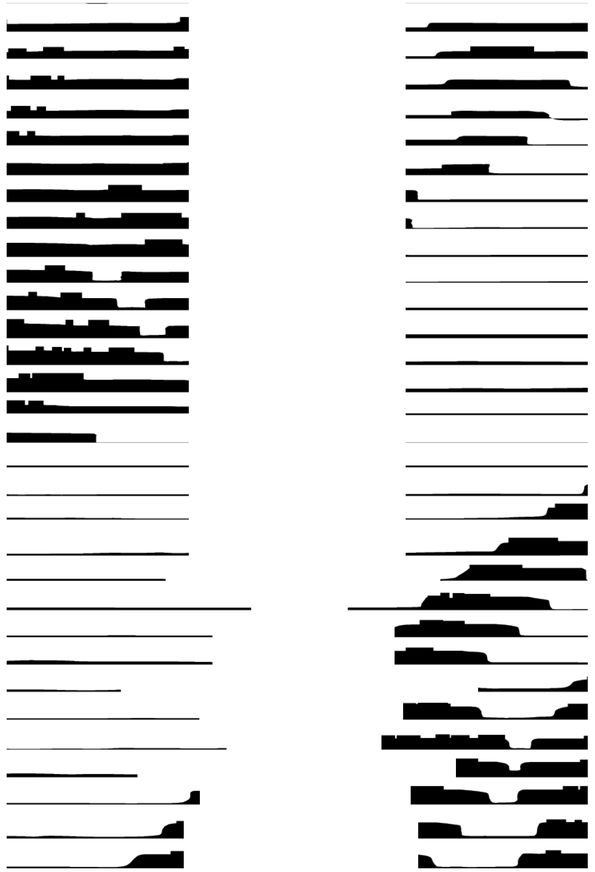
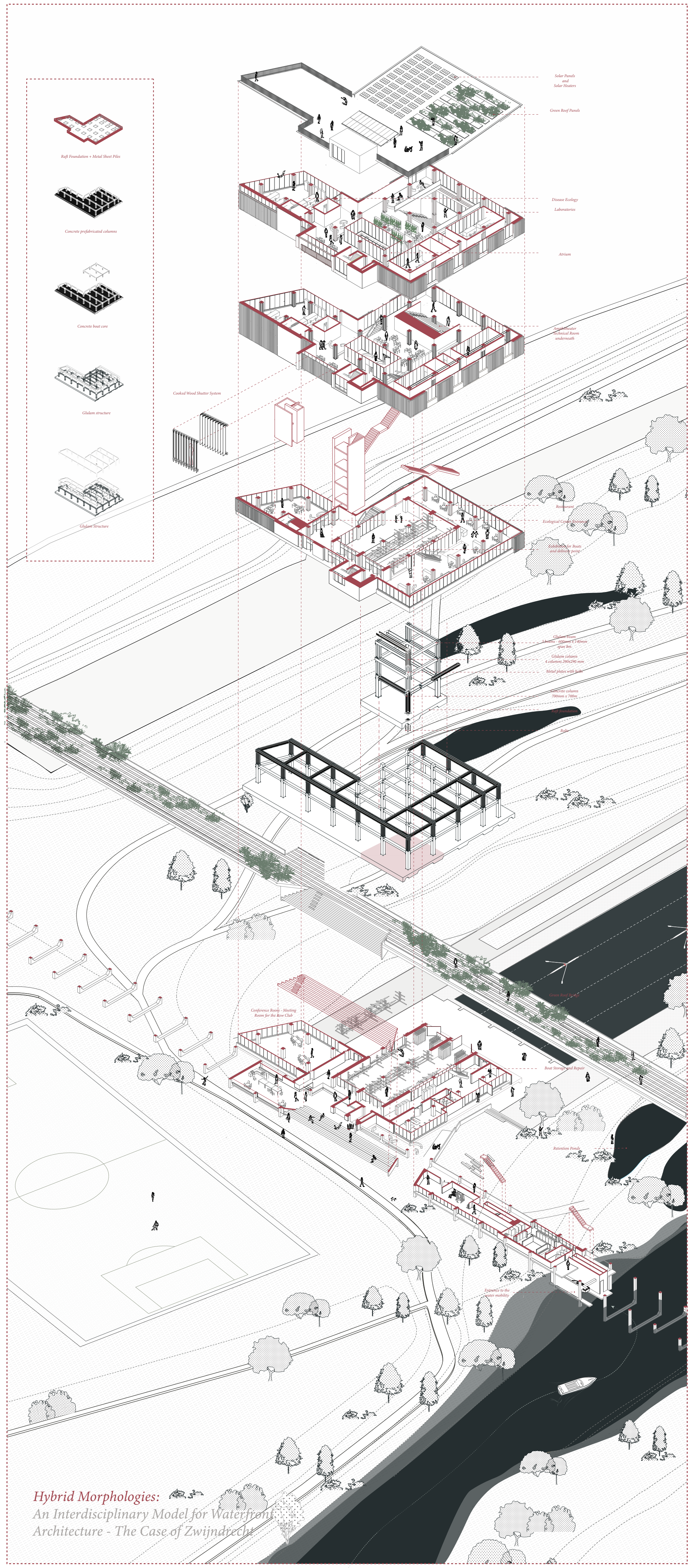


Hybrid Morphologies:
An Interdisciplinary Model for Waterfront Architecture - The Case of Zwijndrecht

Sonja Draskovic | 5085284
P5 - City of the Future
05 - 07 - 2021


Hybrid Morphologies:
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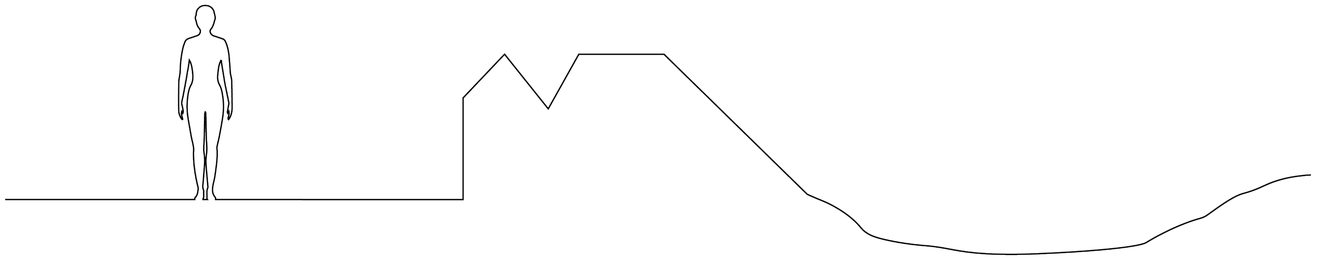
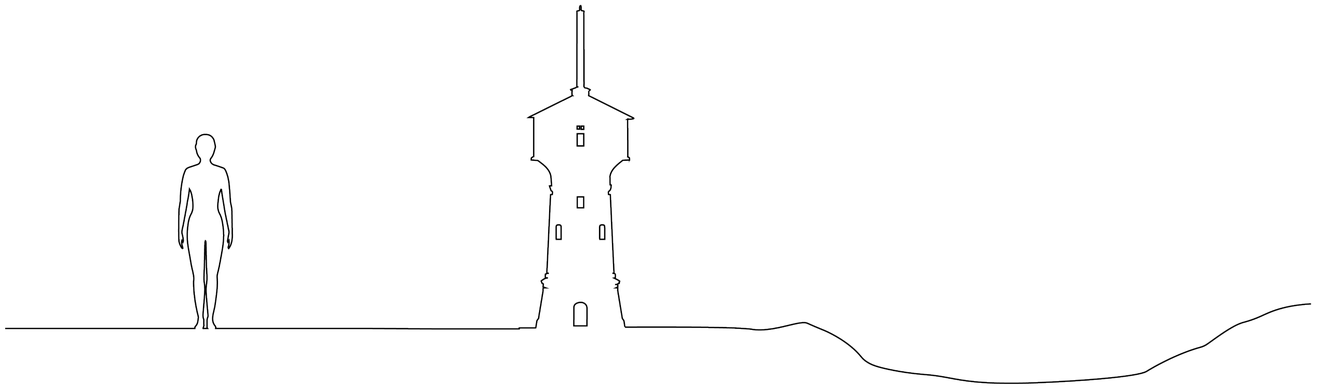
Architecture - The Case of Zwijndrecht



Humans

Architecture
Infrastructure

Nature



Humans

Infrastructure
Architecture

Nature

Perception of water

our territories (land), codes (policies) and bodies (architecture) reflect our cultural memory and the way we live with water

Threat and Resource

Flow/ Flood

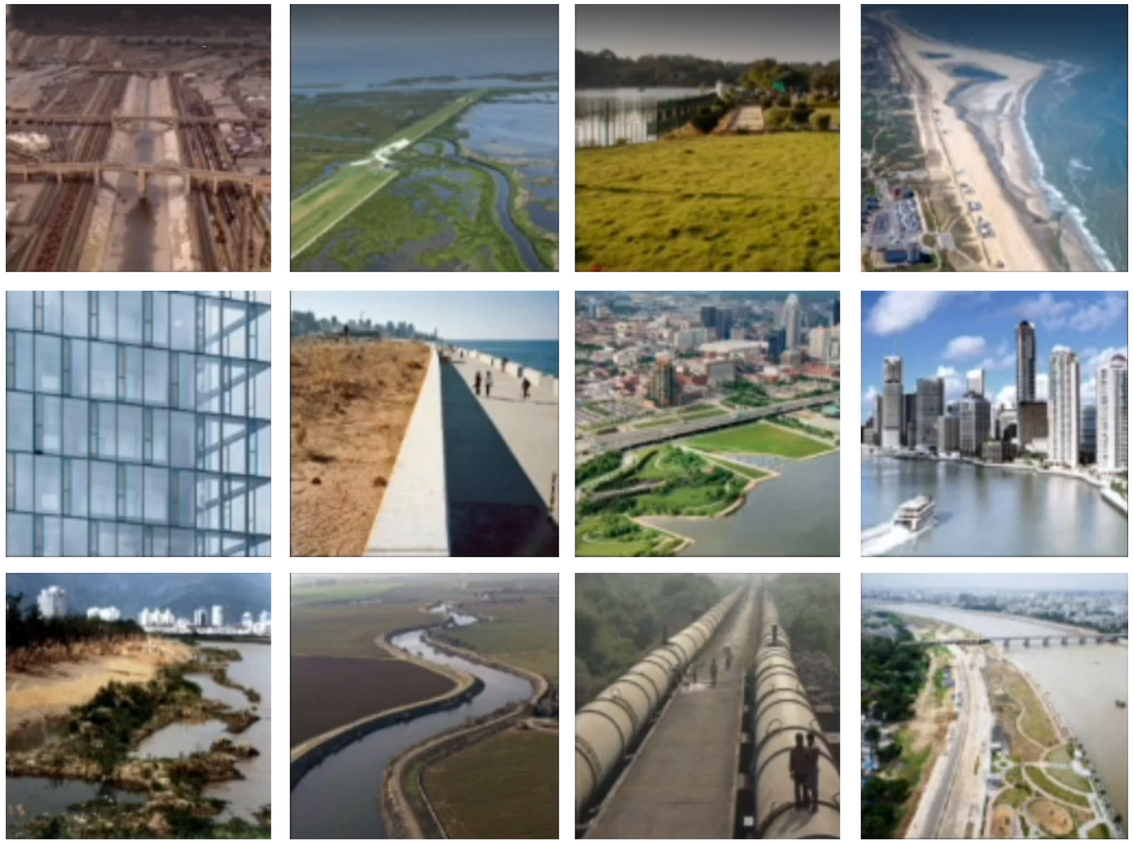
changing the perception of water

Wetness

Anuradha Mathur and Dilip Da Cunha

designing, building, living with water (Inhabiting The Hydrological Cycle)

Rise/Fall



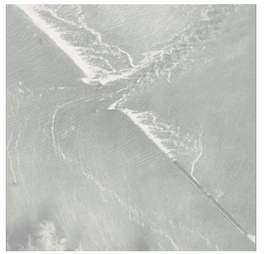
Water is treated as an enemy and resource

Water responds and takes over

Perception of water

our territories (land), codes (policies) and bodies (architecture) reflect our cultural memory and the way we live with water

Threat and Resource



Flow/ Flood

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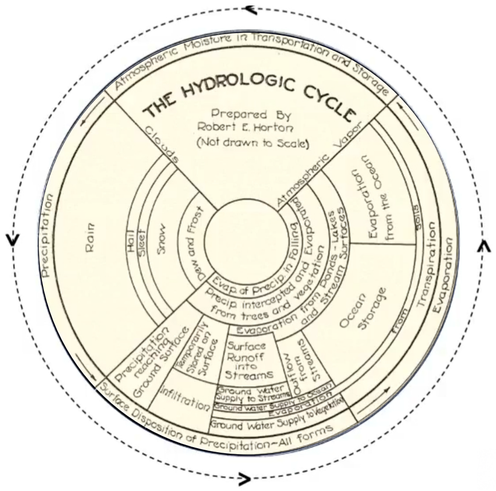
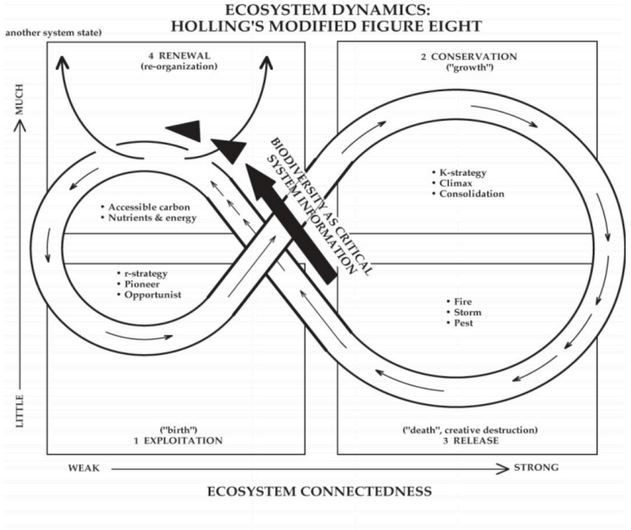


Inhabiting the water cycle



Following the Adaptive Cycle
Ecosystem Dynamics and the Adaptive Cycle: Holling's Modified

Designing with nature:

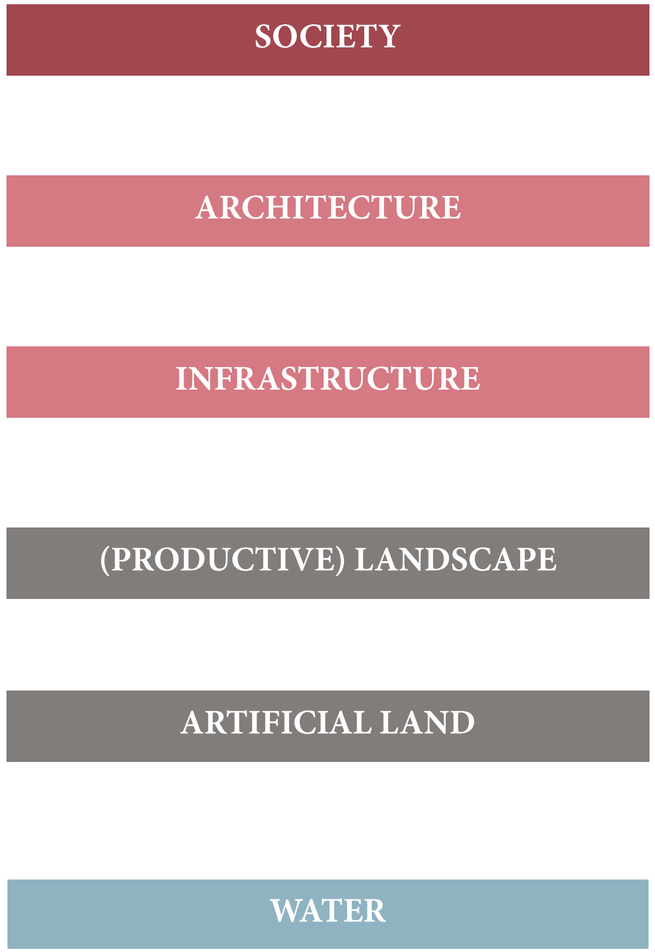
1. *Inhabiting the water cycle*

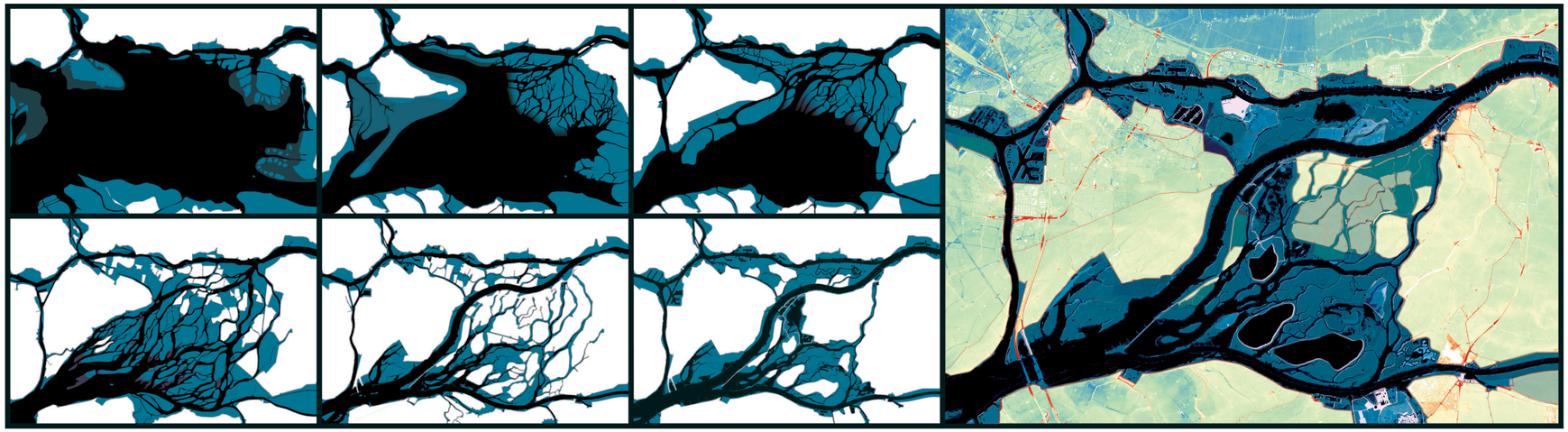
2. *More adaptive to change in water levels*

How can an architectural design intervention and a landscape strategy alter our relationship with water in areas prone to flooding (e.g. urbanized delta areas)?

Context
The Netherlands - A country built on water

Polder Landscapes as a framework
for the Dutch Society


SOCIETY
ARCHITECTURE
INFRASTRUCTURE
(PRODUCTIVE) LANDSCAPE
ARTIFICIAL LAND
WATER



Flood and reclamation history of the area Biesbosch area, in the early 15th, mid-16th, mid-17th, mid-18th, mid-19th, mid-20th centuries, and in the 2010 and 2015, before and after the completion of the "Room for the River

SOCIETY

ARCHITECTURE

INFRASTRUCTURE

(PRODUCTIVE) LANDSCAPE

ARTIFICIAL LAND

WATER

SOCIETY

CURRENT POLICIES
AND CODE

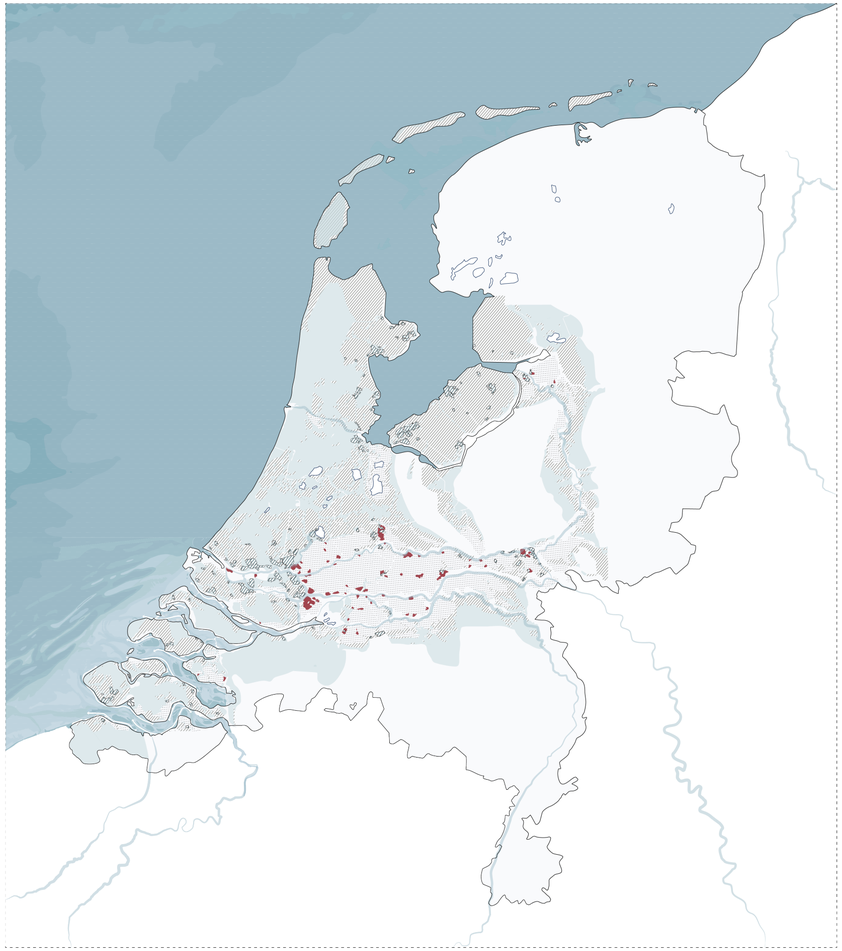
ARCHITECTURE

INFRASTRUCTURE

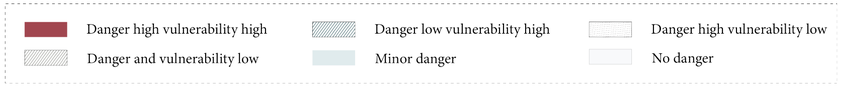
(PRODUCTIVE) LANDSCAPE

ARTIFICIAL LAND

WATER



Flood Risk vulnerability areas (*dutch: Overstromingsrisico's*)



Drawing by Author (source: PBL Netherlands Environmental Assessment Agency, Bilthoven, The Netherlands, 2012)

Research began:

1. Cartographic research into vulnerable areas + defense strategies

2. Spatial manifestation

THE CODE

policies
building codes
ect

SPATIAL
MANIFESTATIONS

landscape
architecture
infrastructure

Research into policies and their spatial manifestation begins

Drawing by Author (source: Steenhuis 2018, 21)

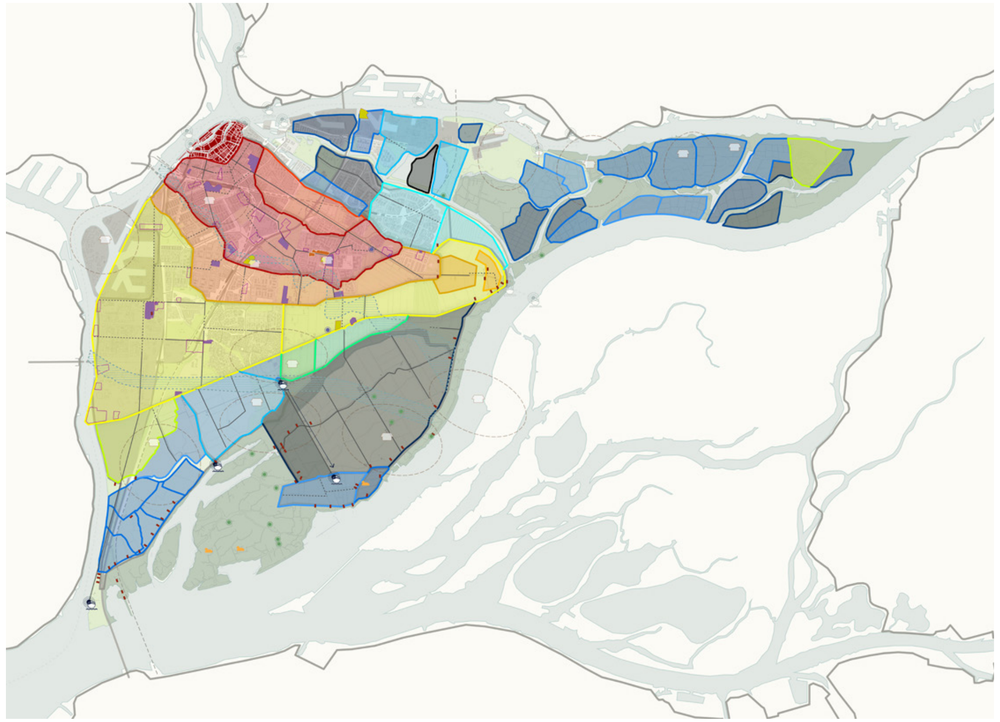
Room for the River

Gap between spatial design and policy (most interventions are landscape, urban, and infrastructural)

Lack of social awareness in areas prone to flooding (people depend on the governments and higher powers to keep them safe - this is necessary however it has also created a lack of awearness)

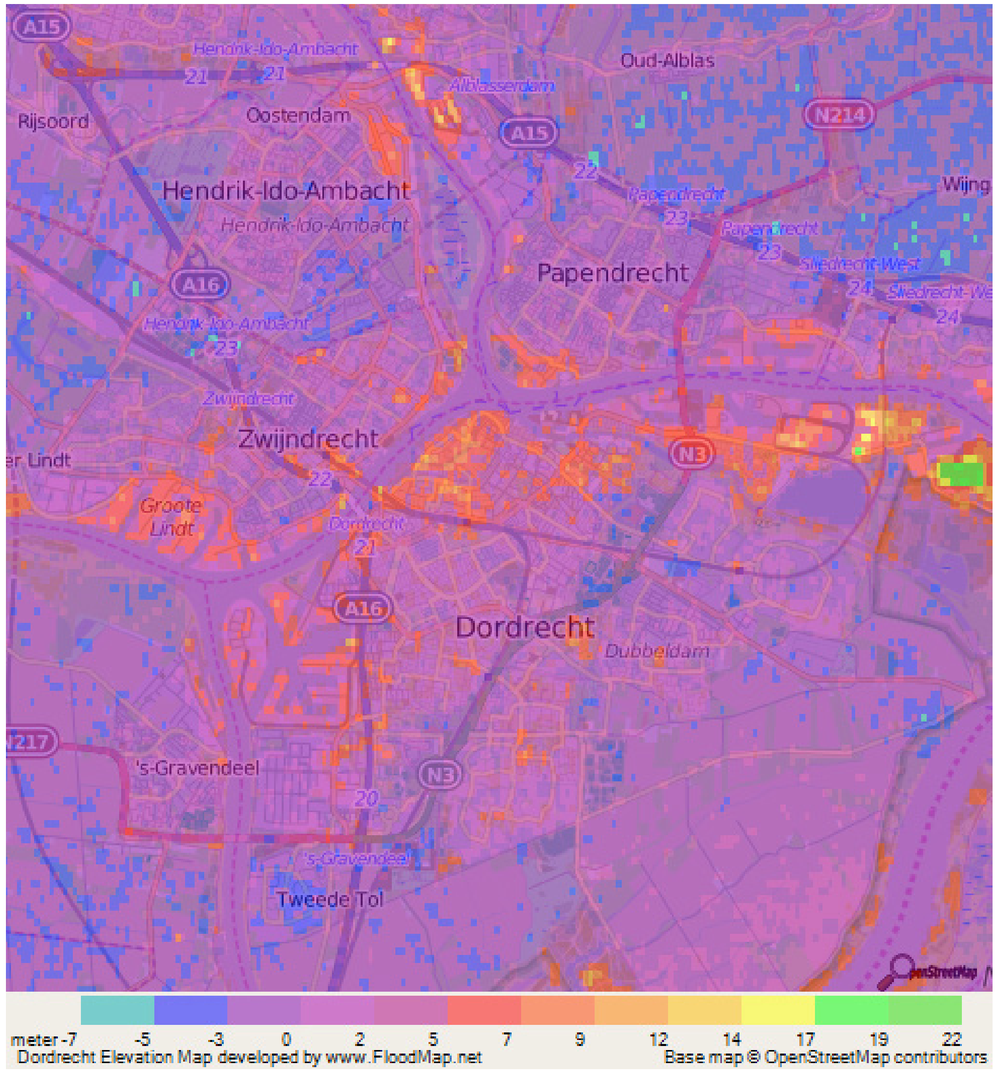
Gap between spatial design and policy
(most interventions are landscape,
urban, and infrastructural)

Where can you build?



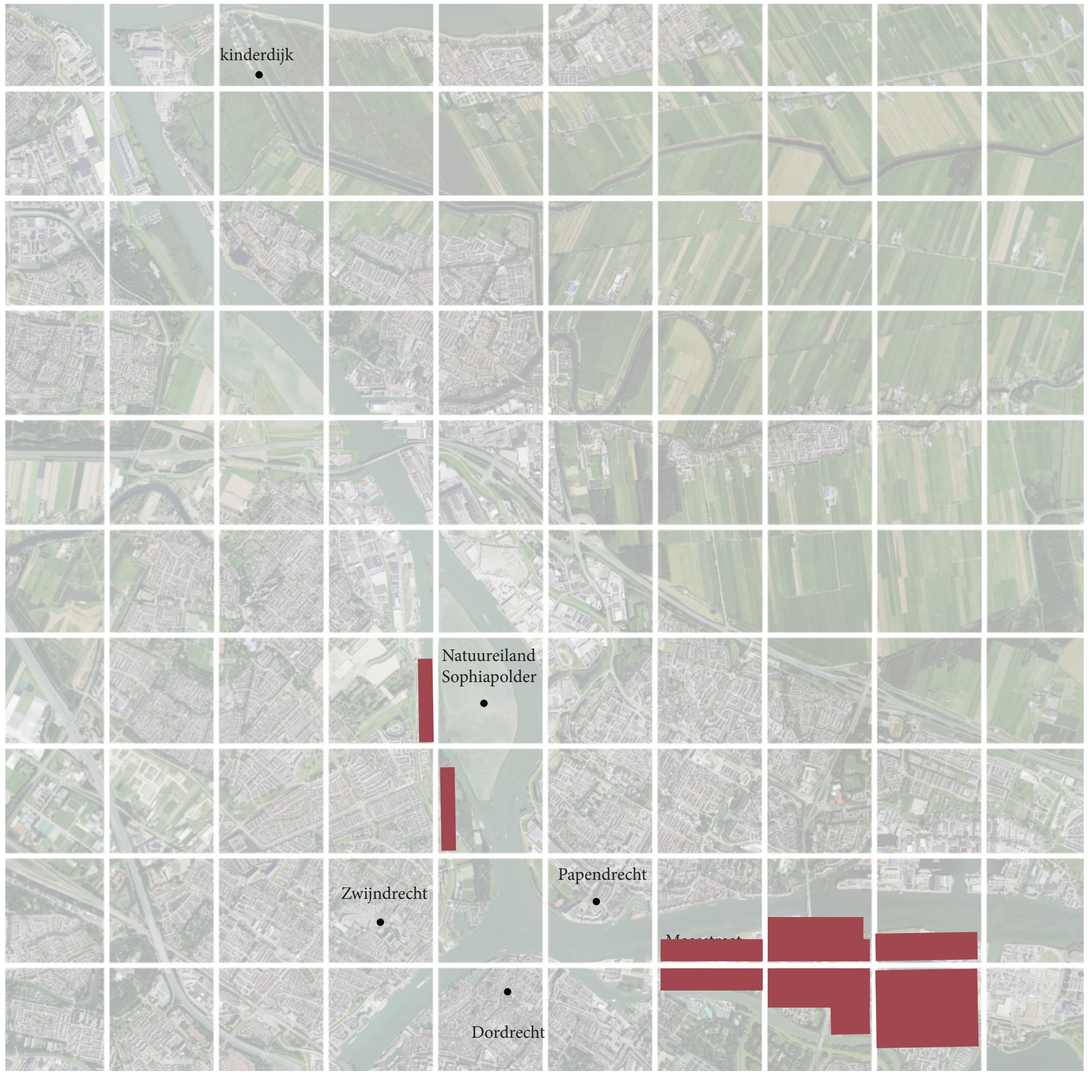
The dangerous of codes is that they give us an illusion that we can neatly organize the complexity of this world in a static RGB spectrum

- James S. Scott (Waterloo Architecture, 2019)



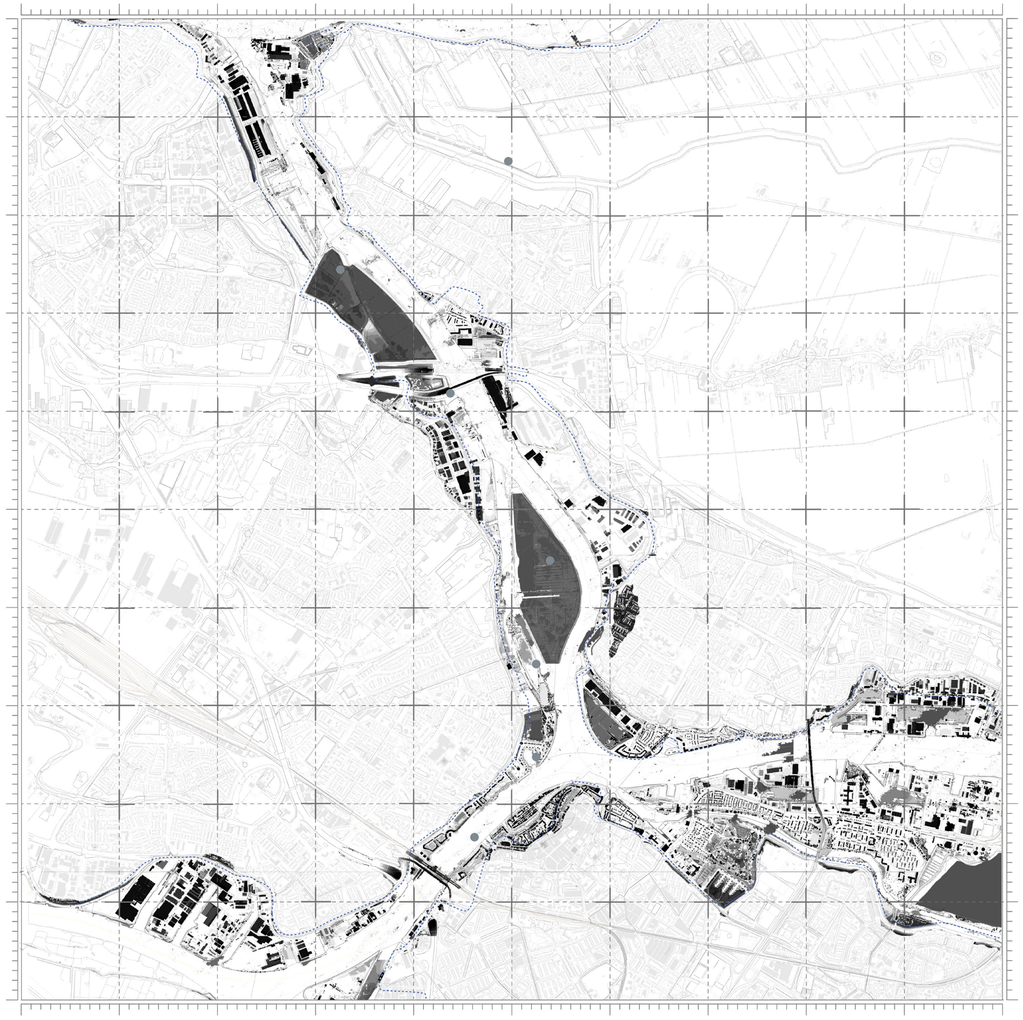
Flood zones in Dordrecht

Flood zones in Dordrecht

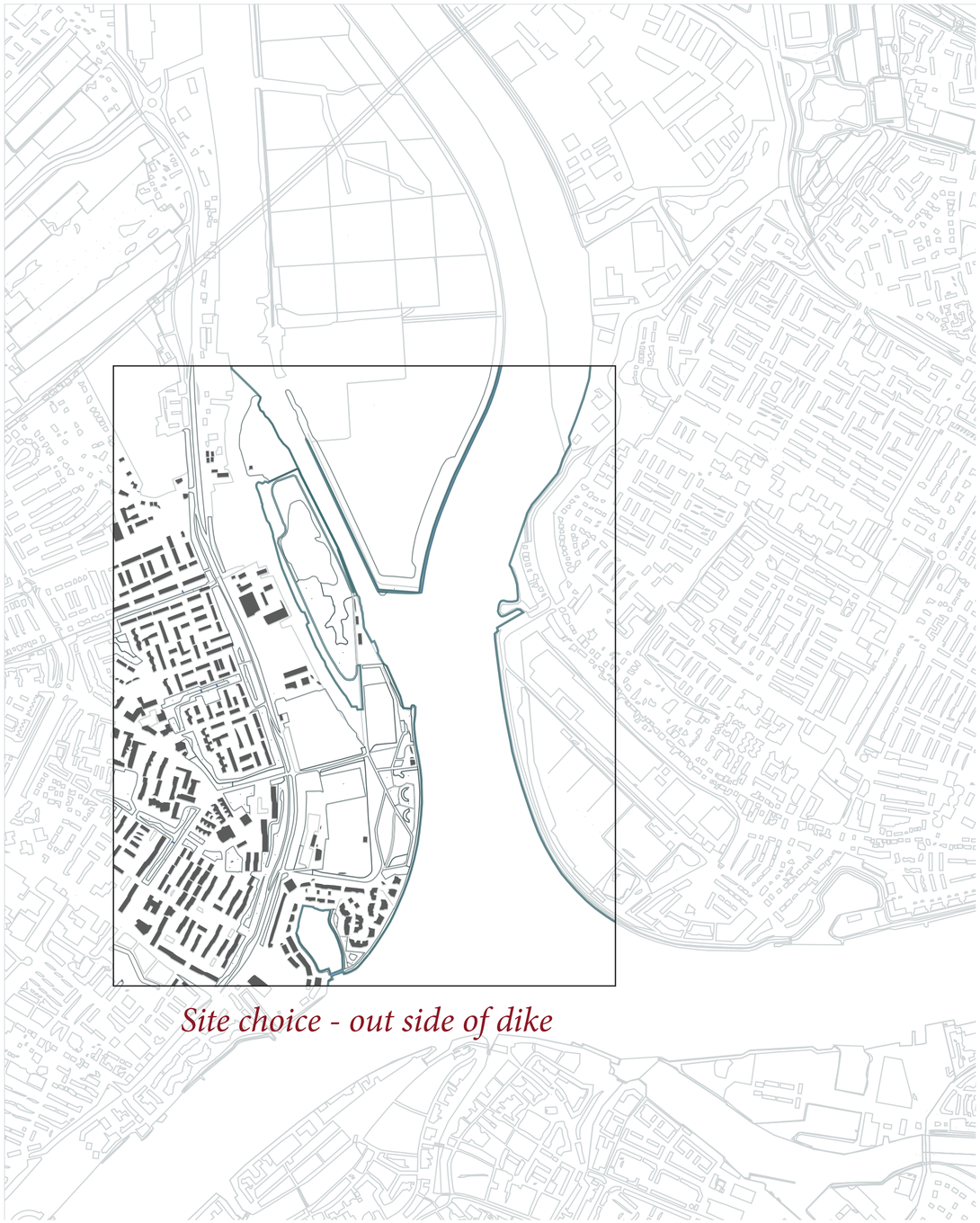


Areas elevated above the NAP water level due to site being used for industry

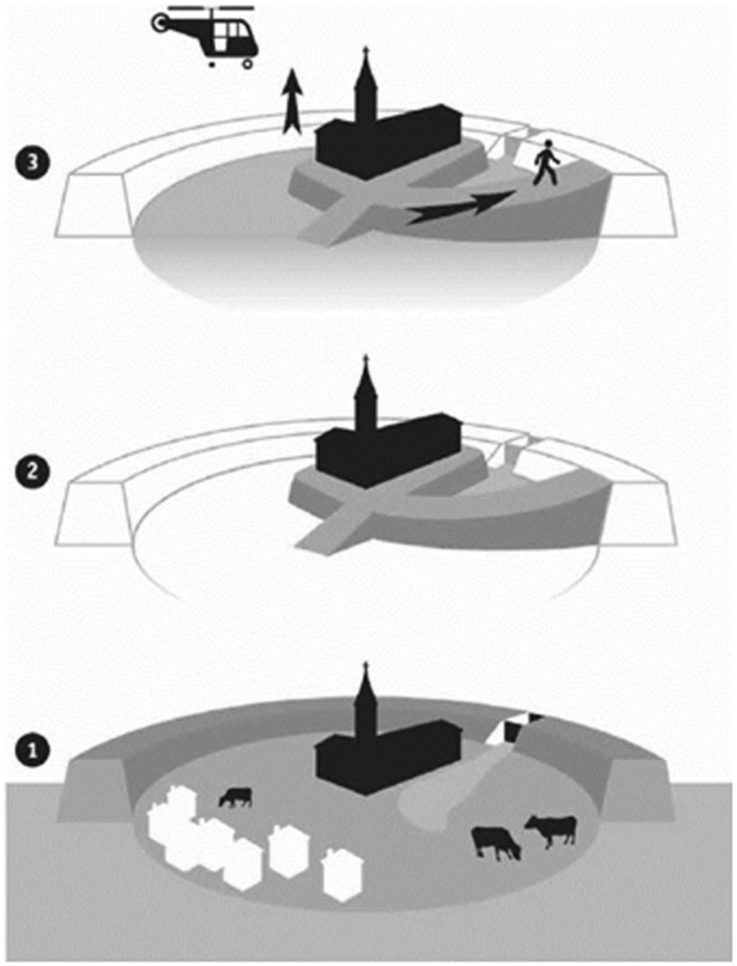

kinderdijk
Natuureiland
Sophiapolder
Zwijndrecht
Papendrecht
Maasstraat
Dordrecht



Behind the Dike



Site choice - out side of dike



Multi-layered Flood Safety Policy

1. Vertical evacuation
2. Dike reinforcmentt
3. Spatial reorganization

Zwijndrecht - Dordrecht
areas developing an adaptive approach to planning and policy in combination with risk management

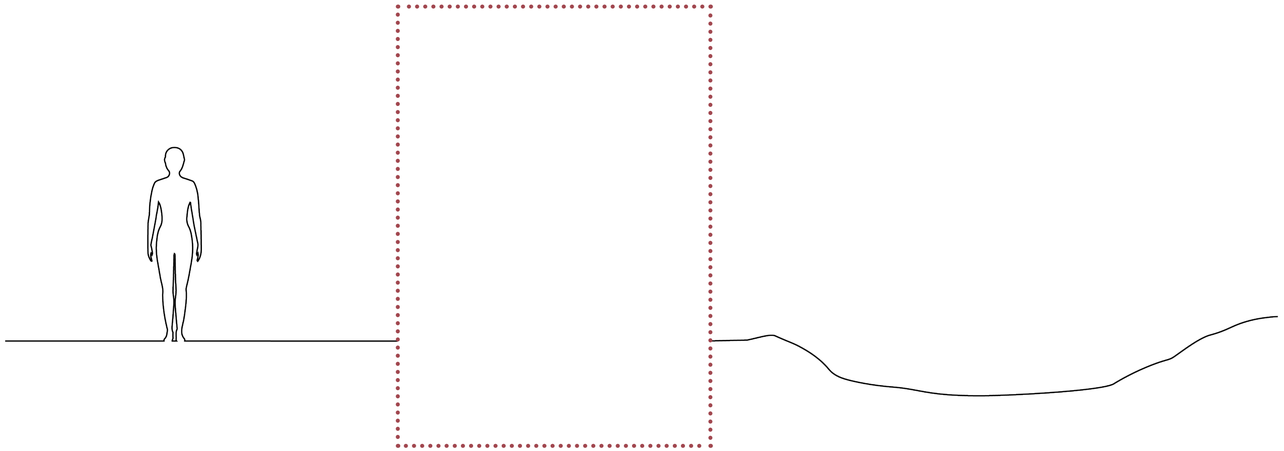
Designing with nature:

1. *Inhabiting the water cycle*

2. *More adaptive to change in water levels*

Site specific

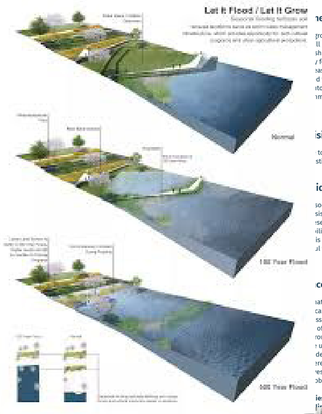
3. *Integrating the new safety policy,*
   Vertical evacuation,
   spatial adaptation and
   dike reinforcement

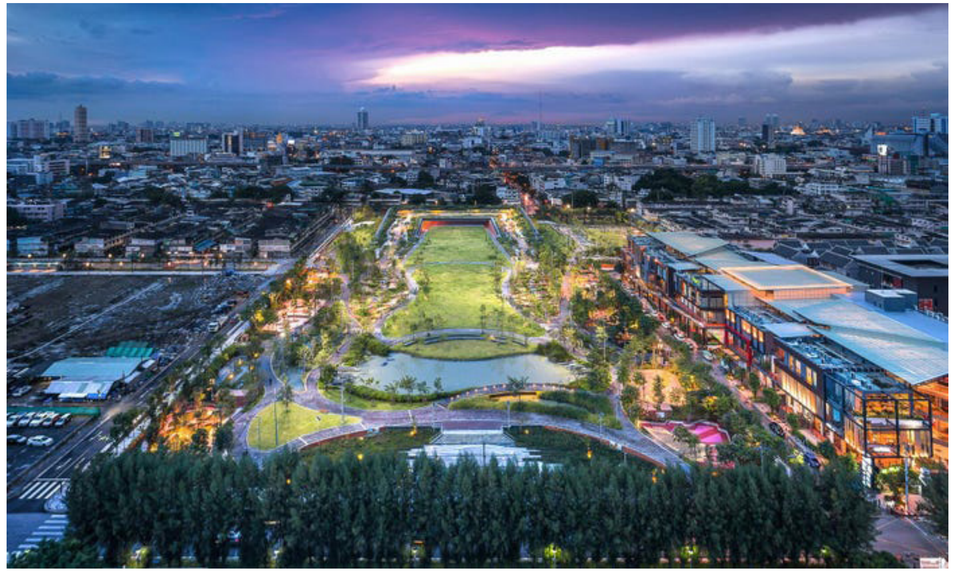


Humans

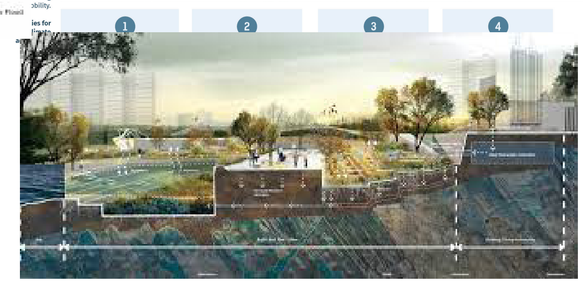
Architecture
Infrastructure

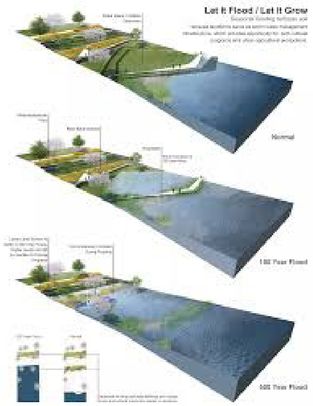
Nature

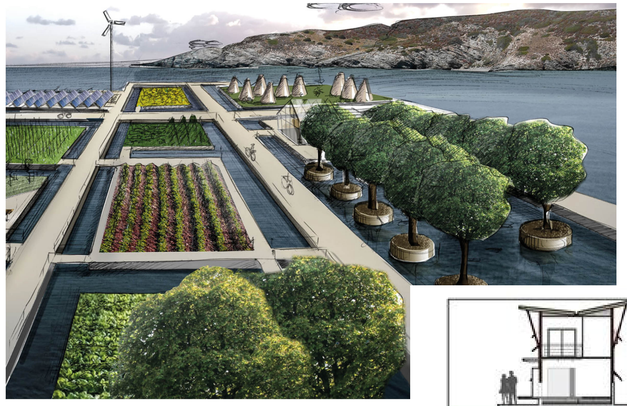


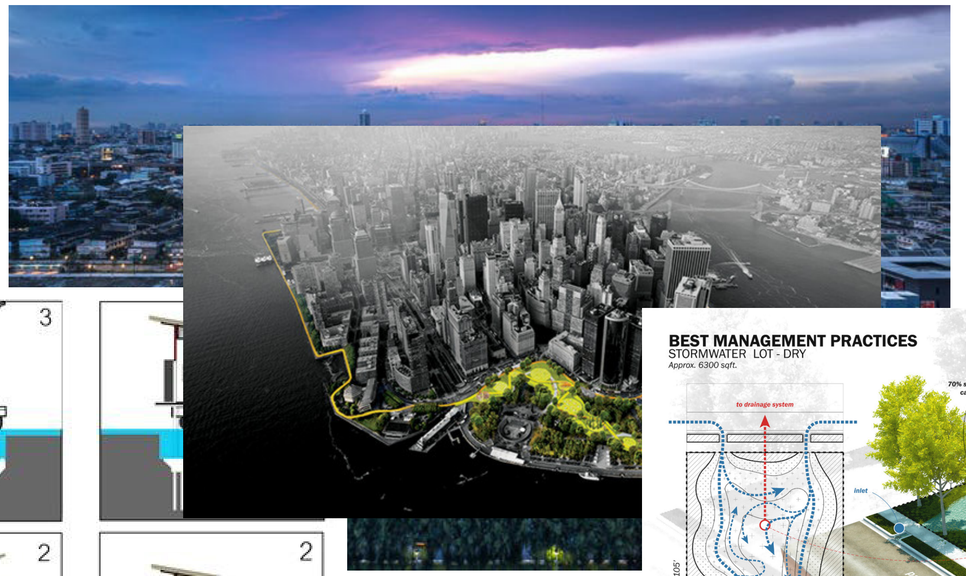


floating food farm
by SOE & nexus product design









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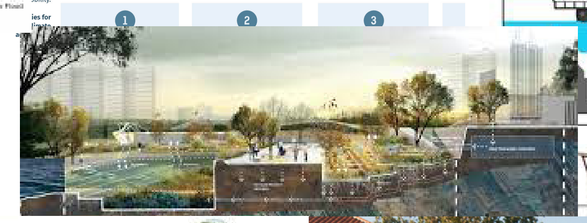
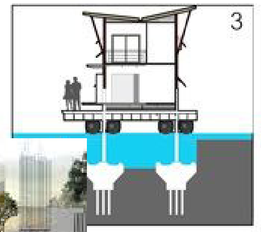
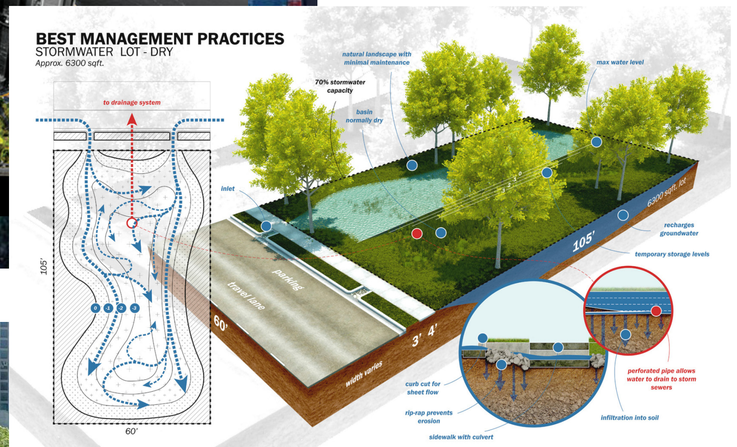
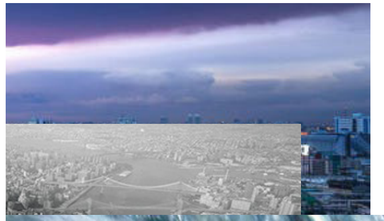
















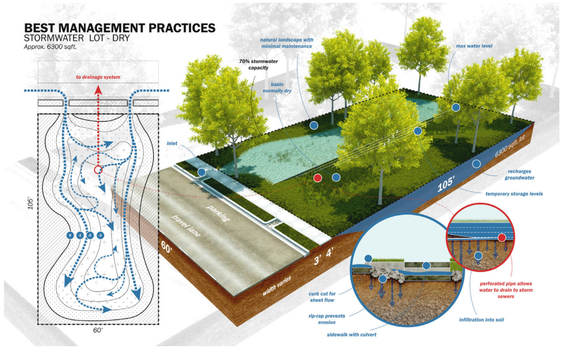

Solar Cell
Water Tank
Water Level

Connectivity

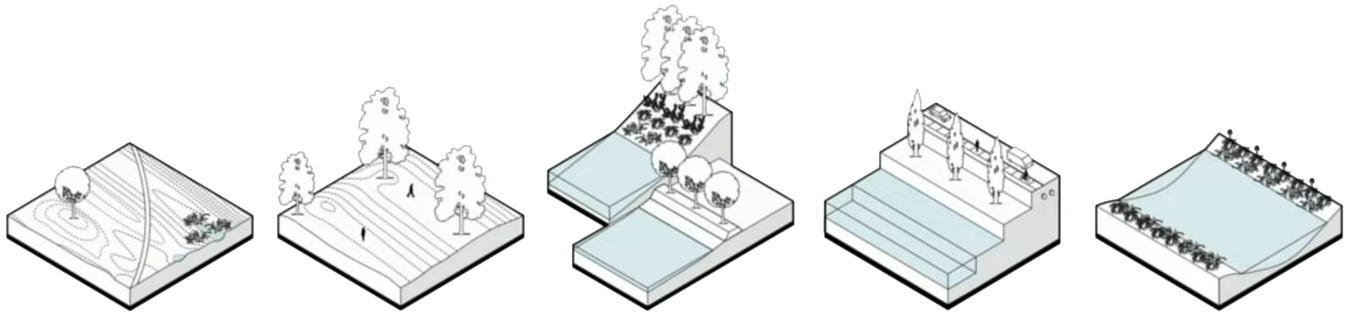
Open Ended Flexibility

Landform as Failsafe + Buffer

Integrating Green, Blue + Gray



Landscapes as a filter



1

Connectivity +
Reading the

2

Open Ended
Flexibility

3

Landform as
Failsafe + Buffer

4

Integrating
Green, Blue + Grey

5

Landscape as
Filter

Designing with nature:

1. *Inhabiting the water cycle*

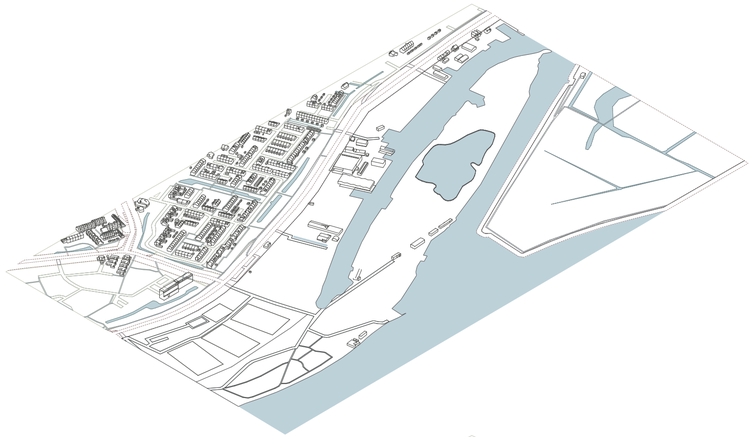
2. *More adaptive to change in water levels*

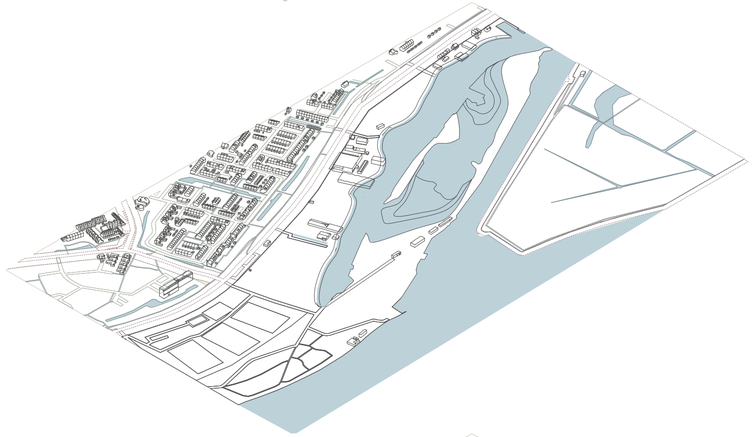
Site specific

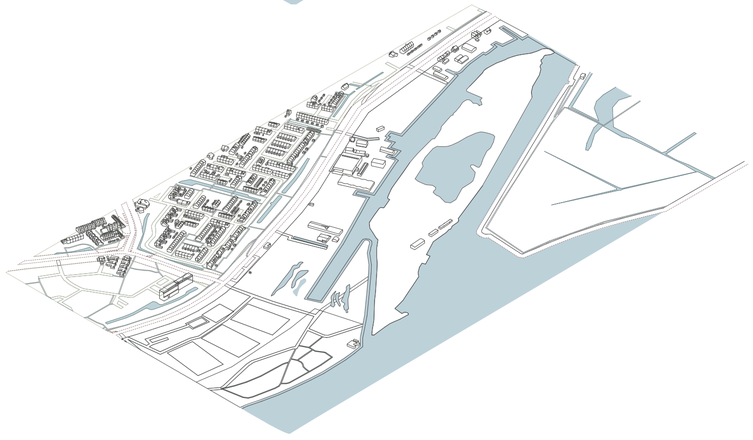
3. *Integrating the new safety policy,*
   Vertical evacuation,
   spatial adaptation and
   dike reinforcement

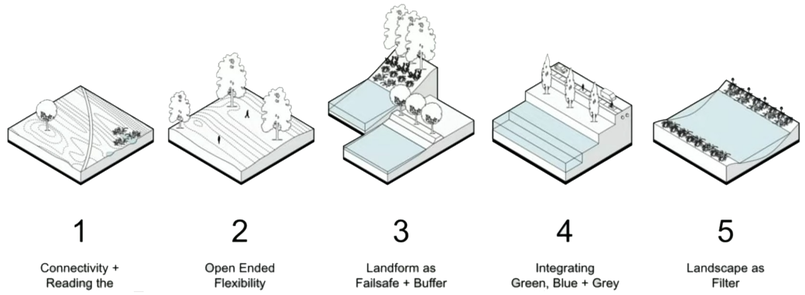
Landscape strategy

4. Following the 5 principles of designing with waterscapes









Using the three territories (left) I apply the research of the 5 principles of landscapes and water (derived from the numerous competitions and presidents and the work of Fadi Masoud)

DYNAMIC

MOST SUSCEPTIBLE TO ECOLOGICAL CHANGES
BETTER ADAPTING TO ATMOSPHERIC, GEOLOGICAL
AND HUMAN INFLUENCES

STATIC

LEAST SUSCEPTIBLE TO ECOLOGICAL CHANGES
RIGID FORMS AND LARGE SCALES OF INTERVENTION
WITH THE LANDSCAPE

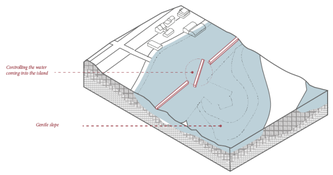
WET

MORE AREA IS FLOODED

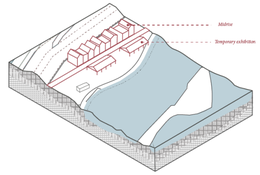
DRY

LEAST AREA IS FLOODED

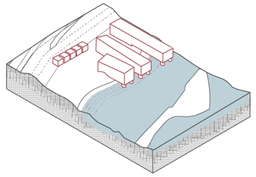
WF - ES - 0 land type use density — *Wetland Flux - Ecological Services*
organic constructed wetlands, marshes, new habitats , controlled through an operable barrier



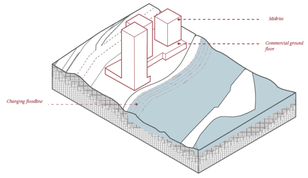
WF - MR - 3 land type use density — *Wetland Flux - Medium Residential*
Medium density housing with local street wetland, civic spaces for public activities along the river front.



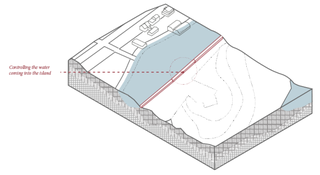
WF - MC - 3 land type use density — *Wetland Flux - Medium Commercial*
Architecture on pylons as a means of flood protection



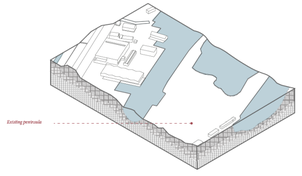
WF - HR - 5 land type use density — *Wetland Flux - Hight density mixed use*
High density with a commercial podium



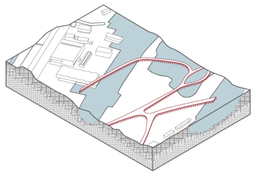
WF - ES - 0 land type use density — *Wetland Flux - Ecological Services*
organic constructed wetlands, marshes, new habitats, controlled through an operable barrier



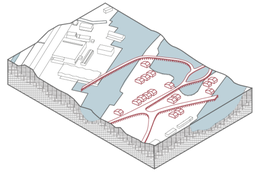
RI - ES - 0 land type use density — *River Island - Ecological Services*
organic constructed wetlands, marshes, new habitats



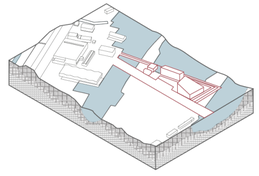
RI - R-ES - 0 land type use density — *River Island - Recreational & Ecological Services*
Elevated walkway that provide recreational use on the wetland



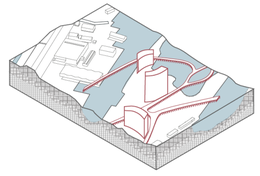
RI - LR - 1 land type use density — *Wetland Flux - Low Density Residential & Recreational*
Low density housing in upland areas, floodable water retention areas and wetlands connected through infrastructure



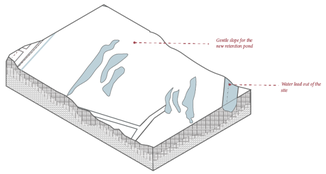
RI - MP - 2 land type use density — *River Island - Medium Public building*
public building connected with an elevated path



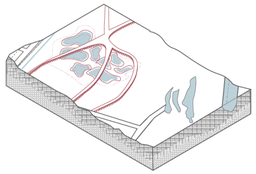
RI - HD - 5 land type use density — *Wetland Flux - Hight density*
High density connected through elevated paths



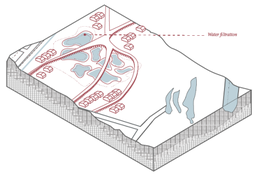
WT - ES - 0 land type use density — *Wetland - Ecological Services*
organic constructed wetlands, marshes, new habitat, retention ponds for water filtration



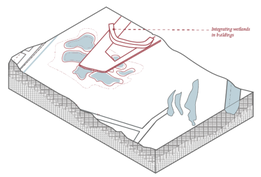
WT - R-ES - land type use density — *Wetland - Recreational & Ecological Services*
Elevated walkway that provide recreational use on the wetland



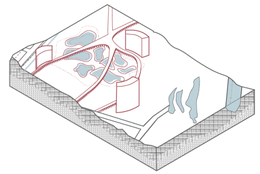
WT - LR - 1 land type use density — *Wetland - Low Density Residential & Recreational*
Low density housing in upland areas, floodable water retention areas and wetlands connected through infrastructure



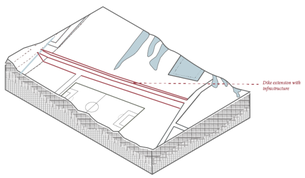
WT - MP - 1 land type use density — *Wetland - Medium Public building*
public building connected with an elevated path



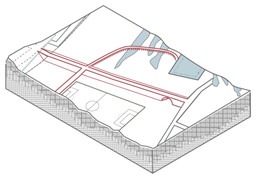
WT - HD - 5 land type use density — *Wetland Flux - Hight density*
High density connected through elevated paths



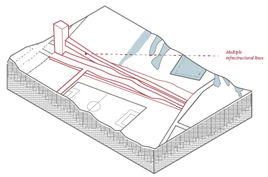
DI- ES - 0 land type use density — *Dike - Ecological Services*
extension of the dike providing a new dry land to build on



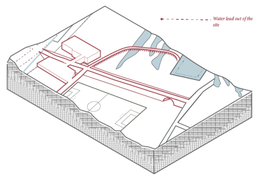
DI - R-ES - 0 land type use density — *Dike - Recreational & Ecological Services*
Elevated walkway that provide recreational use and connection



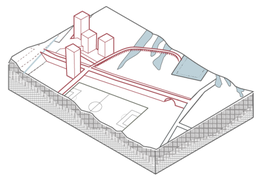
DI- MP - 3 land type use density — *Dike - Medium Public building*
public building connected with an elevated path



DI- MP - 3 land type use density — *Dike - Medium Public building*
public building connected with an elevated path

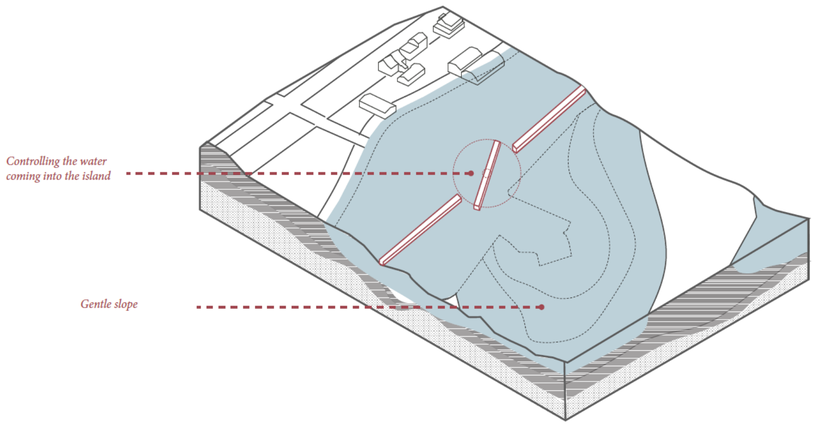


DI- HD - 5 land type use density — *Dike - Hight density*
High density connected through elevated paths



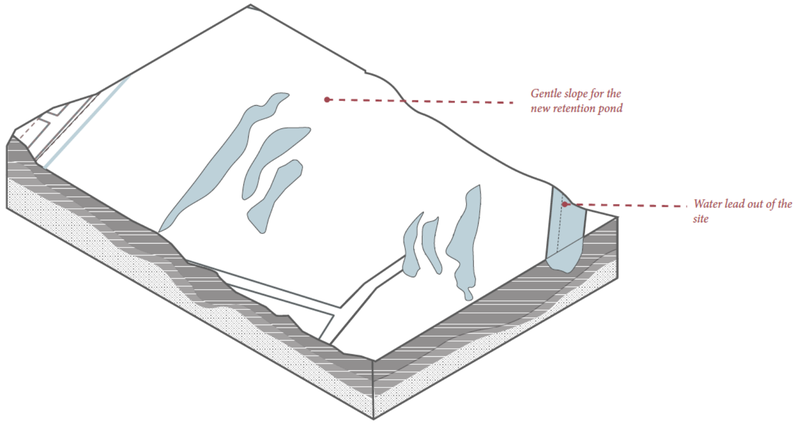
WF - ES - 0
land type use density

Wetland Flux - Ecological Services
organic constructed wetlands, marshes, new habitats , controlled through an operable barrier



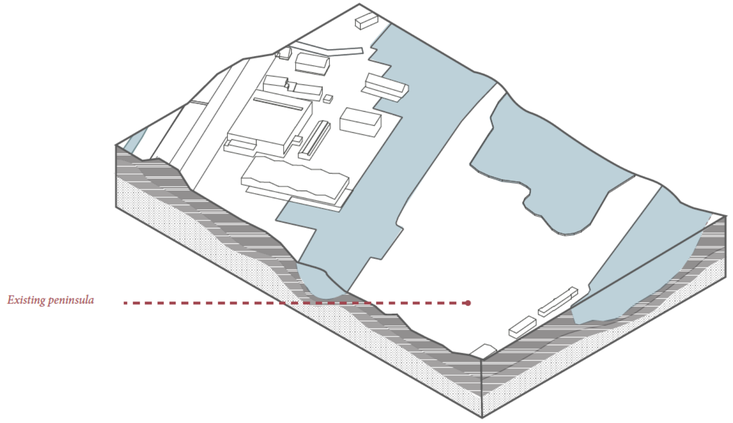
WT - ES - 0
land type use density

Wetland - Ecological Services
organic constructed wetlands, marshes, new habitat, retention ponds for water filtration



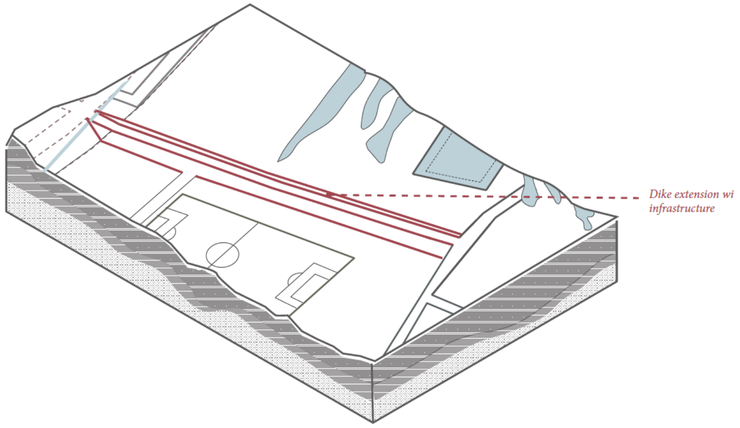
RI - ES - 0
land type use density

River Island - Ecological Services
organic constructed wetlands, marshes, new habitats

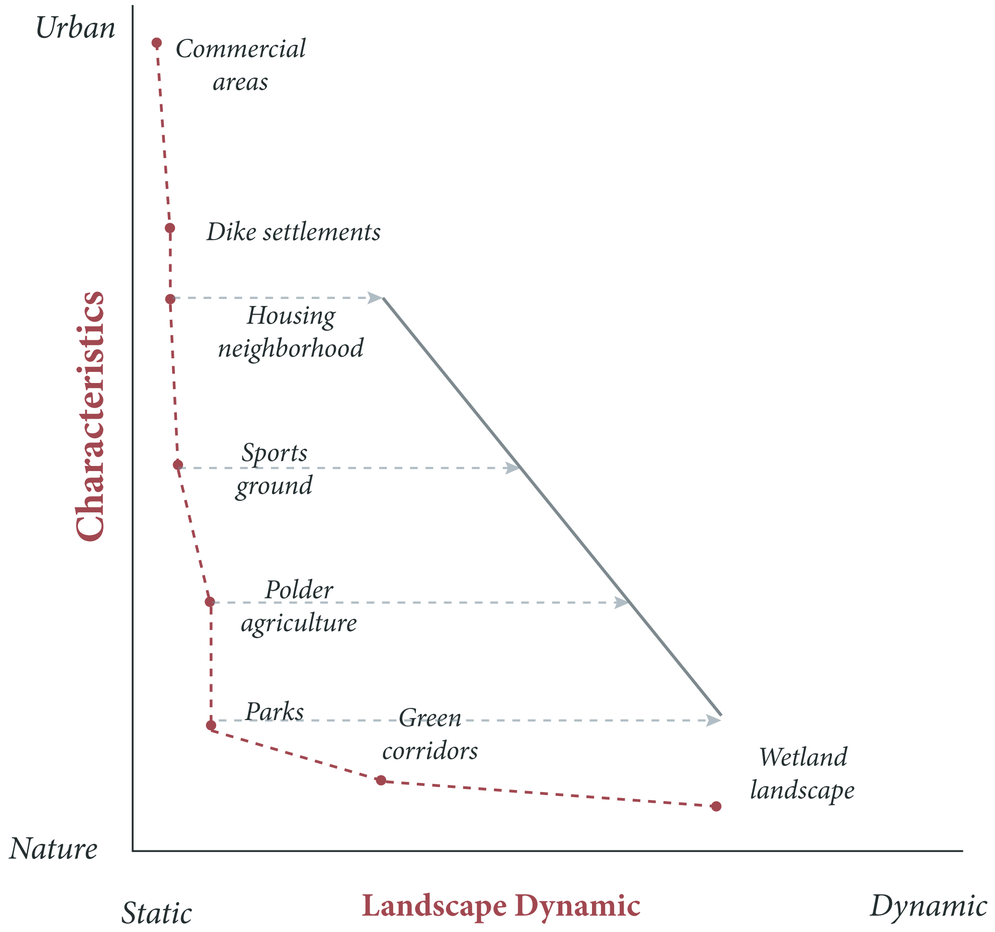


DI- ES - 0
land type use density

Dike - Ecological Services
extension of the dike providing a new dry land to build on



How can an architectural design intervention and a landscape strategy alter our relationship with water in areas prone to flooding (e.g. urbanized delta areas)?


Urban
Commercial areas
Dike settlements
Housing neighborhood
Sports ground
Polder agriculture
Parks
Green corridors
Wetland landscape
Nature
Characteristics
Static
Landscape Dynamic
Dynamic

Designing with nature:

1. *Inhabiting the water cycle*

2. *More adaptive to change in water levels*

Site specific

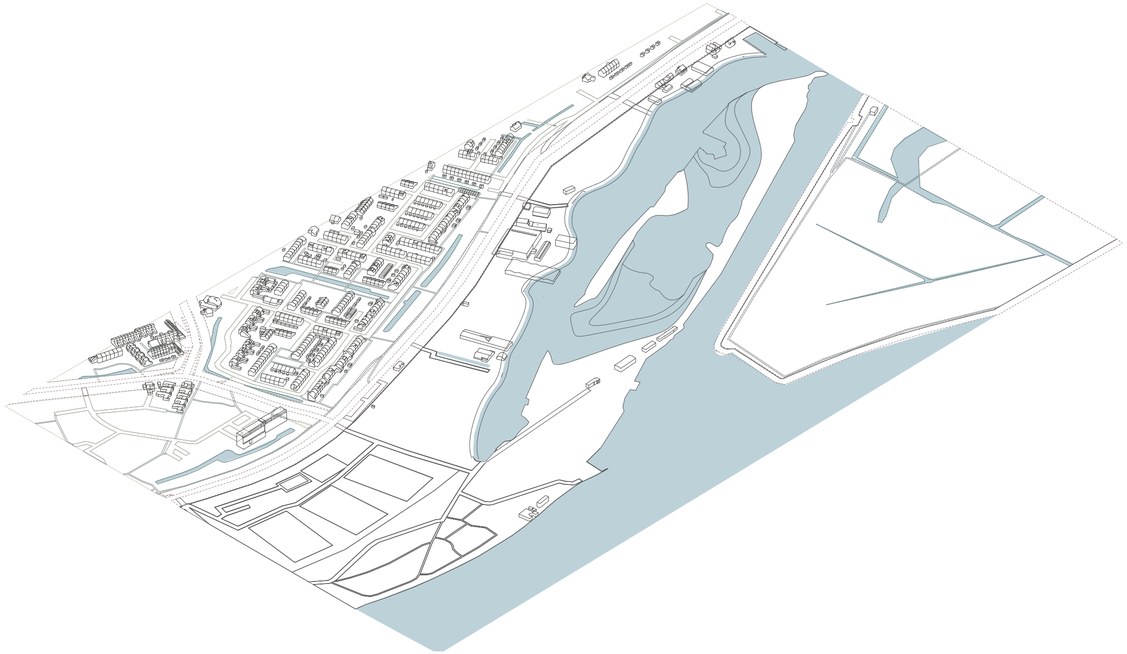
3. *Integrating the new safety policy:*
   Vertical evacuation, spatial adaptation and dike reinforcement

Landscape strategy

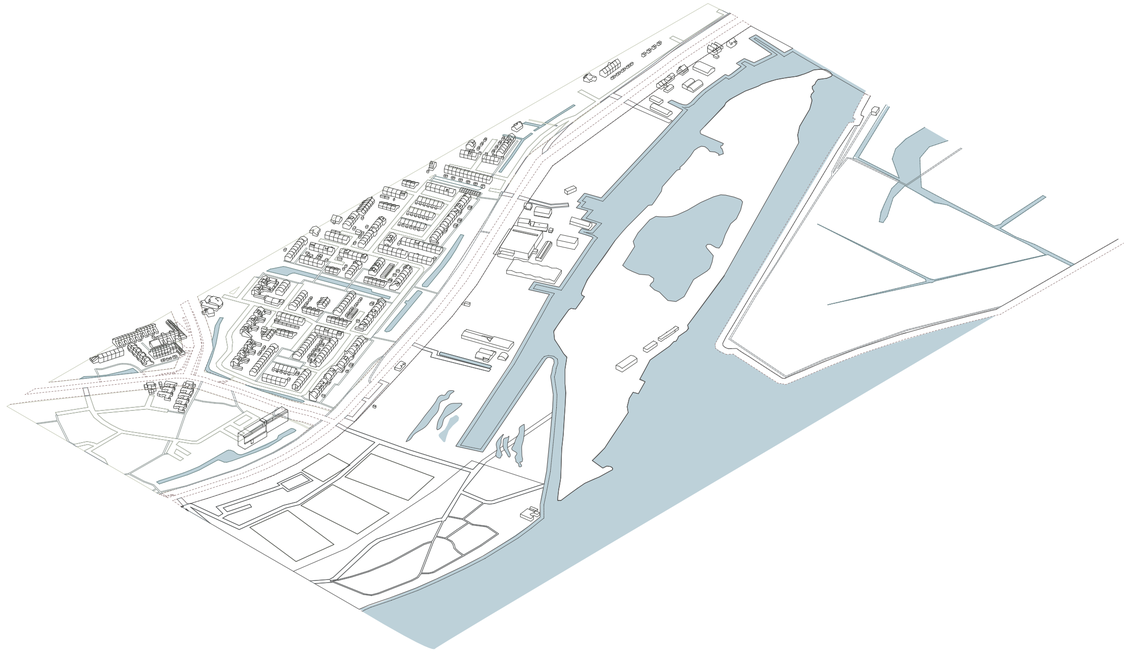
4. Following the 5 principles of designing with waterscapes

Social Awareness

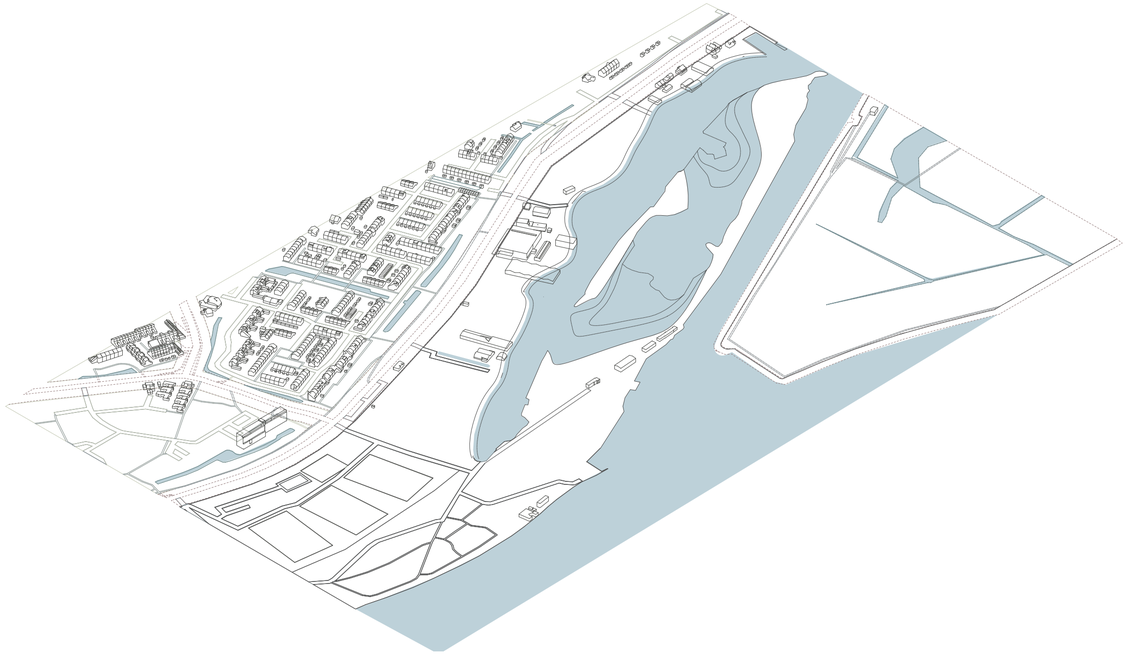
5. Public program - accessibility and connection to all



Introducing a more dynamic Ecosystem



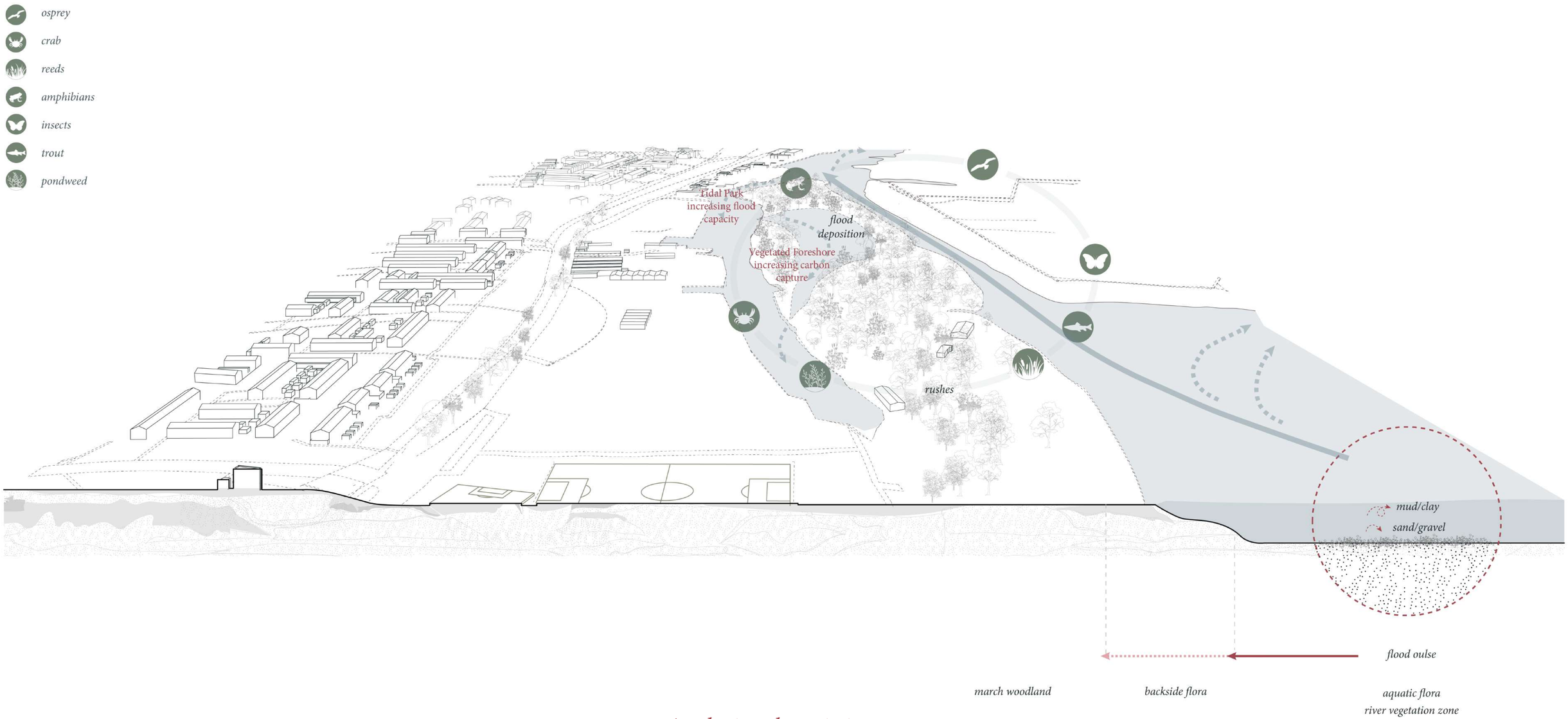
Redeveloping the site programmaticly



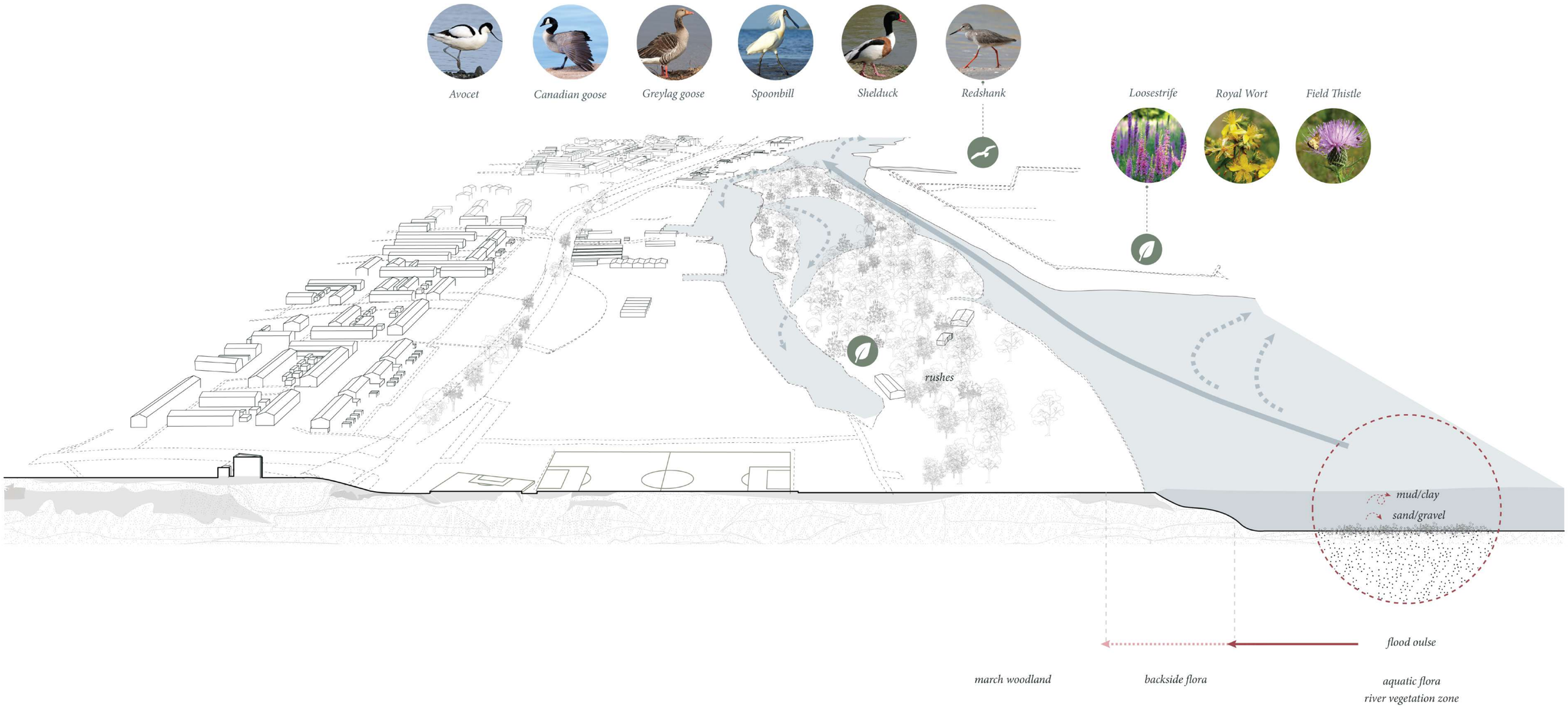
Introducing a more dynamic Ecosystem

1. Analyzing the existing ecosystem
- site analysis and textbook research

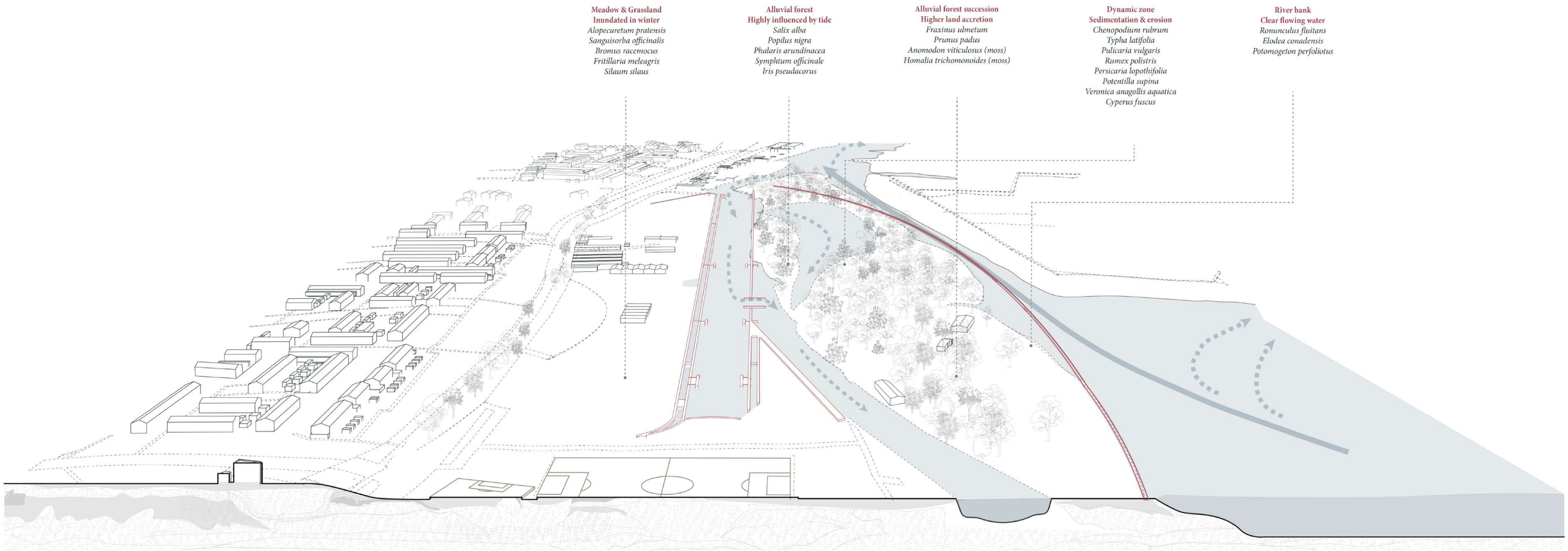
2. Applying landscape strategies to create a better response to the changing water levels



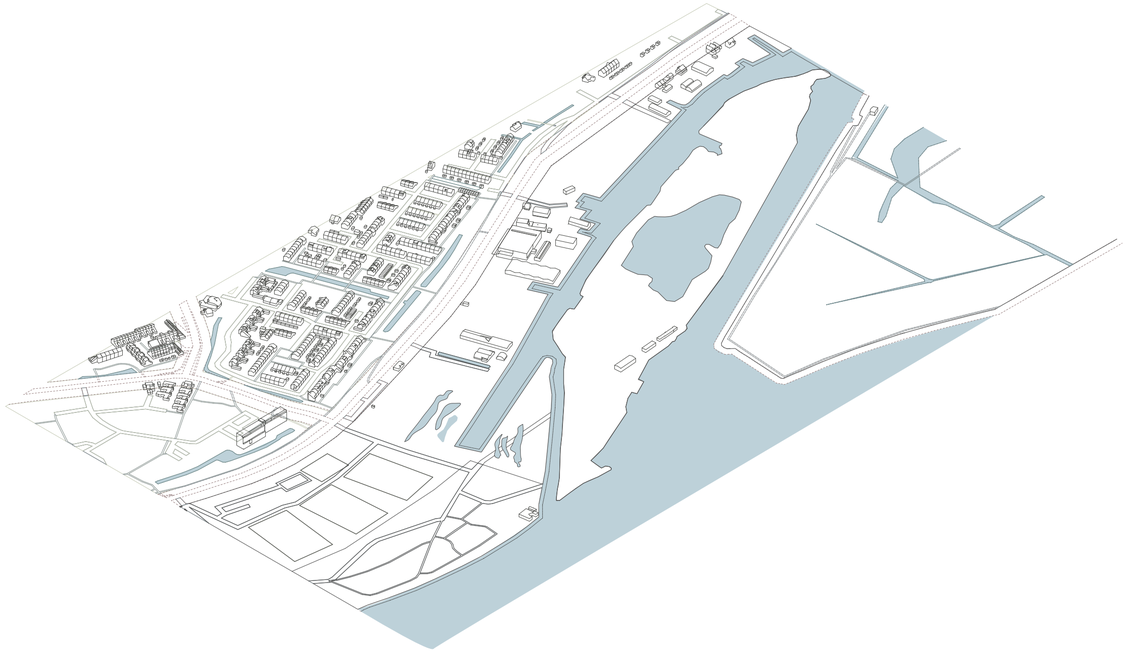
Analyzing the existing ecosystem

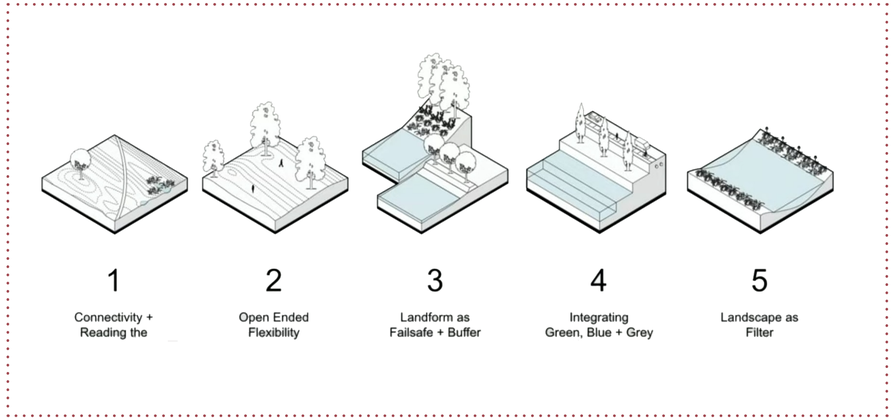


Birds + Trees + Vegitation

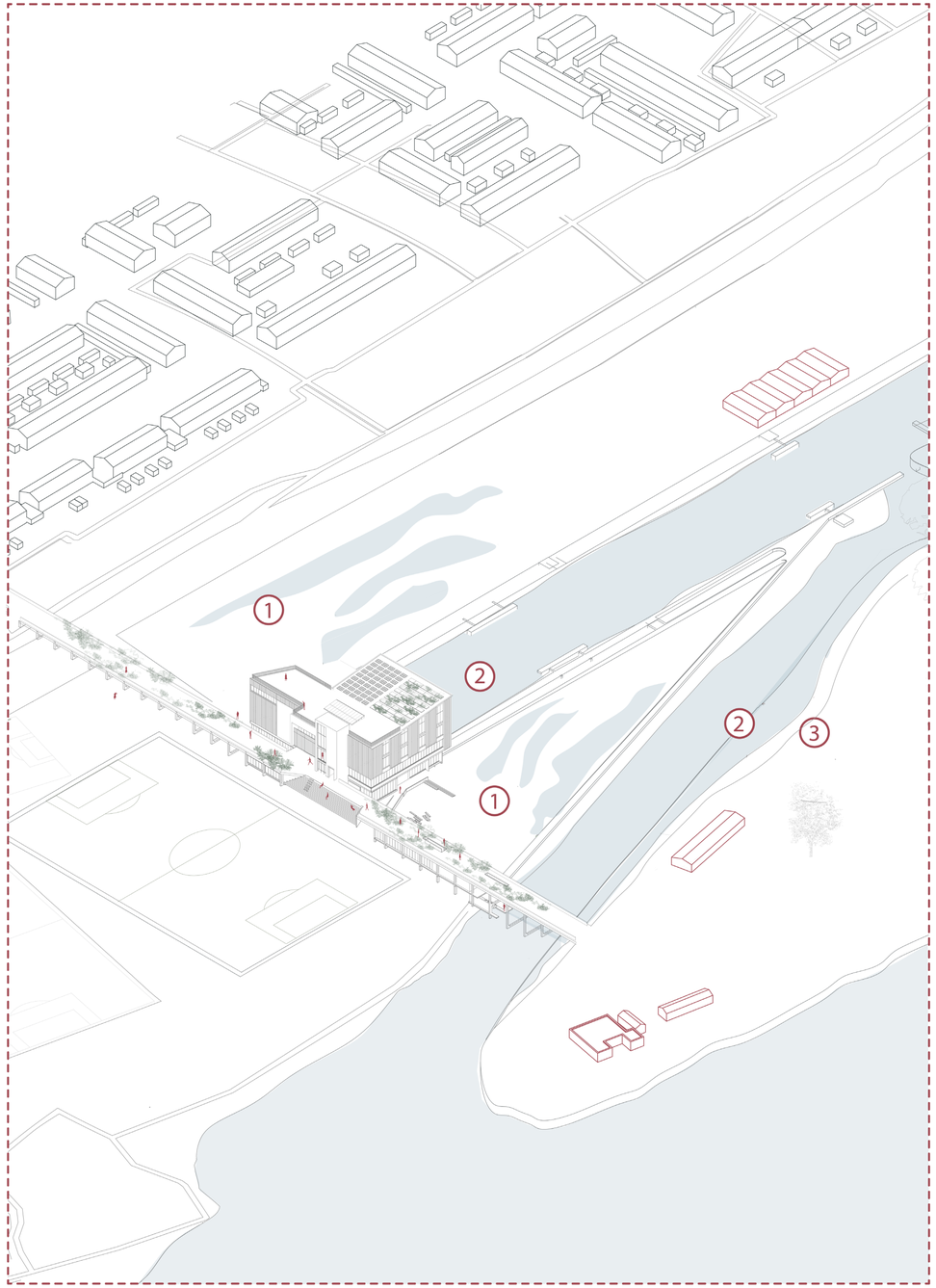


Introducting a new Landscape





Redeveloping the site programmaticly

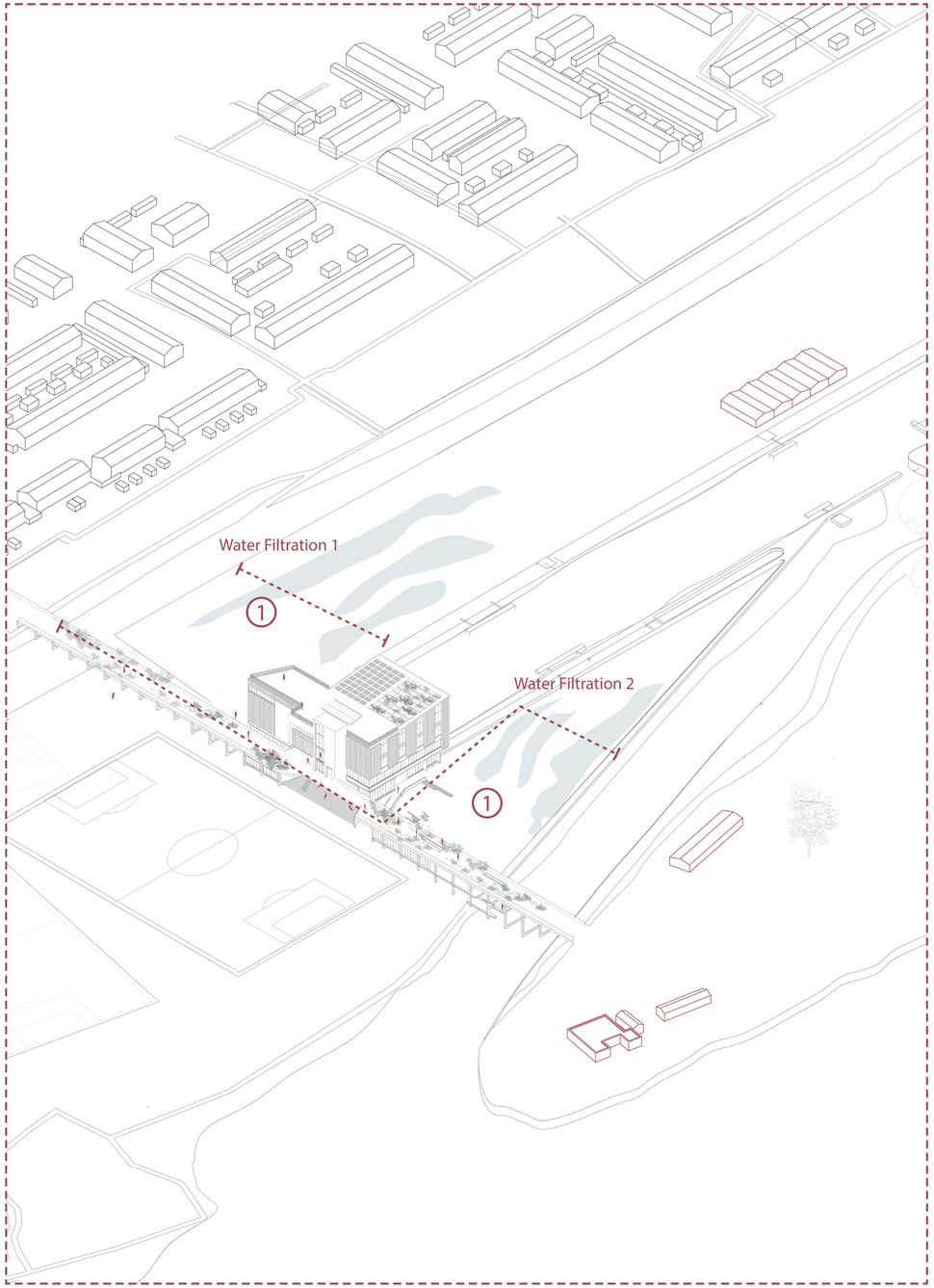


Waterscape strategy

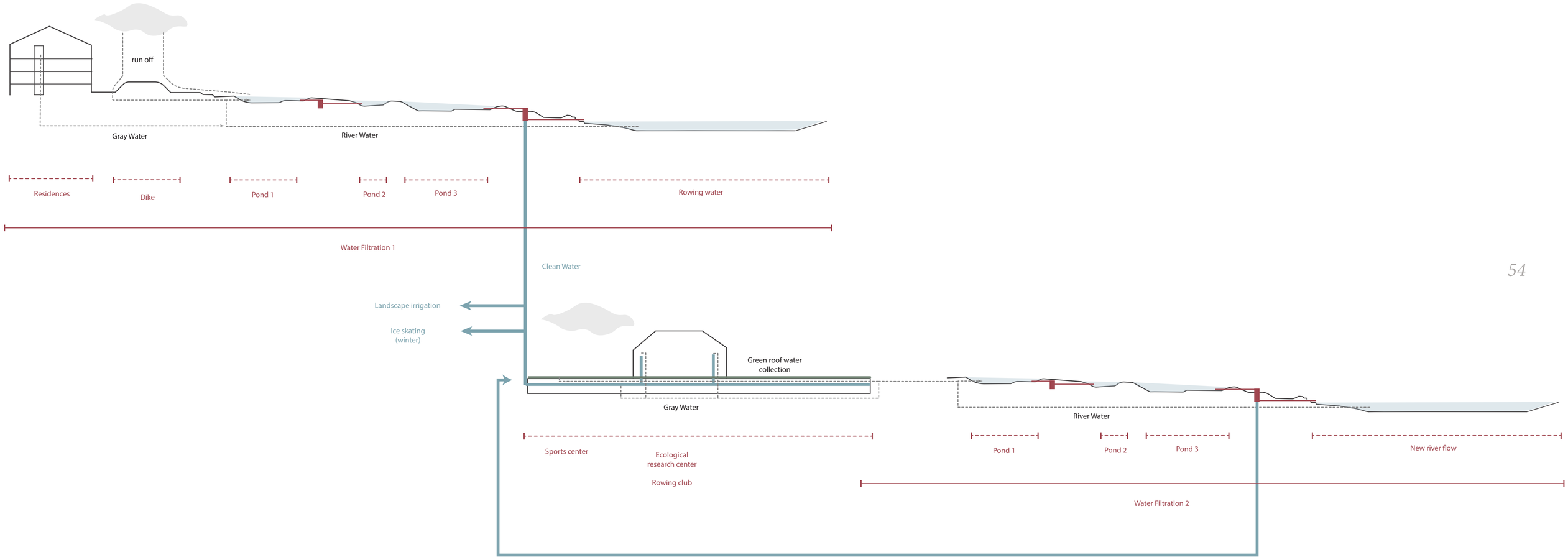
1. Water retension ponds used for filtrating gray water, run off, and river water

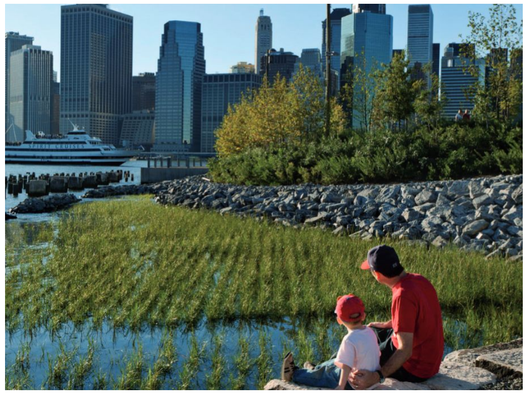
2. Dug out soil - allowing recreational water sports and water relief

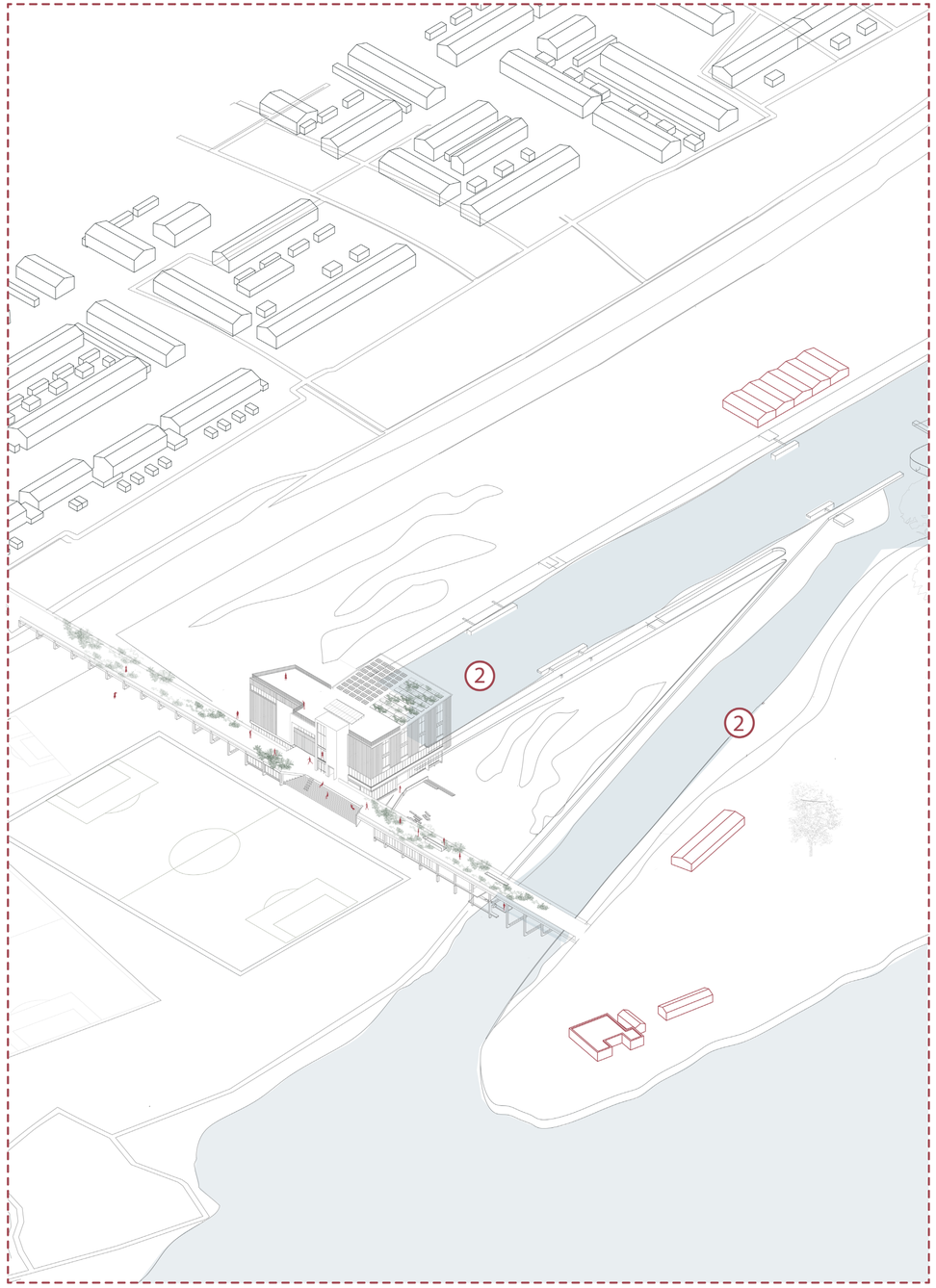
3. Water feature - theater on the water, allowing the water to overflow


Water Filtration 1
1
Water Filtration 2
1

Water filtration using water retension ponds



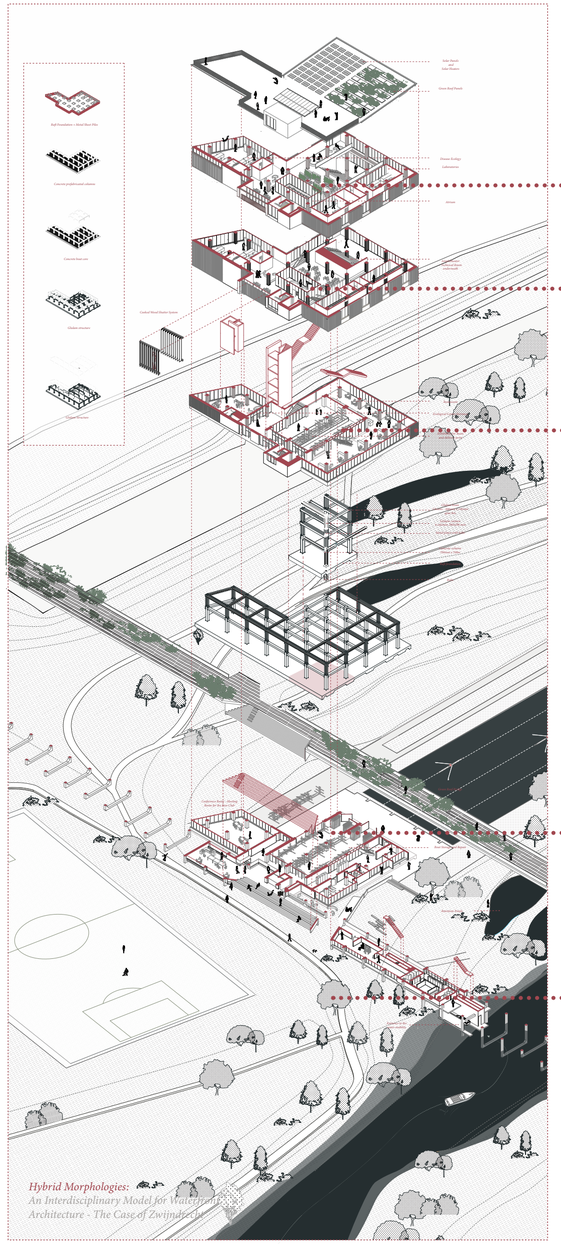




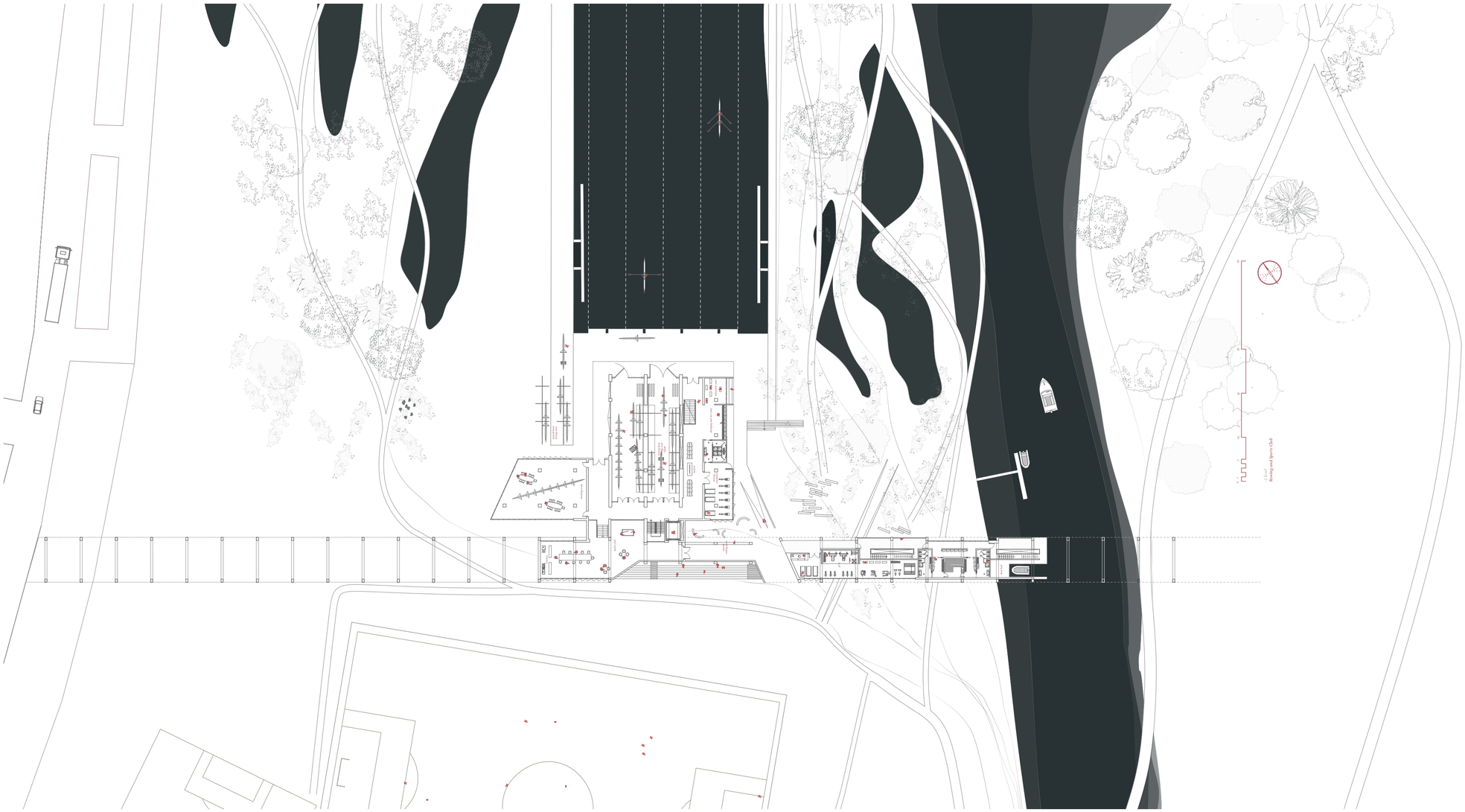
Social integration
+
Biodiversity
+
Water Cycles
+
Ecology Reseach on biodiversity

01 Filtration ponds
02 Sports center
03 Rowing club
04 Retention ponds
05 Restaurant
06 Rowing watch tower
07 Bird watching

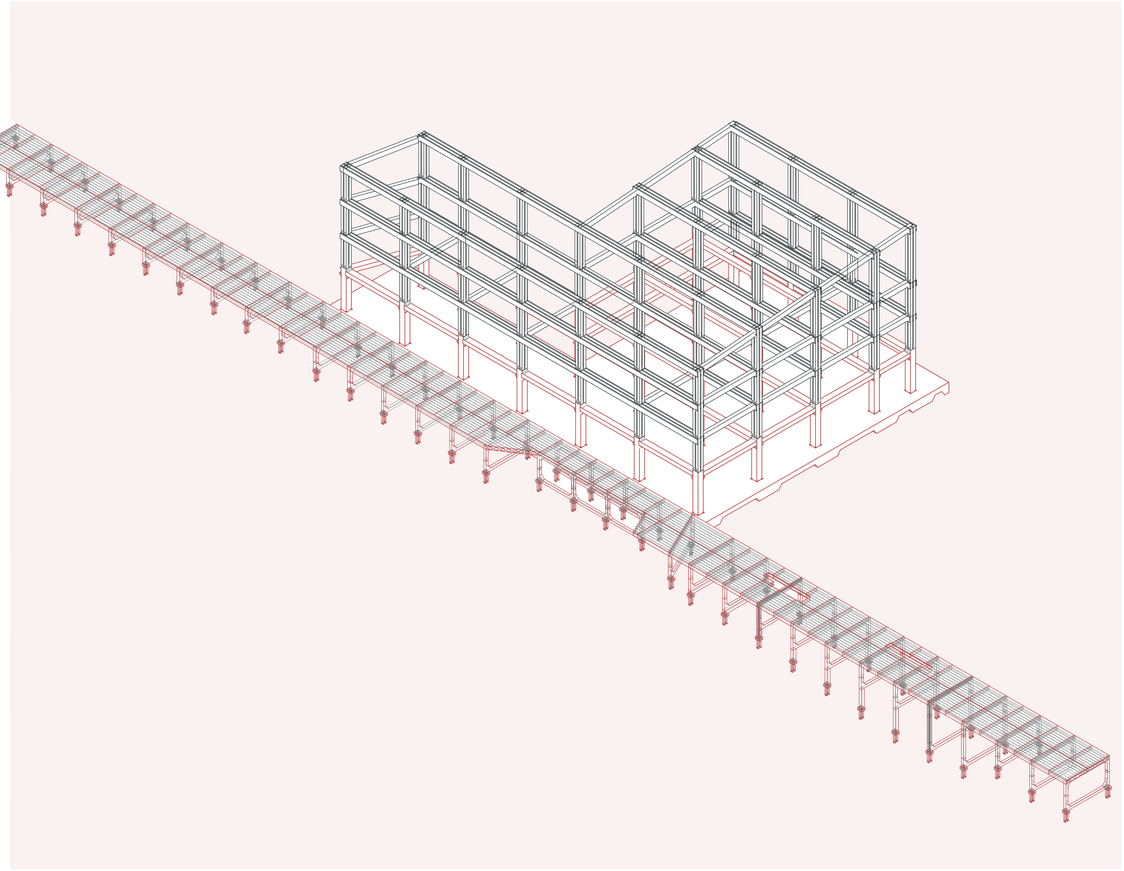
0 100m 200m 300m 400m 500m

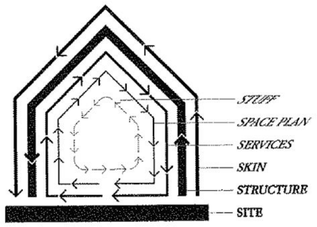

Ecological Research Center
Visitors Center and Boat Exhibition
Rowing Club and Boat Storage
Sports Club and Football Club
Hybrid Morphologies:
An Interdisciplinary Model for Waterfront
Architecture - The Case of Zwijndrecht

Design Concept
The Dynamic and Static



Urban Plan



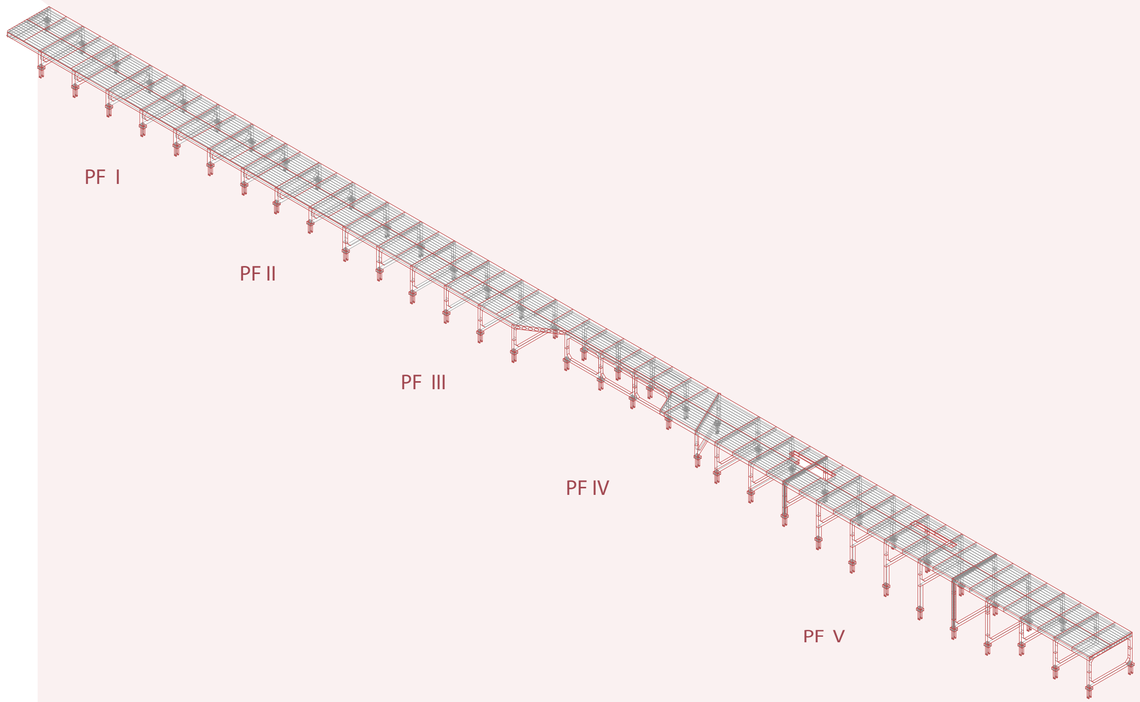


The two structure

Demountable wooden construction

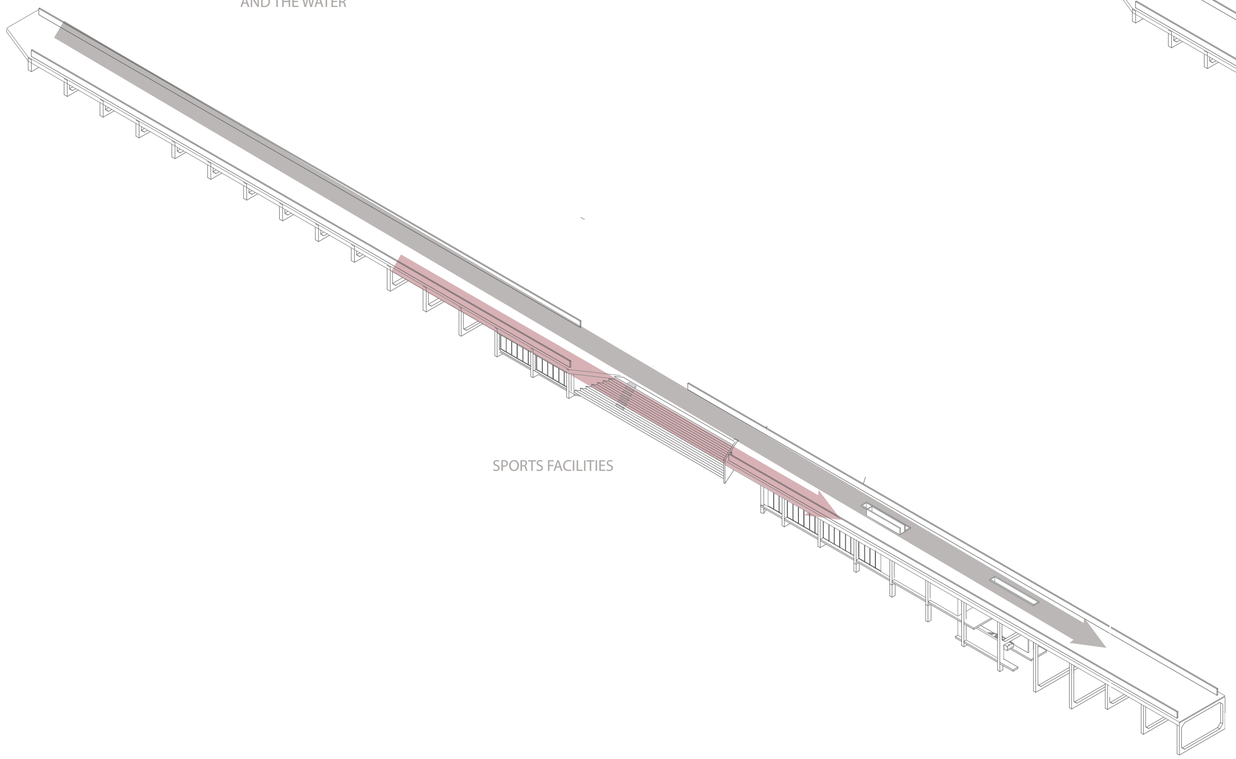
Life Cycle - as building on site 50 years as seperate elements 30 - 40 years
Prefabricated concrete

Life Cycle - as building 100 years as Landscape 150 - 200 years

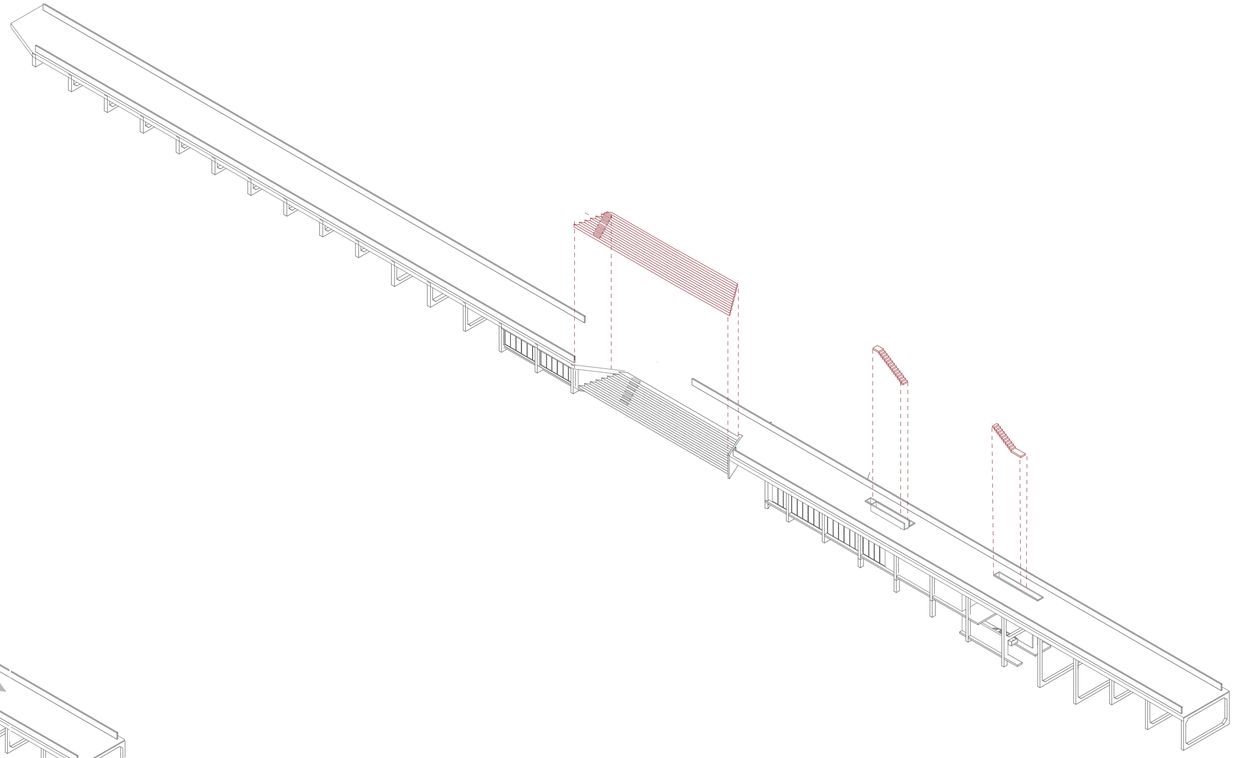

PF I
PF II
PF III
PF IV
PF V

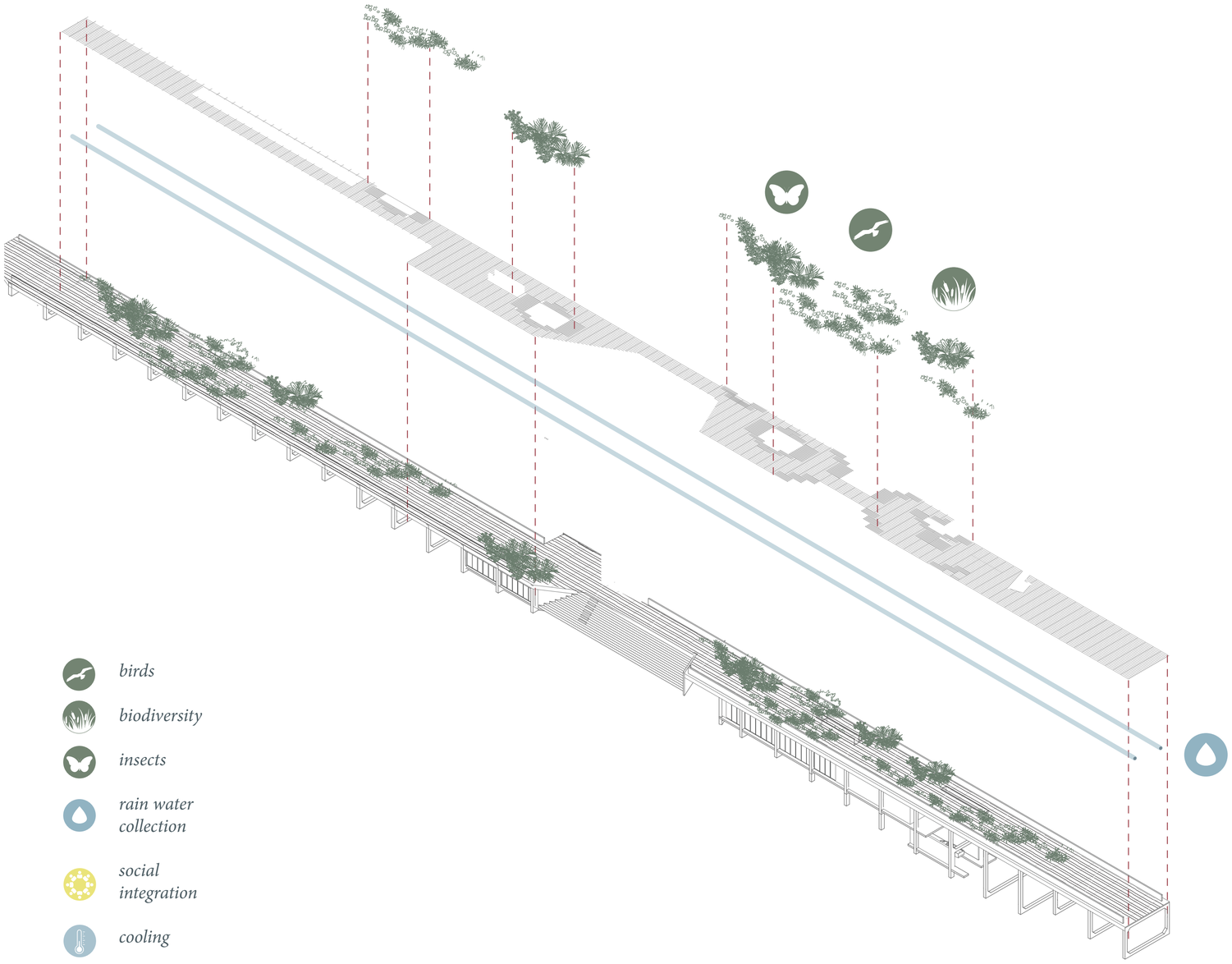
CONNECTING THE URBAN (BEHIND THE DIKE)

AND THE WATER

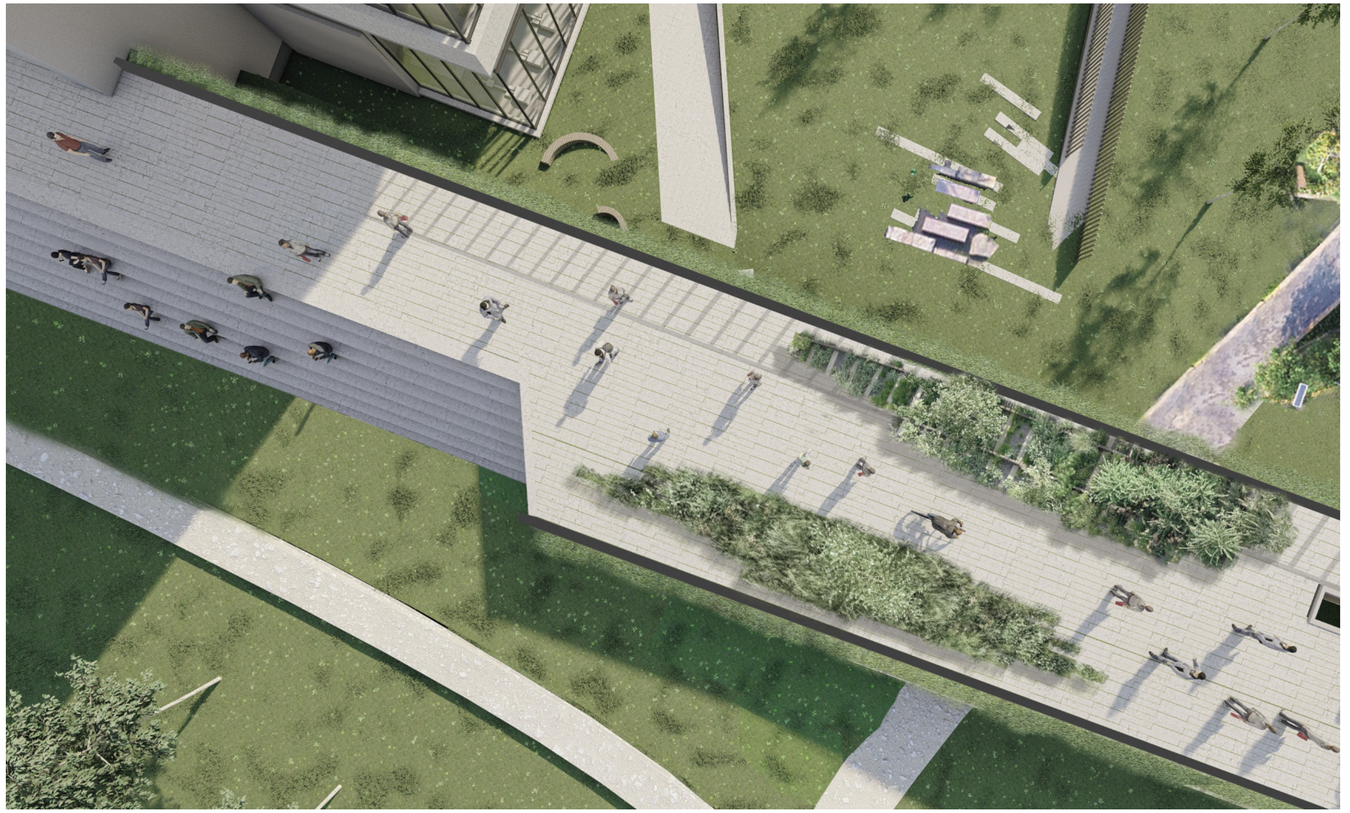


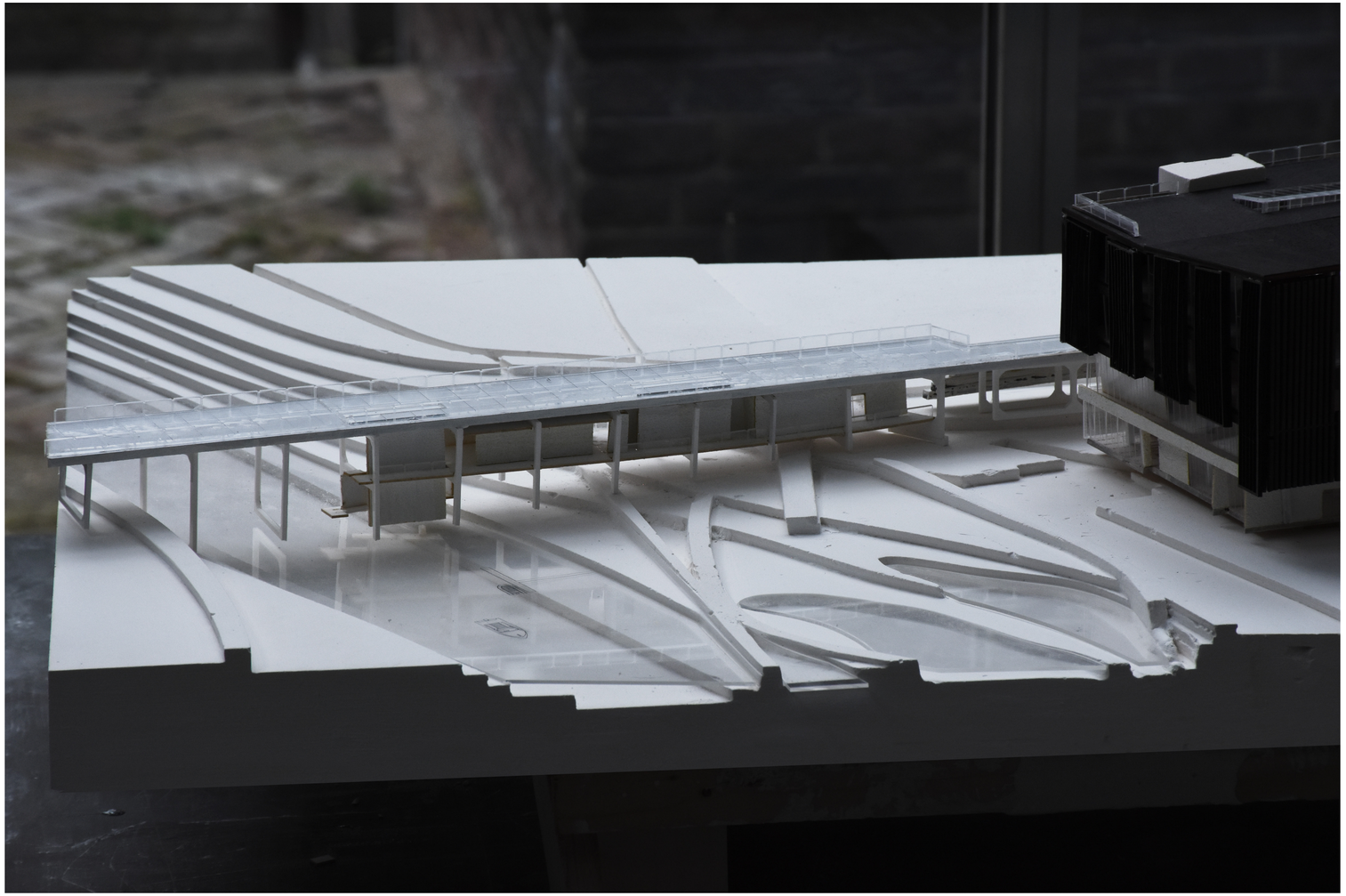
SPORTS FACILITIES

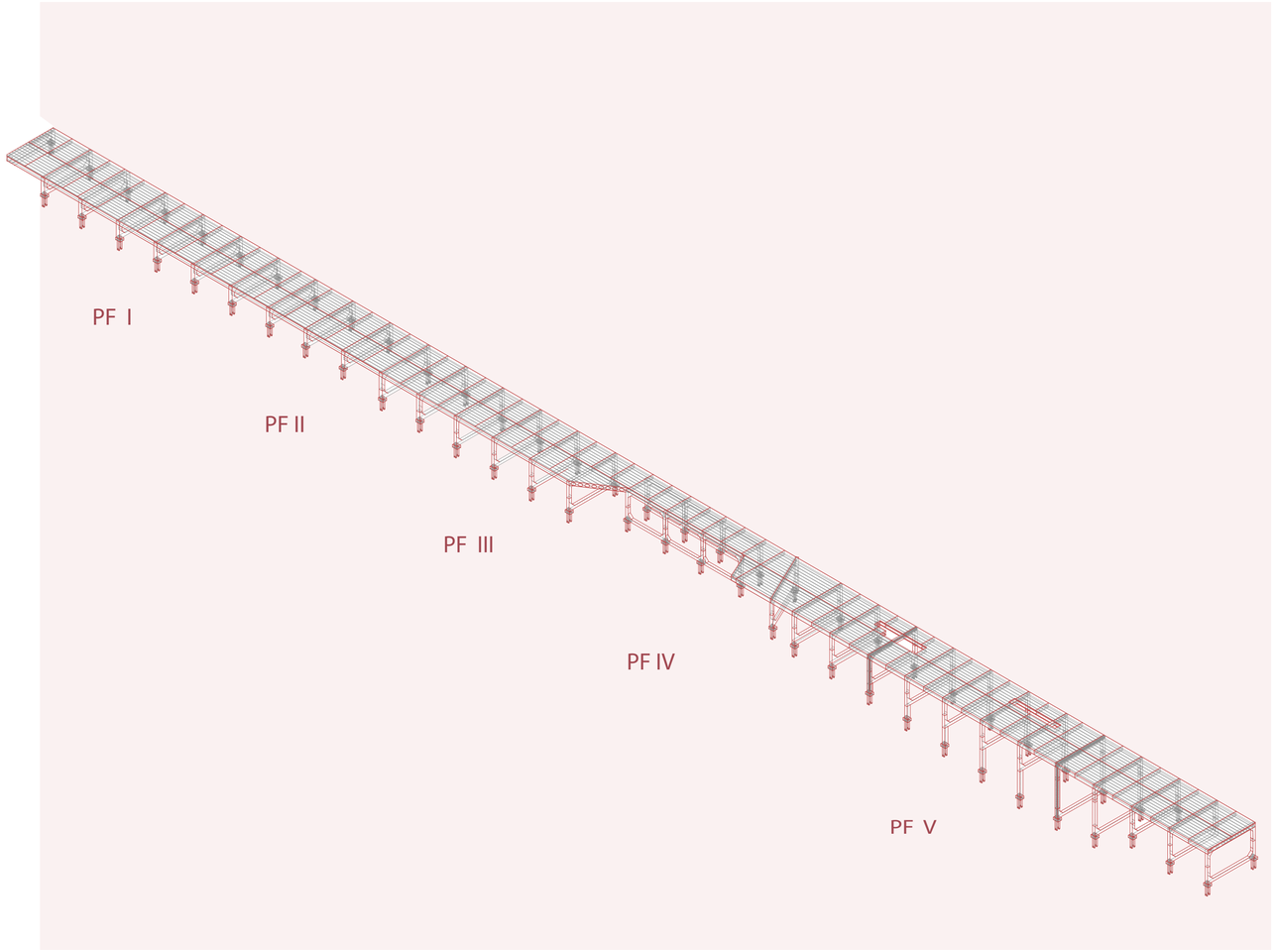


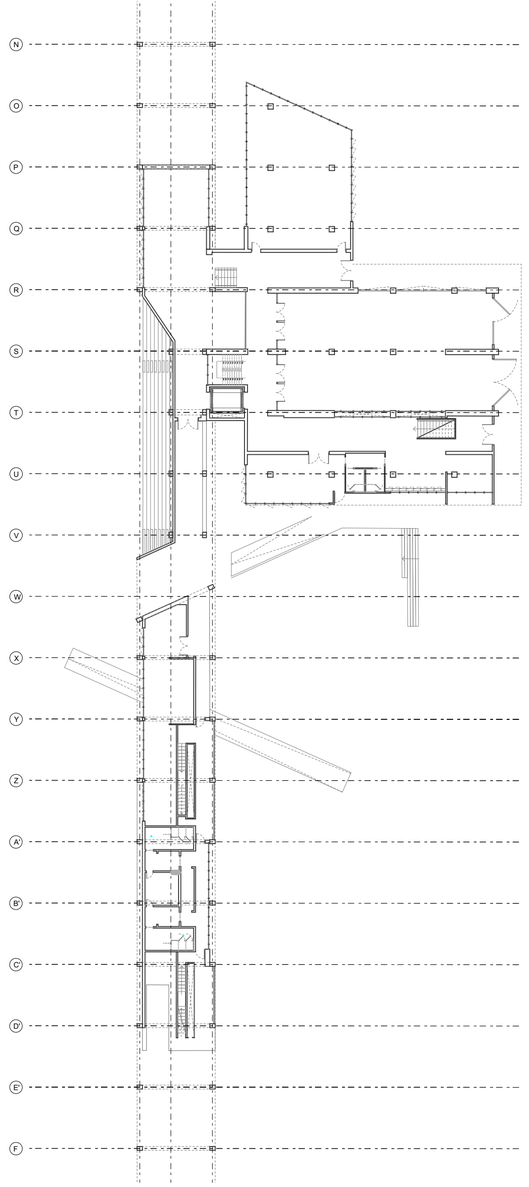


Social integration
+
Biodiversity
+
Water Cycles
+
Ecology Reseach on Green Roofs






PF I
PF II
PF III
PF IV
PF V


N
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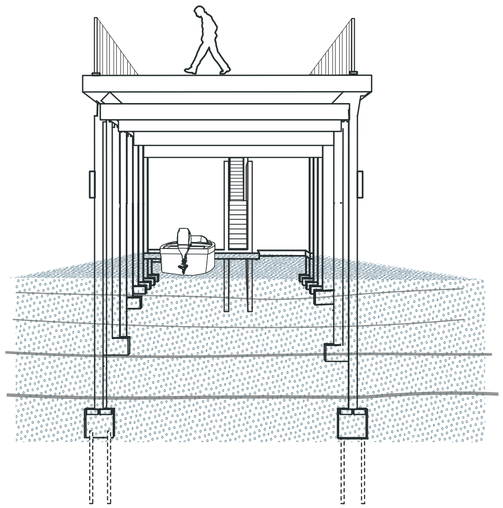
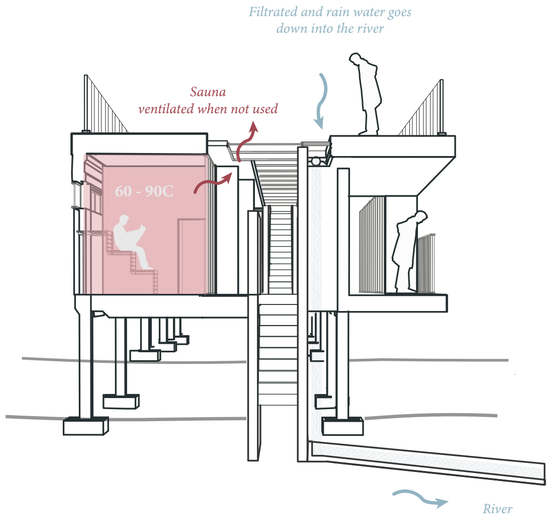
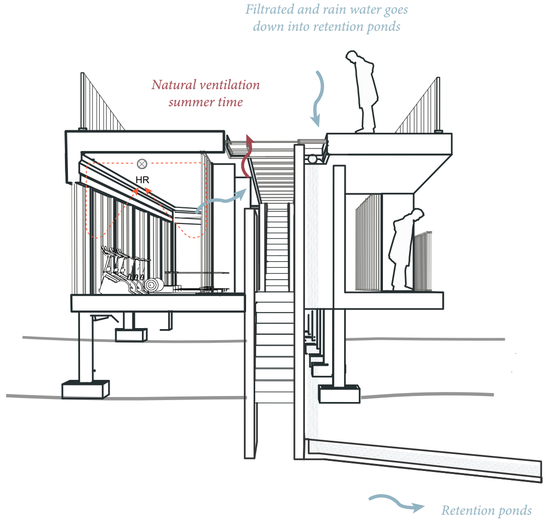


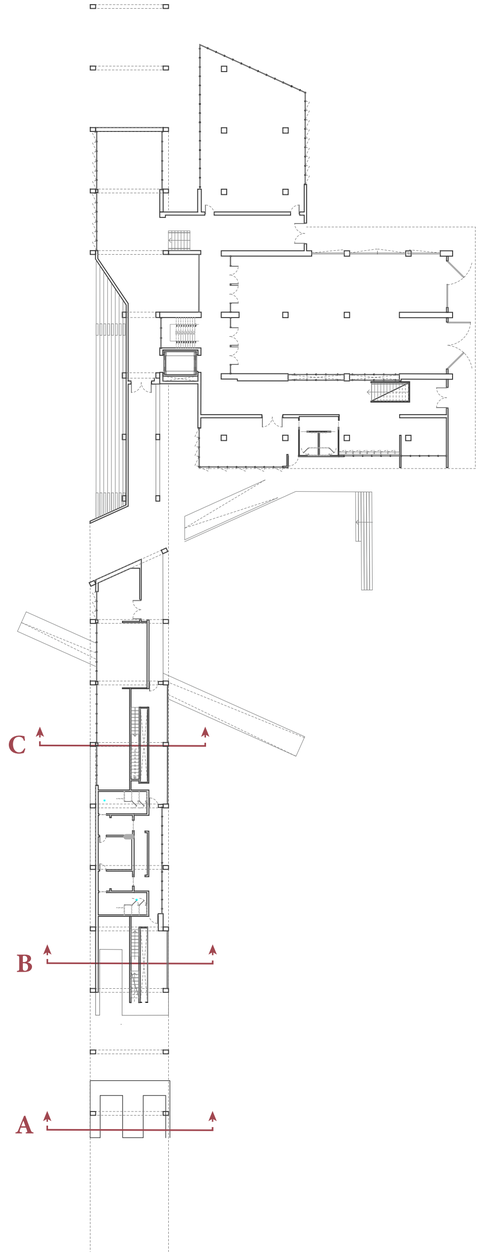
A - Water Mobility Hub

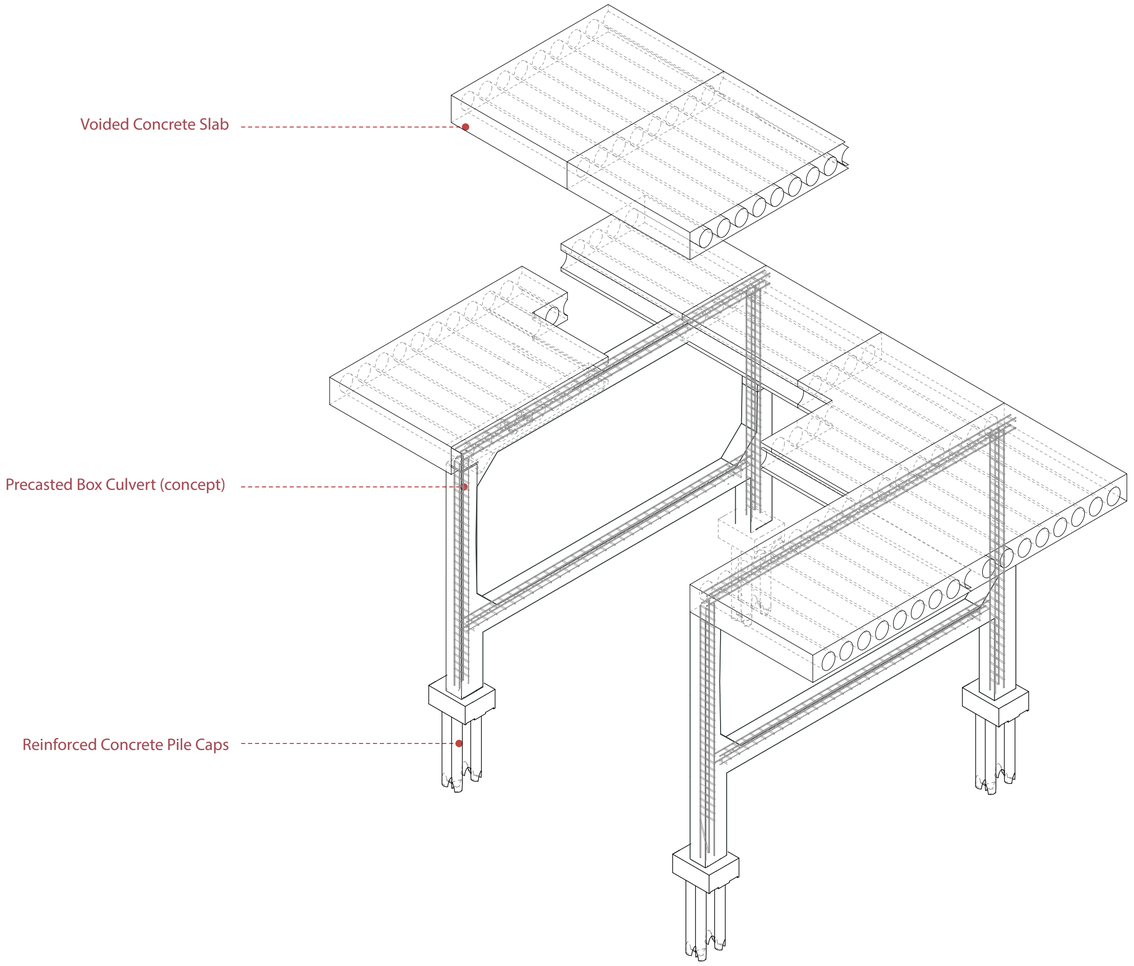


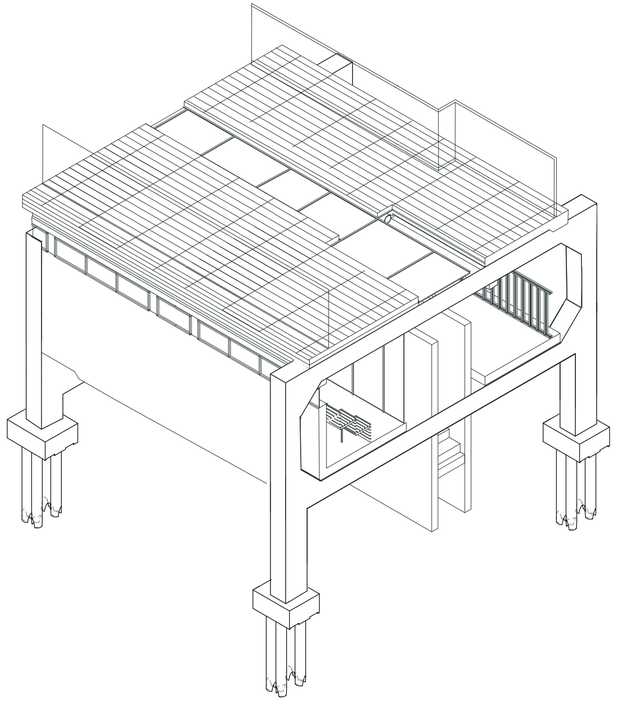
B - Water filtration - free -
goes to the river

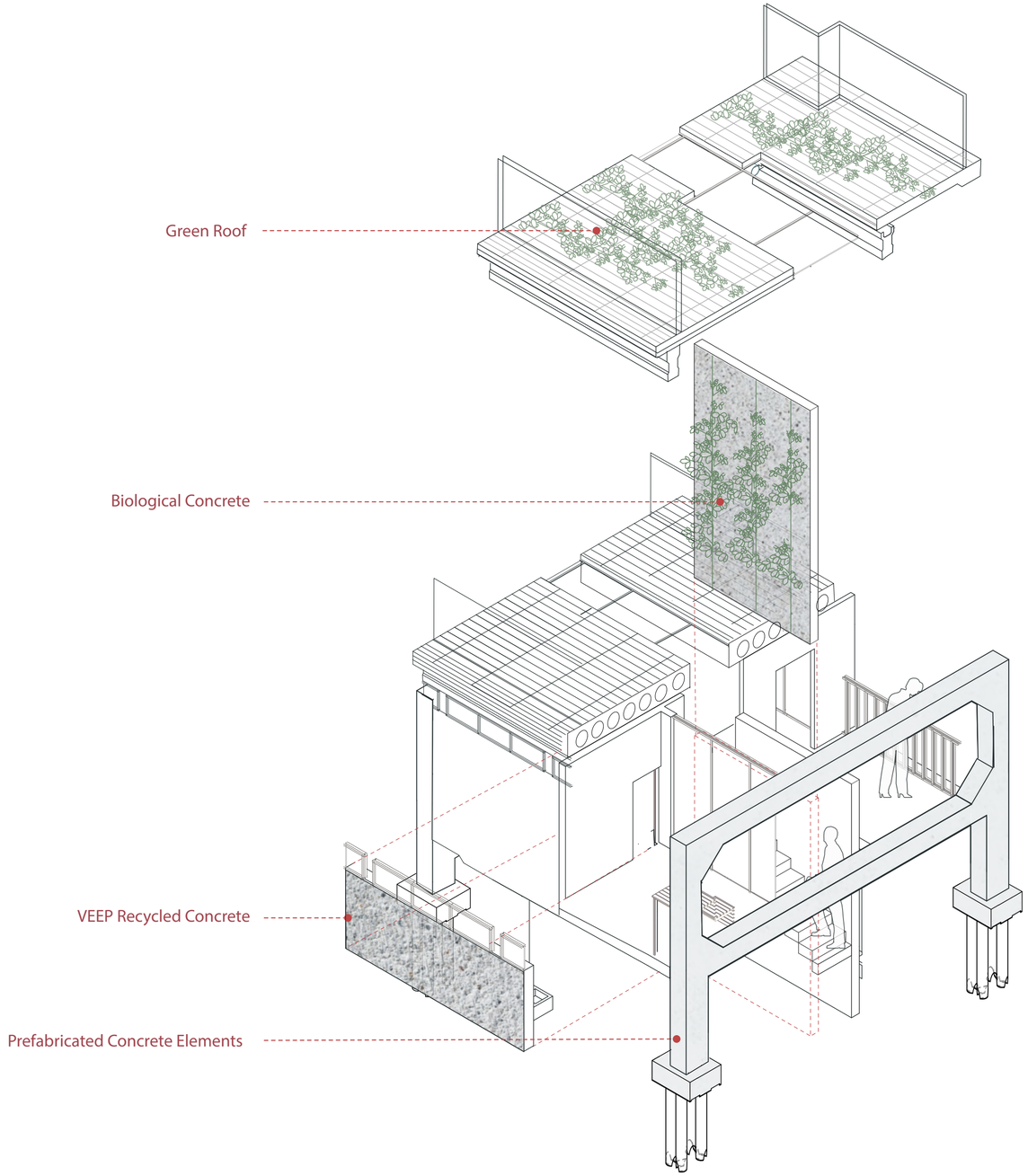


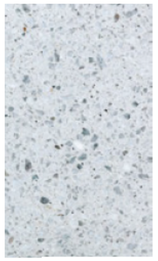
C - Water filtration -
controlled - goes to the
retention ponds where it
can be reused




Voided Concrete Slab
Precasted Box Culvert (concept)
Reinforced Concrete Pile Caps







Biological Concrete

Pre casted Concrete

VEEP Recycled Concrete

From top to bottom:

Plant Community
"Urban Climate Roof"

System Subsurface "Rocky Type

Dripperline 500-L2

Floradrain FD 40 - E

Protection Mat SSM 45

Root Barrier WSF 40

Concrete slab 60 mm

Gravel fill 50 mm

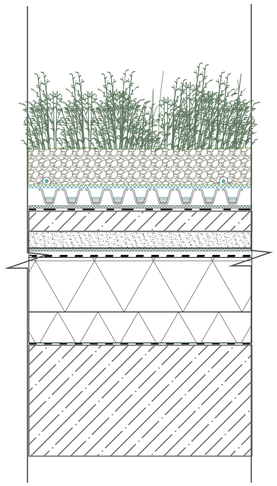
Drainage mat rubber shot 10 mm

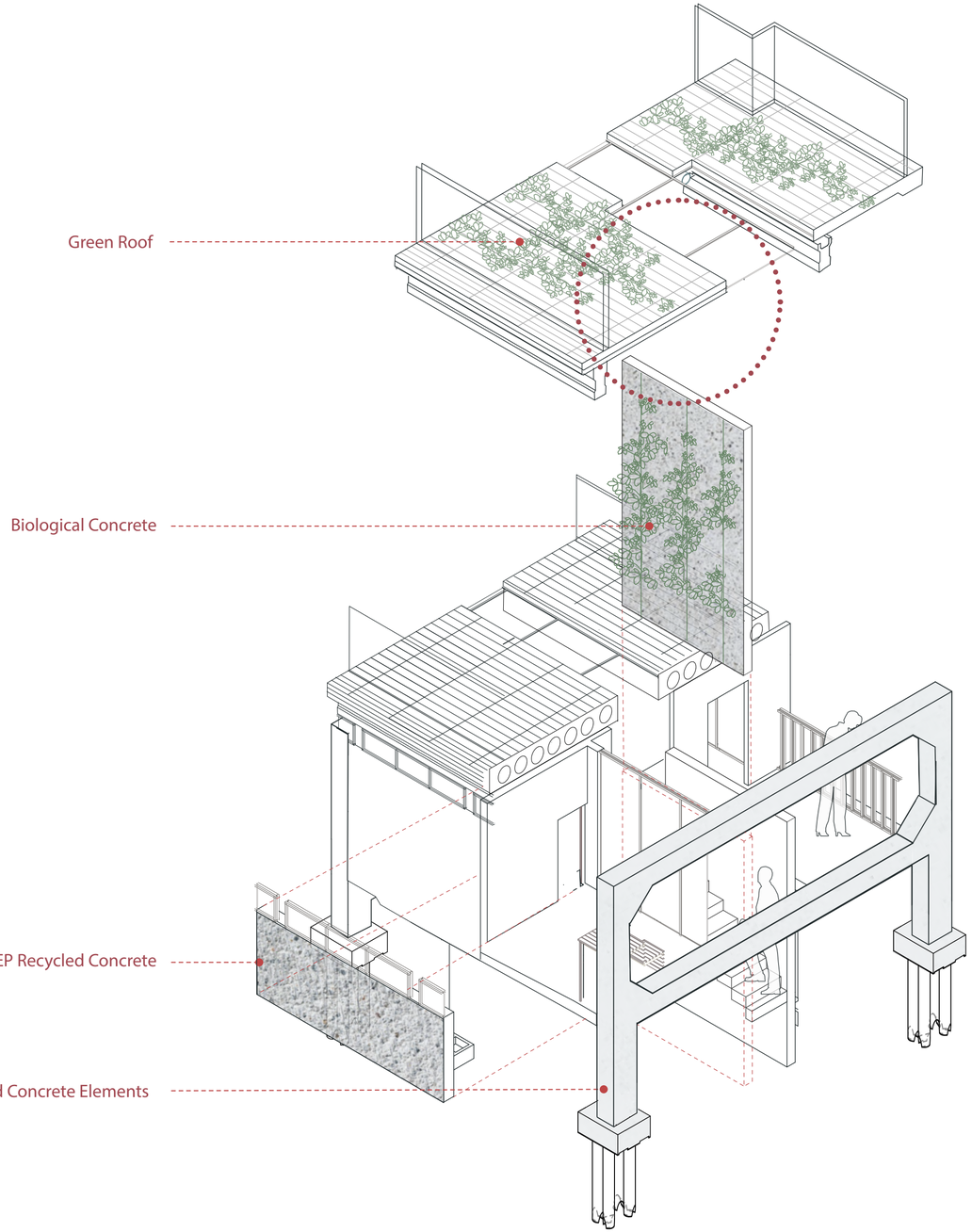
Sealing bitumen, two layers, 20 mm

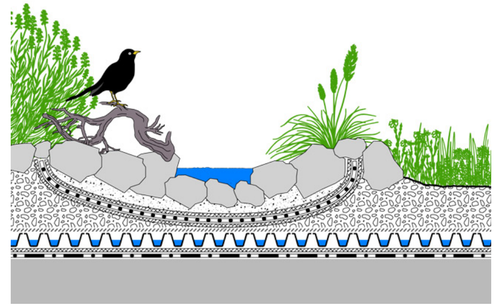
Thermal insulation 360 mm

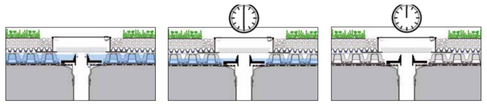
Vapor barrier

Reinforced concrete 320 mm





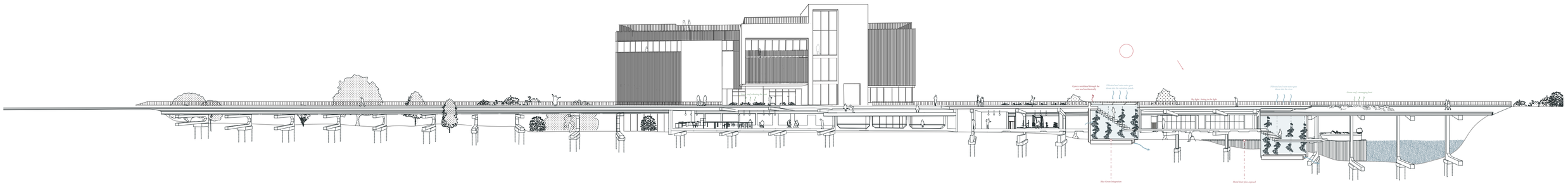




During extreme rainfall events, the water in the retention space of the spacer element will rise up to the upper edge of the inlet pipe.

The water will run off again through the retention orifice at a strictly controlled rate and over a pre-defined period (e.g. 24 hours)

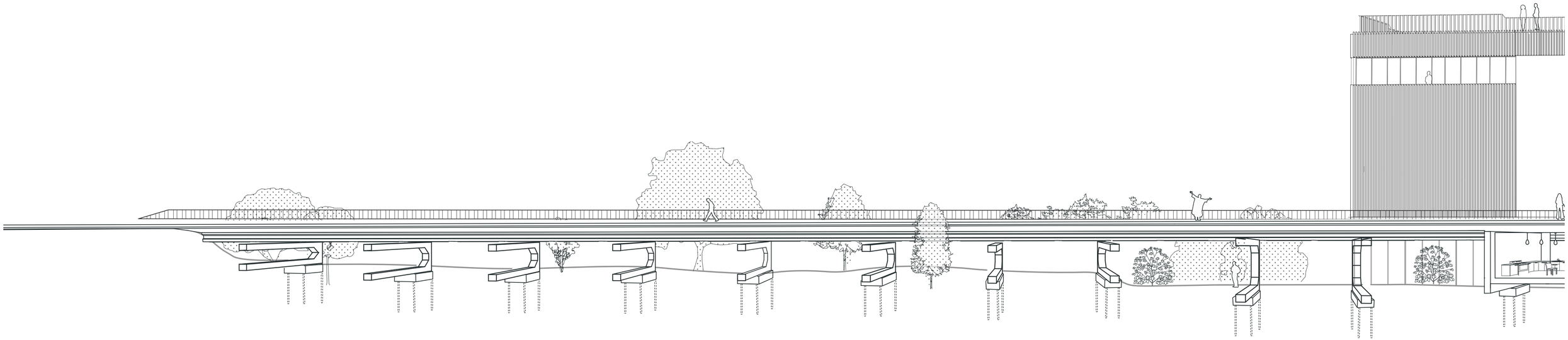
... so that the retention space is emptied and is then available for the next precipitation event.



Perspective Section
1:200

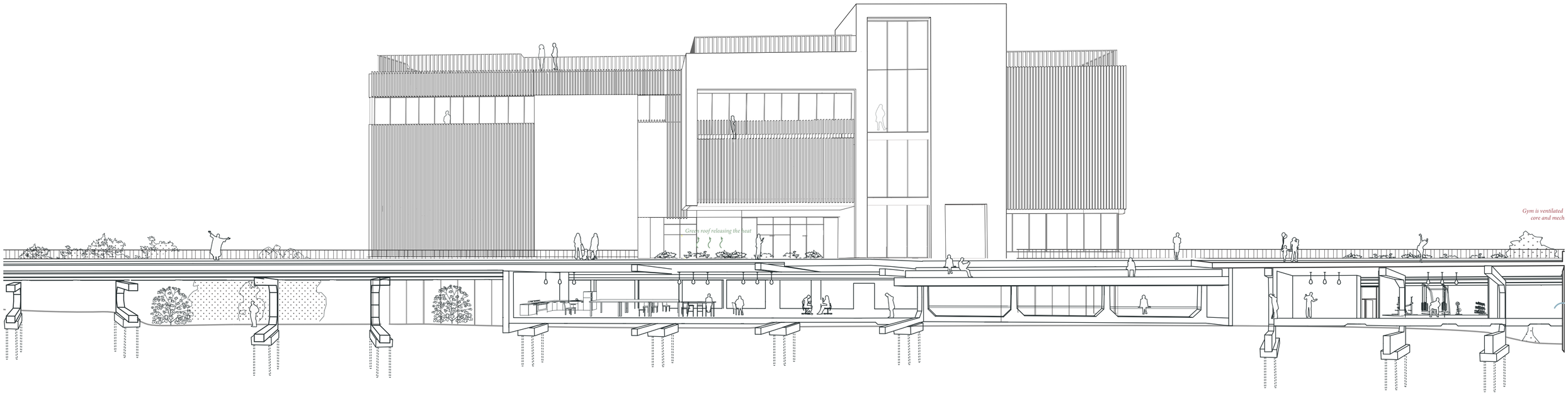
Hybrid Morphologies
a deck, bridge, pier, pontoon, dike

Perspective Section



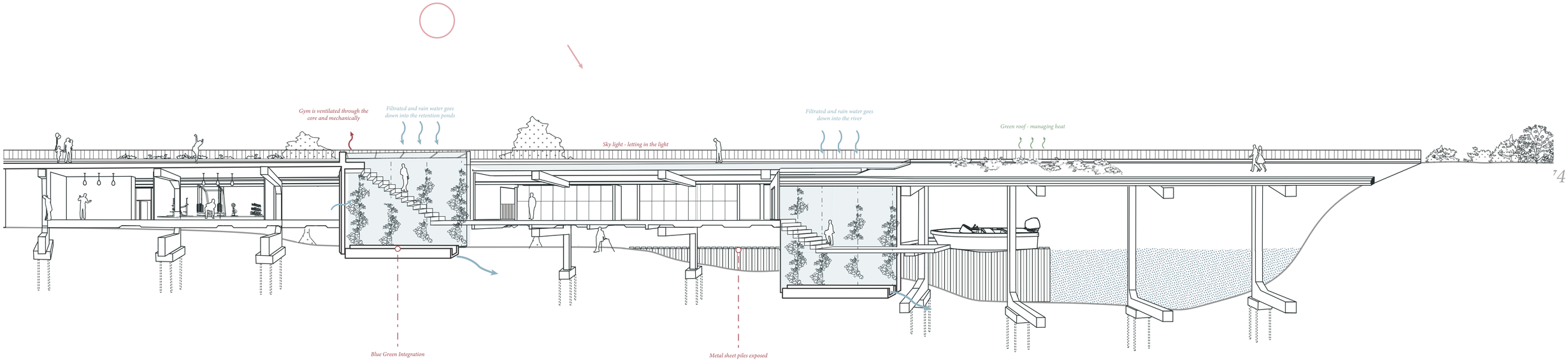
Hybrid Morphologies
a deck, bridge, pier, pontoon, dike

Perspective Section



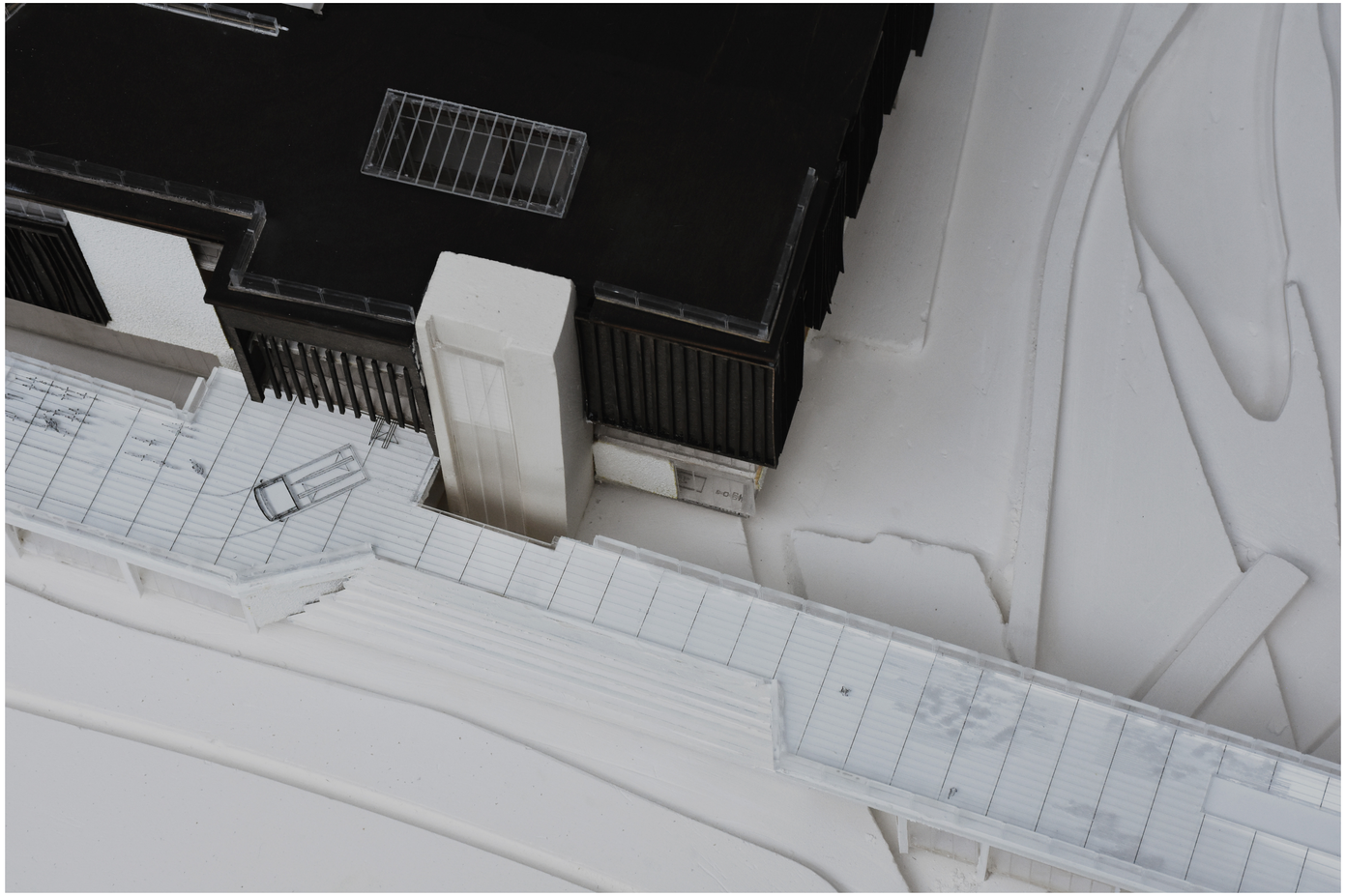
Hybrid Morphologies
a deck, bridge, pier, pontoon, dike

Perspective Section



Hybrid Morphologies
a deck, bridge, pier, pontoon, dike

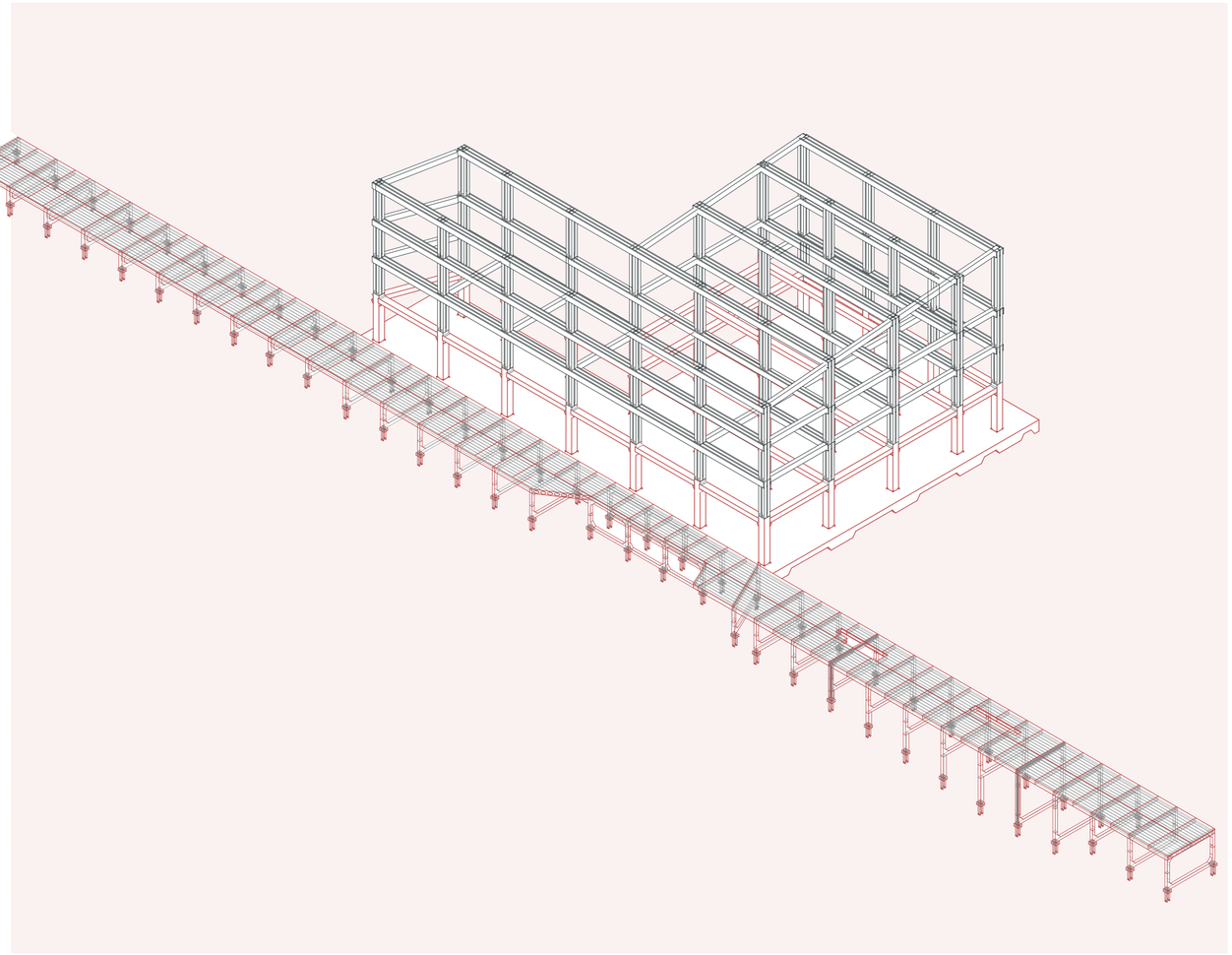
Perspective Section

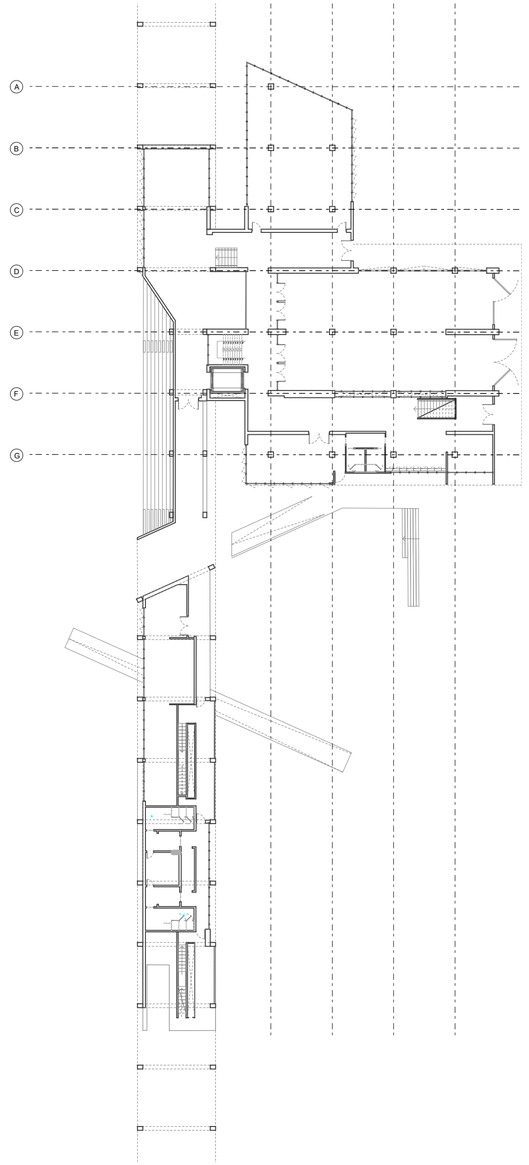


The intersection between two structures

Perspective Section


LUMION
PRO STUDENT




A
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0 1
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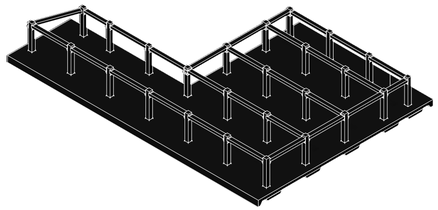
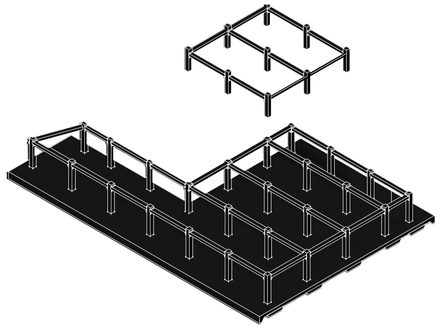
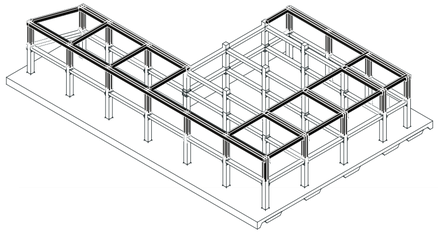


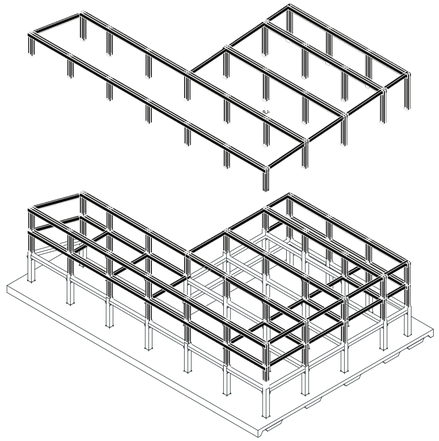
Concrete prefabricated columns



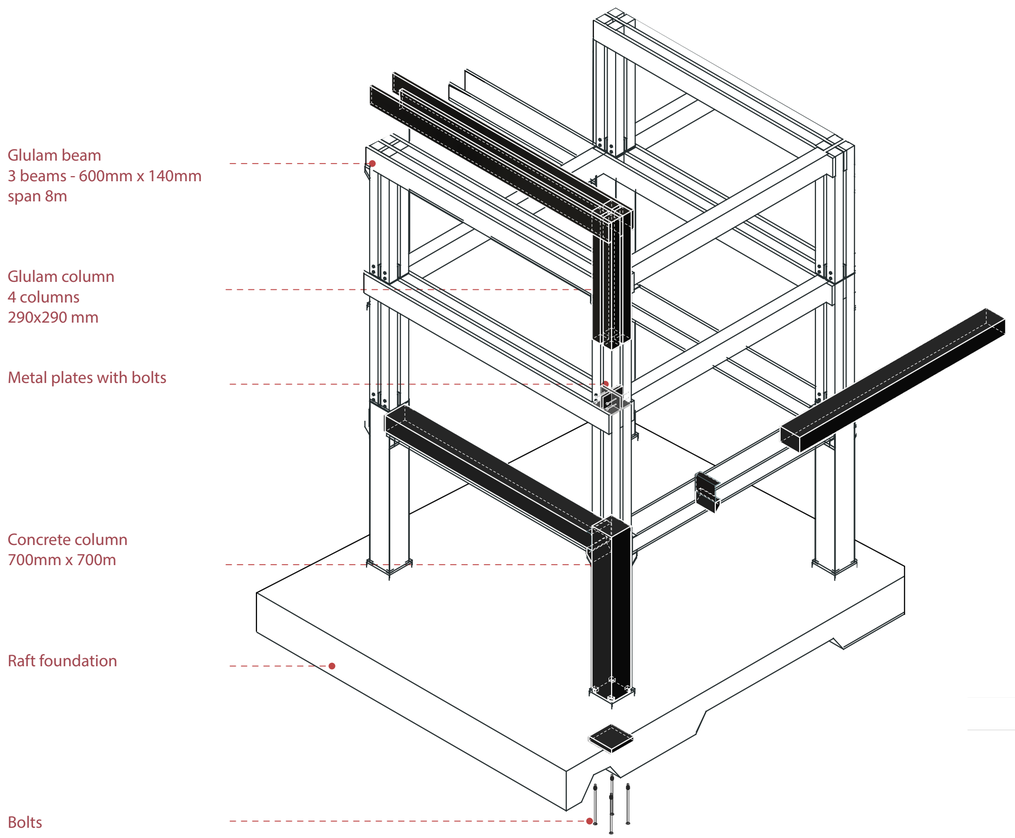
Concrete boat core

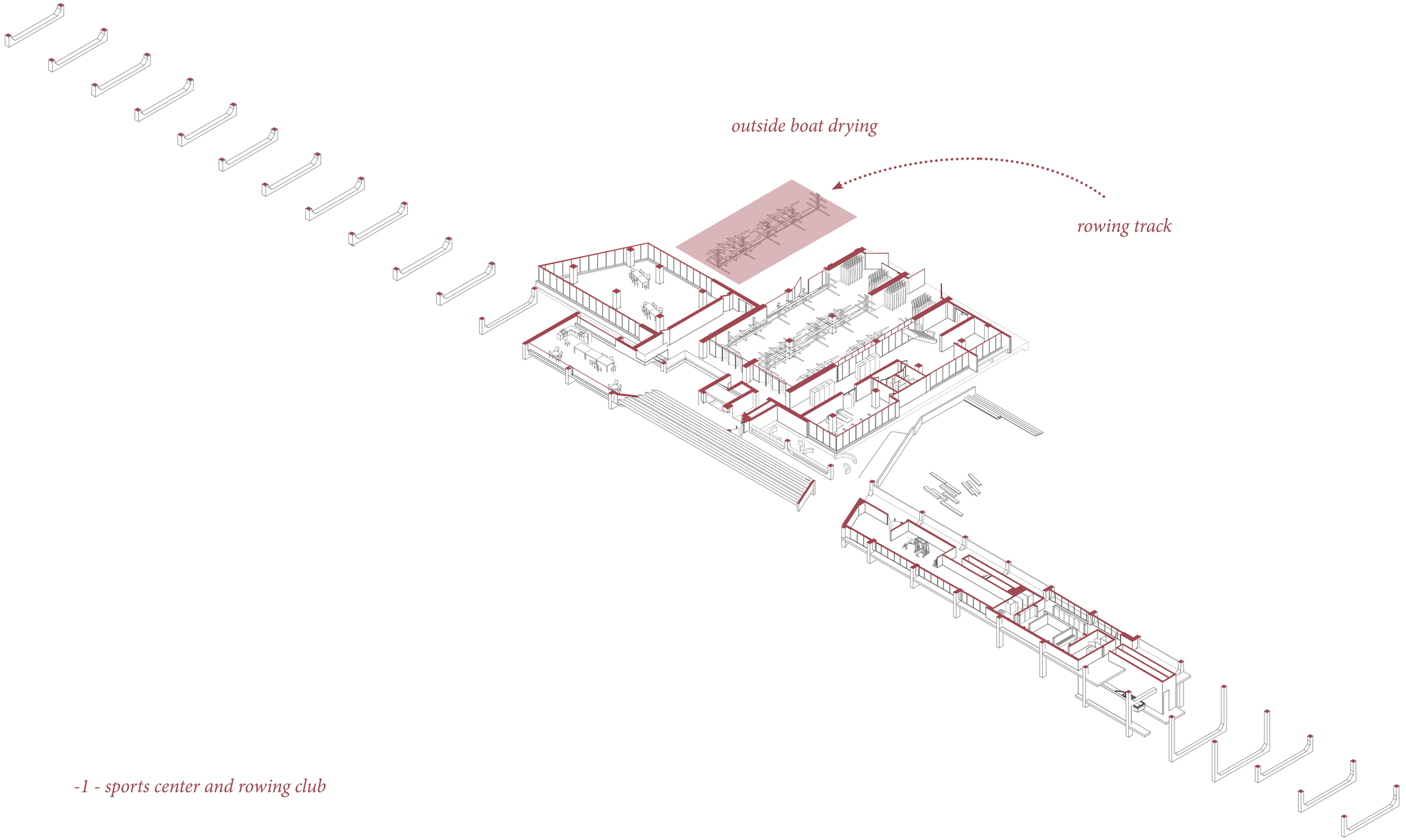


Glulam structure

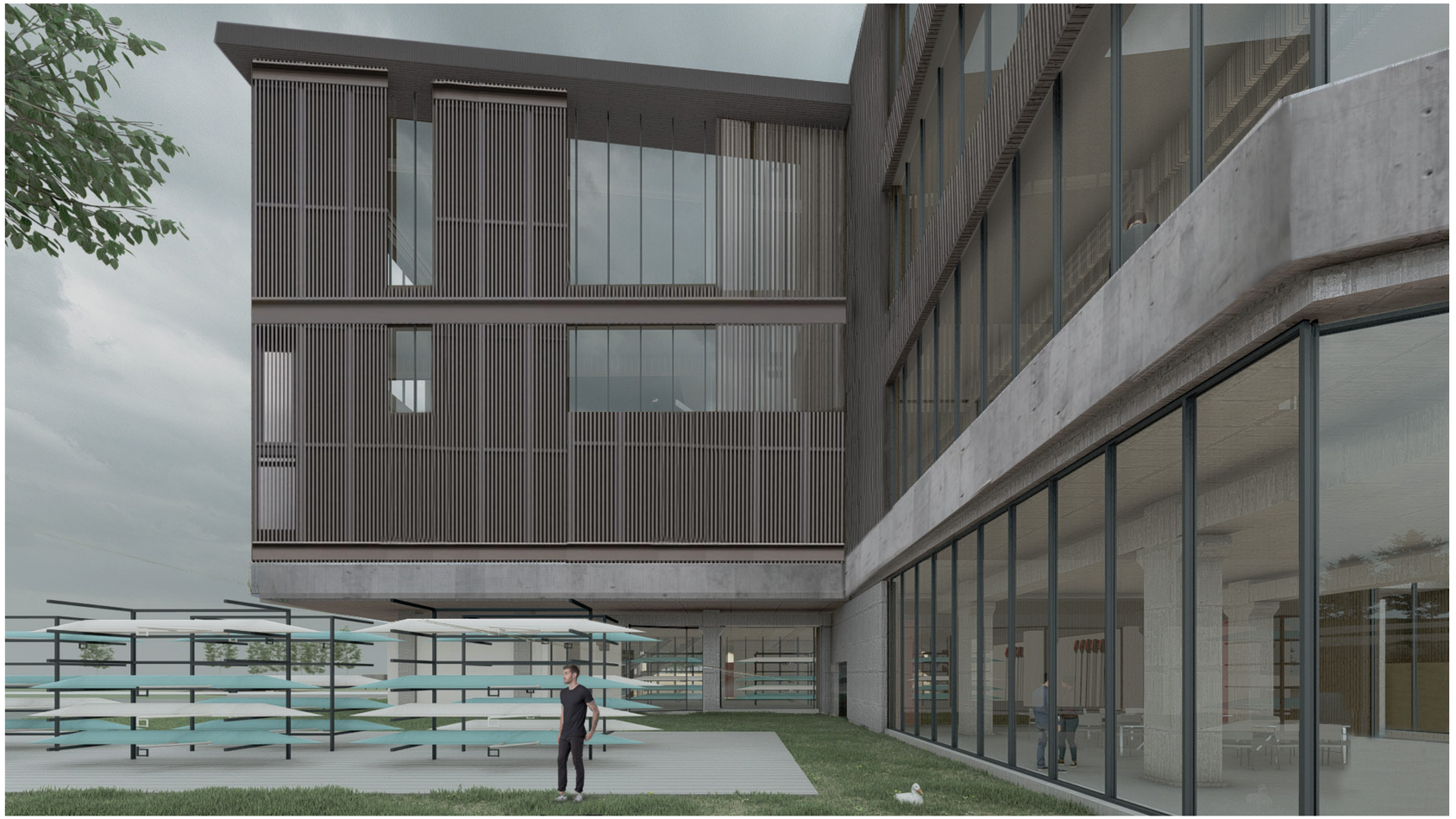


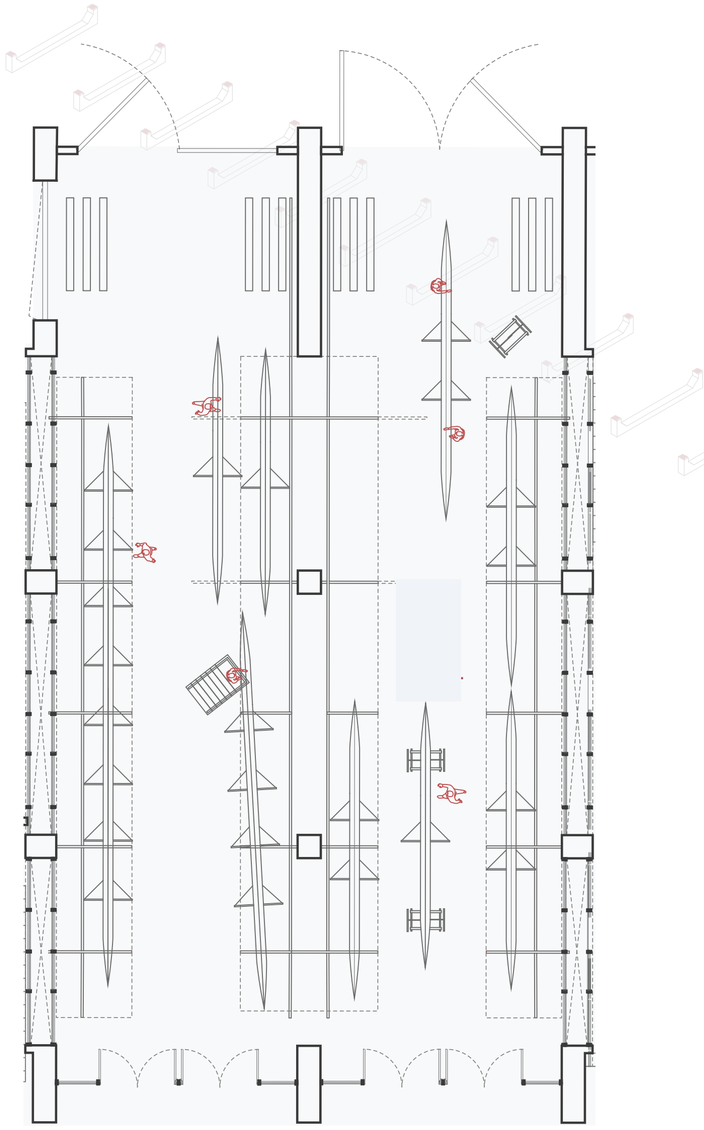
Glulam structure


Glulam beam
3 beams - 600mm x 140mm
span 8m
Glulam column
4 columns
290x290 mm
Metal plates with bolts
Concrete column
700mm x 700m
Raft foundation
Bolts

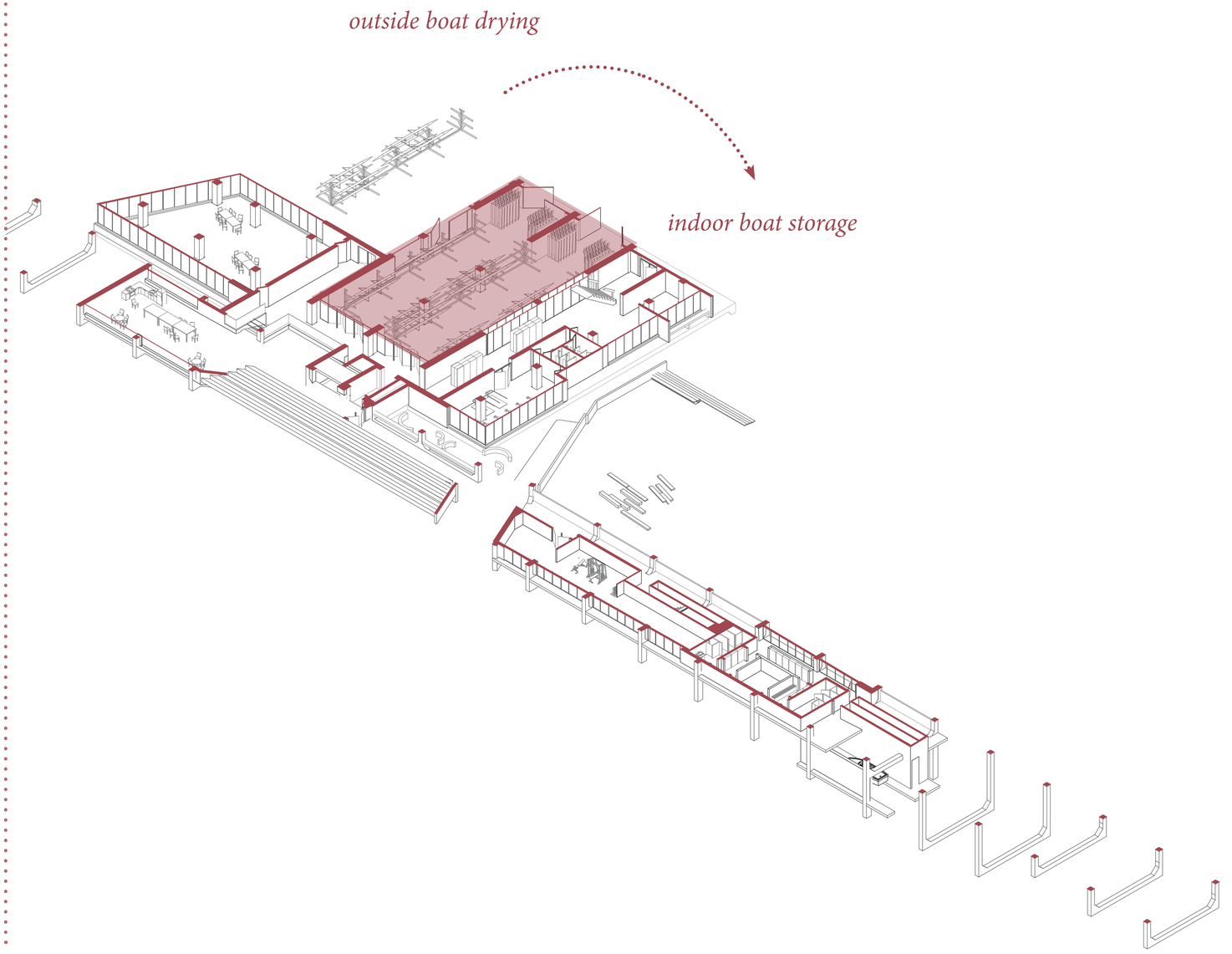


-1 - sports center and rowing club





Boat Storage, Exhibition and Repair



01
Cleaning the Boats

02
Oar storage

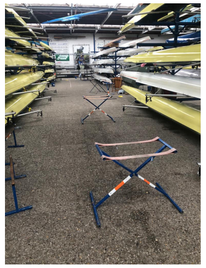
03
Boat storage stacking

04
Boats are demounted for transport

05
Boat metal storage that can be pulled out

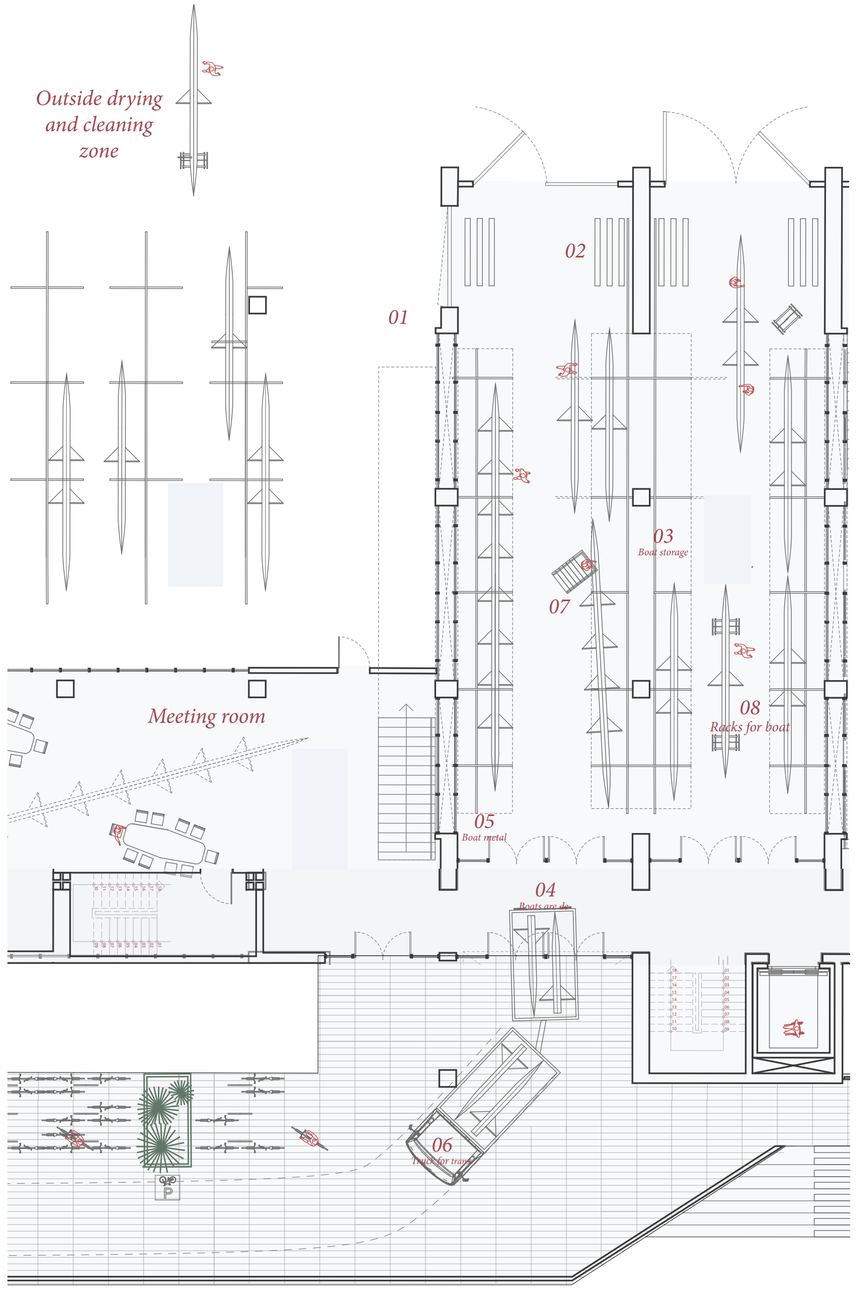
06
Truck for transporting boats on the ground level

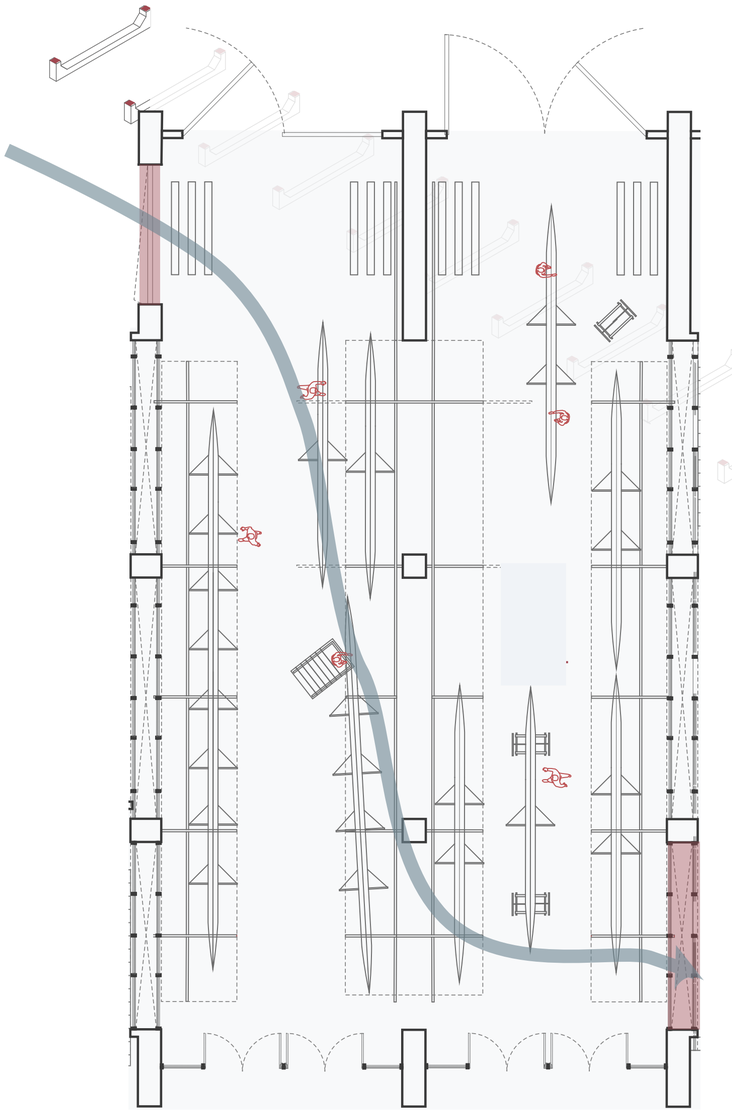
07
Vertical elements for reaching the boats



08
Racks for boat placement

-1 level and ground floor level - showing the boat storage and the delivery point on the ground level. Boats are lowered down using a pulley system





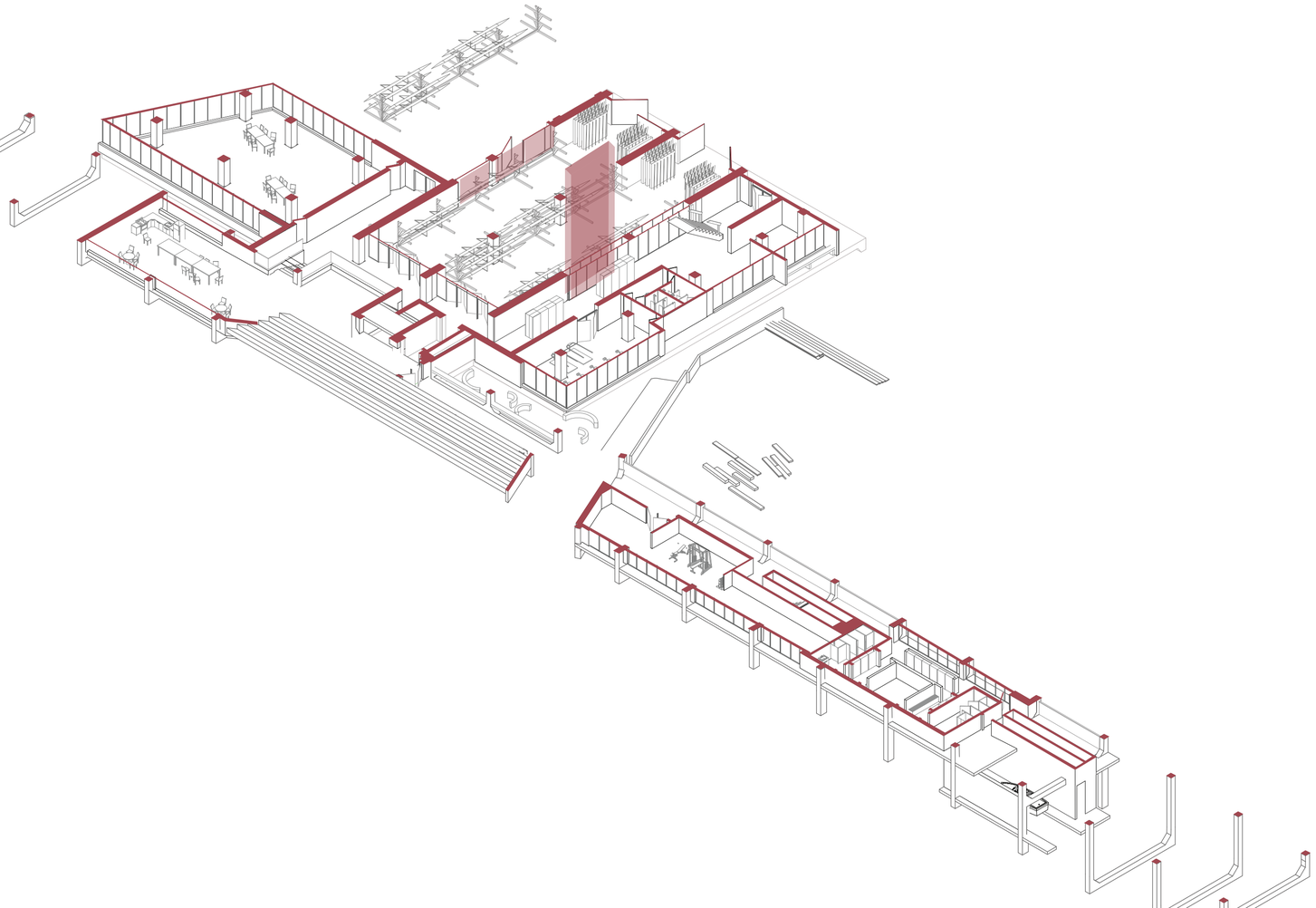
Ventilating the space during summer

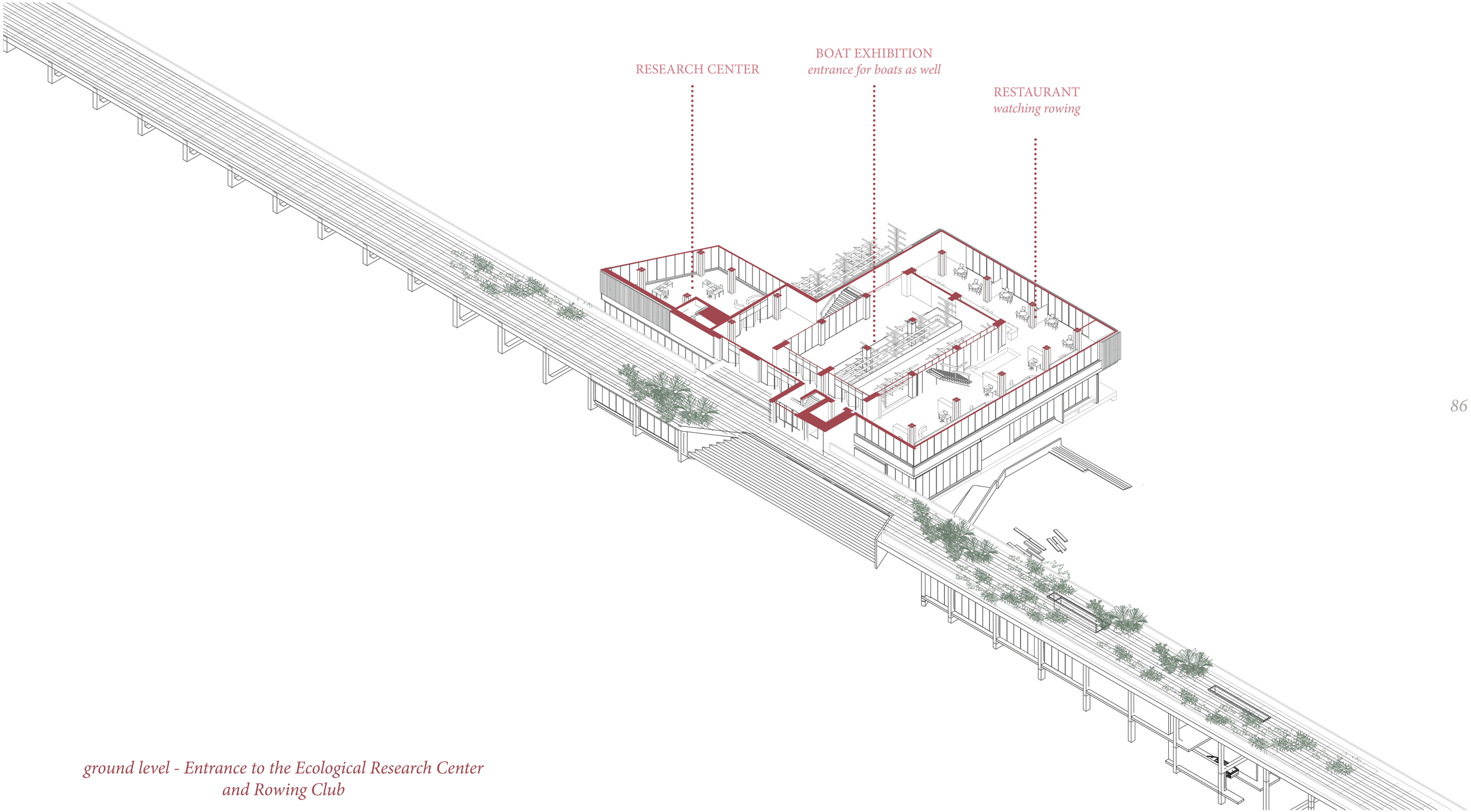
Controlling moisture through ventilation

5 square m window for 400 sq m of boat storage

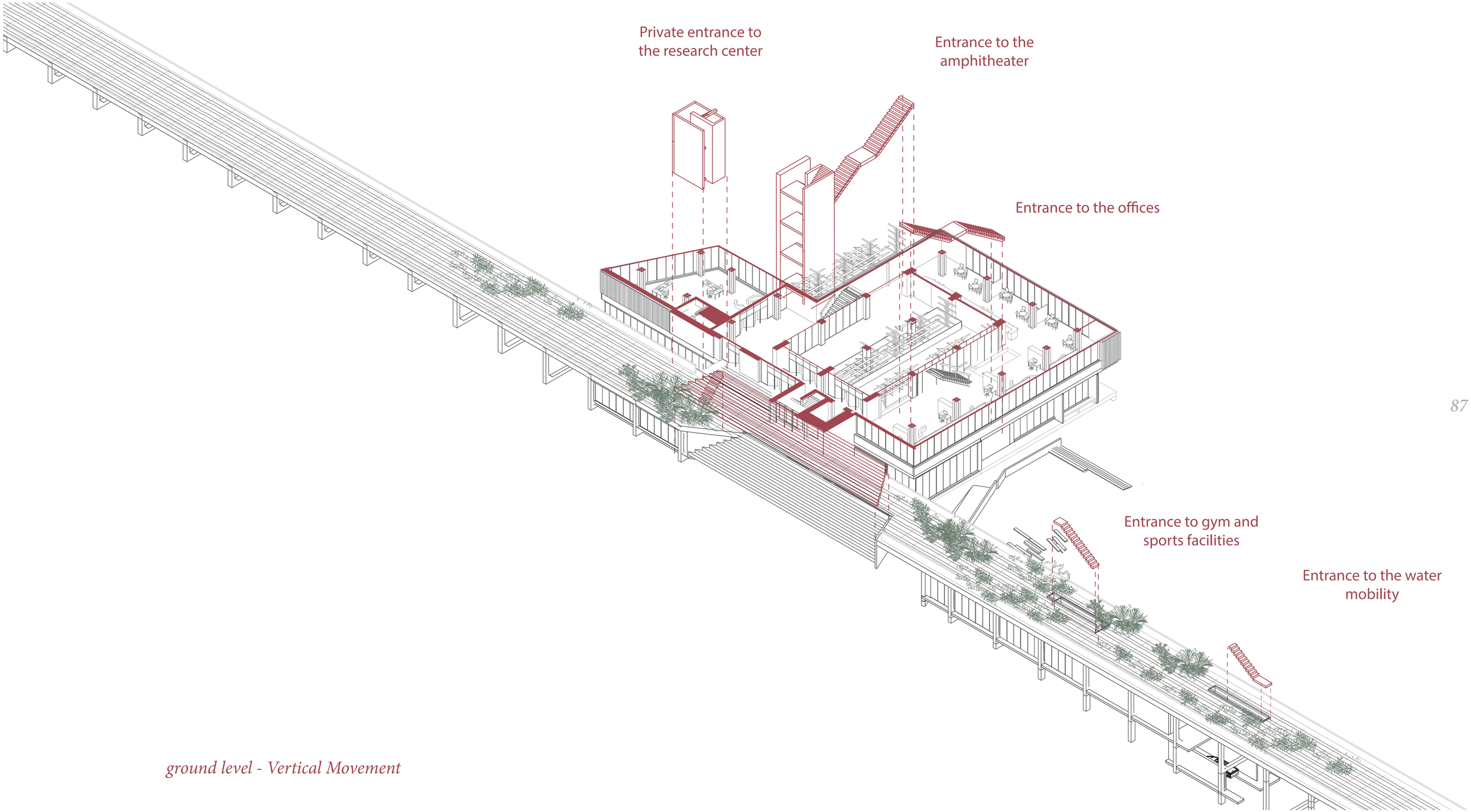
Shaft size: 8x5 x16m3

Goes up to the roof

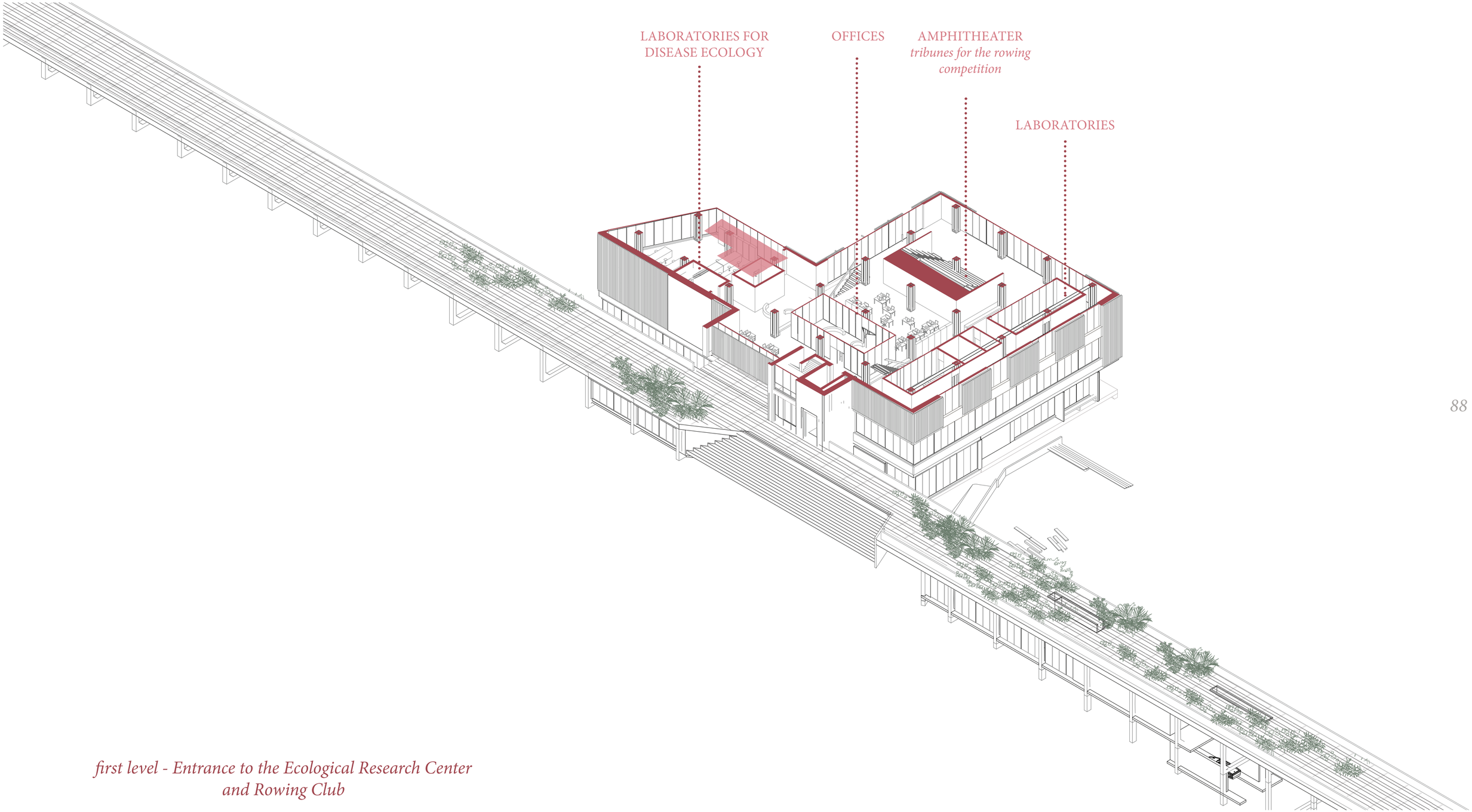




ground level - Entrance to the Ecological Research Center and Rowing Club



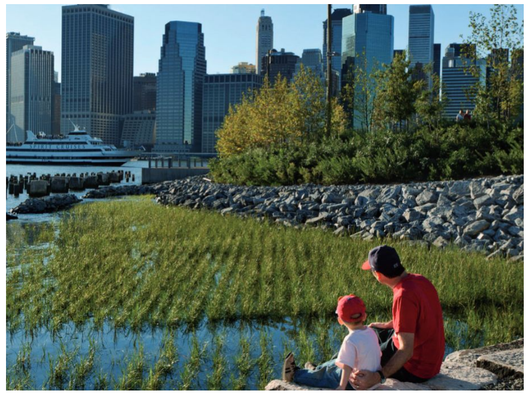
ground level - Vertical Movement



first level - Entrance to the Ecological Research Center and Rowing Club

Ecological Research Center -
Landscapes as testing grounds


01
02
03
04
05
06

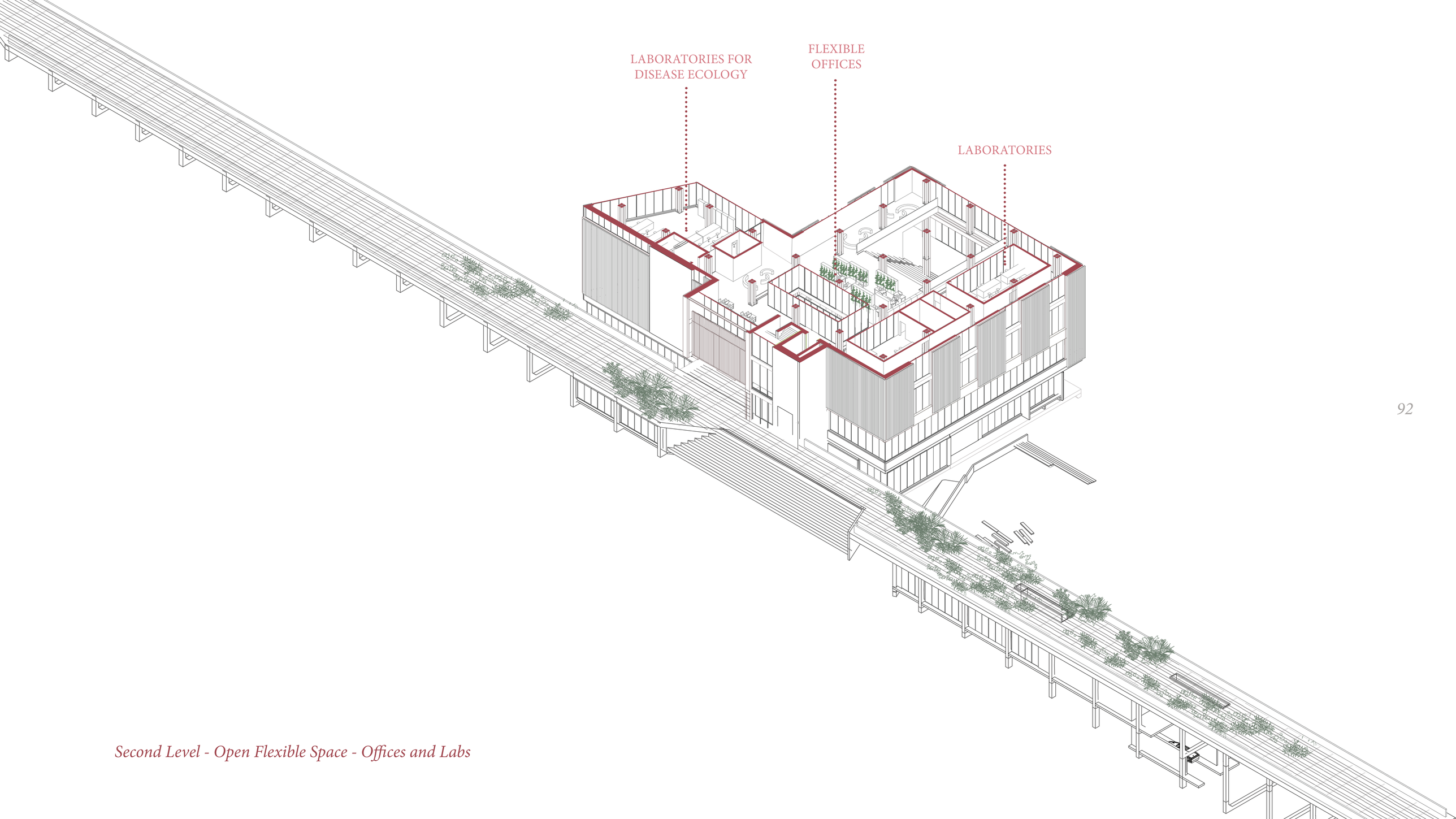


LANDSCAPES OF LEISURE

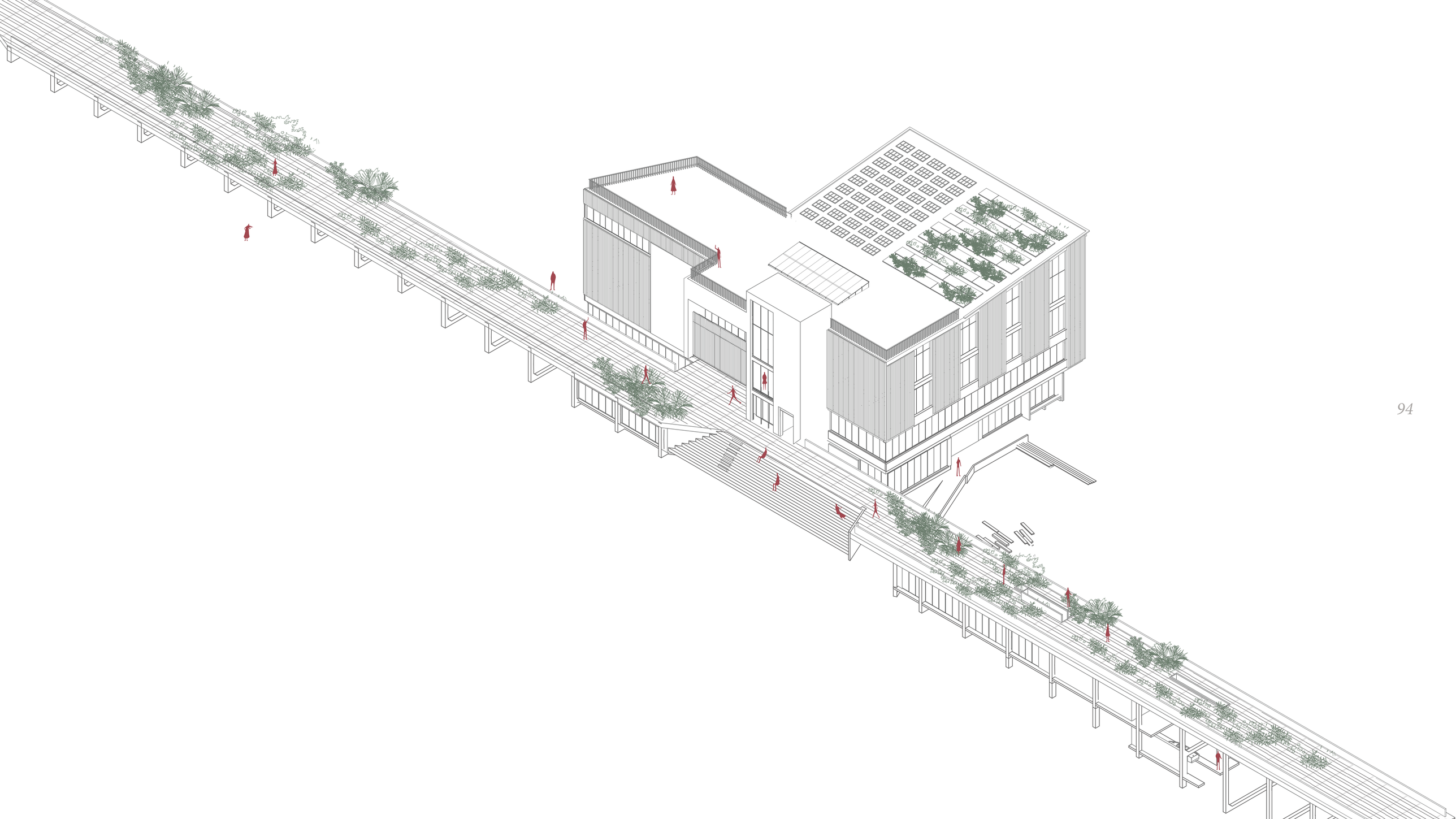
MEET

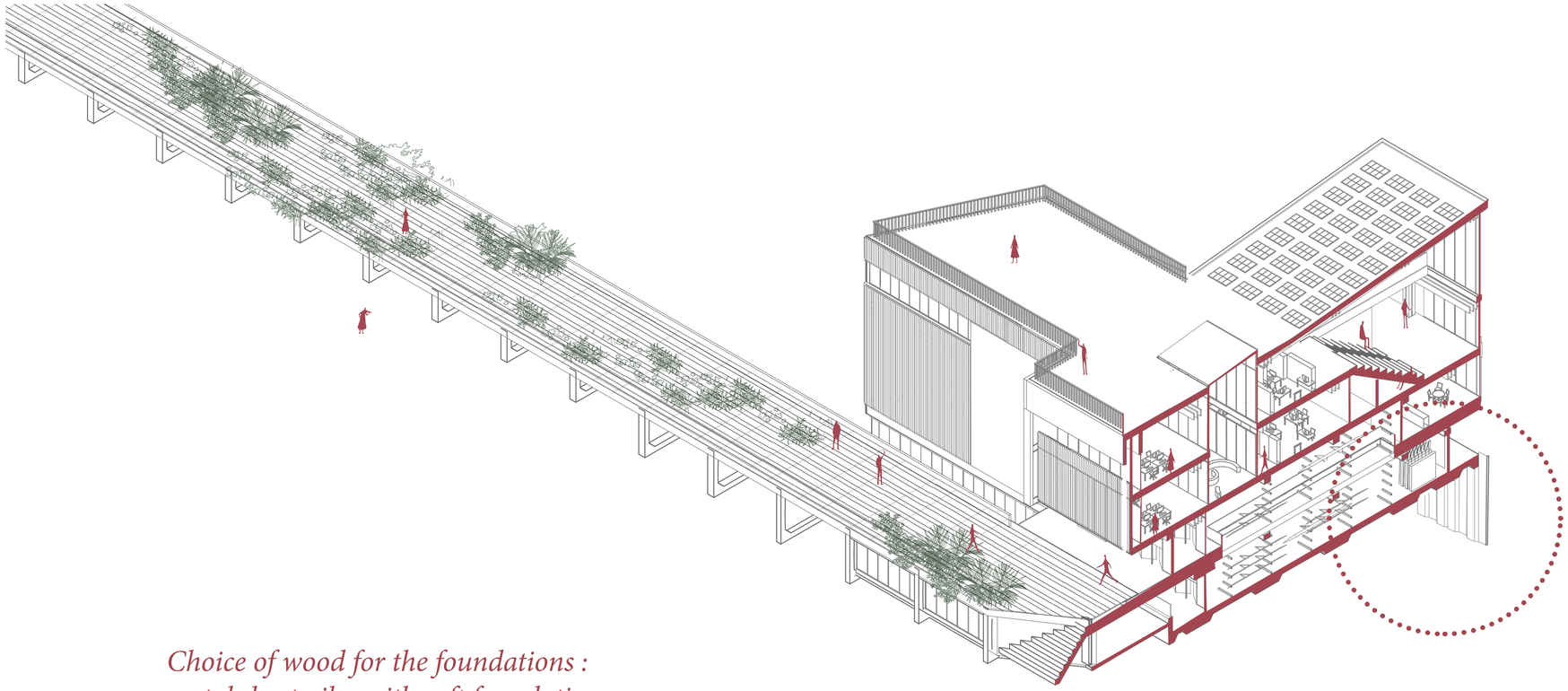
LANDSCAPES OF CURIOSITY

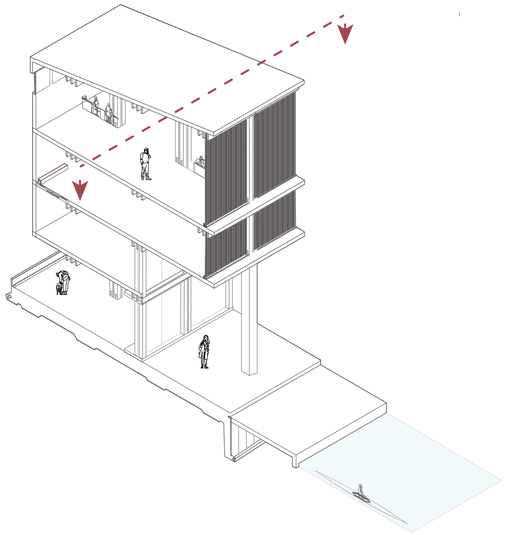
Creating moments of spontaneous interaction between visitors and ecologists from the research center to share valuable knowledge



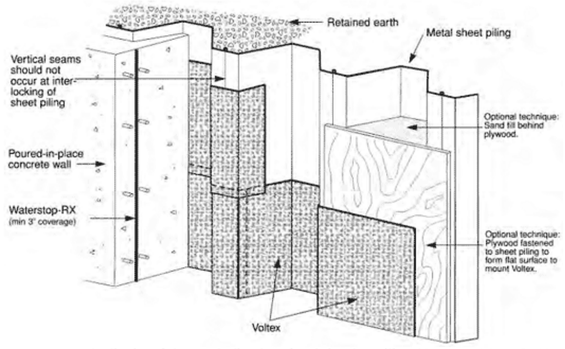
Second Level - Open Flexible Space - Offices and Labs

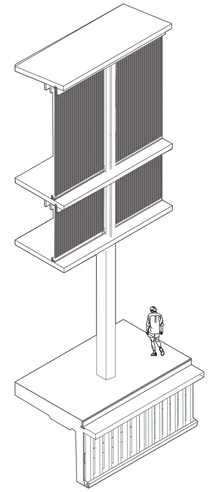


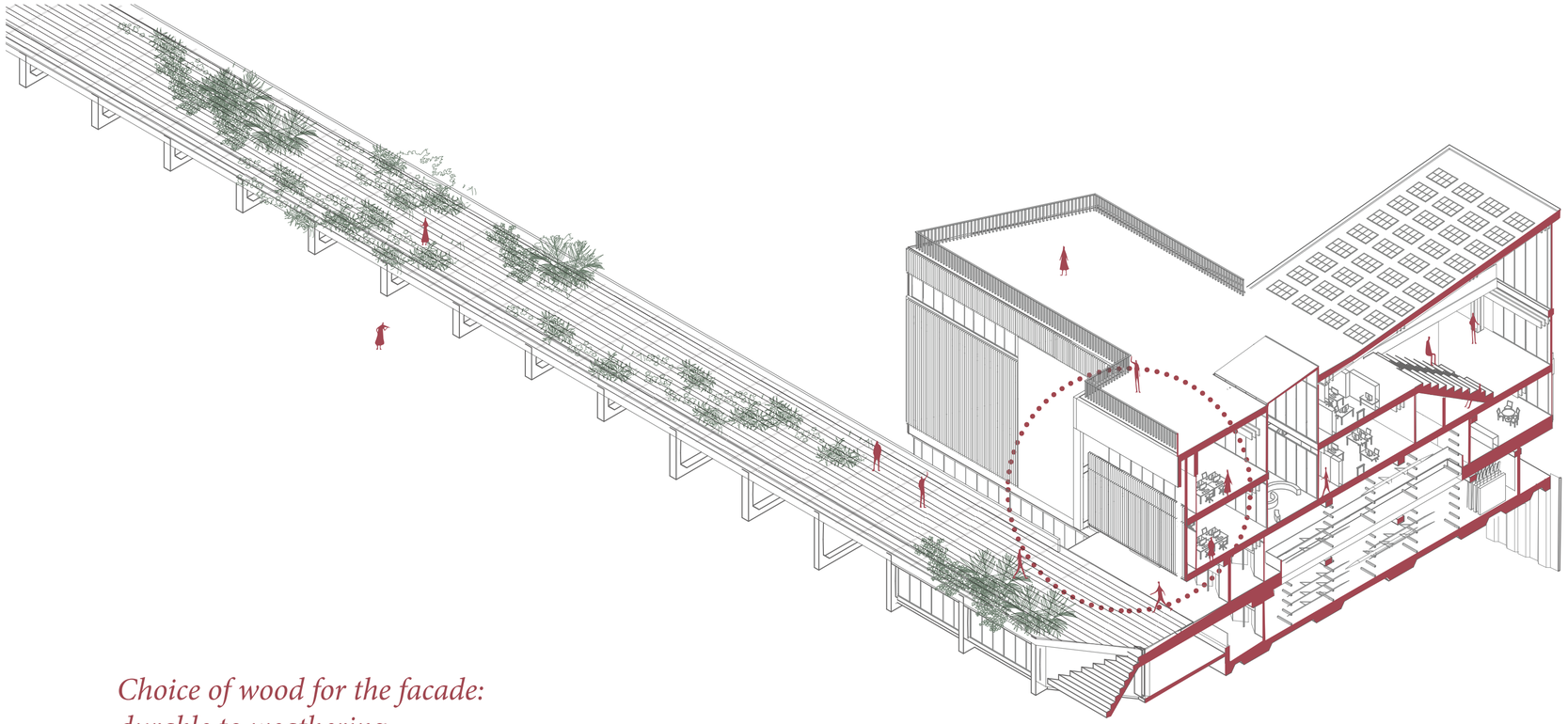




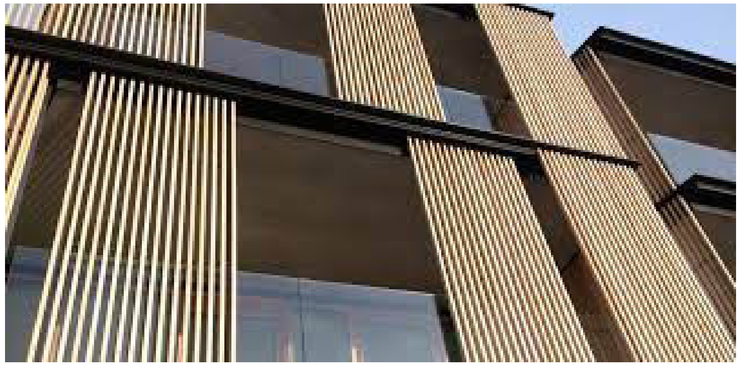
Choice of wood for the foundations :
metal sheet piles with raft foundation

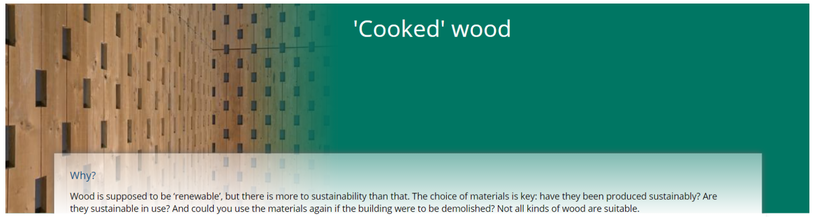






Choice of wood for the facade:
durable to weathering
“Plato wood”- cooked wood





Why?

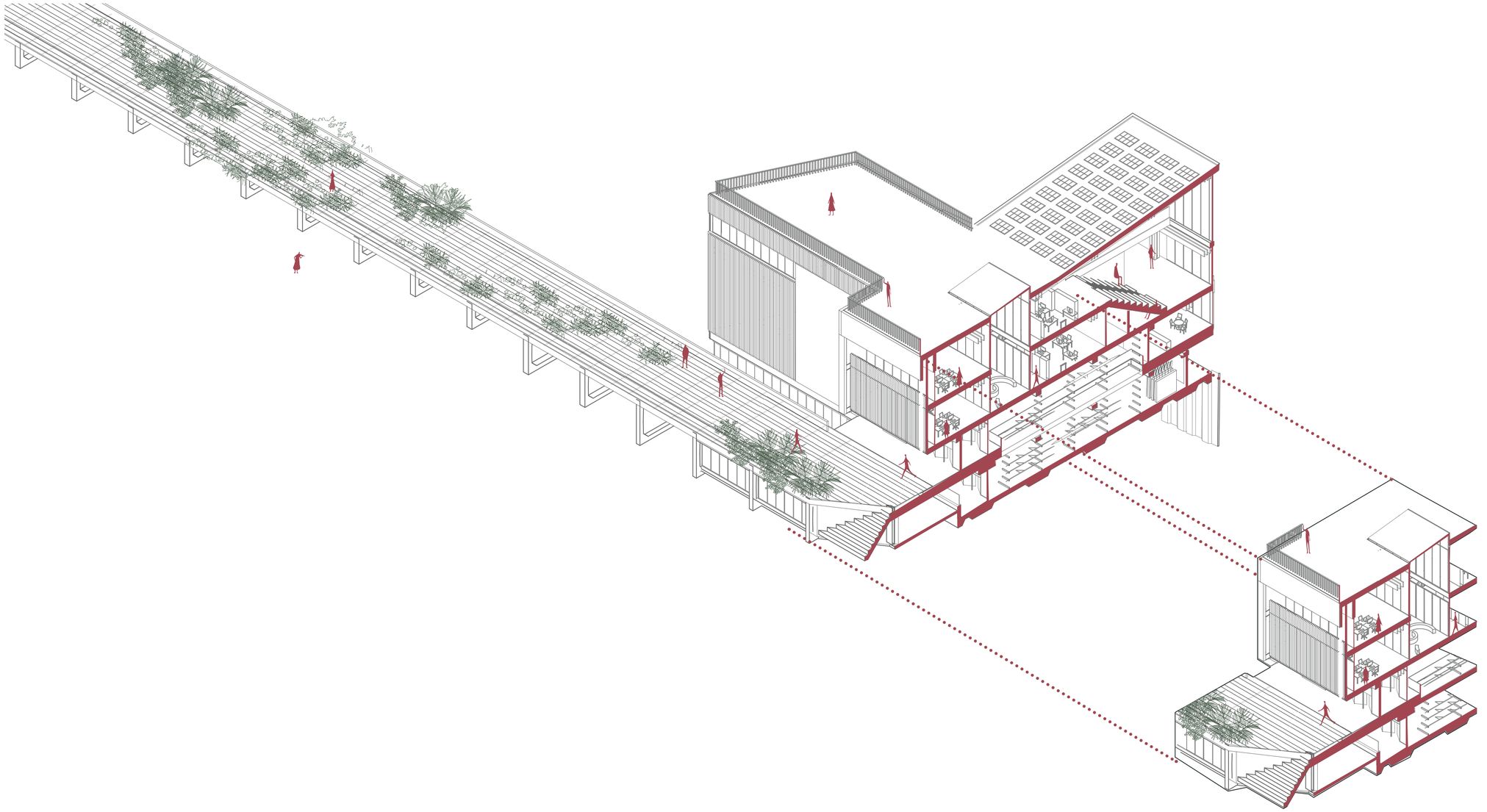
Wood is supposed to be ‘renewable’, but there is more to sustainability than that. The choice of materials is key: have they been produced sustainably? Are they sustainable in use? And could you use the materials again if the building were to be demolished? Not all kinds of wood are suitable.

How?

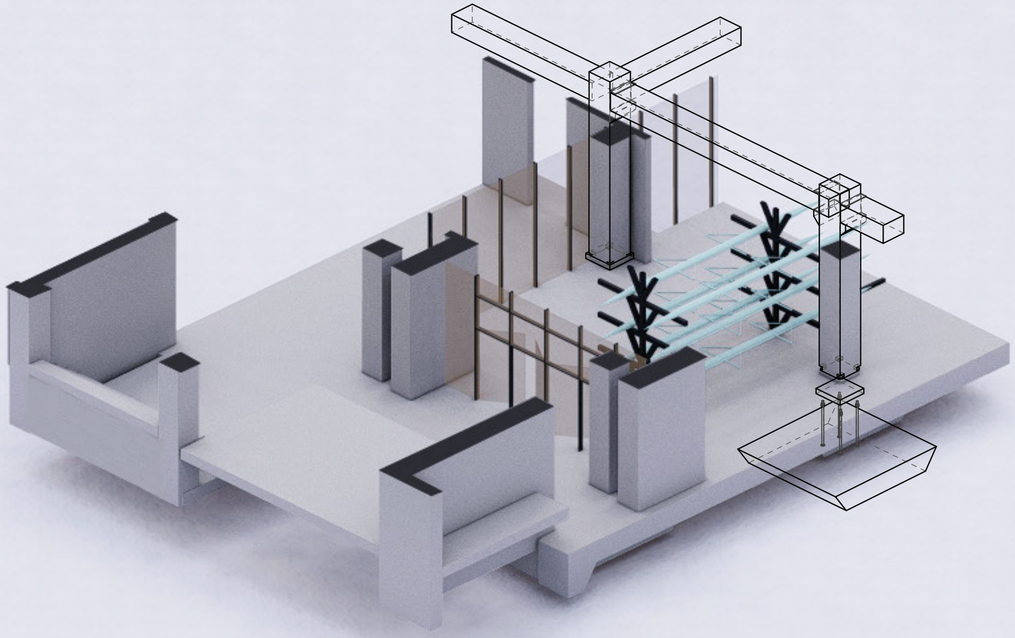
The building utilises so-called ‘Plato wood’: wood that has been modified to make it more sustainable. Using a combination of pressure and heat without any chemical additives, the wood is thoroughly refined. This ‘platonising’ process fits in perfectly with the building’s cyclical, ‘Cradle to Cradle’ philosophy. It gives fast-growing timbers the same durability as tropical hardwoods, but without the disadvantages. FSC-certified wood is used for the procedure.

Plato wood is used both inside the building and on its exterior: as wall covering, as cladding for the doors, as solar shading and on boardwalks.

- Back to ‘Highlights’

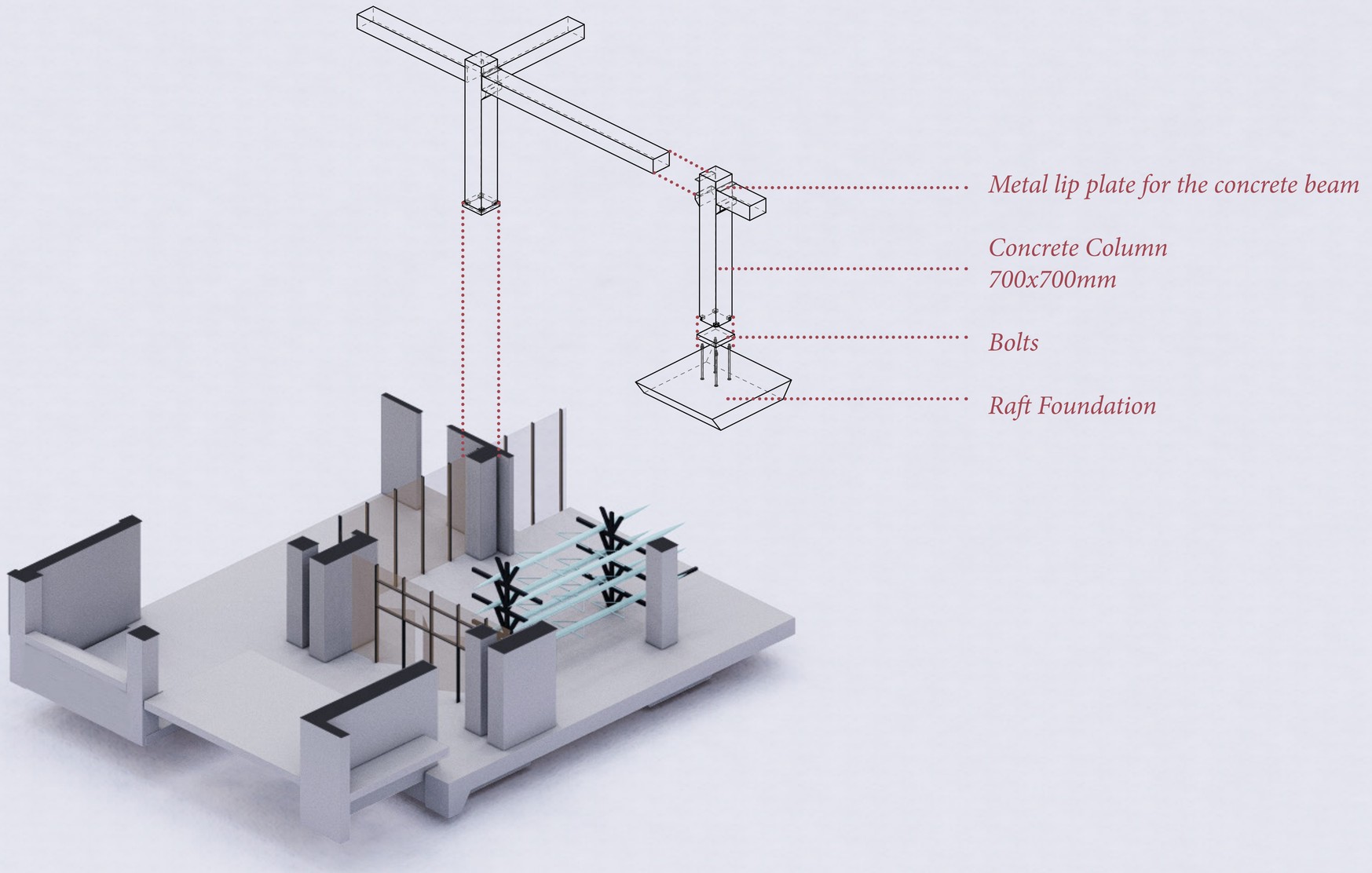


1to20 Building Fragment



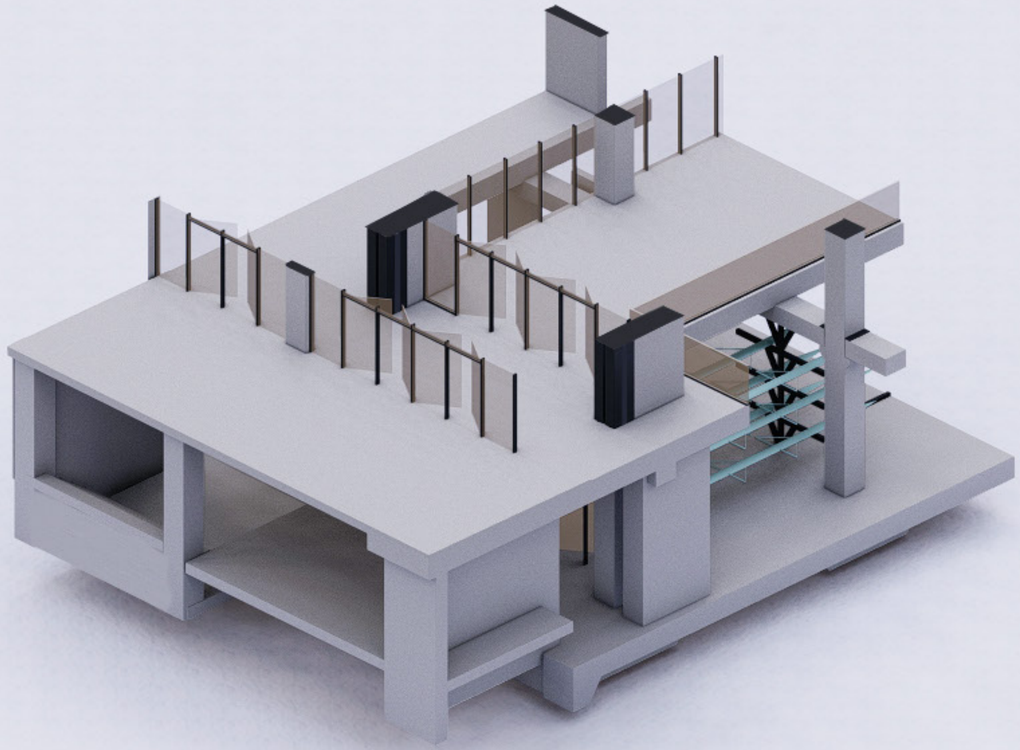
Raft Foundation + Concrete columns

-1 Rowing Club

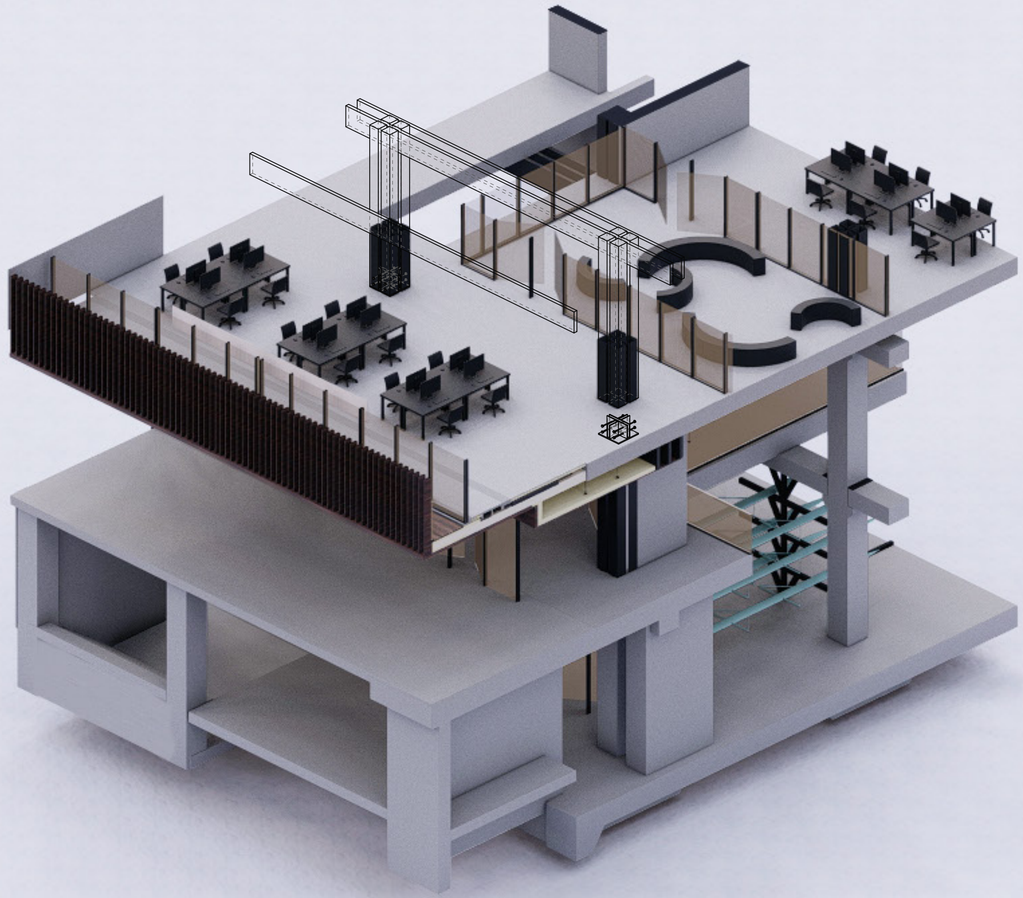


Raft Foundation + Concrete columns

-1 Rowing Club



Ground Floor - Boat Exhibition



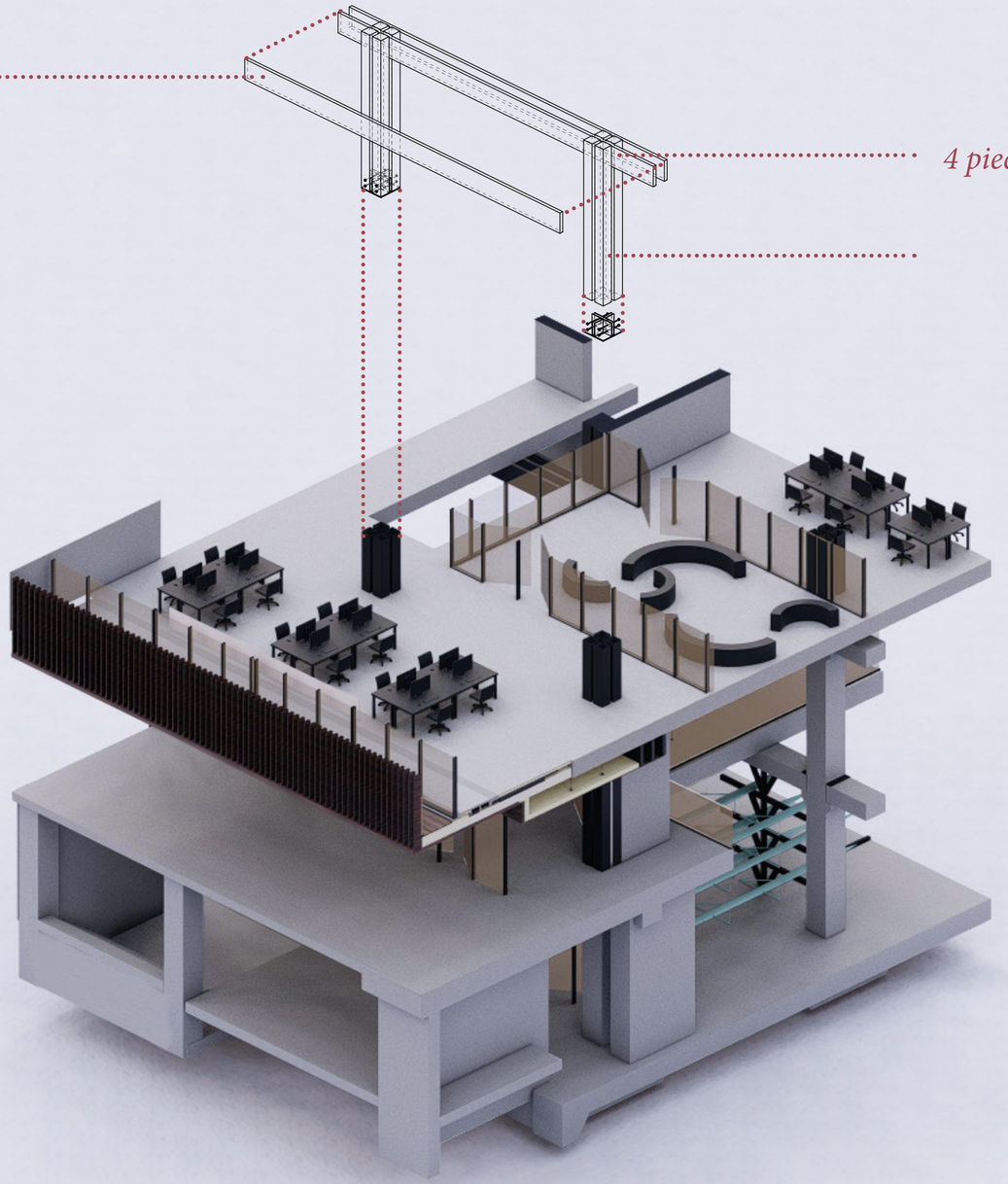
Glulam Columns

First Floor -Ecological Center

Glulam Beam
3 beams
(600x140mm - span 8m)

4 piece Glulam Column (290x290mm)

Metal Plate with bolts



Glulam Columns

First Floor -Ecological Center

Glulam beam
3 beams - 600mm x 140mm
span 8m

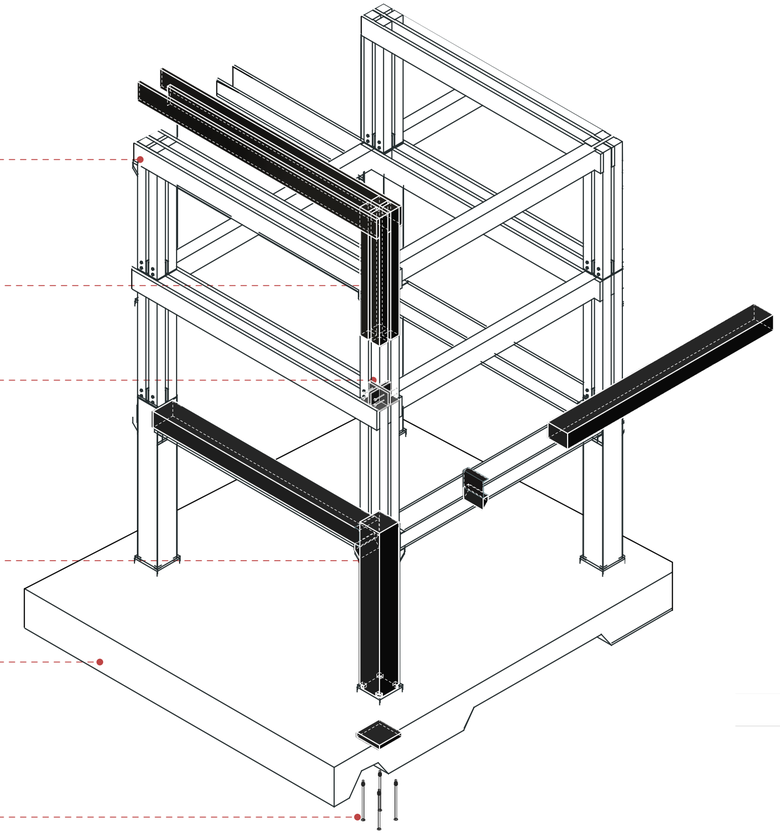
Glulam column
4 columns
290x290 mm

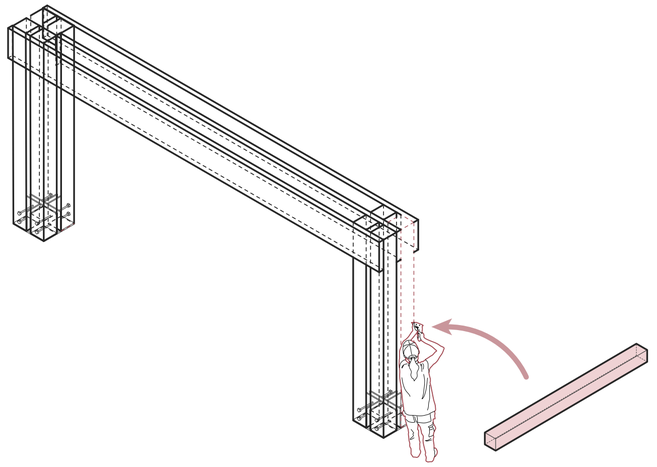
Metal plates with bolts

Concrete column
700mm x 700m

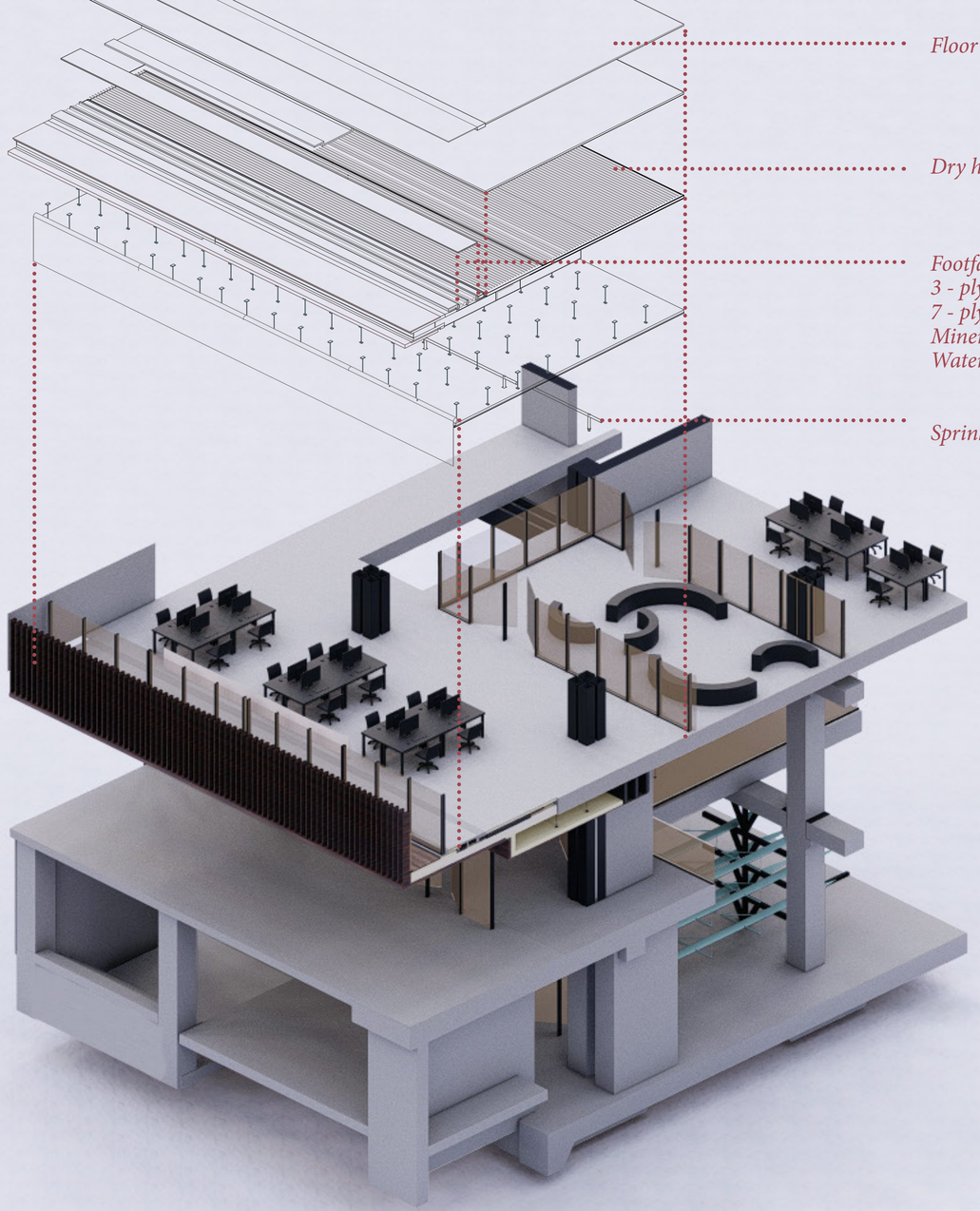
Raft foundation

Bolts





Demountability
Structural Diagram



Floor covering 20mm

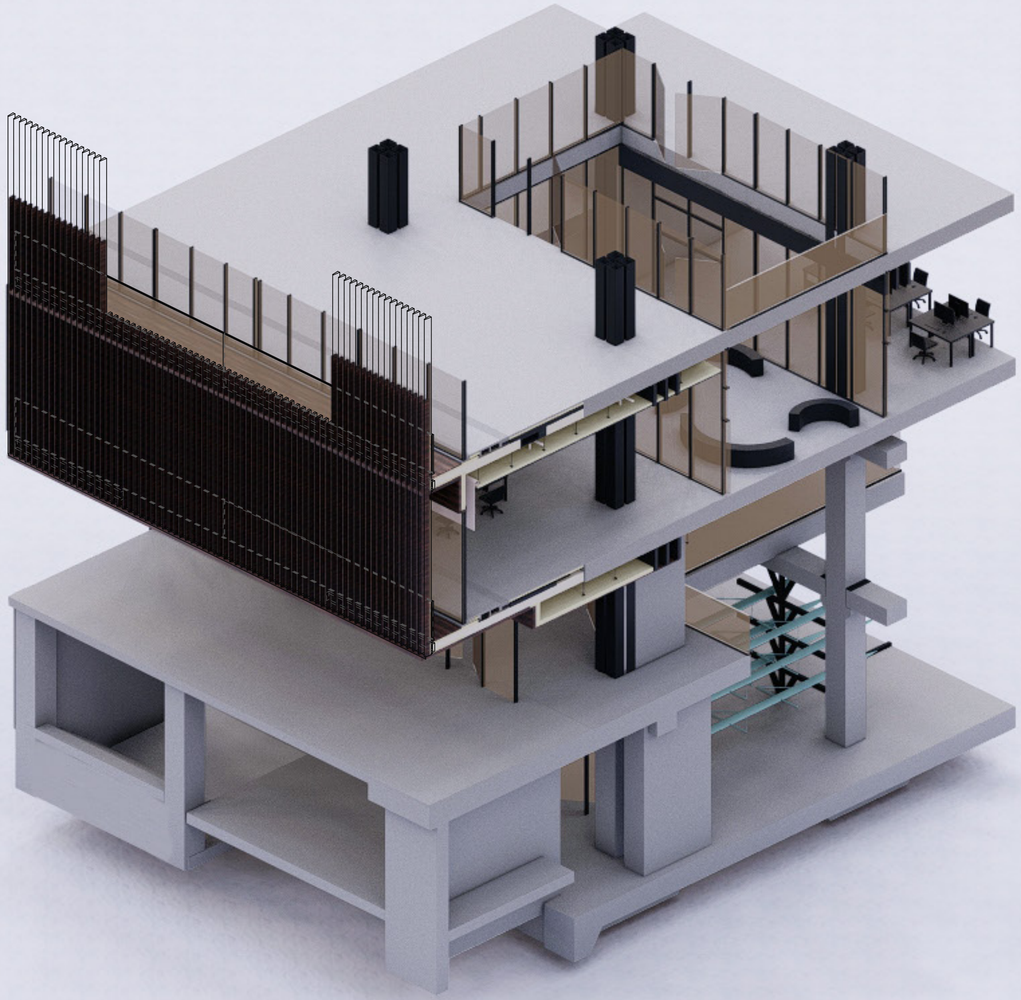
Dry heating screed, concrete overlaid 75mm

Footfall sound insulation 40mm
3 - ply CLT pruce panel, iomm
7 - ply CLT sprice panel, 260mm
Mineral Fiber acoustic insulation 40mm
Water Supply Ducts

Sprinkler System

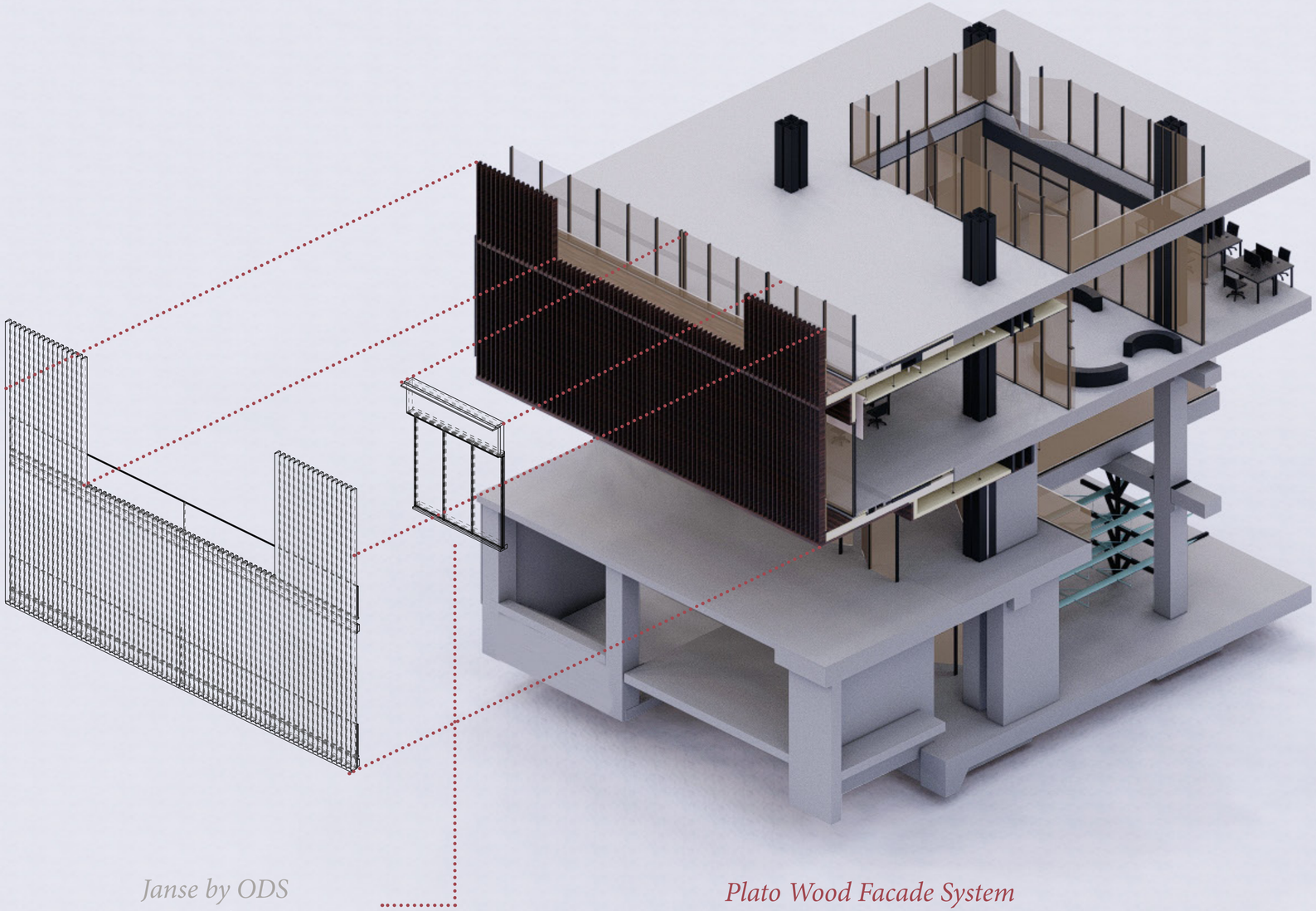
CLT Floor System

First Floor -Ecological Center



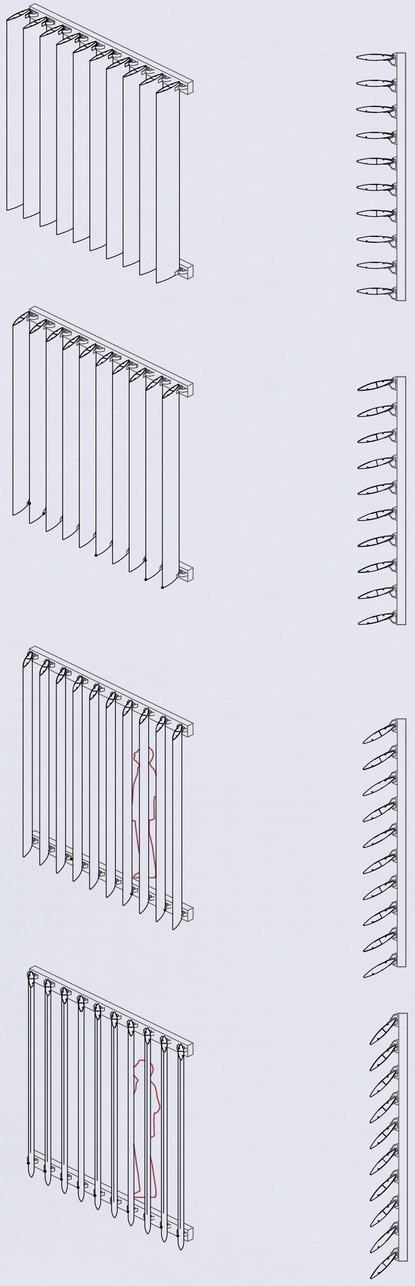
Plato Wood Facade System

Second Floor -Ecological Center

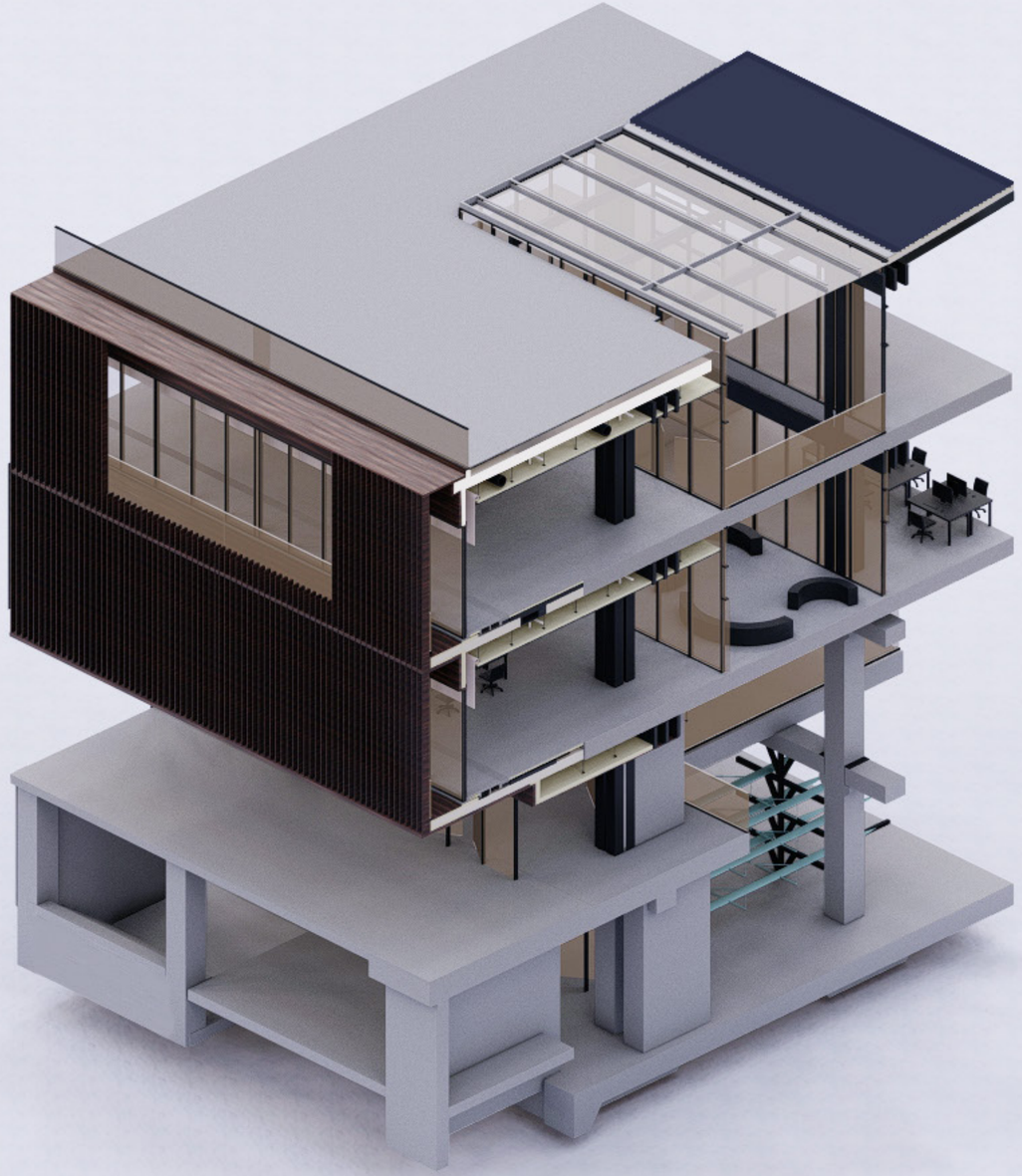


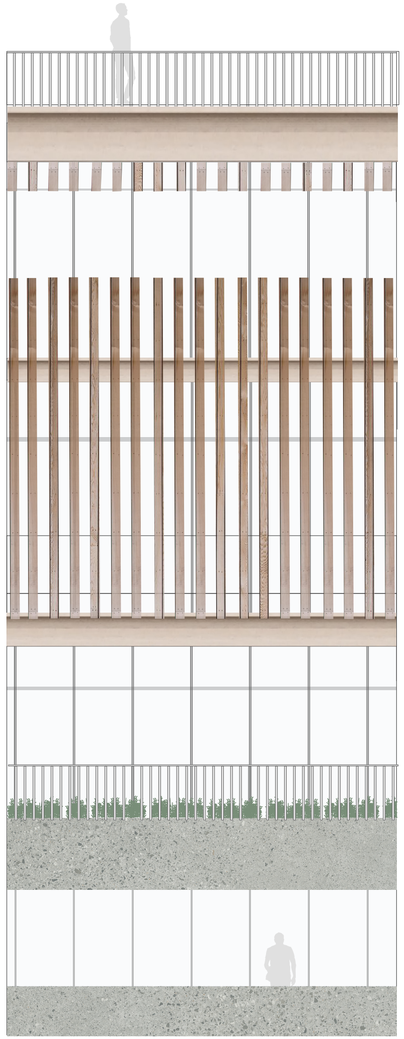
Janse by ODS
VISS Facade System

Plato Wood Facade System
Second Floor -Ecological Center



Facade System



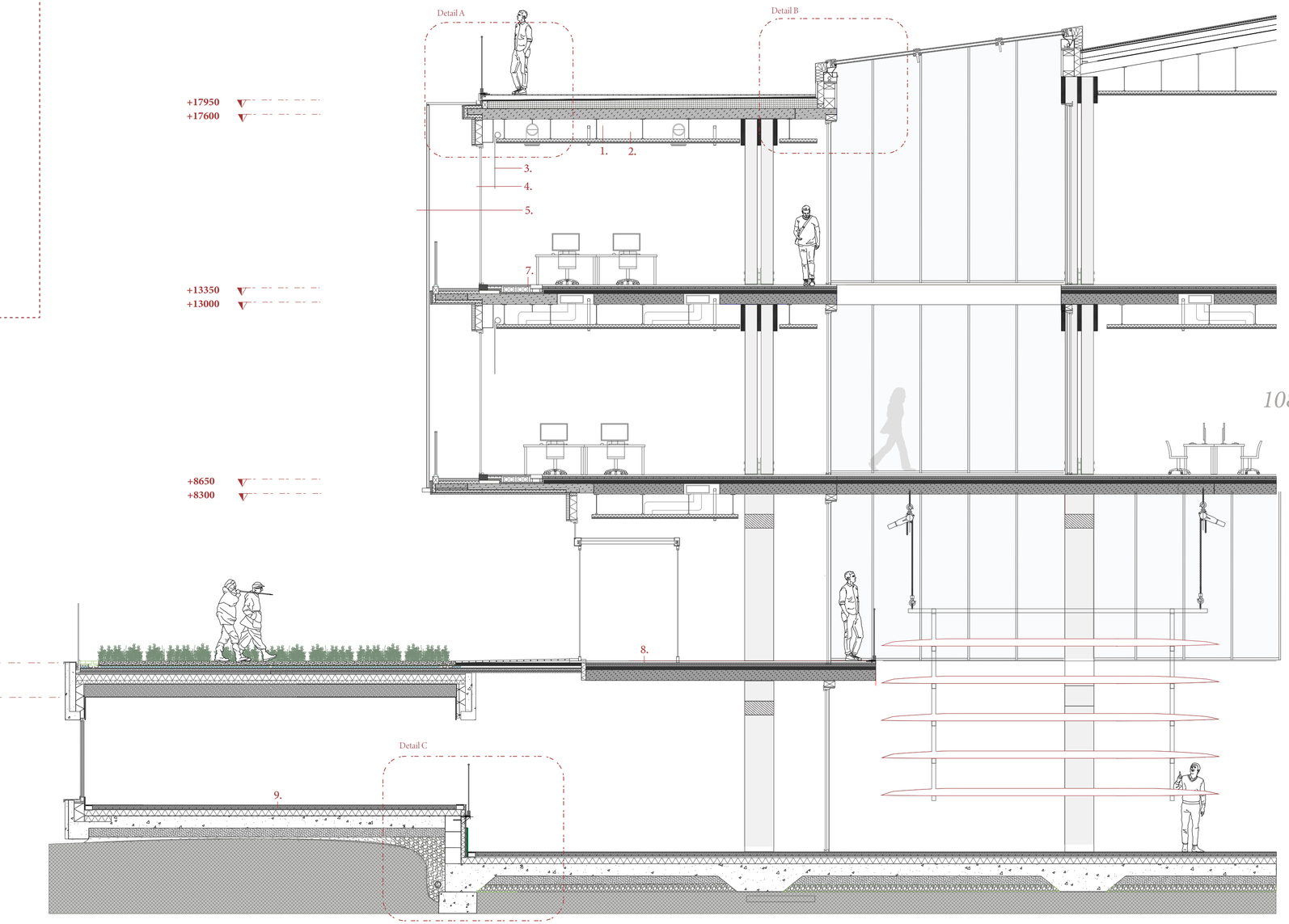


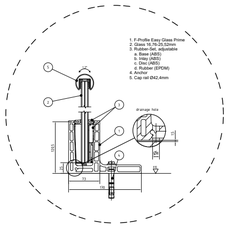
1. Fire safety sprinkler system
2. Laminated Timber roof:
   Accoya battens 120 x 21mm (subfloor), 80mm:
   Fireproof waterproof membrane, 1.8mm
   Thermal insulation to fall, rockwool, 150 - 100 mm:
   Thermal Insulation, rockwool, 120 mm;
   Vapour barrier, bituminous membrane, 1.2mm
   7-ply CLT spruce panel, 260mm;
   3 GLT beam,150x600mm
   Mineral Fiber acoustic insulation 40mm
   Acoustic suspended panels

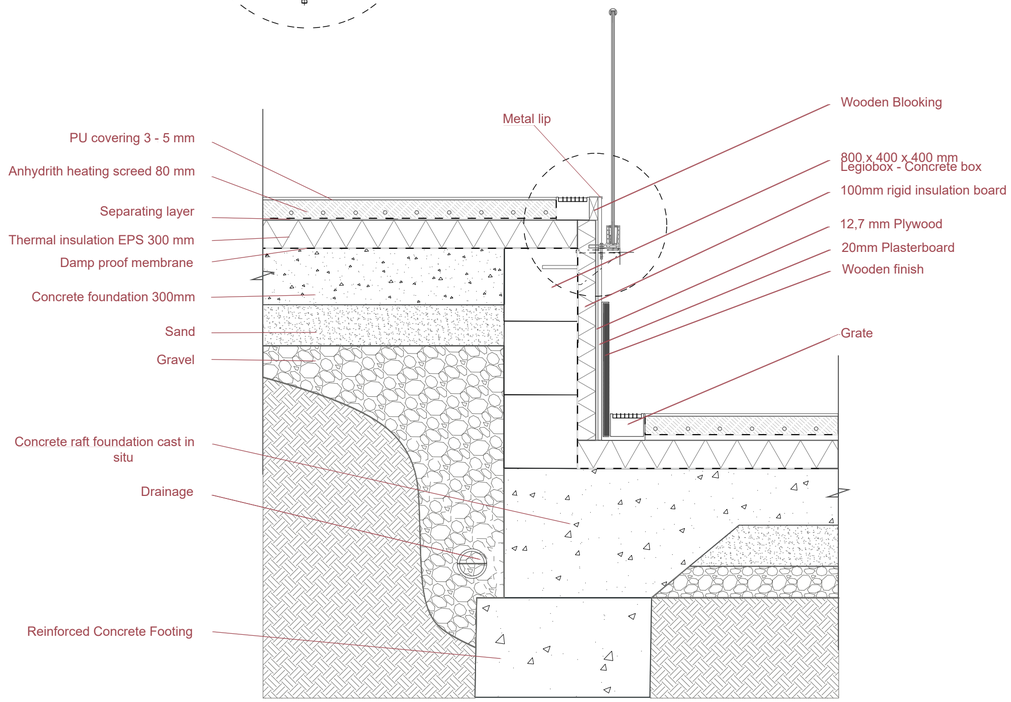
3. Solar control: textile
4. Therman glazing: 8mm toughned glass +12.7mm
   cavity + laminated safety glass of 2x8mm
5. Vertical fin, cooked wood, 100x30mm
6. Mechanical ventilation duct, max 580x220mm
7. Water suply ducts 4x of O 100mm
8. Internal Laminated Timber Slab:
   Floor covering 20mm
   Dry heating screed, concrete overlaid 75mm
   Footfall sound insulation 40mm
   3 - ply CLT pruce panel, 90mm;
   7-ply CLT spruce panel, 260mm;
   Mineral Fiber acoustic insulation 40mm
   Acoustic suspended panels 35mm

9. PU covering 3 - 5 mm
   Anhydrith heating screed 80 mm
   Separating layer
   Thermal insulation EPS 300 mm
   Separating layer
   Concrete 220 mm

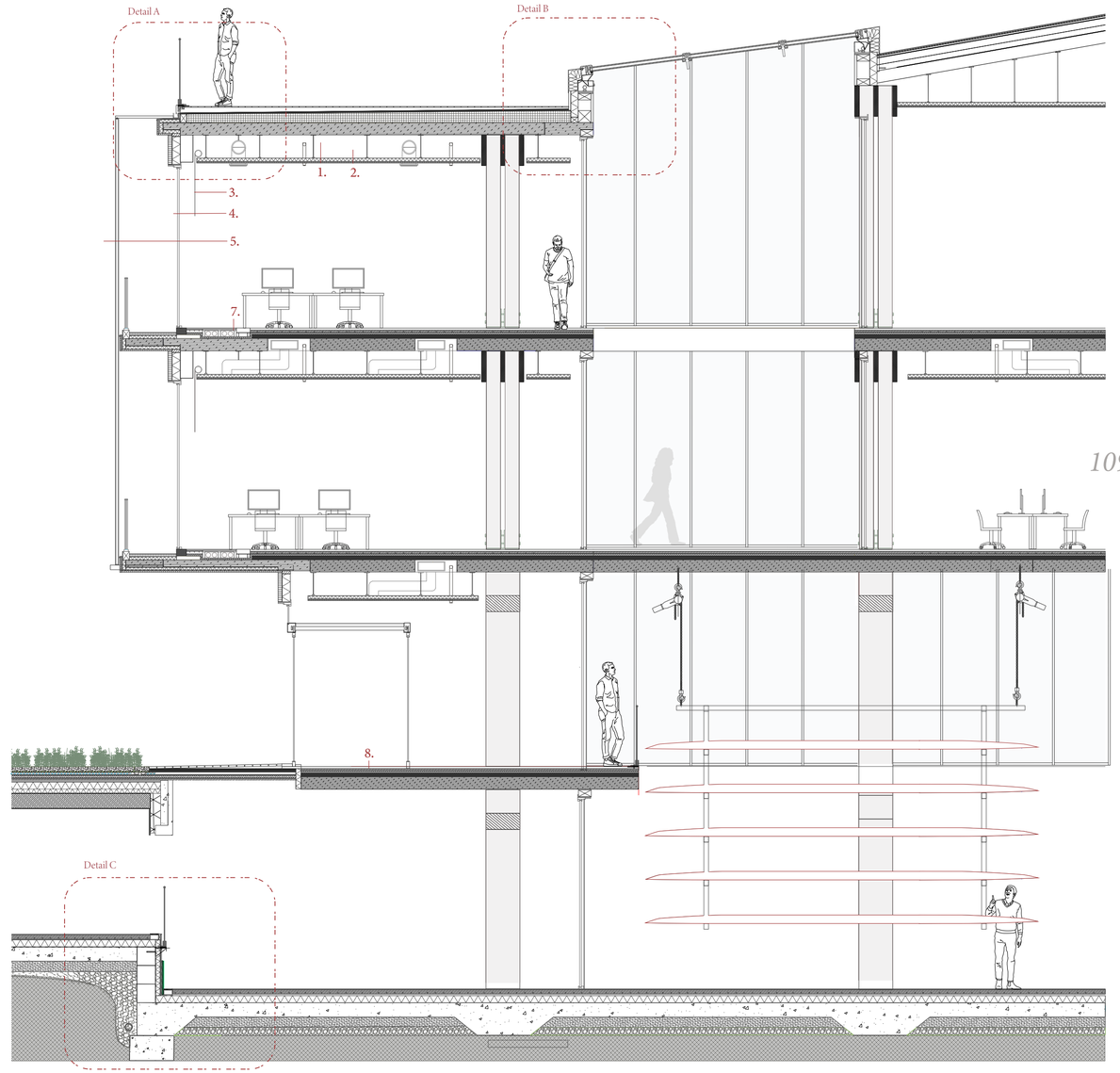
1 to 20 Building Section

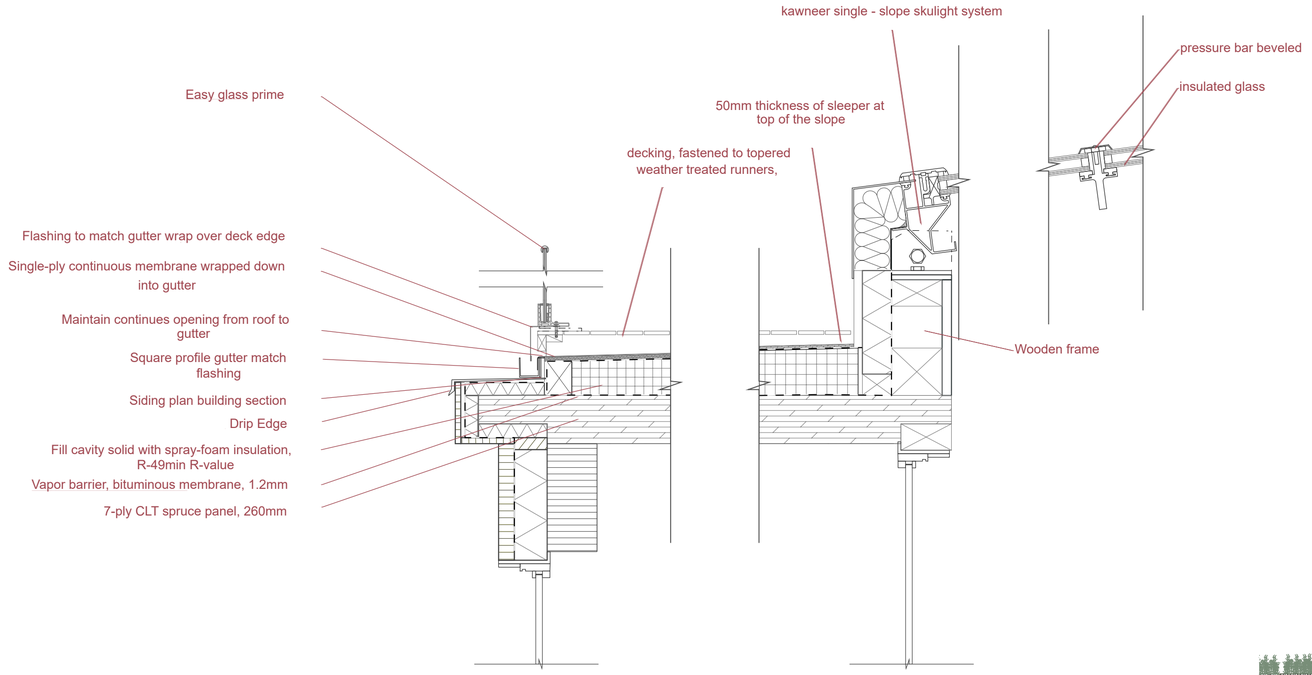






1 to 5 Foundation Detail
The two structures coming together





1 to 5 Roof Skylight and edge detail

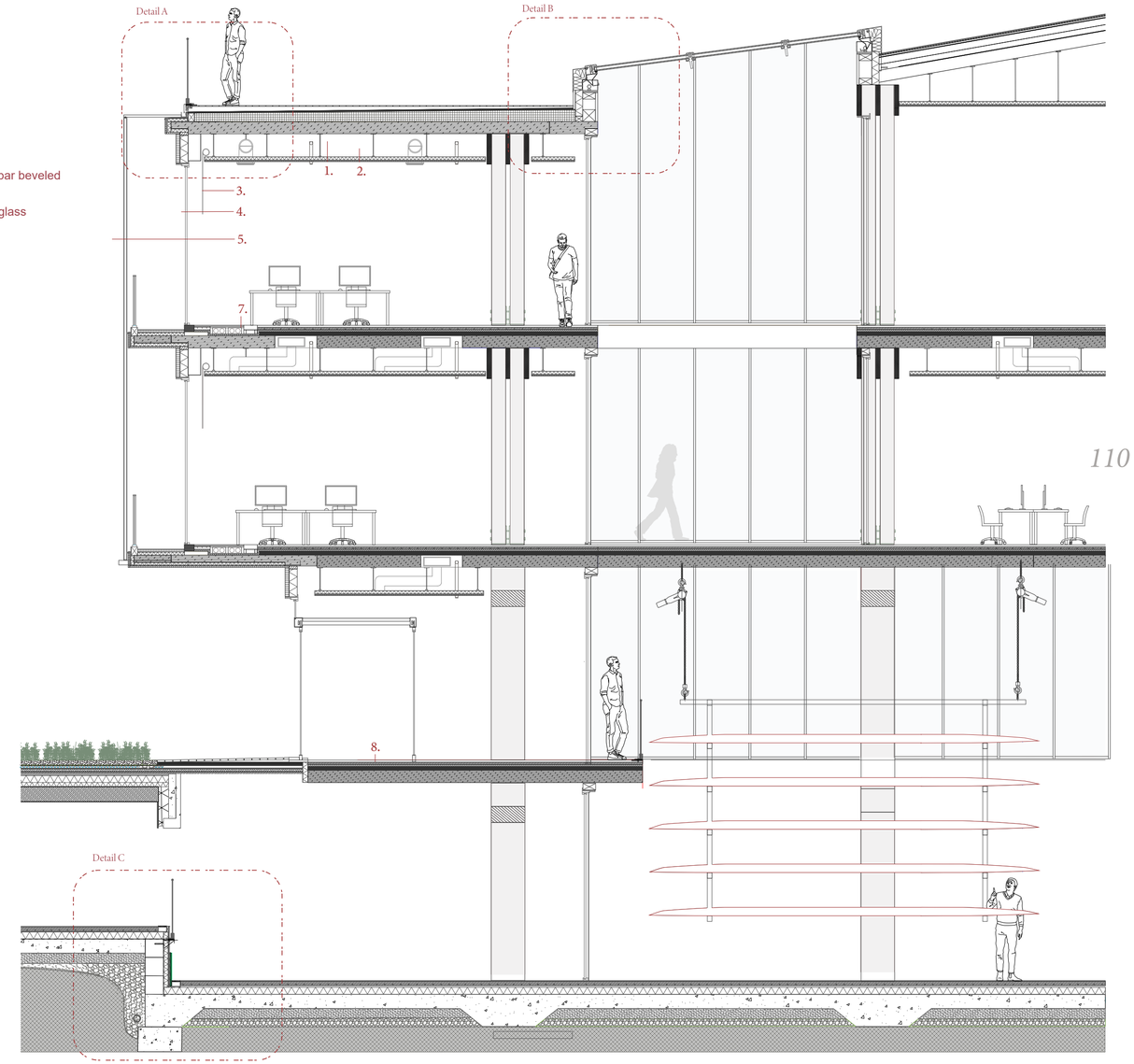


Figure 23: Bio safety level 4 laboratory with radial flow diffusers

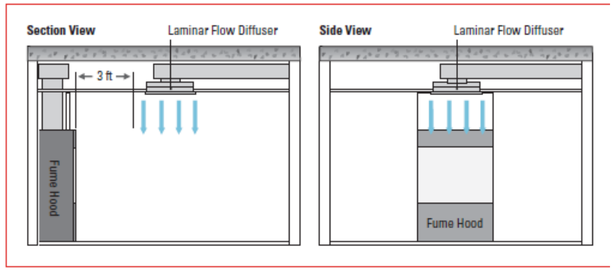
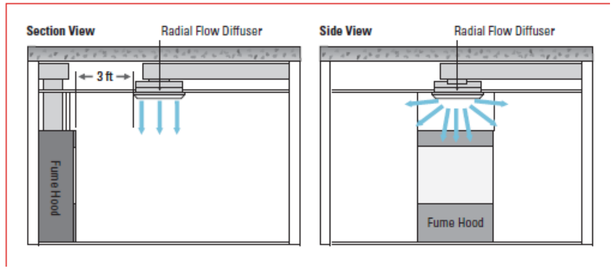
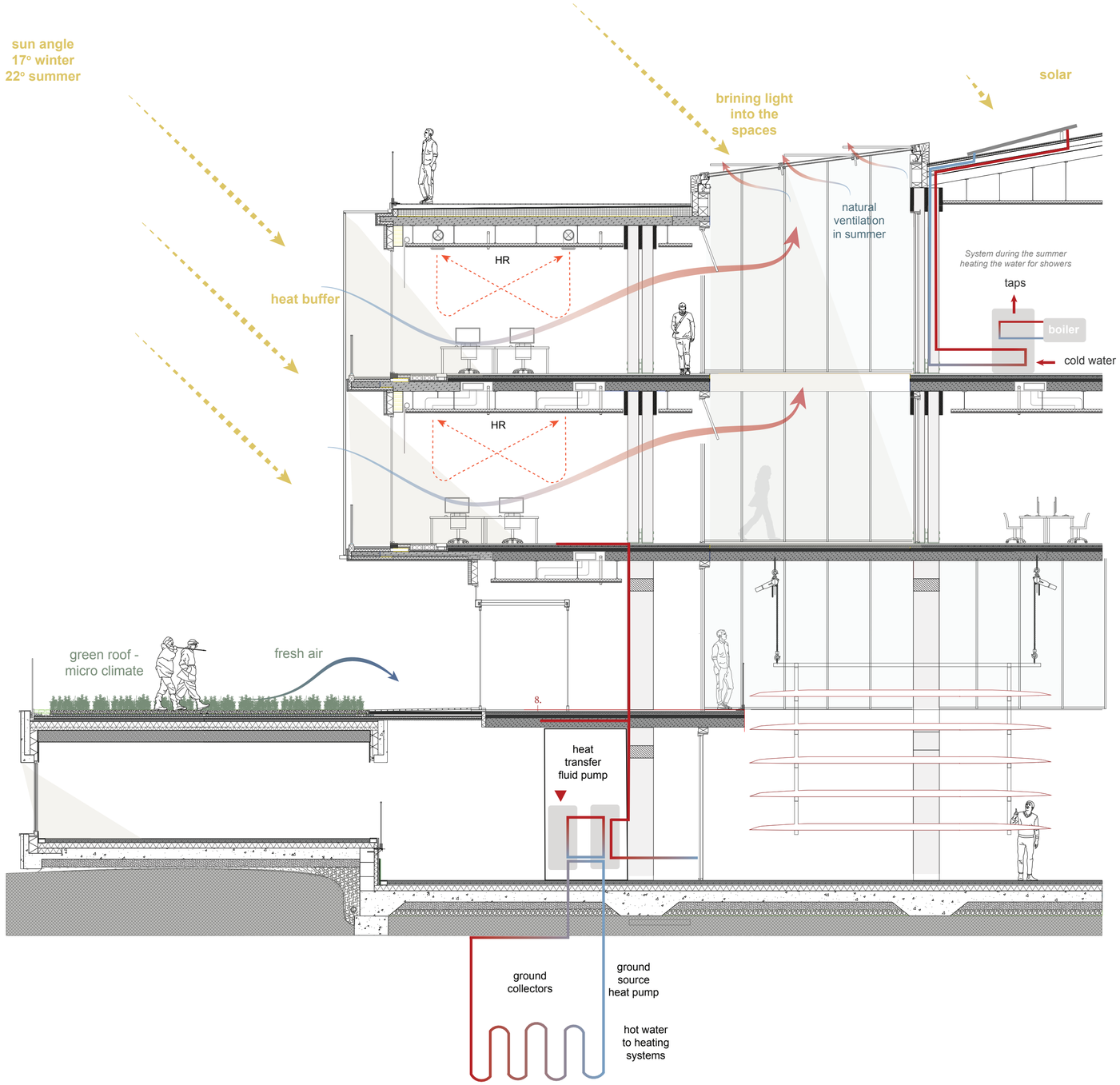
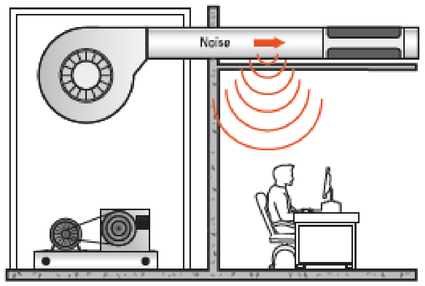


Figure 24: Laminar flow diffuser installed near fume hood



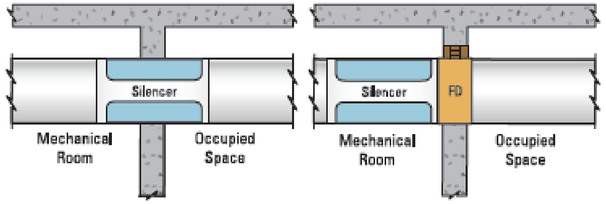
Ventialtion for the LABs
Heat Recovery for the Offices





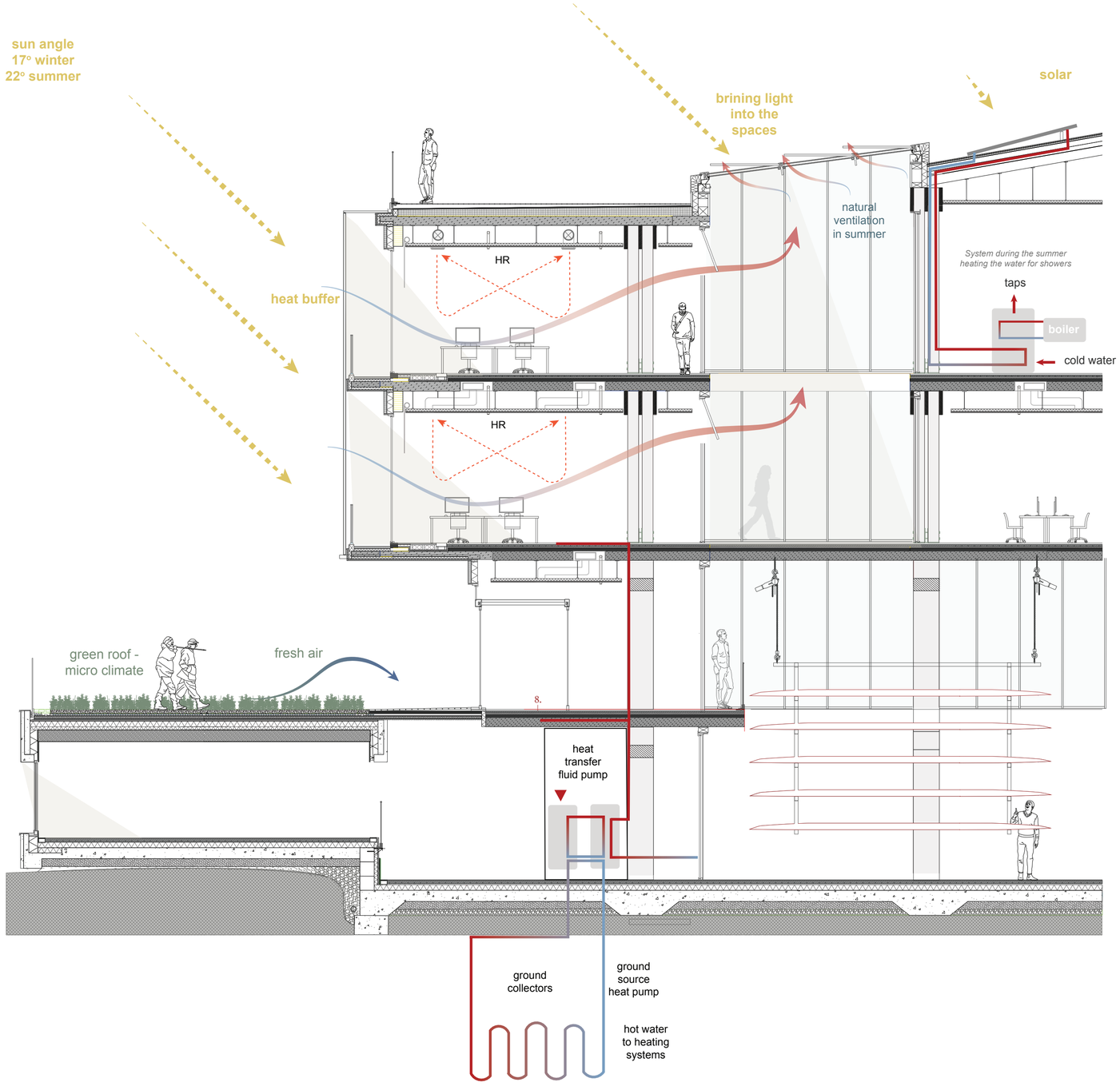
Transmission Loss

Construction		Transmission Loss (Rectangular Silencers)							
Class	Gauge	63 Hz	125 Hz	250 Hz	500 Hz	1K Hz	2K Hz	4K Hz	8K Hz
CL1	22	25	26	28	30	33	37	40	40
CL2	16	27	28	30	32	35	38	41	41
HTL1	16	28	29	31	33	36	39	42	42
HTL2	10	31	33	34	36	38	42	45	45



Best Silencer Location if No Fire Damper Best Silencer Location if Damper is Required

Ventilation and Noise



What happens to the building over time?

The glulam structure can be demounted and it becomes durable in time

And the concrete dike can remain on site,
servicing the local shipments

Kuja's Electronic Samizdat: Andreas Levers

Architecture as an apparatus - measuring the rising water

Thank you!