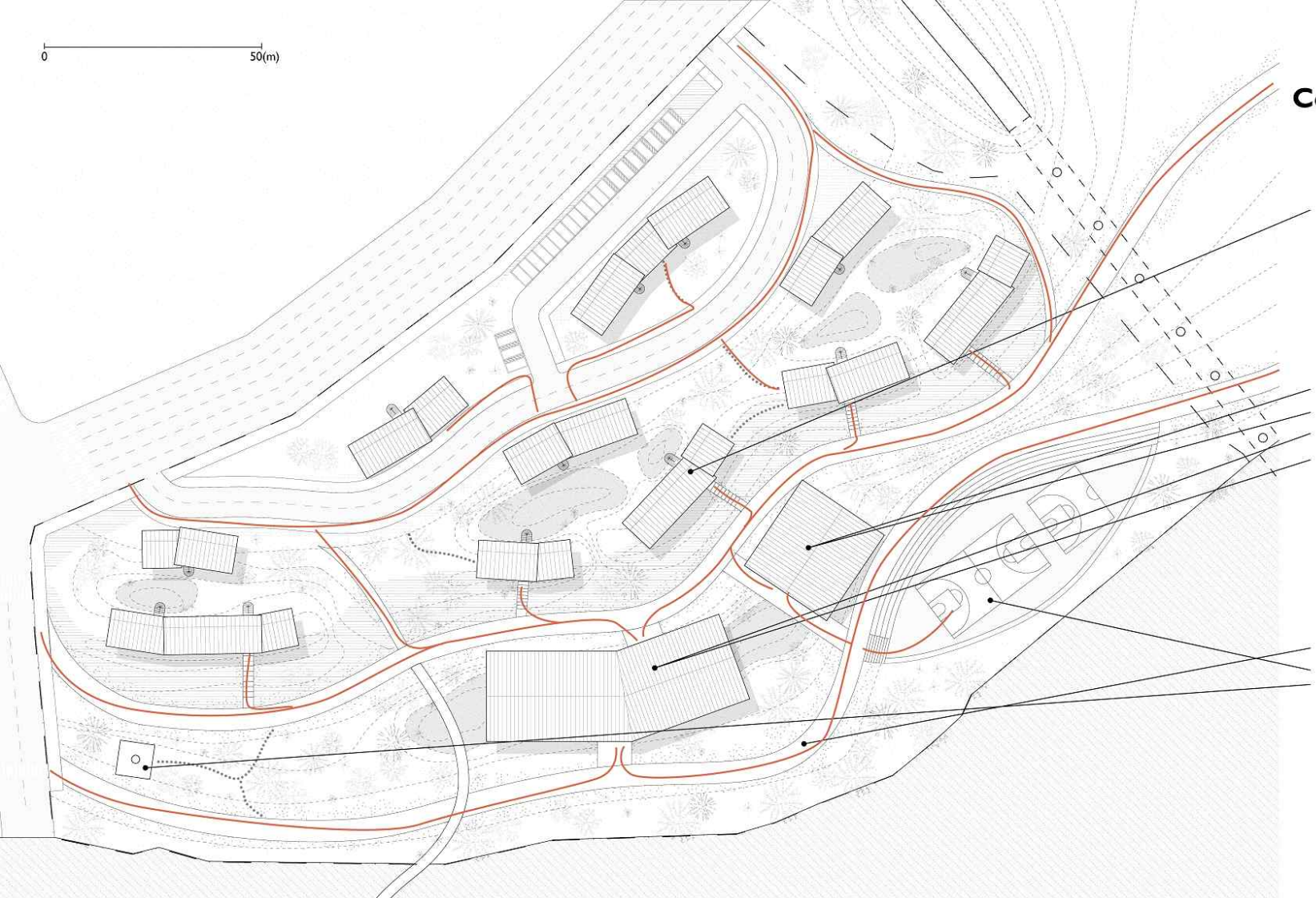
usual days

September to December

April to June

Maximum Water Level

Floating with Sava.



A Floating Community Center as a connection

accommodations

for athletes.
fixed and stabilized ground.

shared kitchen
cafeteria
gym
recovery room

for athletes and visitors.
floating structure.

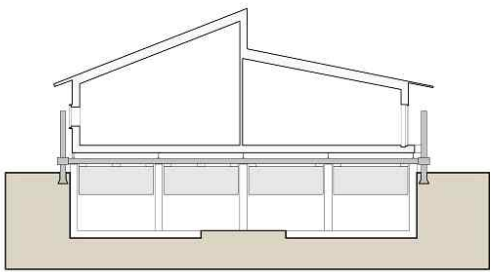
river bank of sava river
basketball court
pygmy observatory

for athletes and visitors.
sinking ground.

A Floating Community Center as a connection

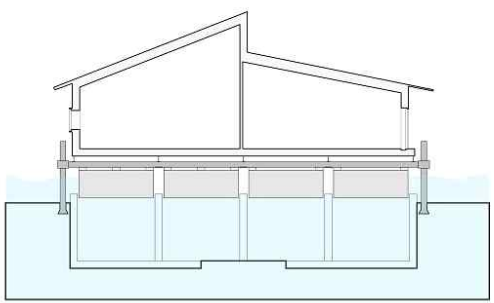
Amphibious Architecture / Bouyant Foundation

Mechanism of a Bouyant Foundation



Original State

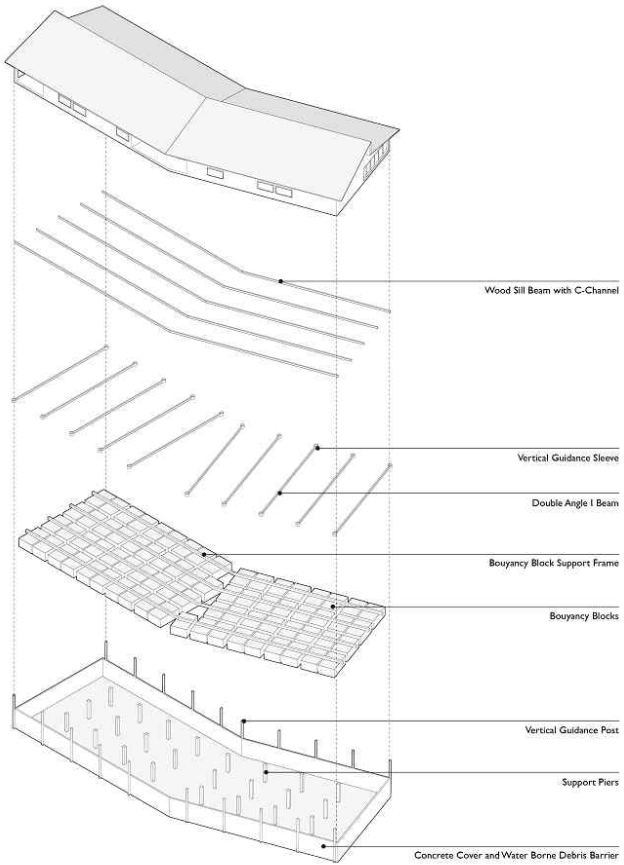
Vertical Guidance systems are fixed on the ground., as well as the buoyancy system.



Flooded State

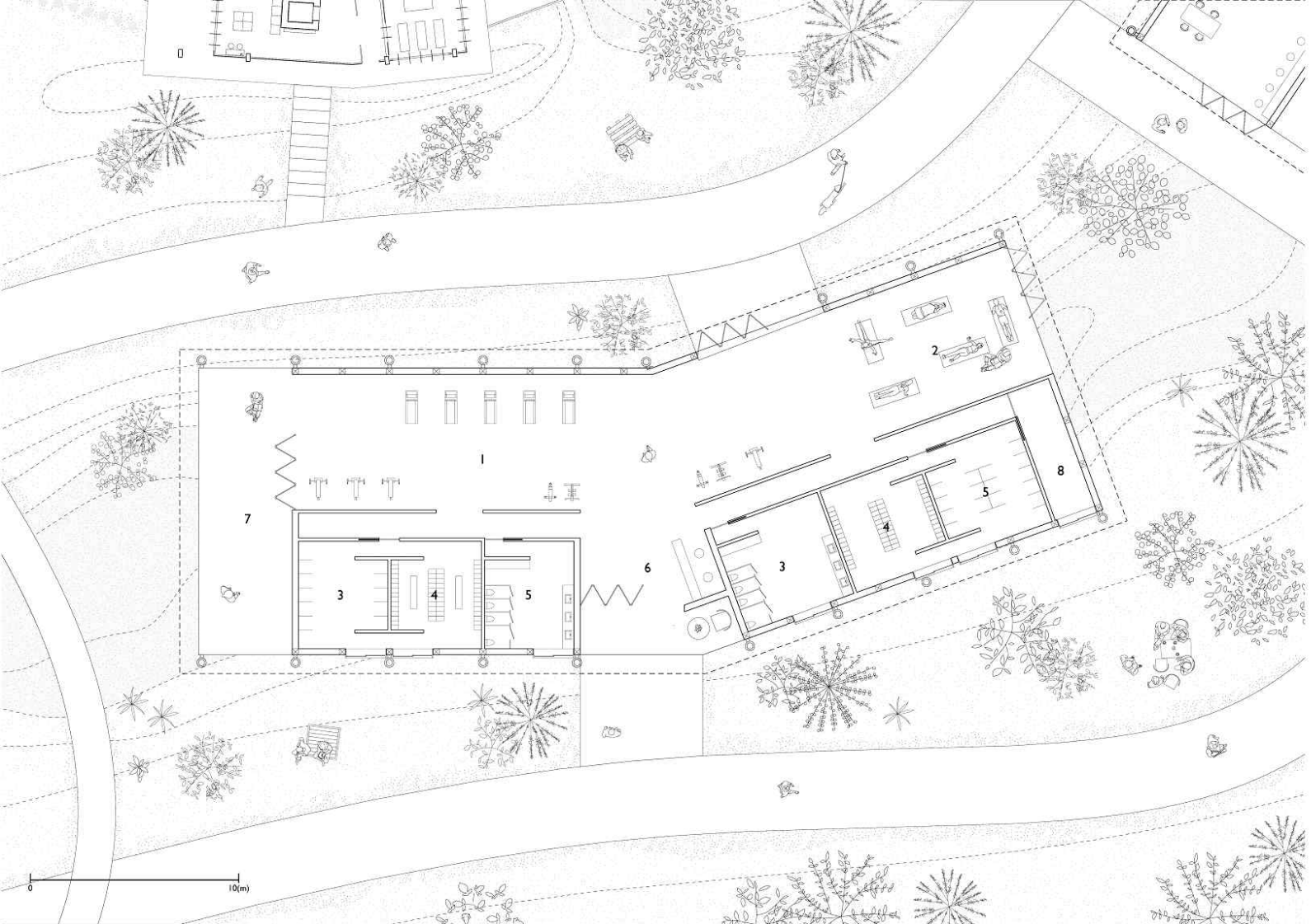
The structure is pushed upwards as the water leverl rises. The building rises alonf the vertical guided posts

Bouyant Foundation Components



The Amphibious Architecture allows buildings to adapt to harsh flooding climates. Through this system, buildings are able to kept unharmed and expand their life cycle.

Floating
Gym and Recovery



Ground floor plan

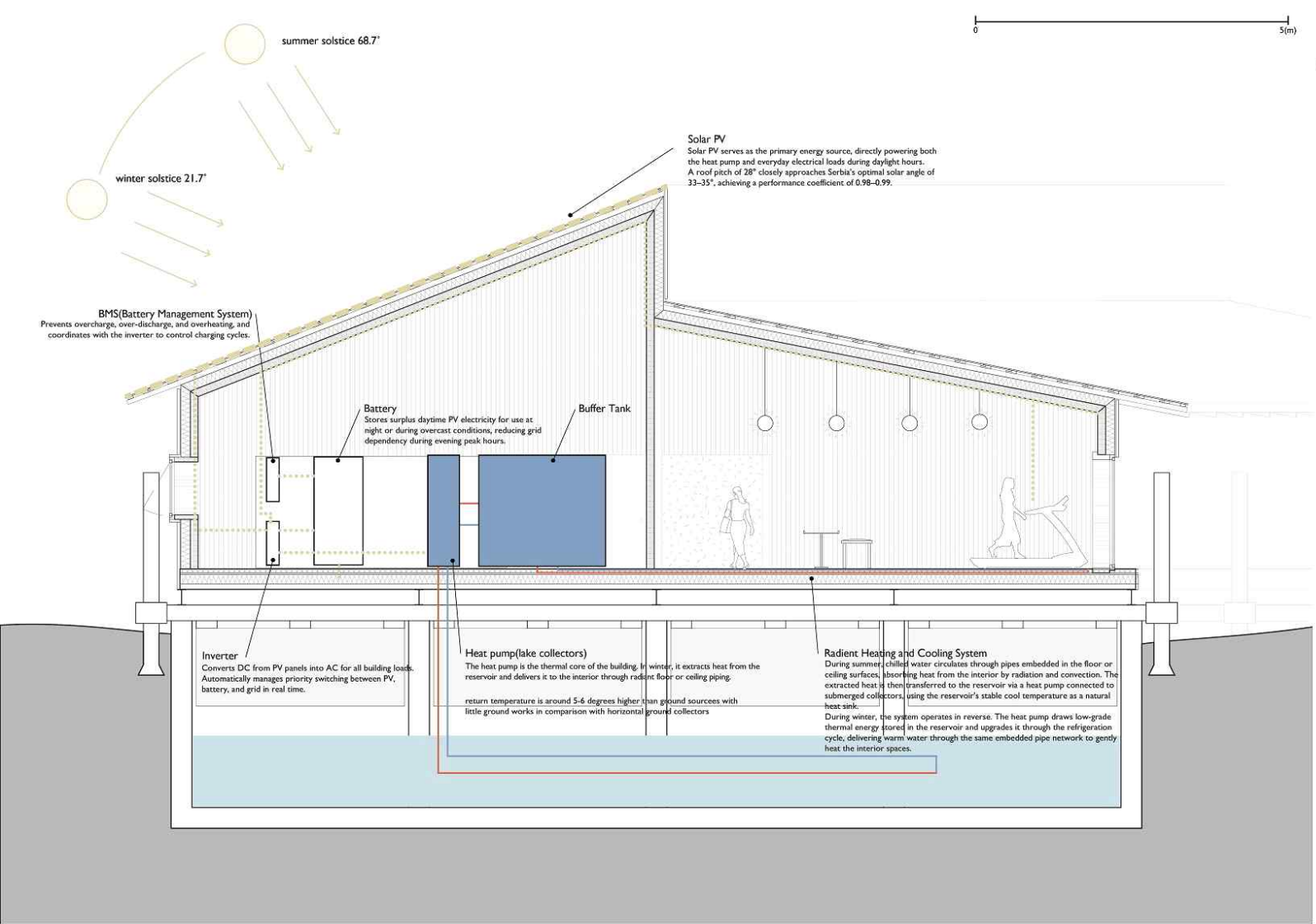
1. Gym
2. Recovery Area
3. Shower Room
4. Locker Room
5. W.C.
6. Reception
7. Common Area
8. Boiler Room

Floating
Kitchen and Common Spaces

Ground floor plan

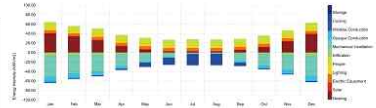
1. Shared Kitchen
2. W.C
3. Common Area
4. Cafeteria

Cooling and Heating



Results confirm a heating-dominated profile peaking at ~40 kWh/m² in January, partially offset by high internal gains from occupants and gym equipment. A lake-source heat pump (COP 3.0), powered by rooftop PV, addresses the remaining demand. Over 924 m², total heat pump electricity reaches 44,660 kWh, with daily living loads adding 27,720 kWh for a combined demand of 72,380 kWh. A 100 kWp system occupying 500 m² of the south-facing roof produces 127,652 kWh annually, fully covering demand with surplus fed back to grid.

The monthly energy balance was simulated using Honeybee with the thermal zone defined under the ASHRAE 2019 Small Hotel, Exercise program type and Climate Zone 5, Mass construction set, reflecting Serbia's heating-dominated climate classification.



High cooling demand : 32,340 kWh/year
High heating demand : 73,920 kWh/year
Heat pump electricity demand : 44,660 kWh/year
(heating + cooling + hot water)
Daily living electricity demand : 27,720 kWh/year
(lighting, appliances, ventilation)
Total electricity demand : 72,380 kWh/year

Solar PV energy production : 127,652 kWh/year

0 5(m)

1.

1. Schweizer Solrif® photovoltaic in-roof module system (frameless PV module with Solrif aluminium frame profiles, interlocking double-fold edge system)
2. Solrif® mounting clamp system fixed to 120×30 mm timber mounting battens
3. Ventilated rear cavity formed by vertical timber counter-battens
4. Breathable waterproof sarking membrane compliant with ZVDH / SIA 232/1
5. 180 mm Isover Saint-Gobain Forte 18 glass mineral wool friction-fit insulation roll (high-elasticity glass fibre clamping felt for pitched roof, attic and interior wall thermal insulation—friction-fit between rafters, no mechanical fixing required, λ = 0.034 W/m·K, Euroclass A1)
6. 150 mm 5-ply cross-laminated timber (CLT) structural roof panel

2.

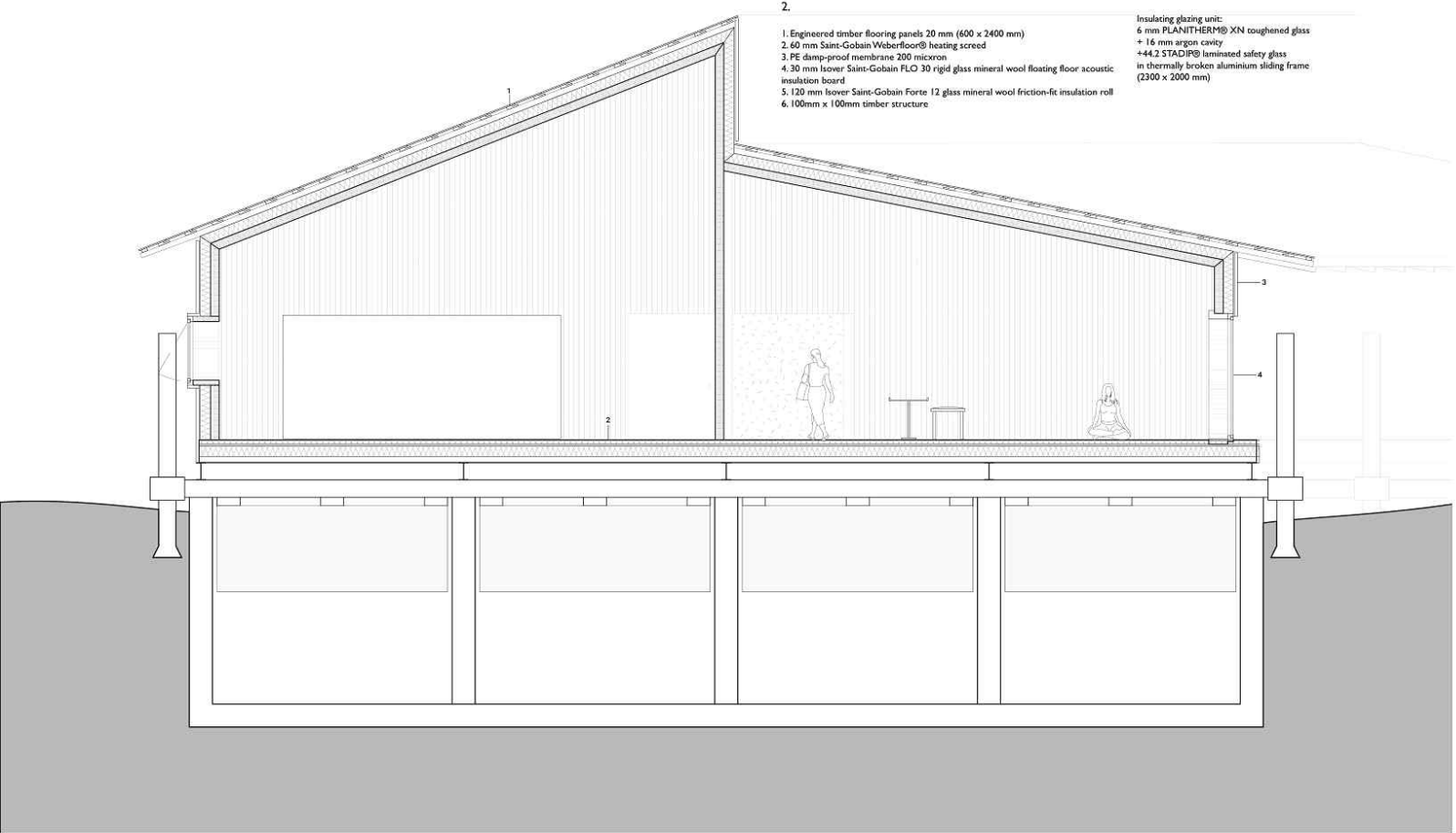
1. Engineered timber flooring panels 20 mm (600 x 2400 mm)
2. 60 mm Saint-Gobain Weberfloor® heating screed
3. PE damp-proof membrane 200 micxron
4. 30 mm Isover Saint-Gobain FLO 30 rigid glass mineral wool floating floor acoustic insulation board
5. 120 mm Isover Saint-Gobain Forte 12 glass mineral wool friction-fit insulation roll
6. 100mm x 100mm timber structure

3.

1. 50 mm expanded cork façade panel adhered with Saint-Gobain Weber® reinforced lime mortar
2. 180 mm Isover Flora hydrophilic stone wool vegetation roof substrate board
(hydrophilic mineral fibre board for extensive/semi-intensive green roof systems
— balanced hydroaccumulation and drainage, λD = 0.037 W/m·K)
3. 150 mm 5-ply cross-laminated timber structural panel

4.

Insulating glazing unit:
6 mm PLANITHERM® XN toughened glass
+ 16 mm argon cavity
+44.2 STADIP® laminated safety glass
in thermally broken aluminium sliding frame
(2300 x 2000 mm)



Planitherm®
Glass that makes a difference

Schweizer

weber
SAINT-GOBAIN

ISOVER
SAINT-GOBAIN

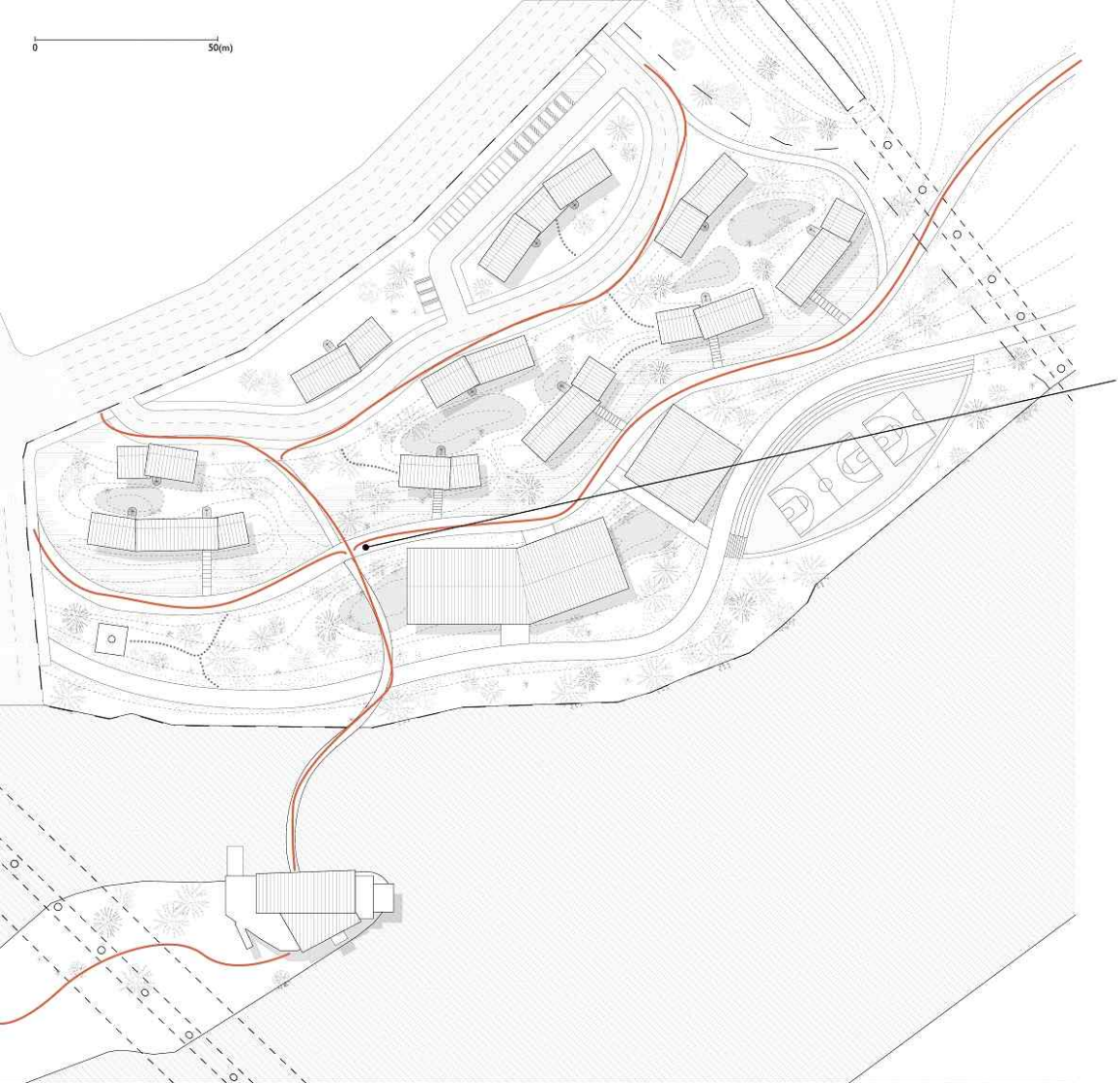
usual days

April to June

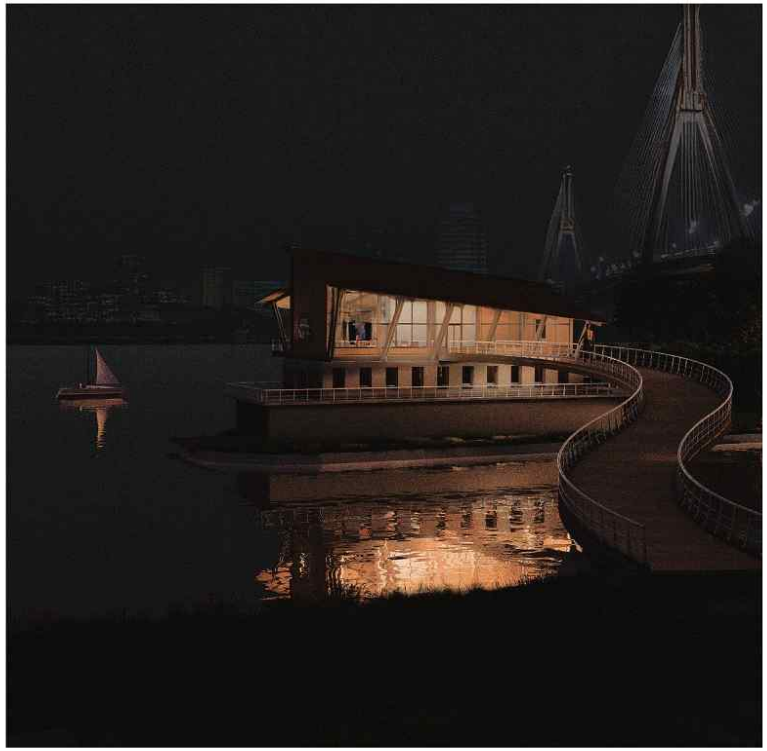
September to December

Above and into Sava

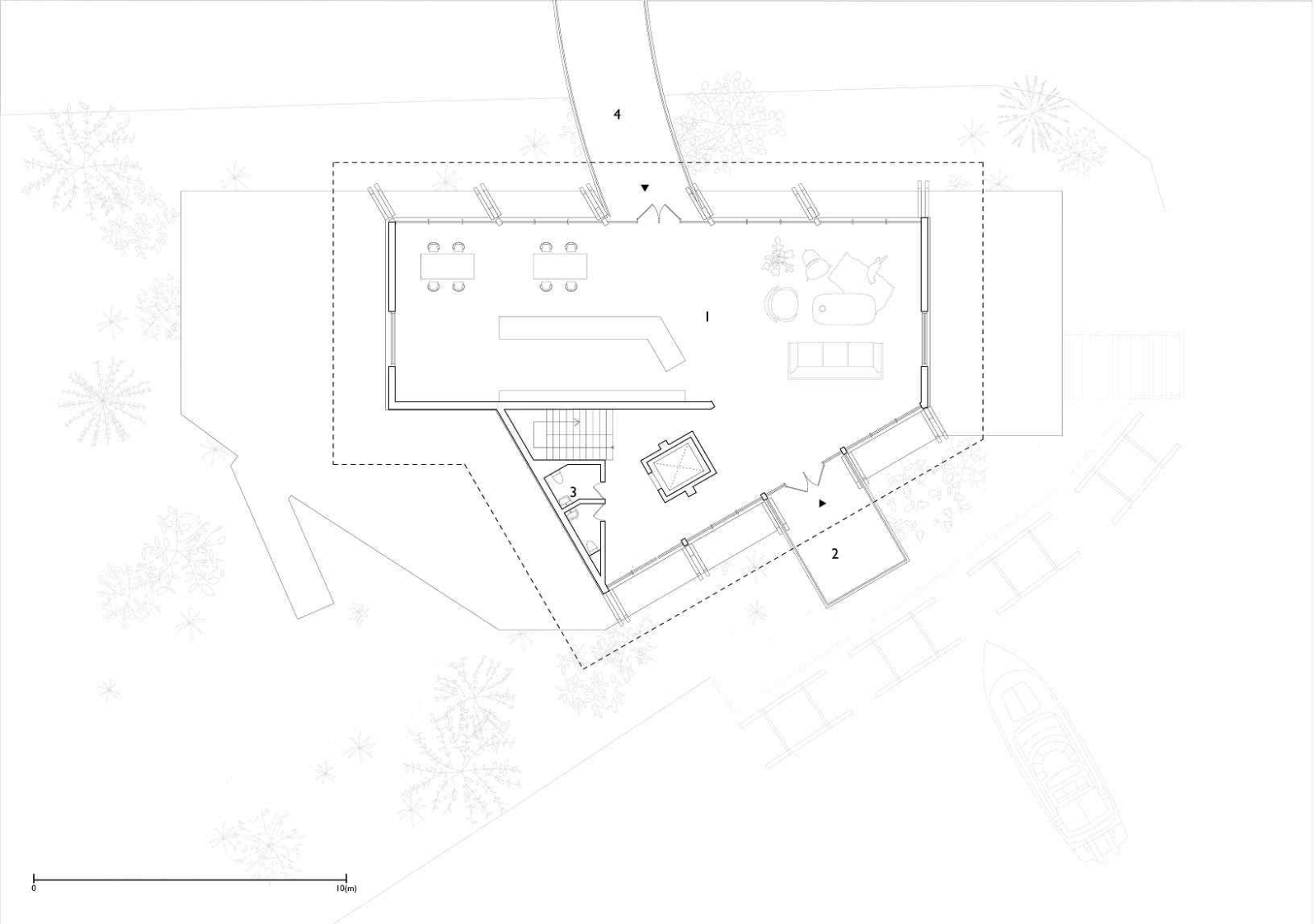
Across and Above Sava River



Connection between Zone A to the Renovation site by a bridge



Above Sava

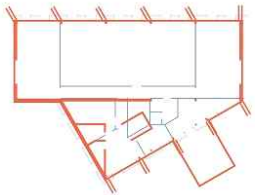


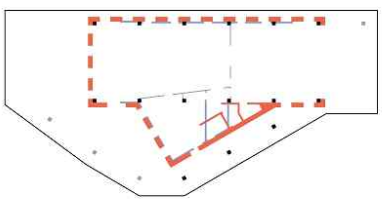
Second floor plan

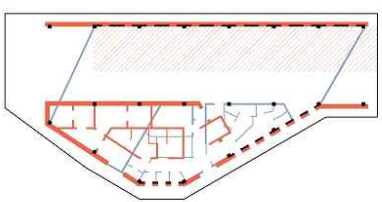
1. Cafe
2. Observatory
3. W.C
4. Bridge

Renovation Building Strategy

to reuse the structure and to shape a new form







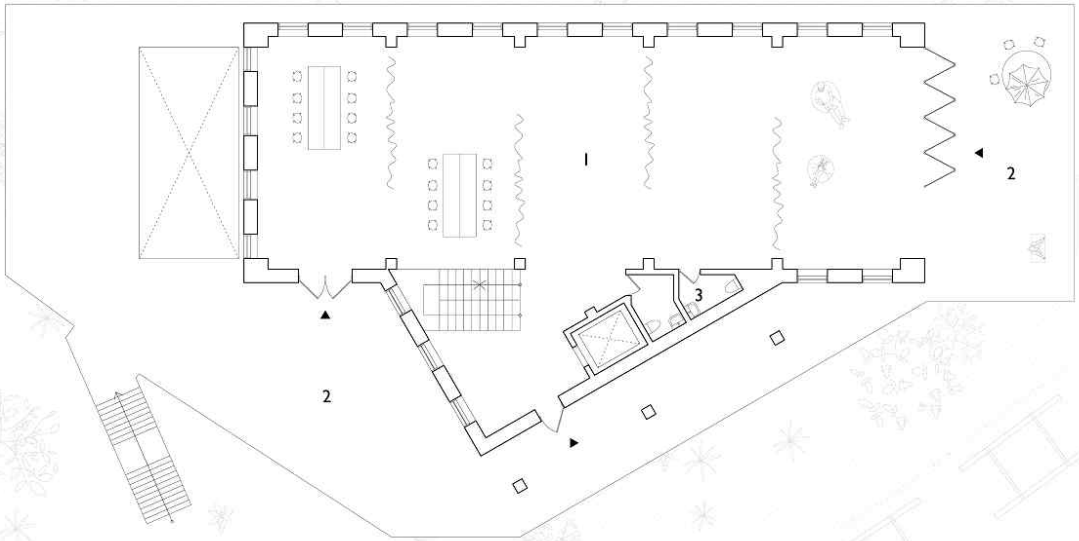
demolish

remain

new

a complete new structure for the third floor

Above Sava



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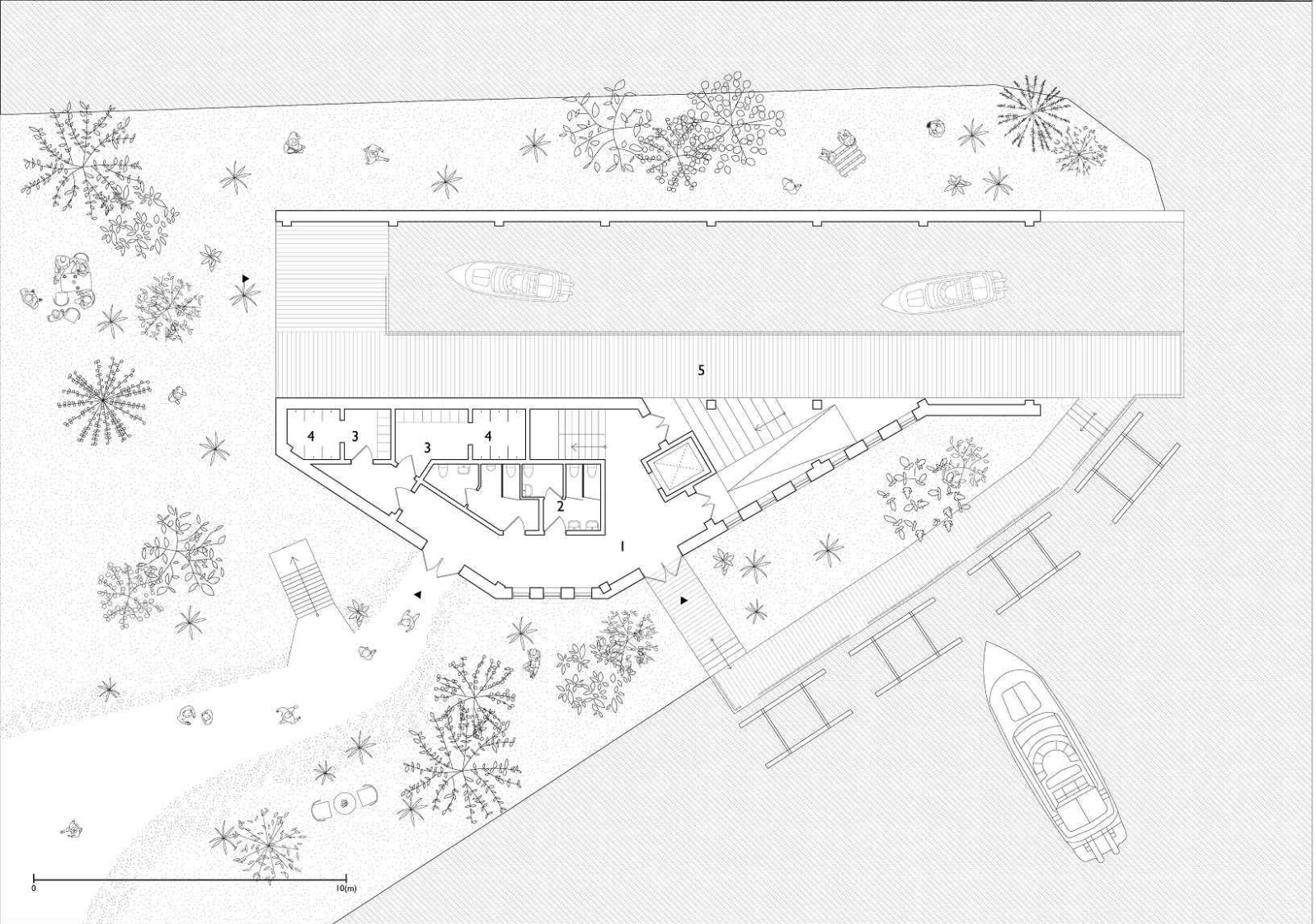
First floor plan

1. Meeting Room
2. Outdoor Terrace
3. W.C

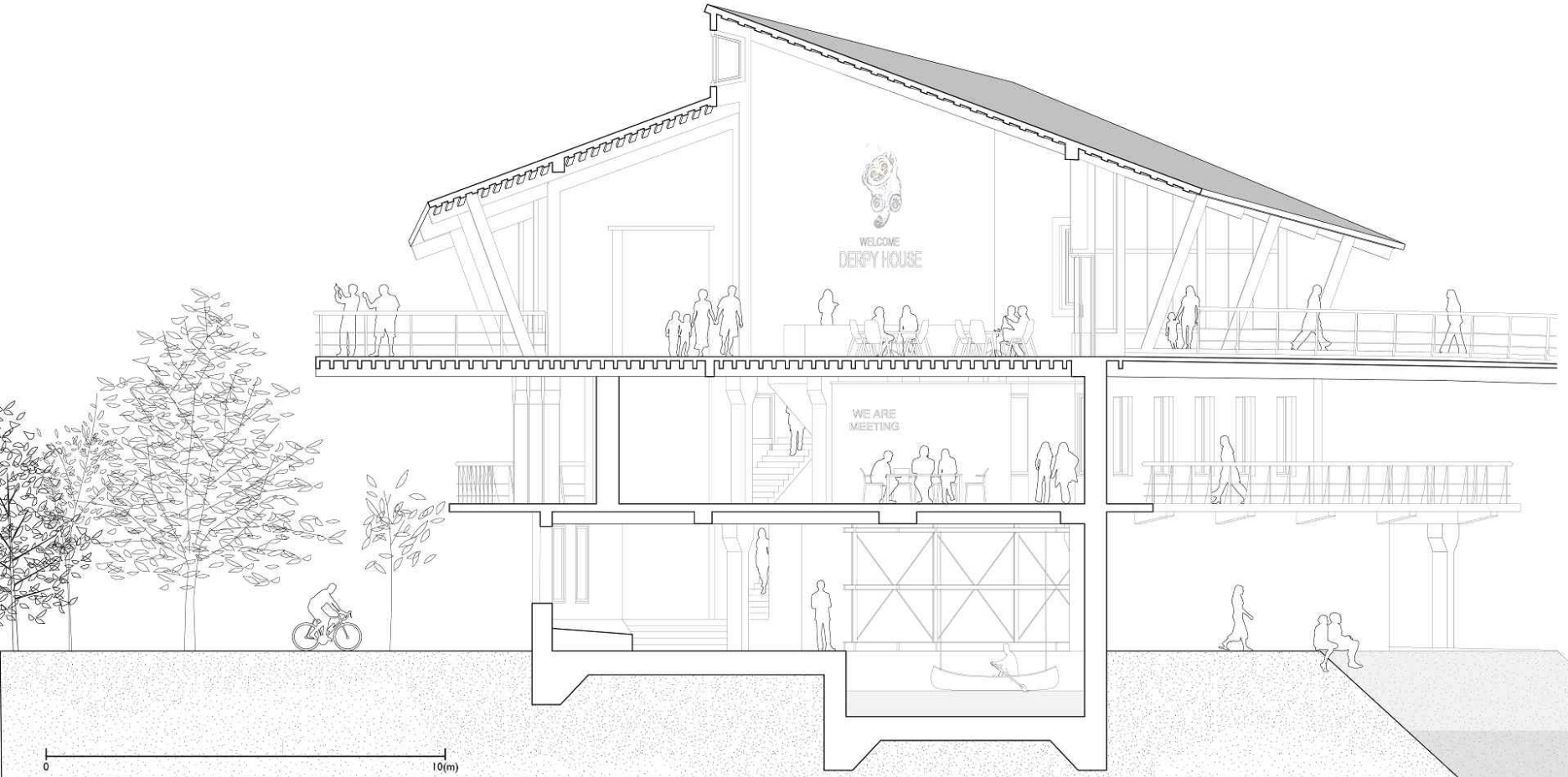
Into Sava



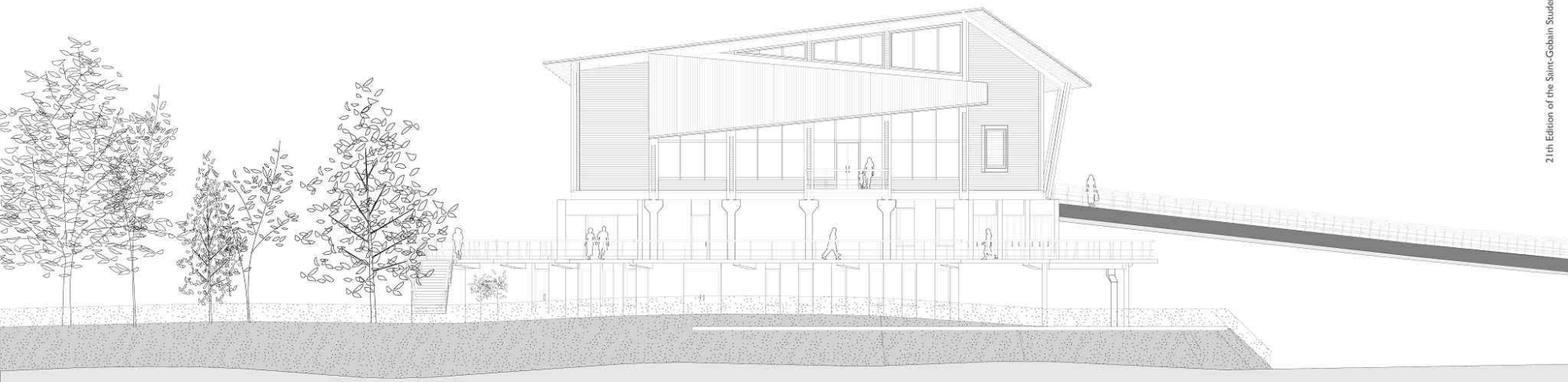
Ground floor plan

1. Common Lounge
2. W.C
3. Changing Room
4. Shower Room
5. Yacht Deck and Storage

Above and Into Sava



Above and Into Sava



0 10(m)

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usual days

September to December

April to June

September to December

Sponge