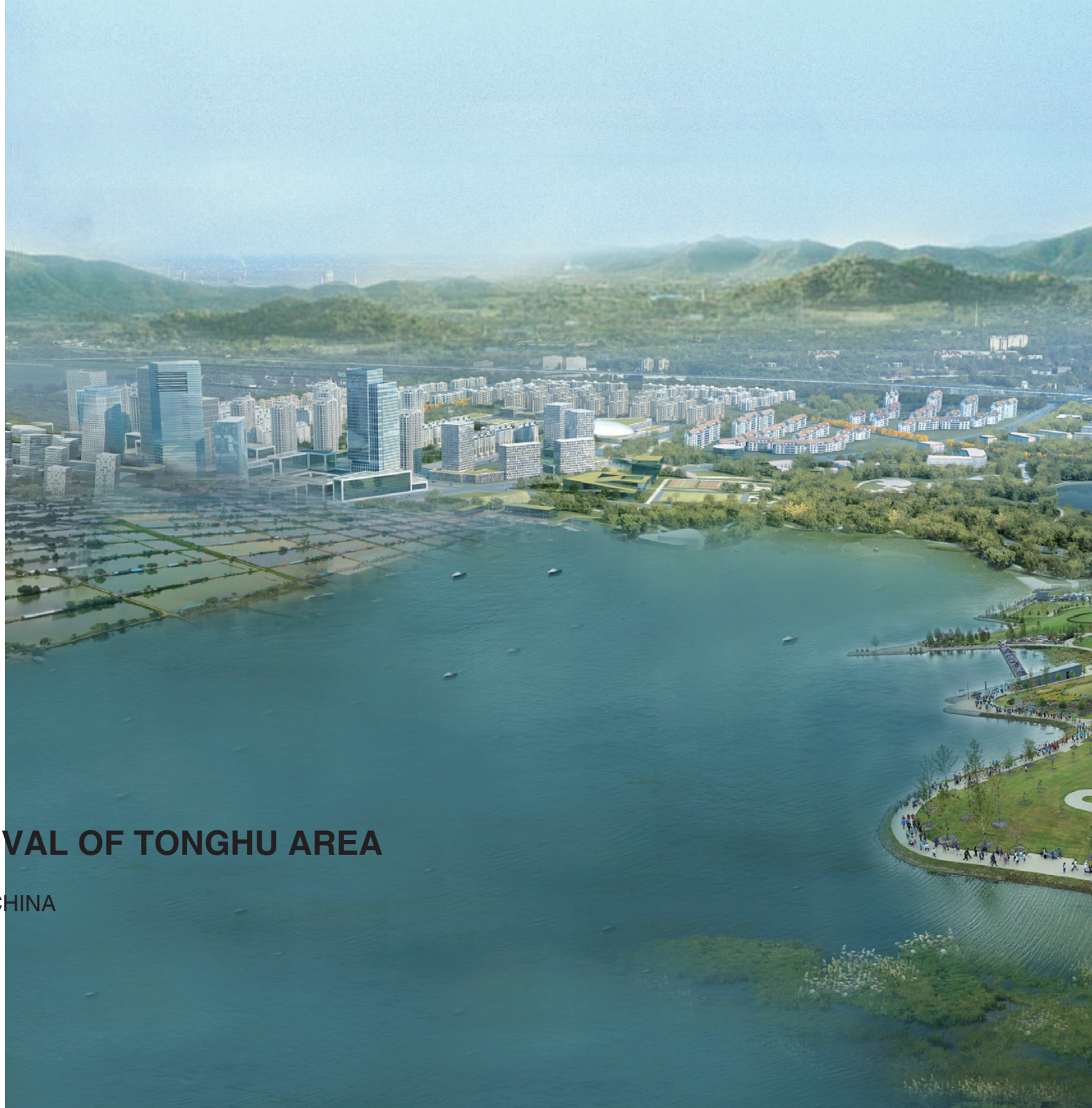

RESTORATION AND REVIVAL OF TONGHU AREA

TONGHU, THE PEARL RIVER DELTA, CHINA

Yun Sun
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Resilient Coastal Landscape
Graduation Project, TU Delft

The Rivers Xiao and Xiang, Dong Yuan
https://en.dpm.org.cn/collections/collections/2014-09-05/96.html

ABSTRACT

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 roosted and bred here.

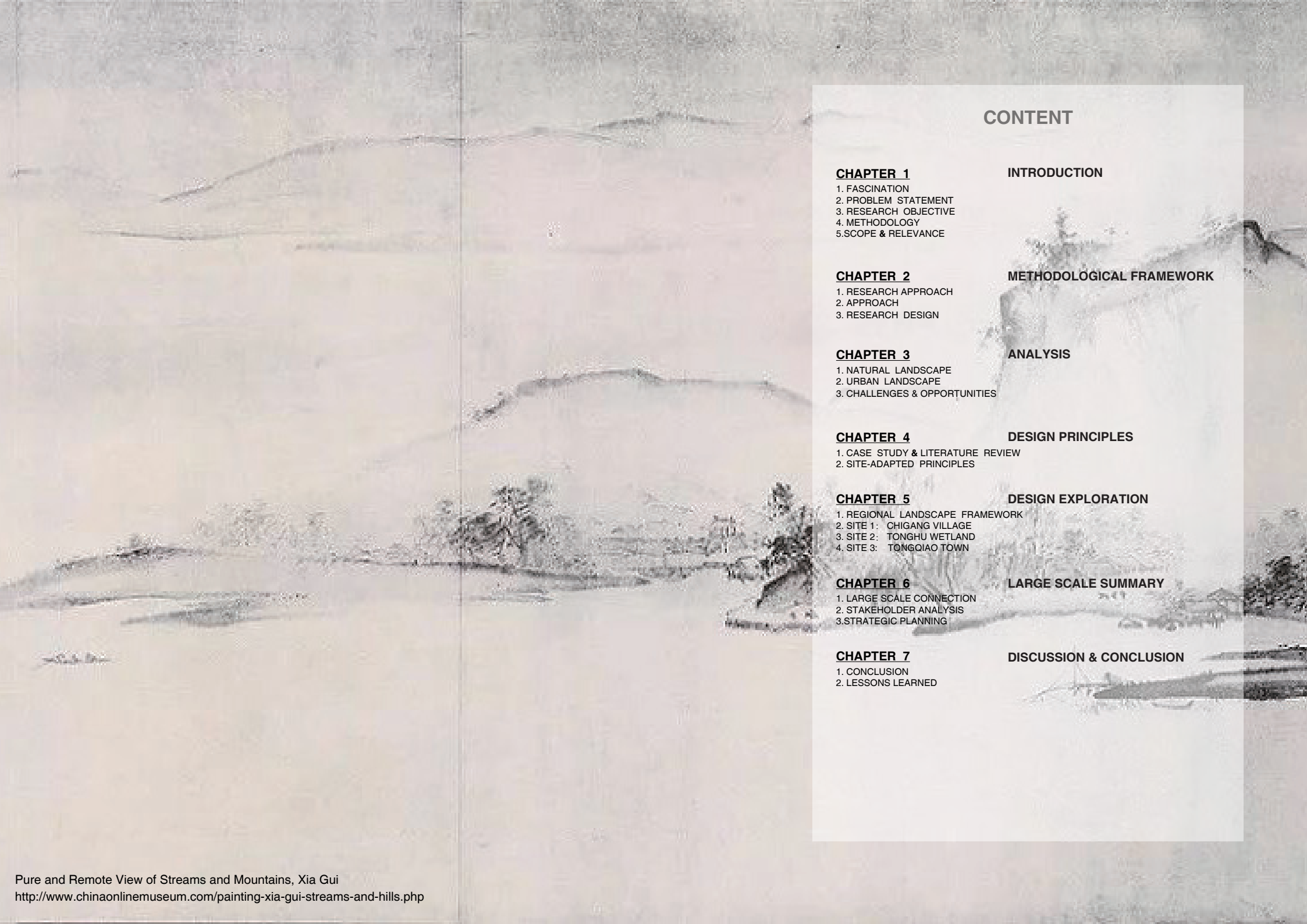
Nevertheless, this incredible picture disappeared after urbanization and industrialization. The reclamation reduced the flood control capacity of Tonghu, brought severe pollution to the water and the soil, and destroyed the local biodiversity. Besides, the development fragmented the green and blue spaces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

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

It starts from studying the local 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. In conclusion, the strategic planning with stakeholders involved will be discussed to get insight into implementing this resilient landscape framework.

In general, this project aims not only to provide a framework for resilient development in the Tonghu area. More importantly, it is to provide a reference for areas with the same problems.

KEYWORDS:
Resilient landscape framework; Green-blue structure; Urban transformation; Ecological restoration; Historical village reactivation; Transitional interfaces; Biodiversity.



CONTENT

Pure and Remote View of Streams and Mountains, Xia Gui
http://www.chinaonlinemuseum.com/painting-xia-gui-streams-and-hills.php

This chapter focuses on the discussion of the research context and related theoretical background to the research objective.

Start with understating the site by giving an overview of the Pearl River Delta in terms of its characteristic landscape and some problems brought by development. Based on the overall context, Tonghu, a typical developing and transforming area, is chosen to study how to reconcile nature and the city by designing a resilient landscape structure. The following in-depth research of the design conditions and problems leads to the identification of this research objective. In this process, the study of theories helps develop a more systematic knowledge of the topics involved. The final relevance is to determine the expected outcome and direction of this project.

CHAPTER 1
INTRODUCTION

FASCINATION

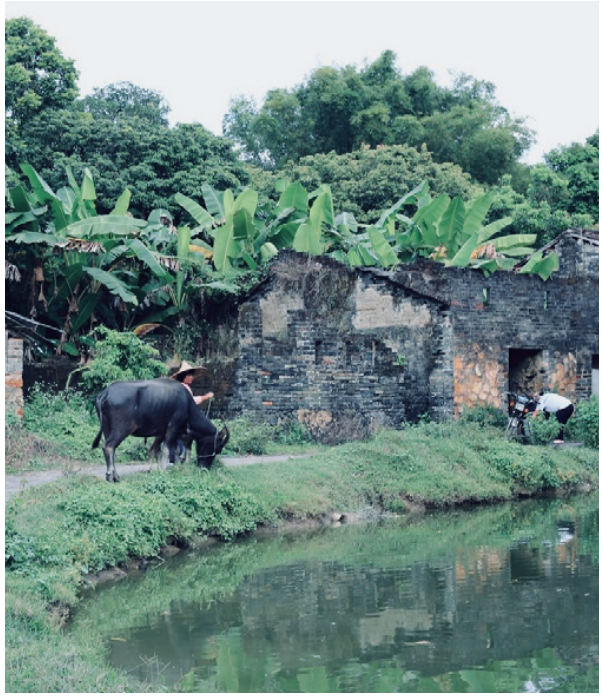
“潼湖水浪高，潼湖多财宝：大海沥鱼沙埔草，黎村女子赤肩斗；
潼湖人力大，潼湖人勤劳：山陂头围鹅鸭多，杨屋磜是龙船头。”

Tonghu is located in the coastal zone, spanning six towns in Huizhou and Dongguan, with low-lying terrain and abundant rainfall, making it a precious wetland area in Guangdong Province.

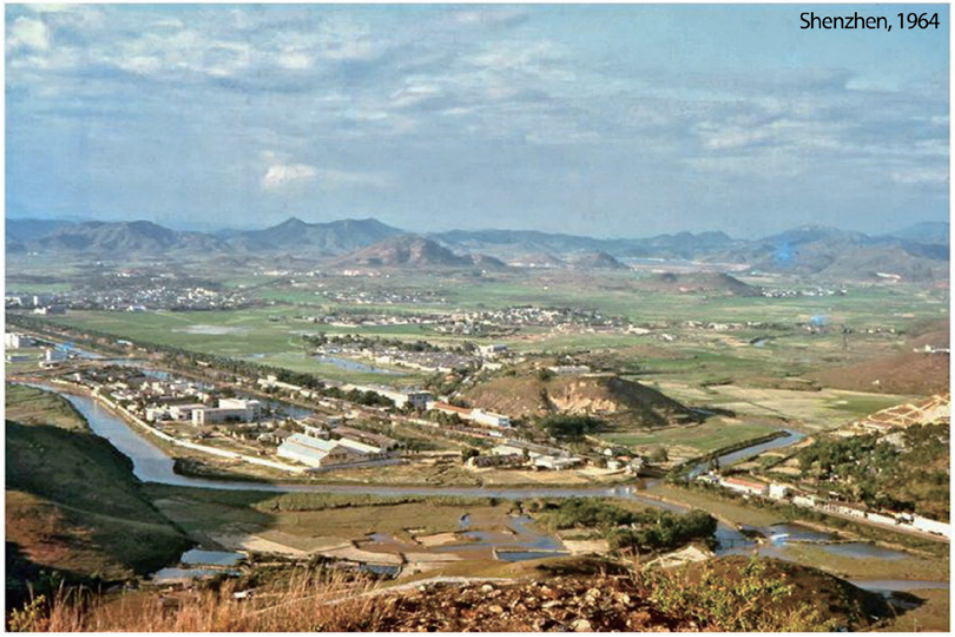
There has been a proverb in Tonghu since ancient times: "Tonghu has high waves of water, Tonghu has many treasures: There are countless fish in Dahaili, and the grass is abundant in Shapu, which makes the dam a beautiful scene in spring. It is famous for girls from Li village and cattle from Chigang village. Tonghu has a large workforce, Tonghu people are diligent: geese and ducks surround Shanpotou village, the layout of Yangwuying village's houses follows the shape of a dragon boat." (In the early days, people were afraid of flooding, so they lined up their houses in the shape of a boat's prow to make it safe.).

Because there is no large-scale development, Tonghu reserve many site identities. It is vast in scope, transforming into lakes and reservoirs for water storage during the monsoon season. Moreover, it is used as arable land for crops and vegetables in the dry season. It used to function very well in regulating floods and runoffs. Tonghu wetland is close to the East River and has rich water resources, providing habitat and breeding grounds for many birds and wild animals.

We can see the traditional dike-pond system. People used to drain the extra rainwater from the fishponds and farmlands during the monsoon season to ensure daily production. There is also an artificial wetland that once attracted thousands of birds during the migratory season. Besides, there are many historic villages. These villages follow a "Feng Shui" principle, with mountains at their backs and water in their faces, and some are still full of life despite the centuries.



Tonghu Photography
http://m.xinhuanet.com/2017-03/13/c_1120564397.htm



"The Great Leap Forward: China's Pearl River Delta Now and Then"
by The Guardian (UK)

PROBLEM STATEMENT

/Rapid Urbanization/

The Pearl River Delta is located in the south-central part of Guangdong Province. It's downstream of the Pearl River, adjacent to Hong Kong and Macao. The PRD includes nine cities: Guangzhou, Shenzhen, Foshan, Zhongshan, Huizhou, Dongguan, Zhuhai, Jiangmen, and Zhaoqing, with a land area of 54,763 square kilometers, accounting for 30.5% of the province.

Since the reform and opening up, with the rapid economic development, the level of urbanization in the PRD has increased significantly. Driven by foreign investment, the rapid rise of the manufacturing industry in the PRD city cluster requires a large scale of industrial workers, attracting a large number of the migratory population inside and outside Guangdong Province to gather in the PRD city cluster.

Especially after 2000, the PRD has gradually developed into the urban cluster with the largest population concentration, the most significant innovation capacity, the most developed economy, and the highest degree of urbanization in China.

In 2016, the urban population in the PRD region was 50,897,000, an increase of 20,187,000 compared with 2000. In the 2015 World Bank report, it showed that the PRD surpassed Tokyo, Japan, became the world's largest urban agglomeration in terms of population and area.

However, the rapid urbanization has led to many problems, such as the industrial structure needs to be optimized at a deeper level, the civilization process of agricultural population is lagging behind, the development of public services and infrastructure support is relatively slow, the shortage of land resources is prominent, ecological and environmental issues still remains unsolved.

Although the urbanization and industrialization of Tonghu started late, the impact still increased significantly in recent decades. According to statistics, in 2010, there were 230 industrial enterprises, most of which are with heavy pollution. Meanwhile, due to the shortage of land resources, urban expansion has occupied many wetlands, fishponds, and farmlands, impacting its ecological environment.

"Urbanization of the Pearl River Delta" observed by NASA

PROBLEM STATEMENT

/Ecological Degradation/

In the early years of China's development, Tonghu was still a small basin-like plain, with about 100km2 of natural water body.

In 1966, the army started the reclamation, which significantly reduced the original size of the area and changed the natural environment significantly. The grasslands disappeared, and the species of birds, fish, and shrimps were reduced, replaced by thousands of hectares of newly reclaimed rice fields.

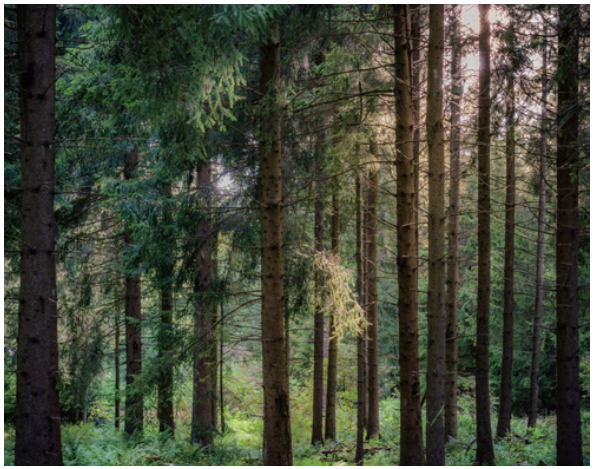
Subsequently, due to the rapid industrialization and urbanization in the PRD, the number of factories and small family workshops around Tonghu started to increase.

Combined with the growth of the residents, the industrial wastewater generated by some industrial and mining factories (especially chemical factories such as electroplating and bleaching and dyeing) was directly discharged into Tonghu without treatment or not up to the standard.

Moreover, a large amount of domestic sewage was also continuously discharged into the wetland. As a result, sand, gravel, and mud flow into the wetland, resulting in the 0.8m rise of the lake bed, forming a more threatening overhanging lake.

On the other hand, due to the long-term lagging water conservancy construction, the wetland water flow is not smooth, which eventually leads to severe water pollution and eutrophication problems. The aquatic environment is damaged, coupled with the spread of water lilies and other vicious invasive plants, the number of fish and shrimp is greatly reduced, wetland biodiversity is declining, ecological and environmental problems are increasingly prominent.

Habitat destruction has also affected the survival of the birds and wildlife that were originally here. For example, the brown-winged cuckoo and the tiger frog, which are categorized as the national class II protected animals, are all under serious threat.



Tonghu Photography
http://m.xinhuanet.com/2017-03/13/c_1120564397.htm

PROBLEM STATEMENT

/Flooding & Urban logging/

Decades of reclamation and canalization have also weakened the natural water bodies' capacity to regulate and store flood, especially during extreme weather conditions.

The first problem is that the current status quo flood control levees are only of the 1-in-10-year standard.

Most flood control levees are constructed with soil, and some sections of the levees have not been reinforced. In the case of heavy short term rainfall, it is easy to have pipe surges and seepage. The whole dike system is not up to the standard of 20-year or even 100-year floods, and once it encounters a significant flood, there may be a breach, a flooded dike, and other dangerous situations.

The second problem is that the drainage channels and ditches are inadequate in water storage and drainage capacity.The early years of canalization resulting in the low depth and width of the flood drainage channels means it can effectively achieve neither the purpose of water storage, nor flood control. Especially when encountering heavy rainfall, flooding is easy to occur.

The third problem is the lack of sponge city design.Due to the lack of green space and the hardening of the subsurfaces, rainwater has no place to infiltrate but retain in the city.

The fourth problem is the inadequacy of sewage treatment facilities and equipment. This has led to excess nutrients in the lake (river) water, rich in nitrogen, phosphorus, potassium and other elements. Many flooding rivers and ditches and most of the water surface of Tonghu are full of water lilies, which bringsdanger to the flood control and drainage and affects the growth of other water plants.

RESEARCH OBJECTIVE

/Research Objective & Sub Questions/

The objective of this research is to:

EXPLORE POTENTIALS FOR THE DEVELOPMENT OF A RESILIENT LANDSCAPE FRAMEWORK THAT PROVIDES CONDITIONS FOR URBAN TRANSFORMATION AND ECOLOGICAL RESTORATION WHILE IMPROVING FLOODING CAPACITY AND BIODIVERSITY IN TONGHU AREA.

The project intends to build a blue-green framework that can guide and guarantee the symbiotic development of urban and nature in the future. The framework is based on the existing natural landscape structure and integrates potential spaces with ecological values. It can also help restore the ecological bases of Tonghu, improve the flood storage and regulation capacity, and assist the surrounding suburban areas to transform into an eco-friendly smart city.

In order to deepen this research topic, the following sub questions need to be considered:

1. HOW THE LANDSCAPE FUNCTION?

- How have nature and urban evolved? What are the major components of these landscapes, and how do they interrelate?

2.HOW TO CREATE A RESILIENT LANDSCAPE FRAMEWORK?

- What kind of resilient landscape framework can balance nature and city in promoting ecological restoration and urban transformation? Moreover, what spatial strategies and design principles can be applied to promote this landscape framework?

3. HOW TO APPLY IT TO TONGHU?

- What are the spatial possibilities to create an adaptive landscape framework? Furthermore, how to apply these design principles and strategies in different geographical environments (mountain or valley or suburban or urban areas) about water management, ecological restoration, and urban transformation?

4. WHAT IS THE TAKEAWAY?

- Is this resilient framework applicable to other undeveloped or developing areas in the PRD to help them achieve a symbiosis between nature and city in their future development?

CAN IT BE SOMETHING LIKE THIS?

Eco village by Roman Roschencko

Eco village by Roman Roschencko
https://www.behance.net/gallery/35406455/Eco-Village

RESEARCH STRATEGIES

/Research Through Design/

Research through design as method to explore possibilities. Three phases are distinguishable in the search associated with a design process: analysis, synthesis, and evaluation. (Nijhuis & De vries, 2019) The analysis focuses on collecting and integrating data to create a scientific and objective understanding of the site. Synthesis is a process of exploring initial solutions and refining these ideas further based on the results of the analysis. Evaluation is a comprehensive approach to finding the opportunities for challenges, and exploring multiple possibilities to provide multiple ideas for design. Design as a dialogue between a problem and a solution through analysis, synthesis, and evaluation. (Nijhuis & De vries, 2019)

/Design Research/

Design Research refers to design-oriented research. Because of the design-oriented direction, the research is not boundless. The research includes learning the relevant knowledge and case studies, analyzing the design needs and problems. This approach saves a lot of time in the design process helps to integrate knowledge into design thinking efficiently. Literature review and case study are two helpful approaches in the design research process. They can help provide a general perception of the interdisciplinary knowledge related to the design, leading to a further scientific and systematic understanding of the site. At the same time, the interpretation of real projects (with similar design conditions) can help designers learn how to apply design principles adaptively to the site.

These two methods are not separable. Design is like a sequential upward spiral. In the process of design exploration, more problems are finding out by reading the site more deeply. We can target these problems with case studies, literature reviews, consult experts in related fields, and discuss with classmates and teachers to get feedback and inspiration. These ideas can lead us to improve the design further.

SCOPE AND RELEVANCE

/Unstoppable Urbanization/

According to the National New Urbanization Plan (2014-2020), China's urbanization rate is growing at an annual rate of 0.9 %. This trend will remain unchanged, which means that more new areas will be developed and more land with certain ecological functions will be encroached upon. Under the current hard constraint regulation to protect the ecological environment, the superior ecological areas are prioritized for protection. However, how should we guide the future urban development in areas that have an excellent ecological base, but its ecological functions were weakened by rapid development in recent years? Should natural areas be used for urban development, or should urban development be prohibited? Or is there a way to integrate urban development and nature conservation? Is it necessary to partially restore or rebuild their ecological functions and make them functional again? These are the questions we need to pay attention to in the next decades of development.

/Voices from Landscape Architects and Urban Planners/

In recent years, ecological theories are introduced in urban planning and design, such as the "anti-planning" theory proposed by Kongjian Yu and the Low-impact Development theory. However, the former focuses on ecological baseline analysis before planning construction sites, drawing ecological control lines, or building ecological infrastructure systems. The latter focuses on the specific area of stormwater management. Tonghu, on the other hand, differs from those blank spaces. It has extraordinary innate natural conditions. Nevertheless, industrialization and urbanization have weakened the original ecological functions. In such places, in addition to protecting the remaining ecological substrate, as designers, we need to pay equal attention to ecological restoration or reconstruction. We hope to provide for linking existing and potential blue-green spaces based on protecting and restoring the ecosystem. In this way, we can create a resilient landscape framework that works as guidance as well as a buffer for future development, assisting the city in developing into an eco-friendly smart city.

/Into the Future/

How to reconcile nature and the city? This question is informative not only for Tonghu but also for PRD's undeveloped or low-intensity developing cities. This study aims to use a practical case - planning the Tonghu area's landscape structure - to explore the ecological restoration methods of ecologically damaged areas and the ecological transformation of surrounding industrial and urban areas.

STRUCTURE OF THESIS

In chapter two, the methodological framework is explained and serves as the basis for the whole thesis development. Then in chapter three, through reading landscape as a system, problems and challenges are identified, which, in chapter four, are addressed by landscape-based design approaches. Then a resilient landscape framework is proposed and explored on different scales. Then chapter five summarizes referring different designs back to large scale and discusses their implementability with stakeholder analysis and strategic planning. The last chapter is to look back at the whole project and give reflection and conclusion.

This chapter outlines the theoretical background, research approach and research design.

It gives us a more systematic understanding of design: the development of theory, specific ideas, research object, etc.
Research approach: how to make it operational? What kind of research methods can help us deepen our research? For example, methods for understanding the site? Methods for understanding design principles?
Research design: what are you going to do? It involves some specific research methods, such as site research, photos, mapping, interviews, visualization, case studies, literature reviews, etc. These methods can help us develop some ideas, and by combining representations, we can test whether the idea is operational. Keep repeating this process, and we will find an optimal solution.

CHAPTER 2
METHODOLOICAL FRAMEWORK

METHODOLOGICAL FRAMEWORK

/Theoretical Background/

/Resilient Landscape/

Broadly speaking, resilience refers to a system's ability to maintain the same functional structure when it receives an external shock. Resilience does not necessarily mean that the system after a disturbance looks the same as, before the disturbance, it will maintain its original function. However, various parts of the system may have changed and adapted to the new environment.

The evolution of resilience thinking has gone through three main stages, from "engineering resilience" to "ecological resilience" and finally to "evolutionary resilience."

First, the thinking of resilience was introduced by theoretical physics, which mainly refers to the ability of mechanical systems to restore the original state of "engineering resilience." It proposed that a system has only one equilibrium state, reduce the system change can enhance the system's stability.

With ecology development, ecologists introduced the concept of resilience into ecology—the proposed ecological resilience, a theory that suggests that a system has more than one equilibrium state. The equilibrium state formed by a system after external disturbance can be inconsistent with the previous equilibrium state (Sillitoe 1998).

Finally, evolutionary resilience overturns system equilibrium perception by arguing that no ecosystem can be maintained in a particular state. The whole system, equilibrium states, and equilibrium points are constantly changing, so it is not meaningful to discuss the system's equilibrium. This concept of "dynamic non-equilibrium" completes people's thinking from result to process and paves the way for landscape design to understand and apply resilient landscapes in-depth (Folke et al. 2002).

Landscape resilience refers to a landscape system's ability to withstand and repair itself without fundamental changes in the landscape system's structure and the evolution of the internal community of life when it is disturbed from outside. Resilient landscapes have two characteristics: one is the rigidity of not being deformed by external forces. The other is the ability to recover quickly to reach a new balance after excessive deformation.

Resilient Landscapes are important resilient spaces used in cities to resist natural disasters and maintain urban ecosystems' stability, emphasizing natural ecosystems' ability to repair themselves based on artificial participation. Resilient landscapes are designed to combine different ecological space functions with stormwater management, biological habitat, public recreation, and aesthetic needs. It connects the "green" and "blue" hubs, links, sites of nature and city. Meanwhile, it is an essential ecological barrier for the urban ecological environment.

/Landscape-based Regional Design Approach/

The landscape-based regional design aims to afford spatial development by applying bioregional planning and design principles that regard the urban landscape as an inclusive, dynamic and complex system. (Nijhuis et al., 2019)

Based on natural and urban landscapes, the design helps identify strategies and interventions for the future sustainable development of nature and urban by taking advantage of the landscape's diversity, dynamics, and adaptability.

The landscape-based regional design identifies and guides the most advantageous places, functions, scales and inter-relationships for a region's sustainable growth — strategy — and sets the scene for local initiatives — intervention. Regional design forms the physical shape of regions based on knowledge of the natural and urban landscape physiology and functioning and focuses on generating circumstances for future development. (Nijhuis et al., 2019)

Meanwhile, landscape-based regional design is not only the landscape itself. It more reflects the significance of landscape as a cross-discipline by integrating multiple disciplines such as water, engineering, ecology, and environmental protection. It also considers the opinions of government, people, NGOs, academic institutes, and other stakeholders to give the most appropriate regional landscape solutions.

/Landscape as a System/

“Involving a number of subsystems, landscape can be considered as a complex and dynamic system.” (Yılmaz,2014) This system includes many layers, such as nature, transportation network, and infrastructure. Each layer includes many elements, for example, nature includes elevation, soil, humidity, plants, animals, etc. Each layer has its characteristics and interacts with other layers. In the design, we need to understand the characteristics of each layer, but at the same time we need to see the landscape as a whole, and through some adjustments we can bring some improvements and this can lay the foundation for future development.

In total, there are two types of typical landscapes in this project - natural and urban. The natural landscape includes water, soil, vegetation, and wildlife; the urban landscape includes residential areas, industrial areas, historical villages, wastelands, and transportation systems. By studying each layer's characteristics and the relationship between them, we can understand the evolutionary history and the reasons for forming the natural-urban landscape of Tonghu. Furthermore, later provide ideas for identifying and solving problems.

APPROACH

/Layered Approach/

The Layered approach is a way of understanding landscape as a system.

The landscape of Tonghu Area can decompose into three layers: natural, cultural, and urban. Data is collected by integrating government planning policies, literature review, and QGIS analysis.

The natural layer covers the existing green-blue network and ecological substrate, which serves as the base for resilient development. The cultural layer includes the gathering of historical villages. The urban layer integrates three typologies of industrial land and urban residential areas with different densities.

Meanwhile, the Mapping Method is also applied. ‘The unfolding agency of mapping may allow designers and planners not only to see certain possibilities in the complexity and contradiction of what already exists but also to actualize that potential.’(Corner,2011)

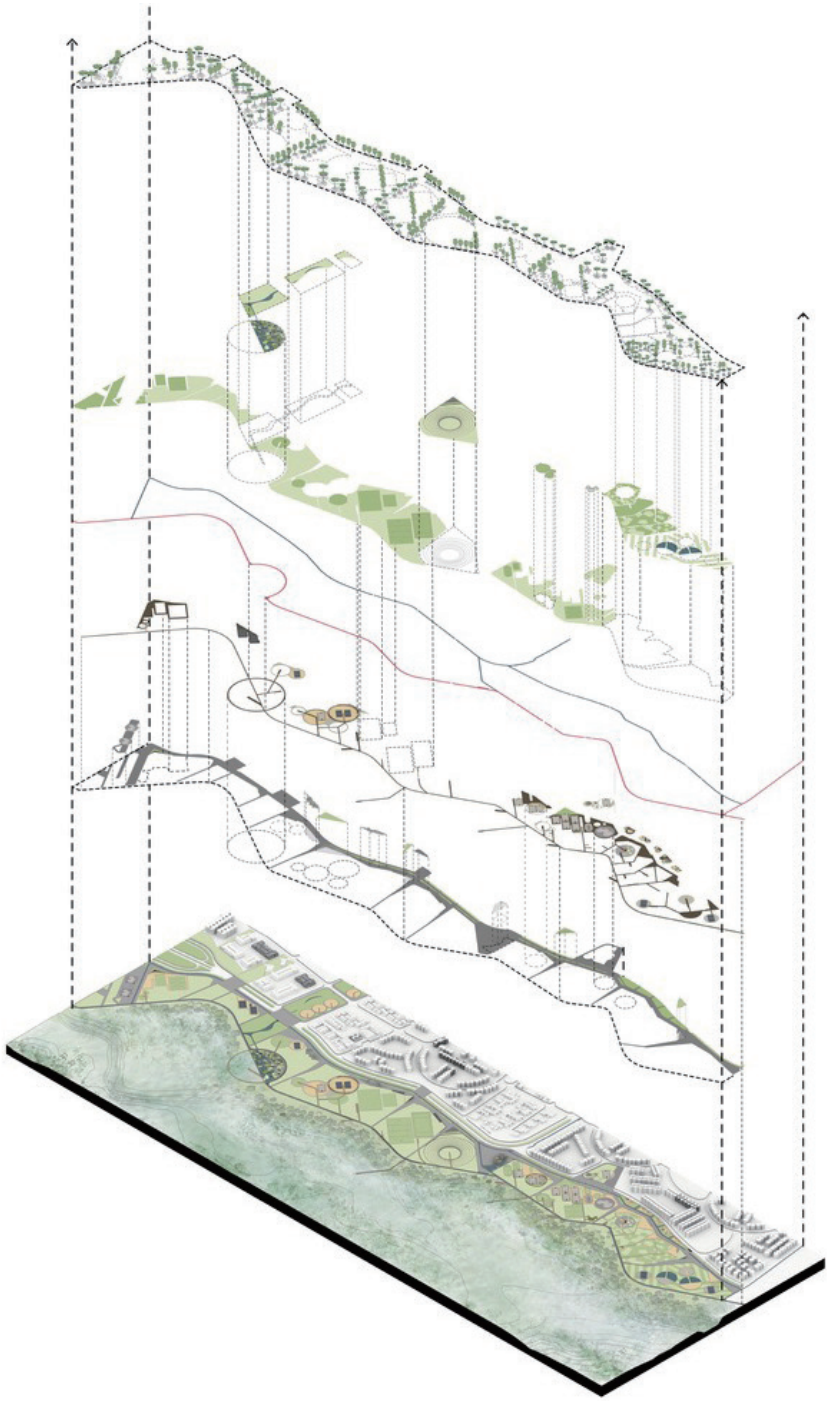
The overlap of different landscape elements helps to explore the potential challenges and opportunities of the site. These evaluation analyses can scientifically support the design exploration.

For example, by overlaying the green structure and urban industrial and residential areas, we can see that the existing green spaces in the city are small and scattered, resulting in a discontinuous ecological connection in the city. However, those wasteland and class III industrial land (heavily polluted) have great potential for regeneration and can therefore be converted into urban green spaces and absorbed into the green network.

/Multi Scale Approach /

Because landscapes are spatially heterogeneous areas, their structure, function, and change are scale-dependent (Turner, 1989). Many designs only consider the site's function at its scale, ignoring the connectivity and interaction with other scales, resulting in the envisioned effect not being realized. Hence, the integration of different landscape scales of analysis provides a significant opportunity to develop further the scale and benefits of the existing frameworks (Taneha & Richard & William & Meta, 2013).

So the multi-scale approach proposed here includes three main scales-macro scales, mesoscale and micro scale. The macro-scale aims to create a resilient blue-green network that integrates the existing landscape spaces and potential ecological value areas. The mesoscale focuses on how the different categories of design locations achieve their proposed functions. The microscale will address the specific design details, such as ecological engineering methods and the communities of native species.



Example for Layered Approach
Juan Amarillo Park by DARP

RESEARCH DESIGN

/Mapping/

Mapping can help us understand the landscape as a system, how each of its elements works and how they affect each other. We can get data resources through papers, planning documents, open-source maps, QGIS analysis, etc. Then pick out the layers we think are useful to analyze. By overlaying different layers or highlighting or deleting elements, we can identify the site's problems and potentials, guiding our design.

/Literature Review & Case Study/

After constructing the research objective, then the question is how to design? At this stage, referring to cases in the same natural or cultural context or cases addressing the same problem can help us get some ideas. The existing projects are more worth reference because we can see how much the project vision has been realized and its positive and negative impacts. Take the best from the worst and try to incorporate these design principles into our project.

/Online Filed Study/

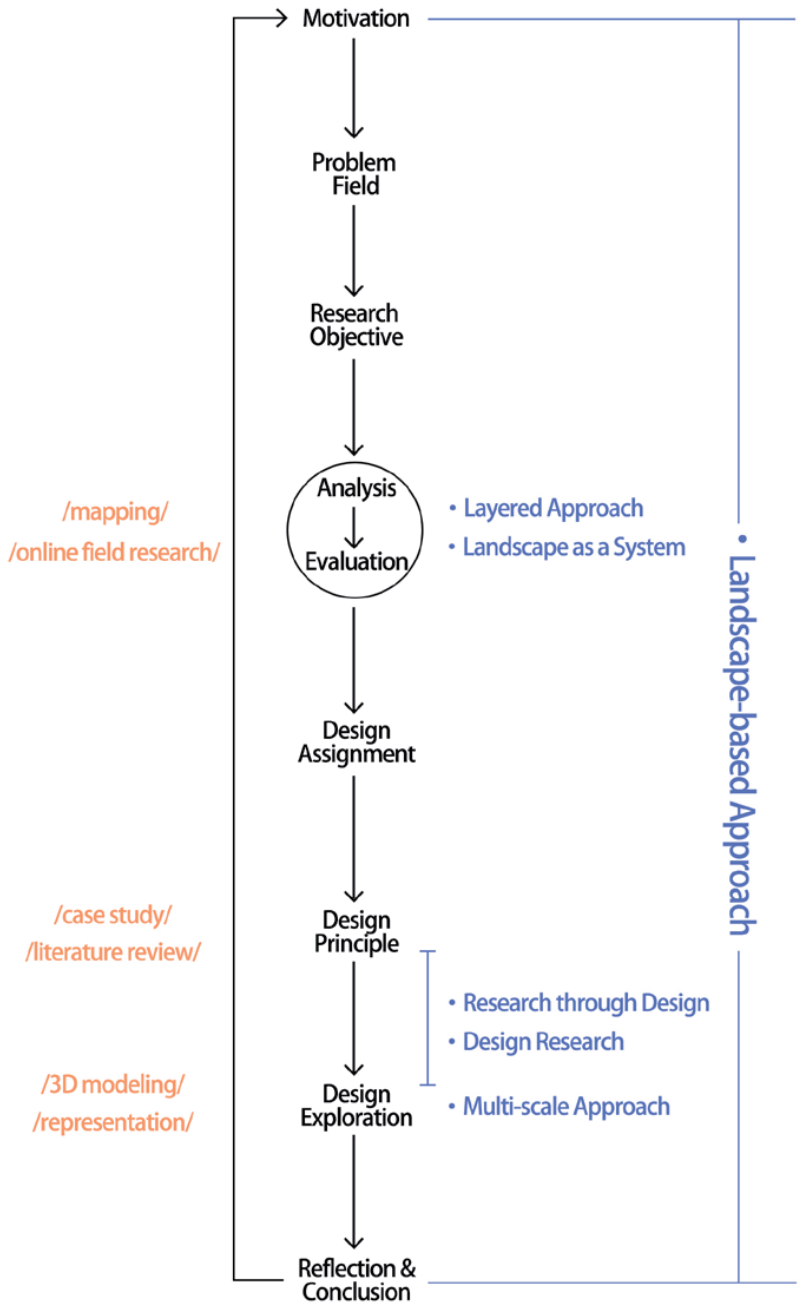
Due to the corona situation, there is no way to reach the site to conduct on-site research. So I took an online research approach. Through some travelogue sharing platforms, I learned about the real situation of some sites that I could not read from the maps and literature. Including some photos of the local customs and natural scenery gave me a more personal perception of the site's atmosphere.

/3D Modeling/

3D modeling is a useful way to help experience the spatial feel of the site. By combining Google Maps, photos, and terrain (extracted by QGIS), a model of the site can be roughly constructed. This digital model helps to spatialize the two-dimensional plane into a three-dimensional space. In this way, we can better explore whether an intervention works and consider its spatial effects in the design exploration stage.

/Representation/

Representation is a fast and direct way to anticipate results. Visual thinking, such as collages, can help us test our ideas visually on the site, and then we can consider if this is the function of atmosphere we want to achieve as designers. Visual communication, such as renderings, can help us communicate vividly with other designers or the public so that others can immediately understand our intentions and give feedback. So visual thinking and visual communication are both critical in the design phase.



This chapter focuses on exploring the challenges and opportunities of the site by studying the landscape structure (the landscape elements and their interrelationship).

"Involving a number of subsystems, landscape can be considered as a complex and dynamic system." (Yılmaz,2014) This system includes many layers, such as nature, culture, and infrastructure. Each layer has its characteristics and interacts with other layers. It is important to understand layers one by one but still see the landscape as a whole.

There are two types of typical landscapes in this project - natural and urban. Reading layers and finding their relationships help to understand how the landscape is composed and how it functions. This leads to identifying the problems and potential of the site, which further directs the design.

CHAPTER 3
ANALYSIS

Tonghu Wetland
Photoed by Recola Chou

NATURAL LANDSCAPE

Nature is the foundation on which everything is evolved. In earlier times, when there was no human activity, the mountains, water, and creatures in nature have built a dynamic ecological balance through natural succession. The artificial landscape is also formed based on the natural landscape. Therefore, studying how the natural landscape is composed and how it changed under artificial intervention helps discover the essence of problems and find the design breakthroughs.

So how to understand natural landscape? What are the main layers of the natural landscape?

Forests are mainly divided into two categories: artificial forests and natural forests. The zonal vegetation in the Tonghu area is subtropical evergreen broad-leaved forest. The forest ecosystem of low mountain hills and mountains represented by subtropical evergreen broad-leaved forest is well preserved in nearby and nearby areas.

forest

Reservoirs are categorized into natural-formed type and quarry-remained type. Located on higher ground, the mountainous area, the reservoirs can collect and store natural rainwater. The surrounding ecological environment is superior, with rich flora and fauna resources.

reservior

Tonghu has many significant **wetland** characteristics. For example, the wetland elements such as artificial wetlands (historical function: flooding regulation), river wetlands, inlet wetlands, mudflat wetlands, wet plants, aquatic plants, wetland animals (benthic, fish, birds, amphibians, reptiles, etc.).

wetland

In 1966, due to production needs, Tonghu reclaimed a large number of **fish ponds** based on natural wetlands. In conjunction with this, a dike-pond system was created that could discharge excess water in the rainy season from the smallest unit of fish ponds in a graded way to the East River.

fishpond

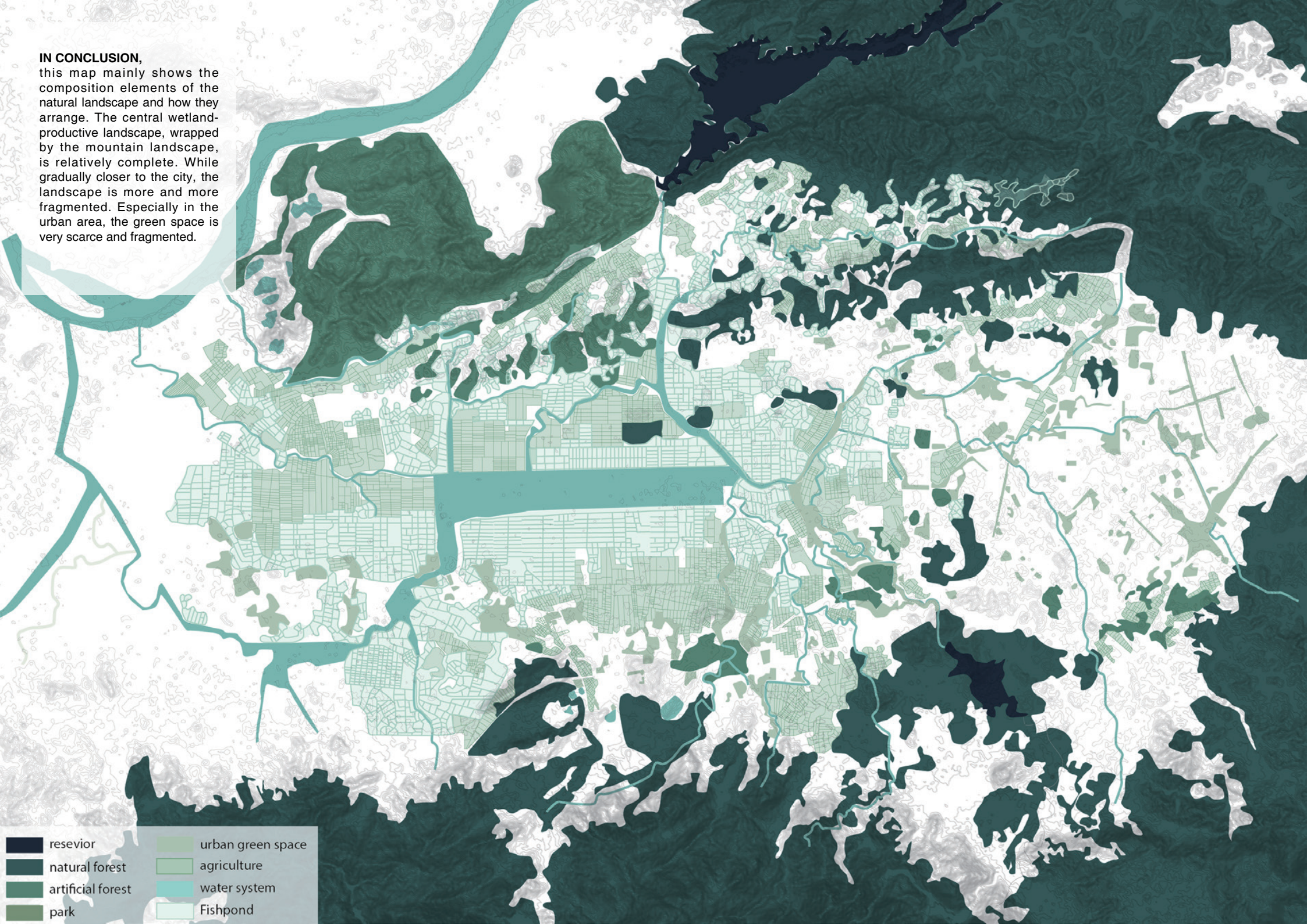
Along with fishing industries' development, some surrounding areas, which are away from the large water bodies are reclaimed as **farmlands**. These farmlands are rotated to match the local rainfall and soil conditions and are mainly planted with rice, vegetables, and fruits.

farm land

The early urbanization did not consider a blue-green network to control the urban expansion. As a result, a large number of lands were directly transformed to residential, industrial, and commercial land use, resulting in limited and scattered green areas within the city. Moreover, those green spaces do not form a park system and have a low ecological value.

urban parks

IN CONCLUSION,
this map mainly shows the composition elements of the natural landscape and how they arrange. The central wetland-productive landscape, wrapped by the mountain landscape, is relatively complete. While gradually closer to the city, the landscape is more and more fragmented. Especially in the urban area, the green space is very scarce and fragmented.



BLUE STRUCTURE

/Water with Flexibility/

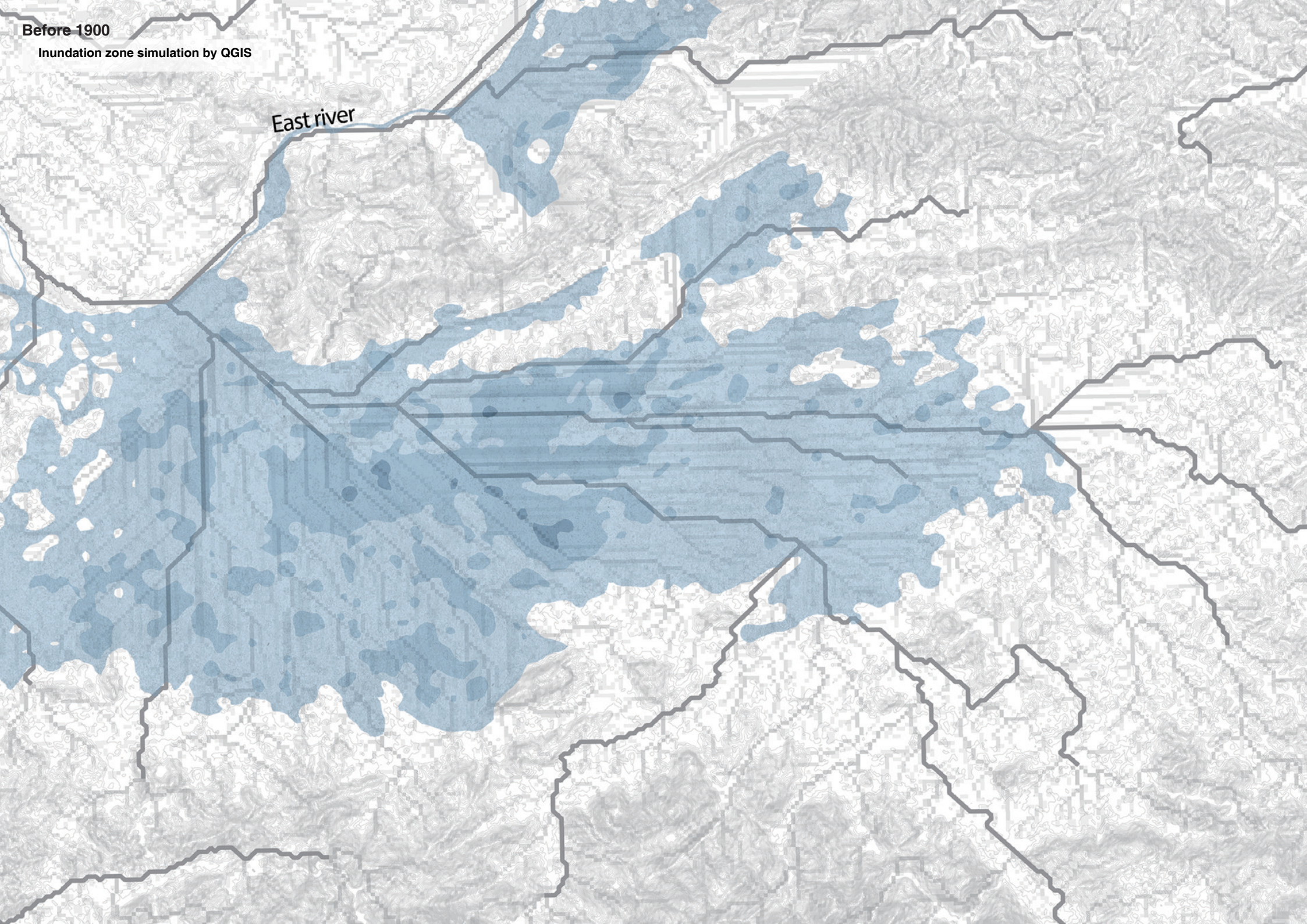
Huiyang County Political District Map

Before 1960, Tonghu was a 100km2 waterlogged depression surrounded by a mountain range spanning more than 100 miles long, where rainwater from the mountain range converged to form a lake in the summer rainy season. In spring, autumn, and winter, the area is a small basin-like plain.

More than 670 hm2 of lake wetlands, 630 hm2 of river wetlands, and 1,350 hm2 of reservoir wetlands could be found in the Tonghu area.It was one of the very few typical inland freshwater lake wetlands in Guangdong Province. The area has sufficient light, abundant rainfall, fertile soil, and wide ecological suitability. So it developed an integrated wetland ecosystem, which is a rare natural treasure, both for the habitat growth of plants and animals and the development of ecological tourism.

According to statistics (Dongfenng Li, 2011), the wetland used to have 203 species of vegetation, 51 species of birds, and 30 kinds of fish. There are still two species of national Class II protected animals (brown-winged cuckoo and tiger frog). Furthermore, ten species of provincial key protected terrestrial wild animals (black water hen, white-winged gull, heron, great egret, cattle-backed heron, night heron, yellow reedbuck.). It is called a rare "biological treasure." Moreover, historically, Tonghu Wetland was also an essential natural ecological regulating area for water conservation, water purification, flood and drought prevention, and climate regulation.

In conclusion, the landscape (mountains with water) is the foundation of development. Before the reclamation and canalization of the Tonghu wetland, it had a very superior natural basis: abundant water and grass, rich in species. It nurtured the development of historical villages, dike-pond systems, and farmland. Although some traditional landscape has disappeared or been artificialized, the palimpsest left behind are still precious and of high research value.


Before 1900
Inundation zone simulation by QGIS
East river

BLUE STRUCTURE

/Water with Life/

“近水源，避水灾。背山面水，负阴抱阳。”

Initially, the arrangement of these historical villages based on three main principles:

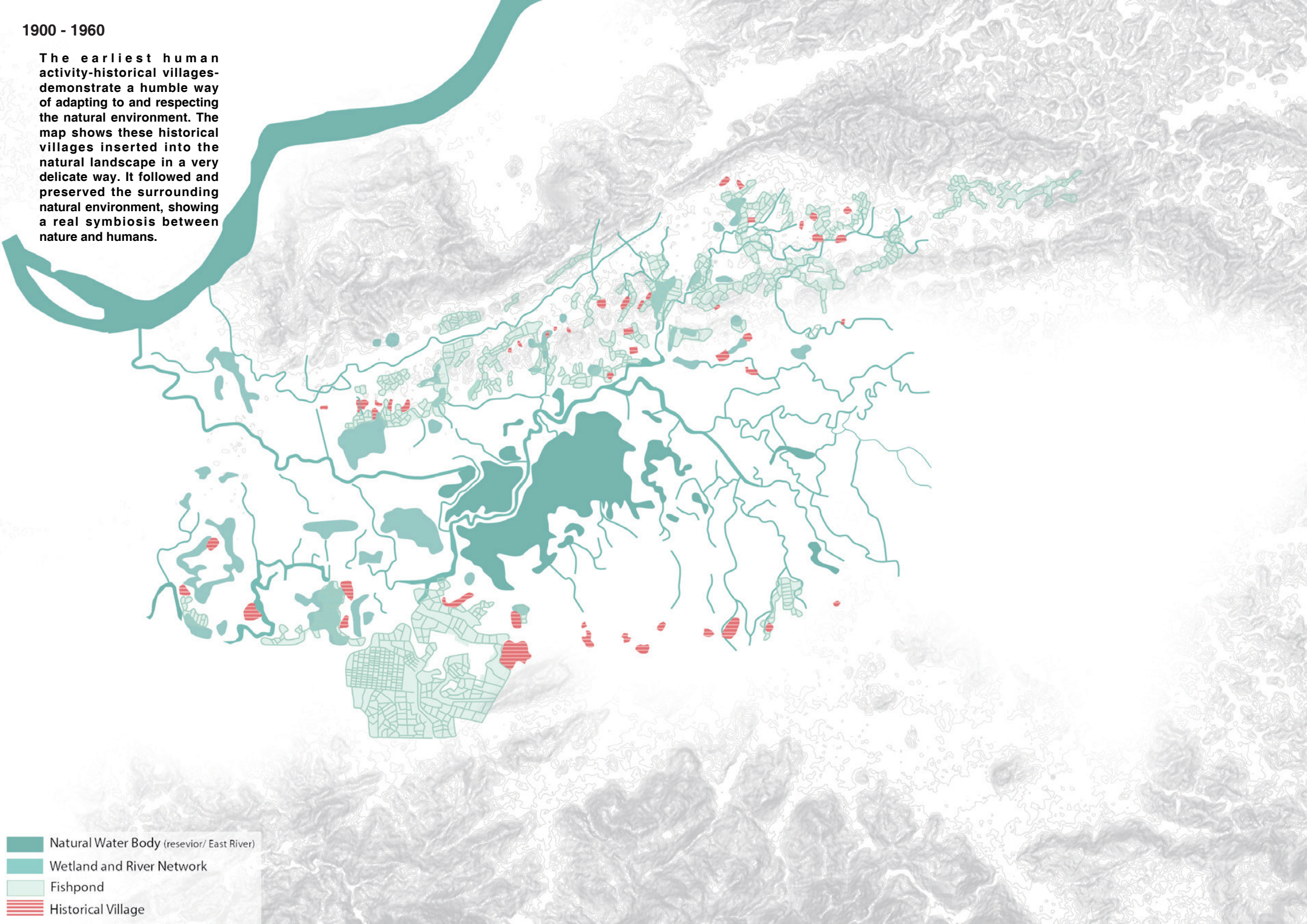
1. Productive: proximity to farmland
2. Safety: higher terrain, avoiding flooding
3. Water: sufficient water resources

This is why villages could be found close to ponds and rivers for both irrigation and flooding. Moreover, the villages were mainly following the direction of the summer wind: southeast. This is a nature-adaptive way of living: the summer wind would pass over the Feng shui ponds in front of the villages, allowing the water to cool the air, and then blow through the cold alleys within the villages, cooling the hot settlements naturally.

Simultaneously, there is usually a grouping of trees behind the village, which serves to connect the village with the surrounding natural spaces such as farmland and fish ponds and blocks the cold winds coming from the north-west in winter.

1900 - 1960

The earliest human activity-historical villages-demonstrate a humble way of adapting to and respecting the natural environment. The map shows these historical villages inserted into the natural landscape in a very delicate way. It followed and preserved the surrounding natural environment, showing a real symbiosis between nature and humans.



BLUE STRUCTURE

/Water with Production/

Locals invented a stepped drainage system in 1960. It helps to get rid of excess flooding quickly during the monsoon season to ensure normal production functions.

The external river, the regional dikes, and the sluices form the primary outer protection. The internal rivers, township dikes, canals, ditches, fish ponds, and gates form a unique hydraulic system in the dike-pond landscape.

The fishpond would hold most of the water during the rain. The extra water will flow from ditches to the internal river and be pumped out to the East River.

Map of Qingqiang Farmland, Longshan, Shunde, late Qing dynasty (structure map of the embankment and waterway)

Source: compiled by Rueneng Wen, Jiaqing "Longshan County Records"

How it works

fishpond

cannel & ditches

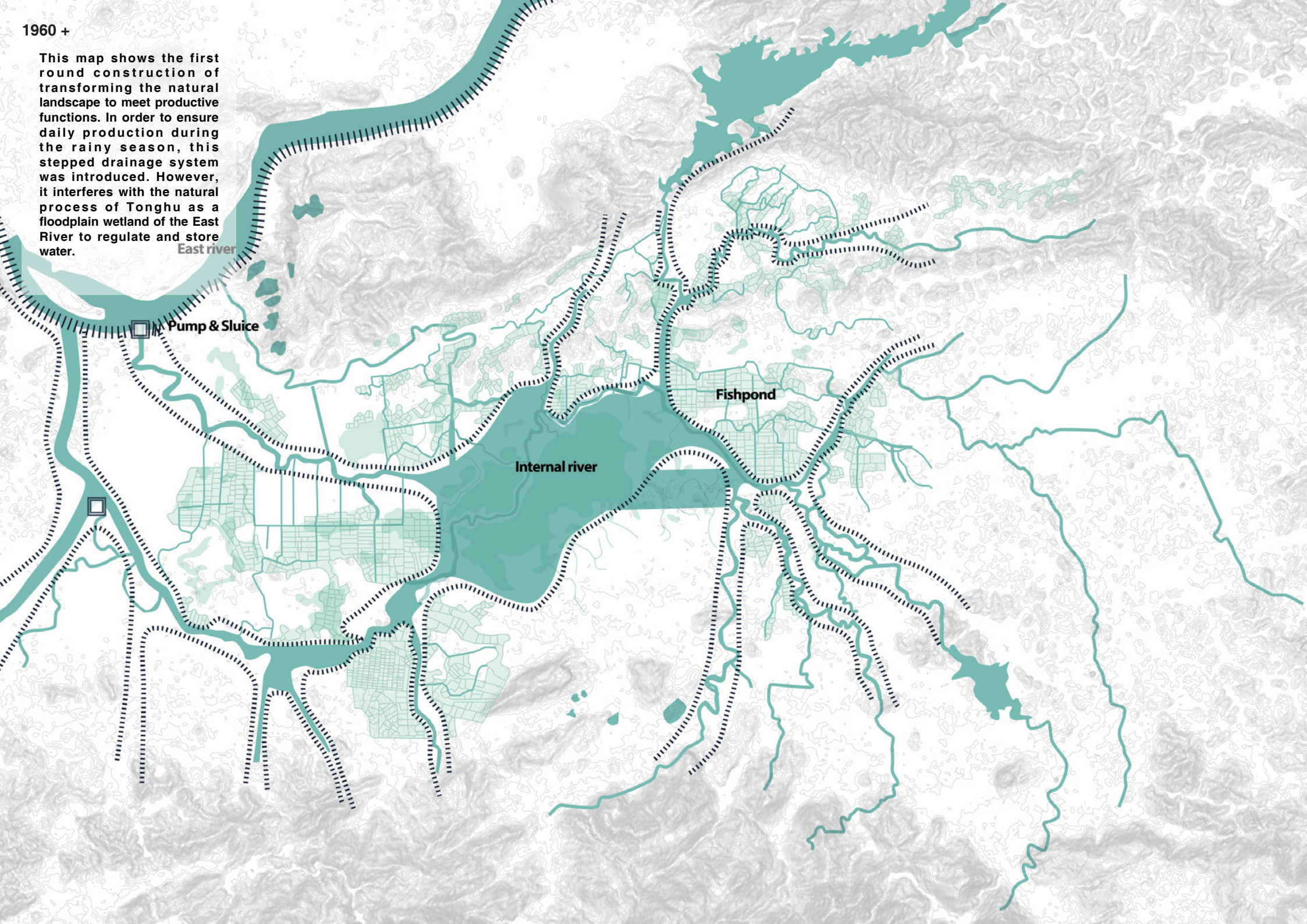
township dike

internal river

regional dike external river

1960 +

This map shows the first round construction of transforming the natural landscape to meet productive functions. In order to ensure daily production during the rainy season, this stepped drainage system was introduced. However, it interferes with the natural process of Tonghu as a floodplain wetland of the East River to regulate and store water.

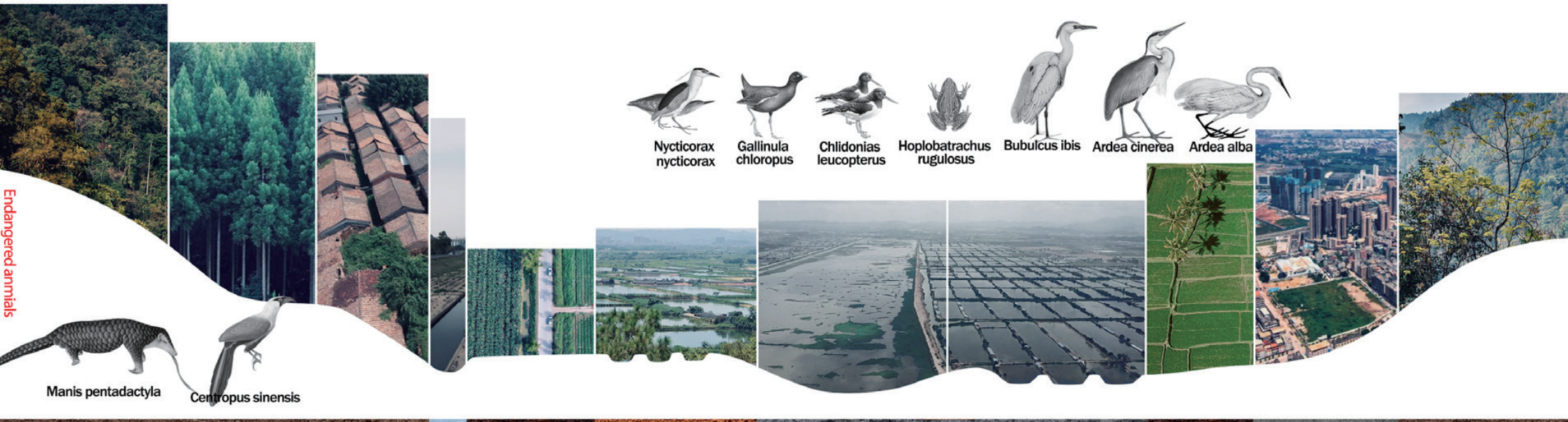


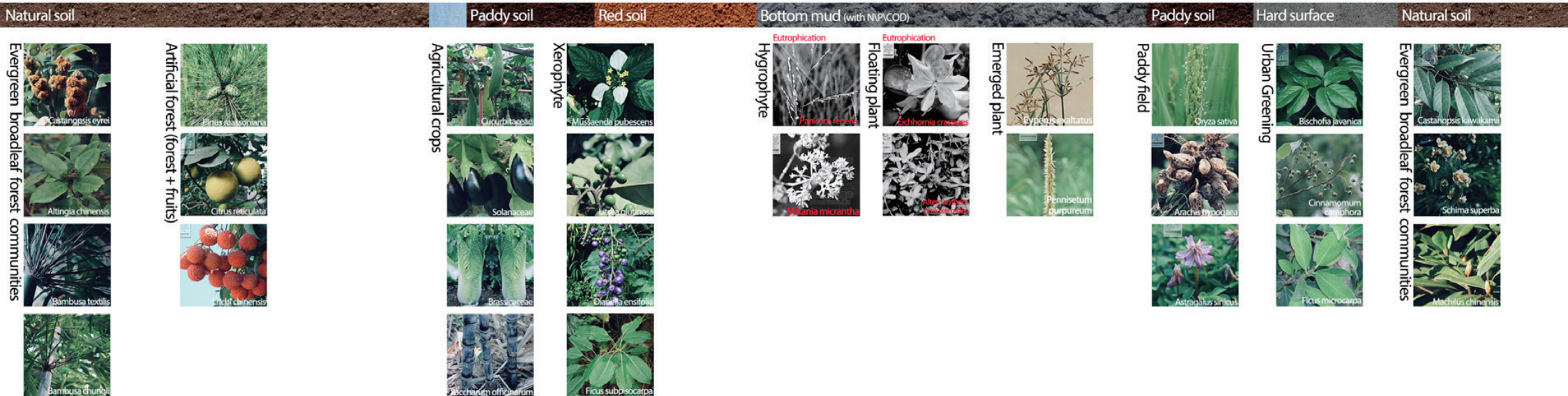
GREEN STRUCTURE

/Discontinuous Gradients from Mountain to Valley/

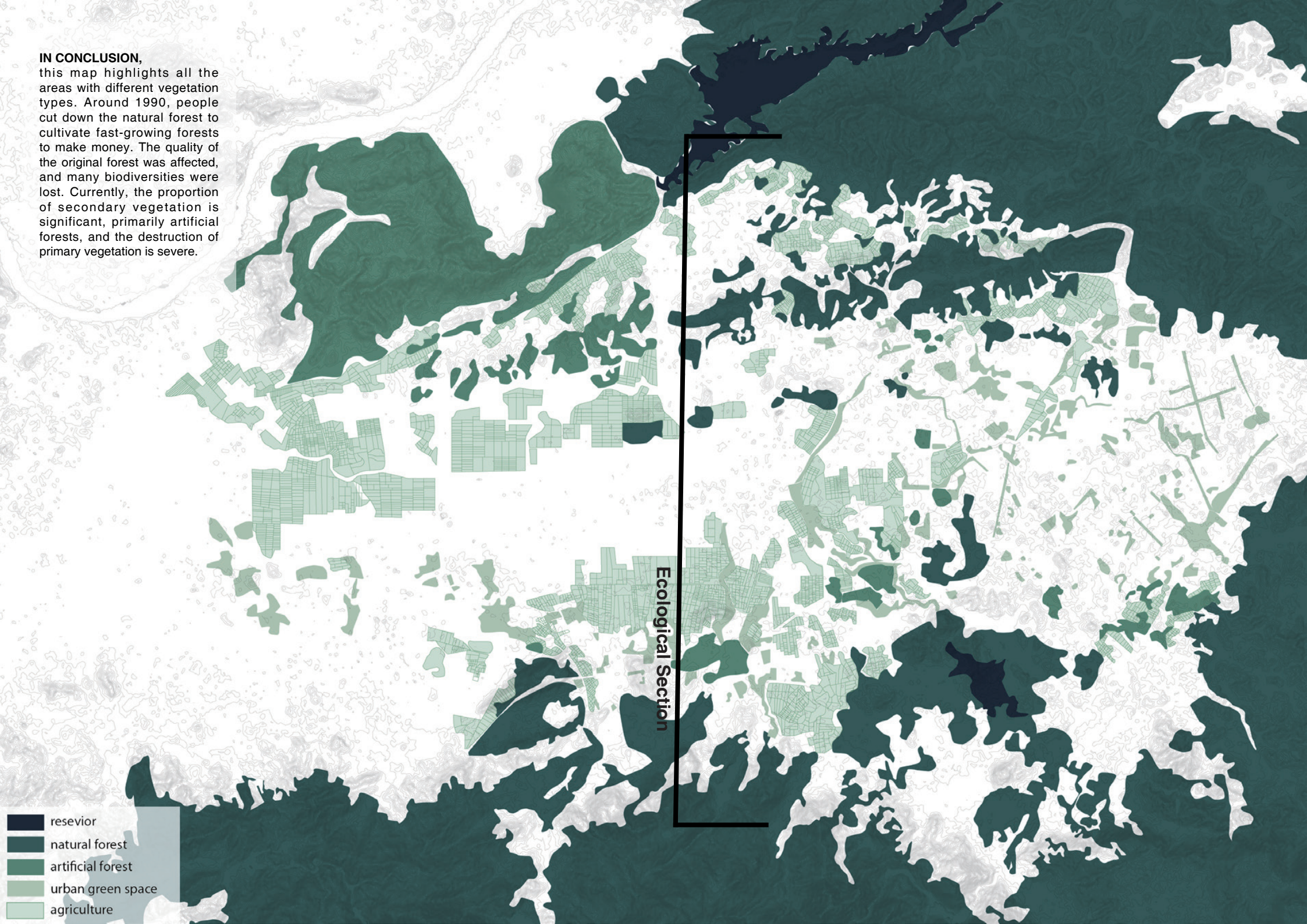
The greens' vertical connection is not very high, and the natural vegetation has been destroyed due to long-term human interference. The section below is showing the transition from mountain to valley. We could see the species in the mountains are not very diverse. Meanwhile, frequent traffic and farming activities have brought many invasive species to the area, either intentionally or unintentionally. Some of these invasive species have even developed and expanded rapidly, bringing adverse effects on the local ecological environment and people's production and livelihood. For example, Mikania micrantha is now covering almost all Tonghu embankments, which significantly reduces habitat diversity.

Another example is the eutrophication of water bodies, which has led to the formation of a thick "mat" of water lilies, especially in rivers and ponds where water bodies are less mobile. This leads to the blockage of watercourses and a reduction in the diversity of the water environment. It also causes severe pollution of the water used for agriculture and domestic use.





IN CONCLUSION,
this map highlights all the areas with different vegetation types. Around 1990, people cut down the natural forest to cultivate fast-growing forests to make money. The quality of the original forest was affected, and many biodiversities were lost. Currently, the proportion of secondary vegetation is significant, primarily artificial forests, and the destruction of primary vegetation is severe.



URBAN LANDSCAPE

The urban landscape is formed based on the utilization and modification of the natural landscape. Studying the urban landscape helps us understand how different activities change the natural structure and their impact on the site.

So how to understand the urban landscape? What are the main layers of the urban landscape?

The industrial area is excessive, and the layout is relatively scattered. Mainly low-end manufacturing industries, like electronics, chemicals, textiles, hardware, machinery, around the layout of Tonghu, resulting in industrial "three wastes" has become a significant threat to the ecological environment.

industry

Residentials are divided into three-density categories. Due to the current high-density development, a large number of residential areas are connected into one piece. On the one hand, this has caused the hardening of the city's substrate, and on the other hand, there is a severe lack of green space to regulate and buffer in the middle.

residential

Due to the lack of supporting facilities in these areas, the phenomenon of indiscriminate disposal of domestic waste, pesticide abuse, sewage leakage, and small underground workshops are more prominent in the **urban redevelopment district**.

urban redevelopment district

Due to policy and funding issues in irrational development, there are a large number of **wasteland** in the city. These places are potential spaces that can be ecologically developed.

wasteland

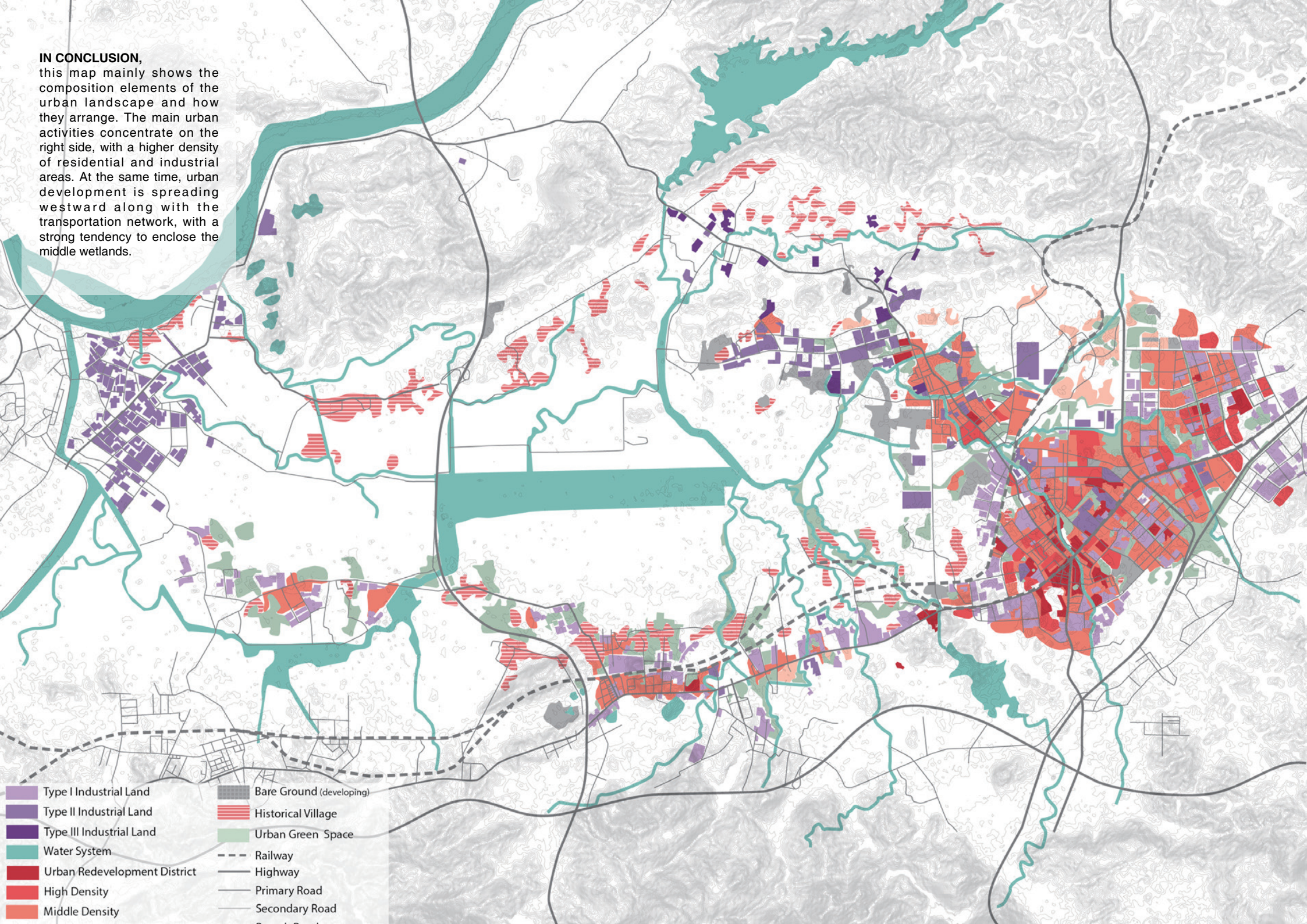
Historical villages are mainly concentrated in the low and gentle hills, following the layout of the front ponds and the back hills. Historically, by combining the surrounding natural environment, a tight blue-green network was built to alleviate rainfall and flooding problems while achieving ecological connectivity.

historical villages

There is a severe lack of land for public facilities, roads and squares, municipal utilities, and **green areas**, which has a greater impact on the overall ecological balance.

urban parks

IN CONCLUSION,
this map mainly shows the composition elements of the urban landscape and how they arrange. The main urban activities concentrate on the right side, with a higher density of residential and industrial areas. At the same time, urban development is spreading westward along with the transportation network, with a strong tendency to enclose the middle wetlands.



URBAN LANDSCAPE

/Landscape Changes 1967-2020/

This series of maps shows the trend of industrialization and urbanization from 1967 until now.

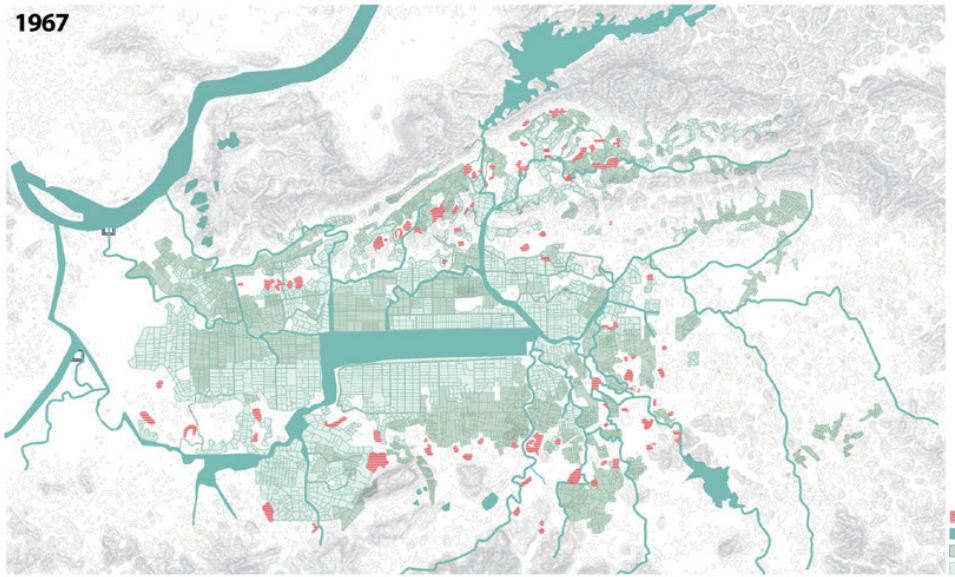
The city was slowly taking more and more farmland and fish ponds as it grows. Potentially it will grow continuously and link two sides together

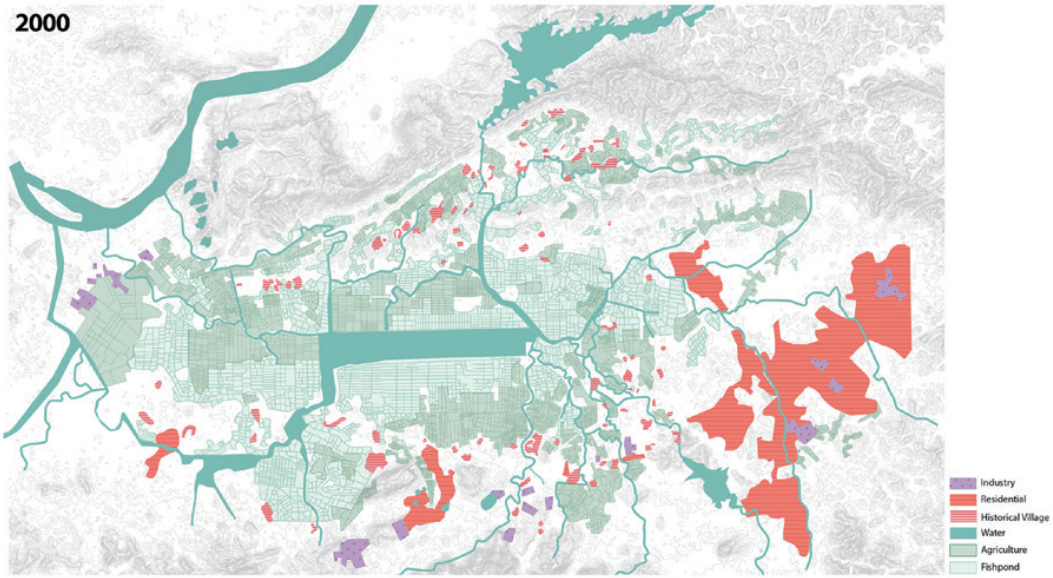
Since 1960, due to the accelerated urbanization and industrialization, the population has increased dramatically. Due to the large population, the land resources of the Tonghu area have been heavily reclaimed and used by people. The degree of anthropogenic impact has been profound, resulting in significant landscape structure and ecological quality changes.

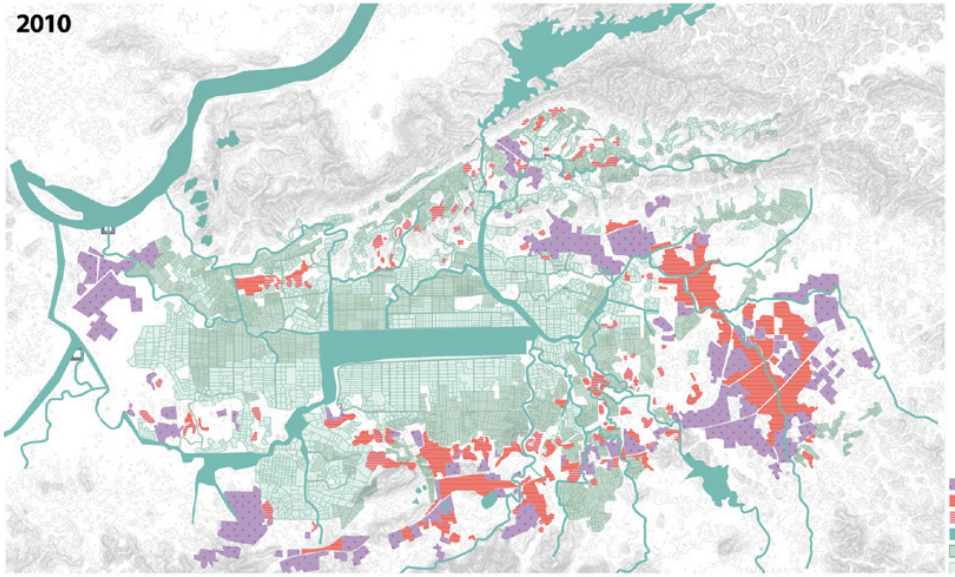
The most significant phenomena of human interference are:
(1) the reclamation of Tonghu wetland, which obviously reduces the size of Tonghu and significantly changes the ecological values;
(2) excessive farming and cultivation, which polluted the water bodies and soil;
(3) the increasing construction lands and the continuous reduction of wetlands led to decreasing habitat quality and low diversity of wetlands, forests, plants, and animals.

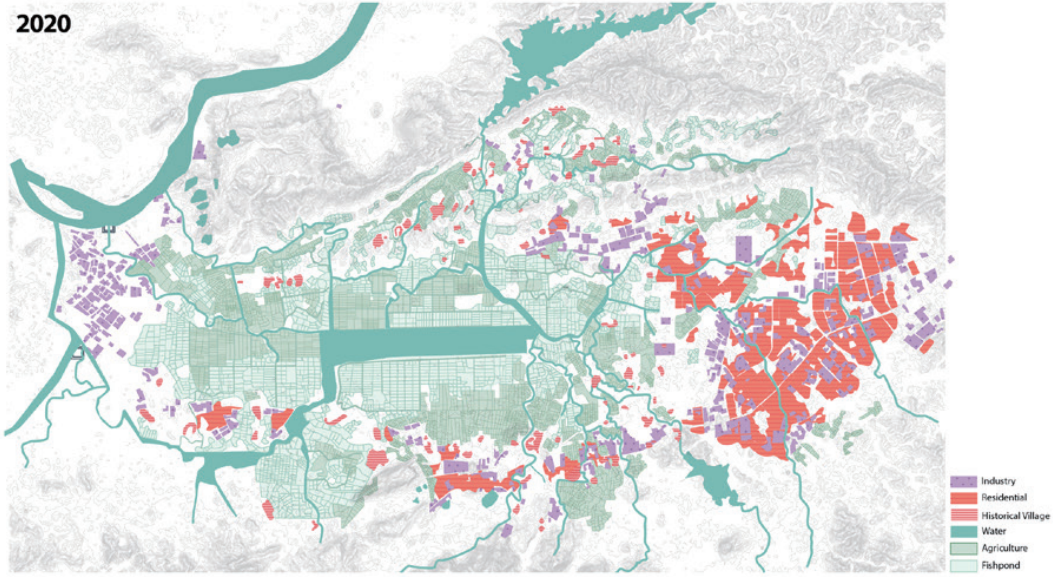
It also shows the development of the industry during these fifty years. From 2000, the collective industry started to happen along the river in small groups. According to statistics, there are 230 industrial enterprises in Tonghu area, including two state-owned, 30 collective, and 200 individual enterprises. The primary industrial forms are steel rolling, silk plower, food processing sugar, sewing, garment making, hardware, electroplating, bleaching and dyeing, building materials, etc. Most of these industries are with high water consumption and high water pollution. These pollutions are still left in the river and the soil and are tough to remove.

IN CONCLUSION,
the lack of consideration for the coordinated development of each township and the surrounding nature in the early days; and the absence of a systematic, networked, and flexible planning caused the disorderly expansion of the city to squeeze the natural resources. At the same time, urban and industrial development itself, due to its more scattered and fragmented location, also did not form a good collaboration and information exchange. In the new urban landscape planning, the idea is to think about a landscape framework that can guide the city and nature to achieve a delicate development pattern of interpenetration.


1967
Historical Village
Water
Agriculture
Fishpond


2000
Industry
Residential
Historical Village
Water
Agriculture
Fishpond


2010
Industry
Residential
Historical Village
Water
Agriculture
Fishpond


2020
Industry
Residential
Historical Village
Water
Agriculture
Fishpond

LANDSCAPE STRUCTURE

/Summary of the Overall Landscape Structure/

At the level of natural landscapes:

The Tonghhuu area has the characteristic landscape structure of "water surrounded by mountains," just like the characteristic landscape of Lingnan (the South part of China).

Low mountains and hills surround the wetland landscape and productive landscape and urban landscape in the middle. The central part of the site has the water landscape of Tonghu, river inlets, and rivers. Many rivers and streams flow centripetally from the surroundings to the central area.

The most characteristic ecological landscapes in the Tonghu area are inland freshwater wetland landscape, migratory birds habitat landscape, and low hill subtropical evergreen broad-leaved forest landscape.

However, due to the accelerated urbanization and ecological process in recent years, many problems emerged. Wetland reclamation, river canalization, farming and cultivation, clustering of heavily polluting industries, and hardening of the urban substrate, the landscape pattern and ecological quality of Tonghu have undergone significant changes.

Although its natural ecological landscape is greatly affected by human activities, the ecological basis is still quite good with landscape types such as wetland landscape and mountainous forest landscape.

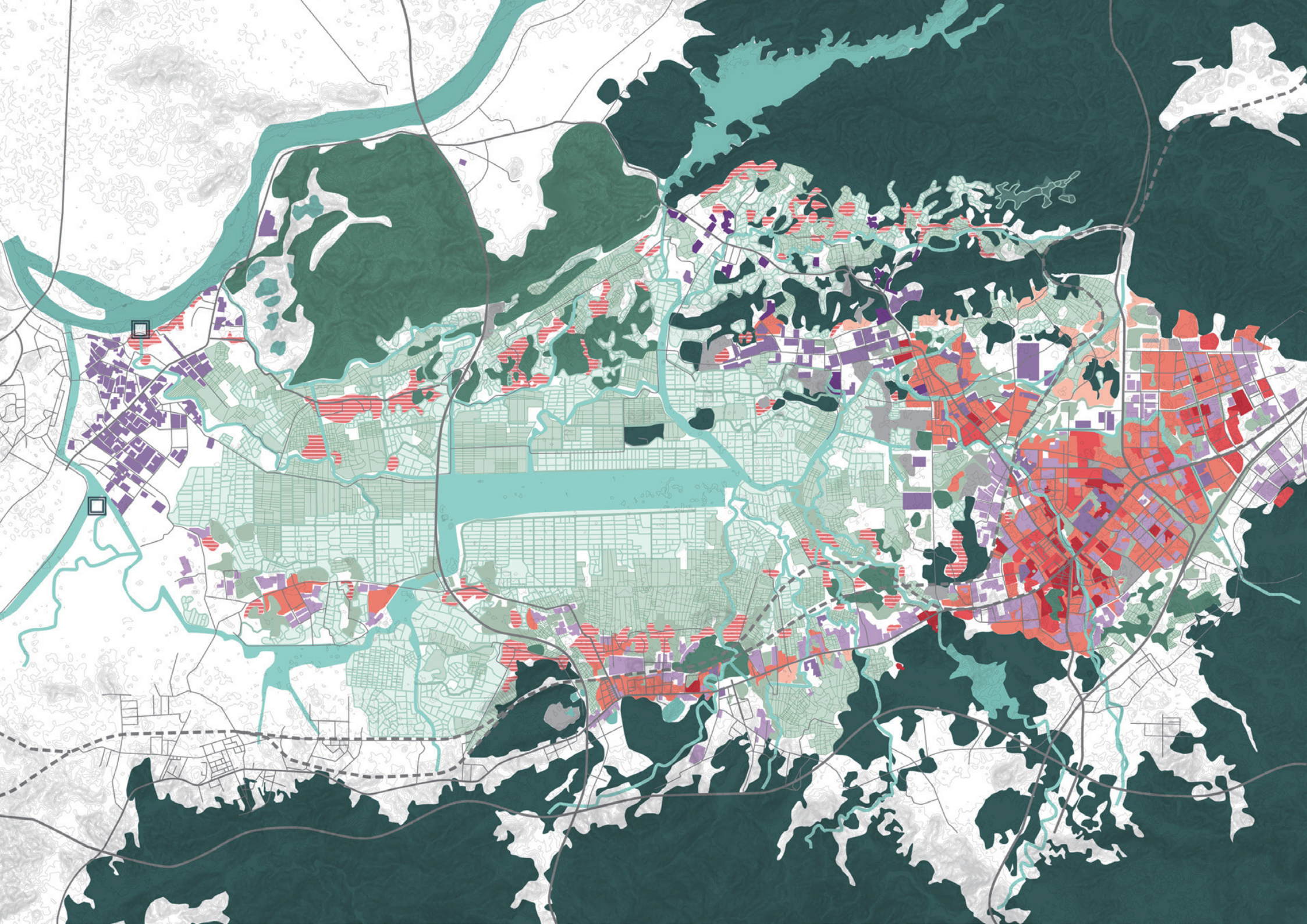
Historically, the bird habitat of Tonghu is well preserved. The wetland is a migratory route for Asia-Pacific migratory birds, a wintering and resting place for migratory birds in the Pearl River Delta, with a wide variety of migratory and resident birds and a large population size.

At the level of the urban landscape:

Industrialization and urbanization have taken up many landscape resources and squeezed greatly on ecological values. Combined with the lack of uncontrolled planning in the early days of the entire Tonghu area, the planning was done by each town alone. As a result, it failed to form the spatial pattern of grouping, networking, and compactness. During the development process, many wastelands and dilapidated urban abandoned areas remain on the site due to funding and policy issues. These sites have highflexibility for ecological transformation and can be considered part of the blue-green landscape structure.

IN CONCLUSION,

The entire Tonghu area presents a mosaic landscape pattern by the intersection of natural and artificial mechanisms. The overall blue-green structure is fragmented and does not form a substrate-patch-corridor ecological connection. Although part of the natural foundation is preserved, there is still room for further strengthening in coordinating urban development and ecological resource preservation. Many problems need to be taken into account and addressed: crucial wetlands and forest landscapes are more seriously damaged; urban development layout does not form a connected, networked and compact spatial pattern; industrial development is relatively lagging, and the amount of pollution is significant, and industrial upgrading is urgently needed; ecological resources are abundant, but there is a lack of corresponding preservation planning. All of these need attention in the following design step.



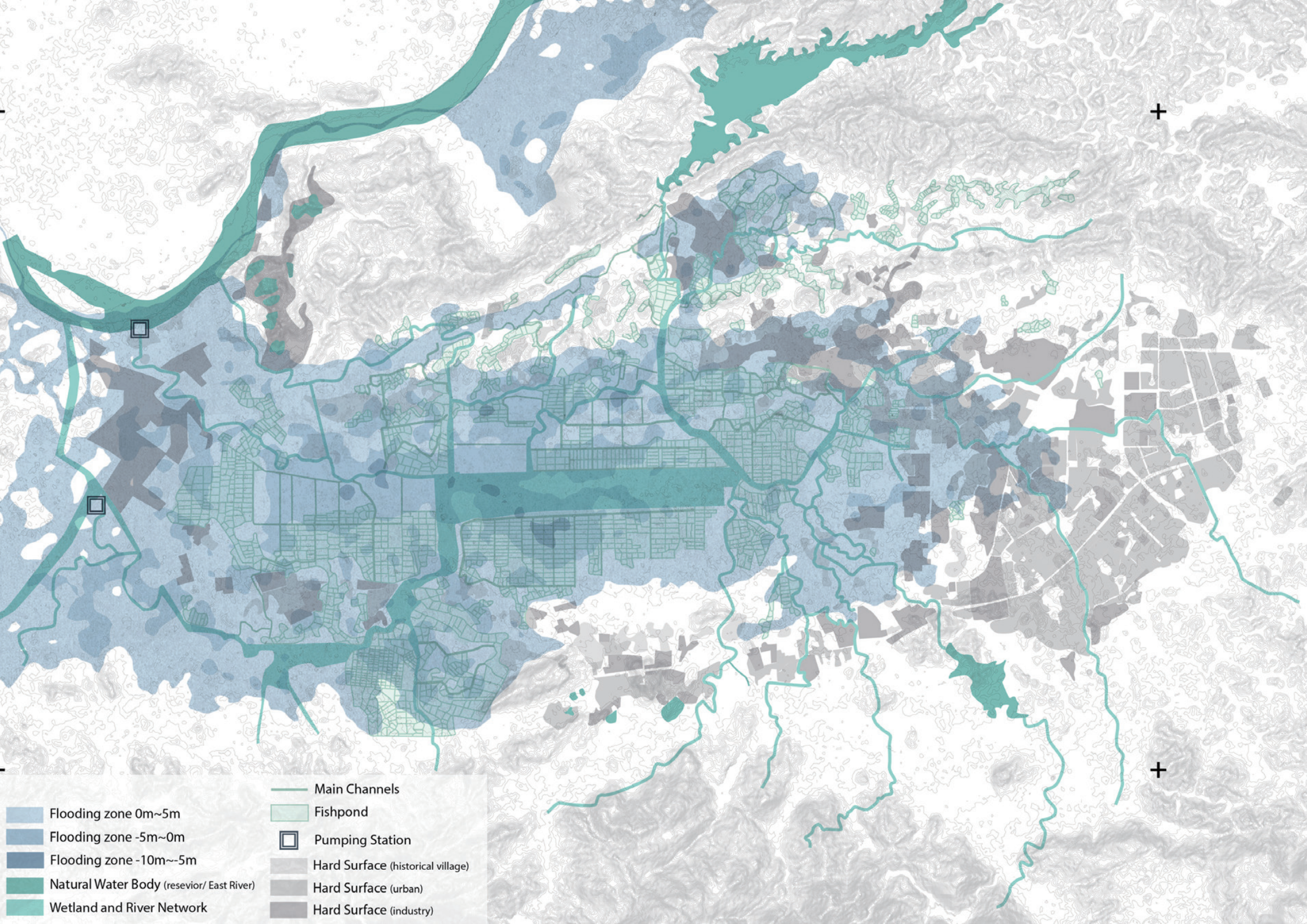
Problem Statement

/Flooding/

According to 1961 data, the Tonghu area was historically a floodplain, one of the essential recharge areas of the East River, with a floodplain area of about 71.53 sq. km. In 1966, troops began to move into the Tonghu area to reclamation and resettle refugees from other countries. The natural floodplain was transformed into a "knife-handle" reservoir. The surrounding land was gradually changed to fish ponds and farmland, leaving only 6.88 square kilometers of wetland. Since then, the floodplain disappeared.

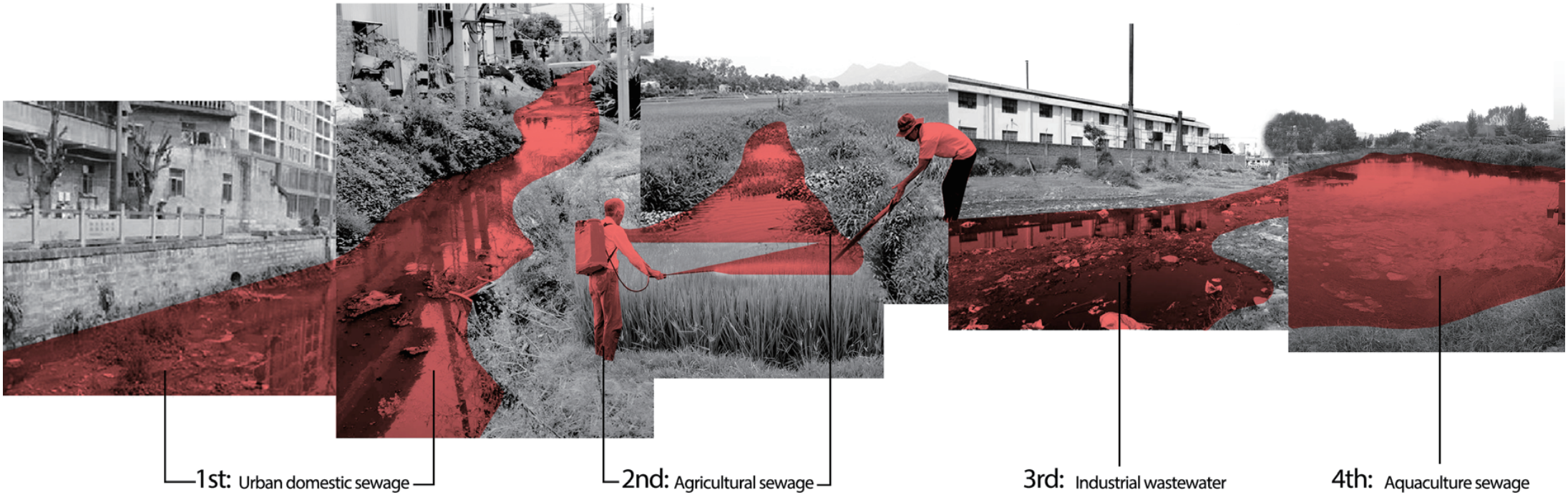
At the same time, along with urban construction, many rivers have been straightened and channelized. The relationship between city and river was broken. This seriously affected the flood regulation capacity of rivers, increasing the risk of urban flooding during the monsoon season.For example, in September 1979, Huiyang was hit by "a 500-year rainfall and a 200-year flood". The flood caused more than 1,200 villages in the Huiyang area to be flooded, flooded 1.1 million mu of crops, collapsed 135,949 houses, and affected 620,000 people.

IN CONCLUSION,
when looking back at history, Tonghu, as a natural East River flood plain, initially has the natural ability to regulate the flood. However, with urbanization, this rainfall regulating ability was cut down considerably by unscientific construction practices. So whether some transformation of wetland and river can restore the rainwater regulation ability of Tonghu area is a key point to be considered in the design.


Flooding zone 0m~5m
Flooding zone -5m~0m
Flooding zone -10m~-5m
Natural Water Body (resevior/ East River)
Wetland and River Network
Main Channels
Fishpond
Pumping Station
Hard Surface (historical village)
Hard Surface (urban)
Hard Surface (industry)

Problem Statement

/Pollution/

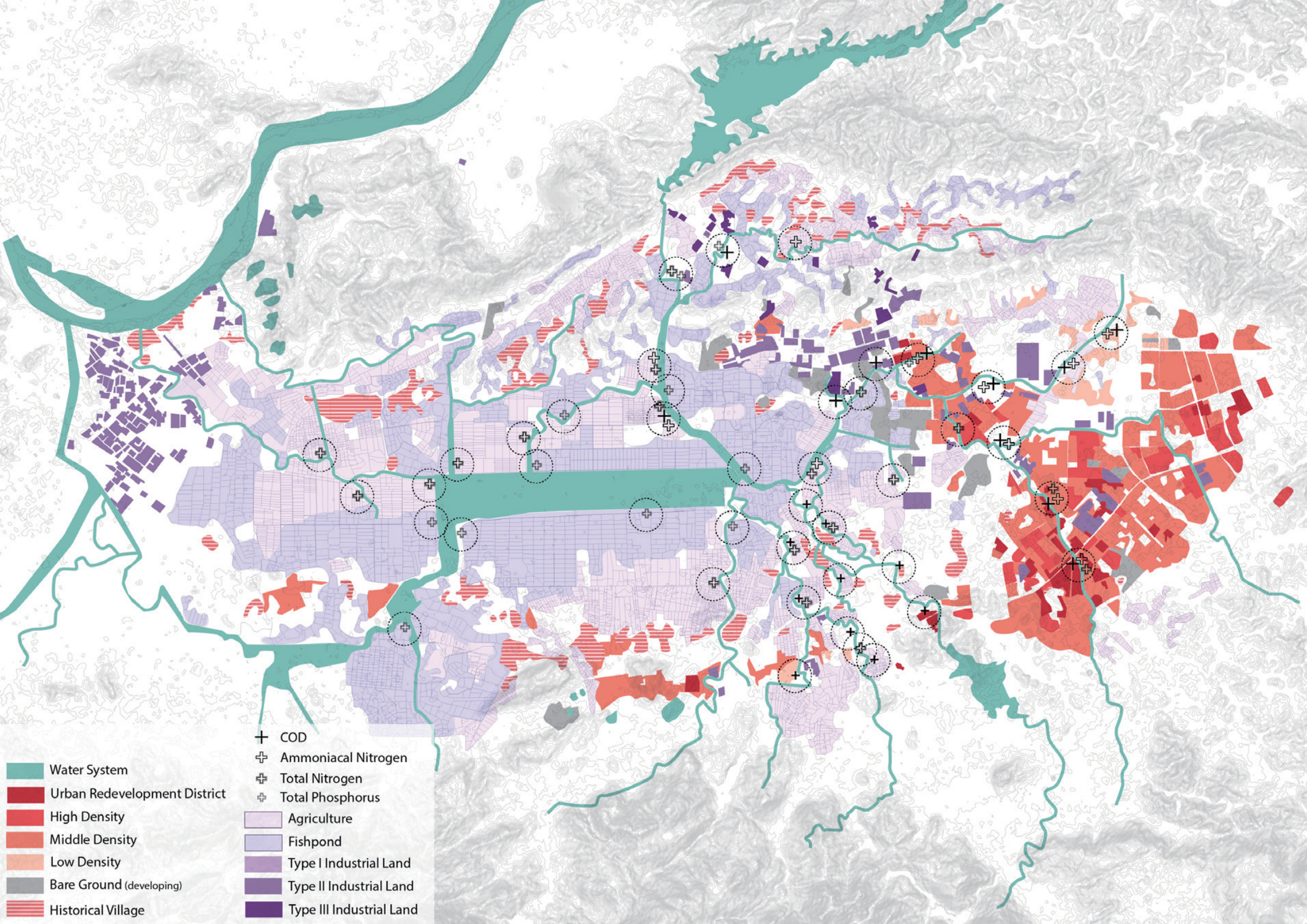


Urbanization and economic activities are the most important reasons for the increasing pollution problems.

According to the 2016 environmental statistics database, there are 98 key pollutant sources in the Tonghu area. The volume of wastewater discharged by these major pollutant enterprises is 6382517t/d. Many village and township enterprises have high water-related volumes, high discharge volume. These enterprises lack the technology and equipment for wastewater treatment. The wastewater they produce is not included in the treatment scope of sewage plants. Instead, it is just discharged into rivers through simple pretreatment, which causes severe pollution to the water quality of rivers and lakes.

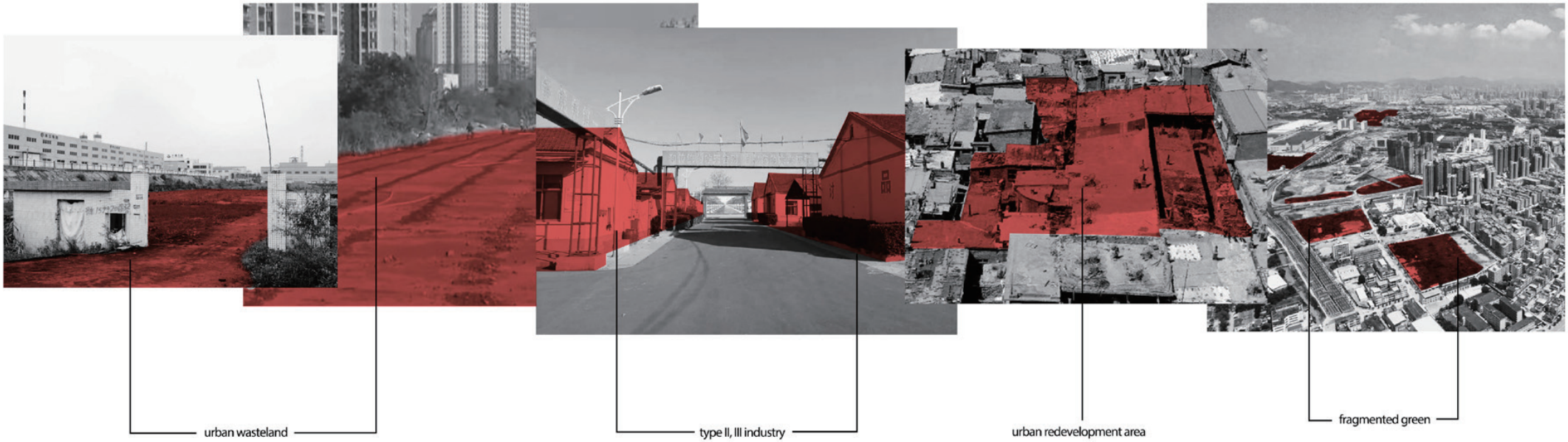
Second, domestic water is also an important source of pollution. According to statistics, the capacity of the Tonghu sewage treatment facilities for 170,000 tons/day, only the amount of domestic wastewater will be 106,800 tons/day, has accounted for a large proportion of the sewage treatment capacity. In addition, agriculture and aquaculture also have a certain impact on water quality. Fertilizers in agriculture and fish farming bait are important sources of eutrophication in water bodies. Meanwhile, another source of pollution includes dilapidated urban villages (urban redevelopment areas).

IN CONCLUSION,
the four main sources of pollution are industry, production industry, domestic and urban redevelopment areas. Due to the lack of water purification measures, the N, P, COD, and other pollution caused by these activities accumulate in the water and soil for a long time and are difficult to remove. Therefore, the key to solving the pollution problem is whether we can change to an ecological development method, cut the pollutants at the source, and achieve long-term water and soil purification and restoration through landscape measures.


Water System
Urban Redevelopment District
High Density
Middle Density
Low Density
Bare Ground (developing)
Historical Village
COD
Ammoniacal Nitrogen
Total Nitrogen
Total Phosphorus
Agriculture
Fishpond
Type I Industrial Land
Type II Industrial Land
Type III Industrial Land

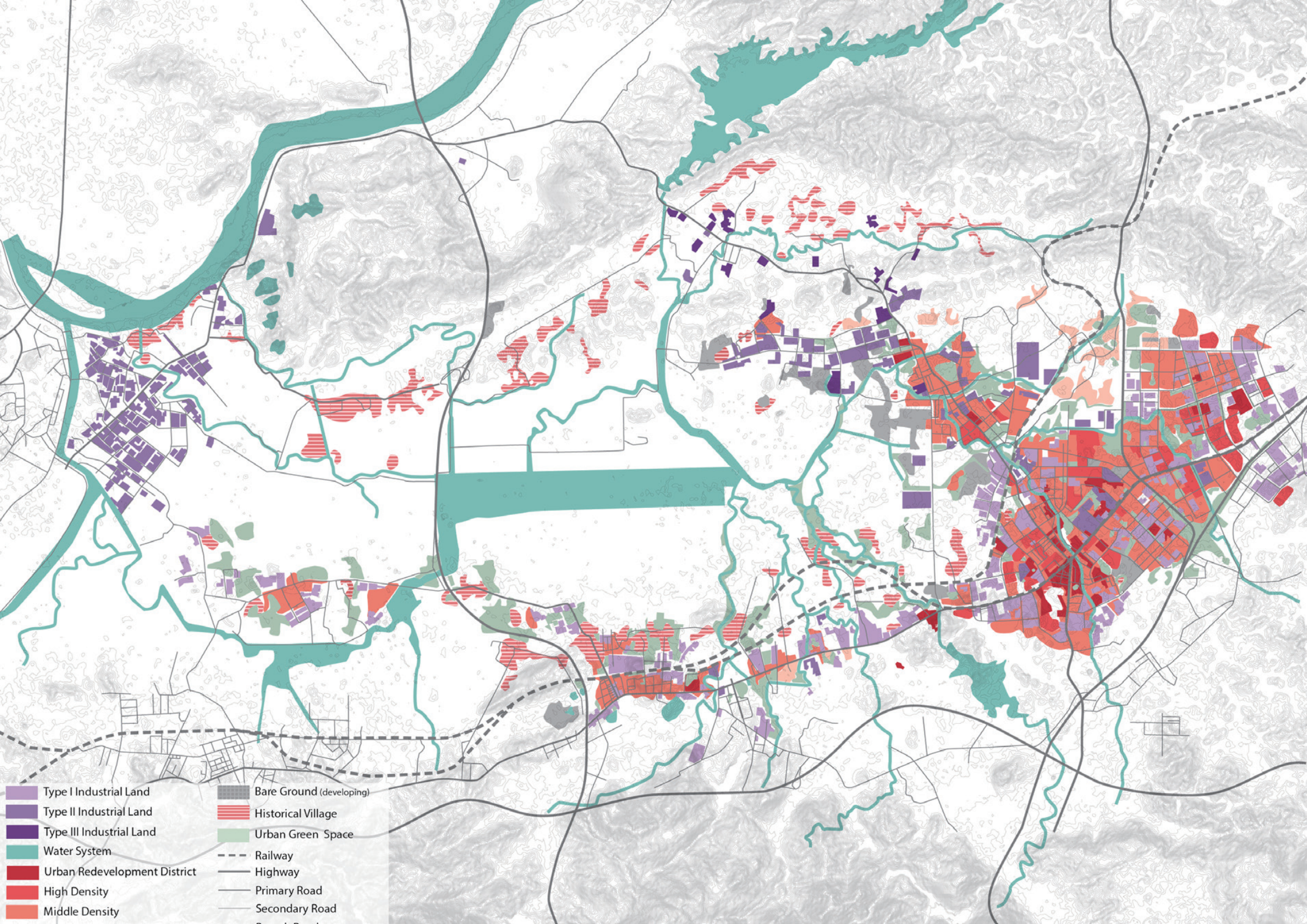
Problem Statement

/Fragmented Green Space/



The landscape types in the Tonghu area are rich, including forests, farmlands, fish ponds, wetlands, marshlands, rivers, and urban green spaces. Some landscapes, such as wetland landscapes and fish pond landscapes, have larger patches; some landscapes, such as urban green spaces, are more fragmented. However, the common point of these landscape types is that they are weakly connected. For example, in the Tonghu area, there is a limited number of urban parks. Moreover, they are scattered in the city, lacking connections such as the green belt or blue-green corridor. This greatly reduces the ecological value of these green areas. At the same time, the cross-regional blue-green flows are also limited. In addition, the current trend of urban expansion has the potential to fragment the wetland landscape in the middle and the surrounding urban landscape.

IN CONCLUSION,
in order to maximize the site's ecological value, we need to protect and restore the ecological foundation of the existing blue-green space on the one hand. On the other hand, it is necessary to improve the connectivity and integrity of the entire blue-green structure to form a network that can realize the blue-green flow.


Type I Industrial Land
Type II Industrial Land
Type III Industrial Land
Water System
Urban Redevelopment District
High Density
Middle Density
Bare Ground (developing)
Historical Village
Urban Green Space
Railway
Highway
Primary Road
Secondary Road

Problem Statement

/Summary/

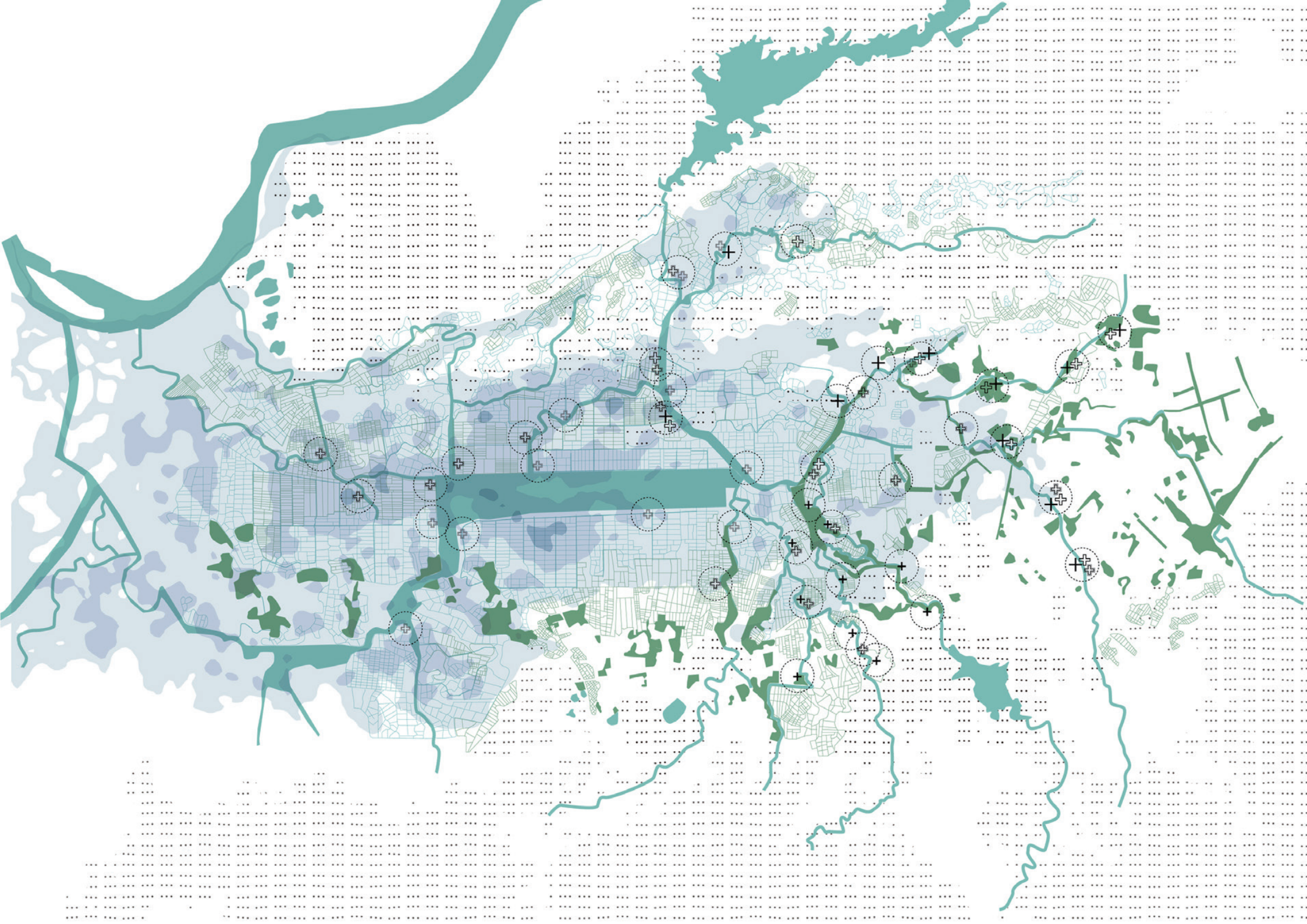
To sum up, there are three typical problems in the whole Tonghu area:

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. The sources of pollution include heavy polluting industries in small workshop mode; agriculture and fishery; pollutants from domestic water use; and urban waste areas (lack of infrastructure). 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. There is no way to maximize the benefits of these ecological patches due to the lack of a systematic blue-green structure (such as green belts or blue-green corridors) to connect these blue-green spaces. Also, 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.

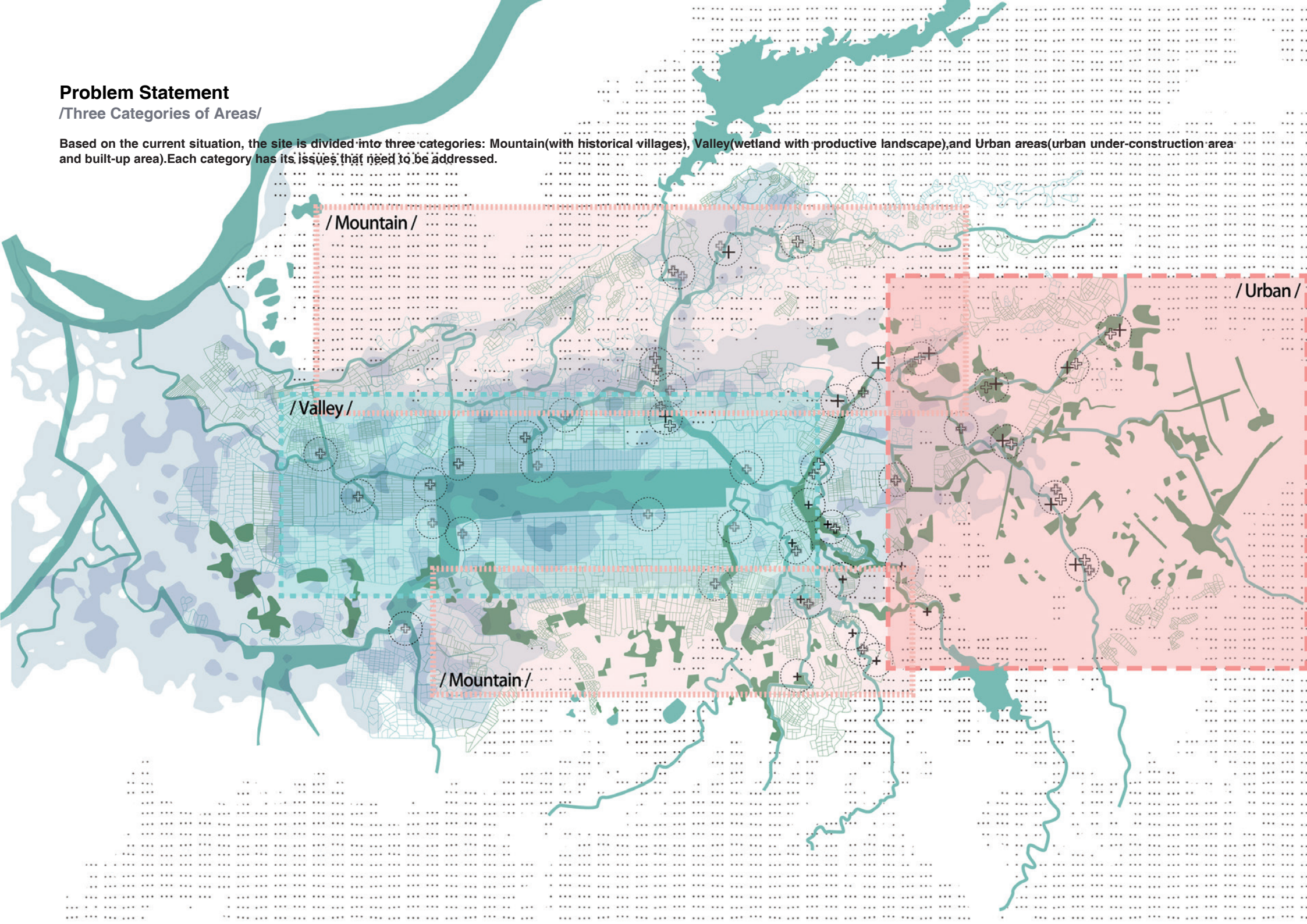
The next step is to divide the whole area into three typical site types: Mountain, Valley, and Urban, based on these problem statements. Each area has its typical problems, and the subsequent design provides ideas for solving these problems based on the specific site conditions.



Problem Statement

/Three Categories of Areas/

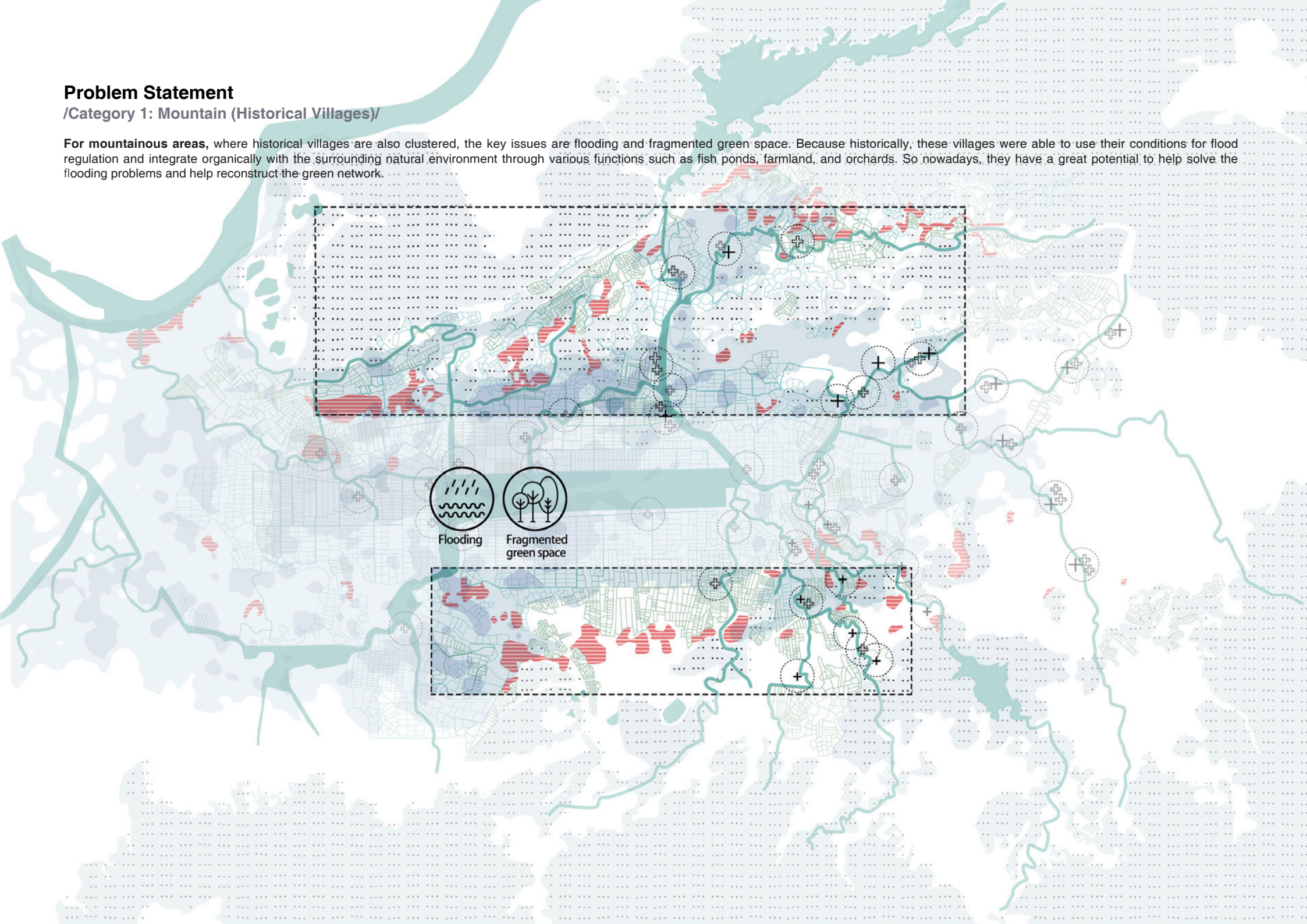
Based on the current situation, the site is divided into three categories: Mountain(with historical villages), Valley(wetland with productive landscape),and Urban areas(urban under-construction area and built-up area).Each category has its issues that need to be addressed.



Problem Statement

/Category 1: Mountain (Historical Villages)/

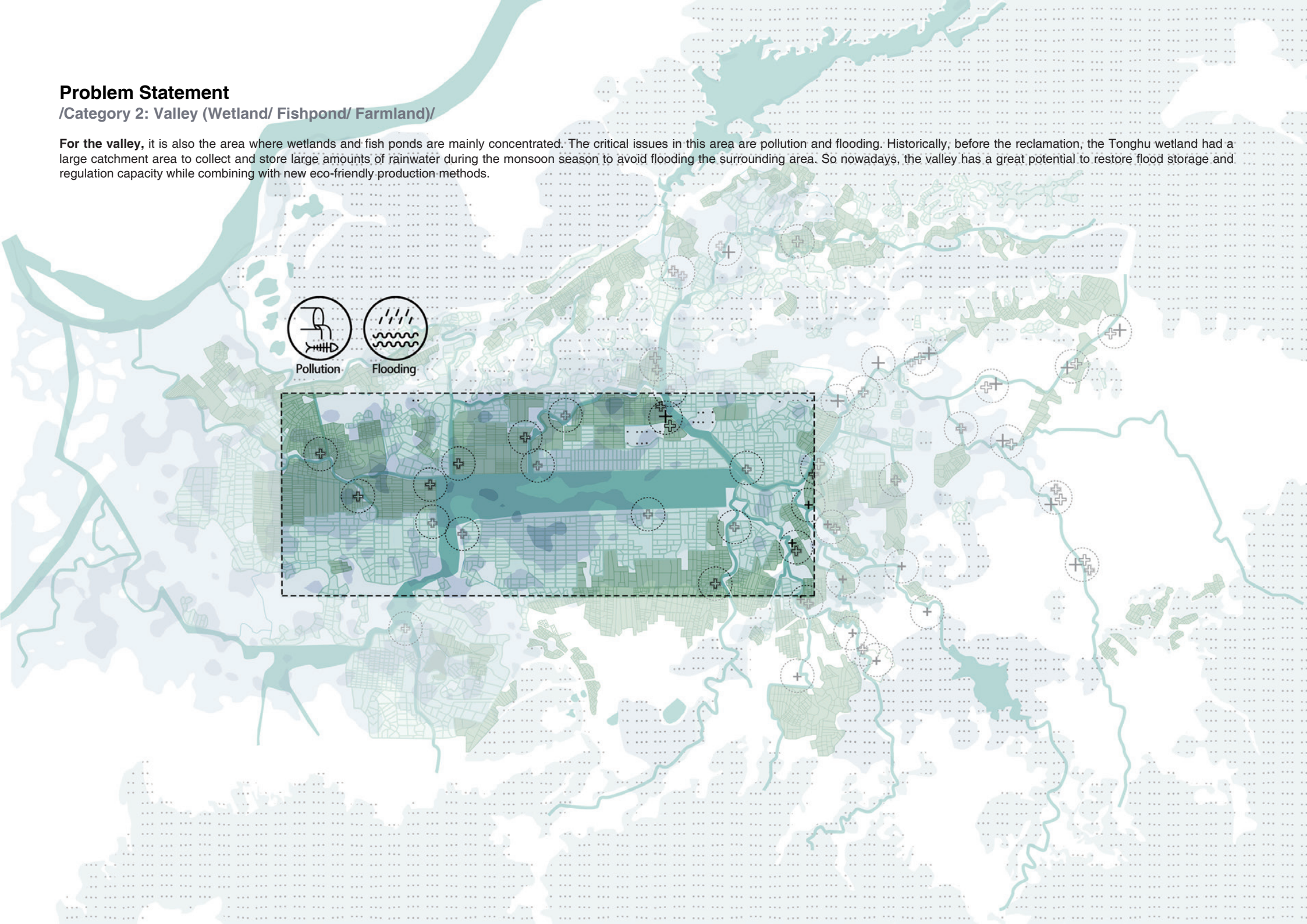
For mountainous areas, where historical villages are also clustered, the key issues are flooding and fragmented green space. Because historically, these villages were able to use their conditions for flood regulation and integrate organically with the surrounding natural environment through various functions such as fish ponds, farmland, and orchards. So nowadays, they have a great potential to help solve the flooding problems and help reconstruct the green network.



Problem Statement

/Category 2: Valley (Wetland/ Fishpond/ Farmland)/

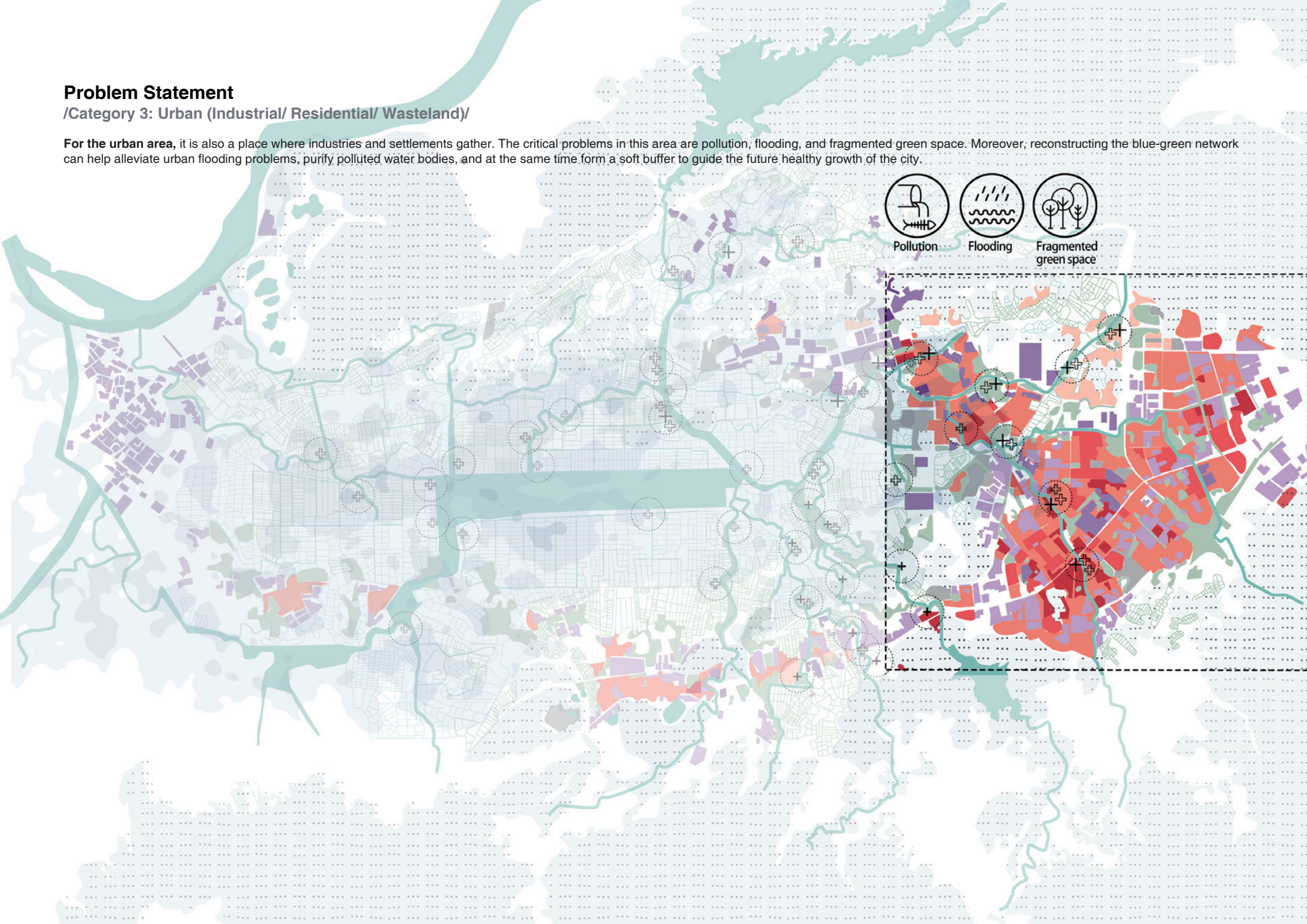
For the valley, it is also the area where wetlands and fish ponds are mainly concentrated. The critical issues in this area are pollution and flooding. Historically, before the reclamation, the Tonghu wetland had a large catchment area to collect and store large amounts of rainwater during the monsoon season to avoid flooding the surrounding area. So nowadays, the valley has a great potential to restore flood storage and regulation capacity while combining with new eco-friendly production methods.



Problem Statement

/Category 3: Urban (Industrial/ Residential/ Wasteland)/

For the urban area, it is also a place where industries and settlements gather. The critical problems in this area are pollution, flooding, and fragmented green space. Moreover, reconstructing the blue-green network can help alleviate urban flooding problems, purify polluted water bodies, and at the same time form a soft buffer to guide the future healthy growth of the city.



Literature review and case study are approaches for supplementing design thinking. In particular, the study of completed projects with similar site conditions can help extract design principles, which can then be tested through sketches to see if they are suitable for the design area.

The exploration of design principles and the refinement of design are two repeated and advanced processes. When new problems are solved, or previous design principles do not match the site's condition, it is necessary to refine the design principles by literature review and case studies.

Therefore, the research and test of design principles(by literature review and case study) are important to derive design proposals from problems.

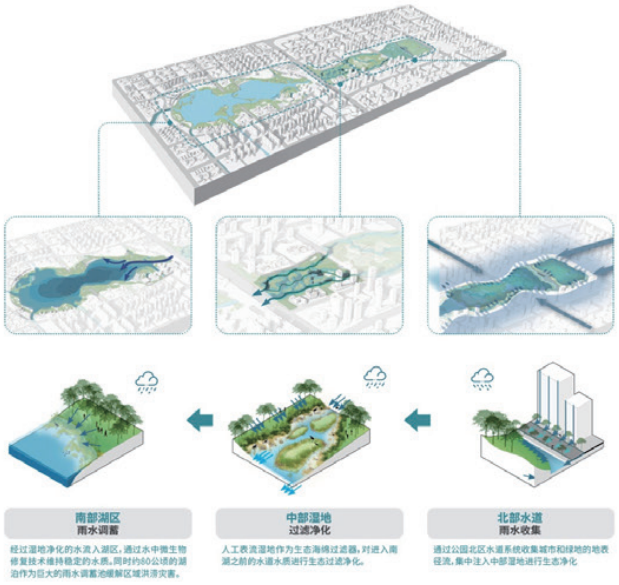
CHAPTER 4
DESIGN PRINCIPLE

1. CASE STUDY **&** LITERATURE REVIEW
2. SITE-ADAPTED PRINCIPLES

Design Principle

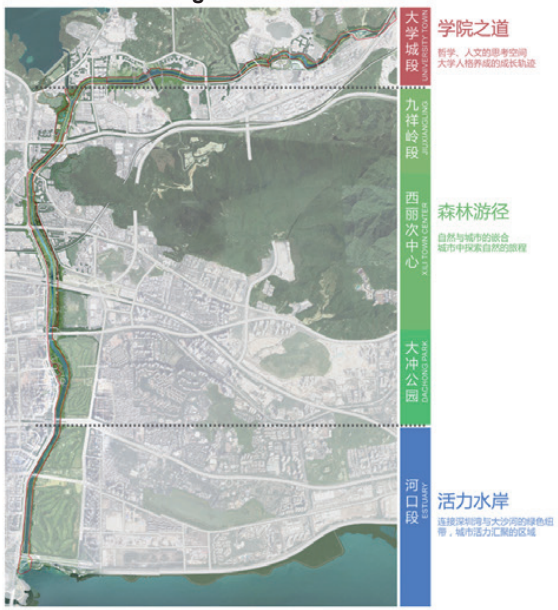
/Case Study & Literature Review/

Zilang Park / AECOM



The project in Zilang Park demonstrates how creating an ecological riverbank connects people to nature and provides a habitat for plants and animals. By studying hydrodynamic models, the water system is reorganized to purify the water bodies. Moreover, from a resilient perspective, a stable wind corridor microclimate system is established by restoring the river, creating mountains and valleys. It helps to mitigate the urban heat island effect and create a sustainable urban green heart.

Dasha River Ecological Corridor/ AECOM



The Dasha River Ecological Restoration Project demonstrates how to rebuild the relationship between people and water, the city and nature. Based on ensuring the urban flood control function of the Dasha River, landscape approaches are applied to stitch together the fragmented urban ecology. Design strategies such as water resource management, ecological habitat creation, and building a systematic ecological structure are used to create an ecological riverbank landscape zone.

Weishan Lake Wetland Park / AECOM

The Weishan Lake Wetland Park project provides a new paradigm for wetland restoration. The project explores balancing water restoration, wetland conservation, and tourism development in rapid social development. The park transforms a rural wetland into a destination for science education and ecotourism, promotes economic development in the adjacent urban areas, and contributes to environmental protection along the waterways of China's South-North Water Diversion Project.

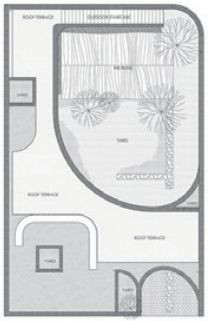
Design Principle

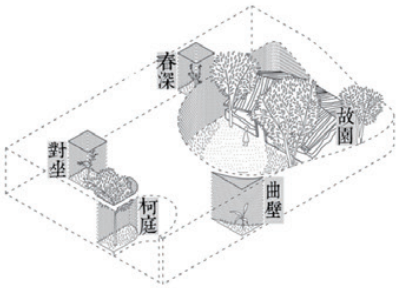
/Case Study & Literature Review/

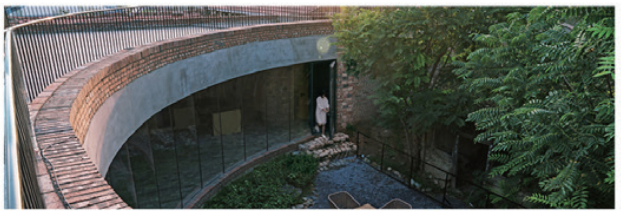
Erhai Ecological Restoration / ZEHO

The Erhai Ecological Restoration Project demonstrates how to restore a lake based on "Nature-based Solutions (NbS)." Through ecological reconstruction, natural restoration, protection, and conservation measures, the design transformed a farmland encroached area into a natural lake shoreline for water purification and ecological recovery. The design also achieves a self-maintaining, disturbance-resistant and dynamically balanced ecosystem through the natural succession of communities.

Renran Tang/ Magical Architecture Research Office

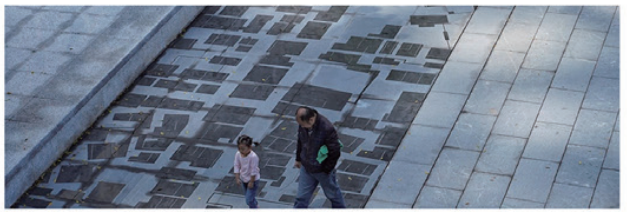






Rengrang Tang shows how to examine the meaning of historical traces, respect the beauty of ruins and time, and lead people to pay attention to the land. The main idea of the design is to preserve a ruin in the base and use it as part of the architectural landscape. A new guest hotel is designed beside the ruins but perfectly integrated with the ruins. New life is going on among the old remains of the once decaying site.

Hakka Culture Living Room/ GND Jiedi Landscape Design

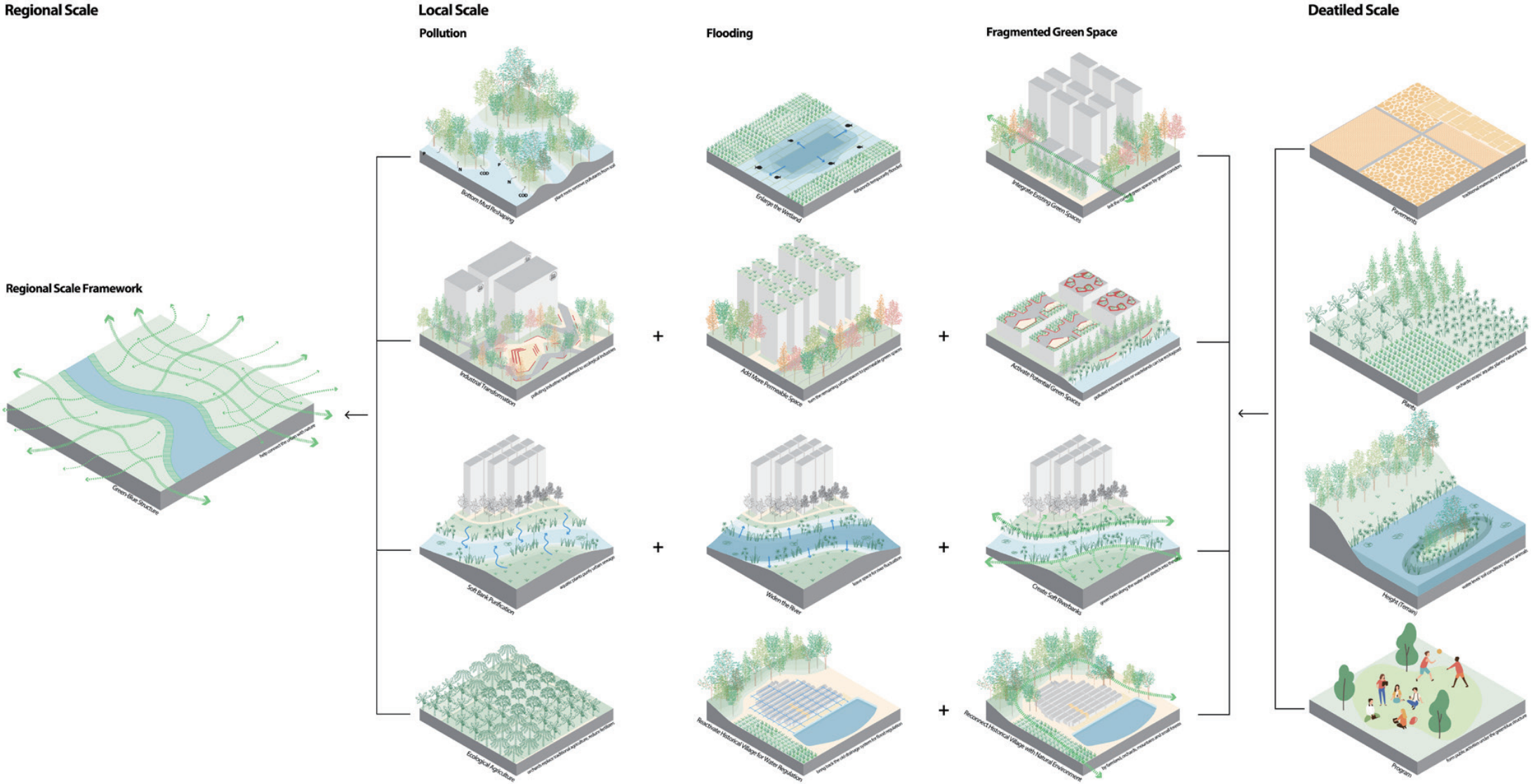


The target of the project is Evolution - Regeneration - Integration. Integrating the zoning of Hakka ancestral halls and commercial plazas resolves the conflict between tradition and modernity. The city square is designed as a window to showcase Hakka culture. Meanwhile, the design also incorporates local elements like rural settlements, farming fields, and folk culture. Moreover, it allows more people to come close and appreciate this Lingnan cultural heritage which is on the verge of being forgotten.

Design Principle

/Site-adapted Principles/

Based on the above problem analysis, design principles are summarized on three scales: regional scale, local scale, and detailed scale to tackle pollution, flooding, and decreasing biodiversity. These design strategies correspond to each other at different scales: the small scale is a continuation of the large scale. For example, by using substrate reshaping technology, the bottom mud in the wetland is dug out and mounded into some terrains. Local aquatic plants are introduced according to the changing water level. In this way, the plant roots can absorb nutrients(N\P) from the soil to purify the soil. Secondly, it creates a variety of habitats through plants and height differences. More importantly, by deepening the lake, the water storage capacity is increased, and the risk of flooding is reduced.



This chapter builds on the previous site analysis to propose a resilient landscape framework applying the design methods and principles(learned in Chapter Four). This framework needs to be adaptive to the site and meanwhile address the problems mentioned before.

In this design exploration process, the research through design and design research approaches are fundamental to advancing the design process. A regional landscape framework is firstly proposed at the regional scale. Then the sites are divided into three categories based on the current situation, from natural areas to areas where construction and nature are integrated, to areas with more development. Through the analysis and design of example sites, the design strategy is extracted, which will be used in the next chapter to discuss how these projects and strategies can help implement this framework back to a large scale.

CHAPTER 5
DESIGN EXPLORATION

Summary:

Based on the current situation and problems of the Tonghu area, a regional landscape structure is proposed at the regional scale.

After that, four specific sites are selected, namely Tonghu Wetland (artificial nature), Chigang Village (urban in nature), Tongqiao Town (nature in urban), Hongqi Village (urban built-up zone), to discuss how to continue this regional resilience into the design from local scale and detailed scale.

In this part, two design methods through research and research design, are applied to advance the design. Design principles learned from literature review and case study are tested on each site to see if they can fit into the resilient structure meanwhile solve the problems.

Visualization approaches like 3D modeling, collage, and sections are quick and visual ways to give a general impression of the sites' atmospheres.

Meanwhile, design principles extracted from these four sites are also applicable to other locations in the Tonghu Area.

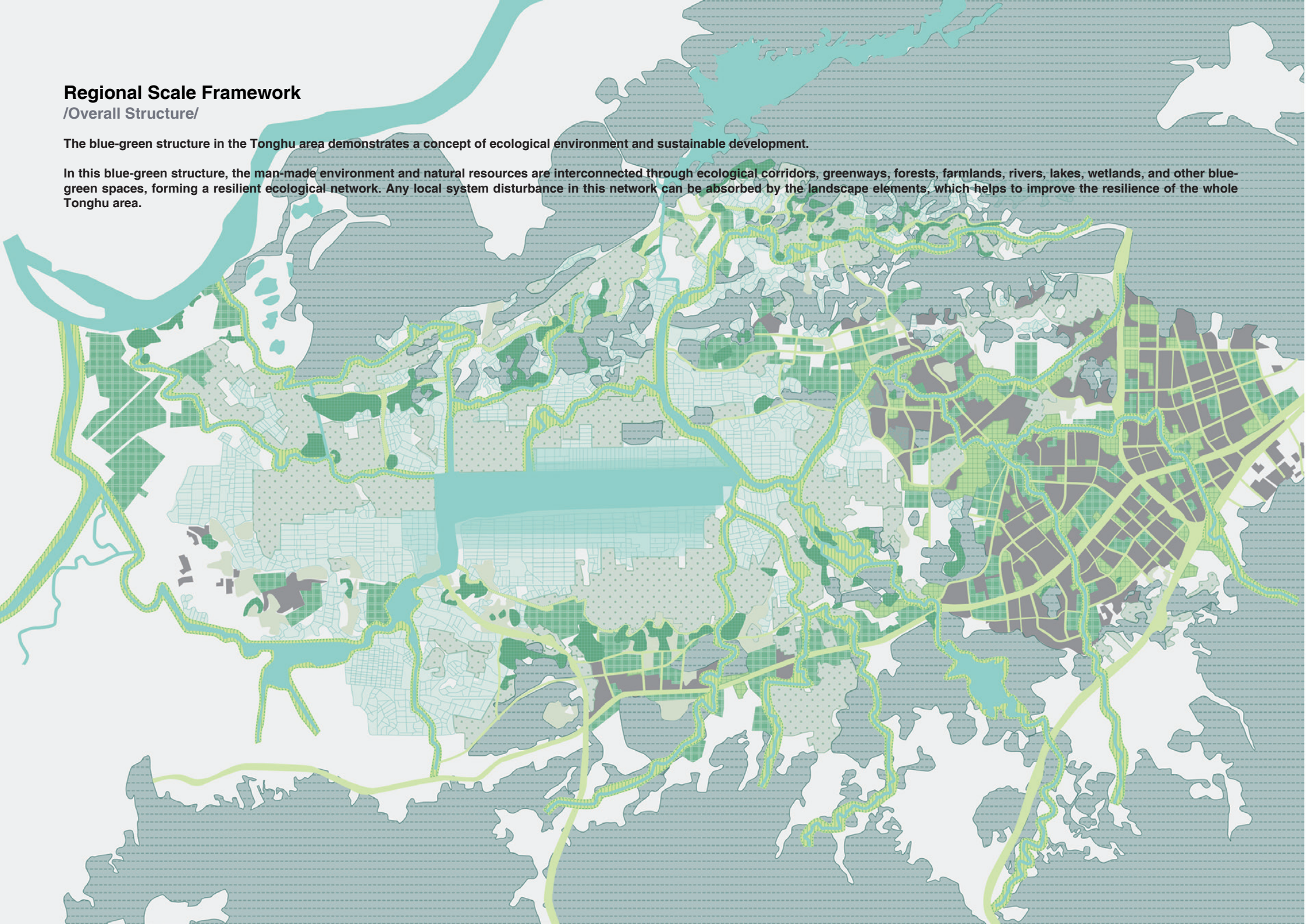
Huizhou- Huiyang Logistics Center
https://www.prologis.cn/en/industrial-logistics-warehouse-space/china/huizhou/huizhou-huiyang-logistics-center

Regional Scale Framework

/Overall Structure/

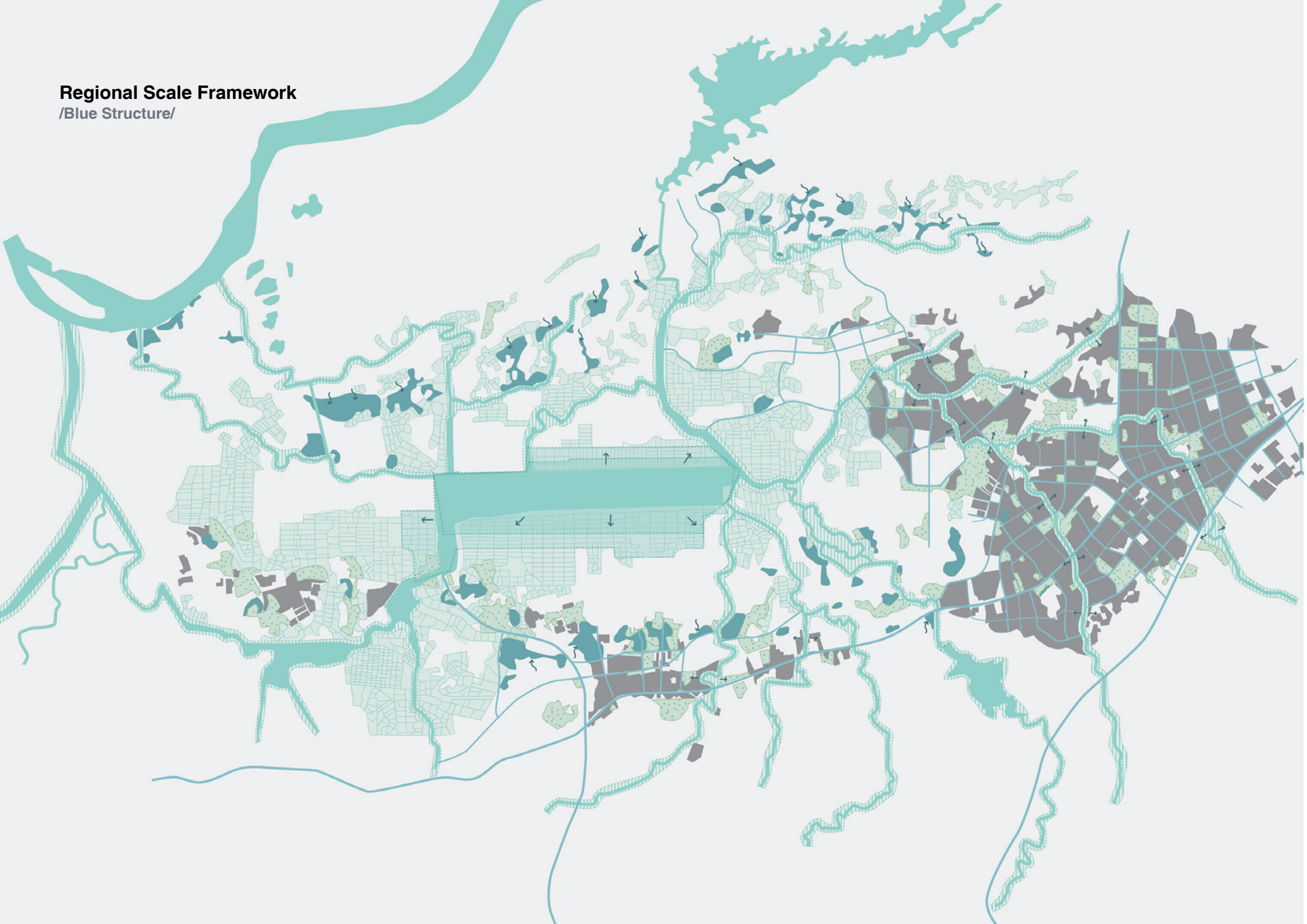
The blue-green structure in the Tonghu area demonstrates a concept of ecological environment and sustainable development.

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 blue-green spaces, forming a resilient ecological network. Any local system disturbance in this network can be absorbed by the landscape elements, which helps to improve the resilience of the whole Tonghu area.



Regional Scale Framework

/Blue Structure/



Regional Scale Framework

/Blue Structure - Strategies/

Water is the backbone of the entire Tonghu area and is the basis for the overall natural and urban landscape pattern.

The main idea is to change the traditional "hard resistance" strategy of expelling water and flooding from the city to a resilient adaptation approach that allows moderate flooding.

Within the ecological river corridor, the buffer zone green areas, woodlands, grasslands, and wetlands can be partially flooded according to the geological and topographical conditions.

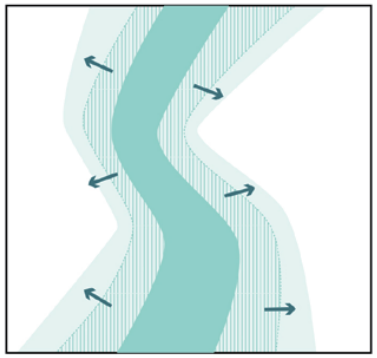
In addition, spaces such as agricultural lands, mountain forests, and wetlands outside the ecological corridor can be locally low-lying as a detention area during flooding. For example, to reduce the economic loss caused by flooding of agricultural land in low-lying areas near rivers, flood-avoidance agriculture can be used, alternatively, by using species wheel patterns or selecting hardy and flood-resistant crops. Systems such as wetlands can also achieve natural ecological processes through water replenishment during the flood season and gradual natural recession.

The design needs to consider how to allow flooding to enter the city but not interfere with average urban production and life within cities. We can elevated walkways in low-lying areas, creating soft riverbanks along rivers with different elevations that can be partially flooded. The plaza can be turned into rainwater plazas which can be flooded and stored water for short periods.

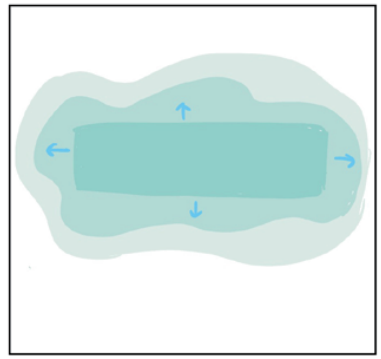
At the same time, rivers and lakes are not the only carriers of water. All kinds of forest and grassland and urban green space are also important spaces for water. Therefore, in the blue-green network, green should interpenetrate and work together with blue. The green space within the ecological corridor can purify water and expand the flooding regulation capacity of the river. Also with native plants can attract local birds, insects, and other small animals.

IN CONCLUSION,
by constructing a blue network, the idea is to give back more space to water and create more permeable space to improve the resilience of the Tonghu area against rain and floods. Moreover, combined with green infrastructure, it will create a habitat for flora and fauna while purifying the water.

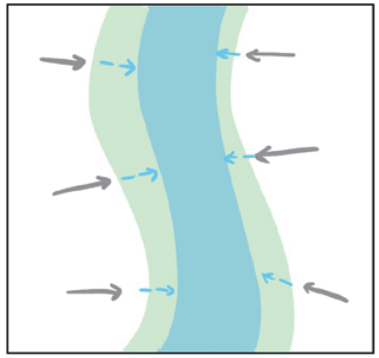
Widening the river



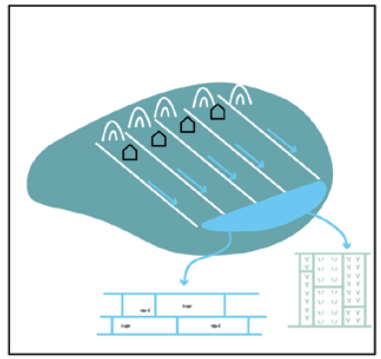
Enlarge the wetland



Sponge for purification



Flood regulation in historic villages



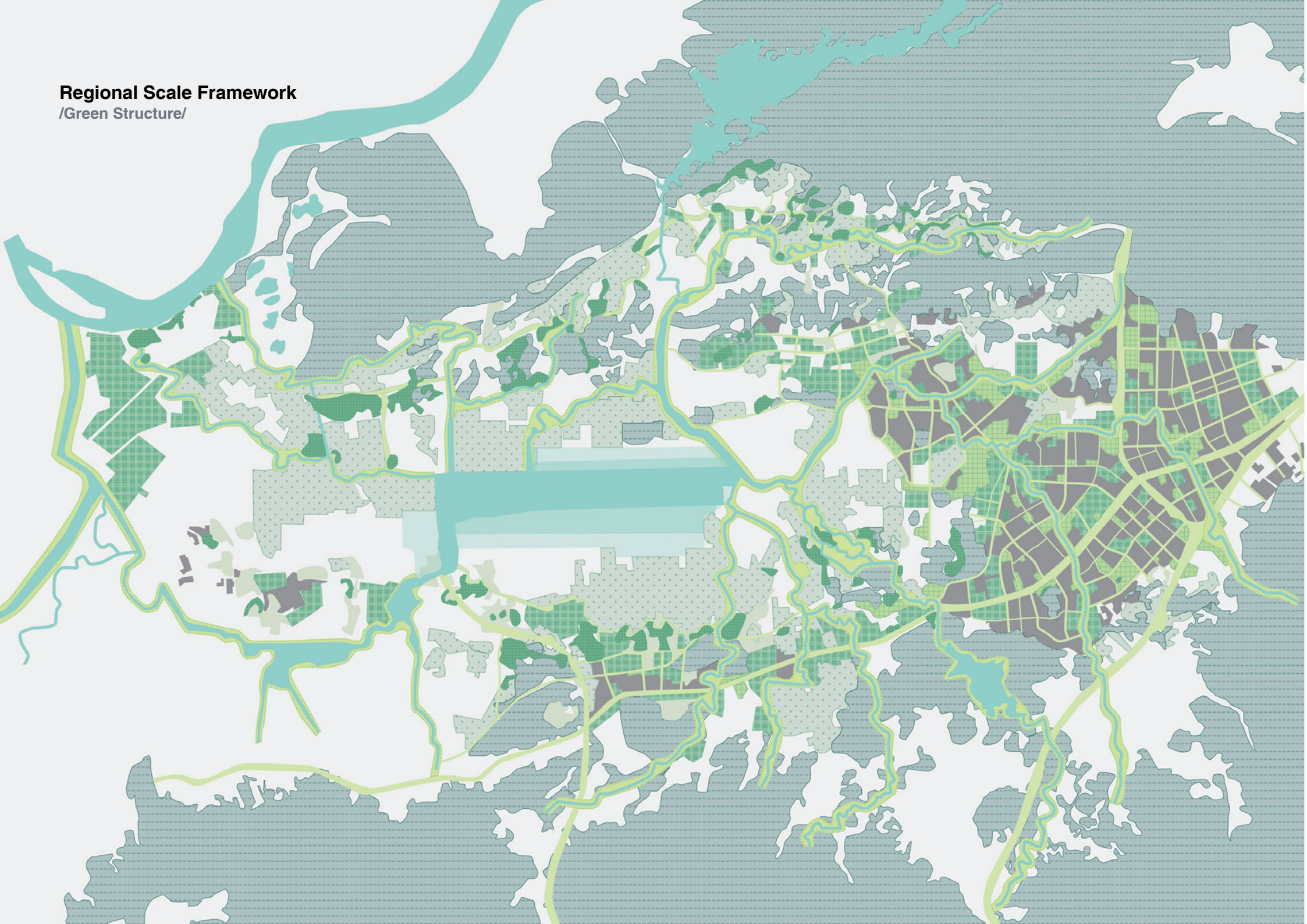
There are three strategies:
The first one is by widening the river. The flood space can be enlarged by widening the river channel in the parts with high flood frequency, a large difference between flood and drought, and limited width. Different slopes combined with diversified aquatic plants can beautify the riverbank landscape at the same time to achieve the purification effect.

The second strategy is to expand the wetland area. Although the wetland perimeter has been artificialized to varying degrees, some construction is difficult to eradicate. However, the effect of increasing the wetland detention area can be achieved by some adaptive landscape interventions. For example, fish ponds with similar hydrological conditions can be partially opened up and gradually transformed into semi-artificial wetlands through natural succession. These fishponds can be flooded for short periods when rainfall is high. The change of water level can also help to form complex ecological communities.

The third strategy is through activating the rainfall regulation capacity of historic villages. Historically, these villages could smoothly direct water to Fengshui ponds in front of the village for storage and use through drainage ditches, combined with the natural topography. This system is a good experience of adapting to local conditions and making friends with water, only to be abandoned in the rapid development of recent years. So if this function of the village could be reactivated, it would alleviate the flooding problem of the village and at the same time improve the flow of blue in the larger structure.

Regional Scale Framework

/Green Structure/



Regional Scale Framework

/Green Structure - Strategies/

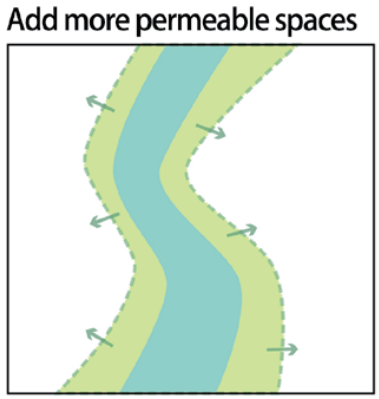
The idea is to increase the proportion of green space in the city by protecting and restoring the existing green spaces. Moreover, create blue-green corridors by combining with the blue network to connect the current fragmented green spaces. Also, penetrate the ecological effect to the surrounding hinterland by these green connections.

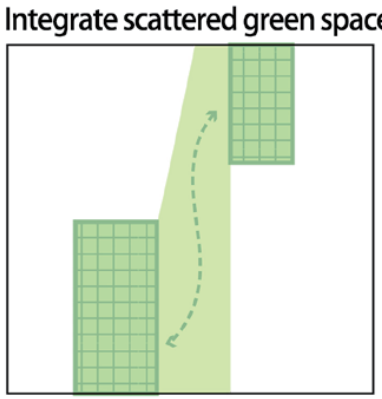
We should avoid thinking about the green line as a separation line between ecological land and urban land in the design. Green should not have a fixed boundary range but should interpenetrate with other landscape elements, such as water, cities, and villages.

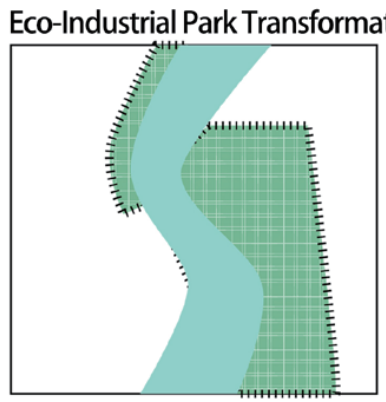
In the city, the permeability of the substrate and the greening rate should be increased. An urban-green transition zone can be added between the water, waterfront green space, and the city. The artificial environment can gradually transition to the natural ecological environment and penetrate layer by layer. More "straw-shaped green corridors" can be created along the rivers combined with blue networks to spread the waterfront ecological effects to the urban environment. At the same time, green corridors can be created along major traffic lanes to connect existing green patches for the continuation of green spaces.

At the same time, the existing natural green patches should be protected and conserved. For example, around the Tonghu wetland, some key ecologically fragile areas, such as lowlands, grasslands, and mudflats, are precisely the habitats of rare plants and animals that need to be protected. The ecological value of wilderness should be recognized by preserving the native habitat environment as much as possible. Then there are forests, in which the design should focus on protecting the existing rich natural forests. At the same time, natural transformation of artificial forests, the introduction of a variety of native tree species, to create a diverse tree - shrub - grass composition habitat for animals.

To conclude, by creating a green structure, the idea is to connect and enrich green spaces, forming a composite network of matrix-patch-corridor and maximizing green ecological benefits. At the same time, it integrates with the blue structure to penetrate the blue-green ecological benefits to more places.







There are four strategies:

The first one is adding more permeable spaces, especially in the urban context. It could be urban parks, pocket parks, greenery along the street, or river corridors. These green areas will help the city increase the greening rate and create spaces for people to relax. Meanwhile, the permeability is improved, and the flooding pressure is relieved.

The second strategy is integrating scattered green spaces. There are many existing and potential green spaces in the city. For example, linear landscapes can along abandoned railroads; small open spaces can be designed into pocket gardens. They can be linked by constructing a green network, and then the ecological values can be maximized.

The third one is transforming wasteland and polluted industrial sites into eco-industrial zones. The site's functions are preserved, while their ecological bases can be used as part of the green network.

Furthermore, the fourth strategy is creating a historical village green belt. This helps to preserve historical villages, on the one hand. On the other hand, it helps link these villages to the surrounding natural environment and then to the large green structure.

This part of the design exploration is by studying the examples to extract strategies that can be translated and applied to other projects with similar design conditions.

Based on this landscape framework proposal and site classification, four typical sites are picked out for further design exploration. Each site has different design conditions and specific issues that need to be tackled with.

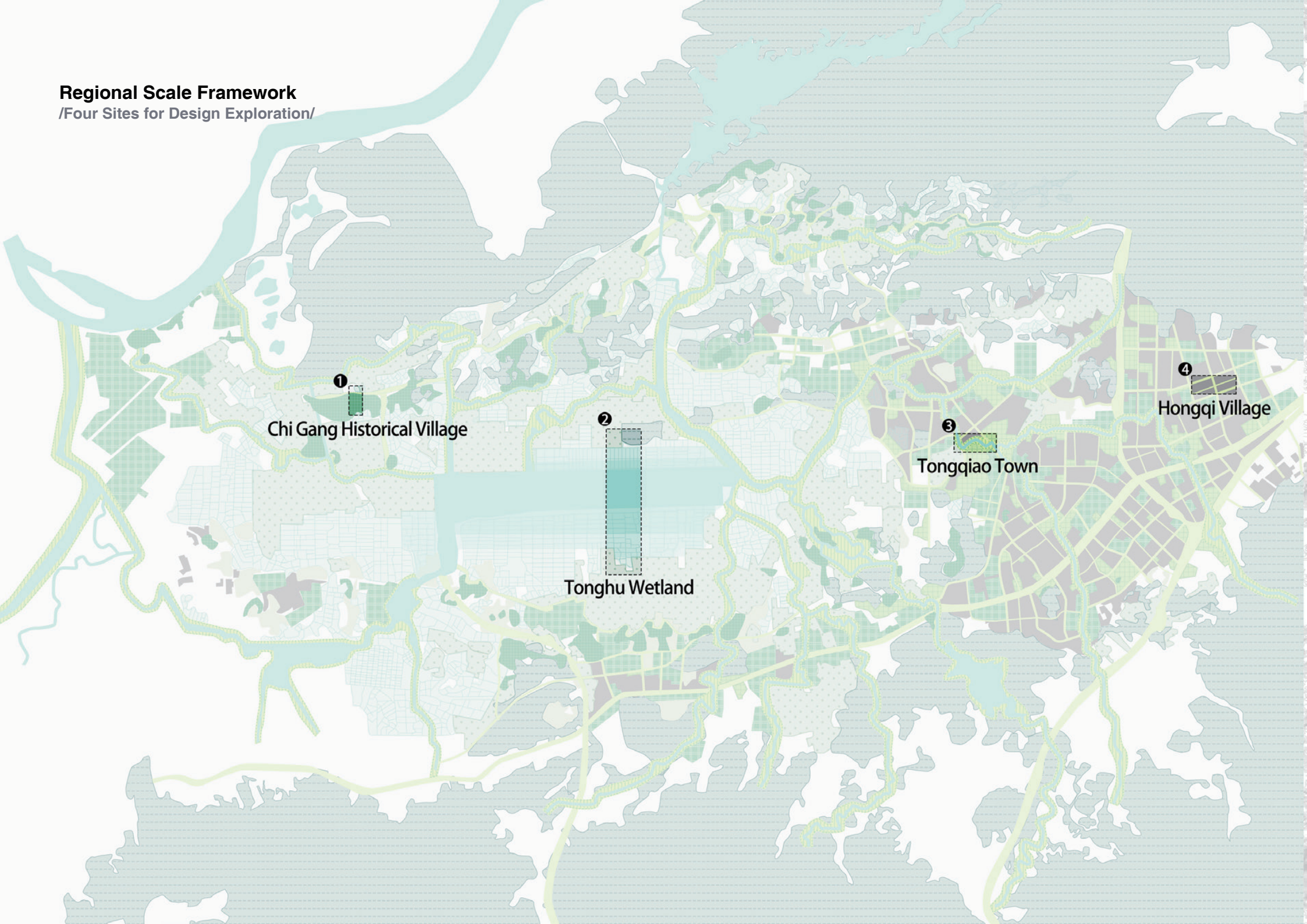
In the mountain-historical village zone, because Chigang Village's historical condition is relatively well preserved; meanwhile, it is one of the key protected ancient villages in Guangdong Province. Therefore, it is selected as an example to study the restoration and revival of historical villages.

In the valley zone, due to the consideration of the landscape's integrity, especially in the wetland landscape where water, vegetation, and biodiversity work as a whole. Therefore, the central Tonghu wetland combining the surrounding production landscape is chosen as the whole design area.

The urban zone is divided into two categories: under construction area and built-up area—one with more flexibility and the other focusing mainly on regeneration. Therefore, Tongqiao town(under construction area) and Hongqi village(built-up area) were selected for the study, respectively.

Regional Scale Framework

/Four Sites for Design Exploration/

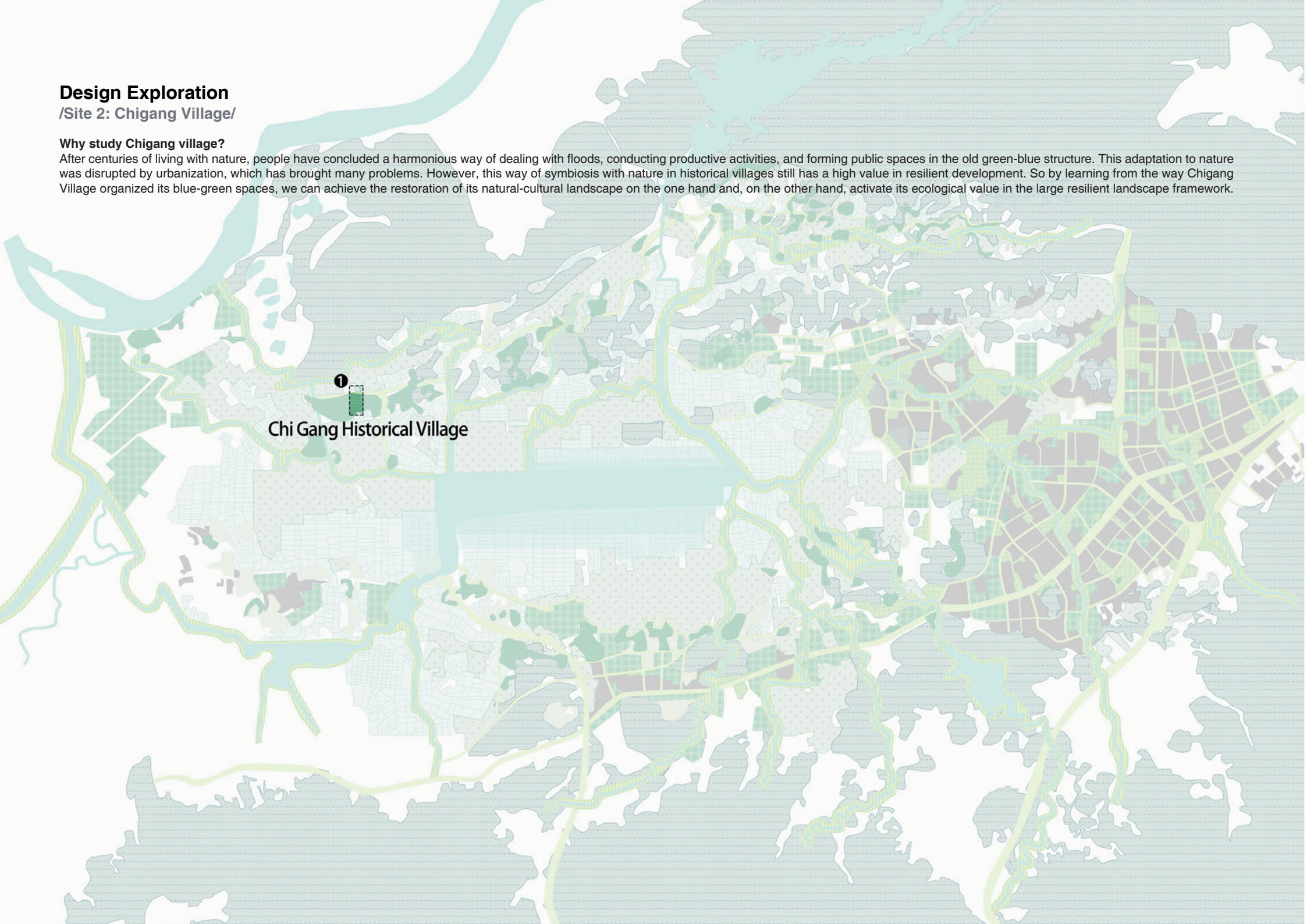


Design Exploration

/Site 2: Chigang Village/

Why study Chigang village?

After centuries of living with nature, people have concluded a harmonious way of dealing with floods, conducting productive activities, and forming public spaces in the old green-blue structure. This adaptation to nature was disrupted by urbanization, which has brought many problems. However, this way of symbiosis with nature in historical villages still has a high value in resilient development. So by learning from the way Chigang Village organized its blue-green spaces, we can achieve the restoration of its natural-cultural landscape on the one hand and, on the other hand, activate its ecological value in the large resilient landscape framework.



Chigang Historical Village
Photoed by Tao Jin

Design Exploration

/Site 2: Chigang Village Historical Landscape Structure/

Plan

The plan shows how the village regulated the water by following the topography and how the village integrated with the surrounding natural environment through fish ponds, farmland, and orchards.

Blue Structure

There is a network of drainage ditches along the alleys and behind the houses. This ditches system can help direct the water out from the village to the feng shui pond in the rainy season. Also, the wells in the front square can store some rainwater for the people to use later.

Green Structure

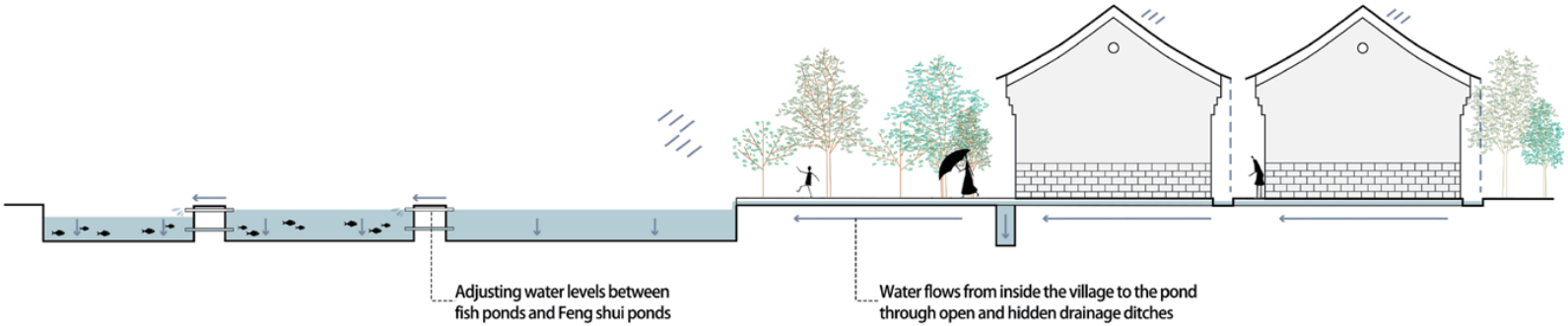
There are mainly some big banyan tree groups at the village entrance, which also function as public spaces for people to gather around. There are also some small groves of trees at the back of the village. Further away are farmlands and orchards connecting the village with the natural environment.

Design Exploration

/Site 2: Chigang Village Historical Section/

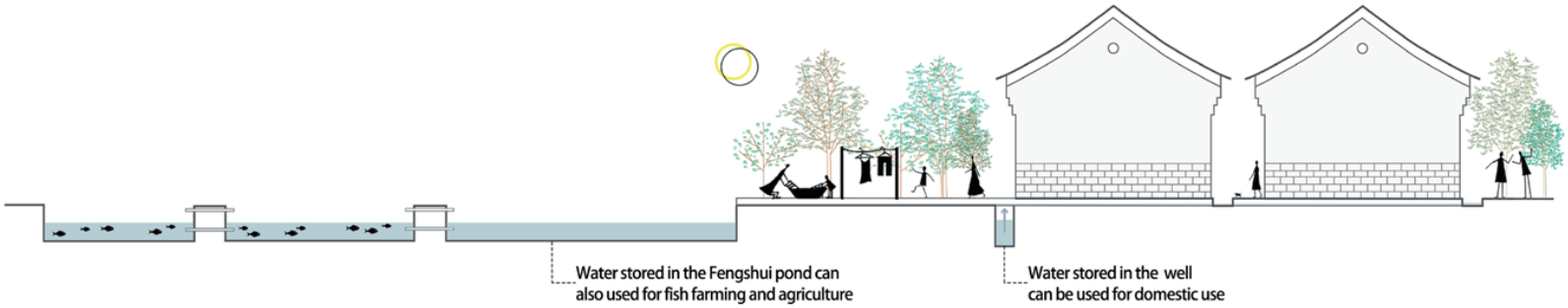
Flood regulation /Rainy/

In the rainy season, water flows from the village to the Fengshui ponds at the front of the village. Meanwhile, Fengshui ponds can exchange and replenish water through pipes with fishponds.



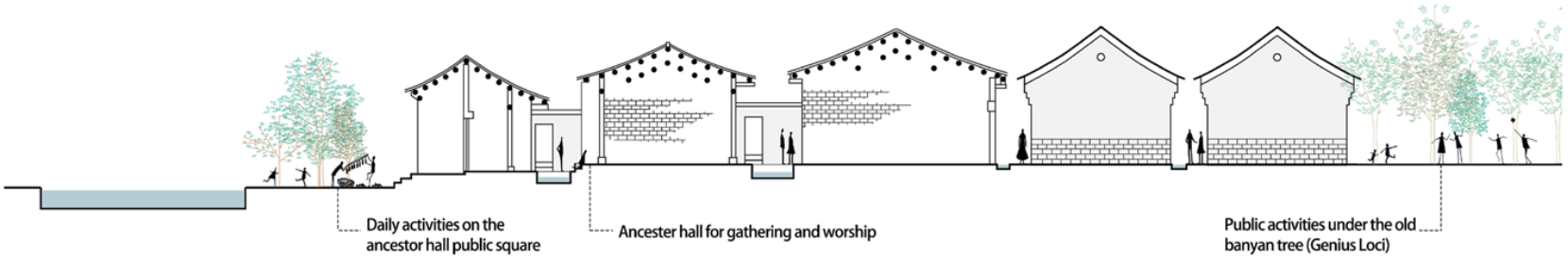
Water regulation /Sunny/

In the dry season, people can draw water from the well for daily use.



Public space organization

This blue-green structure also forms the public spaces for the village. Under the big banyan tree by the feng shui pond, people have daily activities, such as washing clothes.

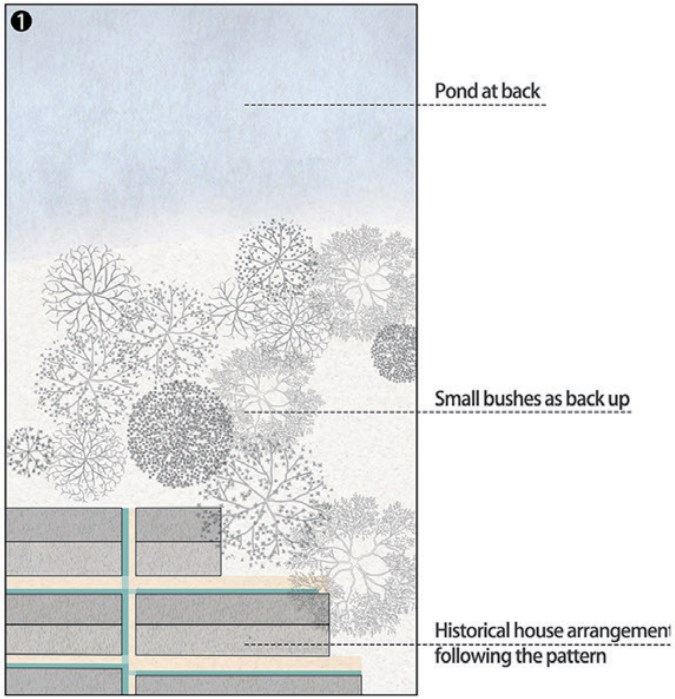


Design Exploration

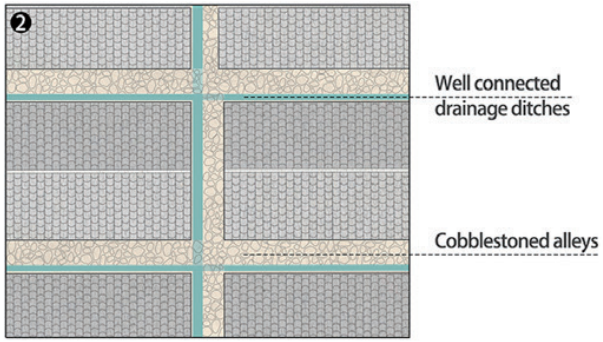
/Site 2: Chigang Village Historical Interfaces/

The interface study explores how different landscape elements inside the village connect for extending green and blue spaces.

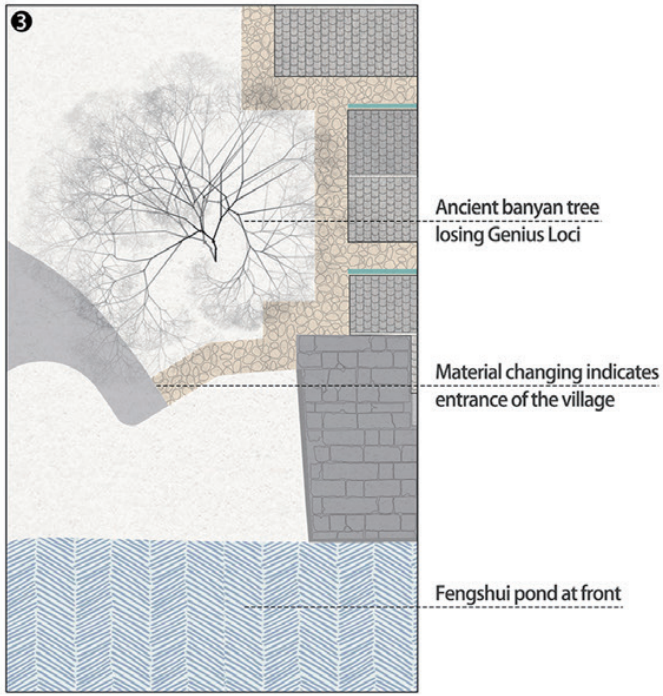
When we zoom in, we can see those different landscape elements closely connected, forming a very coherent interface.



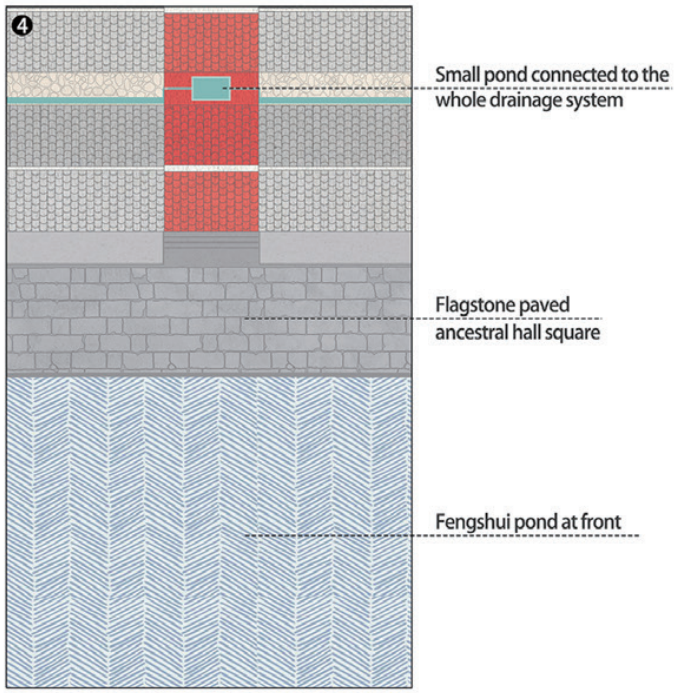
This interface shows the village is connected to the pond at the back by a small group of trees.



This interface shows that cobblestone paths(historical paving material) and drainage ditches connect the houses.



This interface shows the giant banyan tree indicating the boundary of the village.



This interface shows how the ancestral hall - front square - Fengshui pond are connected.

The interface study explores how the different landscape elements within the village connect and how they help extend the green and blue spaces.

Interfaces were composed in many ways: through plants, paving, ditches, etc. They are not only a specific form but also with functions.

For example, the old trees at the village entrance mark the village's location, and the drainage ditches help discharge the floods in summer. At the same time, these landscape elements have a very identical Lingnan style, such as the flagstone used for paving, which is a unique local material.

In conclusion, these interfaces are the medium that connects the houses, water, green space, and the outside environment in the village, sewing the different patches of the village together.

Design Exploration

/Site 2: Chigang Village Current Problem/

Nowadays, some problems are emerging. The modern construction broke old patterns of the village. Some spontaneous house building and farming activities break the open interface from the ancestor hall to the Fengshui pond. Some drainage ditches are covered. Many of the historic houses are abandoned or even collapsed. Some are used as small vegetable plots, and some are filled with wild plants.

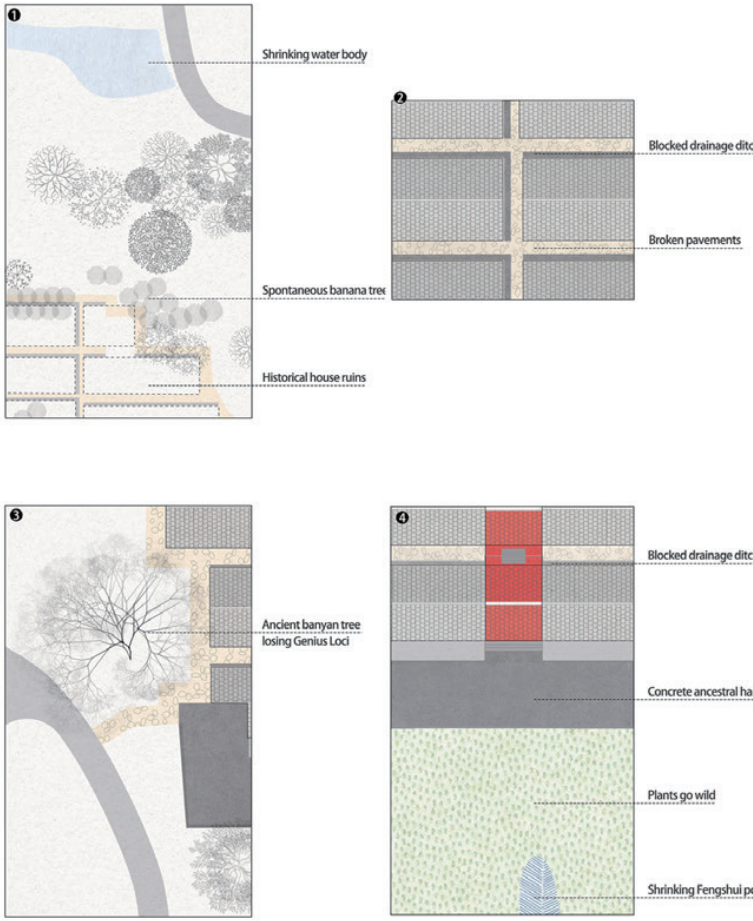
Design Exploration

/Site 2: Chigang Village Current Landscape Structure & Interfaces/

The current spatial structure is not clear now; meanwhile, the interfaces are also broken by uncontrolled construction. The village lost its ecological connection both with the outside natural environment and inside the village itself.

The plan shows that the construction now no longer follows the historical pattern of the housing layout. Houses and other infrastructure have covered some blue-green space. The original continuity of the landscape has disappeared, and the only remaining blue-green spaces are fragmented.

The drainage network is damaged, the ponds are shrunken, and some small Fengshuii ponds are even filled up.

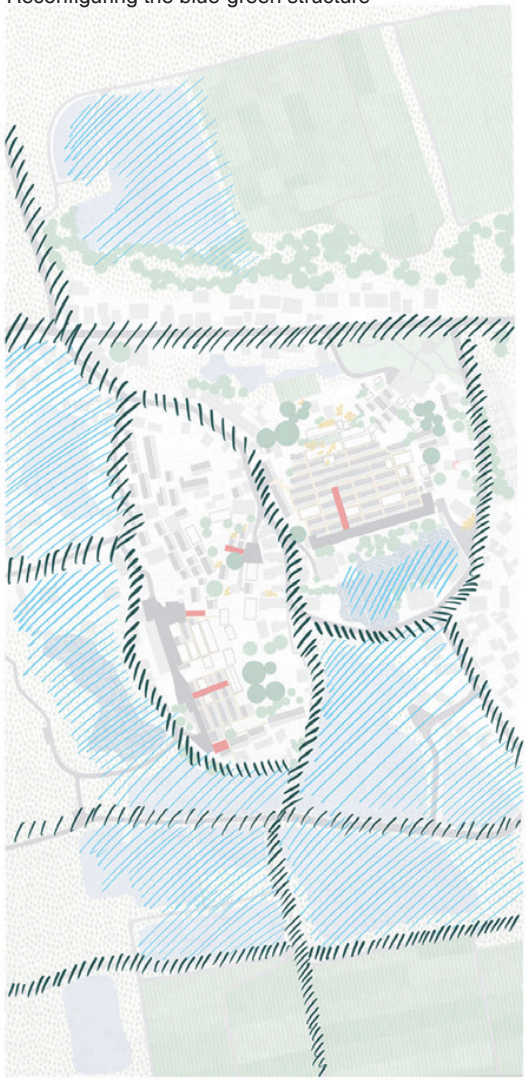


The interfaces were damaged. Many old houses are abandoned, and banana trees grew inside the ruins. The old banyan tree lost its significance as a symbol of the village entrance. The cobblestone paving was scattered. The ancestral square lost its relationship with the Fengshui pond.

Design Exploration

/Site 2: Chigang Village Design Strategy & Plan/

Strategy 1:
Reconfiguring the blue-green structure

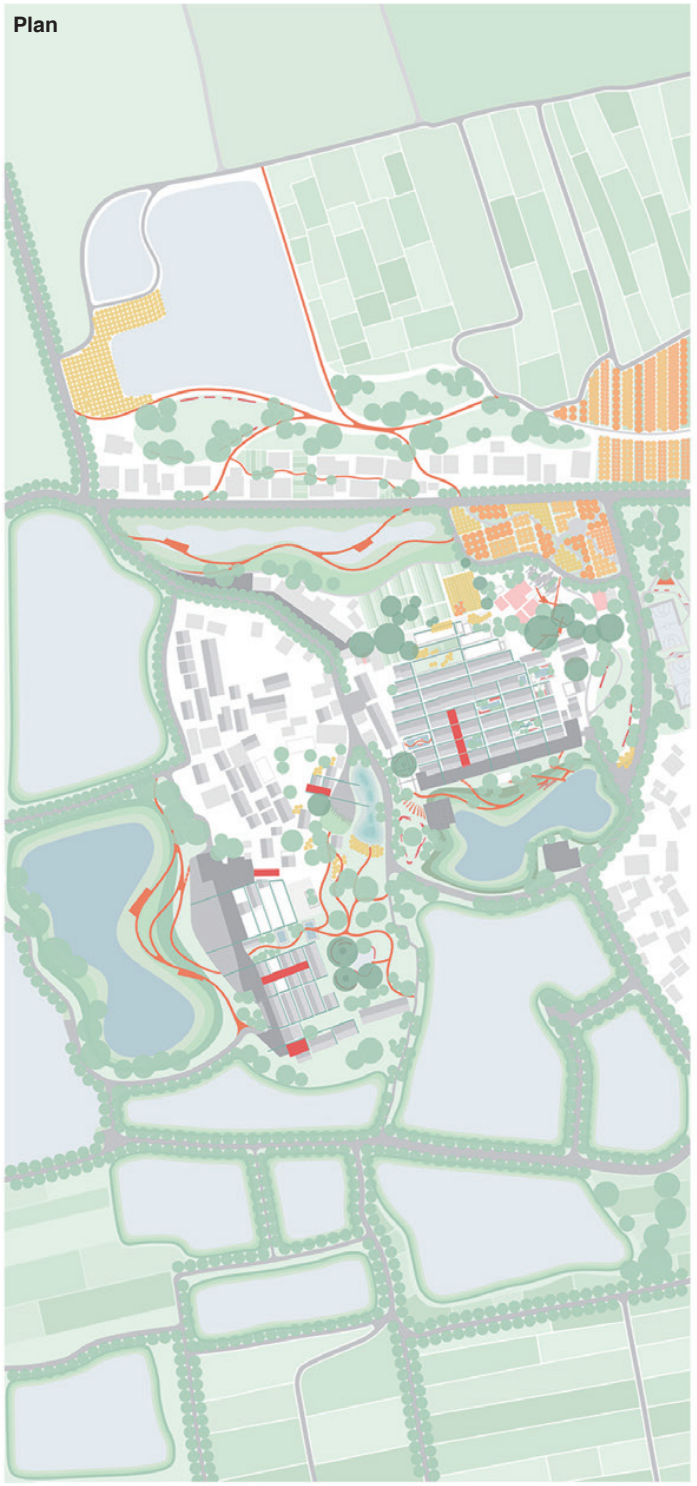


Reconfiguration of the blue-green structure can help connect the village to its surrounding natural environment.

Strategy 2:
Restoring the interfaces

Restoration of the interfaces can help bring back the natural and architectural connections within the village while creating a public space with new functions.

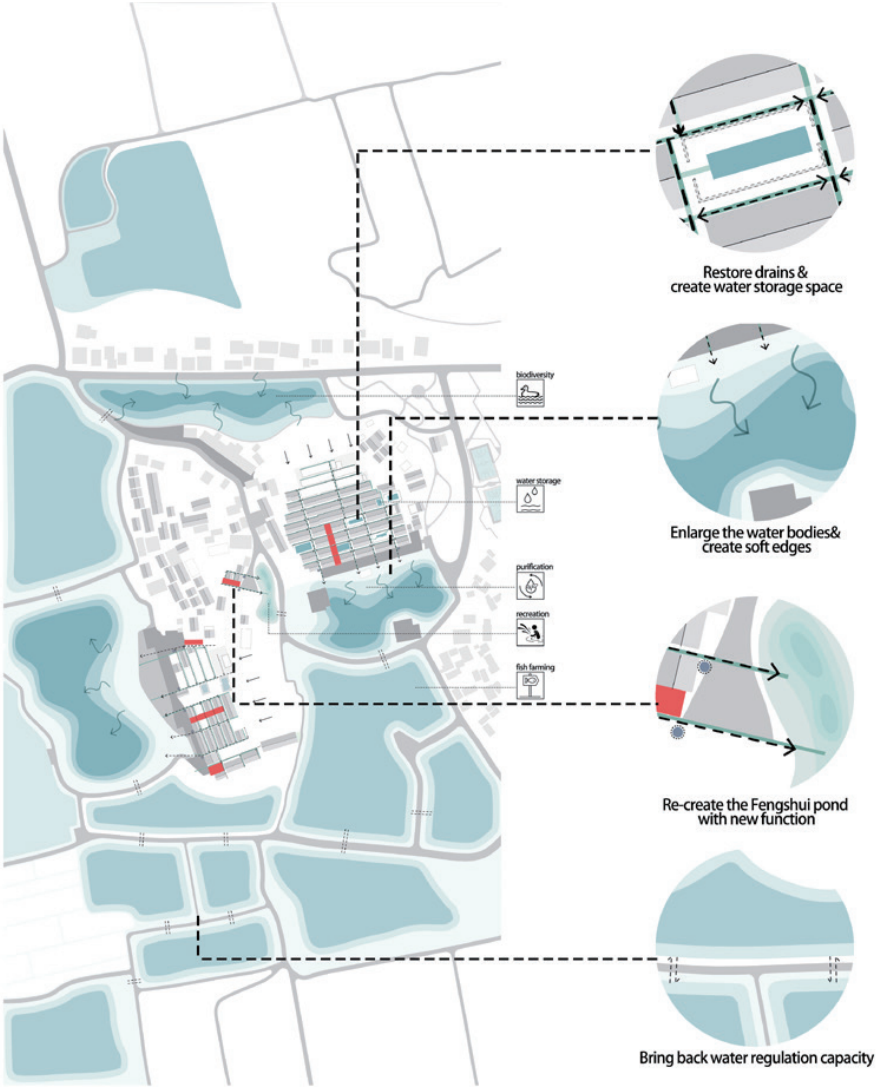
Plan



Design Exploration

/Site 2: Chigang Village Deisgn Plan Analysis & Sections/

Blue Structure



The water structure, is restored by reconnecting the drainage system to improve flood regulation capacity. Some relics can use for water storage. The Fengshui ponds are enlarged, adding water purification by creating soft edges with aquatic plants. Some small ponds are designed for recreational purposes.

Section /Rainy/

The drainage ditches are reactivated. On rainy days, water will be directed by the ditches from the village out to the pond in front. There are more aquatic plants along the boundaries of the ponds to purify the water. After dredging, the underground pipes will re-help the pond to exchange and replenish water between each other.

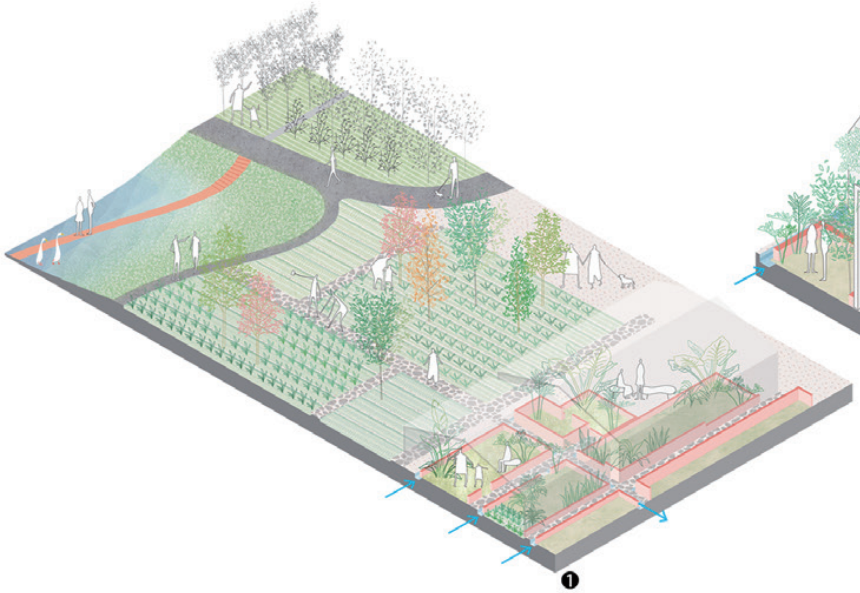
Section /Sunny/

The water stored in the well can be taken out and used for washing clothes. In addition, people can have more activities like sitting on the edge of a pond. Some walkways in between the ponds provide the opportunity for people to approach the water.

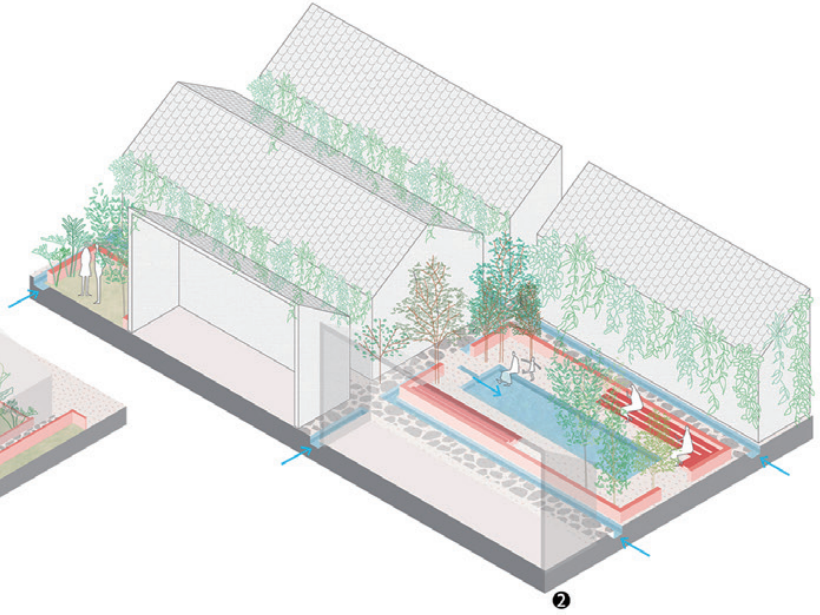
Design Exploration

/Site 2: Chigang Village Design Interfaces/

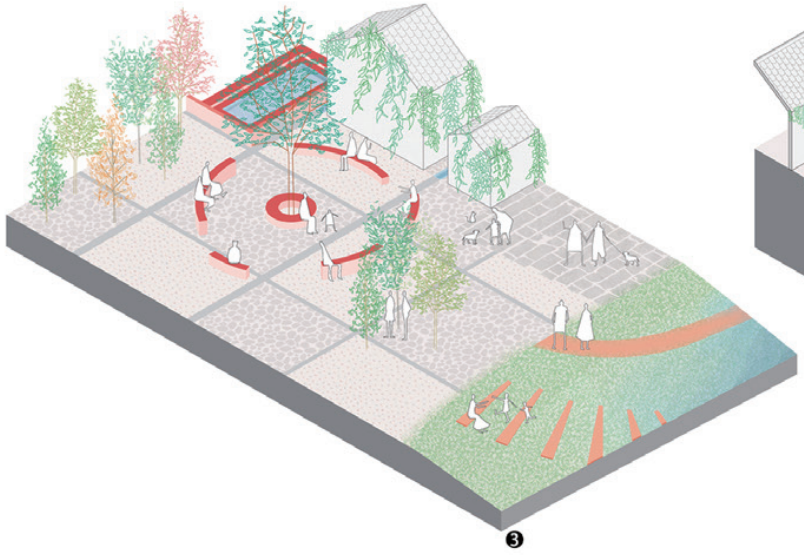
The new interfaces merge the different landscape elements within the village and continue the blue-green spaces from the large scale to the daily-activity scale.



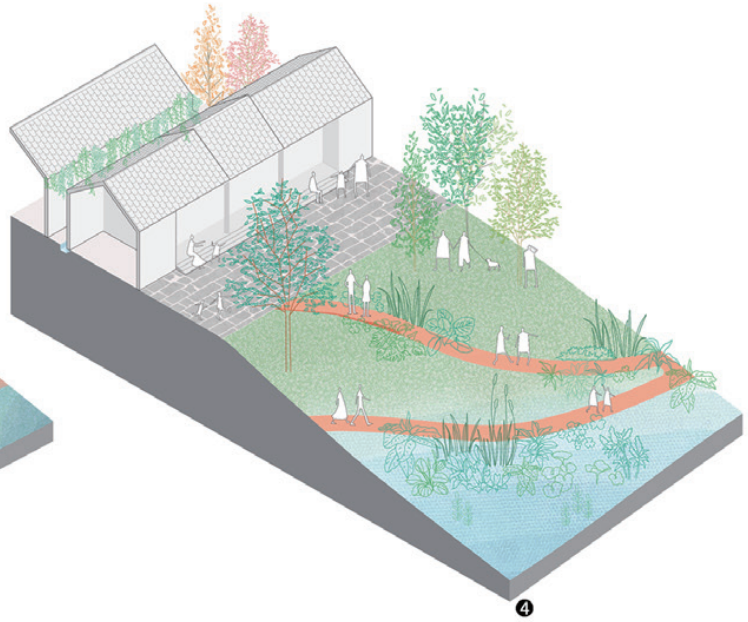
The transition from the back of the village to the pond can be connected by farmland. The relics marked in pink can be preserved and made into a relic landscape, together with the spontaneous growth of banana trees and other plants inside.



Between the houses, the relic can link drainage ditches for water storage and create a small water landscape.



For the old banyan tree at the village entrance, it can be combined with the typical paving of this village to make it a public square. People can gather here, chat and enjoy the landscape.



For the ancestral square, historical paving can be re-paved to replace the impervious concrete. The transition from land to water is achieved by a gentle slope incorporating aquatic plants. People can sit or lie down on the grass or approach the water through the walkway.

The new interface is based on the traditional way of interface composition and adds new functions.

For example, in the feng shui square area, the current concrete pavement is replaced by new permeable flagstone to restore the traditional look on the one hand and improve the permeability on the other.

In addition, the design fully respects the palimpsest of the site. For example, the old house remains are preserved as a heritage landscape; meanwhile, other functions are incorporated: guest houses, open gardens, water landscapes, etc.

In conclusion, the new interfaces play a role in connecting the different landscape elements inside the historical village on a small scale and continue the blue-green structure to the large scale.

Design Exploration

/Site 2: Chigang Village Inside the village/

Design Exploration

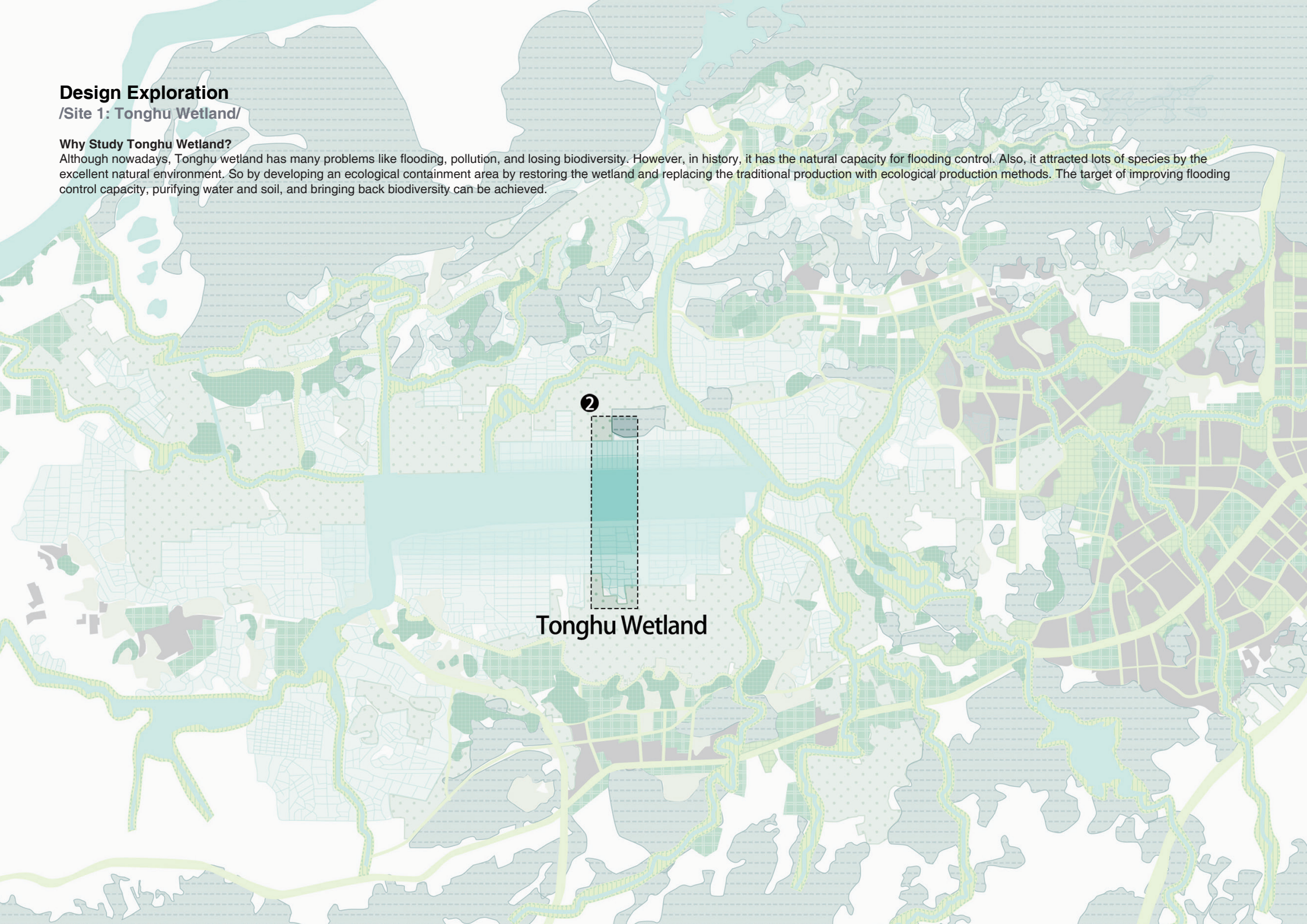
/Site 2: Chigang Village From Village to Fengshui Pond/

Design Exploration

/Site 1: Tonghu Wetland/

Why Study Tonghu Wetland?

Although nowadays, Tonghu wetland has many problems like flooding, pollution, and losing biodiversity. However, in history, it has the natural capacity for flooding control. Also, it attracted lots of species by the excellent natural environment. So by developing an ecological containment area by restoring the wetland and replacing the traditional production with ecological production methods. The target of improving flooding control capacity, purifying water and soil, and bringing back biodiversity can be achieved.



Tonghu Wetland
http://m.xinhuanet.com/2017-03/13/c_1120564397.htm

Design Exploration

/Site 1: Tonghu Wetland Current Problem/

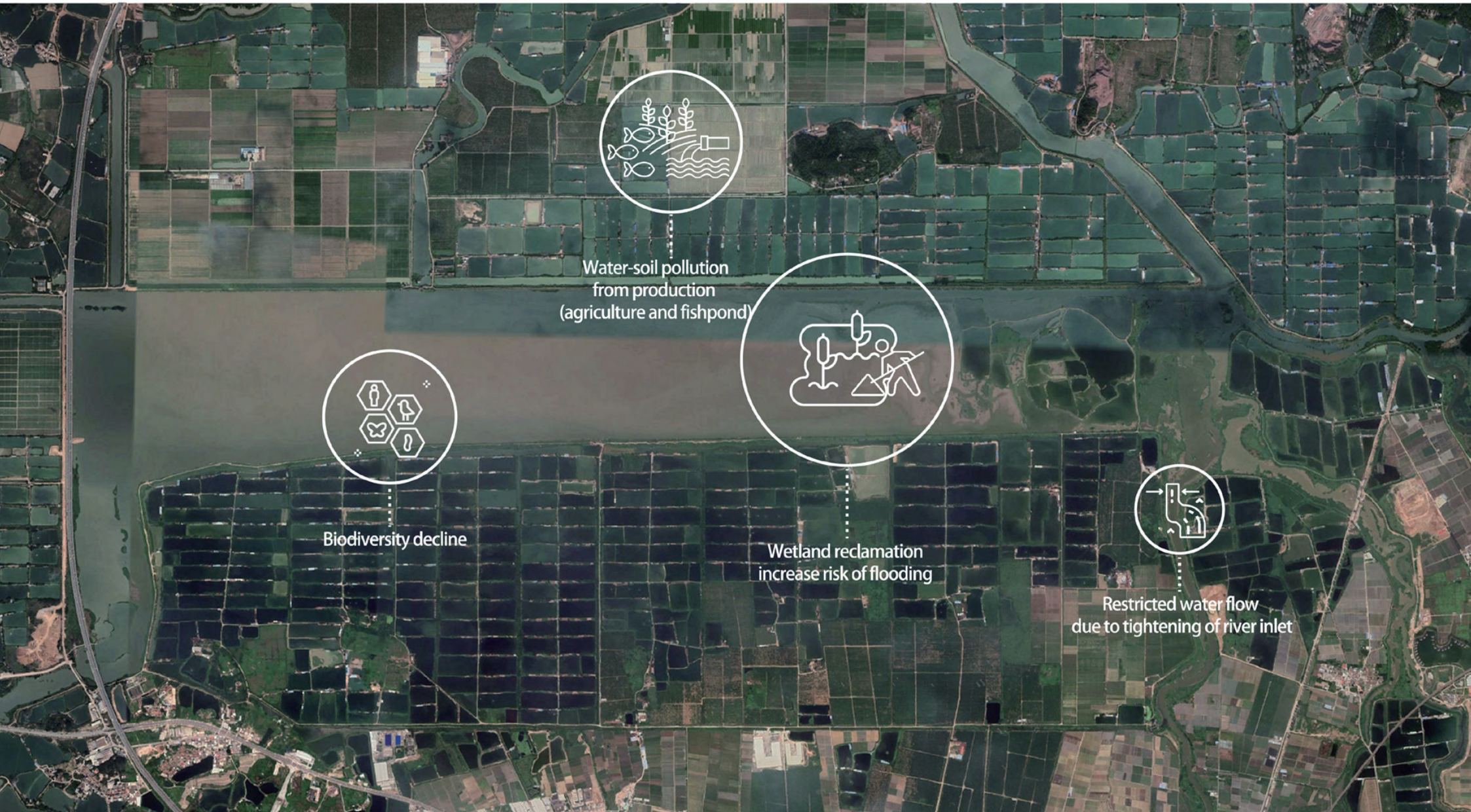
Since the 1960s, with Tonghu wetland reclamation, large areas were converted into artificial fish ponds and farmland for production purposes. On the one hand, this has affected the flood regulation and storage capacity of Tonghu as the floodplain of the East River. On the other hand, pollution from agricultural and fishery production has been discharged directly into the water, leading to a decline in habitat quality. As a result, Tonghu lost its natural advantages as a transit point for migratory birds. And many rare species have gradually disappeared.

Design Exploration

/Site 1: Tonghu Wetland Problem Analysis/

By studying the current landscape structure, we can identify what and where are the main problems:

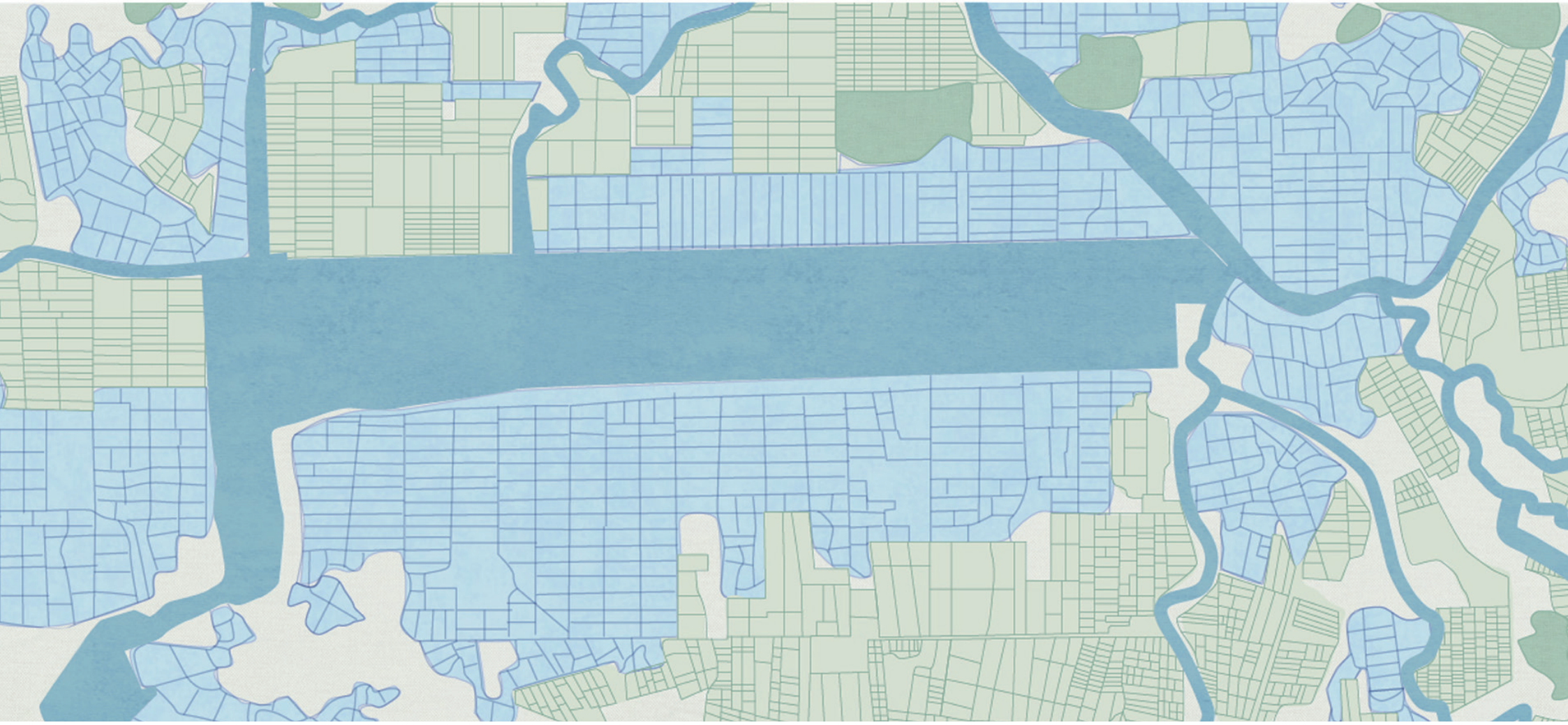
1. The large area of traditional agriculture and fishing brought pollution to the water and soil.
2. The shrinking wetland caused by the reclamation has cut down its flood-retention capacity.
3. The lack of natural edges and land-to-water transition limits animal habitats, cause the loosing of biodiversity.



Design Exploration

/Site 1: Tonghu Wetland Current Situation/

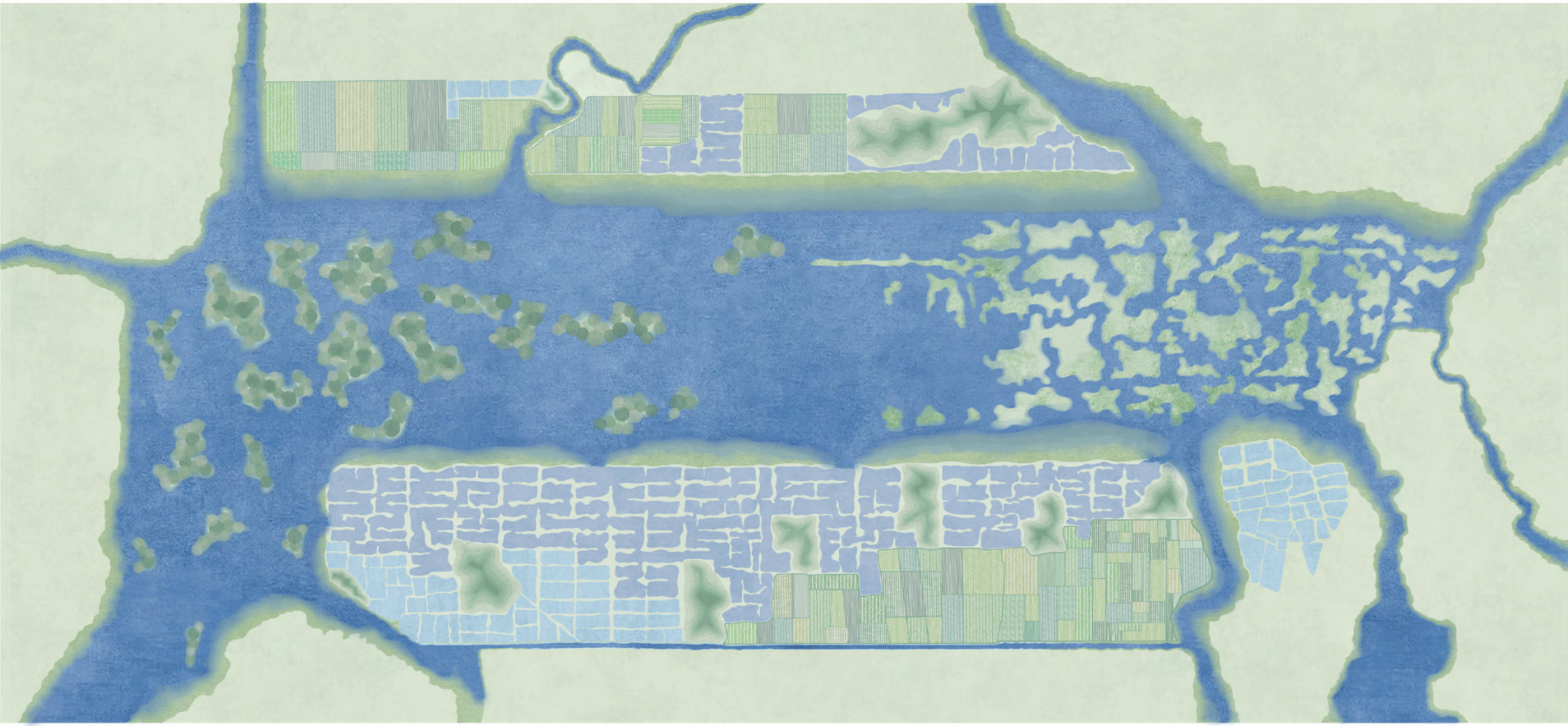
This plan shows Tonghu Wetland with a very rigid layout before design. It can be seen that the shape of water body before restoration is very artificial and narrowed, while there are very clear boundaries from the water to the fish ponds to the farmland.



Design Exploration

/Site 1: Tonghu Wetland Design Plan/

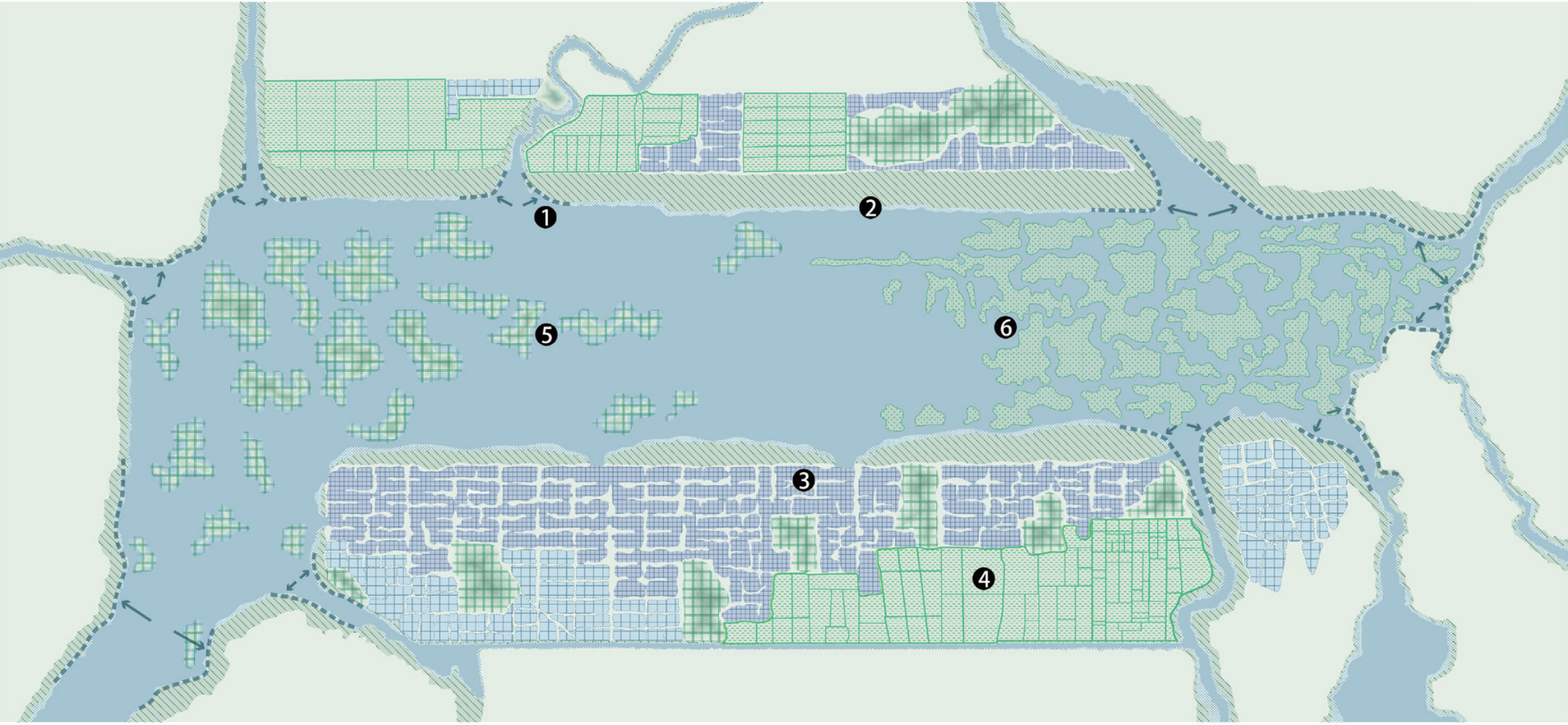
The main idea of the design is to create a landscape that integrates fish ponds and ecological farmlands, balancing the relationship between water restoration, wetland protection, and production. Meanwhile, create different interfaces to achieve a natural transition from land to water.



Design Exploration

/Site 1: Tonghu Wetland Design Strategies/

By literature review and case study, six main design principles are extracted. Then these principles are adapted to Tonghu wetland according to its current situation. The design is to solve pollution and flooding problems while creating diverse habitats for flora and fauna.

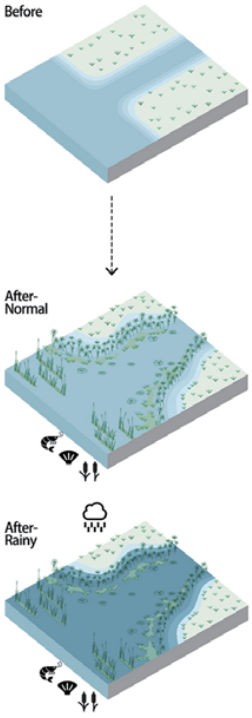


❶ Enlarge water surface ❷ Create soft boundaries ❸ Fishpond transformation ❹ Characteristic ecological agriculture ❺ Bottom mud purification: forest marshland ❻ Marshlands as birds habitat

Design Exploration

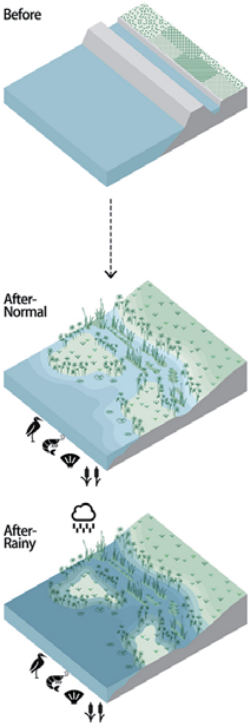
/Site 1: Tonghu Wetland Design Strategies/

❶ Enlarge water surface



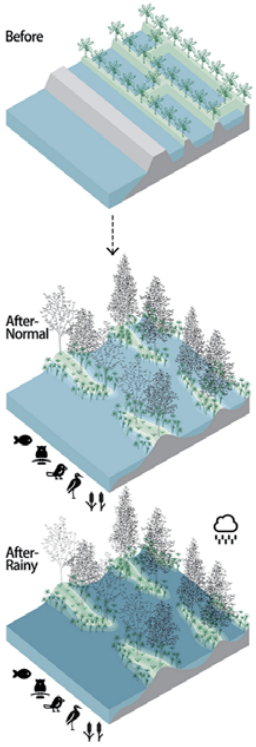
The first strategy is enlarging the water body by flooding some fishponds and farmlands, expanding the inlet from rivers to central wetland.

❷ Create soft boundaries



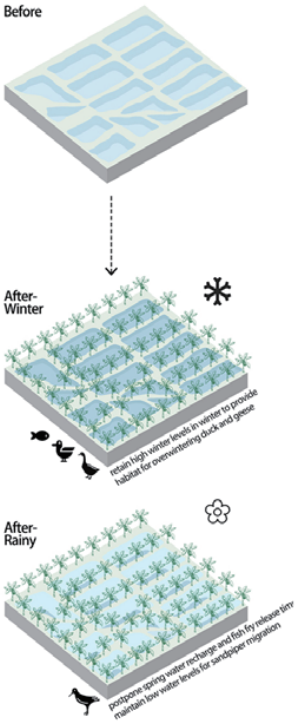
The second strategy is creating a soft ecological interface between water and land. Local water plants are introduced. With seasonal water level changes, it can gradually become a habitat through natural succession.

❸ Fishpond transformation



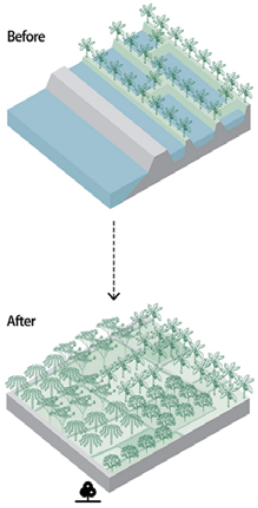
The third strategy is linking some fish ponds together and letting the water in. Gradually, these fish ponds can convert into wetlands.

❸ Fishpond transformation



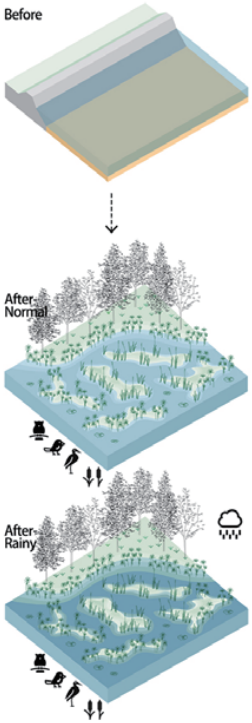
Meanwhile, some fishponds are preserved. It functions both for fish farming and bird habitat. The high water level can help ducks spend their winter here. In spring, the low water level helps sandpiper for migration.

❹ Characteristic ecological agri



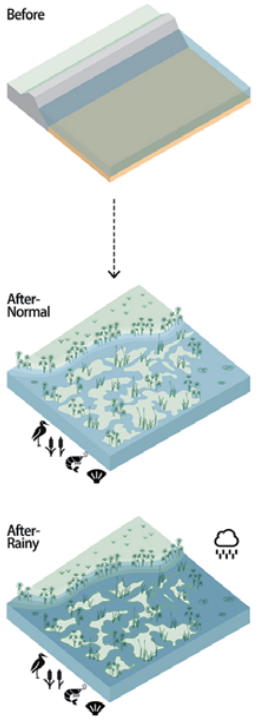
The fourth strategy is to replace traditional agriculture with ecological agriculture. Develop orchards with local fruits like bananas, dragon fruit, lychees. It not only has the agricultural production function but also as tourism to bring income for the farmer.

❺ Bottom mud purification



The fifth strategy uses the dug-out bottom mud to shape some forest marshland in the wetland. The plant roots absorb the pollutants in the soil. Also, it provides a habitat for birds and small mammals.

❻ Marshland as bird habitats

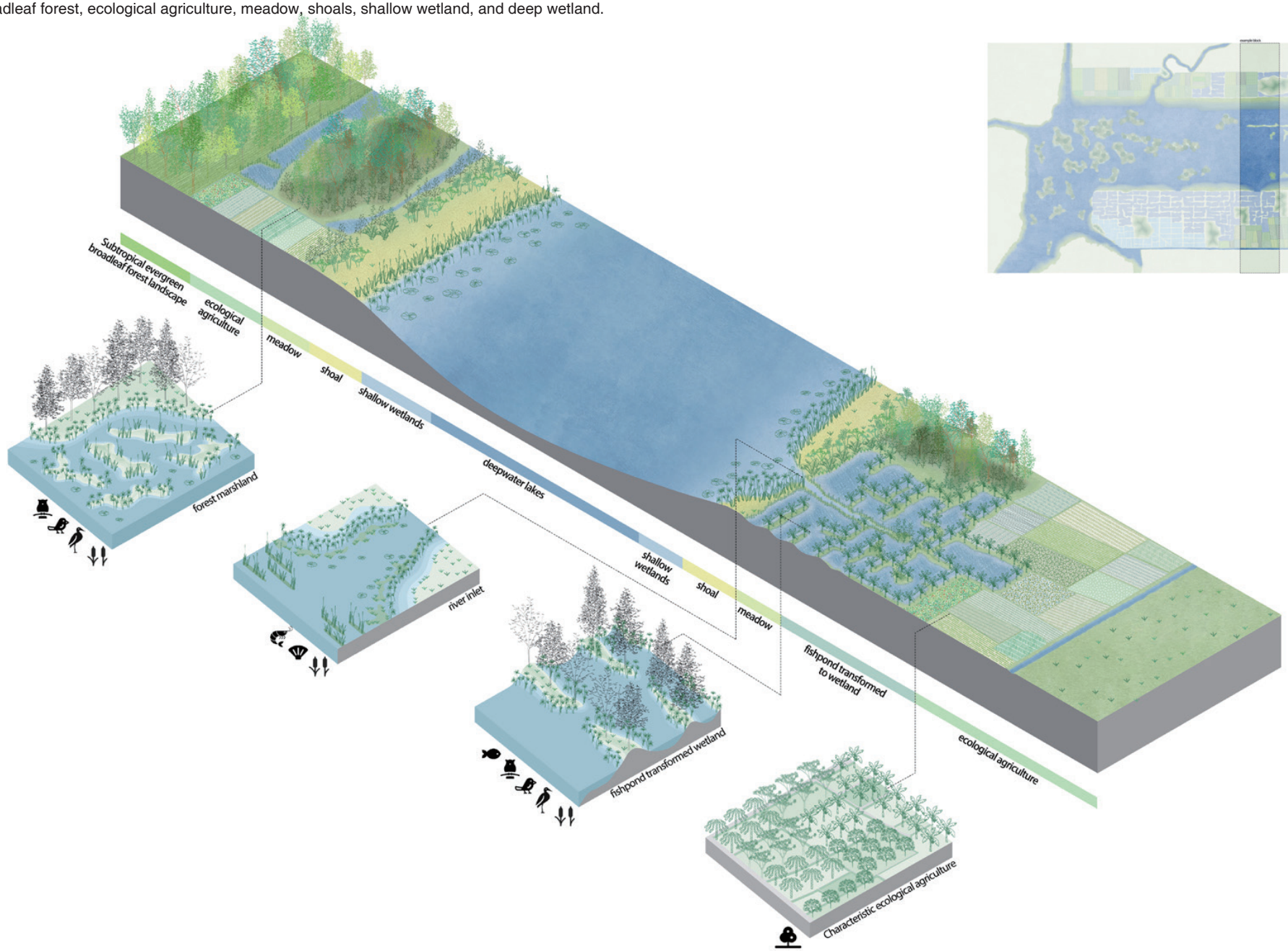


The sixth strategy is by enlarging the marshlands as feeding and resting places for birds. By matching the changing water levels with local aquatic plants, the habitat is created for different birds.

Design Exploration

/Site 1: Tonghu Wetland Design Interface/

This block helps to explain the transitional interfaces between different landscape typologies. Through the design of topography, water level and vegetation, diversified landscape typologies are created, including broadleaf forest, ecological agriculture, meadow, shoals, shallow wetland, and deep wetland.



Design Exploration

/Site 1: Tonghu Wetland Design Strategies/

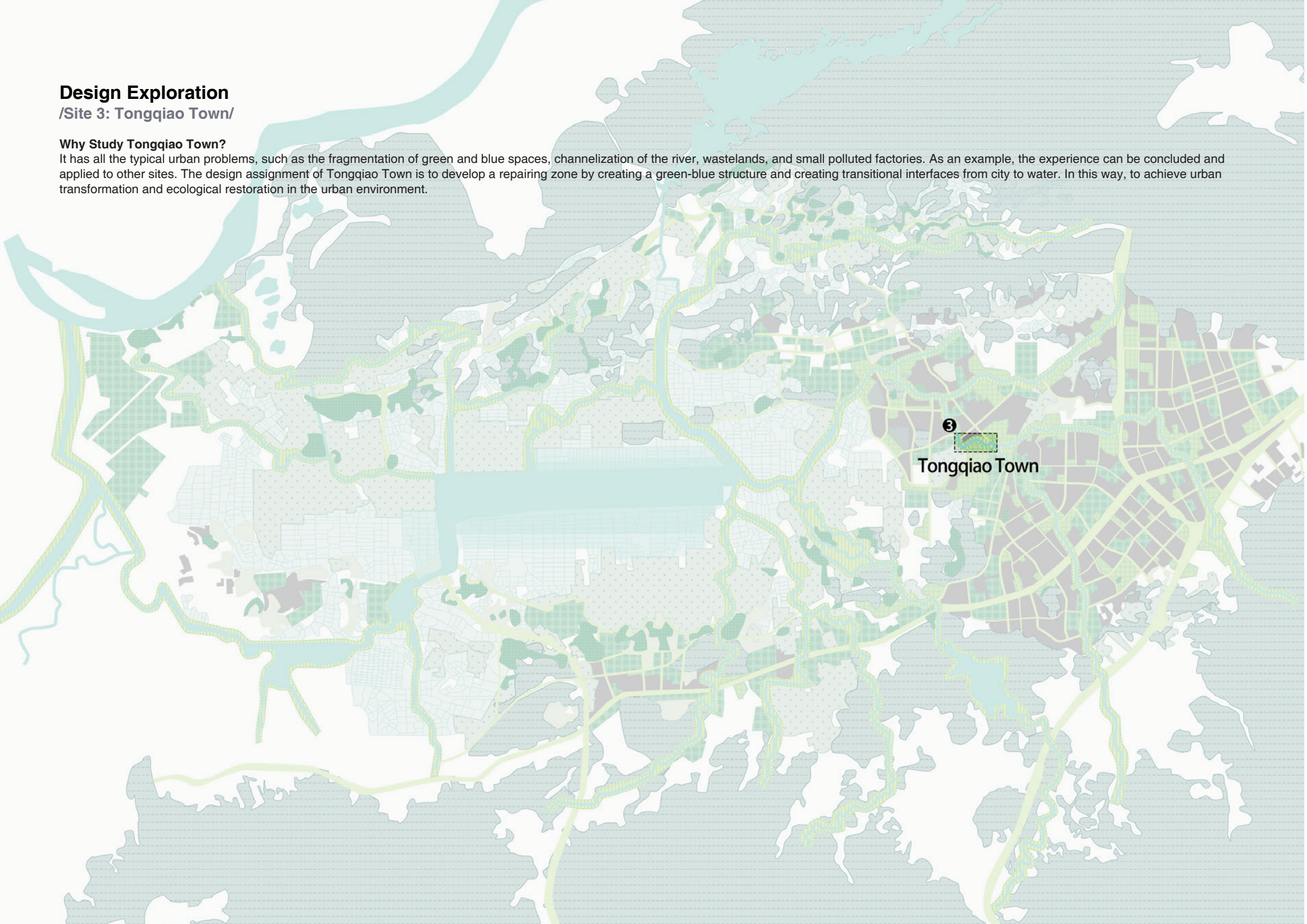
This section shows different habitat typologies designed with terrains, local plant species, and potential animals. The design aims to restore the biodiversity of the Tonghu wetland through ecological succession and create a complex and impact-resistant ecosystem.

Design Exploration

/Site 3: Tongqiao Town/

Why Study Tongqiao Town?

It has all the typical urban problems, such as the fragmentation of green and blue spaces, channelization of the river, wastelands, and small polluted factories. As an example, the experience can be concluded and applied to other sites. The design assignment of Tongqiao Town is to develop a repairing zone by creating a green-blue structure and creating transitional interfaces from city to water. In this way, to achieve urban transformation and ecological restoration in the urban environment.



Design Exploration

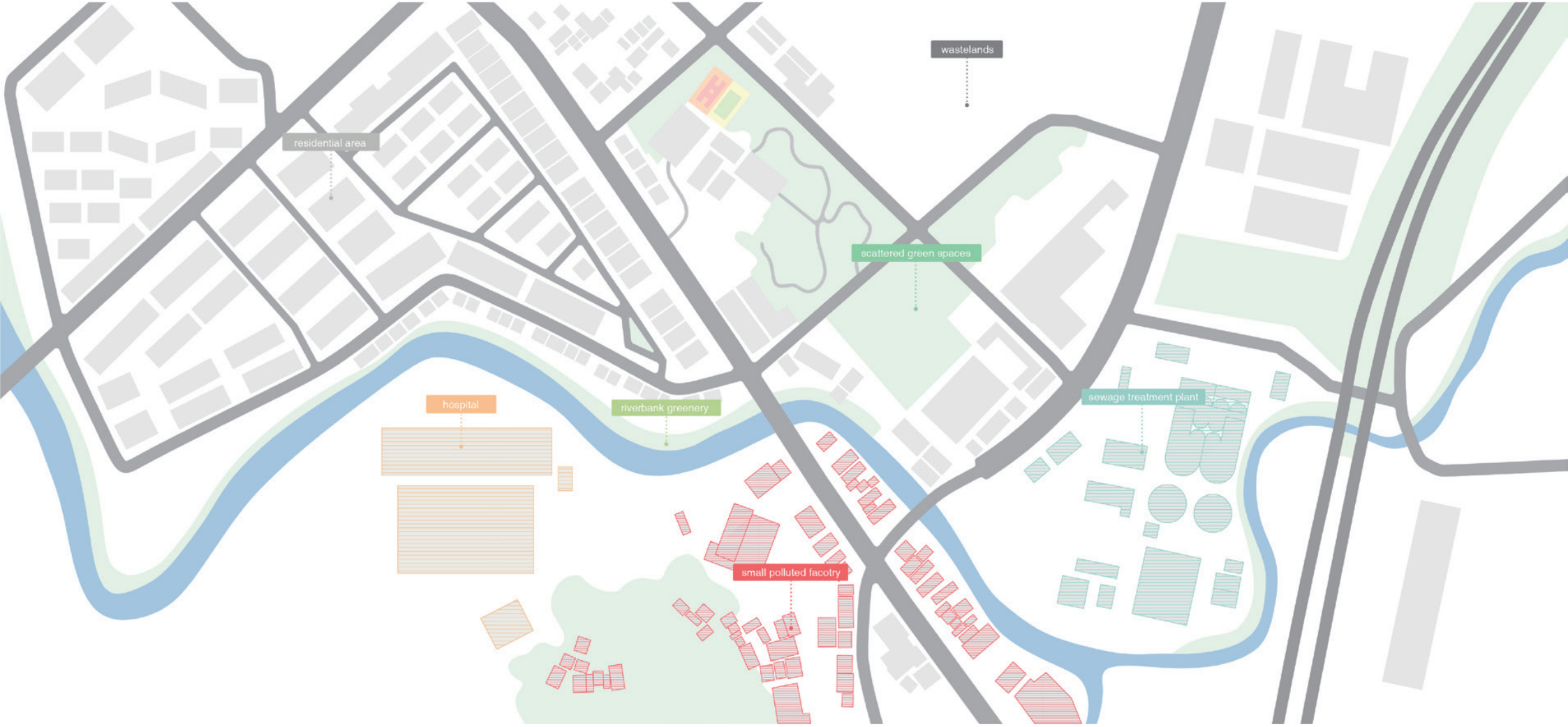
/Site 3: Tongqiao Town Current Situation/

Tongqiao Town is facing some typical problems of an urban under construction area. For example, industrial production in small workshops discharges large amounts of sewage into the river without treatment. The channelization decreases the rivers' capacity to regulate floods while creating a gap between the city and water. Furthermore, there is a lack of green spaces in the city, and a complete greenway-green corridor system is missing.

Design Exploration

/Site 3: Tongqiao Town Current Plan Analysis/

The current layout of the city is very fragmented, as can be seen from the current plan:
There is a lack of green spaces along the river as a buffer between the city and the water; green areas in the city are scattered and have a single function, lacking small street parks, community gardens, sports fields, etc; small polluting factories along the river that need to be transformed; wastelands in the city, resulting in a waste of land.



Design Exploration

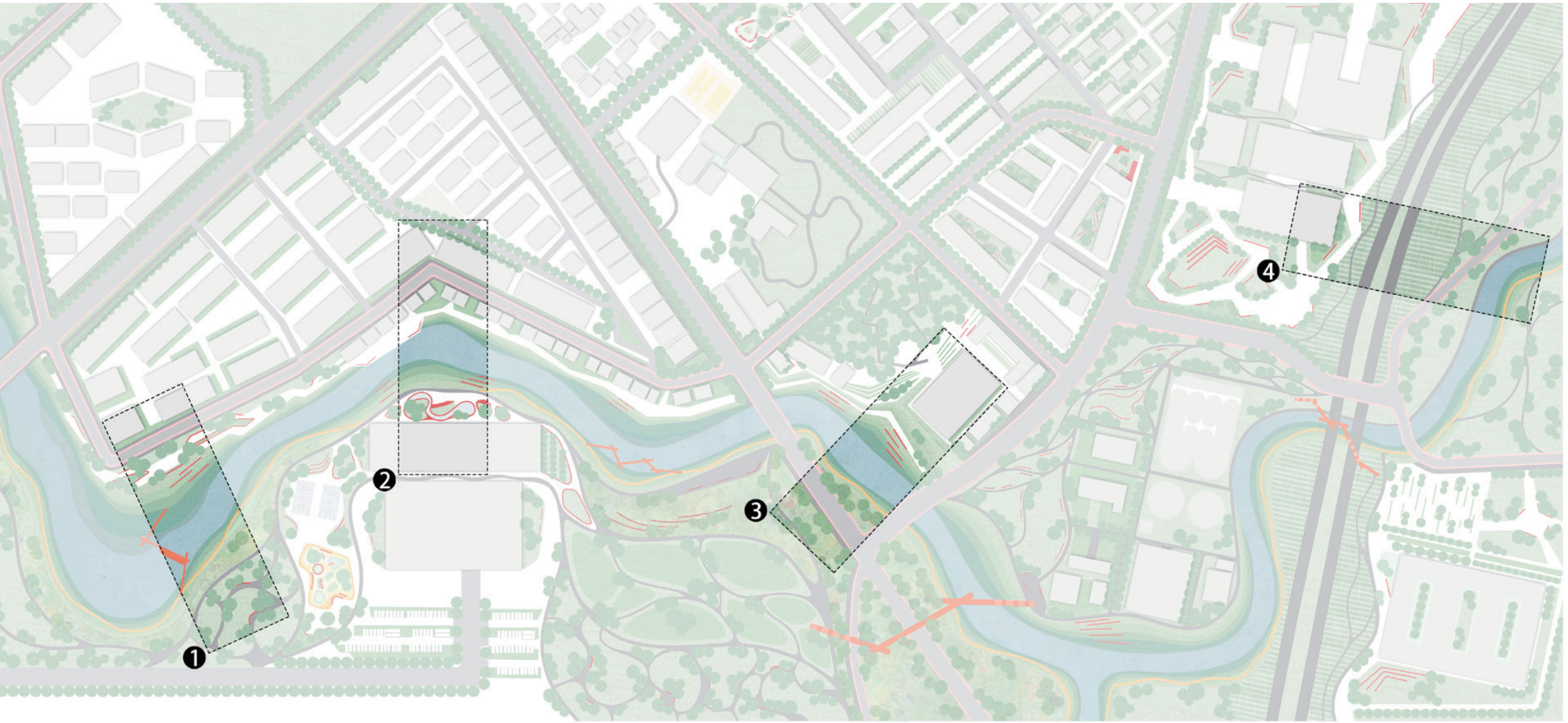
/Site 3: Tongqiao Town Design Plan/

The design idea is reshaping the river as the backbone of the urban landscape. The strategy of widening the river helps alleviate the risk of flooding and creates an ecological buffer zone between the city and water. Meanwhile, by adding a green corridor network along the river and stretching it into the city, we can link the existing and potential green spaces. This new blue-green structure aims to purify sewage from the city, provide small habitats for birds and amphibians, create a rich urban waterfront space, and enhance urban vitality.

Design Exploration

/Site 3: Tongqiao Town Design Interfaces/

Four blocks in the site were selected to explore the following design questions:
1. how to establish the connection between city and water 2. how to create a green network with the riverbank as the core, extending outwards into the urban space 3. how to activate the remaining urban space (wastelands, abandoned small polluting factories) 4. how to guide the transformation of polluting industries into eco-industries 5. how to use the landscape network to connect the existing and potential blue-green spaces in the city.

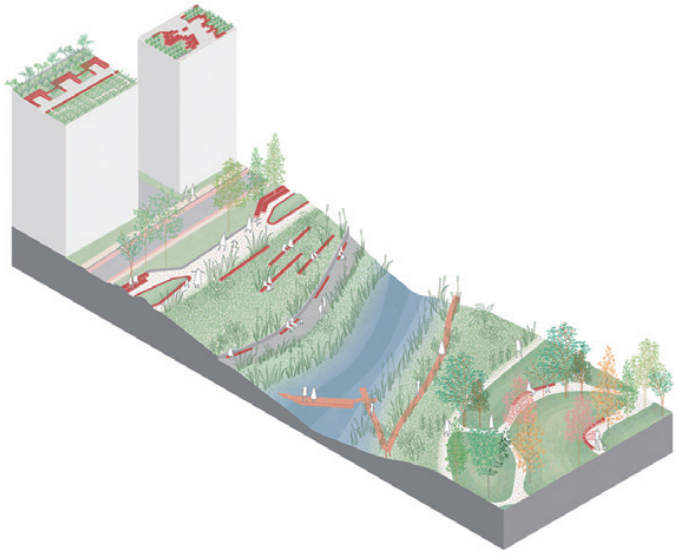


Design Exploration

/Site 3: Tongqiao Town Design Interfaces/

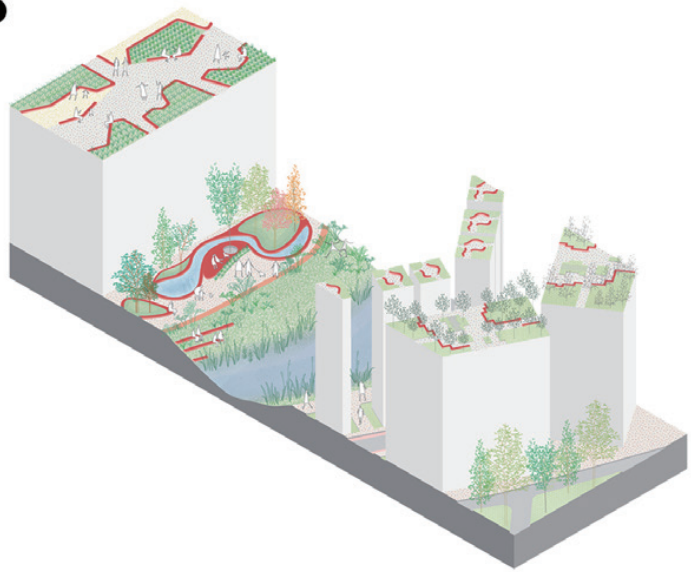
Four areas in the plan were selected to study the relationship between city and water, aiming to merge the gap between city and water by creating a soft transition zone. A more biodiverse riparian zone is constructed, providing shade, foraging, and aquatic and terrestrial wildlife habitat. It also promotes urban vitality by recreating waterfront space and reconnecting people with water.

❶



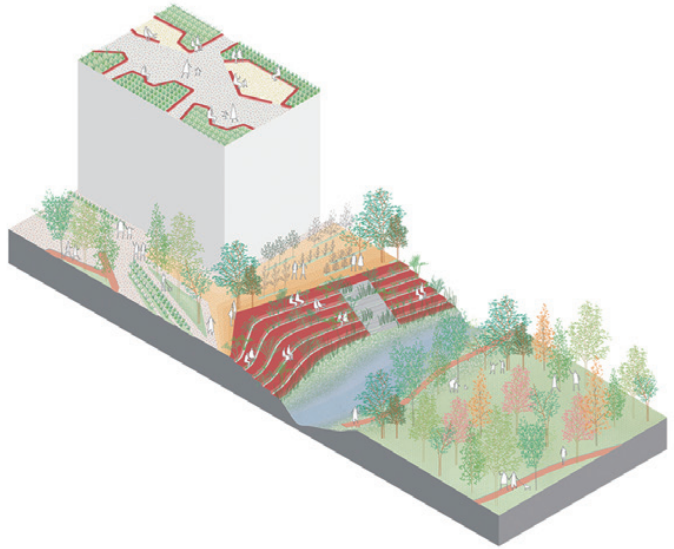
Based on ensuring the urban flood control function of the river, the fragmented urban ecology is stitched together through the landscape. The stormwater runoff pollutants can be reduced by choosing vegetation with ecological capacities like water purification, stormwater filtration, and nutrient absorption. Meanwhile, the footpath forms a flexible boundary with the landscape.

❷



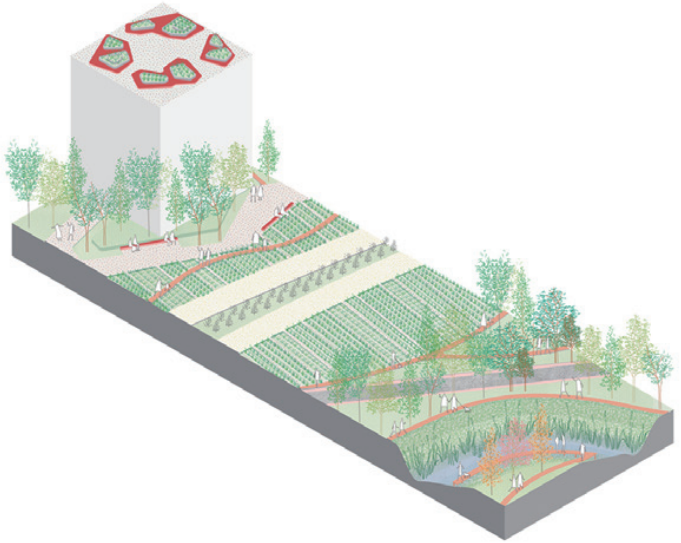
The original single form riverbank is adjusted to meet different degrees of waterfront and long-range view needs. The riverfront interface is combined with the city to form a characteristic public space.

❸



Stormwater management is incorporated into the riparian zone design. Stormwater resources are utilized through low-impact development facilities such as green roofs and soft edges to absorb, store, infiltrate, and purify water. Thus, it can promote a virtuous water cycle required for a healthy ecosystem.

❹



Increase the area and variety of urban green spaces by integrating wasteland near abandoned railroads and integrating it with surrounding parks. Remove illegal construction sites, such as small polluting factories along the river, and transform them into green spaces.

Design Exploration

/Site 3: Tongqiao Town Design Small Factory Before/

Design Exploration

/Site 3: Tongqiao Town Eco-industrial Zone After/

Design Exploration

/Site 3: Tongqiao Town Design Urban Riverfront Before/

In the early days, the river was wide. The residents on both sides of the river lived by the water. With the city's rapid progress, the green areas on both sides of the river were gradually tightened. After several engineering constructions, the river was transformed from a natural river to a functional "channel" mainly for urban flood control and storage. With the increasing economic development, the pollution load accepted by the river far exceeded its self-cleaning capacity, and the river water became black and smelly. As a result, the river has gradually receded into the urban life outside, becoming the "forgotten corner."

Design Exploration

/Site 3: Tongqiao Town Urban Riverfront After/

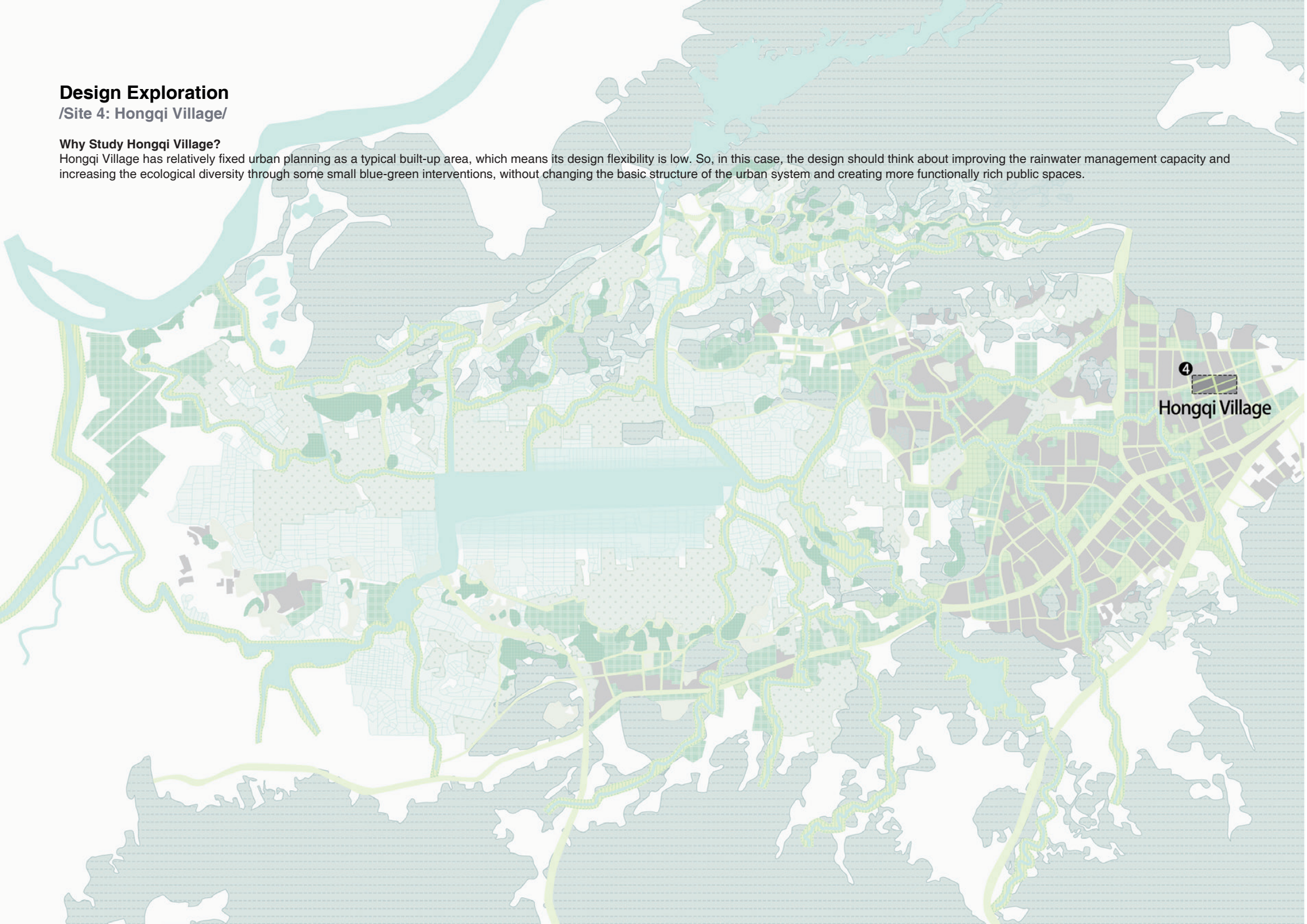
In conculsion, the river carries the memory and civilization of the city; above the river, the city exudes its unique spirit and charm. The integration of the landscape and the reshaping of the relationship between people and the environment reflects the respect for nature, the inclusiveness to the citizens, the innovation of the economy and industry, and the pursuit of the ideal life. After being reborn, the river, people, and the city are reconnected, turning into a river with diverse ecology and a flexible landscape that breathes and reflects the city.

Design Exploration

/Site 4: Hongqi Village/

Why Study Hongqi Village?

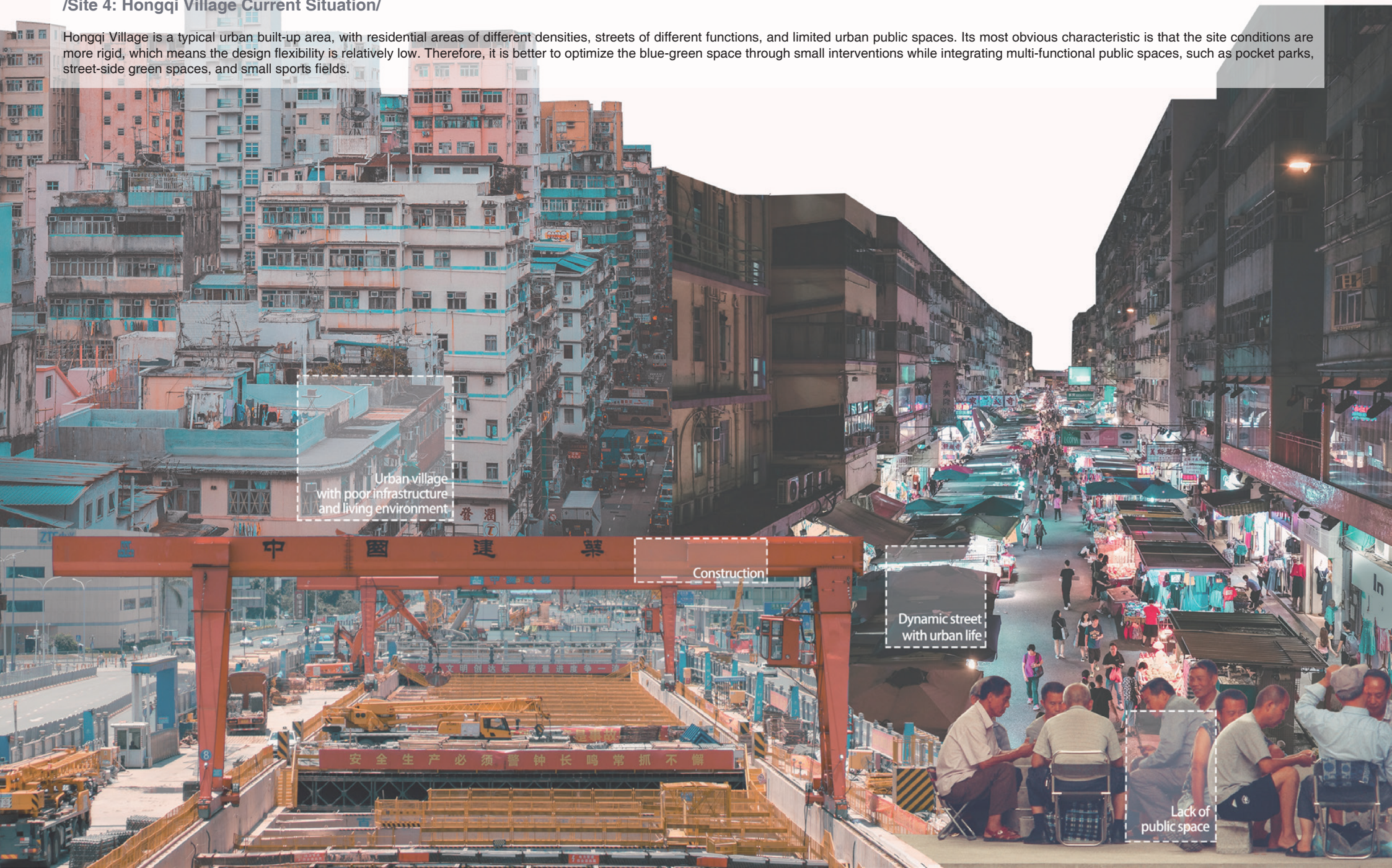
Hongqi Village has relatively fixed urban planning as a typical built-up area, which means its design flexibility is low. So, in this case, the design should think about improving the rainwater management capacity and increasing the ecological diversity through some small blue-green interventions, without changing the basic structure of the urban system and creating more functionally rich public spaces.



Design Exploration

/Site 4: Hongqi Village Current Situation/

Hongqi Village is a typical urban built-up area, with residential areas of different densities, streets of different functions, and limited urban public spaces. Its most obvious characteristic is that the site conditions are more rigid, which means the design flexibility is relatively low. Therefore, it is better to optimize the blue-green space through small interventions while integrating multi-functional public spaces, such as pocket parks, street-side green spaces, and small sports fields.

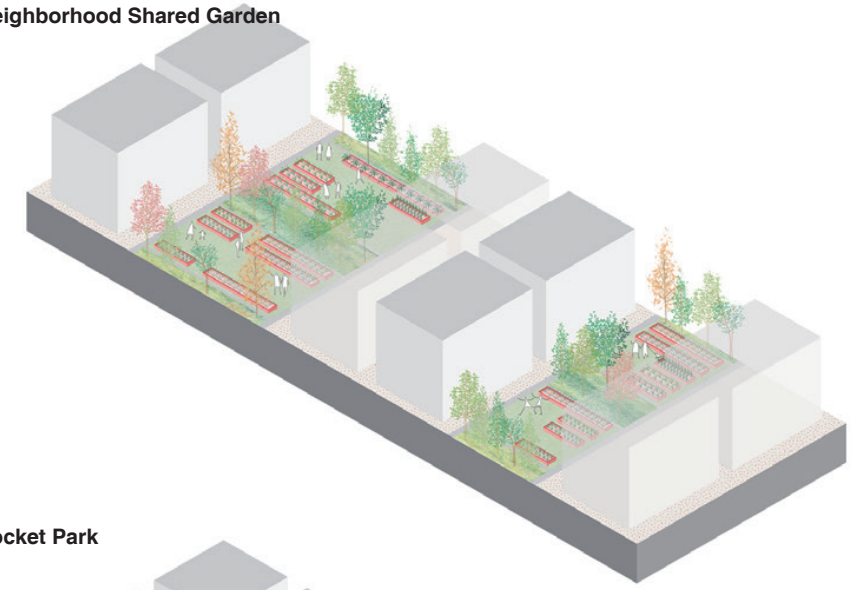


Design Exploration

/Site 4: Hongqi Village Small Interventions/

Because of less flexibility in the urban built-up area, the better way is to have small interventions. For example, greenery along the street, rooftop gardens, community shared gardens, multifunctional parks, etc. In this way, the remaining spaces of the city are efficiently activated by adding more green nodes. Also, it improves the city's resilience by introducing more permeable areas. Meanwhile, these green-blue spaces bring diversity to urban life by creating opportunities for people to socialize and entertain.

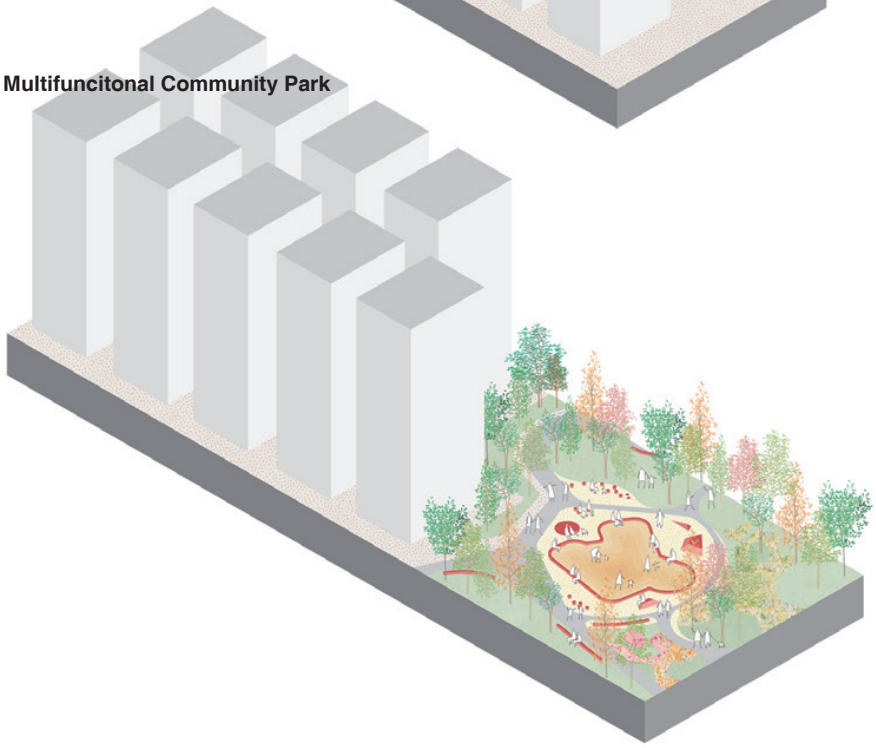
Neighborhood Shared Garden



Rooftop Garden

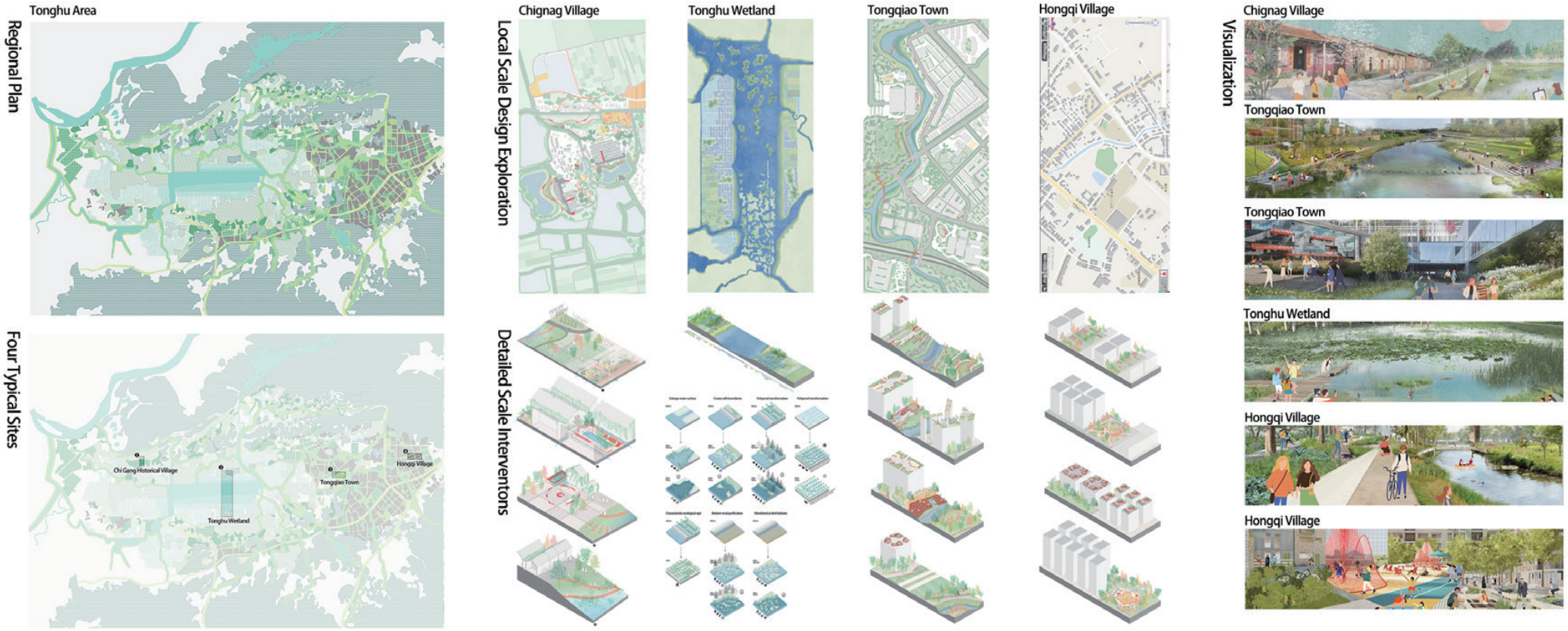
Pocket Park

Multifuncitonal Community Park



Chapter Summary

In response to the current situation and problems of the Tonghu area, a regional landscape structure is proposed at the regional scale. This structure aims to activate and connect existing and potential blue-green spaces, create soft riverbanks for attenuating floods, add more urban green spaces to improve permeability, address river and water pollution, restore ecological bases with diverse habitats, and create multifunctional urban public spaces with ecological benefits.
After that, four specific sites are selected, namely Tonghu Wetland (artificial nature), Chigang Village (urban in nature), Tongqiao Town (nature in urban), Hongqi Village (urban built-up zone), to discuss how to continue this regional resilience into the design from local scale and detailed scale. The local scale focuses on organizing the blue-green spaces according to the specific site conditions, while the detailed scale focuses on how to build interfaces between different landscape elements to achieve the continuation of blue-green spaces.



This chapter discusses how the four designs relate to the regional landscape structure. What role do they play on the larger scale? What are the stakeholders involved, and what are their relationships? Moreover, how these designs help the implementation of the overall landscape framework?

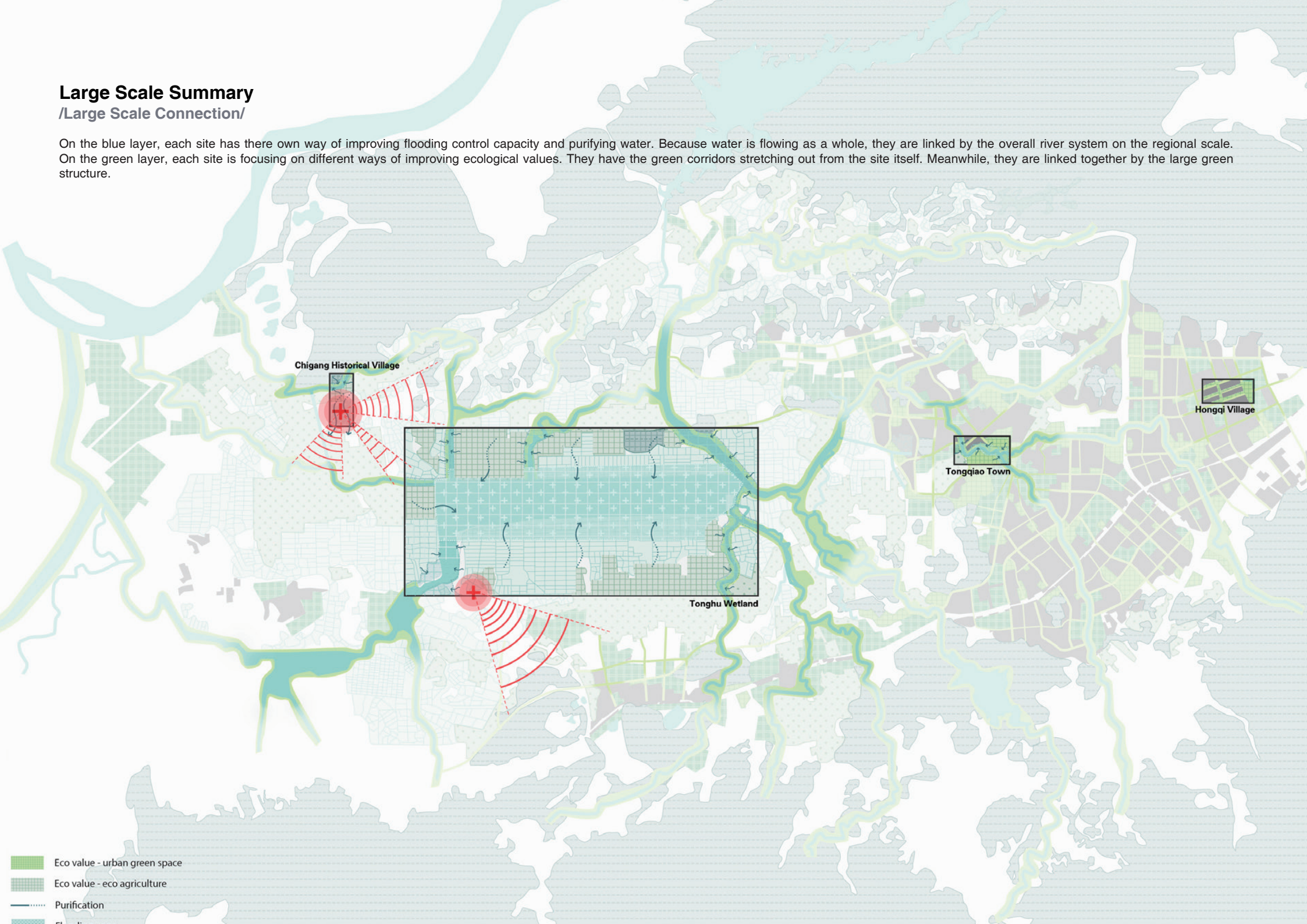
CHAPTER 6
LARGE SCALE SUMMARY

1. THE ROLE OF EACH DESIGN IN LARGE SCALE
2. STAKEHOLDER ANALYSIS
3. STRATEGIC PLANNING

Large Scale Summary

/Large Scale Connection/

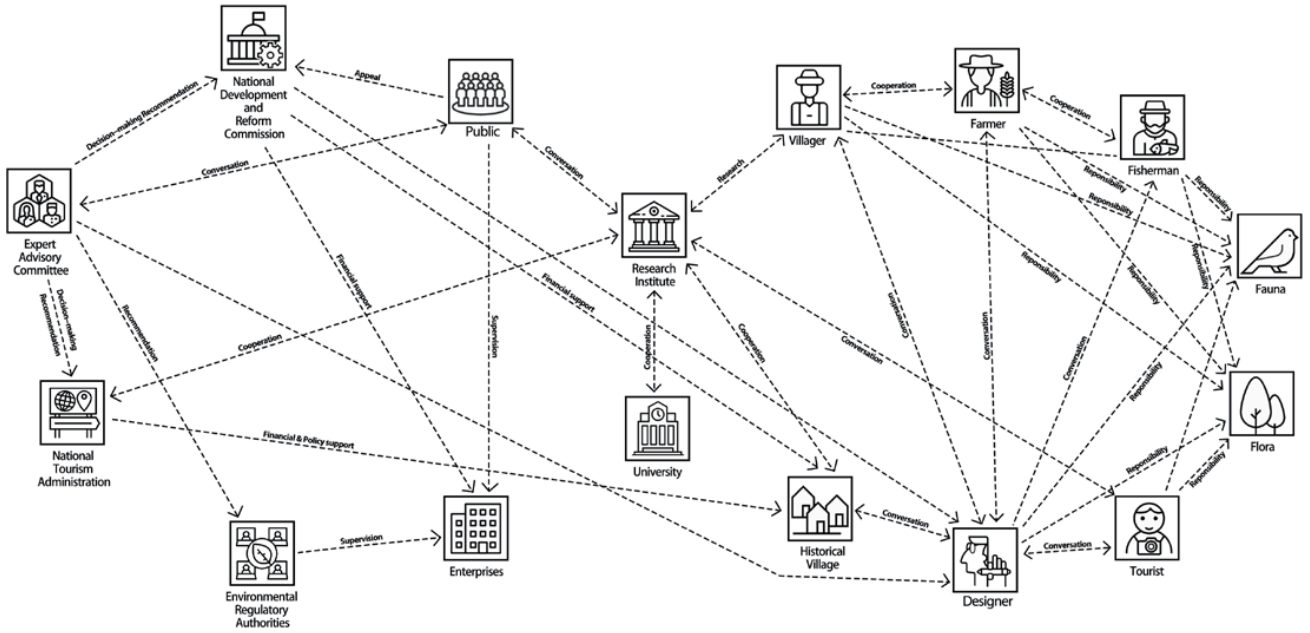
On the blue layer, each site has there own way of improving flooding control capacity and purifying water. Because water is flowing as a whole, they are linked by the overall river system on the regional scale. On the green layer, each site is focusing on different ways of improving ecological values. They have the green corridors stretching out from the site itself. Meanwhile, they are linked together by the large green structure.



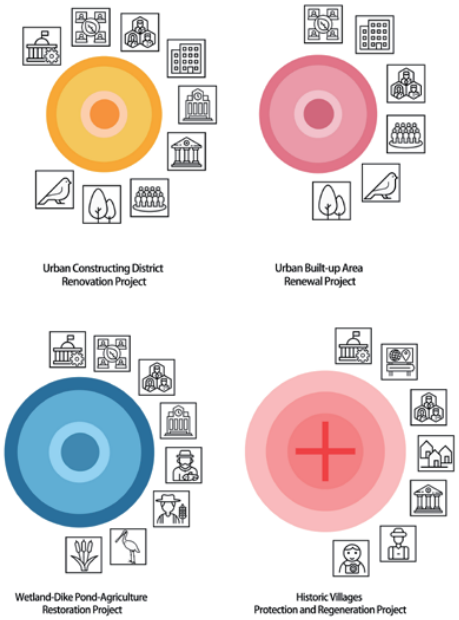
Large Scale Summary

/Stakeholders Analysis/

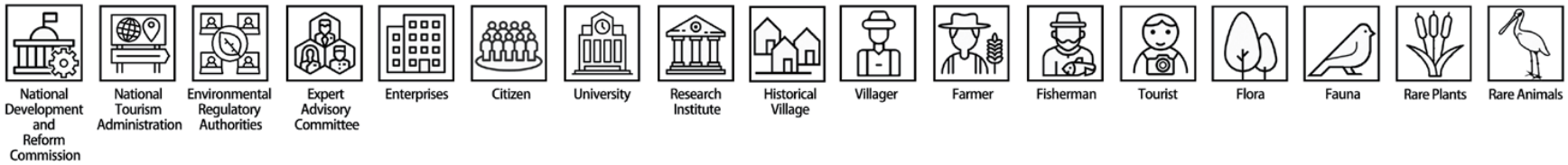
Stakeholders Relationship



Stakeholders for Each Project



Stakeholders Involved



The analysis above shows the takeholders involved in the four example designs and the relationships between these stakeholders.
In conclusion, each project involves different stakeholders according to the site-specific condition and design targets. These stakeholders promote the project through collaboration and provide supervision and timely feedback back to the project. The collaboration of these stakeholders will help the Tonghu area form a sustainable natural-social-cultural system, with a high degree of inclusiveness, shareability, and flowability.

It can provide financial support for major strategic projects at the national and provincial levels, for example, the National High Technology Industrialization Development Project, provided by the National Development and Reform Commission. Since local governments have limited financial capacity, through national funding support, they can introduce a number of high-tech industries with strong technical strength and innovative ideas in high-end technology areas, or support some local enterprises with strong R&D capabilities, thus giving birth to related industrial clusters and actively promoting the transformation and development of the city.

In the management of pollution, it is necessary to improve the governance mechanism under the supervision of environmental protection departments. On the one hand, it is essential to improve the level of environmental protection monitoring, law enforcement, emergency response, and management by promoting monitoring platforms. On the other hand, strengthen environmental protection and management capacity.

To protect and restore historical villages, we can first start with the villages on the historical village protection list. Since the villages themselves may not have the financial capacity nor the knowledge to launch sustainable conservation and renewal projects. In this case, financial support from MCT(Ministry of Culture and Tourism) is needed. At the same time, as a third platform, MCT can create an environment that allows villagers and designers to communicate so that the design can fit the site and meet public opinion.

The Expert Advisory Committee consists of experts and scholars in specialized fields to provide scientific-technical and decision-making support for the long-term planning and development of the Tonghu area.

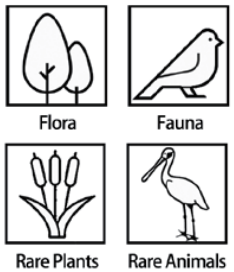
The public-private partnership (PPP) model can be used to establish a relationship of benefit sharing, risk sharing, and long-term cooperation between the government and private enterprises. This cooperation helps enhance the supply capacity and efficiency of public services.

With the advantage of cooperation with universities, research institutes, and advanced enterprises at home and abroad, the idea is to cultivate talents, create a regional innovation platform and obtain independent intellectual property rights. At the same time, through the communion of the university zone, technology park, and communities, it stimulates the development of the commercial and service industry.

Based on popularizing the eco-wise zone's core values, the right of citizen ownership is guaranteed. Moreover, citizens are encouraged to put forward their needs, which will help the government develop practical and feasible construction plans. At the same time, it reduces or avoids potential conflicts between the government and citizens and enhances citizens' participation in urban development.

Some fish ponds and farmlands will be transferred to wetlands in the wetland restoration process, losing some of the original productive functions. First of all, this design idea requires in-depth communication with fishers and farmers to help them understand the significance of ecological conservation in the long-term perspective. Moreover, at the same time, it is necessary to gain their approval of the proposal. At the same time, for the seasonally flooded production sites, we can coordinate with agricultural experts to provide a flood-tolerant crop planting plan. For areas with full seasonal flooding, the surrounding eco-agricultural land can be distributed to farmers and fishers as compensation. Another option is a certain amount of compensation.

Tourism is an important source of funding and information to drive historic villages' conservation and restoration projects. By presenting a quaint historic village to tourists, they can feel their connection with nature and tradition, which is entirely different from the urban environment. The visitors' experience's feedback can be a valuable reference for the next round of historical village renovation projects.



Flora and fauna are also part of the stakeholders. Especially in designing habitats, it is necessary to comprehensively consider the natural environment from native, ornamental, and ecological aspects. For example, some areas with poor aesthetics and fragile ecologies, such as lowlands, grasslands, and mudflats, are precisely the habitats of rare plants and animals that need to be protected most. So we need to respect the ecological value of wilderness and preserve the native habitat environment as much as possible.

Large Scale Summary

/Stakeholders Analysis: Historical Village/

After analyzing the stakeholders involved in the overall design and their relationship, it is necessary to consider further how these stakeholders are involved in the project and how they cooperate to achieve the objectives. So take the Chigang Village Conservation and Renewal Project as an example; the idea is to analyze the roles and connections of the stakeholders in this design.

The designers build up an initial understanding of Chigang Village by communicating with the experts, historical village researchers, tourism bureau, and cultural department. In particular, the cultural history of Chigang Village, the local customs, relevant support policies, and sources of construction funds.

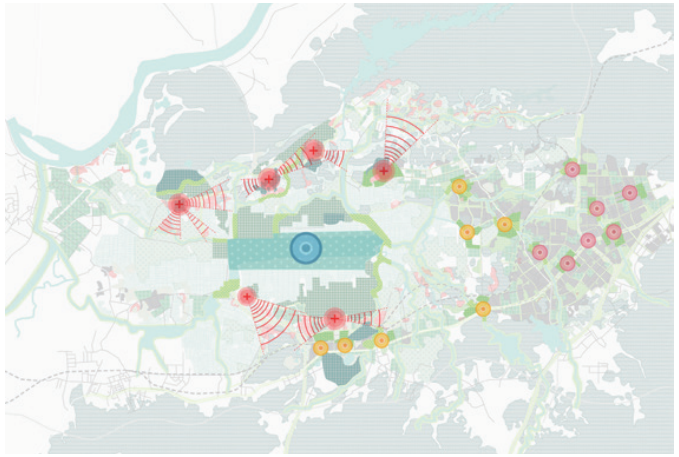
At the same time, because there are still some locals left in the village, including villagers, fishers, and farmers, the designers need to incorporate their demands. For example, their needs for infrastructure renovation, their ideas on new public space, and their attitudes towards new agriculture.Through continuous communication with various parties, the design will be generated and improved to rationalize the demands of residents and departments step by step.

At a later stage, we can expand the benefits of this project through some cultural activities or academic sharing. For example, a forum on historic village preservation and restoration can build a platform to share some insights learned from Chigang Village with other historic villages. And in this way, we can expand the influence of Chigang Village to attract more tourists and research scholars.

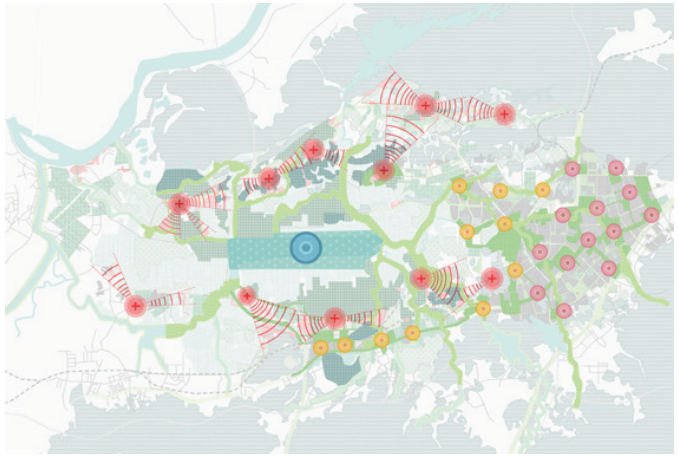
Large Scale Summary

/Strategic Planning/

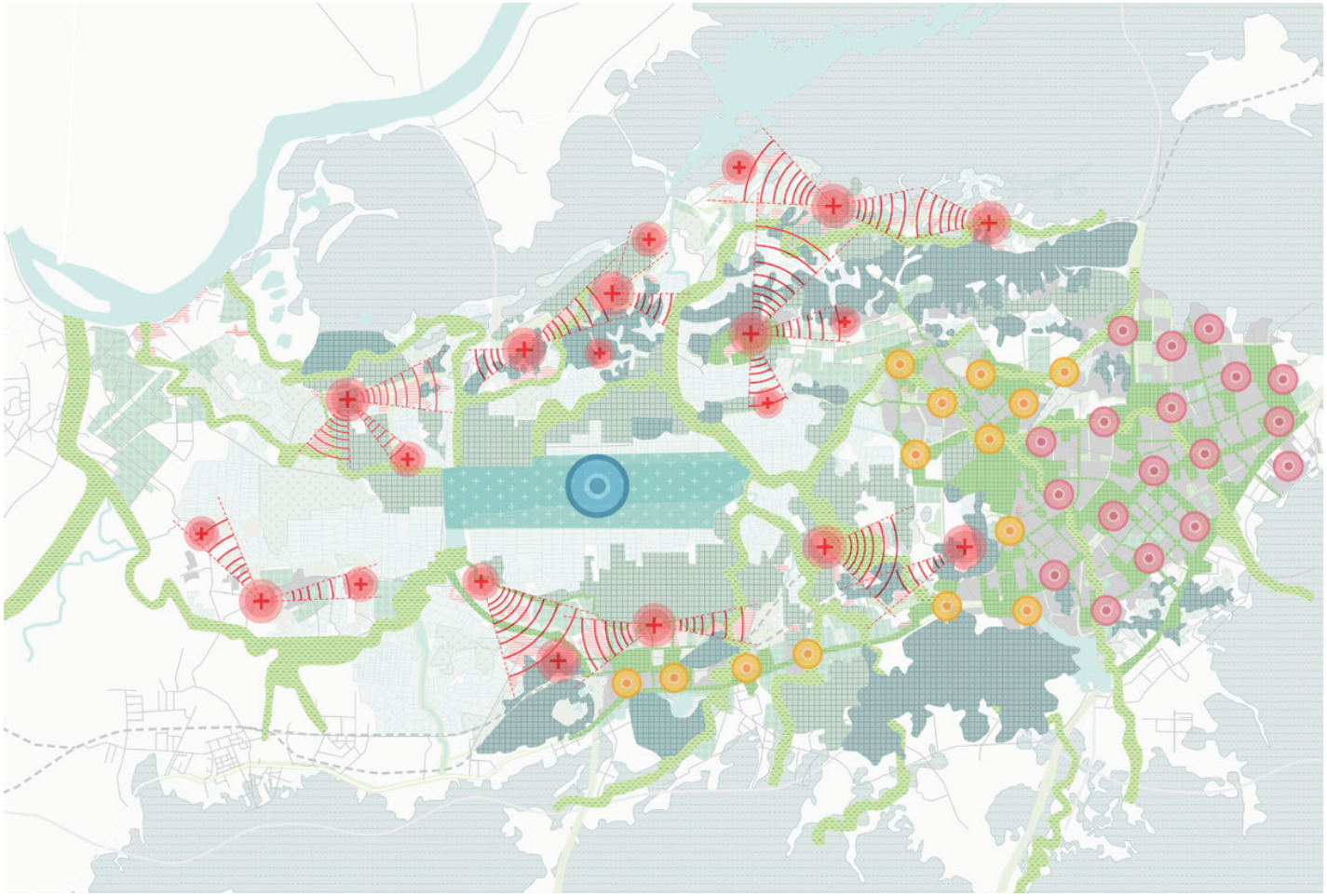
0-20



20-50



50-100



0-20: The first stage of implementation (the first 20 years) can start with some pilot projects. For example, places with financial or policy support or more flexibility or long-term investment and benefits. In this process, designers can get feedback from these pioneer projects to see if the objective is reached or not.
20-50: In the second planning phase (20-50 years), the first phase lessons can be applied and optimized.
50-100: In the following phase(50 years to further), the resilient framework could be realized step by step.

This chapter focuses on the reflection of the project itself, the design approach, design thinking, and the designer's role.

Looking back at the previously proposed research objective and sub-questions helps identify whether the project has solved these problems and achieved the expected results. It also summarizes the design principles and methods that can apply to other projects. Finally, consider what the role of the landscape is in solving natural-urban problems. Moreover, what role as a landscape architect plays in the designing process. The reflection helps the understanding of the project itself and the profession as a whole.

CHAPTER 7
DISCUSSION & CONCLUSION

1. CONCLUSION
2. LESSONS LEARNED

Discussion & Conclusion

/Conclusion/

1.HOW THE LANDSCAPE FUNCTION?

- How have nature and urban evolved? What are the major components of these landscapes, and how do they interrelate?

By interpreting the site from the perspectives of hydrology, topography, flora and fauna, culture, and programs, it can be learned that Tonghu is a natural-urban landscape formed under the influence of natural succession and human intervention. Starting from the floodplain of the East River, the wetland and rivers of Tonghu have undergone a construction process of reclamation and canalization. Later, other construction activities happened, such as agriculture, fishing, artificial woodland, industrialization, and urbanization. These activities have changed the natural landscape step by step and brought many typical urbanization problems such as pollution, flooding, and fragmented ecological spaces. It can be concluded that nature and artificiality are coupling. They influence each other and interpenetrate each other. Therefore the vision is to find a balance between city and nature, achieving a symbiosis.

2.HOW TO CREATE A RESILIENT LANDSCAPE FRAMEWORK?

- What kind of resilient landscape framework can balance nature and city in promoting ecological restoration and urban transformation? Moreover, what spatial strategies and design principles can be applied to promote this landscape framework?

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. Many strategies and principles need to be considered to promote this framework: key strategies such as the cross-scale principle, constructing green-blue structure principle, and creating transitional interface principle. Other strategies are also needed, such as phased design, stakeholder analysis, ecological restoration, water management, historical and cultural preservation, etc.

3. HOW TO APPLY IT TO TONGHU?

- What are the spatial possibilities to create an adaptive landscape framework? Furthermore, how to apply these design principles and strategies in different geographical environments (mountain or valley or suburban or urban areas) about water management, ecological restoration, and urban transformation?

The analysis of the landscape structure (natural landscape and urban landscape) in the Tonghu area shows that human construction activities in recent decades have brought about a certain degree of impact on the natural landscape of Tonghu. However, as it is still in the initial development stage, the artificial disturbance is still low. Moreover, Tonghu itself, as an ecological culmination area in the Pearl River Delta, has the advantage of a natural substrate. Under this circumstance, the intervention of a resilient landscape framework can, on the one hand, help the Tonghu area to restore the broken ecological patches and improve the ecological values. On the other hand, it can provide a guideline for the city's ecological transformation and sustainable development.

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 middle scale, four typical design sites are selected: historic villages, wetlands, urban areas under construction, and urban built-up areas. We investigate how this blue-green structure is adapted to the site and how it functions to improve the local resilience in each site. The study delves into how water, green spaces, cities, and activities are connected at the small scale. Typical design principles and strategies are then extracted from these four samples so that they can be applied further to other areas.

4. WHAT IS THE TAKEAWAY?

- Is this resilient framework applicable to other undeveloped or developing areas in the PRD to help them achieve a symbiosis between nature and city in their future development?

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. In this project, the four small-scale designs are typical. 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.

Discussion & Conclusion

/Lessons Learned/

These lessons could be learned from this project:

1. Long-term Development Process and Strategic Planning

In design, a blueprint is usually conceived to show the final vision of the site. However, the implementation of this blueprint needs to be achieved step by step. A strategic plan is needed to help us think through which areas or projects have priority. It may be because of financial or policy support, such as the conservation and restoration of critical historic villages; or the site's strengths, such as the great flexibility of urban areas under construction; or projects with long-term investment and benefits, such as wetland restoration. At the same time, we can learn the lessons from these pioneer projects and make optimal adjustments in other projects.

2. Stakeholder Analysis

In the design, we can find out more issues that need attention and consideration by considering the stakeholders and their demands. More importantly, improve the practicality of the design. For example, in historical village protection and restoration projects, when we include the government, villages, villagers, and tourists into the scope of interest subjects, relatedly, we need to consider who will organize, who will fund, what are the demands, how to coordinate villagers, how to make profits, etc. These questions are also what we need to think about and face during the actual project landing process.

3.Design by Research and Research through Design

Design Research refers to design-oriented research. Because of the design-oriented direction, the research is not boundless. The research includes learning the relevant knowledge and case studies, analyzing the design needs and problems. This approach saves a lot of time in the design process helps to integrate knowledge into design thinking efficiently. At the same time, the Research through Design approach is also essential in the design process. It consists of two main steps. Step 1: Develop multiple designs on a topic. The second step: by comparing the similarities and differences of these designs, summarizing the general ideas, and improving the existing designs, we can find a suitable solution for the site. These two methods are not separable. Design is like a sequential upward spiral. In the process of design exploration, more problems are finding out by reading the site more deeply. We can target these problems with case studies, literature reviews, consult experts in related fields, and discuss with classmates and teachers to get feedback and inspiration. These ideas can lead us to improve the design further.

4.Multis-scale Approach

In design, thinking at different scales can help us find different key points, and thus design ideas deepen. For example, this project, the regional scale, aims to build a landscape framework to connect and activate the potential blue-green spaces. At the middle scale, the focus is on each site. Based on interpreting the site's current state, the design explores how this landscape framework can adapt to the site conditions and how it functions. At the small scale, attention is paid to plants, habitats, height differences, activities, perceptions.

Meanwhile, the design concept is visualized through visual expression. In summary, each scale focuses on different issues, but they are essentially complementary to each other. They each focus on different priorities, but together they build a complete solution for the project.

5.Other Methods and Approaches

There are many other approaches involved in the design. Mapping. Overlaying different layers can deepen understanding of the site and help explore site issues. Case study, which is a great source for supplementing design thinking. In particular, case studies with similar site conditions can help refine design principles, which can then be tested through sketches to see if they are suitable for the sites. Models, which provide a 3D visualization, can help study how different landscape elements transition over a space. Collage is a quick way to express the design atmosphere. Also, it is a tool for communicating with non-specialists.

Discussion & Conclusion

/Limitations & Improvements/

Knowledge Gaps & Interdisciplinary Communication

Due to knowledge gaps, there were many omissions in the preliminary research and analysis of the site, especially the knowledge gap of flooding regulation and drainage system. For example, the open and hidden drainage system, the drainage volume, the storage volume, etc. Since water shaped the landscape structure of Tonghu, the understanding of the water system can help better identify the problems of flooding and pollution of the site and explore the potentials.

Luckily, under the guidance of my tutors, I have found some alternative ways for the research. For example, through software simulations (QGIS), to understand the natural flow based on the terrains and the low-lying areas prone to flooding. The literature helps to understand the advantages and limitations of historical water conservancy projects. Through case studies, I learned how designs help areas with similar site conditions optimize the water organization system and reduce flooding and pollution.

More importantly, it helps me value the importance of multidisciplinary cooperation. Water experts can identify problems with existing water organization systems and give corresponding advice. Ecological experts can use native plants to create habitats for local species based on water, soil, and microclimate conditions. Ancient village researchers can interpret the historical changes and the changing relationships between villages and nature. In this way, the conservation and restoration of historical villages can be more relevant to the villages' characteristics and meet the villages' requirements.

Furthermore, in this process, I think landscape design is the connection between different disciplines. Based on their interpretations and suggestions from a professional perspective, a more comprehensive and optimized solution can be summarized. It is a process of communication and cooperation, and this is the most exciting part of the design.

Communication & Feedback

Design should fit the current situation and needs of the site, solve problems and achieve long-term benefits. So as designers, how do we explore whether the design meets the objectives? I think communication and feedback are essential.

When I was doing the stakeholder analysis, I found that nature is not the only one in most situations. More importantly, there are human participations. Urban life needs the participation of citizens; the revitalization of historical villages needs the participation of villagers; production needs the participation of farmers and fishers. Therefore, in the design, the demands of these stakeholders cannot be ignored to solve the problem.

For example, I chose to flood some fish ponds and farmlands to restore the Tonghu wetland. Relatedly, I propose to replace traditional agriculture with characteristic ecological agriculture. For example, choose local fruit trees: dragon fruit, lychee, banana. Also, combine fishponds with hydroponic agriculture to create an ecological production model.

However, these are just preliminary ideas. The implementability needs to be discussed further with fishers and farmers. At the same time, when the designers convey the design demands, the stakeholders are also welcomed to put forward their thoughts, which improves communication efficiency. So if there is an opportunity, I think the next step of the design could be interviews of the residents or government officials to analyze the rationality of the design from the local perspective.

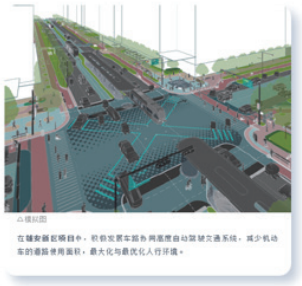
"Resilient City" & "Smart City"

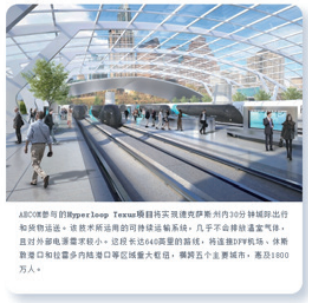
How does the idea of resilient landscapes fit into the vision of "smart cities" that China is now promoting?

"Smart" should be more than just the efficient flow of information such as data and the IP. "Smart city" means that a city is no longer a machine made up of roads, houses, bridges, and rivers but should be an organism that connects nature, cities, and people.

Digitization is not the target but a way to technological integration. The combination of city and digitalization allows us to re-understand the future relationship between cities and nature and create new opportunities for governance and innovation.

Big data can help achieve industrial upgrading, social governance, ecological and environmental protection, improvement of people's livelihood, infrastructure. It can create a new life model in which people, nature, and technology co-prosper and co-exist. In the context of "Smart City," we can build a city where nature and the urban integrate and promote each other. Stand to improve urban resilience, reduce disasters, adapt to change, and enhance resilience. In this way, we can reconstruct the symbiotic relationship between people and nature and drive local economy and culture development.





Provide integrated design proposals across technology fields: planning the future travel model, creating smart communities, developing digital cities, and visualizing infrastructure construction.

—— By AECOM

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I am grateful to my family, who has always been by my side, supporting and encouraging me. Although we are not in the same major, they always provide me with new perspectives on issues. Thank you for being good listeners and good communicators.

I'm also grateful for my friends. Under this covid situation, we still keep sharing and communicating online or offline. I also had the privilege to travel to places and explore some projects, where we got a deeper understanding of different societies and cultures.

Finally, I would like to thank many strangers whom I have never met before. There were authors of papers, experts from lectures, photo-sharers, travel vlogers and so on. With your sharing, I could have a better understanding of design from the academic level and also from the mental level. I am also learning to share what I see and think to the outside world.

Thank you all from the bottom of my heart, and I wish you all the best in your work and studies!

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