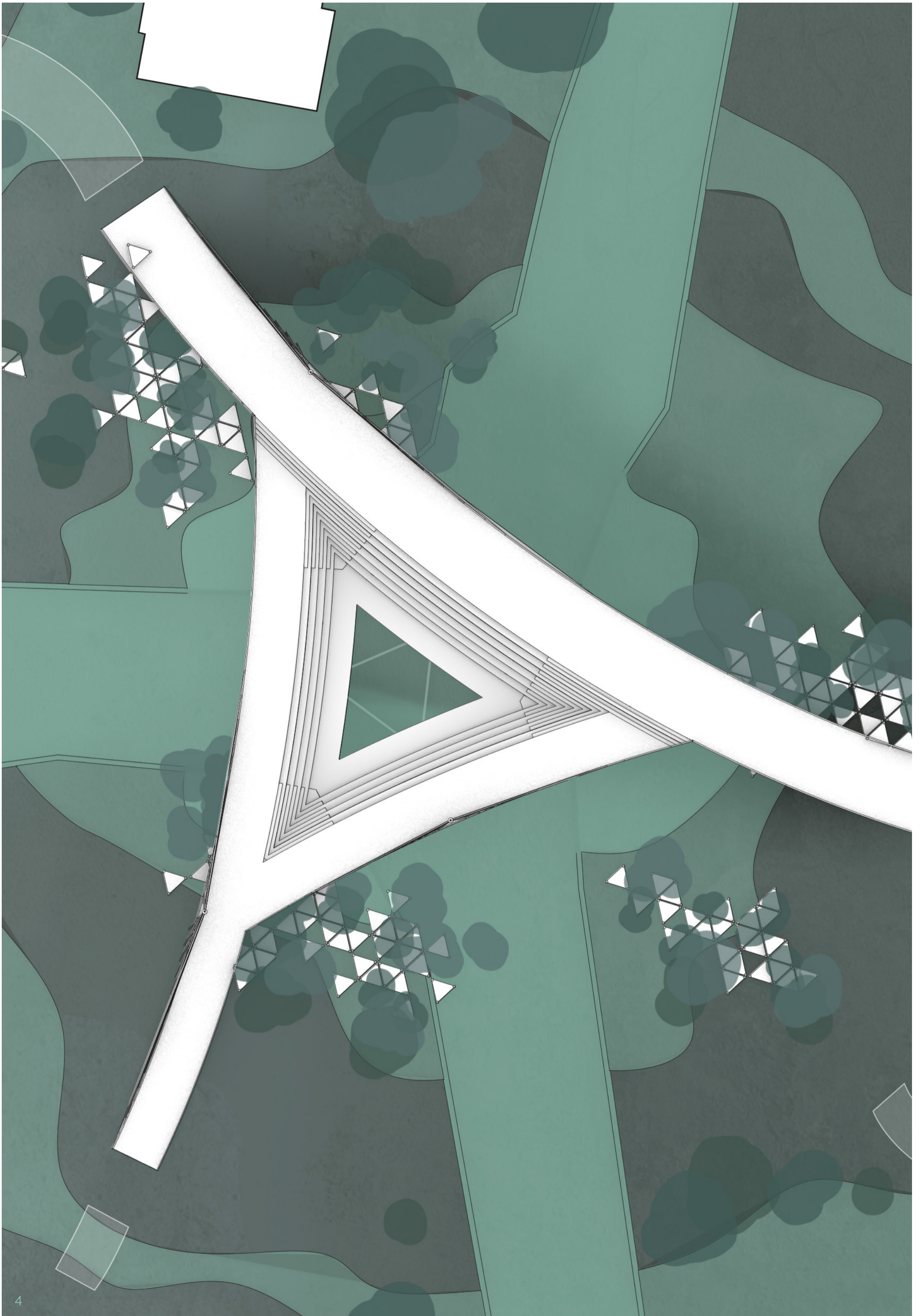


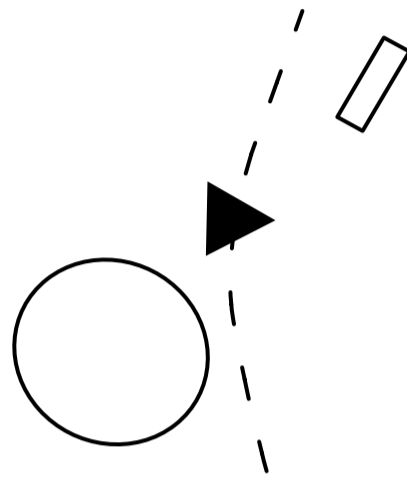
## THREE-RIVER BRIDGE

Mölndalsån, Gothenburg, Sweden  
ACE465 Urban Prototypes, MPARC 23/24  
Aletta Zsuzsanna Tóth









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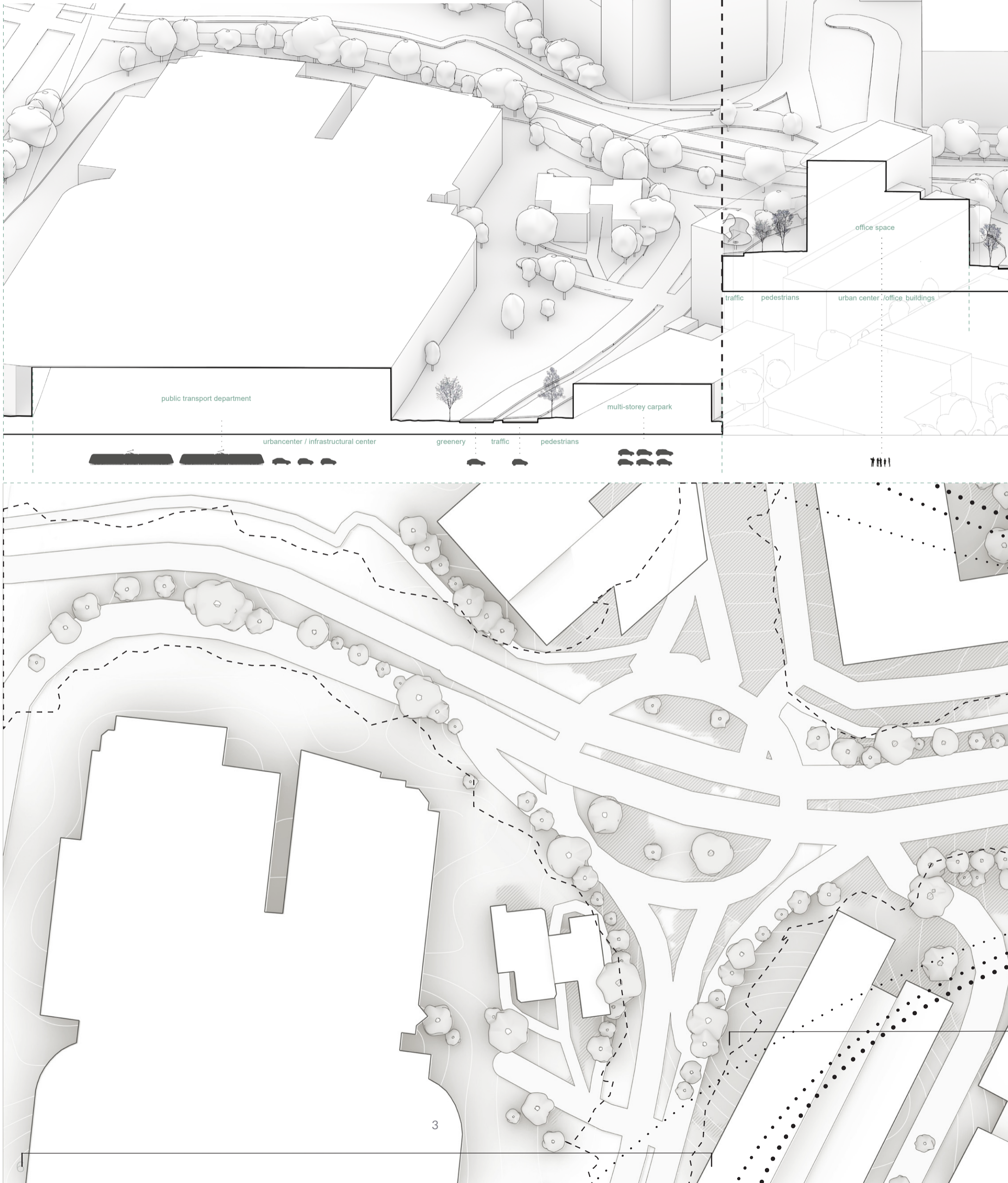
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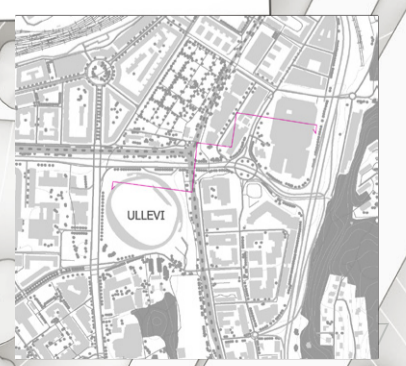
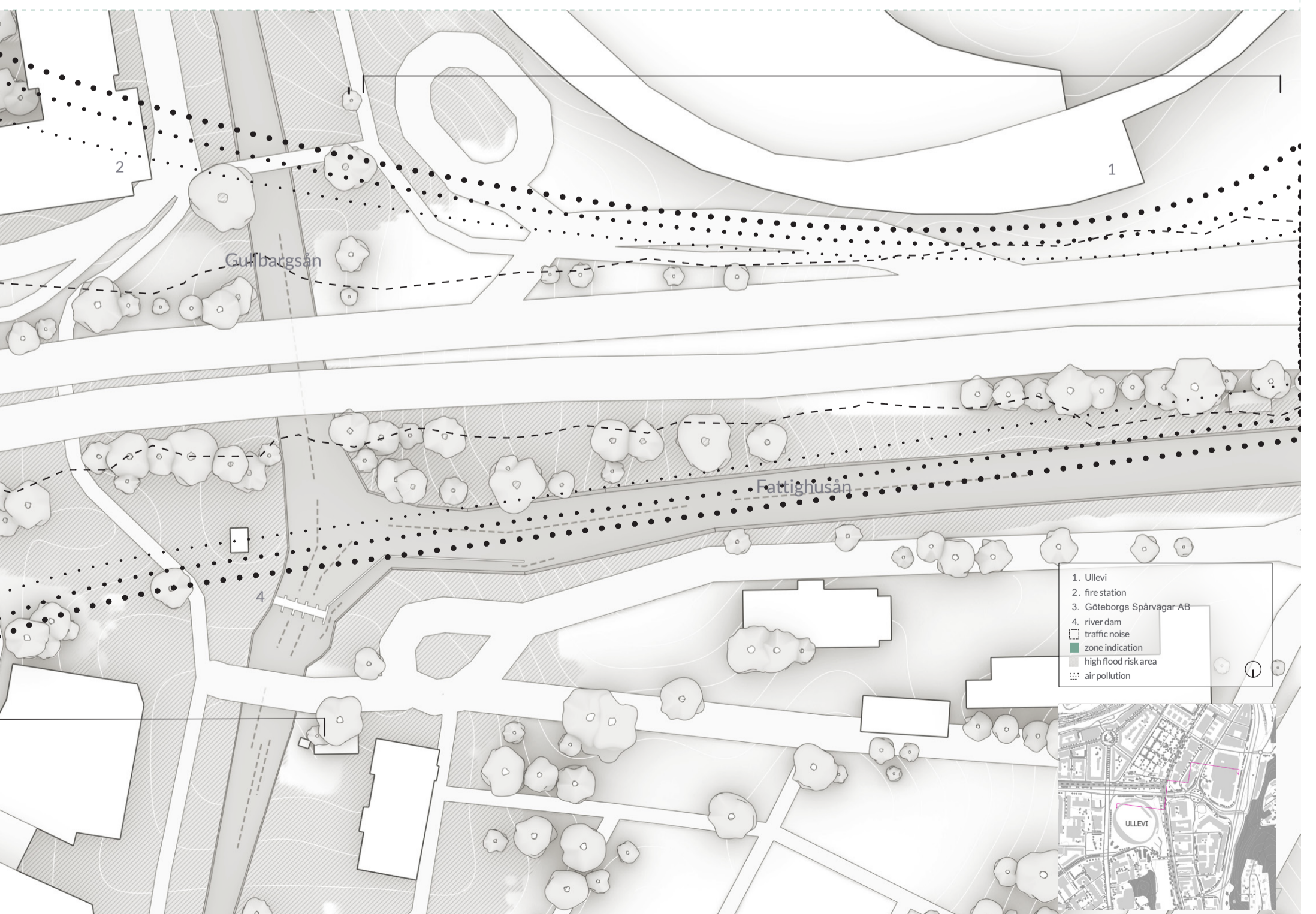
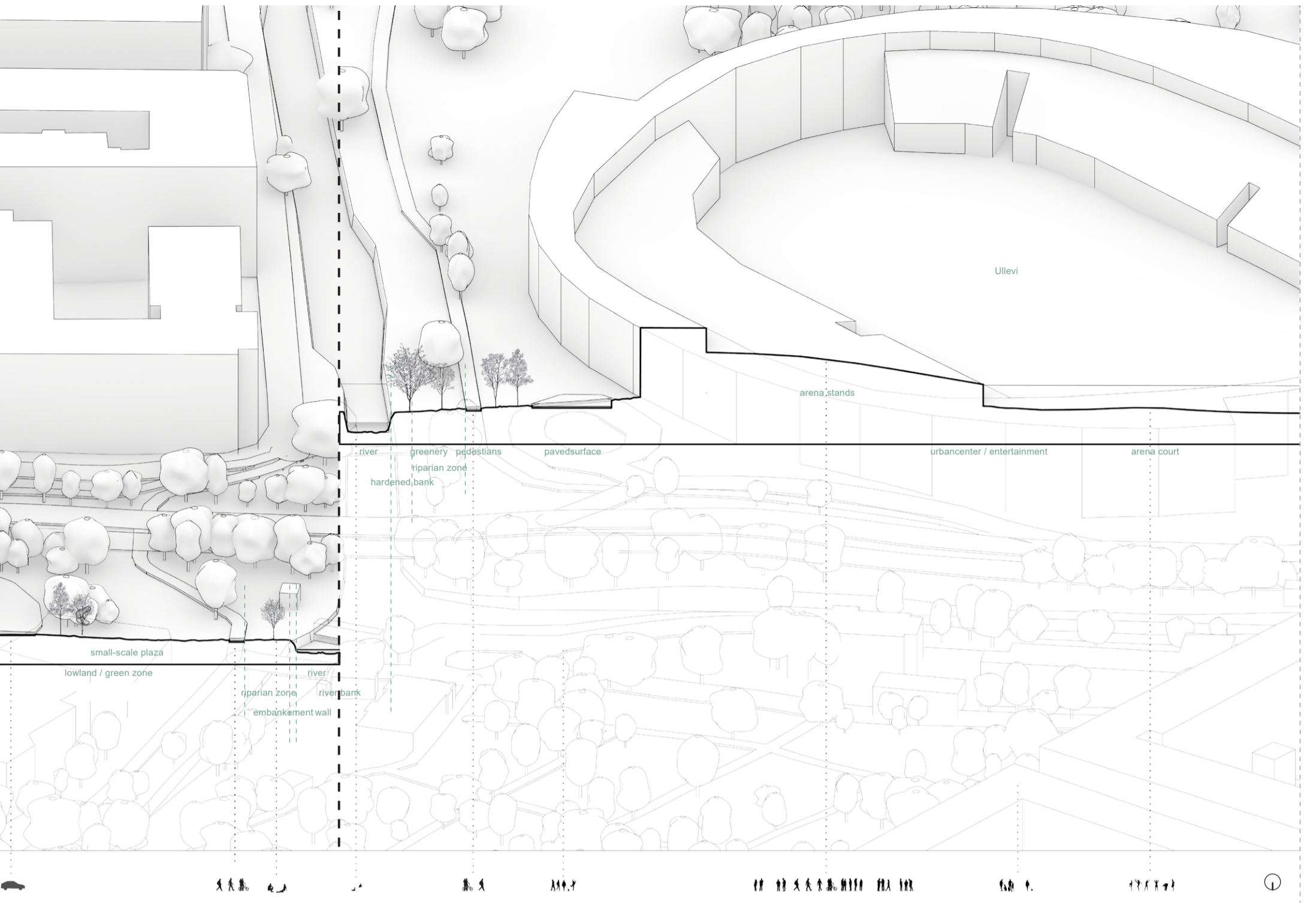
*\*previous design iteration*

# MÖLNDALSÅN

Zuzanna Jakubowska, Aletta Zsuzsanna Tóth, Tomasz Leonik

During the group research of the transect area we have identified three key problems in the urban fabric. Firstly, the area is highly segmented, and multiple buildings and public spaces are underused. Secondly, the air and noise pollution is considerably high. And finally, the entire area of the investigation is threatened by extremely high flood-risk.



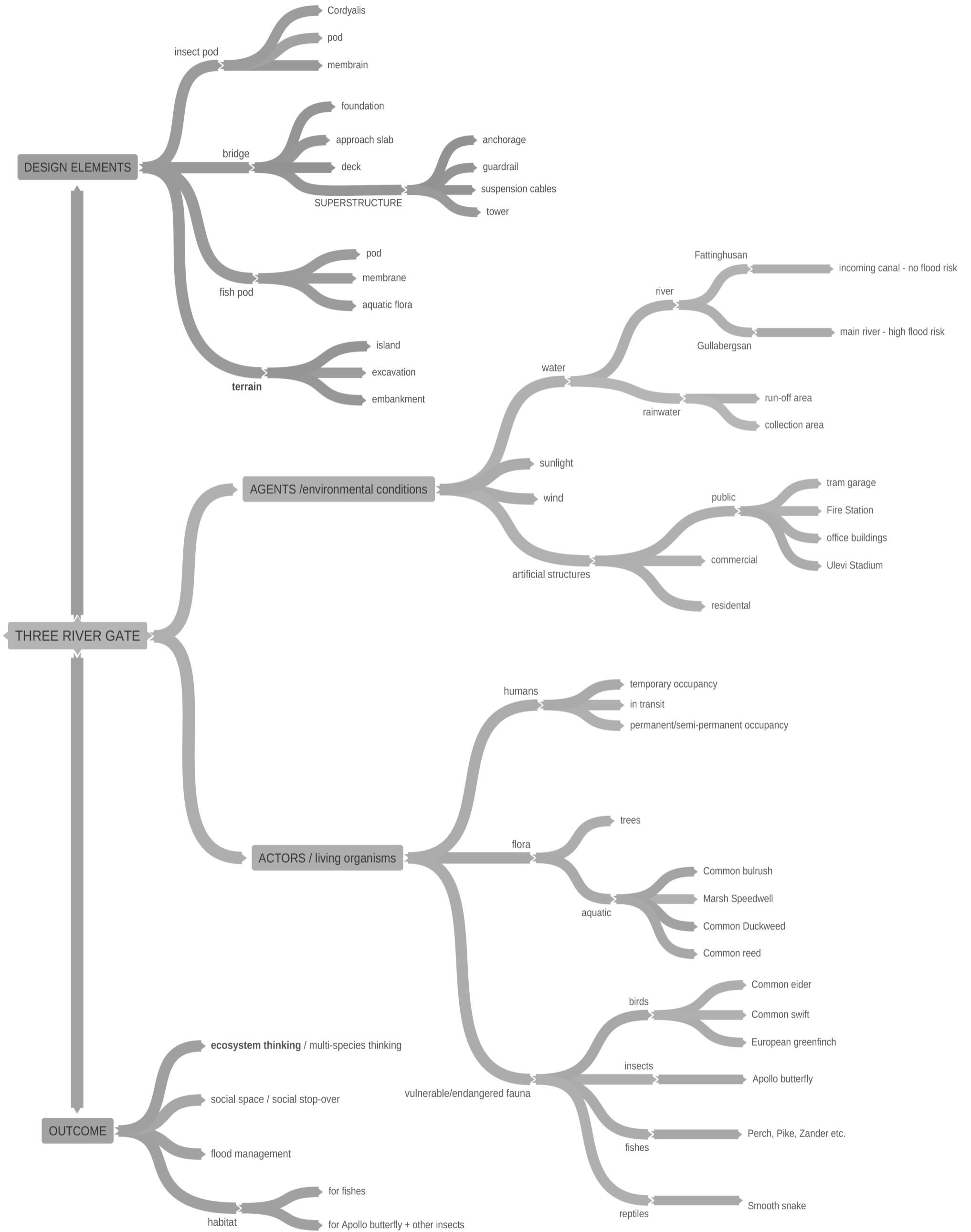


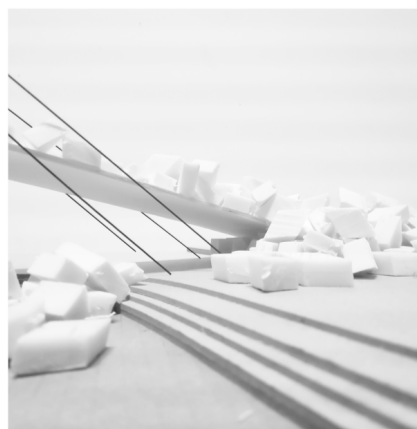
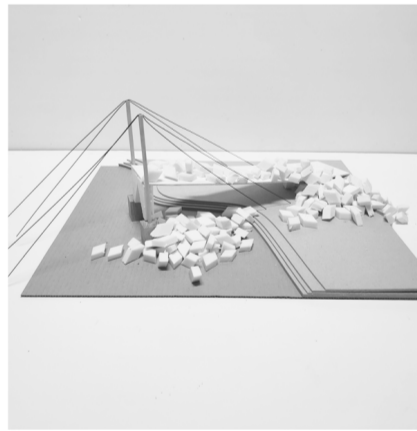
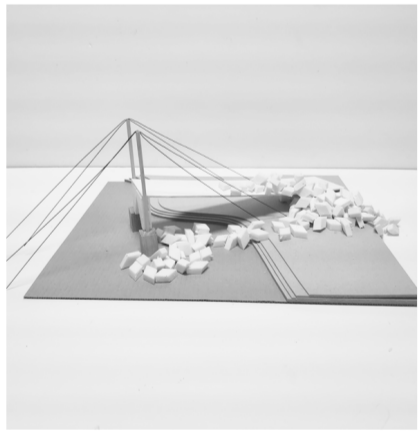
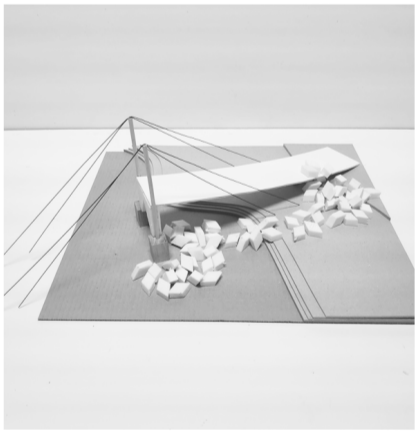
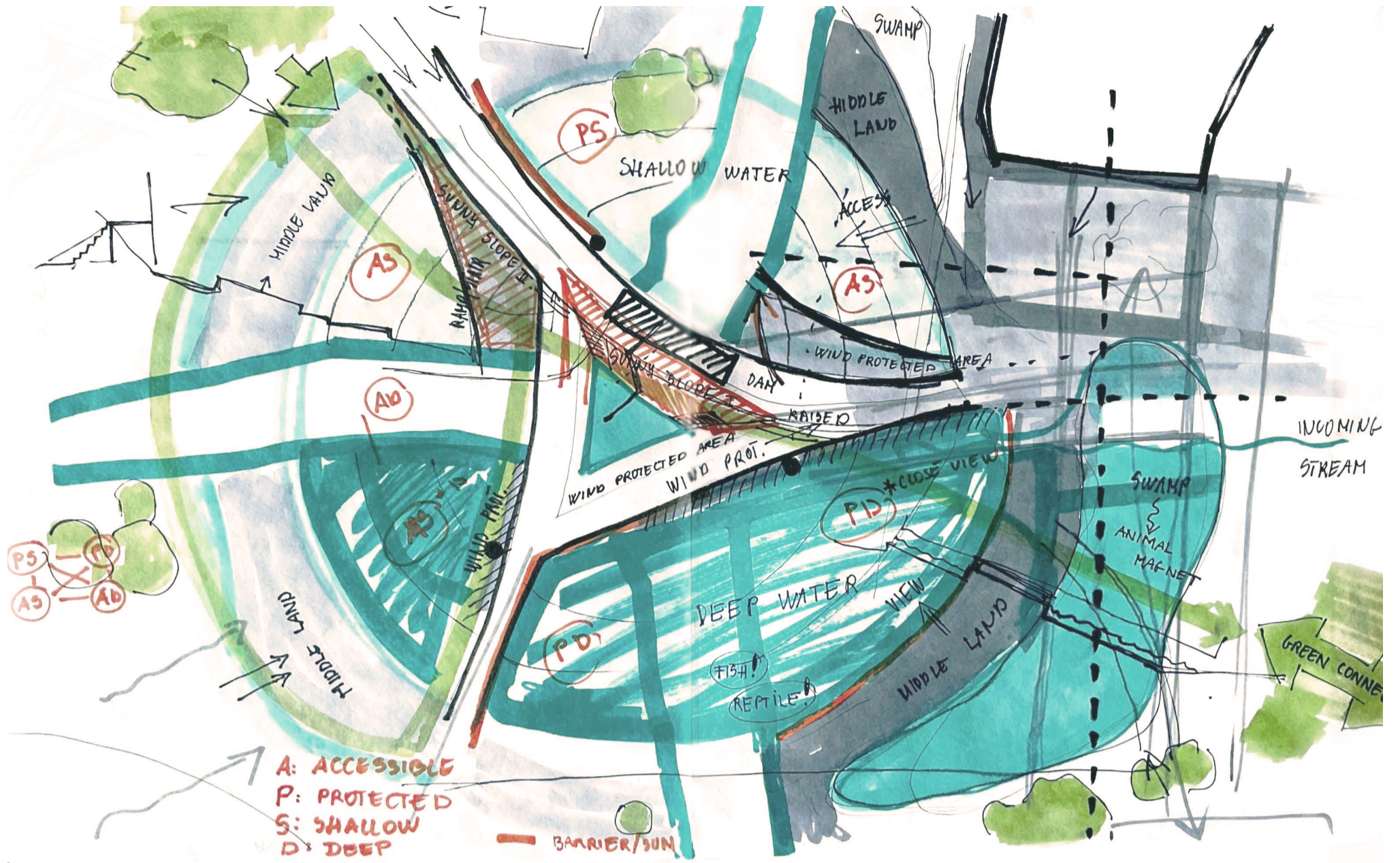
#### INDIVIDUAL DESIGN AREA - AGENDA

What would happen if engineering marvels served not only humans? What if a simple bridge catered to every participant in the wildlife?

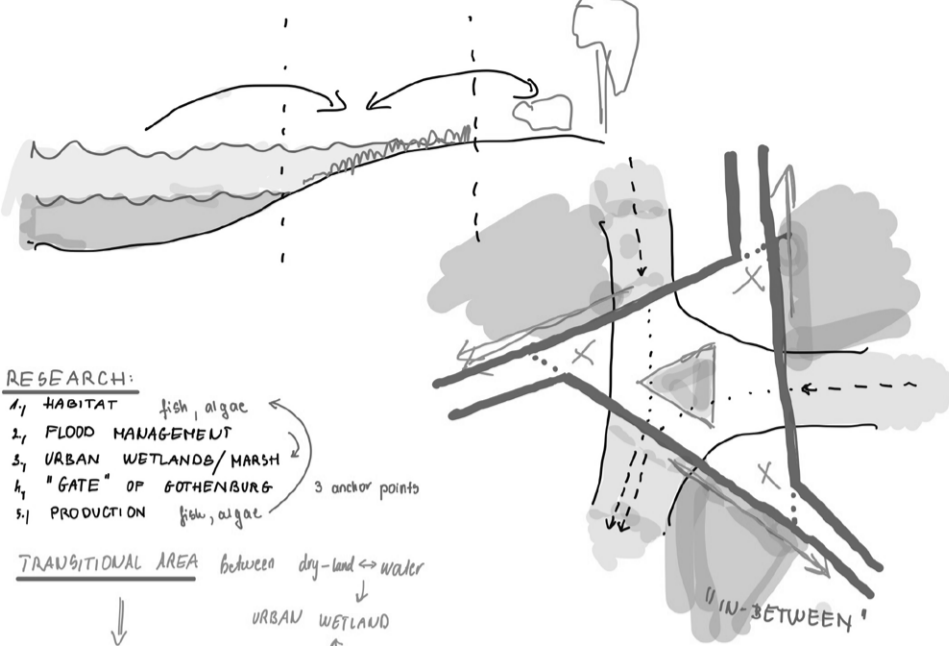
The Three-River Bridge unites three substantially different segments of the city. It connects the business district, the stadium with its enthusiastic sports fans, and the restaurants stretching toward the city center. However, beyond serving humans, this bridge also caters to the smaller wildlife. It expands the habitat for tiny bugs, reptiles, and water birds, connecting the park with the forest and creating a safe haven in the midst of human hustle and bustle.



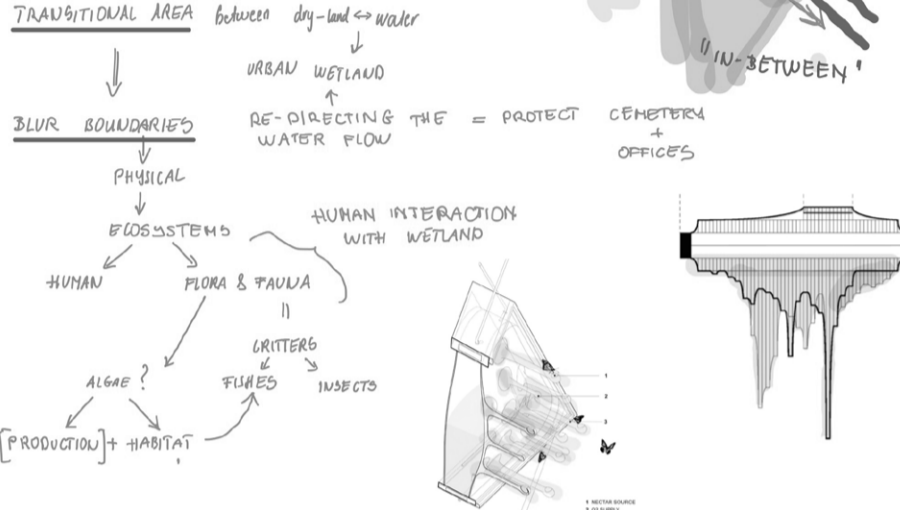




# THREE-RIVER BRIDGE



- RESEARCH:**
- HABITAT: fish, algae
  - FLOOD MANAGEMENT
  - URBAN WETLANDS/MARSH
  - "GATE" OF GÖTHEBURG
  - PRODUCTION: fish, algae
- 3 anchor points

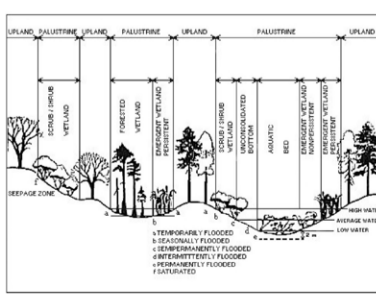
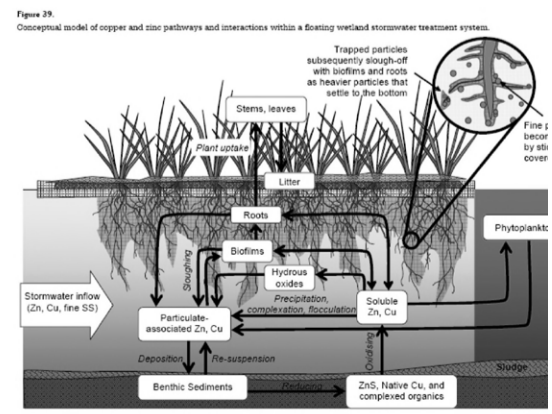
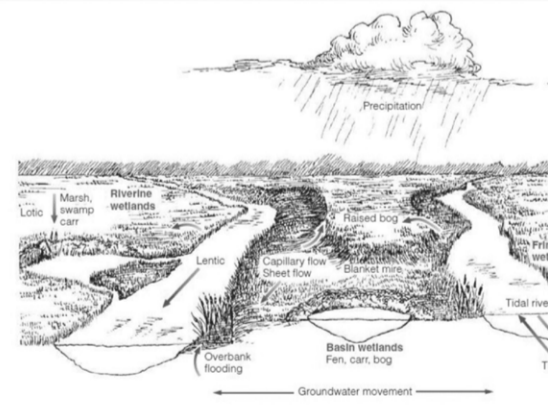
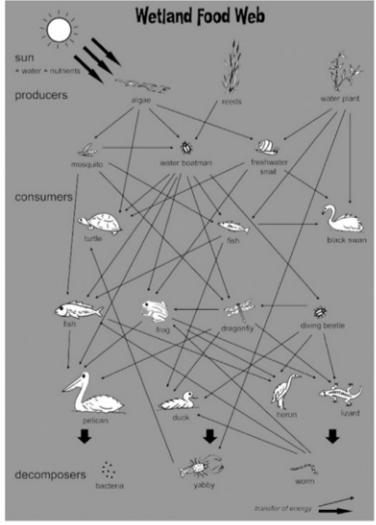


CONNECTION → 3 ANCHOR POINTS →  $\phi$  SEGMENTED LANDSCAPE

## INSPIRATIONS



## WETLAND ANALYSIS



# ENDANGERED SPECIES IN W.G.

**Phyllorhiza (Wetfly) in Västra Götaland, SE**

Photo: (C) Fernando de Jesus, some rights reserved CC BY-NC-SA, updated by Fernando de Jesus

First observation: Small Larva in August 2020 by LarvaGen

Last observation: Small Larva in August 2020 by LarvaGen

Occurrence status: Unknown (U)

Establishment means: Unknown (U)

The small larval moth *Phyllorhiza (Hicobola)* is a species of moth in the family Lasiocampidae. It is found in Austria, Belarus, Belgium, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Italy, Italy, Japan, Kazakhstan, Latvia, Lithuania, Mongolia, Norway, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland and Ukraine. Read the full Wikipedia description.

## Conservation genomics in the Clouded Apollo

Together with Niclas Backström, Uppsala

The Clouded Apollo butterfly is one of Sweden's most endangered butterflies. The species previously had a larger distribution but is today limited to a few localities in Blekinge, Upland and Västernorrland. Experiments are underway with support releases in some populations with butterflies bred in captivity. For this purpose, butterflies from a population kept at Nordens Ark in Bohuslän are used. Our research and our part of the conservation work aims to document genomic diversity, population structure and degree of inbreeding in Swedish and nearby populations in our neighboring countries. The research takes place in collaboration with the Swedish action program for the species, which is led by the County Administrative Board in Blekinge. In this context, the entire butterfly's genome is also sequenced in collaboration with NGL, SOLiD Lab.

**Alcedo atthis in Västra Götaland, SE**

Photo: (C) Mark Klier, some rights reserved CC BY-NC-SA

First observation: Common Kingfisher in April 2019 by Anne Åke

Last observation: Common Kingfisher in July 2022 by medusa

The common kingfisher (*Alcedo atthis*) also known as the European kingfisher, and river kingfisher, is a small kingfisher with seven subspecies recognized within its wide distribution across Eurasia and North Africa. It is resident in much of its range, but migrates from areas where rivers freeze in winter. Read the full Wikipedia description.

European Ash ( <i>Fraxinus excelsior</i> )	Hairy-Christmas ( <i>Aconitum napellus</i> )	Common Snowdrop ( <i>Galanthus nivalis</i> )
Field Maple ( <i>Acer campestre</i> )	Lady's-Slipper ( <i>Cypripedium calceolus</i> )	European Pasqueflower ( <i>Pulsatilla vulgaris</i> )
Hart's-tongue Fern ( <i>Asplenium scolopendrium</i> )	Luminous Moss ( <i>Schizothela penansii</i> )	Silesian Feather-Moss ( <i>Hypnum setigerum</i> )
Willow-leaved Pear ( <i>Pyrus salicifolia</i> )	Service Tree of Fontainebleau ( <i>Forsythia viridis</i> )	
Common Eider ( <i>Somateria mollissima</i> )	Eurasian Oystercatcher ( <i>Haematopus ostragrus</i> )	Northern Lapwing ( <i>Vanellus vanellus</i> )
Green-winged Teal ( <i>Anas crecca</i> )	Common Pochard ( <i>Aythya ferina</i> )	Peregrine Falcon ( <i>Falco peregrinus</i> )
Common Hoopoe ( <i>Upupa epops</i> )	Rook ( <i>Corvus frugilegus</i> )	Redwing ( <i>Tringa haasianus</i> )
Red-throated Loon ( <i>Gavia stellans</i> )	Black-legged Kittiwake ( <i>Rissa tridactyla</i> )	Common Reed Warbler ( <i>Acrocephalus arvensis</i> )

## STRUCTURAL DESIGN

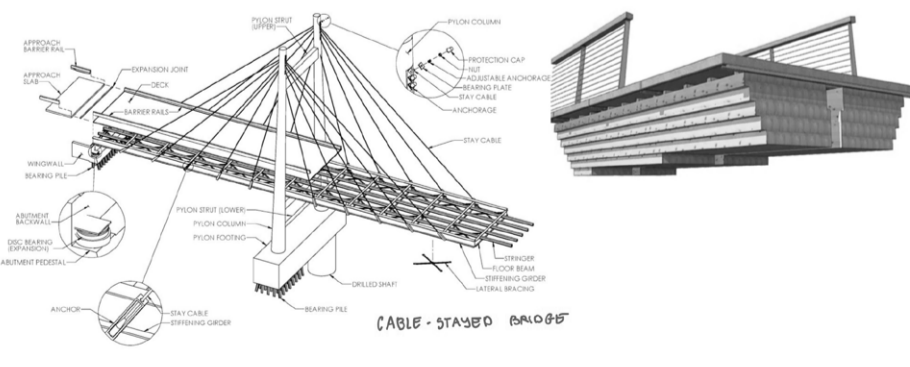
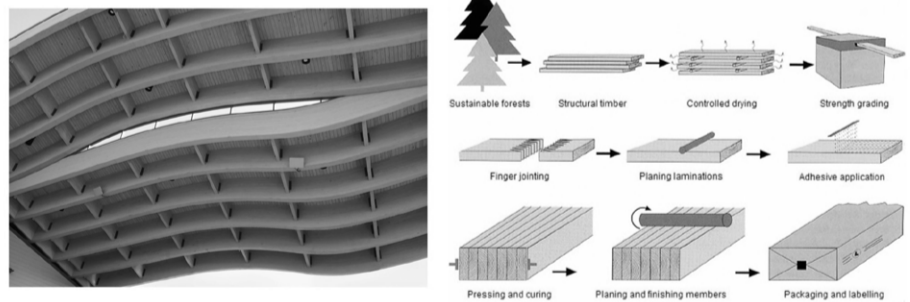
MAIN ELEMENT: GLULAM BEAMS



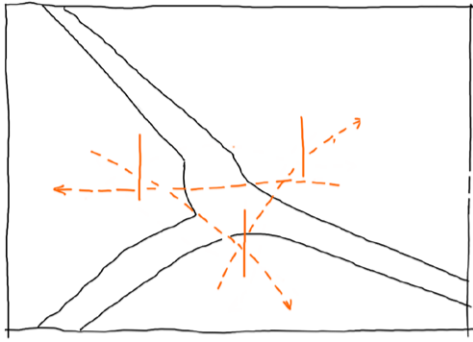
Glue laminated timber has almost the same load bearing capacity as steel, but a far lower weight and excellent fire resistance due to its charring characteristics. When used in heavy timber construction, Glulam ensures high earthquake resistance and excellent resistance to aggressive substances. Many different 'lay-ups' are possible, arranging higher strength 2x laminations near the top and bottom of beams where the stresses are highest to increase the beams capacity.

Glulam allows a high degree of prefabrication, and long structural spans where necessary - but is equally effective for shorter spans. Its thermal properties help prevent cold bridging.

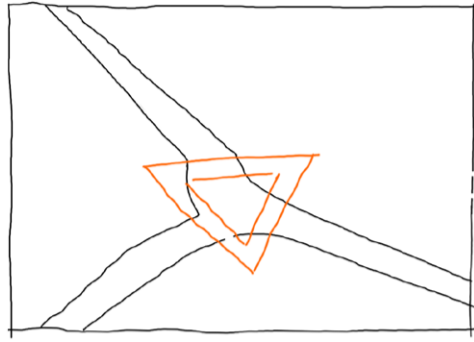
Glulam beams laid on their flat and used as floor or roof panels are known as GLT panels - see [Glue-Laminated Timber Panels](#).



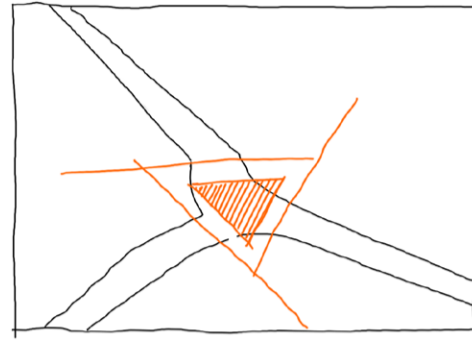
EVOLUTIONARY TREE OF THE DESIGN PROCESS



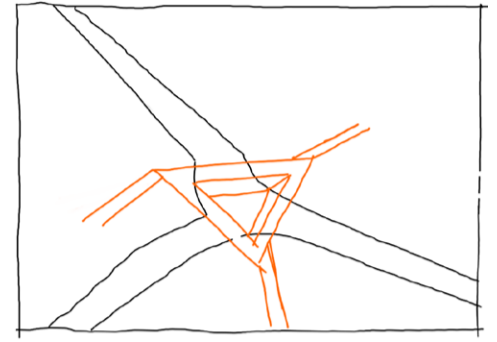
CONNECTION AND SPATIAL ANCHOR POINTS



FORM FINDING / TRIANGULATION

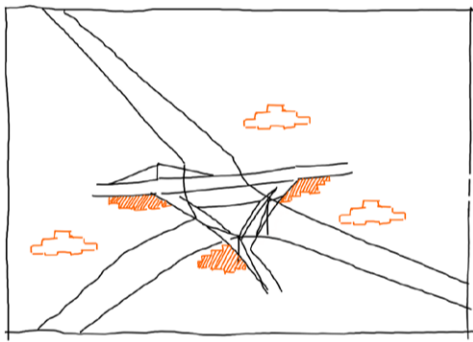


PATHWAYS AND AQUATIC HABITAT

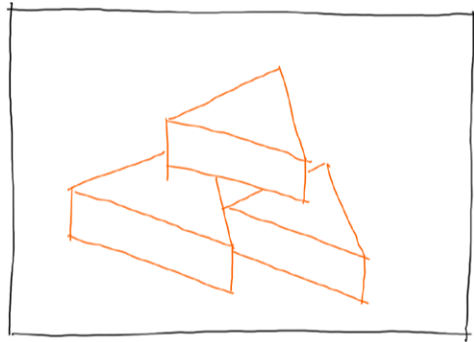


ELEVATION AND PUBLIC SPACE DEFINITION

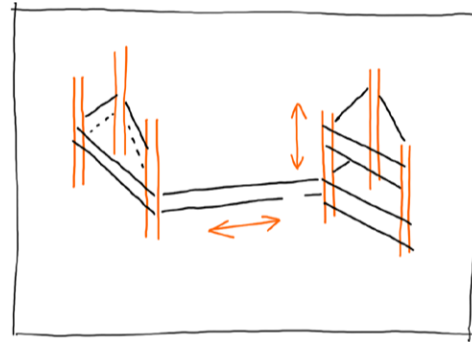
DESIGN ITERATION 'A'



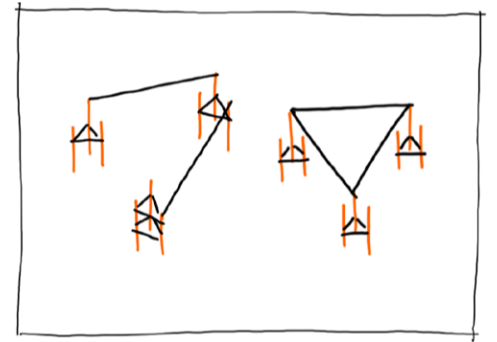
IN-BETWEEN SPACE UTILIZATION AND CONNECTION FOR CRITTERS



SOLID POD DESIGN AND STACKED CONFIGURATION



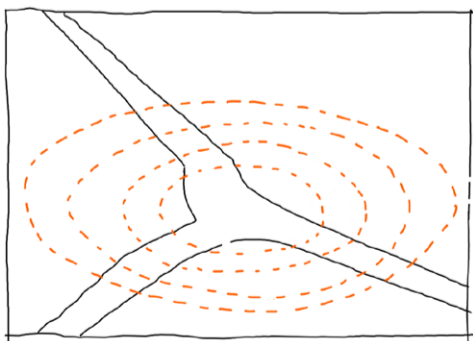
'BRIDGE' CONFIGURATION AND LIGHT STRUCTURE



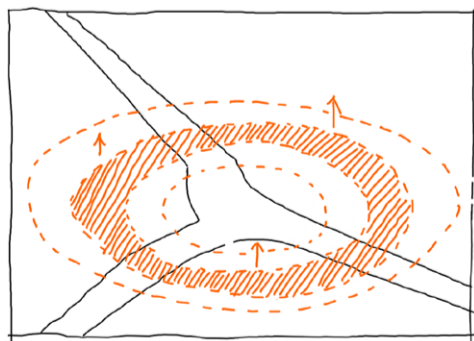
POD CONNECTIONS

DESIGN ITERATION 'A'

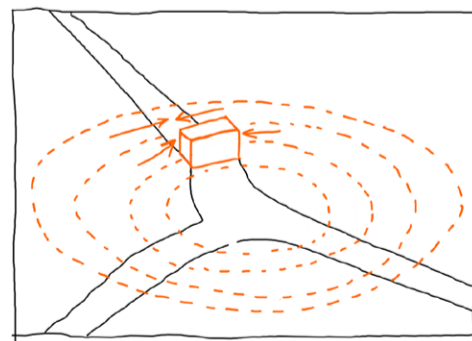
DESIGN



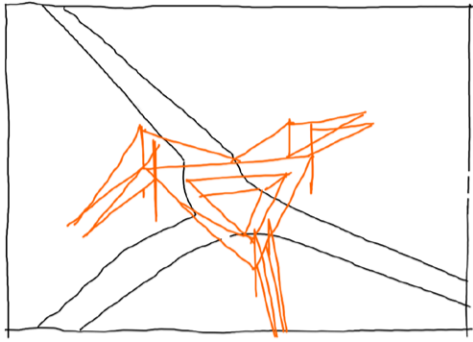
WETLAND AREA DEFINITION



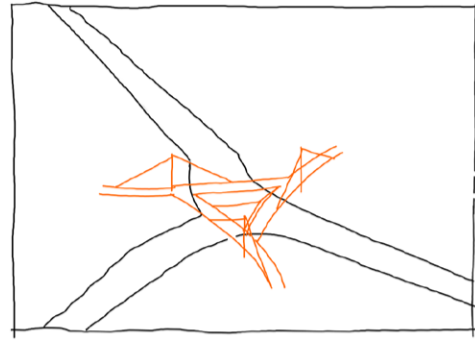
WETLAND TYPE DIVERSIFICATION BY ELEVATING AN INNER RING



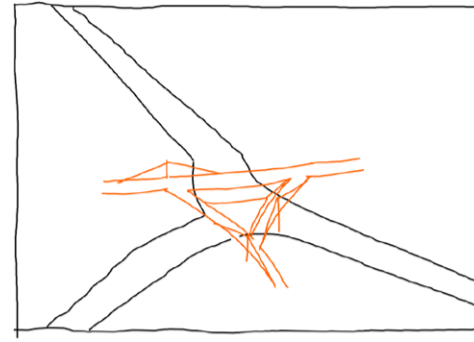
WATER DEPTH DIVERSIFICATION BY THE DAM



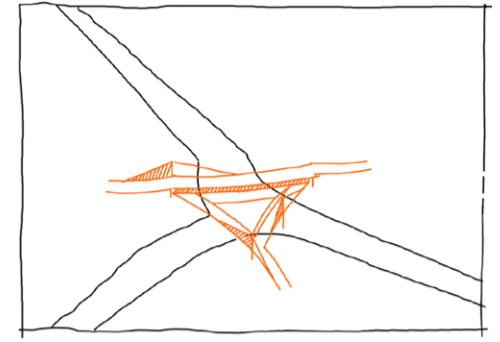
CABLE-STAYED STRUCTURE DESIGN



SCALE-FIX AND ORGANIC SHAPE DESIGN

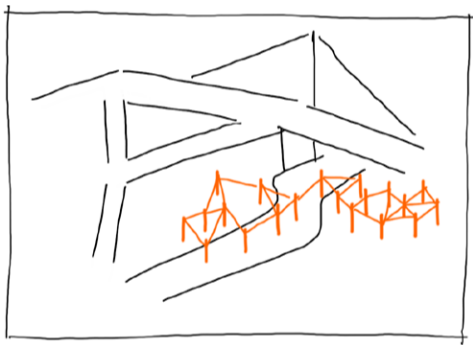


ADJUSTMENT ACCORDING TO TRAFFIC

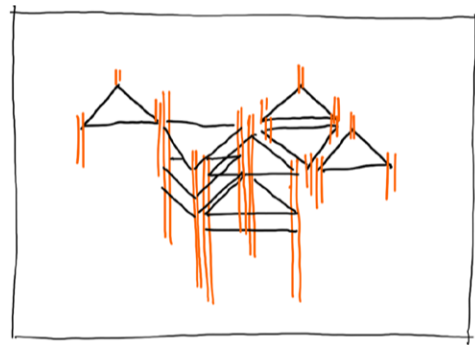


WIND PROTECTION AND SUNNY AREA EXPANSION THROUGH ELEVATION

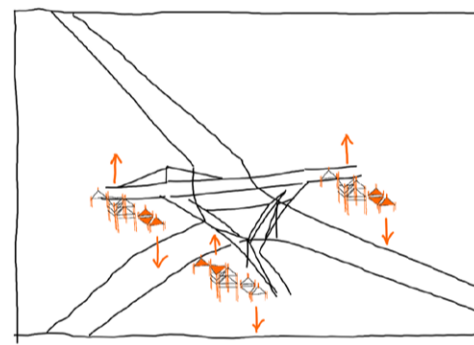
DESIGN ITERATION 'B'



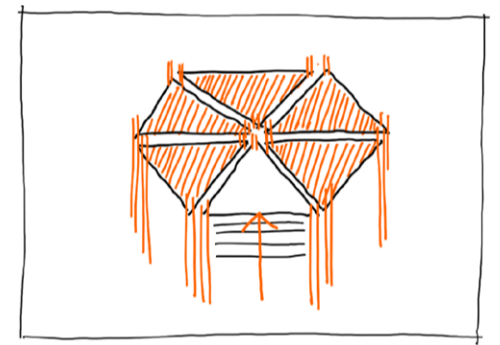
SYSTEM CONFIGURATION



DENSITY ADJUSTMENT



EXTRA FUNCTIONS THROUGH THE VARIATION OF ELEVATIONS



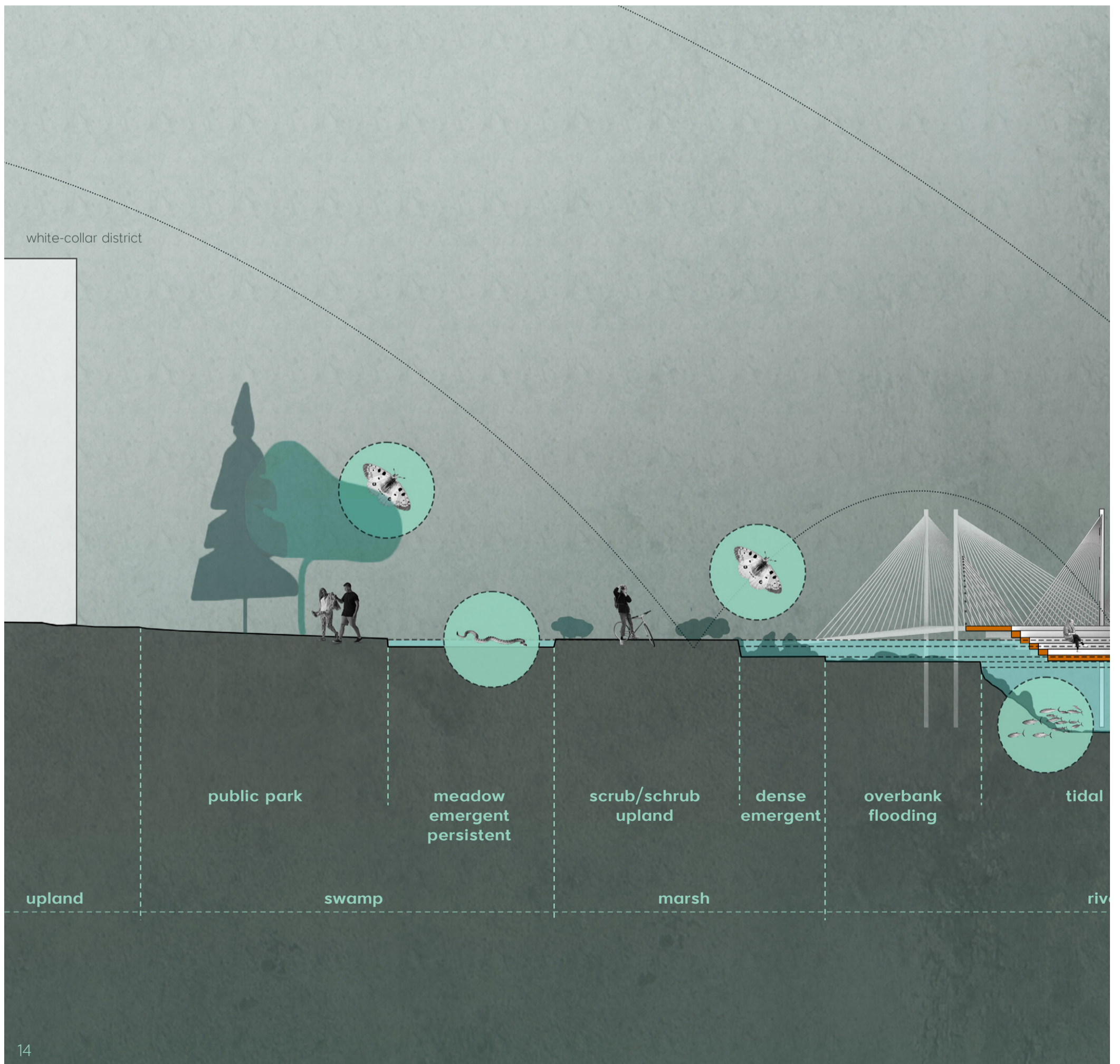
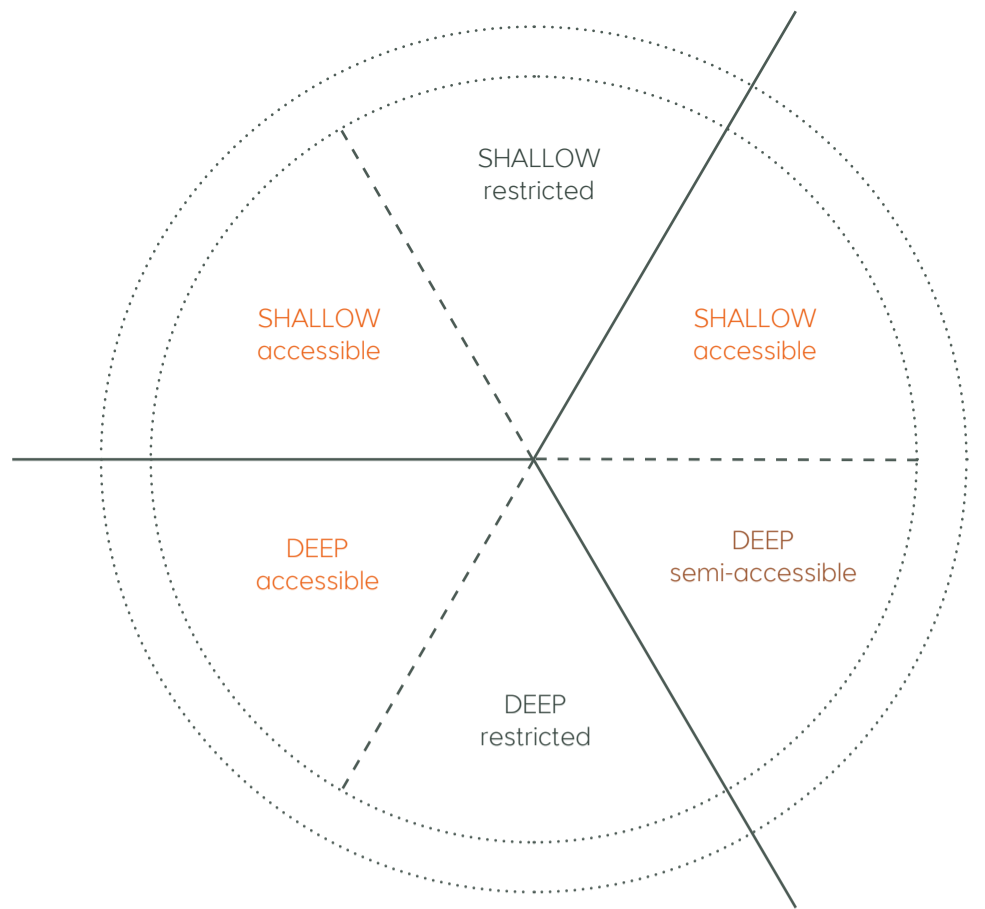
'COMMUNITY GARDEN' POD CONFIGURATION

ITERATION 'B'

DESIGN ITERATION 'C'

# ZONING

The river, the bridge and the pods together divide the area into six zones. The variation of deep and shallow marshlands and the alternation of the area's accessibility create a diverse space structure. This space system allows both the flora and fauna to have a safe territory, free of human interruptions. At the same time, the very same system enables humans to have a controlled interaction with animals in the designated area.

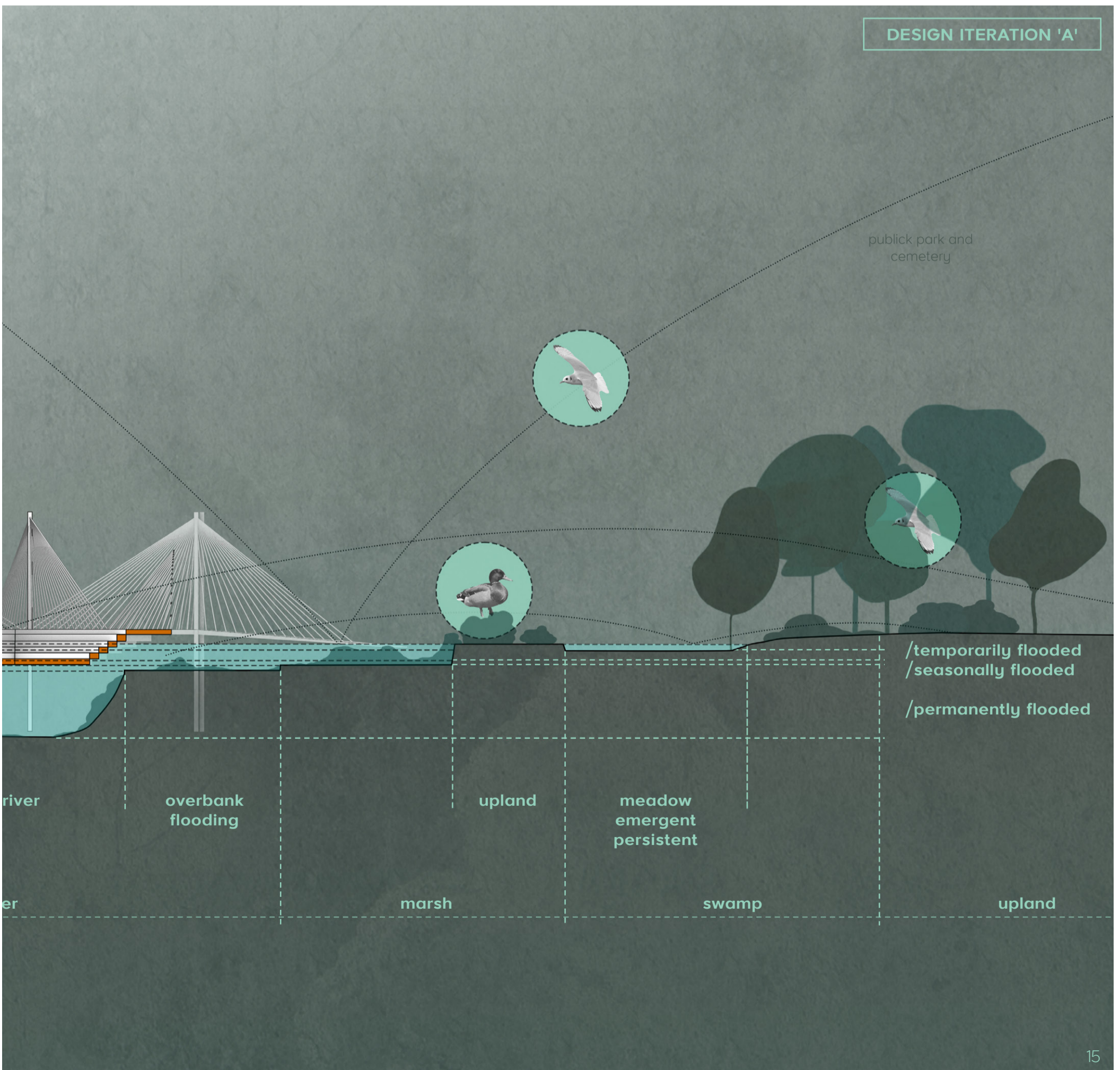
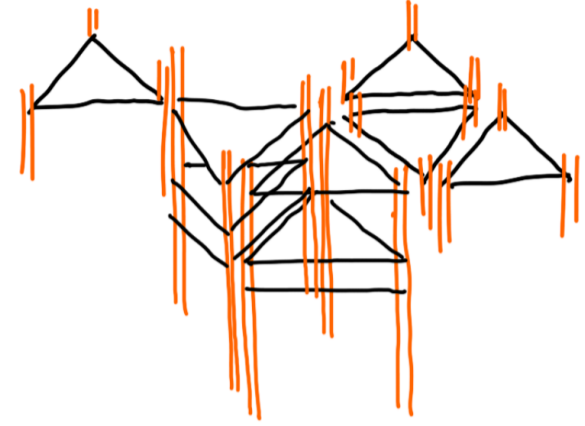
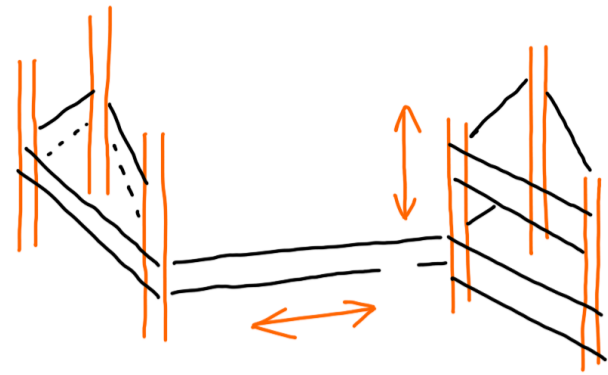


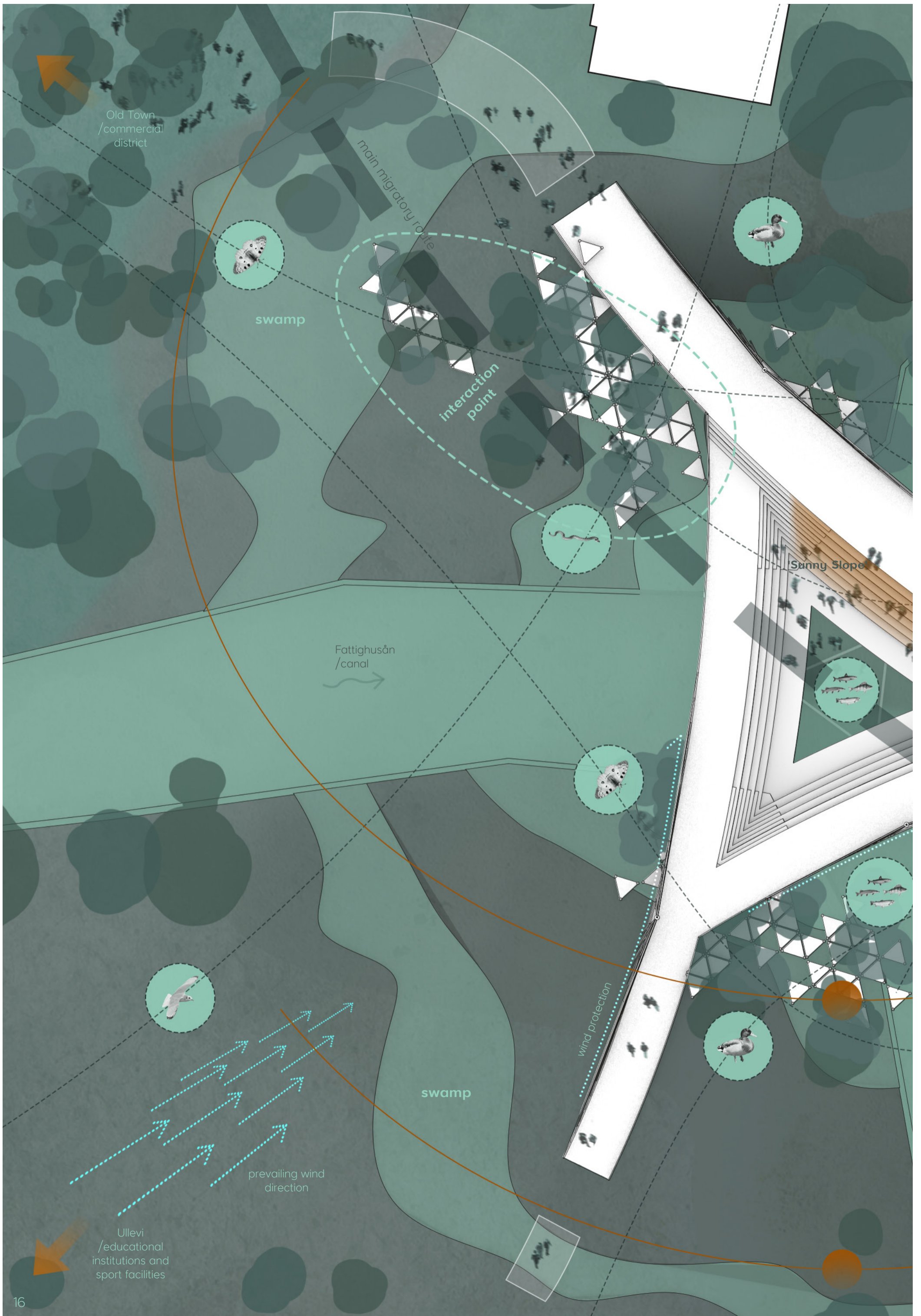
## WETLAND

The artificial wetland manages the flood risk of the rivers meanwhile enhances the area's biodiversity. The four elevation changes of the ground establishes a new, wider riverbank and creates a marshland and swamp. These variation in water depth suits different species' different nesting needs.

## POD SYSTEM

The system of the pod's creates a flexible mean of habitat formation. The upper part of the pod - the net - and the lower part - the basin - establishes a 'safe zone' in between where small animals find a protected nook filled with lush vegetation. Moreover, the system of the pods enables animals with shorter travel distances to cross the river and access the forest. This way the park's tiny residents have a greater area for feeding and reproduction.









white-collar district

Gullbergsån /main river

public area for the office workers

incoming stream of water

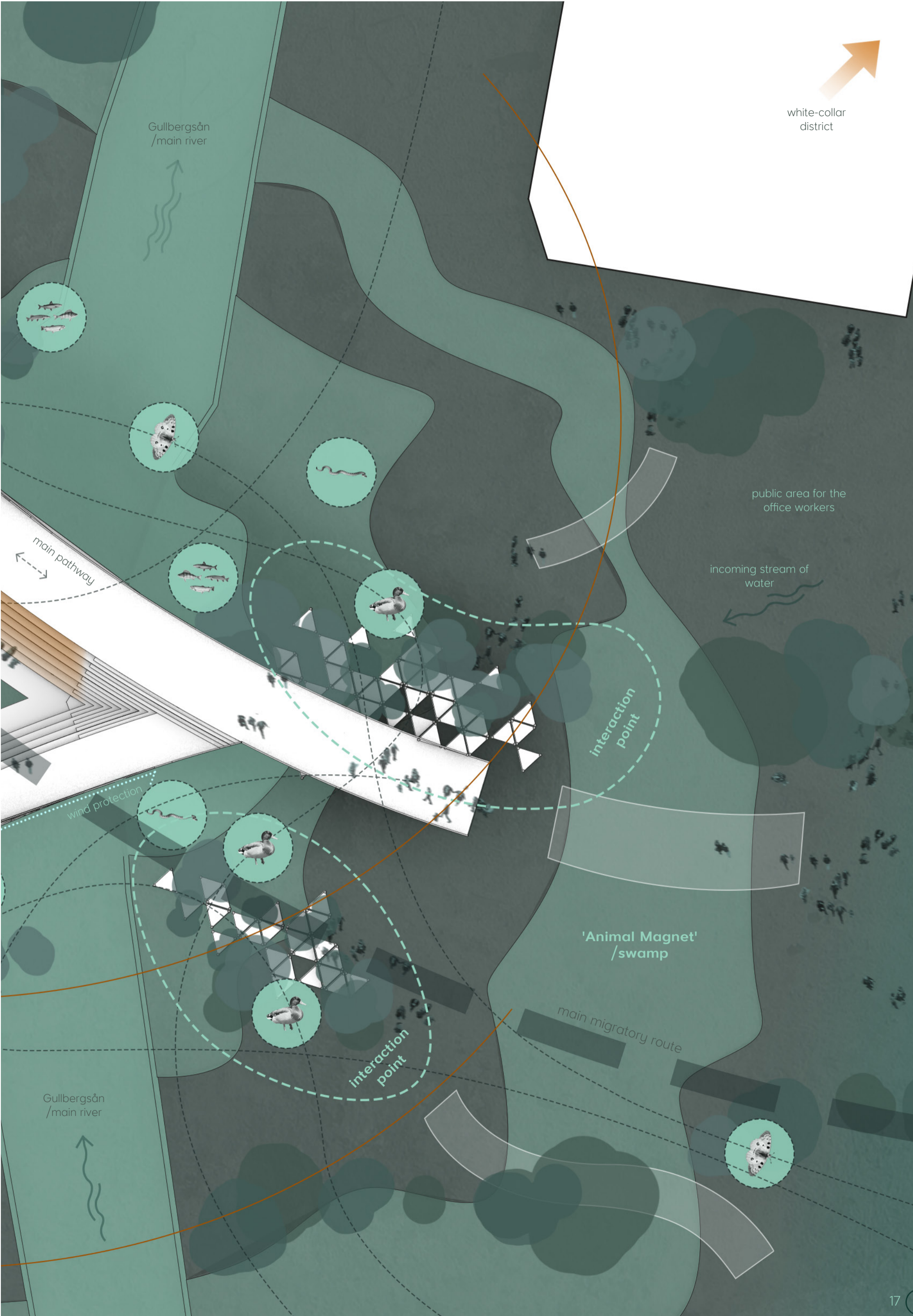
interaction point

'Animal Magnet' /swamp

main migratory route

interaction point

Gullbergsån /main river





## STRUCTURAL SYSTEM

The bridge is a cable-stayed bridge, where the loads are transferred to the ground by the three stay cable systems through the pylon columns and pylon footings.

The three pathways encapsulate the inner basin, which's stairs create a sitting area right over the intersection of the three bridge. The stairs are supported through the gulalm beam strusses.

The bridge is made out of gulalm beams. The glue laminated timber beams have almost the same load bearing capacity as steel, but has a far lower weight. This attributum of the material makes it possible to rely on three columns and not more.

The main pathway is enforced by multiple layers of gulalm beams to support the greater width.

The homogeneity of materials enables the structure to blend into the surrounding nature. The system of pods and high water level further hide away the main structure, and creates a less intrusive design.

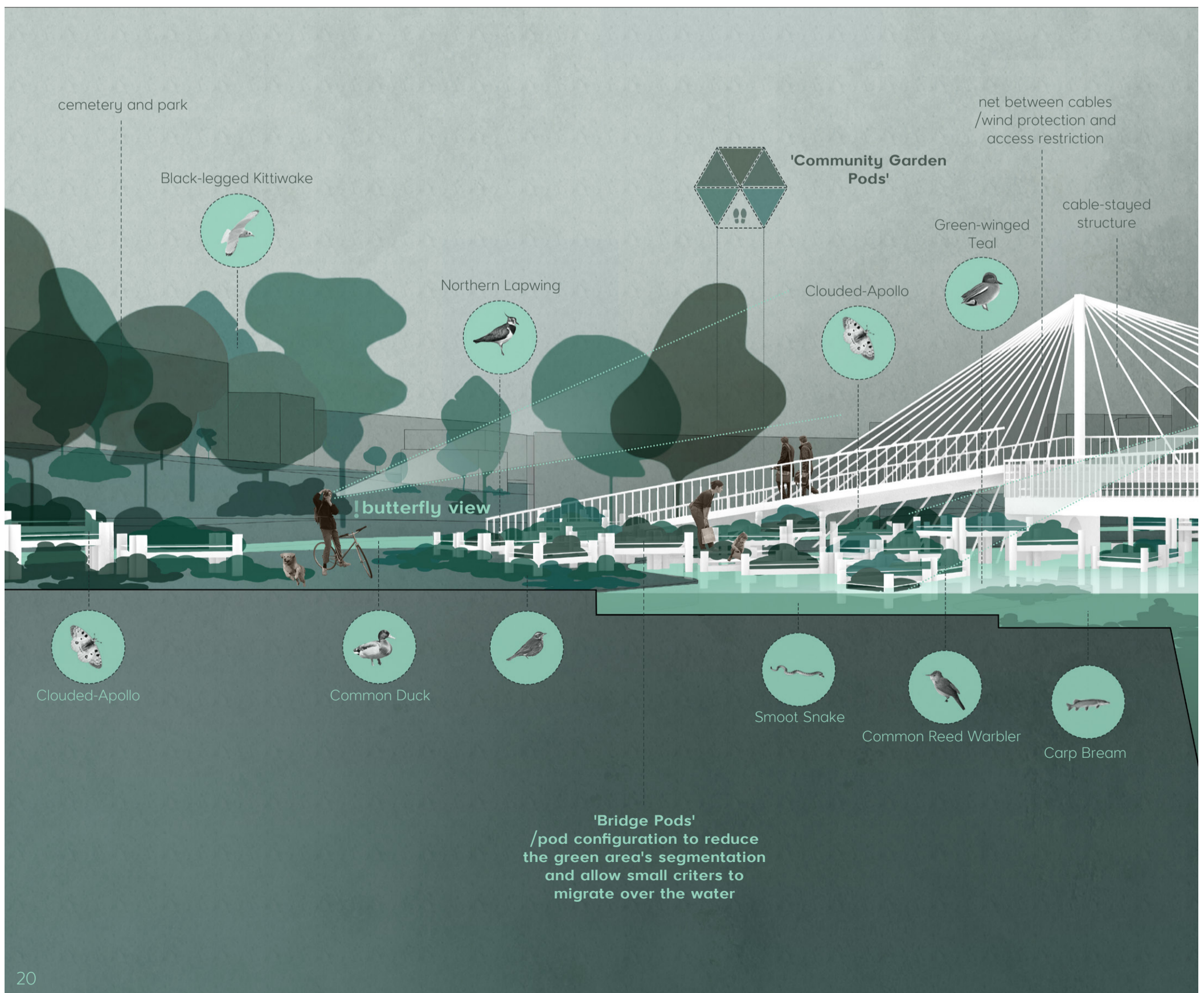
## THE STORIES OF THE THREE RIVER BRIDGE

A young woman walks along the river, with birds flying around her feet. The woman stops and watches in awe as a river snake silently glides in the water from the marshy land. Its body submerges, and it goes hunting. The woman shudders a bit but continues on her way. As she reaches the intersection of the river, she admires the delicate play of green sculptures that resemble a tiny forest but is puzzled as the giant structure of the stadium emerges from behind the towers. She has a strange feeling, as if witnessing a utopia where the forest has reclaimed humanity's intrusive creations. Yet, the usual utopian loneliness doesn't come, as the park buzzes with children projecting a different future. She quickens her pace, tired from office work, escaping the buzzing conversations of colleagues, and seeking the open sky. She wants to sit, take a moment to rest before the big shopping spree on the other side of the river, for which she is not in the mood. She wants to disconnect, quiet her buzzing thoughts for a while.

Suddenly, a child runs across the broad-walk. The little girl is chasing a butterfly, completely absorbed in the crazy fluttering of the tiny creature. Her father, a few meters away, sunbathes his face and is about to tell the girl to

leave the animal alone, but the girl's attention is already elsewhere. A croaking frog catches her gaze. Miraculously, instead of hunting down the source of the sound, she just sits on a pod and stares at the green amphibian, oblivious to the armies of small creatures living beneath her seat. However, the dog, arriving on a leash from the large park, with its jogging-clad owner, is much more interested in the invisible wildlife. Wagging its tail, it roams around, exploring the signs of the intricate dance of the tiny living world.

The square is suddenly filled with loud speech and laughter as employees freed from their workplaces pour out of the office buildings, heading towards the bus stop. But a coffee is still needed to wrap up the day, so they enter the small corner café. The weather is nice, so with their drinks in hand, they head towards the river. If it were summer, maybe they would dip their feet into the water, but the autumn cold is already here, so they look for a secluded sunbathing spot where they can chat comfortably. In the park, they feel completely different; the fresh air and the softly murmuring stream calm their tired nerves. One of them pays no attention to the conversation, staring instead at the sudden appearance of a small army of butterflies, until their colleague nudges him to pay attention because the story is about to have a twist.



In the middle of the river, a grandfather and his granddaughter sit, quietly observing the fish. The grandfather is pleased because the little child is finally quiet after constant restlessness throughout the day. He loves his granddaughter, but sometimes he doesn't have enough energy to entertain her. But now it's not necessary, as the mesmerizing swarm of fish captivates the child's attention. Meanwhile, the caretaker of the area arrives and lifts the cleaning device from the water, temporarily scaring away the school of fish. Reluctantly, the grandfather heads home with the little child, but of course, they have to stop for a few minutes of play.

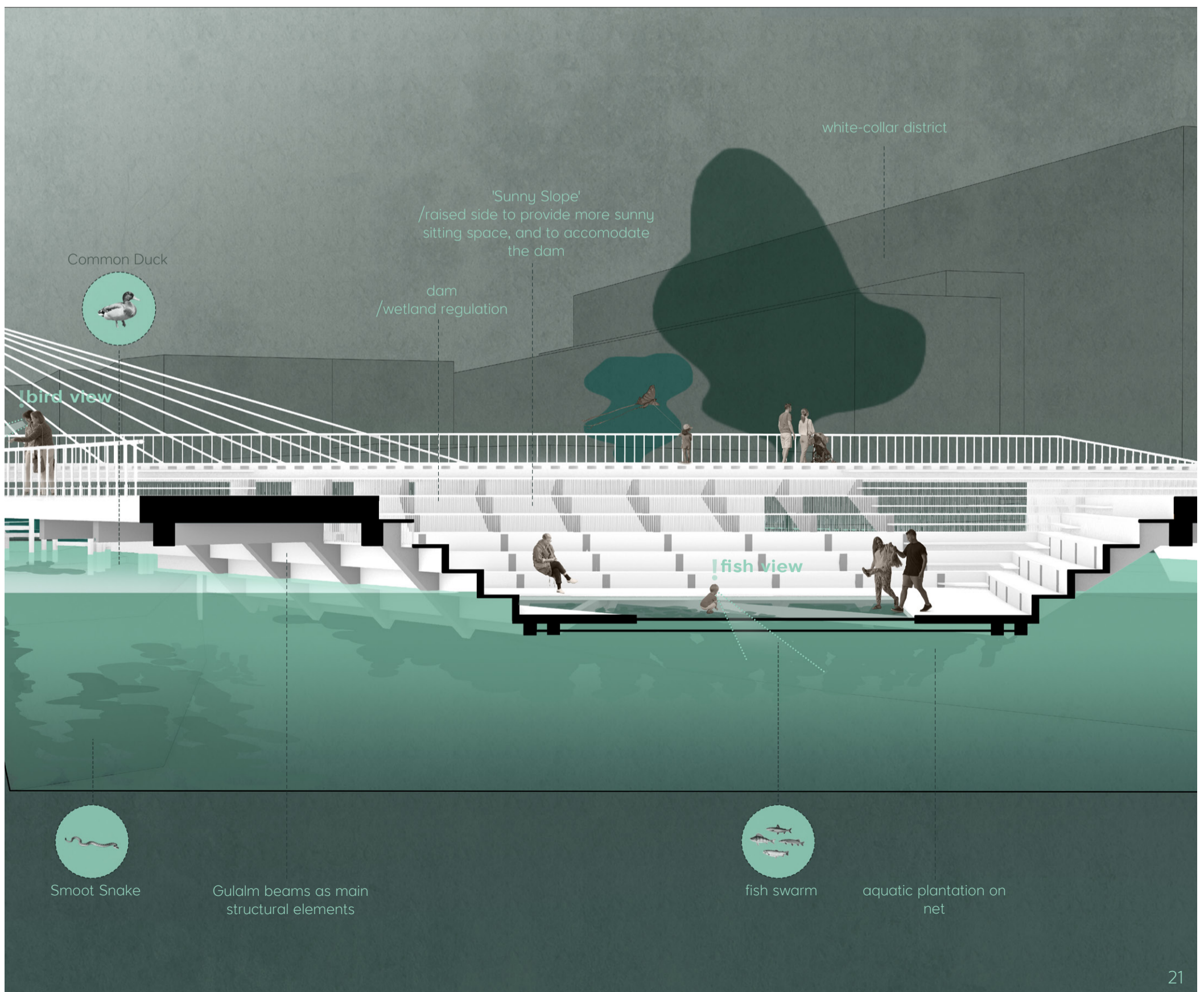
On the horizon, a slowly walking couple appears. This is only their second date; they just came from the café but are not ready to say goodbye yet. They take a big, slow circle around the river. When they reach the sculpture forest, they finally kiss each other while a couple of butterflies flutter away from them. An elderly man, a witness to the scene, skeptically remarks, "Disney is everywhere, huh!" Romance is not his genre; he turns away and continues reading his favorite thriller while grumbling to himself that his friend is late again. They won't be playing chess this time.

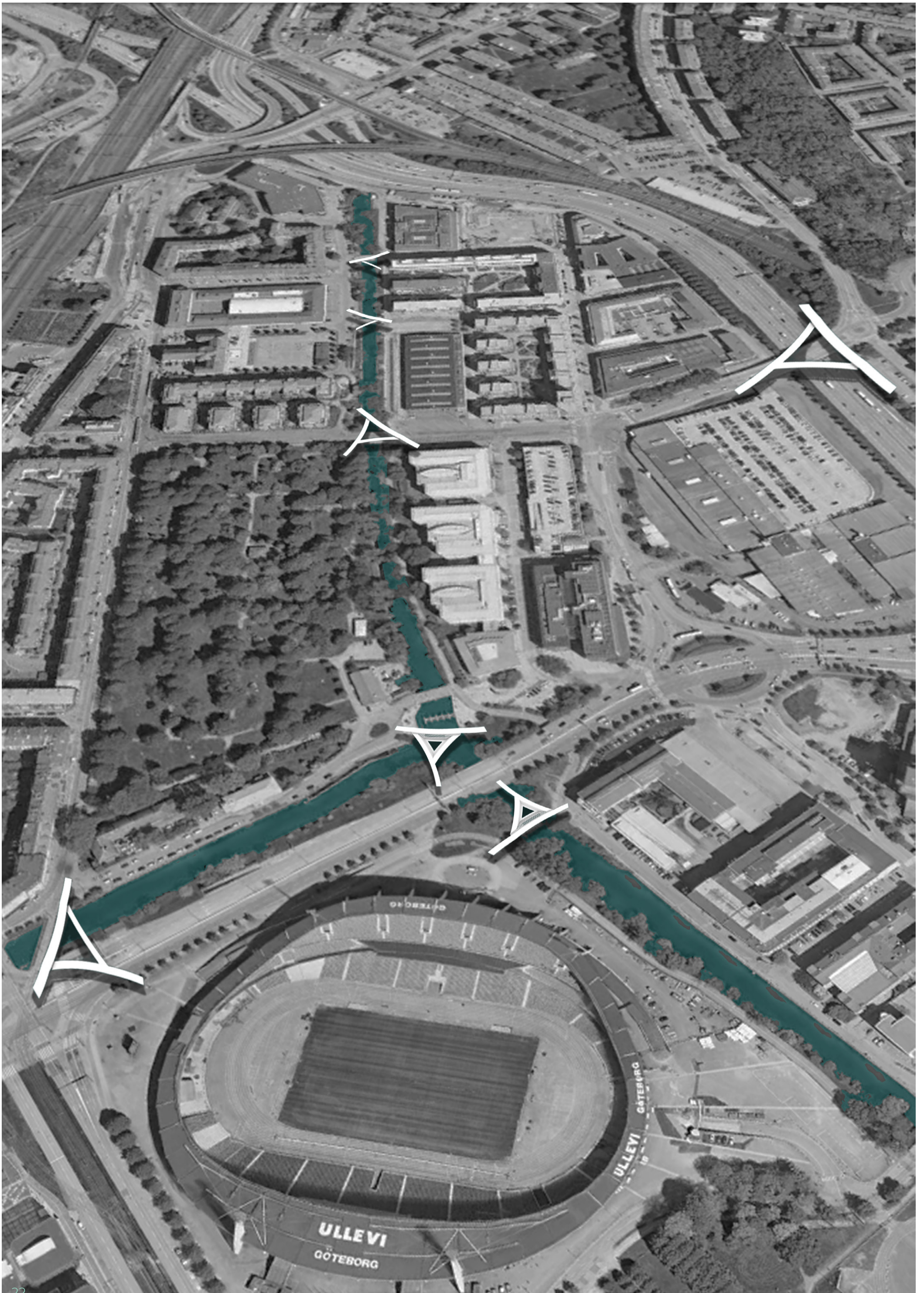
In the depths of the river, a newly arrived cluster of fish searches for food. Their small bodies excitedly explore

the world of aquatic plants floating close to the light. Distracting their hiding place, suddenly the water trembles, and they flee downward in fright. But the noise quickly subsides, and the lush vegetation lures them back to the surface. A little farther away, another school of fish watches the dangling legs of a small bird. Is it coming for them? But the bird was only enticed by the thick bushes in the hidden corners. However, it cannot stay there for long before the local ducks reclaim their territory.

The girl who was observing the frogs now steps into the muddy water with her boots and squeals, "Eww, it's slimy!" - "That's how the beach will be when we go on vacation," says the dad, who, with closed eyes, is still sunbathing. The sudden cold makes his nose run, but maybe the sun will help after a while.

The last employee from the office building peeks out of the window before grabbing her coat. She is glad she no longer has to watch cars during work. She feels at home with the forested aquatic landscape. Memories of her childhood vacation home by the lake briefly come to mind before her phone starts ringing. She must go to the store; they ran out of milk at home. But perhaps she'll take a few minutes to stop by the park first.





## SWOT ANALYSIS

### STRENGTH

- \* creates a clear connection between the three city districts
- \* enables smaller animals to migrate over the river
- \* the lowered inner sitting area creates an exciting experience, which attracts tourists
- \* uses only sustainable, locally sourced materials
- \* the homogeneous material choice makes it easier to recycle or reuse
- \* the flexibility and simple design of the pods creates a system that can be easily expanded if the need arises
- \* the pods can host multiple functions
- \* the flexibility and easy scalability of the pod system allows it to be deployed anywhere

### OPPORTUNITIES

- \* the pod system could be integrated into any urban area, where traditional greening solutions are not applicable for e.g.: on contaminated land etc.
- \* later on, with the help of this system, existing infrastructures could be turned into designs, where not only the needs of the humans are taken into consideration, but all the creatures' of the natural world
- \* hopefully, the design will help increase the society's perceived aesthetic value of a marshland, and will make people appreciate the beauty of chaos in its natural form

### WEAKNESS

- \* until the water level rises significantly, the structure will be an intrusive phenomena in the area
- \* the material choices might not work when the structures are in constant contact to water
- \* the cold weather might cause the sitting area to be under-utilized
- \* the design of the bridges makes it hard to apply elsewhere as it was designed solely to a specific urban context
- \* the scope of the intervention might not be necessary
- \* the diversion of the nearby roads makes the project extremely expensive
- \* the development of the surrounding public parks are necessary for the design to properly function as an attractive public space

### THREATS

- \* the closed-off inner part of the bridge could pose as a security risk in the night
- \* the diversion of the nearby roads makes the project extremely expensive which could cause a public opposition
- \* the ever changing water level endangers the structural integrity of the bridge and pods
- \* the contaminated land of the cemetery and the high flood risk poses a threat on the river and the park
- \* the air pollution from the nearby highway could turn the area temporarily unsuitable for human presence







