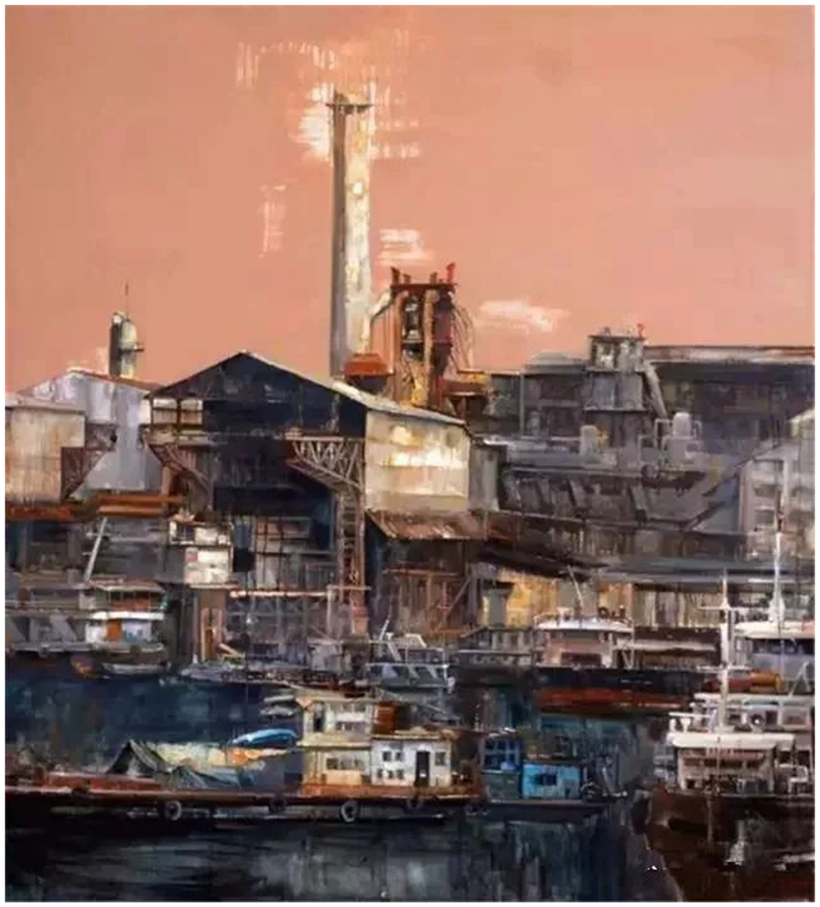


WATER RESILIENT INDUSTRIAL TRANSFORMATION

Yijing Li

First Mentor: Steffen Nijhuis

Second Mentor: Lei Qu

Graduation Project, TU Delft

Yijing Li
First Mentor: Steffen Nijhuis
Second Mentor: Lei Qu
Graduation Project, TU Delft
May. 11, 2020

ABSTRACT

In history, Shunde is famous for its water village culture with dense water networks and a beautiful fish-pond system. After the reform and opening-up policy in 1978, the manufacturing industry is rapidly developed in Shunde. Followed by that, the water village culture is gradually declining. Instead, a large number of factories are scattered in the whole district, which results in severe water problems. Now it is the phase of industrial transformation. This project proposes water resilience strategies and industrial transformation strategies to guide future development in Shunde. It starts from the analysis of existing water management, the relationship between the industrial area and water problem points and the existing condition of the industrial area. Then by doing design exploration, it explores possibilities for water resilient industrial transformation. This project not only provides the possibility of regenerating the industrial area, keeping industrial memory but also improves the water capacity and reshapes the relationship between people and nature.

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CHAPTER 1
INTRODUCTION

- WATER RESILIENT INDUSTRIAL TRANSFORMATION

1. FASCINATION

2. PROBLEM STATEMENT

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3. RESEARCH OBJECTIVE & RESEARCH QUESTIONS

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1. FASCINATION

The fascination of this project derived from my personal experience of growing up in an iron & steel company. When recalling the memory in my childhood, the sky was always grey, the water was dirty and the air was polluted. One of the shocking facts is almost 50% of people in my hometown have a chronic disease – anaphylactic rhinitis. Later, under the guidance of the national policy, the factory underwent industrial transformation. I witness the changes happening in my hometown, high-tech industry gradually replaces the old industry, the air gradually becomes fresh, the river goes back to be blue and we even have more public space for recreation in the industrial area. For me, industrial transformation is not only about the improvement of techniques or facilities, it is also about ecological, cultural, social aspects.

So after that, a question came into my mind. If landscape architecture can help with ecological, cultural and social aspects in industrial transformation? Furthermore, how can give back those qualities by design?











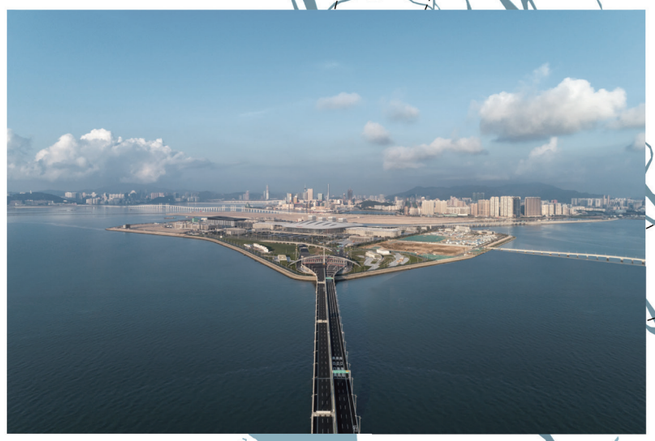
1. FASCINATION

Based on its superior location, convenient shipping and extensive plains, Pearl River Delta has been always taking a leading position in industrialization in China. In the past 30 years, a large number of manufacturing factories have been constructed there and the Pearl River Delta has grown into a global manufacturing hub around the whole world. However, due to backward technology and excessive production, currently, Pearl River Delta is facing the problem of industrial transformation.

At the same time, with the uncontrolled industrialization and urbanization in PRD, the problem of waterlogging becomes more and more severe. During the rainy season, after a heavy rainstorm, the city will become a “vast ocean” where all the public infrastructure is shut down and people’s lives and property are threatened. Now it is the important time of industrial transformation and a large number of abandoned or old factories are waiting for up-gradation and reuse. How to make use of this chance to deal with or alleviate the water problem is the starting point of my report.

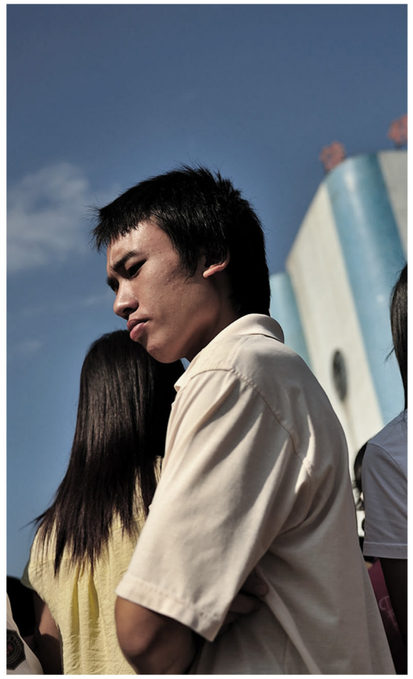






GUANGZHOU
FOSHAN
SHUNDE
DONGGUAN
SHENZHEN
JIANGMEN
ZHONGSHAN
ZHUHAI
MACAO

CHALLENGES AND PROBLEMS IN PRD



Anxious workers



Abandoned factories





Severe waterlogging

1. FASCINATION

Shunde is an important center of the manufacturing industry in PRD. In the 1980s, with the policy of reform and opening up, Shunde developed a large number of village-level factories. From 1978 to 1992, the ratio of industrial land to agricultural land was changed from 49/51 to 92/8 which also reflects the fast speed of industrialization in Shunde. Currently, most of those factories are facing the stage of industrial transformation.

With the rapid development of industrialization, Shunde has experienced huge changes, especially for the relationship between people and water. **In the past, people benefited from water. Later, water gradually becomes a thereat to people's life and property.** In ancient times, the main economic income came from agriculture which was mostly based on the dike-fish pond system. Then, it is gradually filled in and replaced by industrial area. Meanwhile, the dense water network is disappearing and more and more factories and buildings show up. Water village culture is also gradually declining, and water traffic is changed into road-dominated traffic.

Followed by that, waterlogging problem is more and more severe in Shunde.

BEFORE – WORK & LIVE WITH NATURE



Dike - fish pond system



Play with water

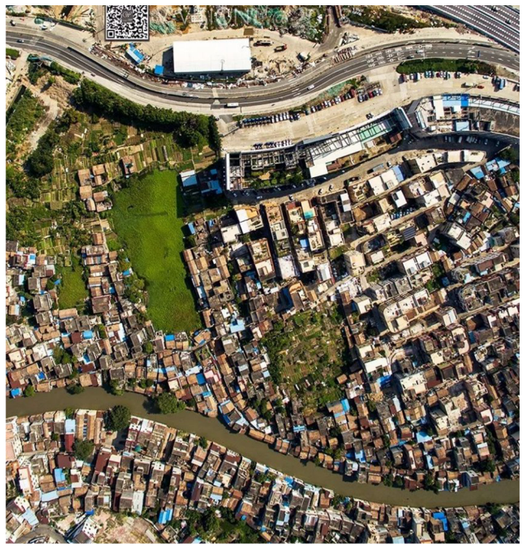


Transport by water

AFTER – INDUSTRIALIZATION AND URBANIZATION



Factories encroach on farmland



Filling in waterway

INDUSTRY IN SHUNDE





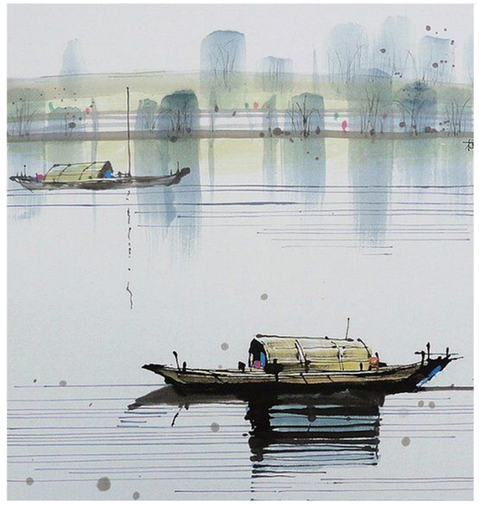








1. FASCINATION













BEFORE, PEOPLE BENEFITED FROM WATER. NOW PEOPLE ARE THREATENED BY WATER.

2. PROBLEM STATEMENT

Shunde changes from the beautiful water village with the completed dike-fish pond system to a place with the severe waterlogging problem and industrial stagnation. With the continued urbanization, the waterlogging problem will only be more and more severe. Guangdong government already came up with some plans and strategies to overcome those problems, for example, increasing the height of existing dikes by 1-2 meters, constructing pumping stations and sluices, and gradually replacing the industrial area with the residential area. However, is that necessary to take such a strong action to tackle those problems? And is that the only choice for dealing with them? To find better solutions, the first step should be figuring out what the problems are and what causes those problems.

Shunde is located in the hinterland of the Pearl River Delta, where two big branches of Zhujiang meet – Bei river and Xi river. Because of the natural low-lying terrain and the climate, it is under the threat of flooding from ancient times. The ancestors of Shunde used their wisdom to protect their homeland. Outside of dike, they made space for river by keeping the flooding buffer zone. Inside of the dike, they constructed the dike-fish pond system to retain and make use of extra water. However, after the urbanization and industrialization, the dike-fish pond system is destroyed and waterlogging is getting worse. Moreover, excessive uncontrolled industrialization has also resulted in the waste of land. The low-efficiency manufacturing industry urgently needs to be transformed into the high-tech industry.



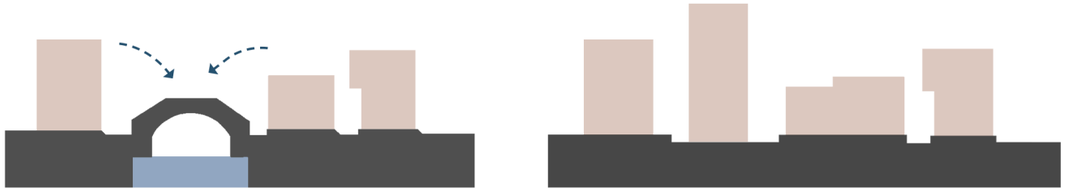
''Nowadays, Shunde is facing some problems and challenges: waterlogging and industrial transformation. They are not isolated issues, to some extent, the latter one intensifies the former one.''

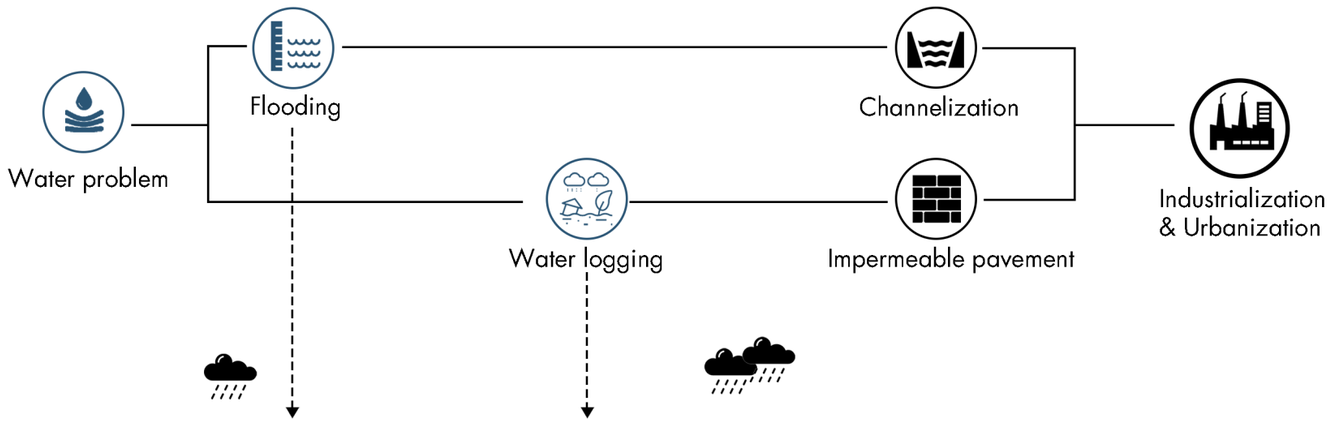
2.1 WATER LOGGING

Waterlogging is happening inside of the dike. Because of the subtropical monsoon climate in PRD, the cloudburst always happens in the rainy season. After a big rainstorm, too much rainwater is accumulated inside of the dike which cannot be discharged outside quickly because of the high water level in the external river. In the past time, our ancestors built a completed dike-fish pond system to slow down the outflow and increase spaces for water storage. However, in the process of industrialization, people fill in the dike-pond system for some short-term profits, such as houses and factories. As a result, water logging is more and more severe and also threatens people's property.

In conclusion, industrialization in Shunde intensifies the waterlogging problem and we should increase the area for water storage especially in the urbanized area with too much impermeable pavement.

▼ Fill in the canal





▶ Before



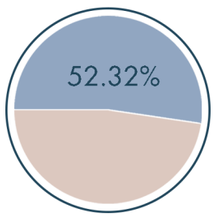
▶ After



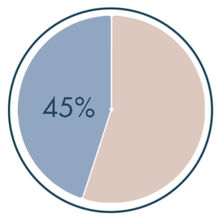
2.2 INDUSTRIAL TRANSFORMATION

From the image of change of the built-up area in Shunde, it shows the water network in Shunde is reduced dramatically from 1978 to 2010. More and more dike-fish ponds are replaced by industrial areas. The water capacity has been drastically reduced.

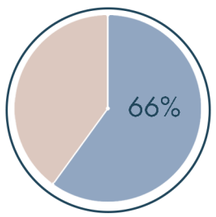
In Shunde, now the industrial area accounts for more than 25% of the whole area, which is far more than the national standard. Among them, most of the factories are old manufacturing factories with the problem of inefficient production, low profits, wasted land and scattered distribution. In this stage, lots of factories are abandoned or facing the point of upgrading. It gives us a good chance to make use of these large spaces to explore a better way to deal with water problems.



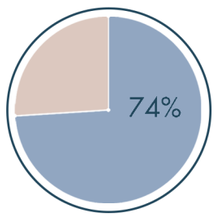
Built-up area/
Whole area



Industrial area/
Built-up area



Low-efficiency
industrial area/



Broken industiral
area



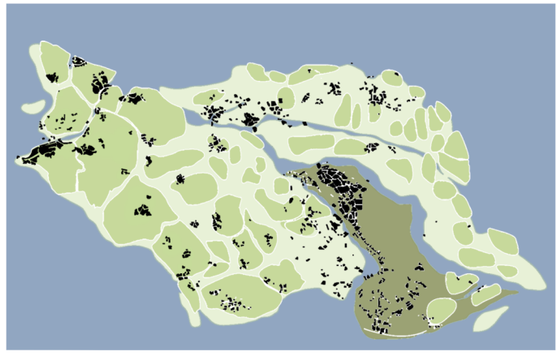




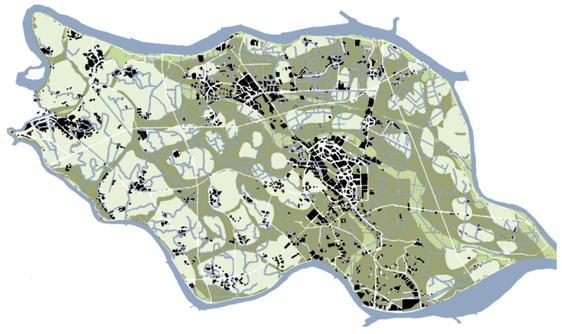


Legend:

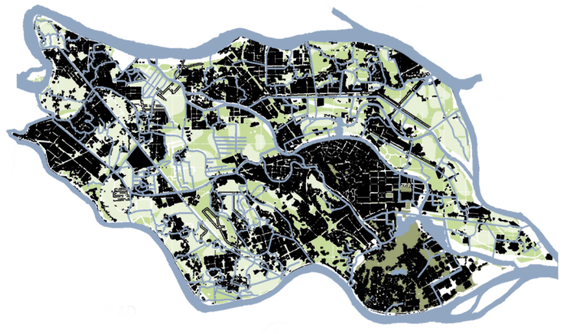
- Water
- Land
- Dike-fish pond
- Built-up area
- Highly-polluted factory
- Medium-polluted factory
- Light-polluted factory



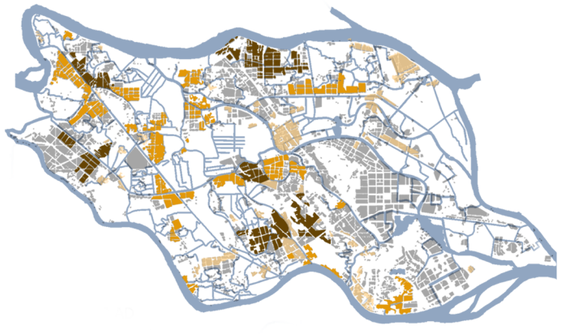
Before 1978



1978 - 1992



2010



Industrialization (2010)

image sause: Xiong, L.

CONCLUSION



Reclamation



Aquaculture



Industrialization

?

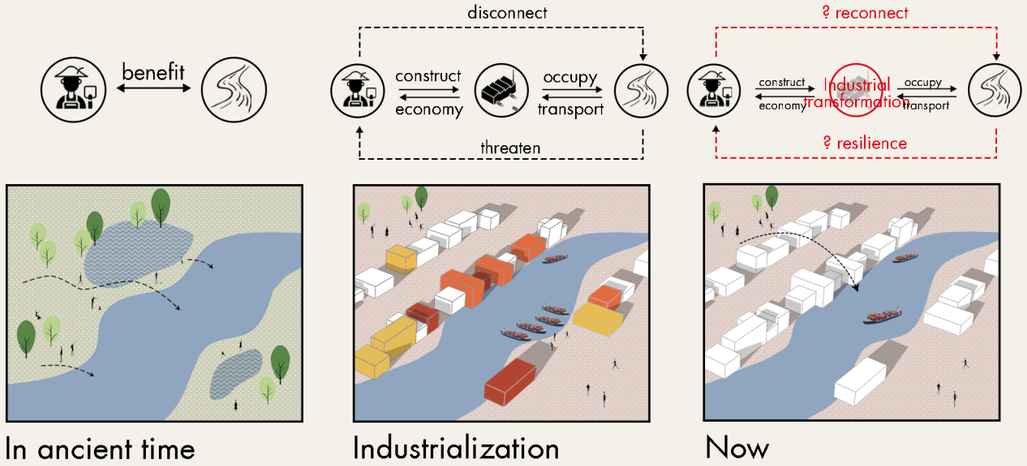
Industrial transformation

In conclusion, urbanization and industrialization make the water problems more severe in Shunde district. Now during the phase of industrialization, what can we do?

Can we make use of the chance of industrial transformation to explore landscape strategies for water resilience?



" Identify and explore landscape based strategies and design principles for water resilient industrial transformation in Shunde district. "



To develop the thesis, the following 5 sub-questions need to be answered:

1. What is the difference between the existing water management system and historical water management strategies in Shunde district? Why the existing water management system cannot satisfy the discharge assignment?
2. What is the relationship between waterlogging and industrialization? Except for waterlogging, what are the other problems caused by industrialization?
3. What landscape-based principles and design strategies can help water resilience and industrial transformation work in an intergrown way?
4. How to apply the design strategies into the site and what are the potentials for landscape development in different scales?
5. What are the lessons learned from combing water resilience and industrial transformation?

4. METHODOLOGY

4.1 Design research and research by design

Design research and research by design are both used in this "water resilient industrial transformation" project to answer the research questions. Design research is about analysing existing designs or precedents in order to acquire object specific or typological design knowledge (acquired through comparative analysis) (Nijhuis & Bobbink, 2012). In particular, by studying landscape architectonic designs we can acquire knowledge of the possible relationships between conceptual thinking and the three-dimensional aspects of landscapes (Steenbergen and Reh, 2003). Research by design is a process of studying through design using knowledge acquired by design research (Nijhuis & Bobbink, 2012). The purpose is to investigate these characteristics and identify their possibilities using 'generalised knowledge' (spatial design principles or types) which can be put to use in the design study (Steenbergen et al., 2008; Nijhuis, 2010).

Design research and research by design are shown respectively in chapter 2 "analysis" and chapter 4 "design exploration". For chapter 3, it's a transitional chapter which presents principles and strategies to help to apply the theoretical study into a practical use. The structure of this project is as follows. All of these chapters are closely related, although it's shown in separated chapters, the process of studying is back and forth.

4.2 Mapping

Mapping which is distinguished from the act of map-making is a mental interpretation of the world and produces a large range of maps and map-like objects (Dorling & Fairbairn, 1997). Its meaning far exceeds the map artifact itself. Its potential lies in the mappers operations and thinking process. It can be regarded as a means of communication that can occur between a cartographer and map reader or between a cartographer and maps. In the former situation, mapping functions as an expression technique. The mapper needs to decide the content and translate it to ensure the accurate information delivered. When it is concerned with communication between the mapper and maps, mapping refers to a performative process. Usually, the map is first employed as a means of finding and then as founding new projects, effectively re-working what already exists. Thus, the processes of mapping, together with their varied informational and semantic scope, are valued for both their revelatory and productive potential (Corner, 1999). Mapping as a process of finding is based on the gathering and manipulation of existing data. Through a series of manipulative operations including selecting, deleting, adding, indexing and so on, specific hidden relations are revealed. These existing relatively objective and rational relationships can provide a logical basis for further design to make it more persuasive and feasible (Corner J, 1999). Mapping as a process of founding produces new relations, or to say design. It is used to create, develop and test spatial possibilities (Nijhuis, 2016). There are some certain mapping methods that are utilized in this project: layering and photography.

4.3 Case study, literature review, field trip

Case study

Case study is a good way to get inspiration and also extract some principles. Case study is not a simple process of copy, it is a process of exploring the possibilities of design. After summarizing design principles from cases, we can develop some design strategies and then do design exploration in the site. In chapter 3, some design principles are extracted from case study.

Literature review

Literature review is the basis of research. No matter the history, hydrogeological or geographical conditions of Shunde, or related theory about industrial transformation, literature review plays an important role. For example, through reading the book "soft city" written by David Sim, I got nine criteria for livable urban density which can be shown in Chapter 4.

Field trip

Field trip in Shunde is very important. For designers, through putting yourself in the environment to experience, the spatial feeling is stronger and can also notice some problems you haven't noticed during analysis. It can also gives more precise feeling about scale, elevation and atmosphere.

Water resilient industrial transformation

In Shunde, with the rapid industrialization in the past 30 years, it is changed from "water village" into "hard industrial city". Followed by that, there are severe water, ecological and urban problems showed in this district. Now most of these manufacturing factories are abandoned and facing the key point of industrial transformation because they cannot adapt to the new market. This project intends to show the potentials of water resilient industrial transformation and arouse people's awareness of overexpansion. It starts form the idea of reshaping the relationship between people and nature, and eventually gives some practical implements for it.

Landscape perspective

For this project, lots of disciplines are joint in to give future plan or vision from their aspect. Engineer prefers to construct more complete pipe network and higher dike in the industrial area to satisfy the water discharging assignment and protect city from flood. Urban planner puts forwards more residential area to replace abandoned industrial area. Ecologist plans two green corridor to guide people, animals and plants from backland to waterfront. As landscape architects, we are thinking about how to transform industrial area in a high efficiency and low expense way with providing ecological, social and economic value. The relationship between people and nature is reshaped by reorganizing the open space and constructing a green-blue network. It's not a vision from one discipline, it's a structure which takes multidisciplinary values into consideration and using landscape approaches to regenerate the site.

Into future

Industrial transformation is a hot topic in the whole Chine. In the past 30 years, the overexpasion of factories caused lots of ecological and urban problems. Now it's the key phase of industrial transformation, how to make use of the chance to tackle with these problem is a question we should think about.

6. READING ITINERARY

Structure	Sub questions	Reading itinerary	Methodology
Water resilient industrial transformation	**Analysis** - existing water management system, historical water management strategies | existing conditions of industrial area | the relationship between waterlogging and industrialization | other problems caused by industrialization	Chapter 2	Mapping literature review field trip design research
Landscape based strategies	**Design strategies and principles** - principles | strategies - strategies for water resilience | strategies for industrial transformation| strategies for public space	Chapter 3	Case study
	Design exploration - design - water resilience| reuse and refunction industrial area | reuse of public space | process	Chapter 4	Mapping research-by-design
	Discussion and conclusion	Chapter 5	

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1.Nijhuis, S., & Bobbink, I. (2012). Design-related research in landscape architecture. Journal of Design Research , 10 (4), 239-257.

2.Steenbergen, CM, Reh, W., & Smienk, G. (2003). Architecture and landscape: the design experiment of the great European gardens and landscapes. Basel, Boston, Berlin: Birkhäuser.

3.Steenbergen, C. (2008). Composing landscapes: analysis, typology and experiments for design. Birkhäuser.

4.Sim, D. (2019). Soft City: Building Density for Everyday Life. Island Press.

CHAPTER 2 ANALYSIS

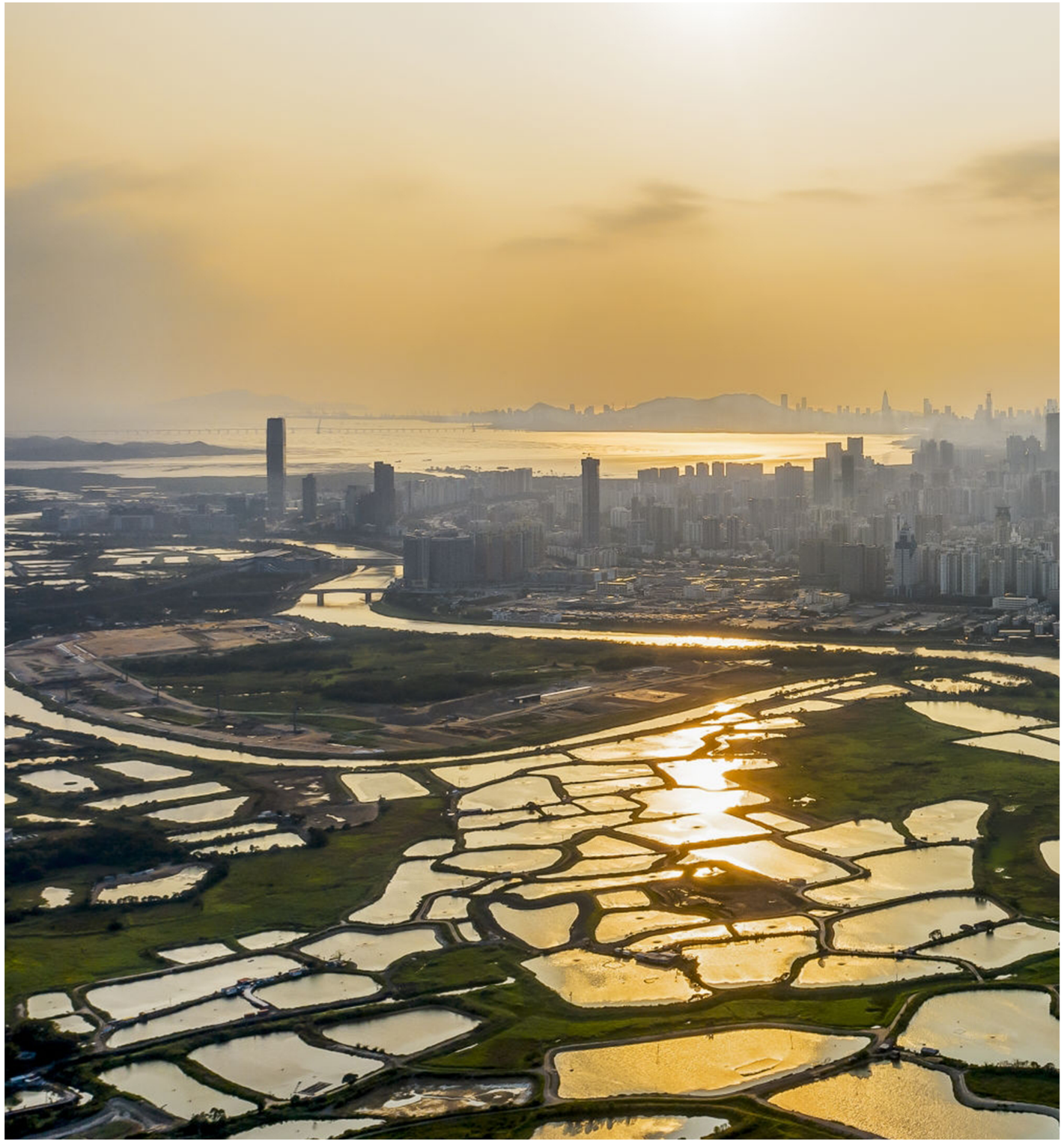
– Understanding Shunde district

1. BACKGROUND OF SHUNDE DISTRICT
2. EXISTING WATER MANAGEMENT SYSTEM & HISTORICAL WATER MANAGEMENT STRATEGIES
3. INDUSTRIAL AREA ANALYSIS
   - Large scale
   - Local scale
   - Small scale
4. CONCLUSION: CHALLENGES & POTENTIALS

1. BACKGROUND OF SHUNDE DISTRICT

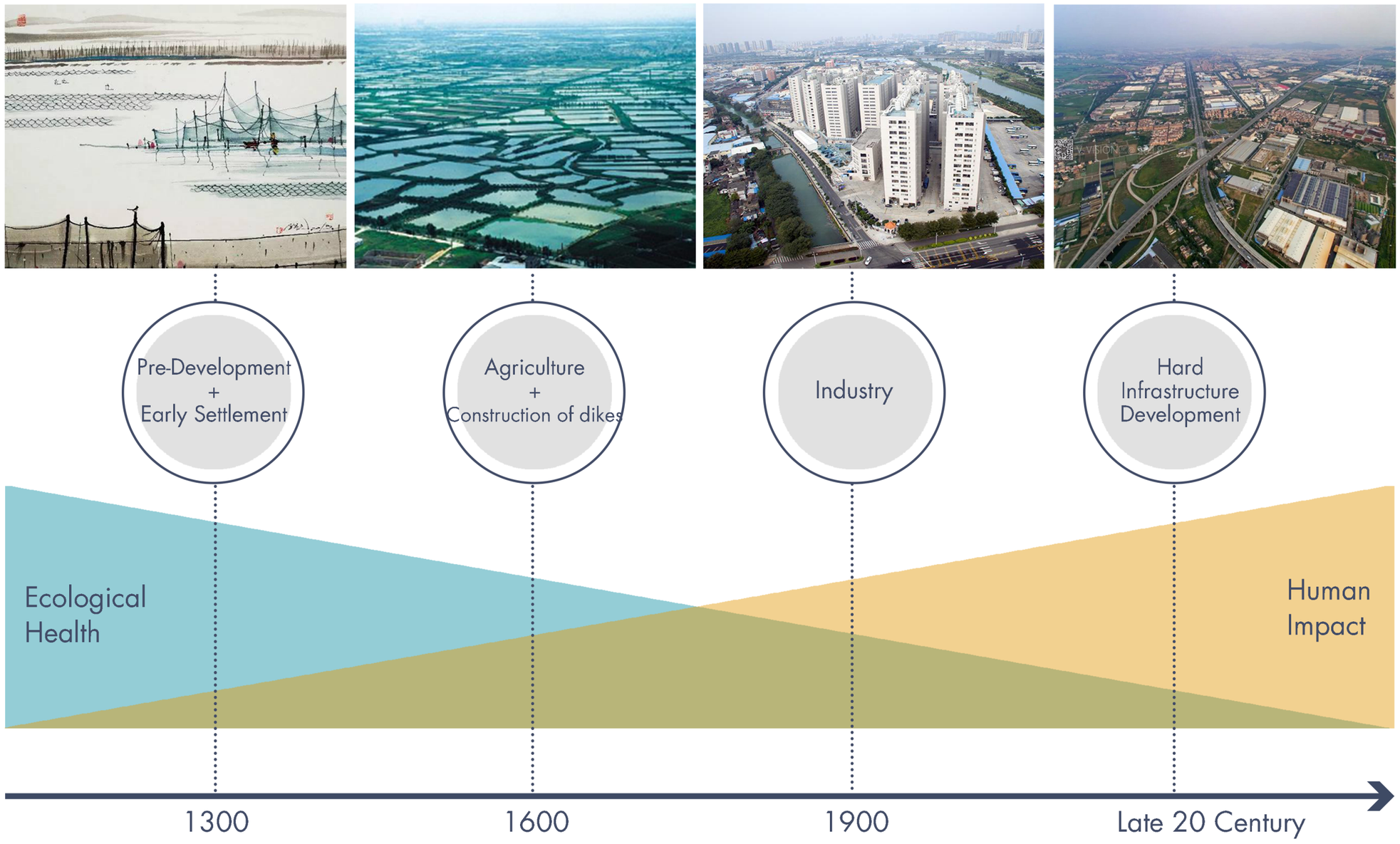
Shunde has dense water networks, abundant rainfall, and a large area of low-lying plain. Based on these favorable natural conditions of agriculture, the ancestors of Shunde created a good dike-fish pond system, in which a comprehensive and multi-dimensional eco-agricultural system was constructed. The mulberry trees are planted along the edge of the fish pond, which can provide leaves for silkworm rearing; then the silkworm feces provide food to feed fishes; and fishes in ponds can provide nutritions for the mulberry fields. Therefore Shunde developed multiple types of agriculture based on the dike-fish pond system, such as silkworm, sugarcane, and fish pond. Shunde was famous throughout China for its agricultural cultivation.

During the end of the Qing Dynasty, the silk industry was transformed from manual operation to machine production, which became the start of the development of industrialization. Then the sugar factory flourished, which greatly activated industrialization in Shunde. After 1978, the policy of reform and opening up was promulgated. Shunde attracted lots of investors coming to construct factories of household appliances, plastic products, clothing and textiles because it has a good location, which is close to Guangzhou city, Foshan city, Hong Kong and Macao, convenient transportation, cheap labors, and good industrial basis. As a result, Shunde was well-known all of China for its manufacturing industry.



1. BACKGROUND OF SHUNDE DISTRICT

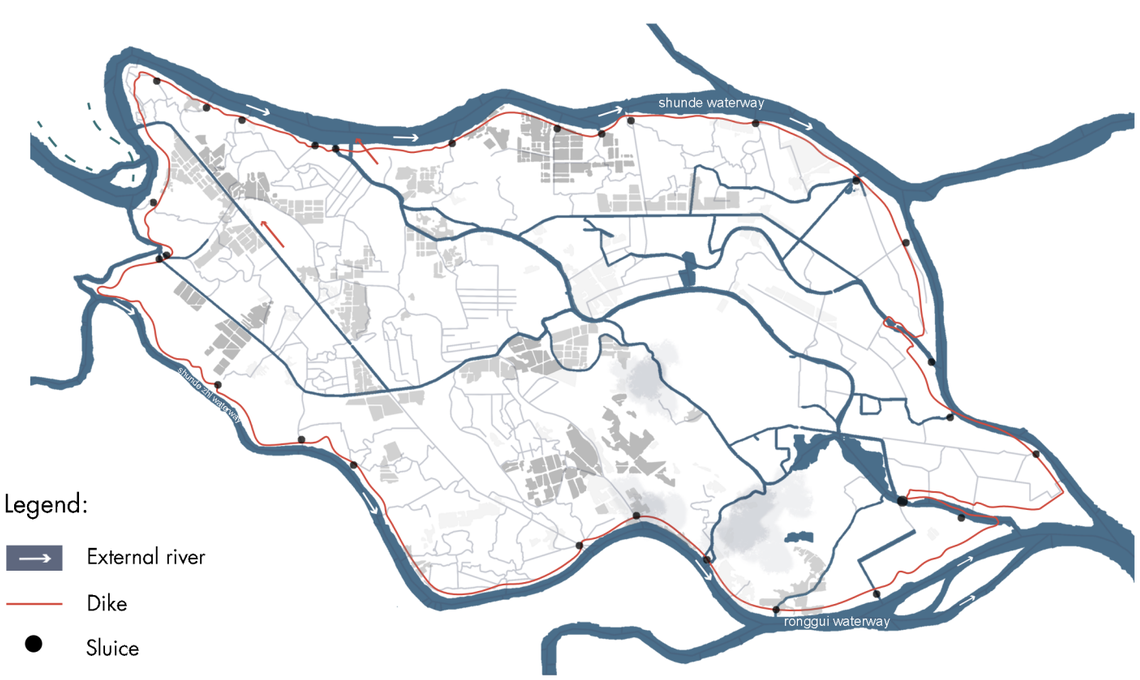
However, in this stage, due to the low technology, overproduction and fierce market competition, the demand for manufacturing products has reduced sharply. What is the existing condition of the industrial area after rapid and uncontrolled industrialization? How to deal with the waterlogging problem which is intensified by industrialization? What alternative solutions we have for water resilient industrial transformation? We need to think about and answer these questions one by one.



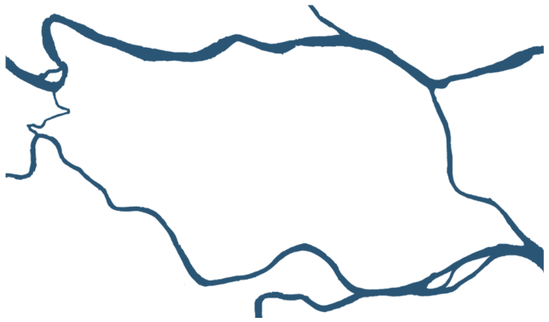
2.1 EXISTING WATER MANAGEMENT SYSTEM

Currently, people in Shunde mainly use hard infrastructure to control water. The water management system can be divided into **4 levels, dike ring, sluices, canal and pipe network**.

The dike ring is a regional enclosed dike that is constructed along the external river and limits the river into the narrow channel. In the rainy season, it can protect the city from flooding. The sluices are built along the dike ring which only would be open after heavy rainfall to discharge water from inner land to the external river. The discharge system inside of the dike mainly relies on the canal and pipe network. Most of the canals are straight and artificial riverway with hard edges. After heavy rainstorms, the pipe network discharges the water from the land to the canal.

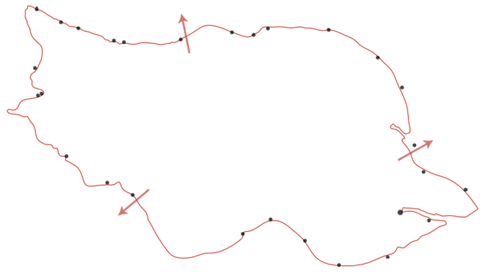


External river





Dike & sluice





Canal





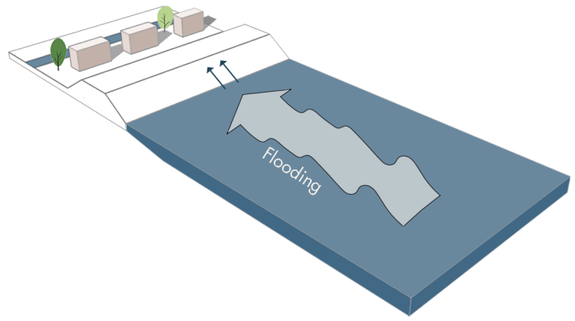
Stream



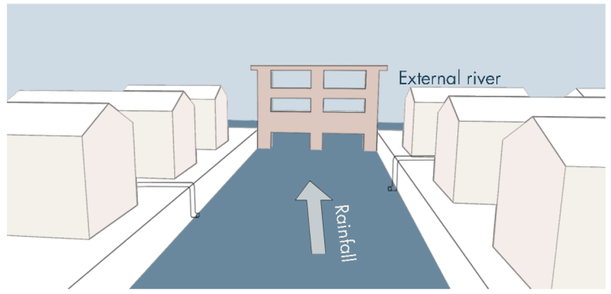


2.1 EXISITNG WATER MANAGEMENT SYSTEM

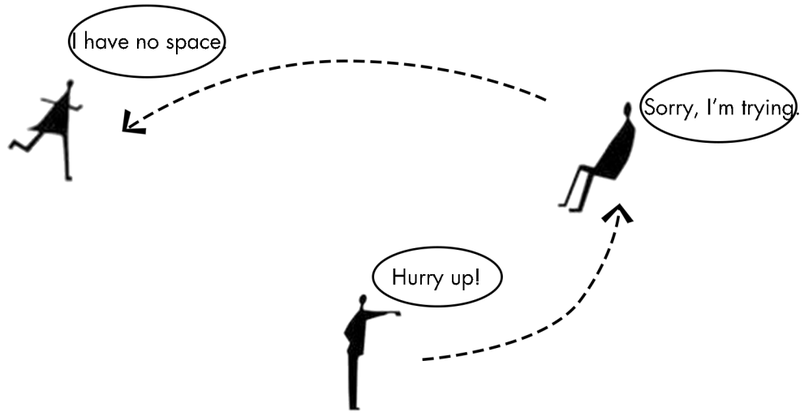
However, the existing water management system cannot satisfy the discharge assignment especially after the rainstorm or extreme weather. As we mentioned earlier, the monsoon and the heavy rainstorm can always meet together in Shunde district. Since Shunde is located in the area where the Xi river and Bei river meet, during the rainy season, too much river water comes from upstream which will cause the water level outside of dike to rise. After a heavy rainstorm, because of the large area of impermeable pavement and little area for water retention, the only way in the city is discharging water to the canal and then to the river. At this moment, the problem is exposed. Because the water level outside of the dike is rising, the rainwater inside of the dike cannot be drained out. Therefore, waterlogging is formed.



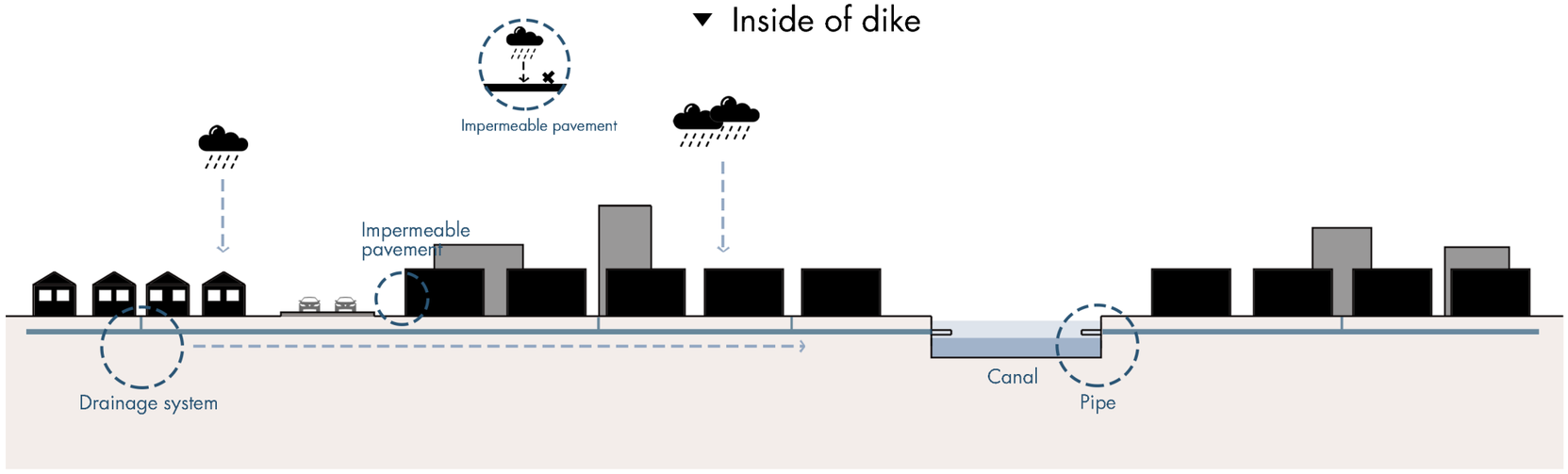
▲ Outside of Dike



▲ Sluice



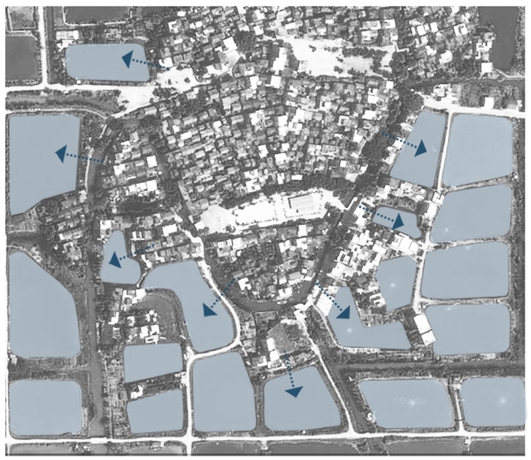
▼ Inside of dike

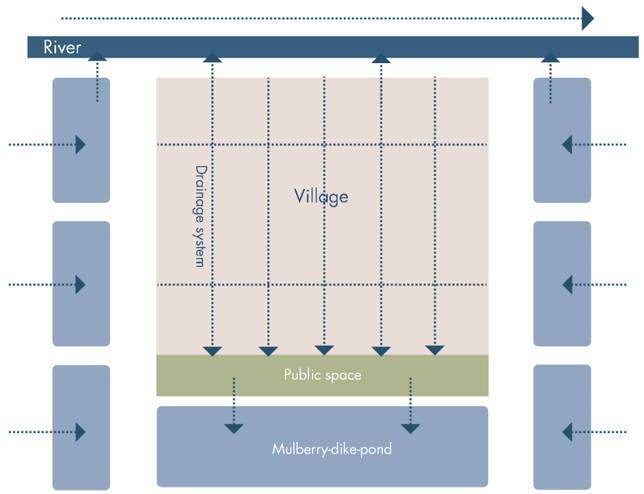


2.2 HISTORICAL WATER MANAGEMENT STRATEGIES

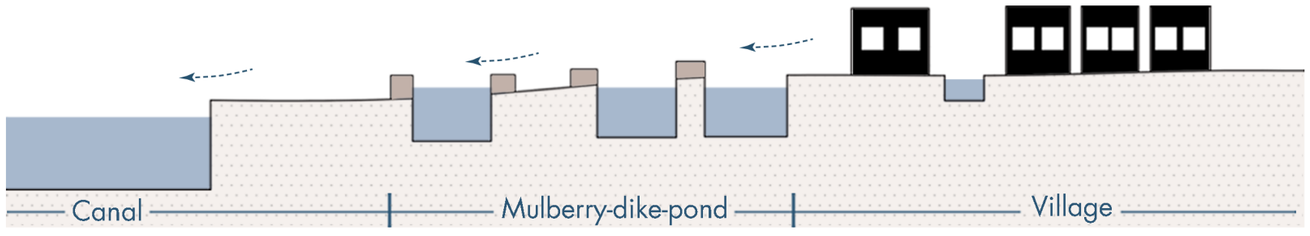
Historically, the ancestors in Shunde have lots of wisdom to deal with waterlogging. On the one hand, they made use of terrain to create natural drainage flow. On the other hand, in the lower area, they constructed the dike-fish pond system to increase the area for water collection and water retention. When choosing locations for the village, our ancestors well considered the natural terrain and set the settlements in a higher place. Then they would expand the lower plain around the village to construct a dike-fish pond system. During the rainy season, the runoff from the village could naturally flow to the dike-fish pond system and then retain there temporarily. Until the water level in the canal was back to normal, the extra water would be discharged out. This strategy effectively slows down the water flow, increases the water capacity, and solves the problem of waterlogging during the rainy season. Meanwhile, there were also lots of small elements that were helpful for drainage, such as, small waterways, gully, and well.

▼ The drainage system of village



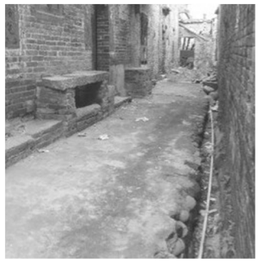


▼ Section



▼ Elements for water management









CONCLUSION FOR EXISTING AND HISTORICAL WATER ANALYSIS

In conclusion, by comparing the historical and current situations, the water management system has been changed a lot in Shunde in the last 30 years. People use hard concrete infrastructure to replace landscape methods because their attitudes towards nature are changed from “respecting nature” into “changing nature”. In this way, people got more areas for urbanized and industrial areas. But we also paid a higher price. The water management system now cannot satisfy the need for water discharge in the rainy season or cloudburst. Inside of the dike, we need more space for water retention.





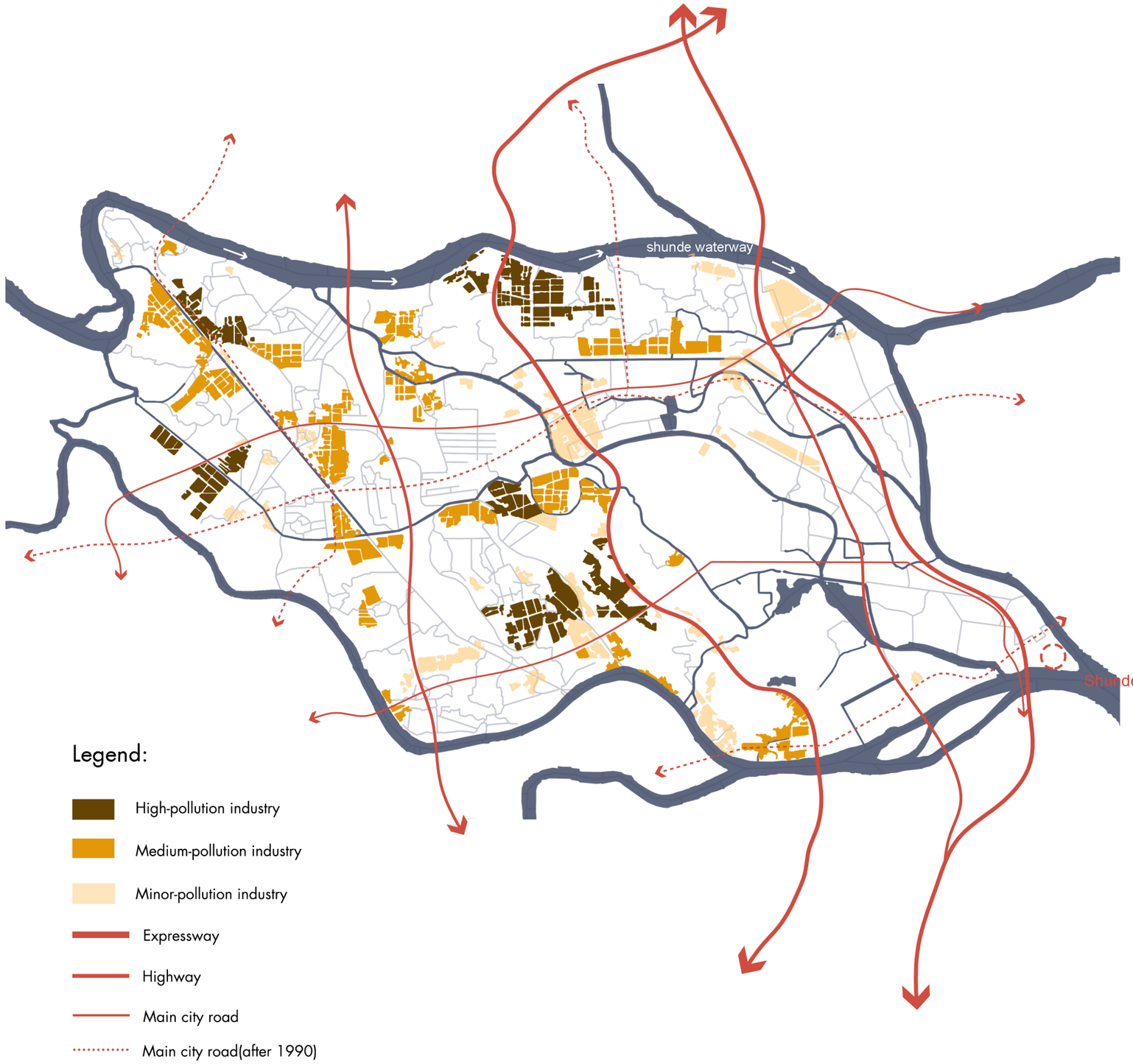
3.1 SCATTERED DISTRIBUTION OF INDUSTRIAL AREA

Different from the large-scale and concentrated industrial area in the other places, the industrial area in Shunde is distributed as scattered patches, which accounts for almost 25% area of the whole district. Most of the factories are about plastic production, household appliances, metals, clothing and textile industry. Now, lots of factories are closed, in a state of being abandoned or waiting for renewal.

Another feature to be noted is that these factories are usually distributed along canals or highways because convenient transportation is an important factor in the selection of factories' locations.



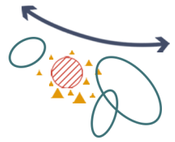
Scattered industrial area



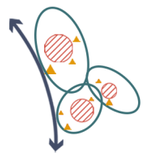
3.2 SPATIAL RELATIONSHIP BETWEEN INDUSTRIAL AREA AND VILLAGES

The reason why the scattered distribution of industrial areas in Shunde is because 80% of these factories are village-owned. After the reform and opening up, with good policies and huge market demand, almost every village started to build factories actively. The first important factor in choosing the location is that it is close to the village, which ensures sufficient labor. Therefore, villagers just filled in the dike-fish pond system around the village and built factories on top of that. These factories are mostly small isolated manufacturing workshops, so they show a dispread pattern. The spatial relationship between factories and villages can be divided into **3 categories**: the entire village is surrounded by factories, scattered factories around the village, and factories in between of village and main road.

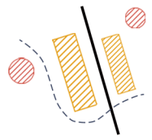
A The entire village is surrounded by factories

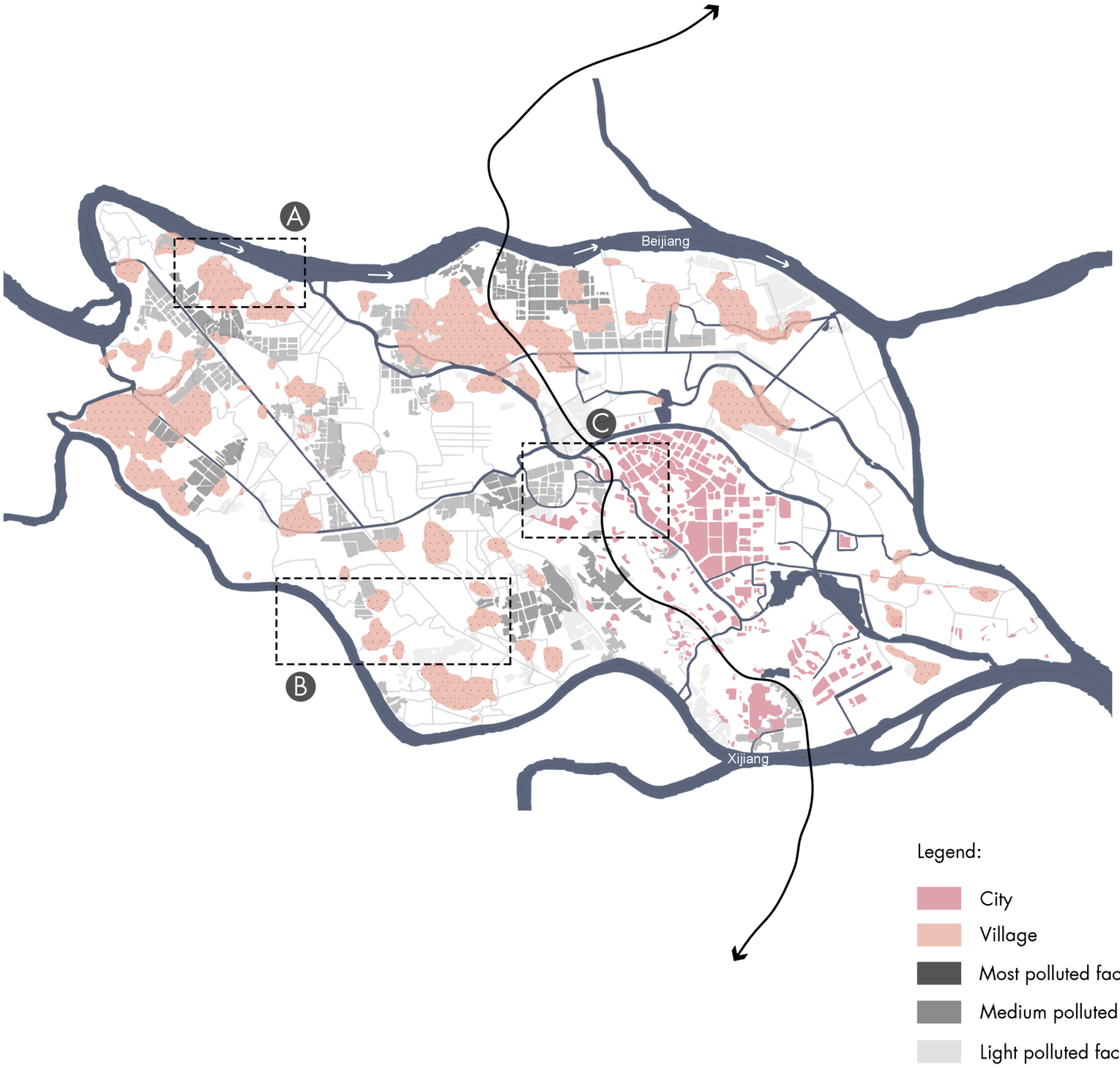


B Scattered factories around the village



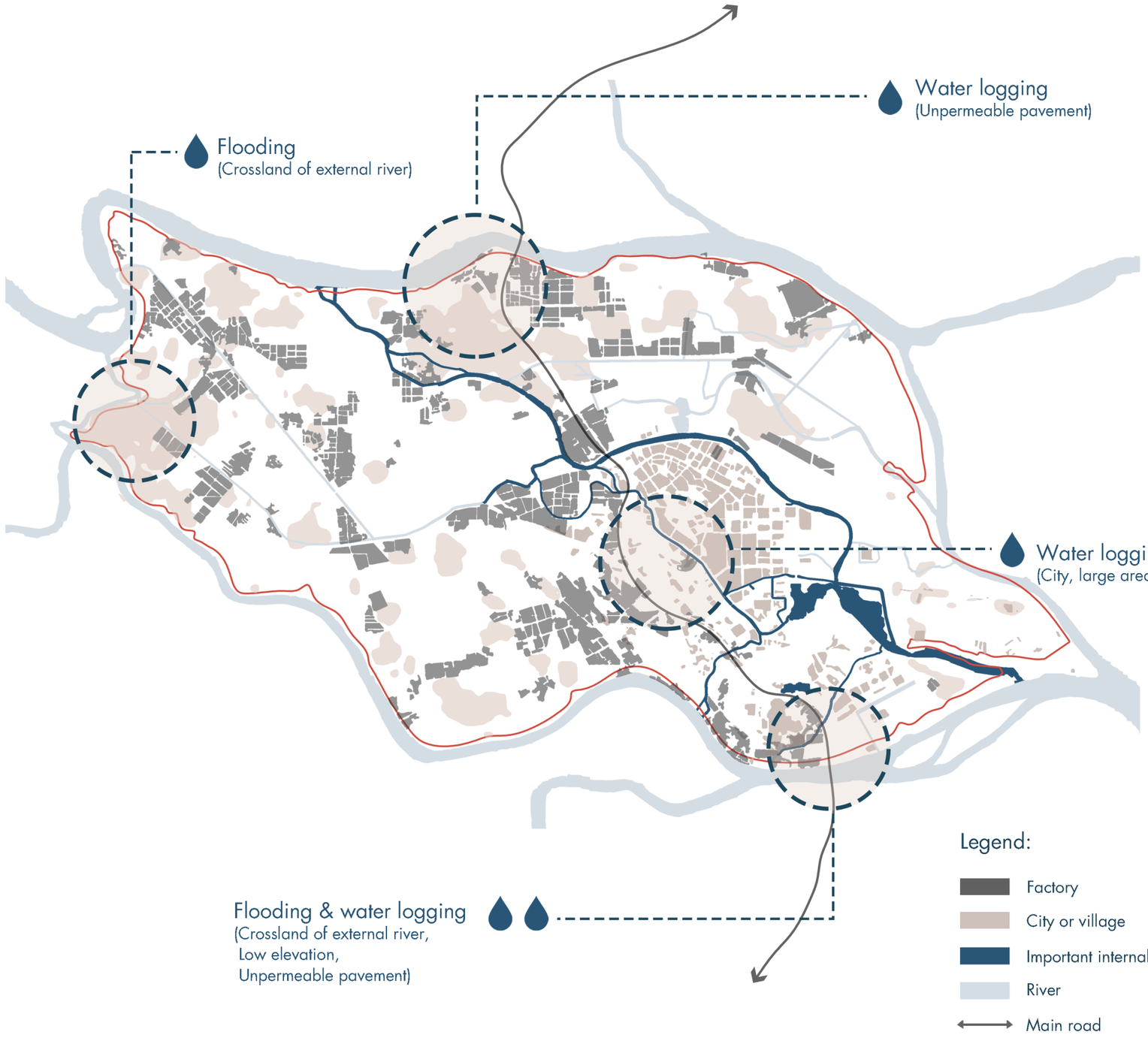
C Factories along the road



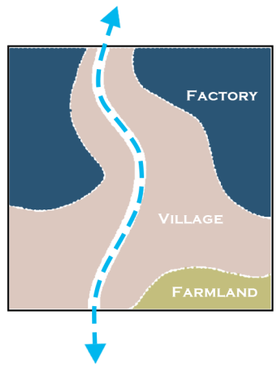


3.3 WATER LOGGING AND INDUSTRIAL AREA

When overlapping two maps of waterlogging points and industrial areas, it is easy to find in Shunde district lots of waterlogging points coincide with the industrial area. There are two reasons for this phenomenon. **Firstly**, industrials are mainly built on top of the dike-fish pond system, which is in the lower terrain. **Secondly**, inside the industrial park, the pavement is always impermeable. After a heavy rainfall, water from mountains or cities will naturally flow to the lower place – industrial area. However, there are now conditions for water retention or water infiltration. Therefore, the waterlogging problem happens in the industrial area.

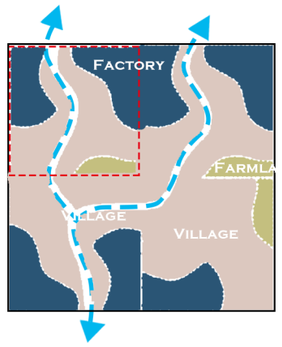


Village-owned factory



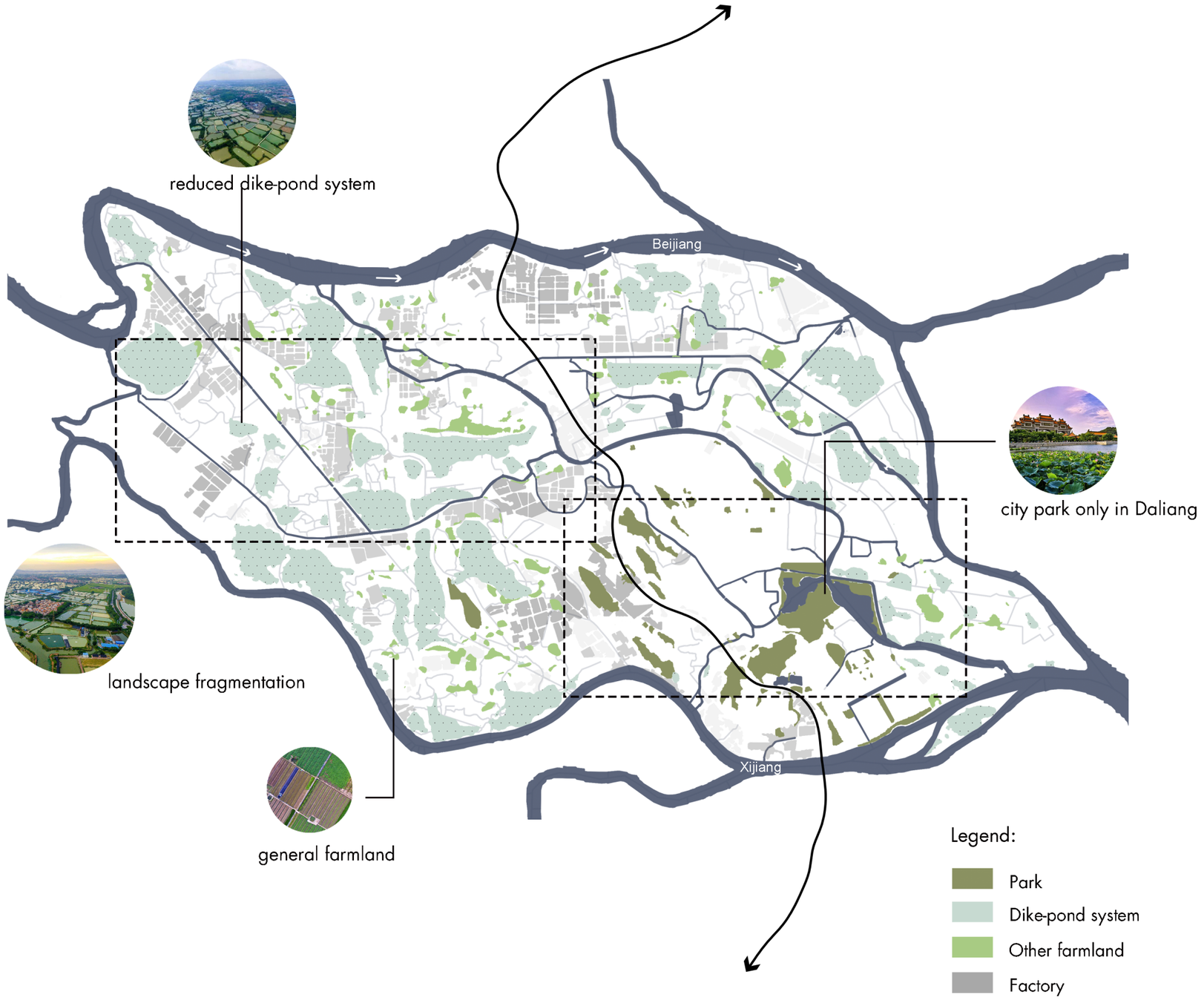
form

Scattered indusitrial area



3.4 LANDSCAPE FRAGMENTATION

From the large scale, industrialization in Shunde also causes landscape fragmentation. Because of the cheaper land pice of farmland, most factories chose to occupy it during construction, which makes farmland scattered. In the southern part of Shunde, there are some good natural mountain resources. During the process of urbanization, people didn't make good use of them and ignored the construction of public green spaces. Overall, the landscape in Shunde has two characteristics: fragmentation and mono function.





Landscape fragmentation

CONCLUSION FOR INDUSTRIAL AREA ANALYSIS (large scale)

From the large scale, factories in Shunde coincides with waterlogging points. Scattered industrial areas also break the structure of green space. We should combine the two problems of industrial transformation and water resilience. By making use of the chance of industrial transformation, we can think about how to alleviate waterlogging problems. On the one hand, it can improve water safety in the industrial area and alleviate water problems in nearby streets or villages. On the other hand, it is also helpful to complete the green structure and provide more ecological and recreational green space for residents.



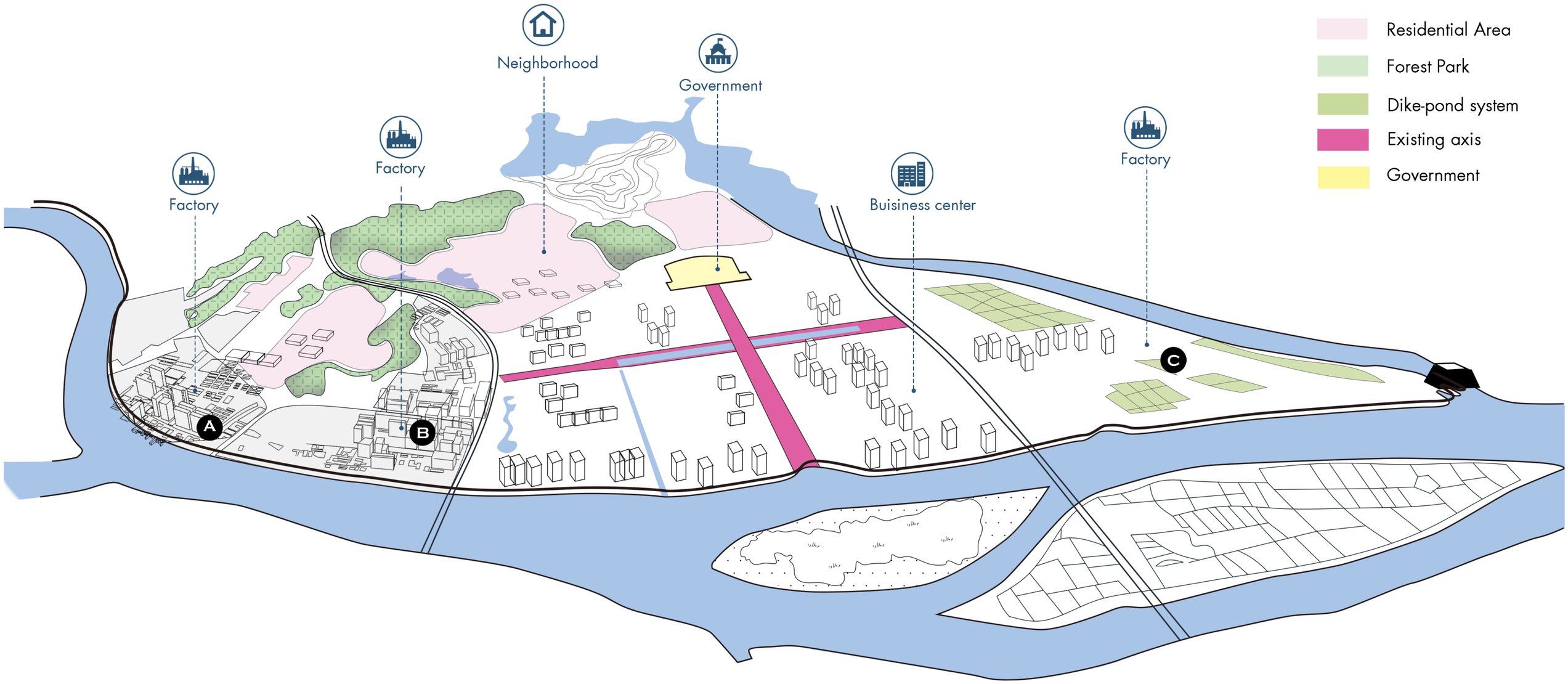
Impermeable pavement
in industrial area



Industrial area
in lower terrain

3.5 BLOCK PEOPLE FROM INNERLAND TO WATERFRONT

When doing analysis on the local scale, what we can obviously notice is that most of the factories are built along the canals or river. There are mainly two reasons: the first one is water is very important for manufacturing production, getting close to water can satisfy the water supply. The second reason is some of the factories rely on water transportation.



3.5 BLOCK PEOPLE FROM INNERLAND TO WATERFRONT

While, because the industrial area occupies the waterfront space, people cannot see or experience water although they live close to water. Before, people in Shunde relied on water and lived with water. Now they almost forget water although it is only one kilometer away. They are blocked by the dike and industrial areas. Meanwhile, being so close to water also causes the problem of water pollution.







3.6 TWO TYPES OF INDUSTRIAL AREA

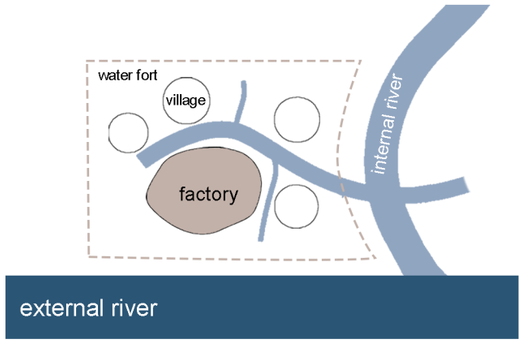
Factories in Shunde can be divided into two types. One is historical factory, the other one is village-owned factory.
They are different in the aspects of location, existing condition and characteristics. Historical factories have more value on preservation,
normal village-owned factories have more good basic conditions for developing new industries. For water resilient industrial transformation, they also have different
For example, the historical factory can be developed as a public park, and the normal village-owned factory can be upgraded as a new industrial area with the fun

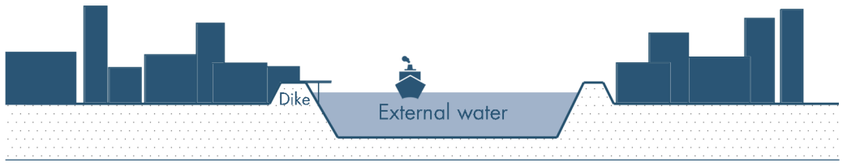
LOCATION

SECTION

HISTORICAL FACTORY

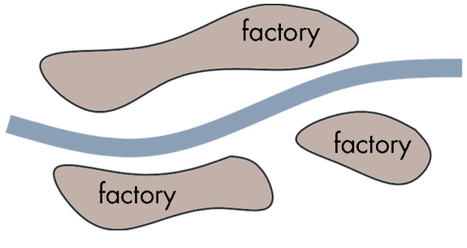


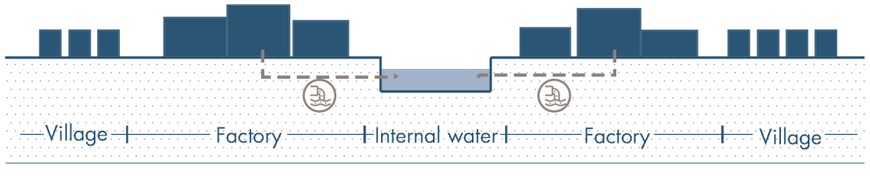




NORMAL
VILLAGE-OWNED
FACTORY







possibilities.
action of water

PATTERN

EXISTING CONDITION

CHARACTERISTIC

POTENTIALS



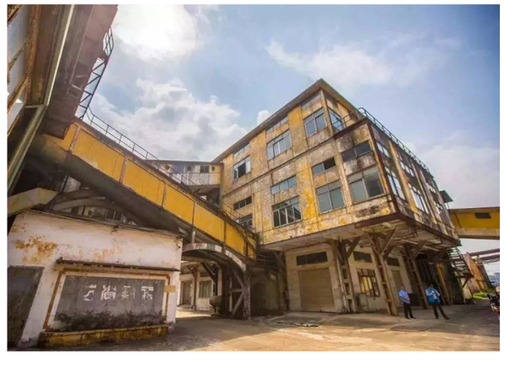


old buildings
& facilites

identity

PUBLIC PARK
WITH RESILIENCE FUNCTIONS





convenient
transportation

scattered
in the whole city

NEW INDUSTRY + WATER RETENTION BOX
(FORM A NETWORK)

4. CONCLUSION

From the analysis of industrial areas in Shunde, the conclusions are as follows:
Most of the industrial areas have the waterlogging problem because of the lower terrain and impermeable pavement.
Scattered factories also cause landscape fragmentation in Shunde. The quality of green space is low and people are lacking space for public activities.
Most industrial areas are distributed along the main road and the main river. It blocks people's way from backland to waterfront and makes it more difficult for people to experience water.
There are two main types of the industrial area, historical factories and village-owned factories. They both have problems with low-efficiency landuse and facing industrial transformation. These types of factories are closely related to water because of the convenient transportation and water supply.



REFERENCE

1. Xinwen. (2016). Research on the urban and rural coexistence features and pattern in the urbanization process of Shunde. (Doctoral dissertation, South China University of Technology).
2. Jiahao Li. (2016). Research on evolution and dynamic mechanism of water features morphology of Shunde since 1978. (Doctoral dissertation, South China University of Technology).
3. Liyun Liang. (2014). Research on evolution and dynamic mechanism of small towns'morphology in Guangdong Shunde. (Doctoral dissertation, South China University of Technology).
4. Liu W. 2015. Study on the relationship between urban canal-system of ancient Guangzhou and city developmentGuangzhou, China: South China University of Technology
5. Qiuxiang Wang. (2011). Study on cultivated land change driving mechanism and spatial distribution optimization of Foshan. (Doctoral dissertation, South China University of Technology).

CHAPTER 3
HOW TO IMPROVE WATER RESILIENCE IN INDUSTRIAL TRANSFORMATION
– principles & strategies

1. PRINCIPLES

    1.1 Green and blue grid

    1.2 Landscape as process

    1.3 Transformative perspective

2. STRATEGIES

    2.1 Strategies for water resilience

    2.2 Strategies for industrial transformation

    2.3 Strategies for public space

1. PRINCIPLES

1.1 Green and blue grid

The Copenhagen Cloudburst Formula

Low technique, low expense, high interaction solution for water resilience

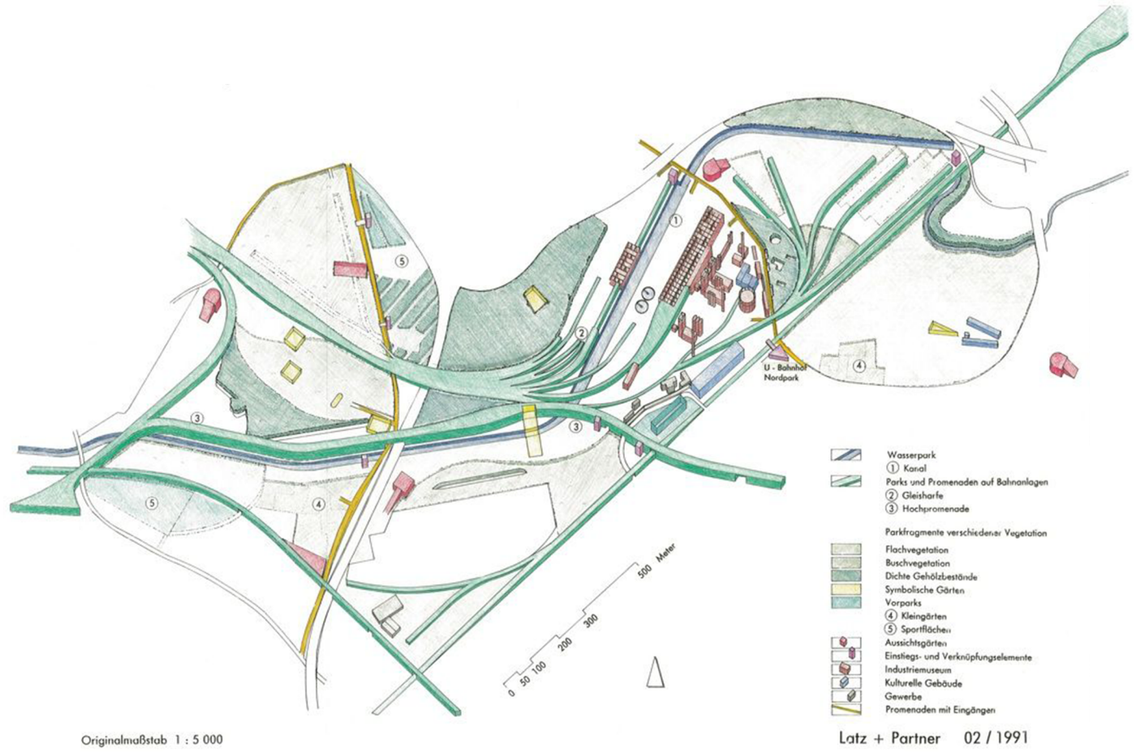


In this case, a flexible and adaptable green and blue structure is constructed in the limited urban area for mitigating increasingly flooding problems or cloudbursts. Compared with hard pipe infrustructure, this solution combines green space and water system together which are both adaptive for weather change, on the one hand, it improves the water capacity, on the other hand, it costs less and improves the interaction between people and nature.

image souce: https://freshkillspark.org/the-park/the-park-plan

Landschaftspark Duisburg Nord—Duisburg, Germany

Transforming canalized river bed with ecological and recreational function



In this case, a green and blue grid was created in order to give a new ecological, economic, social and cultural impulse to the old industrial Ruhr area. The Emscher is transformed from canalised river into a rainwater collection and wastewater purification area. At the same time, it also improves the water quality and experience value of the Emscher. During rainy season, it can be used for temporary water storage.

image sause: https://nl.pinterest.com/pin/856950635320148107/?nic_v1=1aDEYWoNFZIKReTVGNjZPSdgVrLlaB2J2qdppgfWhv4XxQGEws9RfOVgUa7lhp3pH%2F

1. PRINCIPLES

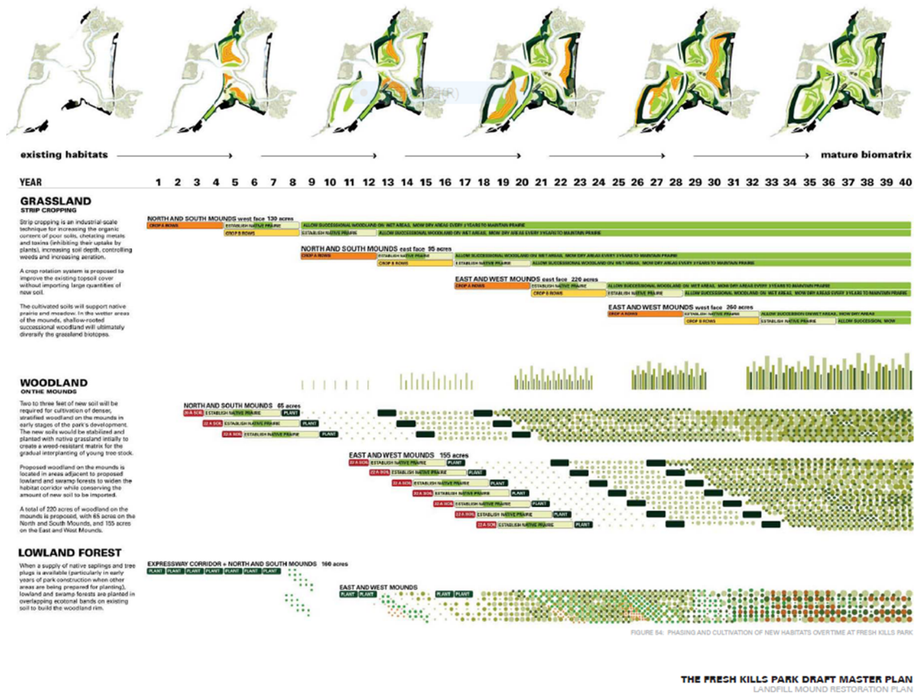
1.2 Landscape as process

Landscape can be changed in time. One case is studied about dynamic landscape.

Fresh Kills Park plan

Phases and dynamic landscape





In this case, James Corner Field Operations proposed a long term plan which will be achieved in 30 years. In this project, it both has natural succession and artificial cultivation. Through design and management, a park is grown not constructed.

image sause: https://www.nycgovparks.org/sub_your_park/fresh_kills_park/pdf/ULURP_Presentation_Mapping_Proposal.pdf

1. PRINCIPLES

1.3 Transformative perspective

The most important principle for industrial transformation is the transformative perspective. It means the context is not a vacant area that could be planned or designed with any intervention. Industrial area consists of buildings, facilities, open spaces and some other supporting infrastructures. This principle is used for redefining the post-industrial area to activate its potential and generate new economic, social and ecological values.

Shougang Park, China

Structural and systematic protection

Day Time Bird's Eye



In this case, to respect the site, the designer tried to protect the the factory in a structural and systematic way. For industrial heritage, the value of the system in the factory is more than individual. It starts from the overall area and the whole system, setting a final goal according to the context and evaluating the buildings, facilities and spaces according to the final goals. Then through adding, subtracting, dismantaling and decorating to activate its potential and generate new economic, social and ecological values.

image souce: The Investigation & Analysis of Shougang Resource PDF

Duisburg Nord Landscape Park

Industrial heritage for new functions



The existing elements are intergrated in new landscape and given new funtions.

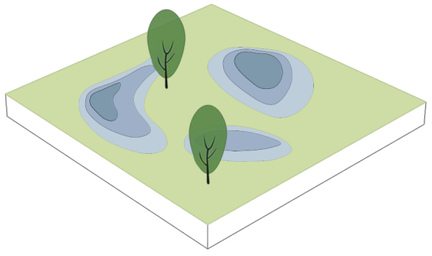
image souce: https://www.google.com/search?q=Duisburg+Nord+Landscape

2. STRATEGIES

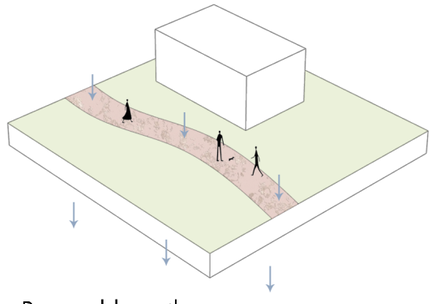
2.1 Strategies for water resilience

WATER STRATEGY: **COLLECTION, PURIFICATION, REUSE**

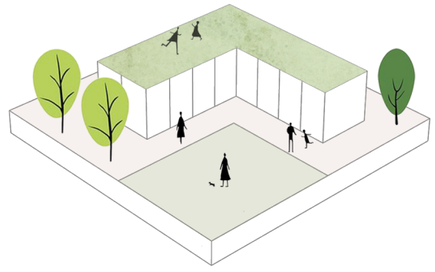
Collection



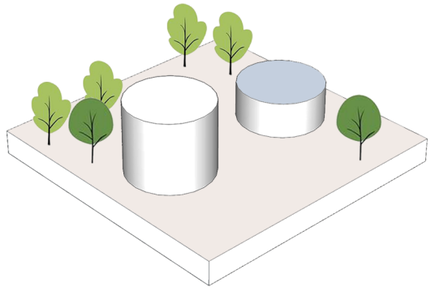
Terrain (grassland)



Permeable path

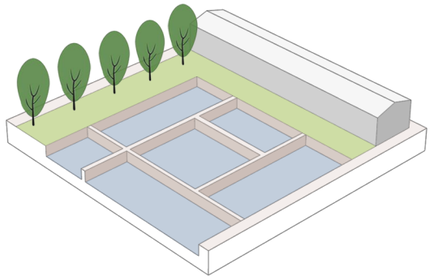


Green roof

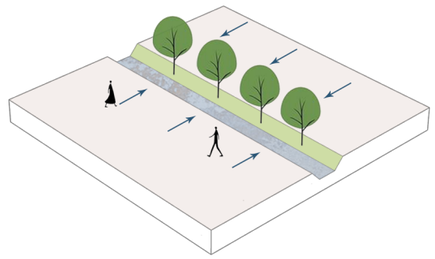


Water tank

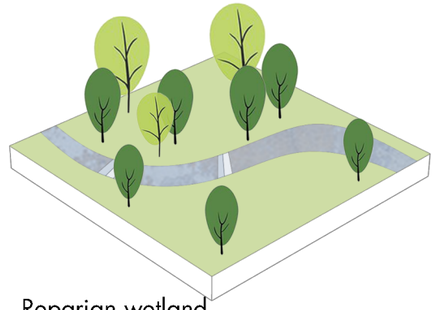
Purification



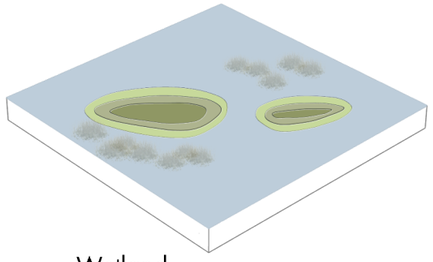
Sunken garden



Bioswale

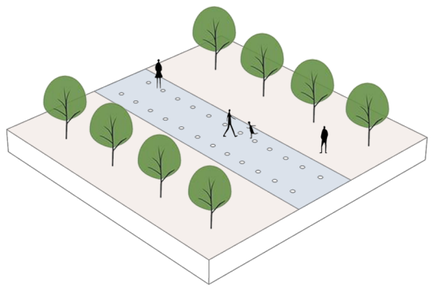


Reparian wetland

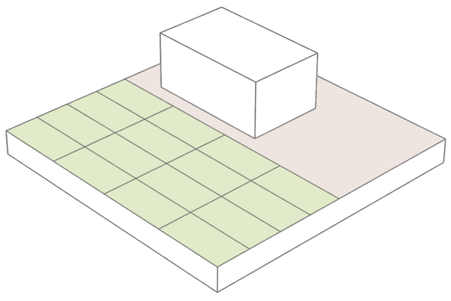


Wetland

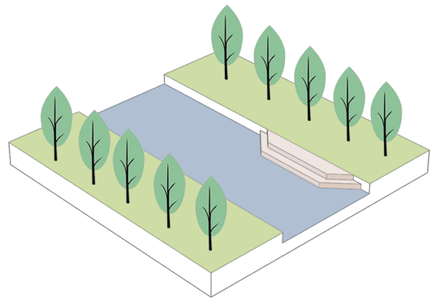
Reuse



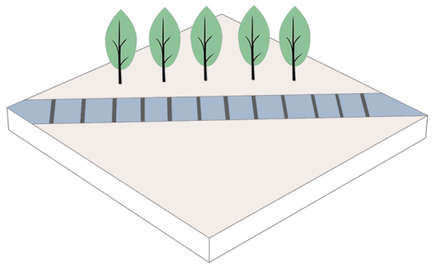
Music fountain



Urban agriculture



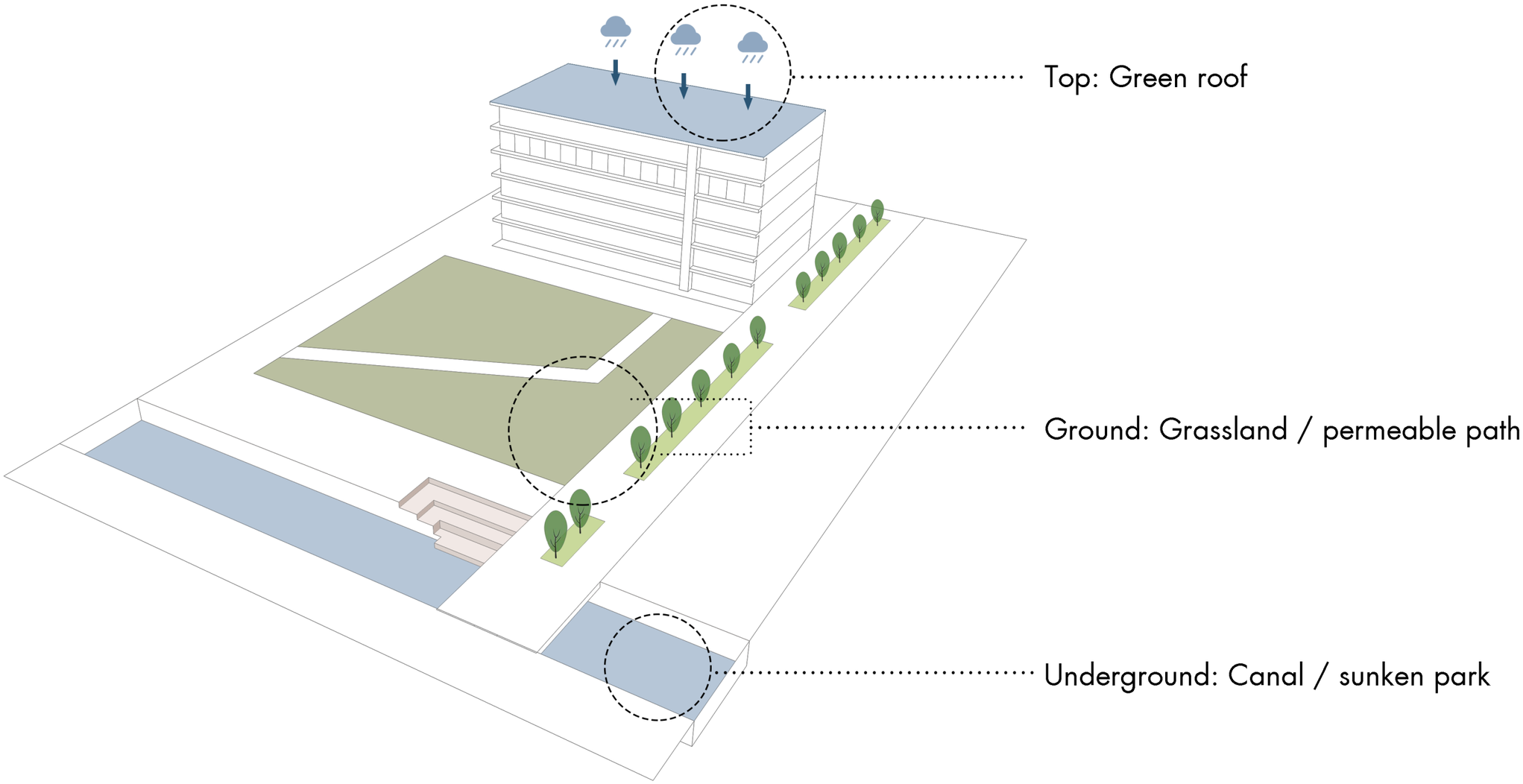
Canal



Train track

2. STRATEGIES

2.1 Strategies for water resilience

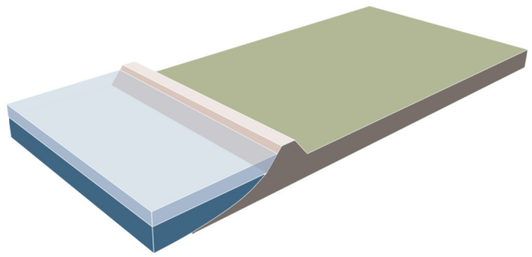


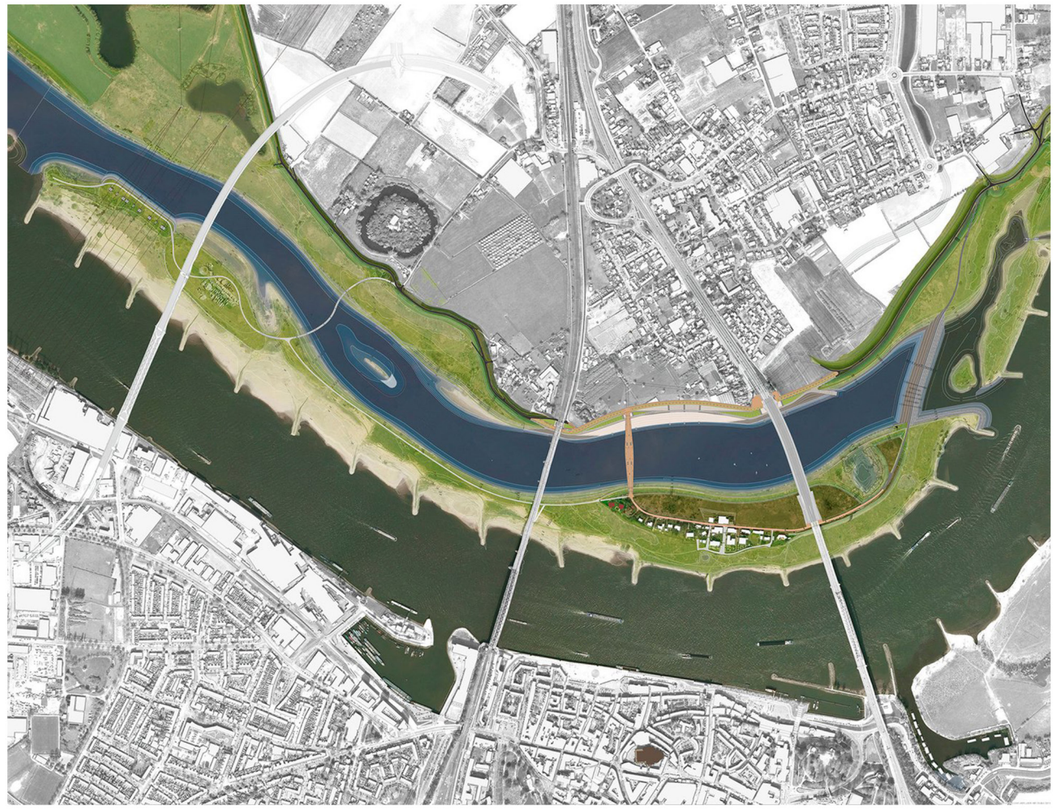
2. STRATEGIES

2.1 Strategies for water resilience

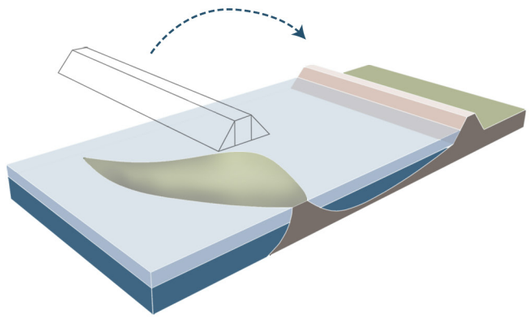
WATER STRATEGY: MAKE ROOM FOR RIVER

Current situation





Relocate the dike



Sedimentation
form wetland

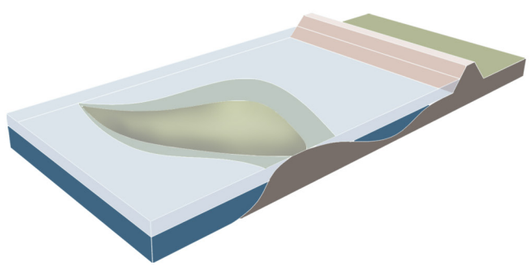




image sause: http://www.hnsland.nl

2. STRATEGIES

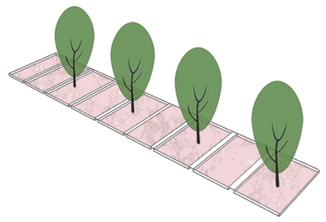
2.2 Strategies for industrial buildings

INDUSTRIAL TRANSFORMATION STRATEGY: ADDING, SUBTRACTING, DISASSEMBLING, DECORATION

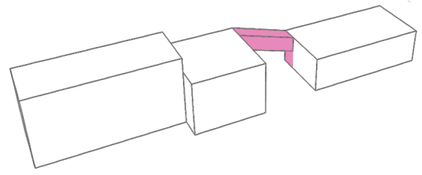
Adding



Chimney – climbing stairs

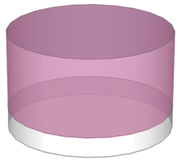


Rail track – plant box

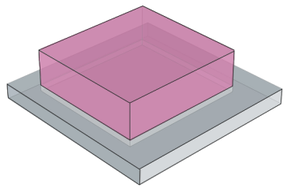


Corridor – stairs

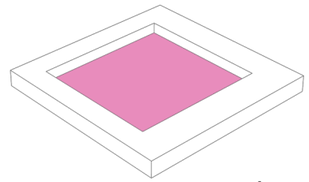
Subtracting



Water tank – water collection

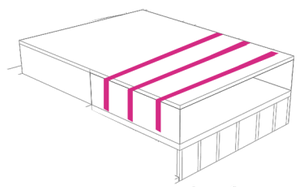


Water plant – sunken garden



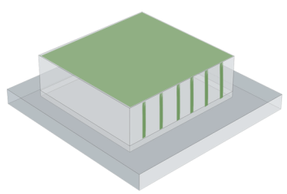
Water reservoir – outdoor theater

Disassembling



Quay – platform

Facade decoration



Warehouse – green facade



Buildings



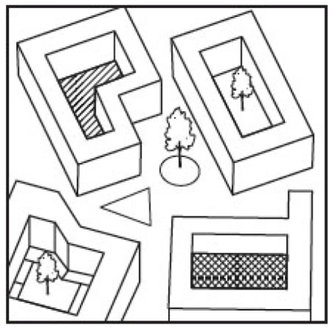
Signal



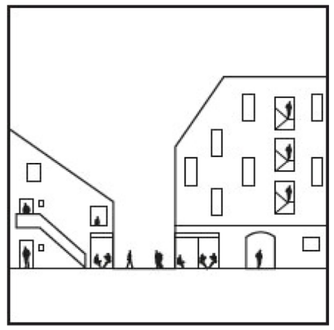
Facilities

2. STRATEGIES

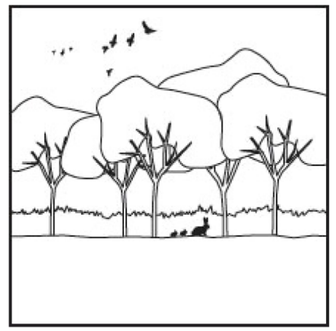
2.3 Strategies for public space



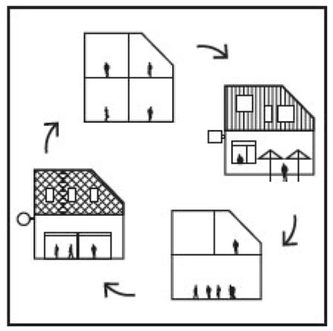
Diversity of outdoor space



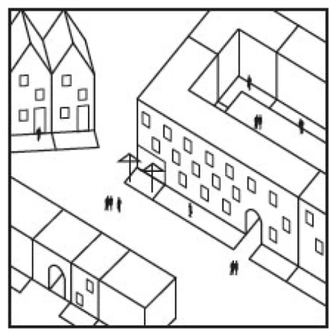
Walkability



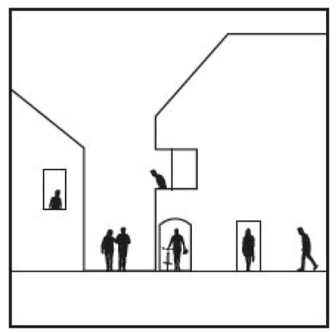
Greater biodiversity



Flexibility



Sense of control and identity



Human scale

image sause: Sim, D. (2019). Soft City: Building Density for Everyday Life. Island Press.

CHAPTER 4 DESIGN EXPLORATION

– explore possibilities for water resilient industrial transformation

1. INTRODUCTION

2. ANALYSIS

3. PROPOSAL

4. DEVELOPMENT PLAN

5. STRUCTURE

6 -10. WATER RESILIENCE IN INDUSTRIAL TRANSFORMATION

- 6. Terrain grassland and natural stream (water collection & water purification)
- 7. Water system – transformed from industrial facilities
- 8. Water system – parkway (water purification & water reuse)
- 9. Water reuse – recreational function
- 10. Outside of dike – make room for river

11. THE IMPLEMENT OF DEVELOPMENT PLAN IN PHASES

12. VISION IN LARGE SCALE

1. INTRODUCTION



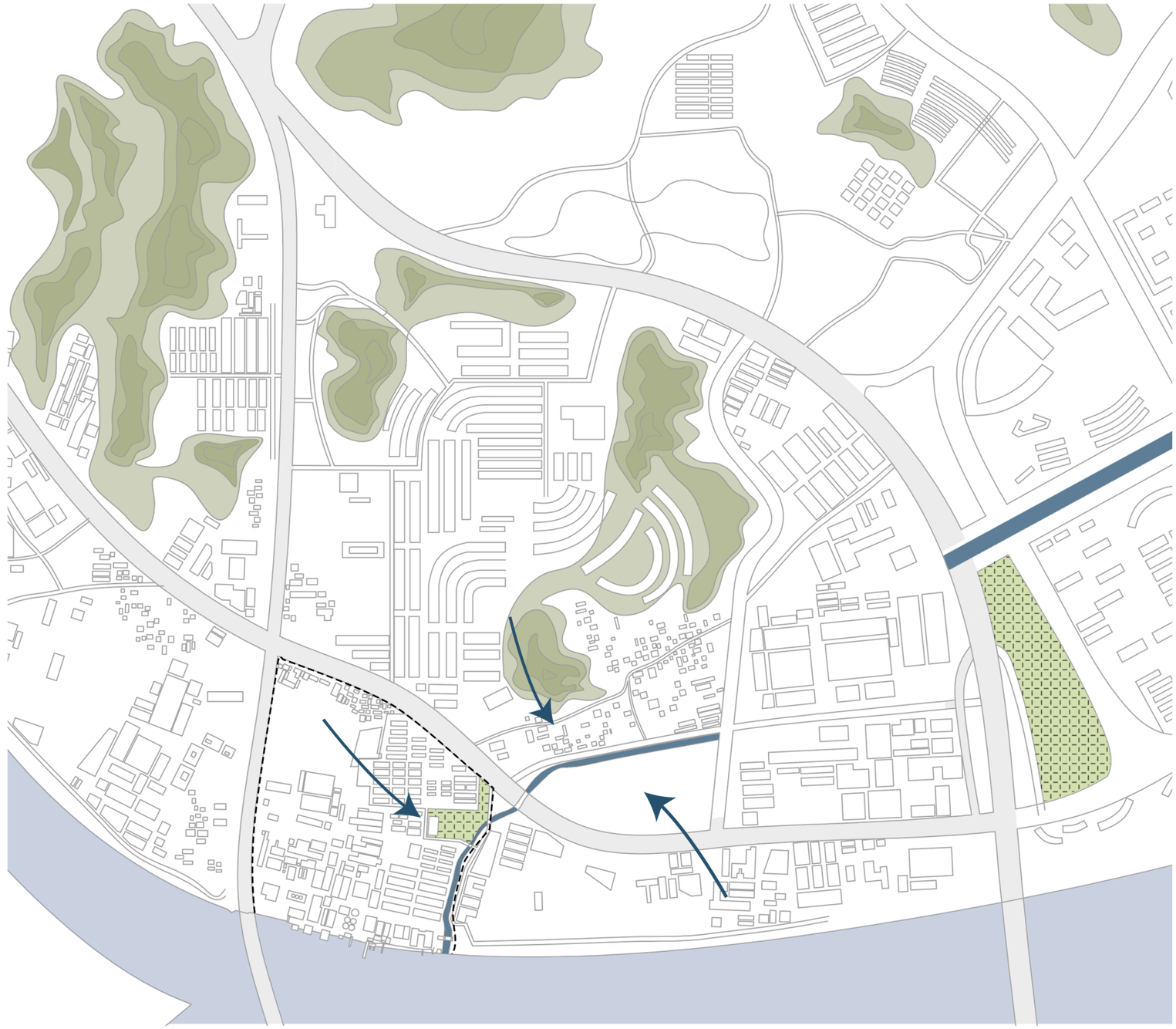
Shunde sugar factory is a mechanized sugar factory, located on the north bank of Desheng river, the mother river of shunde. It is a representative industrial heritage of shunde. It was built in 1934 by Czechs Skoda plant, which was the first and the largest sugar factory in China. With the development of economy, the sugar factory in shunde and even the whole pearl river delta was facing with the situation of reduced production of raw materials. In 2008, Shunde sugar factory stopped production.

This factory records sweet memories of one generation. In 2006, the sugar-making workshop, the sugar-pressing workshop and the warehouse were listed on the list of heritage protection. Its location is on the Desheng river with convenient transportation and geographical advantages. It stands quietly on the bank of Desheng river with the mottled walls, the empty buildings, and the smoke from the chimneys. Such a image has more visual impact than the concrete and steel. So where should Shunde sugar factory go next?

2. ANALYSIS

GREEN AND BLUE SYSTEM

1. Green spaces are lack of connectivity. It is lack of high-quality green spaces for public activities and recreational functions.
2. There are some dead-end canals which are lack of connectivity between each other. During cloudburst the pressure of canal is big and it is lack of water retention area.



2. ANALYSIS

LANDUSE

1. It is a monofunctional place which only has residential area and industrial area. Most of people here are residents and students. Residents living here complain about lacking of park or public space for events. Students studying here complain about no space for sports or getting close to nature. Next to this place, it is the sub city center (business area).
2. Factories are all distributed along Desheng river, which blocks people's way to waterfront. People live next to water but cannot see or experience water.

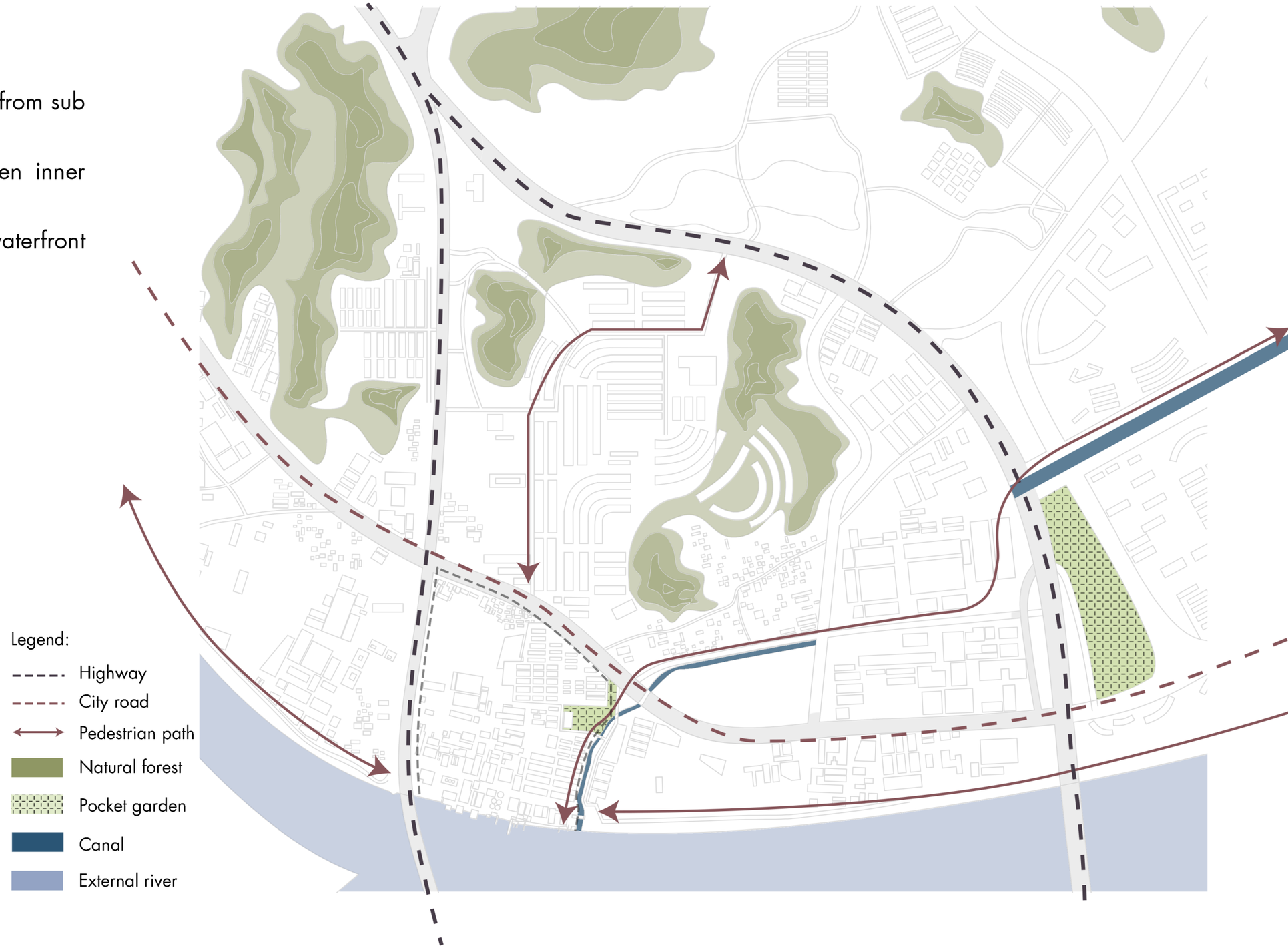


2. ANALYSIS

MOBILITY

The

1. The existing slow walking path from sub city center here is in low quality.
2. Lack of the connection between inner land to waterfront.
3. The connection for waterfront promenade is missing.



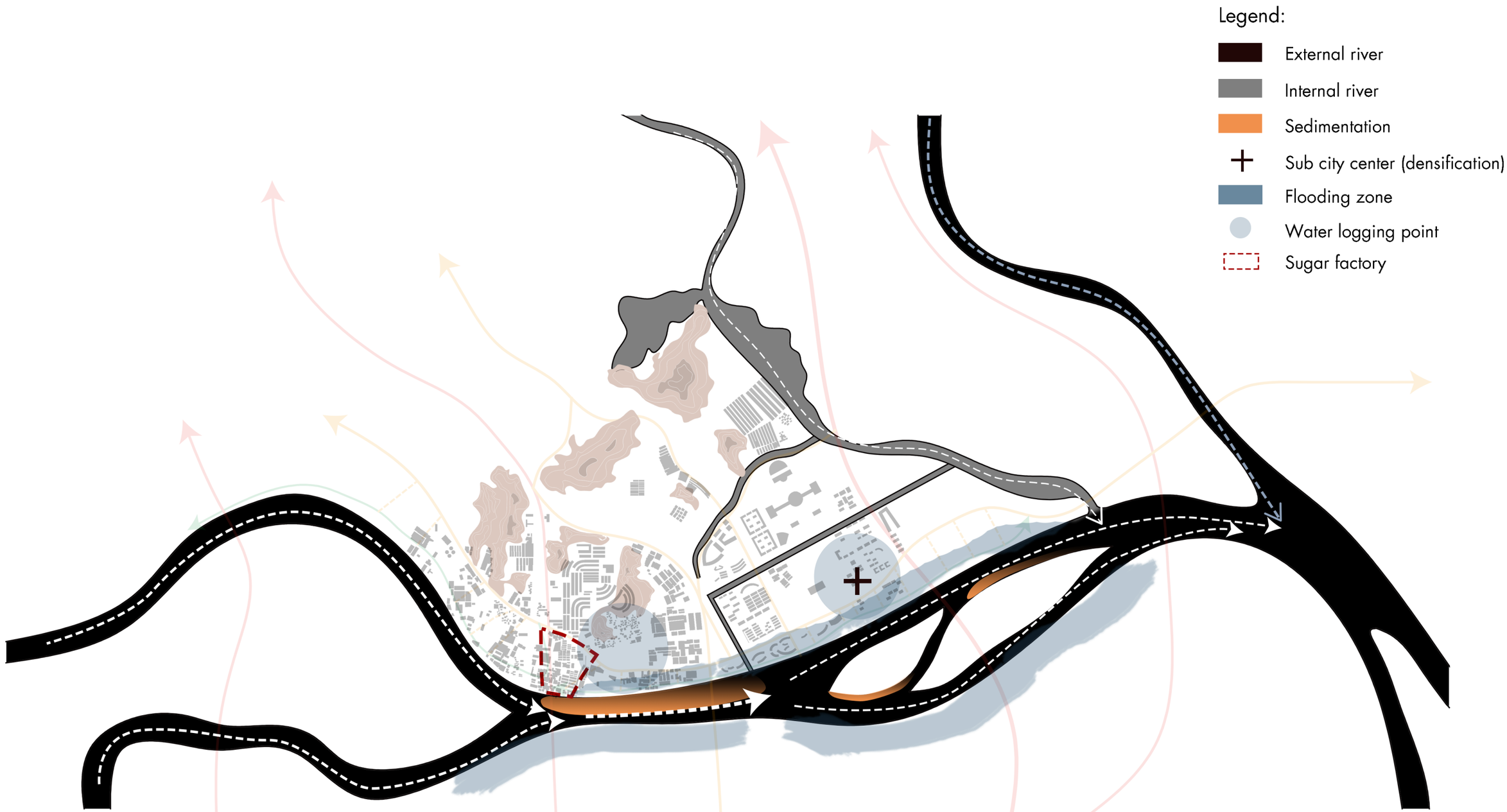
2. ANALYSIS

LANDUSE (SMALL SCALE)

1. After evaluating the quality of buildings inside of sugar factory, production workshop, offices, warehouse, quays and water management system will be kept. Through the strategies of adding, subtracting, disassembling and facade decoration, we can refunction and reuse these buildings and space.
2. The Lingnan park will be kept to be one part of green corridor from sub city center to waterfront.



2. ANALYSIS OF WATER (LARGE SCALE)



2. SUMMARY OF ANALYSIS

WATER ISSUES

1. The waterlogging problem is severe.

2. Lack of space for water retention, lack of water circular system.

INDUSTRIAL TRANSFORMATION

Some industrial heritage should be kept.

PUBLIC SPACE

1. Lack of public space with quality.

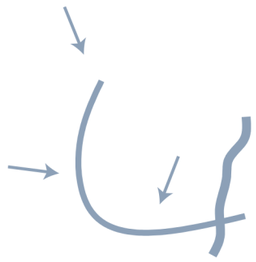
2. Lack of connectivity among green spaces.

MOBILITY

1. The connection from back land to the waterfront is blocked.

2. The quality of the slow walking path from the sub-city center to the waterfront is low.

3. PROPOSAL – ACHIEVE WATER RESILIENT INDUSTRIAL TRANSFORMATION



Increase water retention

Inside of dike, it should increase water retention area. Outside of dike, it should leave some room for river.



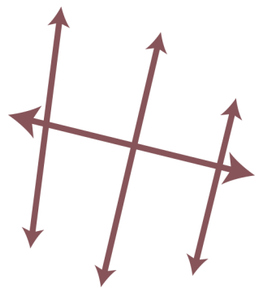
Reuse industrial heritage

Some buildings and facilities in sugar factory can be transformed for new industry, for example, creativity industry or technique park.



Construct green corridors

It is lack of connectivity among green spaces and lack of high quality of green space for public activities.



Improve connectivity

The connection from back land to waterfront should be improved. The quality of slow walking path from sub city center to waterfront should be improved.

4. DEVELOPMENT PLAN



Through the process of design exploration, by implementing design strategies in this area, in the end, the development plan was formed. In this development plan, it consists of four layers – water circular system, industrial heritage, green structure and mobility.

5. STRUCTURE

For the water layer, the canal which goes through the site is transformed from an outdoor wastewater collection area into an ecological waterway. By reshaping the terrain, and reusing existing water facilities in the factory, two water routes are formed which have the functions of water collection, water purification and water reuse.

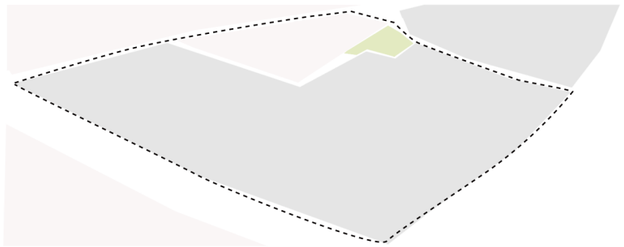
For the green structure layer, green spaces are more diverse, such as artificial forest, terrain grassland and riparian wetland. They provide more spaces for public activities and also can help with water resilience.

The connection from backland to the waterfront is improved. Two bike paths are constructed. The connectivity between east and west is also improved.

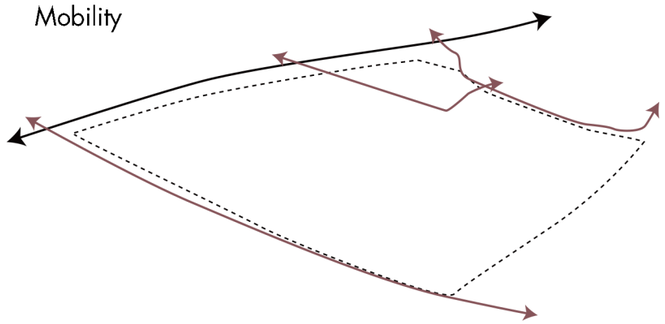
There are more functions in this park that fully meeting the needs of people living around for public activities and educational functions. Working in the park is also achieved.

BEFORE

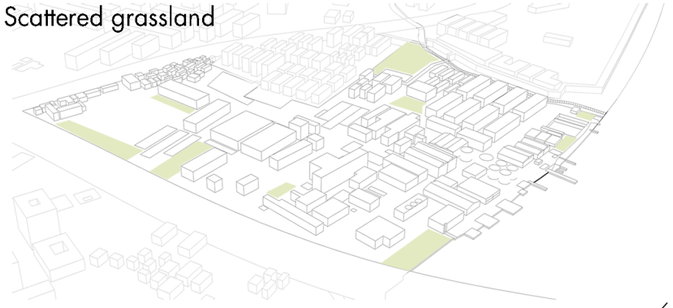
Function



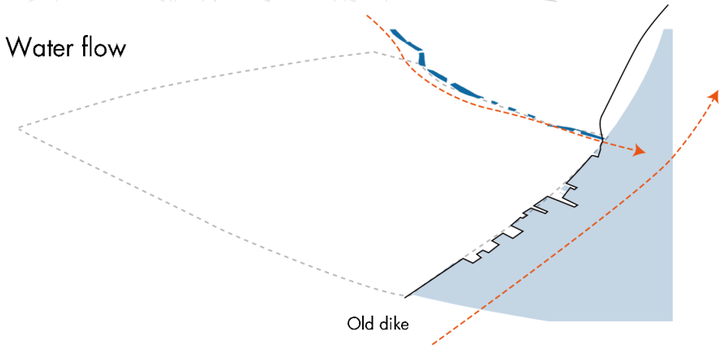
Mobility



Scattered grassland



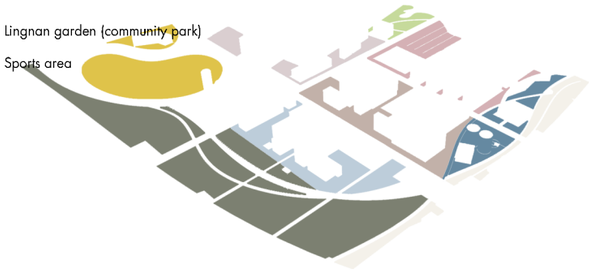
Water flow



AFTER

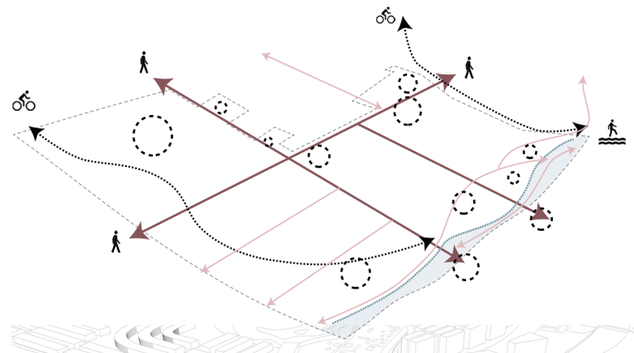
Theme area

- Public recreational park
- Dense forest area
- Museum park
- Technique park
- Creativity industry
- Water management exhibition
- Waterfront wetland
- Lingnan garden (community park)
- Sports area



Mobility

- Main path
- Secondary path
- Bike lane
- New dike wall
- Space for event



Green sturcture

- Grassland with terrain
- Artificial forest
- Reparian wetland
- Bioswale
- Natural wetland



Water system

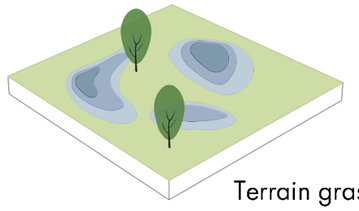
- Water collection
- Water purification
  - Reparian wetland
  - Floating wetland
  - Sucken garden
  - Bioswale
- Water reuse
  - Outdoor ecological park
  - Water theater
- Canal/ bio-pond
- Flooding
- Sluice



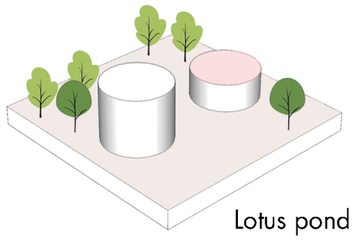
5.1 BLUE STRUCTURE



WATER COLLECTION

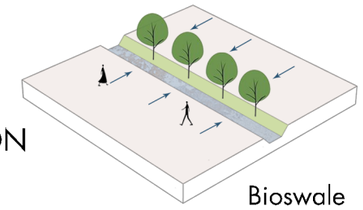


Terrain grassland

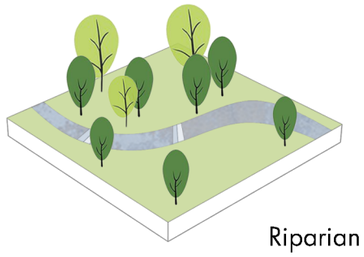


Lotus pond

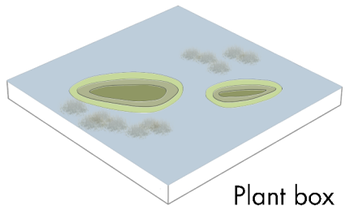
WATER PURIFICATION



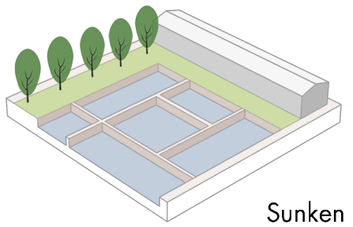
Bioswale



Riparian wetland

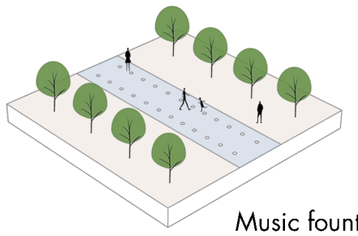


Plant box

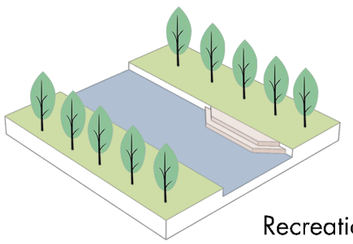


Sunken garden

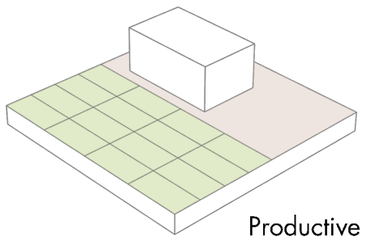
WATER REUSE



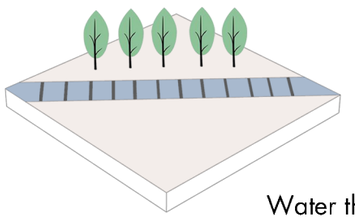
Music fountain



Recreational canal

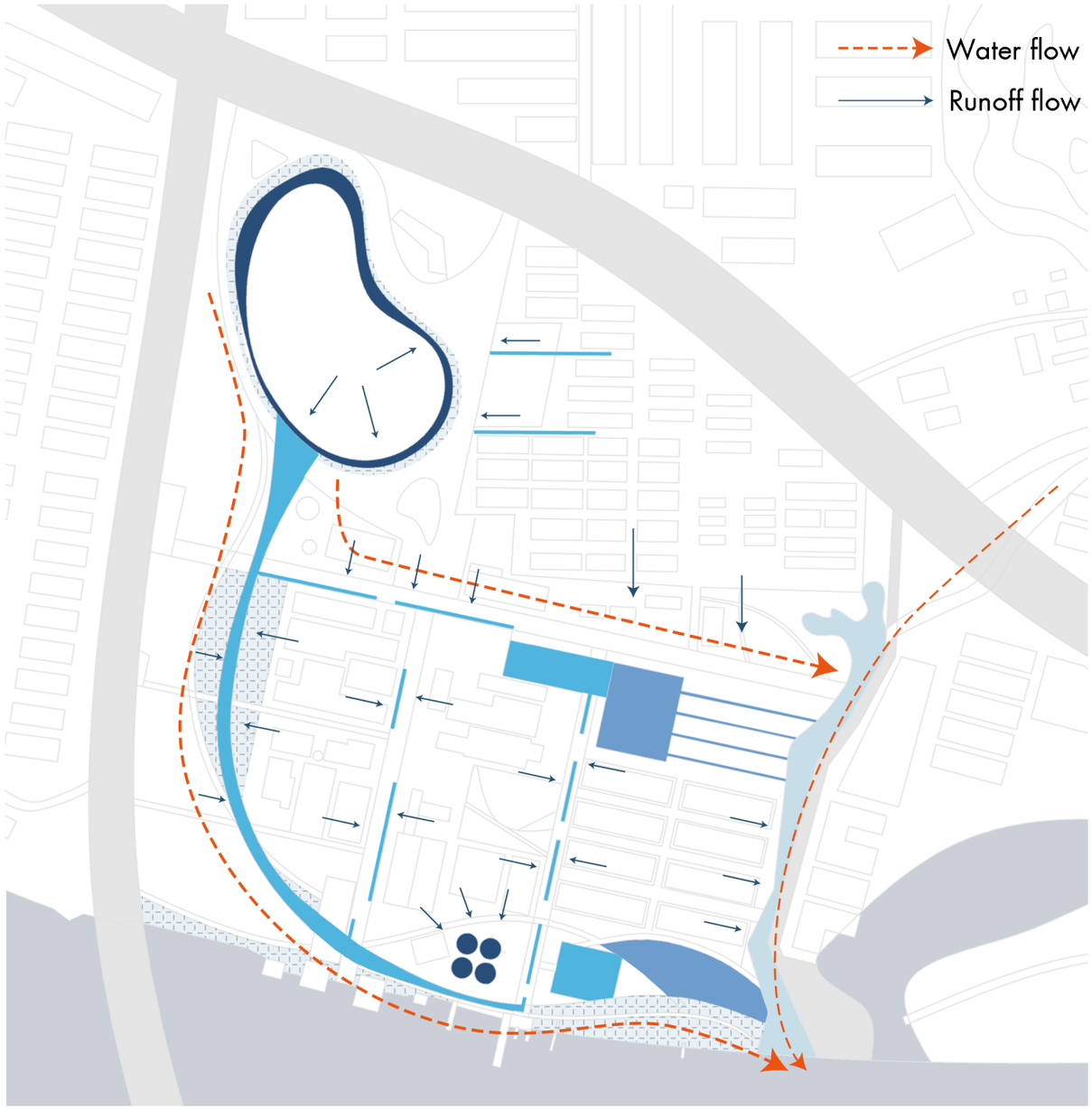


Productive use



Water theater

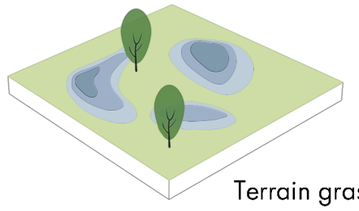
5.2 WATERFLOW IN THE PARK



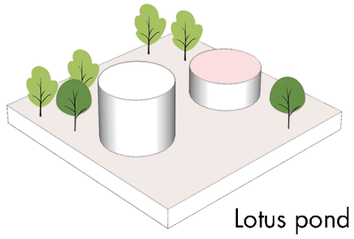
Water flow

Runoff flow

WATER COLLECTION

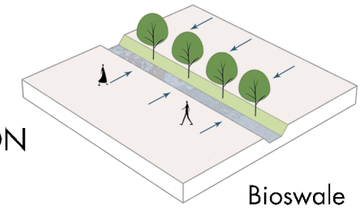


Terrain grassland

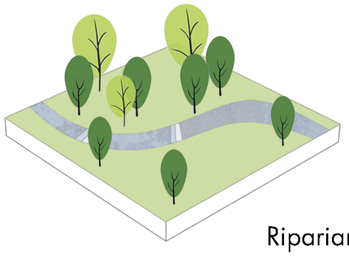


Lotus pond

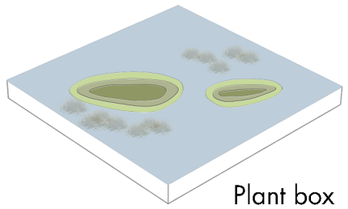
WATER PURIFICATION



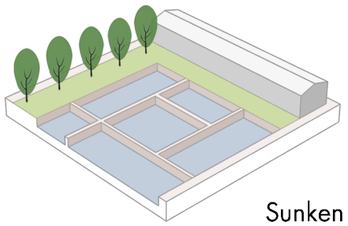
Bioswale



Riparian wetland

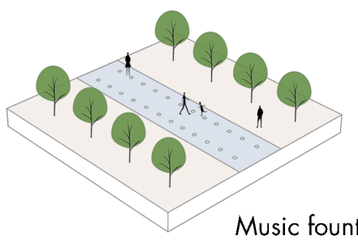


Plant box

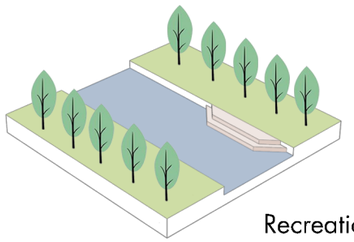


Sunken garden

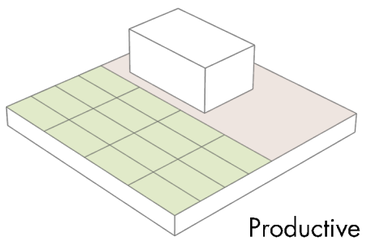
WATER REUSE



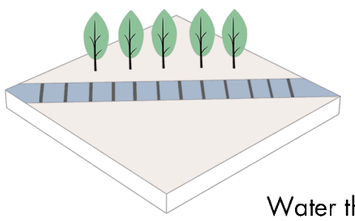
Music fountain



Recreational canal



Productive use

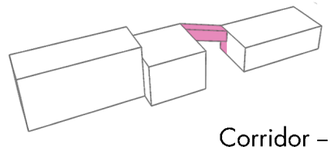


Water theater

5.3 INDUSTRIAL TRANSFORMATION

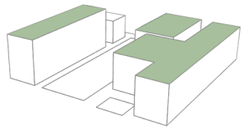


Production workshop



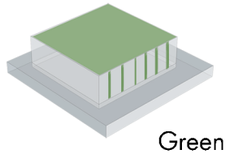
Corridor – elevator

Office building



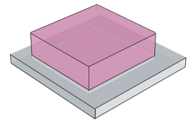
Green roof

Warehouse

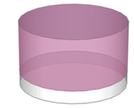


Green facade

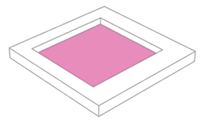
Water facility



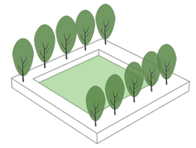
Water plant – purification



Water tank – collection

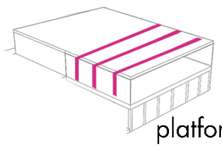


Water reservoir – water theater



Water reservoir – ecological park

Quay



platform

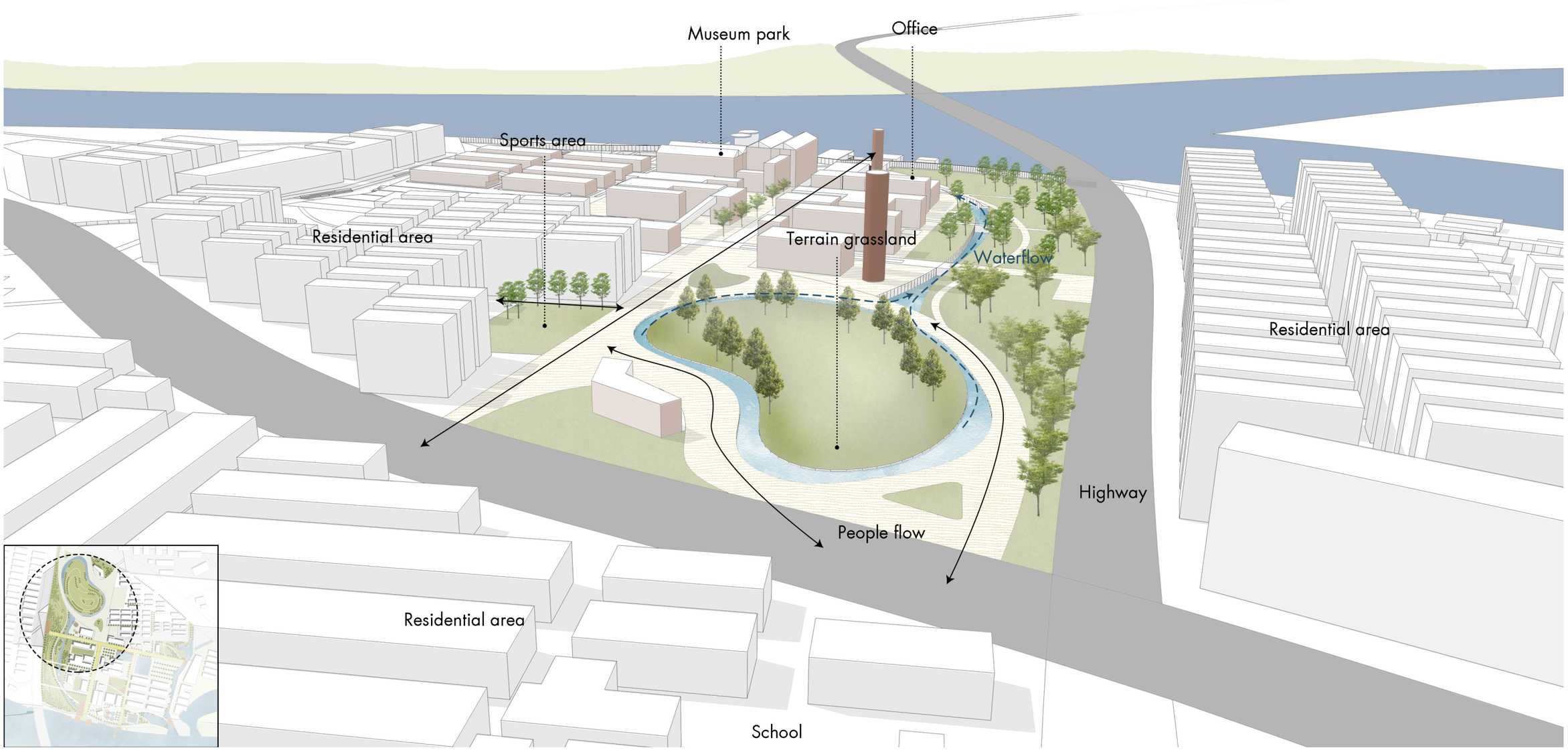
Chimney



stairs

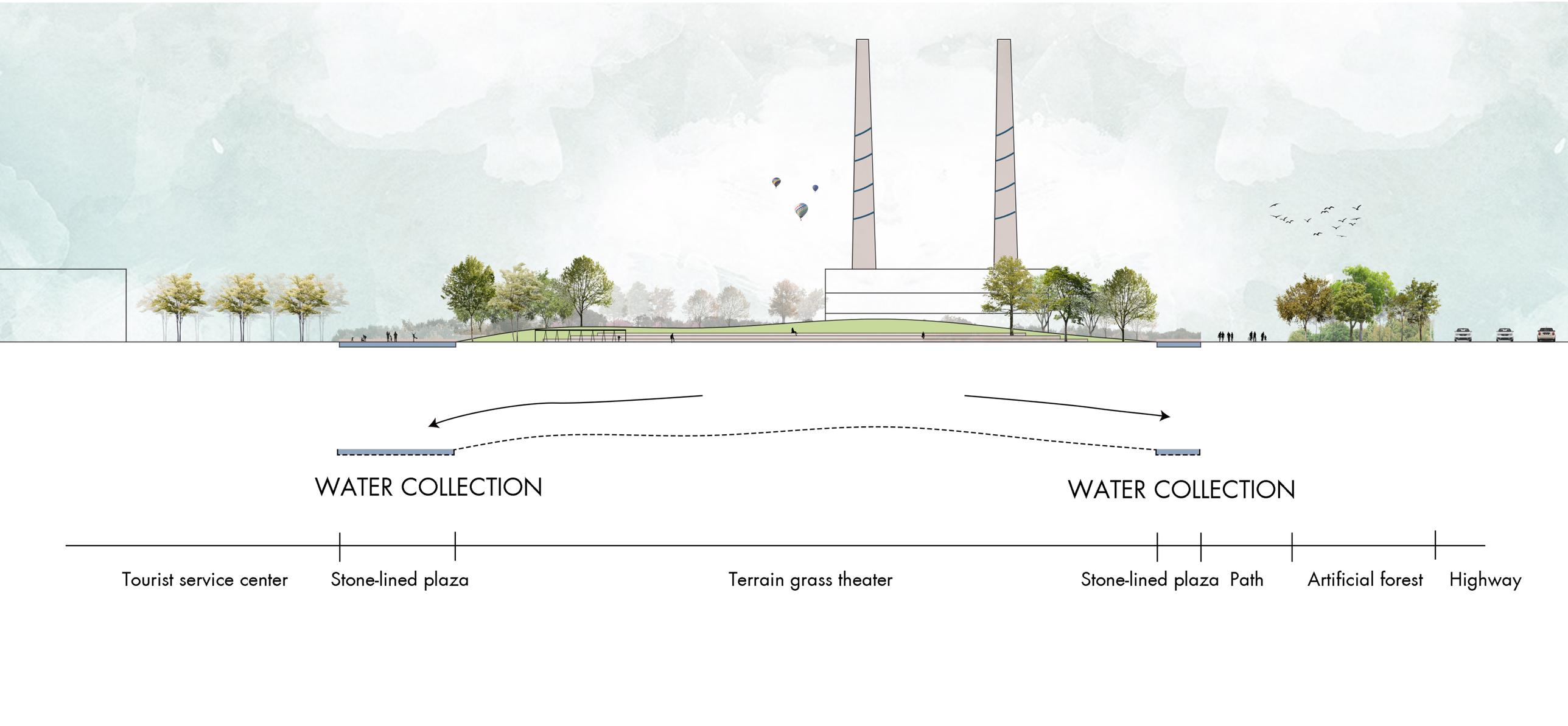
6. TERRAIN GRASSLAND AND NATURAL STREAM

The northwestern part of the factory is located at the foot of the mountain, surrounded by residential areas and schools. After a rainstorm, rainwater flows dow the mountain and gathers here, which causes severe waterlogging. Outside of the factory, a highway goes through connecting Daliand and Desheng tw important districts. Most of this area is empty and flat. Only the chimneys and old office buildings have the value of preservation. Therefore, based on th existing conditions, by reshaping the terrain and restoring ecology in this area, it forms a terrain grassland which is used as the edge park of the mountai and a natural stream. The green corridor formed by them can block the noise and pollution from the highway. After heavy rainfall, the terrain grassland ca slow down the rainwater from the mountain and retain it temporarily. Then when water flowing through the long natural stream, it can be purified.



6.1 WATER COLLECTION – TERRAIN GRASSLAND

The grassland is surrounded by the stone plaza. It has the functions of water infiltration and water collection during rainy days. In normal days, the grassland can also be used as a soccer playground for sports, a terrace theater for performances. The children's playground on the grassland can also satisfy the needs of children's activities, such as swing and slide.



PERSPECTIVE – PUBLIC ACTIVITIES ON TERRAIN GRASSLAND

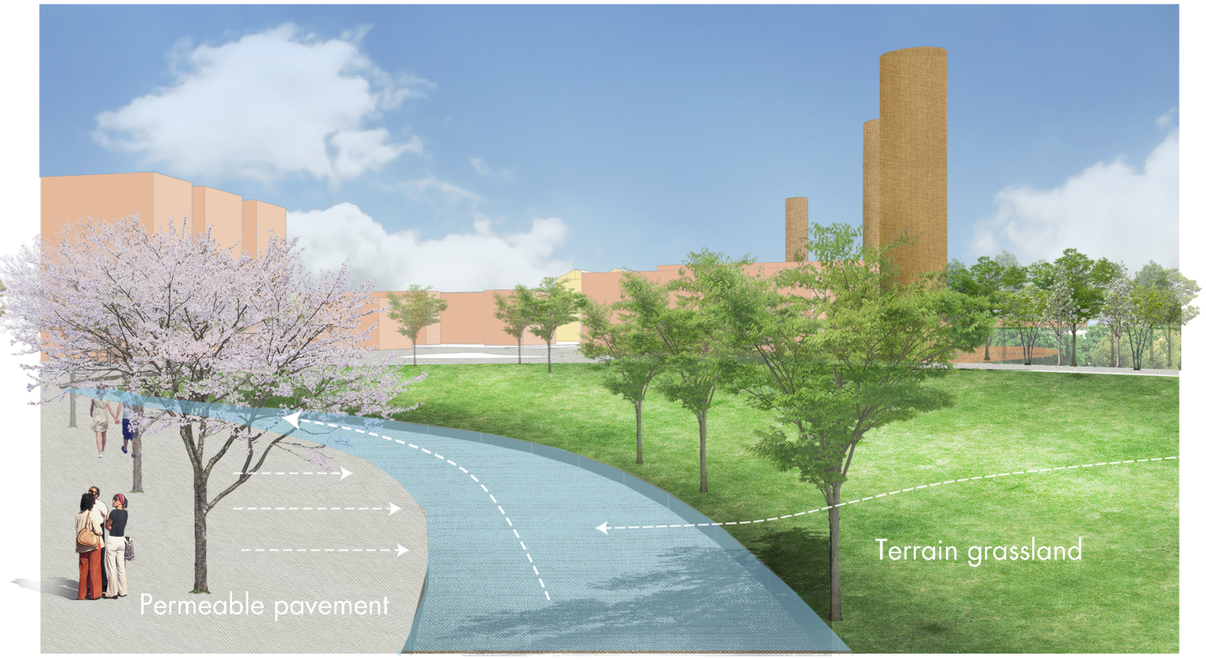


TERRAIN GRASSLAND IN DIFFERENT SEASONS

DRY SEASON



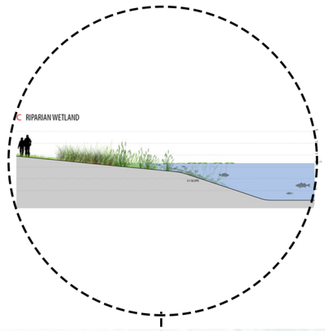
RAINY SEASON

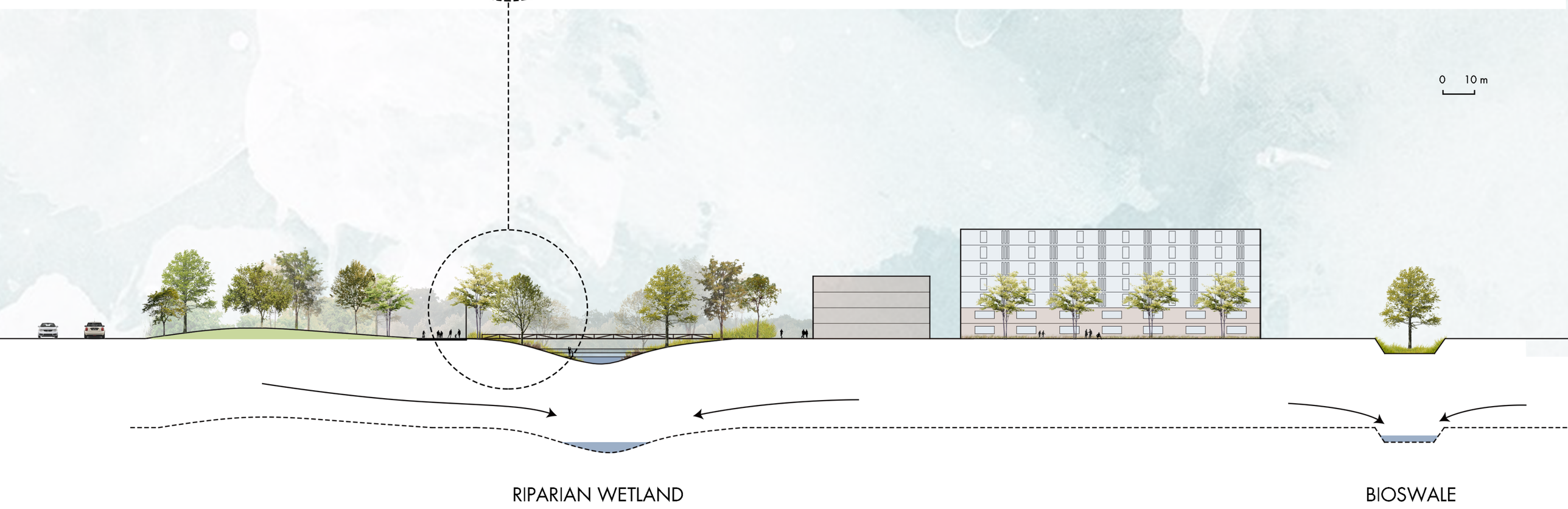


During the dry season, when it is rainy, the rainwater will be absorbed by the grassland and permeable pavement. During the rainy season, when too much rainfall gathers here, it will be collected and temporarily stored in the lower place – stone plaza. Then it flows to the natural stream. Therefore the functions of the stone plaza are different in different seasons. In normal days, it is used for public events. During the rainy days, it is a place for water collection.

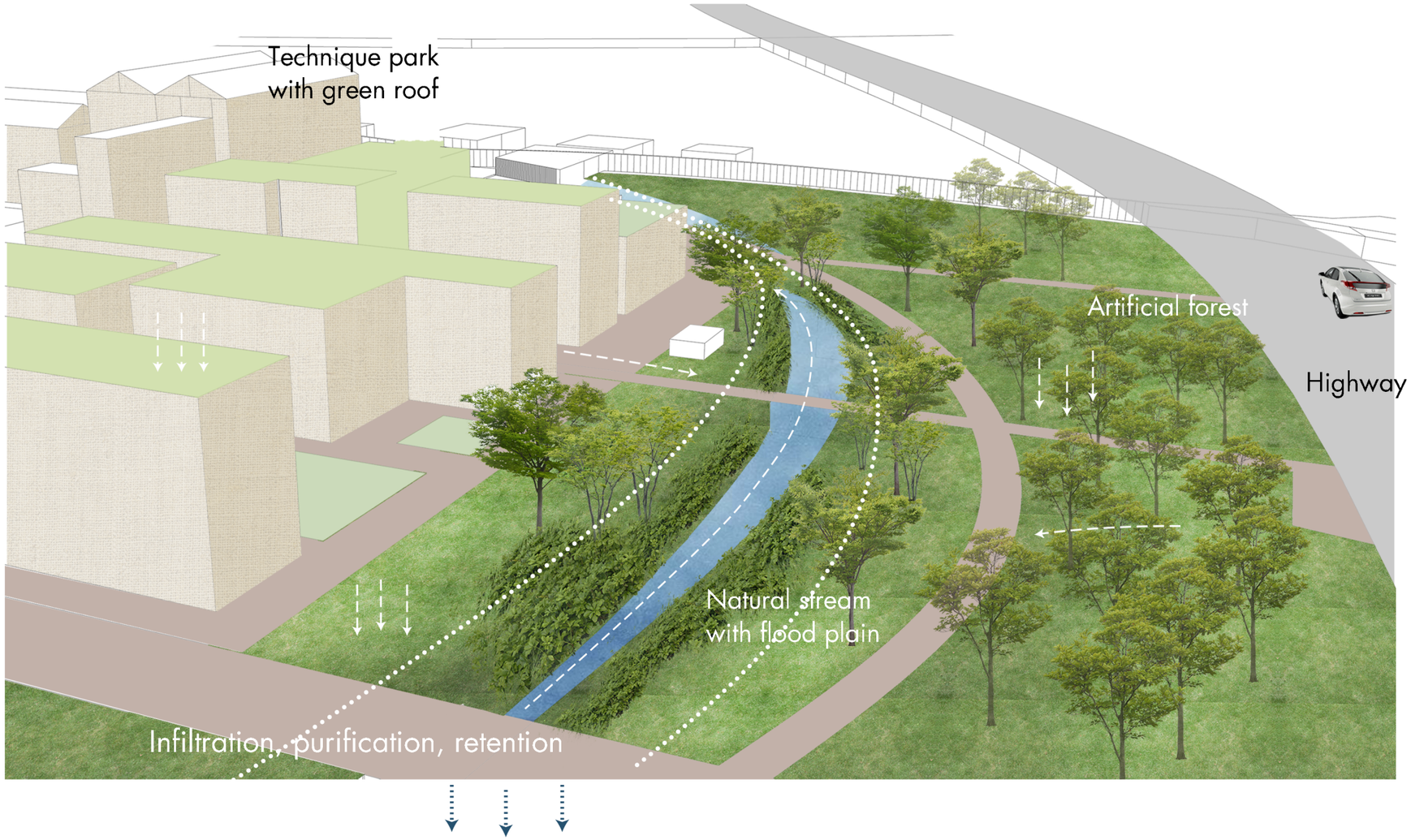
6.2 WATER PURIFICATION – NATURAL STREAM

By digging and filling, and restoring ecology, a natural stream is formed which is surrounded by dense forest. Except for the function of water purification, here you can find a moment of peace in the busy city. People can enjoy family time and have picnics here, people can also get in touch with nature and have ecological education here. In this beautiful environment, the reused office buildings integrate well to become a comfortable working space.





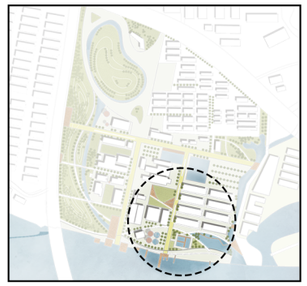
6.2 WATER PURIFICATION – NATURAL STREAM

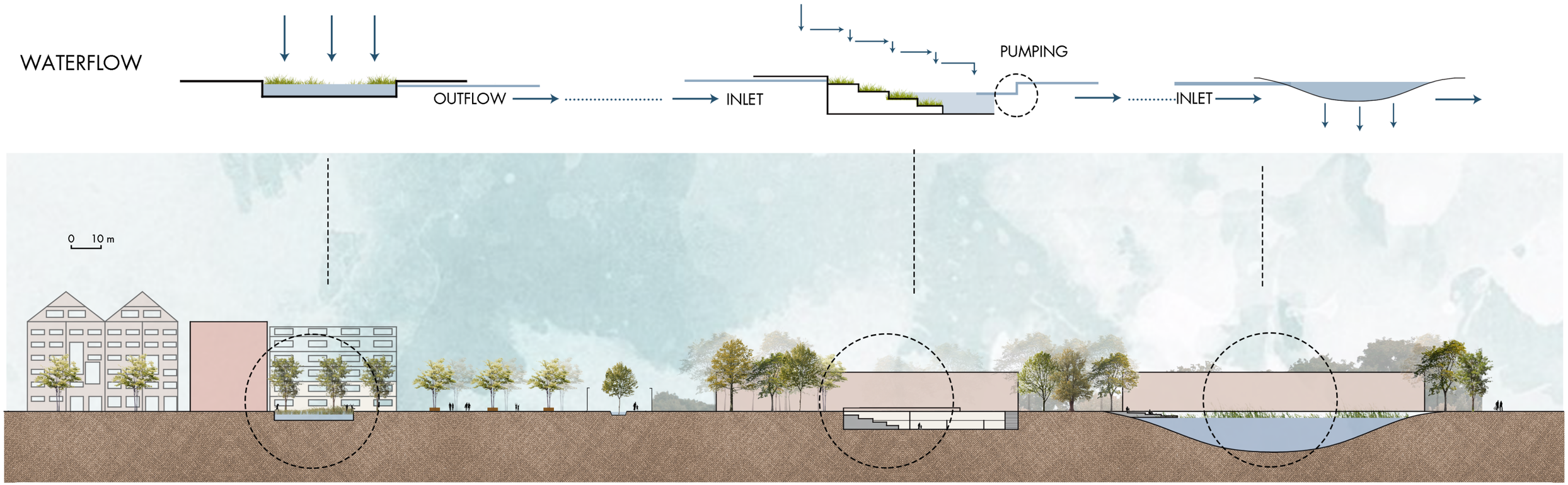


The natural stream has the function of infiltration, purification and retention. It has the flood plain zone which can prove enough space for water retention during the rainy season or for extreme weather. The terrain forest here is not only for blocking the noise from the highway, it can also help to guide water from the surroundings into the natural stream.

7. WATER SYSTEM – TRANSFORMED FROM INDUSTRIAL FACILITIES

The old orange water tank, water plant and water reservoir are respectively transformed into the lotus garden, sunken garden and ecological park with the function of water collection, water purification and water reuse. These three elements are connected by gutters on the ground which are transformed from pipes. By making full use of existing water facilities, it improves water capacity and also brings ecological, recreational, and cultural value when people visiting here, interacting with old facilities and having a dialogue with history.





LOTUS GARDEN – WATER COLLECTION
(Old orange tank)

PATH

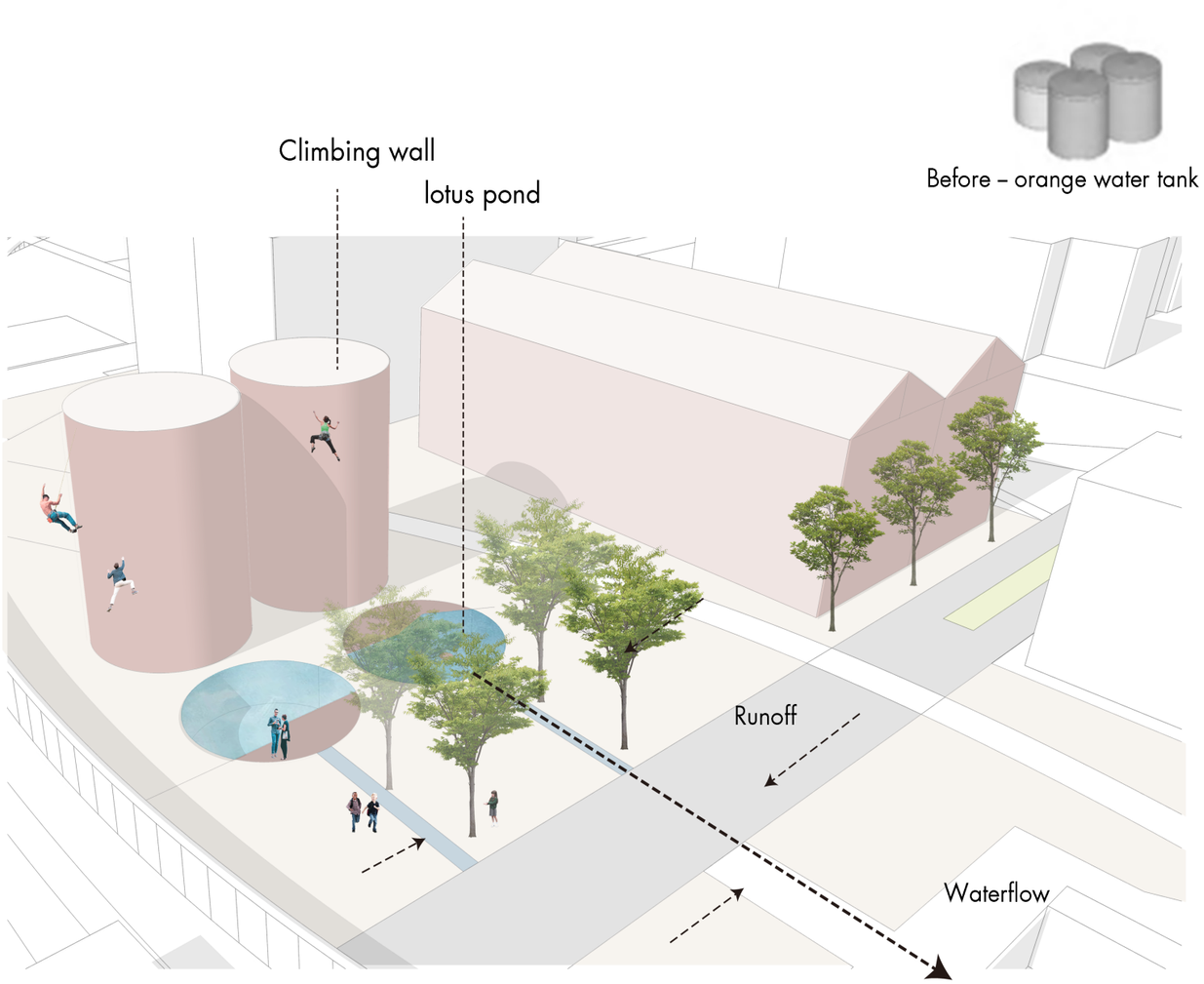
SUNKEN GARDEN – WATER PURIFICATION
(Old orange plant)

ECOLOGICAL PARK – WATER REUSE
(Old water reservoir)

SLOWTRAFFIC

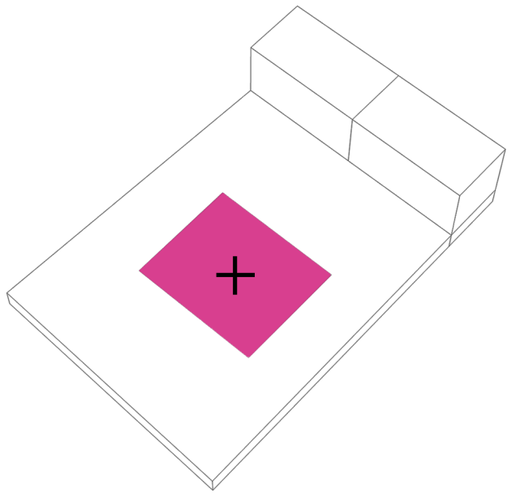
7.1 WATER COLLECTION – LOTUS GARDEN

The 4 old water tank, 2 of them are preserved and 2 of them are removed the top part to become lotus pond. By making use of the structure of 2 preserved tanks, it's changed into the climbing wall. People can enjoy outdoor sports time here. The other 2 are for water collection. All of them are together to form an adventure park.

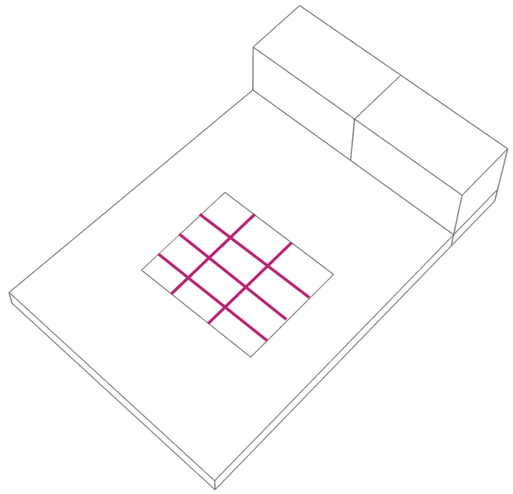


7.2 WATER PURIFICATION – SUNKEN GARDEN

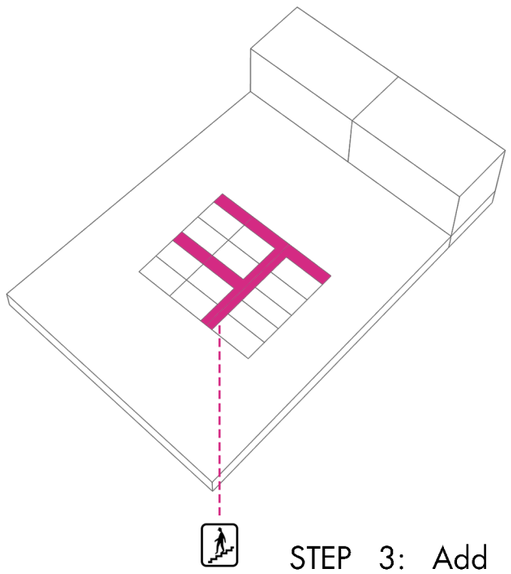
Transform from water plant into sunken rain garden: Maximize to preserve historical traces, dealing with functional measures.



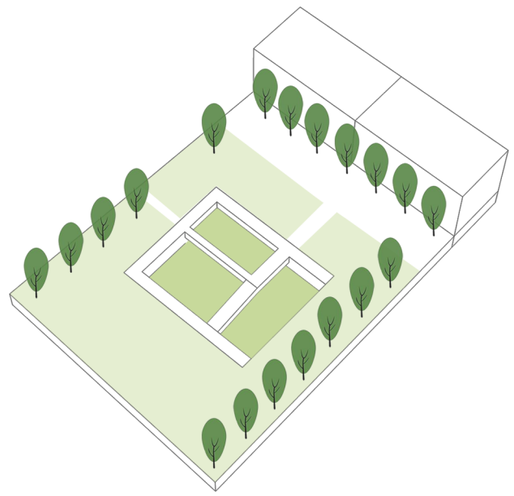
STEP 1: Remove the top cover



STEP 2: Selectively preserve the internal structure



STEP 3: Add pedestrian path and vertical transportation according to original structure

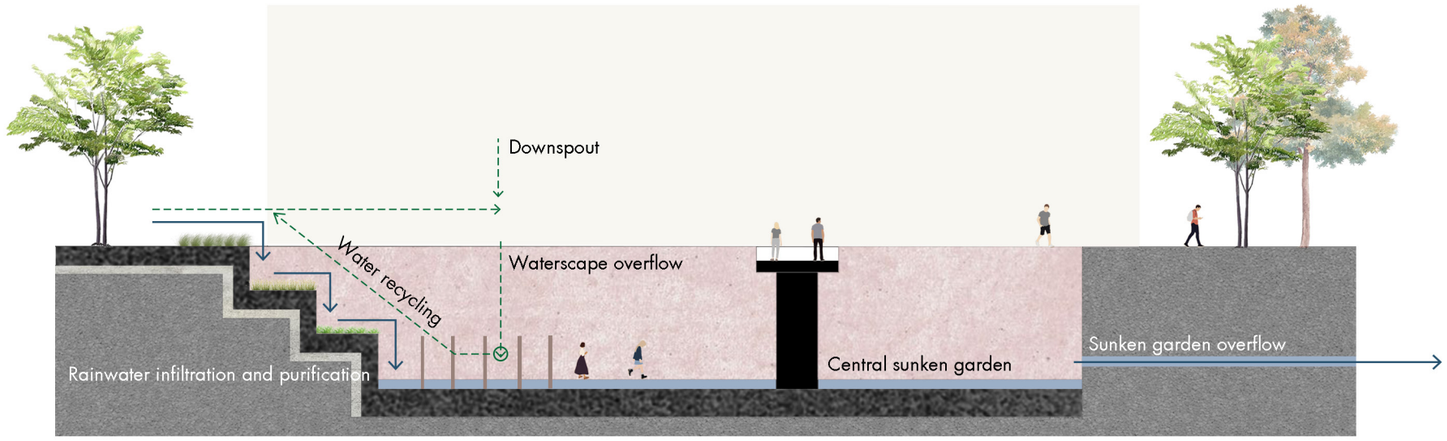


STEP 4: Create a stormwater purification system by keeping the vegetation nearby and adding vegetation to the bottom of the pond

7.2 WATER PURIFICATION – SUNKEN GARDEN

Water purification and infiltration system

Waterscape and water recycling system

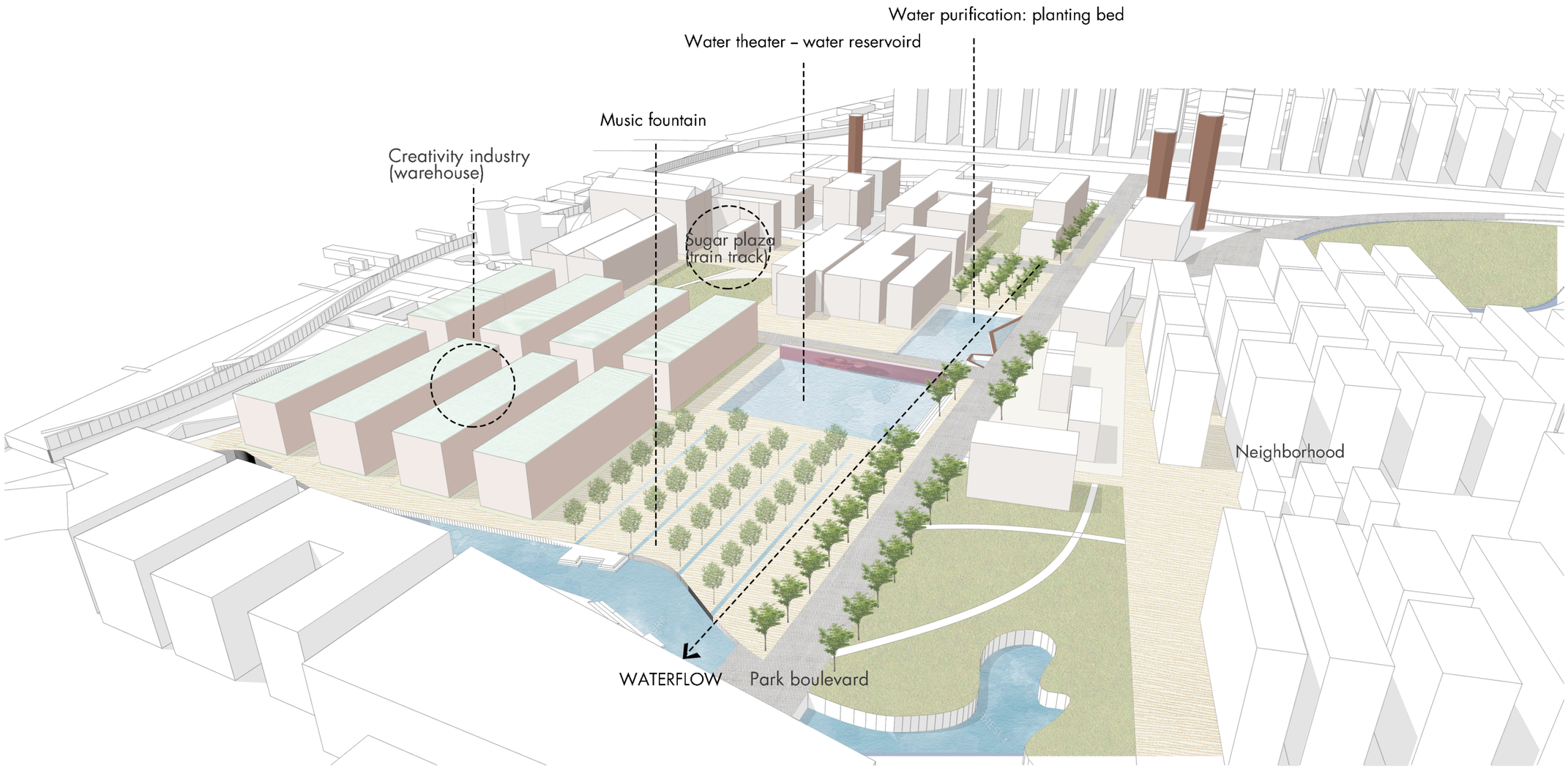




By making use of the old structure in the water plant, it forms the terrace purification system. The purified water will be stored temporarily in the bottom of the sunken garden, for waterscape or being pumped to the ecological park.

8. WATER SYSTEM – PARKWAY

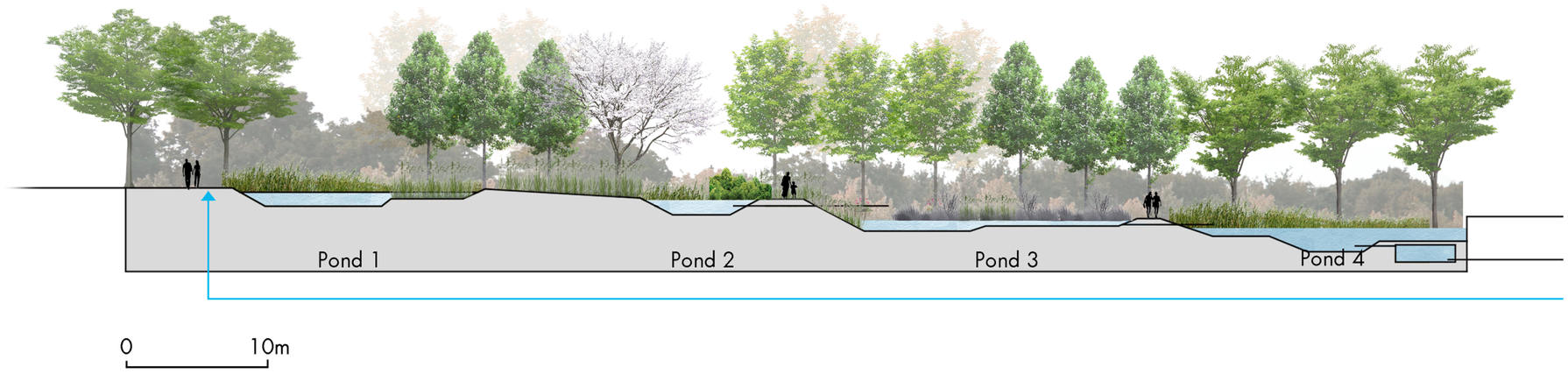
This way is well connected to the slow traffic from the sub-city center and is the only way to go through the park from east to west. According to the context, a new parkway is constructed. Along this way, by refunctioning the old facilities to achieve water purification and water reuse. Also, it provides the varios public spaces for residents, workers and visitors.



8.1 WATER PURIFICATION – TERRACE WETLAND



To purify water in the limited distance, by digging and filing on the basis of old water reservoir, a terraced wetland is formed. Through the 4 purification ponds, the water can be purified effectively. At the same time, it also creates a beautiful environment for working space.

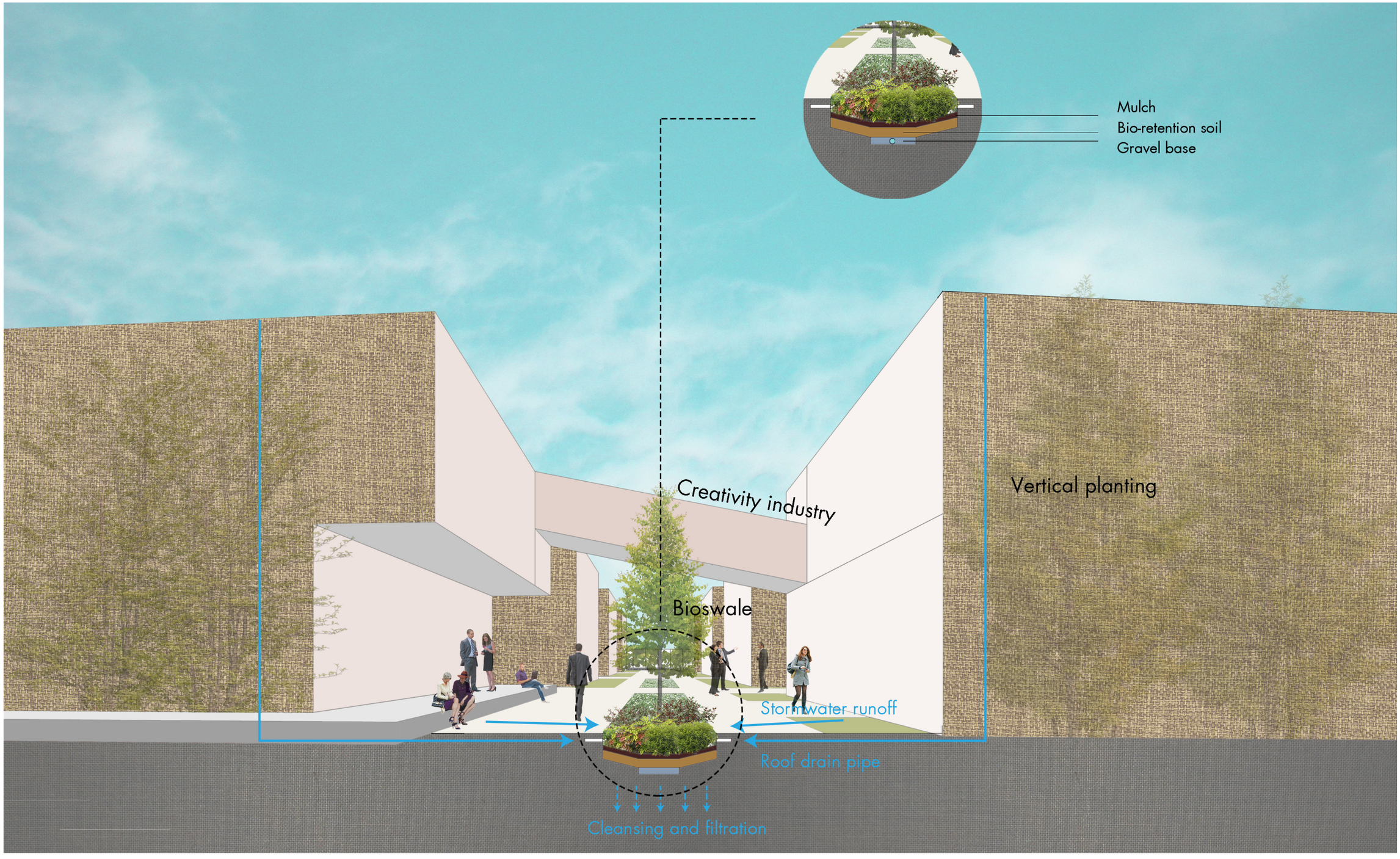


8.2 WATER REUSE – MOVIE THEATER AND WORK IN THE PARK

The ublic space is shared by residents, visitors and workers.



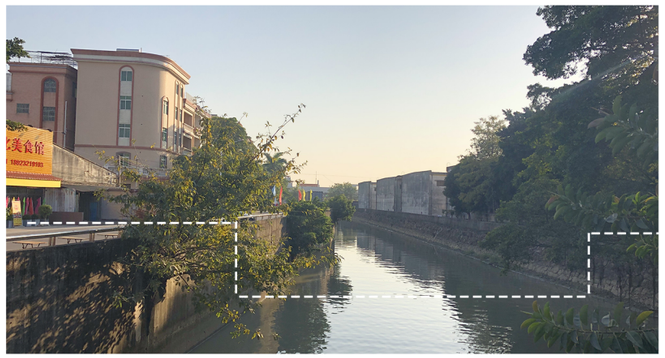
8.2 WATER REUSE – MOVIE THEATER AND WORK IN THE PARK



9. WATER REUSE – RECREATIONAL FUNCTION

Reuse the purified water for recreational function, soften the hard canal to regain its natural characteristics and create neighborhood enhancement opportunities.
Make use of the existing waterfront slow traffic system to sub city center to increase prosperity through redevelopment of industrial area.

Before



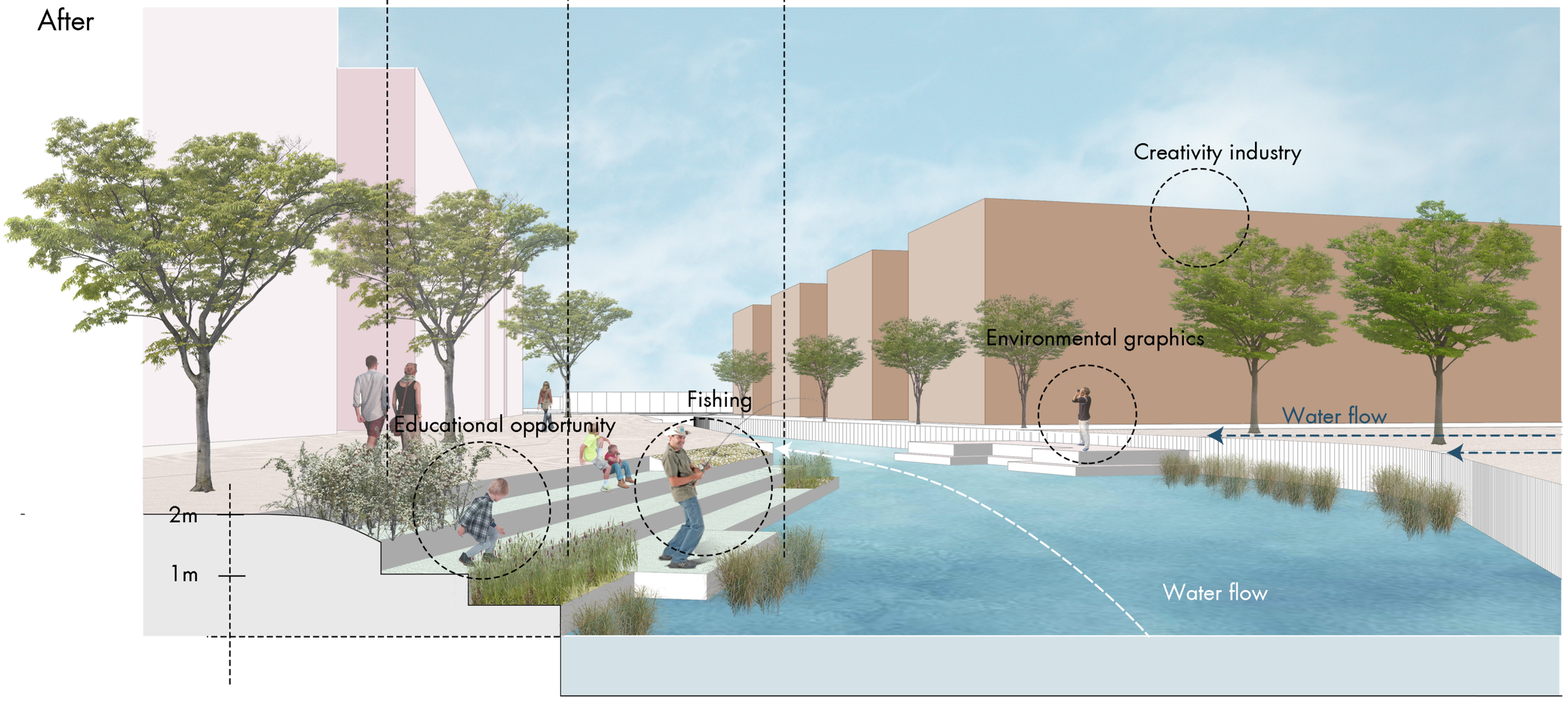


Inundation tolerant

Emergent

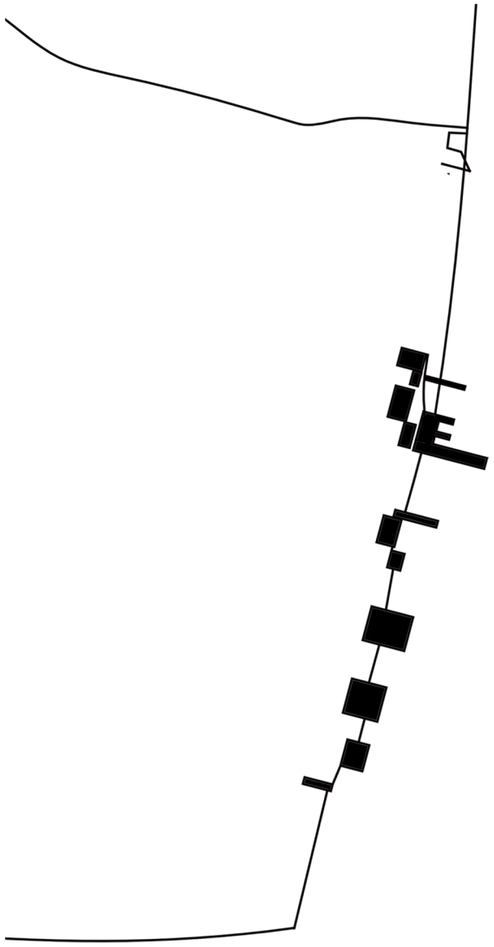
Submergent

After



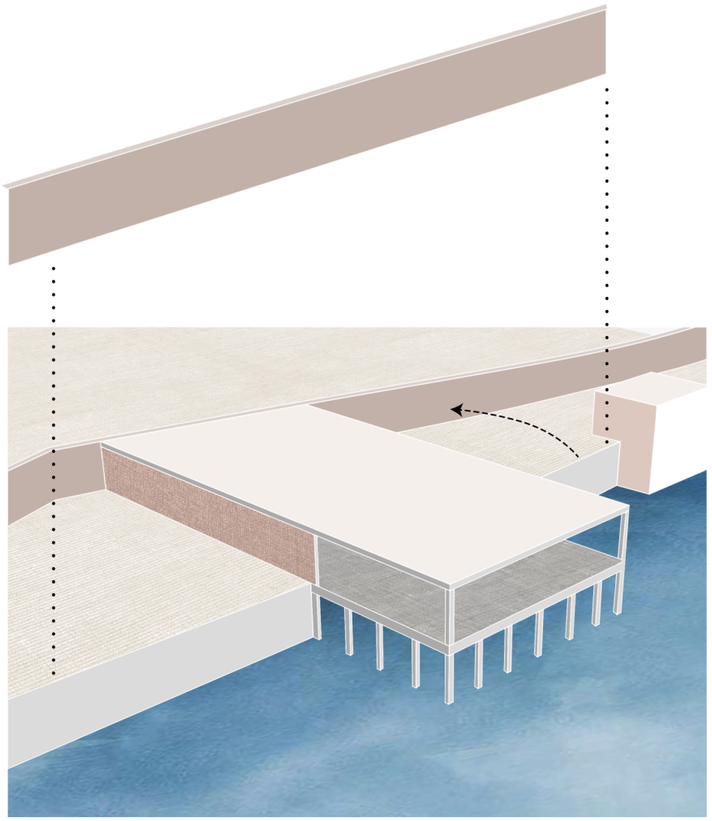
10. OUTSIDE OF DIKE – MAKE ROOM FOR RIVER

Following the strategy of making room for river from the large scale, the dike is moved backward and the pattern along the external river is kept.

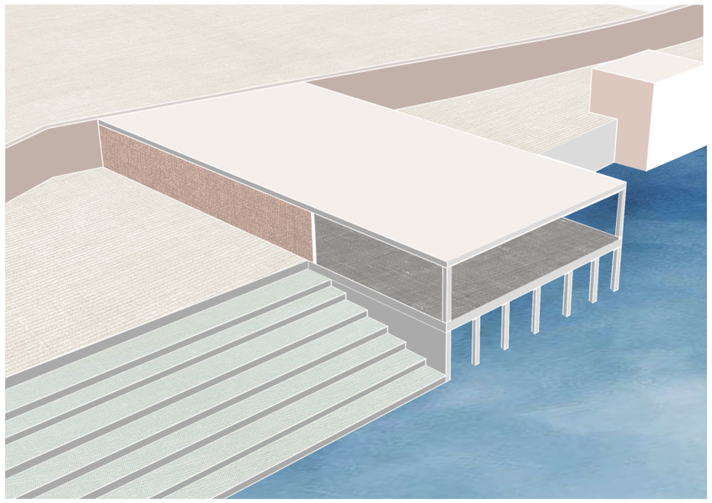




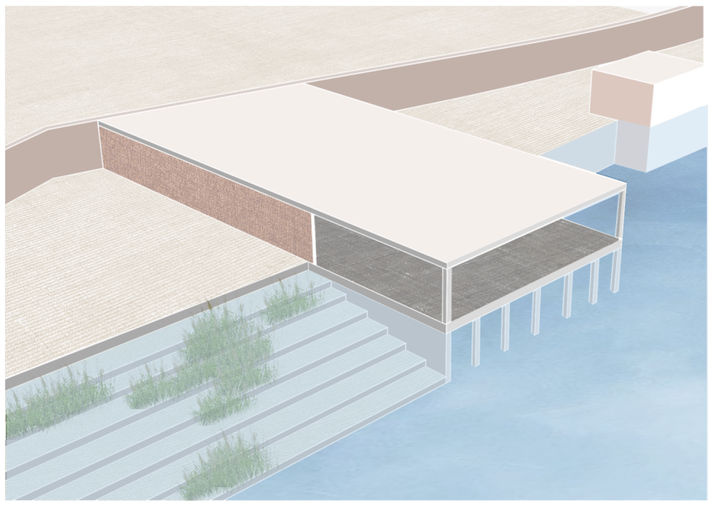
10. OUTSIDE OF DIKE – MAKE ROOM FOR RIVER



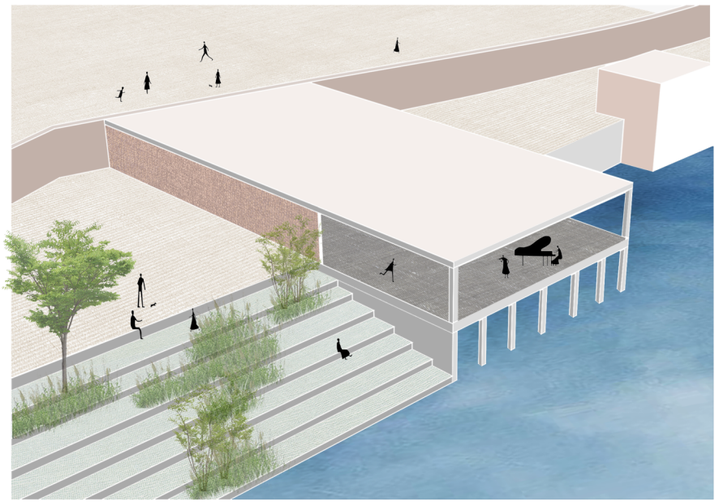
STEP 1: Remove dike to innerland



STEP 2: Add terraces for recreational function and catchment of sedimentation during flooding

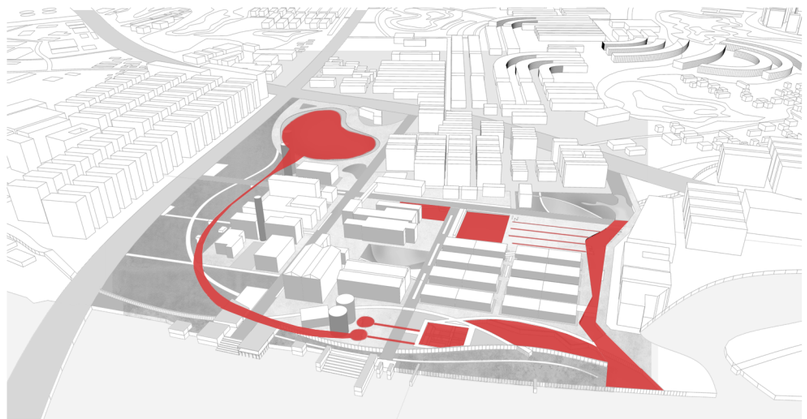


STEP 3: Set sand-fix plant



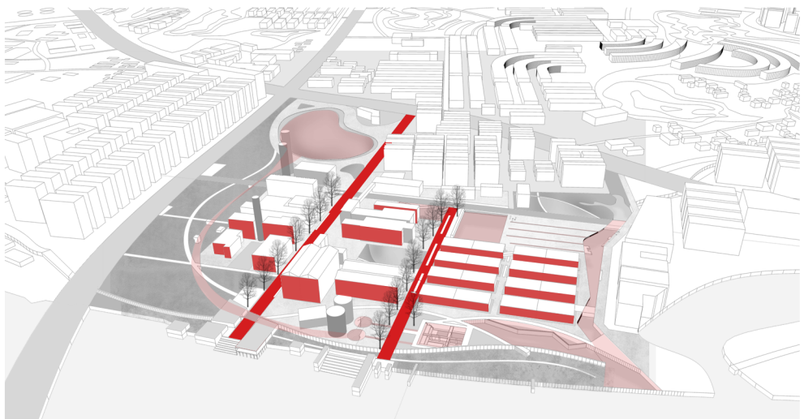
STEP 4: Provide environment for events

11. THE IMPLEMENT OF DEVELOPMENT PLAN IN PHASES



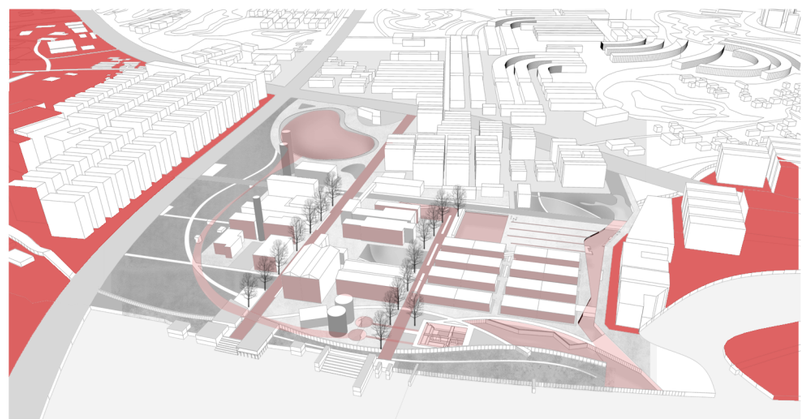
PHASE 1: CONSTRUCT COMPLETED WATER RESILIENT SYSTEM

The first step is based on existing facilities and space to construct a completed water resilient system with functions of water collection, water purification and water reuse. It can solve the waterlogging problem efficiently and also prove water safety in this area. At the same time, the environment in the factory is improved and more and more people will be attracted here for public activities.



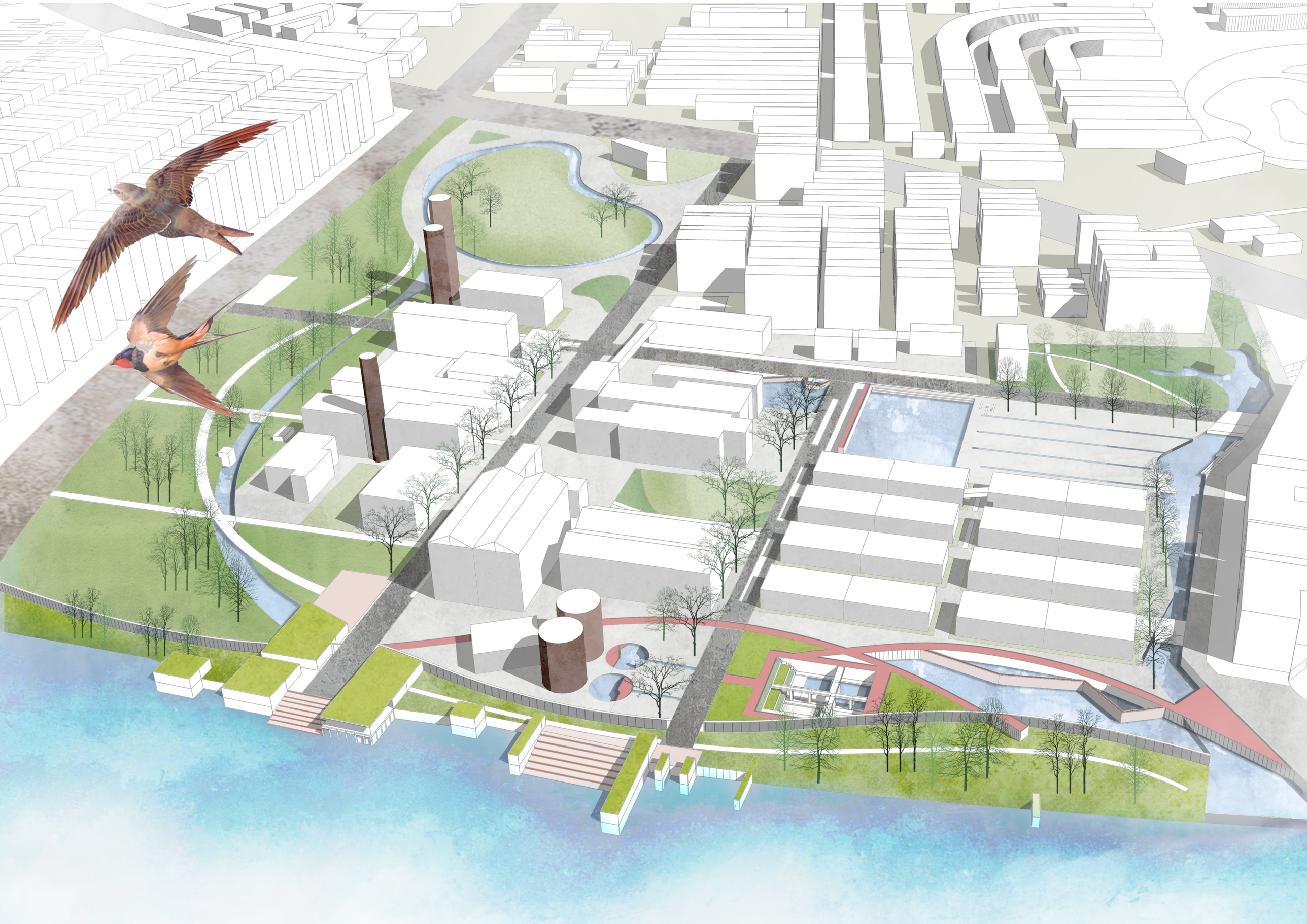
PHASE 2: ACTIVATE INDUSTRY RENEWAL

Then we introduce the new industry to this area to make full use of the old buildings and public spaces. For example, the production workshops are transformed into the sugar museum park, old offices can be reused and old warehouses can be refunctioned for the creative industry. The connection between north to south is improved and more economic value is added to this site.



PHASE 3: ACCELERATE THE SURROUNDING INDUSTRAIL TRANSFORMATION

With the successful transformation in this site and the expansion of the sub-city center, it will accelerate the speed of industrial transformation in the surroundings and integrate to the sub-center very well.

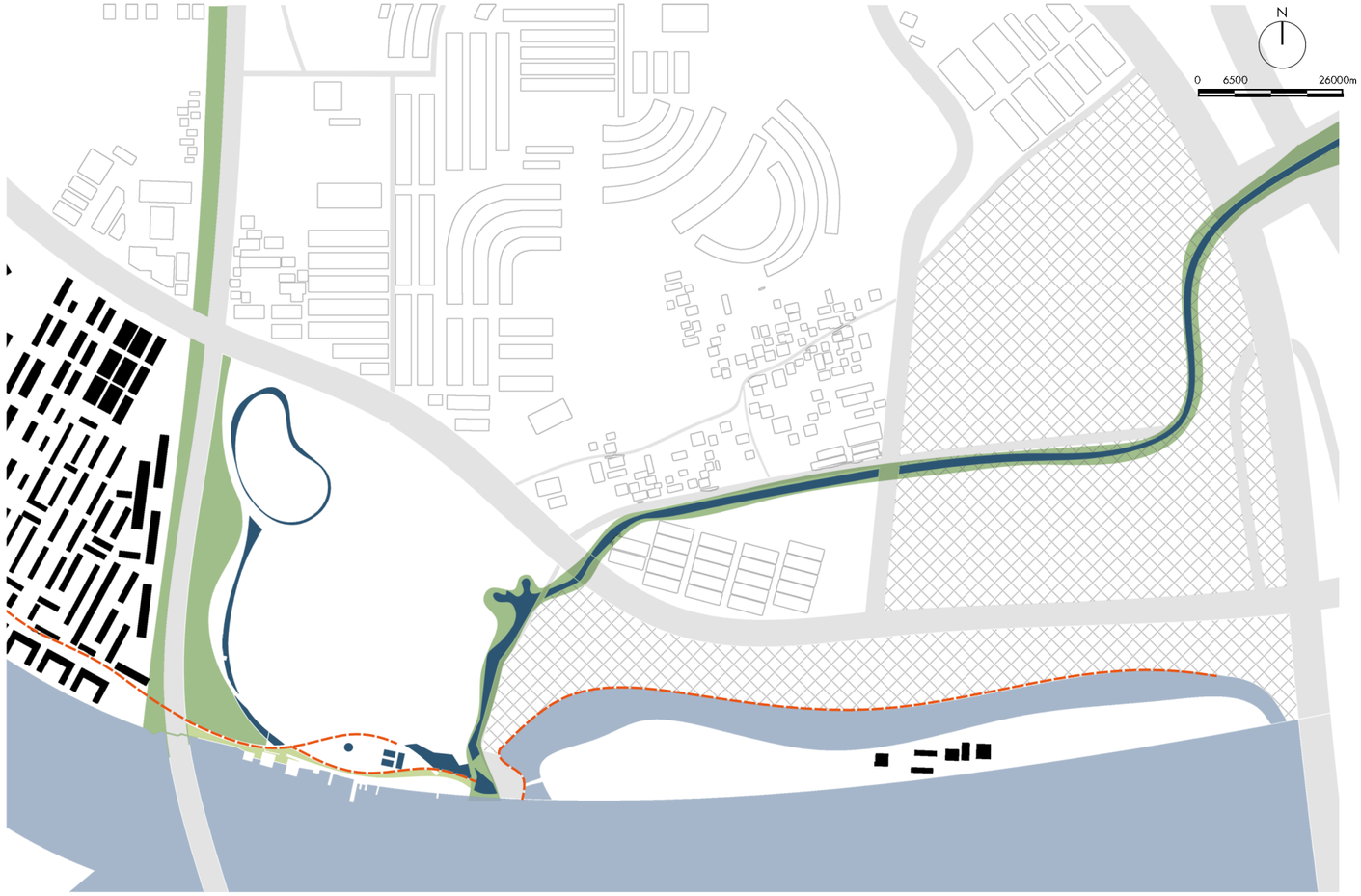


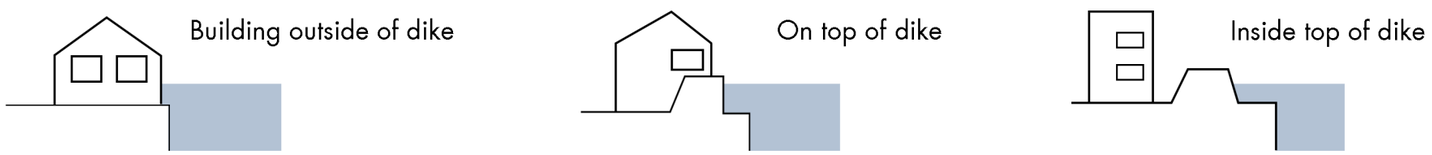
12. VISION IN LARGE SCALE

When thinking about water resilience, you should start from a large scale to form a natural system which can cooperate with each other and then may act in a local scale. The power of a system is far more than a single project.

In this project, from the large scale, the dike is moved to inner land which leave a flooding prone zone for river. As we noticed before, it is the transitional point of Xi river. If here is more place for temporary water storage, the water from upstream can be slowed down, and at the same time the amount of water in downstream can be reduced temporarily, which can protect both this point and sub city center in downstream from flooding. Inside of the dike, the dead-end canals are connected to form a continuous waterway. While increasing space for water retention, it can also improve water quality and revitalize urban space.

Based on the existing green spaces and blue system, green structure will be constructed. One of the green corridors connects forest, sugar factory and freshman quay on the opposite shore together. The other one connects sub city center and waterfront area. By improving the connectivity among green spaces, it not only provides routes for the movement of animals and plants, but also forms a slow walking system that connects people from the back land to the waterfront.





After moving dike inside, the demolished industrial area on the right side of Shunde sugar factory will become into a wetland in 30 years with the cooperation of artificial planting, natural sedimentation and natural procession. It will become a green carpet in the noisy and crowded city.

On the left side, it will follow the goal of this city for densification. It will provide more opportunities for people who cannot afford a house in the city center. Because the dike is moved to inner land, so we need to explore more ways for people to live with water.

CHAPTER 5
DISCUSSION & CONCLUSION

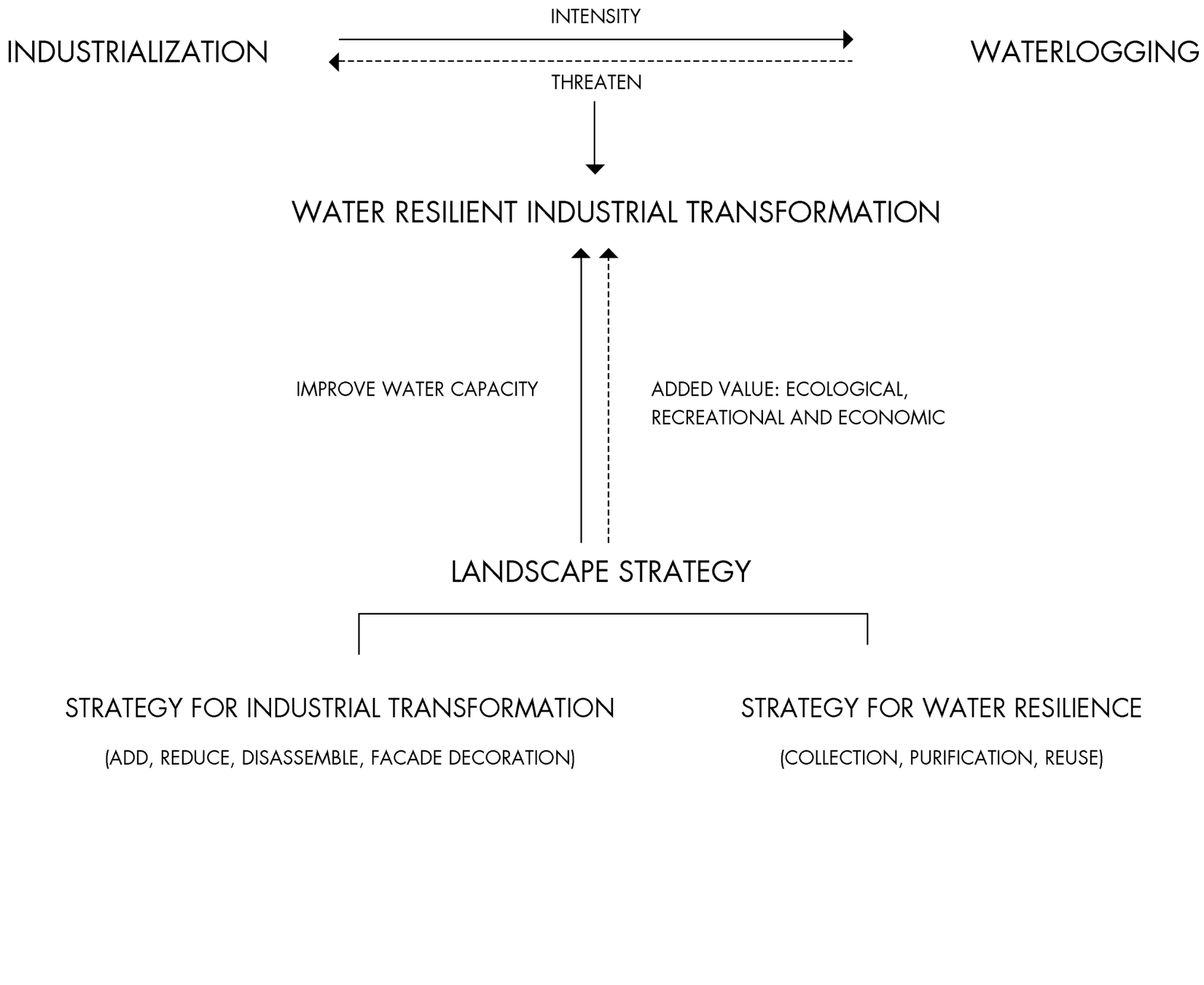
1. CONCLUSION
2. LESSON LEARNED
    2.1 Reflection on argumentation
    2.2 Reflection on the transferability
    2.3 Reflection on methodology
3. RECOMMENDATION FOR THE FURTHUR RESEARCH

1. CONCLUSION

Can we make use of the chance of industrial transformation to explore landscape strategies for water resilience?

– Reflection on my research objective

(Explanation on next page)



1. CONCLUSION

Can we make use of the chance of industrial transformation to explore landscape strategies for water resilience?

– Reflection on my research objective

My answer is YES. In this question, there are three keywords: industrial transformation, water resilience, and landscape strategies. Industrial transformation refers to partly preserving, partly demolishing or reconstructing the old industrial area to achieve the goal of resue and refunction. Water resilience means the ability of the water system to recover from water shocks while adapting and transforming to face long-term stressors, changing conditions, and an uncertain future. The narrow definition means when it rains, the water system can absorb, infiltrate, purify and retain water, and it can also release and reuse the water if necessary. In this way, rainwater can achieve free migration in the city.

First of all, industrial transformation and water resilience are not separated problems. In the construction of the industrial area in the past time, most of it is covered by impermeable pavement, which severely intensifies waterlogging in the city. The other way around, waterlogging also threatens the safety of the industrial area. Secondly, now when facing industrial transformation, we can rethink what alternative we have for the drainage system and use better ways for it especially after reflecting on the previous water management system. Landscape strategies, such as green and blue structures, can deal with water problems in a more efficient way. By adjusting the terrain, enriching vegetation and restoring ecology, it can achieve water collection, water purification and water reuse in the industrial area. In this way, rainwater can be slowed down and stored during rainstorms. During normal days, the water can be released for daily use, landscape water or irrigation. Landscape strategies can also bring added value to industrial transformation. It activates the industrial area and improves the interaction between people and water, people and facilities. It also increases vegetation diversity in the industrial area. In the meantime, it promotes the regeneration of the industrial area.

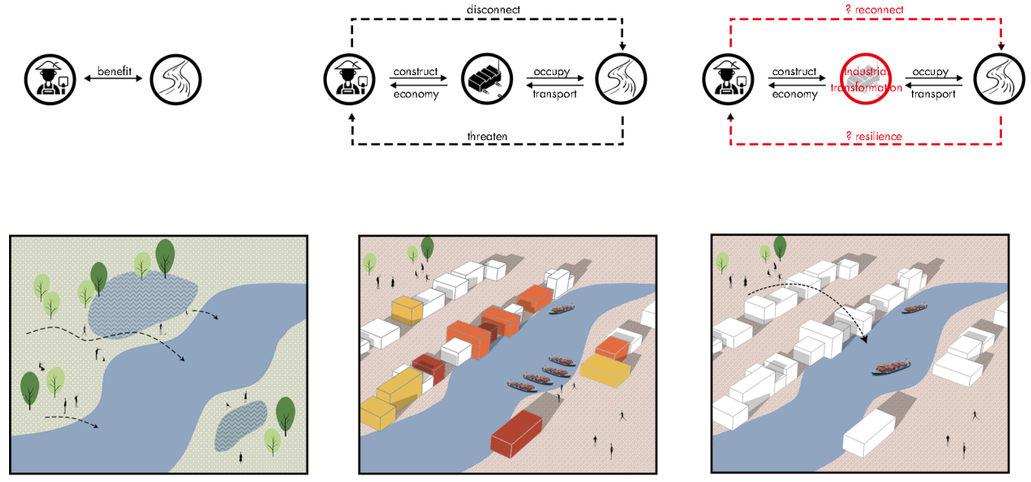
landscape strategies are not only constructing a park, it is also a multi-disciplines way that combining hydrology, ecology and meteorology to deal with problems.

2. LESSON LEARNED

How to understand water resilient industrial transformation?

– Argumentation of my project

Shunde is a famous water village from the history. It had dense water network and beautiful dike-fish pond system. It is a low-lying plain in Pearl Ricer Delta where Xi River and Bei River meets. Because of the natural topology and climate, it is always under the threat of flooding. In the past, the ancestors in Shunde used their wisdom to create lots of strategies for controlling water. However, with the pressure of rapid urbanization and industrialization, places along the external river or canals are transformed into industrial use. With uncontrolled expansion of factories and unreasonable design inside of factories, water problems in Shunde are more and more severe since the 20th century. Now lots of factories are in the phase of industrial transformation, how to make use of this chance to explore more possibilities for tackling with water problems, reusing industrial buildings and facilities, and upgrading industry, how to kill multiple birds with one stone is a hotspot topic.



2. LESSON LEARNED

How to improve water resilience in industrial transformation?

– The choice of method

The principle of green and blue gird is combining two adaptable factors to weather – green space and water together in a limited urban space. Compared with underground pipe system, it has characteristics of adaptability and flexibility. It is applied to explore a high-efficiency, low-expense, high-interaction and high-adaptation way for water resilient industrial transformation. The principle of landscape as a process means the system is dynamic, what we should do is working with nature to create a place together instead of designing a park. The principle of transformative perspective means the context in the site is not a vacant place. Through protecting and reusing the pattern and historical context, we not only keep site identity and memory, but also give new functions and vitality to this site.

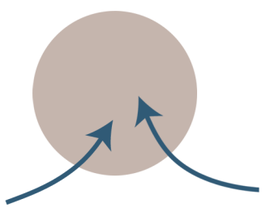
All these three basic principles guide to specific strategies. Water resilient strategies which are reflected to the principle of green and blue grid are the driving force for the project and the strategies for factories and the strategies for public space are supporting it, which are reflected to transformative perspective. All of these strategies cooperate with each other to show landscape as a process.



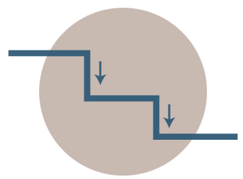
Restore nature



Make use of industrial facilities



Water collection



Water purification



Water reuse

2. LESSON LEARNED

What are the potentials of industrial area?

– The transferability of the project results

Water problem is not only limited in Shunde. Currently, it is a common issue in China that over-urbanization and over-industrialization has changed the relationship between people and nature. Followed by that, we are bothered by lots of urban problems. Water problem is one of the most severe problems. In China, every year during rainy season, big cities such as Beijing or Shanghai, will be changed into sea after big cloudbursts. The whole city is stopped and people's lives and property are threatened. Obviously, underground drainage system cannot satisfy the discharging assignment for extreme weather. We need to explore more sustainable, more flexible but less expensive way to improve water resilience in city. In this project, we propose an effective way – green and blue grid which can become an inspiration for future projects about improving water resilience.

Industrial transformation is also a hotspot topic in China. In the past 30 years, people expand the industrial area in an uncontrolled way. The only thinking behind that more profits in a short time and less expense, which makes only care about production flow and ignore ecological, social and cultural aspects. It intensifies lots of urban problems, such as water logging, water pollution or landscape fragmentation. In this project, these two topics are combined. We propose a way to reorganize the structure of green and blue system, public space and even route to improve water capacity, reshape the relationship between people and nature, conserve industrial memory and introduce new industry.

This project is not only an example for the other projects about demolished or upgrading factories to tackle with water problems and reduce pressure for capacity in the city, but also inspires industrial area which will be built in the future to rethink about the water system to avoid water problems.

2. LESSON LEARNED

Reflection on methodology

The method of design research supports the design strongly and makes the design more suitable and convincing for the site. Research by design is helpful to use design as a tool to test the principles and strategies in my site. I do some explorations and see different possibilities of it. Then I can choose the most reasonable and best one for the site. It makes the principles and strategies more practical, also makes the vision more reasonable.

2. LESSON LEARNED

Having clear research objective and research questions are very important. It can help designers to explore in the right track. Research questions can disassemble research objectives and achieve it step by step.

For the design part, we should explain how different layers work as a system together and them explain details. We also should take the process into consideration. Because as landscape architect, we are working with nature not creating nature in a park. Design in different scales also explains how it works in a system.

3. RECOMMENDATION FOR FURTHER RESEARCH

For my project, it is a pity that there is something I missed. For example, the research about the basic data in this site would be very useful especially for the construction of green and blue grid, such as soil conditions. Secondly, the flooding problem is not so well addressed because of the scope for this project. Dealing with flooding should be a regional thing, it is hard to alleviate in a local scale.

For further research about water resilient industrial transformation, I only focus on a historical factory. There are still some other types of factories missing. For example, the industrial park which needs to be upgraded, or factories without too much value of preservation which will be demolished in the future. The basic conditions of these factories are similar, lower terrain, a large area of impermeable pavement, lacking green space and producing pollution. They also have some special features. For the former one, the production flow needs to be combined with water resilience in the industrial transformation. As for the latter one, normally after demolishing, the area will be reused as a residential area, business area or green space. We can combine with the context to implement water resilient strategies.