Designing Coastal Interfaces

Landscape architecture explorations in the Pearl River Delta, the Haringvliet and Pekalongan City through six MSc-graduation projects

adaptive urban transformation

TU Delft

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This report is a collection of six graduation projects of the master track of landscape architecture at the TU Delft. The Resilient Coastal Landscape Design Laboratory is initiated by Dr. Steffen Nijhuis. As project leader, lab coordinator, and supervisor of all involved students, he was strongly connected to all projects. He inspired and supported us throughout the process and helped us to reflect on our work. Without him, our graduation journey would have never been the same. Therefore we are very grateful for his help. Additionally, we would like to express our sincere gratitude to the other mentors. We could not have developed our projects as deeply and richly without their support.

We sincerely thank Dr Jin Tao, Associate Professor at the South China University of Technology, who is also an expert in traditional village restoration, urban renewal, and historical and cultural heritage preservation. Due to the covid situation, we could not go to the Pearl River Delta for field research. We were fortunate to have a more in-depth overview of the Lingnan historical villages and a comprehensive understanding of the site through the photographs and communication shared by Mr. Jin Tao.

We also like to thank Gabriel Geluk and Sjef Jansen for their constructive comments and input during the tutoring. The contact with the Sheffield University also provided a good foundation for future collaboration.

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The graduate students, July 2021

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FIG. 1.1 A dynamic coastal interface in the Netherlands

Preface

At our Faculty we train students and scholars to enhance the built environment. One way to do this is to engage with socio-cultural, ecological and technological problems from a spatial planning and design perspective. Now and in the future we face complex societal problems such as climate change and urbanization. The development of planning strategies and design principles for multifunctional food protection, ecological restoration and protection, transformation of brownfelds, building with nature, adaptive urban design are the key for sustainable urban landscapes. This can only be done from a trans-disciplinary and international perspective.

International collaboration between universities and their educational and research programs are essential for exchange of knowledge and stimulating creativity. It stimulates students to develop a critical academic attitude and explore the scope and remit of their discipline in an international context.

This publication is the result of such an effort. In a Landscape Architecture MSc graduation studio, students explored landscape-based strategies and design interventions to provide for a future-proof resilient development while working on projects that addressed multiple scales and timely issues. Knowledge input by scholars from the South China University of Technology specialized in historical village restoration, urban renewal, and traditional culture preservation enabled us to learn about the specific landscape context, as well as exchange ideas and alternative views. Also, the collaboration with scholars and practitioners from different disciplines such as Landscape Architecture, Urban Design, Architecture, Urban Planning, Ecology, Urban Studies, and Civil Engineering proved to be very important.

I am happy that our landscape architecture design studio at TU Delft provided a platform for this fruitful collaboration and helped the students thrive. I am proud of the results as they showcase a stimulating and promising array of solutions and possibilities for the development of coastal cities. Our ambition is that studios and exchanges like this strengthen our international relationships and push forward the quality of our education and research in architecture and the built environment.

Steffen Nijhuis

Delft, 13 July 2021

Introduction

This graduation studio explores the potential of a landscape-based regional design approach to contribute to more resilient coastal landscapes around the globe. Such an approach addresses the interaction between the natural and urban landscape throughout the scales of space and time. It takes the landscape as the basis for sustainable urban development and employs research through design as a strategy to explore the possibilities of landscape architecture principles for water-sensitive design, nature-based solutions, heritage protection, and socio-ecological inclusive development. This landscape approach is transdisciplinary in nature and exploits the power of design to address the complex challenges of our times while connecting long-term strategies and short-term interventions. The projects presented here showcase the wide range of possibilities of the landscape-approach in nature conservation, reduce flood risks, promote sustainable urban transformation and achieve a symbiosis between nature and culture.

Landscape Challenges

In the history of people living with water, our attitude towards nature has changed from avoiding and fearing to transforming and utilizing. We can identify those symbiotic landscape patterns of farmlands, settlements, and river networks in many places. Artificial and nature intertwine with and adapt to each other. One can say that that is the essence of the landscape as the visible result of action and interaction of humankind with their natural context displaying a wide variety of identities.

Unfortunately, rapid urbanization and climate actions often lead to the destruction of valuable ecological and socio-cultural systems and are often the cause of flooding events or shortage of water.

We strongly advocate that the landscape should is the basis for more sustainable societies and economies. Building with nature, traditional ecological knowledge, and water-sensitive design are powerful concepts that substantiate landscape-based design approaches that lead to more resilient and adaptive urban environments.

Objectives

This lab explores landscape-based design strategies for creating resilient landscape structures that can provide sustainable development opportunities from natural, economic, social, and cultural perspectives. Reading landscape by layers helps interpret the composition of urban and natural landscapes. Studying the landscape as a system promotes the understanding of how different landscape elements interact with each other.

Design research and research through design methods help explore and optimize site-adaptive design principles for the Pearl River Delta, Indonesia, and the Netherlands. The following design explorations test how these resilience frameworks can be realized from regional to local scales and how they contribute to guiding future development back to a large scale.

Flowscapes

The lab belongs to the "Flowscapes" studio that aims to explore dynamic landscape systems from different perspectives and in various contexts (Nijhuis & Jauslin, 2014). The studio encourages students to explore design strategies that address natural, social, and cultural issues at different scales through design research and research through design approaches. This approach is elaborated through different individual projects while generating knowledge in an exploratory research and design process.

Six design projects

/Live BY Water/ Yu Zheng

This project aims to redefine the historic canal system in Guangzhou (China) as an urban landscape infrastructure and explore its potential in future urban development. The important design principles are learned from history, and they are adapted to the current situation by combining them with theory exploration and related case studies and using design as an important tool of research. This process explores the possibilities of the canal system and the use of historical knowledge.

/Restoration and Revival of Tonghu Area/ Yun Sun

This project proposes a resilient landscape framework that provides urban transformation and ecological restoration conditions while improving flooding capacity and biodiversity in the Tonghu area (China). The design exploration focuses on three scales- regional, local and detailed scales, addressing different problems. Principles and strategies from this project can be learned, optimized, and applied to other sites.

/Developing a Resilient Xi Chong/ Kailun Qi

The objective of this project is to develop a resilient landscape framework that facilitates Hakka culture, coastal safety and tourism development in XiChong near Shenzhen (China). Xichong has the longest and the most popular beach in Shenzhen, which attracts many tourists every year. Local people have a special name: Hakka. They have been living there for over 600 years. Recently, local's peaceful life is facing serious challenges, both from human activity and extreme weather.

/Eco-cooperation Landscape/ Yu Liu

The project explores an adaptable landscape framework for dyke pond systems, water safety, ecological development, and urbanization in the Modaomen estuary (China). The project will enhance the water security of the coastline and establish stepping stones and habitats. Besides, The design also serves as the engine to facilitate city development. The adaptive landscape framework is a bold experiment to solve multiple problems of urban, agricultural, ecological issues using interdisciplinary knowledge.

/A new dynamic landscape for the Haringvliet/ Esmee van Eeden

This project provides a design exploration for a new estuarine landscape that includes the initiative Delta 21 (Berke & Lavooij, 2019). The project is located at the Haringvliet estuary (the Netherlands) and plans to implement an energy lake and a tidal lake sea inwards. This design exploration aims to create a sustainable landscape in harmony with ongoing natural processes, which restores the gradual land-water transitions to bring back the dynamics of this delta landscape. The new landscape structure ensures flood protection, increases the use of renewable energy, introduces aquaculture, creates very valuable natural habitats and corridors and provides new recreation.

/Colored Water/ Yayun Gao

The objective of this project is to design a resilient landscape framework that facilitates water safety and batik development in Pekalongan city (Indonesia). By conducting strategies in three water-related assignments, coast protection, discharge capacity, and water circulation, this project proposes a new resilient water-batik system to address the dilemma between natural resource and cultural industry. The design proposal that focuses on water also works as a pioneer in generating the city's potentials in urban green structure and economy. The nature-based solutions intend to make the plan to protect the city from being disturbed and functions well with the fluctuating water level in the long term.

DYNAMIC INTERFACE

FIG. 1.2 The tidal movement of the ocean and the succession of plants on the beach create a dynamic interface. The wind break forests behind the beach provides a protective barrier to the historic village and creates a unique micro-habitat.

URBAN EXPANSION

FIG. 1.3 With rapid urbanization and industrialization, constructions are encroaching on more and more natural spaces. The old connection between the historical village and the ocean is broken by new development.

HARD BOUNDARY

FIG. 1.4 Traditional fisherman's villages in the Pearl River Delta have strong relationship with the water and display intelligent water adaptive strategies.

INTERACTION WITH WATER

This photo shows the layout of a small village called Obertraun that follows the topography dotted in the valley. There are soft transition zones between the village and the water, such as lawns, farmland, and small forests. The village is urban in nature, changing with and adapting to its natural environment.

ECO UTILIZATION

FIG. 1: Nature is more than just undulating terrain and beautiful landscapes; it is also a constant source of resources and material support. The Dike pond system is a typical way of adapting to nature and using it for a productive life.

INFRASTRUCTURE CONSTRUCTION

FIG. 17 The infrastructure construction facilitates the exchange of different flows between cities, but some also have particular ecological values. The photo shows the Haringvliet, whose sluice prevents saltwater intrusion and maintains freshwater supply when closed. When open, it allows migratory fish from the North Sea to swim into Lake Haringvliet.

CULTURAL HERITAGE

FIG 1.8 Many historical villages nurtured between the mountains and waters tell the story of people adapting to nature and making use of it. Chigang historical village has a typical Feng Shui layout of a front pond and a back forest. This layout can use the natural topography to organize drainage and ventilation for cooling, highlighting the wisdom of the ancient people.


CCB CCB

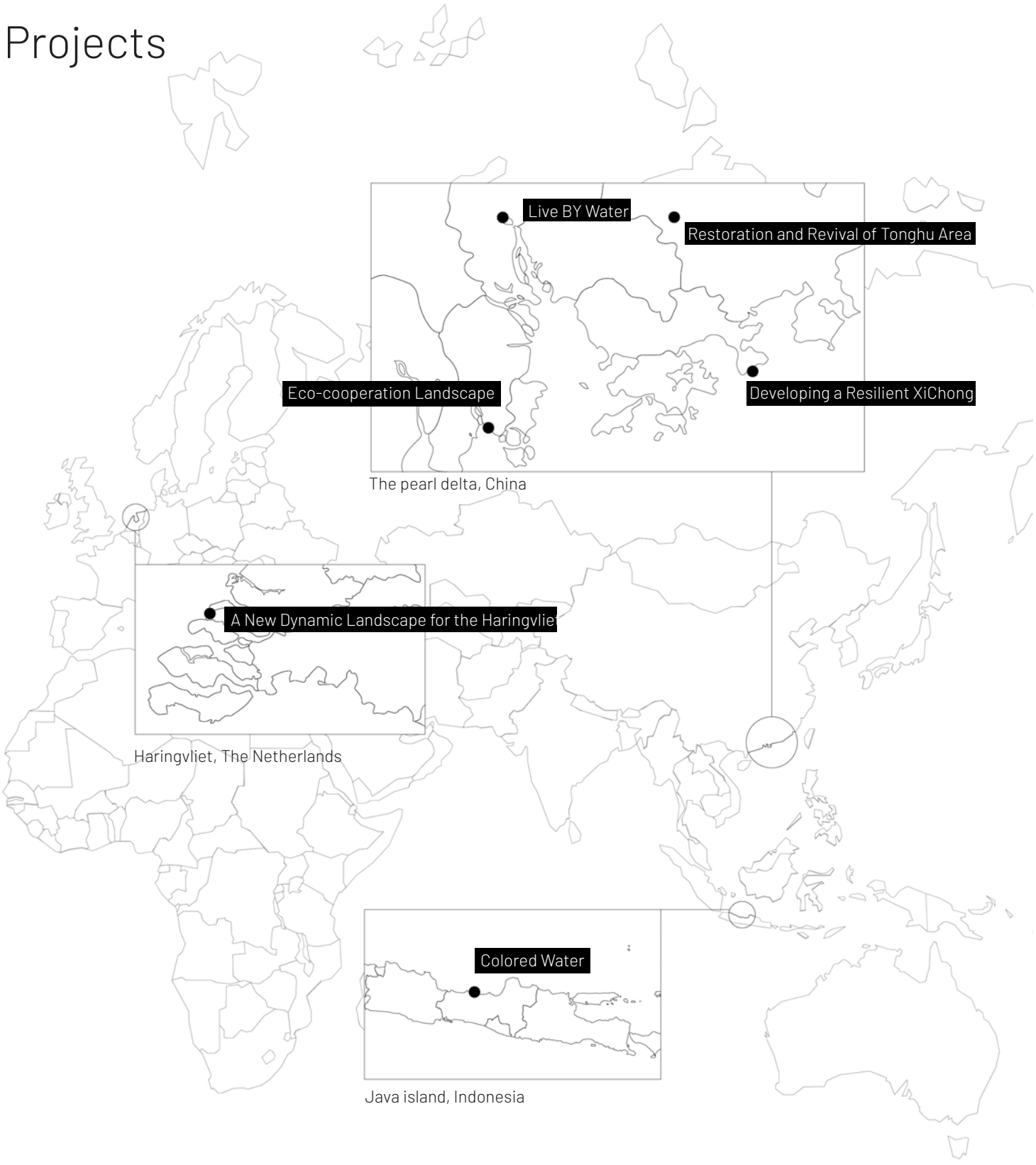
LIVE BY WATER

Fig. 1.1 In modern cities, water is also closely related to people's life. This photo shows a pocket park under a highway in Guangzhou, complemented by a water landscape, creating a new vibrant urban public space for socialization and entertainment.

WATERSIDE HABITATS

FIG. 1.10 **Coastal dynamics create a wealth of water-related habitats and ecological gradients.**

Projects


Live BY Water
Restoration and Revival of Tonghu Area
Eco-cooperation Landscape
Developing a Resilient XiChong
The pearl delta, China
A New Dynamic Landscape for the Haringvlie
Haringvliet, The Netherlands
Colored Water
Java island, Indonesia

Project Overview

1. /Live BY Water/ Yu Zheng

Designing the Historic Canal System of Guangzhou as Urban Landscape Infrastructure

2. /Restoration and Revivla of Tonghu Area/ Yun Sun

A resilient landscape framework that provides conditions for urban transformation and ecological restoration

3. /Developing a Resilient Xi Chong/ Kailun Qi

A resilient landscape framework that facilitates Hakka culture, coastal safety and tourism development in Shenzhen

4. /Eco-cooperation Landscape/ Yu Liu

Design explorations in the Modaomen estuary for an adaptive and sustainable dike-pond system, water safety and ecological development

5. /A new Dynamic Landscape for the Haringvliet/ Esmee van Eeden

A landscape architecture exploration for Delta 21

6. /Colored Water/ Yayun Gao

Design a resilient landscape framework that facilitates water safety and batik development in Pekalongan city.

FIG. 1.11 Lake Stone in the Historical Lingnan Garden

live BY water

Designing the Historic Canal System of Guangzhou as Urban Landscape Infrastructure

Yu Zheng

Surpervisors
Steffen Nijhuis, Landscape architecture
Gregory Bracken, Spatial planning & strategy

Introduction

Guangzhou is one of the biggest cities in China, and it is located in Pearl River Delta, which has a vulnerable natural environment. In history, the development of Guangzhou city was inseparable from its canal system, which was developed from the natural dense river network. On the one hand, this system had played its role in water management very well. It could quickly discharge rainwater into the Pearl River during the rainy season to prevent floods, and it could also function in water storage during the dry season. On the other hand, the canals were also an important part of people's daily life. It carried most of the people's main activities, such as sailing, trade, and socializing. The historic canal system was the lifeline of Guangzhou.

However, in the rapid development of the city in the past 100 years, due to the rise of the automobile road system and the improper planning of the drainage system, the historic canals in Guangzhou have gradually left only a single drainage function. Different kinds of industrial wastewater and domestic wastewater are discharged into the canals, causing the canals and the surrounding environment to become bad; at the same time, the river is narrowed and the drainage function has deteriorated. In the rainy season, the surrounding area of the river is often flooded. The historic canals have gradually become the backside of the city, the disease of the city.

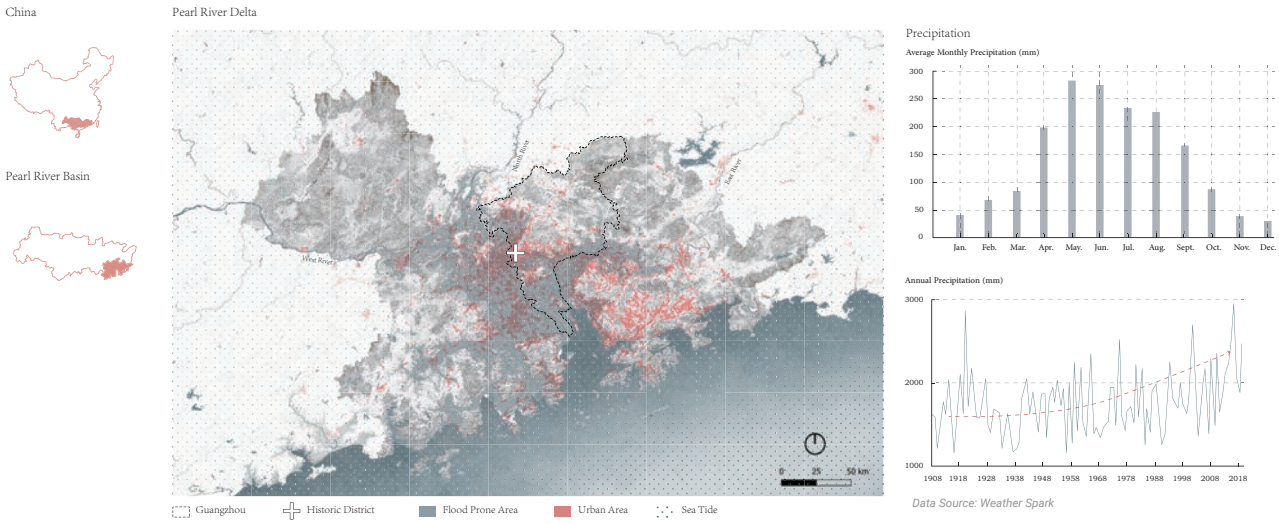


FIG. 1.12 Natural Condition of Guangzhou

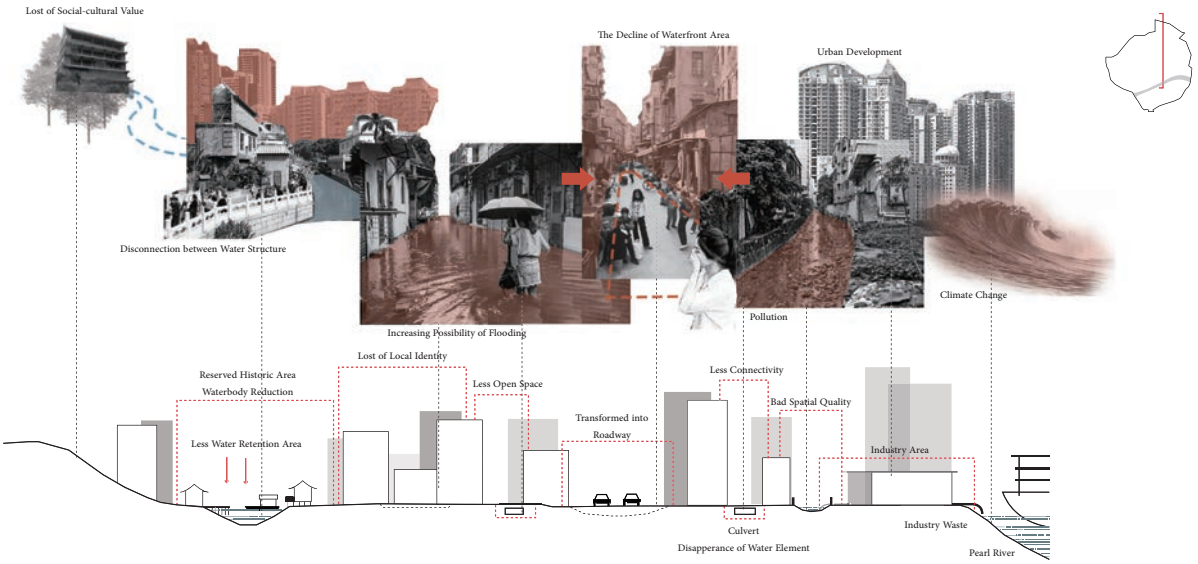


FIG. 1.13 Challenges of Historic Canal System and Canal Area in Guangzhou

The water issues of the historic canals have greatly affected the spatial quality of its surrounding area, they are losing their local identity as the historical waterfront area, and have gradually been separated from the water. For the future development of Guangzhou, how could people live with water, and what role water could play in people's daily lives?

Therefore, there are two parts of the design assignment in this project. To restore a systematic canal structure and create a vibrant public space connect to it.

Principles

To answer the research questions, understanding the nature of the historic canal system is very important. In history, people worked well with the water. The canal system in Guangzhou was not only an important water infrastructure but also the center of urban life.

As an old saying goes in Chinese, history could be a mirror to today's question. Looking back into history does not mean to just copy-paste what was looked like in history, it means to understand the nature of problems by comparison, it means to learn the design principles in history,

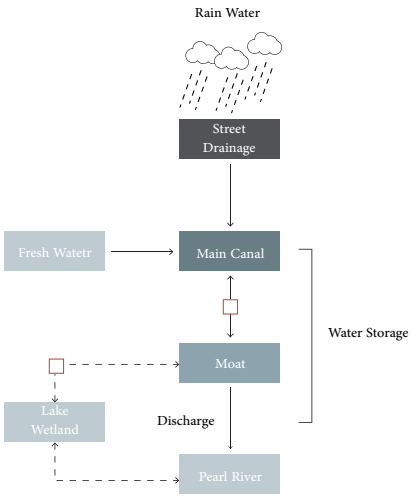


FIG. 1.14 The canal system with different hierarchies

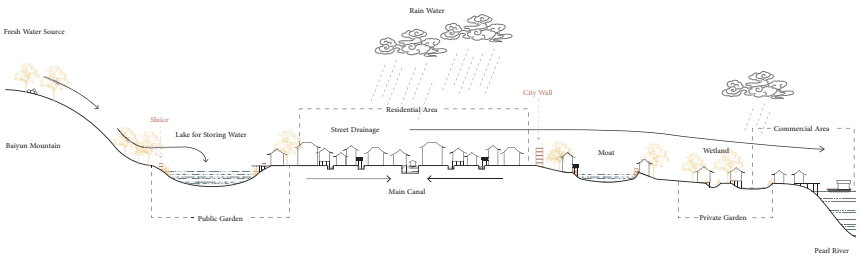


FIG. 1.15 The canals shaped the built environment and facilitated different social and ecological interactions, for instance, the freshwater lake could be the public garden in the whole city, and also there was a royal garden that greatly combined with the water purification system.

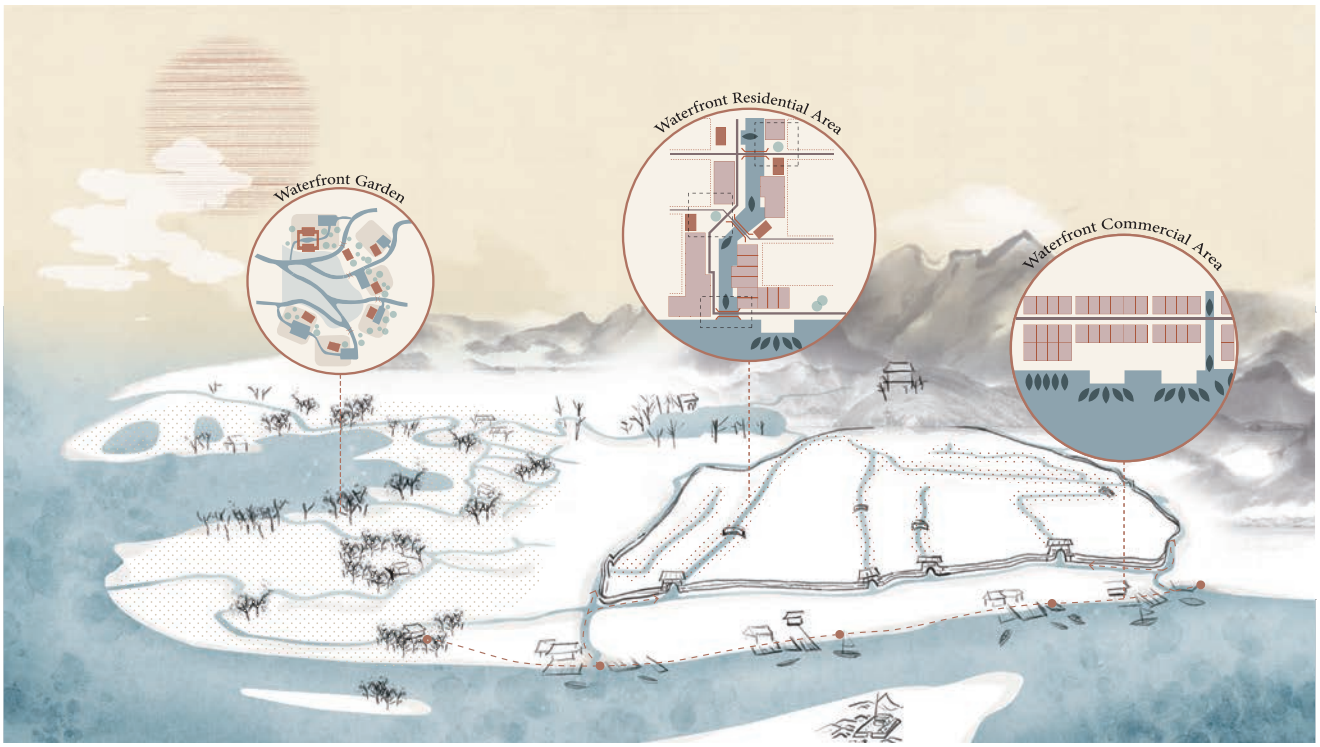


FIG. 1.16 zoom into the local scale to see how the canals interacted with people and the surrounding area. In this analysis, the canal system and the city are divided into three landscape types.

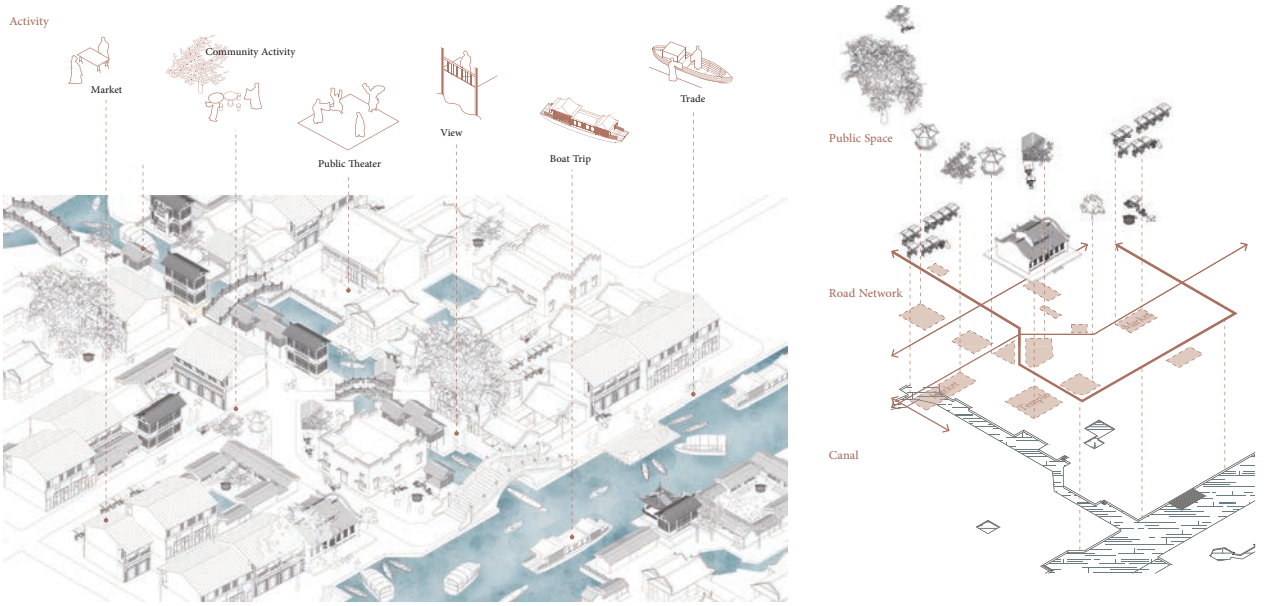


FIG. 1.17 Analysis of Waterfront Residential Area

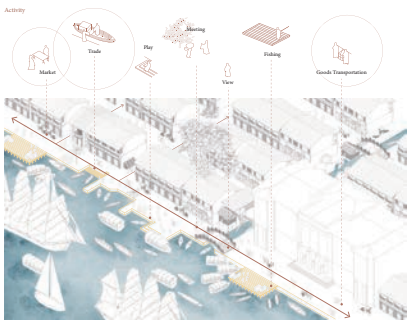


FIG. 1.18 Analysis of Waterfront Commercial Area

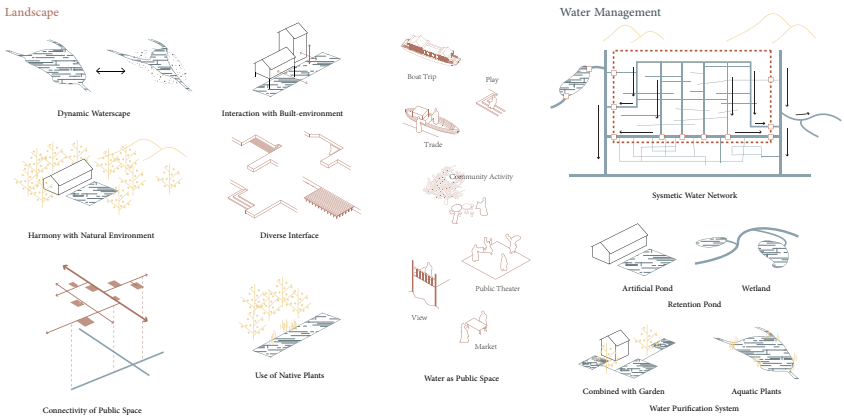


FIG. 1.19 Design Principles in History

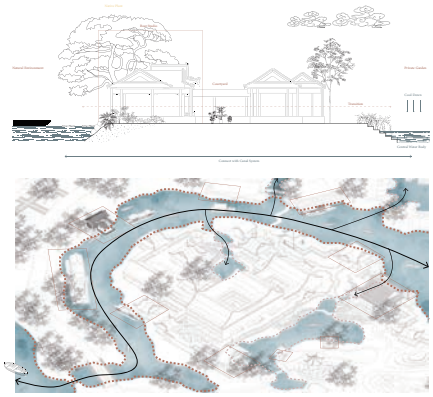


FIG. 1.20 Analysis of Waterfront Garden and Its Interface

In different landscape types, the surrounding urban tissue is built around the canal, and the canal is also the core of various activities. The canal system shaped the built environment and urban form in each area based on their different characteristics.

To conclude the design principles learn from history. they are divided into two aspects according to the design assignment, the landscape aspect. In the landscape aspect, the design principles include the connectivity of public space and the water as an important part of it. As for water management, the systematic water network in history is the core of the design principle.

By these design principles, the canals worked well in water management, and also have a good spatial quality, and played an important role in people's daily lives.

Results

How to apply the design principles?

The process of design exploration has three steps. First, select the suitable design principles in history, and adapt them in the sections and specific sites, to explore the possibilities of the sites and also the possibilities of the design principles in different situations. This is a back and forward process, then it comes to the final design.

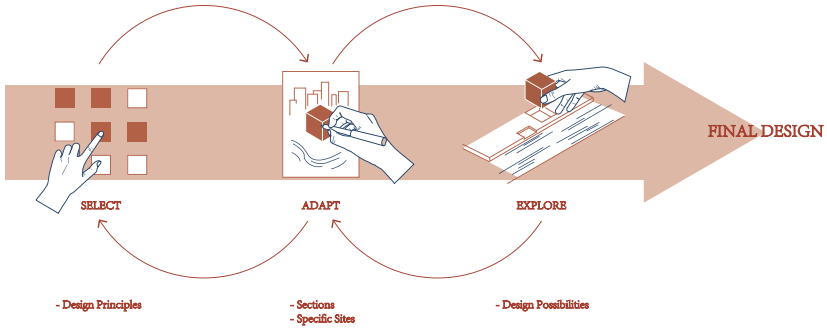


FIG. 1.21 Process of Design Exploration

Identify the problematic areas

East Moat, one of the typical examples of the historic canals in Guangzhou, is isolated in this neighborhood, because of the hard interface between them. The canal is located at the backside of the neighborhood. Because the interface condition is different according to these surrounding elements, so I have made these sections to analyze different types of interface.

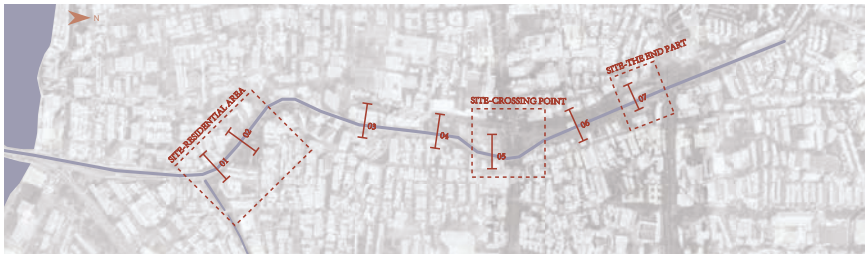


FIG. 1.22 Specific Sites and Sections along the Canal

Read the Interfaces

There are seven types of interfaces, including the apartment complex, community park, office building, and open square. Different elements like the parking lot, temporary housing in bad condition, and the car road create the hard boundary between them and the water.

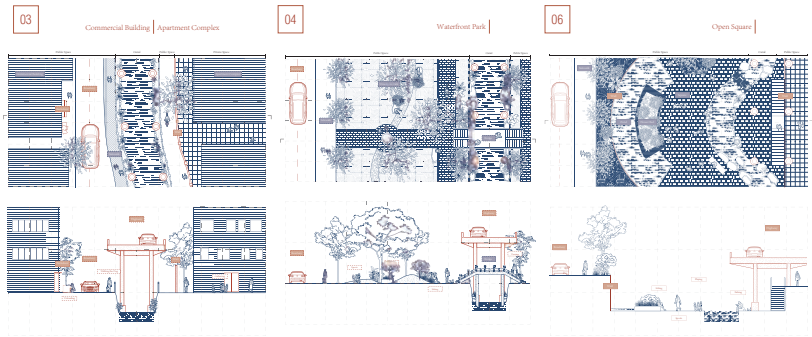


FIG. 1.23 Exemplary Sections of Current Situation

Design Exploration

For different conditions of the interface, different design principles learned from history are tested in the design models, to visualize the possibilities of sites and design principles. The design models include the wetland park, water-adapted neighborhood, and traditional water town. It is also an important step to transform the design principles from history and adapt them into the current situation.

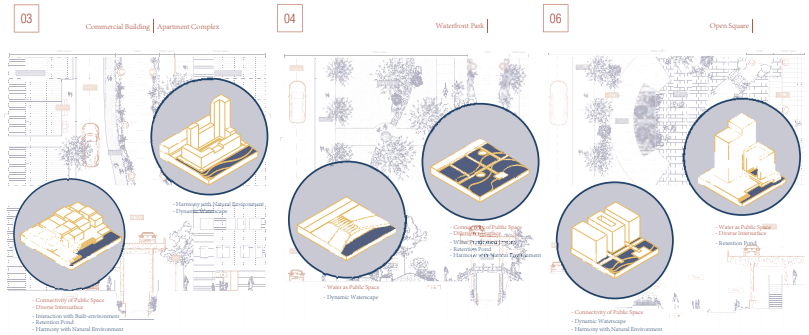


FIG. 1.24 Exemplary Design Models

Example: Site-residential area

After the exploration for multiple possibilities for the sites and design principles, the connection and interaction between sections and the surrounding area need to be considered, and it is also the important step of choosing the suitable design from the explorations. The site-residential area is one of the typical examples. It has the characteristics of the main canal part, the design here could also be applied in other residential areas along the canal.

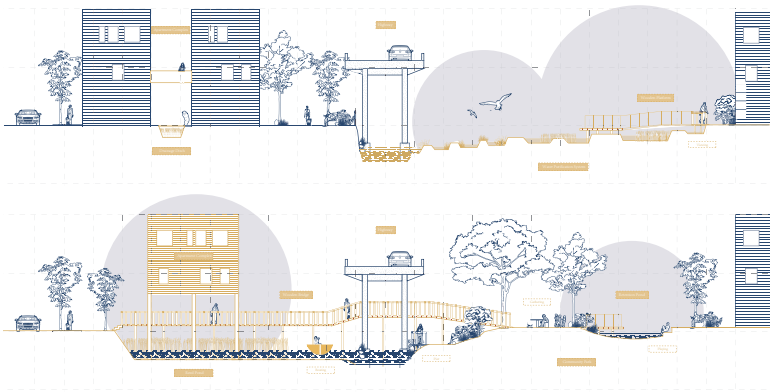


FIG. 1.25 Exemplary Sections of Design Exploration in Site-residential area

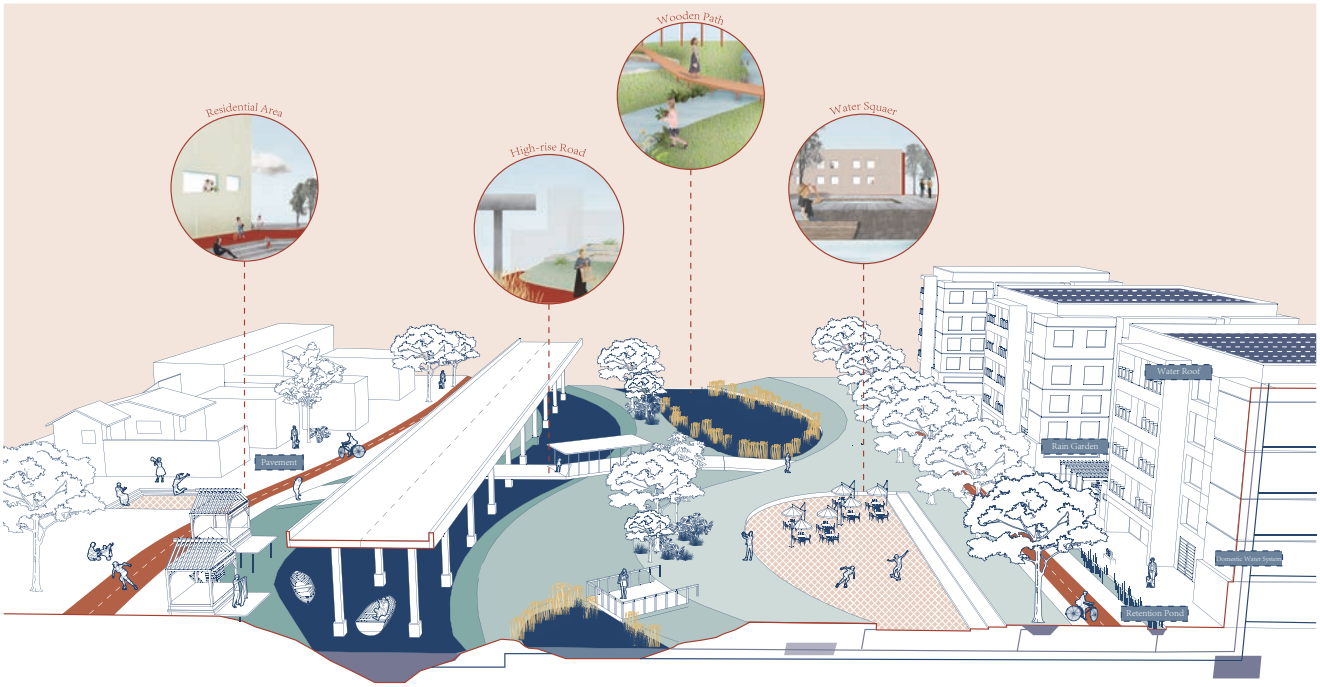


FIG. 1.26 The new neighborhood is connected with the canal in green structure, the public space, and also the water system. The retention pond with reeds can purify the water from the families, On the social aspect, the new water system also creates a different lively scene. In this new urban system, new social and ecological interactions would be facilitated, and the new process could shape the built environment into a better place.

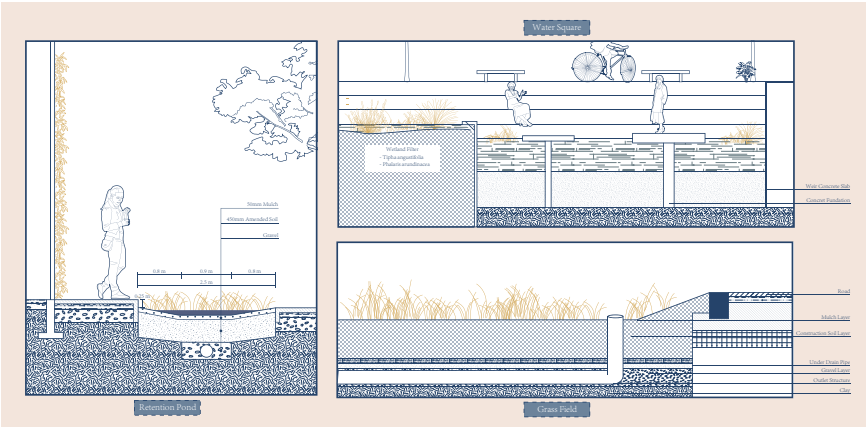


FIG. 1.27 technical details in it that are hidden underground with water storage or drainage capacity. Showing the design is trying to design the urban landscape infrastructure, trying to combine the ability of water treatment and improving the spatial quality.

Other Possibilities

FIG. 1.28 Wetland Park in Rainy Seasons

In the site-residential area, the wetland park provides the possibilities of diver waterscape and water activities on one hand and purifies and stores the water on the other hand.

In the site-crossing point, there are layers for different transportation and activities, to create a complete and continuous experience for the pedestrians, cyclists, and people on boats.

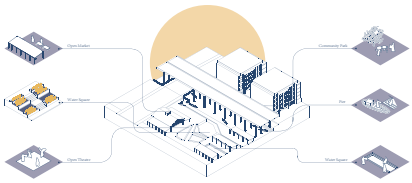


FIG. 1.32 There are water features, such as the platforms that offer an opportunity for children and families to engage with water at the canal's edge.

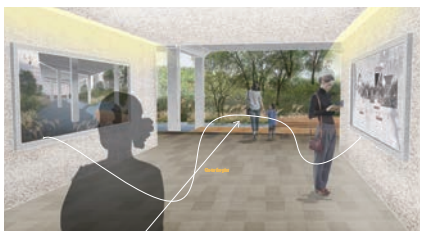


FIG. 1.33 Underground Walkway towards the Canal

The disfunction public space in the site-ending point could be replaced by the natural area, in harmony with nature, giving more space for water, and it can also be connected with the surrounding area with an underground walkway, offering space for an exhibition of the story of East Moat.

FIG. 1.29 Wetland Park in Dry Seasons

FIG. 1.30 Water Square

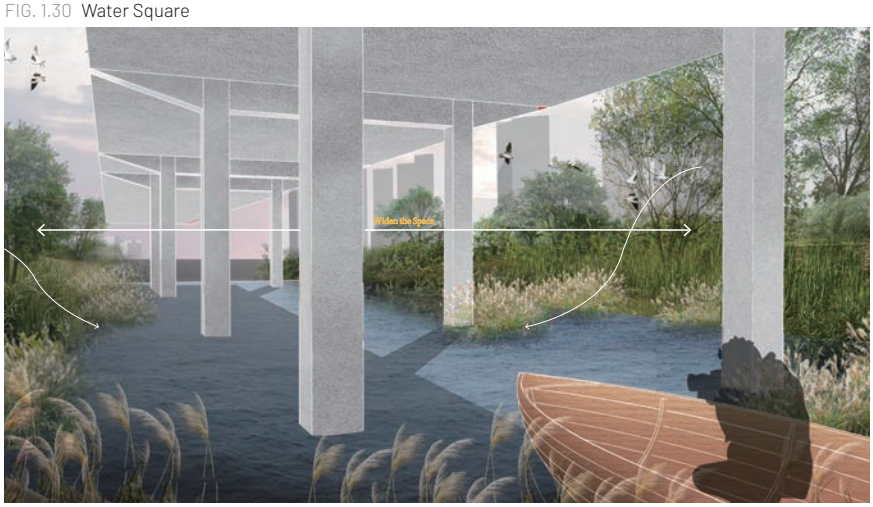


FIG. 1.31 Natural Ending of the Canal

Conclusion

To redefine the role of the historic canal system in Guangzhou as water landscape infrastructure adapting to future urban development, first of all, the historic canal and its surrounding area need to be understood as a whole system. Since the canals have a long history and have a deep relationship with the city, to understand the system, looking back to the history is necessary for this project. By comparing the condition between history and the current situation, the nature of the challenges they faced now could easily understand. Also, looking back to history does not mean to recreate the scenes from history, it means to learn the design principles from it, and apply them to the current situation. These days, people always seek the solution from modern technic. However, the nature of the problem could be very similar to a historic situation in many cases, and the answers to the questions are already in history.

To understand the challenges Guangzhou is faced with, layer analysis has been done in this project. The urban landscape is a complex system, consisting of the natural layer and urban layer, and they affect each other. To look into the challenges of the urban area, the basic nature condition is the essential element to be taken into account because it is the base of the city development. The question is answered by the mapping layers in the diagnosis part of this project. The analysis begins with the natural base, then into the city development and condition of public space.

Lastly, how could the reborn historic canal system work as a new urban landscape infrastructure? Landscape infrastructure is an important driving force for the process of shaping the built environment and contemporary space. The reborn historic canal system could be the driving force for the development of the surrounding area. It creates a new green-blue structure and reorients the city back towards the canal. A new active waterfront area is created along with the canal.

Guangzhou is not the only city with abundant canals and close cooperation with water. In the process of modern urban development, the canals suffered from flooding and other water source problems due to their geographical conditions and urban development and gradually disappeared in local life. A new perspective has been raised in this project for solving this problem by reviewing the history and exploring the potential of the city's long-standing waterways in terms of cultural and social value and spatial quality. The design has provided the possibility for the development of adaptable coastal cities and guide other similar projects.

FIG. 1.34 Vision for East Moat Canal

FIG. 1.35 Vision for East Moat Canal

Restoration and Revival of Tonghua Area

A resilient landscape framework that provides conditions for urban transformation and ecological restoration

Yun Sun

Surpervisors
Steffen Nijhuis, Landscape architecture
Lei Qu, Spatial strategy & planning

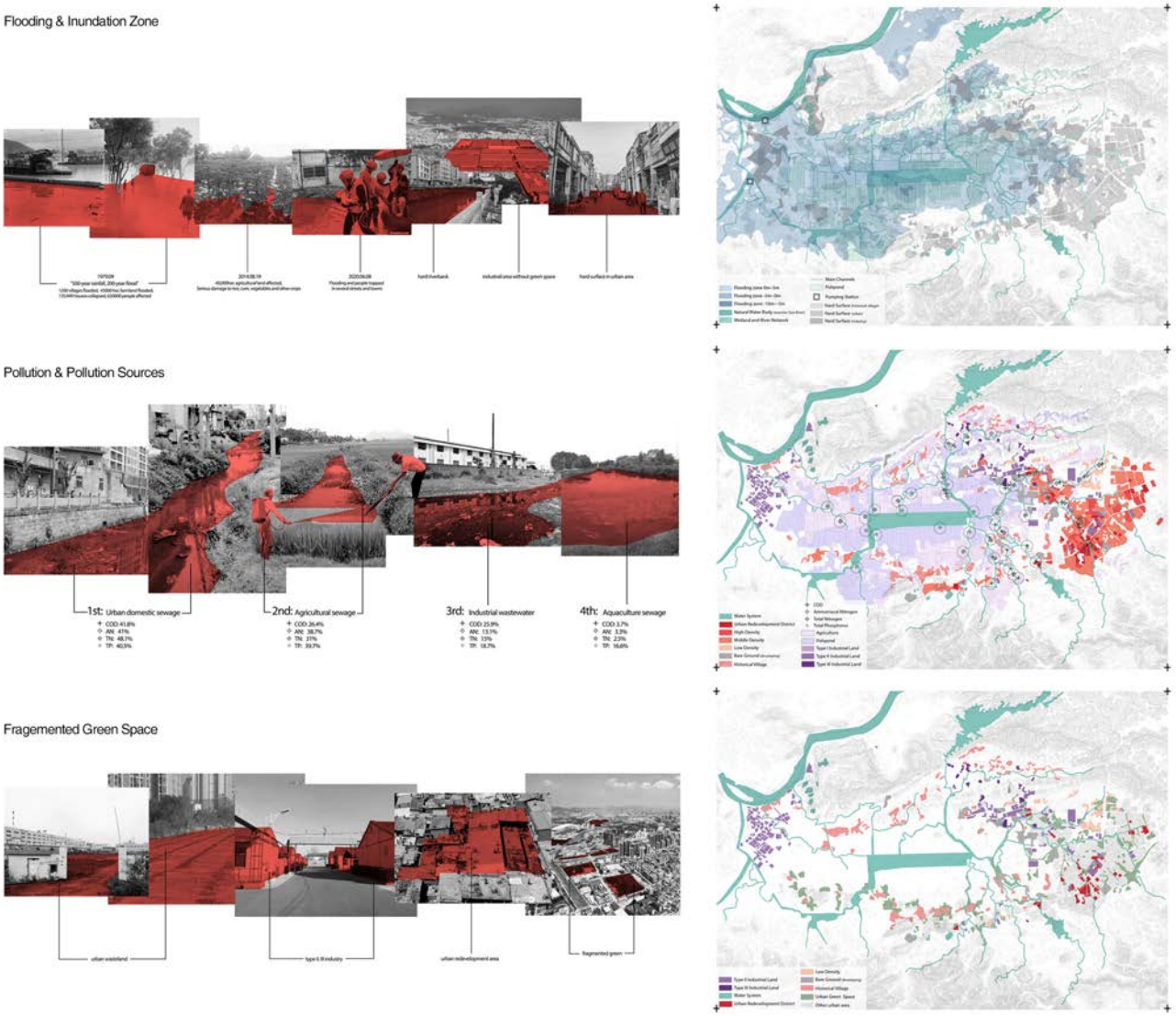
Introduction

Tonghu was historically a flood plain in the middle and lower reaches of the East River. A mountain range stretches across the edge of Tonghu. In summer, rainwater flows down these ravines to Tonghu, turning the floodplain into a lake overnight. Many migratory birds and rare animals

Nevertheless, this incredible picture disappeared after urbanization and industrialization. The reclamation reduced the flood control capacity of Tonghu, brought severe pollution to the water and the soil, and destroyed the local biodiversity. Besides, the development fragmented the green and blue spaces and greatly reduced the ecological

This project aims to create a resilient landscape framework that can balance natural restoration and urban development.

It starts from studying the landscape structure to understand the evolutionary history of natural and urban landscapes and their interactions. Based on this, a resilient landscape framework is proposed adaptive to the site addressing the problem of flooding, pollution, fragmented green spaces, and losing biodiversity. Then four typical sites are selected for design exploration in the middle scale, combined with small-scale exploration on how to perpetuate the blue-green spaces by reconstructing the landscape interfaces.



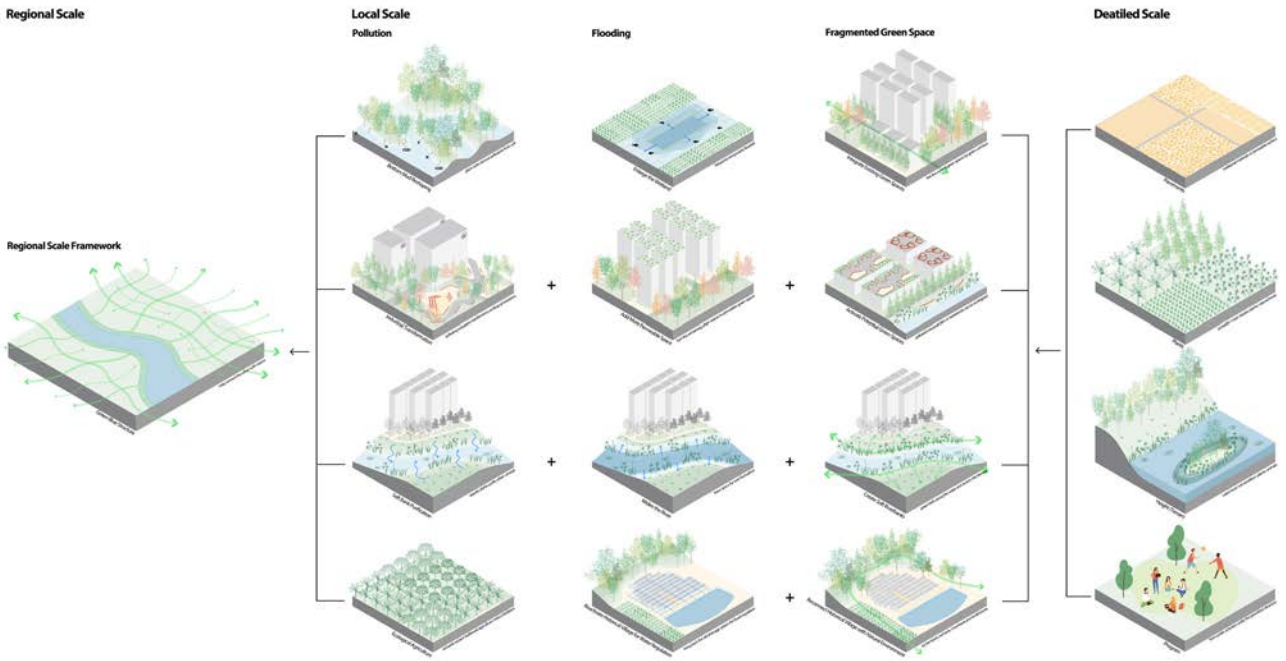
1.1

FIG. 1.36 Flooding, Pollution (soil and water) and Fragmented Green Spaces are three main problems of the Tonghua Area.

1. Flooding problem. The reclamation of wetlands and the channelization of rivers have caused the shrinking of open water surface and the hardening of river banks, thus reducing the ability to buffer and absorb rainfall and floods.

2. Pollution problems. The main manifestations are water pollution and soil pollution. Besides polluting the river, these pollutions also follow the river into the central wetland, polluting the natural habitat of the wetland and posing a severe threat to biodiversity.

3. The problem of discontinuous green spaces. Broken green areas are scattered between mountains and valleys. The amount of green space within the city is small and scattered and lacks integrated regional planning. As a result, the ecological benefits from surrounding green and blue patches (such as forests and wetlands) are hard to penetrate the city.



1.2

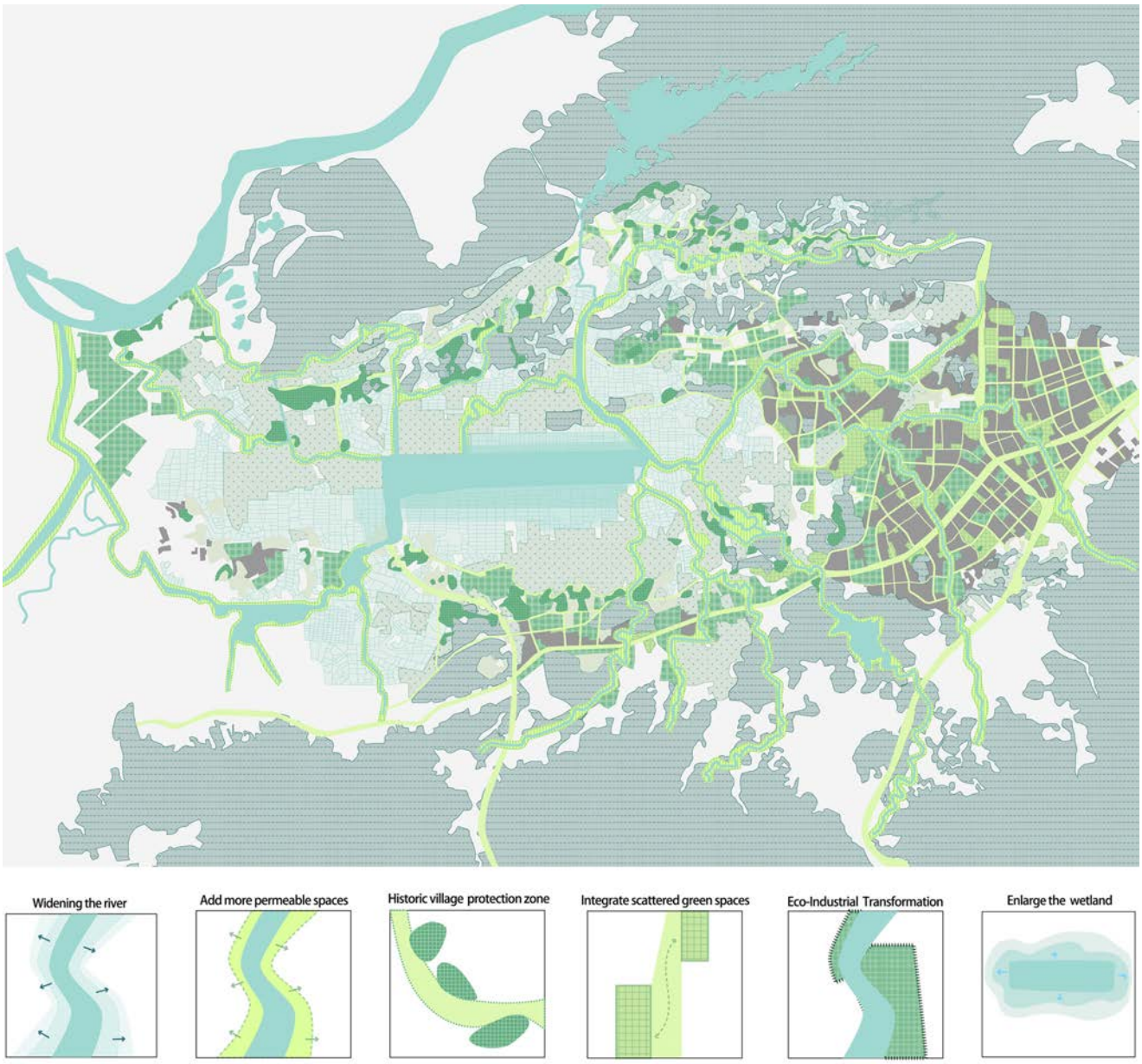
FIG. 1.37 Principles at different scales targeted on different problems

Principles

Plan documents analysis, literature survey, and case studies can help extract some design principles. They are categorized in three different scales: regional scale, local scale, and detail scale. We can directly apply some of these principles to the site, such as adding more permeable space in the city—some need to be adapted according to specific site conditions. For example, we learn from many wetland restoration projects that we can improve flooding control capacity by enlarging the wetland. In the case of the Tonghu wetland, we can refer back to its historical water catchment area as the floodplain for the East River.

Moreover, each scale has different focuses. The regional scale aims to build a landscape framework to connect and activate the potential blue-green spaces. At the local scale, the focus is on addressing problems on each site. Based on interpreting the site's current state, the design explores how this landscape framework can adapt to the site conditions. At the detailed scale, attention is paid to plants, pavements, height differences, programs, which emphasize the preception and engagement of people and animals.

Furthermore, these design principles are not separated at different scales or across scales but complement each other and work together. For example, by widening the river and creating soft riverbanks, we can, on the one hand, improve the flooding capacity of the river and solve the problem of urban logging. On the other hand, the soft river banks with aquatic plants can help purify the sewage from the city and create small habitats for aquatic animals and birds. And part of the waterfront can also be integrated with public activities, creating new urban open spaces.



1.3

FIG. 1.38 Regional scale landscape framework proposal & strategies

In this blue-green structure, the man-made environment and natural resources are interconnected through ecological corridors, greenways, forests, farmlands, rivers, lakes, wetlands, and other bluegreen spaces, forming a resilient landscape structure. This framework can help Tonghu area resist external disturbances while also creating a guiding framework for the future sustainable development.

The green strategies aim to connect existing green spaces and activate potential green spaces to form a composite 'matrix-patch-corridor' structure to penetrate green ecological benefits.The water strategies aim to improve the flooding control capacity by giving space back to water and adding more permeable space. In addition, this framework also helps create habitats for plants and animals while purifying the water.

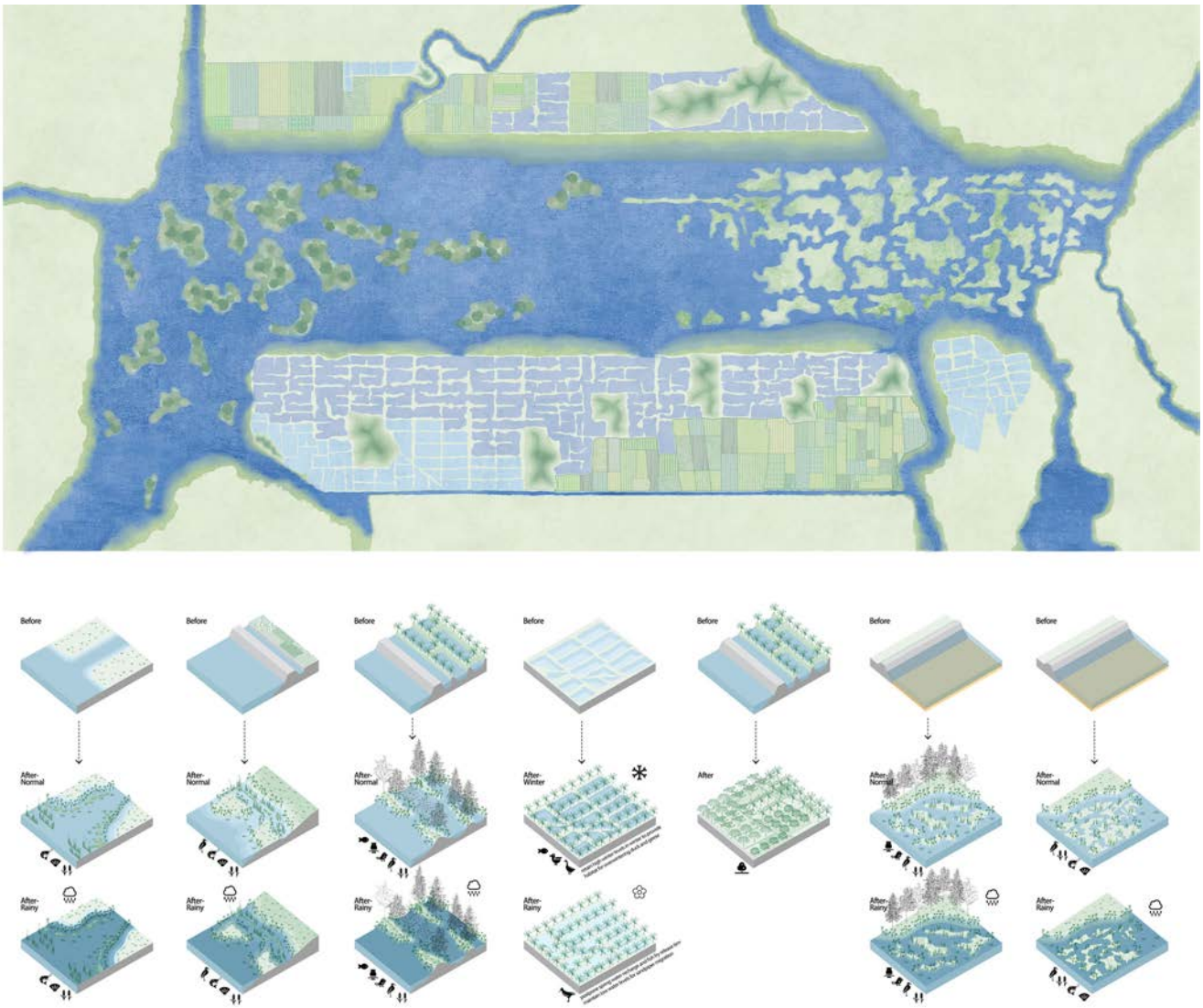


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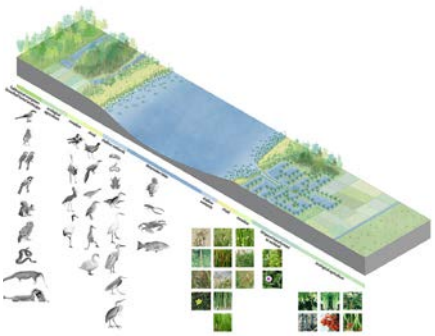
FIG. 1.39 Tonghu wetland plan & strategies



1.5
FIG. 1.40 Landscape typology with biodiversity from land to water

The deisgn aims to develop an ecological containment area by restoring the wetland and replacing the traditional production with ecological production methods. Meanwhile, improve flooding control capacity, purify water and soil, and bring back biodiversity.

By referring to Huizhou's guidelines for restoring and protecting Tonghhuhu wetlands and other wetland restoration cases, some strategies applicable to Tonghu wetland are summarized. In one sentence, the design idea is to make it natural, make it a whole, by creating diverse ecological interfaces.

Different landscape typologies are created through the design. For example, broadleaf forest, ecological agriculture, meadow, shoals, shallow wetland and deep wetland. Different vegetation communities match the changing water level and terrains, which helps create diversified animal habitats.

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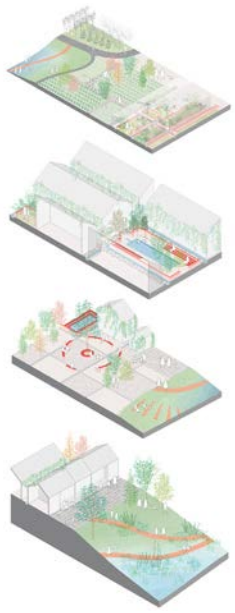

1.9

FIG. 1.41 Historical blue-green structure, with drainage ditches-wells-Fengshui ponds system for flood regulation, and orchards with farmlands linking the village with the surrounding natural environment.

FIG. 1.42 Existing blue-green structure, in which the connections between village and nature are broken by urban construction. Inside the village, the interfaces are also fragmented.

FIG. 1.43 Plan for a new green-blue structure that learns from the historical pattern meanwhile integrate new functions inside.

FIG. 1.44 New interfaces merge the gaps between different landscape elements inside the village.

FIG. 1.45 Sections in history and after design.

Chigang Village shows an ancient way of living with nature. This nature-adaptive pattern was disrupted by urbanization. However, the symbiosis between the village and nature still has a high value in resilient development. So by learning from the old way of organizing the blue-green spaces, we can achieve the restoration of its natural-cultural landscape, meanwhile, activate its ecological value in the regional resilient landscape framework.

Two strategies are applied to reconstruct the landscape structure: first, reconfiguring the blue-green network to connect the village with its surrounding natural environment. Second, re-creating the interfaces to restore the relationships between different landscape elements while creating spaces with new functions.

For example, the farmland connects the back of the village with the pond. The relics are preserved as relic landscapes. Between the houses, the relics can help link the drainage ditches and create a small water landscape. The old tree at the village entrance, with the old paving, form a new public space for people. A soft transition from ancestral square into the water is also created.

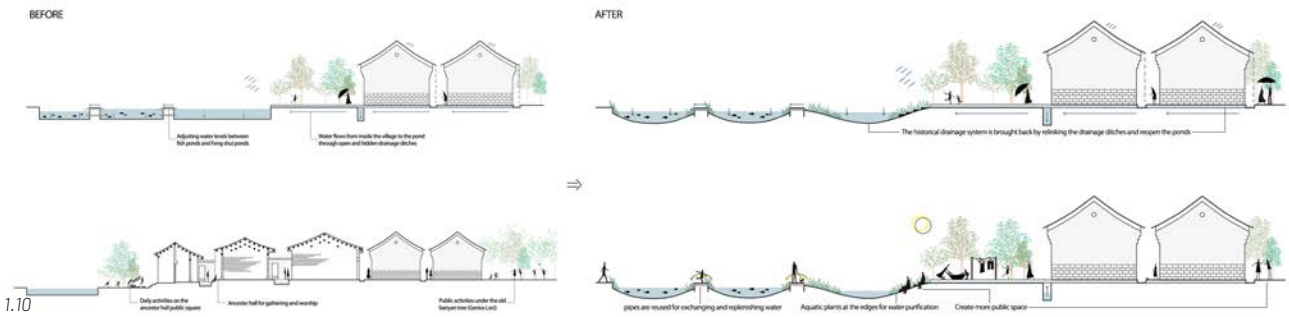

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FIG. 1.46 Chigang Historical Village - the open interface from village to water.

FIG. 1.47 TongqiaoTown - public waterfront with new urban life.

FIG. 1.48 Tonghu wetland - ecological containment zone for flora and fauna.

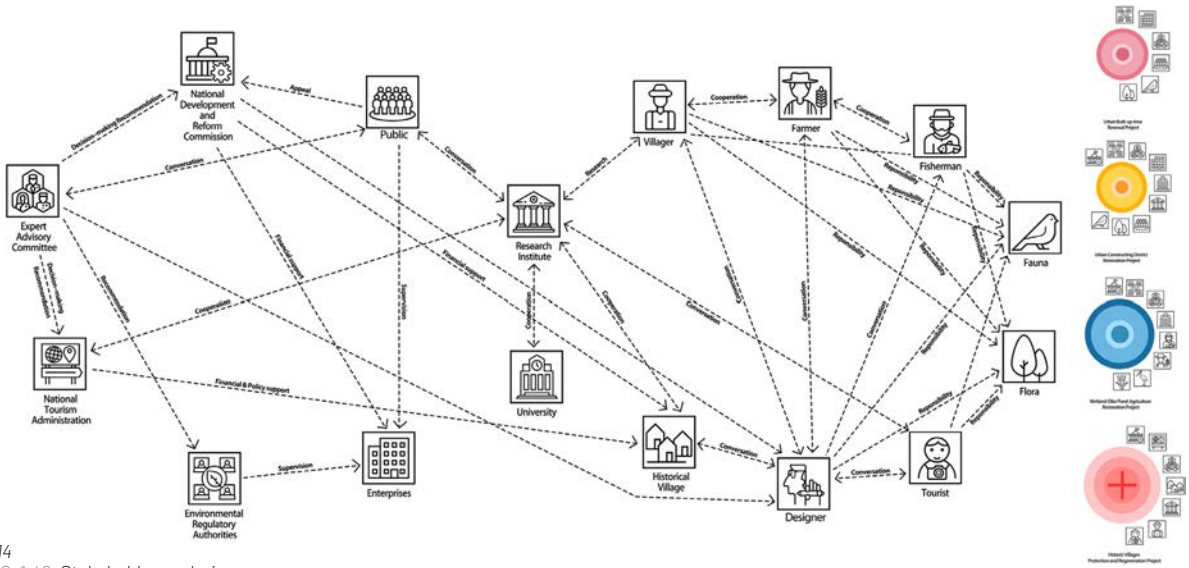

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FIG. 1.49 Stakeholder analysis

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FIG. 1.50 Strategic planning

Conclusion

The construction of the landscape framework needs to base on the current state of the site. Rather than prescribing a fixed red line, this framework can create an opportunity for the city and nature to interpenetrate. By connecting and activating blue-green spaces, the idea is to improve urban and natural resilience to stormwater, purify pollutions, restore biodiversity, improve habitat quality and create a buffer between nature and the city.

The realization of this framework can be achieved through multi-scale design. A resilient blue-green network is constructed at the regional scale to connect and stimulate existing and potential blue-green spaces. At the local scale, four typical design sites are selected: historic villages(urban in nature), wetlands(artificial nature), urban areas under construction(nature in urban), and urban built-up areas(nature in urban). The study delves into how water, green spaces, cities, and activities are connected at a detailed scale. Typical design principles and strategies are then extracted from these four samples so that they can be applied further to other areas.

Although the Pearl River Delta has a high urbanization rate, there are still many natural treasures of ecological value, such as Tonghu. These places currently have a low level of human interference, which means that there is a great potential for the intervention of resilient landscapes to achieve sustainable development of cities while preserving the existing ecological values. The design principles and strategies can be extracted and then applied to many other areas of the Pearl River Delta. At the same time, site types not covered in the project can also find appropriate solutions with the principles of resilient landscapes

Developing a Resilient XiChong

A resilient landscape framework that facilitates Hakka culture, coastal safety and tourism development in Shenzhen

Kailun Qi

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Diego Andres Sepulveda Carmona, Spatial strategy & planning

Introduction

Xichong is located in the southeast of Shenzhen on the Dapeng Peninsula. Xichong Beach is the longest and most popular beach in Shenzhen. The landscape structure of Xichong shows a gradation from the sea to the mountains. The beach is located on the sea, followed by dunes. Windbreaks stand on the dunes to resist high winds. Further in is the agricultural landscape, including fish ponds and cultivated land. Then comes the historical Hakka villages nestled at the foot of the mountain, and finally the forest on the mountains.

The two external pressures are being posed on xichong. One is rapid and uncontrolled expansion of tourism; the other is climate change such as hurricanes, storms, and sea-level rise. Overall, Xichong is in a phase of rapid territory transformation. The disorderly expansion of tourism, urbanization, and rigorous coastal climate change leads to inadequacy of traditional culture, water sensitivity absence, and ecology decline, gradually showing an unsustainable development trend.

Three landscape typologies are divided to understand the landscape: village landscape, agri-aquaculture landscape, and seafront landscape. Seafront landscape includes nearshore, beach, dune, and windbreak forest; agri-aquaculture landscape includes farmland and fish pond. Village landscape is mainly about Hakka villages. Each of them has its characteristics and problems.

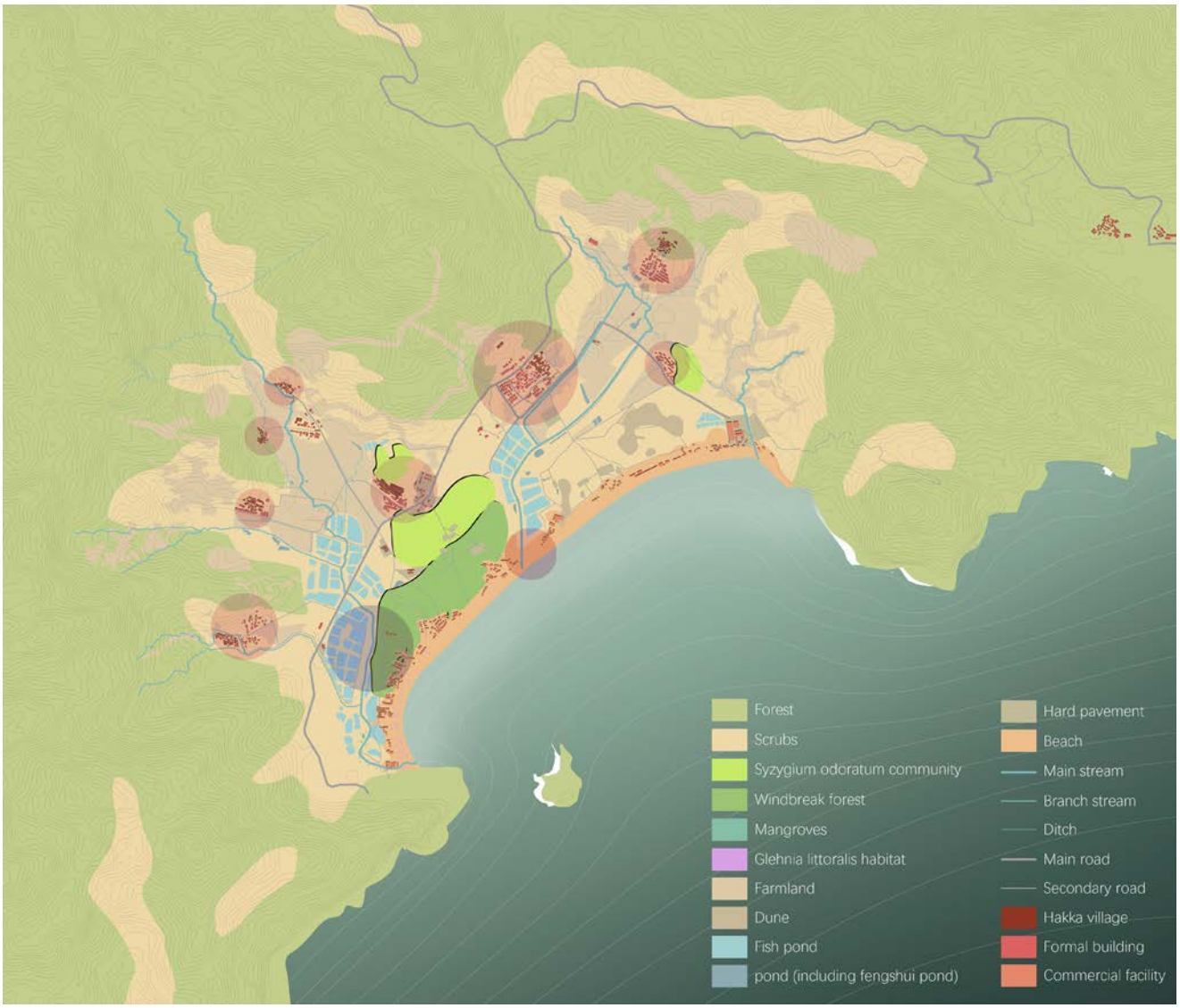

FIG. 1.51 Landscape structure and its problems

After many case studies and literature reviews, several design principles have been summarized in addition to those that are more widely applicable. Related design principles are like a toolbox that can be used as a manual for subsequent design exploration. In the following design, it is essential to appropriately adjust these design principles to make them more suitable for the site and solve Xichong's problems.

Corresponding to three landscape typologies, design principles also follw this classification, focusing on encounter with the non-adaptibility in village landscape, agri-aquaculture and seafront landscape.

Principles

After many case studies and literature reviews, several design principles have been summarized in addition to those that are more widely applicable. Related design principles are like a toolbox that can be used as a manual for subsequent design exploration. In the following design, it is essential to appropriately adjust these design principles to make them more suitable for the site and solve Xichong's problems.

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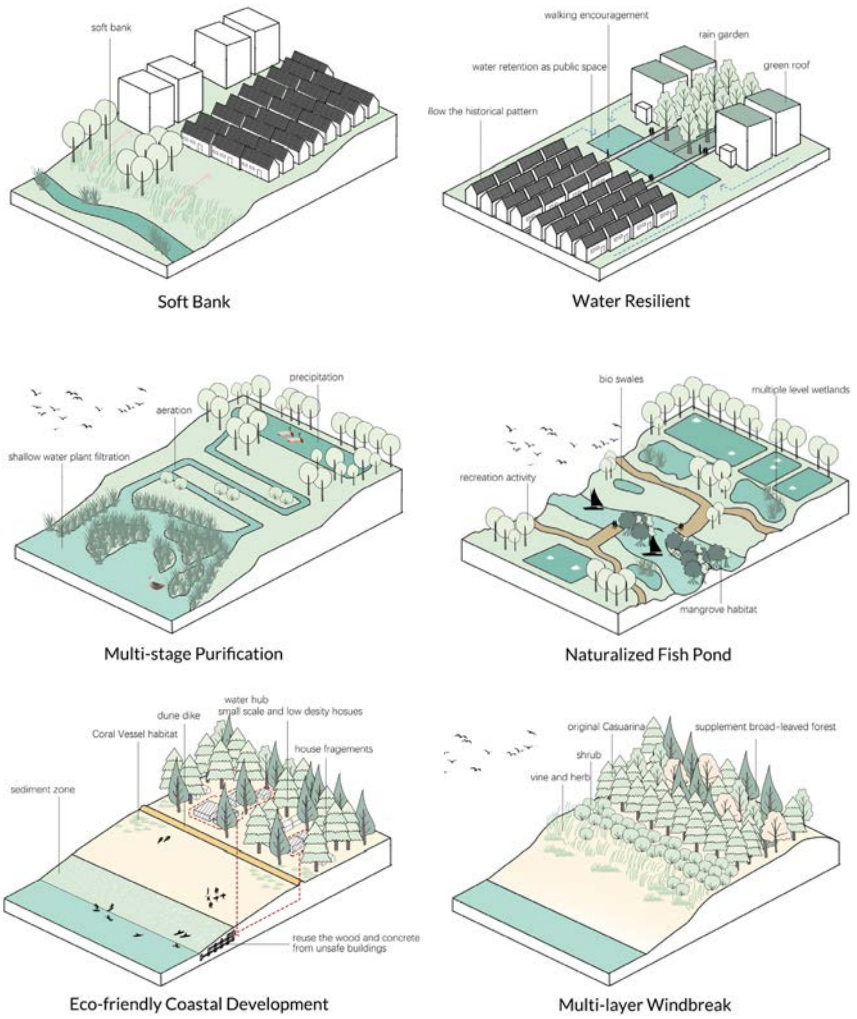

FIG. 1.52 Design principles corresponding to village landscape, agri-aquaculture landscsape and seafront landscape

Results

The **first** design exploration happens in the windbreak forest. To guide current single species community to a mixed forest, approaches such as let it grow can be combined with sow, with let it grow as the main method. Refer to the process of forest succession, pioneer trees can be planted to activate the transformation.

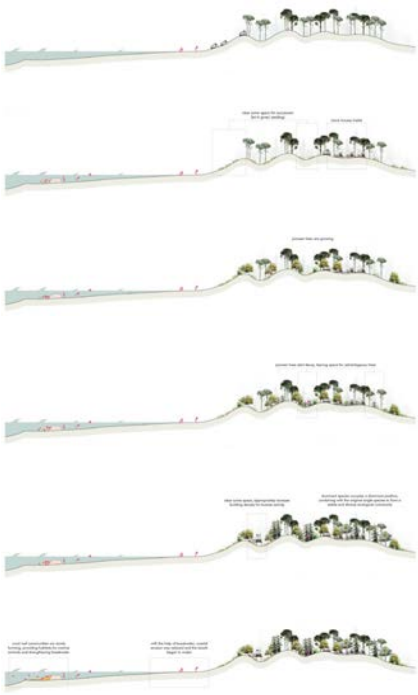

FIG. 1.53 Development process of the windbreak forest and housing layout

It takes time to achieve the proposed ecological sound atmosphere. First, the houses have to be moved inside, and some old trees can be cleared to provide space for pioneer trees to grow. It takes 15 to 20 years for the pioneer trees to grow up. Then, Pioneer species have provided an excellent growing environment for various dominant species. Pioneer species are beginning to decline, and diverse dominant species are starting to grow up. About 50 years later, multiple dominant species will mature and form an ecological sound ecosystem with the original single species. This shift is complete.

Besides, to ensure the continuity of the landscape, the breakwater was chosen to be constructed underwater. The material selected for the breakwater is a combination of pebbles of different sizes and artificial stones. Such a structure can provide a living environment for a wide variety of marine life and also helps the establishment of coral reefs. In addition, the breakwater can weaken the impact of waves, reduce coastal erosion, and help the expansion and reconstruction of the beach. Moreover, the current activity inside the breakwater is weak, providing a comfortable recreational environment for visitors.

The **second** design exploration happens in the fish ponds. To make a biodiverse fish farming, combined with water management, something has to be done with current interfaces. Adjusting the fish pond earthworks, widening and irregularities for the river section, moving the excess earthworks to the sides to create a more smooth transition from low to high.

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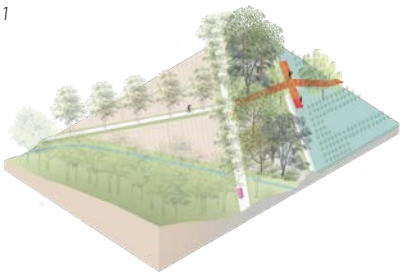

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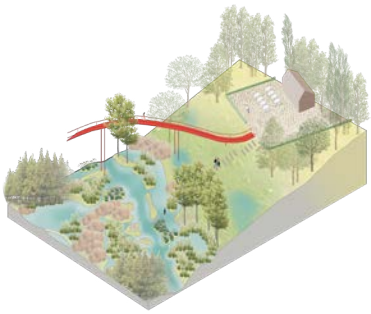

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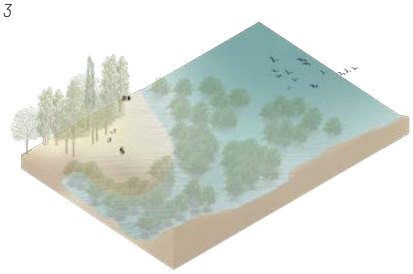

The water flow strategy includes adjusting the earthwork to create a smooth gradient, transform and integrate some fish ponds into wetlands. In this way, the wastewater from fish farming can be purified by small wetlands and be collected in the extensive marsh on the bottom, which provides clean, fresh water for mangrove development. Meanwhile, a connection should be established to ensure the landscape connectivity from village landscape to seafront landscape.

1. The first interface focus on attract people go from hinterland to beach. On the platform, they can have a panorama of the whole landscape

2.Second interface shows a gradient from wet to dry, from paddy soil to sand., from low to high. The small ponds on it can detain and purified water. Besides, a service center is placed there as a transportation node. Also, due to the diverse topography and moisture conditions of this kind of interface, it can provide multiple habitats for various vegetations and animals.

3. As the water becomes saltier, different species emerge. The reestablished mangroves can work with windbreaks together to protect against high winds and storm surges, and also, it can promote sediment and reduce coastal erosion

FIG. 1.54 Important interfaces to show biodiversity, eco- tourism, water management and mangrove habitat restoration.

The **third** design exploration happens in the fish ponds. TIn history, Hakka people in this village follow the elevation, discharge, and collect rainwater in the Fengshui pond. The village also has a close connection to farmland. But now, things have changed. The Fengshui pond is gone, and roads cut their connection to farmland.

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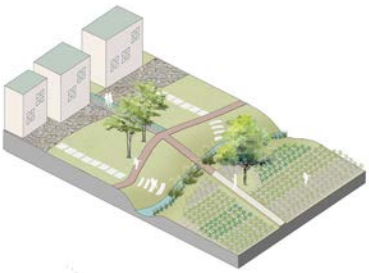

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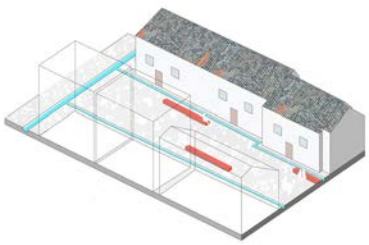

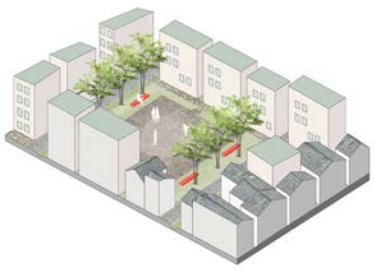

To improve this situation, a water strategy is proposed. Like the Hakka people did before, a new water system can be built by bringing the Fengshui pond back, transforming the roads inside into a walking path with bioswale on one side. Some water can be collected in the restored pond; others will flow into the creek and arrive at the fish pond. It is also necessary to remove some roads to reconnect the village with the whole landscape. Meanwhile, the creek's hard bank should be turned into soft banks to make a smooth interface.

1. The first two are on the edge of this village. Some water can be transported by the bioswale into the creek, then into the fish pond, and finally, arrive at the wetland. Some can be collected in the new Fengshui pond. In the second interface, an attractive entrance space is created to improve living and commercial quality and to attract people to go inside.

2.The next two are inside the village. In the developing area, hard pavement is replaced by permeable pavement. Roads are also turning into the walking path with bioswale. In the original village, the water system is restored to collect water from the sloping roof. In addition, both interfaces provide space for communication and taking a seat.

FIG. 1.55 Important interfaces to show biodiversity, socio-culture and water management.

Conclusion

Although the landscape system of Xichong is very complex and involves a wide range of aspects, three landscape types have been uncovered after intensive research and classification. Each landscape type exhibits its unique characteristics. On a large scale, the three are closely linked in terms of economy, water management, and socio-cultural aspects. And their problems and challenges are well illustrated.

For each of the three landscape types, each system faces a different focus of problems. On this basis, the design principles for each landscape type are customized privately. The sponge city theory and low impact development related to water, let it grow related to forest succession, and the transformation of buildings or public spaces related to village conservation are all categorized and integrated into a specific design principle.

The design principles are suitably adapted to fit the local character—for example, the construction of water purification systems for agri-aquacultural landscapes. And, the application of such design principles is also realized at different scales. For example, the design of public space, streets, and squares is attempted at villages' scale.

After this project, these lessons are learned:

1. Design through time. In this project, design through time focuses on two aspects, namely the development process of the landscape and the construction process of human participation. It helps me understand that constructing a healthy and perfect landscape system cannot be done overnight but should be given time to let the natural flow do its work and slowly take shape.

2.The relation between design and research. These two approaches are like brothers, complementing each other almost throughout the whole project.

3.Design through multiple scales. This approach is essential for large-scale landscape design. It provides a systematic perspective to see and interpret the landscape. Each system may operate across scales and be closely linked to each other. It helps to facilitate a comprehensive understanding of the landscape and to provide appropriate feedback.

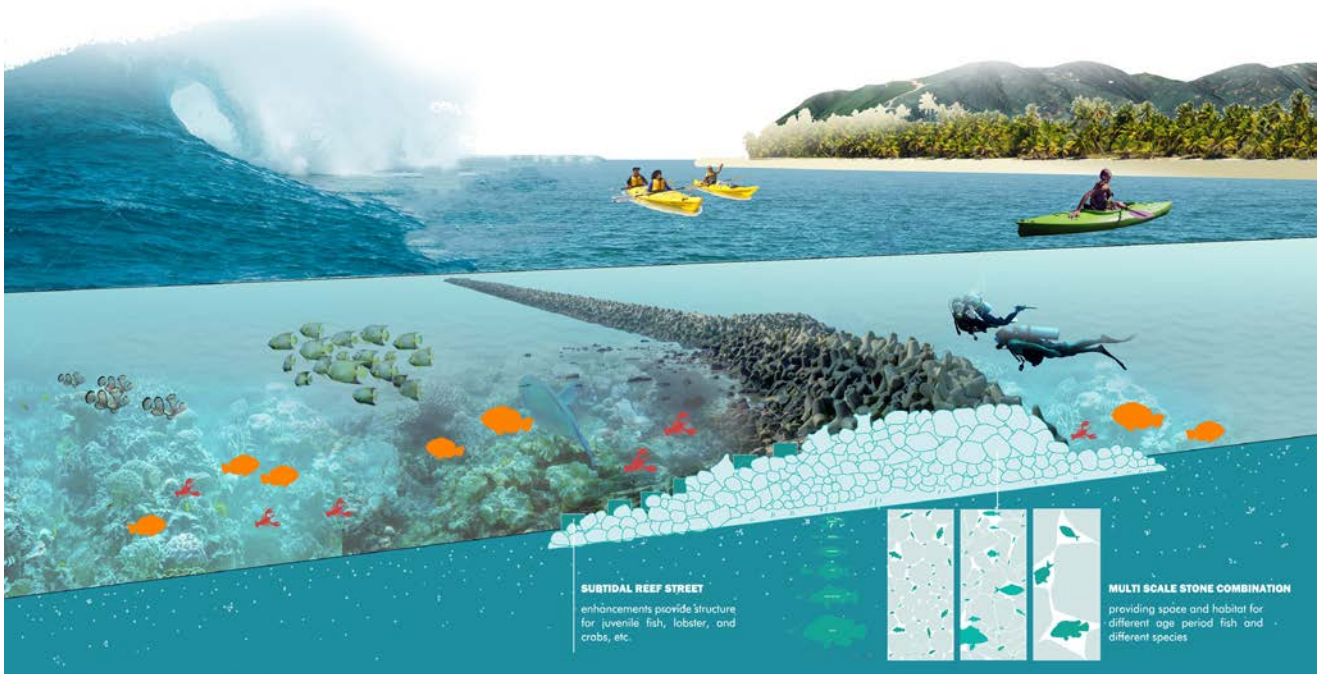

FIG. 1.56 Coral barrier

FIG. 1.57 Proposed adaptive fish farming in rainy days

FIG. 1.58 Proposed adaptive fish farming in sunny days

FIG. 1.59 Proposed resilient landscape framework of Xichong

Eco-cooperation Landscape

Design explorations in the Modaomen estuary for an adaptive and sustainable dike-pond system, water safety and ecological development

Yu Liu

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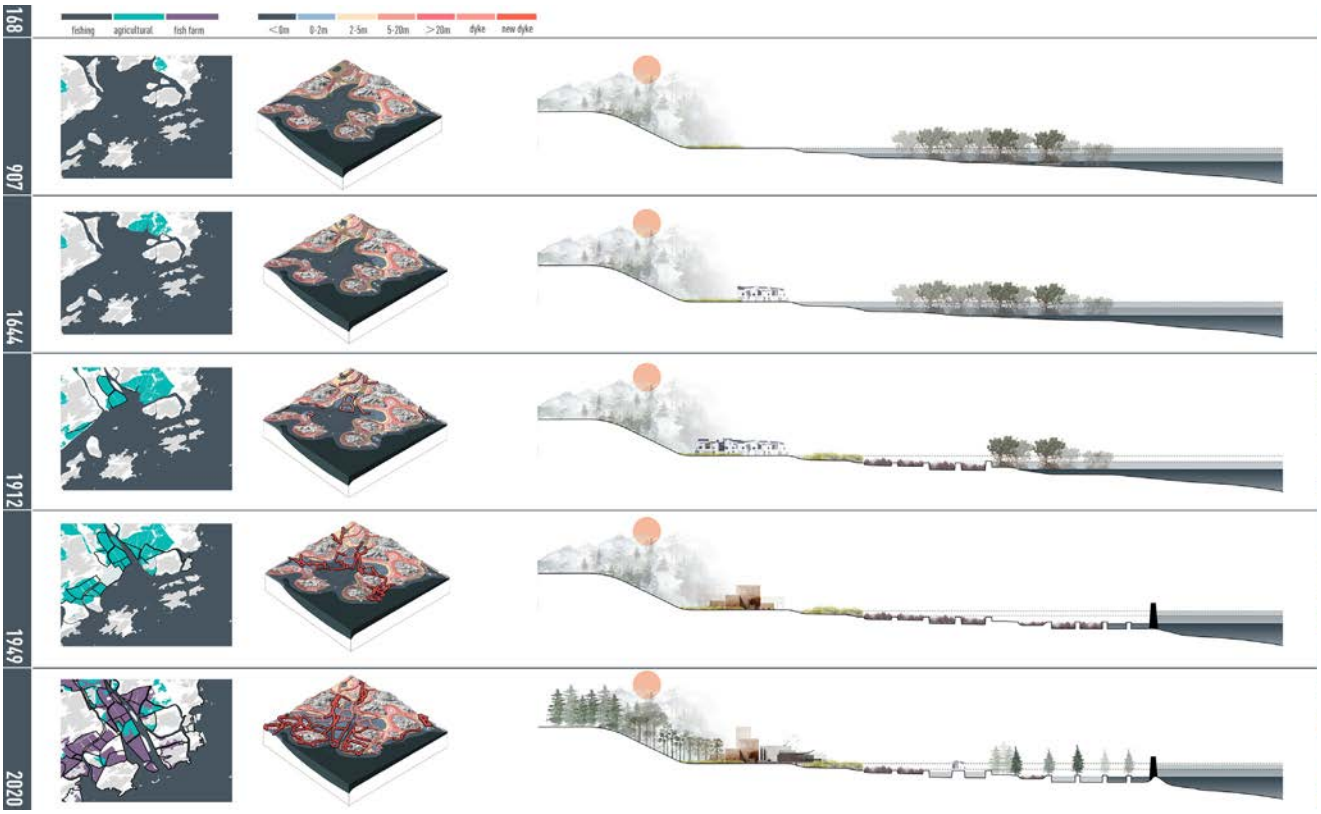
Steffen Nijhuis, Landscape architecture
Luiz de Carvalho, Spatial strategy & planning

Introduction

Pearl river delta is a very dynamic tidal zone, especially in the southeast part of the delta, Zhuhai province, Modaomen estuary. The small fishing tribes in Modaomen estuary developed into promising productive villages during decades of reclamation. However, there are many coastal natural disasters and ecological problems, such as saltwater intrusion, soil subsidence, hurricanes, ecological destruction, especially when after several generations of reclamation these days, 20% of marshland in Modaomen estuary is replaced by aquatic dyke ponds(Fig. 1.1).

Those dyke pond systems and excessive fish farms on the one hand lead to ecological destruction and increase vulnerability to many natural disasters. On the other hand, the dyke pond system as the man-made wetland provides potentials for future alteration, such as ecological restoration and city development.

The project explores an adaptable landscape framework for dyke pond systems, water safety, ecological development, and urbanization. The adaptive landscape framework is a bold experiment to solve multiple problems of urban, agricultural, ecological issues using interdisciplinary knowledge.



Principles

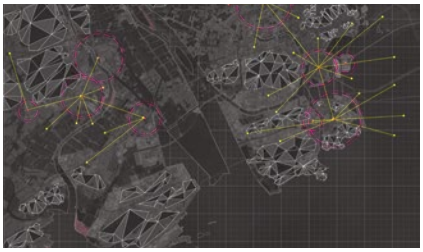


FIG. 1.60 Time succession of dyke pond system

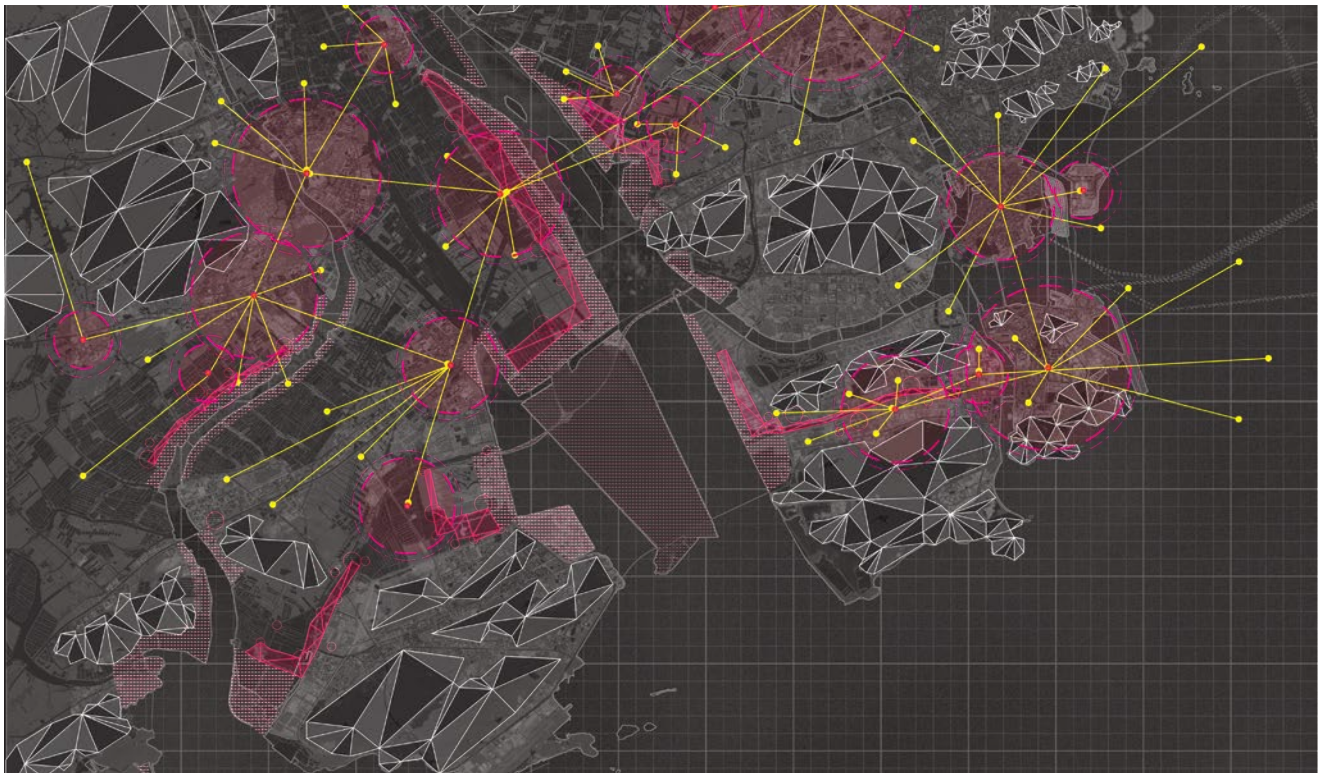
FIG. 1.61 Current conceptual situation

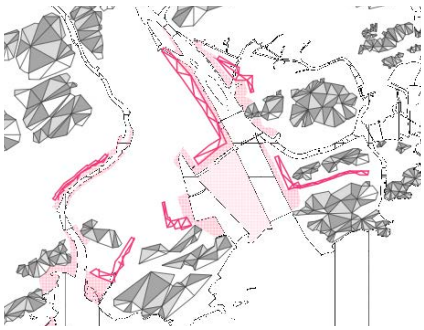
Modaomen estuary is a productive landscape, the green structure bases on the fish ponds, the wetland area accounts for 3%, thus the green structure is not continuous. The main urban agglomerations are concentrated in Doumen District and Jinwan District, both of which are dominated by primary and secondary industries, and both are relatively isolated. (Fig.1.2)

The new landscape framework requires a more adaptive plan for both scenarios of city development and nature sustainability. The proposed framework, structured in three layers provides new opportunities for future sustainable planning.

Water structure

The new landscape framework of the Modaomen estuary takes the new water system as the backbone. (Fig.1.3) The proposed new water structure includes the freshwater reservoirs and brackish water wetlands based on its context of the dike pond system at the edge of the marine ecosystem. It functions to restore, retain and recharge the freshwater resources and to develop its peat to build wetlands of mangroves. It could increase resistance to natural disasters, while this water structure can also provide habitats for the flora and fauna.





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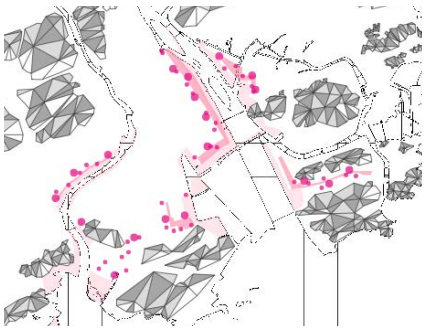

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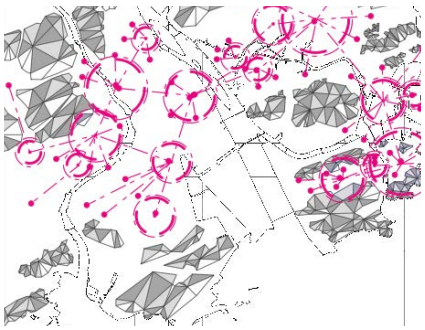

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FIG. 1.62 Proposed framework

FIG. 1.63 Proposed water structure, proposed new programs, proposed centralities

New programs structure

The new programs are proposed along with the water structure. Different activities will be arranged for the water of different levels of the atmosphere, to provide recreational, educational, cultural opportunities, corresponding industry and employment opportunities, including kayaking, bird watching, volunteer events, etc.

New centralities structure

The new programs enable new centralities. The new programs provide the potential for tourism, the city could correspondingly develop the tertiary industry for city transformation. Therefore, the landscape framework could work as an effective system, multi-point centralizes can interact, cooperate and develop together. and to develop its historical villages, to develop the tertiary industry.

FIG. 1.64 masterplan

Results

The project explores an adaptable landscape framework (Fig.1.5) for dyke pond systems, water safety, ecological development, and urbanization.

The scenario consists of 3 structures, the natural brackish water wetland, the freshwater reservoir controlled by the double dyke system, the urban area integrating with the dyke pond system.

The natural wetland will be formed by the local dynamic natural process. It will protect the coastline and establish stepping stones and habitats, The resilient double dyke systems and retain, restore, recharge freshwater to the greatest extent. It will also enhance water security. Besides, Both landscapes also serve as the engine to facilitate city development. It provides local residents with opportunities for entertainment, education, culture, and community construction.

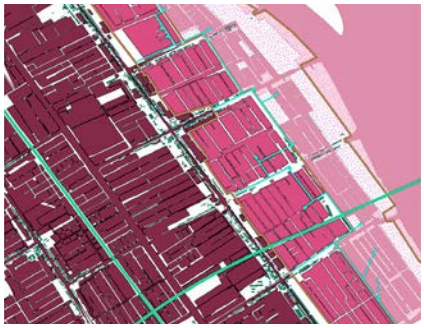
Results

FIG. 1.65 Time succession

Natural wetland

The Outer dikes will be opened for the construction of brackish and freshwater wetlands. Over time, the erosion process will reshape the environment between the external dyke and the intermediate dyke, and finally, use the natural process of the once formed delta landscape to form a more adaptable and feasible continuous wetland.(Fig. 1.6)

This strategy requires only a limited budget to complete the establishment of wetland and also protects the urban agglomerations within Zhuhai's urban area from hurricanes.



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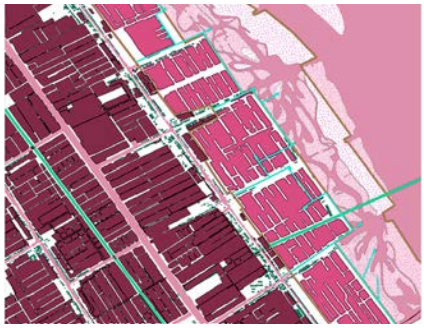

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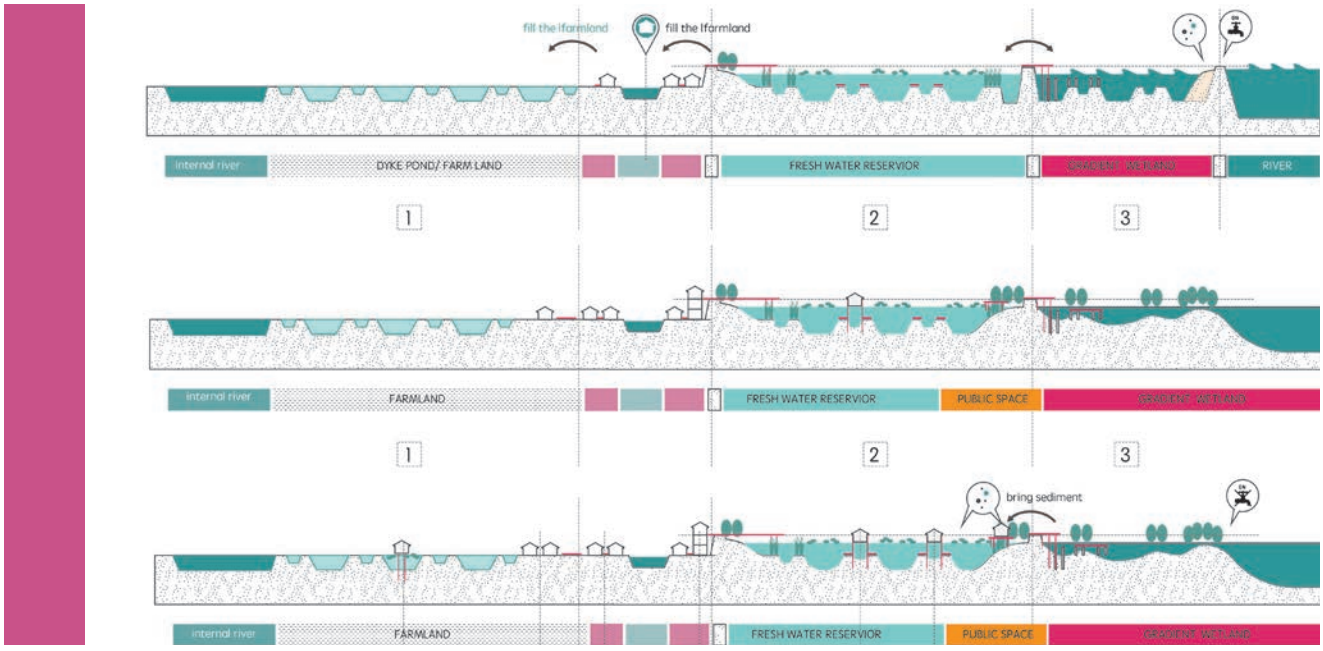


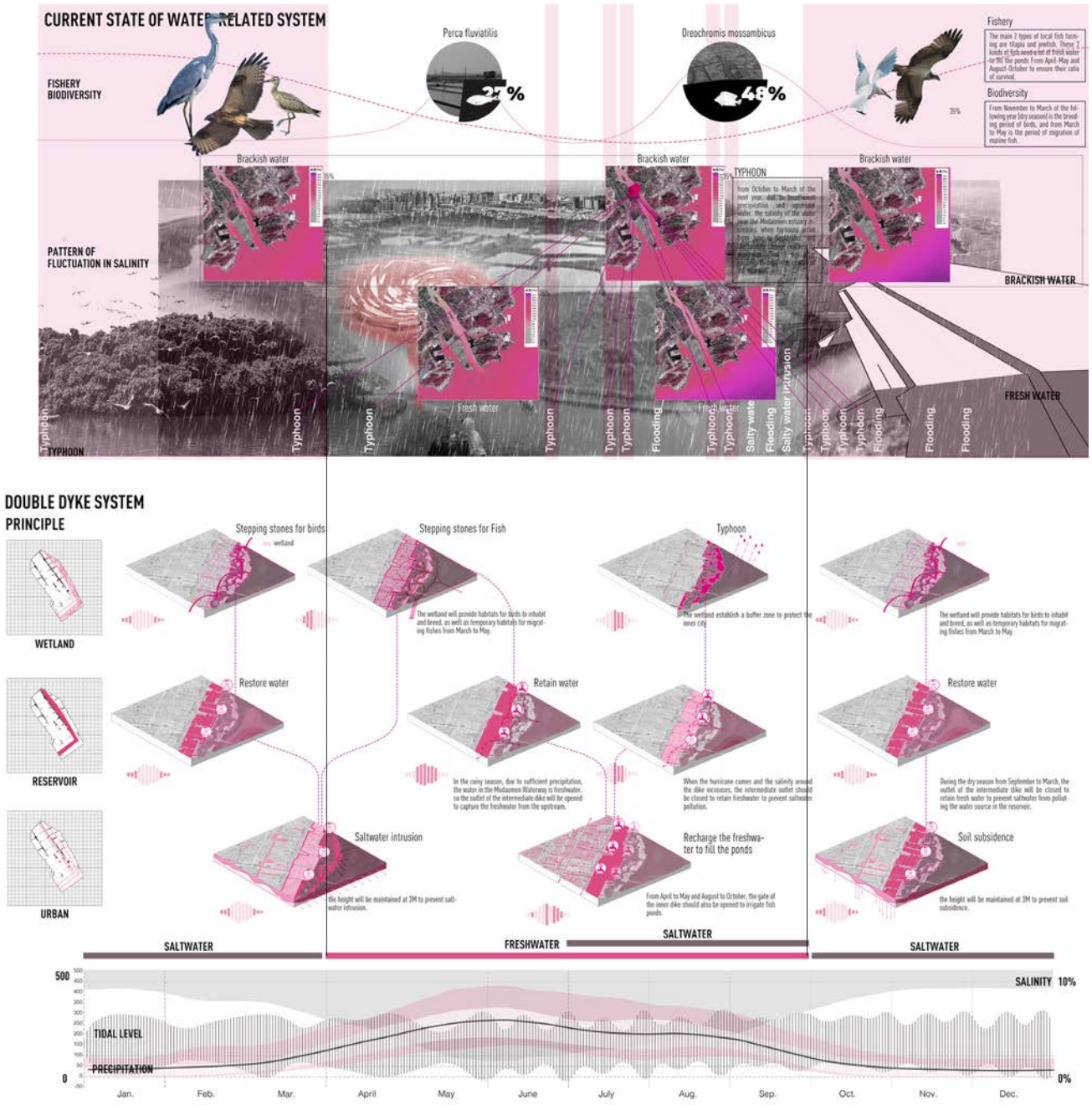
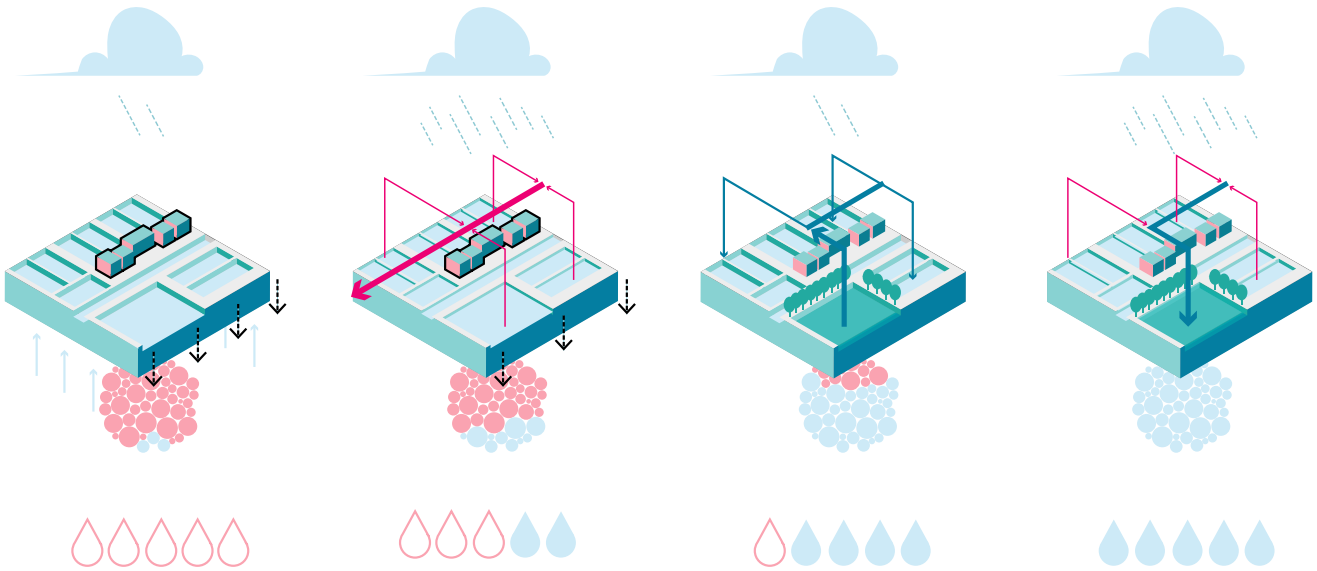


FIG. 1.67 The pattern of ocean salinity changes mainly corresponded to the precipitation, in the wet season from the April to September, the from October to March of the following year, due to insufficient precipitation and upstream water, the salinity of the water near the Modaomen increases. when hurricanes arrive from June to September, and the salinity change reaches its maximum about 1 day after passing through the center of the typhoon.From November to March of the following year (dry season) is the breeding period of birds, and from March to May is the period of migration of marine fish. The season of birds, fish migration is from November to May.The main 2 types of local fish farming are tilapia and jewfish. These 2 kinds of fish need to fill the pond with lots of fresh water in April- May and August-October to ensure their survival. The pattern of this system operates following the salinity changes of the Modaomen waterway. The system can adapt to the local complex water environment and can capture the freshwater to supply the whole area throughout the year.



Conclusion: Resilient double dyke system

The main proposed strategy is to build two new dykes within the original dykes. The reservoir will control the gate of the outlet according to the fluctuation in the salinity of the Modaomen waterway.(Fig. 1.8) The intermediate area will be water retention for restoring, retaining, and recharging the freshwater. And in the wet season, when the water's salinity in the Modaomen estuary decreases from April to September, the intermediate dyke can be opened to replenish the reservoir by capturing fresh water in the Modaomen waterway.(Fig. 1.10, Fig. 1.11)

The strategy will maximize freshwater resources, including drinking water, agricultural and fishery water, and groundwater. Besides, it also prevents problems such as soil subsidence and saltwater intrusion.(Fig. 1.9)

FIG. 1.68 Soil subsidence and saltwater intrusion

FIG. 1.69 Fresh water reservoir in the dry season

FIG. 1.70 Fresh water reservoir in the wet season

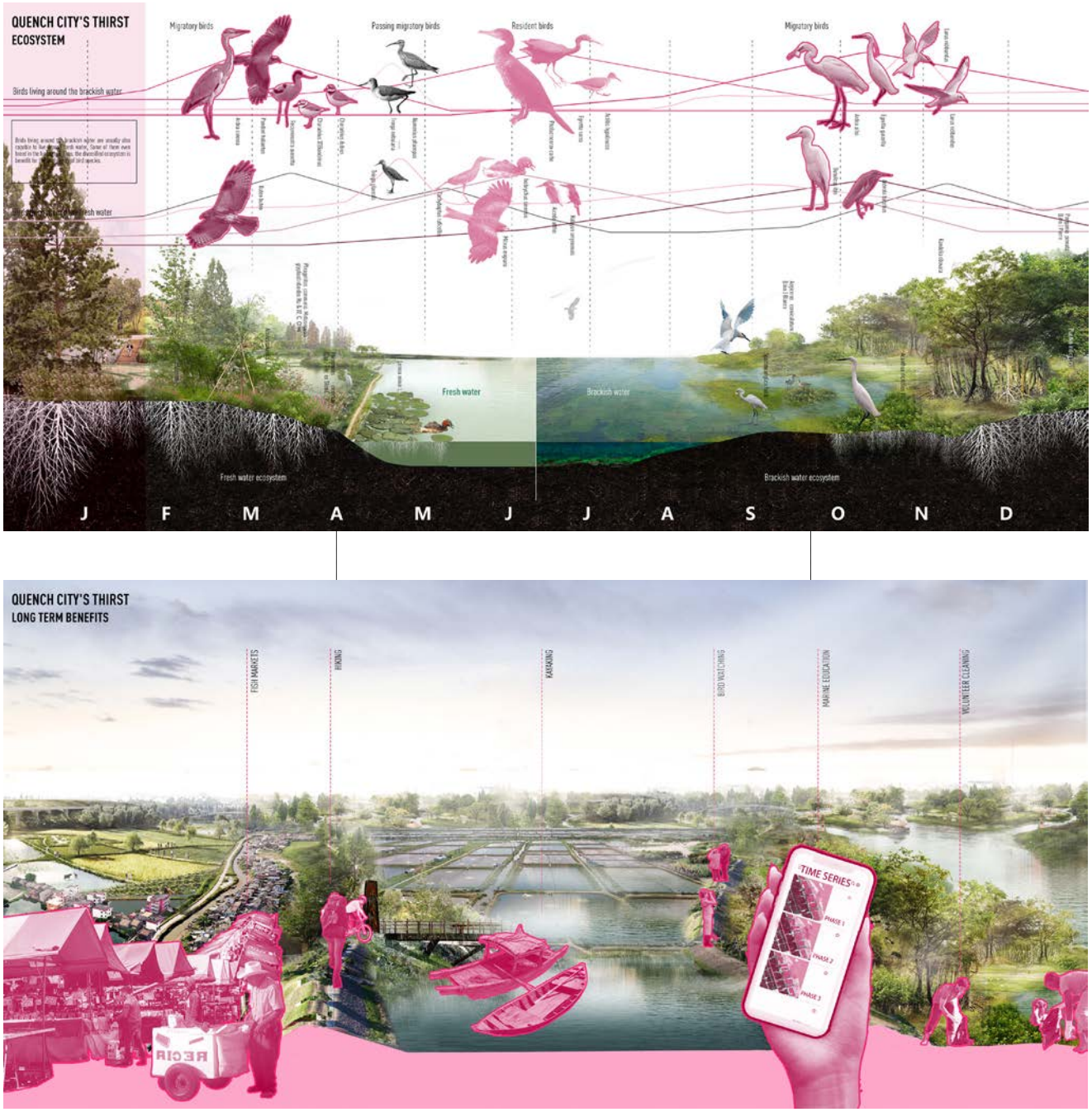


FIG. 1.71 The plants in the reservoir and the wetlands are freshwater plants and saltwater plants respectively. Diverse biodiversity makes the ecosystem more sustainable and more adaptable to the local dynamic nature process.

FIG. 1.72 As the proposal advances, there will also be recreational, educational and cultural opportunities and corresponding industry and employment opportunities, including kayaking, bird watching, volunteer events, etc.

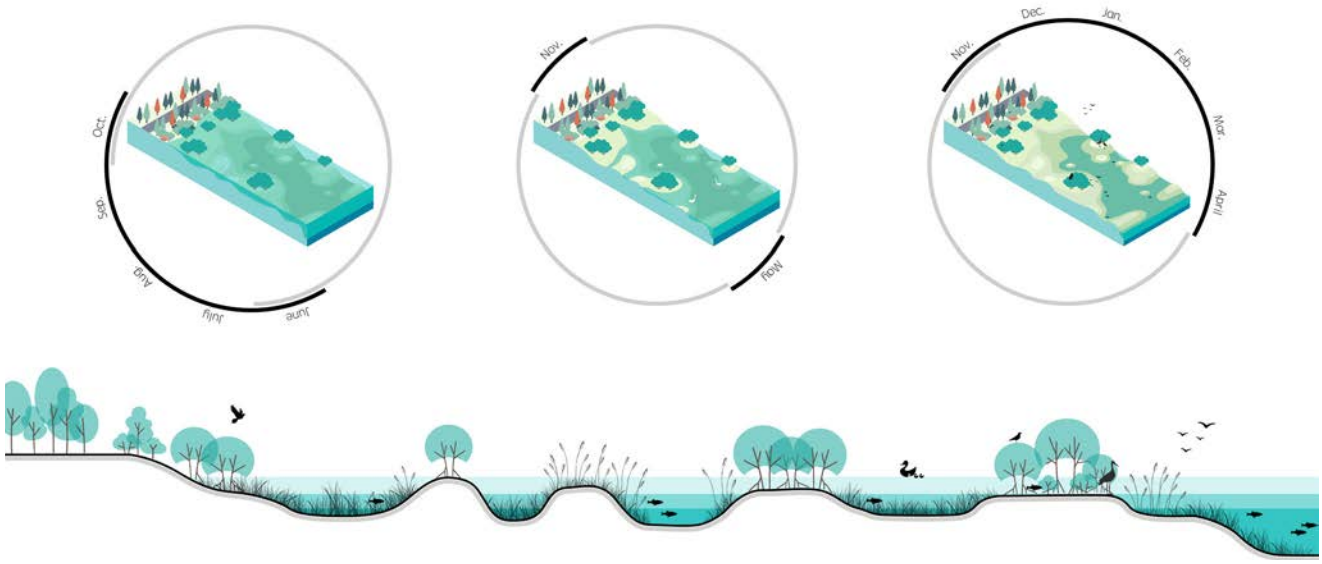


FIG. 1.73 ceosystem in different season

Long term benefits

Reservoirs and wetlands provide different ecosystems(Fig.1.14), accommodate a greater variety of plants and animals, and provide protected stepping stones and habitats for birds and fish(Fig.1.12). The proposal also provides entertainment, education and cultural opportunities for local residents to get together, corresponding industries, and employment opportunities, including kayaking. Hiking, bird watching, volunteer activities, marine education, museums, fish markets, etc. Those new programs also enable new centralities.(Fig.1.13)

Conclusion

China has been in a state of rapid development for decades, keeping taking territories and resources from nature. The land and city expansion, the blue-green structure fragmentation, and the ecological degradation have led to frequent natural disasters. The Chinese government and the local municipalities have been working on reducing the impact of natural disasters. The common scenarios for the coastal plans in the world often focus on solutions by constructing still and everlasting structures, such as preventing hurricanes by building higher dams or preventing saltwater intrusion by developing upstream pumping stations. However, such a scheme is not suitable for urban delta which has specific geographical features and dramatically complex dynamic natural process.

However, the proposed landscape framework functions as a dynamic process rather than a static object, interacts with natural conditions, and changes by natural conditions. The landscape framework could also benefit nature and humans in the long term, own potentials in resilience and sustainability, provide conditions for entertainment, education and cultural opportunities and the city transformation.

Hence, this project can be regarded as a pioneering pilot project of an adaptable landscape framework for dyke pond systems, water safety, ecological development, and urbanization in the dynamic coast/estuary, based on the perspective of a landscape architect, by using interdisciplinary knowledge.

To conclude, the proposal, strategies, principles could provide the insight of using landscape as framework on the coastal area not only in Modaomen estuary but also in other coastal areas all over the world in time and space dimension, to deal with the spatial-social-ecological problems brought by the dyke pond system and city expansion.

A New Dynamic Landscape for the Haringvliet

A landscape architecture exploration for Delta 21

Esmée van Eeden

Surpervisors
Steffen Nijhuis, Landscape architecture
Mark Voorendt, Hydraulic engineering

Introduction

This project provides a design exploration for a new estuarine landscape at the Haringvliet mouth where the initiative Delta 21 (Berke & Lavooij, 2019) will be incorporated. Delta 21 is located at the Haringvliet mouth and plans to implement an energy lake and a tidal lake sea inwards. This new structure ensures flood protection, increases the use of renewable energy, produces food, creates very valuable natural habitats and corridors and provides new recreation. The Haringvliet region has a long history of living with water. People build dikes, dams and sluices and created a safe living environment. The downside is that the damming causes strict land/water and river/sea separations and the soft gradients which once dominated the delta landscape have disappeared. Over the past decades the landscape has become more monotone. The disappearance of the dynamic interface and the corresponding natural processes resulted in a landscape that is losing the identity of the delta. This design exploration aims to create a new sustainable estuarine landscape that is in harmony with the natural processes. In this new landscape, gradual land /water transitions bring back the dynamics of this delta landscape for the purpose of ecology and experience. The proposed design layout is based on the morphological processes along the coastline, the expansion and preservation of valuable habitats like the Hinderplaat and the open connection from the sea to the Haringvliet. With this new estuarine landscape the deltaic dynamic and experience is restored, providing new nature, aquaculture, recreational routes, holiday housing, restaurants and a visitors centre.

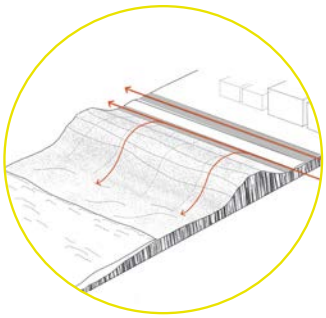
FIG. 1.74 DELTA 21.

Berke, L., Lavooij H., (2019), Update 2019: DELTA21 - Een actualisering van het plan, retrieved from: https://www.delta21.nl/het-plan/.

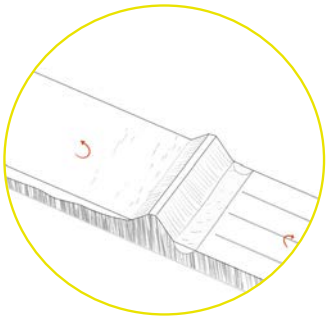
FIG. 1.75 Overall landscape structure

The Haringvliet region is a very rich landscape in structures and experiences. Different landscape types, such as the coast, polder, sea-arm, utilitarian landscape, flood protection structures and the villages, add value to this delta landscape in different ways. However, each landscape type stands on its own and is strictly separated by dikes and dunes. This makes the delta a fragmented landscape.

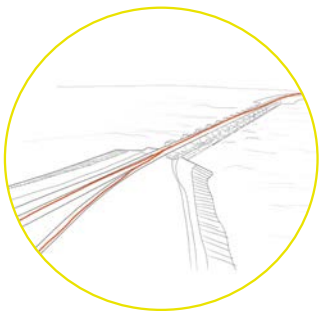
FIG. 1.76 Challenge and opportunity map



1 Dune as one narrow single dune row



2 Concrete dike without recreational space



3 Haringvlietdam, strict barrier between river and sea

Results

The Southwest delta is fragmented into different landscape types which are strictly separated from each other spatially and systematically. Natural processes do not shape the landscape but human regulation is. This means that natural dynamics do not create the dynamic estuarine experience that belongs to the Southwest delta. The region became better protected against floods but also more monotone. The natural processes are still present and can be stimulated again by opening the Haringvliet sluice and by replacing the hard edges into more gradual transitions with space for natural adaptation. This is where the opportunity lies to connect the diverse landscape types to each other with interesting and valuable transitions that invite people to explore the diversity of landscapes in the region.

Challenge:

Get rid of the hard edges and return the estuarine environment and experience without compromising the protection against floods.

Opportunity:

Create one dynamic estuary by implementing more gradual dynamic interfaces for the Haringvliet and Delta21 to reintroduce the estuarine landscape in the Haringvliet region that can be experienced as a whole.

Principles

The land/water transition can hold many more values next to the function of flood protection. To investigate all the opportunities, the dike can be approached through different perspectives.

Being aware of the dike in different contexts, although conceptual, helps in becoming more creative in the way a flood protection barrier can be designed.

FIG. 1.77 Land/water transition in different contexts

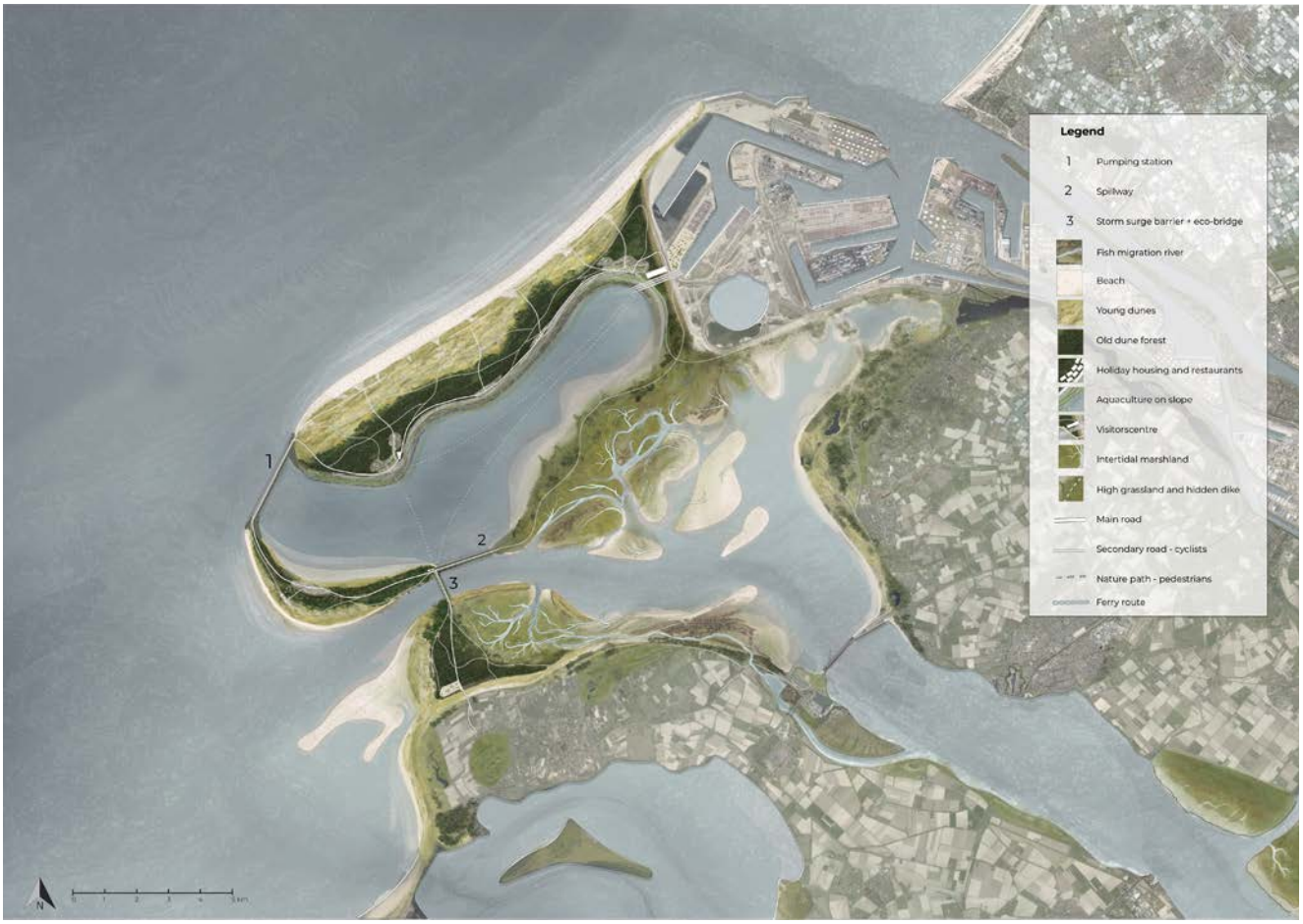
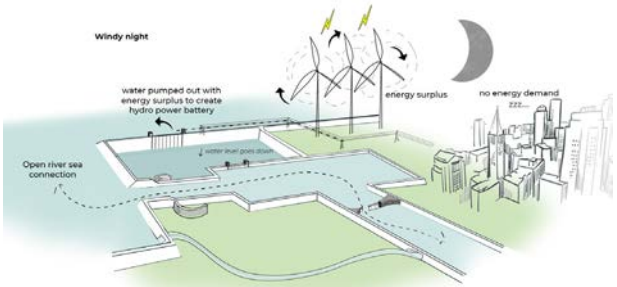


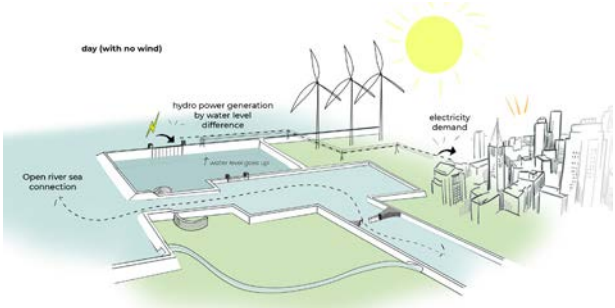
FIG. 1.78 Masterplan new estuarine landscape

The new estuarine landscape

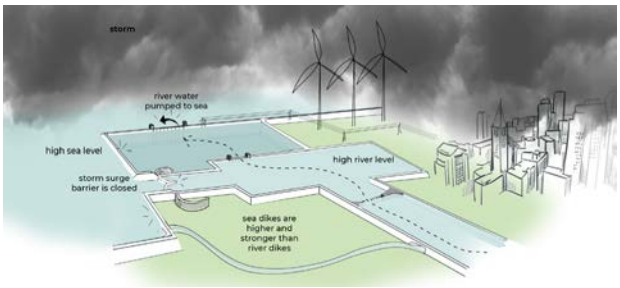
The new landscape is created by designing with natural processes to harmonize it with the natural dynamics. In this way, the landscape becomes more sustainable and requires less maintenance. Within this new landscape, Delta 21 is embedded to increase flood protection, renewable energy, aquaculture and nature. The masterplan shows a new estuarine landscape that includes Delta 21. The layout of the plan is the result of the dominant southwest to northeast sea current and the corresponding morphological processes. The zones and vegetation result from the technical requirements, the local conditions and case study research. The key purpose of the design is to create soft transitions between land and water to build space for natural dynamics, recreation and ecology. Some small scale interventions like green bridges, uncovered dunes, paths, holiday housing, and the visitors centre result from more detailed design explorations. Here, the focus lies on the experience of the dynamic transitions, including ecological flows. To make the new landscape more interesting, the dominant soft transitions are alternated with a harder gradient; the north and east slope of the energy lake. Due to this harder gradient, changes in water level can be experienced. This can greatly be sensated at the shoreline with aquaculture on the slope and at the visitors centre where a water cascade exposes the water level differences between the sea and energy lake. These recreational experiences benefit the region and provide new nature experiences for visitors.



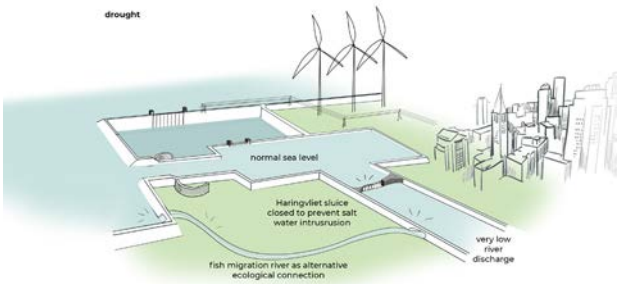
During the night with wind, the wind turbines generate energy, but there is almost no energy demand because it is night. The energy surplus (which is normally lost) is used to pump out the water in the energy lake to create potential energy that can be generated again with turbines.



During the day, without wind, there is a demand for energy. Seawater can enter through the turbines back into the energy lake that generates power which is directly transported to the industry and houses.



When there is a storm that causes a high sea level and a high river level, the water accumulates in the rivers. The river dikes are less high and not so strong as the sea dikes. To prevent dike failure, the storm surge barrier is closed, the spillway (between tidal lake and energy lake) is opened and the river water is pumped out to the sea. In this scenario, it is really important that the pumps are working, however since the pumps are working almost everyday to store energy this will not be a problem.



In the scenario that there is a drought, the risk is that seawater intrudes too far in the rivers and causes salinization. In this case, the Haringvlietdam will be closed. This will negatively influence the fish migration. Therefore, in case this scenario occurs the fish migration route is placed as an alternative route for migratory fishes.

FIG. 1.79 Functioning of the watersystem

Zooming in on transition zones

The goal of this project is to create dynamic land water interfaces in a new estuarine landscape. Four transition zones are elaborated further on the next page.

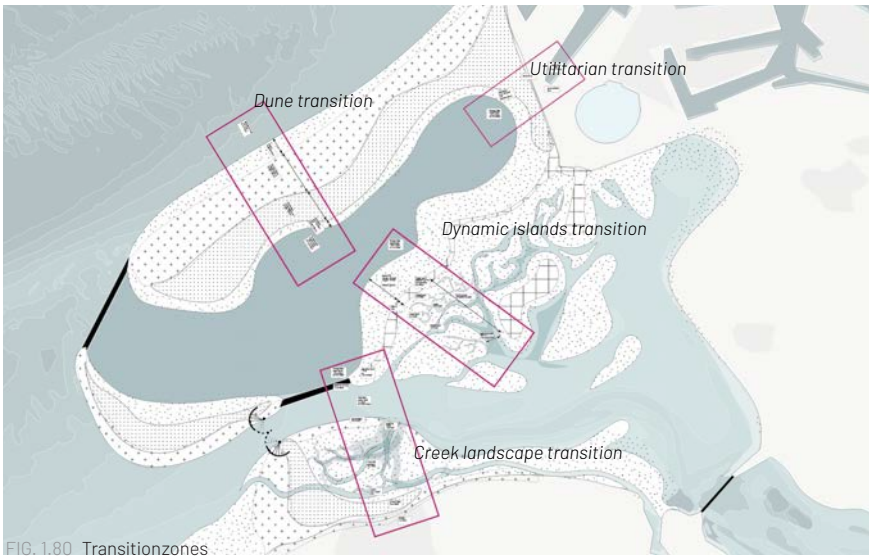


FIG. 1.80 Transitionzones

FIG. 1.82 Transition zone dune are - slope energy lake

This impression provides an image of how this area might turn out. At daytime the water in the energy lake is high and the activities will be mainly recreational. During the night and early morning, if there is wind, the water in the energy lake is pumped out. At this moment the farmers can work on the aquaculture slope and harvest their crops and shellfishes.

FIG. 1.81 Transition zone creek - eco-spillway and eco- bridge

At this point many flows merge. The spillway and bridge are both infrastructure for people and animals. The bridge connects Voorne to Goeree and is therefore an alternative route for the Haringvlietdam and provides a new ecological corridor.

FIG. 1.83 Utilitarian transition zone - vistitors centre and water cascade

Between the Maasvlakte and the energy lake the transition is quite narrow with one dune row. By placing the visitors centre here, the Maasvlakte and the energy lake can be connected visually. The water cascade moves water from the sea (NAP 0 m) to the energy lake (NAP -25 m to -5 m) with a continuous streamflow. This helps in understanding the system of the energy lake and also serves as a nice recreational feature.

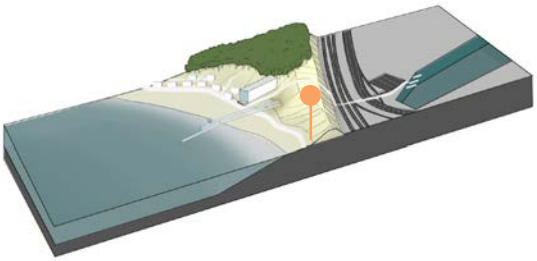
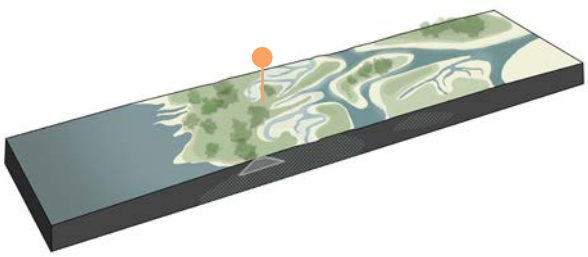


FIG. 1.84 Transition zone dynamic islands - creek and marshland

The seperation of the energy lake and the tidal lake is achieved by a hidden dike. Therefore the transition is very gradual with a lot of space for natural dynamics and nature. The image shows an impression of the creek and marshland with in the distance larger waterbodies and islands. This very dynamic landscape is interesing for many different endangered species and is also a lot of fun for people to explore.



Colored Water

Designing A resilient landscape framework that facilitates water safety and batik development in Pekalongan city

Yayun Gao

Surpervisors
Steffen Nijhuis, Landscape architecture
Taneha Kuzniecow Bacchin, Urban design

Introduction

As one of the most important ecosystems on the planet, the coastal zone accommodates a more dense population than the hinterland and faces faster urbanization . Meanwhile, the coastal zone is exposed to several climate change disasters in the context of a sensitive environment dominated by water.

Problem statement

This master thesis in Landscape Architecture focuses on the Northern Java island, specifically Pekalongan city, Indonesia. Pekalongan city locates at the interface between Java sea and Dieng Plateau, the downstream area of the Kupang watershed. Due to the geological distribution, the city is facing many water-related disaster, frequent inundation of the rising sea level, floods and freshwater scarcity etc. At the same time, the local see a dilemma between natural resources and their dominant industry, batik production. The industry is highly reliant on natural resources, and chemical dyes used in this industry leads the heavy metals in wastewater which causes heavy water pollution.

Pekalongan people actively fight against natural disasters and try to boom the cultural significance. But, without understanding the natural process and resilience thinking, the interventions are slightly ineffective, and even could be counterproductive from a long-term perspective.

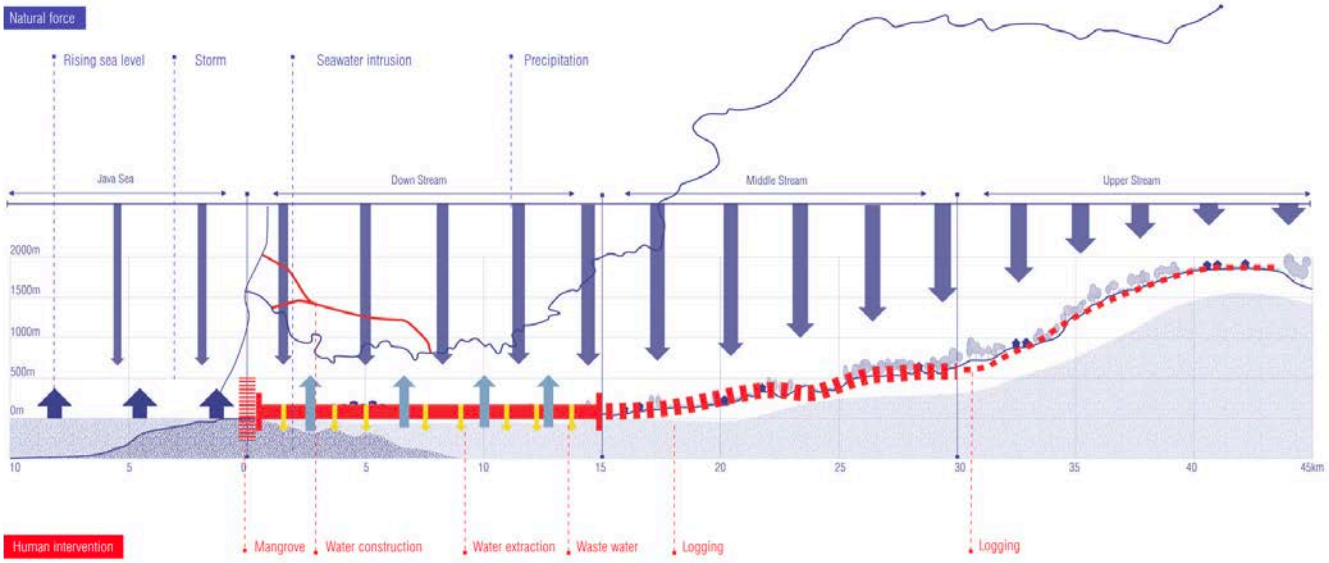


FIG. 1.85 Problems along Kupang watershed

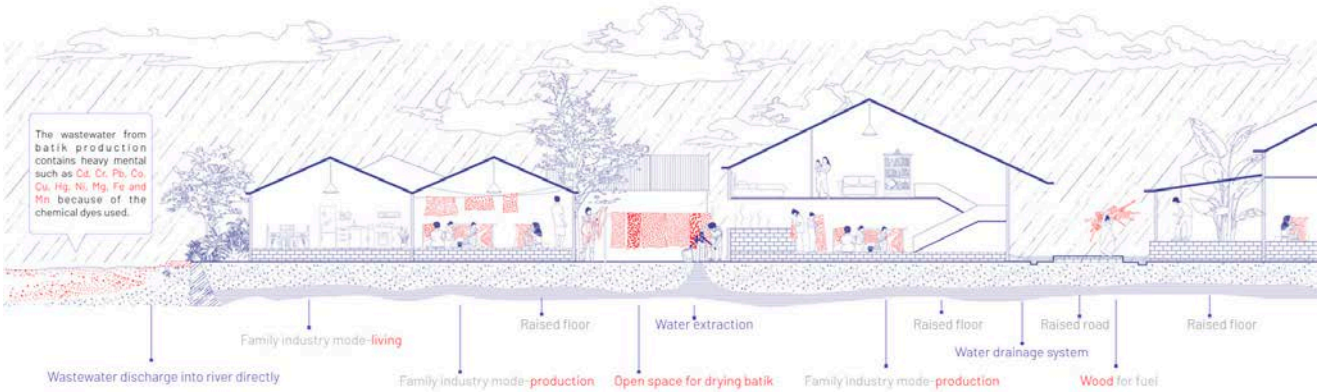


FIG. 1.86 The water-batik system in Pekalongan

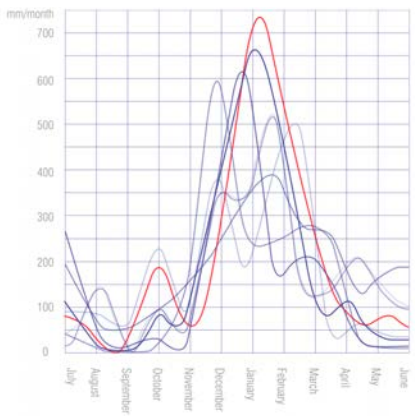


FIG. 1.87 The monsoon weather type with more intense precipitation and shorter rainy season

Objective

Therefore the objective of the thesis is to create a resilient landscape framework to facilitate water safety and batik development in Pekalongan city by focusing on water-related design assignments. Moreover, the project aims to consolidate and enhance the cultural significance of batik and raise awareness of landscape potentials.

Under the resilient landscape theoretical framework, with the guidance of landscape-based solutions, the project seeks to build a new relationship between people and nature to mitigate the threats of climate change disasters and batik development from a long term and sustainable perspective. Design research and research by design provide the methods to conduct the investigations.

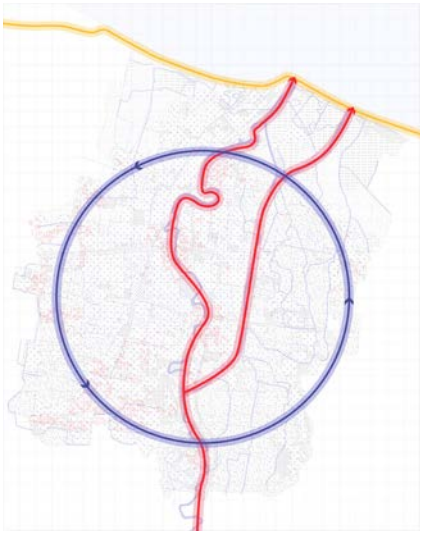


FIG. 1.88 Three design assignment, coast protection, discharge capacity, water circulation

Design assignment

Base on the understanding of the water-batik system, the assignment is cleared as coastal protection, discharge capacity and water circulation. The design work is conducted in three different scales, proposing strategies on a regional scale; detailed elaboration on selected sites; infrastructure design. Besides, a toolbox is also included to provide inspiration and clue for coastal zones which face similar threats and dilemmas as Pekalongan city.

Principles

General principle

According to Ahern (2011), resilience refers to "the capacity of systems to reorganize and recover from change and disturbance without changing to other states— in other words, systems that are safe to fail." Under this framework, multi-functionality, modularization&redundancy, bio & social diversity, multi-scale networks and connectivity, adaptive planning and design are the five main principles to consider.

(1) Multi-functionality: achieving different functions in different timing/conditions by combining or intertwining functions. (2) Modularization&redundancy: Ensure multiple elements in one system can provide similar or backup functions. (3) Bio & social diversity: Ensure a larger number of species provide the same or similar eco service. The same vein in terms of social values. (4) Multi-scale networks and connectivity build up multi-networks from small scale to large scale. Decrease the fragmentation of landscape elements and ensures the ecological process. (5)Adaptive planning and design: Principles of three water-related design assignments: Ensure the design have the opportunity to "learn by design" with uncertain disturbances.

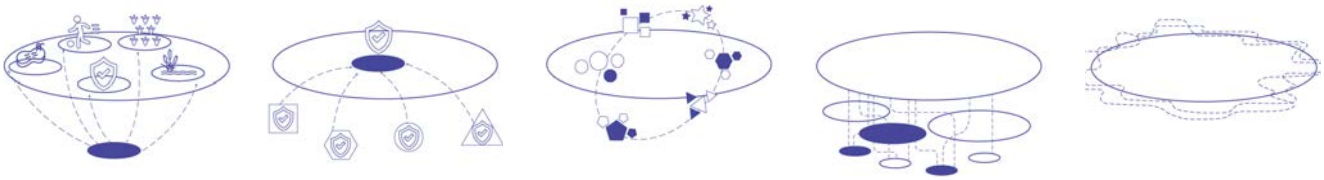


FIG. 1.89 Five principles under the resilient theoretical landscape framework

Principles of three water-related design assignment

Coastal protection: Instead of boxing, the hard infrastructure, with the wave and the natural force, judo, the soft defence gives more flexibility to the coastal landscape and functions better in defence.

Discharge capacity: Understand the logic behind water movement, create conditions to help water flow smoothly. Meanwhile, the river is important to the city and it should connect to the urban context.

Water circulation: Instead of getting rid of the rainfall, sponge space should be designed to store rainwater and recharge back to the city during the dry season.

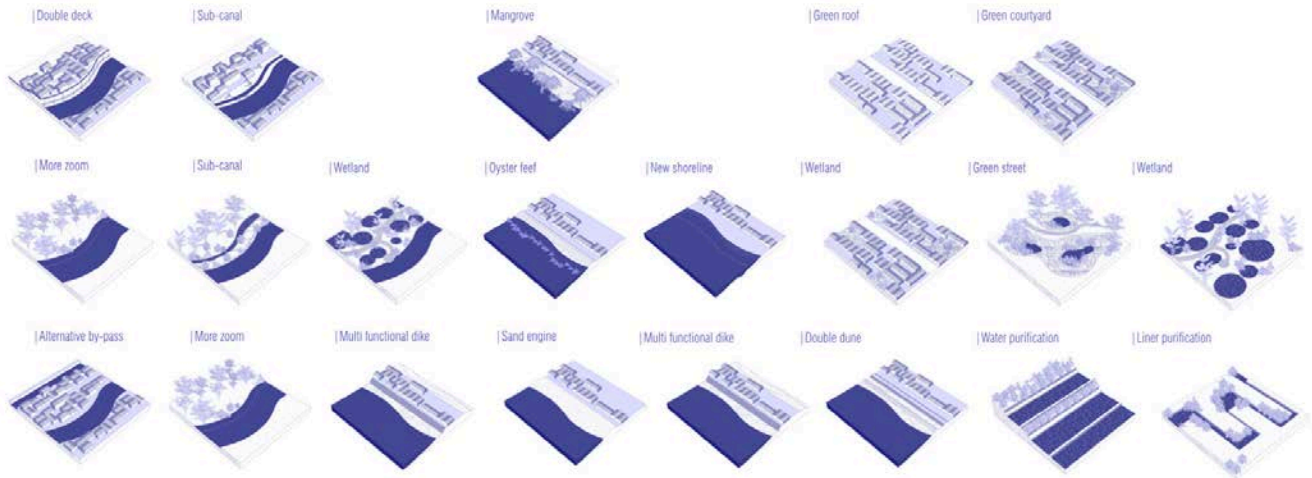


FIG. 1.90 Design principles about coast protection, discharge capacity and water circulation in three different scales

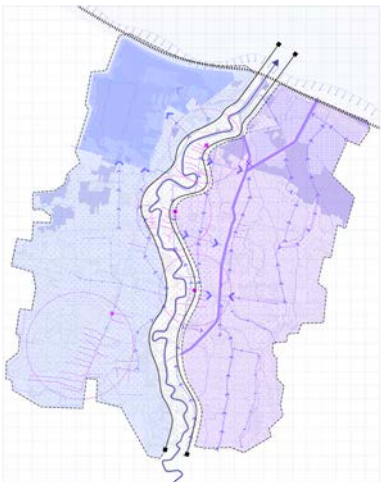


FIG. 1.91 The new proposed water system

FIG. 1.92 Water infrastructure

Results

New water-batik system

Base on the understanding of the landscape potential, the water-batik system is improved to address the challenges. By collecting the rainwater and increasing the discharge capacity, floods caused by intense precipitation can be solved. The collected rainwater will be recharged to the city during the dry season. Soft defence, mangrove, protect the city from storm surge. The waste fruit from mangroves is going to replace the chemical dyes in the batik industry as an environmentally-friendly natural dye and reduce the pollution relieved into the environment.

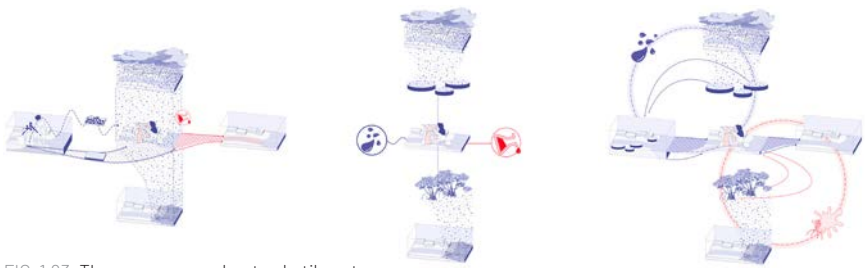


FIG. 1.93 The new proposed water-batik system

Water system as the base

To realize the new system spatially, the interventions focus on the water takes the pioneer place. The core concept is to separate rainwater, river water and wastewater to relieve the discharge pressure of the Pekalongan river, achieve water circulation by collecting, purifying and reusing rainwater and improve water quality. The rainwater is directed away from the Pekalongan river, into the Banger canal at the east and the fields at the north. Wastewater will be collected.

The Pekalongan river will focus on discharging the water from upstream Kupang river into the Java sea. In the North, rainwater collection is combined with coastal aquaculture and at the east, the Banger canal will be the core sponge to store the rainwater during the rainy season.

FIG. 1.94 Strategy for coast protection, a protective and productive transition zone

FIG. 1.95 Strategy for discharge capacity, new connection and green network

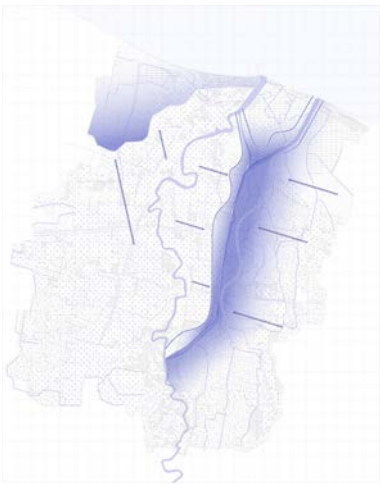


FIG. 1.96 Strategy for water circulation, redirect the run off and create sponge space

Coastal protection:

Aimed to be productive and protective, the coast defence consists of three basic structures. Outer dike (mangrove or groynes), a hidden dike that functions as the green way along the coast, and the buffer zone focused on aquaculture. These three parts consist of the transition zone from Java sea to the hinterland of Pekalongan city.

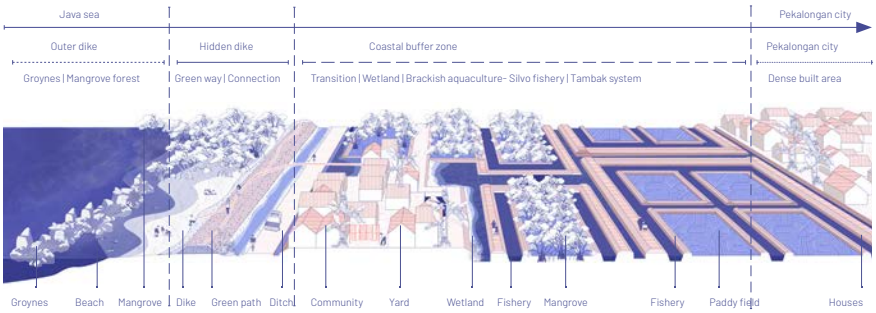


FIG. 1.97 General concept for coast protection

Discharge capacity:

Aimed to increase the discharge capacity, and make the water more accessible, new short cuts are dug. The original river bend, due to its special curve, shows potential in water purification. It will become an important part of the urban green structure.

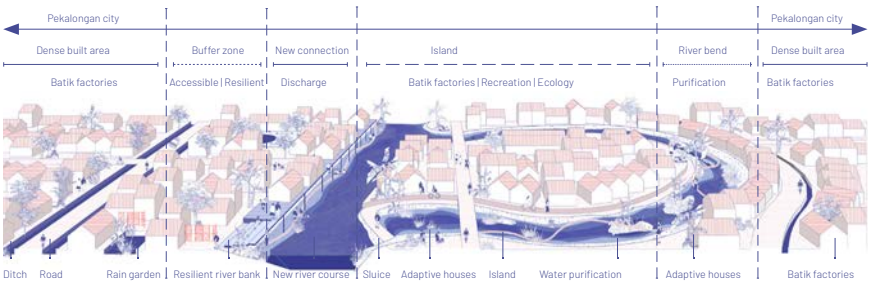


FIG. 1.98 General concept for discharge capacity

Water circulation

Sponge spaces are created through all scales for water storage, from courtyards to canals. The fish ponds are the core sponge for the east system while the Banger canal is the main sponge in the east system. Stored water will recharge the city during the dry season, from March to September.

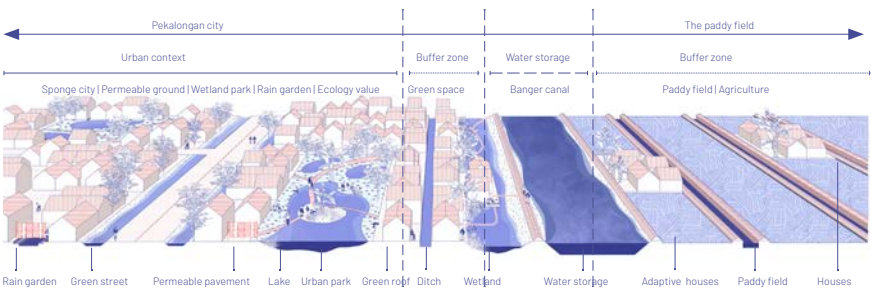


FIG. 1.99 General concept for water circulation

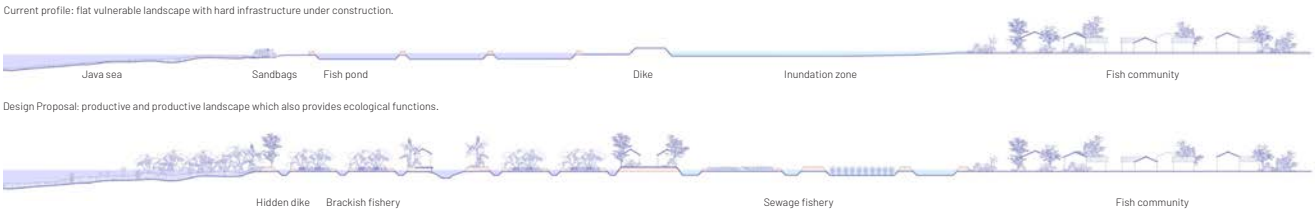


FIG. 1.100 The local implementation on coast protection, transform the flat vulnerable landscape into a protective and productive one.

Local implementation

Coastal protection- aquaculture: the aquaculture transforms from the brackish fishery to the sweet water Tambak system. The brackish fishery is integrated with mangrove planting while the fish is fed on the nutrients in sewage water from the city. This structure provides vegetables and fish as food and increases job opportunities. Meanwhile, fruit from mangroves and freshwater from sewage aquaculture also support the local culture industry, batik production.

Discharge capacity-Resilient riverbank and urban green structure:
Along the new river course, steps, benches and bridges provide the defence for the city under extreme situations. At the same time, the design of a resilient riverbank ensures the water is accessible and well connected with the batik museum, factories and residential area around it. Thus people become more aware of the importance of the water within the city.

Water circulation- Banger canal and rain garden: Re-naturalization of Banger canal gives more space for water storage. According to the difference in land use along the Banger canal, the wetland buffer zone and paddy field buffer zone is designed to maintain the water. Compare to the concrete riverbank, gradient riverbank have more possibilities for nature. Rain gardens in courtyards store the rainwater for batik protection and it is connected with the outside water system.

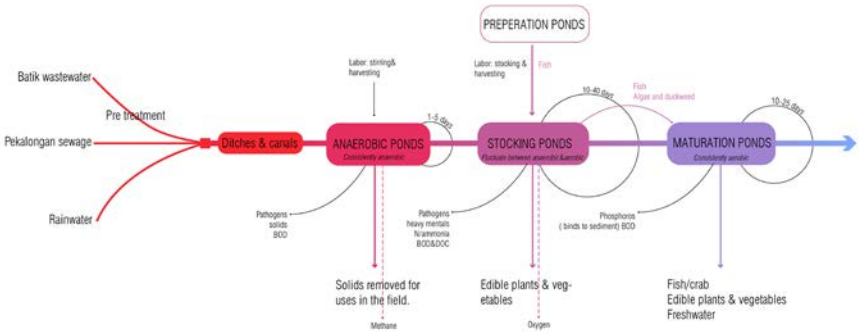


FIG. 1.101 The local implementation on coast protection, the sewage fishery system which produce eat-able vegetable fish and clean water for batik production.

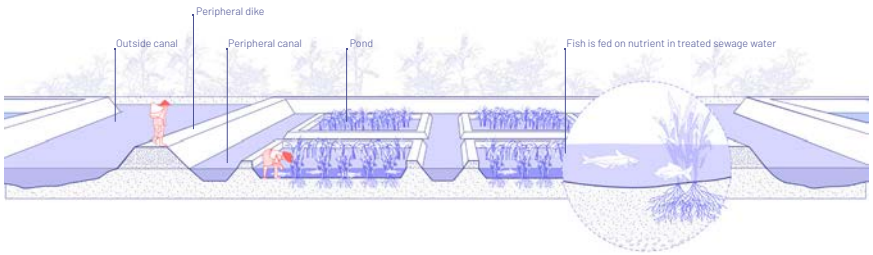


FIG. 1.102 The local implementation on coast protection, the structure of the sewage fishery pond.

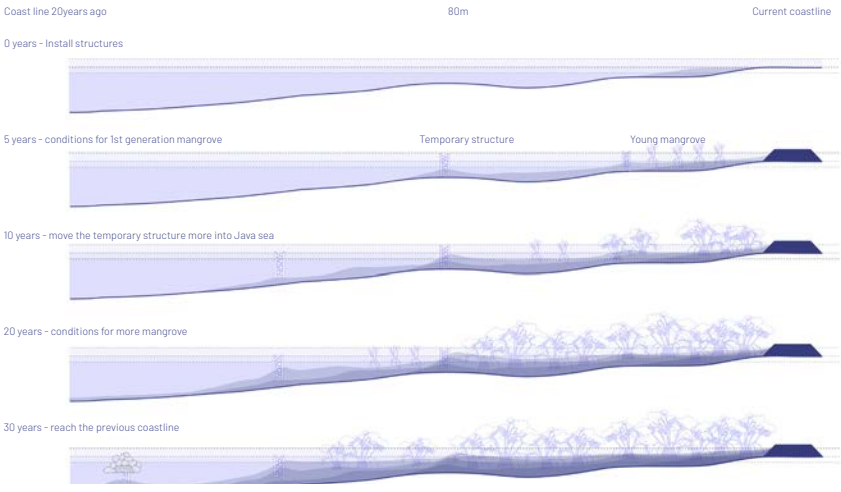


FIG. 1.103 The local implementation on coast protection, the mangrove rehabilitation. The temporary bamboo structure helps to catch the sediments for mangrove to grow.

Local implementation-discharge capacity

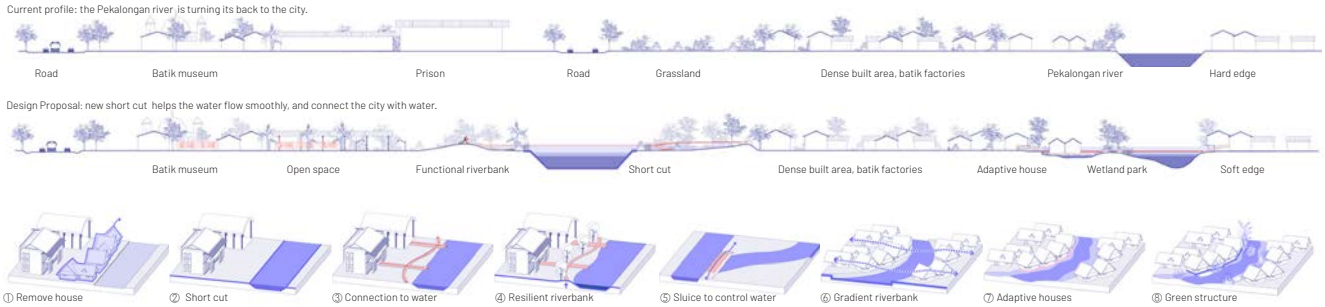


FIG. 1.104 The local implementation on discharge capacity. New connection is created and the river is more accessible. Resilient riverbank protects the city from being flooded.

FIG. 1.105 The local implementation on discharge capacity. Steps to create new watercourse and prepare the previous river bend to function as water purification while connects the green space in the city.

FIG. 1.106 The local implementation on coastal protection.

FIG. 1.107 The local implementation on discharge capacity, in normal situation.

Local implementation-water circulation

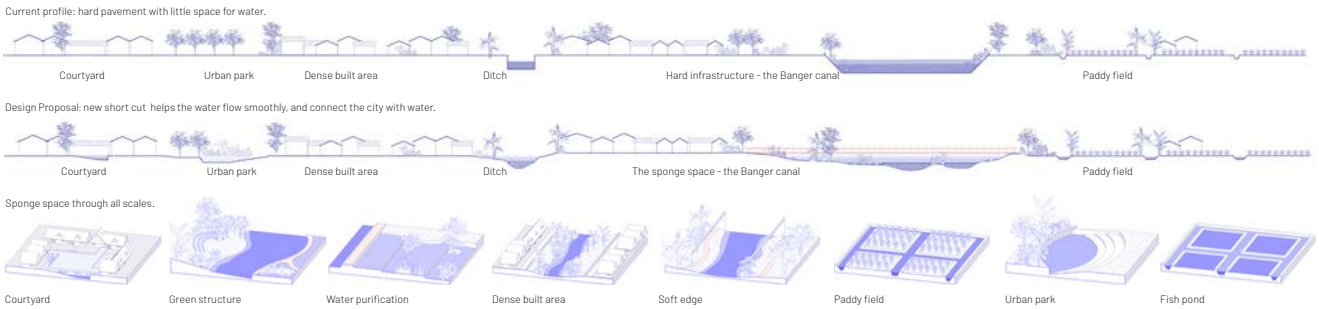


FIG. 1.108 The local implementation on water circulation. Turn the potential water retention space in the city to the urban sponge to store the water and recharge the city during dry season.

FIG. 1.109 The local implementation on water circulation. Different types of landscape are created.

FIG. 1.110 The local implementation on water circulation. Banger canal.

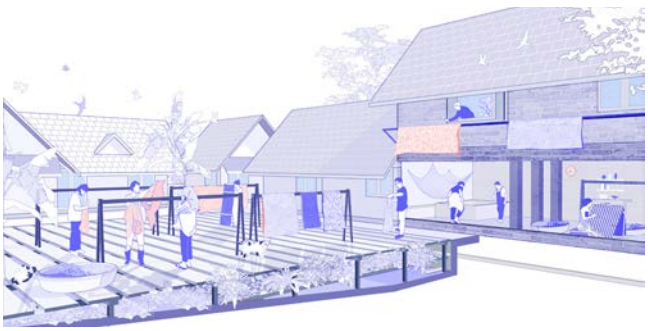


FIG. 1.111 The local implementation on water circulation. Courtyard.

FIG. 1.112 Material change of three systems

FIG. 1.113 Integration of three systems

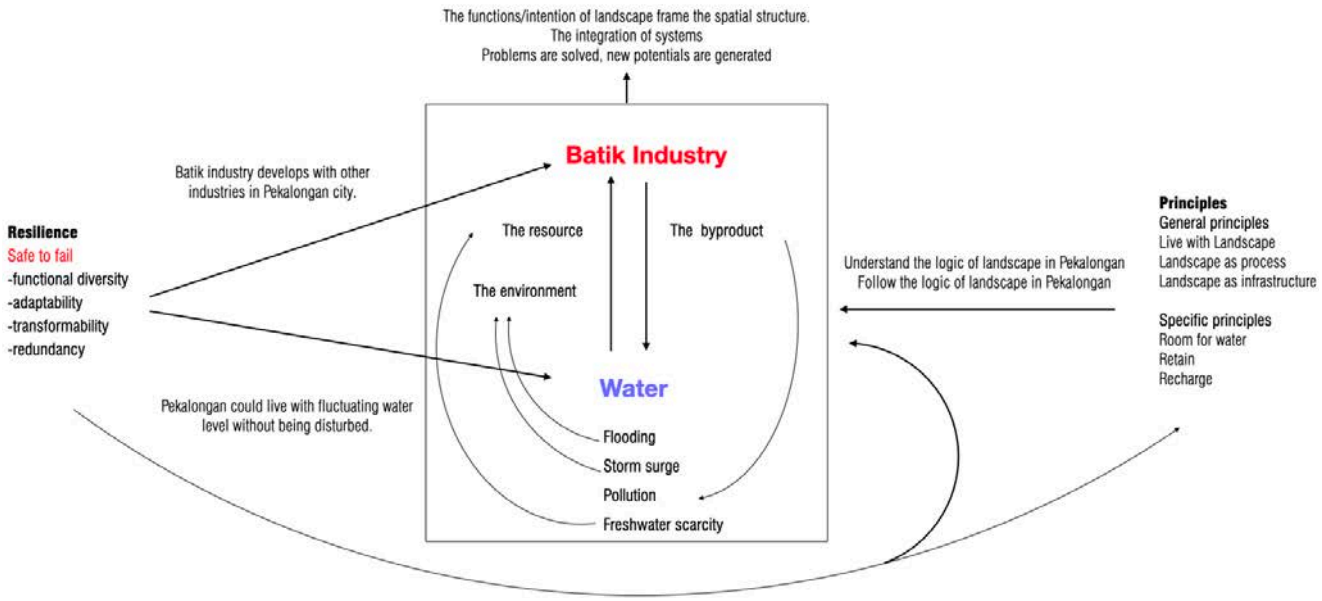
Landscape as the whole

During the exploration process, the three strategies were found connected spatially and logically. All the elements are still in the one system base on the landscape. For long-term development, the pilot projects are the most effective and important ones. They frame the backbone of the plan. Other values will be added to the framework gradually. In the end, it will achieve the whole resilient framework.

FIG. 1.114 The resilient landscape framework in different situations: dry season, wet season, extreme situation.

FIG. 1.115 Strategic plan, pilot project, 10-20 years, 20-50 years.

Conclusion



Reflection

Reflections allows to analyze how personal experiences and observations influence thinking and acceptance of new ideas. Reflections can inspire to think about the developed ideas and to communicate individual thoughts rather than to summarize the views of others.

The objective, a dynamic estuarine landscape interfaces that integrate flood protection, ecology, sustainable economies and recreation, is reached. Delta 21 solves the threat of floods for the far future and increases the use of renewable energies. The layout of the new landscape is in harmony with the expected erosion and sedimentation forces. The new land provides a lot of space with suitable conditions for intertidal areas, marshland, creeks and dunes. The brackish environments in the tidal lake and the fish migration river restores ecological corridors and habitats. The circumstances in energy lake are suitable for aquaculture because every day the water is refreshed. At least a lot of new recreation is added to the Haringvliet region, in nature experience and in the experience of the water level differences of the energy lake.

—— Esmee van Eeden

"The Chinese government and the local municipalities have been working on reducing the impact of natural disasters. The common scenarios for the coastal plans in the world often focus on solutions by constructing still and everlasting structures. However, the proposed landscape framework functions as a dynamic process rather than a static object, interacts with natural conditions, and changes by natural conditions. The landscape framework could also benefit nature and humans in the long term, own potentials in resilience and sustainability, provide conditions for entertainment, education and cultural opportunities and the city transformation.

Hence, this project can be regarded as a pioneering pilot project of an adaptable landscape framework for dyke pond systems, water safety, ecological development, and urbanization in the dynamic coast/ estuary, based on the perspective of a landscape architect, by using interdisciplinary knowledge."

—— Yu Liu

"Research by design and design through research is essential, nearly throughout the whole project. From knowing to understanding, from analyzing to designing, both complement each other all the time. Within this process, design plays a critical role. It helps explore various developing possibilities on a local scale, providing potentials for the future, especially in the village, fish pond, and windbreak forest. Besides, landscape architects give a systematic and multifunctional perspective to understand the landscape and solve the problems of XiChong, involving ecology, water, economic, and socio-culture. In PRD, these landscape approaches are also applicable to the similar bay and coastal areas. It is necessary to mention that detailed information related to water can be added to make it a better project."

—— Kailun Qi

"Research and design are the two core methods during the thesis. They complement each other and work in parallel. The collaboration of design and research conducts analysis, synthesis, evaluation, the final solutions and also the reflections back to the proposed problems. Research in terms of existing materials helps to understand the local situation and leads to clear the design assignment. Design is used as a tool to frame spatial problems, explore possibilities and generate solutions. Sometimes the research and design went into very details which are important but do not necessary to answer the research questions. So it is always important to keep the objective to guide the research and design.

The story in Pekalongan gives some clue what is the possible connection between the natural environment and the social aspects, batik industry in this case and it indicates that against nature is not a sustainable way to deal with climate change disasters. Understand and follow the logic behind the local landscape could save Pekalongan from disaster, so it also applies to other vulnerable coastal cities.

—— Yayun Gao

"I have understood that the urban landscape is a layered and complex system in the research part. In this system, designing a landscape infrastructure means that I need to create the condition that could facilitate new interaction and flows, and these flows shape the built environment and landscape to a better place. Learning from history is very important in this process. It helps me to understand the nature of the challenges by getting into the development of the system. The design principles I learned from history are not set in this project. The toolkit of the design principles has been enriched and could be developed further by design exploration, in which I tested the possibility of them in a different situation. Therefore, design is not only the orientation of the research in this project, it also an important tool for the research. As a landscape architect, I have explored the new possibilities of the historical canals as urban landscape infrastructure, and also the potential of the knowledge from history in the current situation.

—— Yu Zheng

"I think research through design and design research are the two most important methodologies driving my progress in my thesis development. Design is like a sequential upward spiral. Reading the landscape by layers and summarizing the landscape as a system helps me identify more possibilities. Meanwhile, with case studies, literature reviews, discussion, and reflection, I got feedback and inspiration, contributing to further improvements.

This thesis project helps me understand landscape architect's role, which is not simply studying the natural environment or public spaces but more on the relationship between humans and nature. For me, the ultimate vision of landscape design is to harmonize the relationship between human-land and establish a connection between the urban-nature. The value of design is that it not only solves the site's problems. More importantly, the strategies and principles extracted from this project can be learned and optimized when developing other areas."

—— Yun Sun

Conclusion

The landscapes of the Pearl River Delta, the Haringvliet, and the Pakalongan city are the results of dynamic urban development and coastal natural process, which interact and influence each other. By reading landscape in layers and understanding it as a system, students understood the logic of local landscape from natural, social, and cultural perspectives. Meanwhile, research through design and design research as the main tools help students to advance their understanding of theory in the process and promote the design explorations. When facing with challenges of future coastal development, the landscape-based approach provides a way of exploring the possibilities in both local implementation and the regional framework while reconciling multiple disciplines and stakeholders.

Despite the limitations due to the Covid-19 pandemic working in an online environment all the students proved not only to be able to design resilient landscapes, but also to be resilient themselves. They all displayed a steep learning curve, growing into their role of future professionals. From identifying problems, to defining research directions, exploring alternatives, applying principles adaptively to the site, and finally summarizing and reflecting on them. They are all worthy ambassadors of the TU Delft landscape approach.

Although the graduation projects are completed, still big questions are left for further elaboration. What role can the landscape architect play in coordinating the relationship between nature and culture? What is the role of design in addressing complex problems of our times? Theories, strategies and design methods need to be developed further. Well, landscape architecture is like the landscape itself, it is a living system that develops over time...

FIG. 1.117 Online group meeting under covid situation

FIG. 1.118 Steffen sharing drawings and books

FIG. 1.116 An excursion to Rotterdam to visit some projects about architecture, city and nature

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A publication from the Section of Landscape architecture
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