Hybrid Morphologies:

An Interdisciplinary Model for Waterfront Architecture - The Case of Zwijndrecht

Sonja Draskovic | 5085284

As designers we feel
like we have made an
enemy of water. We
separated from land,
we confined the flows
between riverbanks, to
canal between edges,
to pipes into sleeves,
we incarcerated the
seas with coastlines,
and leaks with edges
and reservoirs behind
dams. We keep it out
by designing increas-
ingly impervious skin
of buildings. So even
when we design nature
based architecture we
impose limits on it. We
keep water to a place.
But water erases
boundaries and floods, it
consumes
coastlines with sea
level rise and in its
confinement it smells sickens and kills
with pollution. Water
it seems to want
to be free. Or perhaps water wants
to be appreciated in its
own terms as wetness.

- Anuradha Mathur 2019

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An Interdisciplinary Model for Waterfront Architecture - The Case of Zwijndrecht

by

Sonja Draskovic

Graduation Thesis
Presented to

TU Delft

.

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City of the Future - AR3CS100

5th July 2021

V*isual Essays*

Research Plan

Position Paper

Reflection

The CODE

Atlas of Water

The TERRITORY

Territory programmed by CODE

Atlas of Sections

Soil Extraction

The BODY

Landscapes, Infrastructure, Architecture

Tectonics of The BODY

Visual Essays

Research Plan

Position Paper

Reflection

Terrain of rising water
future of living with water

by

Sonja Draskovic

Research Plan
presented to

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

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

Figure 2 - Flood Risk vulnerability area

Problem Field & Context

Relevance
Problem Fields:
- Rising sea level
- River Discharge

Problem Statement
Research Question &
Sub-research questions

Relevance

In this thesis, I will address the pressing issue of climate change and how it affects the way we build our cities to improve our livability, health, and our environment. Cities are responsible to incorporate movements of climate actions, global prosperity, peace, and human rights.

Rising Sea level

Sea level along the Dutch coast and globally have risen steadily over the past 129 years by approximately 24 cm (an increase of 1.9 mm per year) (Clo 2020). The rise in sea level is accelerating, and consequently causing an increase in river discharge in the Netherlands. In my thesis I will focus on the area which is encompassed by the river Oude Maas, Beneden Merwede, Noord, and Wantij; branches of the river Rhine (Appendix A). The increase in river discharge will increase the chances of flooding in urbanized delta areas (Figure 2) (Hinborch 2010, 18).

Problem Statement

Water has played a great role in shaping our cities to this day. It is perceived as a resource, serving the population by enabling the production of food, land, transport, and settlements. Countries that are built on water, such as the Netherlands, adopted strong water and risk management, urban planning, and building techniques. The formulation of land through dikes, canals and plodders became the framework on which the society was built, and this heavily influenced the perception of water and how people live with it.

We are facing an unpredictable, and an uncertain future due to climate change, and the acceleration in sea level rises has caused more extreme weather conditions resulting in, what we perceive as, flooding. Coastlines, docks, ports, deltas are becoming consumed in the escaping water and wetness, leaving behind sorrow and grief for lost property and life. In recent research there has been a strong focus on adaptive policy[1], risk and water management, and building with water has solemnly focused on large scale projects in the field of landscape and urban design. There is a lack of research and architectural projects that deal with the way we build for uncertainty. In this thesis I position myself as an architect to design with water, by rethinking the perception of water and how that affects the connection between new adaptive planning measures, and architecture.

1 "adaptive management is an iterative learning approach that helps decision-makers establish procedures and strategies that work efficiently. Uncertainty can be viewed as an opportunity to learn rather than a recipe for failure." (Kohler 2018)

Hypothesis

In my thesis, I focus on improving our cities and their relationship with water as a means to address climate change on a local scale. In the Netherlands there is a strong focus on climate-proofing and water-robustness of delta areas to upkeep the quality of life on long-term planning. However is this a sustainable way of dealing with water and flooding?

My hypothesis is that the gap between spatial design and policy can be minimized by altering our relationship with water. To do so I hypothesize that the relationship between architecture, landscape and infrastructure , in out of dike territories, will become more hybridized, furthermore the border between land and water, technology and ecology should become blurred.

Figure 3 - North Sea Flood 1953

Research Question

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

Sub Questions

How can the notion of uncertainty be introduced in the design of our built environment in order to mitigate rising water levels?

What is the role of architecture, landscape, and engineering in flood prone areas?

Can architectural and spatial interventions impact water management and delta programs?

What architectural and landscape strategies can help create an adaptive, resilient and robust response to flooding?

How can new construction in cities shift our perception and relationship to water, whilst also brining awareness?

In which areas is an architectural and spatial intervention needed to mitigate the acceleration in the rising water levels?

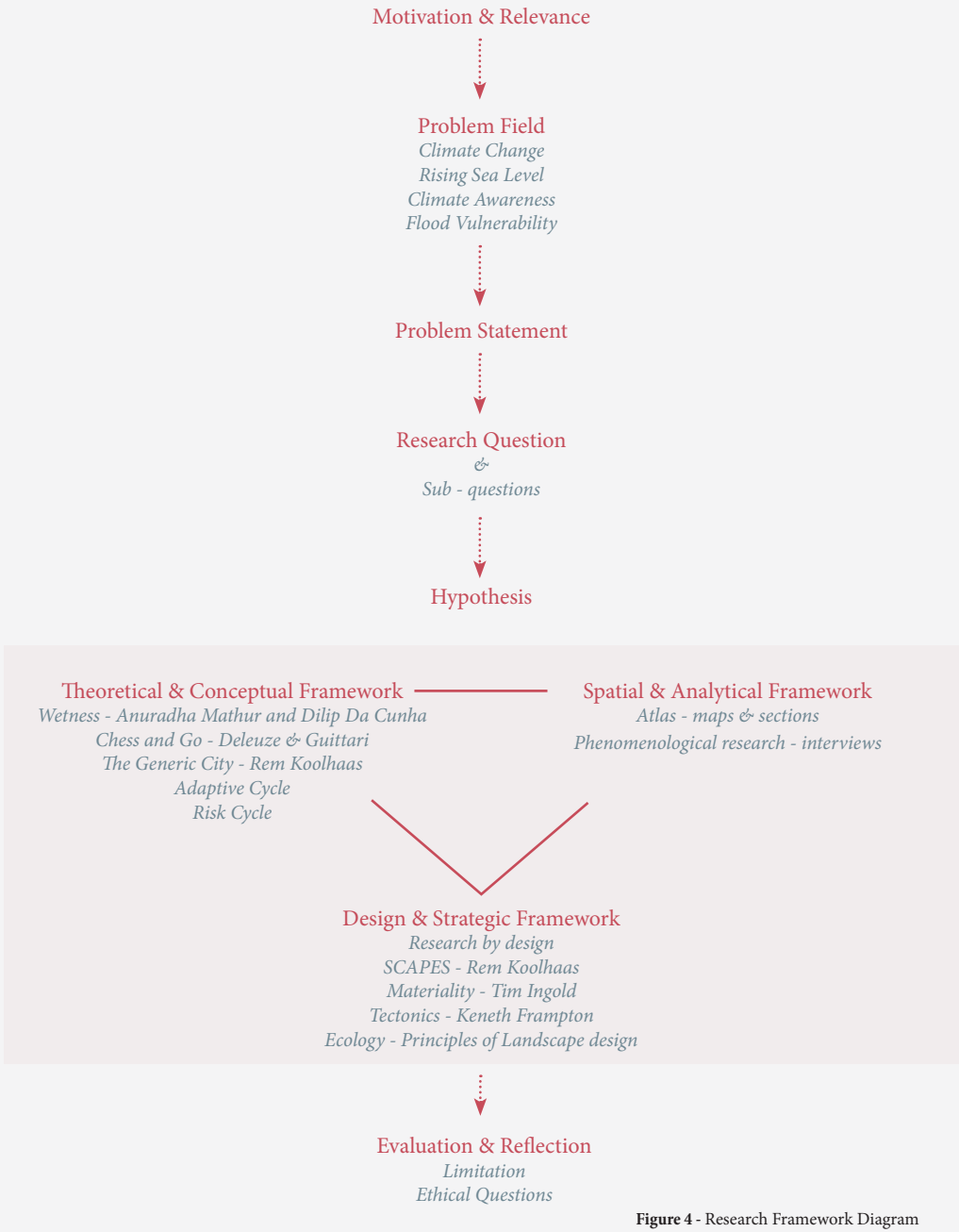


Figure 4 - Research Framework Diagram

Methodology

Introduction
Methodology
Research Frameworks:
- Theoretical & Conceptual Framework
- Analytical & Spatial Framework
- Strategic & Design Framework

Introduction

The research frameworks are the guiding tool in this thesis. They are a means with which I answer the research question and sub-questions. The RF is followed with suggested methods with which I will carry out the research, the tools I will use to create products and predict outcomes.

The research is divided into three sets of frameworks:

- Theoretical & Conceptual [2]
- Analytical & Spatial
- Strategic & Design

This thesis uses research by design as a means to establish a relationship between a spatial solution and the identified problems. In my thesis I am driven to understand how human experience of water reflects the way we design. To do so, I have formed a strong theoretical & conceptual framework using a combination of theories. The experience and perception of water, is discussed through the theory of Anuradha Mathur and Dilip Da Cunha, and formed into a conceptual framework of, what they refer to as *Wetness*. Through this theory I develop a research technique, which explores the relationship of water through sectional drawings. This research combines qualitative and quantitative design methods, through the means of photography, sectional drawings, interviews with locals, and journal writing. Furthermore, through the theory of *Chess and Go*, by Deleuze & Guittari, I discuss the concepts of Territory, Body, and Code. The notion of code refers to existing policies, water management, risk management and spatial regulation in the Netherlands This is explored in my historical research that is part of my Spatial and Analytical framework. The outcome of this research is made into a form of Atlas, where maps are collected and analyzed (Appendix A).

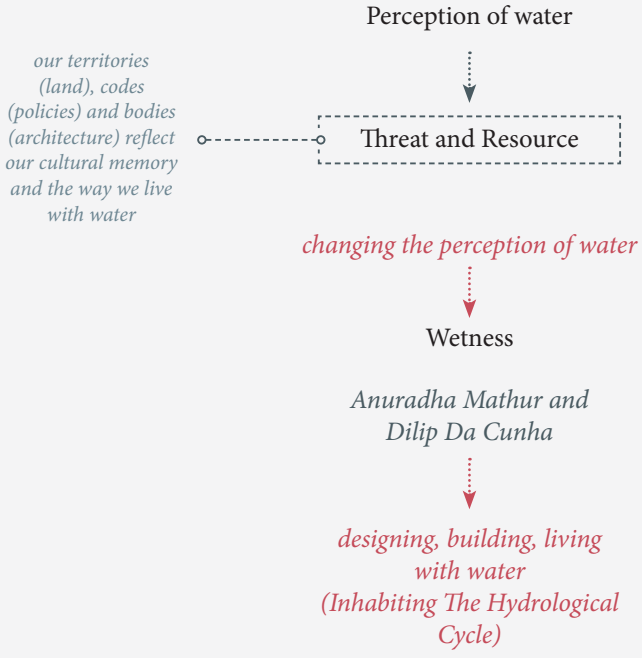
The notion of body, is perceived through the three components of design: infrastructure, architecture, and landscape and uses the theory of SCAPES, by Ram Koolhaas. The borders between these design elements diminishes, hybridizes and forms into a site specific spatial strategy, whose relationship to water is characterized to be adaptive, resilient or robust.

Furthermore, my design and spatial framework will focus on inhabiting the Hydrological Cycle through principles of landscape ecology (Richard T. T Forman). The design strategy will reveal the tectonics (Kenneth Frampton) and materiality of the design intervention (Tim Ingold).

2 theoretical and conceptual framework, in my thesis, are discussed in relation to one another as they are inseparable due to the nature of the theories

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)?

1. Relationship with water - Perception of water



for terms refer to Glossary

2. Relationship with water - Design, build and live with water

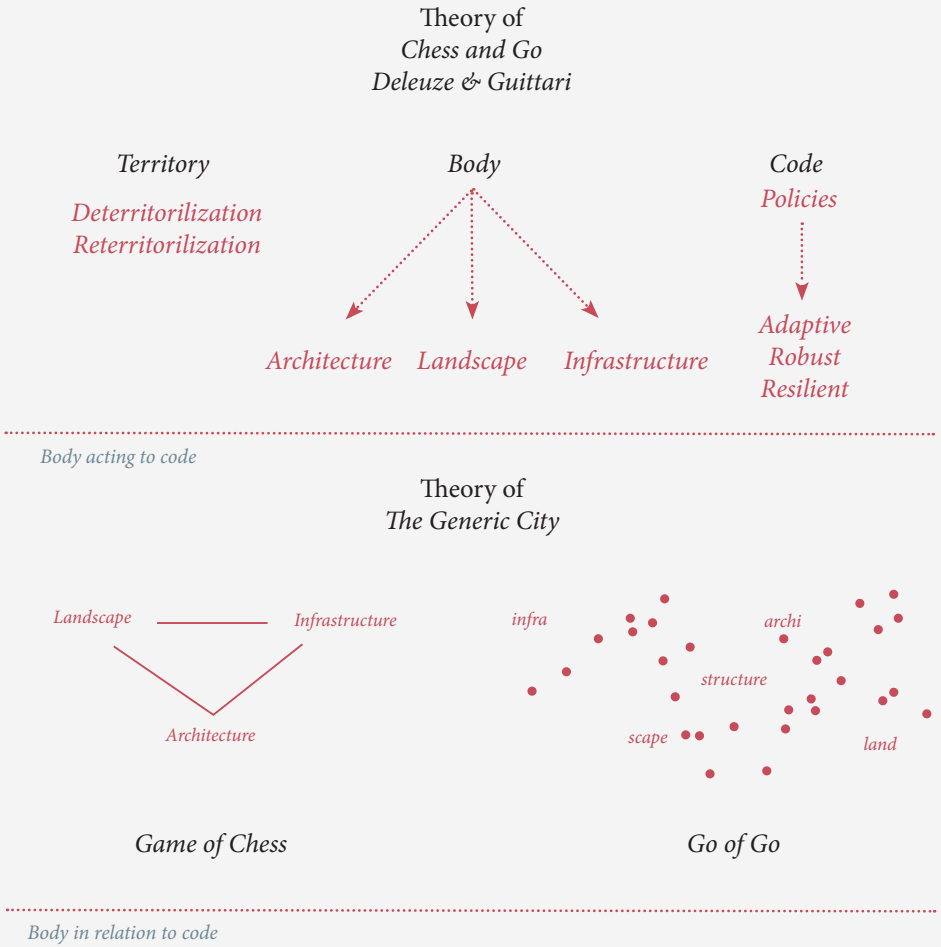


Figure 5 - Theoretical and Conceptual Framework

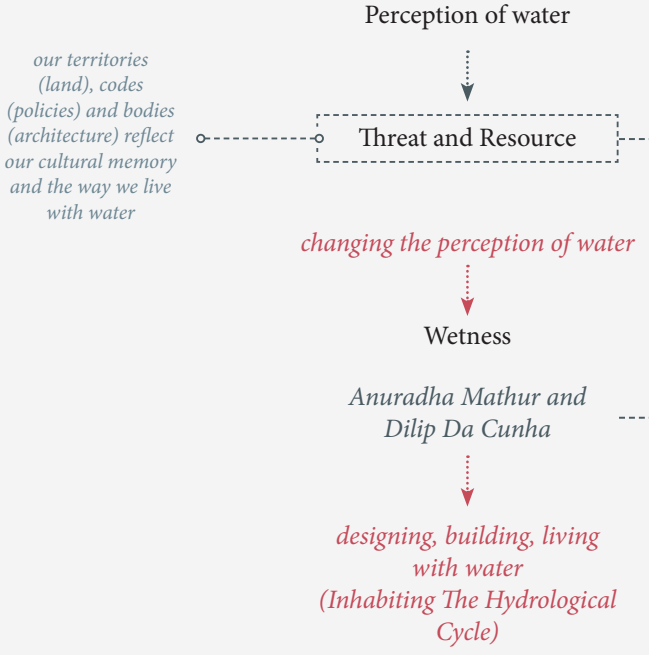
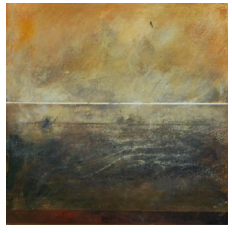


Figure 6 - Conceptual Framework

Water is somewhere, where wetness is everywhere. Its in the soil, in the air, on our hands. The sea is very wet and the desert less so. In reality there is no such thing as dryness. Wetness is everywhere because of it gradience. Water drains off land, it gathers in rivers, lakes, puddles [ect]. Wetness on the other hand does not drip off the land, it soaks, seeps, transpires [ect]. Water flows but wetness holds. Water is heled by the surface of the ground. It is used to power, to drain it, transport it, and provide it with a urban fronts. Wetness on the other hand is prior to this land water binary.
- (Anuradha Mathur 2019)

Flow/ Flood



Rise/Fall

Figure 7 - Flow/Flood and Rise/Fall images

Conceptual Framework

The conceptual framework is used to understand the key concepts in this thesis and provide a link between them. Through this framework I will investigate the concepts of water, wetness, flow/flood, rise/fall, lever, mound and the hydrological cycle.

Water, wetness, flow/flood, rise/fall

These concepts are discussed by Anuradha Mathur and Dilip Da Cunha[3] in their work and practice. In their conference, *What We Learn from Water,* Mathur, as quoted below, argues that designers have created an enemy from water, treating it as a threat and resource (Anuradha Mathur 2019). A river, following its natural Hydrological Cycles, can percived as water that flows outside of its parameters (perception from above) or as a rise and fall of water (perception in section).

Dilip defines flooding as "nothing more than water crossing a line" (Anuradha Mathur 2019, 11:37). This line is designed by human to create habitation within it boarders.

"As designers we feel like we have made an enemy of water. We separated from land, we confined the flows between riverbanks [...]. We keep it out by designing increasingly impervious skin of buildings.We keep water to a place. But water erases boundaries and floods, it consumes coastlines with sea level rise [...]Water it seems to want to be free. Or perhaps water wants to be appreciated in its own terms as wetness." - (Anuradha Mathur 2019)

3 Landscape Architects and professors at the Pennsylvania University

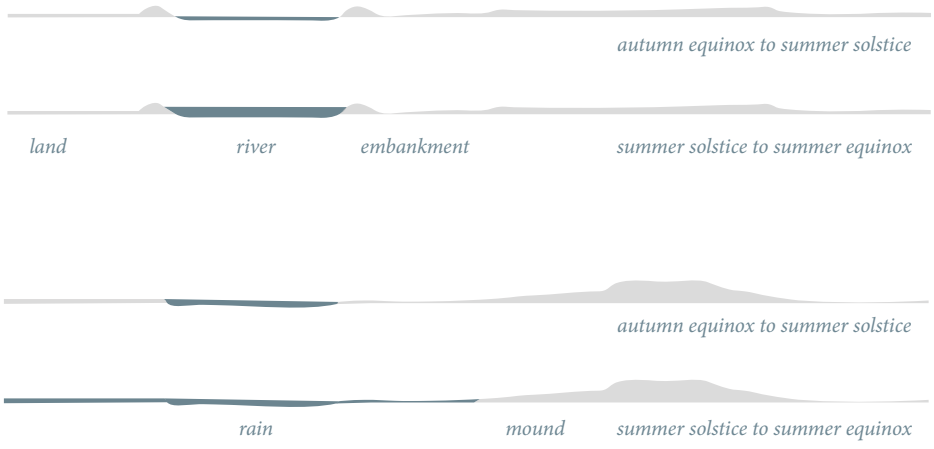


Figure 8 - Lever and Mound section (above) & images (right)

Levers

Mounds

Figure 9 - Hydrological cycle

From perception to design:

Flow/Flood → Lever

The first is the separation of water and lands with levers. Design with the constraints and to contain water within two levers.

Rise and Fall → Mounds

The second is the inhabitation of the mounds. This type of inhabitation comes from the appreciation of water, allowing water to be free.

The Hydrological Cycle

Often design only addresses one moment of the The Hydrological Cycle, the moment of flow formation as a time of "reality" (Mathur & Cunha 2019). Weather is subtracted from the measurement of design creating maps of static time, where temporarily is lost. In order to develop a new paradigm in design the point between clouds and aquifers must be inhabited (Mathur & Cunha 2019). Perceiving the water in section, which leads to a method of site surveying in section

Theory of
Chess and Go
Deleuze & Guittari

Territory *Body* *Code*

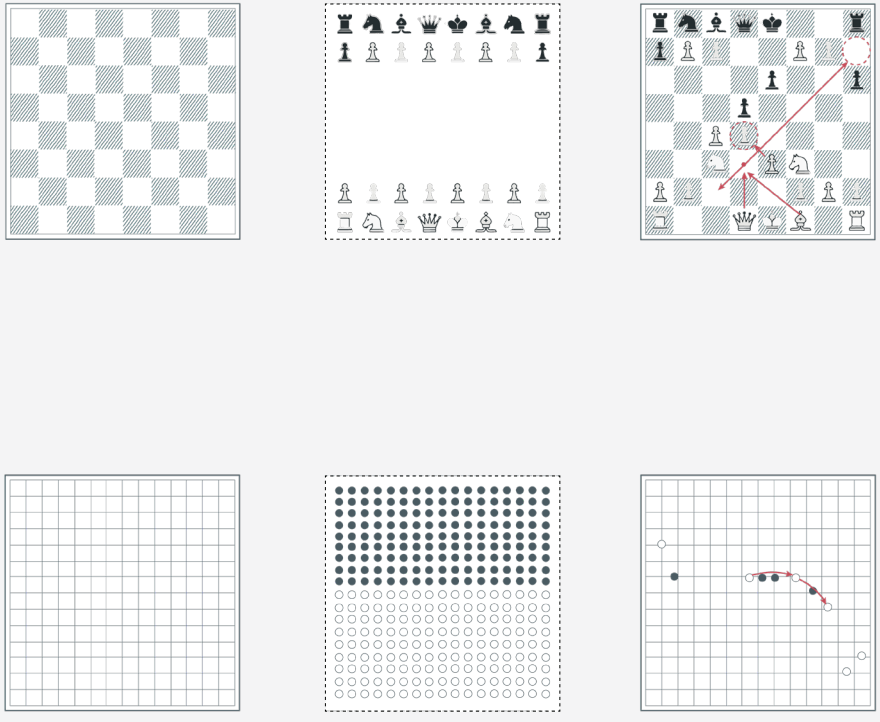


Figure 10 - Game of Chess and Go - components

Theoretical Framework

The theoretical framework uses a set of existing theories to give direction and a critical method to the research. As part of my research I am using the theory of *Chess and Go*, by Deleuze & Guattari as a basis of my understanding of territory, body, and code (Deleuze and Guattari 1972, 196).

Territory	→	*Deterritorialization Reterritorialization*
Body	→	*The Generic City by Rem Koolhaas*
Code	→	*Adaptive and Risk Cycle*

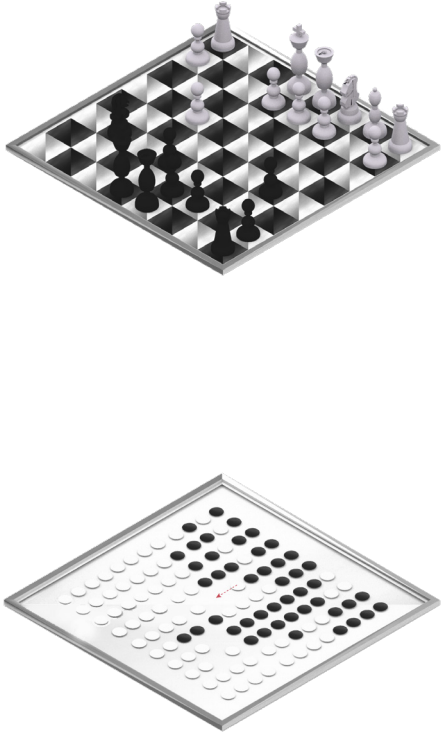


Figure 11 - Game of Chess and Go

Theory of Chess and Go

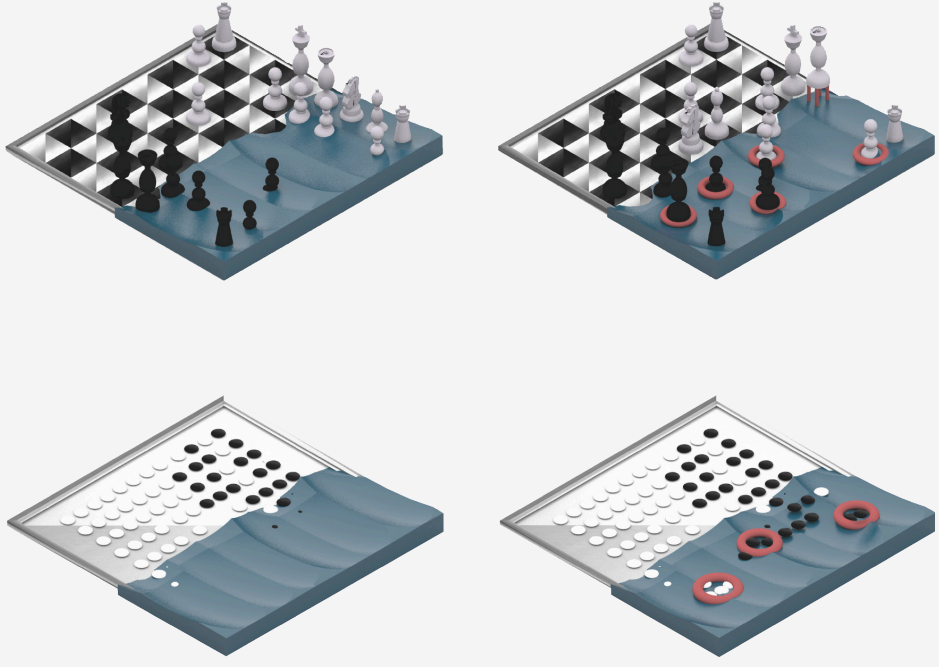
Three concepts; territory, body, and code. I broke apart these three components (figure 10) and use them as concepts to understand the difference between the elements in my thesis. The code is a representation of policies (rules for robust, resilient or adaptive construction [ect]), the body refers to the three elements of design (*The Generic City* by Rem Koolhaas) infrastructure, architecture and landscape, and territory is discussed through the concepts of reterritorialization and deterrrionzation.

Deterritorilization Reterritorilization

Territory controls the body - according to a set of limitations - codes

code - norms
overcodes - laws (Deleuze and Guattari 1972, 196)

When a territory is regulated it is territorialized. When the territory is no longer governed by these norms and laws, the territory becomes deterritorialized. Finally, when new codes are formed the territory becomes reterritorialized. The event of deterritorialization is manifested by a foreighn body moving into the territory and once it is accepted the space is reconfigured and new codes are formed (figure 15). In the moment of deterritorialized, all codes parish, and the terrain enters a chaotic state, mixture of movements, temporarily, untraceable patterning, resulting in the 'decoded' of entering bodies (Deleuze and Guattari 1972, 196).



deterritorialized *reterritorialized*

Figure 12 - deterritorialized and reterritorialized

The risk and adaptive cycle

A code in my thesis can become a way a body is regulated to respond to the threat of water, a system as defined by Stefan Nijhuis can be:

1. Complex adaptive system - a system is able to adapt to a changing context (Meyer and Nijhuis n.d., 8)

2. Robust system - a system is able to protect itself against sudden extreme events (Meyer and Nijhuis n.d., 8).

3. Resilient system - a system is temporarily disordered by a sudden extreme event (Meyer and Nijhuis n.d., 8).

Addressing this concept I am looking into the theories of the risk and adaptive cycle (figure 13). The risk cycle identifies how management of people, property and safety all together is controlled in the context of a disaster (KIT 2020):

1.Mitigation – prevention of disaster
2.Preparedness – prepare for a disaster occurs
3.Response – immediate reaction
4.Recovery – restore critical infrastructure
(KIT 2020)

The adaptive cycle is derived from the comparative study of the dynamics of ecosystems (Lister 2016, 310). It focuses attention upon processes of destruction and reorganization (Lister 2016, 310):

1. Growth or exploitation (r)
2. Conservation (K)
3. Collapse or release (omega)
4. Reorganization (alpha)
(Lister 2016, 310)

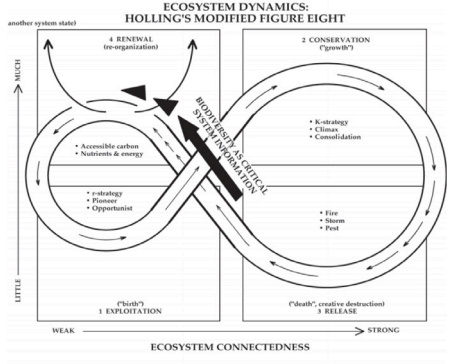


Figure 13 - Ecosystem Dynamics and the Adaptive Cycle: Holling's Modified Figure 8. Ecologist C. S. Holling's

Theory of
Chess and Go
Deleuze & Guittari

Territory *Body* *Code*

Architecture *Landscape* *Infrastructure*

Body acting to code

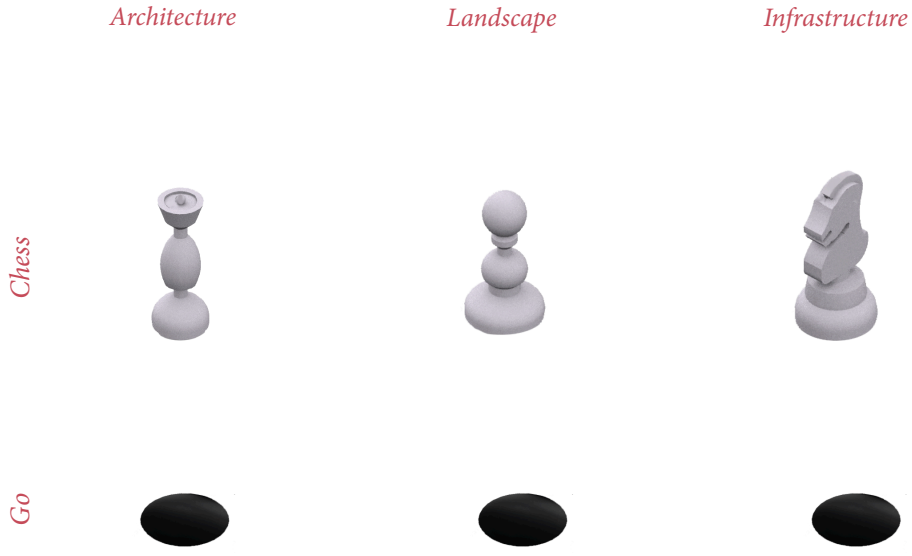
Theory of
The Generic City

Game of Chess *Go of Go*

Body in relation to code

Architecture	*Landscape*	*Infrastructure*
Robust *Resilient* *Adaptive*	*Adaptive* *(Theory of* *Adaptive* *&Hydrological* *cycle)*	*Robust* *(Theory of Risk* *cycle)*

Figure 14 - Theoretical Framework
(Game of Chess and Go - Body)



Theory of The Generic City

In the paper Hybrid Morphologies, Marc Angelil and Anna Klingmann discuss the hybridization of architecture, landscape and infrastructure based on the theory of Rem Koolhaas (Angelil and Klingmann 1999, 18). In this theory Koolhaas introduces the concept Scape, which implies a reading of the urban territory as landscape (Angelil and Klingmann 1999, 18). I will use this term as it implies a disfigurement and a blurring between the different elementals of a city, between water and land and a blurring between technology and ecology.

Using this theory I will identify three component of my design, where they will follow the code of Landscape Ecology (Furman 1986, 20). Where architecture, infrastructure and landscape follow the inhabit the hydrological cycle and use the adaptive cycle.

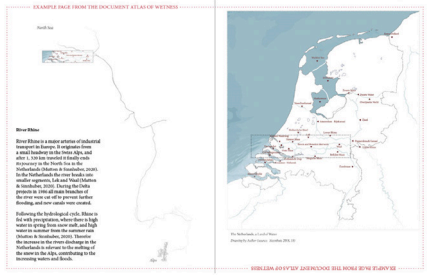


Figure 15 - Appendix A - Atlas of Wetness

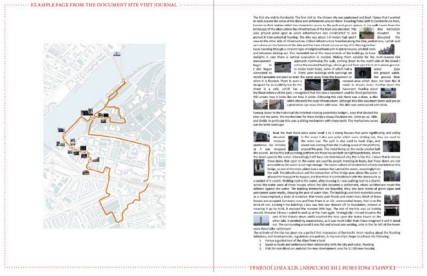


Figure 16 - Appendix B - Site Visit Journal

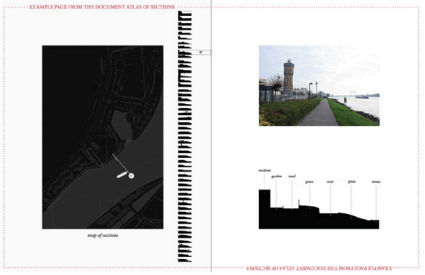


Figure 17- Appendix C - Atlas of Sections

Spatial & Analytical Framework

Spatial & Analytical framework formulates the quantitative and qualitative analysis which help answer the research and sub-questions.

Methods

1. Historical Maps - Atlas of Wetness - Appendix A

2. Site Research - Journal - Appendix B

3. Site Surveying - Sectional drawings - Appendix C

1. Historical Maps - method of determinative evidence (Groat & Wang D 2002, 195). A cartographic approach to create a Non-Site analysis based on data and research of flooding in the Netherlands. This is considered a non - interactive method, gathering research from news papers, expert reports, research articles, governmental website [ect].

Aim: better understanding of existing spatial projects dealing with flooding, salinization, subsidance[ect] and identifying critical zones based on research of urbanization, program, flood protection and fonds. The final outcome: collection of Maps in a form of an Atlas intended to bring awareness of the following topics:

Flood Risk vulnerability areas
Depth of fresh-salt interface
Degree of urbanization of Dutch municipalities
Distribution areas for water companies
Netherlands 2300
Flood prone areas
Flood protection program 2
Stone revetments Zeeland
Room for the River
Maaswerken (Meuse Works)
Delta Plan Major Rivers
Flood Protection Programme 2014-2030
Flood Protection in 2020 and 2050
The Netherlands, a Land of Water
Water Authorities

2. Site Research - using phenomenology as a qualitative research method (Groat & Wang D 2002, 195).

Aim: Closely engage with the experience of water through interview, descriptive journal entries, photography, observatory and reflectional method of research. The notion of "sense of place" (Groat & Wang D 2002, 195) with shape the way I approach vulnerability of these areas.

Limitation: Subtracting ones prejudgment to the research subject (as described by Heidegger). How do we understand a very subjective human experience and develop an objective approach to it?

Site visit plan: five site visits to the area of Dordrecht, Zwijndrecht, Papendrecht:

1st site visit – spontaneous wondering
2nd site visit – using a local online guide, a walk on the dikes
3rd site visit – guided tour by a local and interviews
4st site visit – area specific site visit and survaying
5st site visit – vr site interaction

3. Site Surveying - after site research, and choosing a specific site conduct a site survey which is an interactive method. Derived from my theoretical and conceptual framework survey site in drawing section: identify different site program, degree of wetness, and spatial developments.

Aim: Understanding how landscapes reflect flooding, , through architecture, infrastructure and nature. Recoding site conditions, program near water, damage, appearance, accessibility and land strategies. The outcome of this survey is an Atlas of Sections, drawn through photographs from walks. Use these sections to construct a topographical paper model which will analyzed the landscape strategy of the area investigating. Method of approaching the site surveying:

1.On-site familiarity: On site visit with means of recording. Measurements, drawings, recordings [ect]
2.Material evidence
3.Reenactment/testimonial: the memory imprinted on the material evidence in the means and ways it has been done but also proof of damage and it degree

(Groat & Wang D 2002, 195)

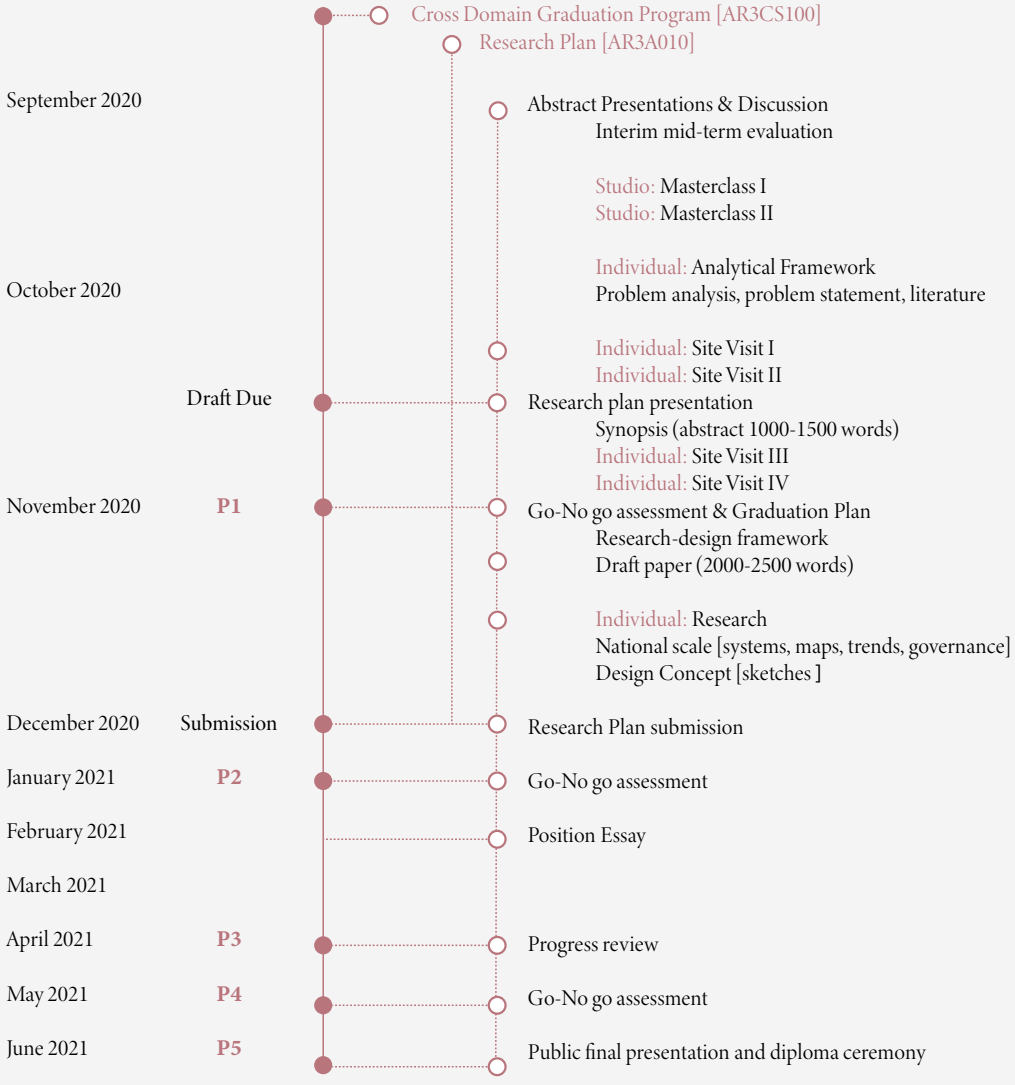


Figure 18 - Graduation Plan Diagram

Framwork TC Theoretical and Conceptual SA Spatial and Analytical SD Strategic and Design

Scale C City NA National N Neighborhood B Building

Sub-questions	Framework	Scale	Method
How can the notion of uncertainty be introduced in the design of our built environment in order to mitigate rising water levels?	SA SD	C NA	Literature review, Research by design
What is the role of architecture, landscape, and engineering flood prone areas?	SA SD	N B	Literature review, Research by design
Can architectural and spatial interventions impact water management and delta programs?	SA SD	N NA	Literature review Mapping, Data analysis
What architectural and landscape strategies can help create an adaptive, resilient and robust response to flooding?	SA SD	N B	Literature review, Research by design
How can new construction in cities shift our perception and relationship to water, whilst also brining awareness?	TC SD	N B	Interview, Literature review
In which areas is an architectural and spatial intervention needed to mitigate the acceleration in the rising water levels?	SA SD	N B	Mapping, Data analysis
How can our perception of water alter the way we design, build and live with water in areas pone to flooding, and water damage?	TC SD	N B	Case studies, Literature Review

Tools	Outcome	Aim of the research
Ecological theories, design reports Adaptive cycle theory, reports	Diagrams Maps, diagrams, catalogue	Understanding what an adaptive cycle is and if it can be scaled to a building and urban intervention To understand how resilience can be induced through design, create knowledge for the users
Design reports, Engineering reports, 3d modeling	Design outcome urban & architecture & catalogue	Identifying exact strategies on the scale of the urban and architectural interventions
reports, design reports Governmental websites, reports, 3D modeling	Design outcome urban &architecture	Using architecture as a way to shape policies Understand the issues and gaps between spatial planing and it addressing climate change
Governmental websites, reports, design reports, 3d modeling Ecological theories, Adaptive cycle theory, reports	Design outcome urban & architecture	Are there strategies which can help me design that are already used in the Netherlands
Governmental websites, reports, design reports, 3d modeling	Design outcome urban & architecture	Can we integrate flooding more into our way of designing, designing with it To understand how resilience can be induced through design, create knowledge for the users
Design reports, Engineering reports, 3d modeling	Site choice, diagrams, analysis	Understand the issues and gaps between spatial planing and it addressing climate change
GIS, reports, papers, governmental websites, photographs reports, journals	Diagrams Design outcome urban & architecture	Integrate psychological vulnerabilities and see how people during flooding

Figure 19 - Table of Sub - questions, Framework, Scale, Method, Tool, Outcome and Aim

Annotated Bibliography

1. A bulleted list of relevant titles
2. Seeks to be comprehensive
3. Each entry is summarized in a few sentences or short paragraphs, usually with comments by the researcher on how the reference influences or relates to his/ her area of interest
4. Usually does not make comparisons between references, nor does it seek to synthesize themes

How can the notion of uncertainty be introduced in the design of our built environment in order to mitigate rising water levels?

What is the role of architecture, landscape, and engineering flood prone areas?

Can architectural and spatial interventions impact water management and delta programs?

What architectural and landscape strategies can help create an adaptive, resilient and robust response to flooding?

How can new construction in cities shift our perception and relationship to water, whilst also brining awareness?

In which areas is an architectural and spatial intervention needed to mitigate the acceleration in the rising water levels?

How can our perception of water alter the way we design, build and live with water in areas pone to flooding, and water damage?

Title	Summary
Atlasleefomgeving. 2020. https://www.atlasleefomgeving.nl/.	Atlasleefomgeving is a Dutch governmental website providing information in the critical infrastructure of water management. In particular useful for information about fresh water extraction, and drinking water. This information can be used to obtain detailed mapping of facilities for fresh water, as they can and already are affected by salinization, one of many consequence of water infiltrating land. The website also provides information on policies and stakeholders which can come in useful later in the research of funding the project.
ArcGIS Web Application., 2020. Retrieved 26 December 2020	Archigis - website that provides a detailed GIS of dikes in the Netherlands, their conditioning and the policies around the areas of the dikes. This source will help with mapping vulnerable ares, areas outside of the dykes and the building regulation policies in these areas.
Anuradha, M. and Cunha, D., 2009. SOAK. New Delhi: Rupa.	SOAK: Mumbai in an Estuary by Anuradha Mathur and Dilip da Cunha, landscape architects from University of Pennsylvania provides great insight into advance leadership of landscape architecture and the effects flooding has on cities. In this book the drawing method of sectional mapping and photography is introduced. The book provides 12 design initiations as to which landscape can be used to absorb monsoon rains.
Anuradha, M. and Cunha, D., 2014. Design In The Terrain Of Water. Novato: Applied Research + Design Publishing.	Design in the Terrain of Water by Anuradha Mathur and Dilip da Cunha elaborates on the visualization and perception of water through human experience and culture as well as recording, mapping and understanding how to design terrain around using water. Their work provides a range of concepts and theories related to designing with water, and means at which architects, and designers should draw and record wetness.
Angelil, Marc, and Anna Klingmann. 1999. "Hybrid Morphologies Infrastructure, Architecture, Landscape". Daidalos: Architecture, Art, Culture, no. 73.	Hybrid Morpologies written by Angelil, Marc, and Anna Klingmann discusses the concept of SCAPES through the theoretical works of Rem Koolhaas. This is one of the key readings as it discusses the relationship between architecture, infrastructure and landscape, through the abolishment of borders between these object one creates a hybridized landscape.
Belanger, Pierre. 2017. Landscape As Infrastructure. Abingdon, Oxon: Routledge.	Pierre Belenger in the book Landscape As Infrastructure provides definitions of landscape infrastructure, waste flows and energy flows, which inform the way landscapes appear and are composed of systems. In his book these concepts are discussed through examples of different cities and are reflected through diagrammatic representations of flow which comes useful in visualizing the process within cities.
Bajc, Katarina, Daniel Stimberg, and Martin Prominski. 2017. River. Space. Design. Planning Strategies, Methods And Projects For Urban Rivers. 2nd ed. Basel.	River. Space. Design. Planning Strategies, Methods And Projects For Urban Rivers is a catalogue book which provides a series of landscape, infrastructural, and architectural strategies of river cities. They are visualized through sections, and elaborate on the case studies of over 50 design solutions around the world in the way spatial design is constructed through different concepts of the edge between land and water.
Colenbrander, Bernard. 2005. Limes Atlas. Rotterdam: 010 publishers.	Limes Atlas by Bernard Colenbrander, is an atlas of the Netherlands, depicting different water management strategies around the country. Through this information and data I was able to extract geographical and political maps which have a great influence on spatial design today.

Title	Summary
Deleuze, G., Guattari, F. and Deleuze, G., 1988. A Thousand Plateaus. London: Athlone.	Deleuze and Guattari in their book A Thousand Plateaus (1980) refer to the theory of Chess and Go, concept of territory, body and code. In the theory of Deleuze and Guattari I will focus on elaborating the concepts of deterritorialized and reterritorialized. The former can refer to the disconnect between the human and natural sphere and the latter to the reconnection of the two. The perception of nature as a resource and a threat has led designers to design land out of water, freeing the land from water while constructing borders and barriers.
Deltabeslissing Ruimtelijke adaptatie - Deltaprogramma, 2020. Retrieved 26 December	Deltabeslissing Ruimtelijke adaptatie website provides information about the Delta Program in the Netherlands. General information on consequences of flooding, spatial adaptation, climate-proofing and water - resilience.
"Flood Embankments And Floodwalls | Coastal Management Webguide - RISC KIT". 2020. Coast-al-Management.Eu.	Risk-KIT is a website developed by the EU to help mitigate and bring awareness areas prone to flooding e.g. coastal management. The content of the website includes Governance, Coastal Features, Strategies and People and Stories. It provides inside into the different factors that play in during disasters, and provides a wholesome view on flooding and risk management within the EU. The section on the Risk Cycle (Response, Recovery, Prevention and Preparedness) will help me answer some sub-questions. The website also provides information in social resilience, and inducing knowledge, this is noted through different case studies.
Frampton, Kenneth, and John Cava. 2001. Studies In Tectonic Culture. Chi-cago: Graham Founda-tion for Advanced Studies in Fine Arts.	Studies In Tectonic Culture by Kenneth Frampton elaborated on the concept of tectonics. The literal meaning of this word is simply "pertaining to building". In architecture his writing refers to the tectonics as the essence of the architectural form, where the struc-ture and construction are the fundamental unit of architectural expression. This writing formulates an architectural position towards design.
Forman, Richard T. T, and Michel Godron. 1986. Landscape Ecology. New York: Wiley.	Landscape Ecology by Richard T. T Forman, is a key reading as it discusses the principles of landscape design. How to maintain and embellish existing ecosystems while designing landscapes. In the book there are diagrammatic depictions of rules within ecosystems and ecology which help designers design with nature.
Goh, Kian. 2019. "Urban Waterscapes: The Hy-dro-Politics Of Flooding In A Sinking City". International Journal Of Urban And Regional Research 43	Urban Waterscapes: The Hydro-Politics Of Flooding In A Sinking City by Kian Goh is a key reading in understanding the flooding, and how cities such as Jakarta deal with this phenomenon. The reading argues the role of political and economic decision which are made on watershed management, land development and water infrastructure. The paper elaborated on the role and of urban planning and maintenance of existing infrastructures and vulnerability of areas near the coast.
Girot, Christophe, and Dirk Sijmons. 2012. Rising Waters, Shifting Lands. Zürich: Institut für Landschaftsarchitektur ILA.	Rising Waters, Shifting Lands is a Studio Pamphlet which addressed the are of Dordrecht through landscape interventions of students. The studio is ran by the Chair Christophe Girot, who has for the past decade been developing a studio methodology for water management through landscapes and approach of designing. The book reveals insight into conversations with water management actors involved in the new program development in Dordrecht. The design approach of the studio is refer to as the "traveling salesman" where their lack of knowledge of the Dutch water management is seen as an advantage to design as they bring a different perspective to landscape design.
Nijhuis, Steffen, Meyer, and Han, n.d. Urbanized Deltas In Transition.	Urbanized deltas in transition written by two TU Delft professors, Han Mayer and Stef-fen Nijhuis is a collection of projects and analysis related to the urbanization of deltas around the world. In this book they address key factors of climate change, flooding and conditions of delta cities. In chapter 3 the Rhine-Meuse -Scheldt Delft in Rotterdam is analyzed through the scope of flood defense, urban development, environmental issues and port economy as a complex body of interdependencies.
Nijhuis, Steffen, Daniel Jauslin, and Frank van der Hoeven. n.d. Flows-capes.	Flowspace - Designing infrastructural landscape written by TU Delft professors Steffen Nijhuis addresses the design of water infrastructures. In this book they exhibit 3 water infrastructure designs done by student, design challenges of multi functional flood defenses. This chapter can provide with inside how to deal with floods through urban and landscape adaptation.
"Ruimtelijke". 2020. Ruimtelijke Adaptatie. https://ruimtelijkeadap-tatie.nl/.	Kennisportaal Ruimtelijke Adaptatie is a Dutch website that provides data on Adaptive agendas for the areas outside of the dikes in the are of Dordrecht and Rotterdam. It also contains photographic evidence of flood damage and high waters.
Lister, Nina-Marie E. 2016. "Resilience Beyond Rhetoric In Urban Landscape Planning And Design".	Document providing design and spatial solutions for making a resilient strategy for urban planing. The document also contains example of where nature and ecosystems are preserved, improving the quality of life.
Slomp, Robert. 2007. "Room for the River, project examples" in . IWASA 37. Aachen: Ministry of Transport, Public Works and water Management.	Room for the River project example written by Robert Slomp from the Ministry of Infrastructure and Water Management. Analyzing the problems of the project, safety against extreme flooding and improvements of the overall environmental conditions. The document provides a series of spatial and technical improvements that can improve the safety of people against flooding. Also provides maps of vulnerable areas around rivers in the Netherlands. An insightful document discussing the lessons learn from the project, and the impact it has. Therefor it bring an urban and landscape perspective to flood management.

Figure 20 - Table of Annotated Bibliography

Glossary of terms

Atlas

Adaptive capacity

Complex adaptive system

Code

Deterritorialization

Dynamic flood plane

Ecology

Flooding

Fluvial ecosystem

Hydrological Cycle

Reterritorialization

Risk cycle

Resilient system

Terrain

Territory

Body

Scapes

Landscape Infrastructure

Wetness

Glossary of terms

Terms derived from the theory of Deleuze and Guattari - terms are relative to one another

Atlas - a collection of maps; maps of Earth or a region of Earth. An atlas contains information of geographical features, topography of an area's landscape and political boundaries. An Atlas is a form with which some research in this thesis is constructed

Adaptive cycle (or Holling Figure 8) - generalized pattern depicting an ecosystems capability to reorganized oneself to change (Lister 2016, 310)

Complex adaptive system - a system is able to adapt to a changing context (Meyer and Nijhuis n.d., 8).

Code (decoded)- a strategy with which a power (e.g. government) operates

Deterritorialization - (applied meaning) Disconnection between natural and human sphere

Dynamic flood plane - term is used to describe a phenomenon of a dynamic natural system of periodic flooding. The term implies a sequence of event, erosion, deposition, deterritorialization of topography, soil vegetation. In this thesis the term is used to describe a landscape approach and a design strategy (term inherited from the Chair of Christophe Girot, ETH)

Ecology - the relationships between air, land, water, animals, plants, [etc]("Ecology | Bedeutung Im Cambridge Englisch Wörterbuch" 2020).

Flooding - water escaping its man made "line"

Flow and Reflow - "The aggregated landscape of wasted cycling, material movement, and resource exhange" (Belanger 2017, 212)

Fluvial ecosystem - "integrates the biota and biological interactions with all of the interacting physical and chemical processes that collectively determine how systems function." (Allan and Castillo 2007, 6)

Hydrological Cycle - "describes the continuous cycling of water from atmosphere to earth and oceans, and back to the atmosphere" (Allan, Castillo and Capps 2007, 14).

Non Site - "Abstract representation of reinterpretation of the site in the form of a text or a sculpture" (Angelil and Klingmann 1999, 18). To alter a site, non site strategies are applied.

Reterritorialization - (applied meaning) Reconnection between natural and human sphere

Risk cycle - identifies how management of people, property and safety all together is controlled in the context of a disaster (United Nations 2018)

Robust system - a system is able to protect itself against sudden extreme events (Meyer and Nijhuis n.d., 8).

Resilient system - a system is temporarily disordered by a sudden extreme event (Meyer and Nijhuis n.d., 8).

Terrain - a specific physical features of an area of land. An example of terrain: a rocky and jagged coastline; terrain of water

Territory - an area of land governed by a "code"(e.g. state) ("Territory | Bedeutung Im Cambridge Englisch Wörterbuch" 2020). In relation to the concepts of deterritorialization and reterritorialization, the territory becomes an action. It is not static, it is dynamic.

Tectonics - "pertaining to building" - the process of building is conceived as one of "revealing" the shaping forces of design; those of materiality, construction, form, and use (Frampton and Cava 2001).

The Generic City - three elements and structure: road (infrastructure), nature (landscape), building (architecture) coexisting in a flexible relationship Angelil and Klingmann 1999, 17)

Body - actors which possess a range of capabilities (movements), whose movements are configured by its territory.

Scapes (is also used as a suffix e.g. landscape) - implies a reading of the urban territory as landscape. Non distinction between waterscapes and landscapes (Angelil and Klingmann 1999, 18).

Scaft - "meaning to give form or to shape" (Angelil and Klingmann 1999, 21) - term coined by Hans Scharoun. We should try to create urban places with an unknown finished result that is adaptable to varying circumstances

Site - "Material reality of a pile-existing situation." (Angelil and Klingmann 1999, 17).

Landscape Infrastructure - landscape designed as a multi-functional, high performance system (Belanger 2017). It is also a way territory can be framed and designed.

Urbanity - "Expression of a mental landscape mirroring society changes both as material and cultural levels" (Angelil and Klingmann 1999, 22).

Wetness - "There is no such thing as dry land. Wetness is everywhere to some degree. It is in the seas, clouds, rains, dew, air, soils, minerals, plants, animals. The sea is very wet; the desert less so"(Mathur, A. and Da Cunha, D., 2019). Using the word *wetness* instead of *water,* as *wetness* is a gradient and *water* is a body.

Bibliography

Key references

Allan, J. David, and Mariá M Castillo. 2007. *Stream Ecology*. [New York]: Springer.

ArcGIS Web Application., 2020. Retrieved 26 December 2020, from https://ez.maps.arcgis.com/apps/webappviewer/index.html?id=d3e3f0cb6aad410aad08c1fb0ae38b78

Appadurai, Arjun. 1990. "Disjuncture And Difference In The Global Cultural Econo my". *Theory, Culture & Society* 7 (2-3): 295-310. doi:10.1177/026327690007002017.

Angelil, Marc, and Anna Klingmann. 1999. "Hybrid Morphologies Infrastructure, Architecture, Landscape". *Daidalos: Architecture, Art, Culture*, no. 73. https://www.scribd.com/document/347267686/Hybrid-Morphologies.

Atlasleefomgeving. 2020. https://www.atlasleefomgeving.nl/.

Belanger, Pierre. 2017. *Landscape As Infra structure*. Abingdon, Oxon: Routledge.

Bajc, Katarina, Daniel Stimberg, Antje Stokman, Hinnerk Voermanek, Susanne Zeller, and Martin Prominski. 2017. *River. Space. Design. Planning Strategies, Methods And Projects For Urban Rivers*. 2nd ed. Basel.

Ban Ki-moon. 2012. *'Our Struggle for Global Sustainability Will Be Won or Lost in Cities,' Says Secretary-General, at New York Event*. https://www.un.org/press/en/2012/sgsm14249.doc.htm.

Colenbrander, Bernard. 2005. *Limes Atlas*. Rotterdam: 010 publishers.

Corner, James. 2007. "Not Un Like Life Itself: Landscape Strategy Now". In *The New Architectural Pragmatism*. London: University of Minnesota Press.

Clo. 2020. "Sea level rise along the Dutch coast and globally, 1890-2018". https://www.clo.nl/indicatoren/nl0229-zeespiegelstand-nederland-en-mondiaal.

Deleuze, G. and Guattari, F., 1972. *Anti-Oedipus Capitalism And Schizophrenia*. Éditions de Minuit, Viking Press.

Deleuze, G., Guattari, F. and Deleuze, G., 1988. *A Thousand Plateaus*. London: Athlone.

Deltabeslissing Ruimtelijke adaptatie - Deltaprogramma, 2020. Retrieved 26 December 2020, from https://deltaprogramma2020.deltacommissaris.nl/5.html

de Louw, P. G. B., Essink, G. O., Stuyfzand, P. J., & Van der Zee, S. E. A. T. M., 2010. Upward groundwater flow in boils as the dominant mechanism of salinization in deep polders, The Netherlands. *Journal of hydrology,* 394(3-4), 494-506.

Evides, Over. 2020. "Over Evides". *Www.Evides.Nl*. https://www.evides.nl/over-evides.

"ECOLOGY | Bedeutung Im Cambridge Englisch Wörterbuch". 2020. *Dictionary.Cambridge.Org*. https://dictionary.cambridge.org/de/worterbuch/englisch/ecology.

Frampton, Kenneth, and John Cava. 2001. *Studies In Tectonic Culture*. Chicago: Graham Foundation for Advanced Studies in Fine Arts.

Forman, Richard T. T, and Michel Godron. 1986. *Landscape Ecology*. New York: Wiley.

France, Robert L. 2002. *Handbook Of Water Sensitive Planning And Design*. Hoboken: CRC Press.

"Flood Embankments And Floodwalls | Coastal Management Webguide - RISC KIT". 2020. *Coastal-Management.Eu*. https://coastal-management.eu/measure/flood-embankments-and-floodwalls.

"Geography In The News: Polder Salvation". 2020. *National Geographic Society Newsroom*. https://blog.nationalgeographic.org/2014/05/05/geography-in-the-news-polder-salvation/.

Ghassemi, F., Jakeman, A. J., & Nix, H. A., 1995. *Salinisation of land and water resources: human causes, extent, management and case studies.* CAB international.

Goh, Kian. 2019. "Urban Waterscapes: The Hydro-Politics Of Flooding In A Sinking City". *International Journal Of Urban And Regional Research* 43 (2): 250-272. doi:10.1111/1468-2427.12756.

Girot, Christophe, Jandirk Hoekstra, Frédéric Rossano, Antje Stokman, Judit Bax, Bruno De Meulder, Martin Hulsebosch, Ellena Groat, Linda & Wang, D, David. 2002. *Architectural Research Methods*. New York: Wiley.

Huisman, P., Cramer, W., Van Ee, G., Hooghart, J. C., Salz, H., & Zuidema, F. C., 1998. *Water in the Netherlands.* Netherlands Hydrological Society, Rotterdam.

Holmes, Damian. 2017. "Room For The River | Nijmegen, The Netherlands | H+N+S Landscape Architects". *World Landscape Architecture*. https://worldlandscapearchitect.com/room-for-the-river-nijmegen-the-netherlands-hns-landscape-architects/.

Hinborch, Milan. 2010. "Flood Defence Town Centre Dordrecht". Master Thesis, TU Delft.

Jeuken, Ad, Nadine Slootjes, and Karin de Bruijn. 2012. "Lessen Uit De Vergelijking Van 'Mogelijke Strategieën'"Deltares. http:publications.deltares.nl/1206053_000b.pdf.

Keller, James Melson, and Dirk Sijmons. 2012. *Rising Waters, Shifting Lands*. Zürich: Institut für Landschaftsarchitektur ILA.

Kolen, B, and R Geerts. 2016. "Als Het Toch Misgaat: Overstromingsscenario'S Voor Rampenplannen. Betooglijn. HKV Lijn In Water."

Kohler, Tim-Frederik. 2018. "Adaptive Management". *Tim-Frederik Kohler*.

"Levee Breach | Wikiwand". 2020. *Wikiwand*. https://www.wikiwand.com/en/Levee_breach.

Lister, Nina-Marie E. 2016. "Resilience Beyond Rhetoric In Urban Landscape Planning And Design". In *Nature And Cities: The Ecological Imperative In Urban Planning And Design*. Lincoln Land Institute.

Mathur, Anuradha & Cunha, Dilip da., 2009. *SOAK*. New Delhi: Rupa.

Mathur, Anuradha & Cunha, Dilip da., 2014. *Design In The Terrain Of Water*. Novato: Applied Research + Design Publishing.

Mathur, Anuradha & Cunha, Dilip da.., 2019. *Keynotes Of Anuradha Mathur And Dilip Da Cunha At WAF 2019*. [online] World Architecture. Available at: <https://worldarchitecture.org/architecture-video/efgcm/watch-exclusive-keynotes-of-anuradha-mathur-and-dilip-da-cunha-at-waf-2019> [Accessed 18 December 2020].

Mutton, Alice F.A., and Karl A. Sinnhuber. 2020. "Rhine River | Location, Length, Map, & Facts". *Encyclopedia Britannica*. https://www.britannica.com/place/Rhine-River.

"Nederland 2300 -". 2020. *Freshresearch.Nl*. https://www.freshresearch.nl/2019/11/06/nederland-2300/.

Nijhuis, Steffen, Daniel Jauslin, and Frank van der Hoeven. n.d. *Flowscapes*.

Nijhuis, Steffen, Meyer, and Han, n.d. *Urbanized Deltas In Transition*.

"North Sea Flood 1953 Photos And Premium High Res Pictures - Getty Images". 2020. *Gettyimages.Com*. https://www.gettyimages.com/photos/north-sea-flood-1953?phrase=north%20sea%20flood%201953&sort=mostpopular.

Oude Essink, G. H. P., Van Baaren, E. S., & De Louw, P. G., 2010. Effects of climate change on coastal groundwater systems: A modelling study in the Netherlands. *Water Resources Research,* 46(10).

Protevi, J. and Smith, D., 2008. *The Stanford Encyclopedia Of Philosophy*. [online] Plato-stanford-edu.tudelft.idm.oclc.org. Available at: <https://plato-stanford-edu.tudelft.idm.oclc.org/entries/deleuze/> [Accessed 15 December 2020].

"PBL Netherlands Environmental Assessment Agenc". 2010. https://www.pbl.nl/en.

PBL Netherlands Environmental Assessment Agency, Bilthoven, The Netherlands. 2012. "On The Potential Contribution Of Spatial Planning In Combination With Unbreachable Embankments In The Design Of A Robust Flood Risk System, Exemplified For The Netherlands."

Peters, George. 2020. "Room For The River, The Netherlands". *Royalhaskoningdhv.Com*. https://www.royalhaskoningdhv.com/en-gb/projects/room-for-the-river-the-netherlands/6055.

Raffestin, C., 2012. Space, Territory, and Territoriality. *Environment and Planning D: Society and Space*, 30(1), pp.121-141.

"Ruimtelijke". 2020. *Ruimtelijke Adaptatie*. https://ruimtelijkeadaptatie.nl/.

Salinization and agriculture in the Netherlands: benchmarking stakeholder perspectives. 2019. "Msc Environment And Resource Management Vrije Universiteit Amsterdam". Universiteit Amsterdam. https://www.waddenacademie.nl/fileadmin/inhoud/pdf/06-wadweten/Scripties/Beauchampet_Salinization_NL.pdf.

"Salinization Definition Und Bedeutung | Collins Wörterbuch". 2020. *Collinsdictionary.Com*. https://www.collinsdictionary.com/de/worterbuch/englisch/salinization.

"Statistics Netherlands". 2016. *Opendata.Cbs.Nl*. https://opendata.cbs.nl/statline#/CBS/nl/.

Steenhuis, Marinke. 2018. *Beyond The Dikes*. NAi Uitgevers / Publishers Stichting.

Slomp, Robert. 2007. "Room for the River, project examples" in . *IWASA 37*. Aachen: Ministry of Transport, Public Works and water Management. https://www.researchgate.net/publication/317824058_Room_for_the_River_project_examples.

United Nations. 2018. *Implementation Guide For Addressing Water-Related Disasters And Transboundary Cooperation*. New York and Geneva.

van Leeuwen, Niek. 2004. "More And More People Live In An Urban Environment". *CBS*. https://www.cbs.nl/en-gb/news/2004/05/more-and-more-people-live-in-an-urban-environment.

Vanham, D., T.N. Mak, and B.M. Gawlik. 2016. "Urban Food Consumption And Associated Water Resources: The Example Of Dutch Cities". *Science Of The Total Environment* 565: 232-239. doi:10.1016/j.scitotenv.2016.04.172.

Warms, Richard, and R. McGee. 2013. "Scapes". *Theory In Social And Cultural Anthropology: An Encyclopedia*.

World Meteorological Organization. 2019. "WMO confirms past 4 years were warmest on record". *World Meteorological Organization*. https://public.wmo.int/en/media/press-release/wmo-confirms-past-4-years-were-warmest-record

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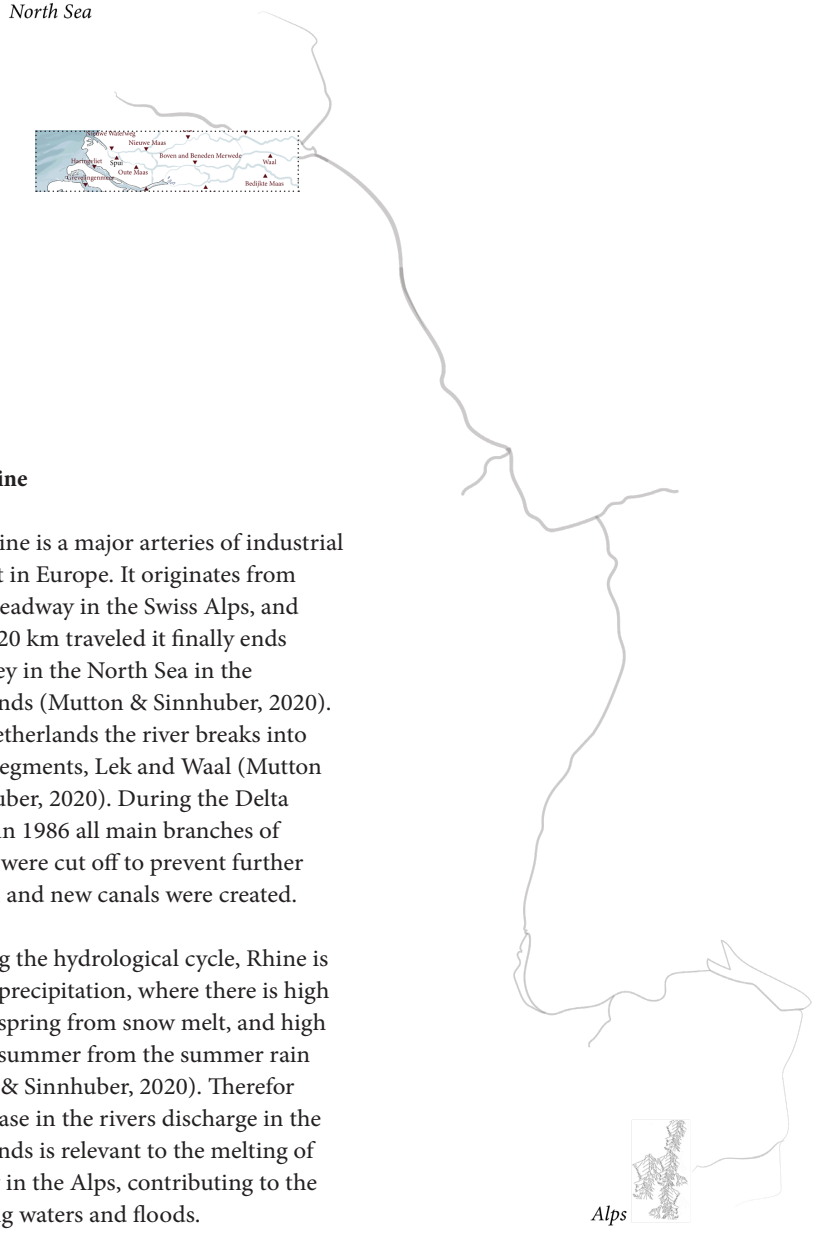
Appendix

A - Atlas of Wetness

B - Site Visit Journal

C - Atlas of Sections

EXAMPLE PAGE FROM THE DOCUMENT ATLAS OF WETNESS



River Rhine

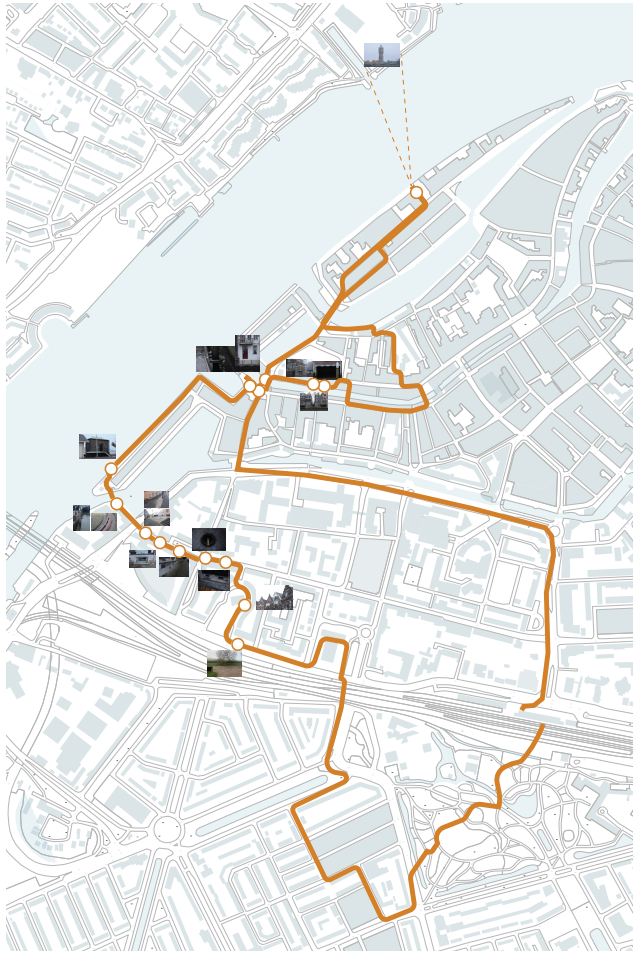
River Rhine is a major arteries of industrial transport in Europe. It originates from a small headway in the Swiss Alps, and after 1, 320 km traveled it finally ends its journey in the North Sea in the Netherlands (Mutton & Sinnhuber, 2020). In the Netherlands the river breaks into smaller segments, Lek and Waal (Mutton & Sinnhuber, 2020). During the Delta projects in 1986 all main branches of the river were cut off to prevent further flooding, and new canals were created.

Following the hydrological cycle, Rhine is fed with precipitation, where there is high water in spring from snow melt, and high water in summer from the summer rain (Mutton & Sinnhuber, 2020). Therefor the increase in the rivers discharge in the Netherlands is relevant to the melting of the snow in the Alps, contributing to the increasing waters and floods.

The Netherlands, a Land of Water

Drawing by Author (source: Steenhuis 2018, 18)

EXAMPLE PAGE FROM THE DOCUMENT ATLAS OF WETNESS



The first site visit to Dordrecht. The first visit to the chosen city was unplanned and brief. I knew that I wanted to walk around the areas of the dikes and settlements around them. Traveling from Delft to Dordrecht via train, I arrive to their station which has immediate access to the park and green spaces. In my walk I went from the landscape of the dikes where the infrastructure of the train was elevated. This

dike formation was: ground pilled upon in which infrastructure was constructed to and elevated to protect it from potential flooding. The dike was about 3-4 meters high and it disrupted the view to the other side of infrastructure. Critical infrastructure travelled along the dike, pedestrians, cyclists and cars where on the bottom of the dike and the train infrastructure on top of it. Moving further

I was traveling through a crescent type of neighbourhood with 4 storey houses, pitched roofs and balconies sticking out. This reminded me of the requirements of the buildings, to have skylights in case there is vertical evacuation is needed. Making them suitable for the multi-layered risk management approach. Continuing the walk, coming closer to the north side of the island I began to notice the elevated buildings, whose ground floor was 1 to 1.50 m above ground. I also began to notice basin holes, some of which had a water pipe connected to it. There were buildings with openings on the ground water, which I presume are used to drain the water away from the basement or the ground floor when it is flooded. There is even a ramped area which does not look like it designed for accessibility but for the water to stream down. Further down the street is a café, which has a basement. Reading about the flood defence of the past, I recognized that this was a basement used for flood protection. Still unsure how it looks like nor how it works. Following this café there was a slope, a dike which elevated the road infrastructure. Although this dike was much lower and you as a pedestrian can cross them with ease. This dike was constructed with brick.

Coming closer to the historical city I started crossing pedestrian bridges , ones that divided the river and the ports. The mechanisms for these bridges always fascinate me, some go up, slide, and divide. In particular this uses a sliding mechanism with sharp teeth. The mechanism carves out the brick landscape.

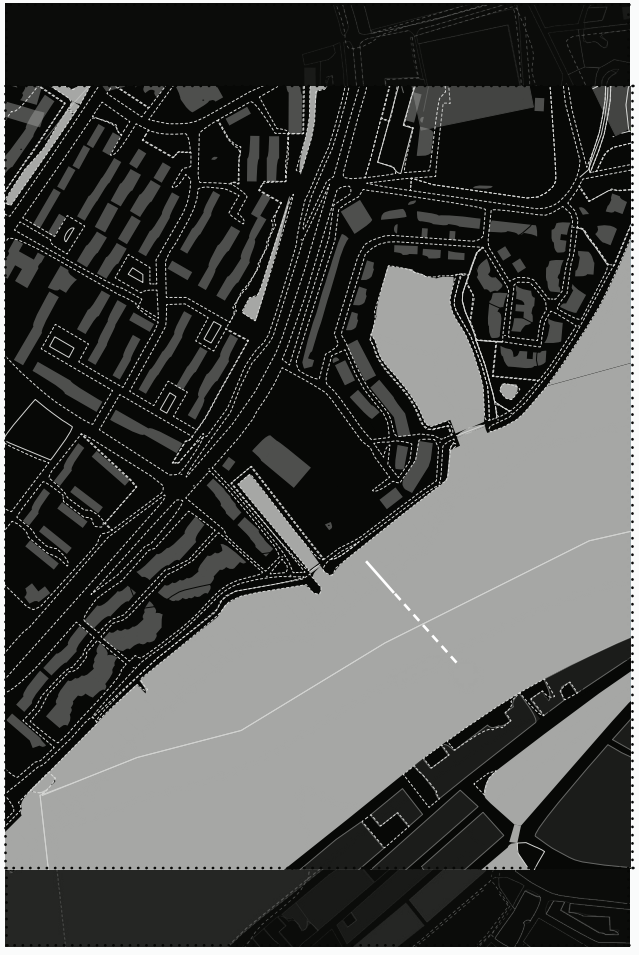
Near the river there were some small 1 to 2 storey houses that were significantly and visibly elevated. measure platforms. An irritable as it was wrapped In the water I also saw poles which were sticking out, they are used to the water rise. The pole is also used to hook ships, and sound was coming from the crushing wood of the platform, around the pole. The metal lining on the inside created bell like sounds. Across this bell sounding platform are these houses built on high foundations, where the doors open to the water. Interestingly I still have not determined why this is like this. I know that in Venice these doors that open to the water are used by people traveling in boats, but these doors are not accessible as the water is not high enough. The water culture of Dordrecht is clearly imprinted on this bridge, as one of the stone plates had a woman that carried the water, assumingly from the well. The infrastructure and the connection of the bridge goes above the water, it allowed for transport to happen and therefore it is embellished with this stonework as a symbol of it creatin. Walking next to the water, after crossing it, I was walking next to a church, across the water were all these houses where the dike becomes a settlement, where architecture meats the defence against the water. The building themselves are beautiful, they also bare marks of green algae and permanent water marks, showing the past of water rises. The buildings and their materials serve as a measuring tool, a body of evidence, that traces past floods and water rises. Most of these houses are occupied, but every now and then there is an old, unrenovated house, that is on the brink of ruin. Looking t the buildings I also saw that one showed off its foundation, instead of covering it up by brick, it exposed the wooden little legs. The rest of my trip was jut looking around. However I knew I wated to end up at the river again. Strategically I moved towards the east of the historic down until I reached the view upon the Water Tower on the other side. It excided my expectations, as it was much taller than I have imagined it and it stood out. The surrounding around it was flat and almost non existing, only to the far left of the tower were there taller settlement.

The entirety of the trip has given me a perfect first impression of Dordrecht. From reading about the flooding initiatives, and developments, regulations and policies, in my next trips I hope to achieve the following:

1. Pursue a guided tour of the dikes from a local
2. Speak to locals and understand their relationship with the city and water; flooding
3. Visit the non diked are and visit the new development area for 11 000 new housing

EXAMPLE PAGE FROM THE DOCUMENT SITE VISIT JOURNAL

EXAMPLE PAGE FROM THE DOCUMENT ATLAS OF SECTIONS



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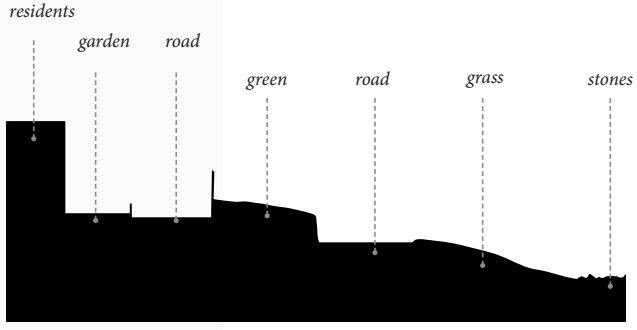

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Transparent paper

Acetate paper

Reflection on the course

The course Research Plan has provided me with a foundation for my graduation thesis, where I have critically and analytically engaged with my research, methods, and methodology. Moreover I was able to form a strong theoretical, conceptual, spatial and analytical framework. This document is a mare summary and breakdown of my theories, concepts and methods, which will help me research and design.

The course has also provided me with a series of lectures and 'how - to' tutorial. The lectures were constructed in three topics: Methods, History and Theory where I have learnt the difference between methodology and methods of research, also showing a diverse range of work from graduated students (primarily explore lab studios). This has proven to be an effective and intellectual way of demonstrating how research is constructed through

examples of past work, however it can also be limited to BK - TU Delfts way of research.

The set research plan (research question, problem statement, hypothesis, methodology, and methods) brought clarity and framing to the way I critically construct my arguments. As my studio is a Cross Domain studio (students from Urbanizam, Architecture, MBE, TIL) my research question was constantly reforming from: "how can architecture…?" to: "can architecture…?". Following an architecture track I would also like my thesis to question whether or not architecture alone can answer problems of grander scale. Moreover, the tutorials discussed the importance of choosing an appropriate and creative method of research. In my thesis I have chosen several methods for researching, interactive, non - interactive, phenomenological, surveying [ect]. The lecture on, Creating the Past to Design the Future by Carola Hein taught me the value of historical research. For my research it was essential for me to determine the past of flooding, through a cartographic method, gathering data on vulnerable areas, sites of damage, and existing programs for their protection today. The lecture also elaborates on the importance of case study and source origins. Looking at examples across the world is informative and eye opening, however when designing one needs to familiarize themselves on their sites, climate, program, material supplier [ect].

Furthermore, in my thesis I was struggling to find an appropriate and innovative method of site surveying, however eventually I was able to draw conclusions from my theoretical research and use this as a method. Researching the human experience I was able to carry out some interviews on my site, however dealing with the sensitive topic of climate change, rising water, and flooding, has proven to be a delicate topic to some which have experienced a loss of property. In my interactive method I conducted several interviews with individuals who live in flood prone areas and this has a great impact on their everyday life. Approaching this sensitive topic guided me to construct appropriate questions.

The biggest breakthrough in my research plan was the glossary, the terminology which I am using in my thesis is essential for framing my view and position on the topic of perception, therefore I hope that my research plan reflects this. I believe that the linguistic and terminological approach to my research was necessary to frame certain concepts and theories (especially the philosophies of Deleuze and Guattari as their theories are heavily based on concepts and rigorous terminology).

Throughout the course I believe I have critically and carefully engaged with the lectures, "how - to" sessions, masterclasses and suggested literature. I have also taken opportunities by asking questions and engaging with the lecture as much as possible. The course has helped me develop clear learning objectives and I have adopted them to my studio and individual methodology. Throughout the course I have managed to form a research plan that will guide me throughout my thesis, I have made a clear separation between quantitative, qualitative, and speculative research and selected appropriate tools to carry them out, and finally I believe that the research question preset now reflects my main goals and objectives, however I am aware it may change.

Visual Essays

Research Plan

Position Paper

Reflection

Positions Essay

Territory, Body, and Code in the terrain of rising waters

Sonja Draskovic
5085284

Abstract

Water has played a great role in shaping our cities to this day. It is perceived as a resource, serving the population by enabling the production of food, land, transport, and settlements. Countries that are built on water, such as the Netherlands, adopted strong water and risk management policies, urban planning, and building techniques to protect the land from water. The formation of land through dikes, canals, and plodders became the framework on which the society was built, and this heavily influenced the perception of water and how people live with it.
Today we are facing an unpredictable future due to our climate change, which is causing an acceleration in sea-level rise and consequently flooding. Coastlines, docks, ports, deltas are at greater risk of flooding and damage, they are vulnerable to the escaping water and wetness, which leaves behind sorrow and grief. In recent research, there has been a strong focus on adaptive policy to risk and water management, and *buildings with water* have solemnly focused on large-scale projects in the field of landscape and urban design. There is a lack of research and architectural projects that deal with the way we build for uncertainty. This paper examines the key theoretical frameworks used to position me as an architect when designing with water, by rethinking the perception of water and how that affects the connection between new adaptive planning measures and architecture.

Introduction

In my thesis, the research focuses on improving how our built environment incorporates water and nature in out-of-dike areas. As an attempt to address climate change I look at the relationship we have with nature through architecture, landscape, and infrastructure. The phenomenon of flooding is addressed by researching policies, water and risk management, spatial and urban planning strategies, however as I have seen there is a lack of architectural research on how architecture responds to flooding on a greater scale, through its programmatic and spatial changes. The design of our cities reflects the governmental decisions and policies which are now already outdated. Therefore I pose a question: what and how do we design with such uncertainty of climate change and its impact? Should this gap between architecture and policy diminish or be embraced?

The location of my project is in the Netherlands where there is a strong focus on climate-proofing and water - the robustness of delta areas to upkeep the quality of life on long-term planning. However is this a sustainable way of dealing with water and flooding, or is it perhaps short-term planning?

By looking at the core of the problem we are looking at our relationship with nature. We can begin by questioning our perception of water, nature, natural cycles, and environmental changes, as they are shaped by the way we design. Anuradha Mathur once said that we are the ones responsible for designing our enemy, water. By treating nature as an enemy, threat, and resource we have limited its flow through artificial borders. And once these borders are crossed, we begin to lose " our property and our land" and we become scared and immobile. Designers think they design with nature when in reality we treat nature as a threat and our built environment reflects this. This leads me to the second design issue, what is the role of architecture, landscape, and infrastructure in building sustainable solutions for our cities on water? These different design disciplines are never seen in their singular form. For example, designing dwellings and trains on top of dikes. This is why it is important to acknowledge the hybrid form the built environment creates when coming together. I assume that these disciplines are too busy curating nature in the desire to accommodate human needs, that they forgot about the cultural consequences spatial manifestations will have on people. Spatial elements are physical manifestations of policies and our relationship with nature, they reassure society of their safety and protection against our "enemy". This has significantly hindered our responsibility for our safety concerning climate change, and we became less aware of actions that we can take.

What is my hypothesis?

I hypothesize that the gap between spatial design and policy is addressed through a more adaptive approach to architecture, infrastructure, and landscape in areas outside of the dike. These three disciplines also need to become mutually integrate, whilst simultaneously integrating seasonal and yearly water fluctuations by adapting their programs, and spatial strategies. Of course, this also means that the architecture is made safe and accessible through waterproofing, following appropriate evacuation and protection policies.

To achieve social awareness, our built environment needs to demonstrate an integrated approach between architecture, infrastructure, and landscape. This also involved opportunities where the public program is introduced in areas outside of the dike, by integrating seasonal flooding and long-term uncertainty as part of the user experience.

What is my theoretical framework?

The theoretical framework uses a set of theories through which I form a critical understanding of territory, body, and code; by linking policies, architecture and context together. Furthermore, the theories helped me position myself as a designer later on in my design approach, and drawing

exploration. My architectural position is derived from three main theories or literature which will be discussed in this paper:

1. Notion of territory, body, code, as written by Félix Guattari und Gilles Deleuze

2. Perception of flooding as a gradient of wetness, work of Anuradha Mathur and Dilip da Cunha

3. Evolution of ecology, theories on metabolism and flux in the work of Daniel Botkin and Steward Pickett

The three theories

Together these theories form the theoretical framework for my research and design. Gilles Deleuze and Félix Guattari in their work distinguished three terms; territory, body, code. The relationship between these three notions is discussed in their theory of reterritorialization and deterrrionzation and is referred back to my initial architectural position. In this thesis, the notion of 'code' is referred to the multi-layered safety approach which follows the logic of the risk cycle. And 'body' that refers to architecture, infrastructure, and landscape are discussed through the work of Mathur and Dilip, as I explore the territory in sectional drawings and 3D scenario modeling. The body is then intertwined with the theory of Daniel Botkin and Steward Pickett in the paper "Coding Flux: Redesigning the Migrating Coast" by Fadi Masoud.

Applying the theory of reterritorialization by Deleuze and Guattari

Gilles Deleuze and Félix Guattari were French philosophers in the late 20th century whose philosophy manifested as the production of concepts. They saw themselves as "pure metaphysicians" (Protevi and Smith, 2008), and together they wrote Capitalism and Schizophrenia, comprising Anti-Oedipus (1972) and A Thousand Plateaus (1980). Their work corresponds to the concepts of artistic practices such as painting, filmmaking, and writing (Protevi and Smith, 2008). Their work has inspired my thesis, through the complexity of their written language, Deleuzian prose which is highly allusive, filled with neologisms and complexly innovative terminology. In their theory, I elaborate on the concepts of deterritorialized and reterritorialized, the former in this case referring to the disconnect between the human and natural sphere and the latter to the reconnection of the two (Deleuze and Guattari 1972, 196).

Humans and Nature

Treating nature as a resource and a threat has led designers to design land out of the water, separating the dry from the wet by constructing borders. By drawing a parallel between these three concepts and my thesis I will discuss how an architect's perception of the territory, and its relationship to the body and the code, can be reestablished in the future of climatic uncertainty.

Contextualizing Territory, Body, and Code

The body is an actors who posesens movements. The territory curates the body, and the code patterns its movement.

The territory controls the body according to a set of concepts, limitations, or as they are referred to as 'codes'. They refer to two concepts, 'codes' which are norms, and 'overcomes which are laws. In both notions when a territory is regulated it is territorialized. When the territory is no longer governed by these norms and laws, the territory becomes deterritorialized. Finally, when new codes are formed the territory becomes reterritorialized. The event of deterritorialization is manifested by a foreign body moving into the territory and once accepted, space is reconfigured and new codes are formed.

In my thesis the code is conceived in many things, it can be the governmental strategy to adapt to climate change, code of technical systems, codes of desire, codes of social behavior, risk management, evacuation routes [ect]. A territory of water possesses different codes to those of land. In my research, I have identified two types of territory in the area of Zwijndrecht, Dordrecht, and Papendrecht. The area outside of the dike next to the water, and the area inside the dike that urban planning gravitates toward the city centers (Diagram 1.1 and 1.2). My area of focus is the out-of-dike areas, which are considered at risk of flooding. The spatial programs of these areas are less public and residential, and the majority of programs are private residences, sports fields, industries, and so on. A landscape element, the dike, divided the territory into two parts, 'dry and wet' land (Diagram 1.2). The codes to which land operates behind the dike are different than the ones in front of the dike. This means that there are different regulations of construction, evacuation, and risk management.

So what happens in the moment of deterritorialized?

In the moment of deterritorialized, all codes parish, the logic to which a territory once operated no longer exists and the terrain enter a chaotic state, mixture of movements, temporality, untraceable patterning, resulting in the 'decoded' of entering bodies (Deleuze and Guattari 1972, 196). In the instance when space is reterritorialized, the bodies 'recode' to a newly formed logic.

If we take a body, for eg a staircase, in a state of flooding it becomes an evacuation route, the space no longer operates according to one code now it follows another. The same can be seen for the landscape, a strategically carved piece of land can provide an area where water is filtrated or a moment of social interaction, but when a water body overflows these areas become an apparatus of retention by which water is retained and it prevents it from over flooding on an area desired to be protected. In a sense this concept is not new, however, it is not exercised enough in areas outside of the dike, and with the hybrid form of architecture, landscape and infrastructure. The only form perceived is the dike, where it combines these three elements, to protect but also provide a spatial program. However,

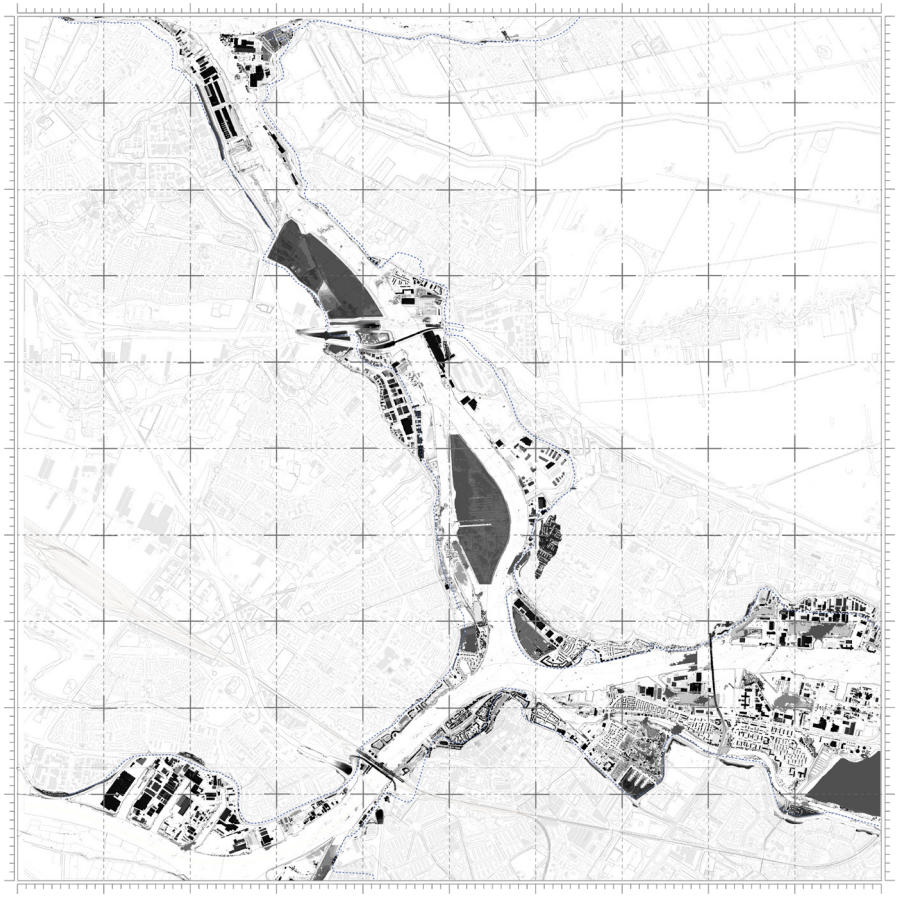


Figure 1 - Drawing of the territory of research in side the dike

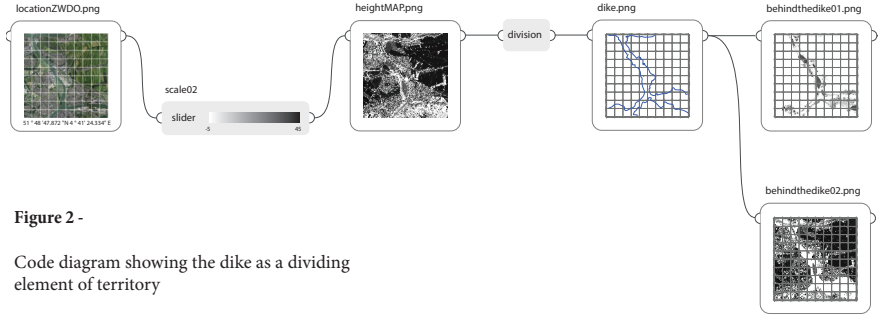


Figure 2 -

Code diagram showing the dike as a dividing element of territory

the code of operation outside of the dike should have an even more adaptive program, a more dynamic system that follows the natural cycle.

Furthermore, land that is vulnerable to flooding and water damage is deterritorialized when water enters the site. The regulations to which the site becomes operational follow a state of emergency, where the codes of operation change. The way people act on an individual scale becomes very unpredictable. The sites prone to flooding operate on a risk cycle that consists of 4 parts: mitigation, preparedness, response, and recovery. These are invaluable codes to which territory operates, however my thesis focuses on reterritorializing the terrain outside of the dike which should be recorded through a reiteration of the existing codes of the territory. The code of living with water can result in a new water management strategy, a new way of construction, and a different perception of water and land. Looking at this area in section and the water table I was drawn back to this notion of flooding and how people experience water in nature vs in the built environment. This led me to the application of water as a gradient of wetness, the theory of Mathur and Dilip.

Introducing Wetness through the theory by Mathur and Dilip

What is water and how do different cultures build with water by integrating it as infrastructure and leisure, but also keeping it out and segregation the build and natural environment? These questions were investigated by landscape architects and professors Anuradha Mathur and Dilip Da Cunha, who talk about the perception of water, and cultures that experience the overflow of water as a natural phenomenon and not as a flood. In their conference, What *We Learn from Water*, Mathur, argues that designers have created an enemy from water, through our perception of it (Mathur and Da Cunha, 2019). Following an exert of

> *Water is somewhere, where wetness is everywhere. It's in the soil, in the air, on our hands. The sea is very wet and the desert less so. In reality there is no such thing as dryness. Wetness is everywhere because of its gradient. Water drains off land, it gathers in rivers, lakes, puddles [ect]. Wetness on the other hand does not drip off the land, it soaks, seeps, transpires [ect]. Water flows but wetness holds. Water is held by the surface of the ground. It is used to power, to drain it, transport it, and provide it with urban fronts Wetness on the other hand is prior to this land water binary*
>
> Mathur and Da Cunha, 2019

their speak Mathur elaborates on two terms, wetness and water:
Concerning my thesis, I am looking at the river and the way we perceive its flooding. Therefore it is essential to discuss the concepts of the rivers, what is a river's normal condition and what are its fluctuations?

In ancient Egypt, the river Nile had different terrain from June – September than from October – May, and to the Egyptians, this was not seen as flooding, as they perceived water to rise and fall and not as a flow. Dilip defines flooding as “nothing more than water crossing a line” (Mathur and Da Cunha 2019, 11:37). This line is designed by us to create habitation and this leads me to the two paradigms of habitation concerning water.

The first is the separation of water and lands with levers. Designers are educated to design with the constraints and to contain water within two levers. The Netherlands has mastered the technique of channeling waters and keeping waters out of the land with barriers, freeing the land from water.
The second is the inhibition of the mounds. This type of inhabitation comes from the appreciation of water fluctuation, rising and falling. Allowing water to be free.

These are two very different paradigms with which we design with water. Furthermore, the essence of time and season become essential in designing with water. When looking at the water we are addressing the hydrological cycle, the circle of precipitation, flow formation, evaporation, and cloud formation. To formulate a design one of these moments is selected as a time of reality inhabiting it. At this moment we separate the waters above and the waters below, constructing a geographical surface, and then we divide land from water. Or as Dilip phrases, we divide wetness and create water and land (Mathur and Da Cunha, 2019). So this act of creation is the act of design.

What we have now, is the land and its gradient of wetness. This is when we begin to design maps in desirable conditions of clarity, where the weather is subtracted from the measurement of design. A surveyor waits for the rain to stop because they can not see the line between land and water. We wait for the rain, storm, and hurricanes to stop so we can record the exact condition of water and land. By doing this, and constructing maps in this form we have gathered moments where time is made static. And this temporarily that is lost is something that is haunting us today with climate change, and sea-level rise (Mathur and Da Cunha, 2019). Now that the concepts of water, wetness, flooding, and time are discussed how do we use these concepts to change the way we perceive water and design with it. Having acknowledged now that we have designed our enemy, we can not use these same paradigms and apply them in research, site analysis, and generate them as design tools.

Developing a new paradigm in design will require us to inhabit the entirety of the hydrological cycle, not just looking at one particular moment in time. Inhabiting the point between clouds and aquifers, instead of looking at rainfall as something which falls, creates a flow and gathers back onto the sea. We are looking at the paradigm, where rain adds to the wetness which is already there. With this statement, we are not looking at the geographical plan that is inhabited by flows but we begin to look at sections.

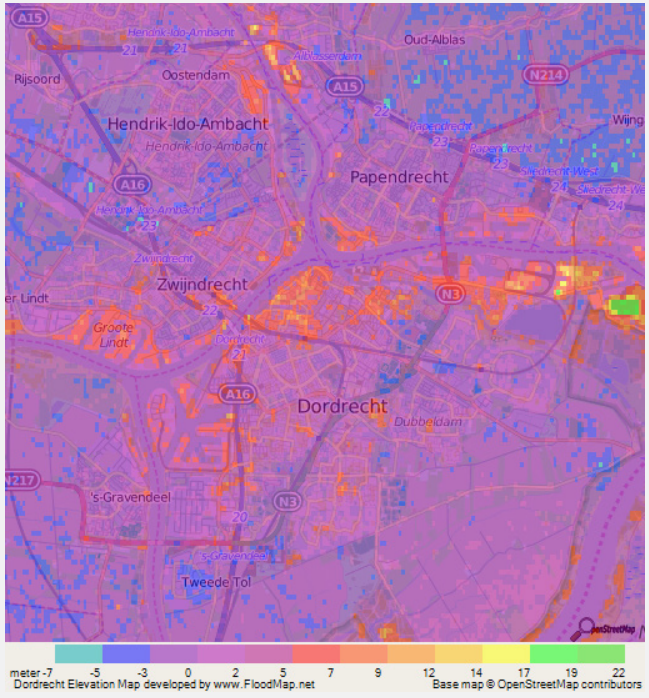


Figure 3 -
Flood zoning in area of Dordrech

Coming back to the code

How that the first two theories explained the concepts of territory body and code I began researching how this territory can be re-codified and determine the principles that will be used to do so?
Looking at the work of James S. Scott I turned to the theory of zoning. The very principle where an entire territory would be codified based on a similar feature. As he describes, zoning is a radical simplification of an urban plan as seen from above, it is practical, aesthetic, and scientific (Waterloo Architecture, 2019). It reduces the number of unknowns in an urban plan, however, when you have too many of the unknowns many design challenges are occurring (Waterloo Architecture, 2019). In comparison to uniformity, diversity is much harder to plan and design for.

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

- James S. Scott (Waterloo Architecture, 2019)

Looking at the example map of my area above, the entire area is codified to a static RGB spectrum of colors, waiting to be populated with building designs that

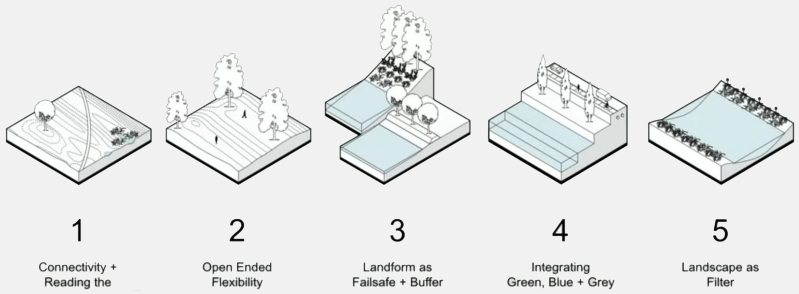


Figure 4 -
Five principles of designing in flood prone areas

fit those standards. Overlaying a map of flooding with a map of real estate one can begin to see patterns of how geographical conditions dictate the urban plan of cities, however in many cases as discussed in Fadi Masoud's work these two seem like they have never met bet before. In the Netherlands, and especially the area of Dordrecht the "original landscape" was a waterscape, where the land was constructed from water, and based on this the codes were made. However, this still does not justify static zoning in areas of flux.

So how does the notion of code meet the theory of wetness?

In the attempt to bridge together the notion of natural cycles and building developments in the areas of flooding, I turned to the writing of Fadi Masoud as he proposes a new way of coding and zoning flood areas. Looking at the concept of metabolic habitat, the ecological systems do not follow a state of equilibrium but rather a dynamic system, where the environment is in a state of constant change (Masoud, 2017). Therefore the policies also need to follow the random and nonlinear interruptions in the natural systems. Masoud in his writing argues that real estate in floodable areas needs to shift from the "best use" principle of zoning to a way in which we accept and change to uncertainty in such a way that multiple outcomes are taken into consideration (Masoud, 2017). Regulation should cater to an open-ended ecological process. Through a multitude of architectural competitions worldwide addressing climate change, the common five principles were derived in diagram 4. The most understandable one is the understanding of the site, its condition and it's potential before we build on it. Understanding the floodplain and using this to determine the zoning of the real estate.

The flux - time, process, and scenario - driven flexibility

Ecologists Daniel Botkin and Steward Pickett oppose the view that our environment is static and constants over time until they are interrupted by human activity (Pickett, Cadenasso and Grove, 2004). Instead, they argue that change is unavoidable and we need to follow the dynamics of nature, creating an open-ended paradigm (Pickett, Cadenasso, and Grove, 2004). Botkins's theory argues that we can't return to the ideal state of nature because ecosystems are patches of conditions that only exist for a finite period, and by nature, they are in constant flux (Pickett, Cadenasso and Grove, 2004). The current zoning prevents the dynamic adaptation of

these areas because the old systems cling to the idea of having a perfect result. This translates to a design that has an end form.

The gap between polity and spatial planing

To answer the question of how the gap between polity and spatial planning can be addressed in areas of flooding I first had to determine the territory and its natural conditions. Understanding my terrain through site analysis, maps, and data, I began looking at different building formations of the site. Creating different building, landscape, and infrastructure scenarios and coming up with a matrix of solutions for my area (Diagram 5). **It was the design which in this case led the code,** instead of imposing a zoning code without looking at the area's natural feature, so I reversed the process and began recoding the area through design scenarios.

Applying the research understanding of Masoud (Diagram 4), the key five principles come back in my design metrics and are further elaborated through my unique site conditions. The series of explorations showcase the dynamic ecological model as the centerpiece planning tool, seeing how architecture as well, transforms itself from static to dynamic objects. Scenario research, can enable a multitude of outcomes and explore the potential of the area at different times. Simultaneously a multitude of scenarios can overlap, adding to the dynamic scape of floodable areas. The terrain when wet can be both dynamic and static, the dynamic and static refers to the degree of changing an area experiences ecologically. Through these design operations, new site programs and potential are revealed, creating new codes.

Conclusion

In conclusion, this paper aims to combine my understandings of the concepts of code, body, and territory, together with the theory of perception of nature as seen from the theory of Delip and Mathur. The essay itself is a gradient from theory to practice where the aim was to create a basis for my design principles. The gap between policy and spatial adaptation of areas outside of the dike is an issue deeply rutted in the network of policies, safety, laws, and even ethics and can not be addressed through a singular project. However, this so-called glitch between design and policy is not only present in the case of water management and flooding, it transpires through many different scenarios. The conclusion that can be observed is that design is often underestimated, and can provide solutions for the urban unknowns, which can not be solved through a super-imposed code of RGB colors. Instead, one by one precedents, scenarios, and possibilities are investigated through the reliable and certain phenomenon of ecological uncertainty, as discussed by Masoud - Following the Flux. Where time, process, and scenarios are tested and where the design may never have a final form, but instead caters to the open-ended ecological process. This was the architecture itself is a continuous flux, form, and program without a result. As a result of these readings and my attempt to understand the issues at hand, I came up with a set of different territory and architectural scenarios which can be translated into a building code for my project, one that takes into consideration the existing site and forms new opportunities through design exploration.

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

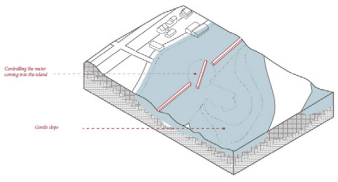
WET

MORE AREA IS FLOODED

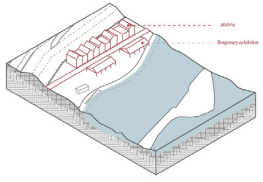
DRY

LEAST AREA IS FLOODED

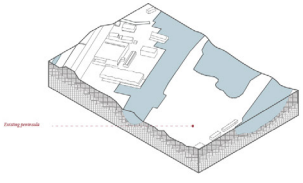
WF - ES - 0 *Wetland Flux - Ecological Services*
organic constructed wetlands, marshes, new habitats , controlled through an operable barrier



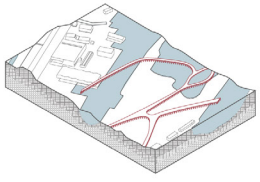
WF - MR - 3 *Wetland Flux - Medium Residential*
Medium density housing with local street upland, civic spaces for public activities along the river front.



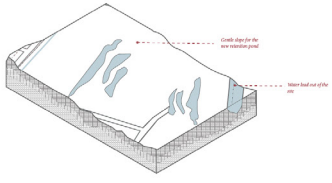
RI - ES - 0 *River Island - Ecological Services*
organic constructed wetlands, marshes, new habitats



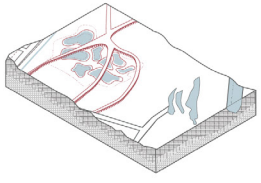
RI - R-ES - 0 *River Island - Recreational & Ecological Services*
Elevated walkway that provide recreational use on the wetland



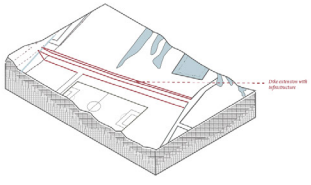
WT - ES - 0 *Wetland - Ecological Services*
organic constructed wetlands, marshes, new habitat, retention ponds for water filtration



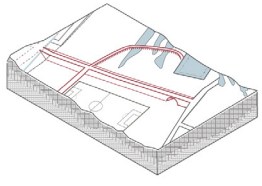
WT - R-ES - *Wetland - Recreational & Ecological Services*
Elevated walkway that provide recreational use on the wetland



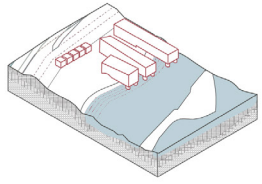
DI- ES - 0 *Dike - Ecological Services*
extension of the dike providing a new dry land to build on



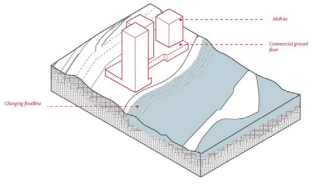
DI - R-ES - 0 *Dike - Recreational & Ecological Services*
Elevated walkway that provide recreational use and connection



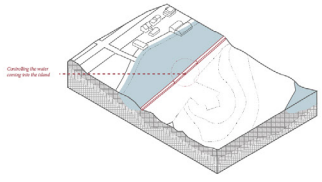
WF - MC - 3 *Wetland Flux - Medium Commercial*
Architecture on pylons as a means of flood protection



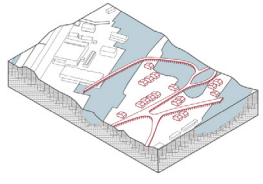
WF - HR - 5 *Wetland Flux - Hight density mixed use*
High density with a commercial podium



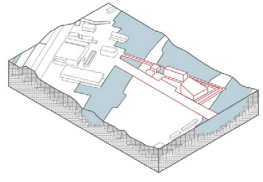
WF - ES - 0 *Wetland Flux - Ecological Services*
organic constructed wetlands, marshes, new habitats, controlled through an operable barrier



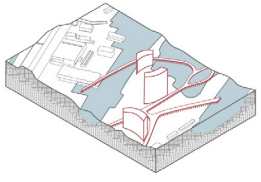
RI - LR - 1 *Wetland Flux - Low Density Residential & Recreational*
Low density housing in upland areas, floodable water retention areas and wetlands connected through infrastructure



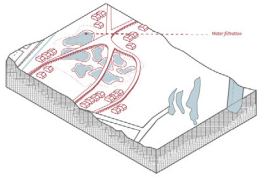
RI - MP - 2 *River Island - Medium Public building*
public building connected with an elevated path



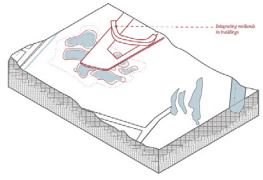
RI - HD - 5 *Wetland Flux - Hight density*
High density connected through elevated paths



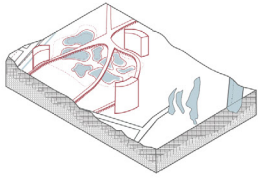
WT - LR - 1 *Wetland - Low Density Residential & Recreational*
Low density housing in upland areas, floodable water retention areas and wetlands connected through infrastructure



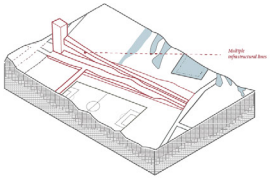
WT - MP - 1 *Wetland - Medium Public building*
public building connected with an elevated path



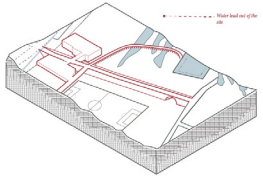
WT - HD - 5 *Wetland Flux - Hight density*
High density connected through elevated paths



DI- MP - 3 *Dike - Medium Public building*
public building connected with an elevated path



DI- MP - 3 *Dike - Medium Public building*
public building connected with an elevated path



DI- HD - 5 *Dike - Hight density*
High density connected through elevated paths

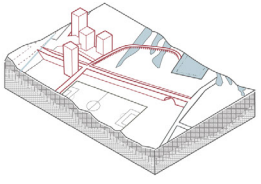


Figure 5 -
Matrix of design solutions

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02	Code diagram showing the dike as a dividing element of territory	62	Drawing by Author
03	Flood zoning in area of Dordrech	64	https://www.floodmap.net/Elevation/ElevationMap/?gi=2756669
04	Five principles of designing in flood prone areas	66	https://www.youtube.com/watch?v=Uvz03WY0vWI
05	Matrix of design solutions	68	Drawing by Author

References

Deleuze, G. and Guattari, F., 1972. *Anti-Oedipus Capitalism And Schizophrenia*. Éditions de Minuit, Viking Press.

Deleuze, G., Guattari, F. and Deleuze, G., 1988. *A Thousand Plateaus*. London: Athlone.

Mathur, A. and Cunha, D., 2014. *Design In The Terrain Of Water. Novato:* Applied Research + Design Publishing.

Mathur, A. and Da Cunha, D., 2009. *SOAK*. New Delhi: Rupa.

Mathur, A. and Da Cunha, D., 2019. *Keynotes Of Anuradha Mathur And Dilip Da Cunha At WAF 2019.* [online] World Architecture. Available at: <https://worldarchitecture.org/architecture-video/efgcm/watch-exclusive-keynotes-of-anuradha-mathur-and-dilip-da-cunha-at-waf-2019> [Accessed 18 December 2020].

Masoud, F., 2017. *Coding Flux: Redesigning The Migrating Coast. [*online] Scenario Journal. Available at: <https://scenariojournal.com/article/coding-flux/> [Accessed 6 May 2021].

Protevi, J. and Smith, D., 2008. *The Stanford Encyclopedia Of Philosophy.* [online] Plato-stanford-edu.tudelft.idm.oclc.org. Available at: <https://plato-stanford-edu.tudelft.idm.oclc.org/entries/deleuze/> [Accessed 15 December 2020].

Pickett, S., Cadenasso, M. and Grove, J., 2004. *Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms. Landscape and Urban Planning, 69(4)*, pp.369-384.
Raffestin, C., 2012. *Space, Territory, and Territoriality. Environment and Planning D: Society and Space*, 30(1), pp.121-141.

Waterloo Architecture, 2019. *Fadi Masoud Arriscraft Lecture, Coding Flux, Landscape Architecture.* [video] Available at: <https://www.youtube.com/watch?v=Uvz03WY0vWI> [Accessed 6 May 2021].

Visual Essays

Research Plan

Position Paper

Reflection

Cross Domain Studio: City of the Future 2020-2021

P4 Reflection paper

Sonja Draskovic

Rethinking design and Dynamic Waterscapes of Leisure Tracing Water through Infrasctuructures of Leisures and Ecology

Main mentor: *Alper Semih Alkan*
Second mentor: *Mauro Parravicini*
Third mentor: *Daniele Cannatella*
External Examiner: *Lidy Meijers*

The P4 presentation offers a possibility for me to show the full spatial manifestation of my project, as an outcome of my research and design processes. This paper offers a moment of reflection where I break down the reasoning behind certain crucial decisions in my design and research, define the relationship between the chosen studio and my topic, and reflect on the overall decisions made throughout the thesis. As this is my last project in my MSc Architecture program, there was a lot of excitement and positive pressure to convey the message I wanted to send before I proceed into my career as an architect. Therefore, the essence of my project was to follow my design instinct and explore as much as possible through writing, reading, modeling, discussions and drawings, in hopes to find the "perfect" answer to my research question. However as everyone can relate there is not a single outcome which is perfect. It is the process and the learning outcomes which count as a successful exploration.

01. The relationship between research and design.

The project began from a broad investigation on the topic of extreme events, the phenomenon of flooding in the Netherlands and the role of architect in flood protections. The main research question relates to how architecture and infrastructure shape our perception of nature as a threat and a resource. This statement is derived from the theory of Anuradha Mathur and Dilip Da Cunha, as they exemplify water architecture as a means to canalize, and control water which can be applied to the overly engineered landscapes of the Netherlands. From my research I focused on identifying the key policies, and water management programs in the Netherlands, in particular the multilayered safety approach which is applied in the city and island of Dordrecht. Dordrecht, London and Hamburg are three cities part of the UFM-project working together to develop a sustainable urban flood management (Kirchengast 2012, 18). And Dordrecht is also part of the MARE project, Managing Adaptive Responses to changing flood risk (Kirchengast 2012, 18). Both these programs allowed a new approach to safety that combines, dike reinforcement, vertical evacuation and spatial reorganization. These three principles are reflected back in my design as the three key elements. Exploring how these policies apply to the island of Dordrecht and areas around, I drew conclusions based on my research and site visits. The out of dike areas, are considered to be the least safe areas to live and build as they are zoned to be under the four meters Normaal Amsterdams Peil (N.A.P.) safety measure. The areas of investigation and my own site were artificially raised above the four meters making these areas safe to build on. However due to the existing policies this information is not taken into consideration and therefor these areas are also considered unsafe, restricting the program to private residences, industries, and sports fields.

My research approach was to combine site visits with cartographic research allowing me to identify different policies in a spatial form. For example, in the site visits I came across many new vertical extensions (staircases) which were added later on to preexisting buildings. This allowed a vertical escape to the roof in-case of a flood. In Dordrecht this was part of the new policy of vertical evacuation following the data that showed that only 11 % of the population would be able to escape Dordrecht during a flood.

From research to site choice

After data analysis and cartographic research, I was looking into several areas which have great potential to build and experiment with water management and safety. In my first two site visits to Dordrecht I conducted several interviews and combined a photographic journal of different areas prone to flooding, depicting their architectural, infrastructural and landscape qualities. The criteria for my site was to chose a site outside of the dike that is considered prone to flooding, and that would also allow me to design a public program. This narrowed my search to Maasstraat, an area outside of the dike on the north of Dordrecht where construction for housing already began. The second site choice was industrial area outside of the dike in Zwijndrecht. Through my research I was able to determine that the site was elevated as a means to create grounds for different industries. I chose this site as it is a crossroad between an existing sports park (south), shipping industries (north), birdwatching island (east) and residential areas (west), creating a perfect focal point in the site that can bring together different programs and audiences. The site (Figure 1) is in the outside dike area in the city of Zwijndrecht, and is surrounded through a great portion blue and green scape.

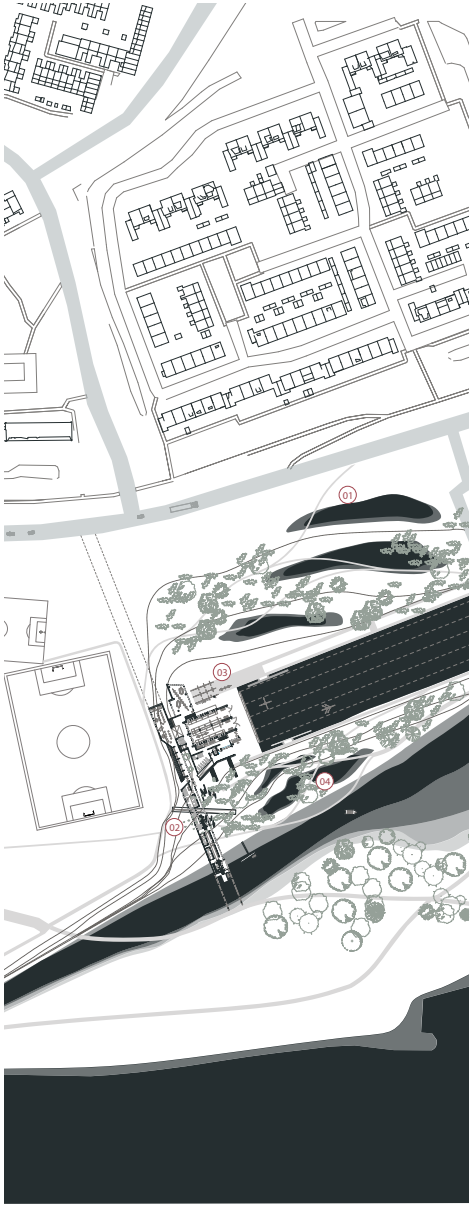


Figure 1 -
Site and Building position

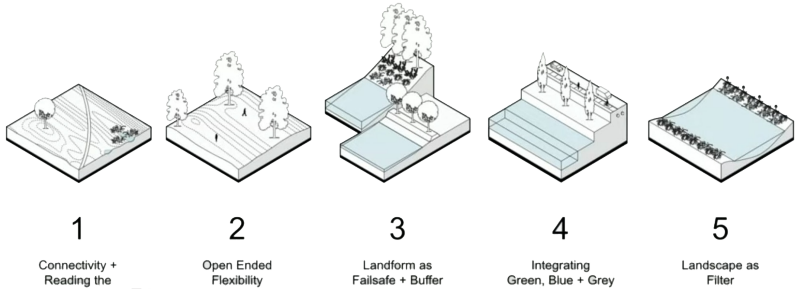


Figure 2 -
Five principles of designing in flood prone areas

The site design intent
My ambition for this site was to combine an architectural intervention with a landscape strategy. Given the sites scale and existing landscape there was a perfect opportunity to apply the knowledge of different landscape strategies as discussed in my position paper and identified through many case studies. The five main principles being:

1. Connectivity
2. Open Ended Flexibility
3. Landform as Failsafe + Buffer
4. Integrating Green, Blue + Gray
5. Landscapes as a filter

The landscape strategy
The landscape strategy of the peninsula was to create a dynamic between artificial and natural waterbodies. The site is dug to create a rowing track (Figure 3 - notation 2), bioswales for water filtration (1), a small river (2) which leads the water outside of the rowing club, and a buffer zone where water can overflow (3). From my research into ecology and adaptive cycles I looked at creating a more dynamic fluvial ecosystem which naturally responds to the change of water level.

The bioswells
They serve the site by filtrating the gray water from the run off and the buildings around the site. The filtered water can then be used as:

1. Fresh water supply in my building,
2. Landscape irrigation
3. Ice skating in winter

This allows me to partially disconnect my building from the critical infrastructure of water, and close the water cycle in my building. Other explorations such as black water filtration were discussed, however I concluded that a successful implementation of this filtration method was not appropriate on my scale and therefore was not feasible. The building program itself was a response to the site conditions and existing site opportunities. My site explorations, as discussed in my research essay showed a variety of densities, and programs. However in order to address my research question, I wanted to design a public program accessible for all. Looking at the landscape of the site I saw an opportunity to dig out part of the landscape and create a 1 km long rowing track, which is not appropriate for the Olympic training but rather for leisure and recreational practice, symbolically pushing the program for all people. The program also connects the rowing and the soccer fields with shared sports facilities. Furthermore the

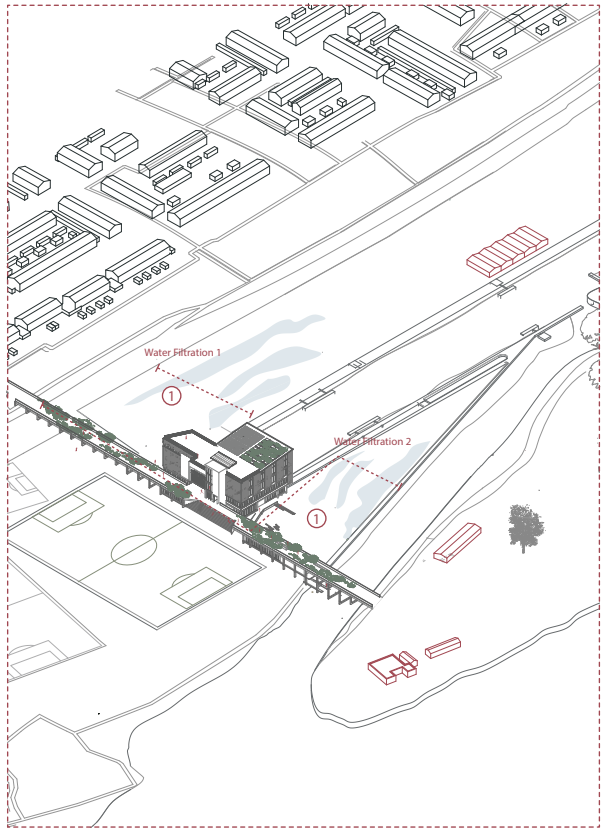


Figure 3 -
Applying the 5 principles of water management

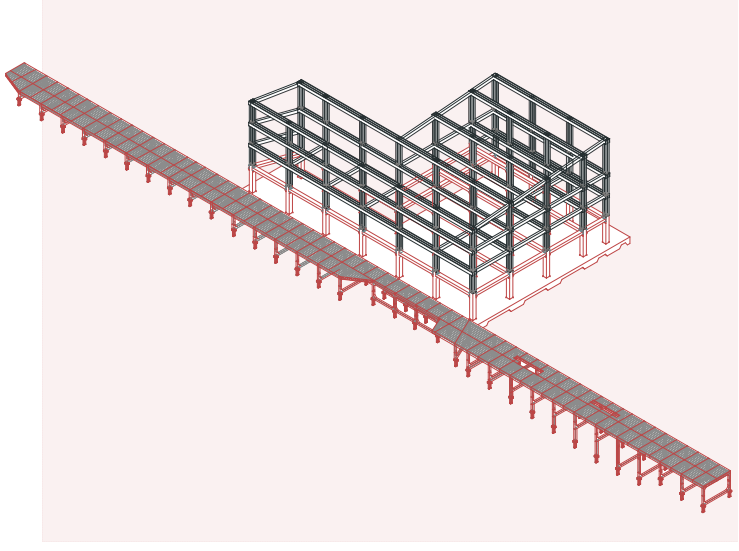
site also provides a beautiful journey through landscapes, landscape being both productive and natural. I address this through the program of ecology. The ecological research center provides several laboratories, depositories and working spaces which allow ecologists to explore the sites around them, and use the landscape as a testing ground. The large site, left almost untouched is a jungle of curiosity for visitors, creating an adventures and exciting visit.

Combining the programs of sports, and ecology I came up with two building masses (Figure 4). These two structures, as seen from the diagram, follow different structural and programmatic logics, however their unity is formed through the concept of the multilayered safety policy.

The design logic

The design logic was derived from the three elements of safety: dike reinforcement, vertical evacuation and spatial reorganization. The horizontal building becomes an extension of the dike, following the principle of water filtration, connectivity and green, blue and gray integration. The building connects the urban side of Zwijndrecht and the river, creating mobility, spatial program, filtration, recreation, biodiverity [ect].

The vertical building symbolicly referes to the vertical evacuation policy, where program changes throughout the different levels demostrating the relationship between verticality and safety. The program organization was placed from the lowest level being the least safe and the highest being the most safe area. The lowest levels of the building are the most regulated and controlled, creating a static organization to it, whereas gradually going up, the spaces become more open and more dynamic in program, symbolizing greater freedom



Structural Plans and Axos

Figure 4 -
The two structures

in movement in safe environments. The counterbalance of my design is the atrium. The first two floors the atrium is used to store, exhibit and repair boats. The rowing boats can be delivered from the ground level and lowered down to reach the lowest level of the rowing club. The architectural intent here is to create a vertical stacking of safety, where boats that are suspended are safer than the ones below, in flood scenarios. On the top two floors the atrium is used to ventilate the auditorium and some working space, serving as a means to bring in light and fresh air.

Section as a method of research Furthermore, another tool of investigation I used was sectional drawings. Through my site visits I took photos along the dike, and drew the program infront of the dike as it appeared in front of my camera. This helped me identify the different programs from the water to the dike. Later on in my design process I bring back the sections and design the program through sectional investigations.

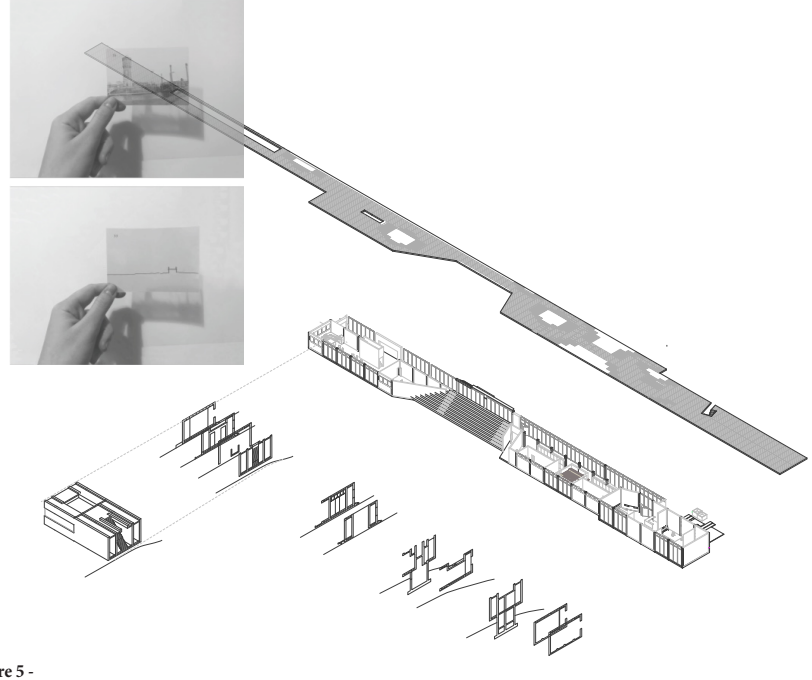


Figure 5 -
Exploring sections

Durability, Construction and Materiality

These three aspects became essential when designing with water. The construction methods, sequence and materials determine the life span of the building. My research encompassed material choice as a means to demonstrate environmental impact and durability, and therefore my project was looking into material and immaterial flows.

The first idea I play with is durability. I began by imagining my building as a ruin. What will remain and what will be taken apart, or become completely integrated with the soil and water. In reflection to this thought I wanted to demonstrate the durability of a material does not necessarily mean that it can withstand any force, but also that it can in parts be demounted and continue its life somewhere else in parts. In this sense the material is durable, in time, but not in the same location. Following this logic I proposed two different structures, both which can be demounted - one concrete and the other wood (figure 6).
The two building masses follow different construction logics (Figure 6), the dike extension building is a single story building made from prefabricated concrete elements, made from recycled concrete that used the new VEEP technology to crush and reuse concrete. The lifespan of this building is between 100-130 years. In order to lower the paved surface area, I decided to integrate greenery on the roof of the mobility. The roof of the building combines four main functions (figure 7):

1. Mobility
2. Water infrastructure
3. Social integration and
4. Biodiversity

Mobility - the roof allows pedestrian and cyclist mobility to occur.

Water filtration - the roof uses its surface area to collect rain water and filtrate it through, where it can be reused again in the building.

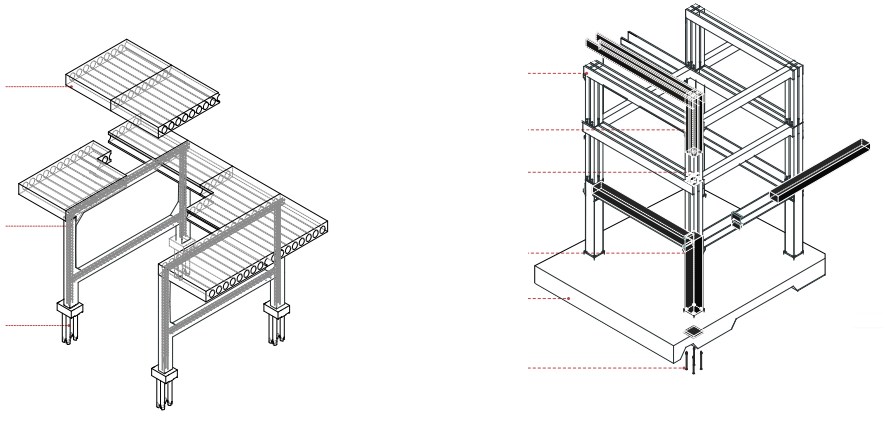


Figure 6 -
Prefab Concrete (left)
Prefab concrete and wood on top (right)

As for the educational aspect of the roof, the ecological center can use this roof as a testing ground for different green roof and constant monitoring.

Social integration - the roof allow visitors to interact with the surrounding, watch the football game or drink a cool beer on the podium.
Biodiversity - through a green roof biodiversity is brought onto the building creating more green surfaces and natural prevention again overheating.

The larder 4 story building (figure 4) is anchored to the horizontal building through a vertical core. It hosts the programs of the ecological research center, social hub and rowing club. The hybrid construction uses concrete and glulam columns as a means to waterproof the building on its ground floor, and create demaountability and easy assembly on the top floor (Figure 6). The structures life span is between 40-50 years and can be reused as it is made in a demountable way. As for other self-sustaining aspects of the building, there is a solar roof providing electricity to the building, and solar collectors which heat the water from the showers during summer, and this can saves up around 50% of the energy needing to heat up the water. On the top floors where there are offices and labs, a heat recovery system is implemented. Moisture and humidity is most crucial in the boat area, where they are store. Through my research and visits to the local rowing club I was able to observe how boats are kept safe from climatic impacts and

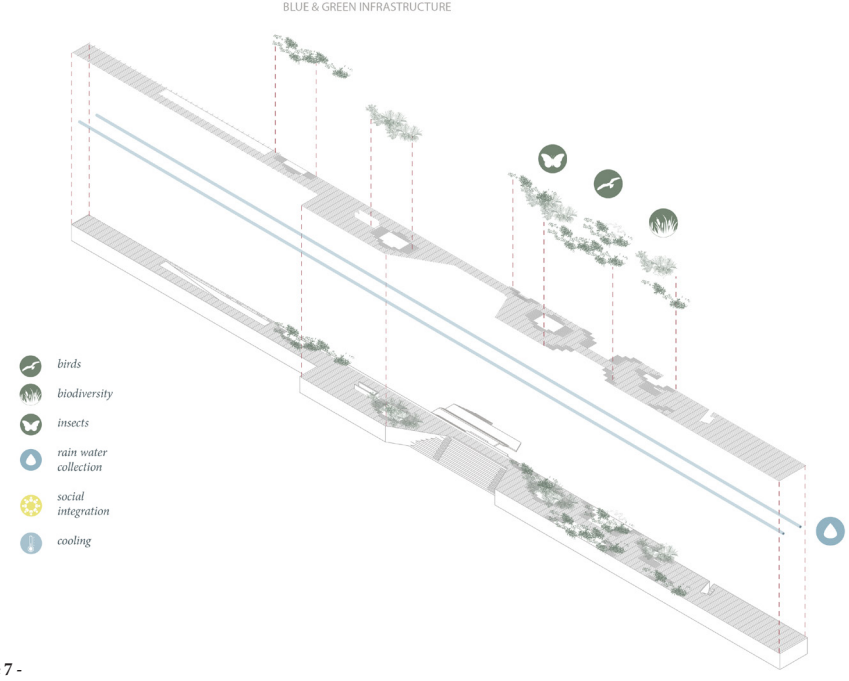


Figure 7 -
Water infrastructure

through different design iterations I decided that the boat area will be ventilated using a shaft which will go up the roof.

My design is a reflection on the current multilayered safety approaches which layer different levels of safety through the levels of the building. Its program accommodates the artificial and natural programs of the landscape site while the vertical element in the building is not just used for evacuation but also for bird watching, game watching and every day circulation.

02. The relationship between your graduation (project) topic, the studio topic, your master track and your master program

Graduation and Studio Topic

City of the Future studio has a thematic emphasis on sustainable developments of future cities, acknowledging the complex systems within which we live. The future of mobility and accessibility, food and waste cycles, energy supply and social inclusiveness is disrupted by the uncertainties and unpredictable event of climate change. As former UN secretary general Ban Kim-moon said: Our struggle for global sustainability will be won or lost in cities" therefore it is the cities responsibility to incorporate movements of global prosperity, climate action, and world peace. My graduation research focused on analysing the existing policies, actions, spatial strategies in a well developed country such as the Netherlands, a country that is dedicated to improving its cities towards a more sustainable future. Yet it is facing an unpredictable future. Society is not prepared to face another year such as the one of 1953, therefore the building environment will need to redefine its relationship to nature and humans. Furthermore the studio focuses on systems and the overall setting of the building from the different domains, MBE, TIL, Urbanism, Landscape, Architecture and Building Technology, and this thematic approach allowed me to test my design through different domains, and address different systems. See how the building design reflects on material flows, current policies, critical systems and infrastructures and many other topics.

Graduation topic and Master Track

The Architecture Master Track aims to teach students how to formulate design solutions based on the encountered spatial, technical and social problem at hand. In my graduation I aim to use design as a means of research, combining disciplines of landscape as an added spatial component to my architectural toolbox. By addressing the whole scope my project goes beyond the architectural manifestation and bring architecture to a context, and vice versa. By tapping into the flows of infrastructure and spatial design I am allowing my research to demonstrate a true societal impact on a larger scale. The fine grain of the building design is resolved through the tectonics of the building in in an area of flooding. Where the aspect of materiality becomes essential, the way it responds to nature, allows it to be inhabited by it and eventually the building is demounted or becomes a landscape element.

Graduation Topic and Master Program

The MSc Architecture, Urbanism and Building Sciences Master Program aims to combine innovation and sustainability in the future of design. In line with this vision my design purposes a redevelopment of an existing industrial site in an innovative and sustainable way adapting the site to water.

03. Elaboration on research method and approach chosen by the student in relation to the graduation studio methodical line of inquiry, reflecting thereby upon the scientific relevance of the work

It is possible to divide my research into 4 phases. First part is the water management and governmental policies research, that focused on the current investments, strategies and methods of protection against flooding. This defined my scope at looking at areas where investments and flood management is more adaptive. The second phase was identifying the area of investigation and site visits. In the site visits I investigated the different spatial configurations in response to flooding through photography, interviews, sectional drawings and more research. Through this I managed to identify what are some of the cultural memories of Dordrecht and how often floods occur. The third phase focused on site choice, and turning my research into design principles, phase one and two provided a clear direction for the building in terms of water management and design techniques. Design principles were developed from the key principles of the multilayered safety approach present in my area, where as the tool of sectional drawings was related to the design process as a primary method of research. Furthermore the design is tested through 3D modeling and different water level scenarios. Other side investigations into building with water was soil analysis, material flows, landscape strategy testing, water filtration, landscape plant research and so on. All this research allowed me to identify the context in which my building sits. Whereas the building itself responds contextually to the program and the site conditions. Finally the this allowed me to form a typology where there are two main massing's of the building both anchoring to one another and forming two different architectural typologies, both addressing the issues of flooding in their own way.

04. Elaboration on the relationship between the graduation project and the wider social, professional and scientific framework, touching upon the transferability of the project results.

Within the context of sea level rise and adaptive construction my project represents and attempt to tackle a building typology outside of the dike, whitest brining social value to the site and therefore reestablishing the relationship between people and nature.

First of all my project addresses the topic of the accelerated sea level rise and how it affects the areas outside of the protection barrier. The research itself, the compilation of maps tries to bring light to the current programs and water management. So it can be used as a tool to investigate. In recent research there has been a strong focus on improving policies, water management, infrastructures and less so on spatial design. The Dutch have presented themselves as the leaders of controlling water and mitigating its flows, this has positively improved their water protection systems, improving dikes and protecting coastlines, however for centuries now the very polders society lays on has framed the perception of water as a threat and resource. Consequently this has resulted in the lack of awareness amongst individuals, a misconception that the government will always protect the people in an extreme weather environments, but it is also a responsibility of the people to take actions of their own safety, to educate themselves and their generations to come of how to live with water. As architecture, landscapes and infrastructure are our interference with nature, we as designers are responsible to

alter the way design with water. There is a great emphasis on adaptive policy, risk and water management, and building with water has solemnly focused on large scale projects in the field of landscape and urban design. There is a lack of research and architectural projects that deal with the way we build for uncertainty. In this thesis I position myself as an architect to design with water I intend to bring a new perspective to the way architecture together with a landscape strategy can redesign an area.

In recent years projects such as the *Room for the River* began by promoting new ways of designing and allowing the water to take over the site, the governmental fonds have reserved 2.4 billion euros for these projects. The Delta plan for Major Rivers has a defined a budget for 944 million euros (Steenhuis 2018, 20), and the flood protection program 2 has 2.7 billion euros, however the area of Dordrecht, and Zwijndrech do not fall under any of these program, they belong to the Multi-layer Safety Approach, where there are three main aspect: dike reinforcement, spatial planning and evacuation strategy. The dike reinforcement or the Afsluitbaar Open' Rijnmond (AOR) (Hinborch 2010, 19), are the two main solutions to protecting this area from flooding. AOR is a temporary closed/ open barriers which will disrupt the flow of fish and boats – hurting the ecosystem and the economy. As for the spatial and evacuation layer, there is a strong call for architectural and spatial redevelopment which encourage the concept of living with water. As the city of Dordrecht, Hamburg and London are part of the explore lab of "living with water" it is only appropriate that my architectural topic will explore how this might be possible through and architectural and landscape strategy. Challenging the existing impervious building skins, elevated foundations and imposed flood gates, my project is exploring a spatial strategy to the architectural design, its positioning within the site, its materialization and functional adaptation.

05. Discuss the ethical issues and dilemmas you may have encountered in (i) doing the research, (ii) elaborating the design and (iii) potential application of the results in practice

During research and design I came across several ethical dilemmas concerning human safety, investment into safety, and environmental impacts of materials choices. The first main ethical dilemma came when I began designing in section, and stacking the program on the different levels of safety. Even though I know that this area does not flood significantly because it is elevated 4 m above the N.A.P., I this hesitated to put functions on the lower level which risk damage to the property and people. In solving this dilemma I wanted demonstrate that through architecture, adequate construction techniques and well designed buildings we can safely construct near water without flooding, In rare cases of extreme flooding this part of the building can be successfully evacuated through vertical stacking, it is adequately water proofed with metal sheet pile around a raft foundation, the expensive equipment such as the boats can be pulled up, and all in all minimum damage will be made. Furthermore the site itself is programmed to flood and minimize the water exposure onto the building. The dilemma can be addressed by looking into the overall site and finding solutions through different compromises.

The second dilemma I had is the proposal of reused concrete, integrating new and current research into the recyclability of concrete and VEEP technology is exciting but also challenging as it is in process of being tested. However as I see this as an academic project, involving current research and possibilities aims to exemplify a hopeful mind, and spirit, that in this case my infrastructural gesture of using recycled concrete can be seen accepted. Furthermore, proposing that structural elements can be demounted and reused is another hopeful gesture in any design. Given that the harvest hub is still developing a method to test structural elements there are not many examples of where this is used. Reuse of windows, and other non-structural elements in my building is possible, and hopefully the market will allow it.

Applicability of lessons learned to practice

My research and design exhibit several important lessons learned which can be used in practice. The research I have done as a "traveling salesman", in other words a foreigner taking upon a Dutch topic, I was able to see some elements of water management differently than someone from the Netherlands. Through my research I was able to find out that the out of dike areas in the industrial zones around Dordrecht are safe, and that the regulations for flooding could and are already following a more adaptive approach. This also gives an opportunity for people to live and experience programs in this area. During my site visits I was impressed by the beautiful waterscapes of my area however no architecture dared to touch the link between water and land. There is a very classical and homogeneous approach to the architecture behind the dike, and I wanted to challenge this whilst still looking at the policies and safety. As for integrating nature and architecture, I tried to do this through to programmatic use, material choice and green integration as well as integrating a self sufficient supply of clean water through filtration. The site is used as both as a leisure and as productive landscapes, natural bioswells clean the water and allow me to connect the gray water from neighboring buildings inside the dike to my building which is outside of the dike. This explored a contextual possibility, using the existing landscape of the dike and surrounding, reusing the dug out soil to create a sloped site which will allow the sloped positioning of my bioswells. As for the building itself I began designing using the design principles of Dilip and Mathur. I was constantly referring to by building in section, understanding how the program and materials are stacked in section. In areas such as mine this can be seen as a different approach to design and perhaps even surveying. Zoning areas of flooding in section to create more accurate maps for people to build in this area.

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References

Amelia LeavesleyResearch Fellow, University of Melbourne, 2012 "*City Climate Leadership A Model For Sustainability*". Pursuit. https://pursuit.unimelb.edu.au/articles/city-climate-leadership-a-model-for-sustainability#:~:text=CITIES%20FOR%20TRANSFORMATIVE%20CHANGE,or%20Sustainable%20Cities%20and%20Communities.

Kirchengast, Albert. 2012. *Rising Waters, Shifting Lands.* Zürich: Gta Verlag.

Steenhuis, Marinke. 2018. *Beyond The Dikes*. NAi Uitgevers / Publishers Stichting.

Hinborch, Milan. 2010. "Flood Defence Town Centre Dordrecht". Master Thesis, TU Delft.

The CODE

Atlas of Water

Atlas of Water

"The map is not the territory"
- Alfred Korzybski

At-las
/Átlas/

a collection of maps; a bundle of maps of Earth or a region of Earth. An atlas contains information of geographical features, topography of an area's landscape and political boundaries.

maps reveal interests of those who drew them

Wetness
/ˈwɛtnəs/

"There is no such thing as dry land. Wetness is everywhere to some degree. It is in the seas, clouds, rains, dew, air, soils, minerals, plants, animals. The sea is very wet; the desert less so."
(Mathur, A. and Da Cunha, D., 2019)

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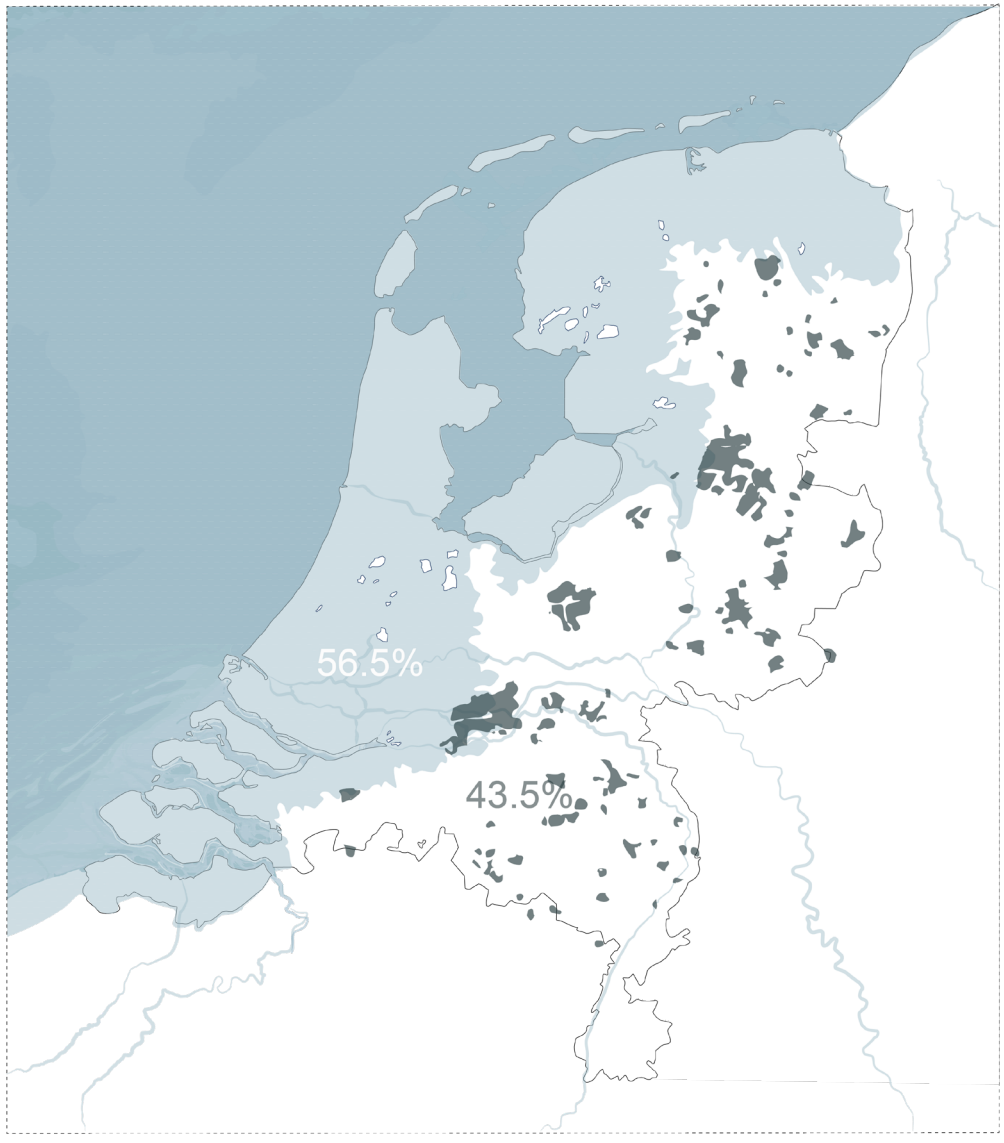
Water Authorities

The complexity and sensitivity of global climate change has a great impact on the way we plan, build, and live within our current environments. To successfully tackle the crisis and uncertainties of climate change we must form strong national partnerships. For example, the United Nations has formed Sustainable Development Goals (SDGs) to help tackle this global challenge together. As the former UN secretary-general, mister Ban Ki-moon said: Our global struggle to archive sustainability will be lost or won in cities. Therefore, cities are responsible to incorporate movements of climate actions, global prosperity, peace, and human rights.
According to the World Meteorological Organization, the past decade was by far the warmest since the measurement began and the world is not being able to keep up with the Paris climate goals. In line with the increasing temperature, there has been an acceleration in sea level rises, causing more extreme weather conditions that directly affecting the livability of our cities. On a national scale, many countries with access to the sea and rivers are facing major challenges in the coming 50-100 years. In the future, planning, policies and regulations are not enough to accommodate consequences of climate change. Instead of planning and predicting scenarios government, and municipalities are prepared to take a more adaptive approach to management, planning, organization, and risk management. However this is not enough, in order to succeed in our battle with climate change we need to incorporate design and spatial planning in our cities of the future. Not only designing our cities to prevent flooding and build resilience but also obtain an added value, perhaps altering our relationship with water, how we build and live with water.



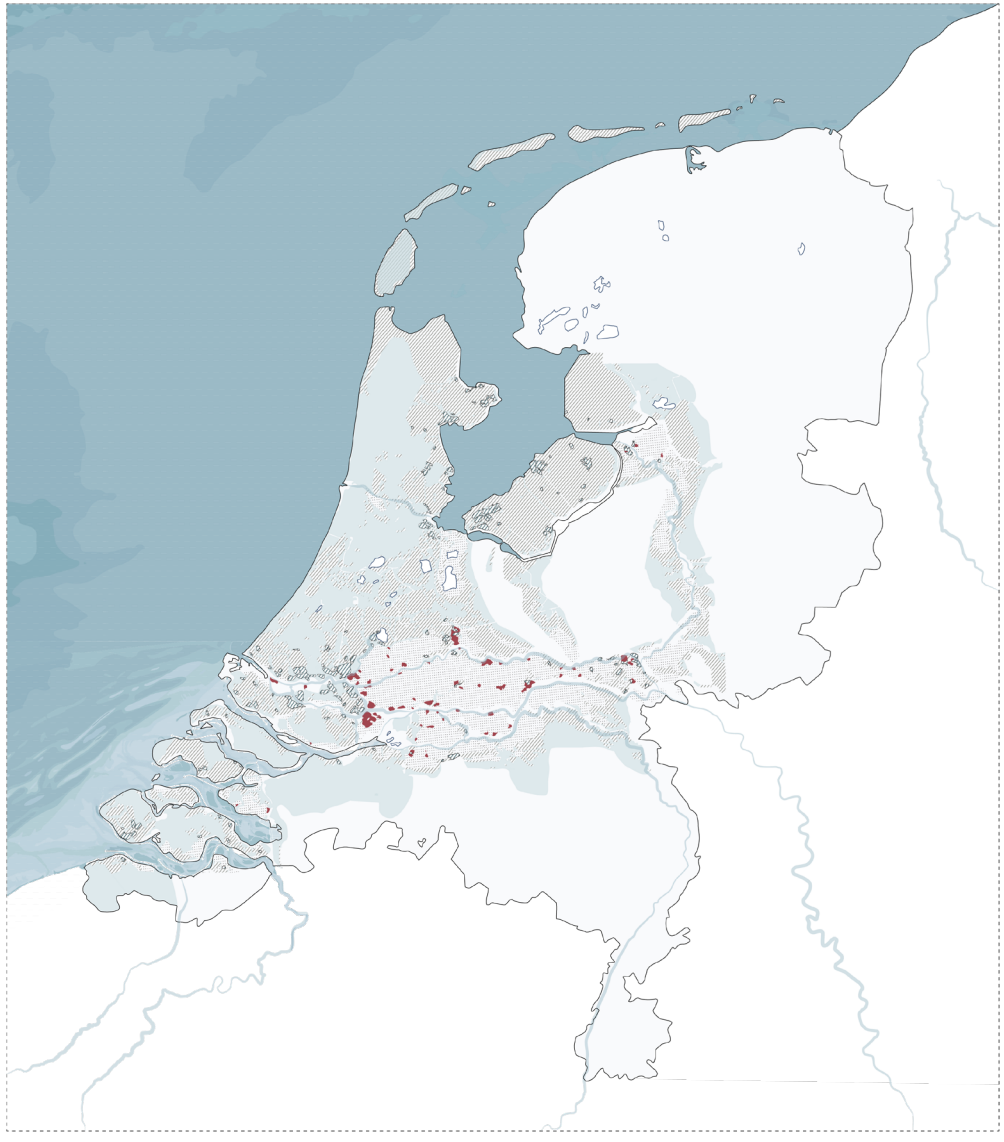
Drawing by Author (source: StudioFresh, 2020)

Rising Sea level

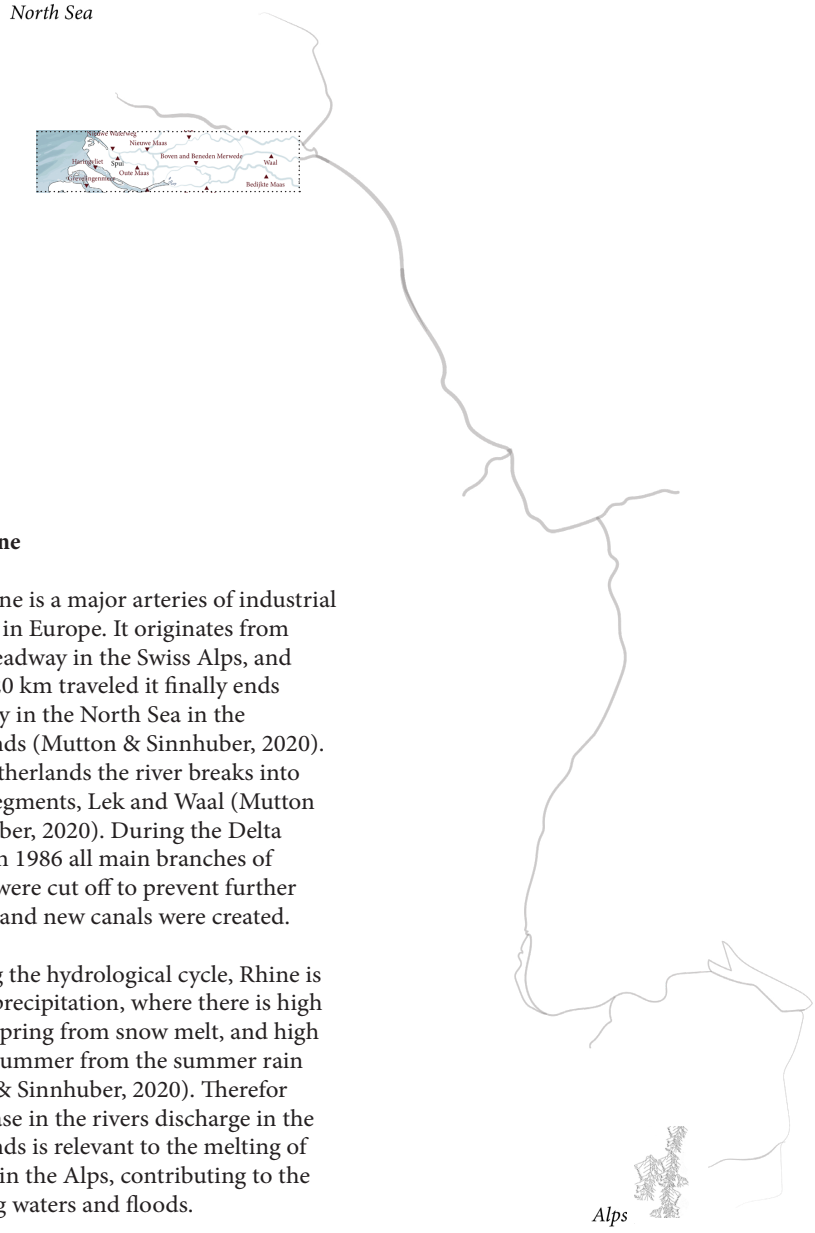
Sea level rise along the Dutch coast and globally 1890-2018 has risen steadily over 129 years by approximately 24 cm, or an increase of 1.9 mm per year. The main cause for this rise is the expansion of warming seawater and the melting of glaciers and land ice in Greenland and Antarctica. Satellite observations over the period 1993-2020 show that in some places the sea level falls by 6 mm / year, but sometimes also rises by 10 mm / year. The global average for the period 1993-2020 is 3.0 mm / year. Recent research shows that in many places the sea level is not only rising, but that the rise is also accelerating. This is especially true for the Pacific.
Observing the Dutch coastline there are 2 scenarios that are possible, a 'low temperature scenario' and a 'high temperature scenario', resulting in 2 or 4 Degrees Celsius. The sea level rise is 15cm to 35cm by 2050 and 35cm to 85cm by 20100. However if we also take land subsidence into consideration this is an additional 10cm until 2100, which is approximately 65cm to 130 cm by 2100.

River discharge

In my thesis I will focus on the area which is encompassed by the river Oude Maas, Beneden Merwede, Noord, and Wantij. There rivers are the branches of the river Rhine that originates in Bonn, Germany and ends in the North Sea. Due to the increase of the sea level water, there will be a decrease in the summer discharge and an increase in the winter discharge of the river Rhine. The chance of the increase in the discharge of the river Rhine to 22.000m3/s by 2100 went from 1 in a 50 to 1 in a 10 chance. The top discharge by 2050 is predicted to be 16. 000m3/s and 18.000m3/s by 2100. This can result in the flooding of urbanized delta areas such as the Rijnmond and Drechtsteden.



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



River Rhine

River Rhine is a major arteries of industrial transport in Europe. It originates from a small headway in the Swiss Alps, and after 1, 320 km traveled it finally ends its journey in the North Sea in the Netherlands (Mutton & Sinnhuber, 2020). In the Netherlands the river breaks into smaller segments, Lek and Waal (Mutton & Sinnhuber, 2020). During the Delta projects in 1986 all main branches of the river were cut off to prevent further flooding, and new canals were created.

Following the hydrological cycle, Rhine is fed with precipitation, where there is high water in spring from snow melt, and high water in summer from the summer rain (Mutton & Sinnhuber, 2020). Therefor the increase in the rivers discharge in the Netherlands is relevant to the melting of the snow in the Alps, contributing to the increasing waters and floods.

The Netherlands, a Land of Water

Drawing by Author (source: Steenhuis 2018, 18)

Management and Control

The water system in controlled through three administrative forces: central governmental, the provinces, and the water authorities (Steenhuis 2018, 18). Rijkswaterstaat is in charge of executing projects and forming new policies. The role of the provinces is to implement spatial planning and guide regional organizations (Steenhuis 2018, 18). Together these three forces for the Security Regions, that are responsible for the disaster management (Steenhuis 2018, 18).

Mayor investments go towards the barriers protecting land and water from the sea, and primary flood defenses are formed around major rivers and lakes. The responsibility of maintaining these flood defenses lays in the hands of the water authorities (Steenhuis 2018, 18).

The map on the right is redrawn to show the water authorities of the Netherlands. The area I am focusion on is situated in the Hollandse Delta water authority.

Water Authorities
Drawing by Author (source: Steenhuis 2018, 18)

The Large - Scale Programmes

After the catastrophic North Sea in 1953 the water authorities commissioned large - scale programmes across rivers and coast. These are the Delta Plan and the Delta Plan Major Rivers (Steenhuis 2018, 20). The approach to dealing with floods and emergency changed, as the strategy to act after the disaster was not sufficient enough, instead water authorities focus on dealing with the issues ahead of time. New projects became favored, such as the Room for the River and Meuse Works, where nature and water were addressed as the main design actors curating development (Steenhuis 2018, 20). Part of these programs is to upkeep, maintain and asses primary flood defenses to insure their performance during major floods.
The leading powers of water authorities, provinces, municipalities and central government together with knowledge institutions (such as TU Delft), communities citizens business are coming together to advise solutions for future water management (Steenhuis 2018, 20).

Implementing urgent dike reinforcement on approximately 1,000 km of dike and embankment trajectories along major rivers and dikes along IJsselmeer and in the southwest delta.

(Steenhuis 2018, 20)

Delta Plan Major Rivers (budget 944 million euros)

Drawing by Author (source: Steenhuis 2018, 20)

Flood protection Meuse, improve spatial quality and self-funding through raw material extraction

(Steenhuis 2018, 20)

Maaswerken (Meuse Works) (Grens- en Zandmaas) (budget 558 million euros)

Drawing by Author (source: Steenhuis 2018, 20)

Stone revetments on the dikes alongst the Ooster- and Westerschelde were not strong enough

(Steenhuis 2018, 21)

Stone revetments Zeeland (budget 740 million euros)

Drawing by Author (source: Steenhuis 2018, 21)

Source (Holmes, 2017) Photo by Siebe Swart

Room for the River project

Unlike the Dutch method of the dike reinforcement through dike extrusion, or rematerialization [ect], Room for the River project echoes a new way of preventing river flooding through the increase of water territory. The goal is to increase the water discharged capacity up to 10% (Peters 2020). This method alters the way land is used, and involves an elaborate spatial planning collaboration with local authorities to enhance and better the spatial experience.
The total budget for this project is 2.4 billion euros and it is to be implemented in 30 river locations (Steenhuis 2018, 21).

This project, being of new and unexplored nature, bares certain risks. These risks are managed through the local authorities, making sure that the social and spatial impact it has does not damage the existing land ownership, and safety (Peters 2020).

Room for the River improves flood protection (from 15,000m^3/ sec to 16,000m^3/ sec water discharge) and improves spatial quality.

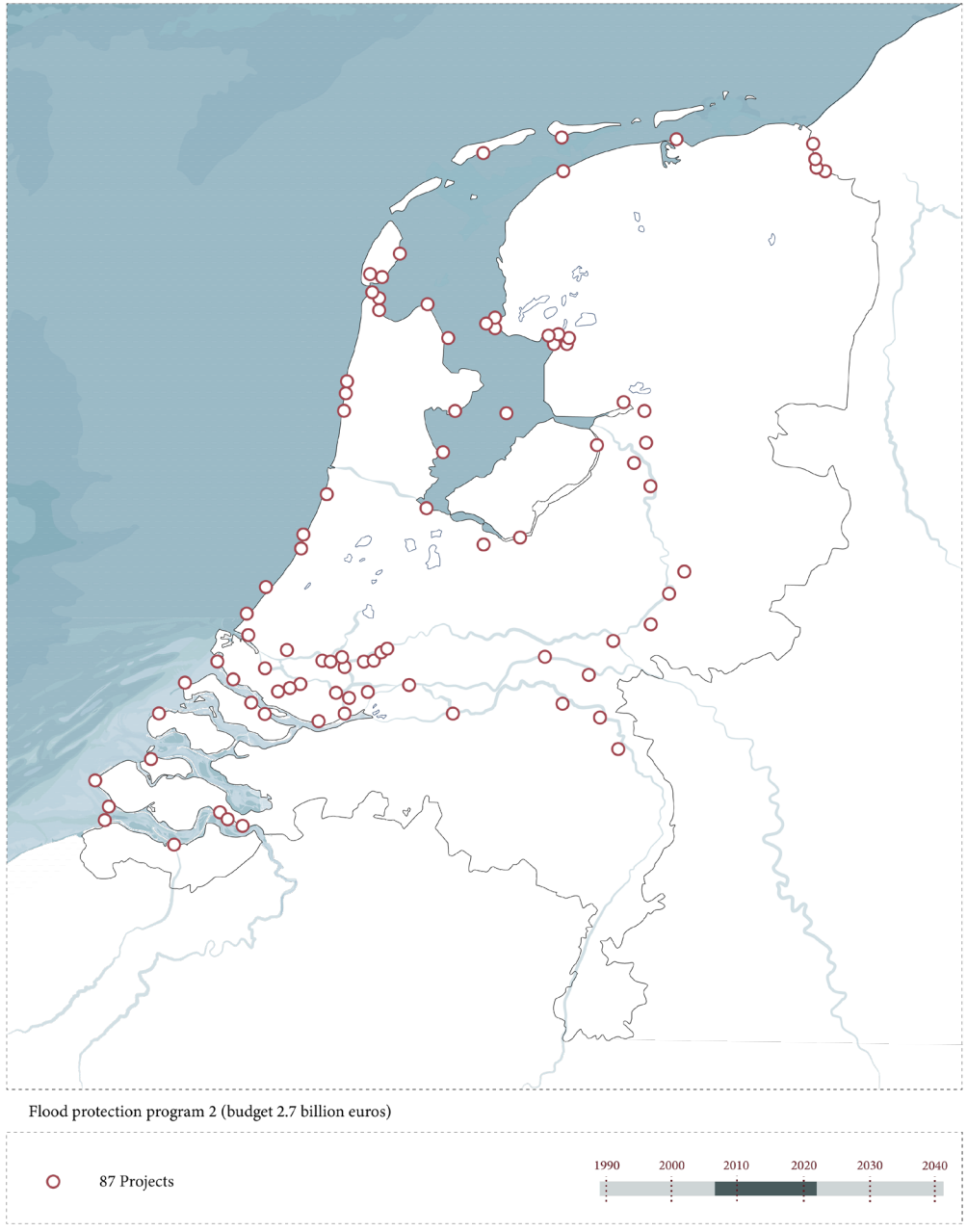
(Steenhuis 2018, 21)

Room for the River (budget 2.4 billion euros)

Drawing by Author (source: Steenhuis 2018, 21)

Reinforcement of 362 km of dikes, dams and dunes and 18 civil/hydraulic engineering works so they so they conform the norm

(Steenhuis 2018, 21)



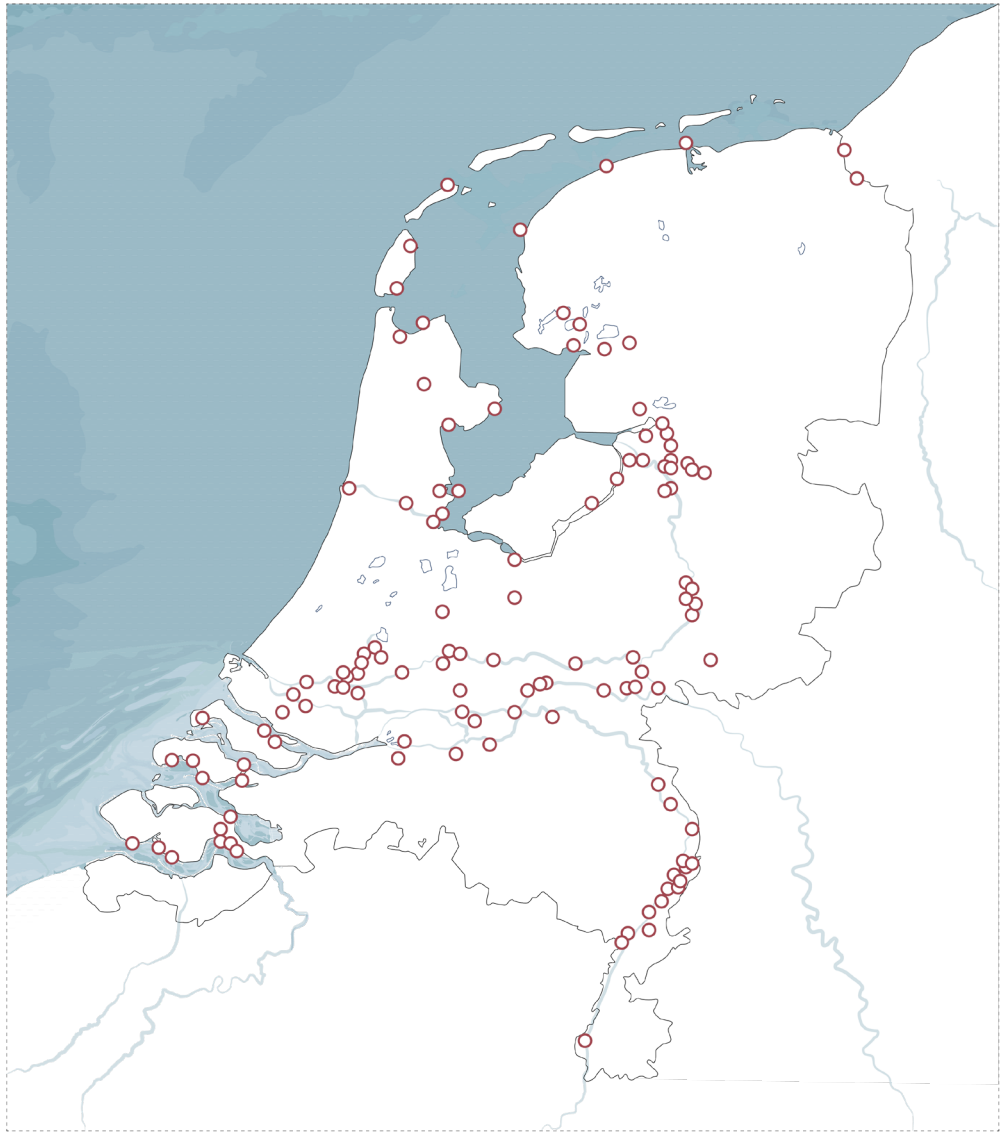
Flood protection program 2 (budget 2.7 billion euros)

Drawing by Author (source: Steenhuis 2018, 21)

Goal for 2022 - 803 km of dike and 468 civil/ hydraulic engineering works

Goal for 2050 - 140km more of dike work

(Steenhuis 2018, 21)

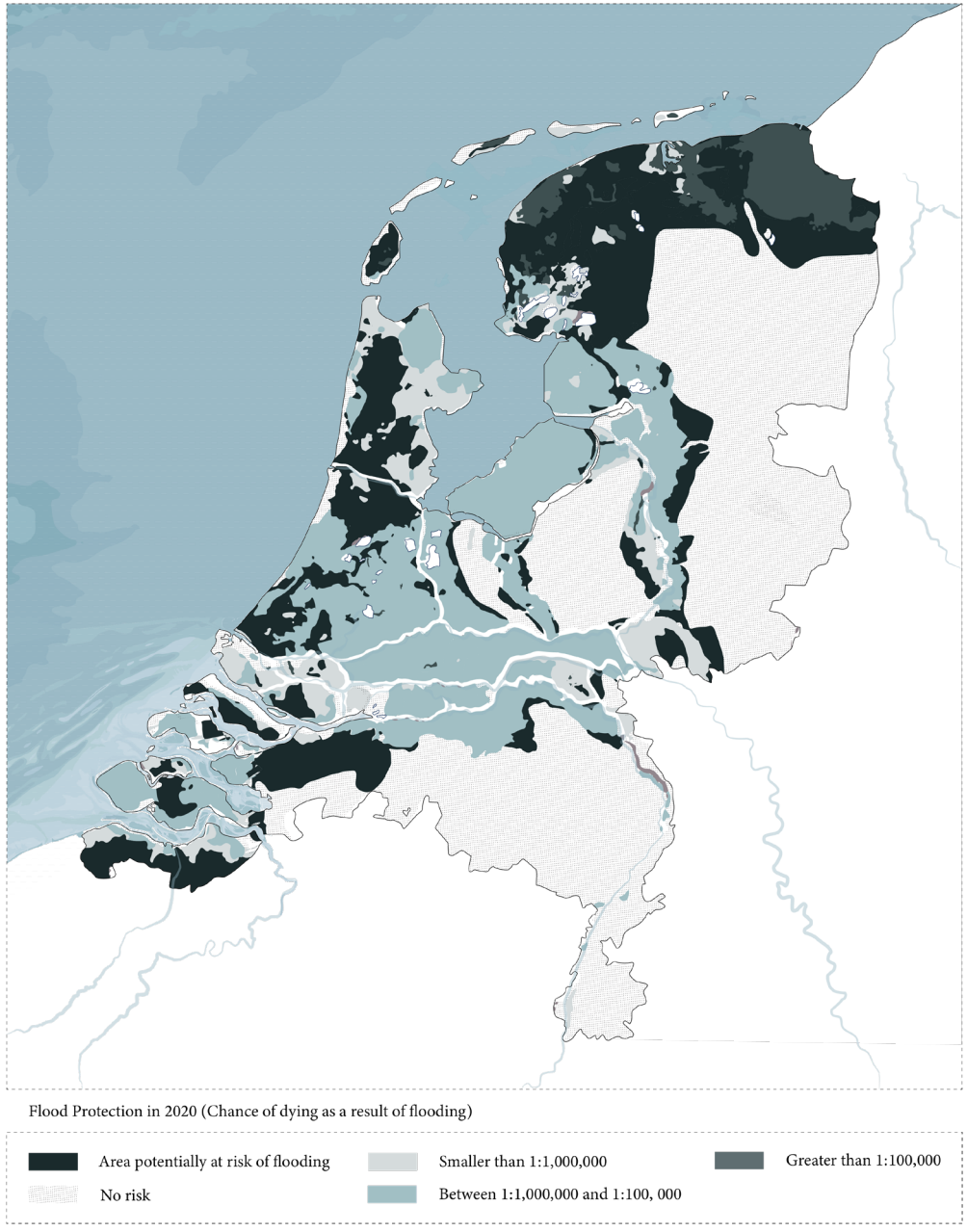


Flood Protection Programme 2014-2030 (budget 4.9 billion euros)

Drawing by Author (source: Steenhuis 2018, 21)

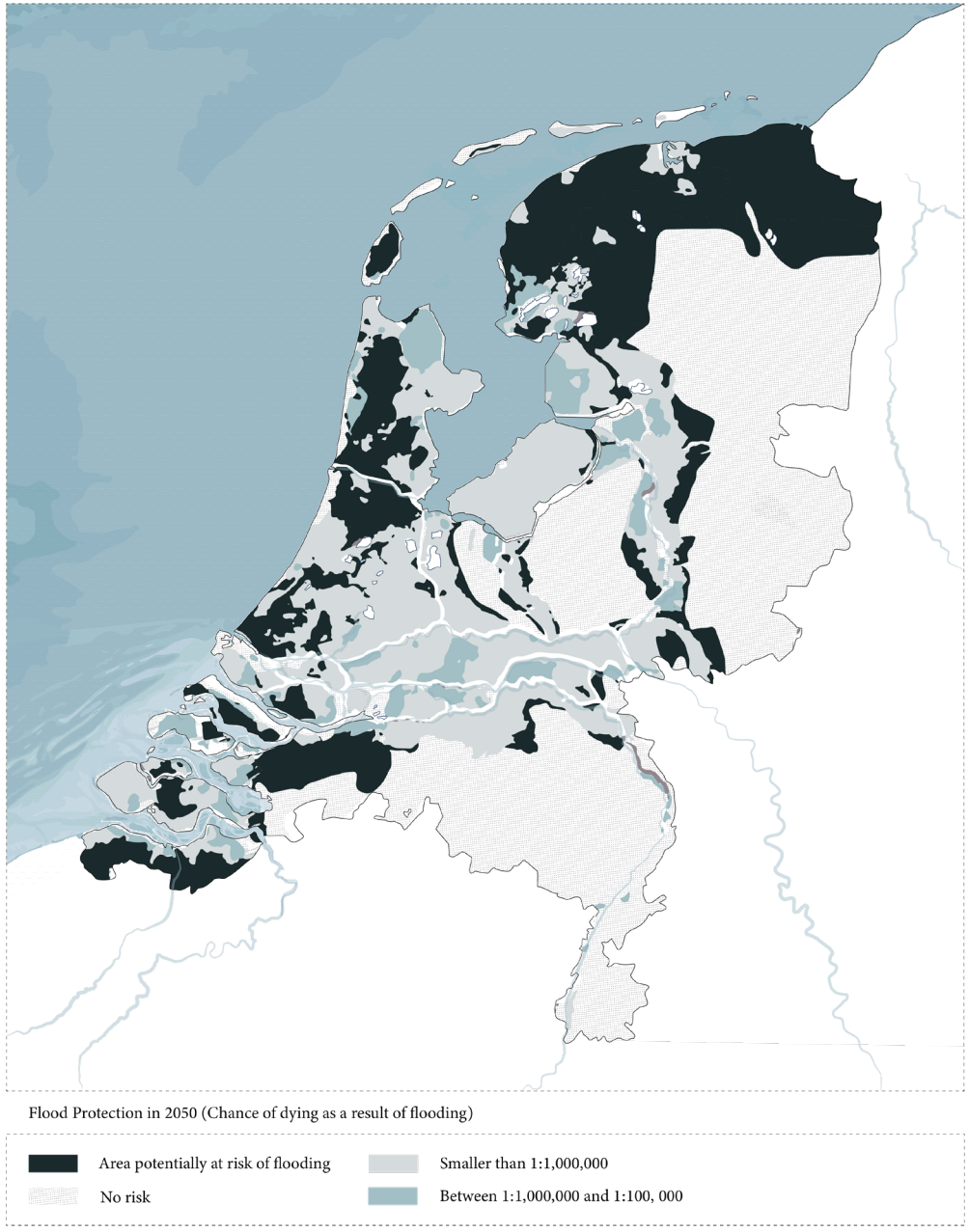
New Flood Defense Policy

Since 2017 the Netherlands has set out new defense policies which are not only based on the chances of flooding but also the consequences of flooding and the impact it has on the inhabitants (Steenhuis 2018, 22). The basic protection applies everywhere in the Netherlands and that is the chance of dying due to flooding is not greater than 1: 100,000 per year (Steenhuis 2018, 22). If the area is at more risk than this, the area is given extra protection.



Flood Protection in 2020 (Chance of dying as a result of flooding)

Drawing by Author (source: Steenhuis 2018, 23)



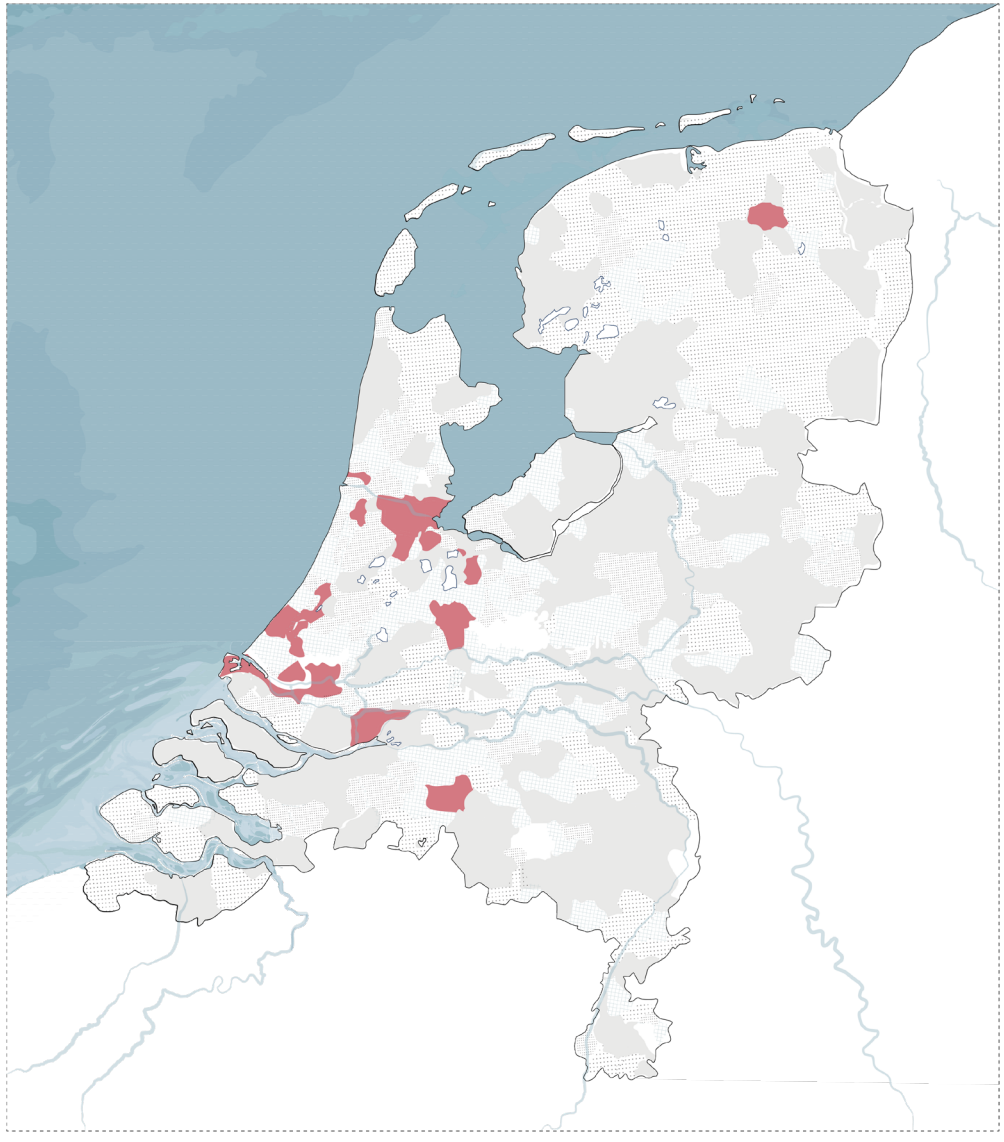
Drawing by Author (source: Steenhuis 2018, 23)

Urbanized Areas in the Netherlands

Urbanized delta regions are a construct of dynamic and diverse natural environments that is complimented by a dynamic economic and urban developments (Meyer and Nijhuis n.d., 7). Some of the largest and most developed metropolitan regions have taken an advantage of the benefits delta areas bring, from fertile landscape, trading position, however these areas also deal with vulnerabilities of flooding, salinization and silting (Meyer and Nijhuis n.d., 7).

In the Netherlands, and across the world, the phenomena of urbanization has been extremely present on the last decades. From 1997 to 2002, according to CBS, number of people living in urban environments has risen from 39.9 to 41.5 percent (van Leeuwen, 2004). Development of industries, cities and living has formed around delta areas.

On the map of urbanized areas (right) the extremely urbanized municipalities are municipalities with 2500 addresses or more per km2 (Vanham, Mak & Gawlik, 2016). These are cities such as Amsterdam, Rotterdam Dordrecht [ect]. Strongly urbanized municipalities are municipalities with 1500 to 2000 addresses per km2 such as Eindhoven, Maastricht, Nieuwegein and Venlo (Vanham, Mak & Gawlik, 2016).



Drawing by Author (source: Statistics Netherlands, 2016)

Salinization

The salinization is an increase in salt concentration of fresh surface and ground water ("Salinization Definition und Bedeutung | Collins Wörterbuch", 2020). This represents a major issue with the rising sea level, as salt water contaminates fresh water used for industries, agriculture, drinking water [ect]. Food production is most affected by this phenomena, as the soil becomes salinized the crops becomes harder to yield. According to research 75 countries face this issues and more than 1 billion hectares of total land is at risk (Ghassemi, Jakeman, & Nix, 1995). Furthermore, due to the increasing sea-level rises this phenomena is permanently changing existing ecosystems, and damaging biodiversity. The weakness and damage the soil, further causing instabilities in the soils construct which affects existing construction, infrastructure and architecture.

Salinization in the Netherlands

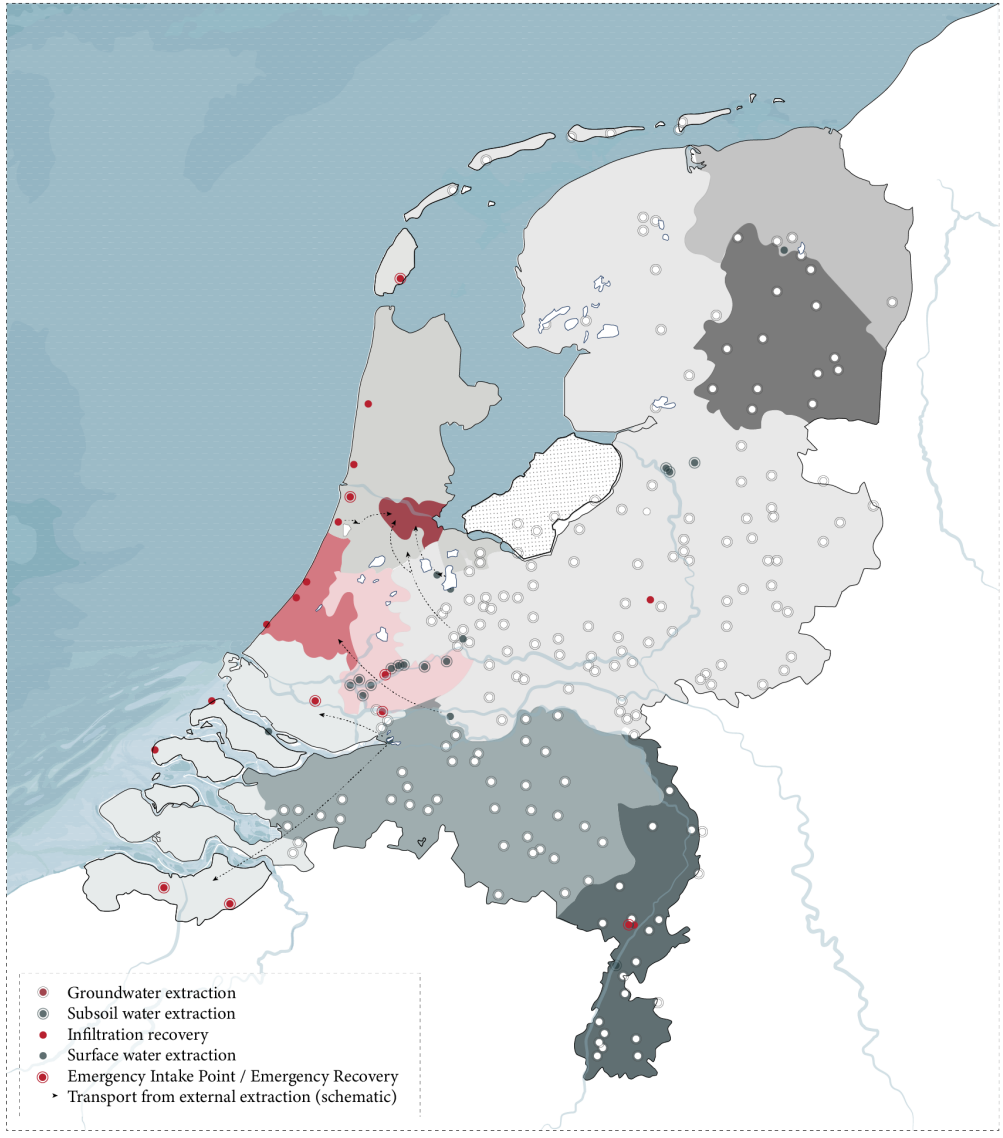
The Netherlands is prone to salinization because of two main reasons:
1. 25% land is below sea level (Huisman et al., 1998)
2. 600.000 ha of land is made of polders*

In the first case the land which lays below the sea level water, saline ground water reaches the surface by upward groundwater flow (saline seepage) (Oude Essink et al., 2010).This affects the drinking water supply, industries, and irrigation (de Louw et al., 2010). According to the map salinization of ground water is most common in the coastal areas where the land meats the North Sea. The m

* "A polder is a large tract of low-lying wetland or former sea floor partially or wholly encircled by dikes and drained mostly with pump" ("Geography in the News: Polder Salvation", 2020)

Depth of fresh-salt interface in meters below the surface level *((CI = 1g/l) m BGL - water is classified as saline in the Netherlands)*

Drawing by Author (source: Salinization and agriculture in the Netherlands: benchmarking stakeholder perspectives, 2019)



Distribution areas for water companies (*dutch: Distributiegebieden waterbedrijven*)

Drawing by Author (source: Evides, 2020)

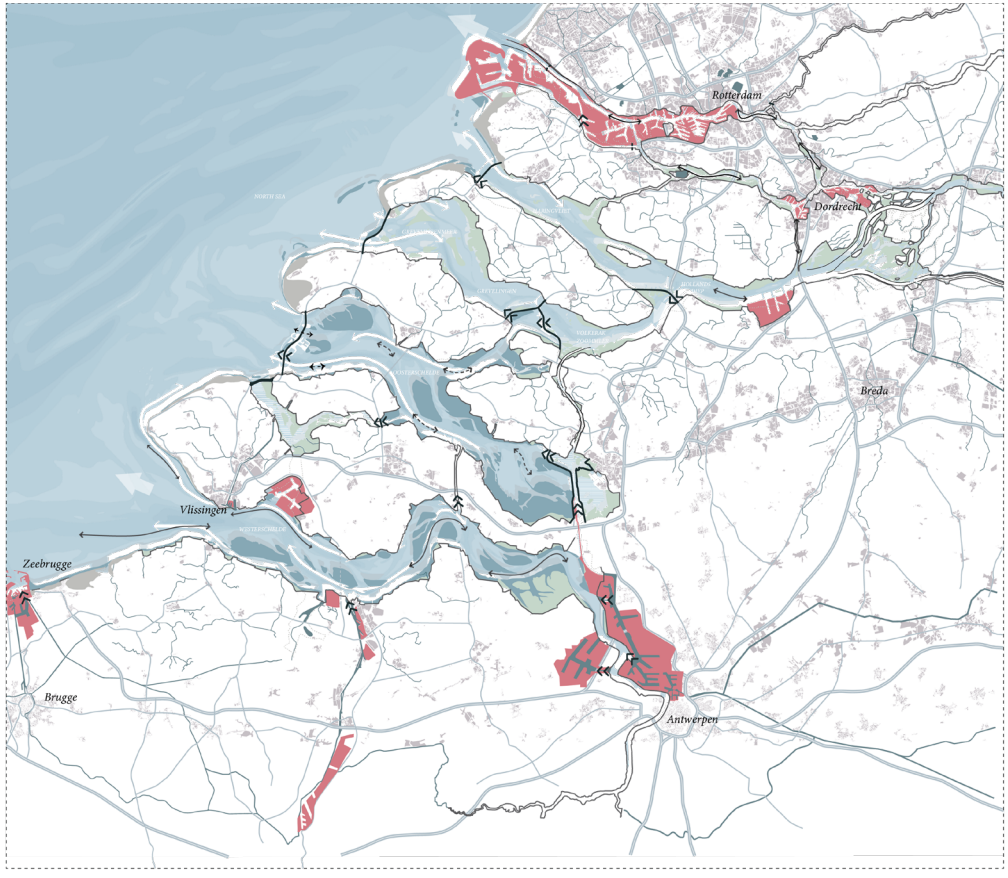
Drawing by Author (source: PBL Netherlands Environmental Assessment Agency / Rijkswaterstaat-Waterdienst, 2010)

Rijnmond and Drechtsteden

The Maesland barrier is designed to withstand 50cm of sea level rise making it suitable at least until 2050 (Hinborch 2010, 19). However in the long term planning there should be additional measurements implemented to prevent flooding. In the planning agenda for the Rijnmond and Drechtsteden area there is a proposal to create a so – called 'Afsluitbaar Open' Rijnmond (AOR), which translates to "Usually Open, Occasionally" closed Rijnmond (Hinborch 2010, 19). The concept behind this planning is to close off the the Maeslant barrier, Haringvliet sluices, Hartel barrier, and an additional 4 barriers when there is an increase in the water levels (figure x)(Hinborch 2010, 19). This will direct the water into the southern delta. In this proposal cities protected from these rivers will need less dike reinforcement as their primary dike systems will become secondary. However, this project still does not guarantee that the water rises will completely lessen in these areas and therefor dike reinforcements and spatial adaptations of these areas still remain in the Delta Programs agenda (Hinborch 2010, 19).

Water rises and consequences in Dordrecht

The thesis focuses on the area outside of the dike in Drechtsteden. Drechtsteden is made up of 3 cities, Dordrecht, Zwirdrecht and Papendrecht. In the north of the island Dordrecht is divided into two parts: 1. Diked historical center, and 2. Not diked port area. The chances of the flooding in this area is 1/ 2000 , and for this reason the Delta Program has planed on improving the dikes and increase it safety to 1/4000 or even 1/10000



Drawing by Author (source: Meyer and Nijhuis n.d., 47)

Water rises and consequences in Dordrecht

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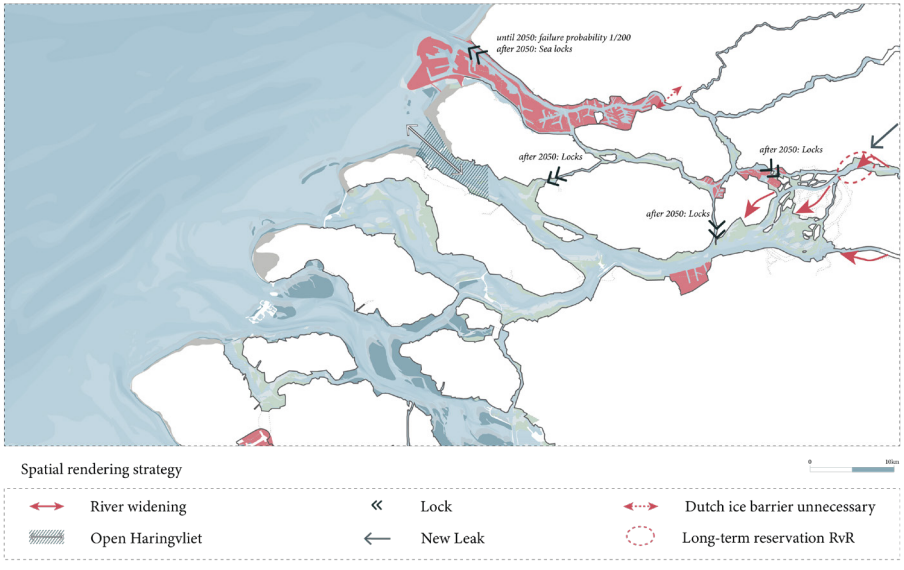
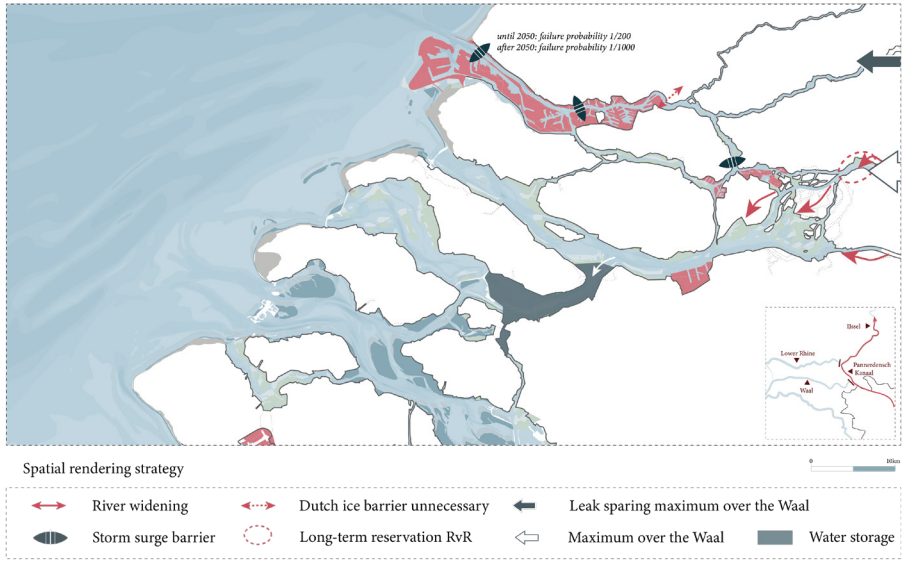
1 Shopping street in the Historic city centre
2 Stop longs are metal barriers that are put up by people to close off streets, doors, bridges [ect] and prevent flooding from entering certain parts of the city



Drawing by Author (source: Jeuken, Slootjes and de Bruijn 2012, 5)



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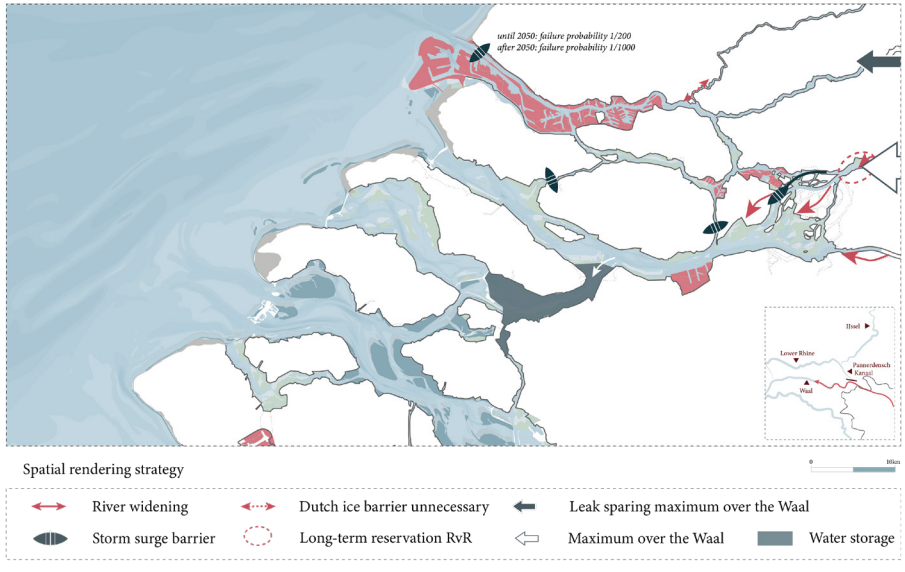


Drawing by Author (source: Jeuken, Slootjes and de Bruijn 2012, 5)

The TERRITORY

Territory programmed by CODE

Atlas of Sections

Soil Extraction

Content

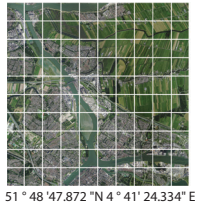
The following segment demonstrates a visual approach to understanding territory. By framing the territory as it is coded by the dike. I use visual representation to break down the site in out of dike area and safe areas, after that I analyze the programmatic functions of the site. What entities are places outside of the dike, what functions allowed in the unsafe area?

Scales

national

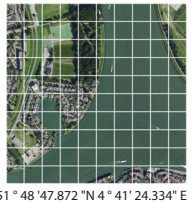
52°12'46.77" N 5°16'45.73" E

regional



51 ° 48 '47.872 "N 4 ° 41' 24.334" E

site intervention



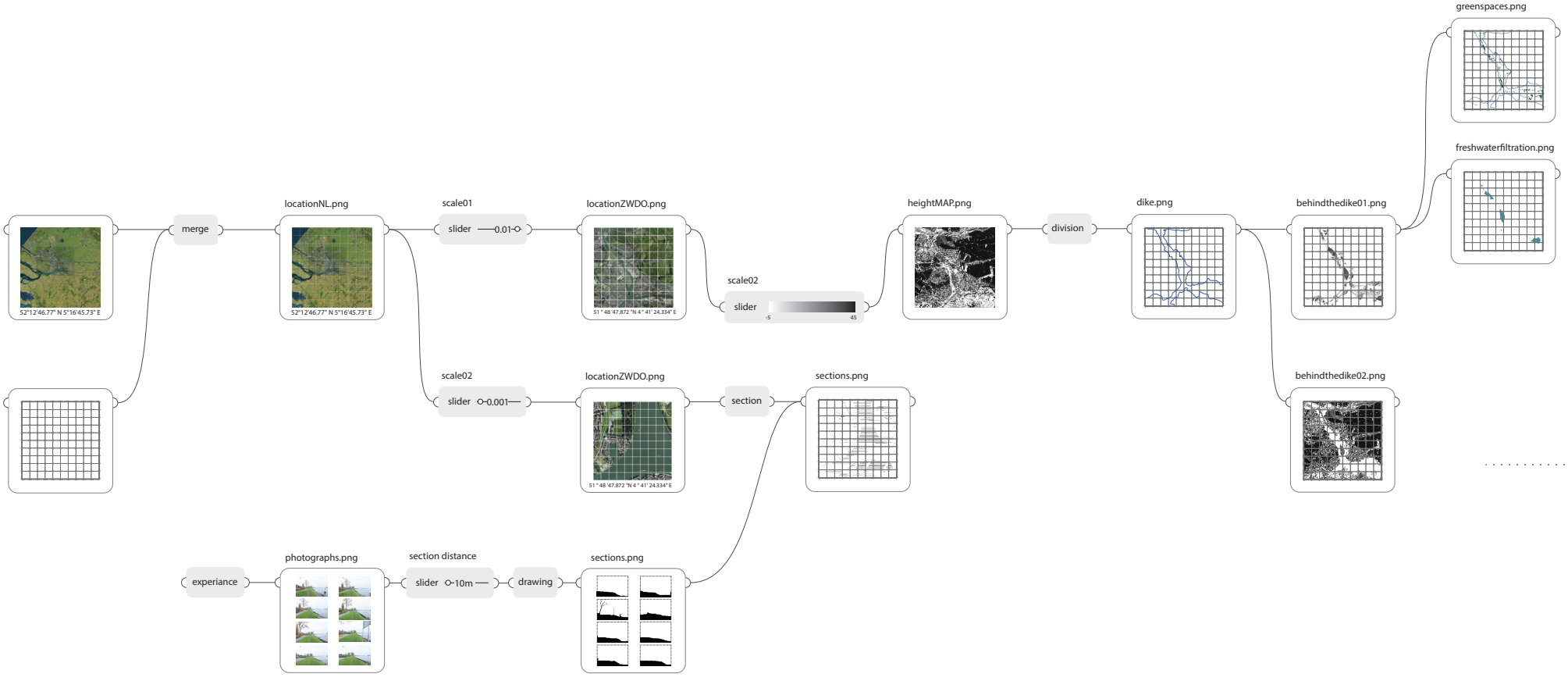
51 ° 48 '47.872 "N 4 ° 41' 24.334" E

Research fields
+
focus

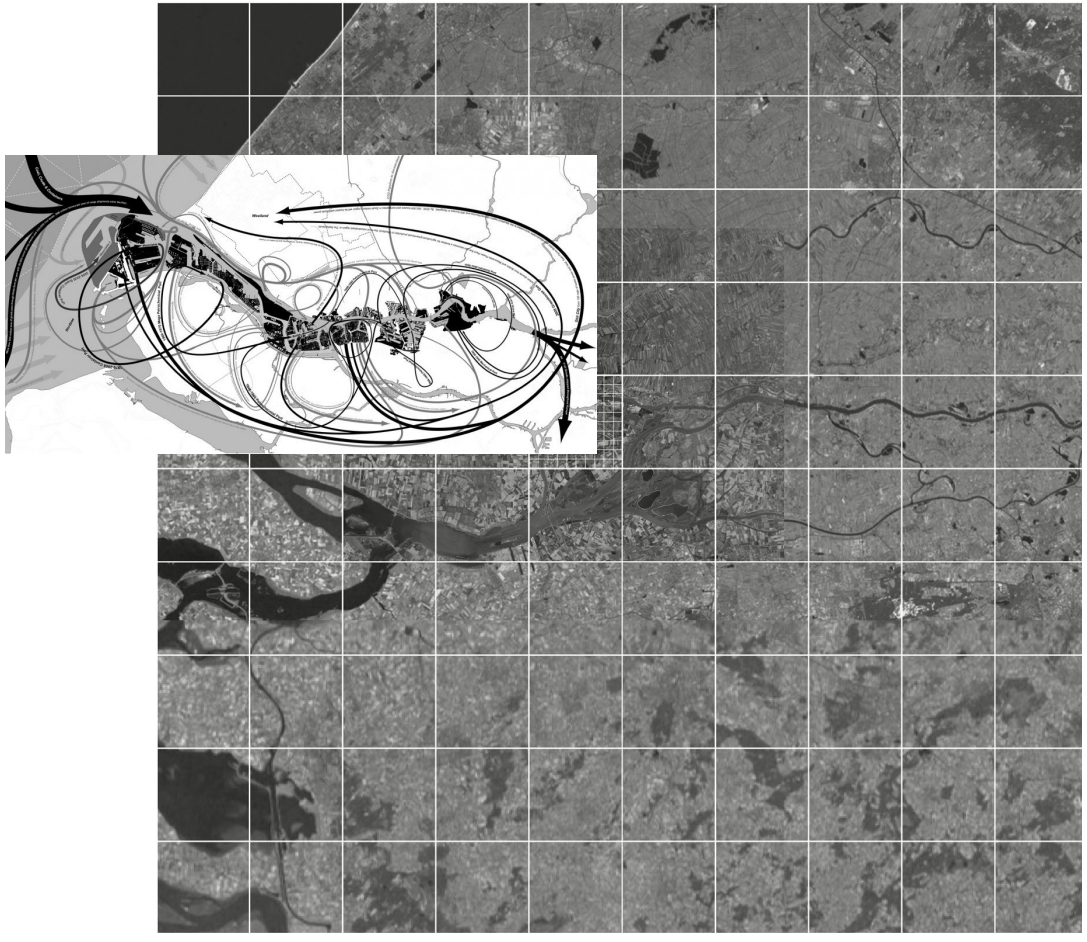
Water management
Risk management
Water flows

Water flows
Economy flow
Ecological flows
Waste flow
Existing program

Water flows
Ecological flows
Waste flow
Existing program
Cultural flows


52°12'46.77" N 5°16'45.73" E
merge
locationNL.png
52°12'46.77" N 5°16'45.73" E
scale01
slider
0.01
locationZWDO.png
51 ° 48 '47.872 "N 4 ° 41 ' 24.334" E
scale02
slider
-5
45
heightMAP.png
division
dike.png
behindthedike01.png
greenspaces.png
freshwaterfiltration.png
scale02
slider
0.001
locationZWDO.png
51 ° 48 '47.872 "N 4 ° 41 ' 24.334" E
section
sections.png
behindthedike02.png
experiance
photographs.png
section distance
slider
10m
drawing
sections.png

10000 km² - territory of water

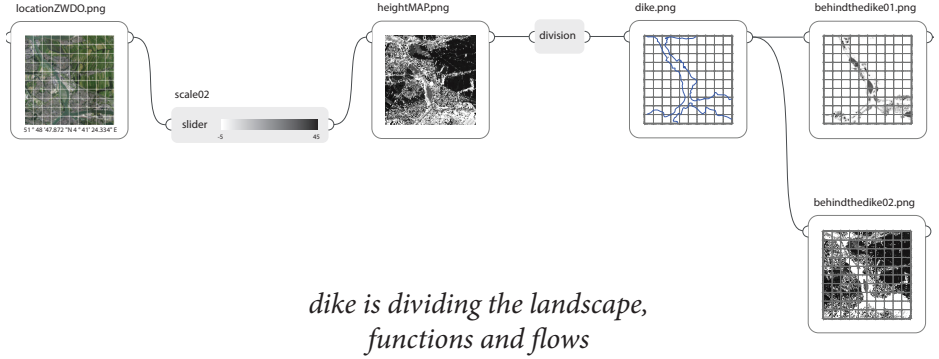


10000 km² - territory of water

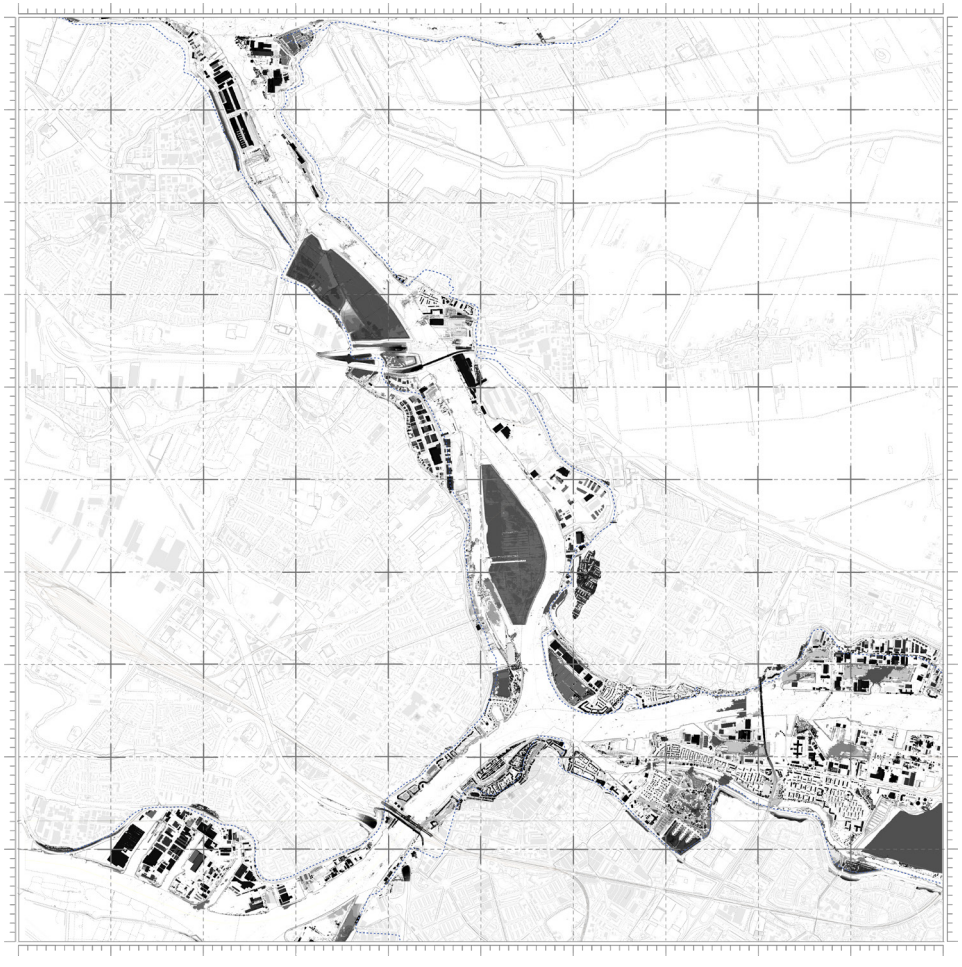
Waste Ecologies

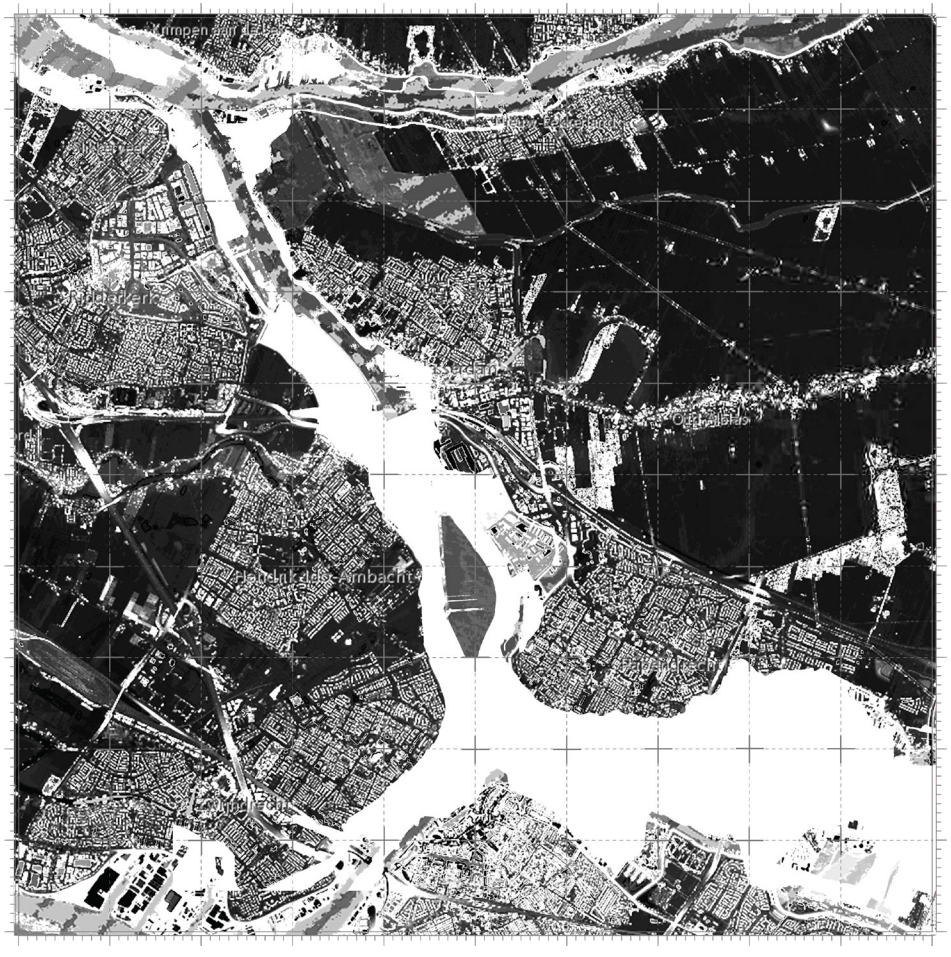
100 km² - tail of the 3 rivers
territory of water

100 km² - tail of the 3 rivers
territory of water



dike is dividing the landscape, functions and flows



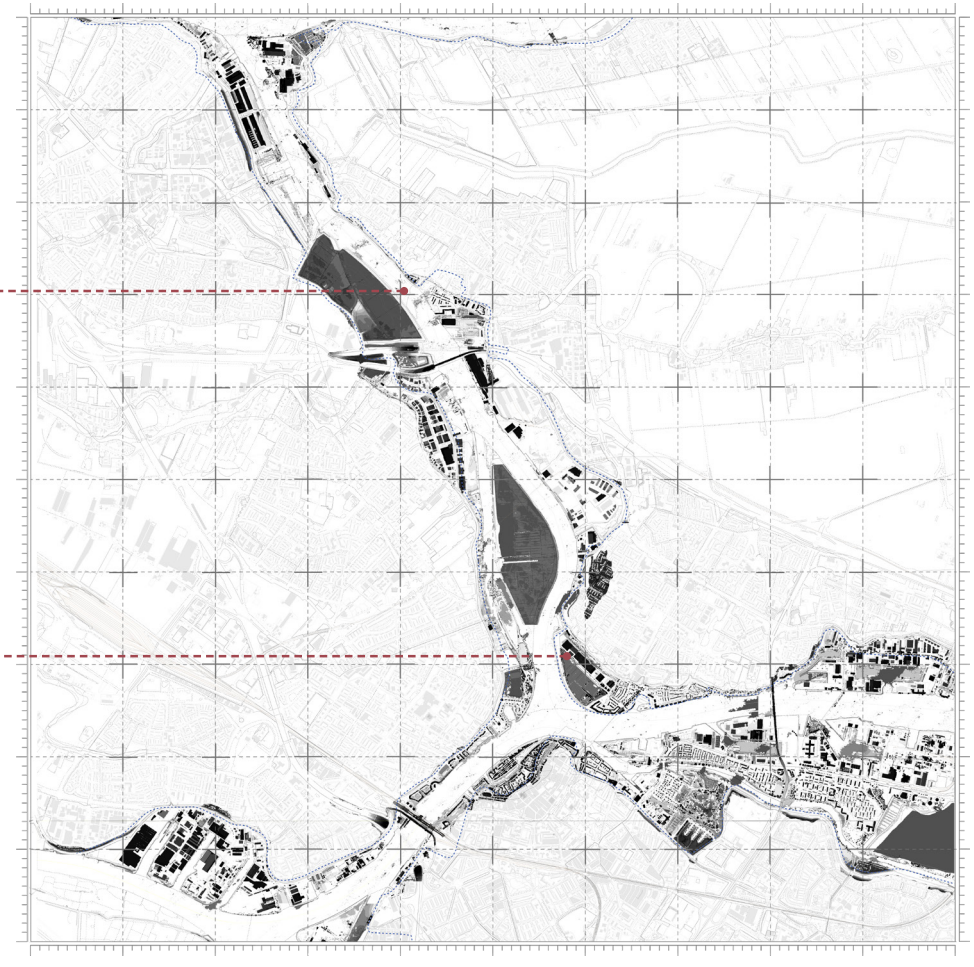


Oude Maas
Main trading route
(toxic materials - propane, ammonia, diesel, gasoline)

fishing

AOR

'Afsluitbaar Open' Rijnmond (AOR)



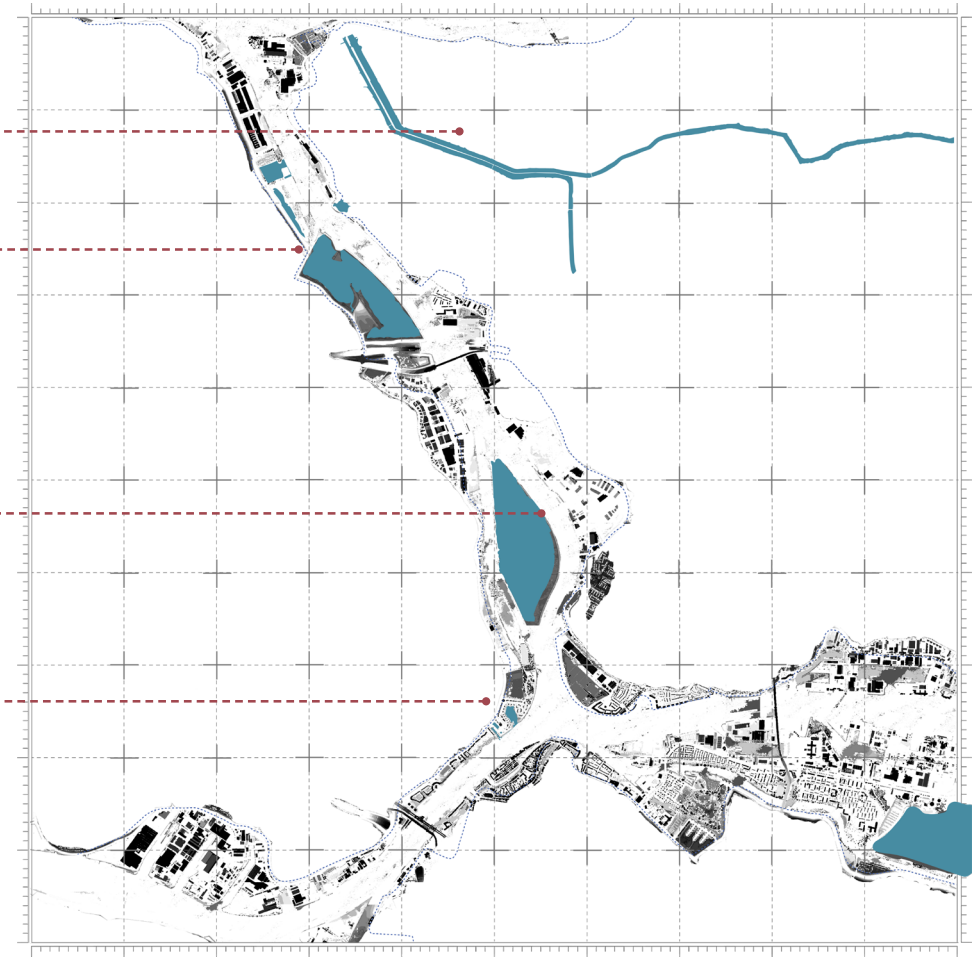
territory behind the dike

kinderdijk

water filtration

natural habitat
bird watching

water tower -
water extraction



water filtration & control

perception

water filtration

golf activity

clean energy supply

camping, windsurfing, cannoying

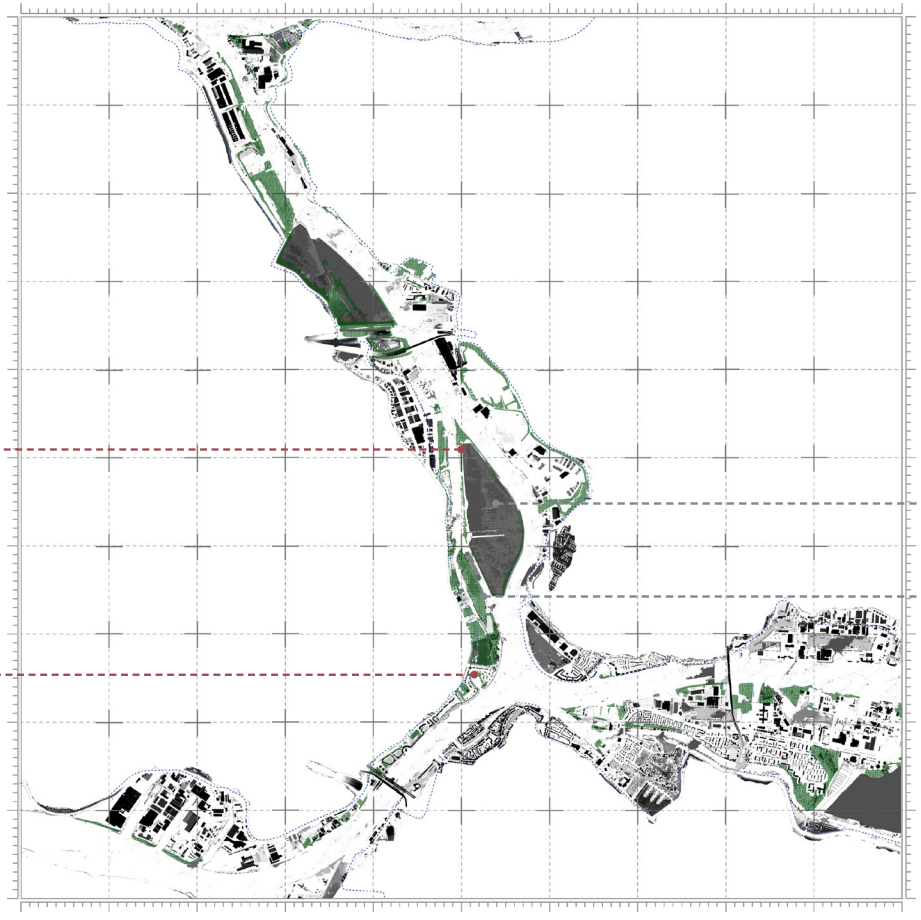
program of spaces

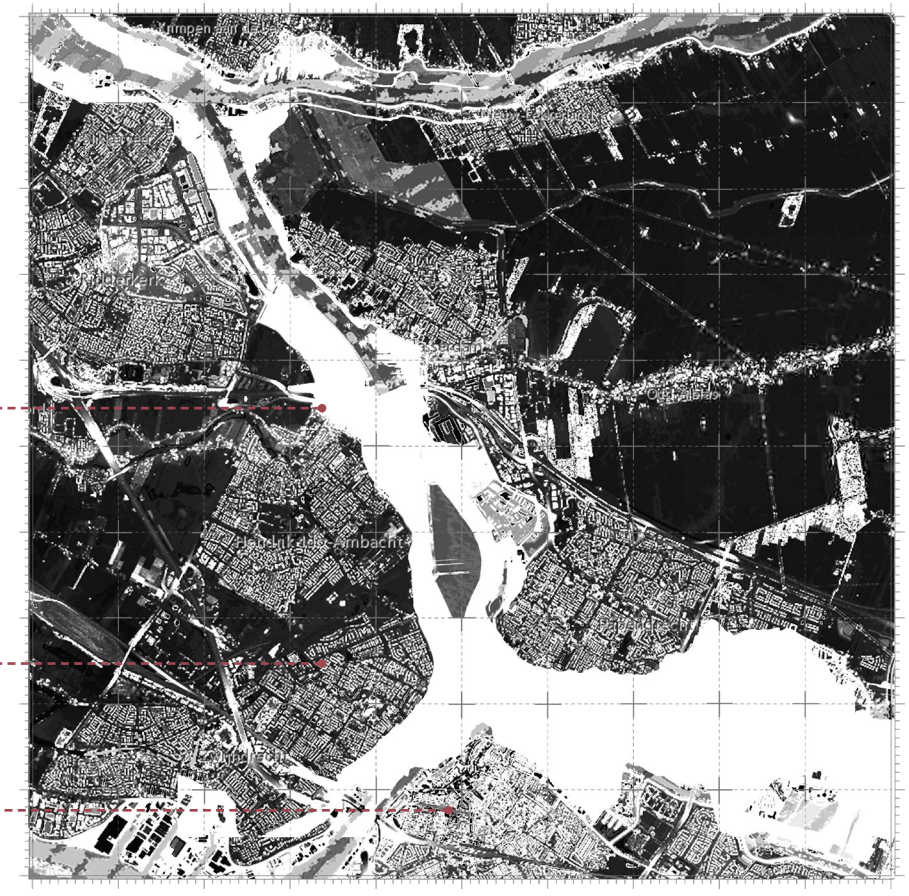
flows around water managent

programe

natural habitat
bird watching

sculptural park

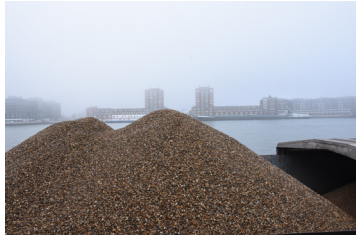




territory inside the dike

program & flows
water - cultural memory

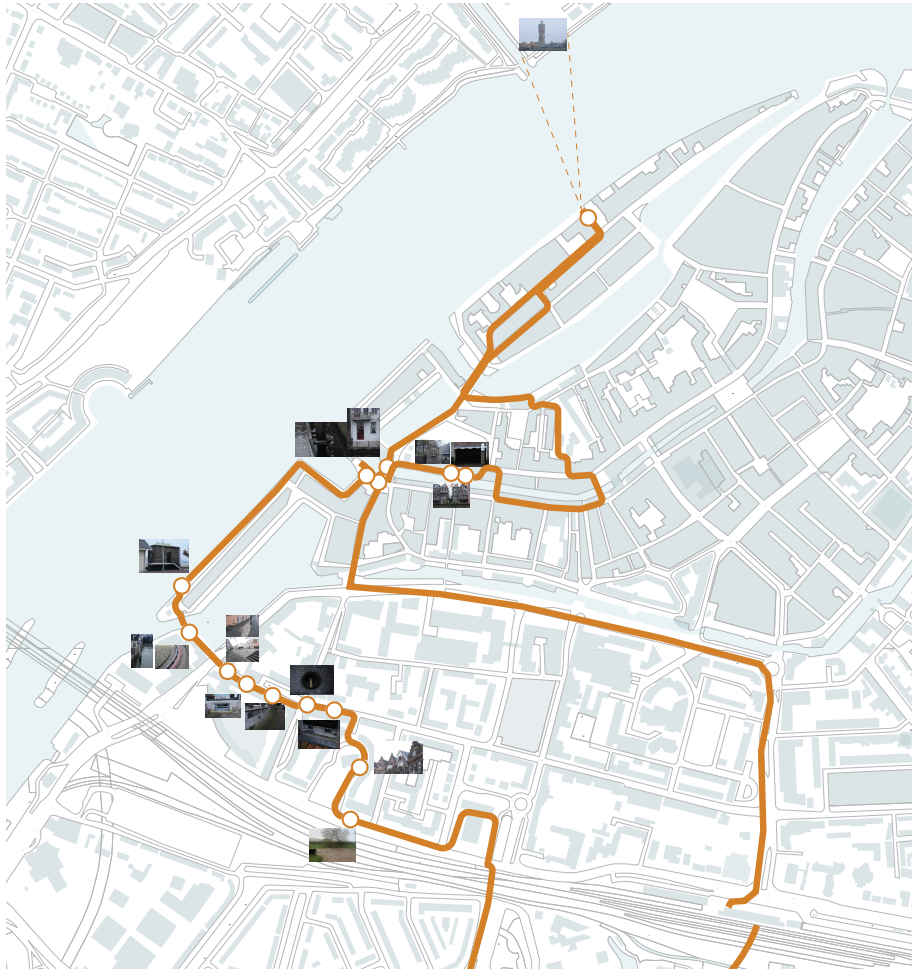
dike as infrastructure



city of trade

sound when water rises

art and painting



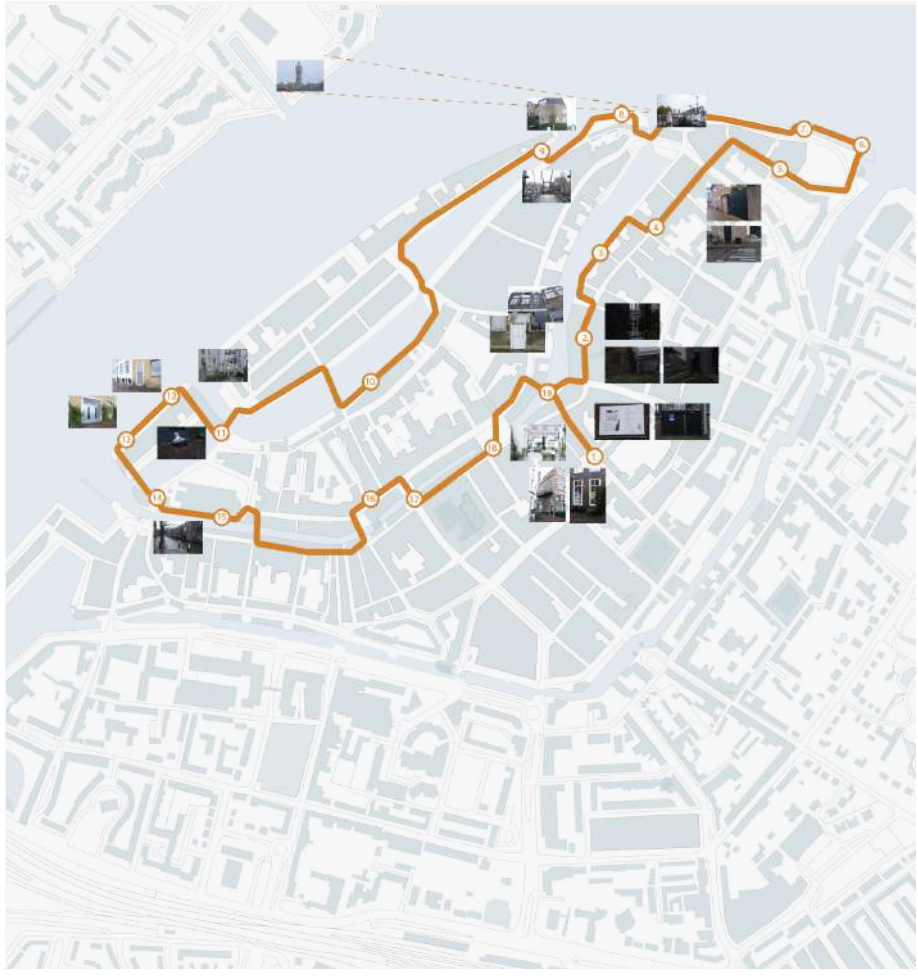
Site visit I - walking
experience of water - phenomenology - cultural memory of water

local prose

flood barriers

protective doors during rise of water

appearance of birds during rain



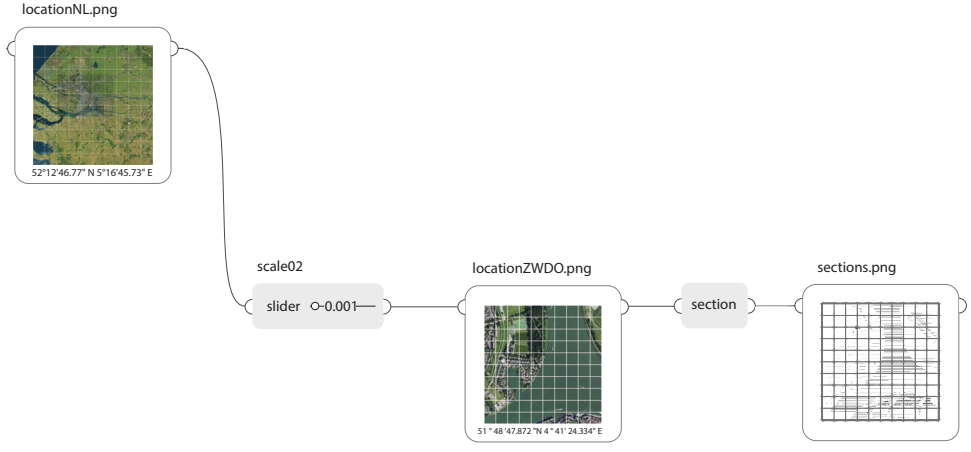
Site visit II - walk alongst the dike
experience of water - phenomenology - cultural memory of water

sculpture park

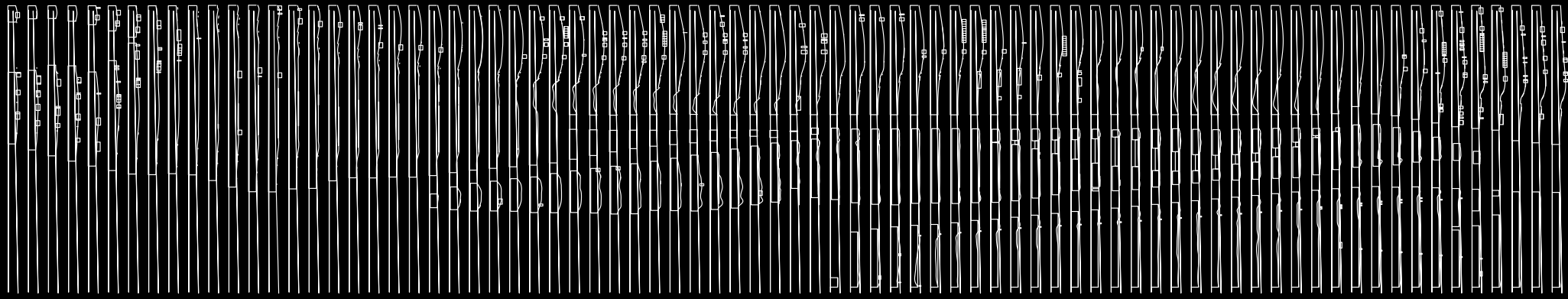
private residence

water tower + filtration

10km² - territory of the rising water



thinking is section - every 20m



topographical drawing

thinking in section

sculpture park

private residence

water tower + filtration

topographical drawing

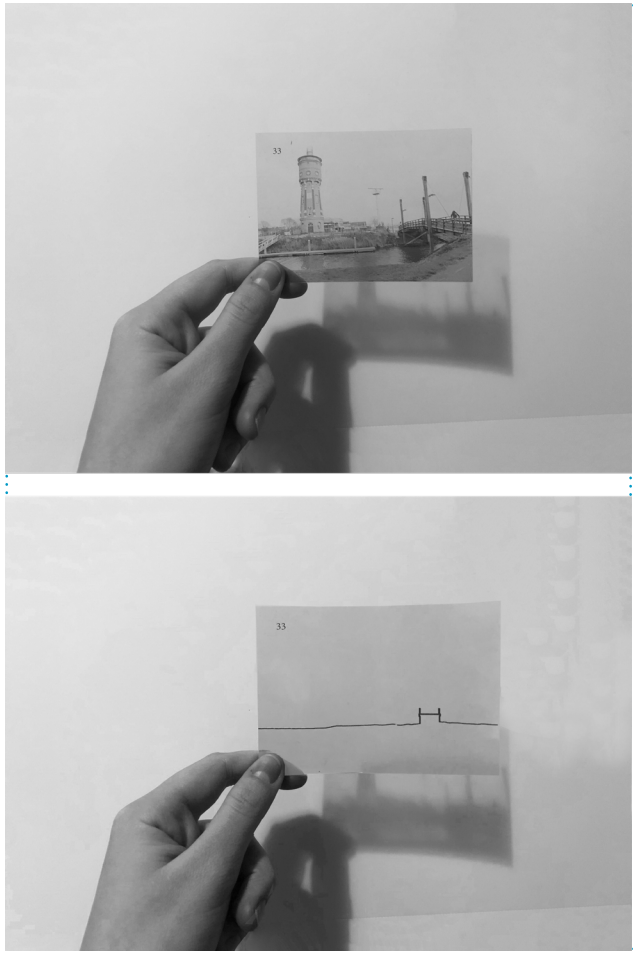
thinking in section

The TERRITORY

Territory programmed by CODE

Atlas of Sections

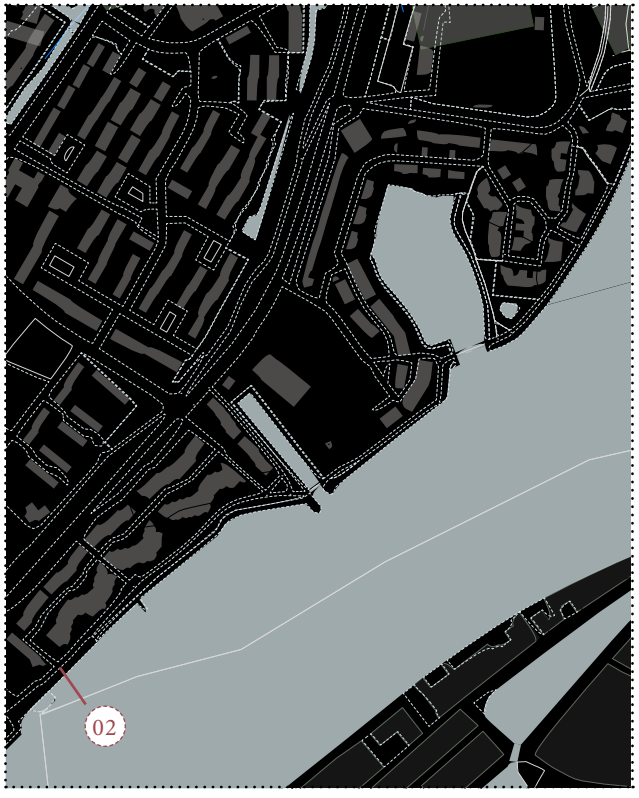
Soil Extraction



Atlas of Sections
Surveying the site through photography
sectional drawing and analysis

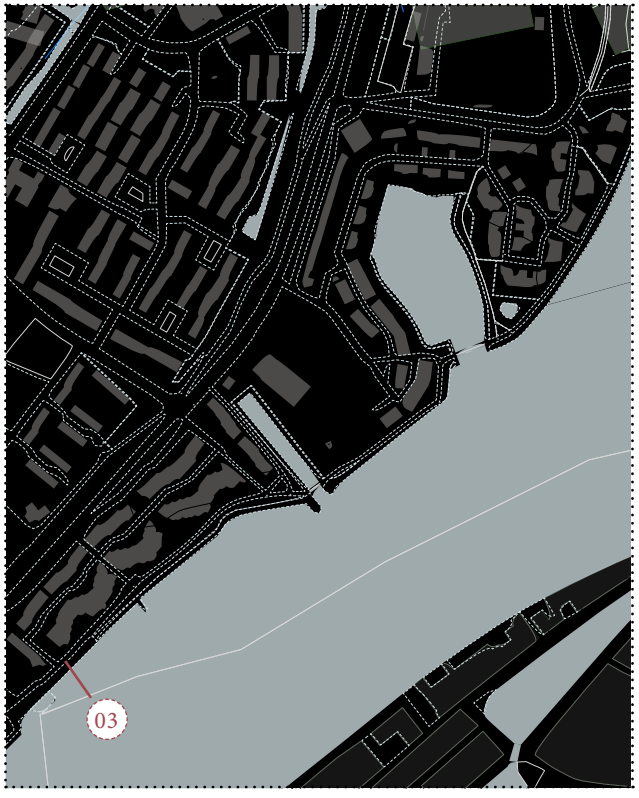
map of sections

01



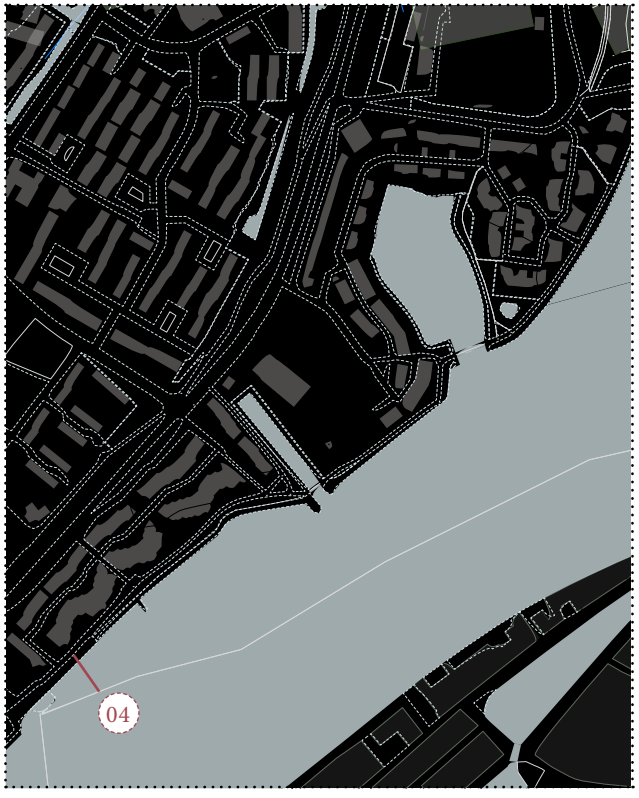
map of sections

02



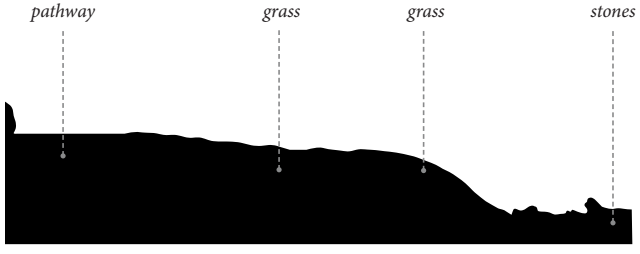
map of sections

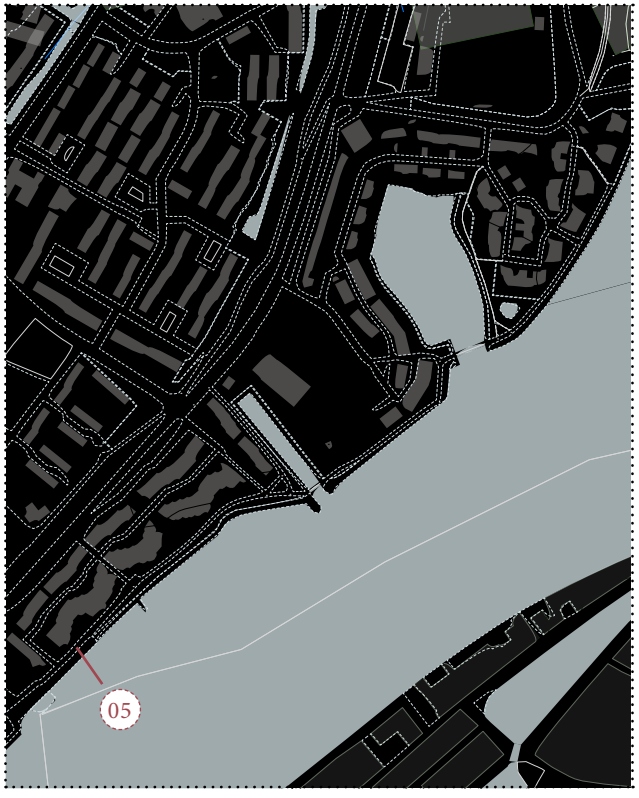
03



map of sections

04



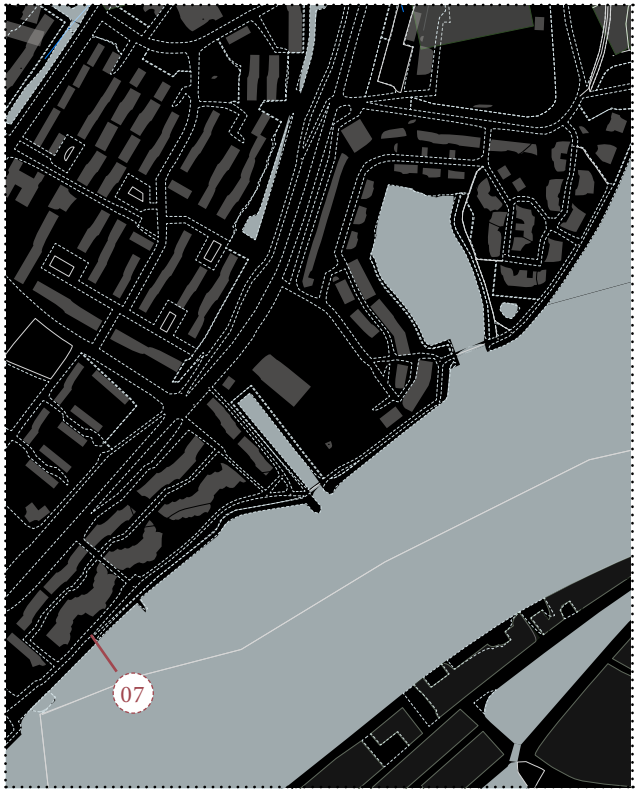


map of sections

05

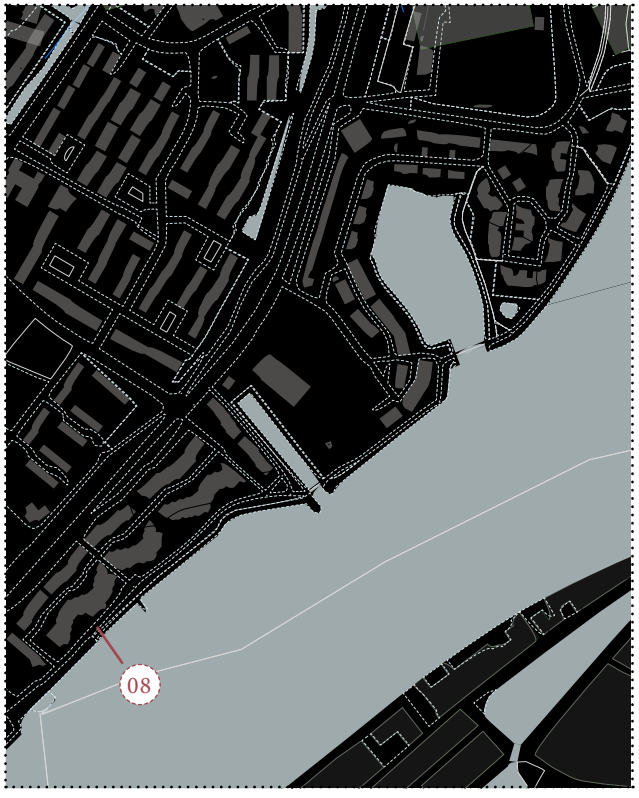
map of sections

06



map of sections

07



map of sections

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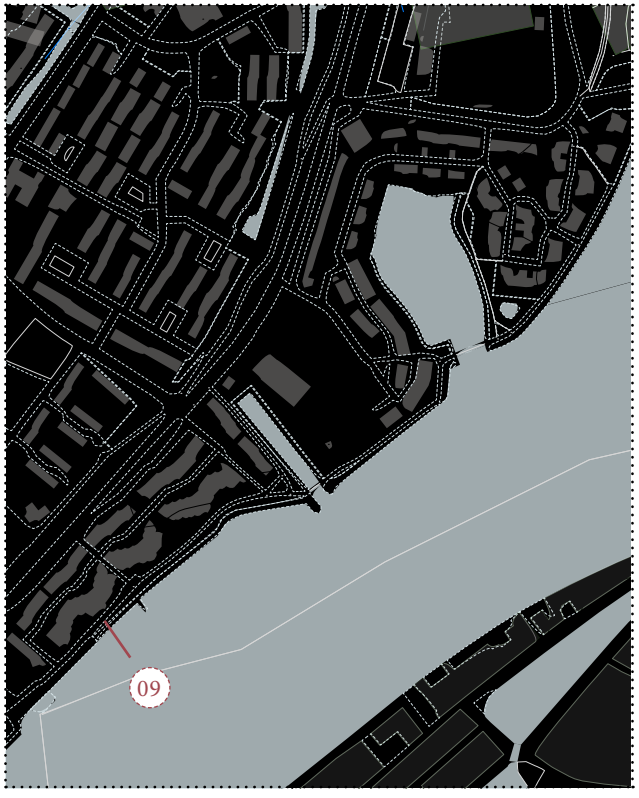
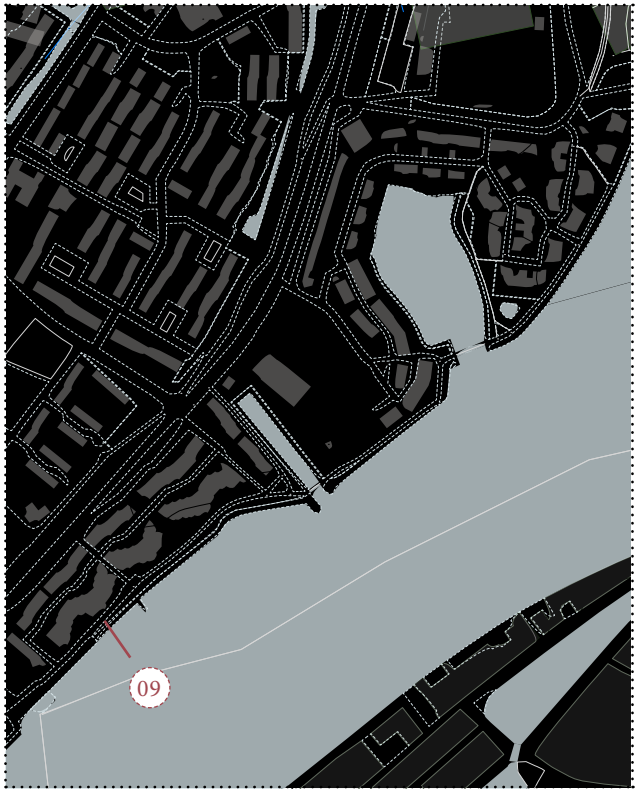


09

map of sections



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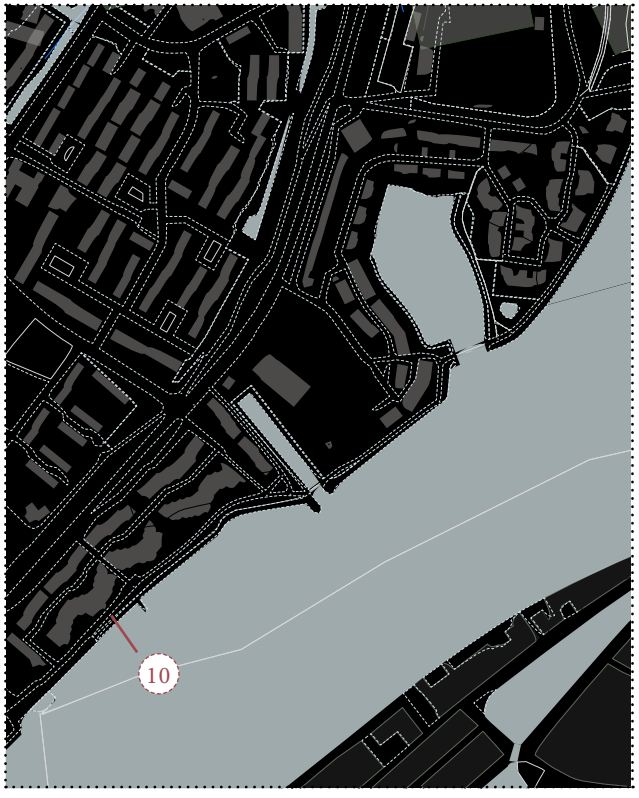
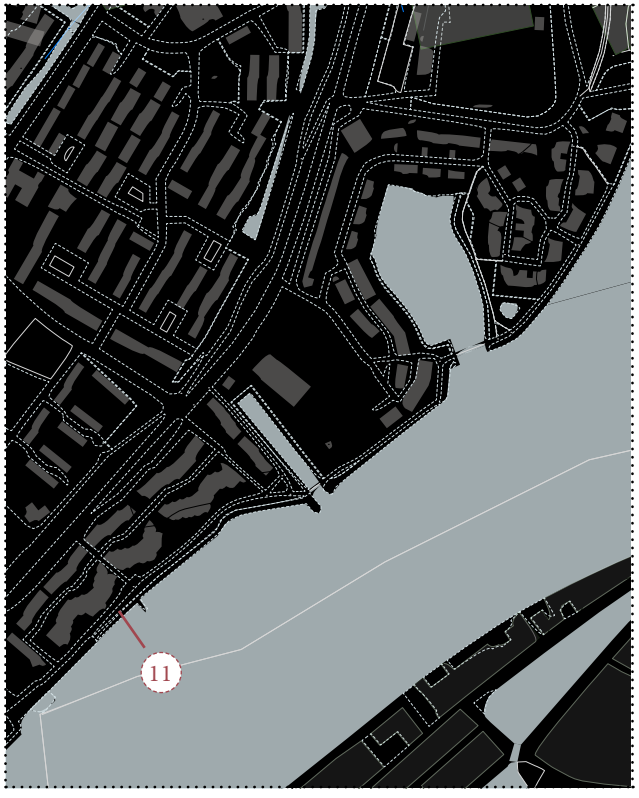
map of sections



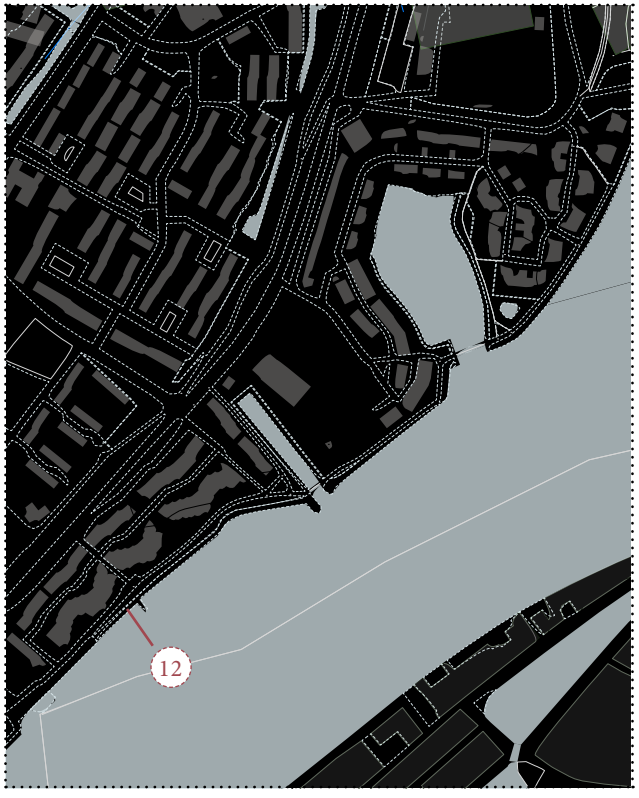
10

map of sections



11

map of sections



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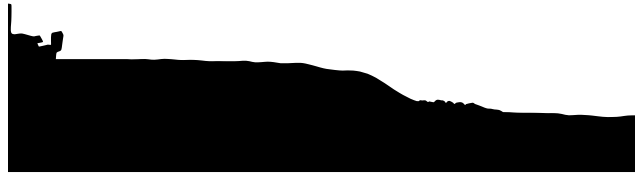
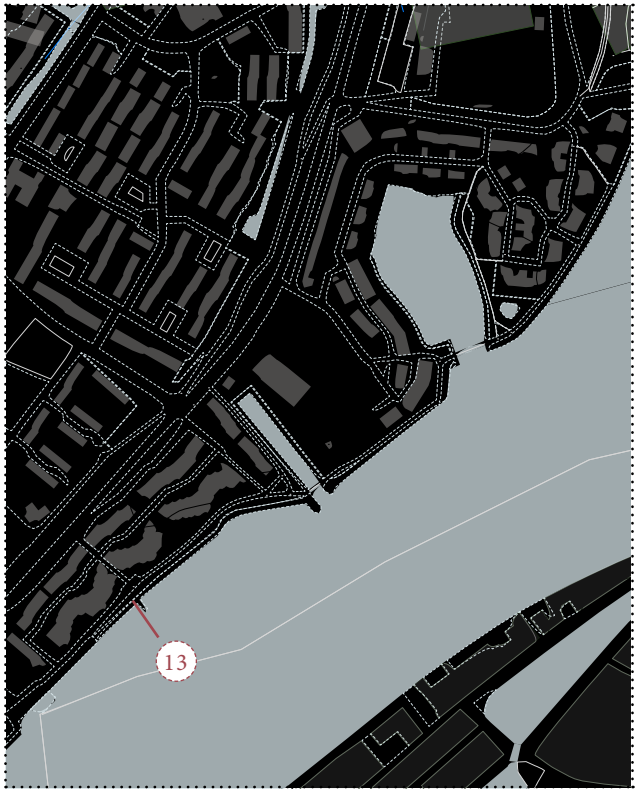
map of sections





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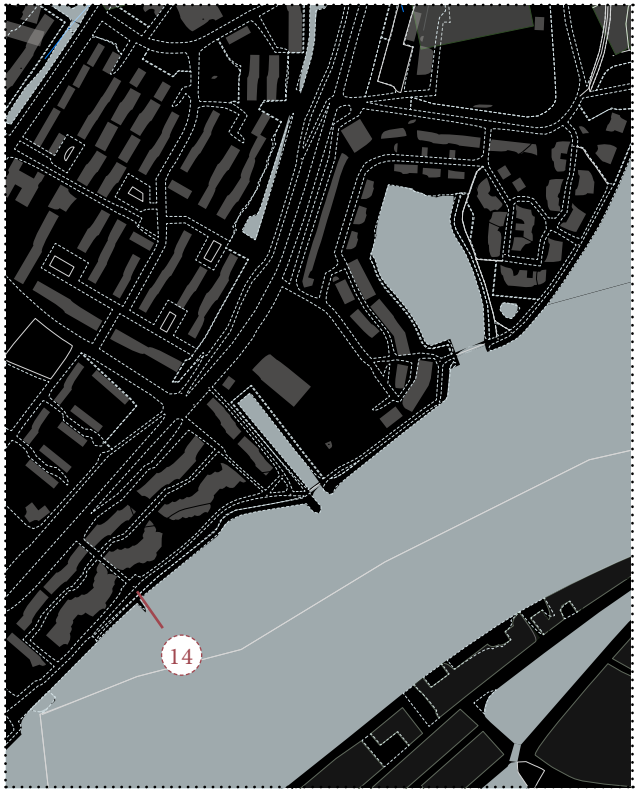
map of sections



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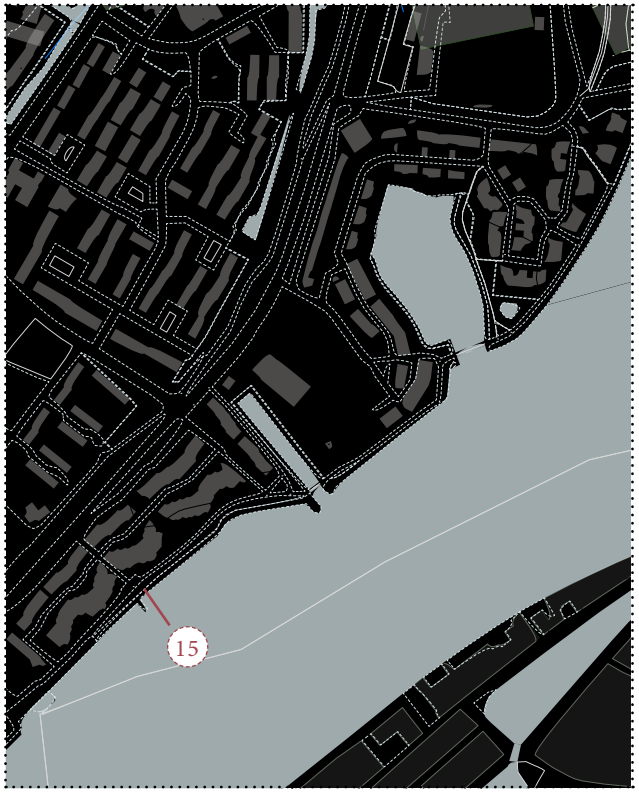
map of sections



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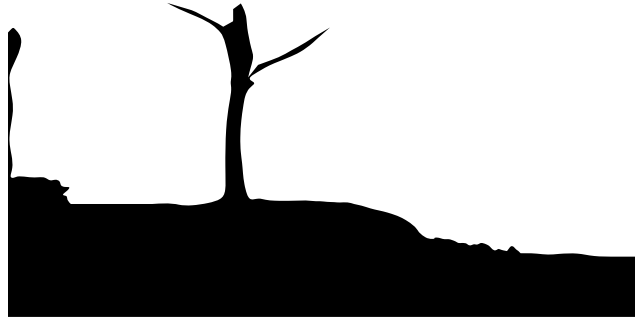
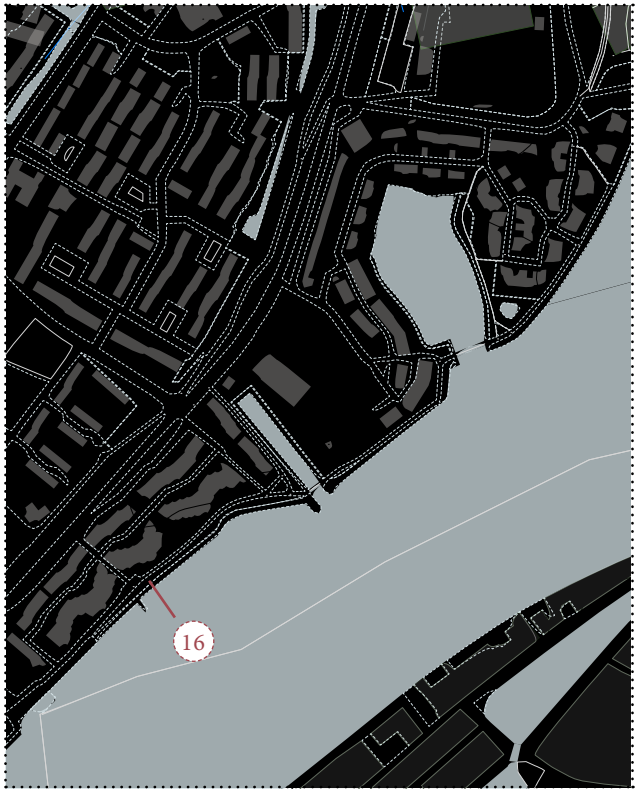
map of sections





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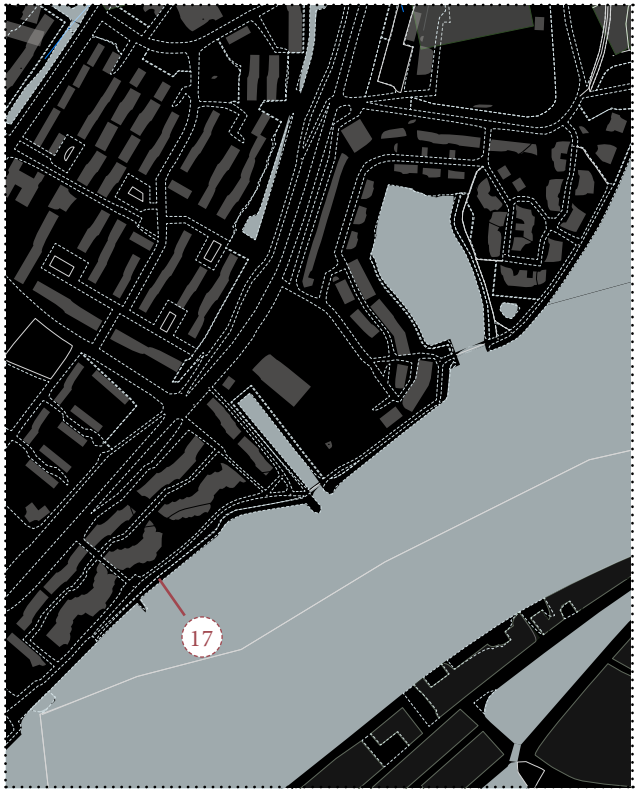
map of sections



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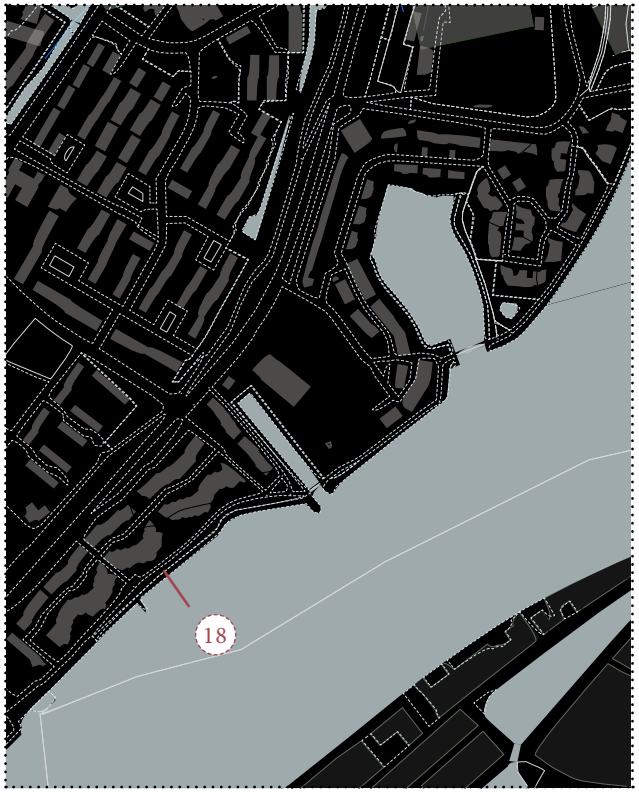
map of sections



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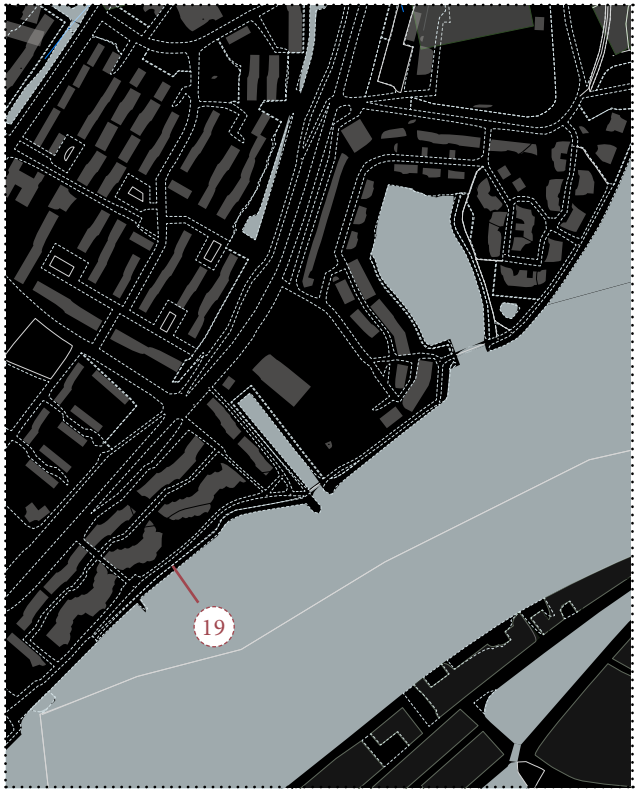
map of sections



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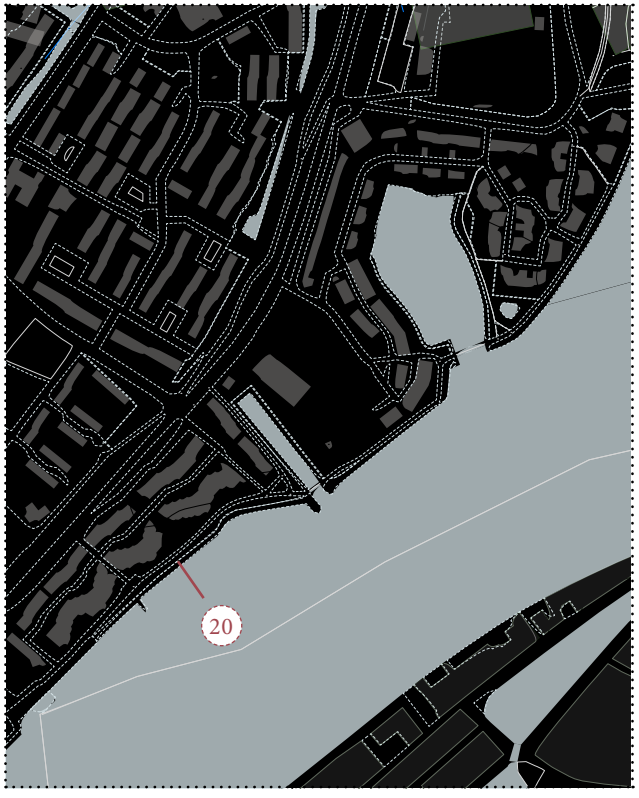
map of sections



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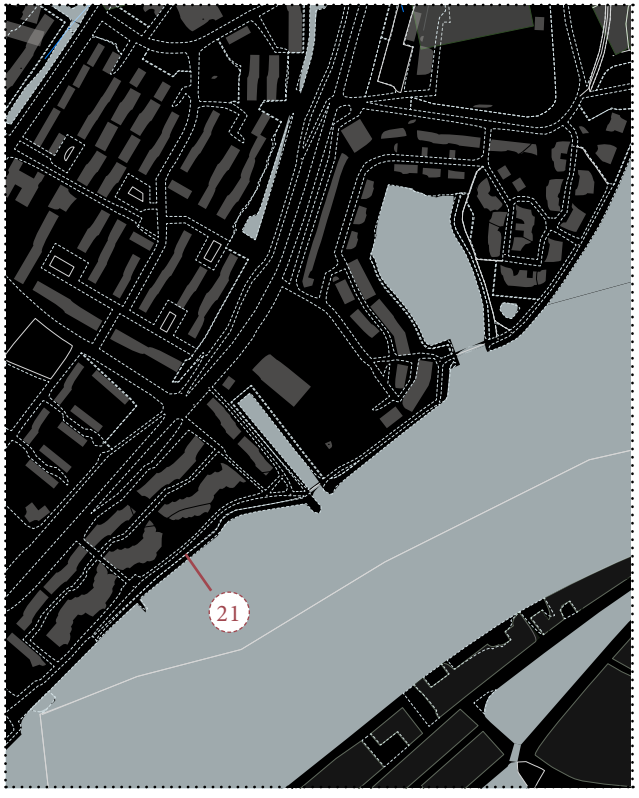

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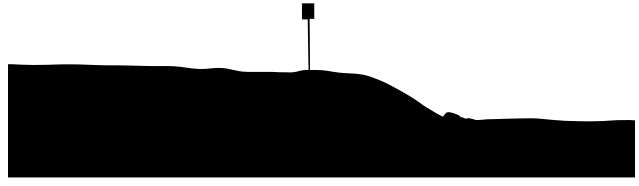

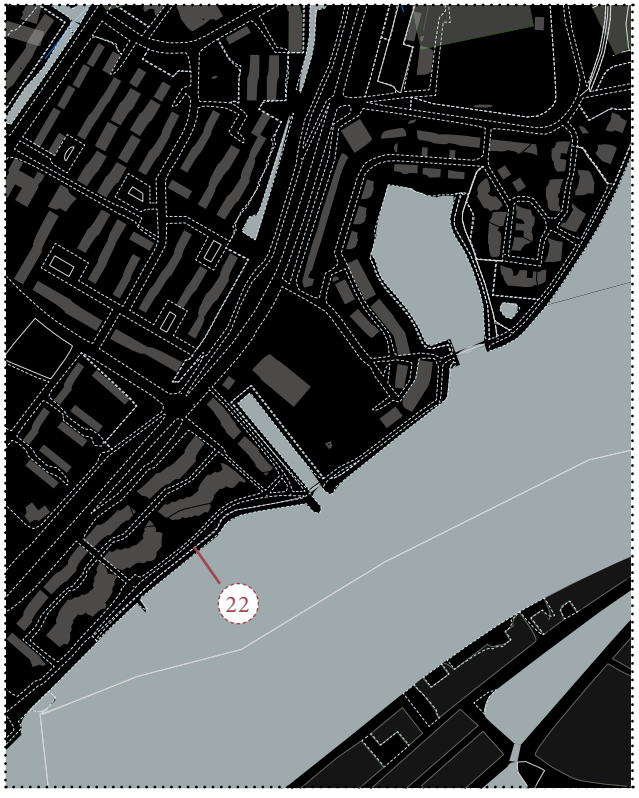

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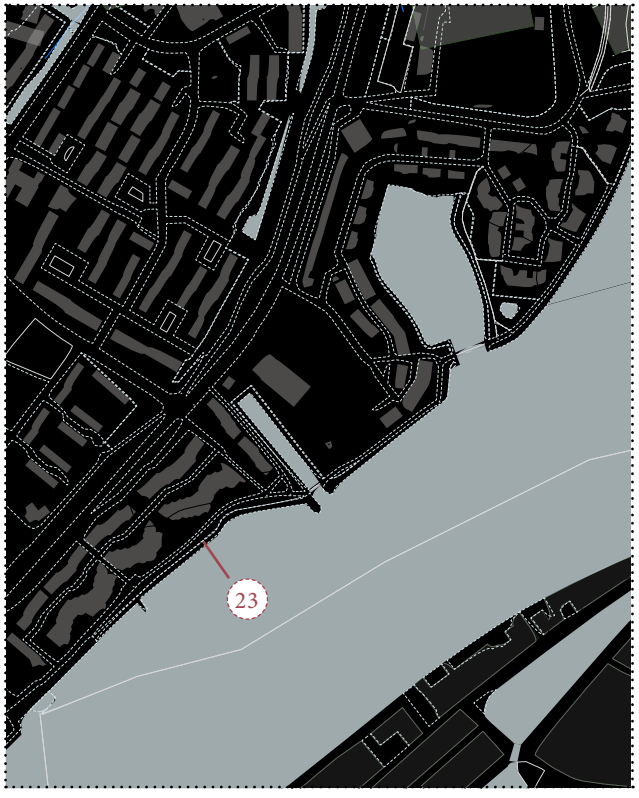
map of sections



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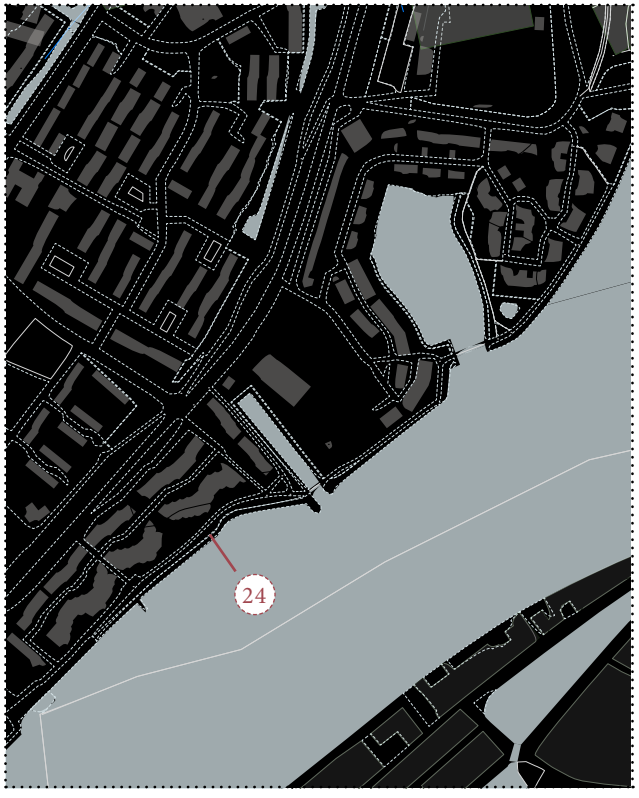
map of sections



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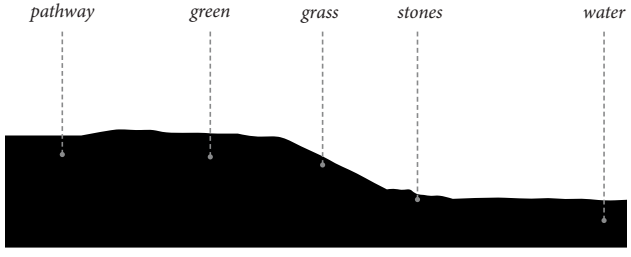
map of sections



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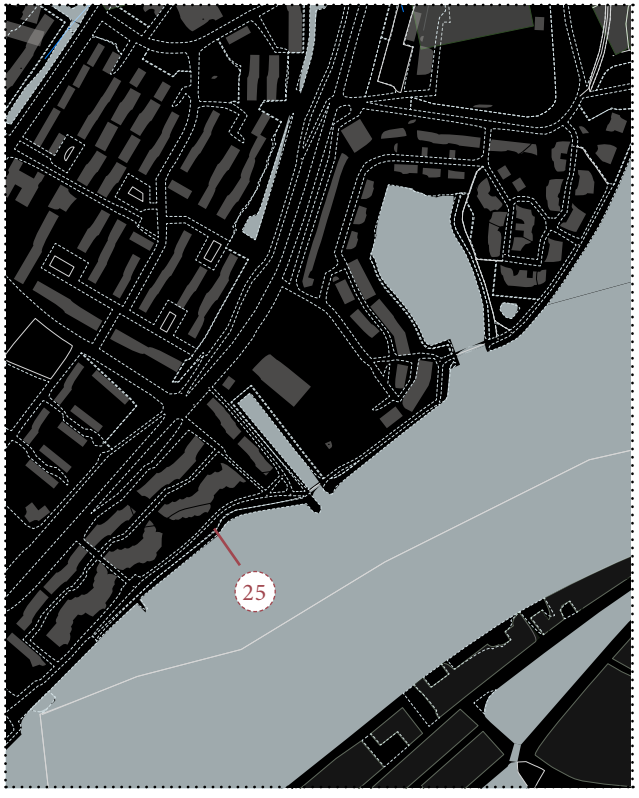
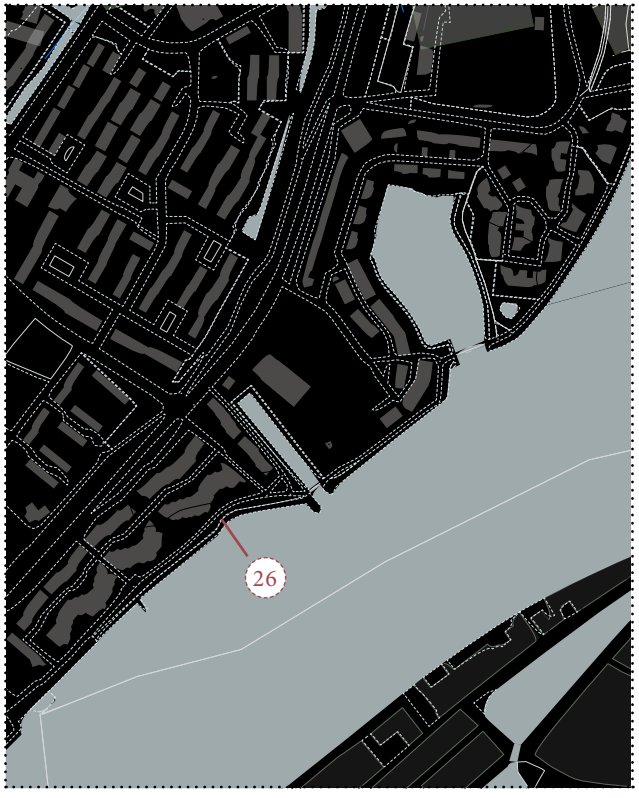


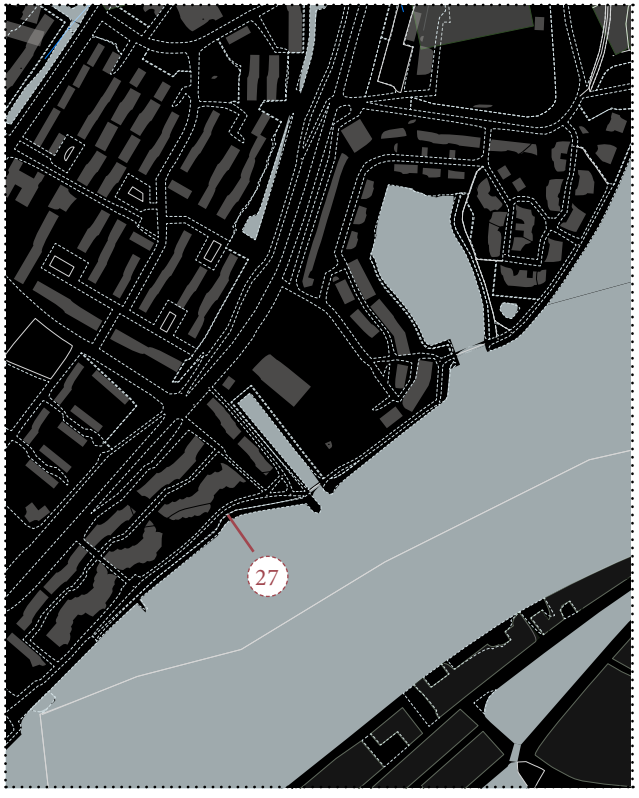
map of sections

26

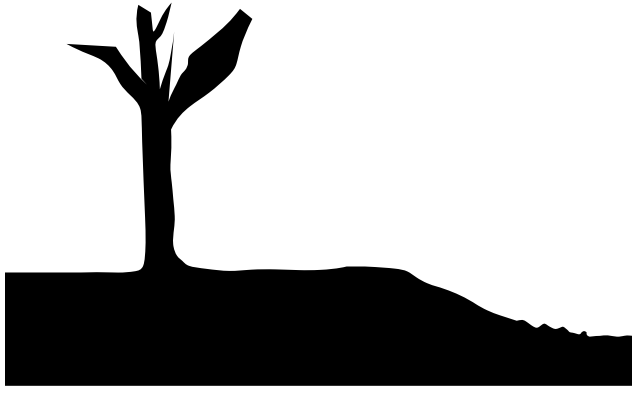


map of sections

27



map of sections



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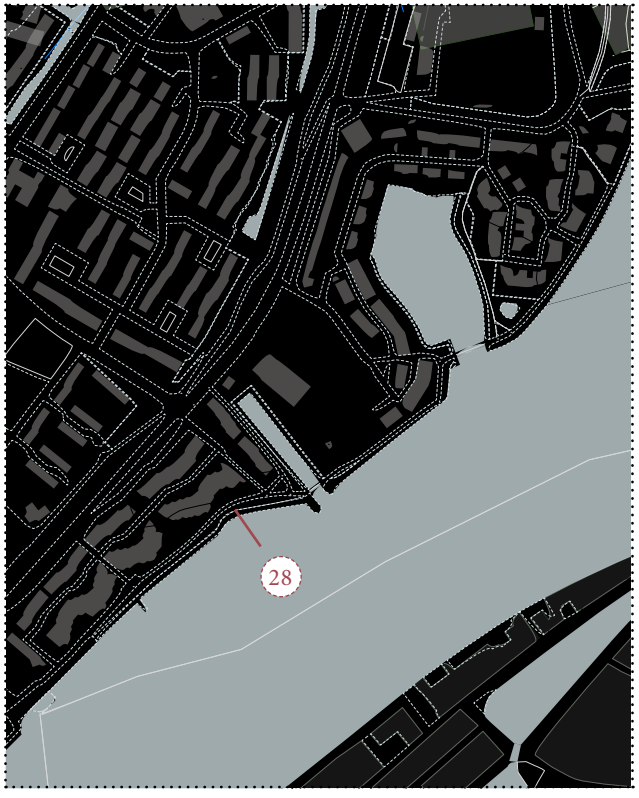
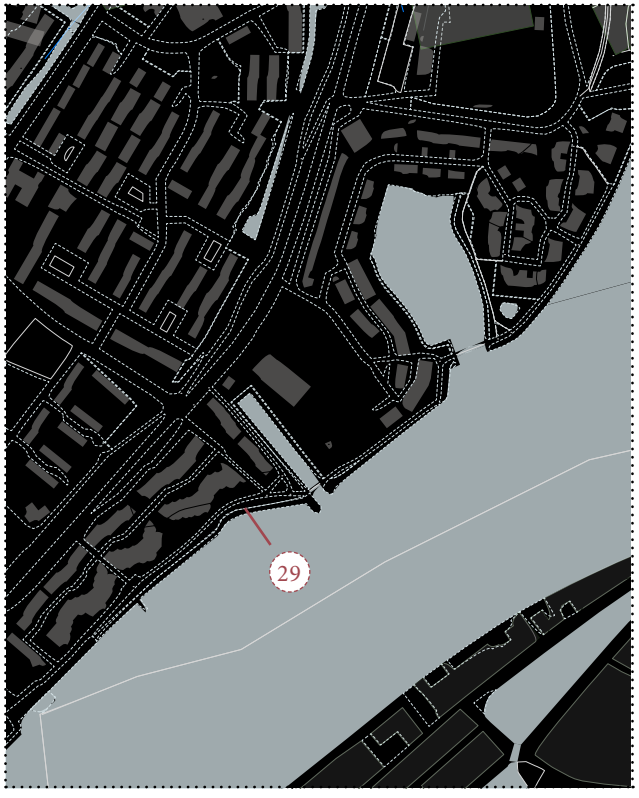


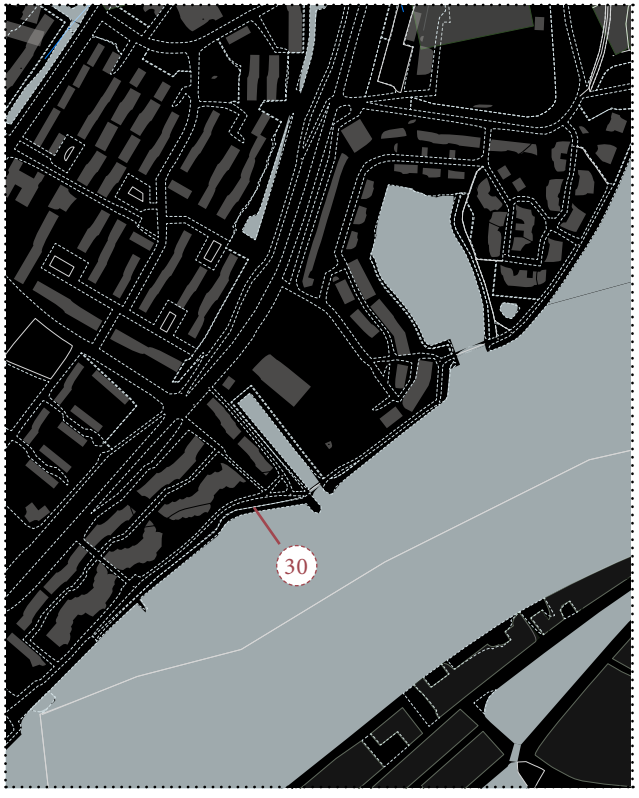
map of sections

29



map of sections

30



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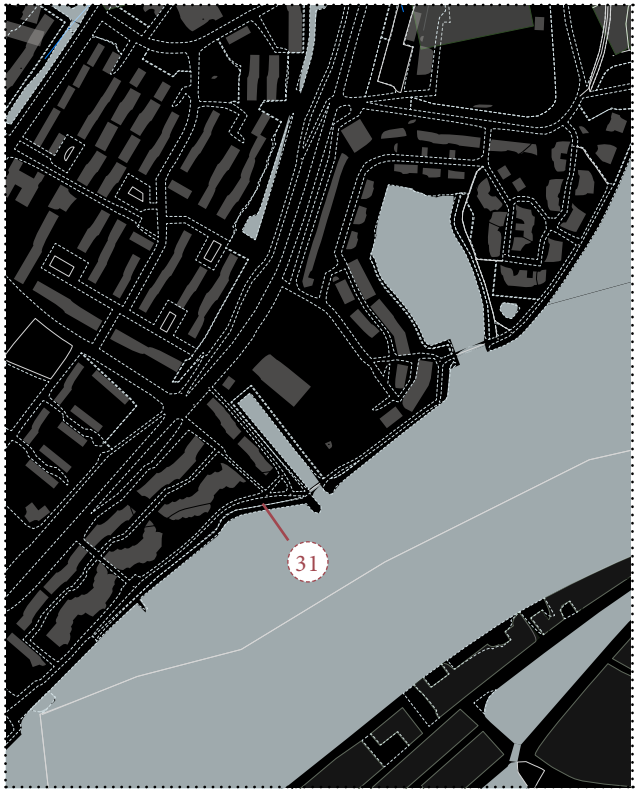

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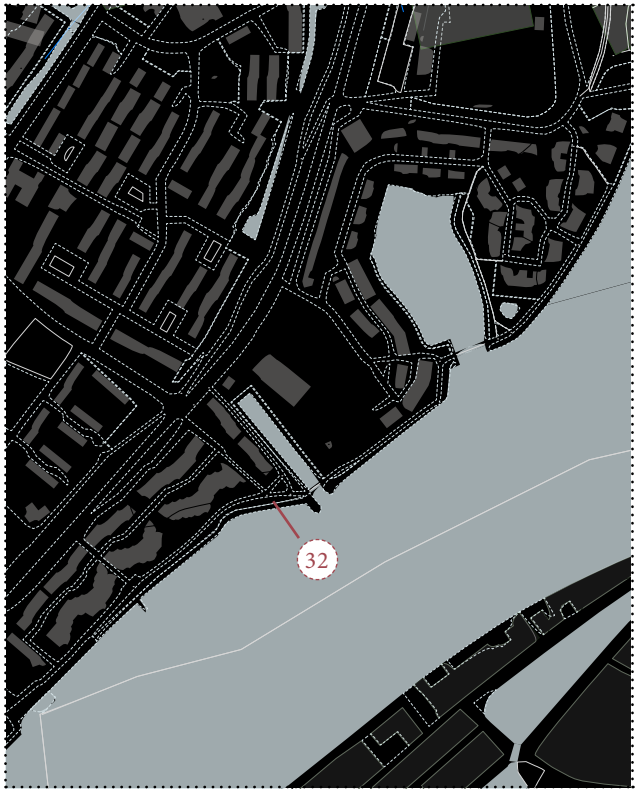

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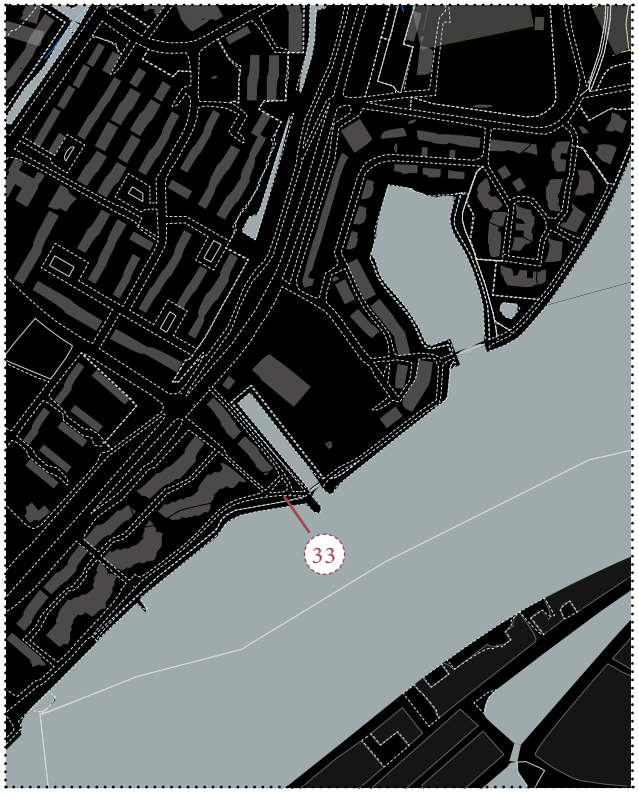

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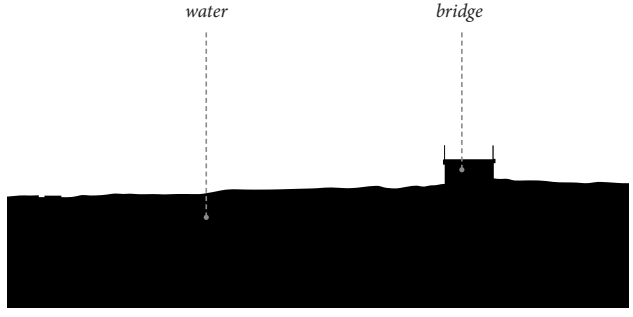

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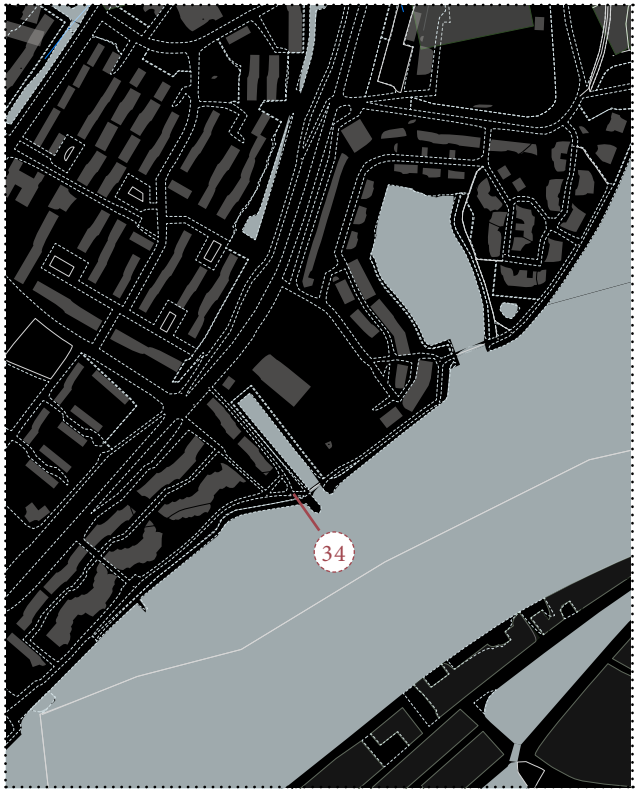

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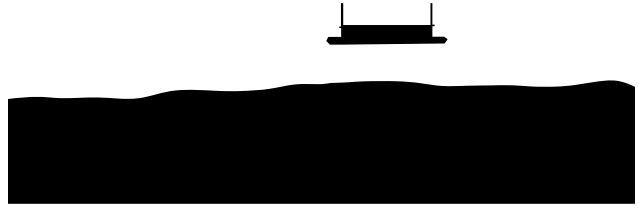

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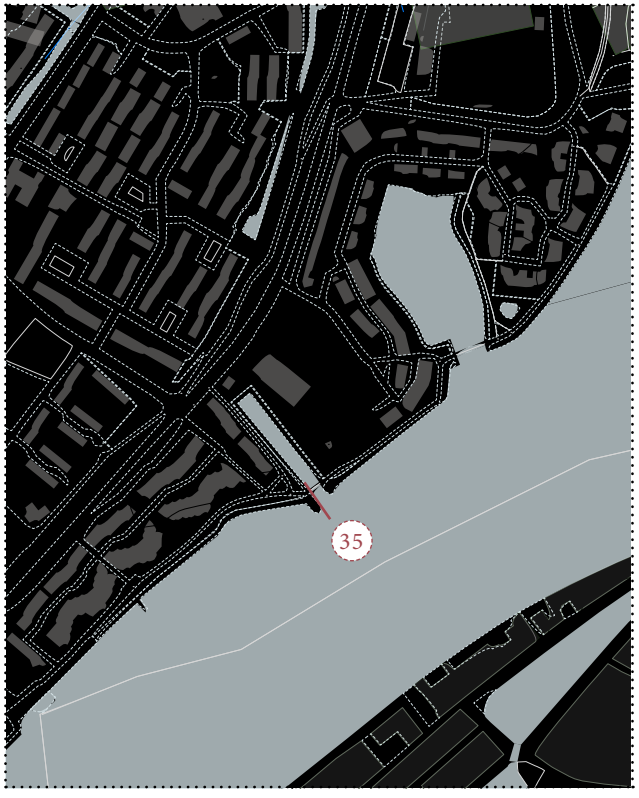

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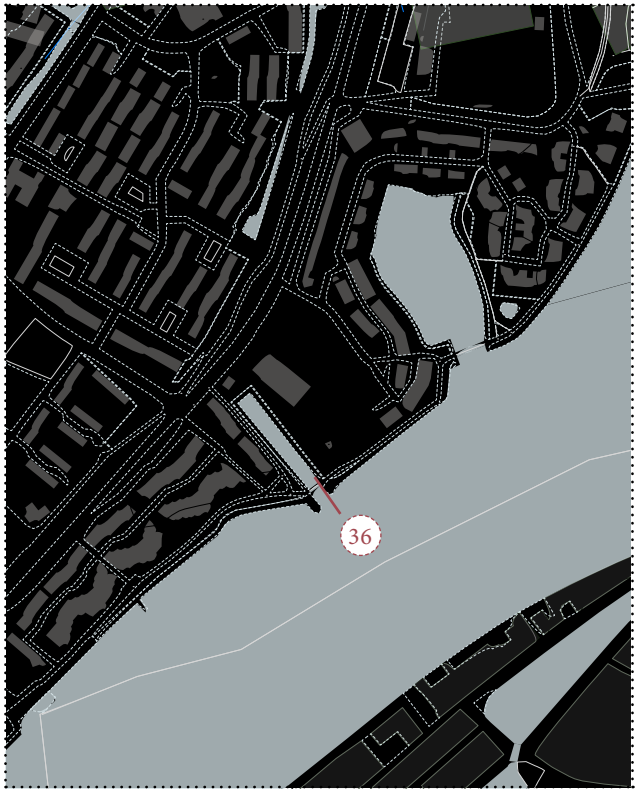

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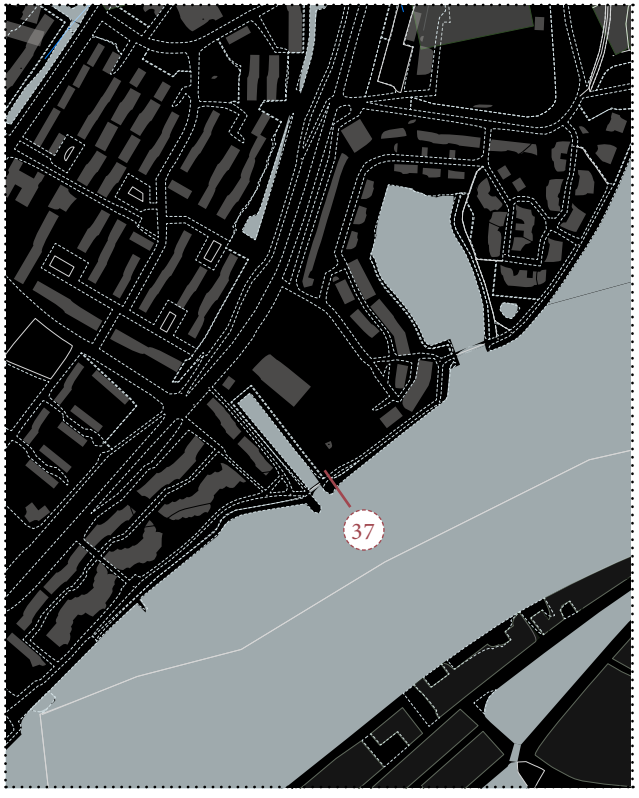

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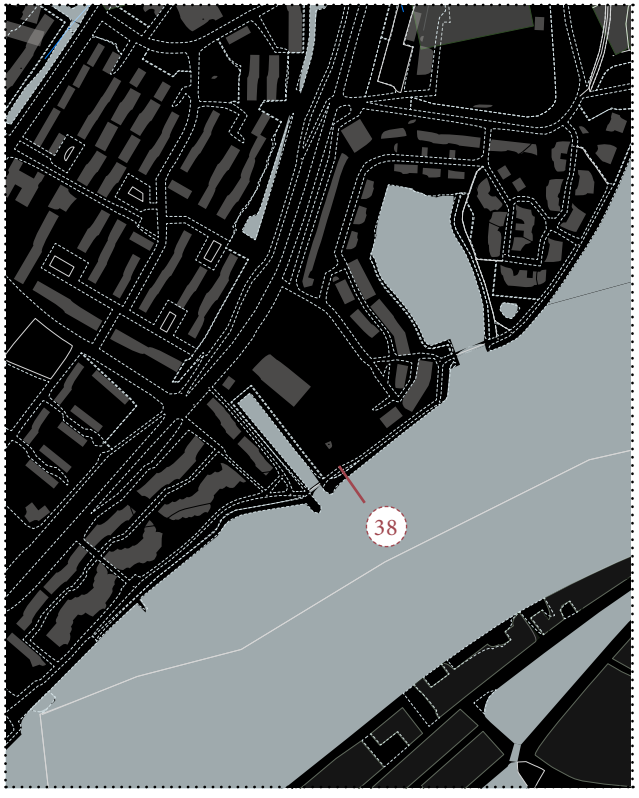

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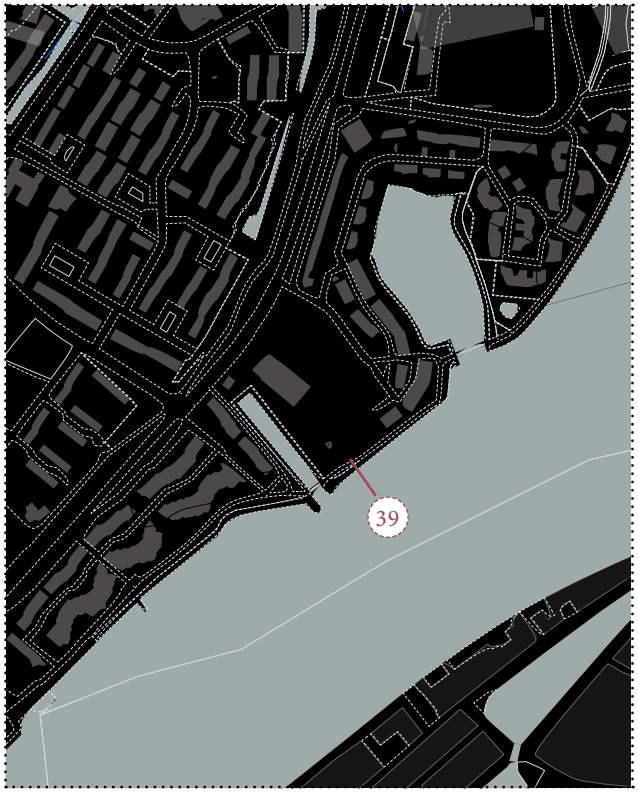

map of sections

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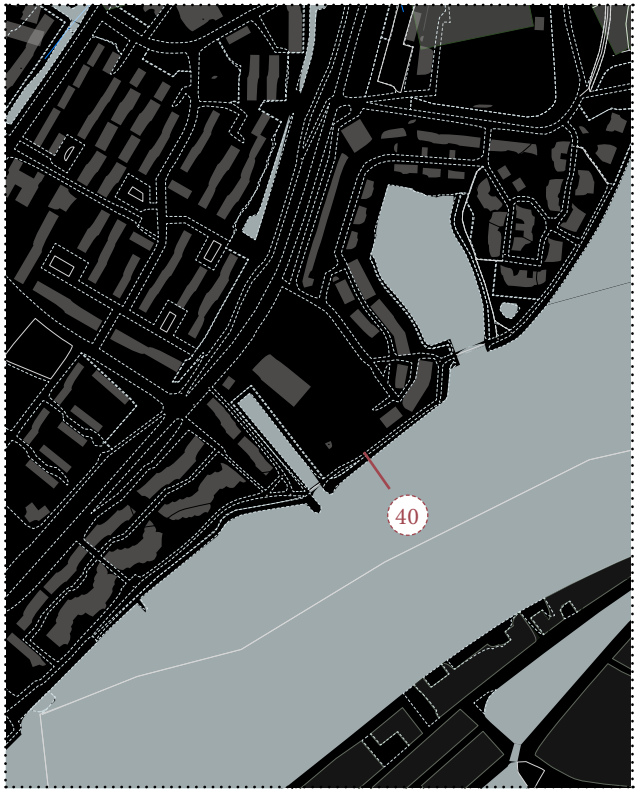

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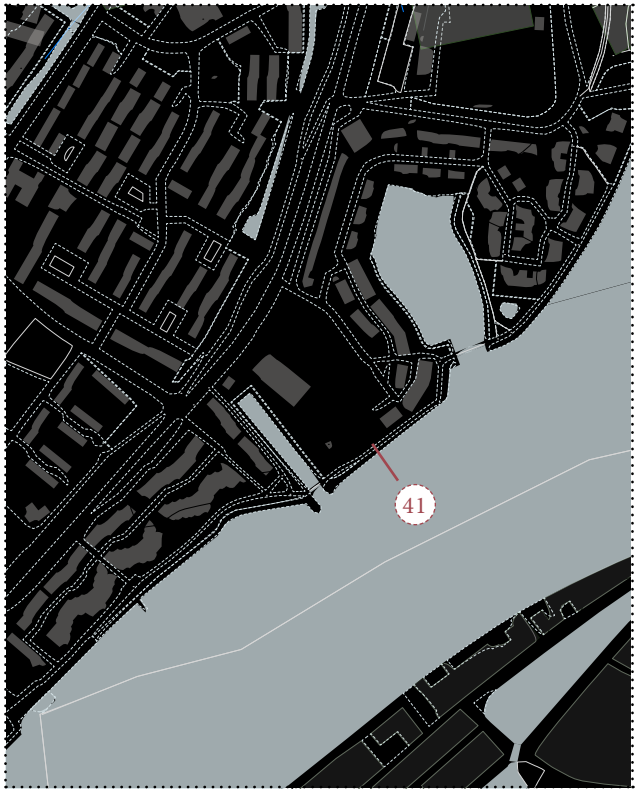

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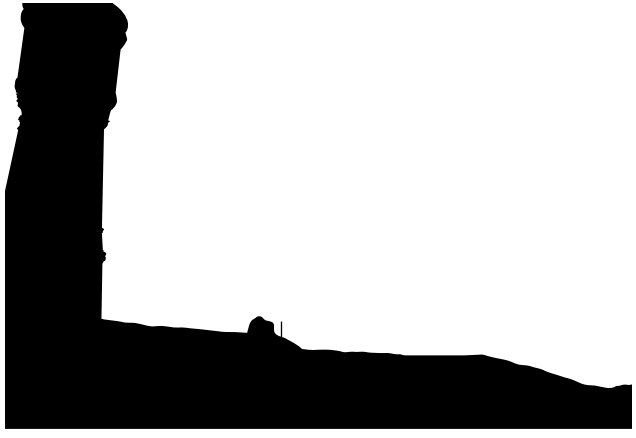

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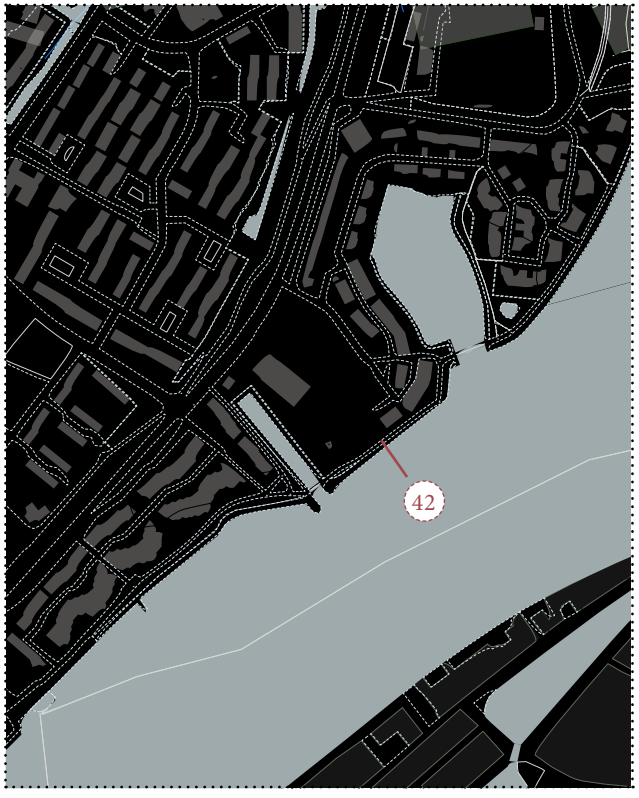

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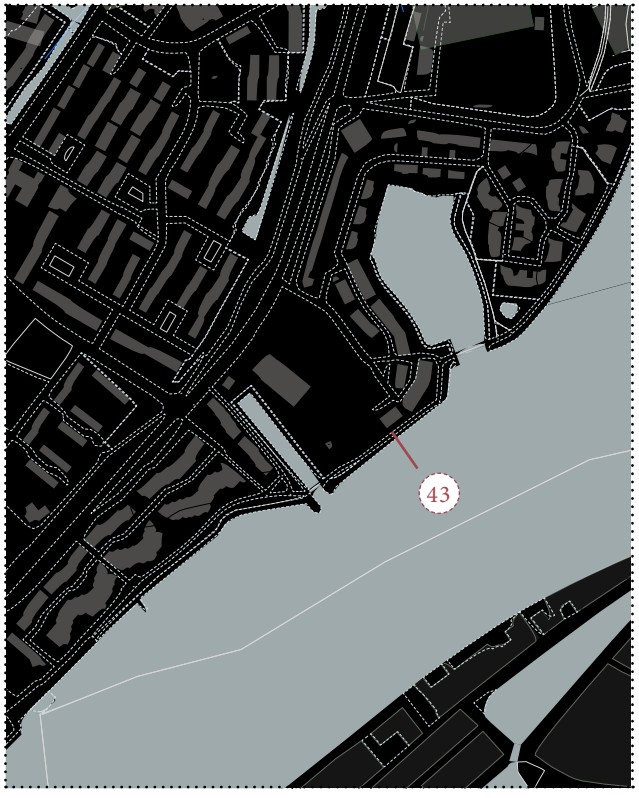

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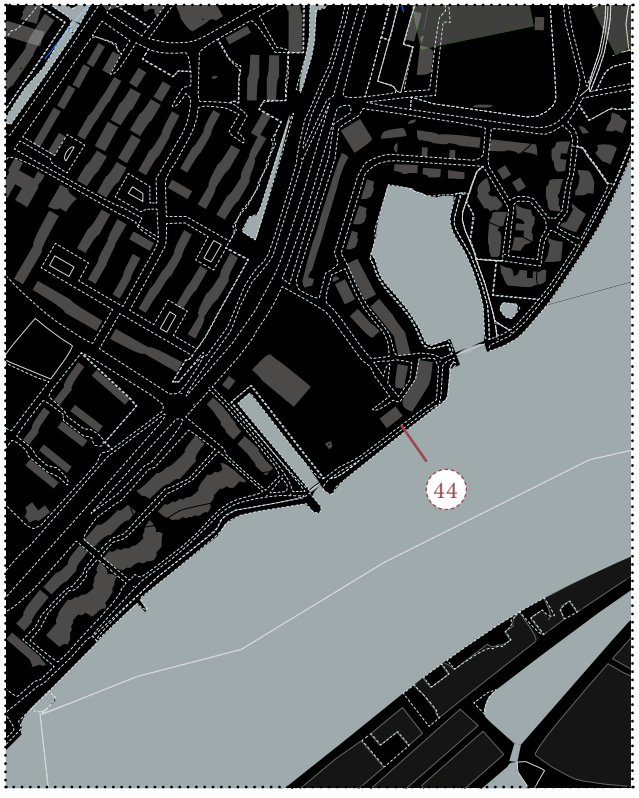

map of sections

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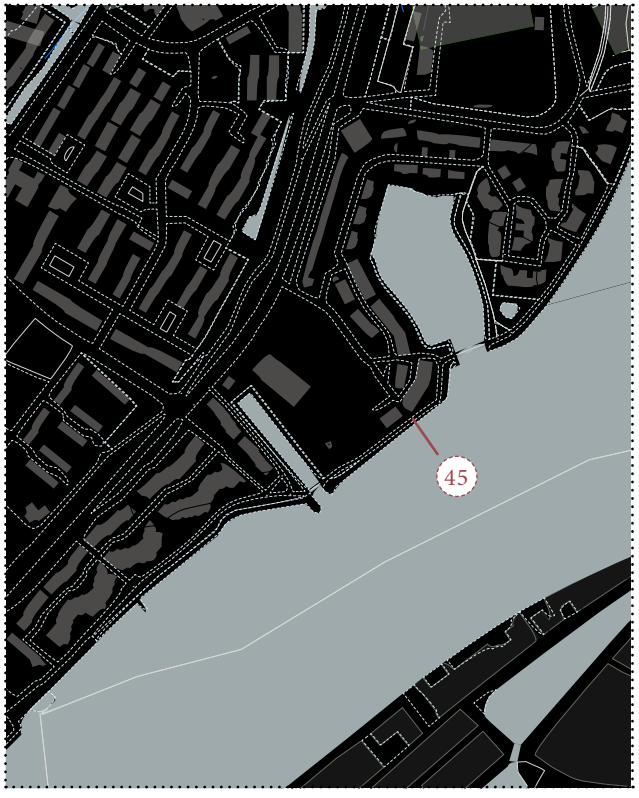

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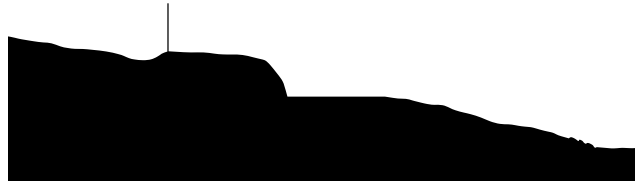

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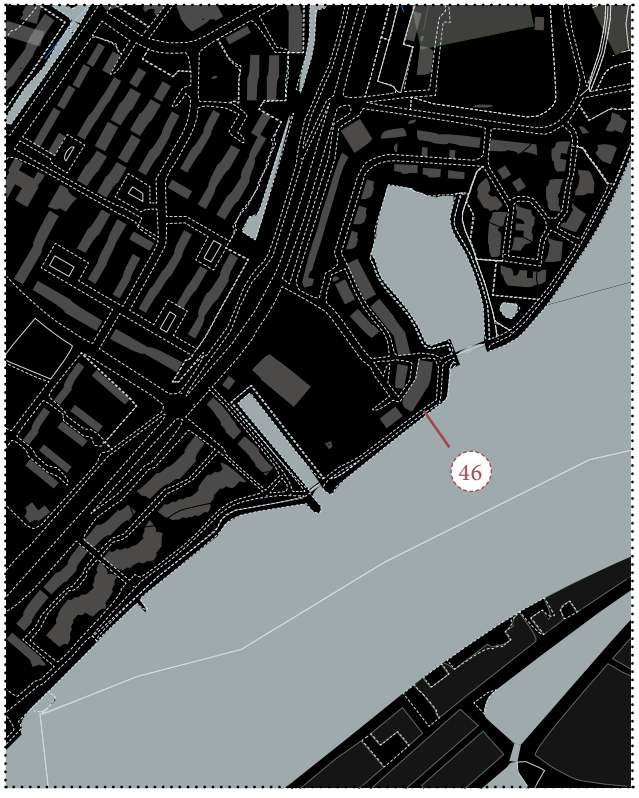

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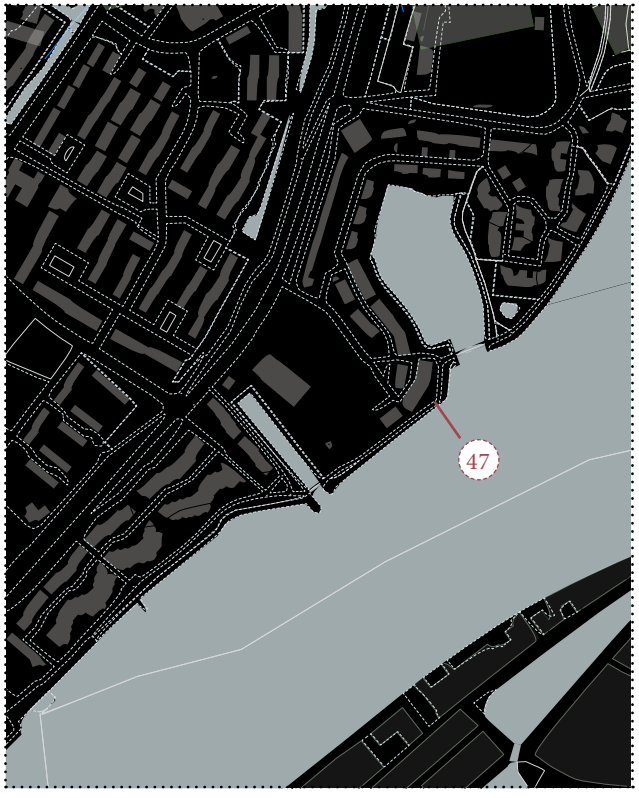

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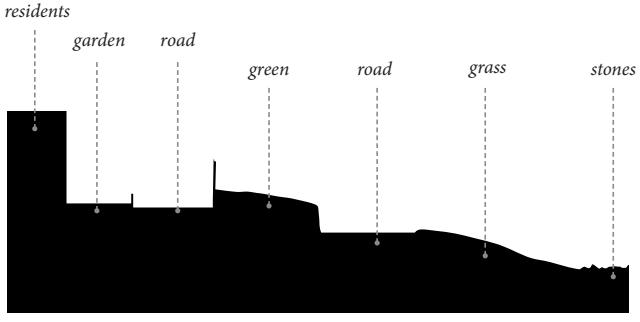

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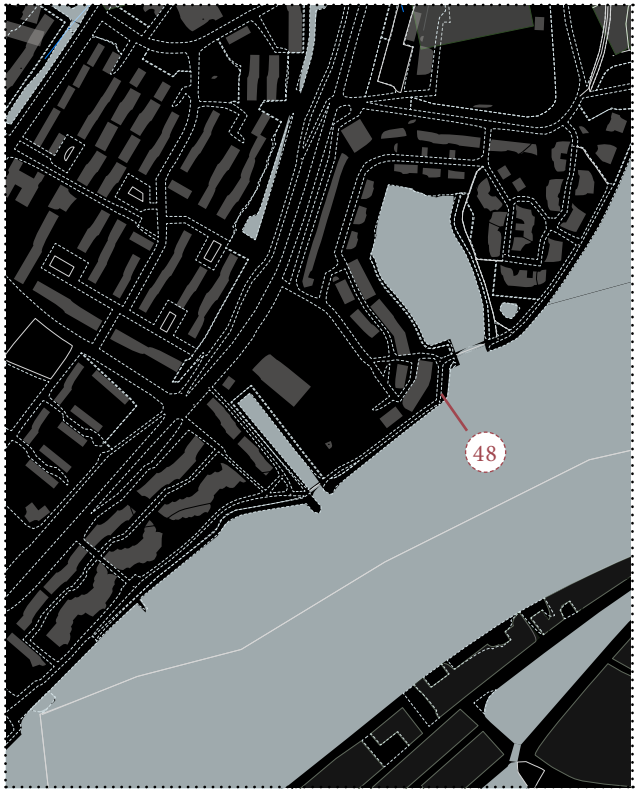

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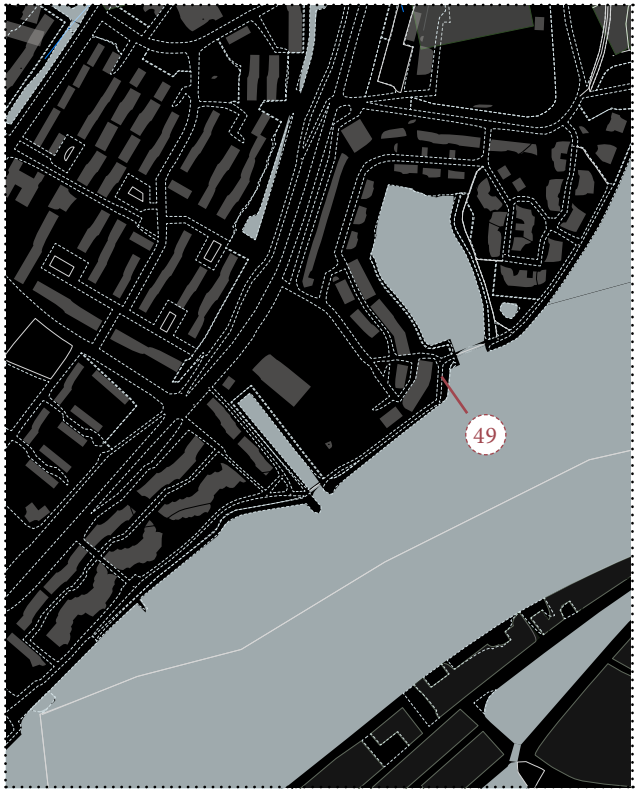

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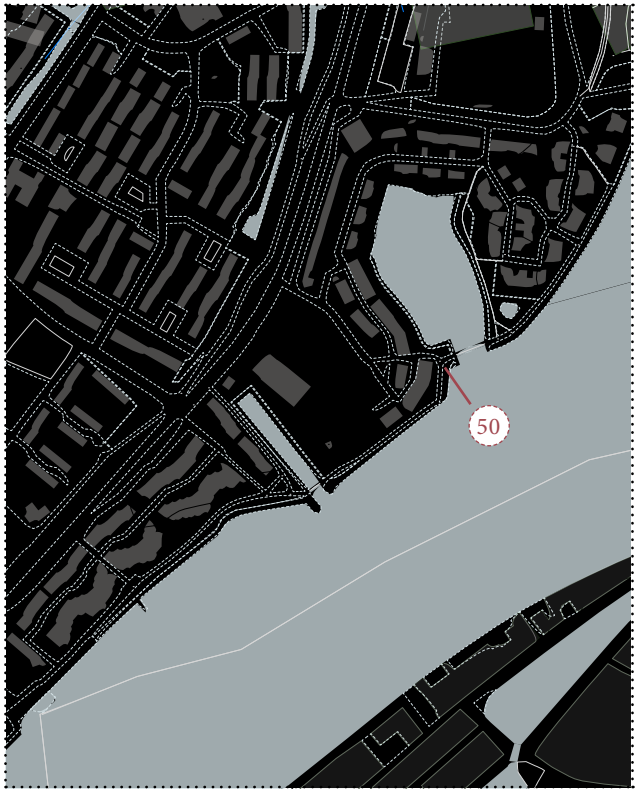

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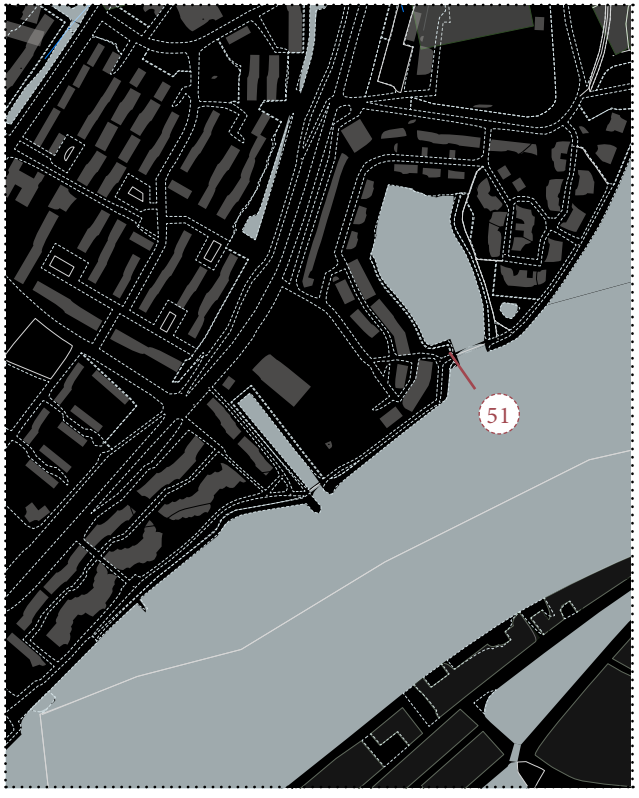

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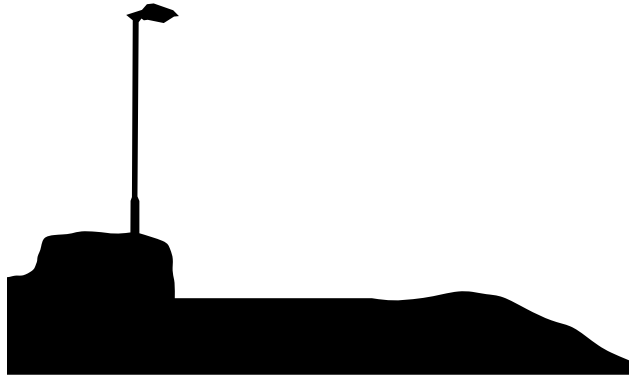

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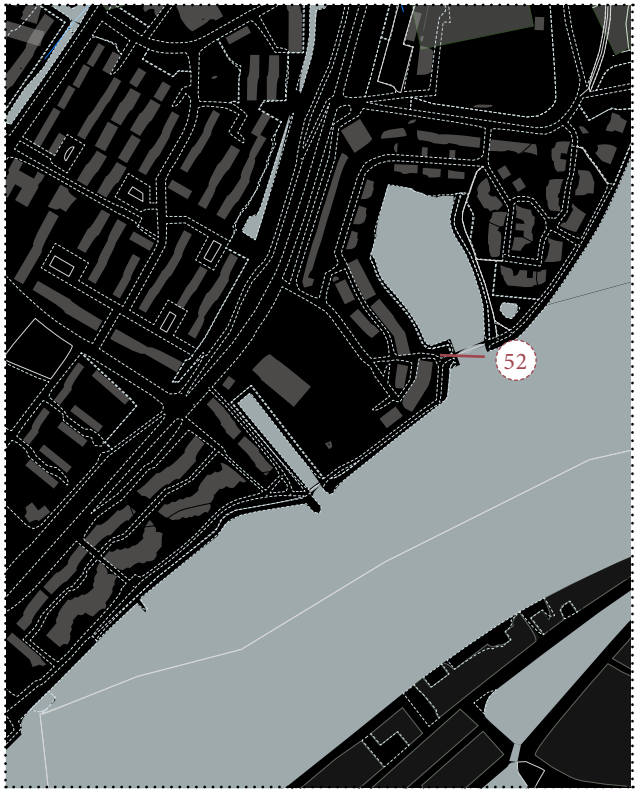

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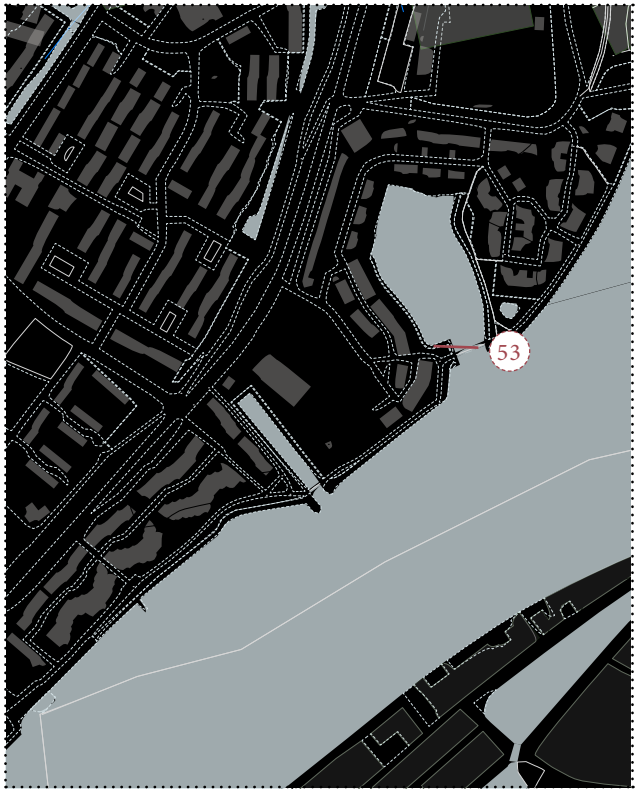

map of sections

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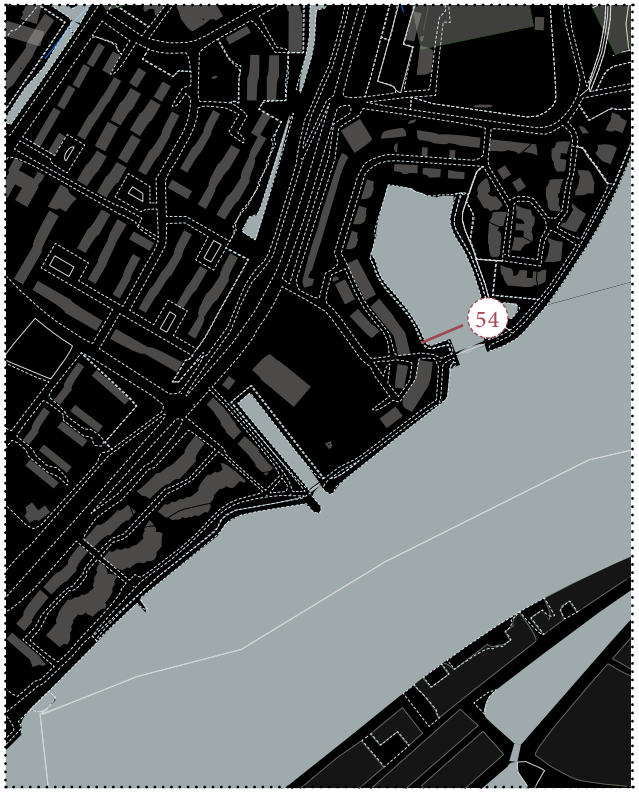

map of sections

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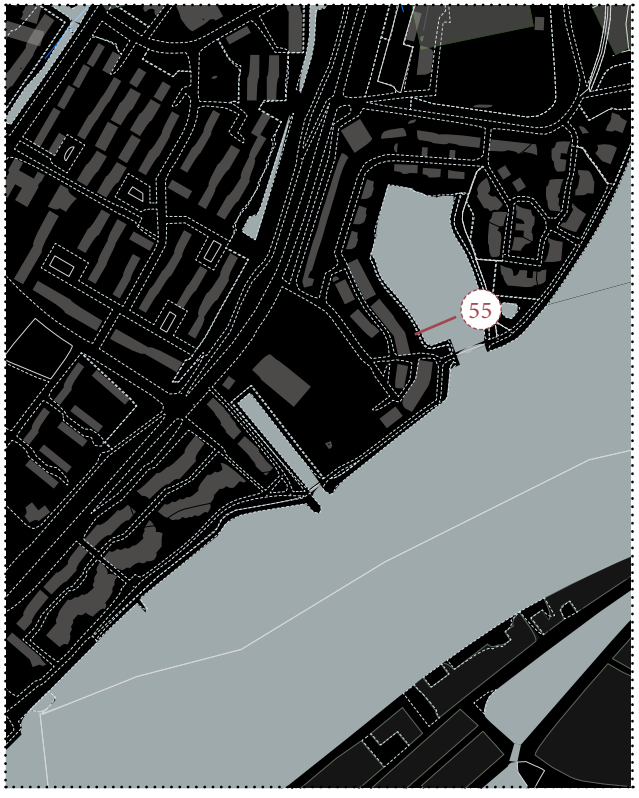

map of sections

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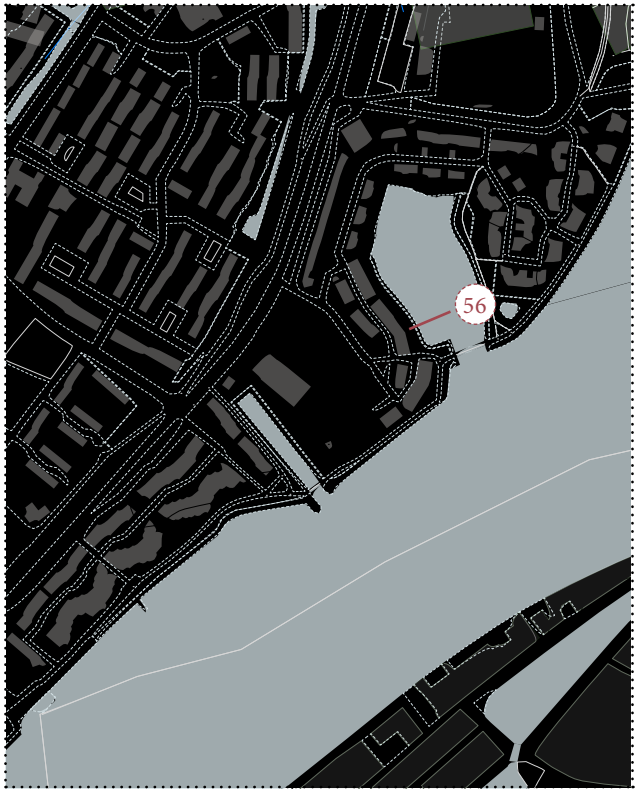

map of sections

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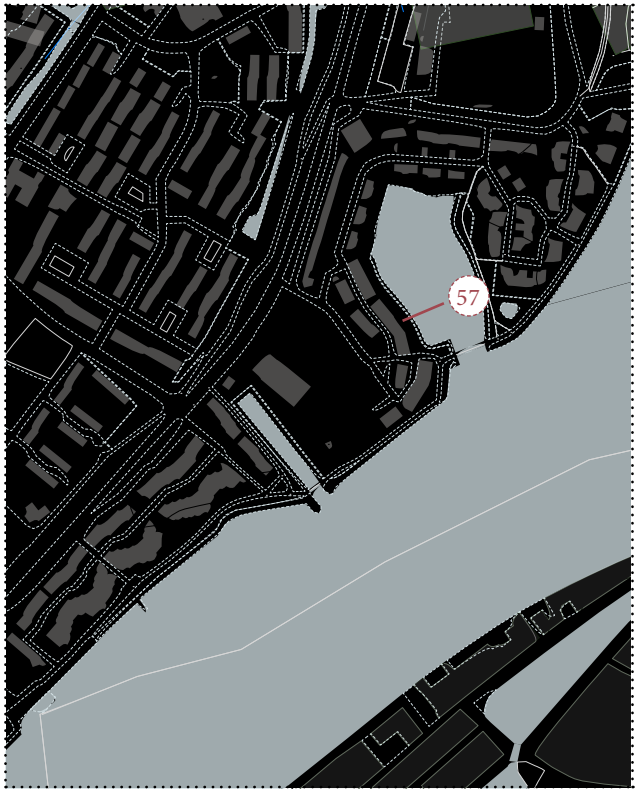


map of sections

Uncovering the silhouette

Discovering what is underneath the soil

The TERRITORY

Territory programmed by CODE

Atlas of Sections

Soil Extraction

The TERRITORY

Territory programmed by CODE

Atlas of Sections

Soil Extraction

Soil Extractions

Understanding the territory is understating the fine grain of materials which make up its surfaces. In order to understand how I can intervene into the site, I wanted to reveal what is below the surface of the eye. After the sectional drawing which only provided a silhouette to my ground, through data I was able to create substance sections. Using available data from DINOloket I began mapping the extraction point where soil is known, and drawing three sections based on the average extraction points. The aim of this exercise is to bring awareness to what is underneath the soil, identify the water table, and later on in my design this will determine what kind of foundation I would be using. In my explorations, the fascination of local materials also drove this exercise, having in mind that with all the digging in my design I can reuse the clay.

Furthermore, after listening to the lecture by Fadi Masoud on the Coding Flux where he mentioned that geological maps of cities and urban planning maps, when overplayed, rarely coincide with one another, I was motivated to understand the surface on which I am building. Instead of taking the zoning for granted, I use the available data to truly understand my sites natural conditions.

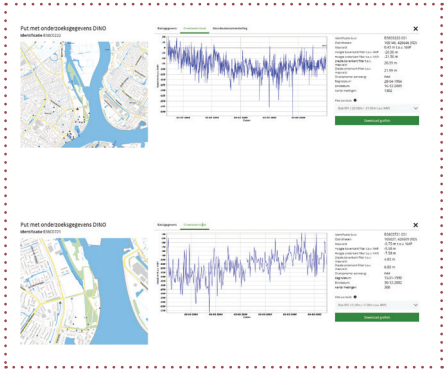
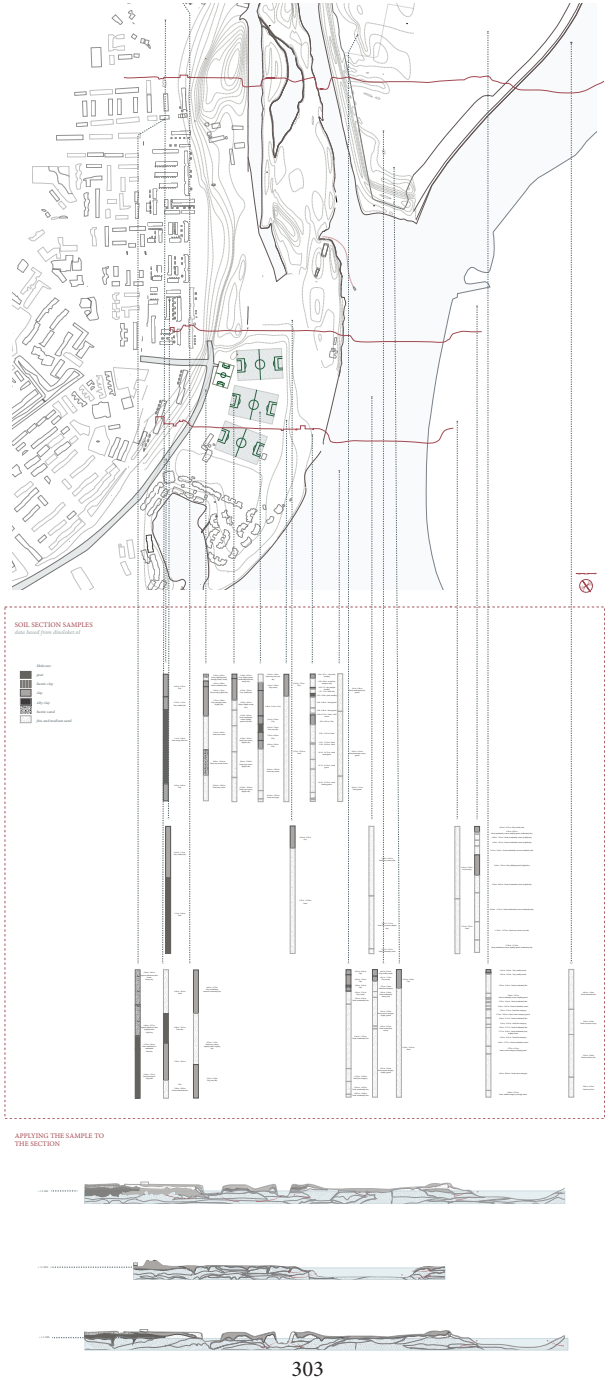
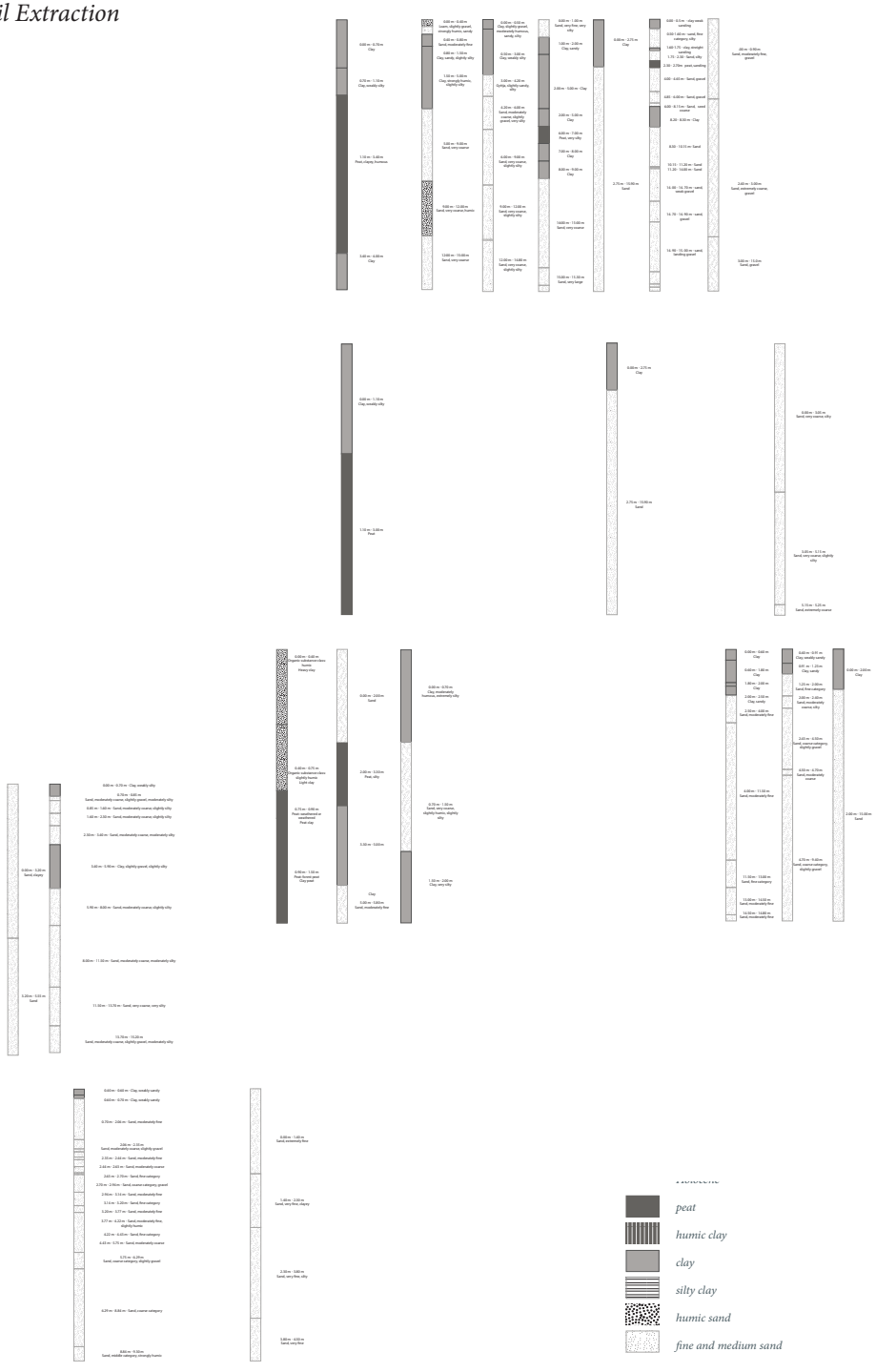
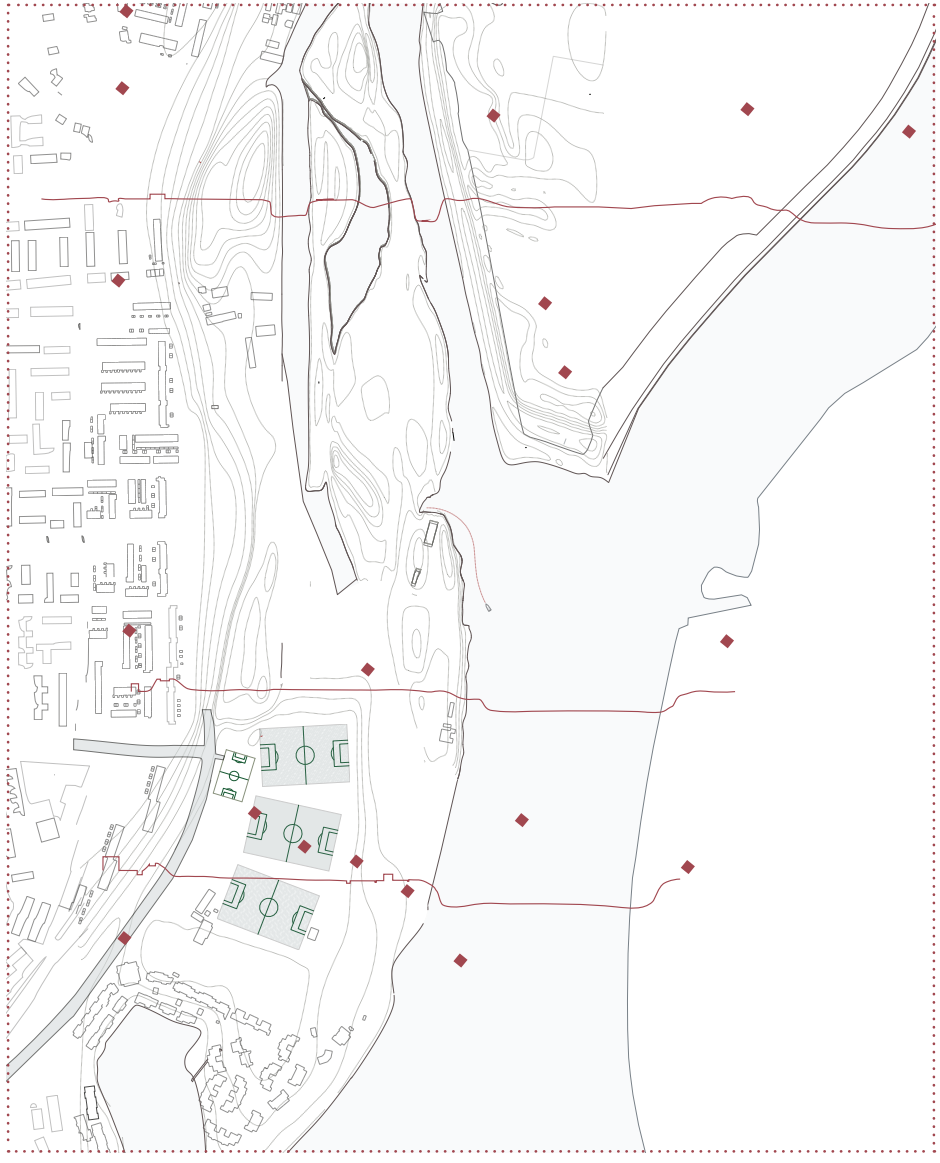
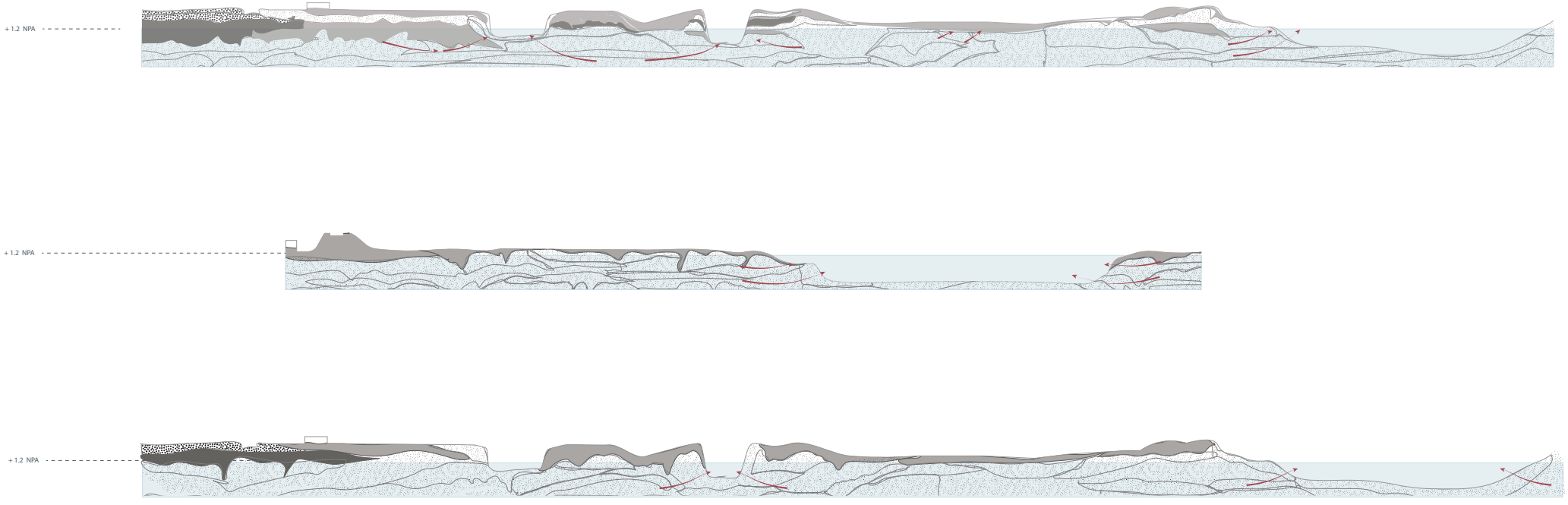


Figure xx - DINOlet data




peat
humic clay
clay
silty clay
humic sand
fine and medium sand



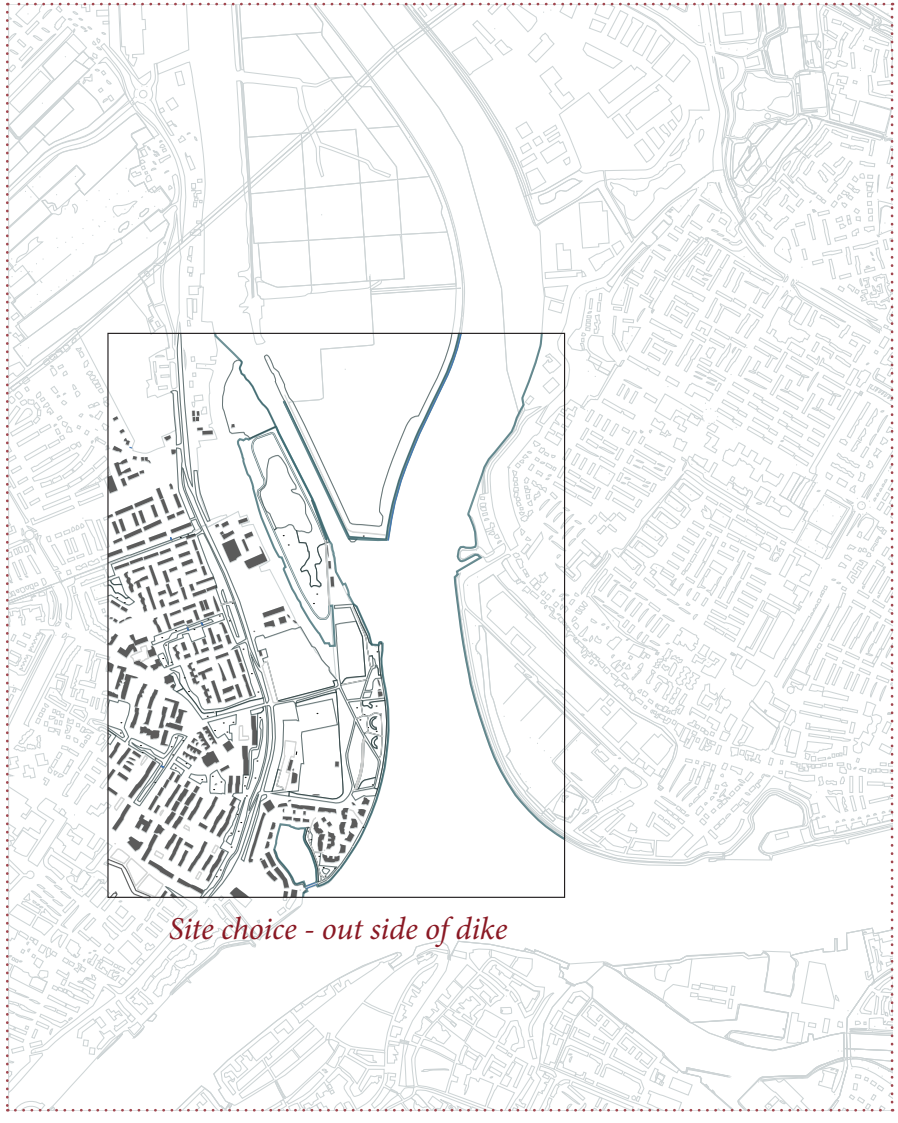

+1.2 NPA
+1.2 NPA
+1.2 NPA

The BODY

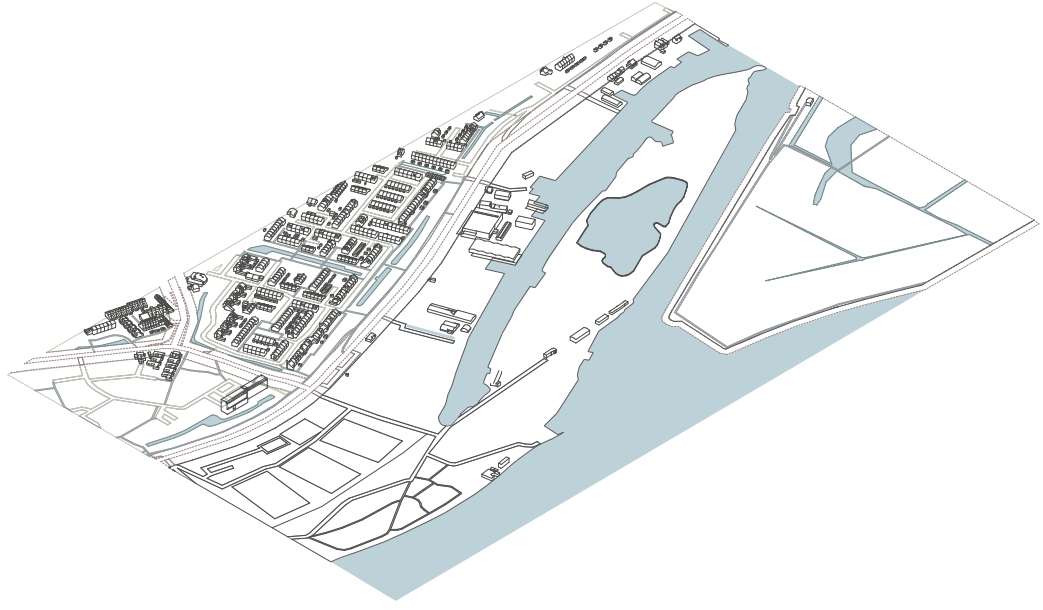
Landscapes, Infrastructure, Architecture

Tectonics of The BODY

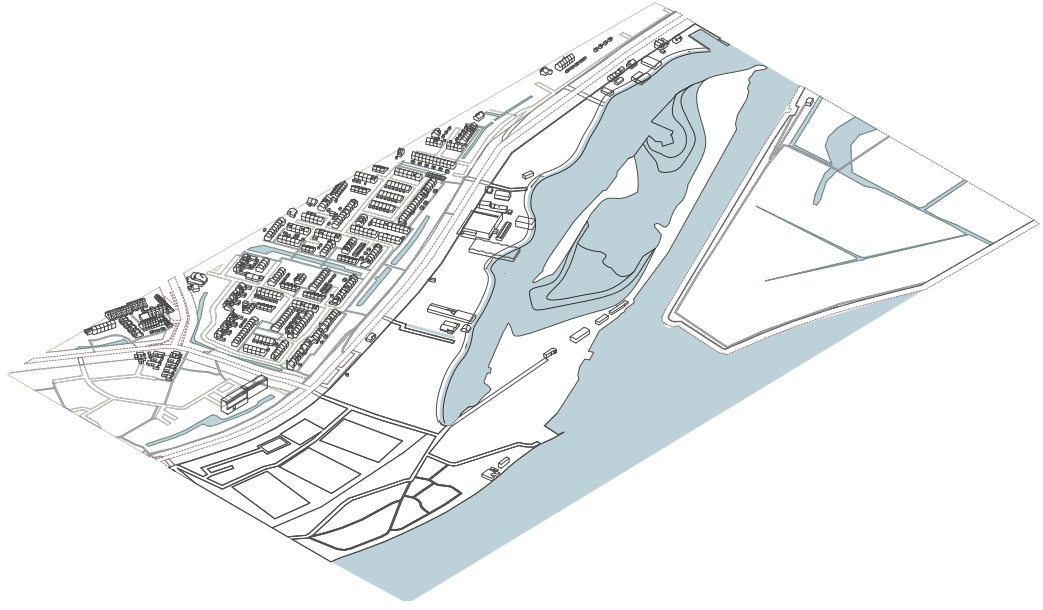
Making of the Landscapes



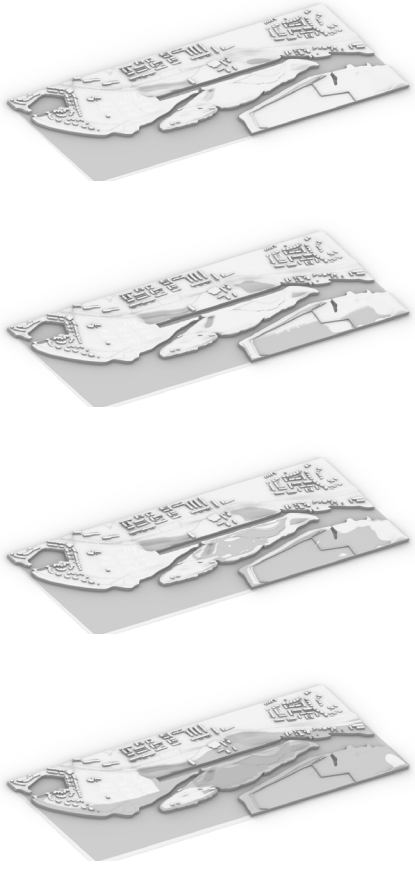
Site choice - out side of dike



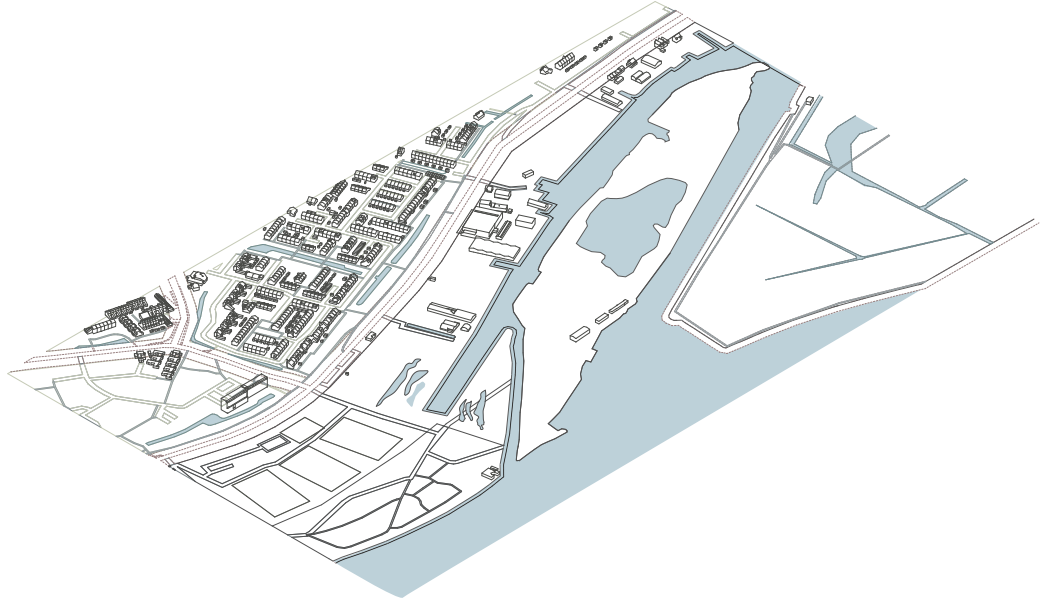
Landscape in its current state



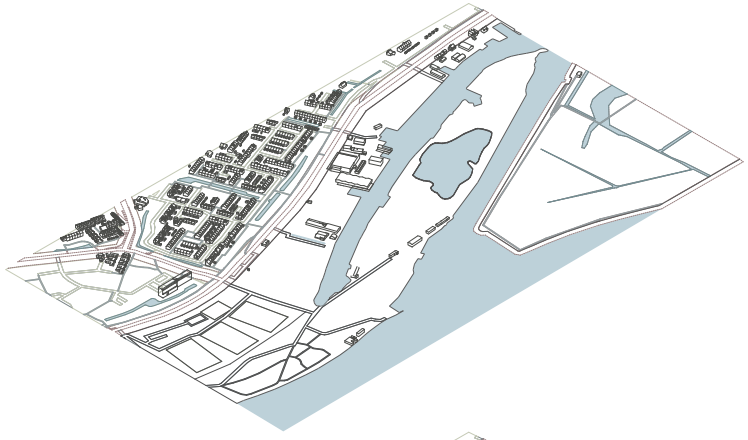
Landscape - applying the principles of Room for the Rive - allowing the lower lying areas to flood during seasonal flooding

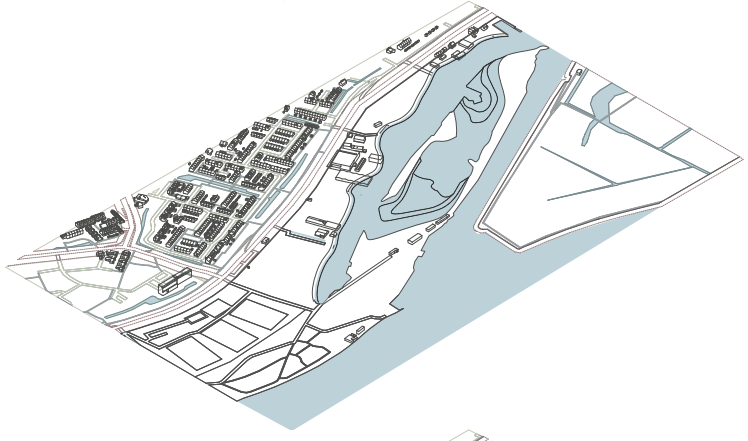


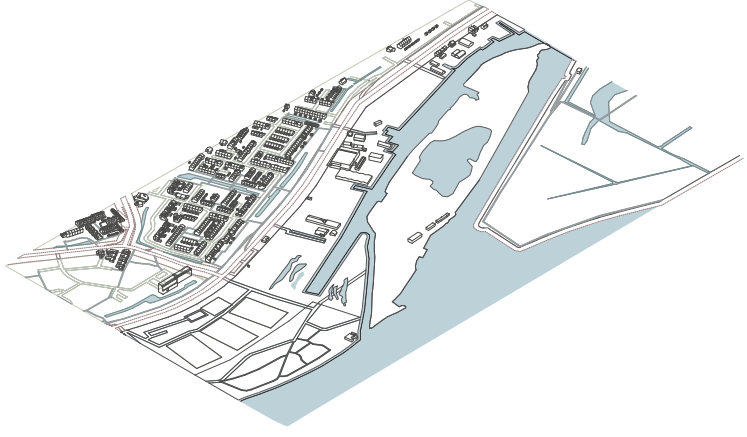
3D simulation - testing which areas flood when water rises
data based on the sections drawn drom DINOlet

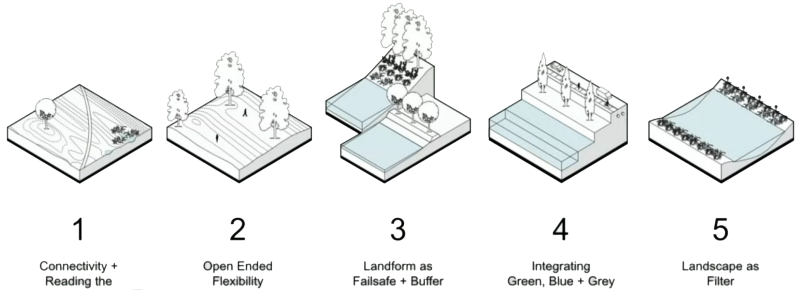


Landscape - extending the water flow as a rowing club - and introducing a flow of water outside of the rowing canal









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)

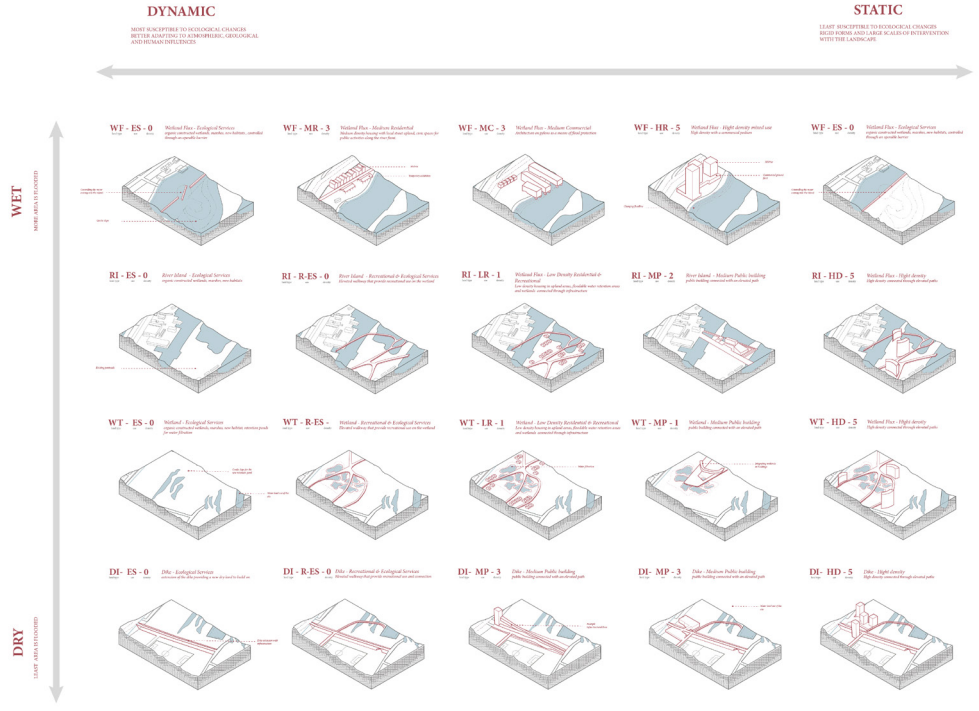
Matrix of potential developments

In the following diagram is the summary of my explorations based on the theory of the 5 design principles by Fadi Masoud:

1. Connectivity
2. Open Ended Flexibility
3. Landform as Failsafe + Buffer
4. Integrating Green, Blue + Gray
5. Landscapes as a filter

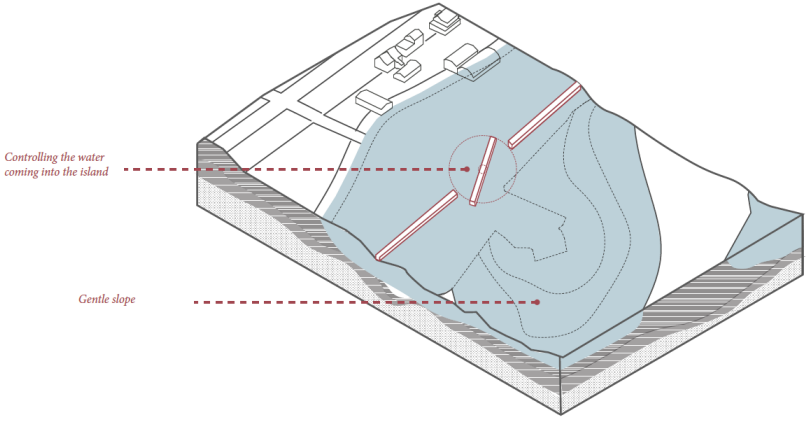
They are then cross examined with the theory of Mathur and Dilip, where everything is a gradient of wetness. Through these principles I build up a matrix where the X can vary from Dynamic to Static, this relates to the Susceptibility of the BODY to ecological changes, the extent to which the BODY can adapt to atmospheric, geological and human influences. It is also characterized as a means to achieve density, static referring to high rise and dynamic to low rise.

The Y is the gradient of wetness, these scenarios in my site are derived from the three landscapes introduced on the previous page, and the positioning of the architectural and infrastructural object on site. This way I do not disregard the landscape but rather take its natural existing form as derived from the section.



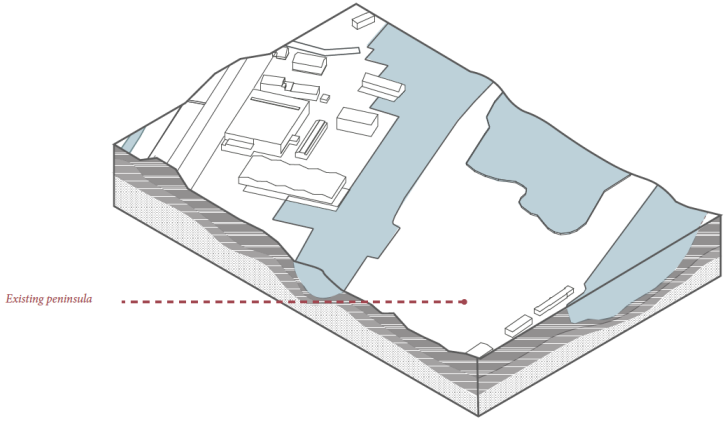
WF - ES - 0
land type use density

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



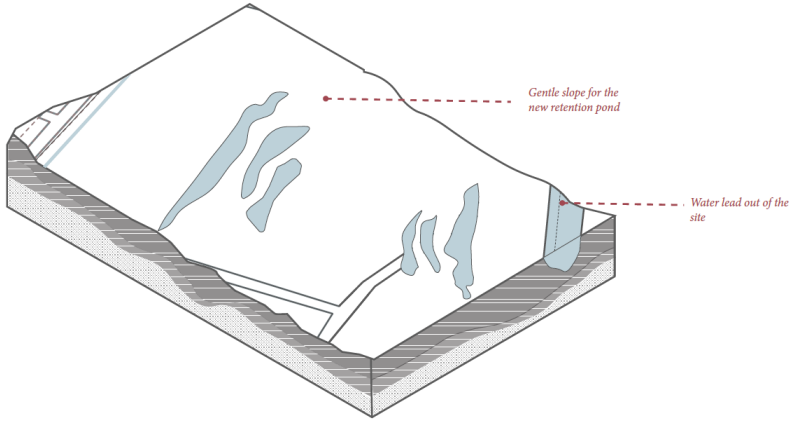
RI - ES - 0
land type use density

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



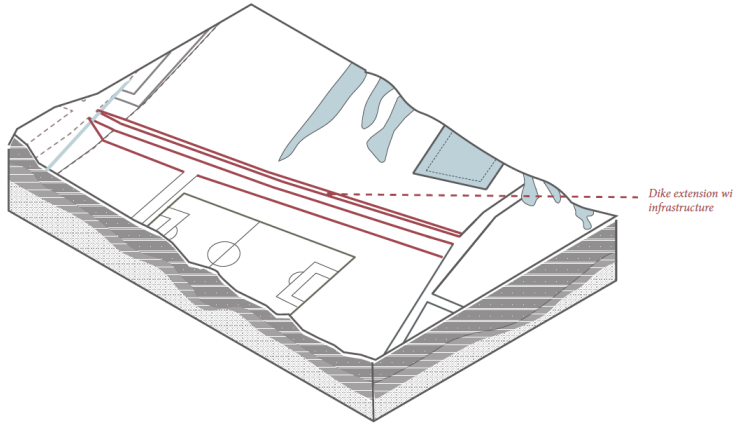
WT - ES - 0
land type use density

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



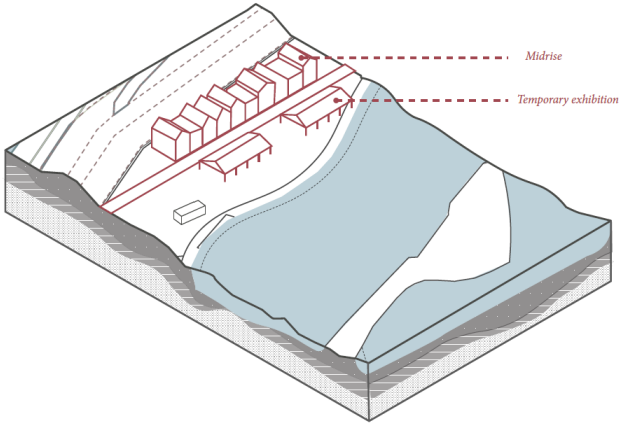
DI- ES - 0
land type use density

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



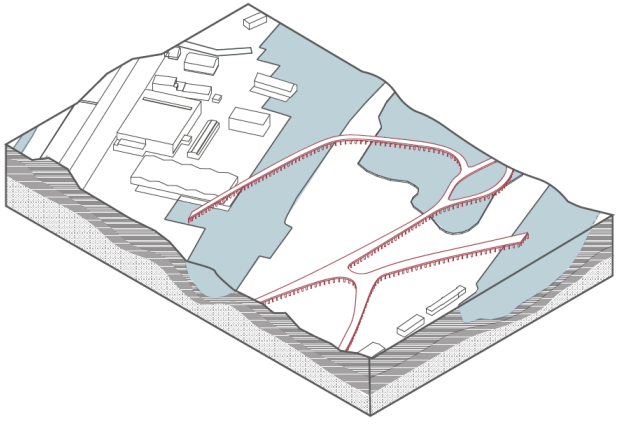
WF - MR - 3
land type use density

Wetland Flux - Medium Residential
Medium density housing with local street upland, civic spaces for public activities along the river front.



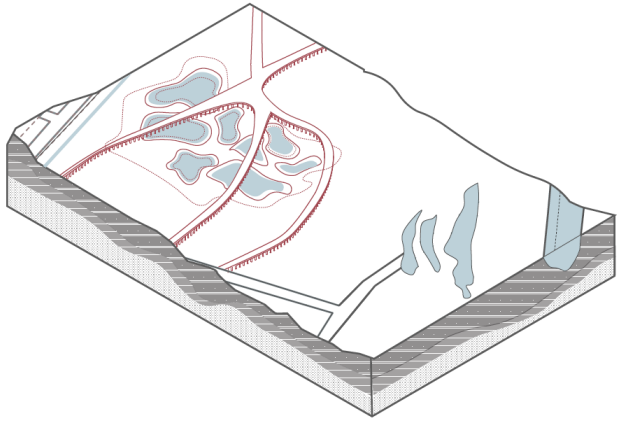
RI - R-ES - 0
land type use density

River Island - Recreational & Ecological Servic
Elevated walkway that provide recreational use on the wetland



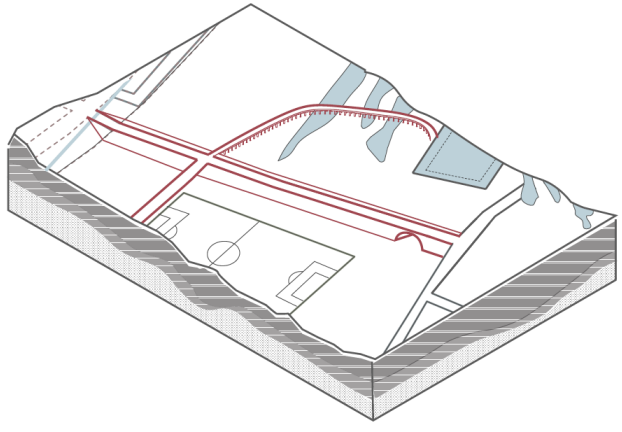
WT - R-ES -
land type use density

Wetland - Recreational & Ecological Services
Elevated walkway that provide recreational use on the wetland



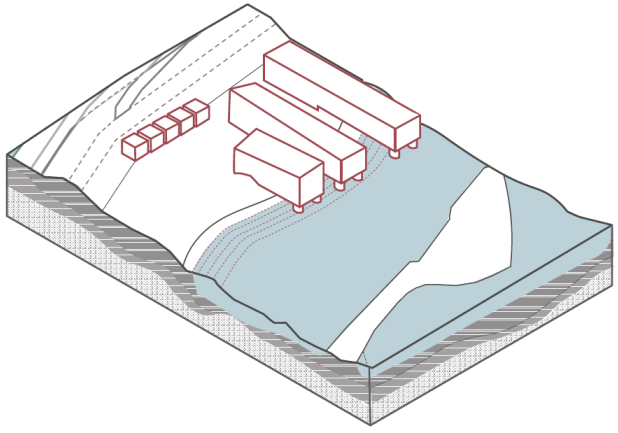
DI - R-ES - 0
land type use density

Dike - Recreational & Ecological Services
Elevated walkway that provide recreational use and connectior



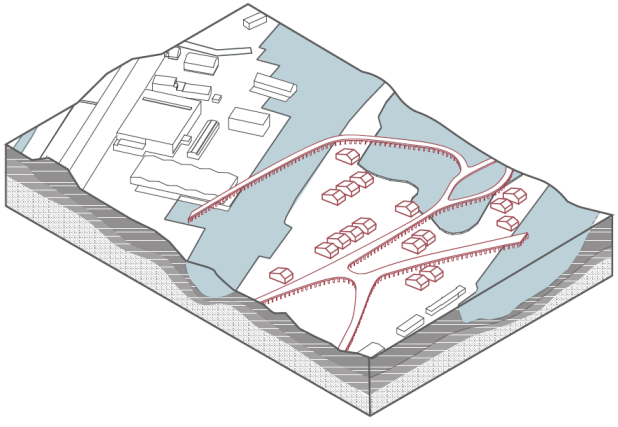
WF - MC - 3
land type use density

Wetland Flux - Medium Commercial
Architecture on pylons as a means of flood protection



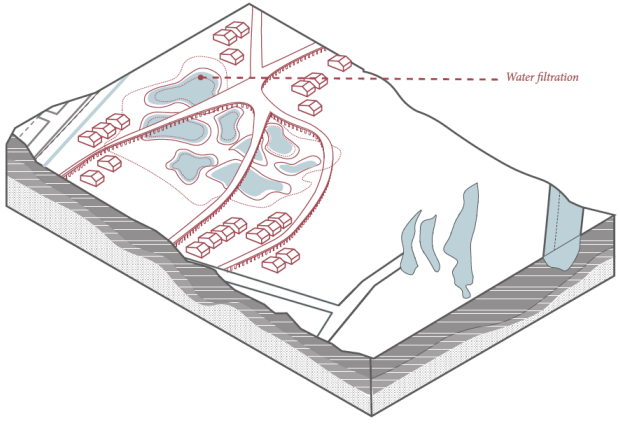
RI - LR - 1
land type use density

Wetland Flux - Low Density Residential & Recreational
Low density housing in upland areas, floodable water retention areas and wetlands connected through infrastructure



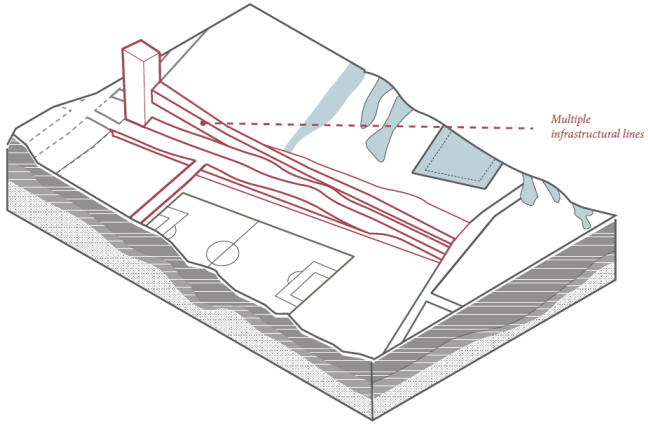
WT - LR - 1
land type use density

Wetland - Low Density Residential & Recreational
Low density housing in upland areas, floodable water retention areas and wetlands connected through infrastructure



DI- MP - 3
land type use density

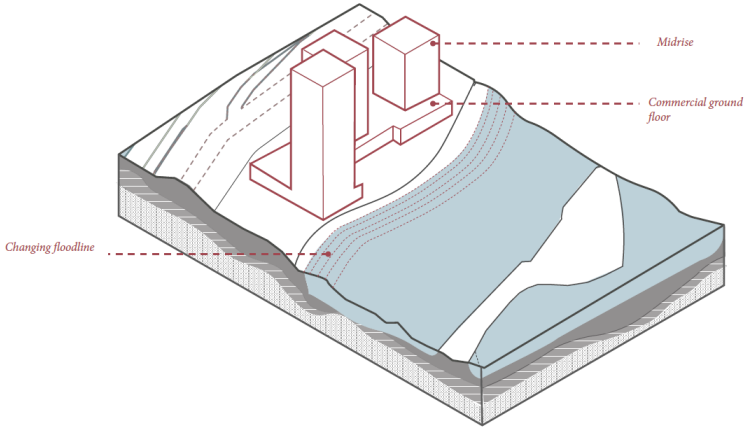
Dike - Medium Public building
public building connected with an elevated path



WF - HR - 5

land type use density

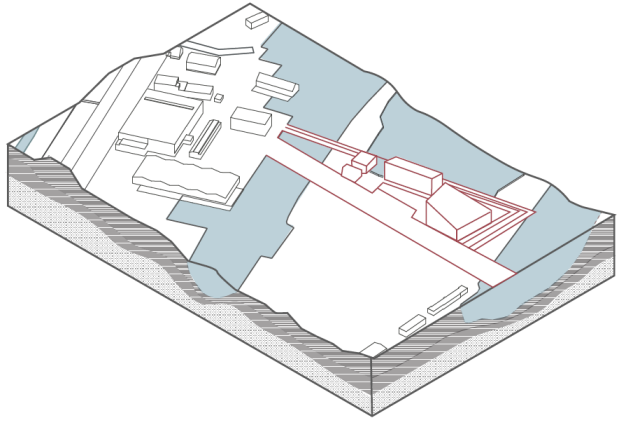
Wetland Flux - Hight density mixed use
High density with a commercial podium



RI - MP - 2

land type use density

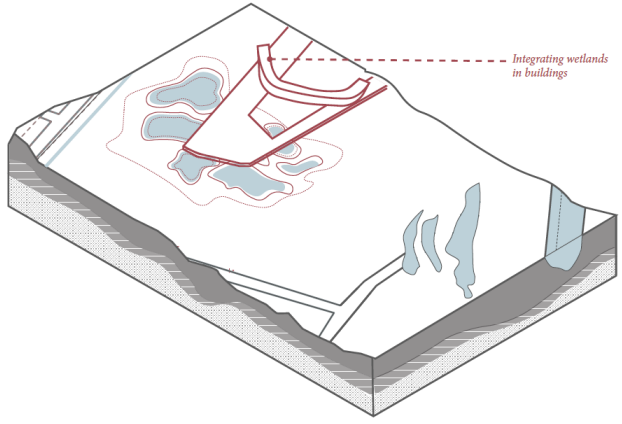
River Island - Medium Public building
public building connected with an elevated path



WT - MP - 1

land type use density

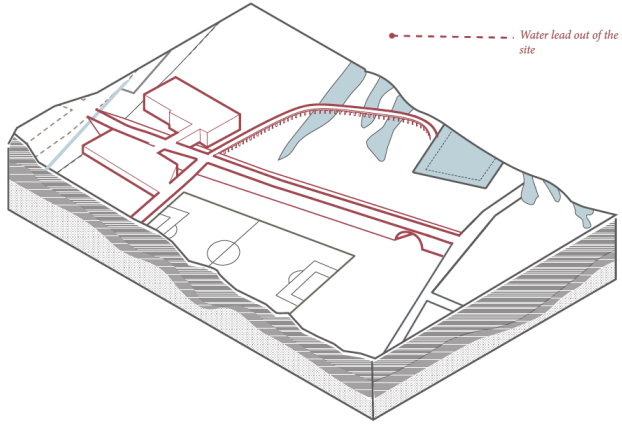
Wetland - Medium Public building
public building connected with an elevated path



DI- MP - 3

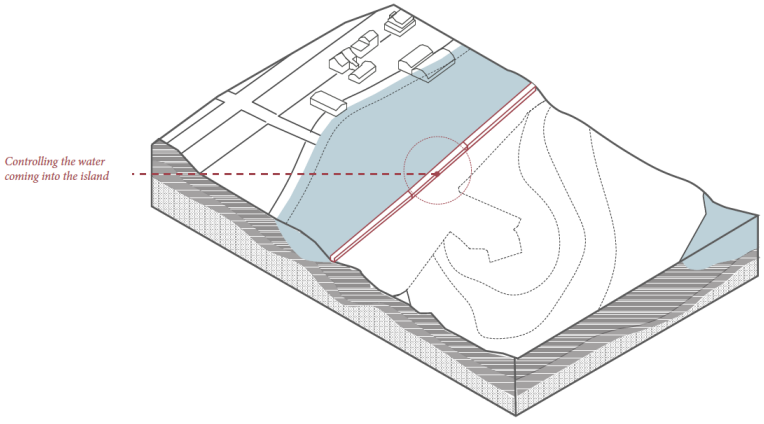
land type use density

Dike - Medium Public building
public building connected with an elevated path



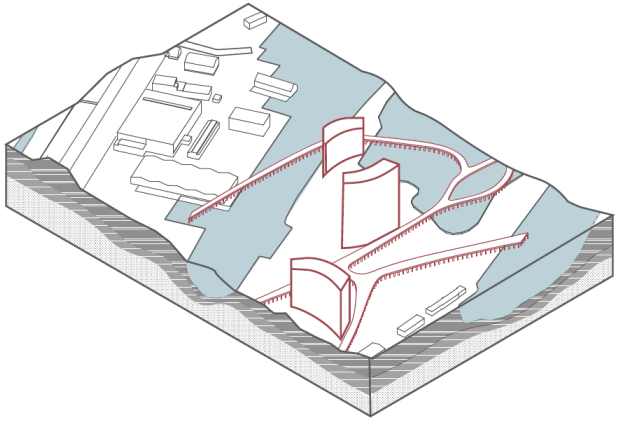
WF - ES - 0
land type use density

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



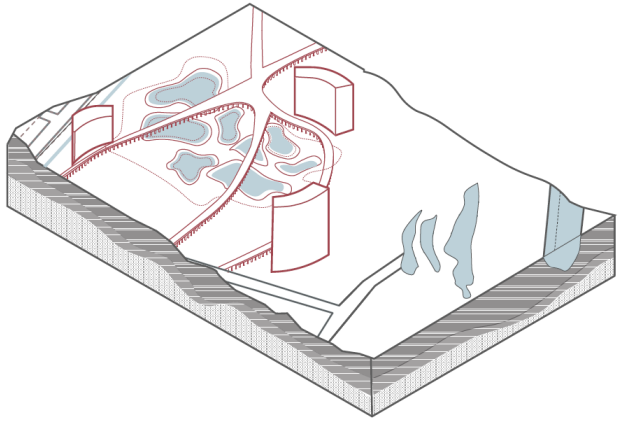
RI - HD - 5
land type use density

Wetland Flux - Hight density
High density connected through elevated paths



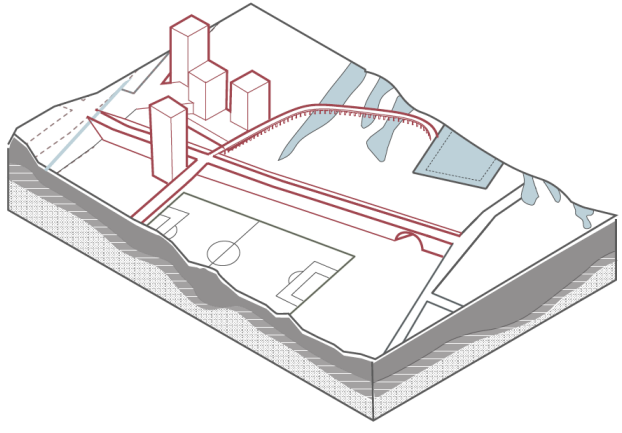
WT - HD - 5
land type use density

Wetland Flux - Hight density
High density connected through elevated paths



DI- HD - 5
land type use density

Dike - Hight density
High density connected through elevated paths

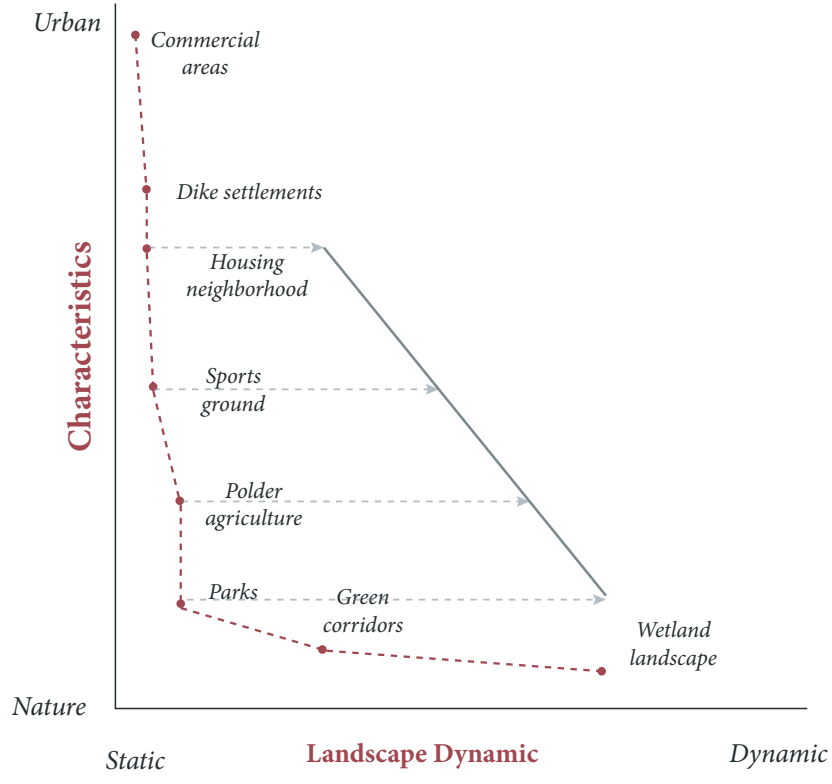


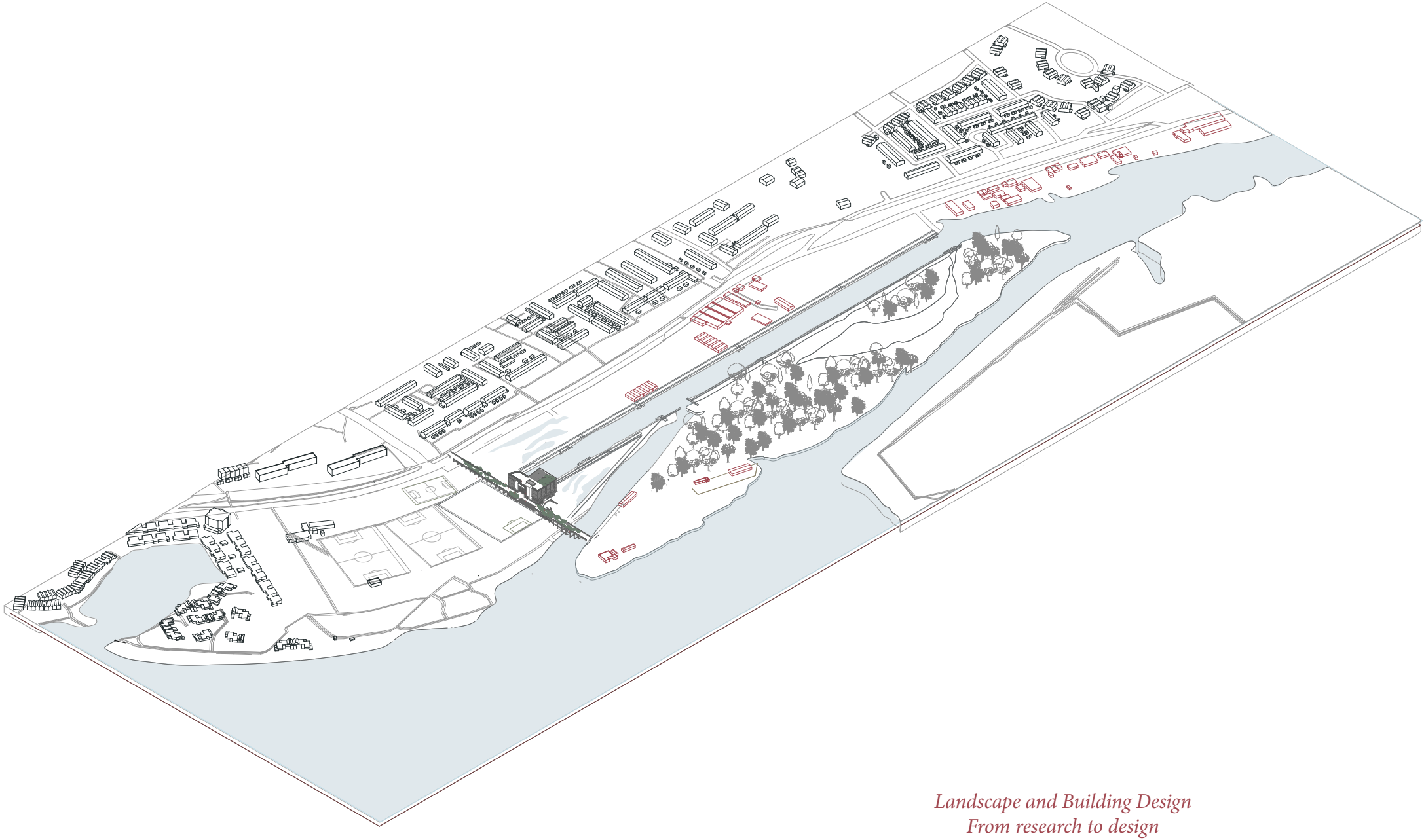
Conclusion

The explorations of the landscape in relation to different architectural typologies, and infrastructural connections brought a clearer understanding of the potentials of the site. However, coming back to my research question "How architecture, infrastructural and landscapes can transform our perception of nature"a nd invoke a healthier relationship with water I knew that i wanted to create a public program. For me the site and its vast potential of developments due to its landscape programs, was too divided by the dike and needed to be reconnected through a public program.

For me this meant completely embracing the public aspect of it, connecting the dike with the water, by using the same tool that divides, the dike. In my culture there is a saying "Klin se klinom izbija, which roughly translates to: "the only way to get a wedge out is with another wedge". So if the dike is the wedge, and it divides the landscape than we can use this spatial manifestation to create another meaning to it, a one where it reconnect.

Coming back to the site research and the programmatic diversity of the site (right), my intent is to push the curve making this area more dynamic by introducing more public functions. Therefore my program began by looking into the site and what it has to offer.





Landscape and Building Design
From research to design

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

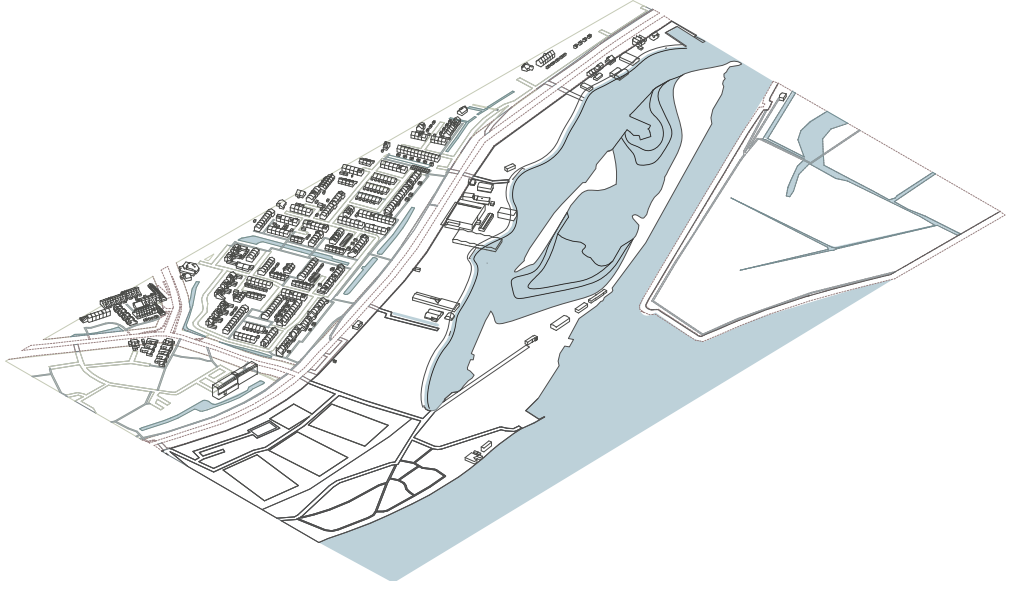
4. Following the 5 principles of designing with waterscapes

Social Awareness

5. Public program - accessibility and connection to all

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

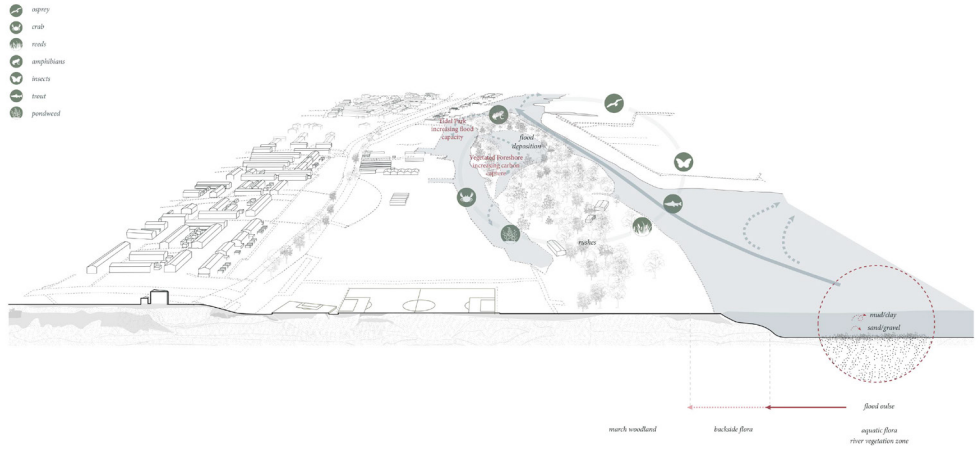
2. Applying landscape strategies to create a better response to the changing water levels



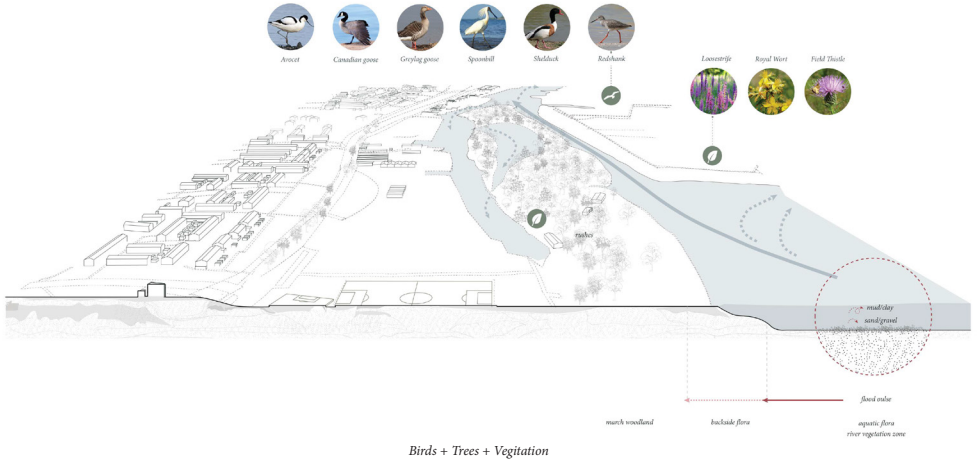
Introducing a more dynamic Ecosystem

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

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



Existing Ecosystems



Birds + Trees + Vegitation

Avocet

Canadian goose

Greylag goose

Spoonbill

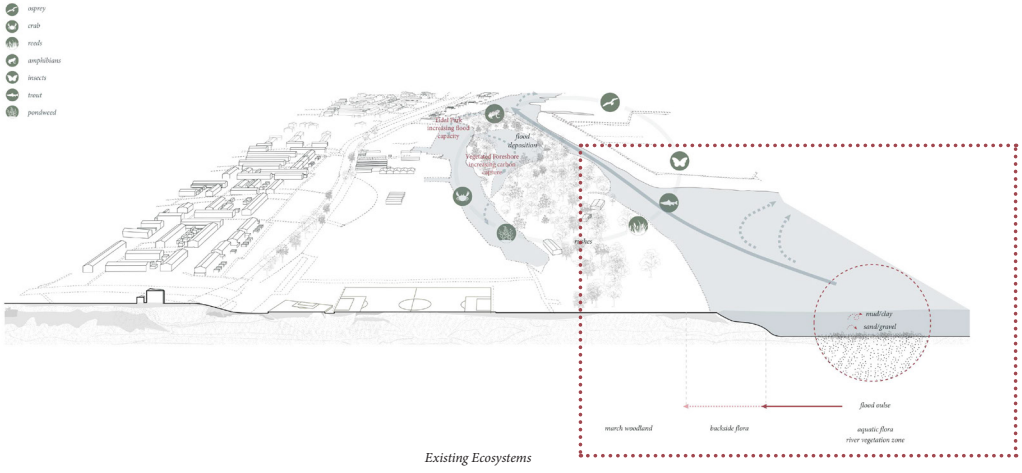
Shelduck

Redshank

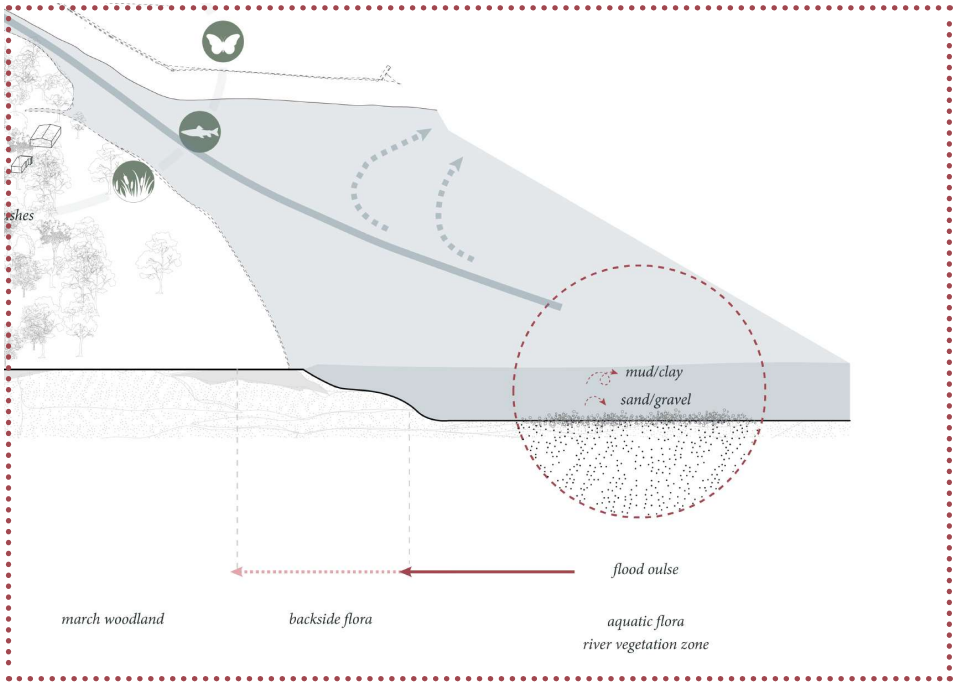
Loosestrife

Royal Wort

Field Thistle



Existing Ecosystems

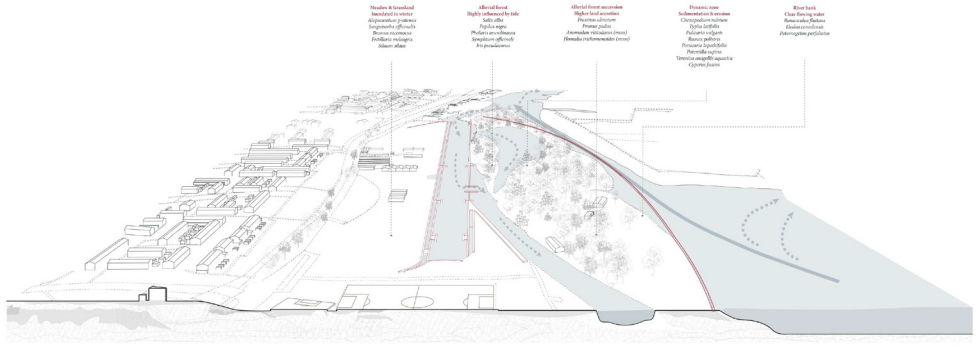


Existing Landscapes

Soil transition between river and "dry land"

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

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



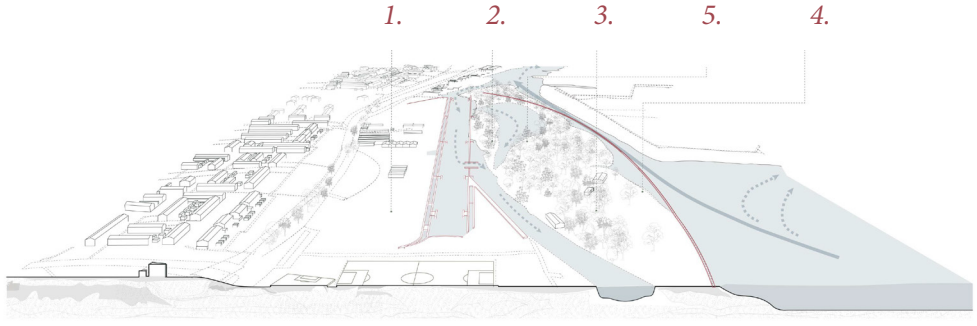
1. Medow &
Grassland
Inundated in winter

2. Alluvial forest
Highlyinfluenced by tide

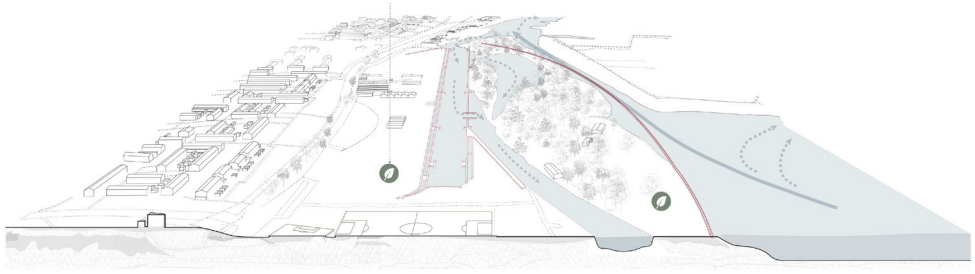
3. Alluvial forest succession
Higher land accretion

4. River bank
Clear flowing ater

5. Dynamic zone
Sedimentation & erosion

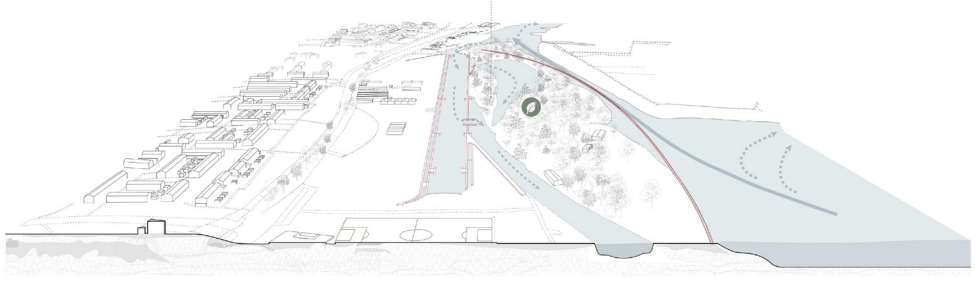


1. Medow & Grassland
Inundated in winter



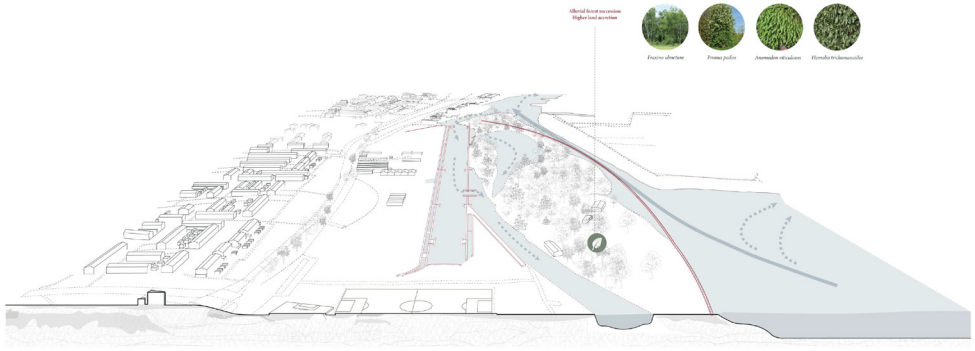
Alopecuretum pratensis *Sanguisorba officinalis* *Bromus racemosus* *Fritillaria meleagris* *Silaum silaus*

2. Alluvial forest
Highly influenced by tide



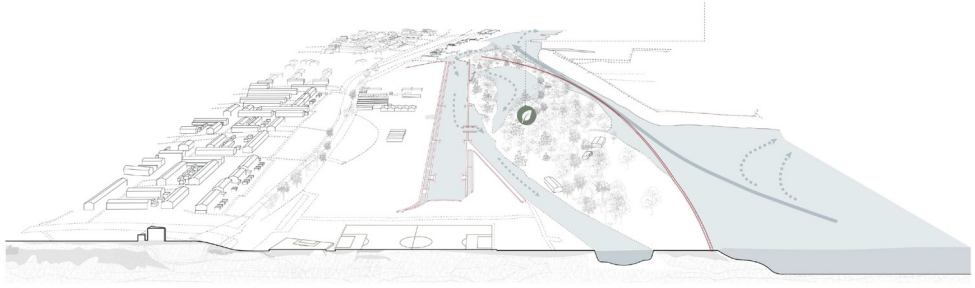
Salix alba *Popilus nigra* *Phalaris arundinacea* *Symphytum officinale* *Iris pseudacorus*

3. Alluvial forest succession
Higher land accretion



Fraxino ulmetum *Prunus padus* *Anomodon viticulosus* *Homalia trichomanoides*

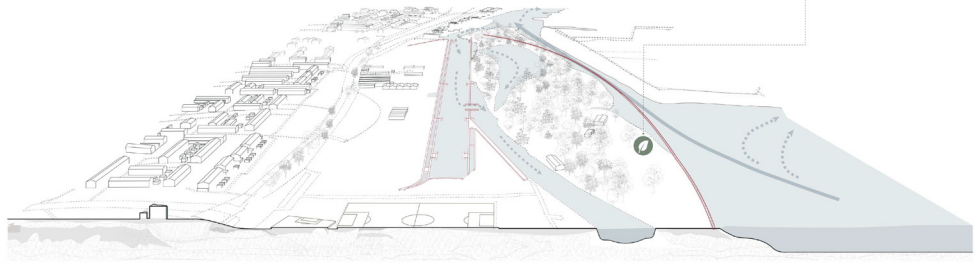
4. River bank
Clear flowing water



Rumex palustris *Persicaria lapathifolia* *Potentilla supina* *Veronica anagallis aquatica* *Cyperus fuscus*

Chenopodium rubrum *Typha latifolia* *Pulicaria vulgaris*

5. Dynamic zone
Sedimentation &
erosion



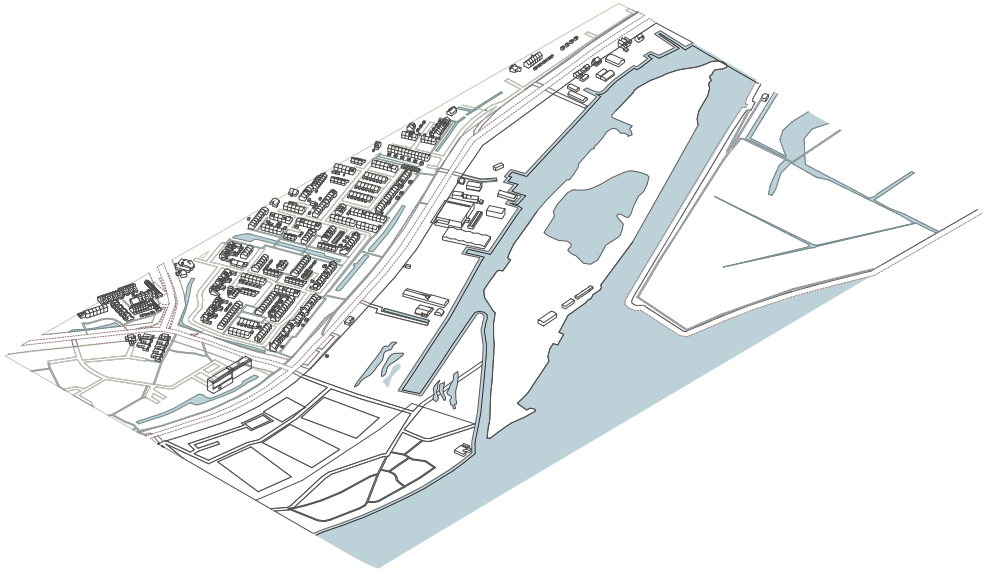
Ranunculus fluitans

Elodea canadensis

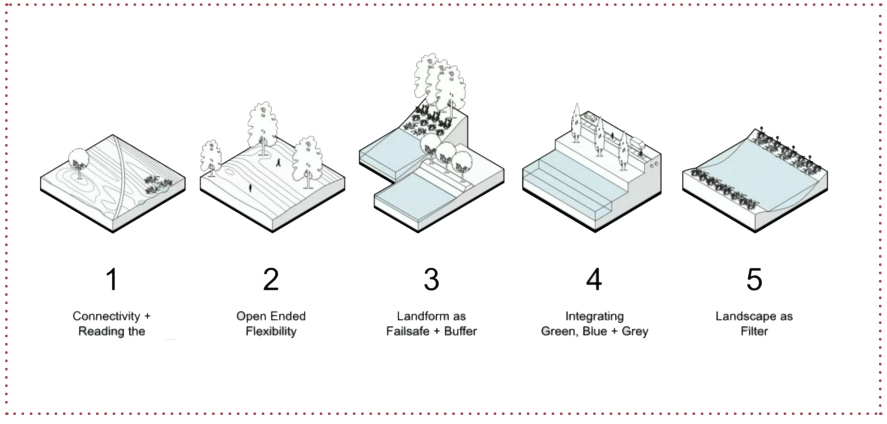
Potamogeton perfoliatus

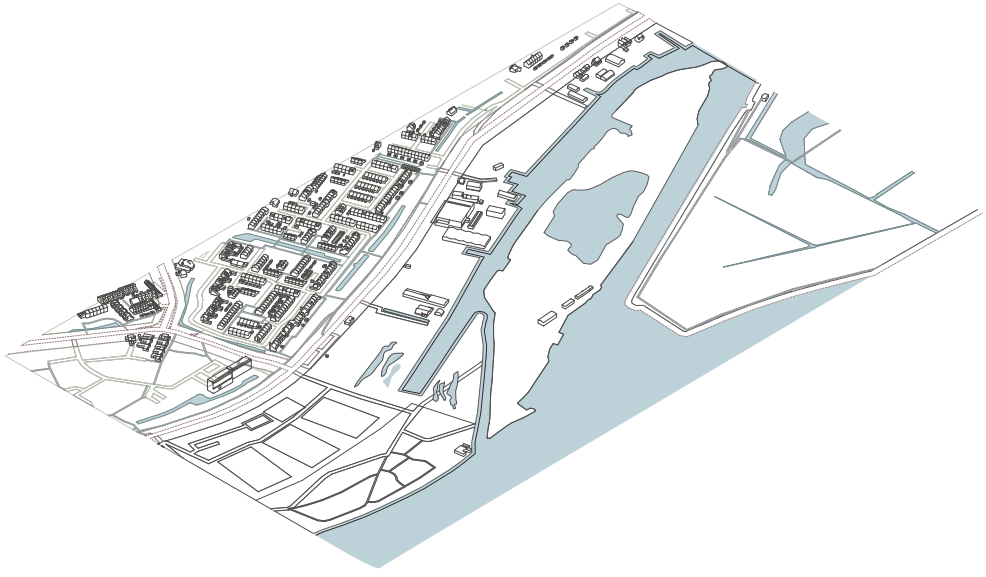
1. Analyzing the existing ecosystem
- site analysis and textbook research

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



Redeveloping the site programmaticly





Redeveloping the site programmaticly

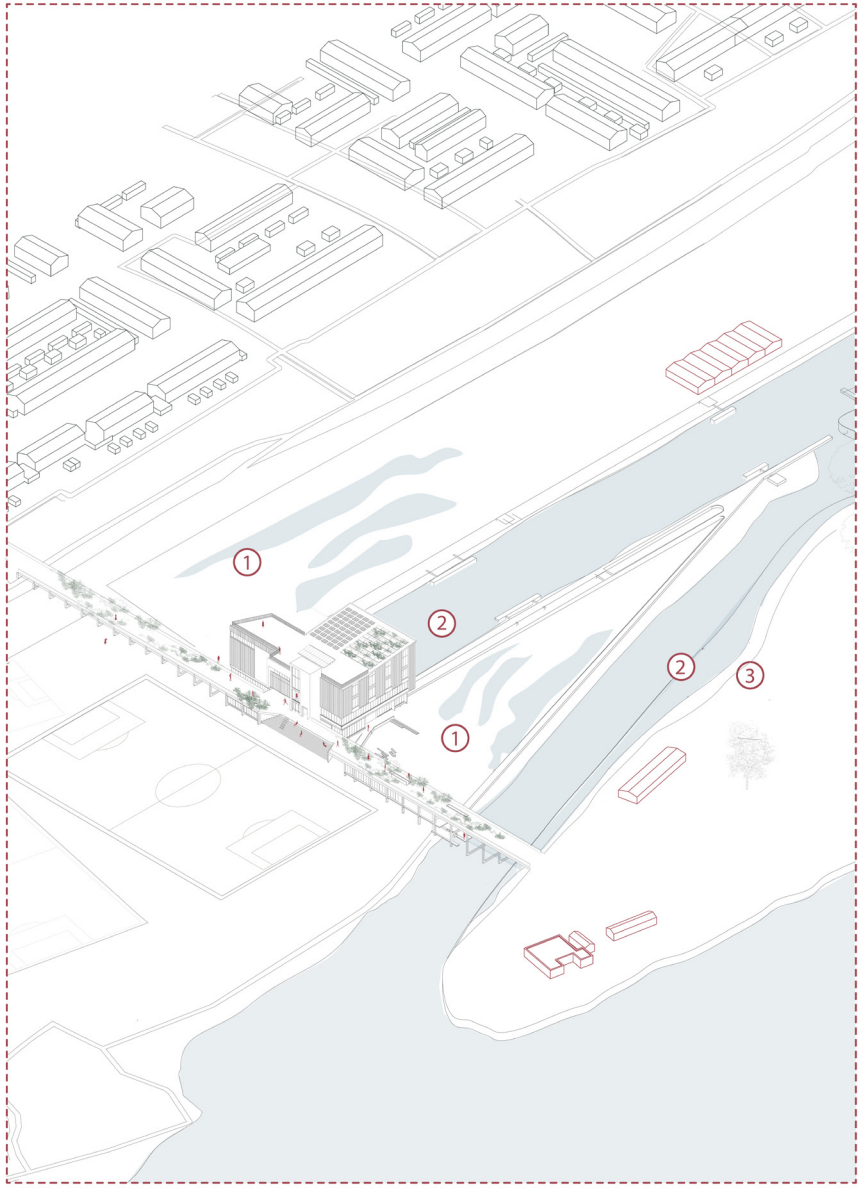
Social integration
+
Biodiversity
+
Water Cycles
+
Ecology Reseach on biodiversity

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



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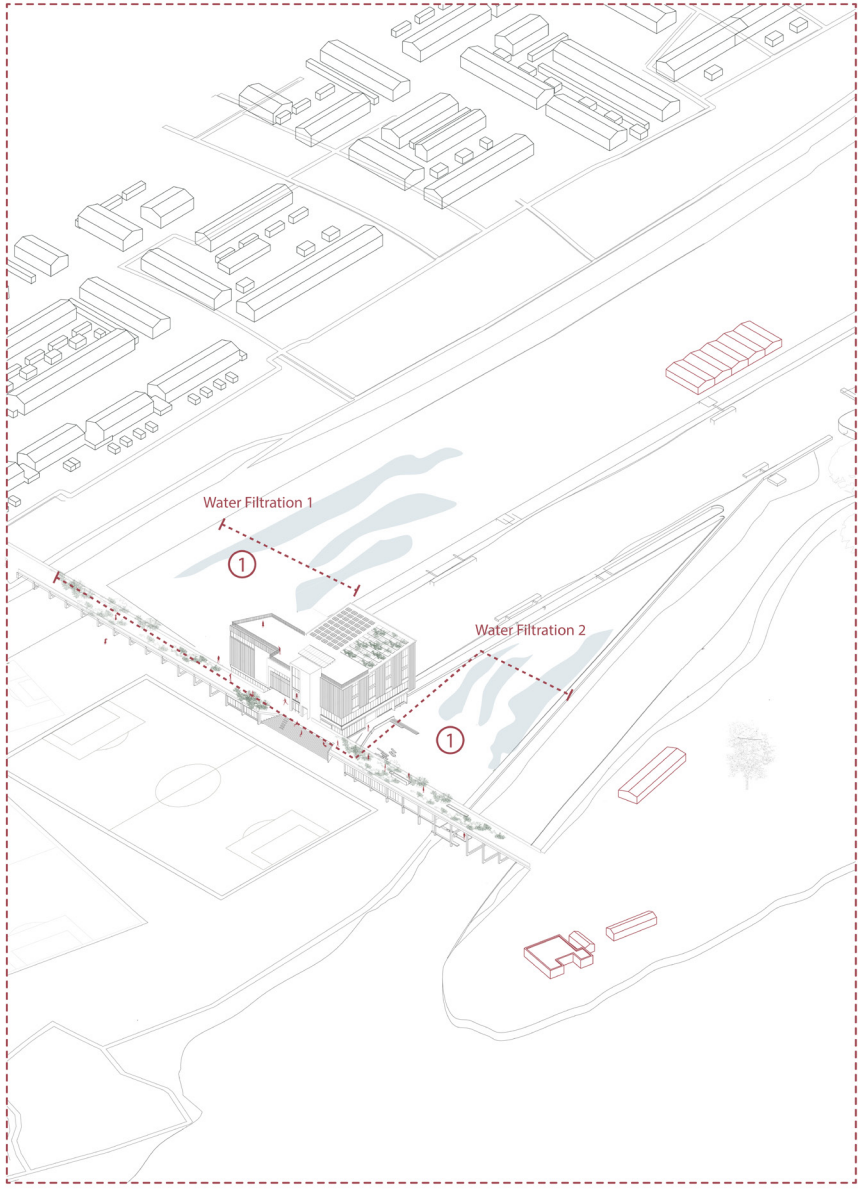
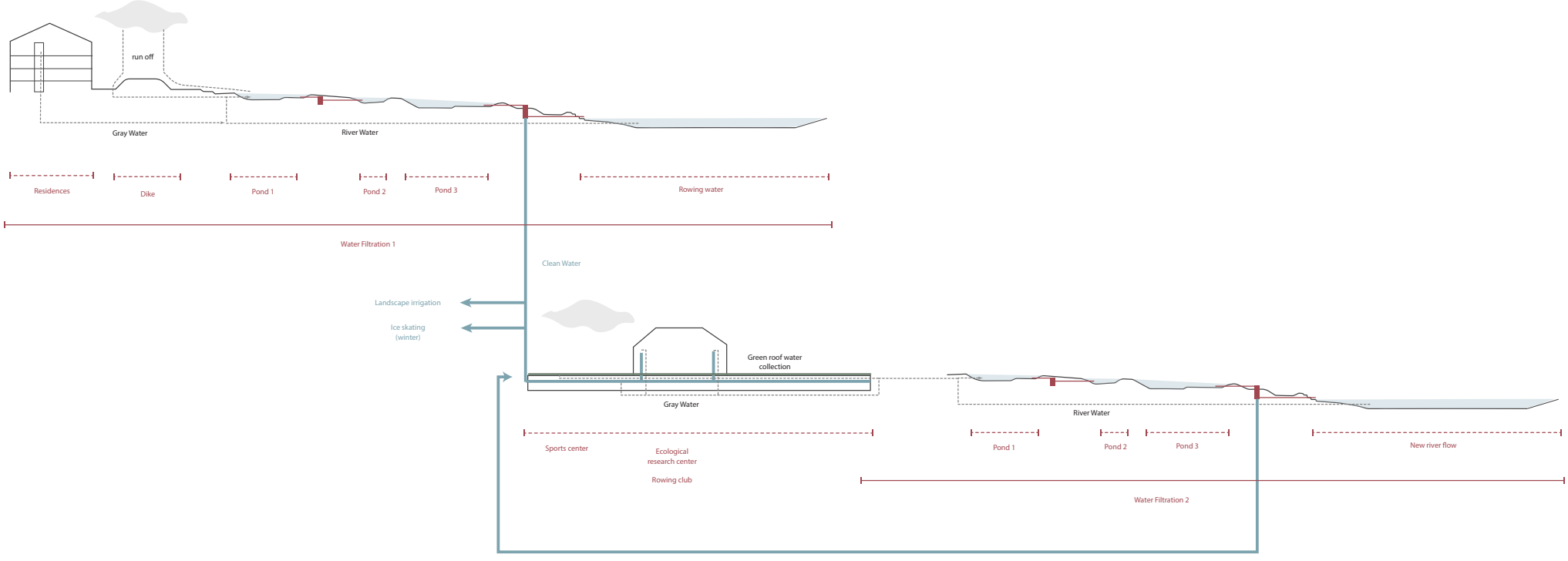


Water filtration using water retension ponds



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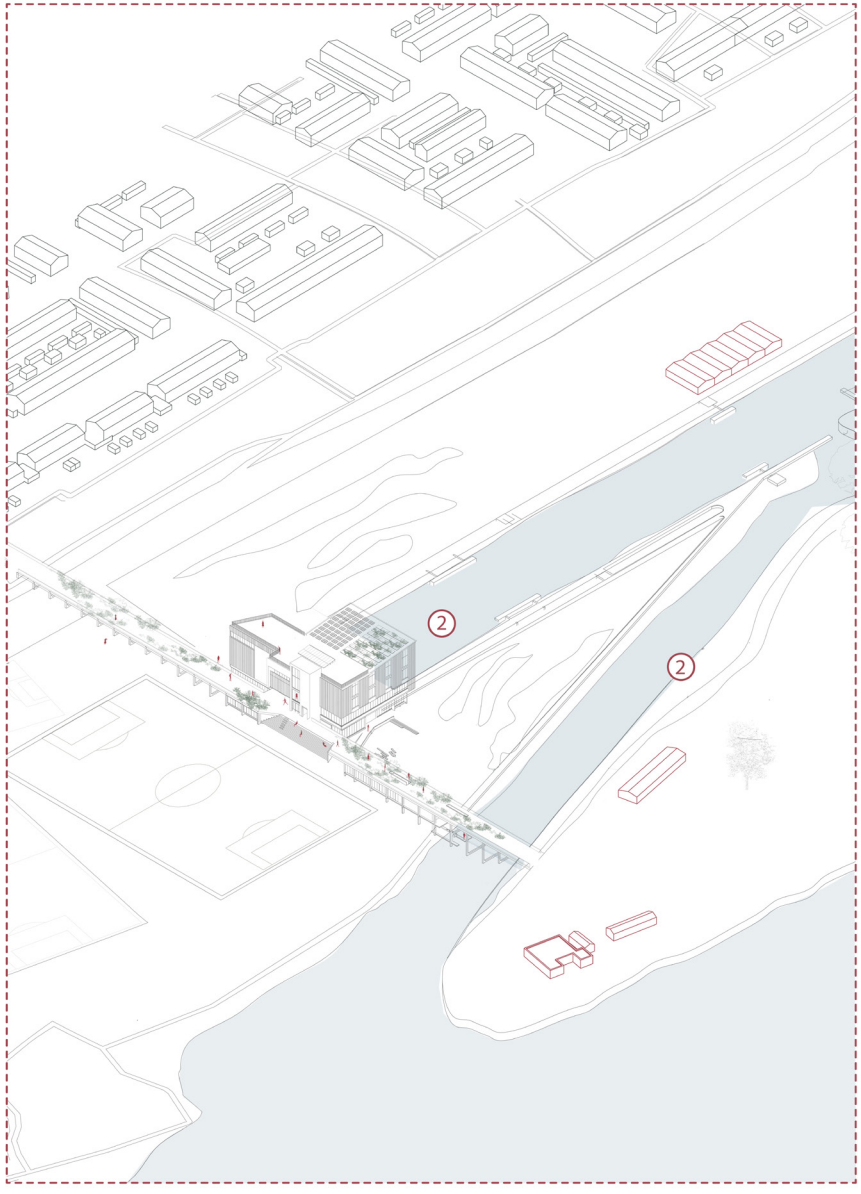

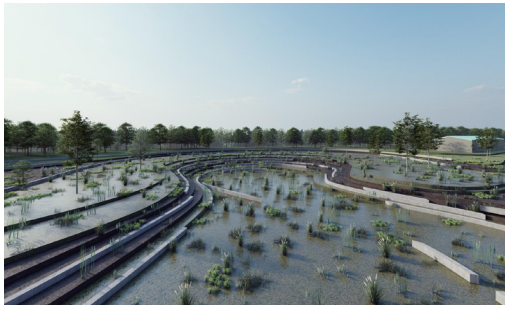

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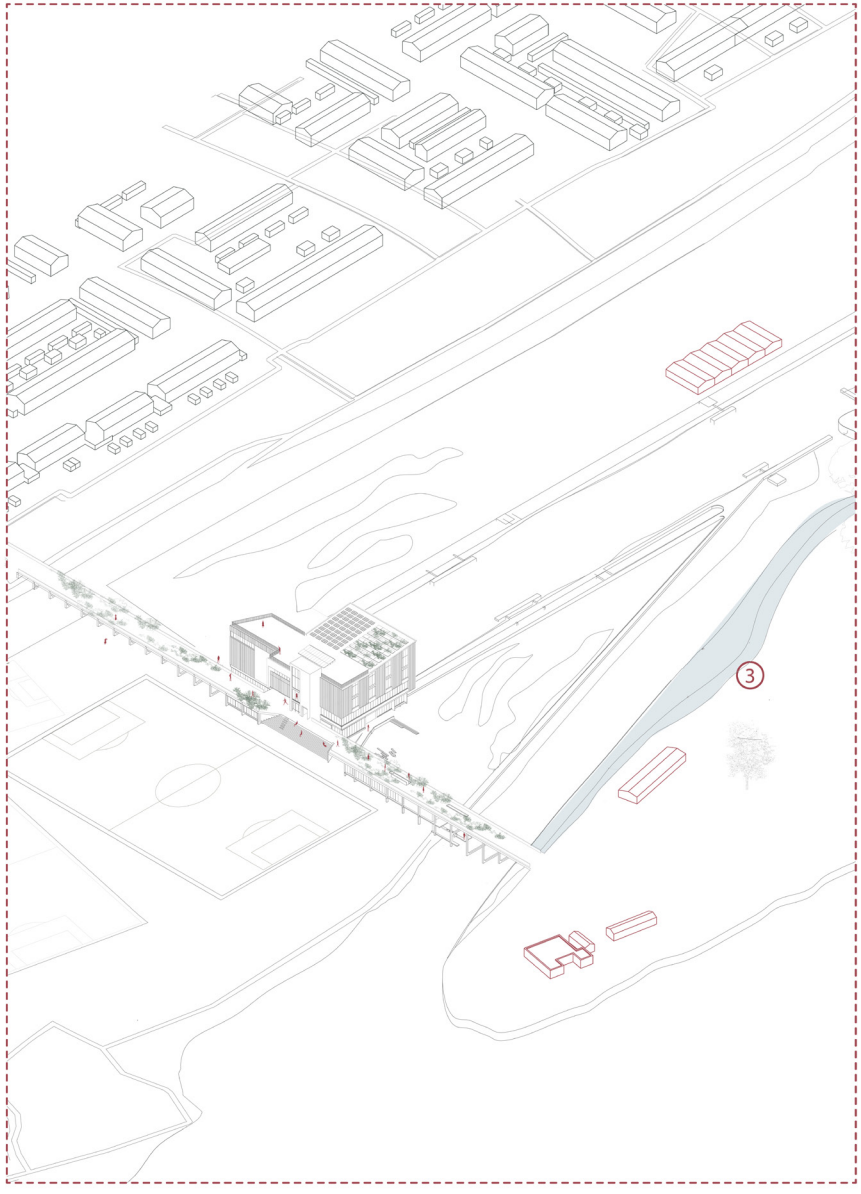

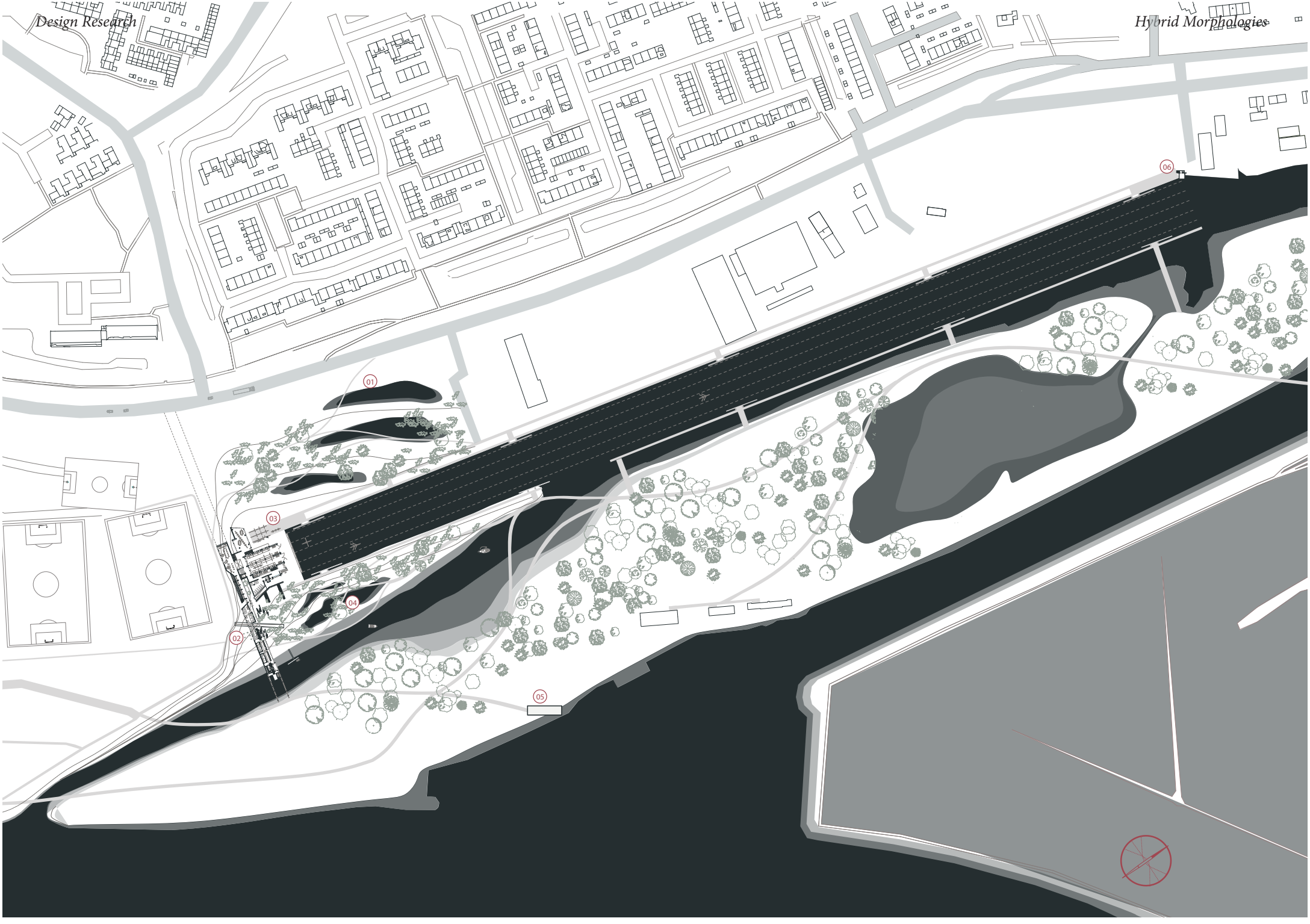
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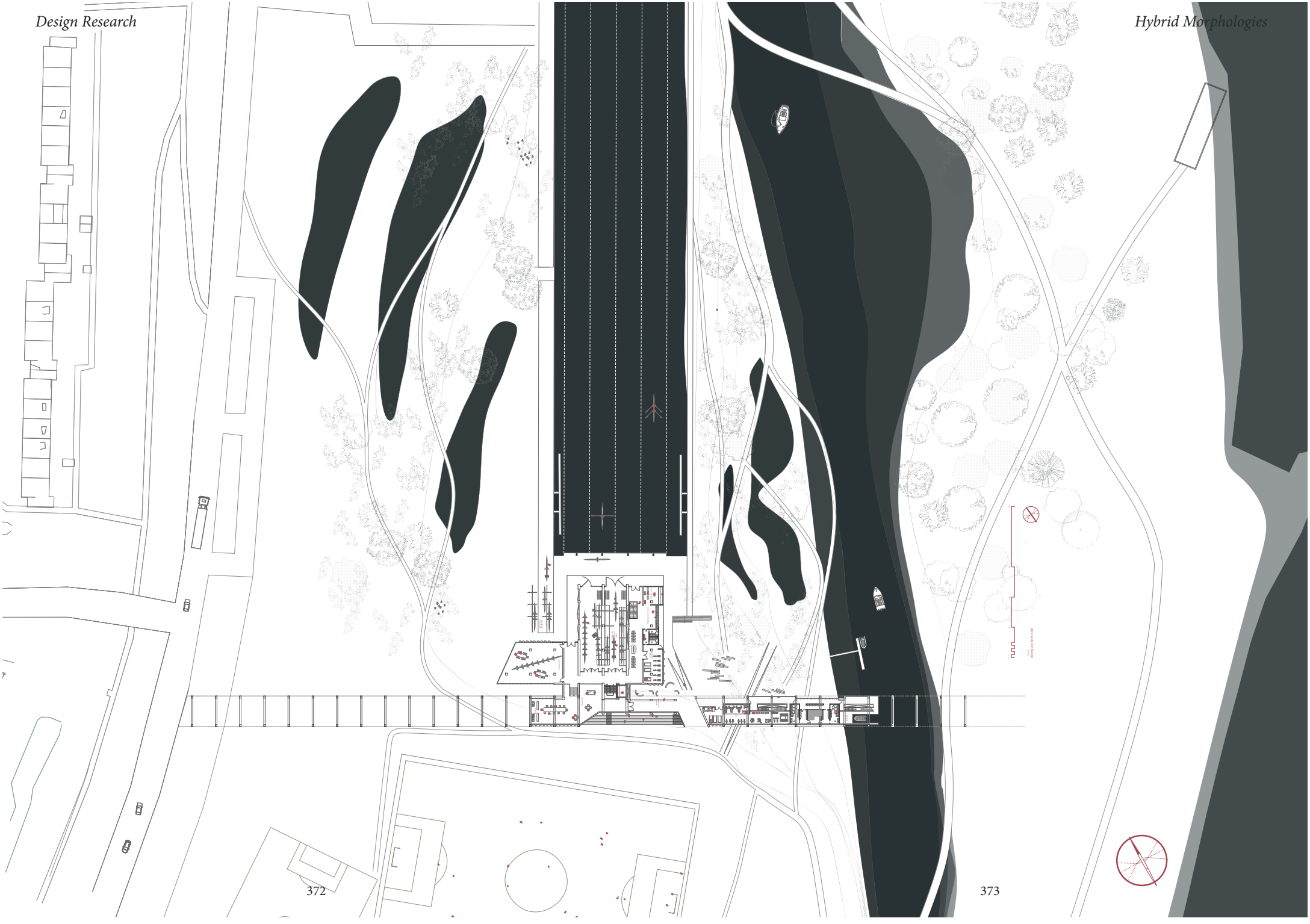
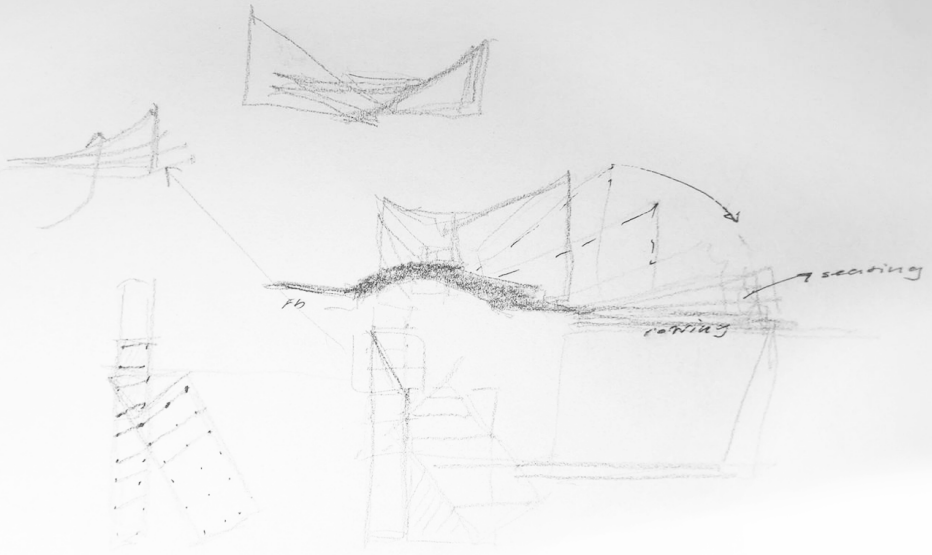
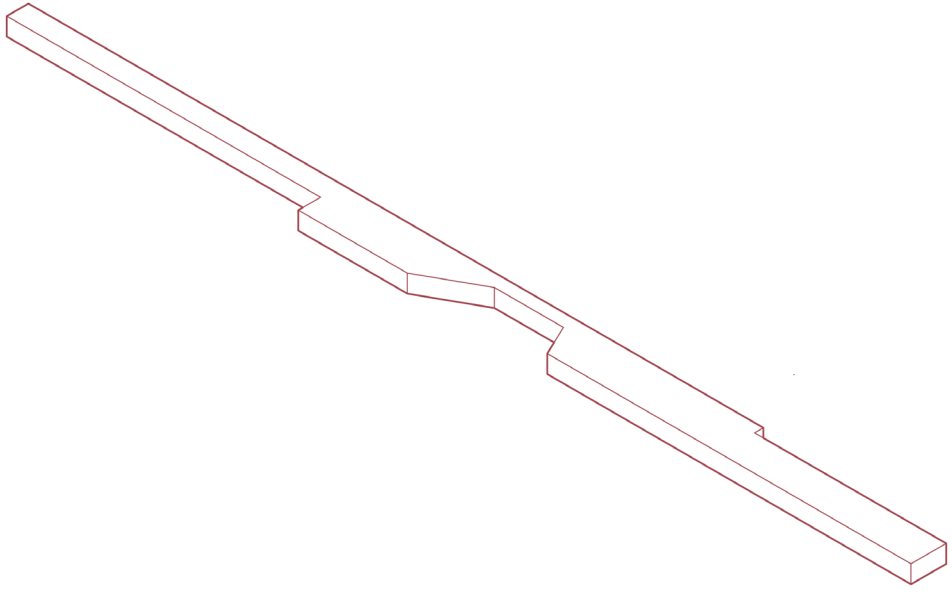


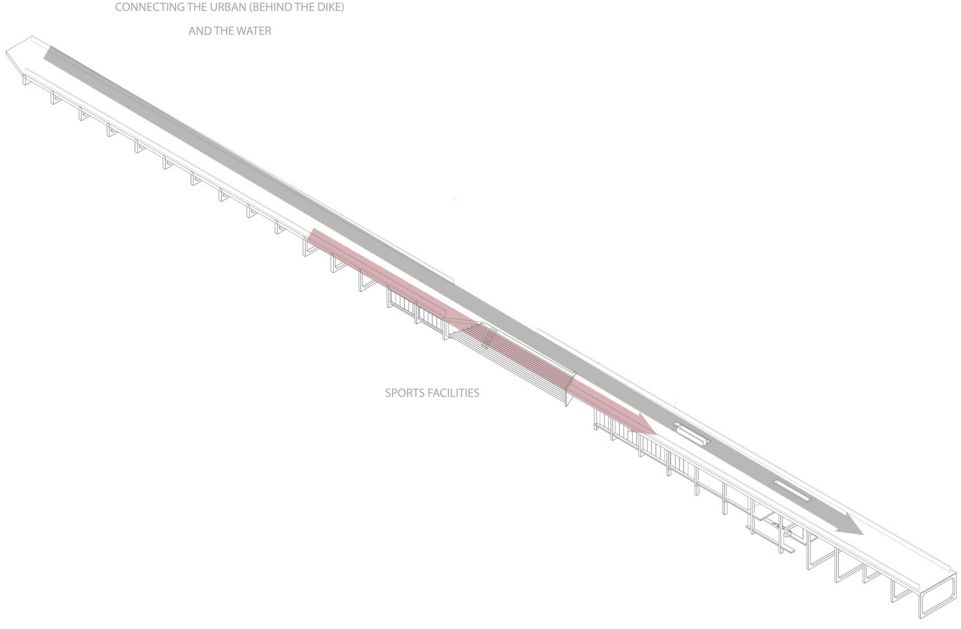


Design Concept Sketch
Movement and Anchoring

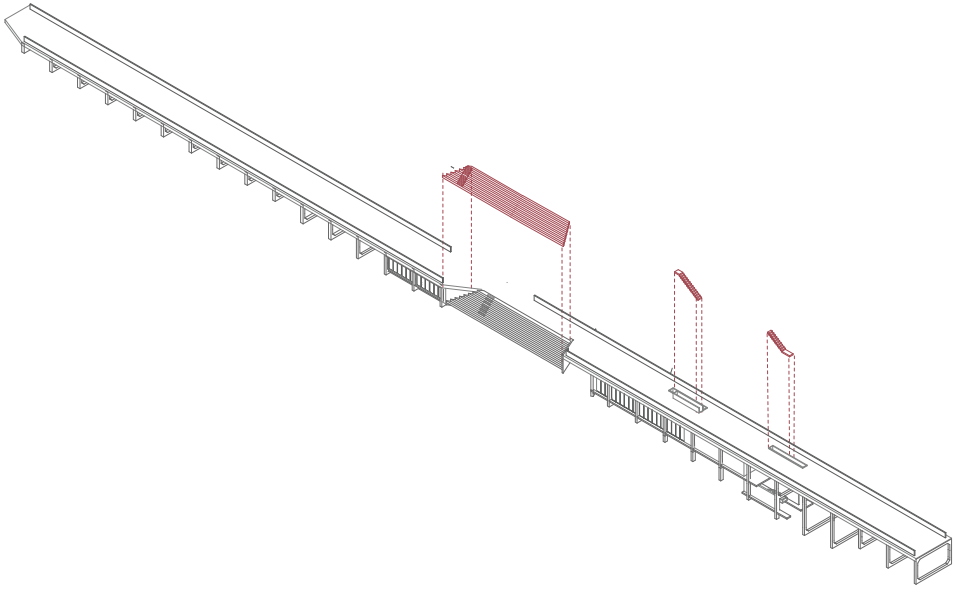
Design Concept Analogy
The Pantoon



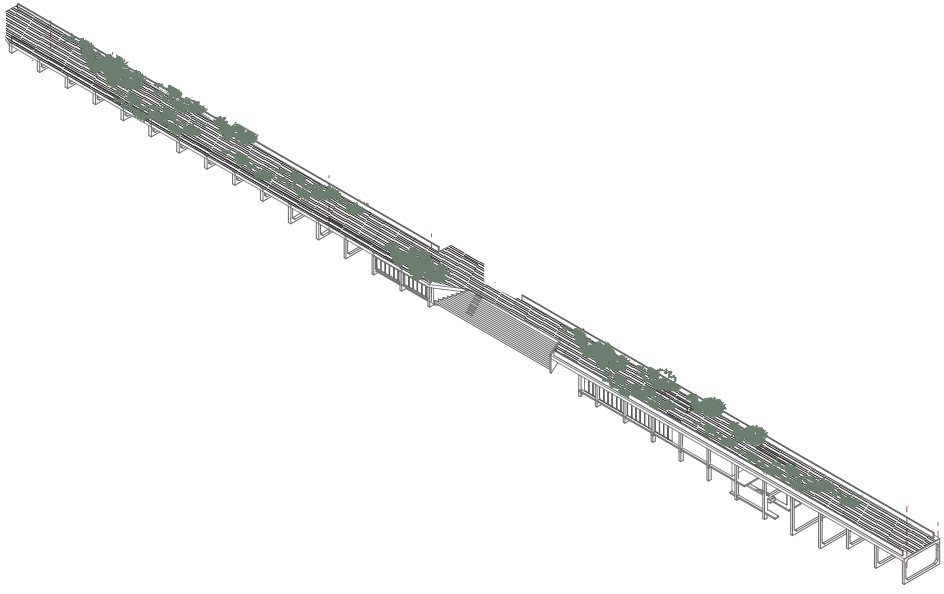
Infrastructure of Leisure



Horizontal Movements

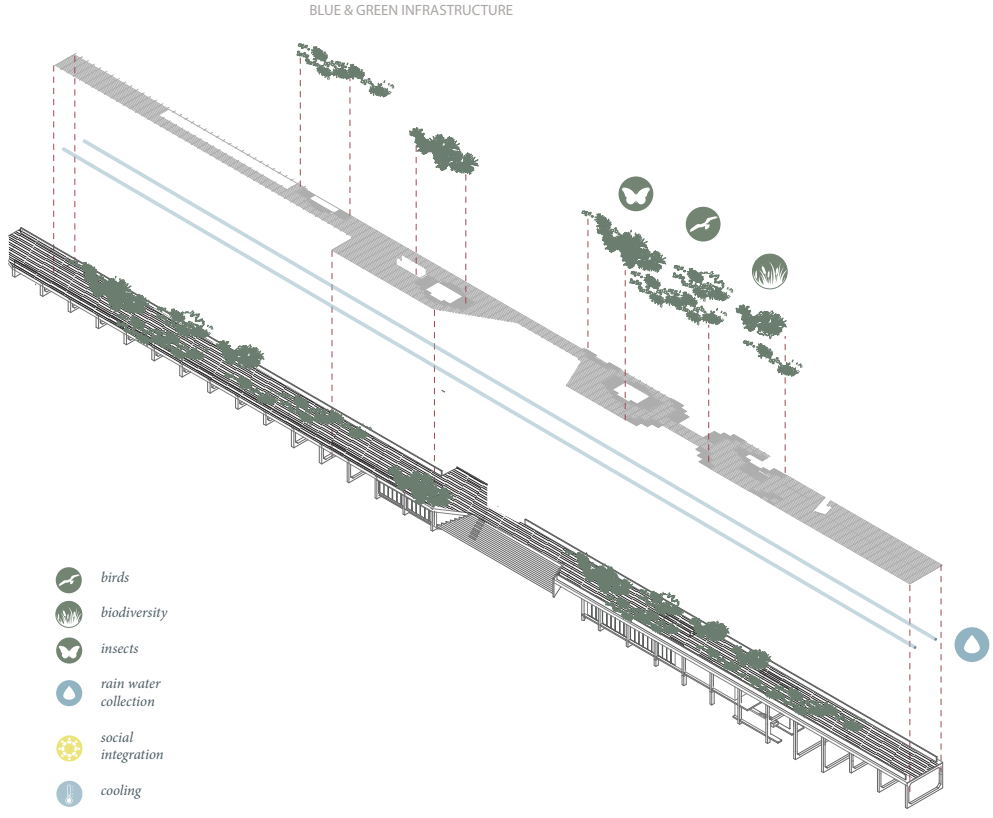


Vertical Movements

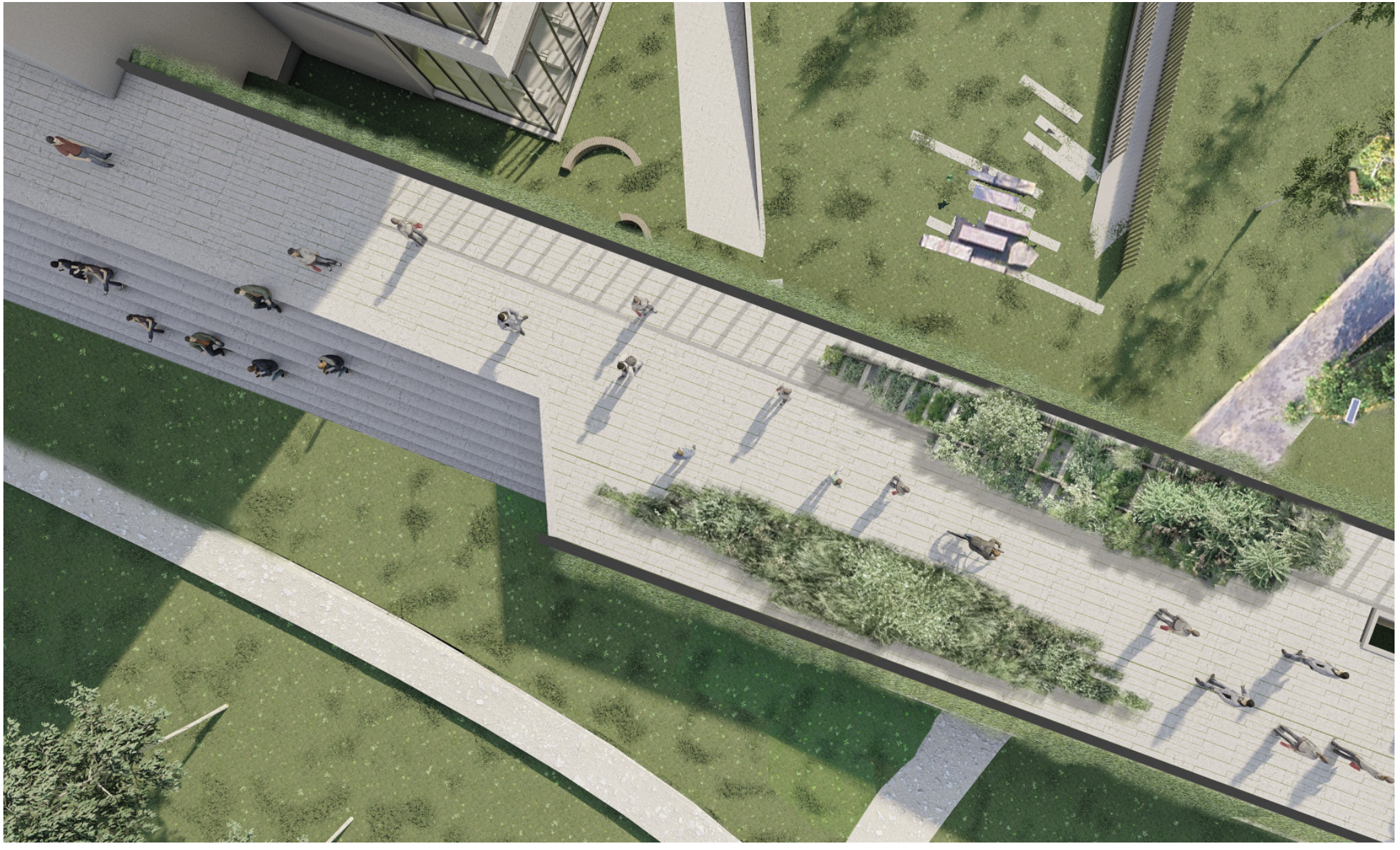


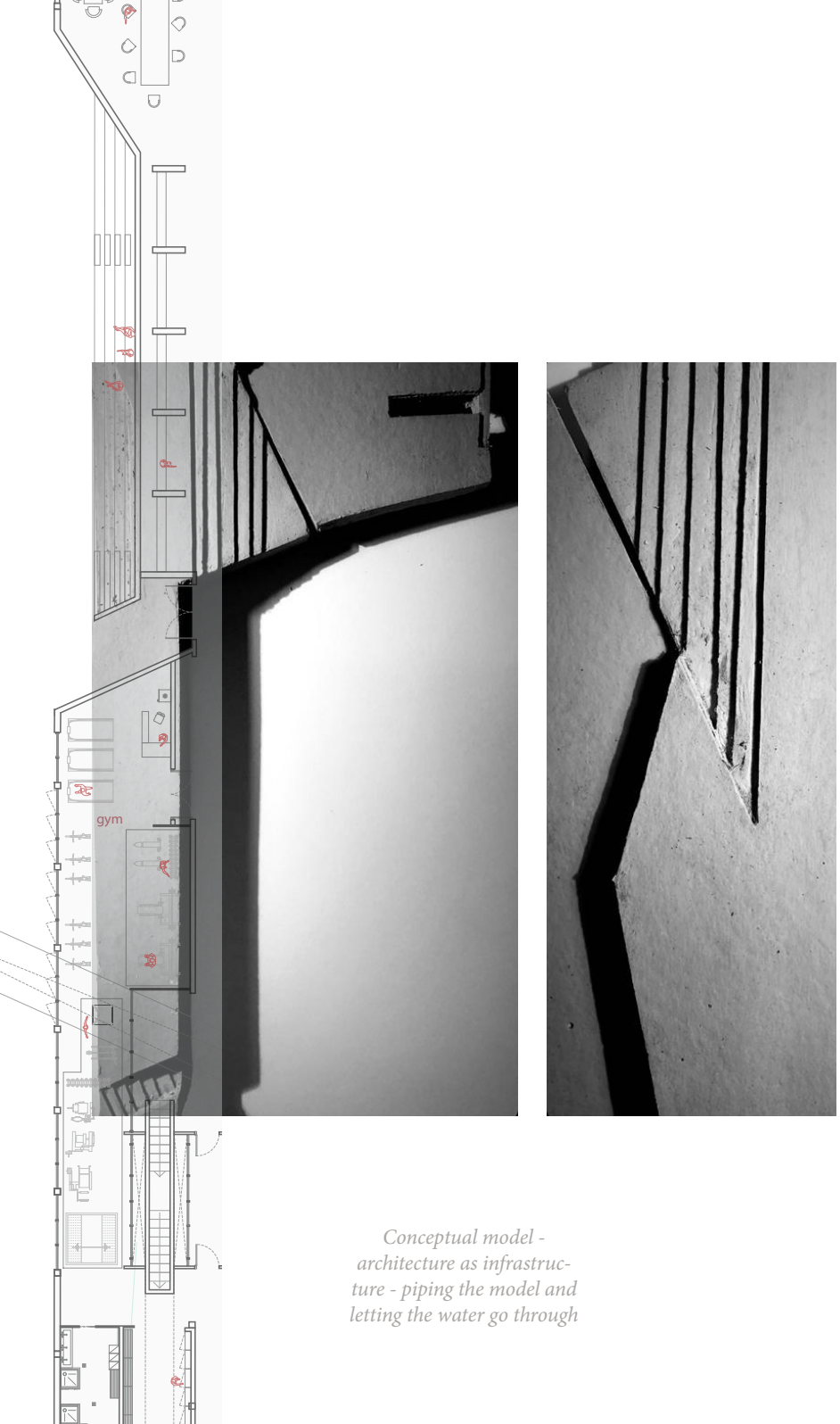
Green and Blue Integration

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



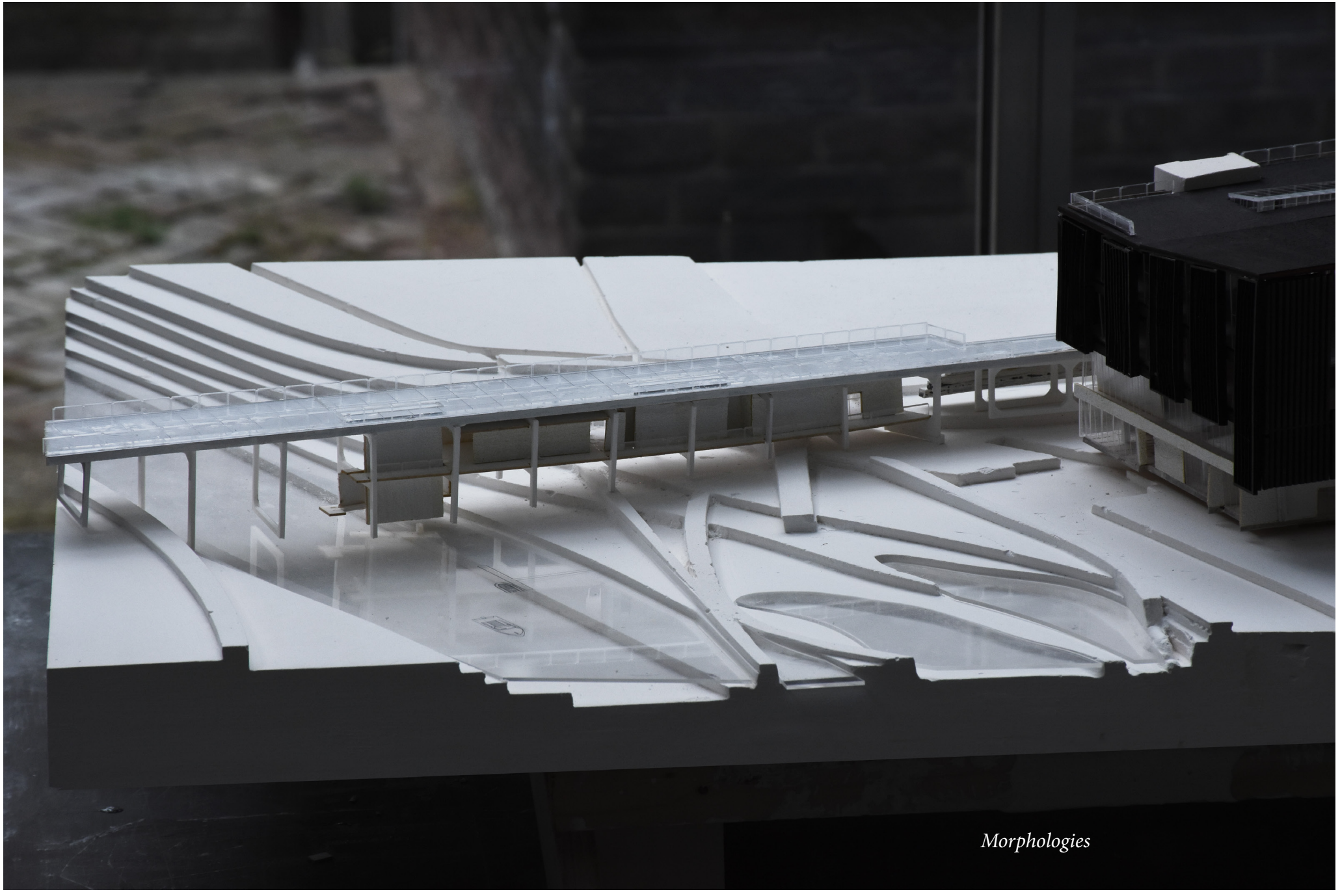
Infrastructure
of Water, Biodiversity, and Social integration





Conceptual model - architecture as infrastructure - piping the model and letting the water go through

Infrastructure
of Water, Biodiversity, and Social integration



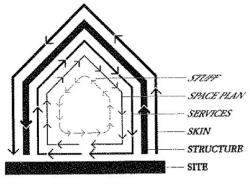
Morphologies

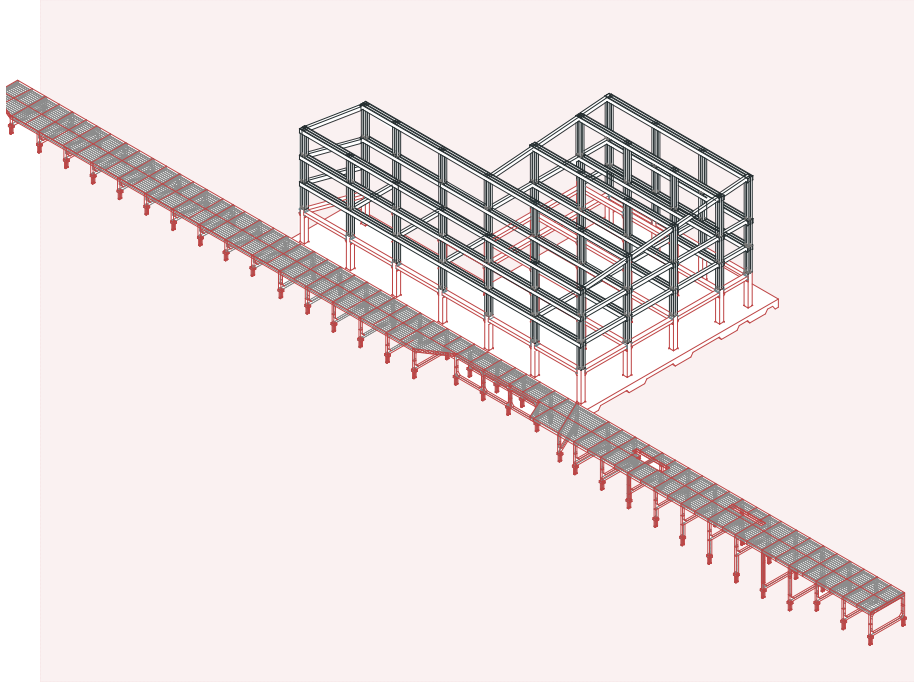
The two structure

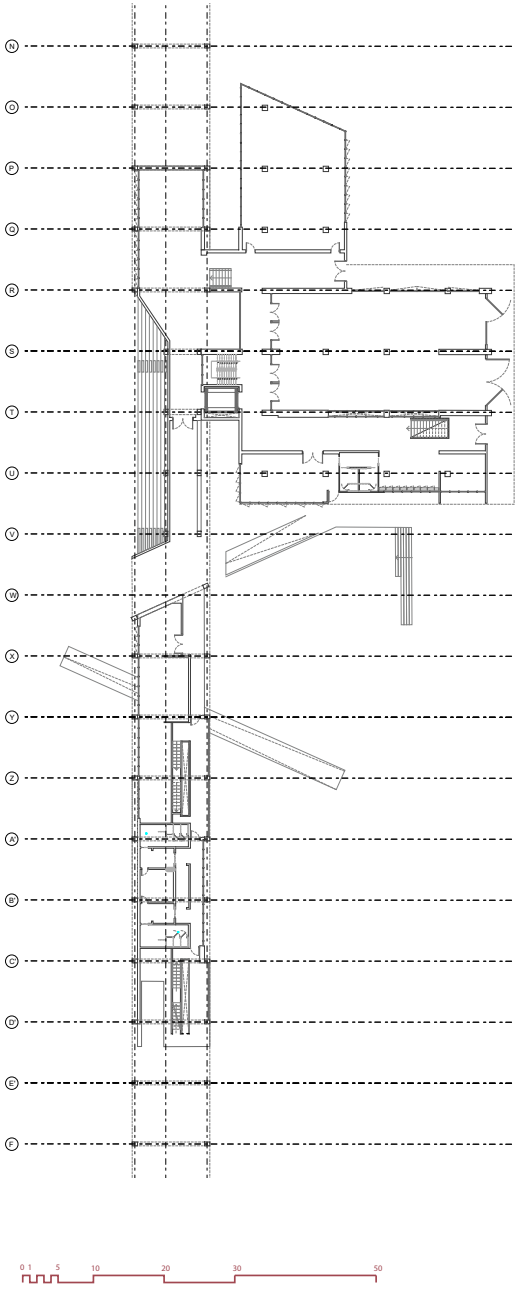
Demountable wooden construction

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






N
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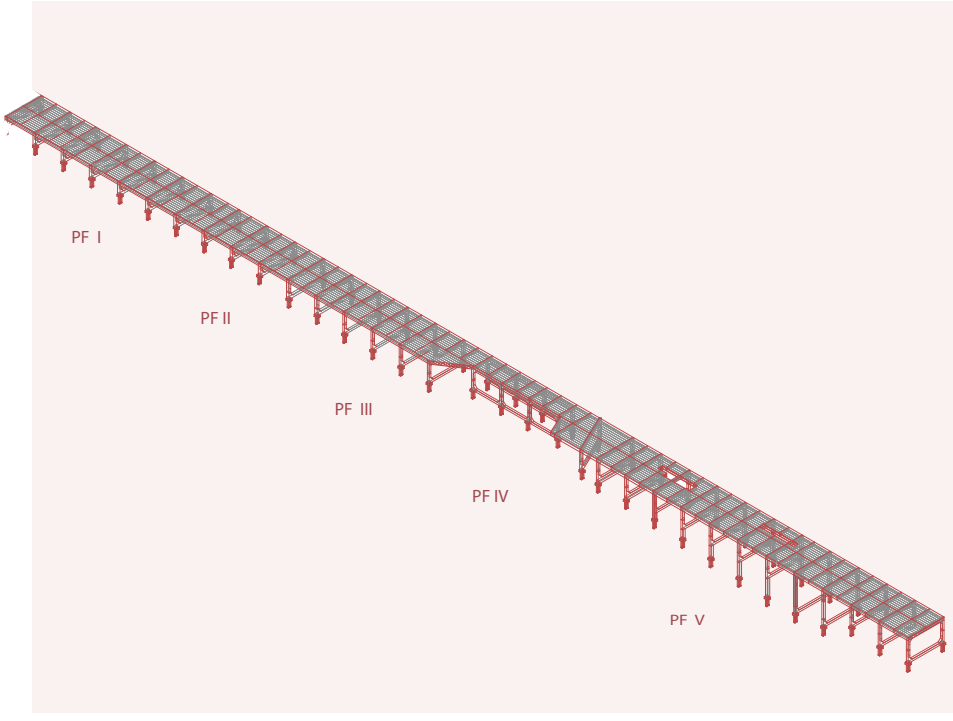
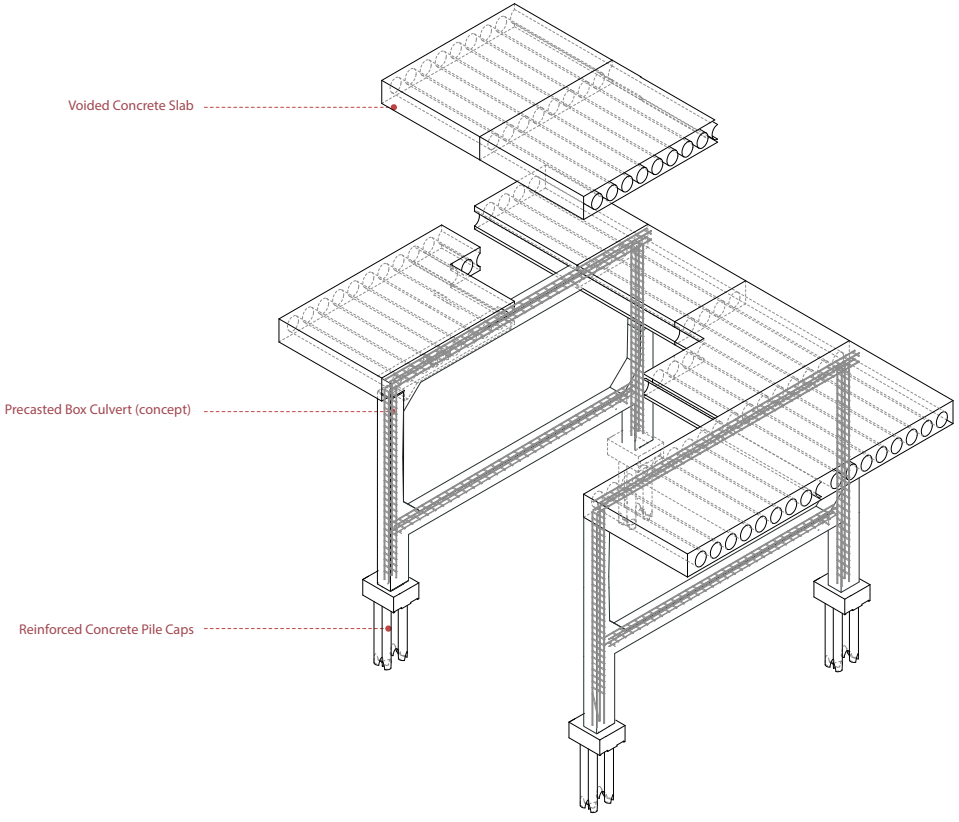
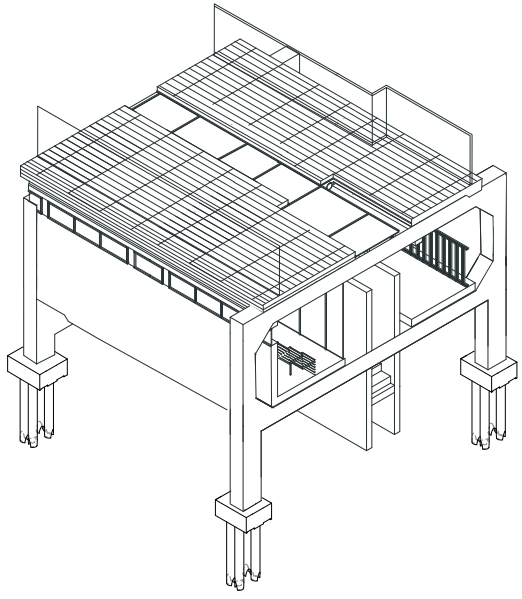
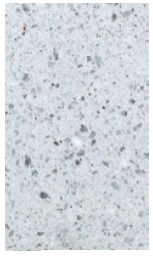

PF I
PF II
PF III
PF IV
PF V

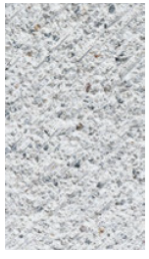

Voided Concrete Slab
Precasted Box Culvert (concept)
Reinforced Concrete Pile Caps



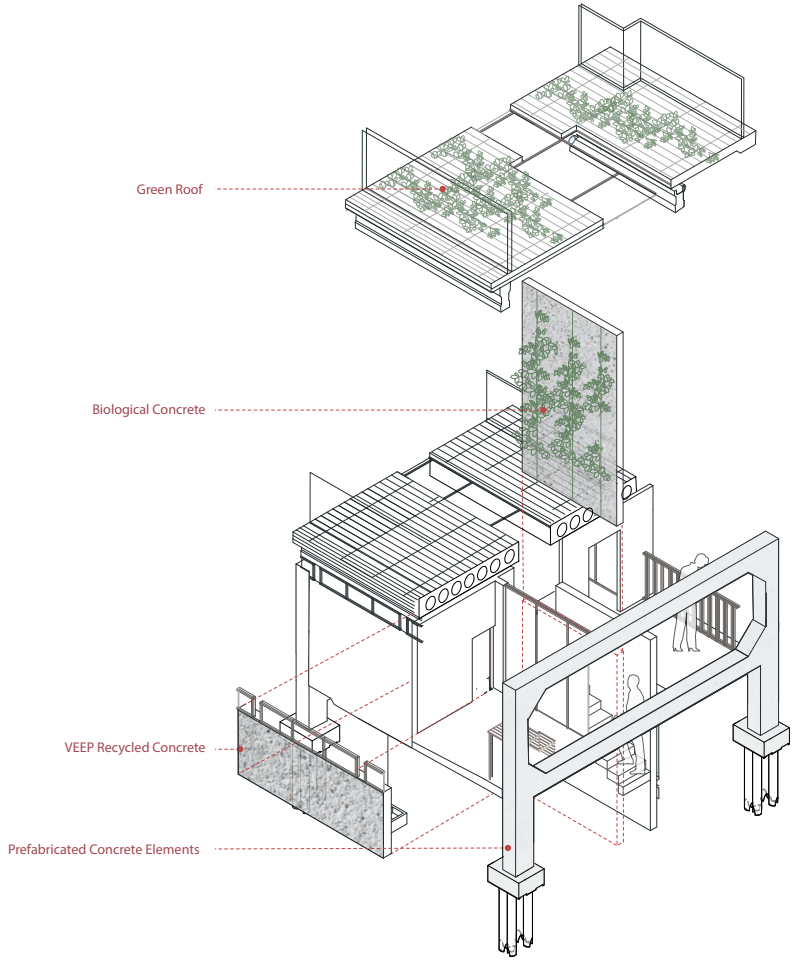


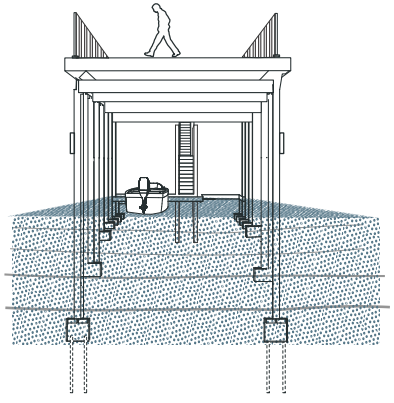
Biological Concrete

Pre casted Concrete

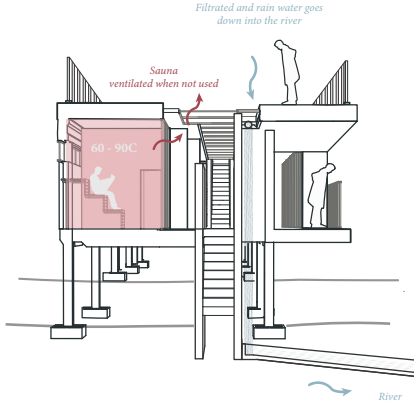


VEEP Recycled Concrete

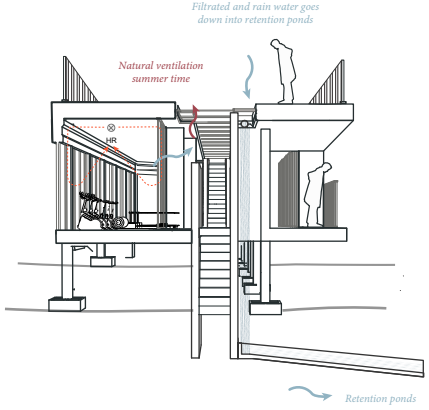




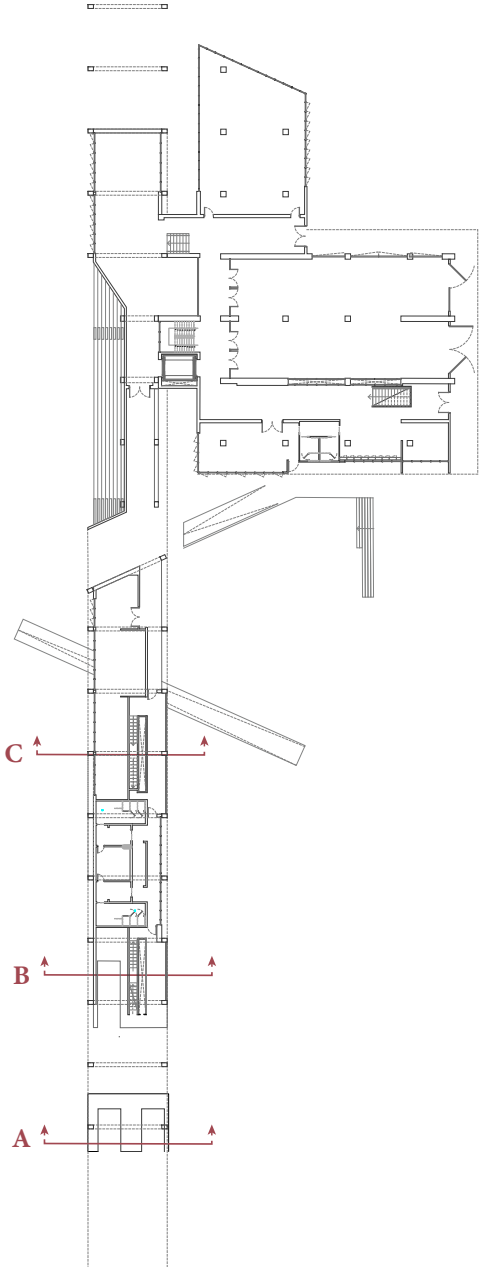
A - Water Mobility Hub



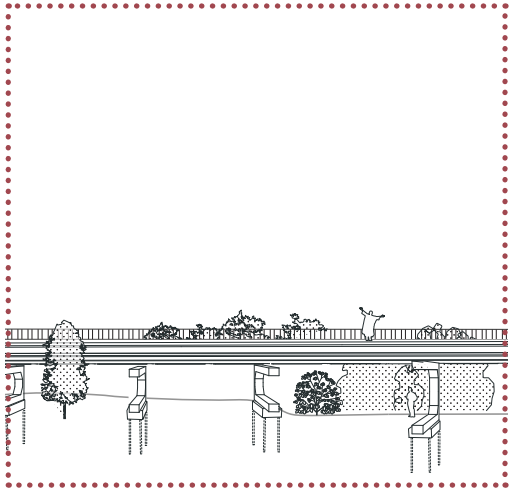
B - Water filtration - free - goes to the river



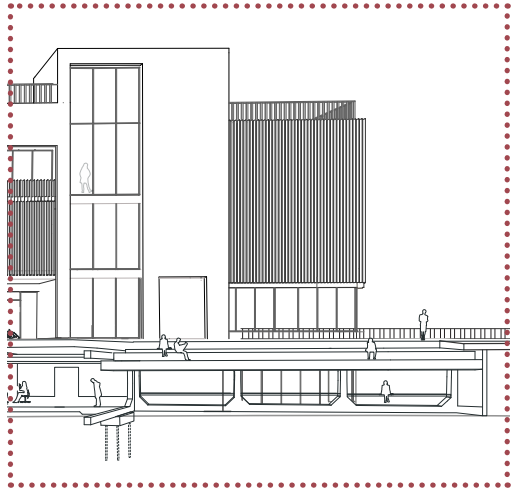
C - Water filtration - controlled - goes to the retention ponds where it can be reused

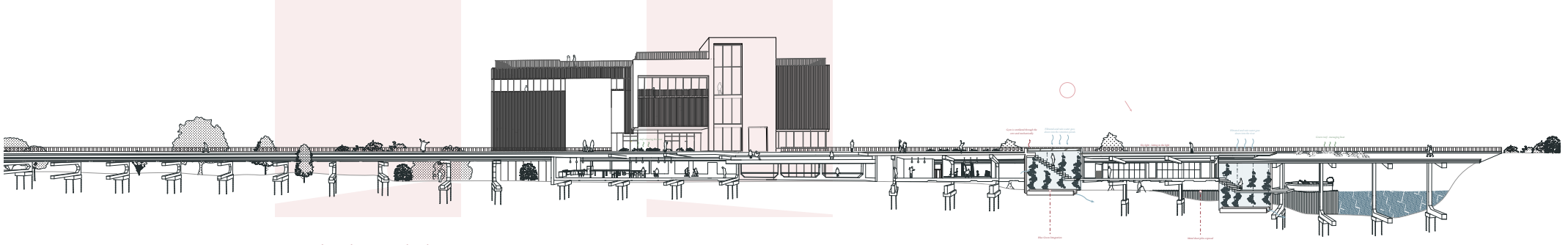


Infrastructure - extension of the dike allows for reconnection and a creation of new evels of landscapes



Framed prefabricated structure turns allowing the exterior and interior to meet, whilst providing a spot for gathering



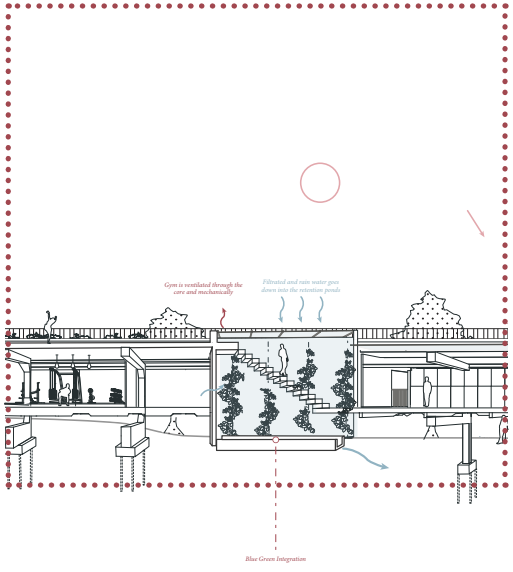


Hybrid Morphologies
a deck, bridge, pier, pontoon, dike

Perspective Section

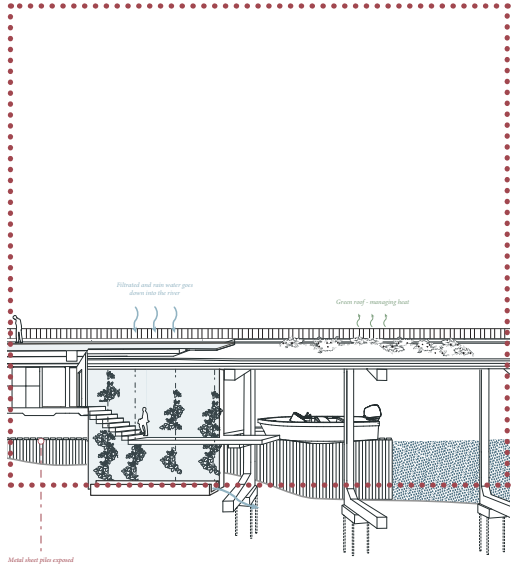
Water is filtrated and it is retained through the retention ponds on the north

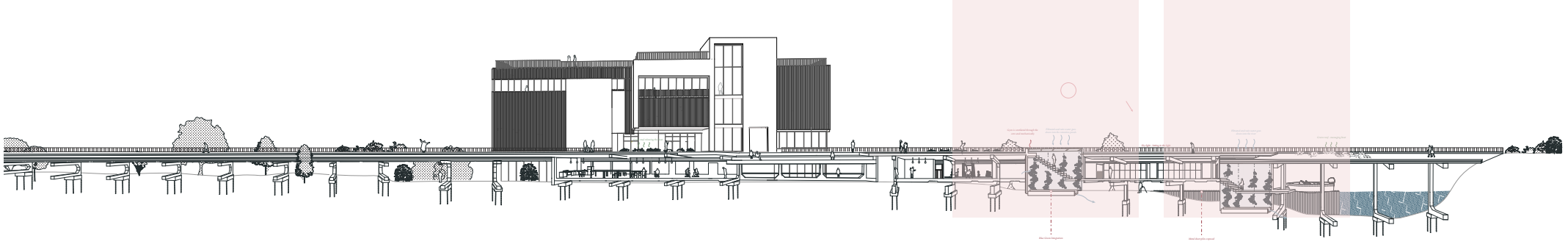
the flow of water exits the structure and flows next to the staircase allowing for a sensory experience

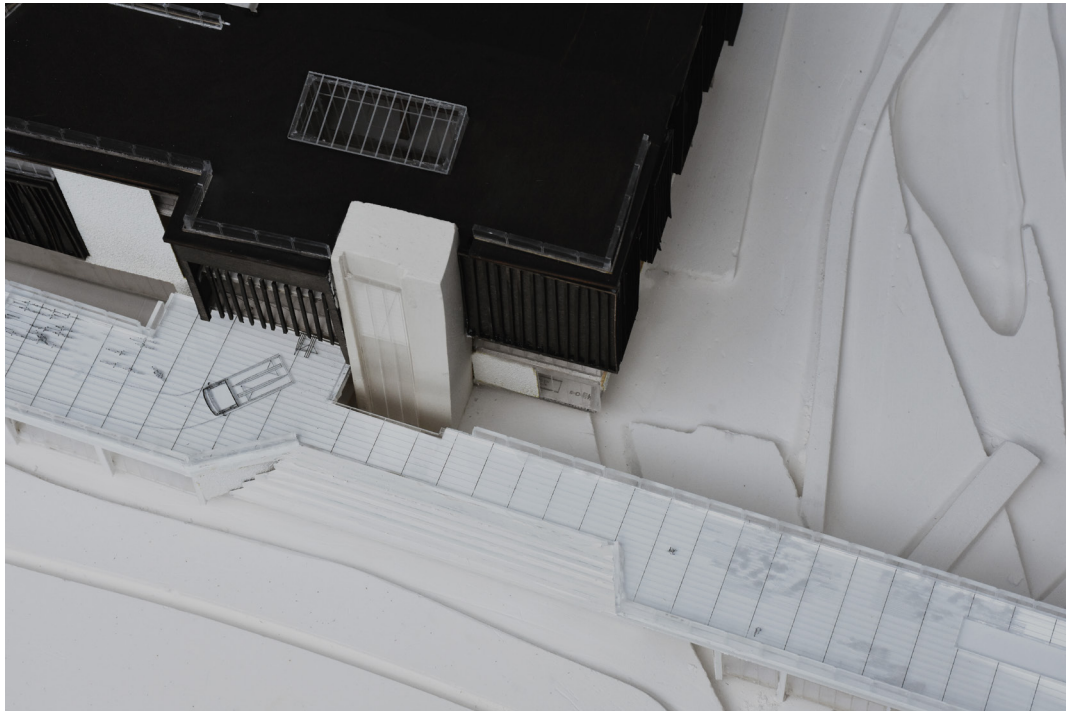


Water is filtrated and freed into the river on the east

This is also where the structure creates a meeting hub for boats



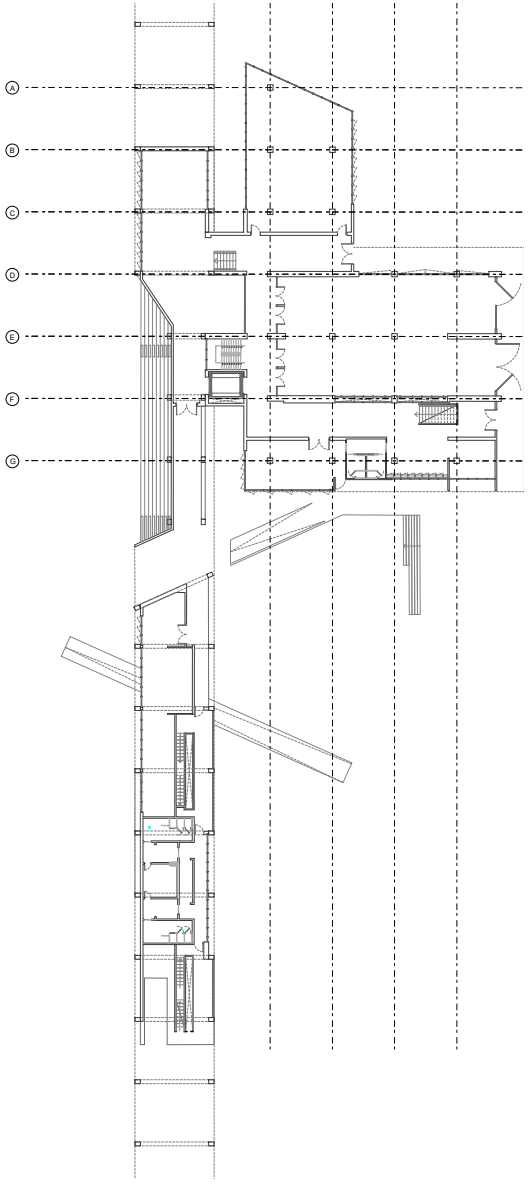


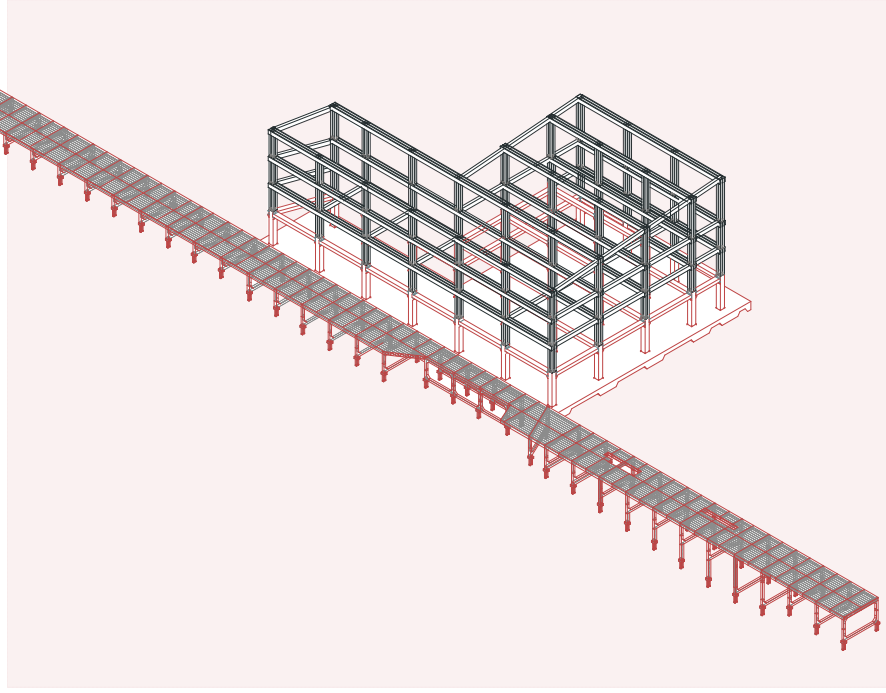


The intersection between two structures

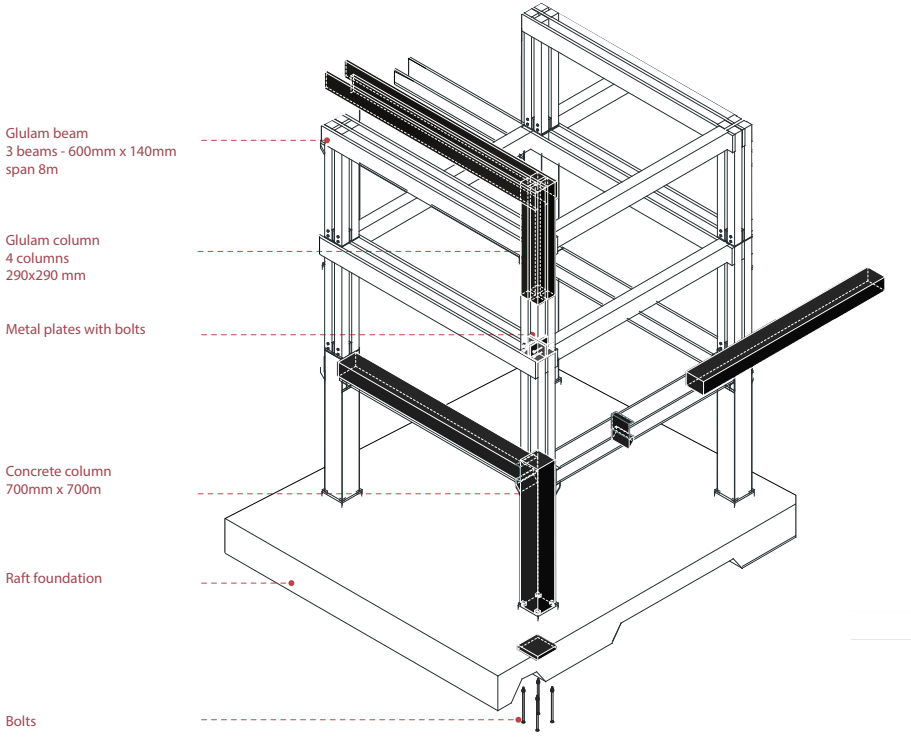
Physical Model

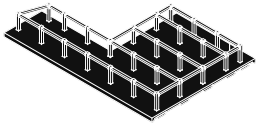
Design Concept Analogy
The Pantoon



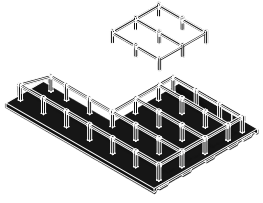


Structural Plans and Axos

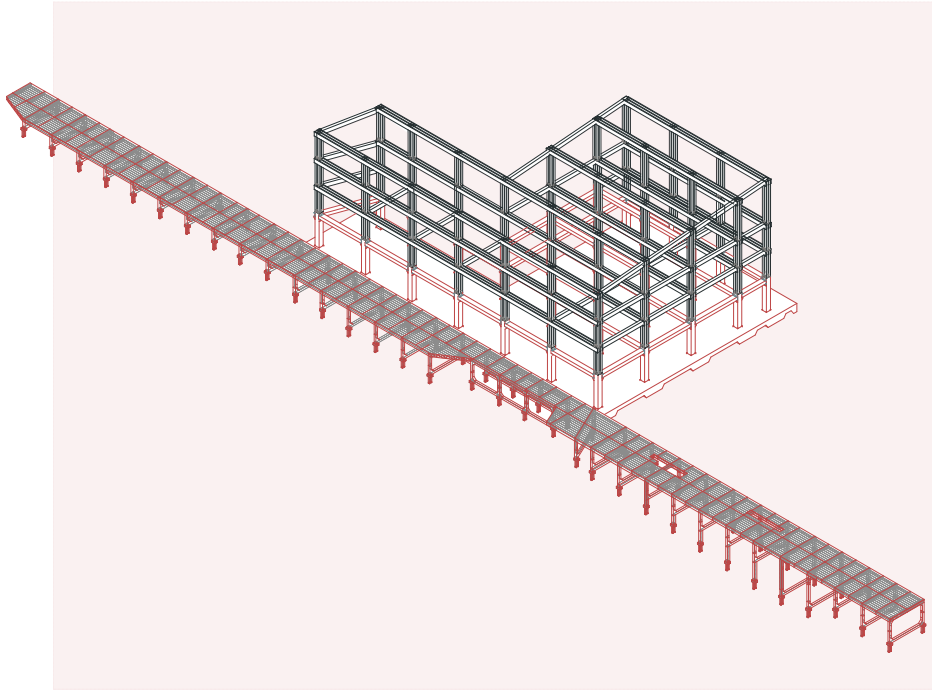




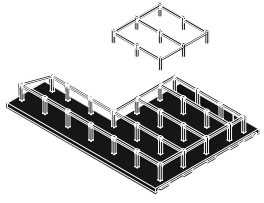
Concrete prefabricated columns



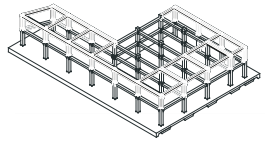
Concrete boat core



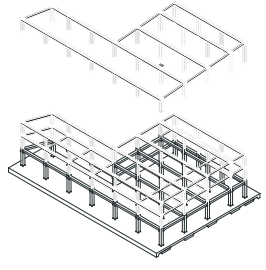
Structural Plans and Axos



Concrete boat core



Glulam structure



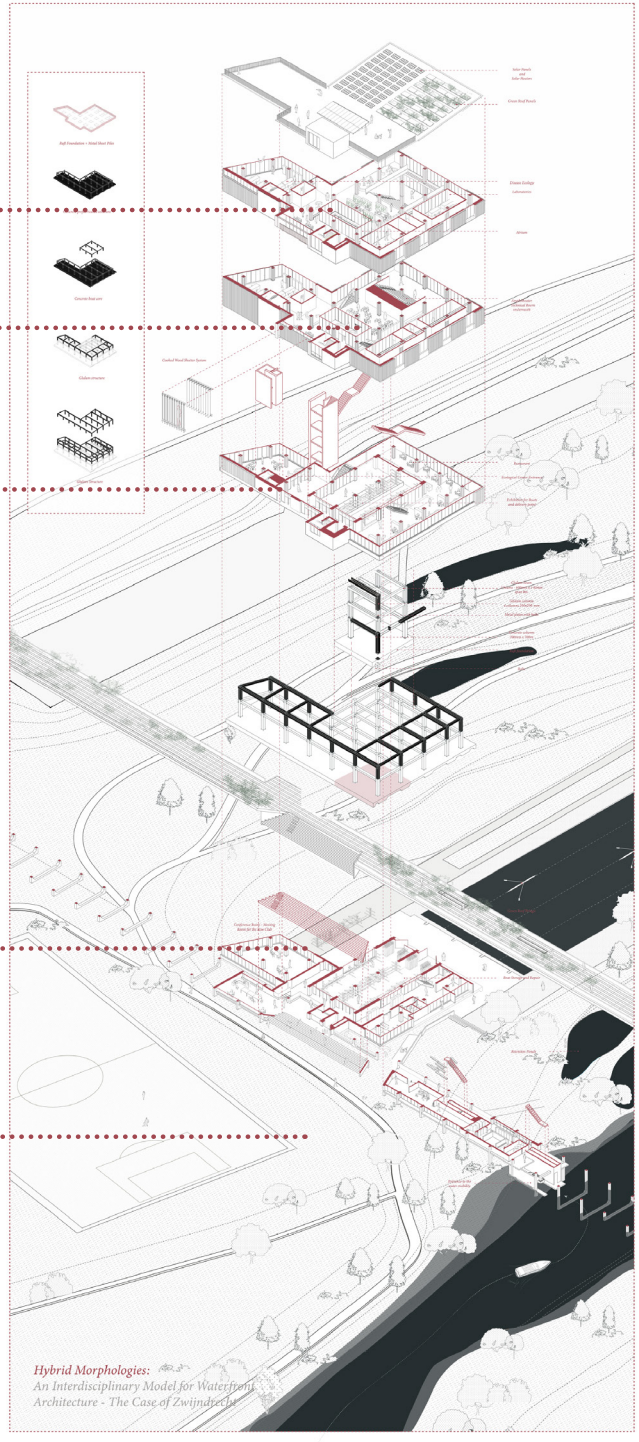
Glulam structure

Ecological Research Center

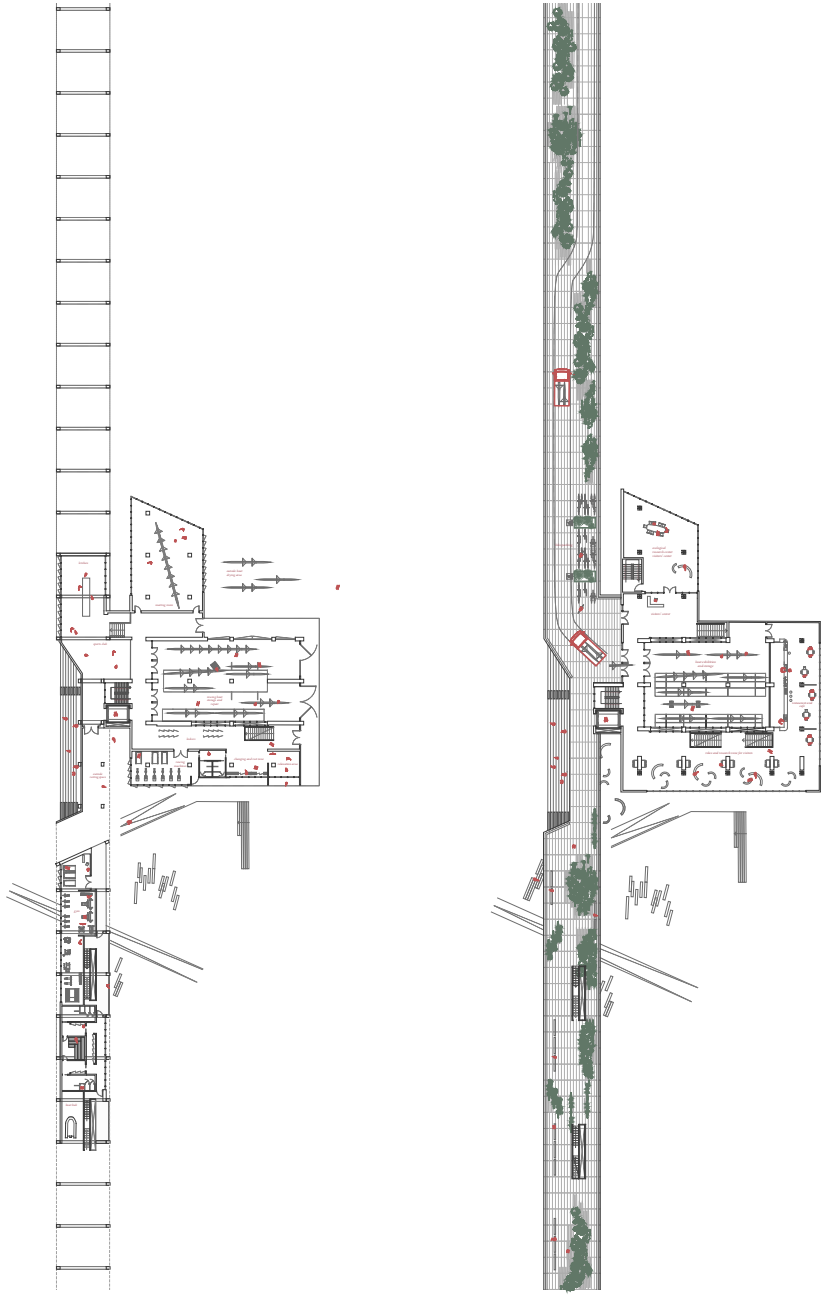
Visitors Center and Boat Exhibition

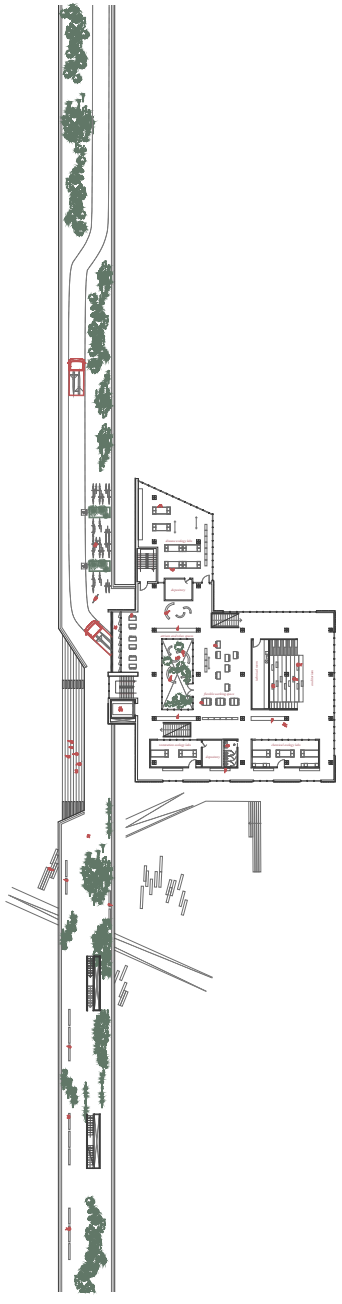
Rowing Club and Boat Storage

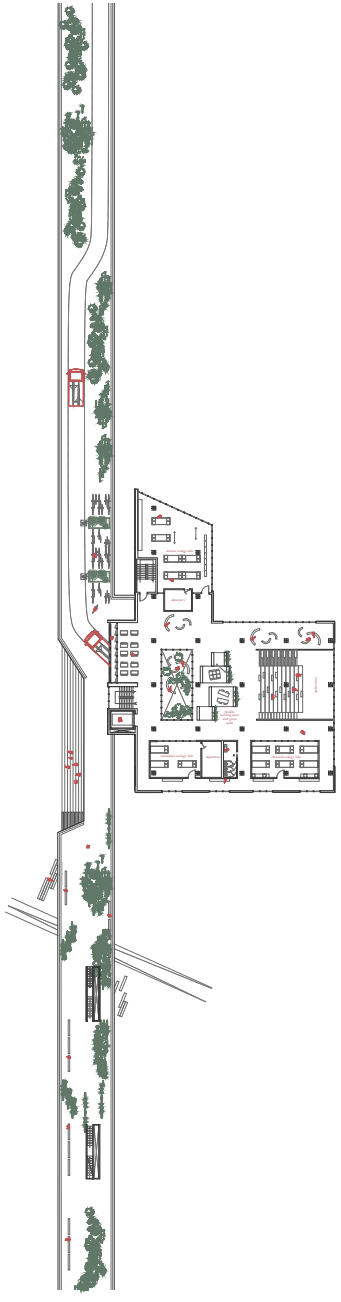
Sports Club and Football Club

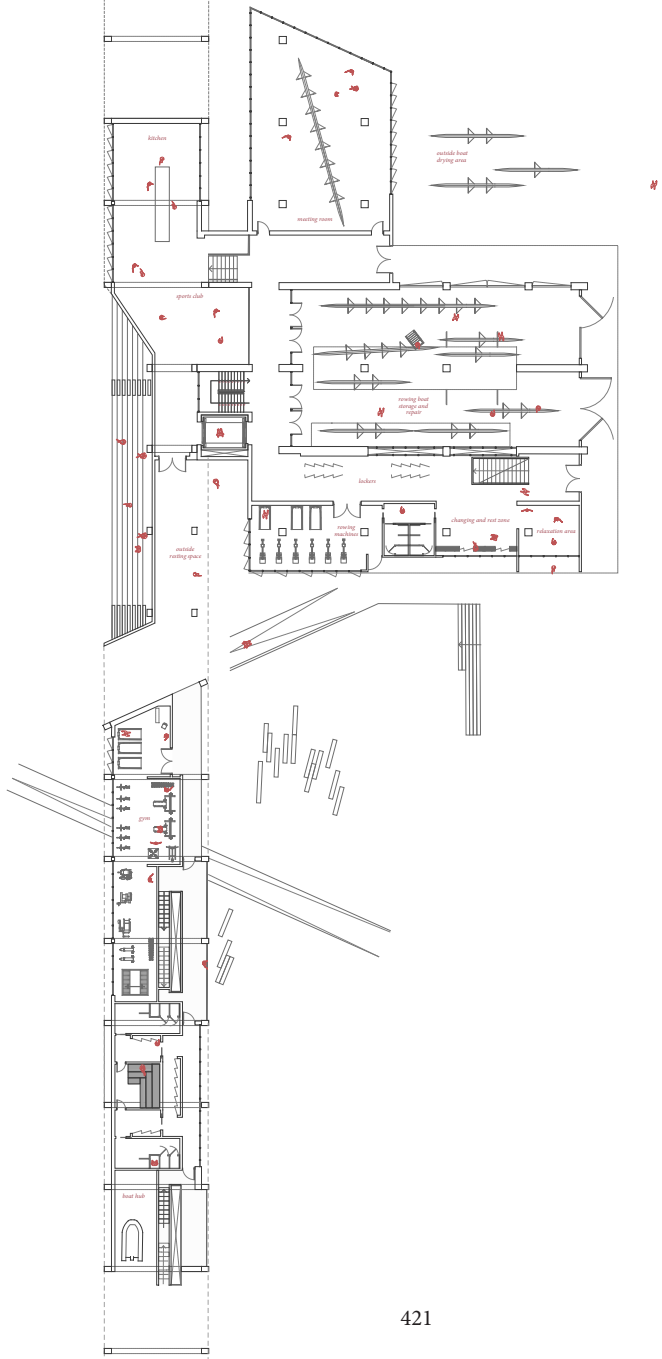


Hybrid Morphologies:
An Interdisciplinary Model for Waterfront Architecture - The Case of Zwijndrecht

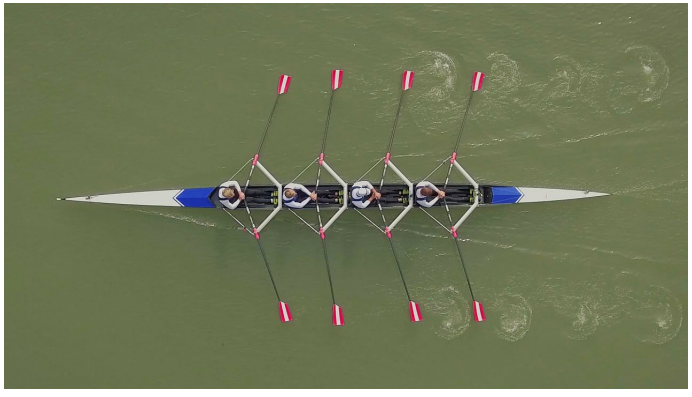




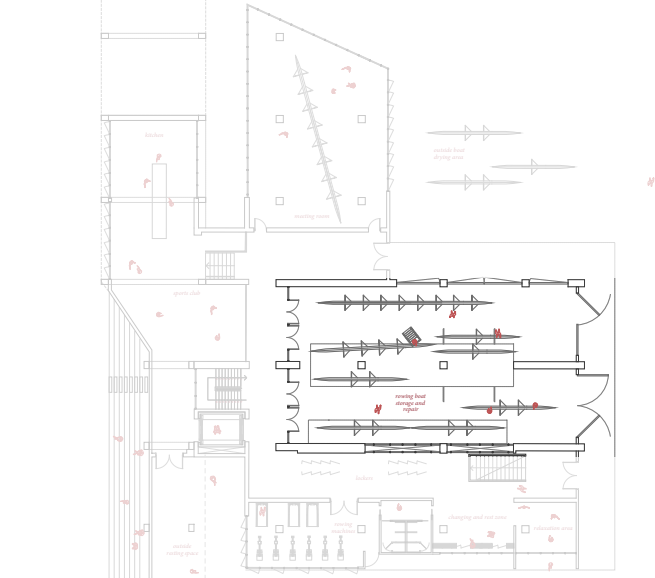


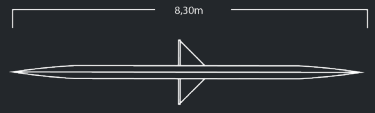


Ground Floor
Rowing Club and Sports Club

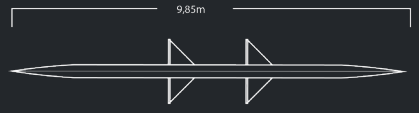


Program research, spatial requirements

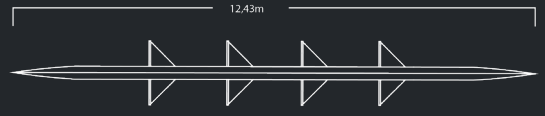




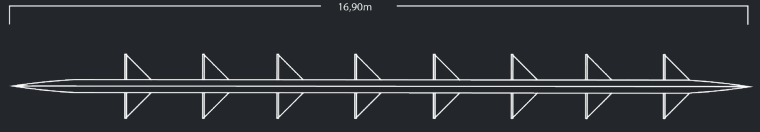
Length over all	Breadth (waterline)	Weight of rowers
8,30 m	0,28 m	95 - 120 kg
8,20 m	0,28 m	85 - 100 kg
7,92 m	0,27 m	80 - 90 kg
7,78 m	0,26 m	75 - 85 kg
7,66 m	0,26 m	65 - 75 kg
7,40 m	0,26 m	45 - 65 kg



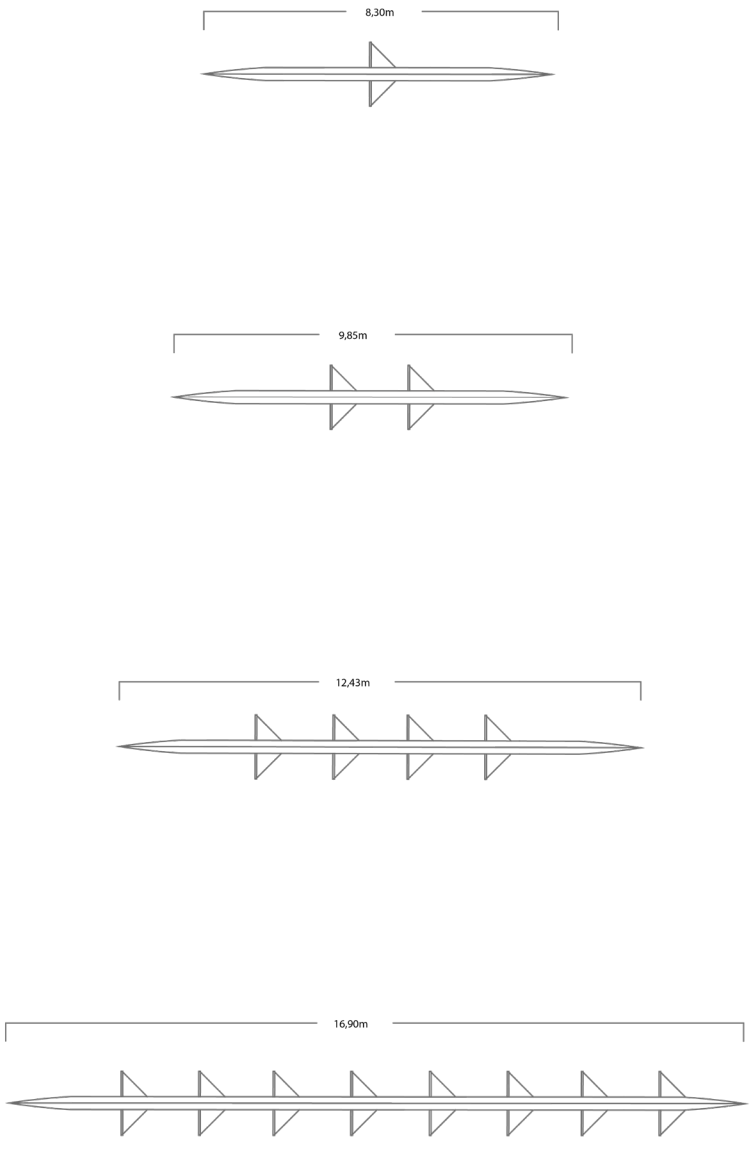
Length over all	Breadth (waterline)	Weight of rowers
9,85 m	0,34 m	95 - 105 kg
9,80 m	0,34 m	95 - 105 kg
9,77 m	0,33 m	85 – 95 kg
9,73 m	0,33 m	80 – 90 kg
9,41 m	0,34 m	75 – 85 kg
9,24 m	0,32 m	65 - 80 kg

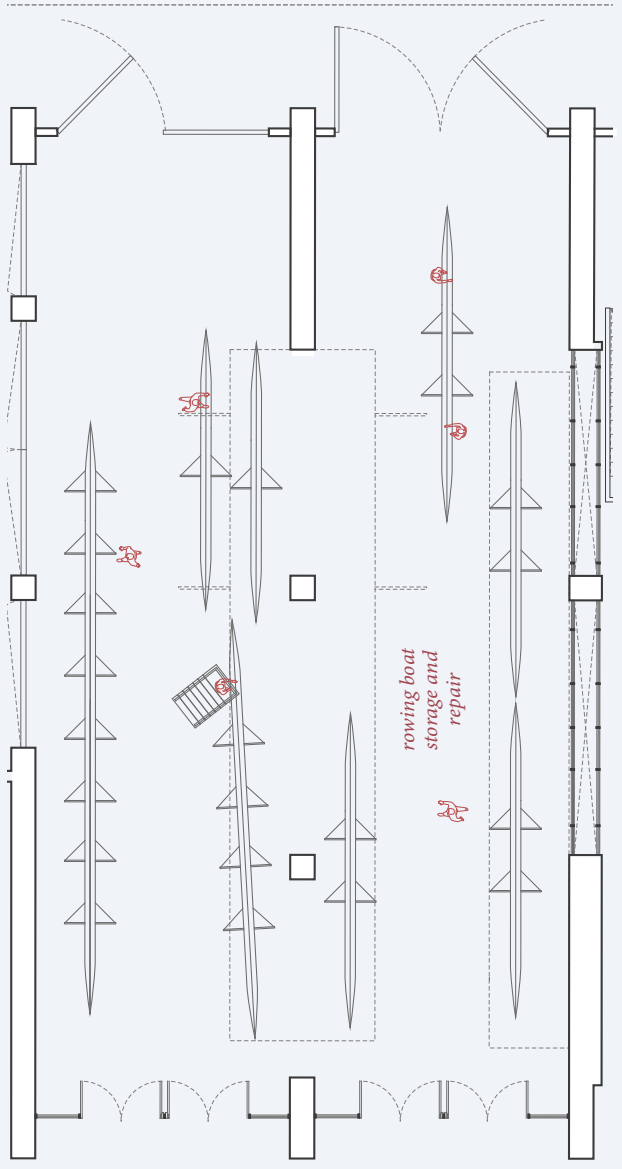


Length over all	Bridth (Waterline)	Weight of rowers
12,43 m	0,43 m	90 - 100 kg
12,26 m	0,46 m	90 - 100 kg
12,02 m	0,44 m	75 - 95 kg
11,78 m	0,43 m	65 - 80 kg
11,69 m	0,39 m	65 - 75 kg
10,50 m	0,37 m	bis 65 kg
12,45 m	0,41 m	90 - 100 kg



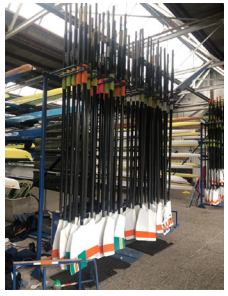
Length over all	Bridth (Waterline)	Weight of rowers
16,90 m	0,54 m	75 - 90 kg
17,63 m	0,55 m	85 - 100 kg
16,85 m	0,56 m	70 - 80 kg



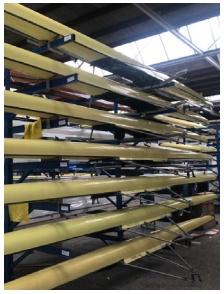


Boat Storage, Exhibition and Repair

01
Cleaning the Boats

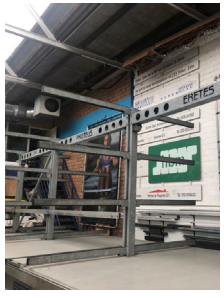


02
Oar storage



03
Boat storage stacking

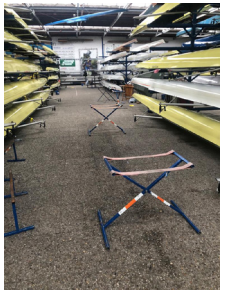
04
Boats are demounted for transport



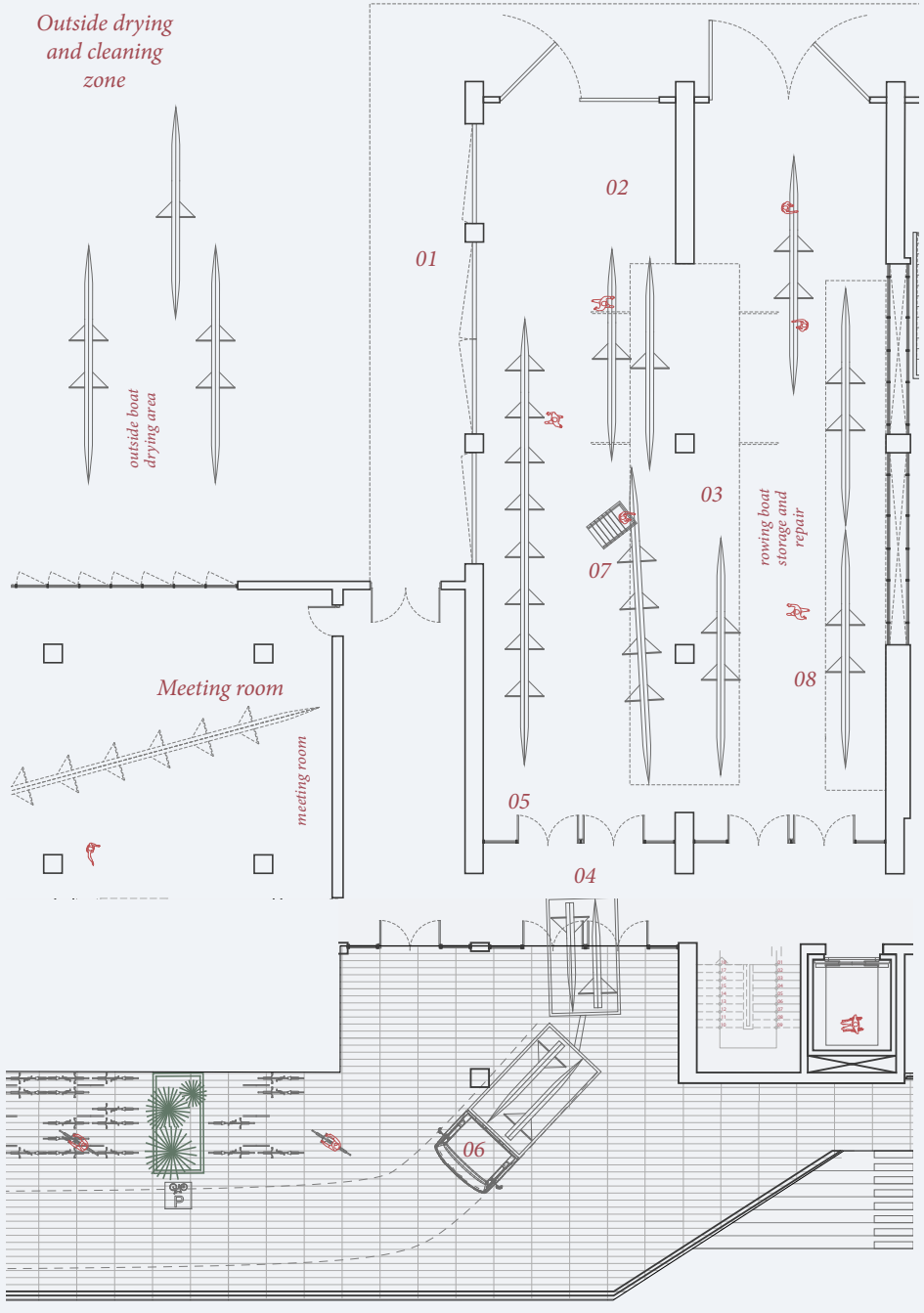
05
Boat metal storage that can be pulled out

06
Truck for transporting boats on the ground level

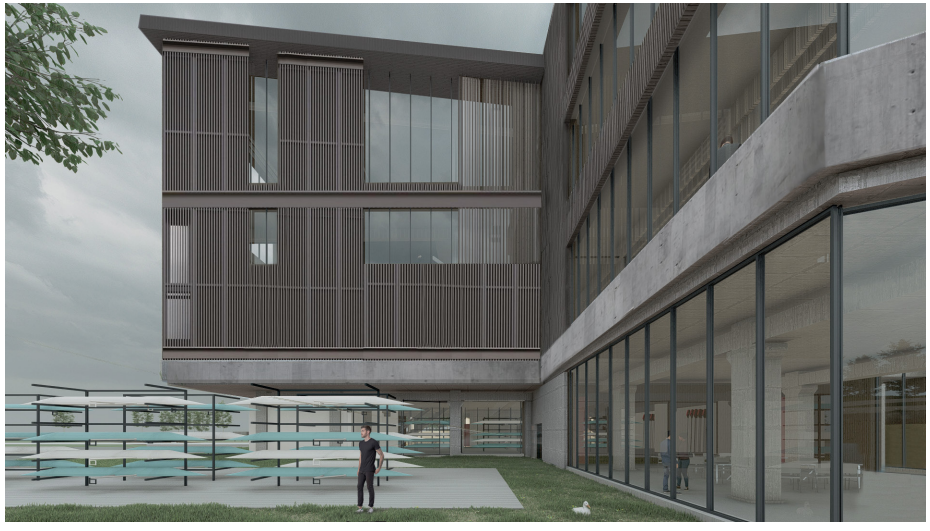
07
Vertical elements for reaching the boats

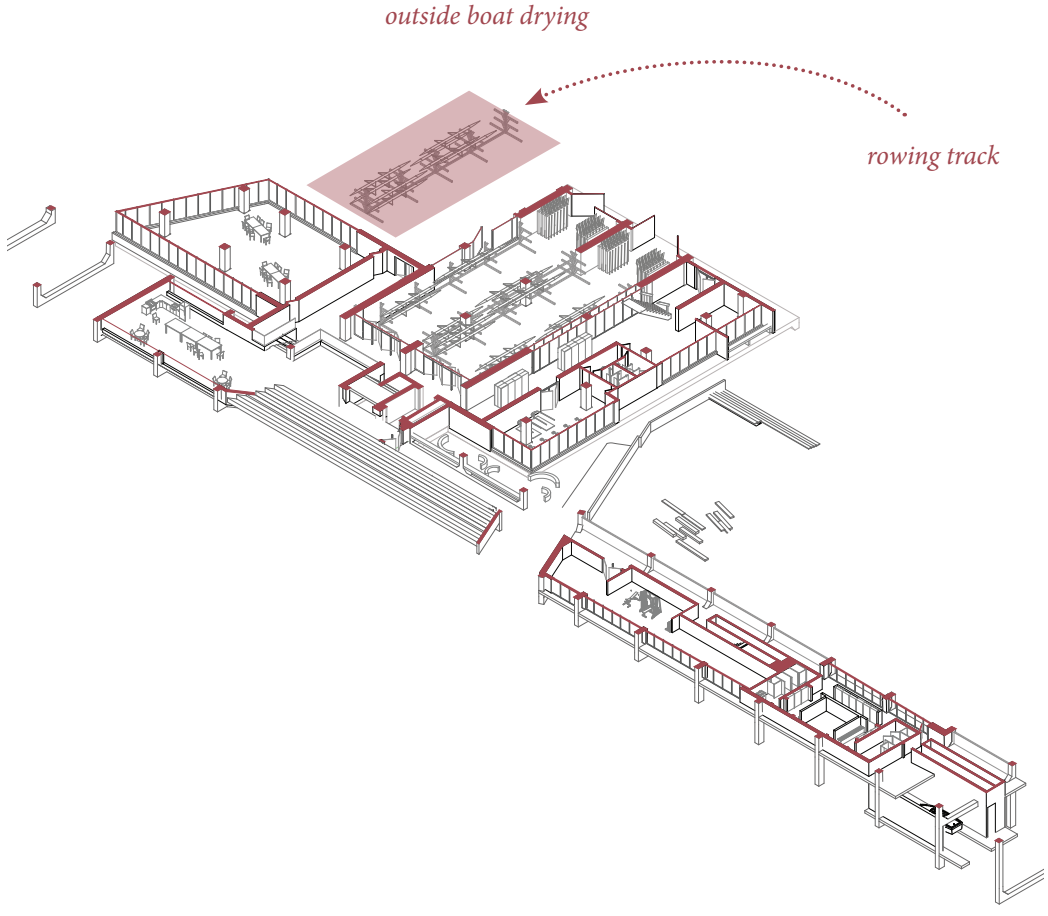


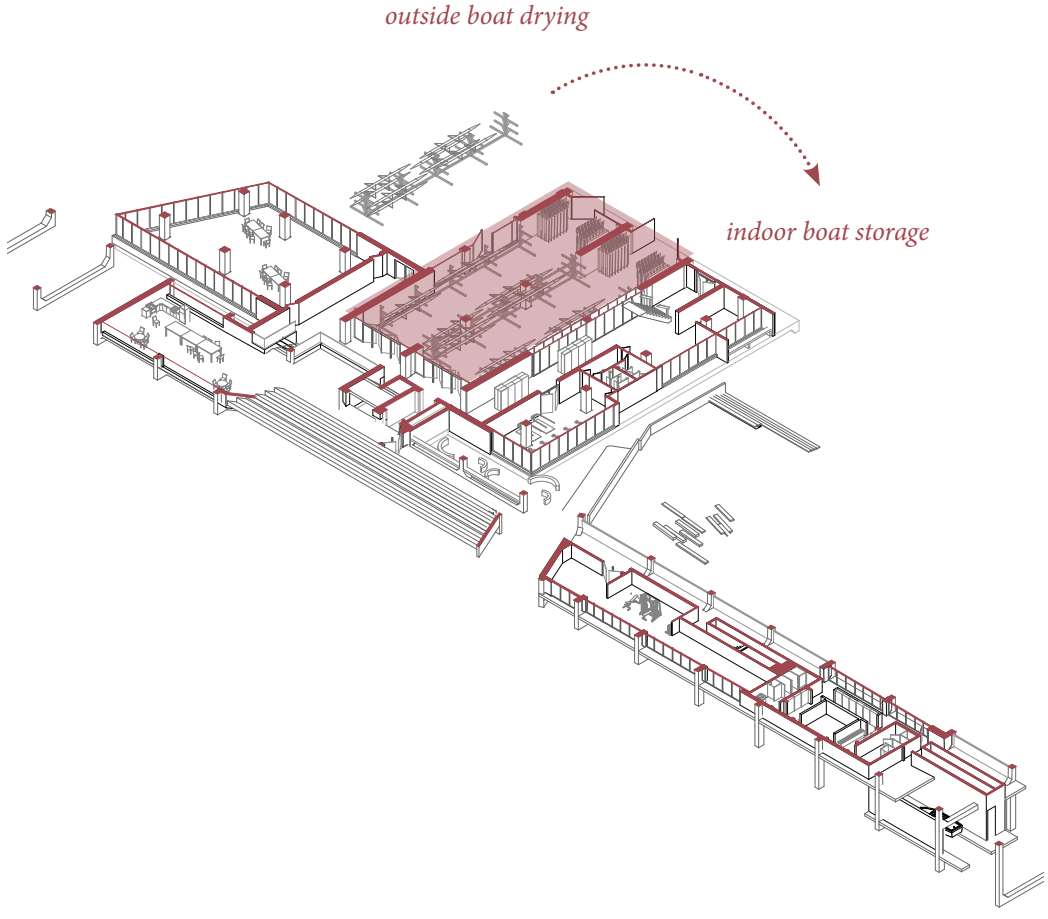
08
Racks for boat placement

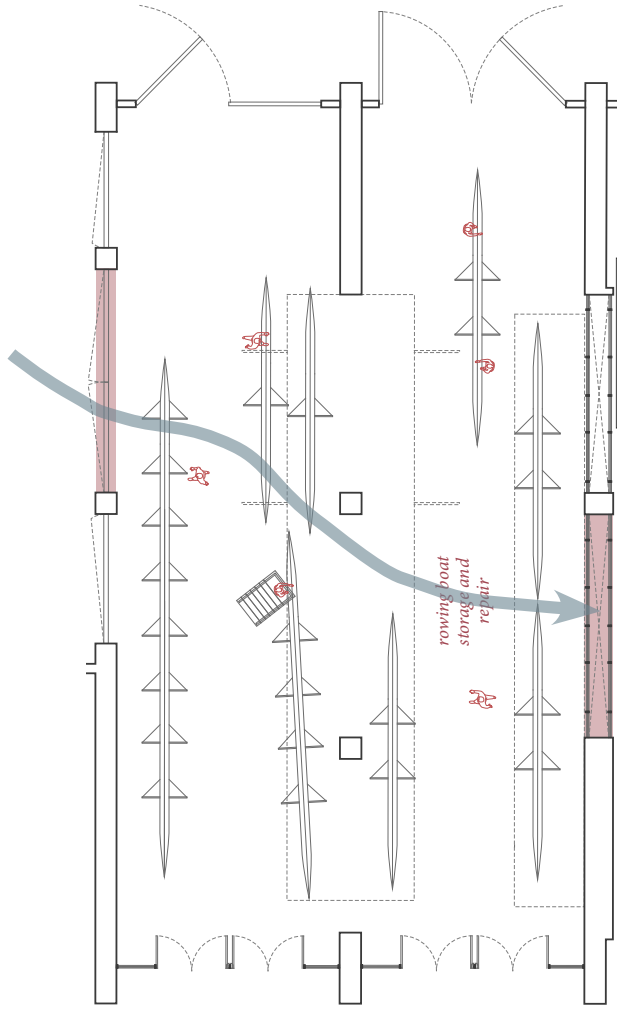


-1 level and ground floor level - showing the boat storage and the delivery point on the ground level. Boats are lowered down using a pulley system




outside boat drying
rowing track


outside boat drying
indoor boat storage



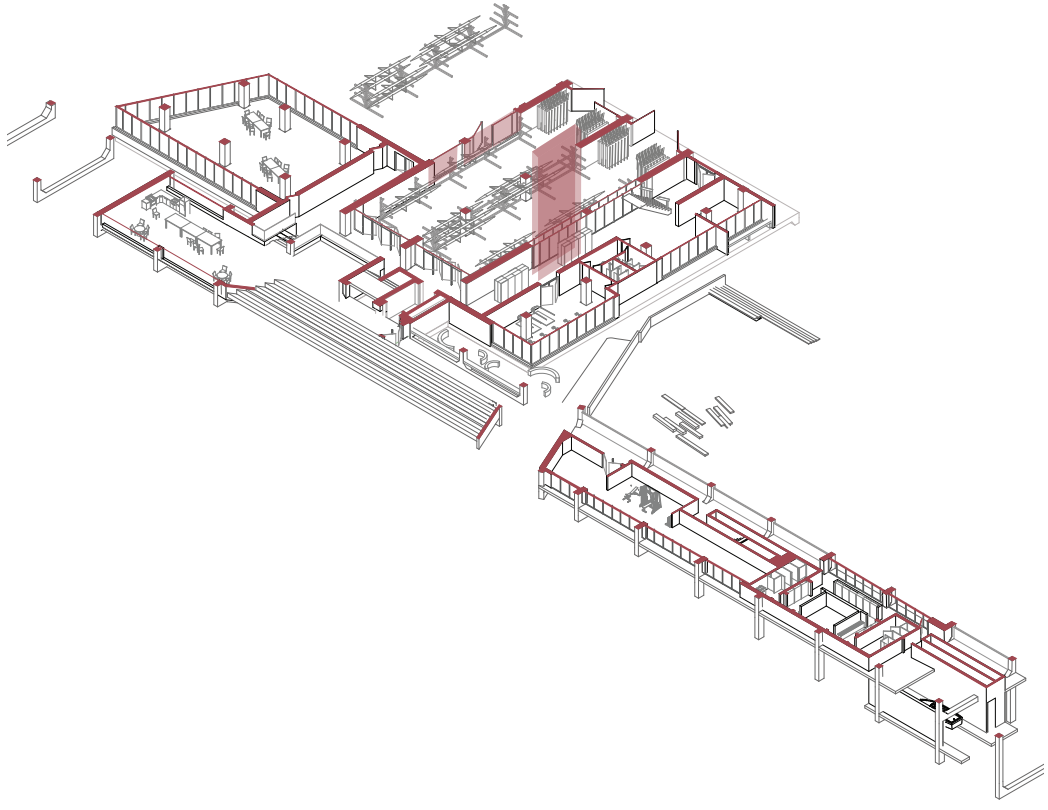
Ventilating the space during summer

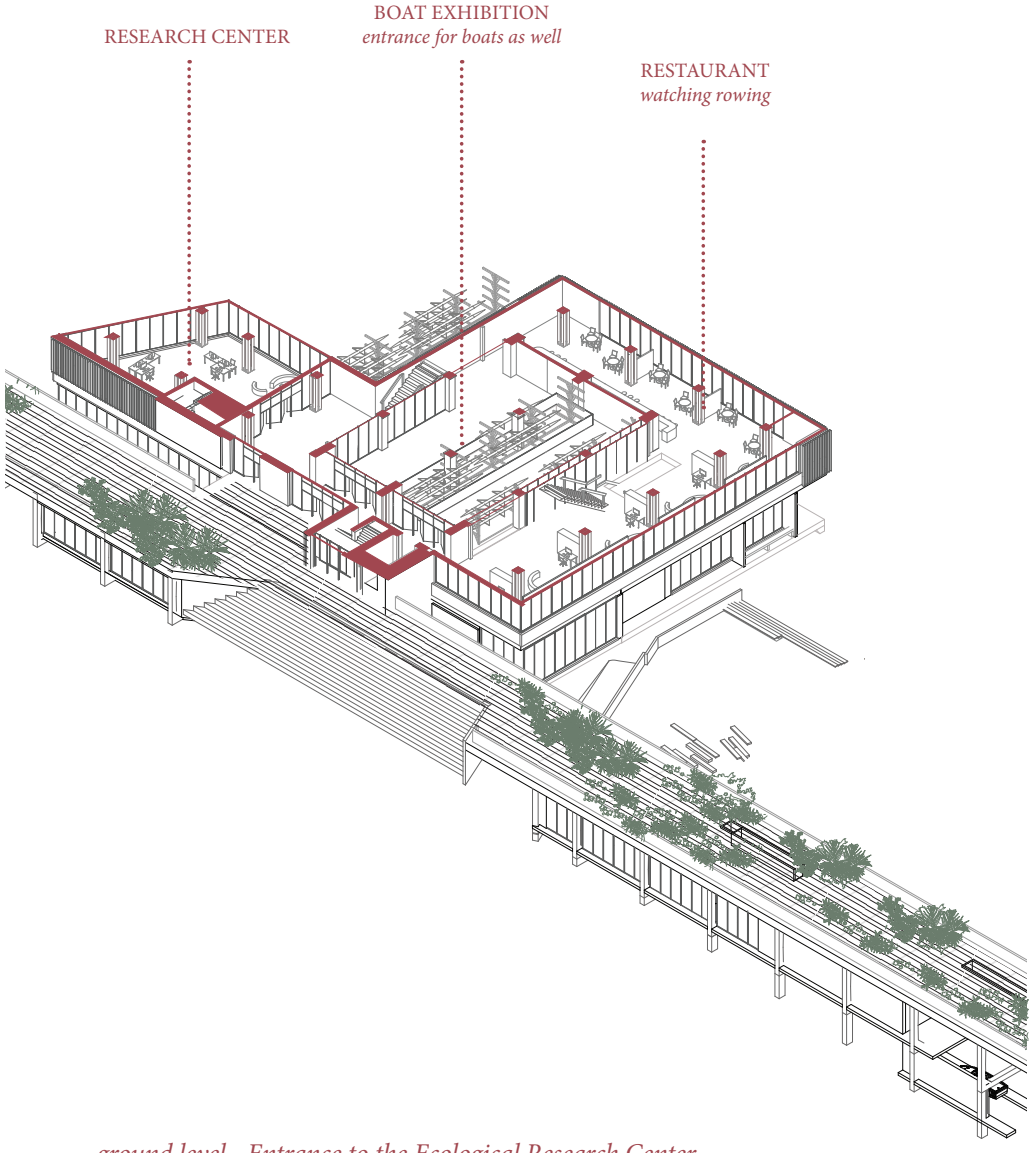
Controlling moisture through ventilation

5 square m window for 400 sq m of boat storage

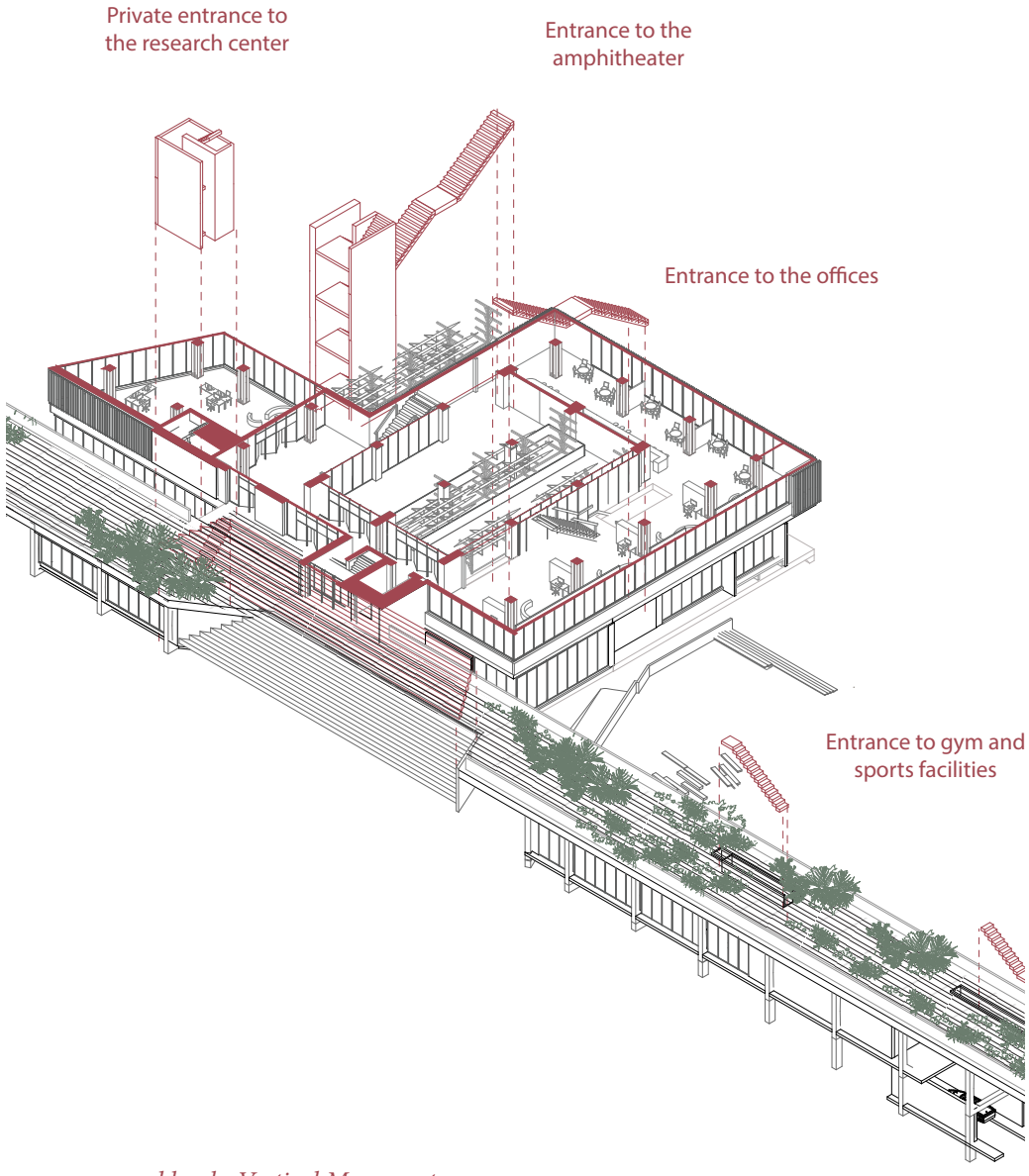
Shaft size: 8x5 x16m3

Goes up to the roof

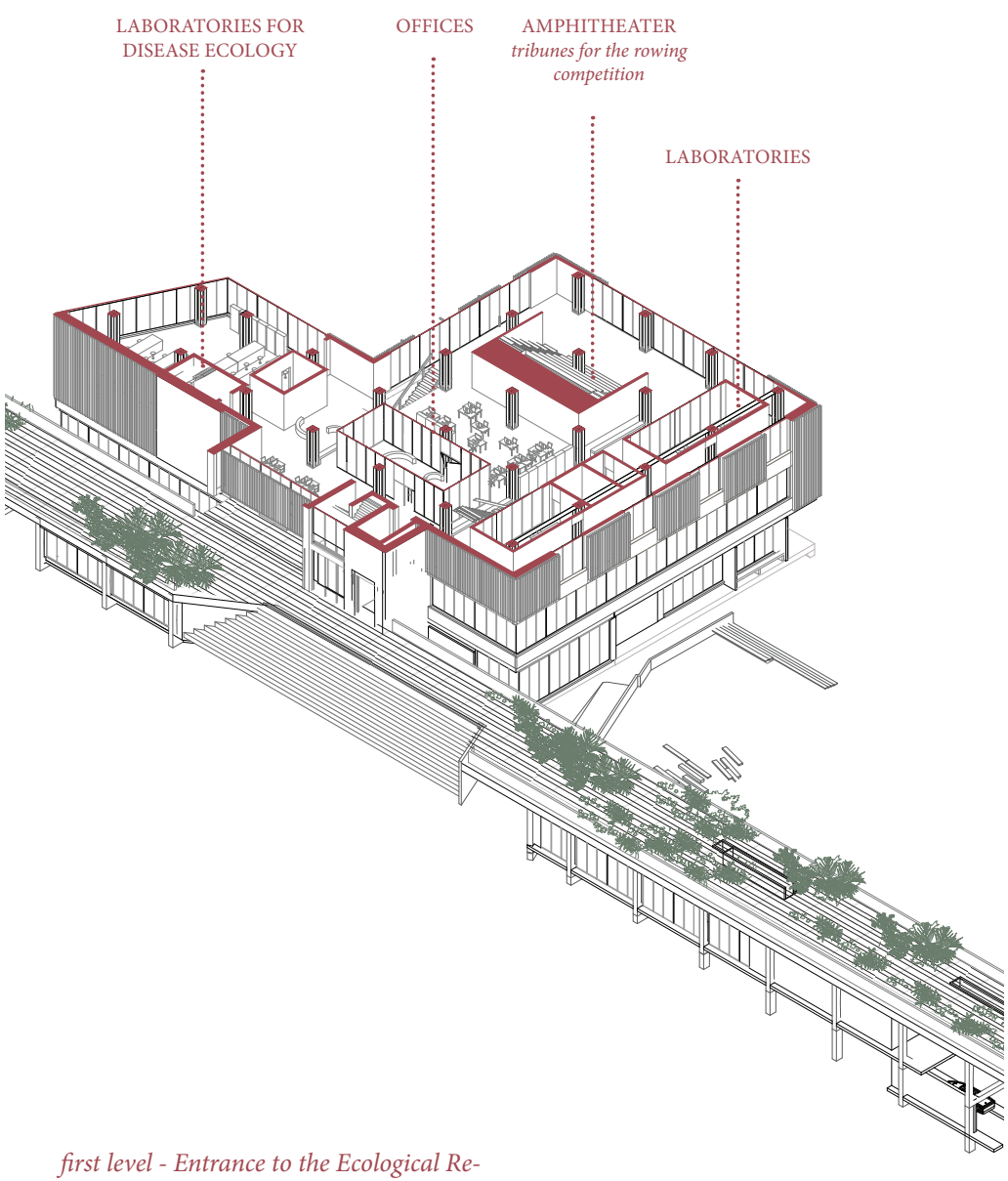




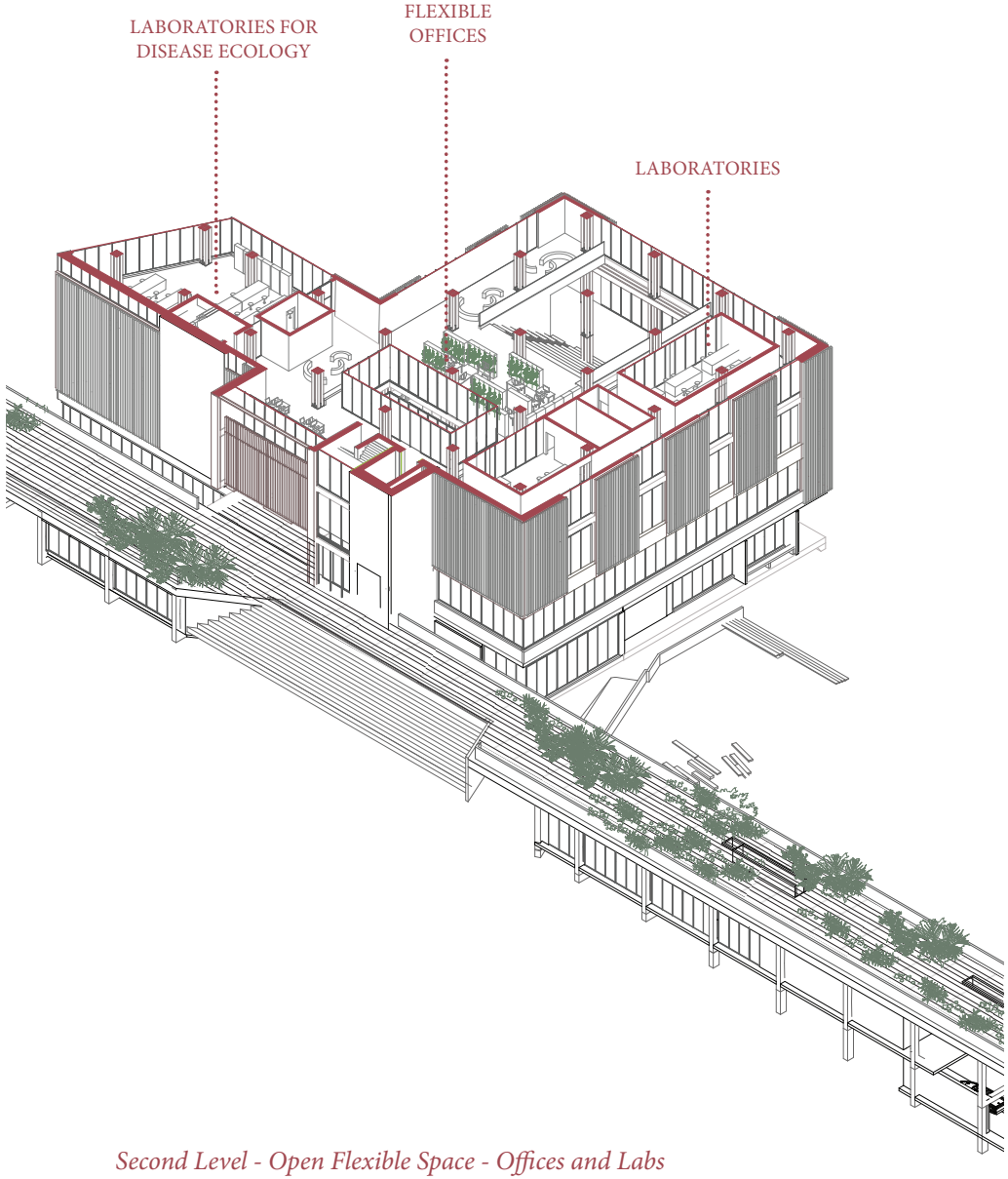
ground level - Entrance to the Ecological Research Center and Rowing Club



ground level - Vertical Movement

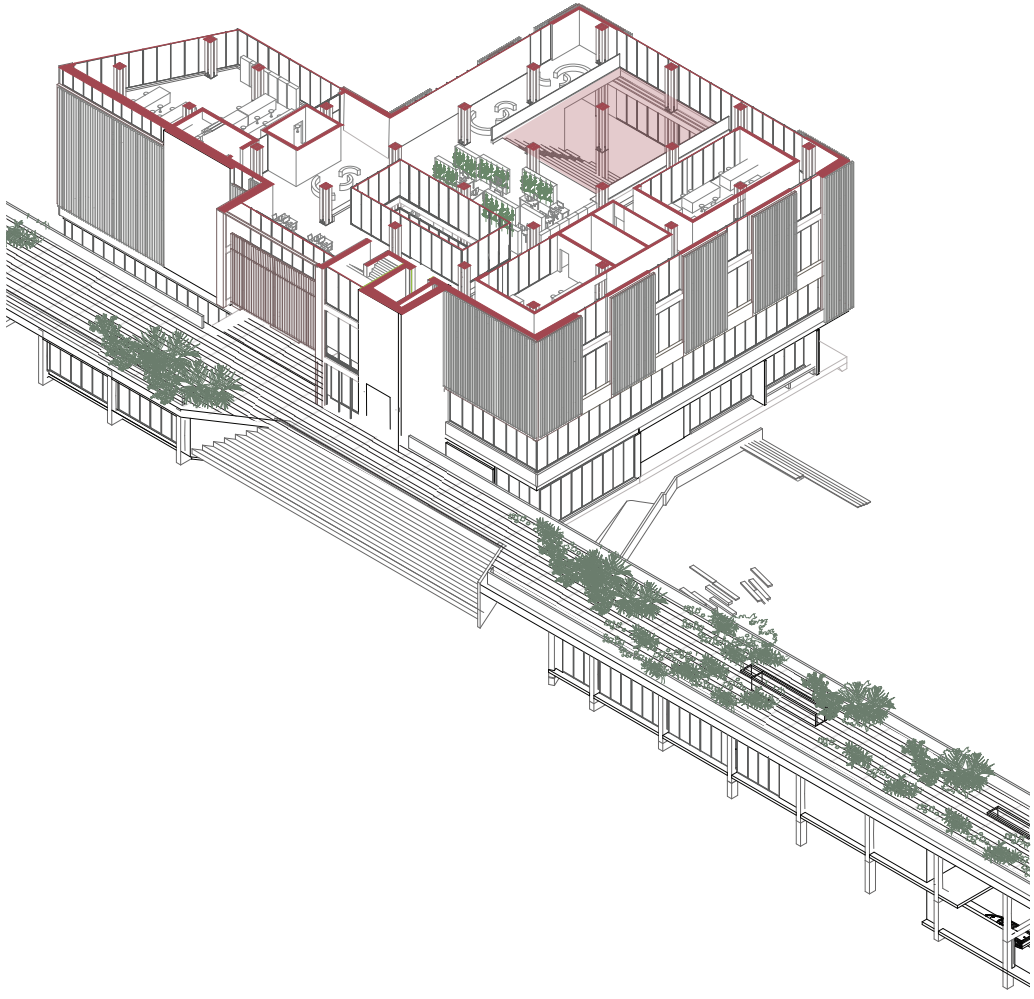


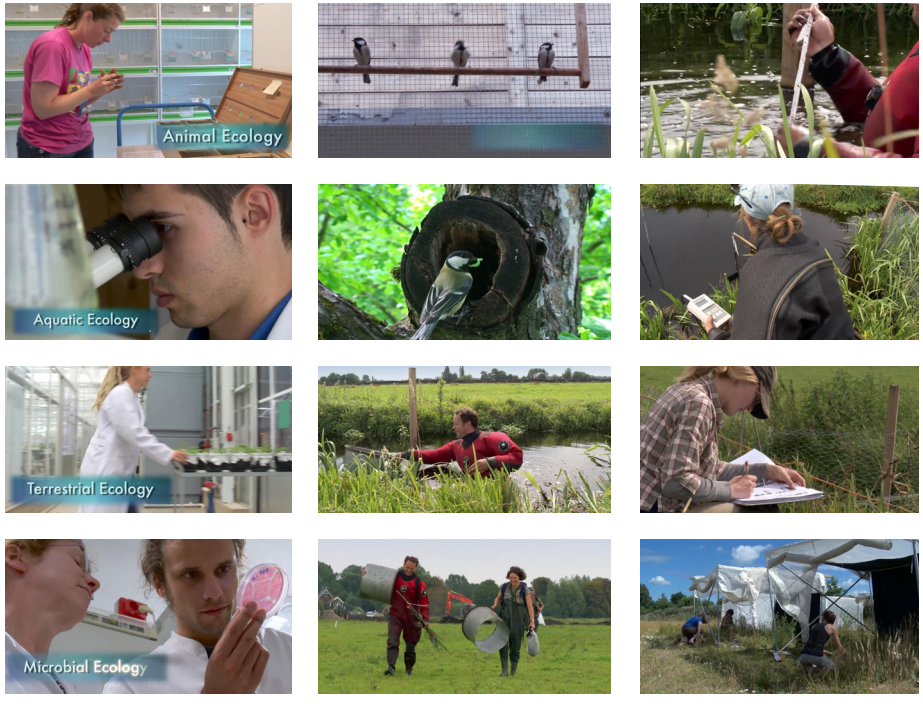
first level - Entrance to the Ecological Research Center and Rowing Club



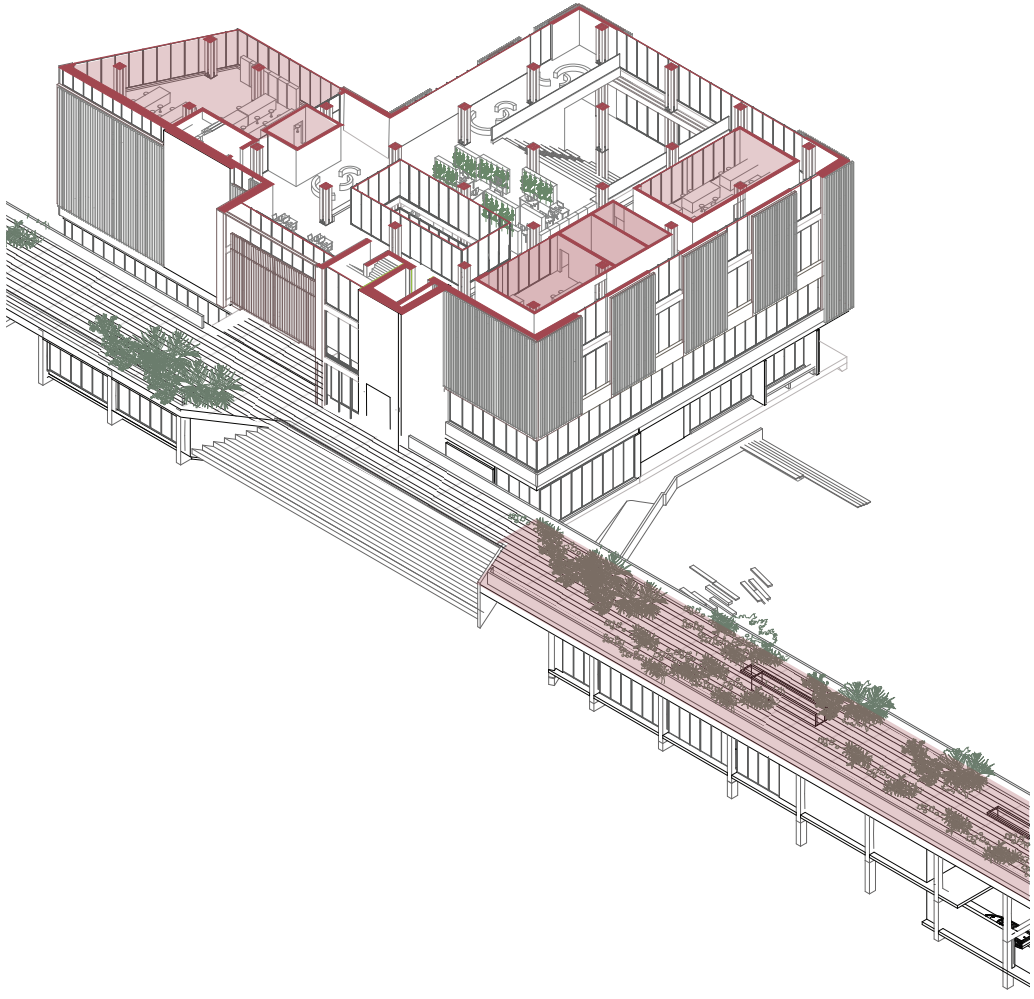
Second Level - Open Flexible Space - Offices and Labs

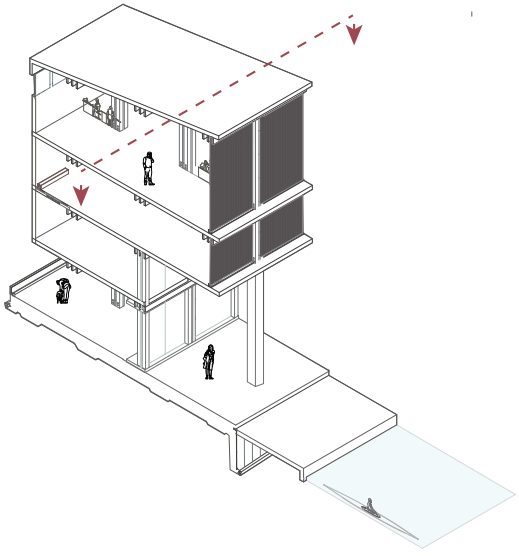
Second Level - Amphitheater

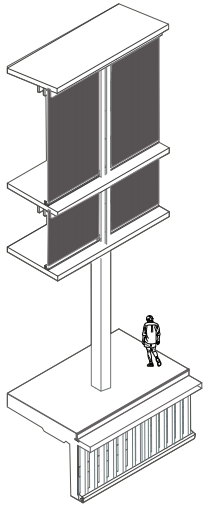


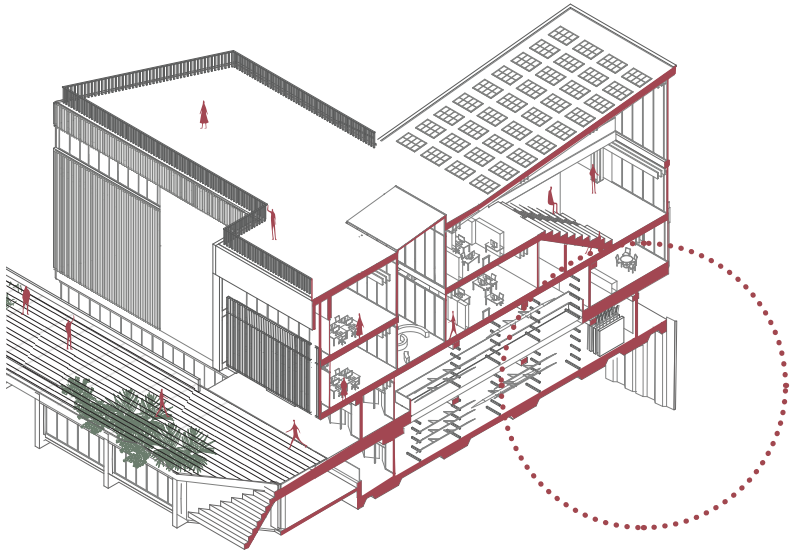


Ecological Research Center -
Landscapes as testing grounds

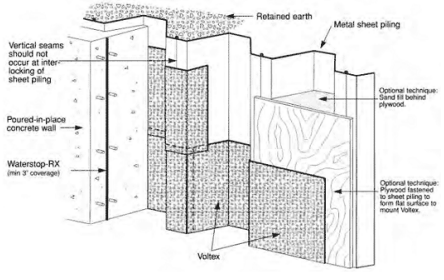


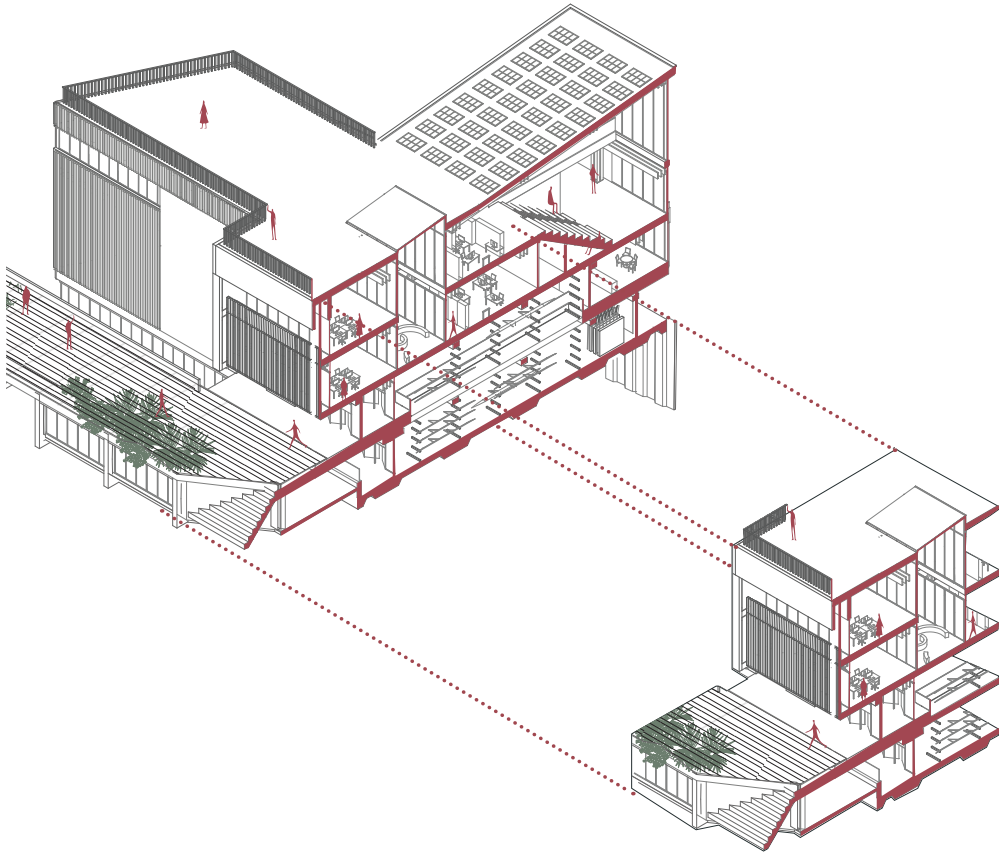




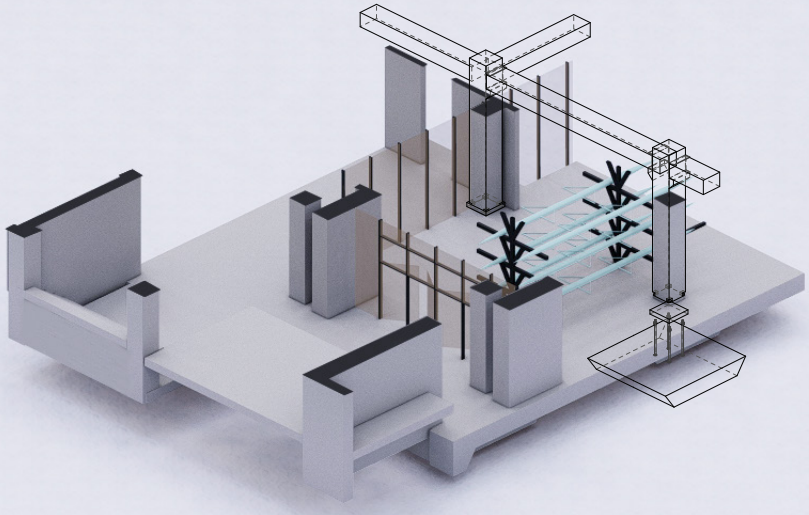


Choice foundation:
metal sheet piles with raft foundation

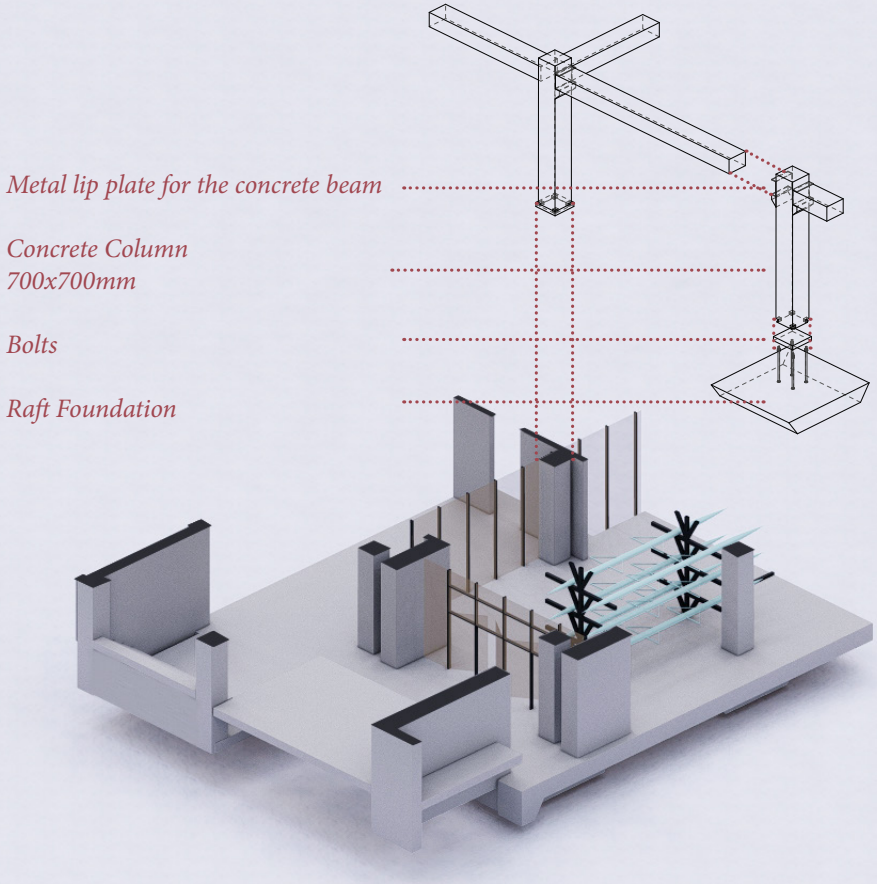




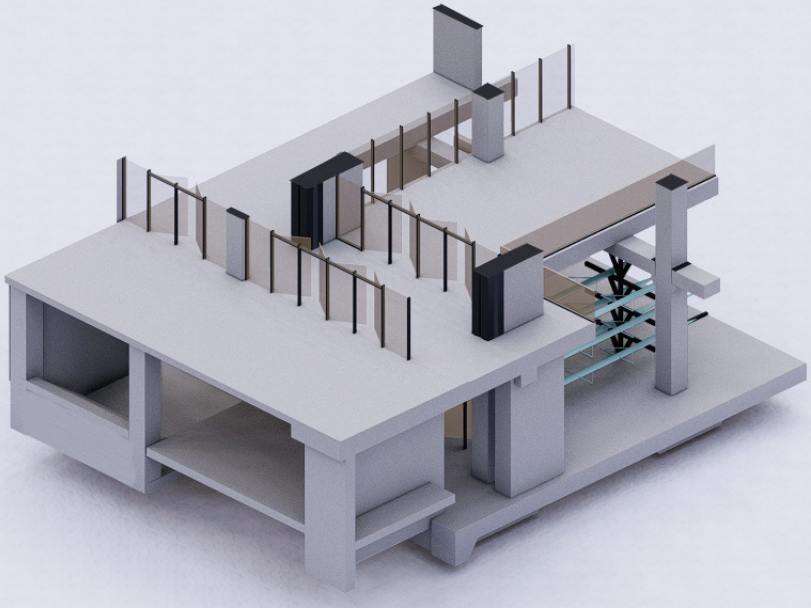
1to20 Building Fragment



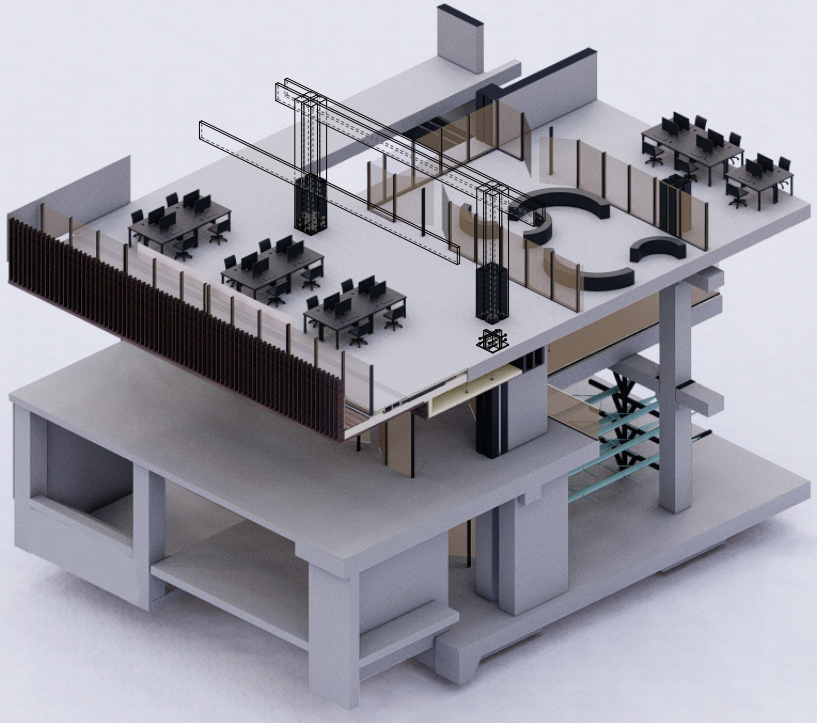
Raft Foundation + Concrete columns
-1 Rowing Club



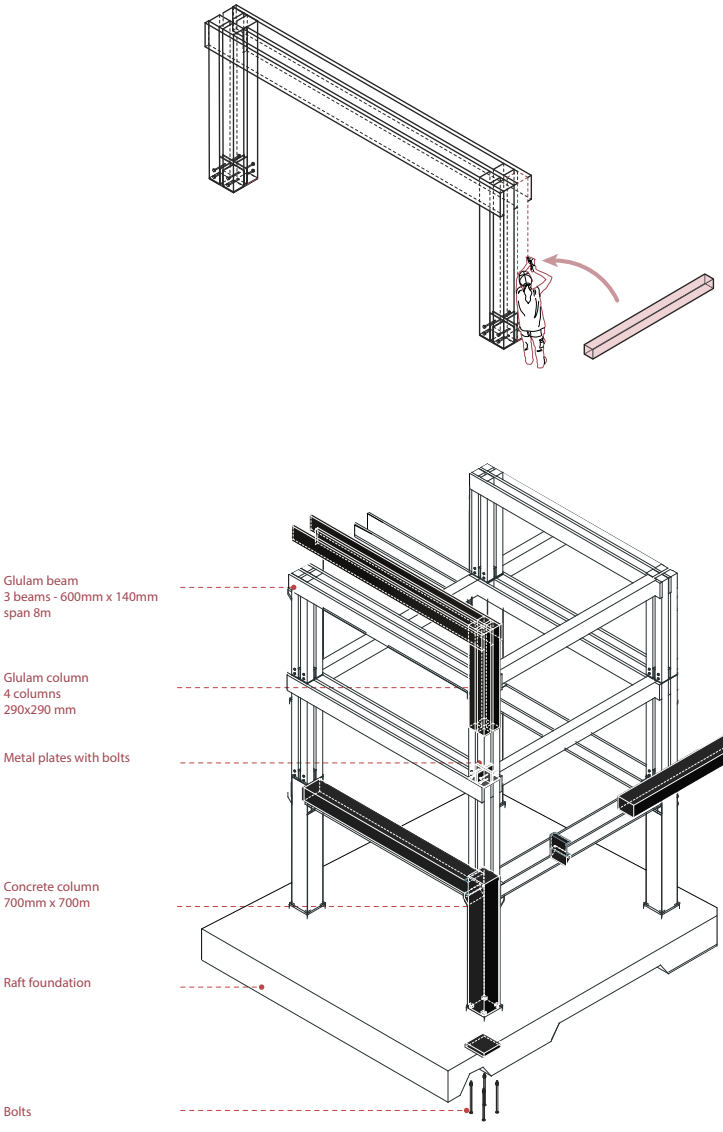
Raft Foundation + Concrete columns
-1 Rowing Club



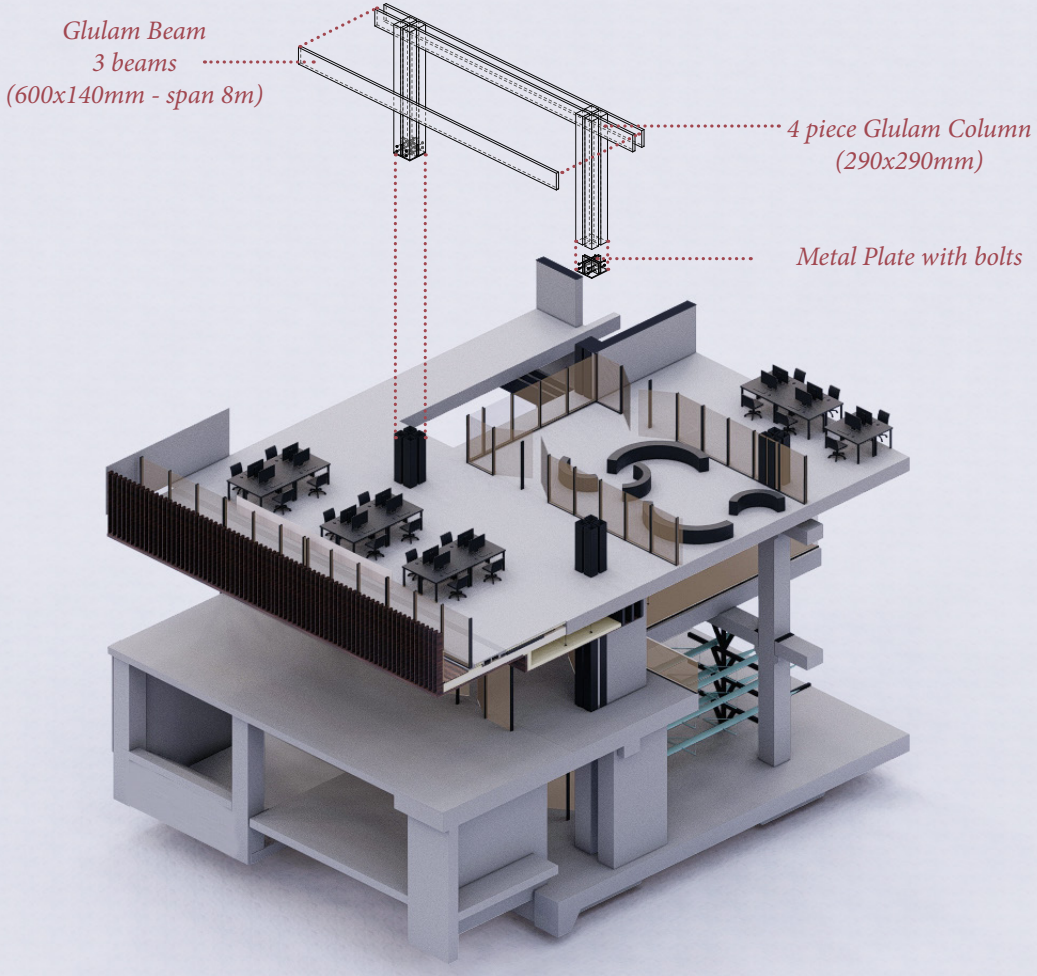
Ground Floor - Boat Exhibition



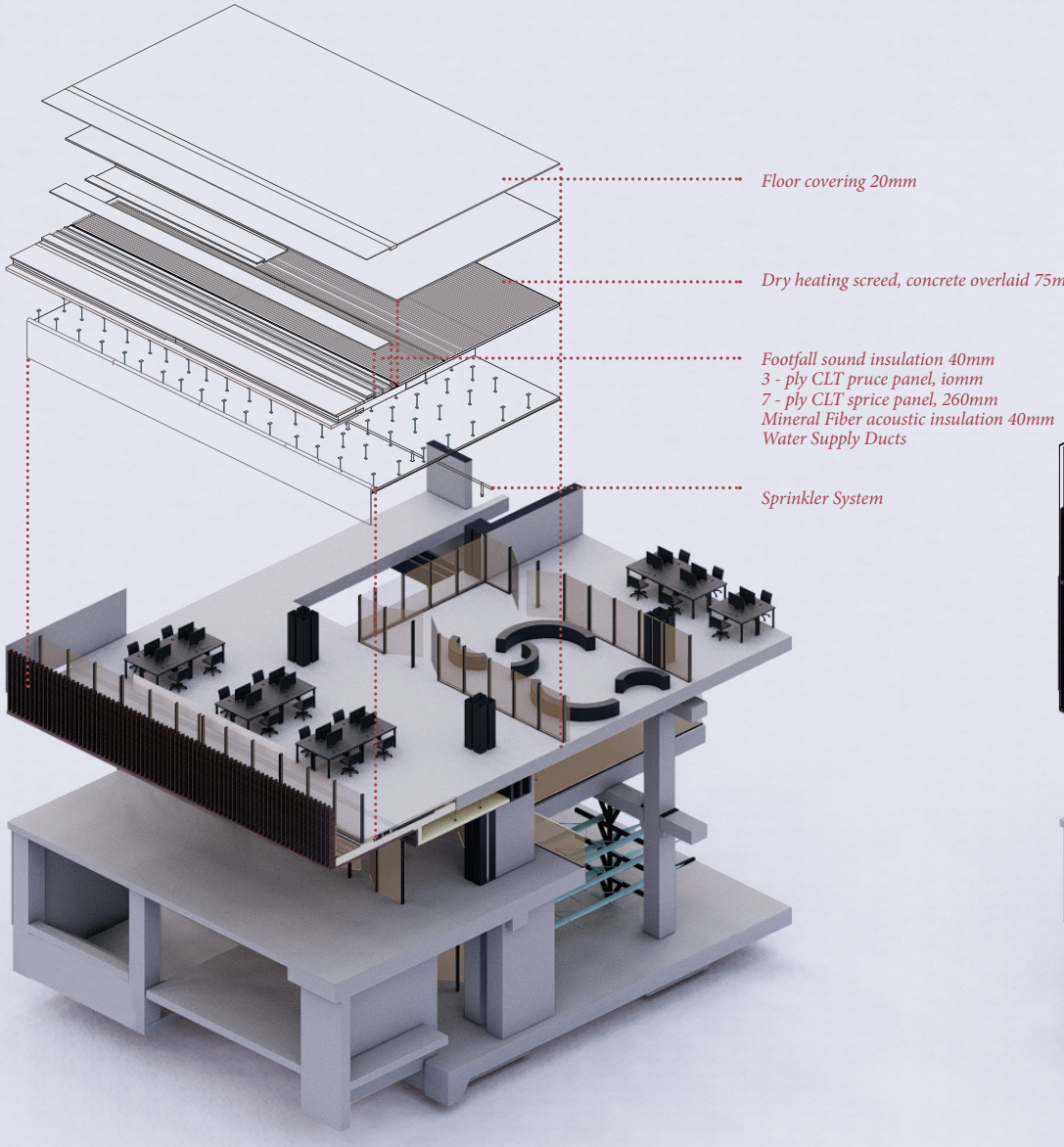
Glulam Columns
First Floor -Ecological Center



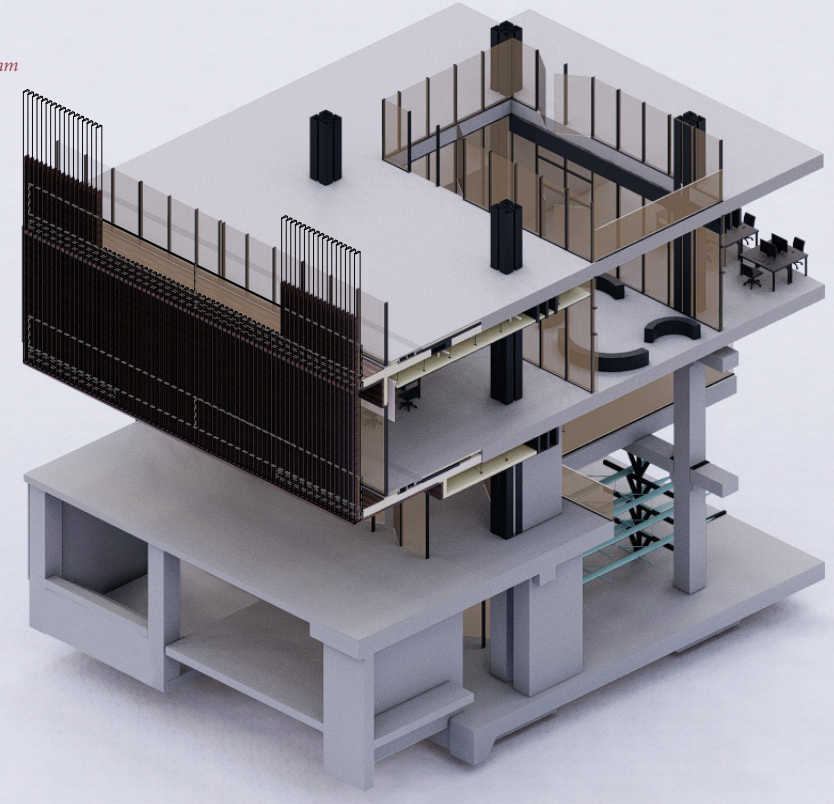
Demountability
Structural Diagram



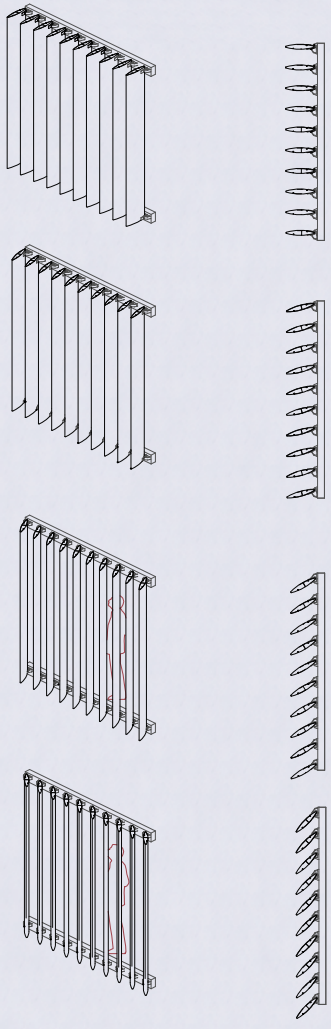
Glulam Columns
First Floor -Ecological Center



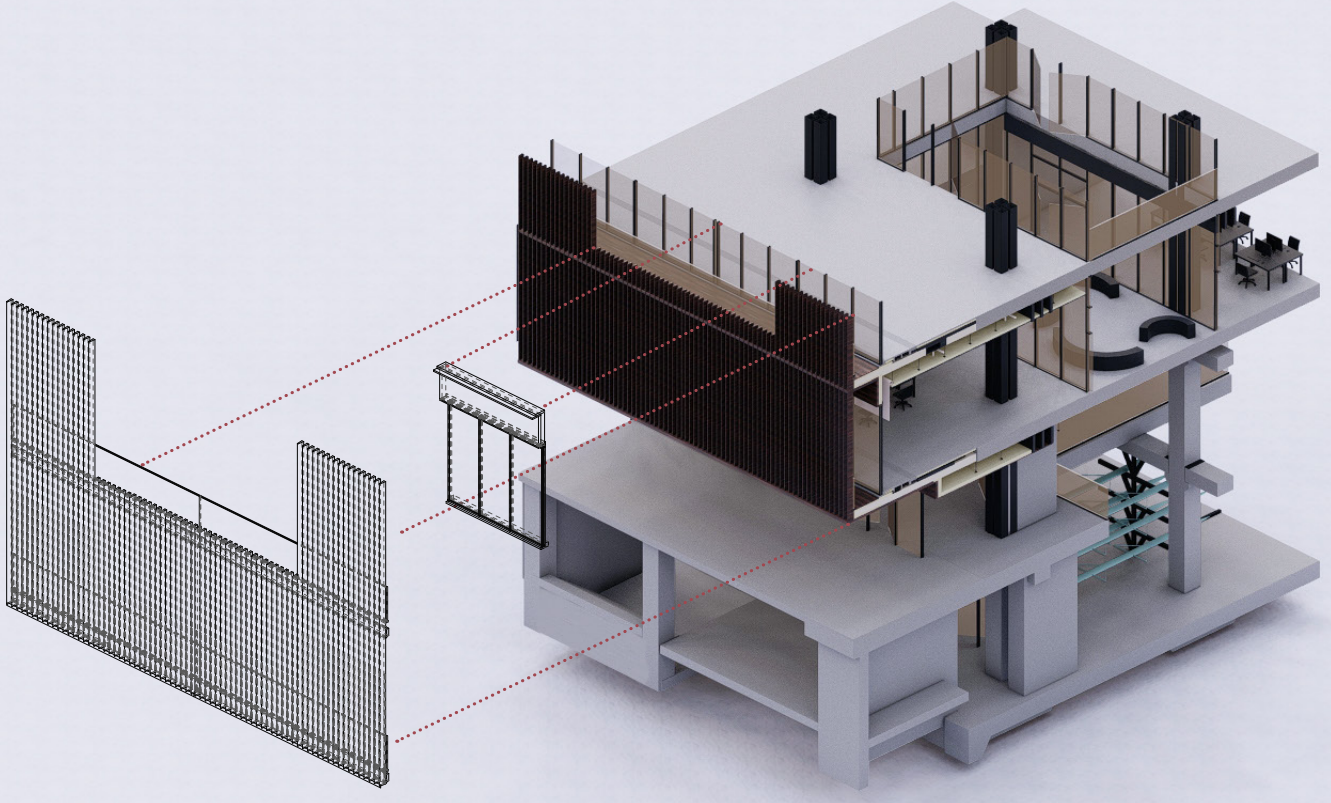
CLT Floor System
First Floor -Ecological Center



Plato Wood Facade System
Second Floor -Ecological Center

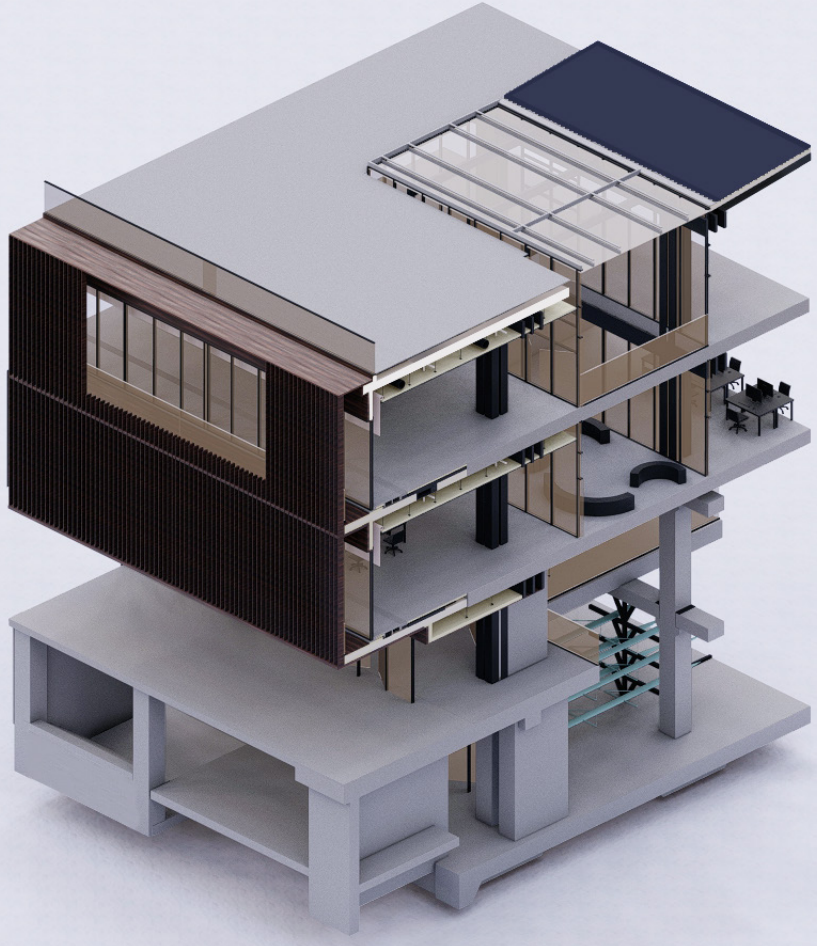


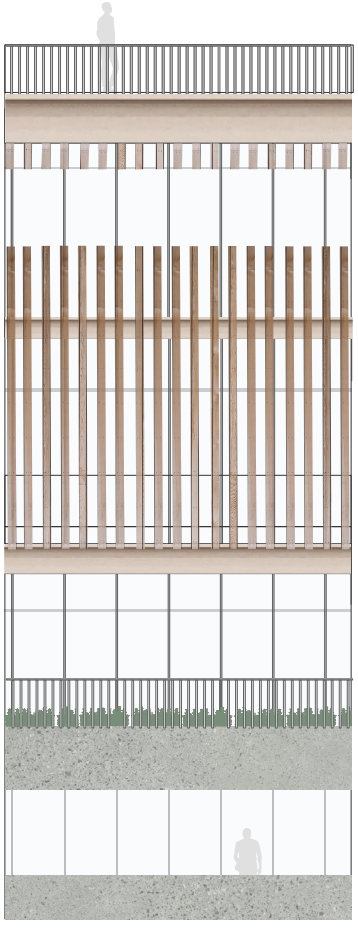
Facade System



Plato Wood Facade System

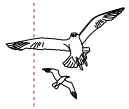
Second Floor -Ecological Center



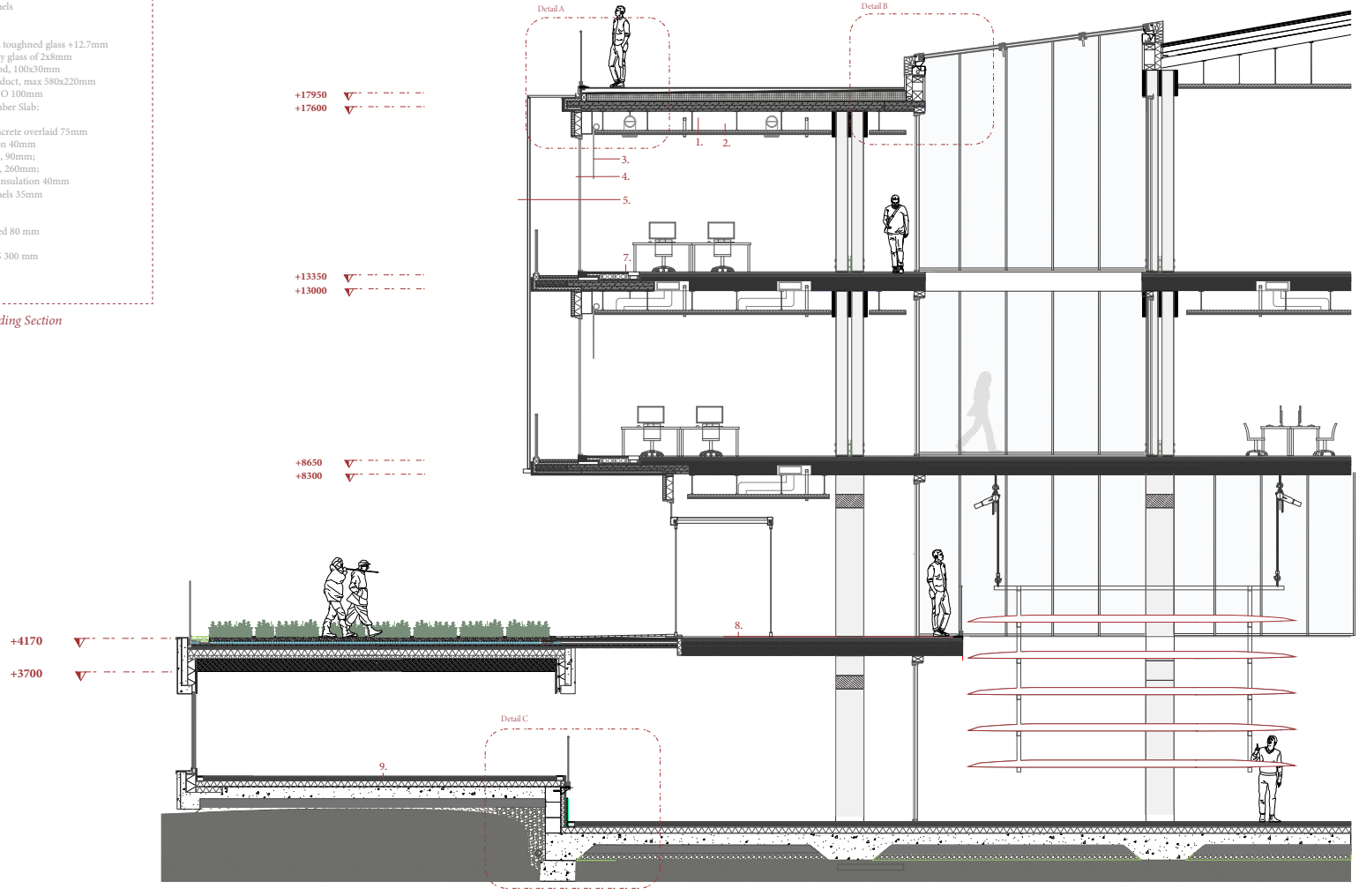


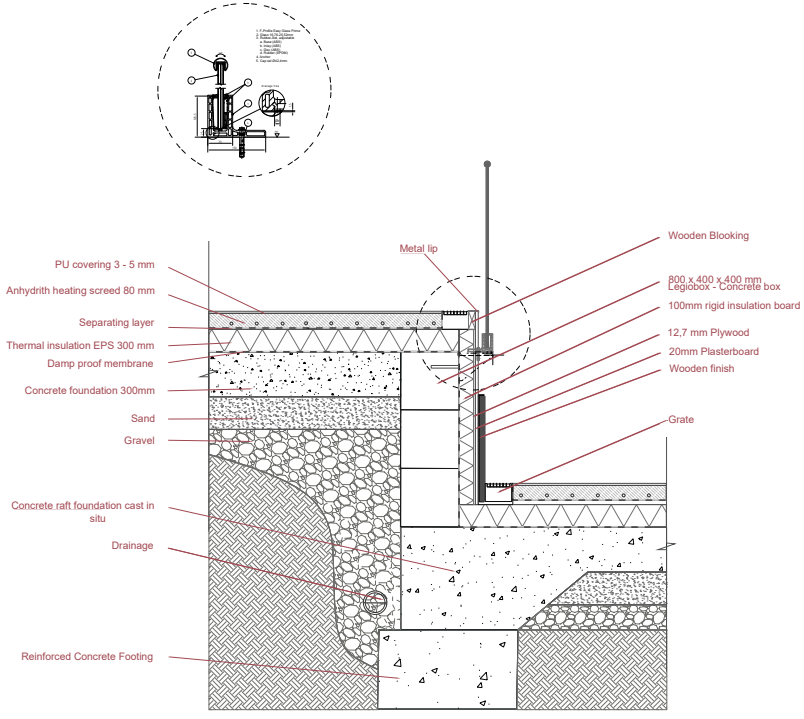
1 to 20 South Building Elevation

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

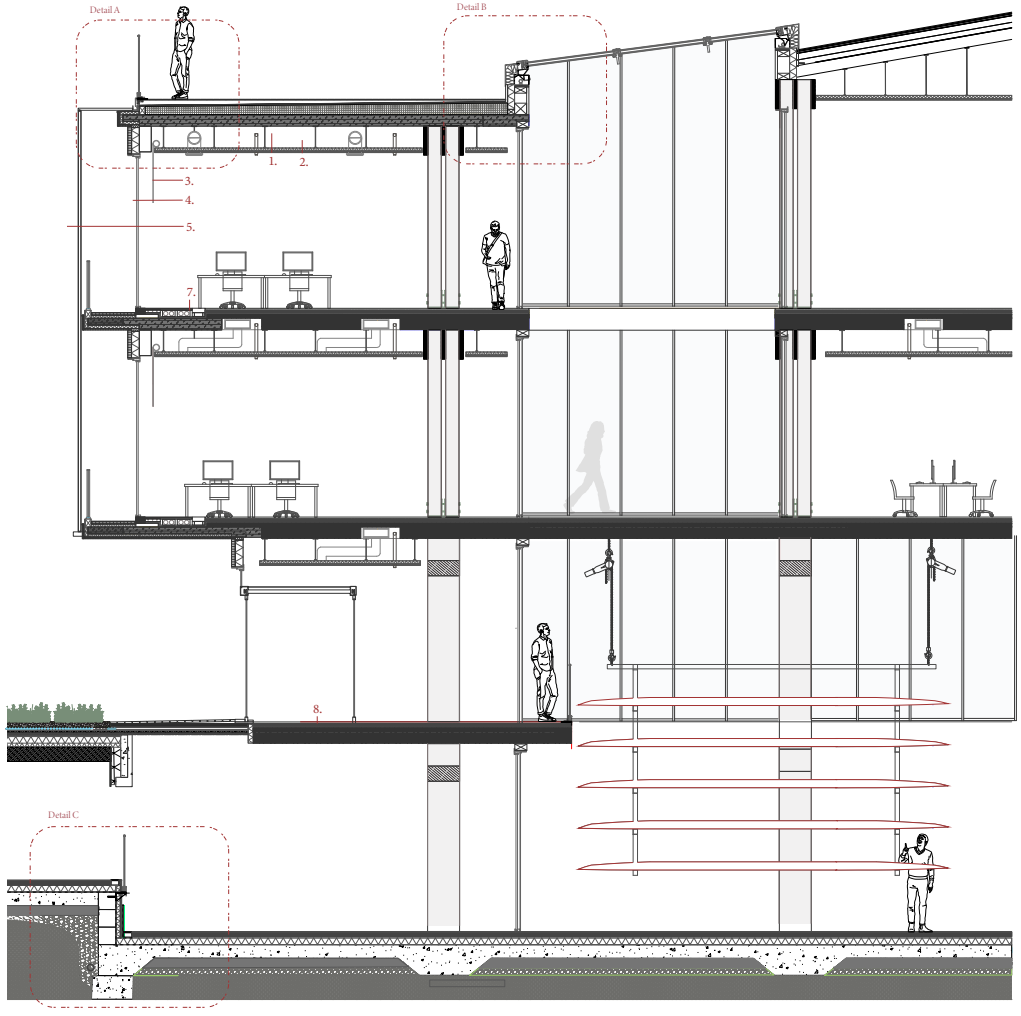


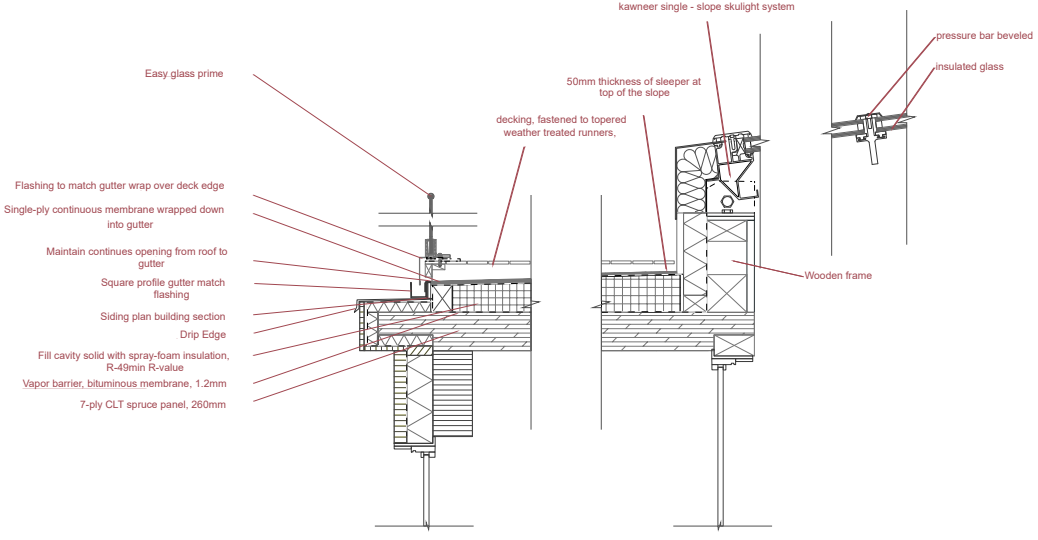
1 to 20 Building Section



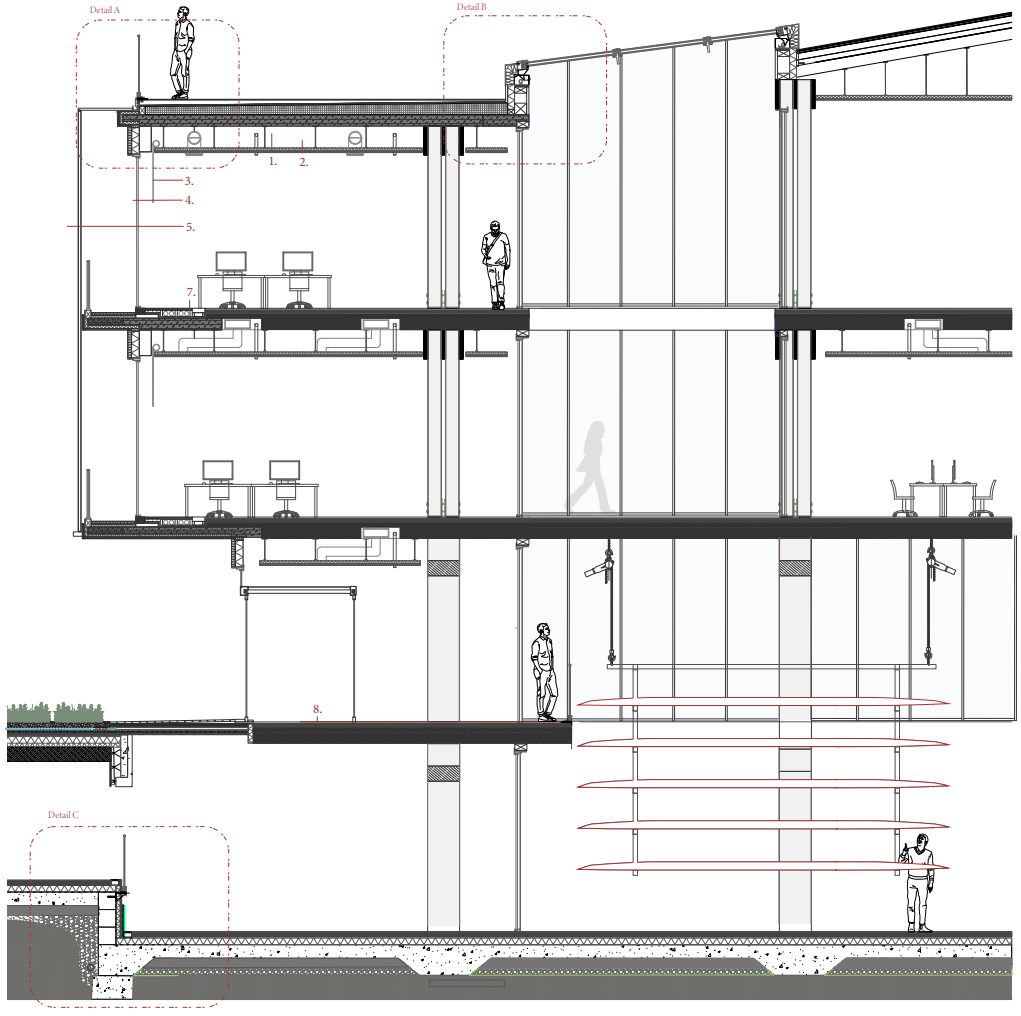


1 to 5 Foundation Detail
The two structures coming together





1 to 5 Roof Skylight and edge detail



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

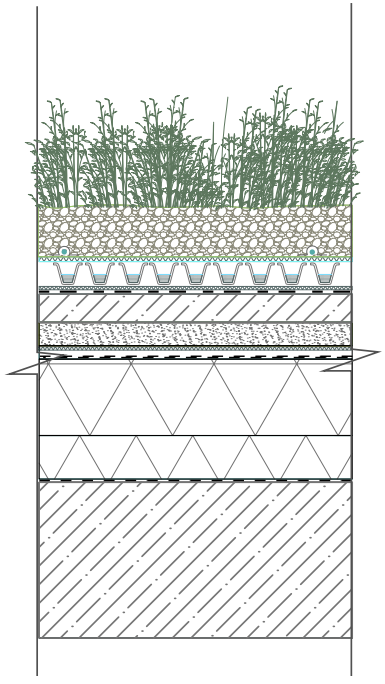
Drainage mat rubber shot 10 mm

Sealing bitumen, two layers, 20 mm

Thermal insulation 360 mm

Vapor barrier

Reinforced concrete 320 mm



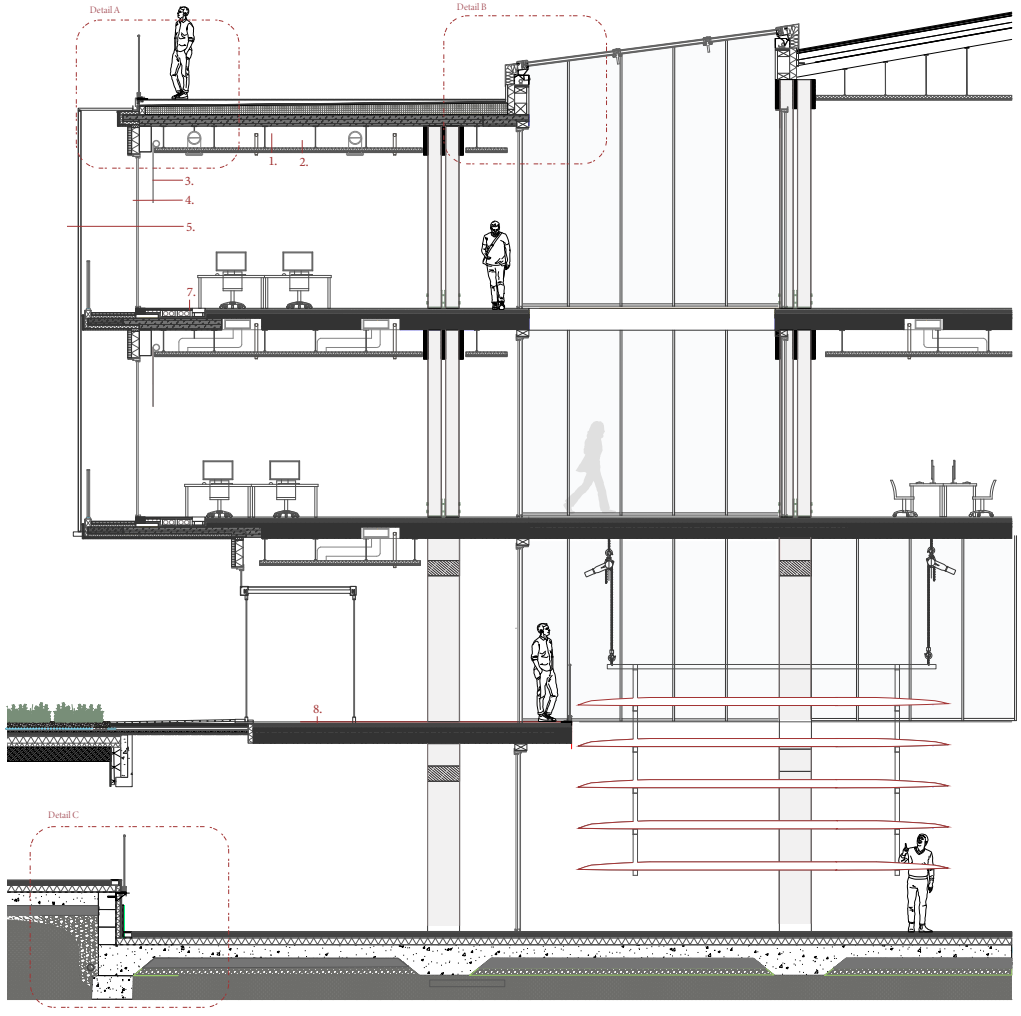


Figure 23: Bio safety level 4 laboratory with radial flow diffusers

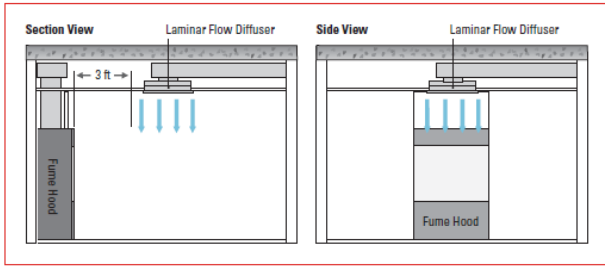
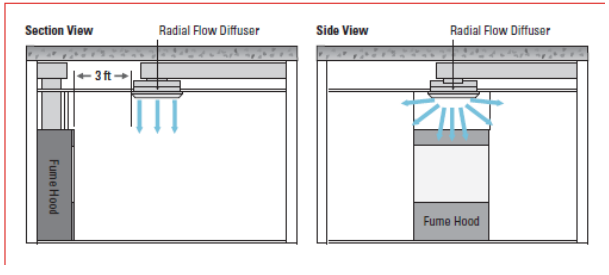
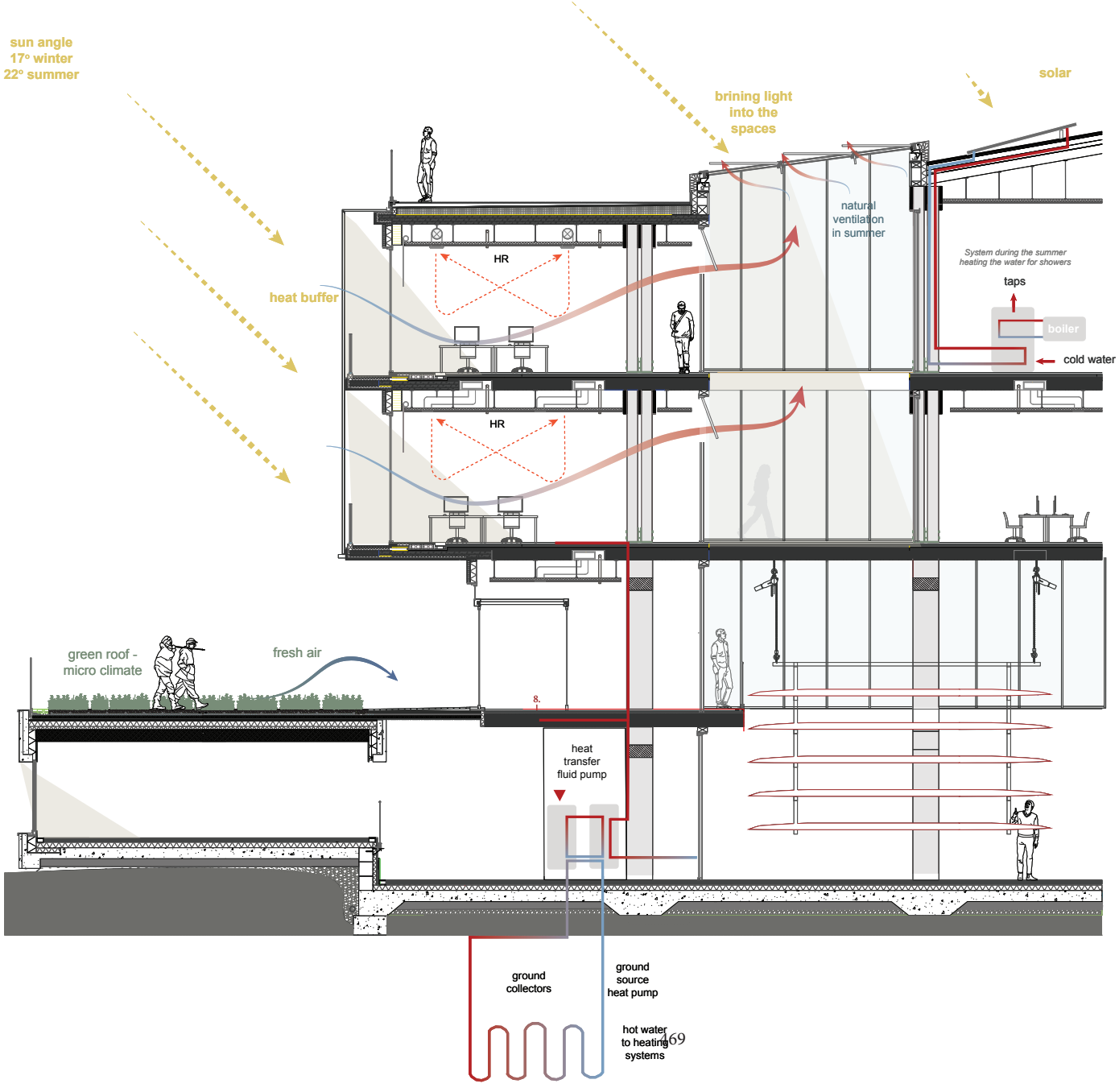
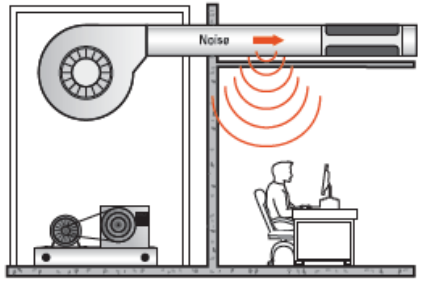


Figure 24: Laminar flow diffuser installed near fume hood



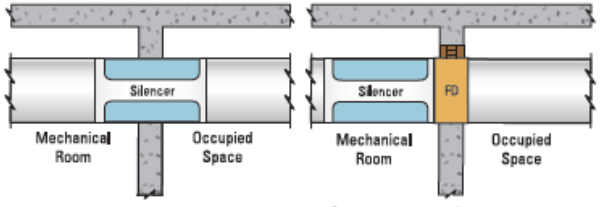
Ventialtion for the LABs
Heat Recovery for the Offices





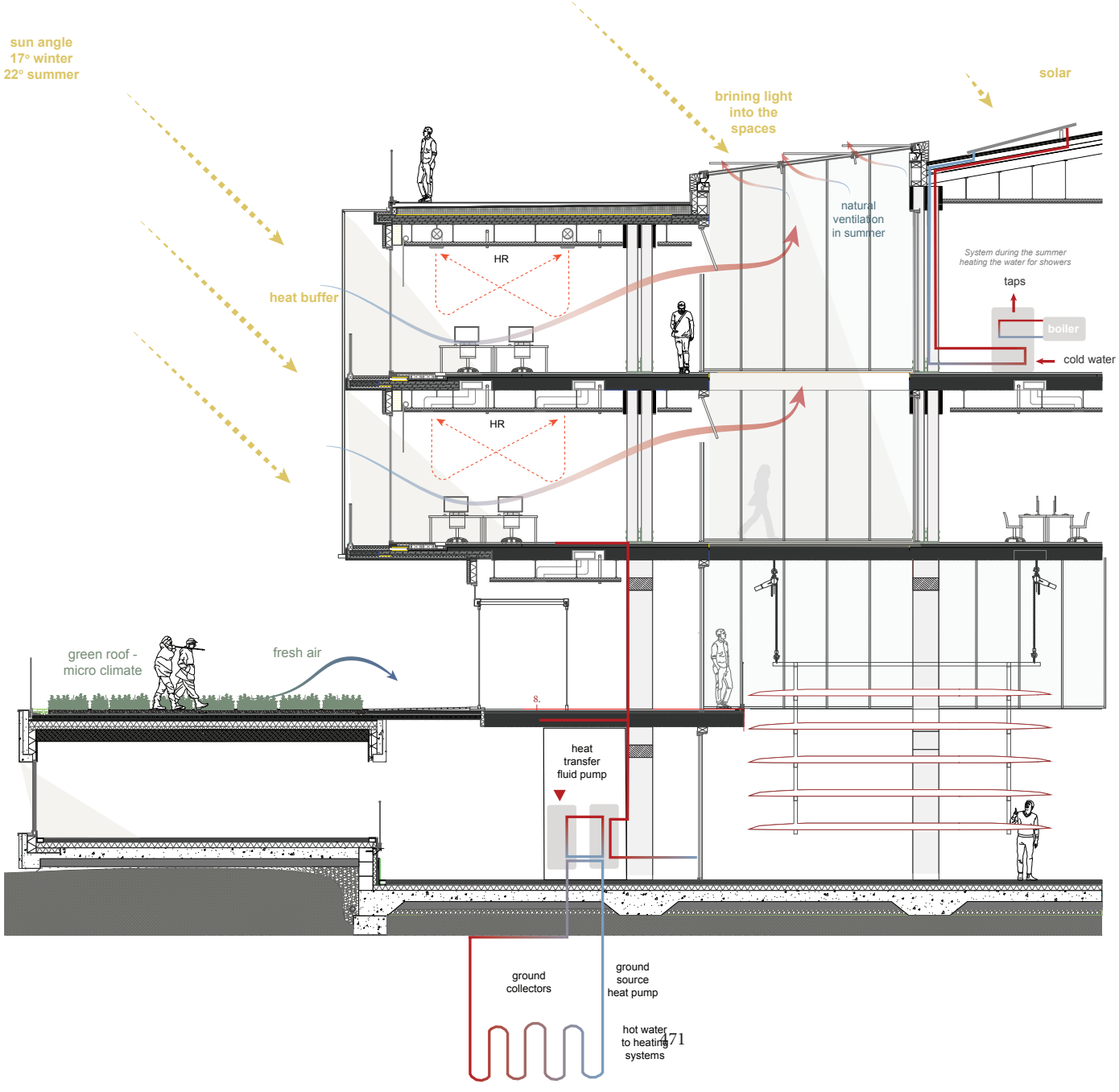
Transmission Loss

Construction Class	Gauge	Transmission Loss (Rectangular Silencers) 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	18	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