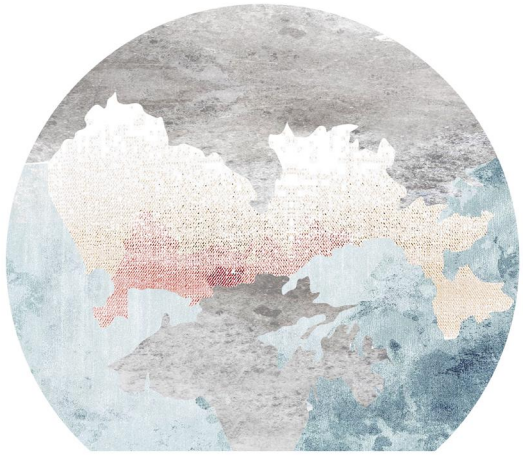

LANDSCAPE AS A SUSTANABLE INTERFACE:

Towards a vibrant boundary area in Shenzhen Second Line Pass

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1 INTRODUCTION

01.01 Facination

Policy can strongly determine the pattern of the boundary so that we can see not only some ambiguous and unclear boundary in most of Schengen country but also some strict conflict boundary like American-Mexico boundary.

At the same time, the issue of border development is prevalent in many countries. It is undeniable that over time the demand for increasing communication and the inevitable trend of urban growth will require more flexible and sustainable strategies over time to cope with future changes. Therefore, when the policy's attitude towards the boundary from the closed mind to open mind, how the current situation needs to be changed to adapt the future development arouse my interest. Due to the prevalence of this issue, I turned my attention to my own country, China.

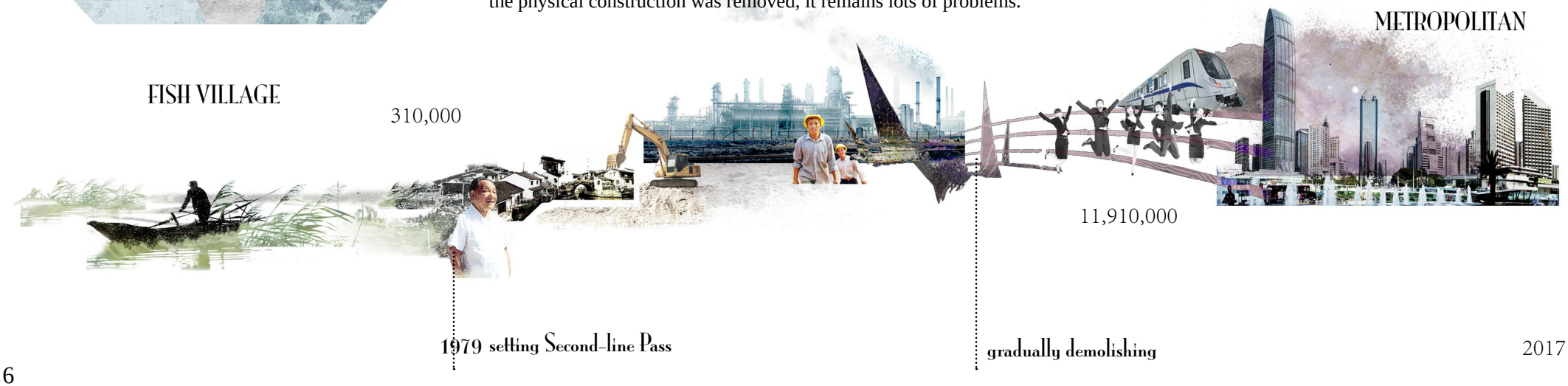
01.02 Context

a. about city& about line

In China, there is a city called Shenzhen who develop so fast that use more than 40 years from a fish village to a metropolitan. Behind the rapidly expanding, there used to be a strict boundary existing in this city that separating this city. In 1983, four years after establishing of Shenzhen economic zone, the government had seta a barrier line with surround districts (Futian, Nanshan, Luohu) being downtown area and the rest countryside, to facilitate the so-called ‘better maintenance on the relationship between Shenzhen and Hongkong.’

The boundary’s appearance was willing to, on the one hand, reduce the pressure of the Shenzhen-Hong Kong Pass in case of reducing more and more illegal immigration. On the other hand, the area inside the boundary can have the economic privilege rather than the other regions of China. Therefore, at that time, any Chinese people who wanted to go across the barrier line had to offer special certification at designated checkpoints and to accept compulsory checking on luggage. Skyscrapers have been emerging all the time in line surrounded downtown area while its counterpart beyond the line is still under construction.

The steel fences and checkpoints consist of this line. And it gradually loses function in 2002, removing progressively until now. Although the physical construction was removed, it remains lots of problems.



b. policy supporting

84km fence, 16 checkpoints

06/1982 began to build 'Second Line'

03/2002 started lose function for separating

08/1980 established Shenzhen Special Economic Region

03/1985 compelete building 'Second Line'

01/07/2010 abolished line's function

Since July 1, 2010, the State Council of the People's Republic of China approved the expansion of the Shenzhen Special Economic Region (using 'SSER' to instead 'Shenzhen Special Economic Region' below) to the entire city, which is no longer divided into within and outside the Shenzhen. However, despite the expansion of the SSAR, the 'Second Line' is still temporarily retained.

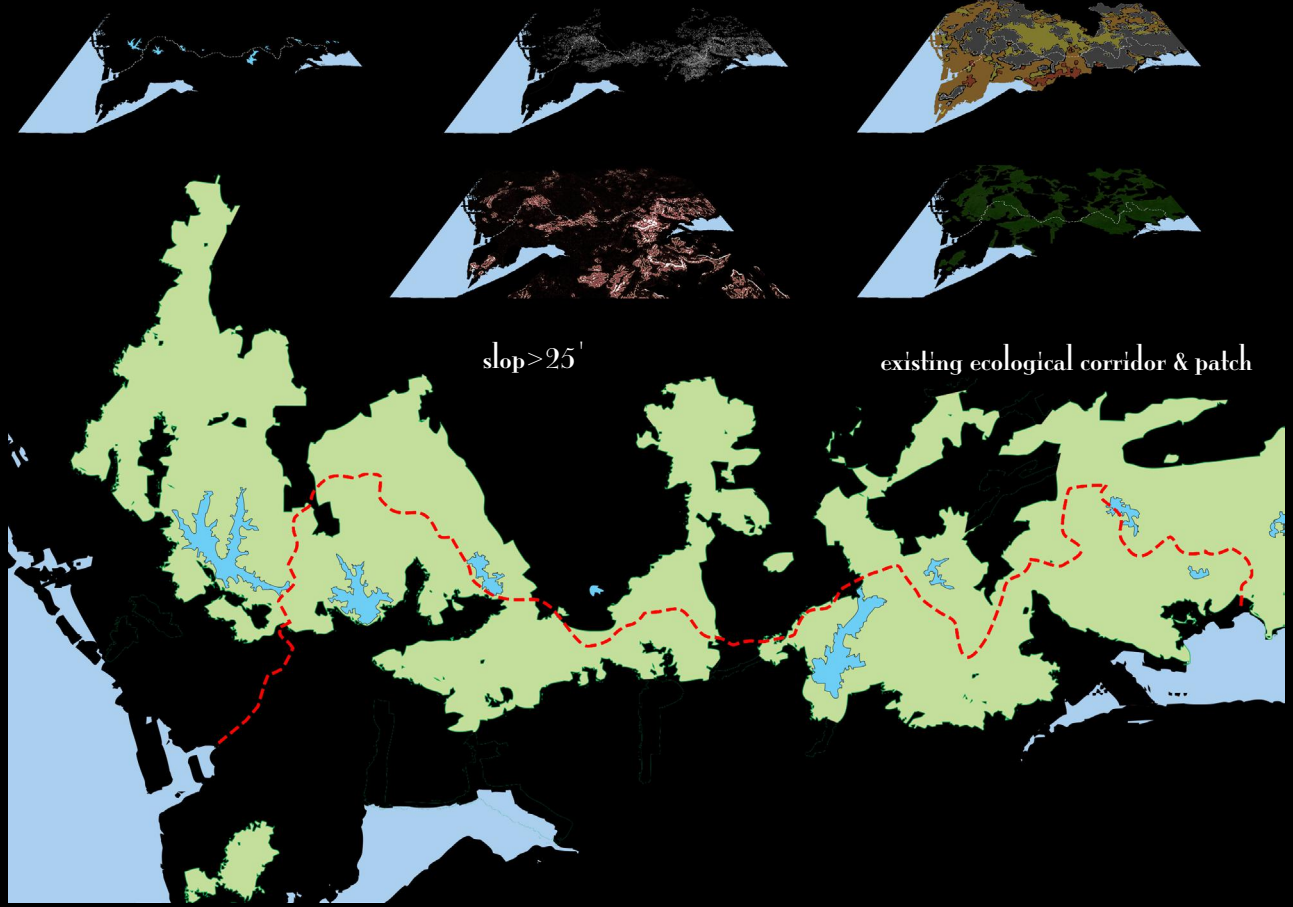
In June 2015, the checking facilities on the 16 checkpoints were successively demolished. Although the "second line" do not have to check function since June 2015, its existence has always created a psychological barrier between the people live in the SSER and outside of the SSER, and also, has influenced the city's landscape.

On January 15, 2018, the State Council of the People's Republic of China issued a reply and agreed to cancel the Shenzhen Special Economic Zone Second Line, which means that there are no physical barriers inside and outside the Shenzhen anymore, although this result should appear since 2010.

drinking water resource

elevation_mountain area

annual temperature in shenzhen



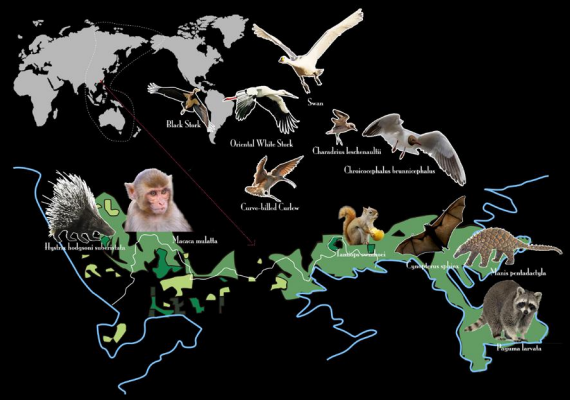
slop>25°

existing ecological corridor & patch

(a) RURAL PARK/HERITAGE DISTRIBUTION

rural park/heritage

(b) ANIMAL HABITATE



(c) GREENWAY FOR PUBLIC

greenway

boundary line

c-2. line go through sensitive area

c-3. ecological and recreation value in sensitive area

From mapping the ecological elements surrounding the line(such as drinking water resources, natural forests area, the area whose the gradient of the slop is over 25', the region containing cooling sources for the urban area, and the existing ecological matrix, corridor, and patch). We can there are quite large and relatively completed ecologically sensitive areas surrounding the line. These areas should be strictly protected and should not be influenced by urban development or human intervention.

The sensitive ecological area protected by line bring some benefits to the city. Due to the political sensitivities in these areas at that time, many areas were not invaded by the urbanization developments, leaving behind many green spaces that became precious natural resources in the cities. These places have a high ecological value and become habitat for many species. What's more, many provincial parks and heritages on both sides of the boundary, and already some routes in the barrier area have changed into the city's greenway serving to the public.

c-4, the urban gap brought by line

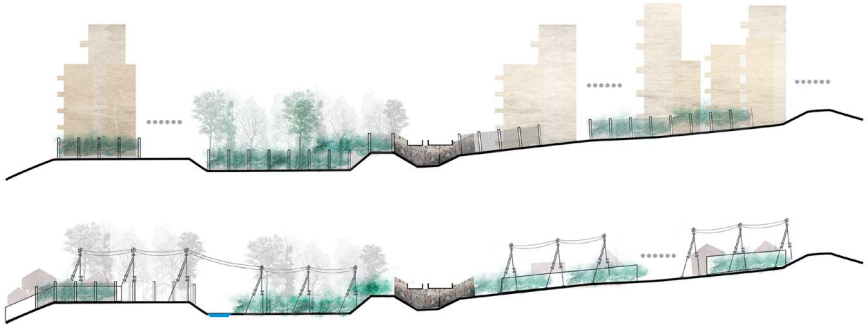
When seeing the urban fabric map of Shenzhen, it is easy to find three gaps. They break the flows, result in apparent urban chaos in the gap area.

In the early establishment of barbed wire line, the area surrounding the line is regarded as 'the end of the plan.' Therefore, most places are not properly planned and in a 'self-development' state. Therefore, many problems have appeared in these gaps.

01.03 Problem Statemnet

In the urban area where this boundary line passes have brought some significant impacts to the city. Fences limit accessibility. Even no barriers, people cannot come into because no path to guide. Much of the unutilized space was abandoned, and poor living conditions and poverty remained in the area. Besides, it is quite common for the encroachment of the natural resources and irrational use of the environment. Massively extensive land-use for fish ponds and farmland completely neglects sustainable development for nature.

In all, due to disorder planning and utterly spontaneous development, the boundary line left behind scattered and depleted landscape structures and closed vacant space to the city.



01.04 Research Question

Therefore, facing the potential but chaotic environment both brought by the boundary, the creation of a landscape system that can suture the urban gap until the 'urban wound' could healed.

A question has to be answered:

How can city and nature be linked in urban landscape gaps in the boundary area using regional and local landscape design?

The sub-question should be:

1)understanding question:
How do the nature and urban system work in Shenzhen Second Line Pass Boundary Region?

2)what can I do question:
What kind of spatial framework to guide the regional development?

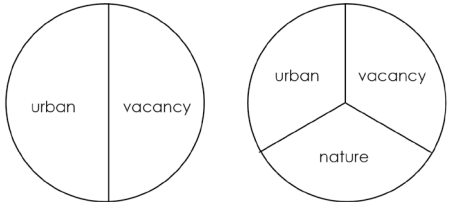
3)application question:
What are the potential landscape approaches can use for spatial development?

01.04 Site Choice

a-1. interface with three: urban, vcancy and nature

When discussing the urban gap, it is often to consider how the gap area merges into the metropolitan area. However, as I said earlier, fences will not only pass through urban areas but also pass through green patches. So in my study of the thesis, it covers three aspects of the interface: urban, nature and vacancy. (figure 1)

So the location I choose to study also needs to cover these three aspects because it is the researchable place have most frequent and valuable interactions.



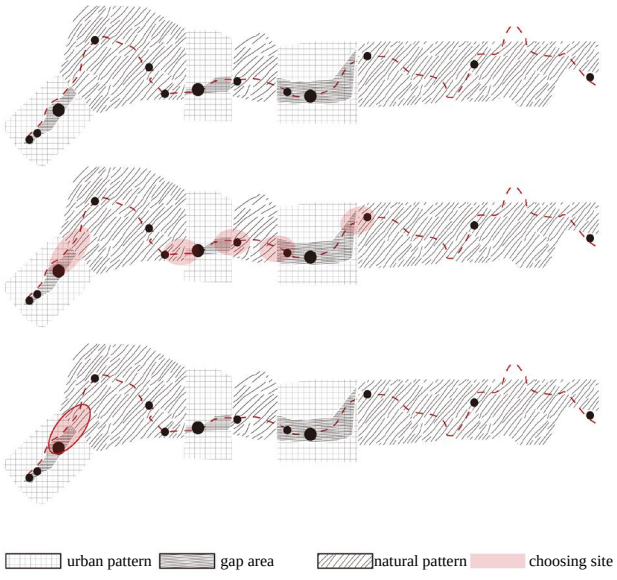
a-2. similarity

1)The reason for gap formation is similar. From the regional scale, the gaps are always located at the boundary of the original central city. The urban area on both sides of the fence are developed and have their systems, so it appears the area where both sides do not want to touch, which, is also the reason for gap formation.

2) They all near the ecological patterns. As I mentioned above, the Second Line is not only pass through the urban areas but also pass through green patches. As a result, a large number of greenbelts and ecological habitats in Shenzhen's cities are protected because it curbed the over-expansion of the central city to some extent. Besides, this green area also provides the conditions for these gaps to establish ecological connections with green patches.

3) Bring urban issues similarly. The chaotic environment formed by the gaps among the cities is similar. Two sides of the boundary created an entirely different dramatic urban image. One side, ordinary urban life scene occurs every day, but another side is an isolated area in this city, where existed many chaotic scenes.

In this way, those urban gaps have certain similarities. Therefore, the study of one can also be applied to other urban gap areas.



01.04 Site Choice

a-3. brief introduction for choosing site

The selected location is in Xili Area of Nanshan District, Shenzhen. It starts from Tongle Checkpoint area and stops near the Tiegang Reservoir area. The choosing site has a distance of 2 km from west to east and a distance of 5 km from the north to the south, nearly the area of Delf.

This area includes both urban areas and natural patches. At the same time, due to the presence of fence, there is also a large number of vacant spaces need to be a plan. The chaotic environment near the fence needs to be rearranged.

In the choosing site, Tong Le Guan is a vital traffic channel connecting Guangzhou and Dongguan (two important cities near Shenzhen)with Shenzhen. On the northwest side of the site, the Tiegang Reservoir with high ecological protection takes responsibility for urban drinking water resource. The northeast side has large areas of orchards, fish ponds, and farmlands. The south side belongs to the metropolitan area and has a large number of factories, warehouses, schools and residential groups. The composition of the site is quite complex and extensive. so it needs to apply the regional analysis to understand the site itself.

01.05 Research Goal

In the past, the line's function is to separate the downtown and the other area, now, it causes a large area which is ignored, however in the future, this area should indeed link with surrounding area and take the responsibility to prevent city's over-expanding and also provide the room for future development.

Therefore, as a landscape architect, based on a natural-based principle, the link between nature and urban potential should be strengthed to encourage interaction between them.

A flexible and improved regional framework is needed that responds to the area's current and future needs, **forming a sustainable landscape** that can connect natural and urban development more systematically and sustainably. Also, **providing a diverse open space** to the public.

2 METHODOLOGY

02.01
Theoretical Framework

Landscape as scale-continuum

The landscape is viewed as a scale-continuum. This principle addresses working through the scales as a fundamental basic premise, for example for the systematic elaboration of planning strategies (e.g., regional planning and design) and design interventions (e.g., project-based realisation). (Steffen Nijhuis, 2013)

Therefore, the landscape should enhance its long-term, sustainable conditions for not only the system level but also on the individual level. Just like I mentioned before, the scale is immense, and the issue produced by the site is quite complicated. On the level of the whole system, finding the area who give priority to develop or change is vital in this research (I regard the area choosing for priorly intervene as the 'node'). Those nodes are the most likely places to intervene, and also all those nodes attributed with capacities to increase sustainable form a sustainable entity, which as a whole developed a higher-quality and durable capacity.

Nature-based framework

Dirk Sijmons(1991) create a framework for sustainable landscape development called 'framework-model.' It argues in favor of letting the spatially compelling, systemic nature of the subsoil structure and geography steer the planning of the occupying structure. The object of the plan was to create a new-living landscape in which nature, soil hydrology, and urban/ agriculture development could all go together.

Behind this method it is a kind of nature-based principle, ask me to create a pattern of interconnected zones. And in this pattern, it can provide the long-term, sustainable conditions for ‘low dynamic functions’ and also leave room for land which has high-dynamic functions, such as urbanization, recreation, and agriculture.

02.01
Theoretical Framework

Multiple interventions

When left relatively untouched, ecological succession occurs on vacant lands, providing measurable and valued ecosystem services. Yet, these abandoned swaths, admirable for their reproductive and sustainable tendencies, underperform culturally and socio-economically. (Sabine Hofmeister, 2009)

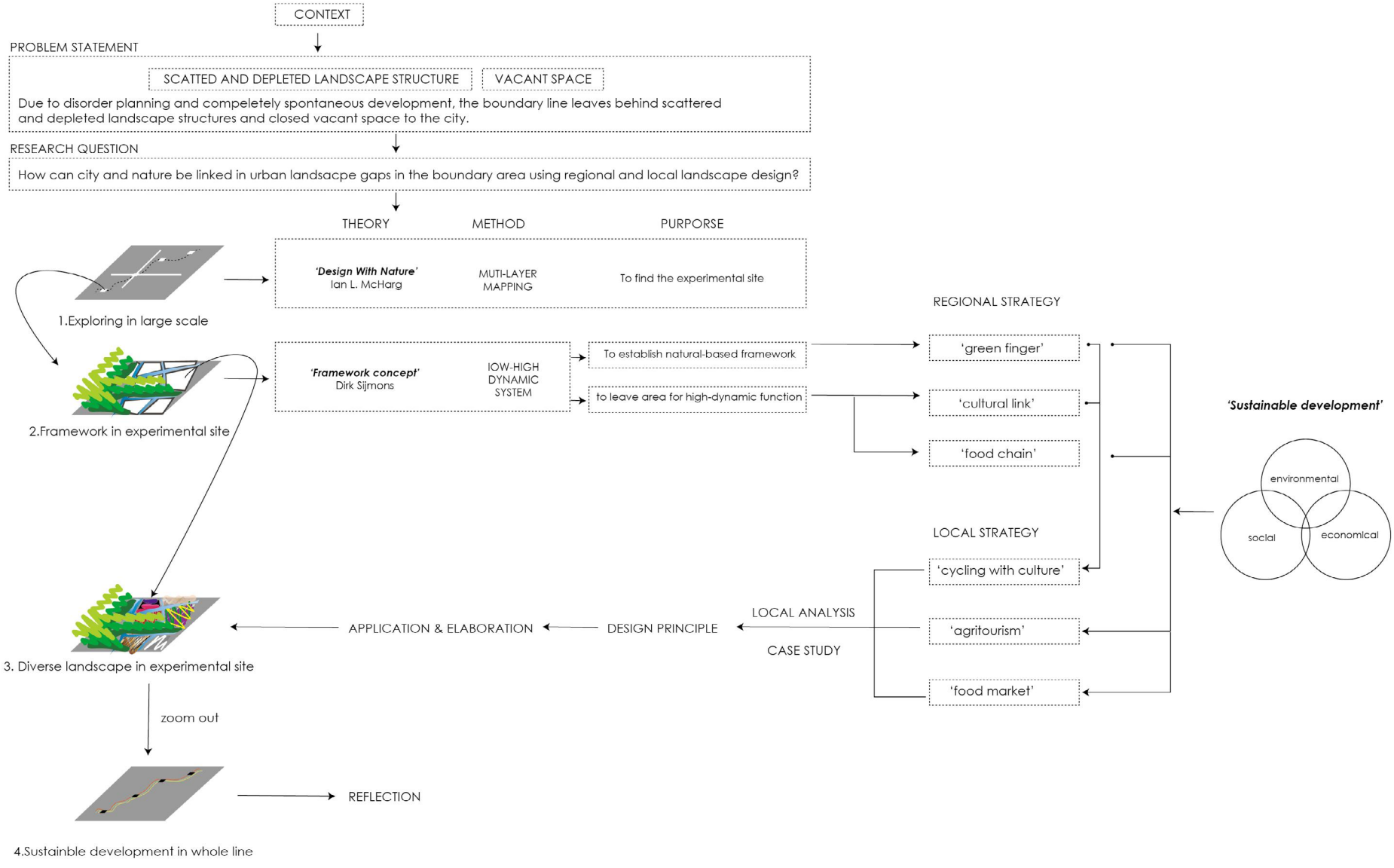
In the project, this boundary area will not be left to gradual re-forestation. Of course, it makes sense to conserve some land for unhindered ecological transformation and research, but it also necessary to give the varied conditions and the active populations. Therefore, a multi-pronged, multi-scale approach must be developed, proactively both in the short- and long-term.

Towards sustainable future

The goal of the project is to build a sustainable framework to create more efficient, dynamic and ecologically valuable spaces better in the urban gap area.

The above three theories can achieve this objective. ‘Landscape as scale-continuum' is to find potential and valuable points that can be improved in the overall context. Through the development of these points, the whole society and economy are promoted. 'nature-based framework' and 'multiple interventions' respectively consider the socio-economic process with ecology from the perspectives of environmental protection and social needs.

The three dimensions of sustainable development; economic development, social development, and environmental protection (Munier 2005, Koglin, 2009, Shen et al., 2011) are included in the combination of the three theories as will be applied in this project.


CONTEXT
PROBLEM STATEMENT
SCATTED AND DEPLETED LANDSCAPE STRUCTURE
VACANT SPACE
Due to disorder planning and compeletely spontaneous development, the boundary line leaves behind scattered and depleted landscape structures and closed vacant space to the city.
RESEARCH QUESTION
How can city and nature be linked in urban landsacpe gaps in the boundary area using regional and local landscape design?
THEORY
METHOD
PURPORSE
'Design With Nature'
Ian L. McHarg
MUTI-LAYER MAPPING
To find the experimental site
1.Exploring in large scale
'Framework concept'
Dirk Sijmons
IOW-HIGH DYNAMIC SYSTEM
To establish natural-based framework
to leave area for high-dynamic function
2.Framework in experimental site
REGIONAL STRATEGY
'green finger'
'cultural link'
'food chain'
'Sustainable development'
environmental
social
economical
LOCAL STRATEGY
'cycling with culture'
'agritourism'
'food market'
LOCAL ANALYSIS
CASE STUDY
DESIGN PRINCIPLE
APPLICATION & ELABORATION
3. Diverse landscape in experimental site
zoom out
REFLECTION
4.Sustainble development in whole line

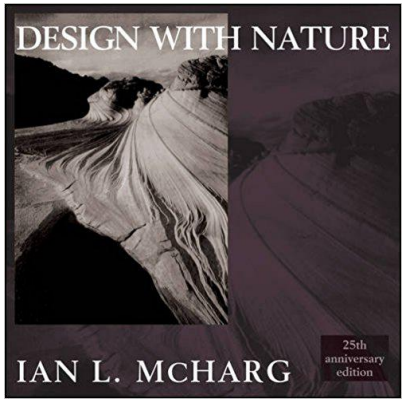
02.02
Method Elaboration

The muti-layer mapping

In the stage of exploring in large scale, because the line is 84 kilometres, and not everywhere have the potential or in urgent need of being designed, so a method is needed to help me define the most problematic place which enjoys the highest natural potential.

Based on the literature, the landscape is a system consisting of several layers. A prominent example is the multi-layer mapping method promoted by Ian McHarg, who decomposed and overlaid maps to establish evaluation system. It becomes an explicit analytical, interpretative model for better understanding the regional context.

So in stage 1, Introducing the multi-layer mapping method to help me evaluate the ecologically sensitive area and also draw the conclusion which part can be considered priory to redevelop.



Framework concept

Sustainable development requires a thorough understanding of the urban system and nature system and more importantly the interaction within them.

So here I will introduce the Dirk Sjimos's framework model, it is nature-based regional planning model. He regards some nature system like subsoil, geography, hydrology as the low -dynamic system, and give the prior room for those systems, letting nature lead the occupying structure, and also leave the room for the high-dynamic system, like urbanisation, recreation and agriculture

from analysing the low-high dynamic system, to find the SWOT(strength, weakness, opportunity and threaten) for establishing a nature-based framework and also to obtain the design principles for the analysis concluded.

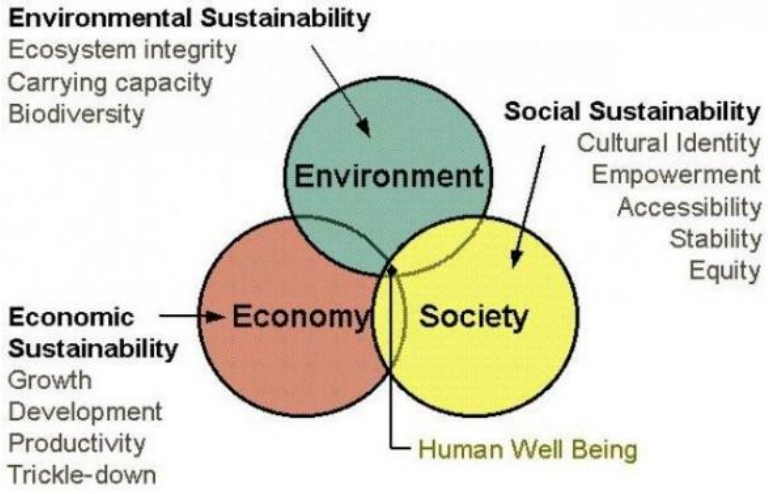
'Framework Concept'
-Dirk Sijmons

Combination of theoretical thinking and practical research

The framework model is the theory which originated and practised abroad. In the study of the regional framework and sustainable development, except for thinking about the background and development of this theory in foreign countries, we also need to examine the social context and urban characteristics in Shenzhen, to explore a combination of theory and practice.

Multi-disciplinary perspectives

The sustainable development contains three dimensions: economic growth, social development, and environmental protection. Therefore, besides thinking about landscape ecology, it is more necessary to think about social learning from urban sociology and to expand sustainable spatial practices under the traditional urban planning theory.



3 UNDERSTANDING THE SITE

03.01 ecological analysis

a) Geology

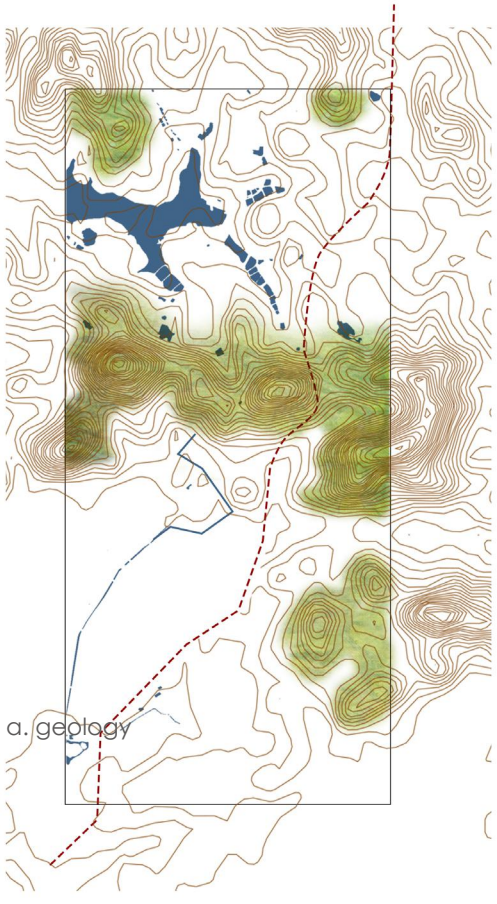
Mountain becomes the natural barrier. The north side is a hilly environment with the Tiegang Reservoir, and the south side is the urban area.

b) Vegetation Structure

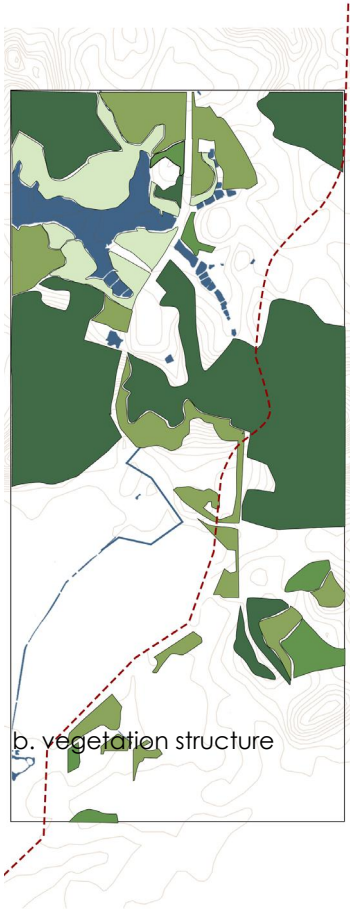
In the north area, a complete ecological system has formed, but some areas were interrupted by the human interventions, need to be restored. The ecological system is not present anymore, so we can introduce some stepping stone in the urban area, establish an ecological corridor for expanding the habitat for flora and fauna.

c) Diversity

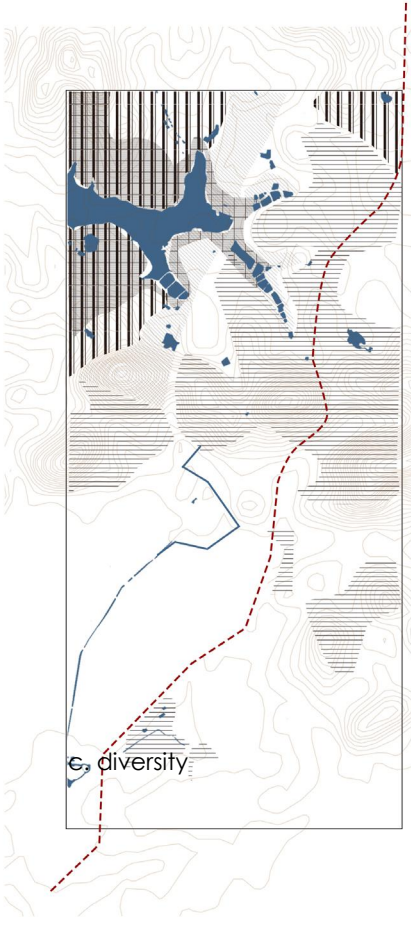
The reservoir is a very strict natural reserve. On the one hand, it is the source of drinking water for the city. On the other hand, reservoir and its surrounding have formed the habitat of flora and fauna. However, due to excessive farmland and orchards in some areas, the species in the habitat is always sole, and also break the continuous environment for the muti-species-habitat. It has become necessary to expand and restore ecological habitats in the north.



a. geology



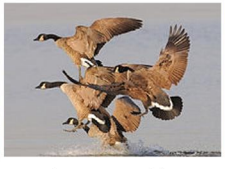
b. vegetation structure



c. diversity

Phalacrocorax

Egretta garzetta



Anser cygnoides

Garrulax canorus

climax community
pioneer species
intermediate species
wetland

Protect landscape

bird habitat

strict natural reserve

managed resorces protected area

Trimeresurus

Odorrana

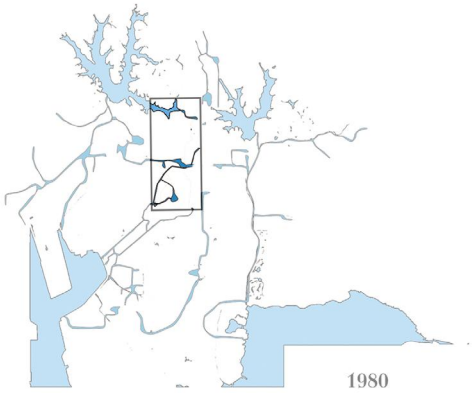
03.02 hydrology analysis

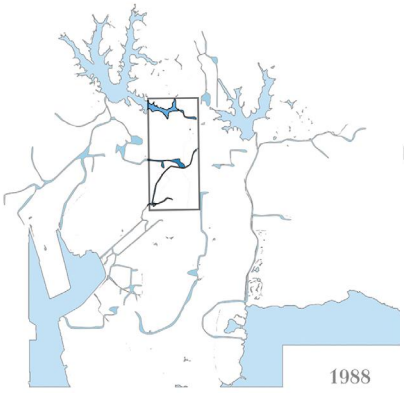
Rapid urbanisation development started from 1980, and from that time on, the runoff in Shenzhen urban area was sharply reduced. From the historical maps, this area used to be rich in water, but with the urbanisation process and people intervention lost of water disappeared. Even the reservoir in the green patches does not perform well, either. So under investigating the water environment, three typical problems exist in the choosing site:

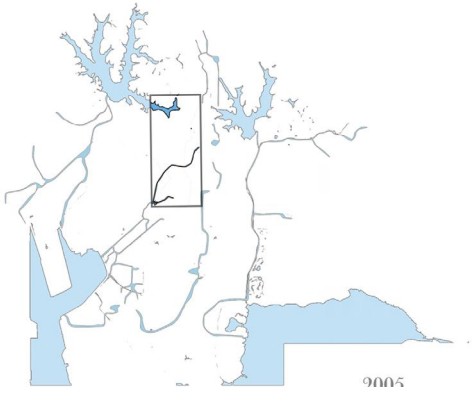
(1) when we zoom in for the three branch, those three branches used to connect with the reservoir, but now sharply decrease reservoir's storage capacity and bring the risk to the low area when in the rainy season just due to people over-reclamation and developing the aquaculture.

(2)Amount of the river were under channelisation, water lose the ecological function.

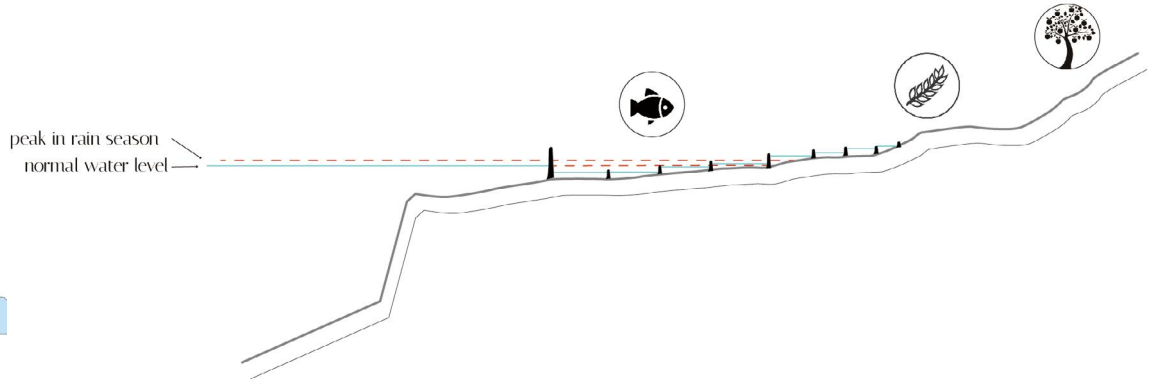
(3) Vehicle road or large truck parking area for those logistic factories directly connect with the water without leaving any room for pedestrians and cycling people. People cannot reach the river bank and lose the experience of the river.



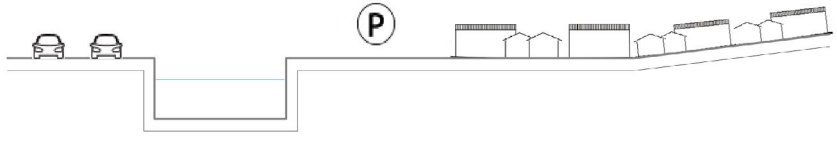




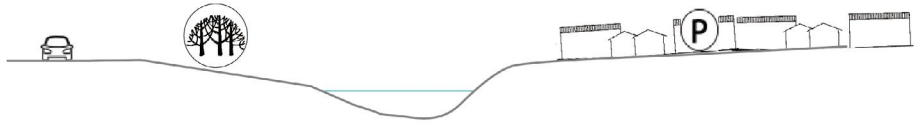
river nerwork in Shenzhen



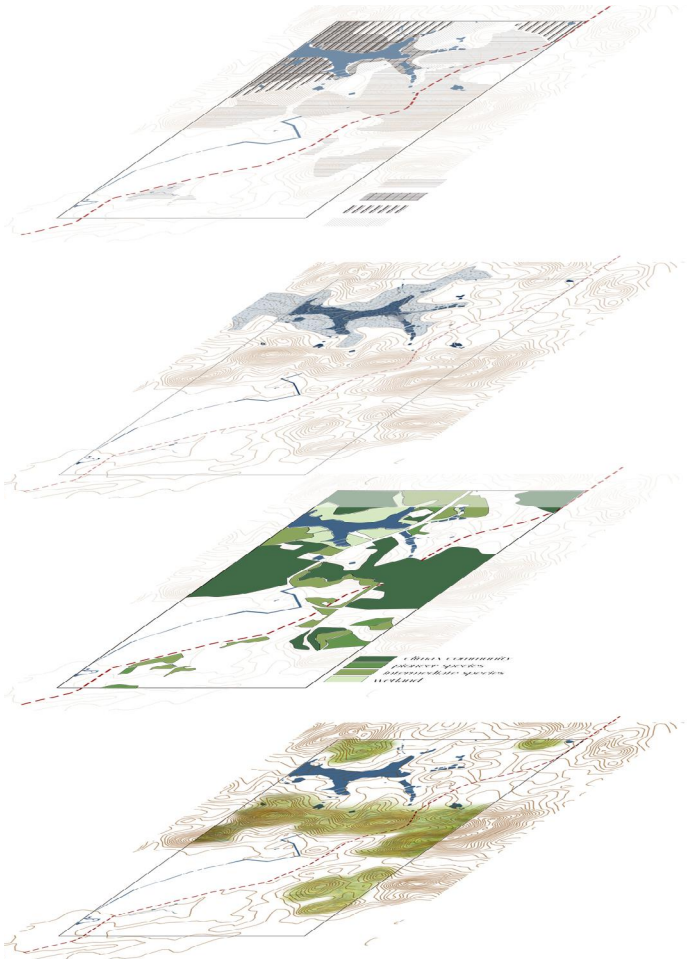
a. over-reclamation and developing the aquaculture.

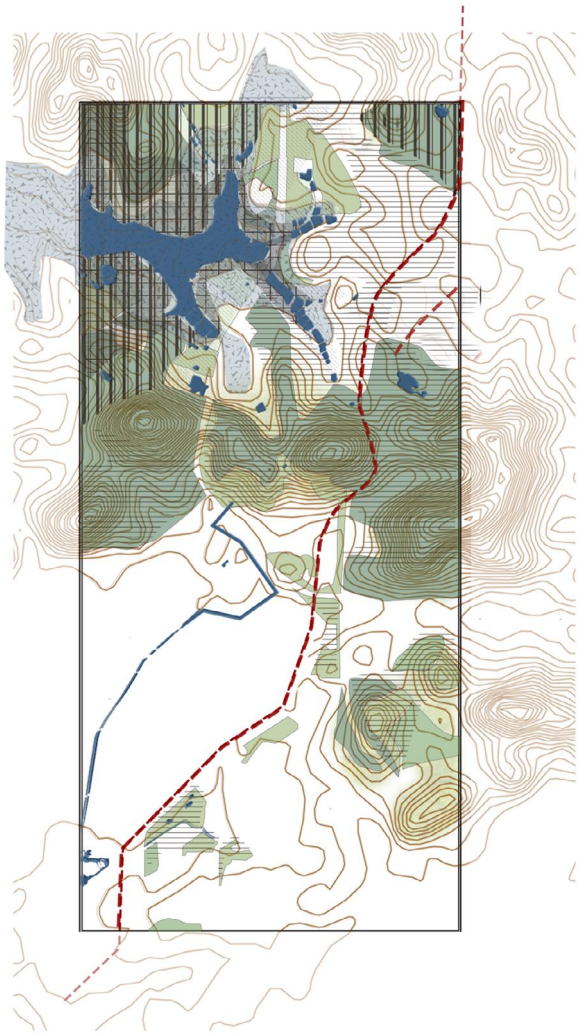


b. channelisation



c. without leaving any room for pedestrians and cycling people





03.03 Low Dynamic Conclusion

According to the above analysis of the low dynamic system of the site, the problems are mainly concentrated on three aspects:

a) The vast amount of over-cultivation, resulting in a single species of animals and plants in the environmental protection area and destroying the ecological environment of the forest itself. What's more, the development of agriculture and fishery has destroyed the wetlands containing ecological value and reduced the reservoir's water storage capacity, causing the risk of flooding.

b) The natural environment stays on the edge of the city. There are no corridors with environmental values that enter the city.

c) The rivers are seriously channelized, and the water quality is low. The residents lose their experience of water.

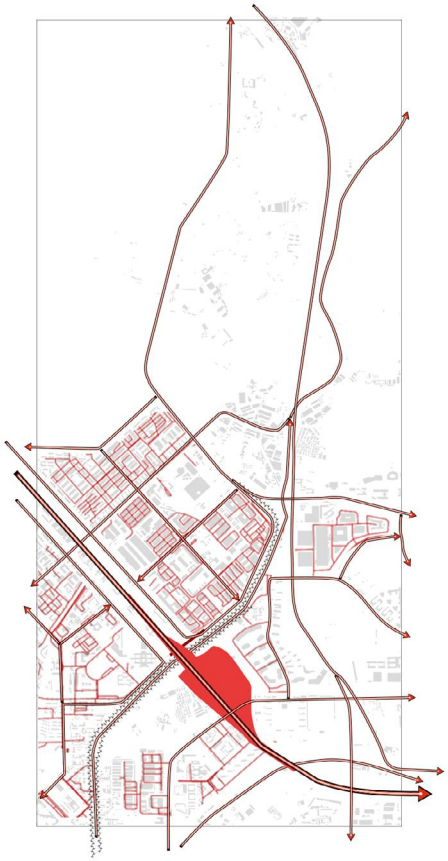
03.04 fast mobility

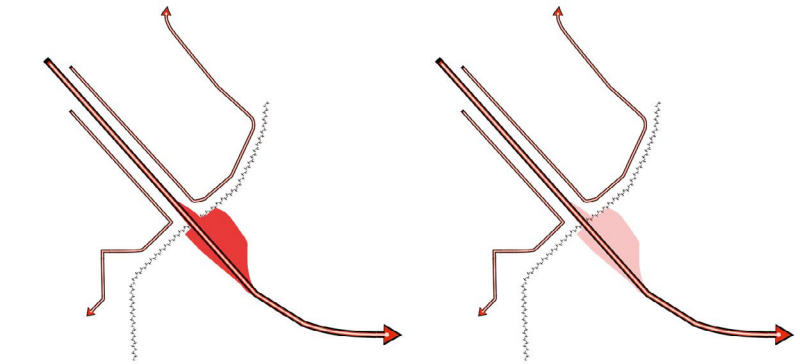
First of all, fence prevents the fast mobility, from southwest to northeast, the connection between the two sides has been completely cut off. The current situation is the vehicle roads are all bypassed along the fence's edge. Only one vehicle road passes across the fence line, but it is elevated checkpoint. And also, this checkpoint lose the checking function, so it takes up a lot of extra lands.

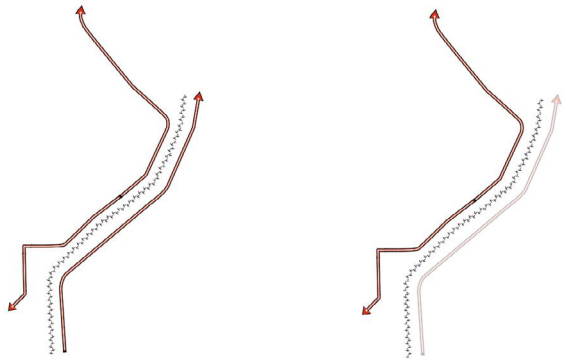
But to some extent, this is still beneficial, because only an elevated checkpoint pass across the fence, which means, it can provide the condition of a car-free environment.

But from the northwest to the southeast, this gap area has a long vehicle road along the fence. It is as long as the fence's length, nearly 84 kilometres. In the past, this vehicle road was used to patrol whether someone illegally passes across 'the second line', but now we do need to keep this road, because firstly there is no need of patrolling, and secondly, on both side of the fence, there will be two parallel vehicle road. However, it doesn't need such close distance.

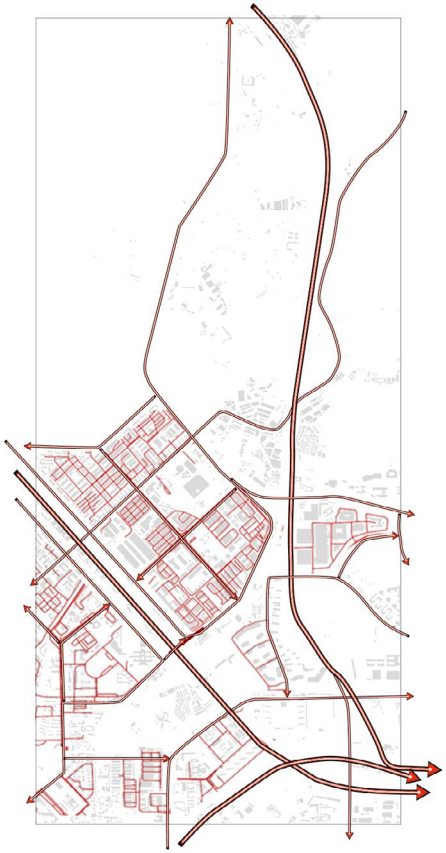
elevated checkpoint and extra space







repeated vehicle road



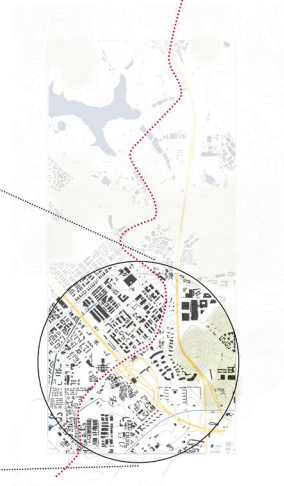
no-car area

03.05 slow mobility & culture

when walking along the vehicle road next to the fence, it is easy to see the isolated scenes: shabby house, dark tunnel, barren land, some area with ecology succession. Although this area drop behind, but it is a great culture and historical treasure for the Shenzhen people, especially this area can be regard as a witness to see the huge changes in Shenzhen. The fences, checkpoint even vehichle road along the fence all can be seen as the elements for the collective memory.

Expect for that, lots of education institution surrounding in the south part of the area, so this area should also take the responsibility for education and culture.

Zooming out to see the surrounding greenway, the vehicle road has the great potential to change into the greenway connecting to the whole greenway system. In fact, the north part of the vehicle road along the fence has already change into the greenway. However, the checkpoint, this huge grey infrastracture can also have the potential to transform to the green infrastracture full with the collective memory.



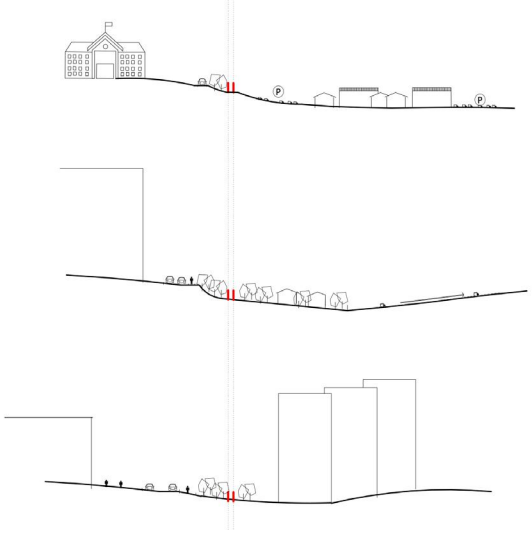
vehicle road

existing greenway

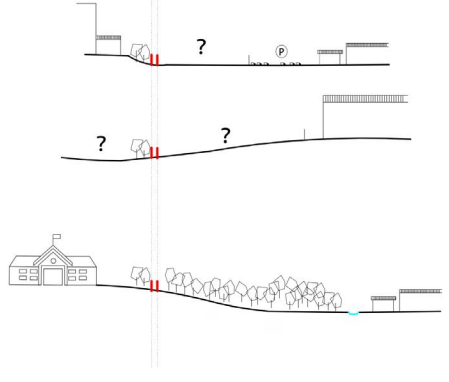
area for check point

park

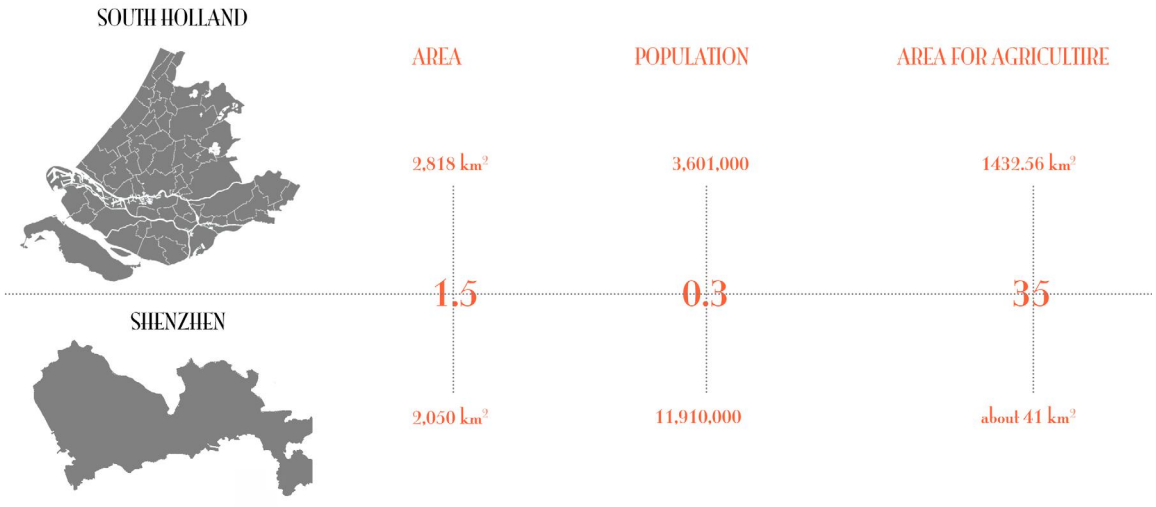
education institution

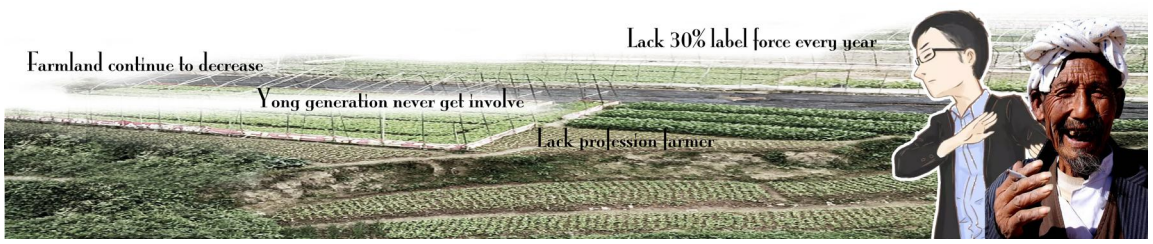


What will Lost_for the new inhabitant



03.06 background supplement





1) The farmland is severely deficient.

We can learn from the Shenzhen and South Holland to see the urgent situation. Choosing South Holland, because South Holland is the region with the highest population density and highest industrialisation in the Netherlands. Then we can easily find South Holland is 1.5 times Shenzhen when considering the regional area. As for the population, South Holland is only 0.3 times Shenzhen, but the agricultural area is 35 times that of Shenzhen.

Due to the large-scale industrial development and the rapid expansion of the city, the factory occupied the farmland. Based on the data, the land for agriculture in Shenzhen are decreasing year by year, which severely restricts the space for traditional agriculture based on land. At the same time, the labour force of young people in agriculture continues to decrease, and the labour force tends to old.

2) The transformation of the ‘world's factories.’

Shenzhen, as the earliest city, carrying out reforms and being open in China, has its position in the global manufacturing industry, even it was named as 'world factory.'

However, with the upgrading of urban industries, the manufacturing industry based on cheap labour has gradually replaced by machinery. Today, small factories that provide low-cost labour services are no longer adapting to the times, and workers who live in those small factories are also facing career transformation.

03.04.01 agriculture / building analysis

Then from the analysis, we can know that:

1) North _fragmental agriculture and aquaculture without sustainability

All fragmental productive landscape are all concentrated on the north side of the site, a relatively high ecological sensitive area. Their stakeholders are residents who live in really shabby houses near the productive landscape. They lack not only fundamental life guarantees but also sustainable awareness. To pursue economic interests, they carried out unrestrained fish ponds, farmland and orchard expansion, even invaded the core protected area of the reservoir, which, greatly impaired the capacity of the reservoir, and destroyed ecology system.

2) South_manufacturing industry factories based on cheap labor, temporary or shabby housing facing transformation

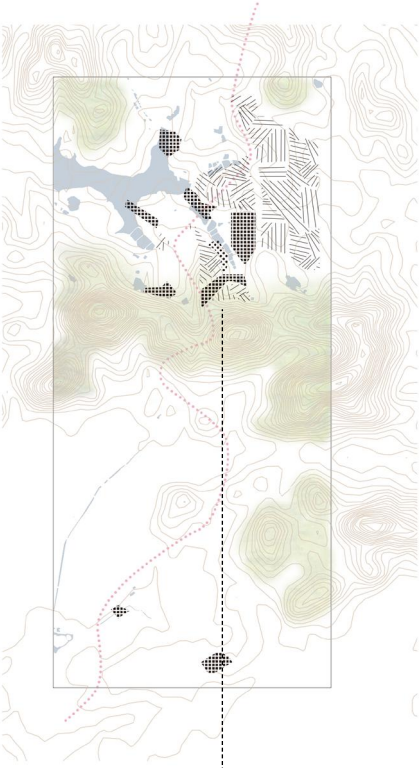
There is a large number of manufacturing industrial factories, temporary housing and poor housing on the south side of the site. They are the results produced by the background when manufacturing industry based on cheap labor grown up. However, as mentioned above, cheap labor has begun to shift to other cities in China or Southeast Asian countries. Therefore, these large numbers of small cheap factories and temporary or shabby housing for workers that were concentrated in the urban gap area faced transformation when corresponding to the needs of current urban development. This gap area formed a larger space full of possibilities when combining with the territory these factories, temporary houses, and simple houses occupied.

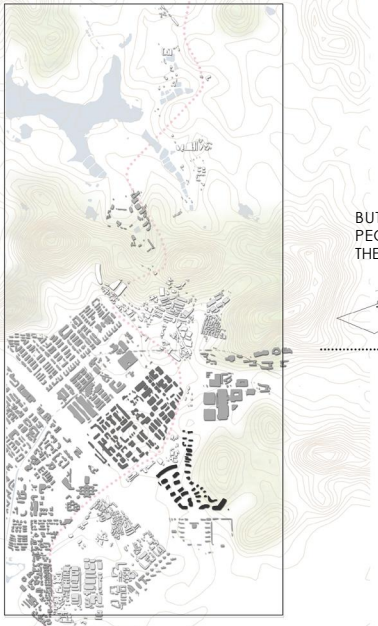
From the low-dynamic analysis, we analyzed that this gap can provide the area for urban ecological corridors and also urban habitat for birds. Also, is it possible to release over-occupation farmland in the ecological-sensitive area and transfer to the metropolitan gap area?

farmland

orchard

fish pond

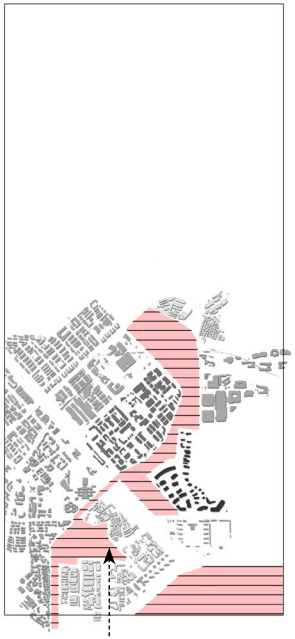




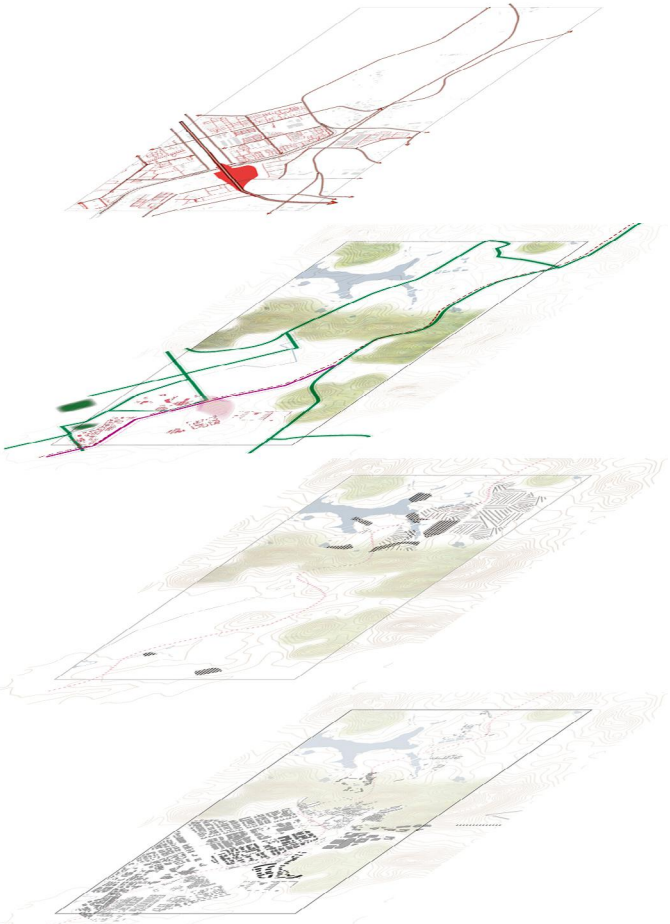
BUT WHAT THE SURROUNDING PEOPLE'S EXPECTATION ABOUT THE THOSE POTENTIA SITE?

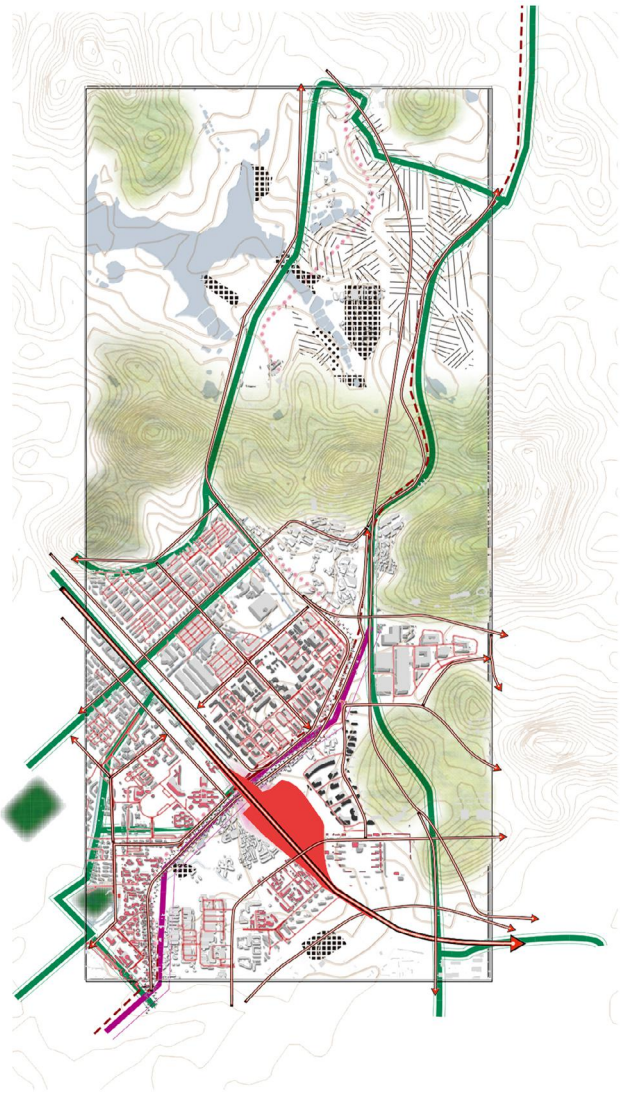
Good

Terrible



replace





03.07 High Dynamic Conclusion

From analysing and overlapping five layer, fast mobility, slow mobility, culture, agriculture and building, we can find:

1) The original mobility system, whether vehicle road or the slow-mobility space, greatly preventing the communication between the two sides of the fence.

2) Historical checkpoints, and two parallel roads along two side of the fence lose their function and take up a lot of extra lands.

3) Farmland invades natural resources, and has no connection with the city

4) A large number of manufacturing factories and industrial lands in the city are facing transformation.

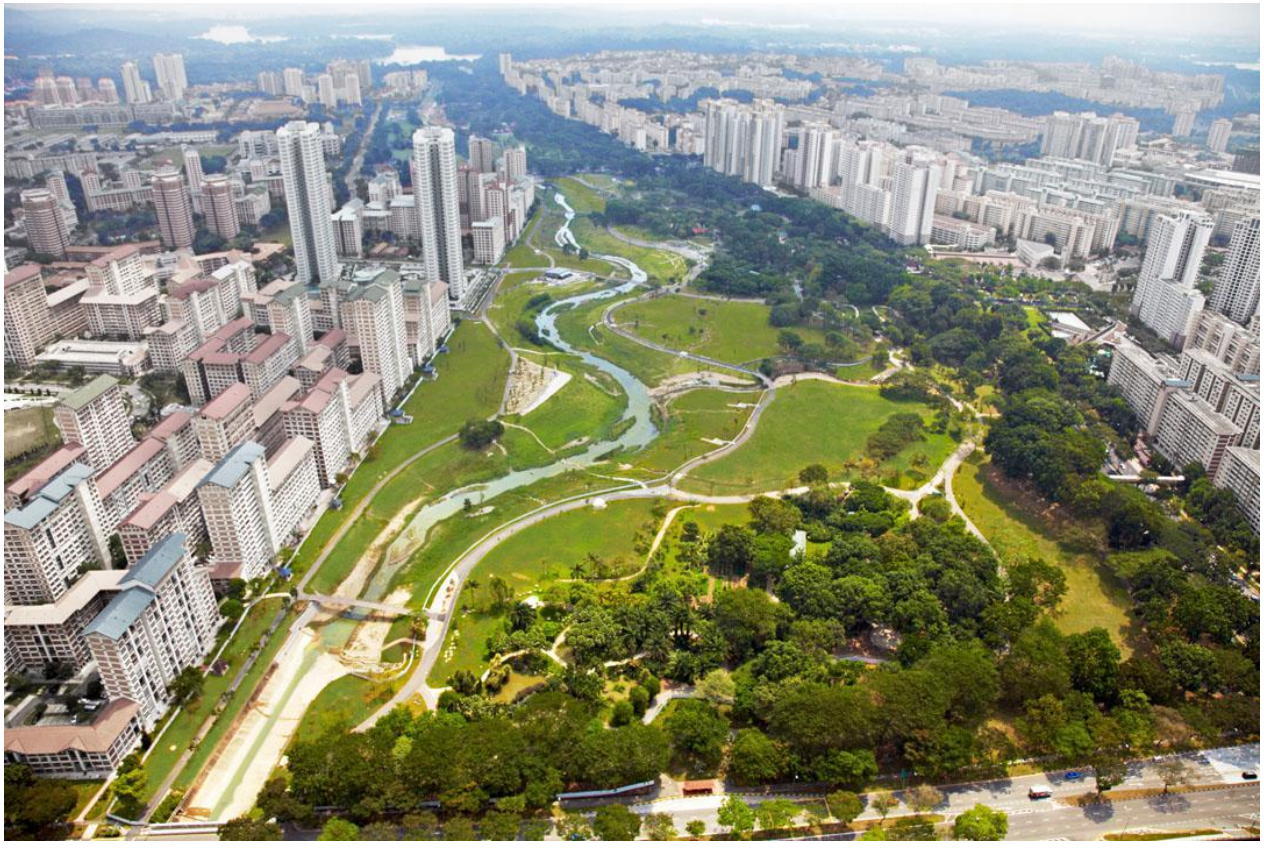
4 STRATEGY & DESIGN PRINCIPLE

04.01 case study

a. landscape as an ecological infrastructure

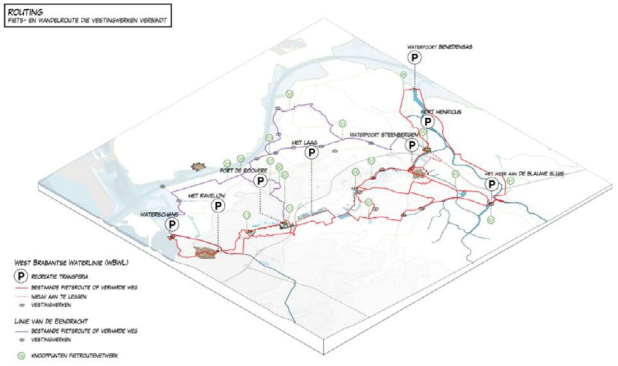
Bishan Park is an inspiring example of how a city park can function as ecological infrastructure, a smart combination of water source, flood management, biodiversity, recreation, and thanks to personal contact and an emotional connection with water, increasing civic responsibility towards water.

The most important aspect is certainly the integrated storm water management with the creation of a natural river. This creates a totally new possibility for cities to deal with their rivers, manage stormwater, bring back nature into the cities and create parks for recreation and healthy citizens. Cities have always been seen as the opposite of nature whereas nowadays we have to find a way to integrate nature and cities. Cities have to become more resilient, the climate change with higher risk of flood events and drought periods will affect cities extremely and in relatively near future. This concept that works with decentralized integration is perfect for the adaption to the future challenges. It holds back stormwater, it cleanses the drinking water resource of the citizens, it allows rare flora and fauna to come back into the city and it gives space, contemplation and nature experience to people. This holistic concept is one piece of a concept that can help assure a future for our planet.

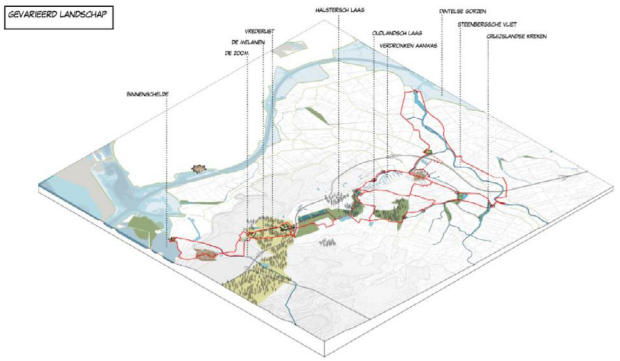


(sources: https://www.gooood.cn/river-restoration-singapore.htm)

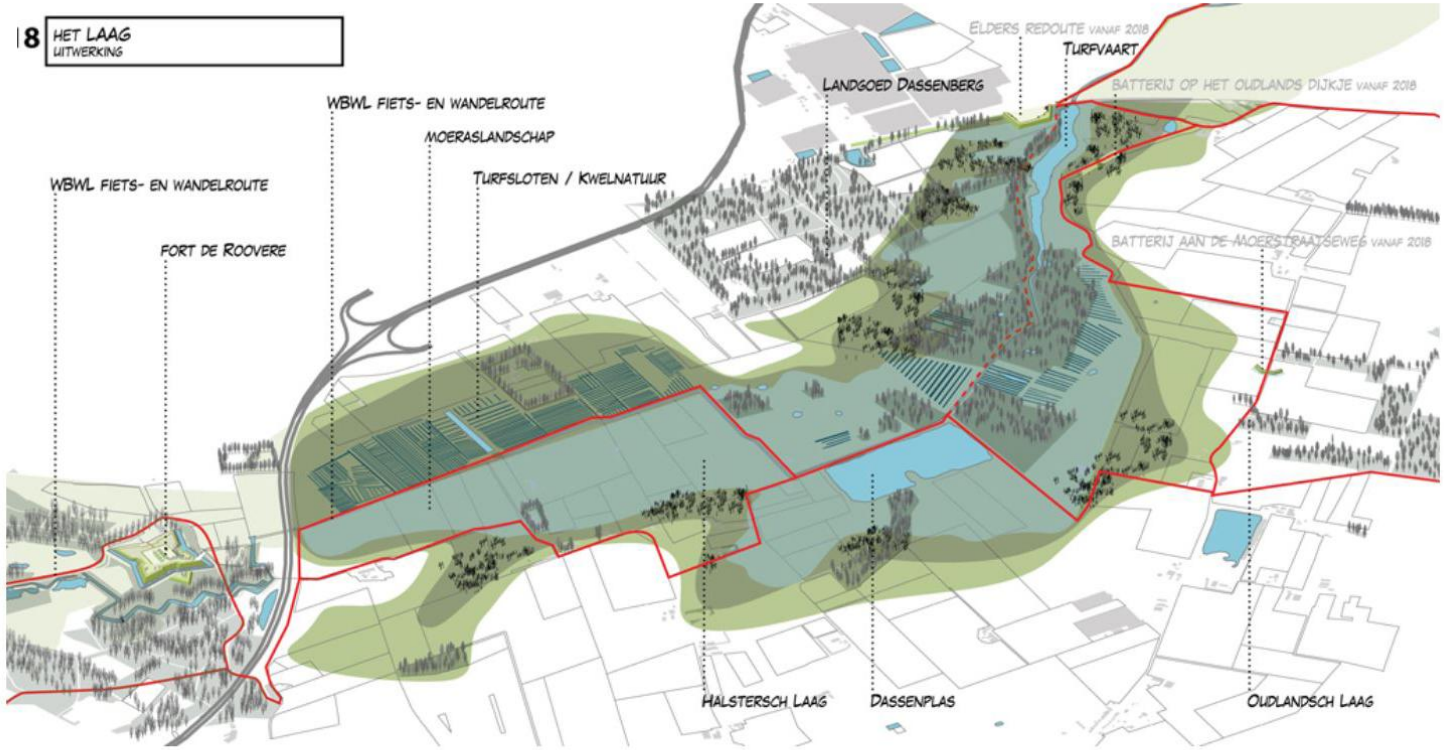
7 ROUTING
FIETS- EN WANDELROUTE DIE VESTINGWERKEN VERBINDT



9 GEVARIEERD LANDSCHAP



8 HET LAAG
UITWERKING



(sources: http://marcovermeulen.eu/projects/projects/137/westbrabantsewaterline/english/)

b. routing make the history more experienceable

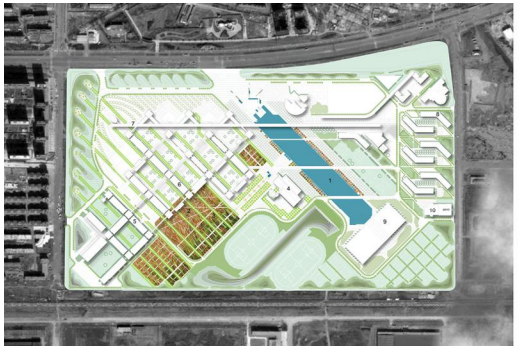
The West-Brabantse Waterline is the oldest water defense line of the Netherlands and is the birthplace of inundation techniques in the world. This defense line was filled with salt as well as fresh water from sea and stream. Unlike the later built New Dutch Waterline, the West-Brabant Waterline has been of service several times for the defense of Holland and Zeeland against the Spanish, French and Belgians. As a result, this area has been inundated six times for a total of fifty years.

The current projects mainly focus on the restoration of the man-made elements of the water defense line. This is a good base for making the history more experienceable. It is, however, not enough to create a destination for bigger audiences. What is missing is a consistent and coherent element between the man-made structures and the landscape which would envision the story of the West-Brabantse Waterline as a whole.

Routing and accessibility play an important role in making the Waterline experienceable. A "West-Brabantse-Waterline Route' which leads pedestrians and cyclist along the Waterline can strongly contribute to the recognition of the defensive line as a whole.The landscape along the West-Brabantse Waterline is incredibly varied and a bike ride will not get bored quickly. Based on the spatial and landscape characteristics a number of areas can be distinguished. The restoration of the historic man-made structures in this region is a good reason to also strengthen the spatial characteristics. This restoration can also be linked to other spatial tasks.

Along the route of the West-Brabantse Waterline there are already some amenities that, together, could grow into a leisure landscape of stature. The quality of these facilities will help to determine the attraction value of the Waterline as a whole. These will be in fact, nodes in the recreational network with facilities such as cafes, restaurants and parking. For most visitors, these recreational hotspots will be the starting point for their exploration of (a part of) the Waterline.

c. the power of the produtive landscape

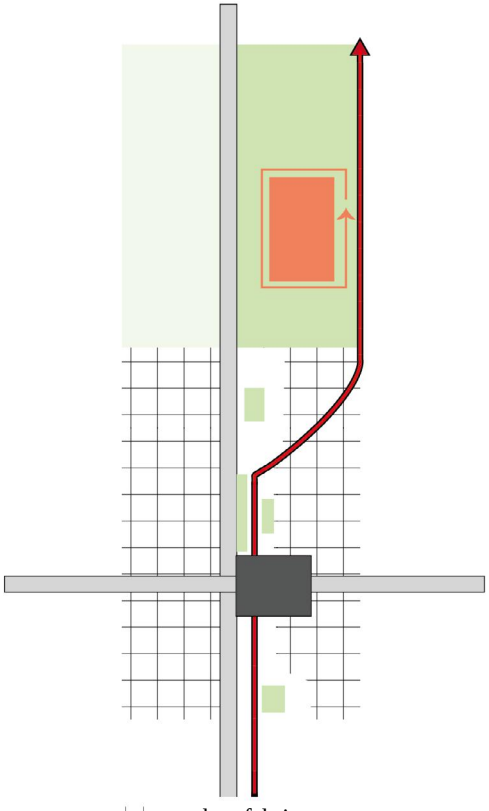


(sources: http://www.architecturenorway.no/questions/cities-sustainability/kongjian-yu/)

Landscape architects working in China must address issues of food production and sustainable land use, two of the biggest current issues on China’s horizon as the country moves towards modernization. The overwhelming urbanization process in China is inevitably encroaching upon a large portion of China’s arable lands. With a population of 1.3 billion people, but with only 18% arable land, China is in danger of using up one of its very valuable and limited resources.

The concept of this design seeks to use rice, native plants and crops to keep the landscape productive while also fulfilling its new role as an environment for learning. It is designed to raise awareness of land and farming amongst college students who are leaving the land to become city dwellers. In addition, the designer also seeks to demonstrate how inexpensive and productive agricultural landscape can become, through careful design and management, usable space as well.

04.02
Three Strategies

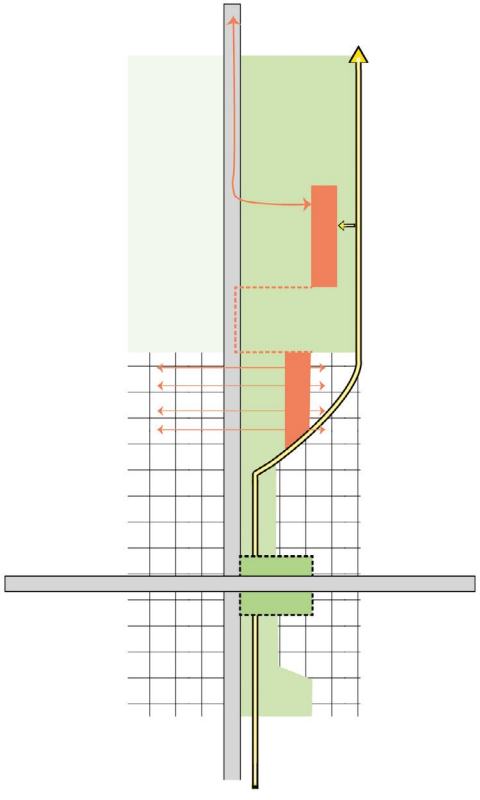


urban fabric
core natural reserve
nature area
agriculture
vehicle road
checkpoint
paralle vehicle road

GREEN WEDGE

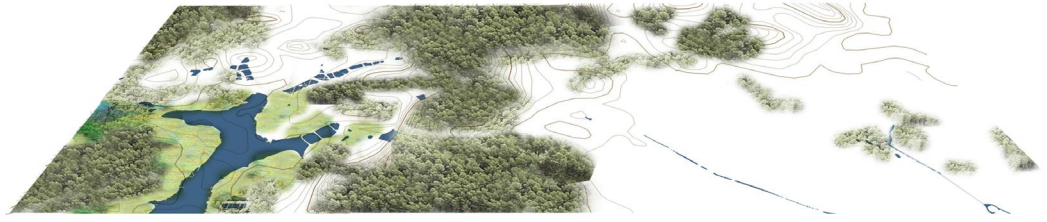
CYCLING WITH CULTURE

FOOD REVOLUTION



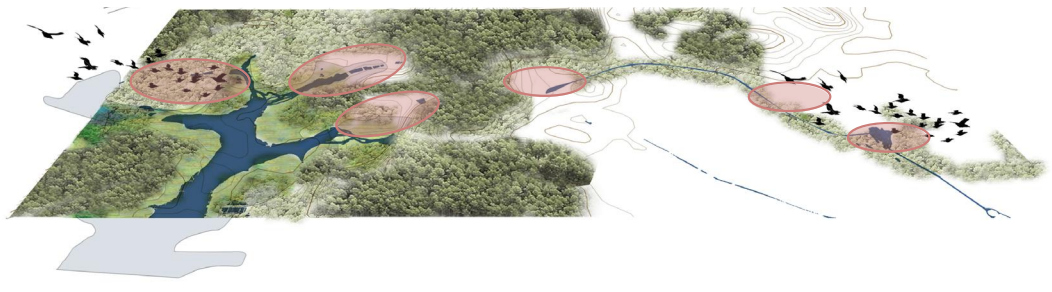
urban fabric
core natural reserve
nature area
agriculture
vehicle road
transformed checkpoint
greenway

04.03.01 Green Wedge
principle & structure

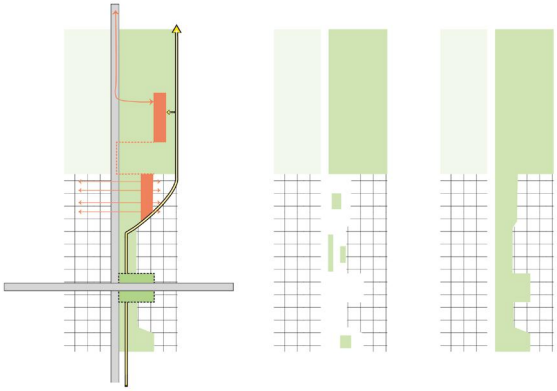


current green patch

link green patch; return over-occupation; form continuous green corridor



the design area for choosing

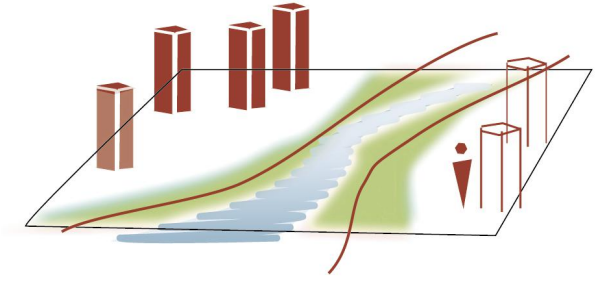


Green Wedge

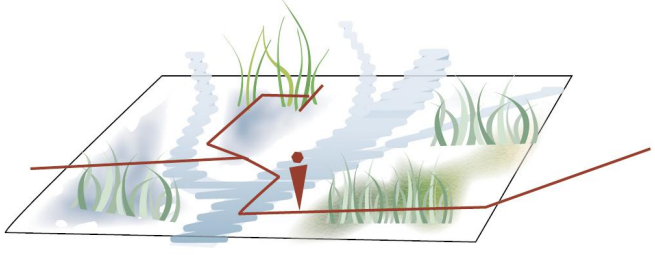
1 Enhance water-edge open space
Change the grey channelization to green, leaving room for encouraging pedestrians to participate, keeping the water-edge area not only ecological but also reachable.

2 Return over-occupation to wetland
Return some farmland areas to the reservoir, to continue doing the ecological succession.

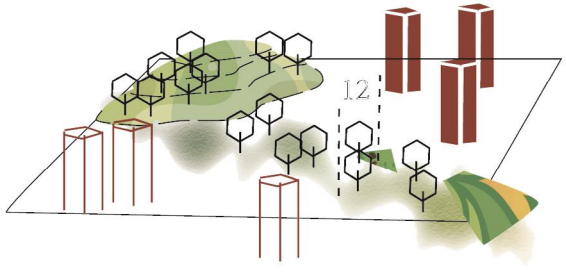
3 Extend habitat in urban area
Recover some open spaces as a natural patch, extending the environmental habitat for the bird, and ensuring the continuity of the ecological corridor.



enhance water-edge green open space



return over-occupation to wetland



extend habitat in urban area

04.03.02 'Green Link Model'

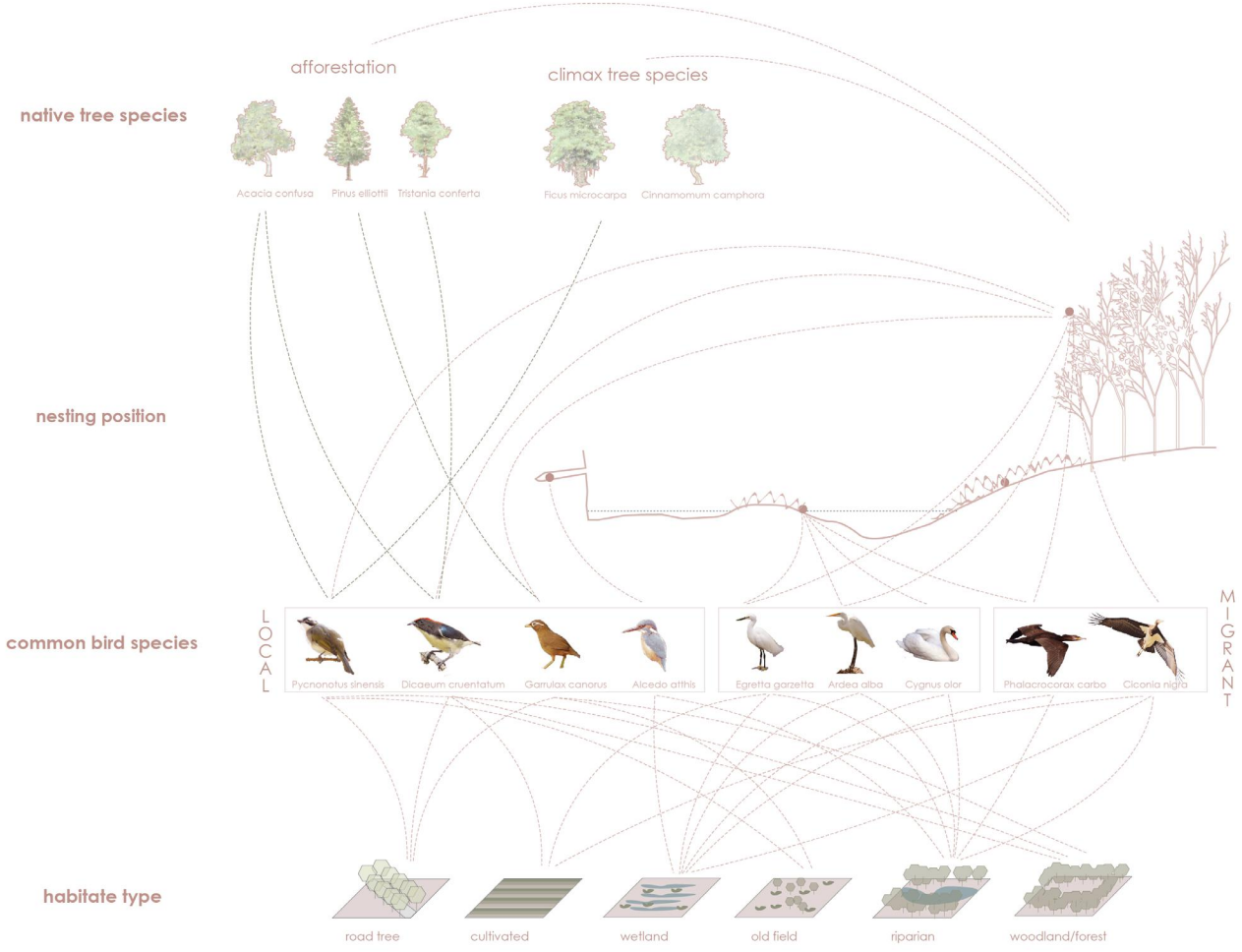
The essential role that birds can provide is to clarify important ecological concerns and variables that not only will help to sustain bird populations but also will contribute to the long-term health of the forest for all species, including humans. (G. Niemi, 1998)

Therefore, I use birds as an important means to test ecological value.
I reviewed some common local and migrant birds of Shenzhen and summarized some habitats that they would often appear.

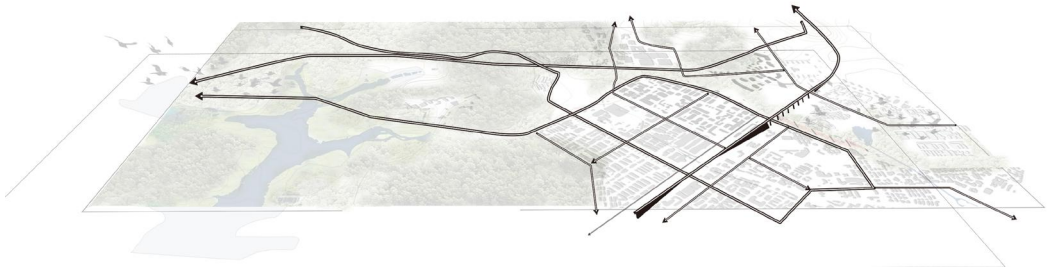
At the same time, in space, each bird has different space for nesting, so designing a variety of spatial forms and enriching plant levels are also quite vital. Moreover, Shenzhen is a coastal city with the rainy and warm weather, so it can be seen that there are many waterbirds in Shenzhen, which means, water is a very important factor to influence the living environment of birds. Therefore, when meeting the area which is close to water space, it is necessary to leave room for this flora and fauna.

Except for that, I also collect some information about the tree species. Using native tree species is also an important design principle. I have a research of two common native tree species: a fast-growing tree that is commonly used for afforestation and a native species that reaches the climax.

Then I built a framework for four-factor: native tree species, nesting position, common bird species and habitat type, which may become the detailed design reference in the future local design.



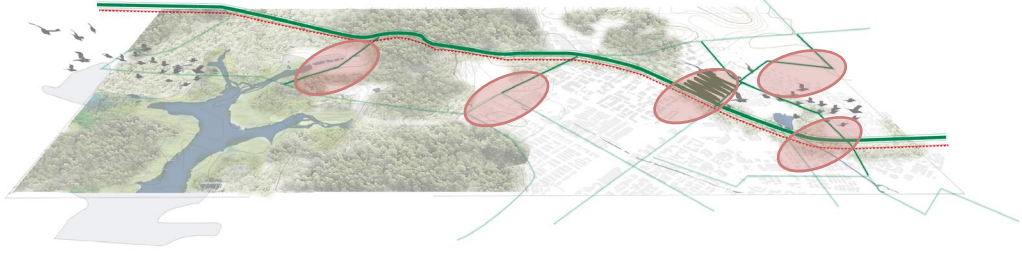
04.04 Cycling with Culture
principle & structure



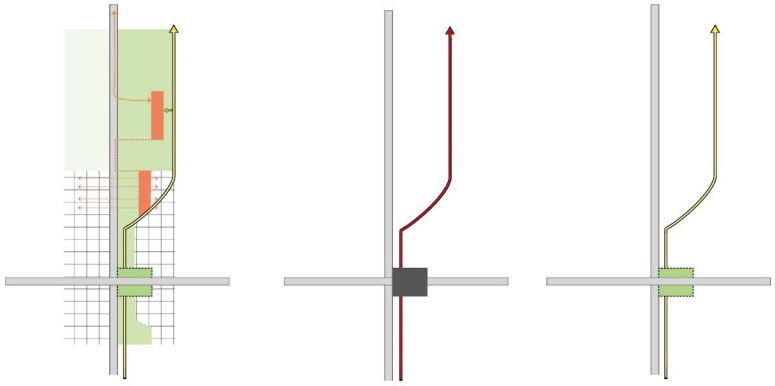
create the no-car zone

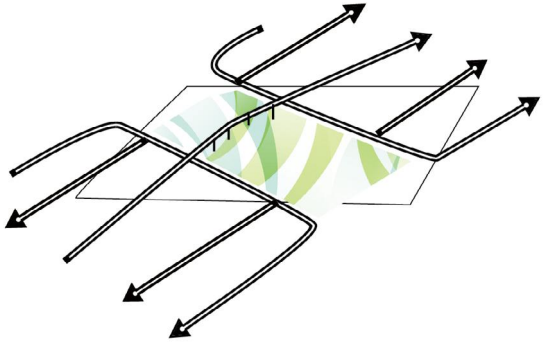
get rid of repeatable vehicle road along the fence

transform grey infrastracture to green; link greenway



the design area for choosing





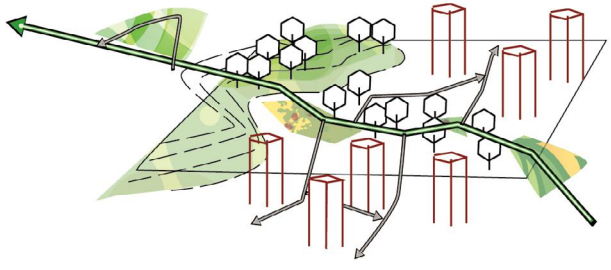
divide vehicle and pedestrian road

Cycling with Culture

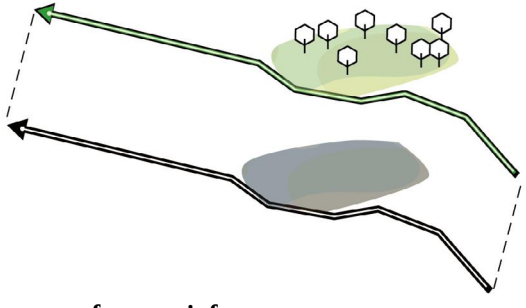
1) Maintain the original car-free environment

2) Replace one parallel vehicle road with bicycle lanes

3) Transform with redundant space where checkpoints bring to create a historic atmosphere



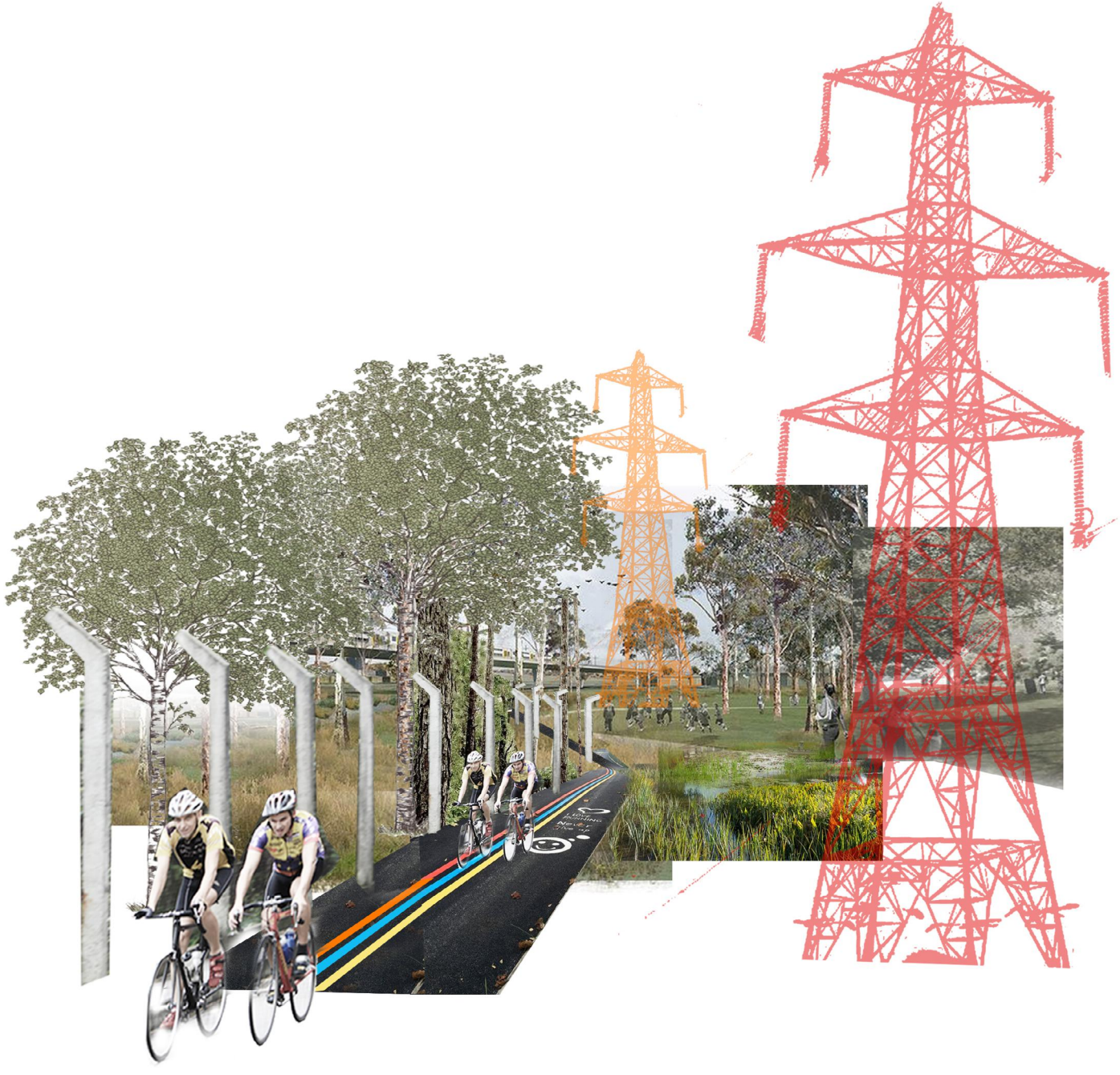
emphasize the cultural thematic route



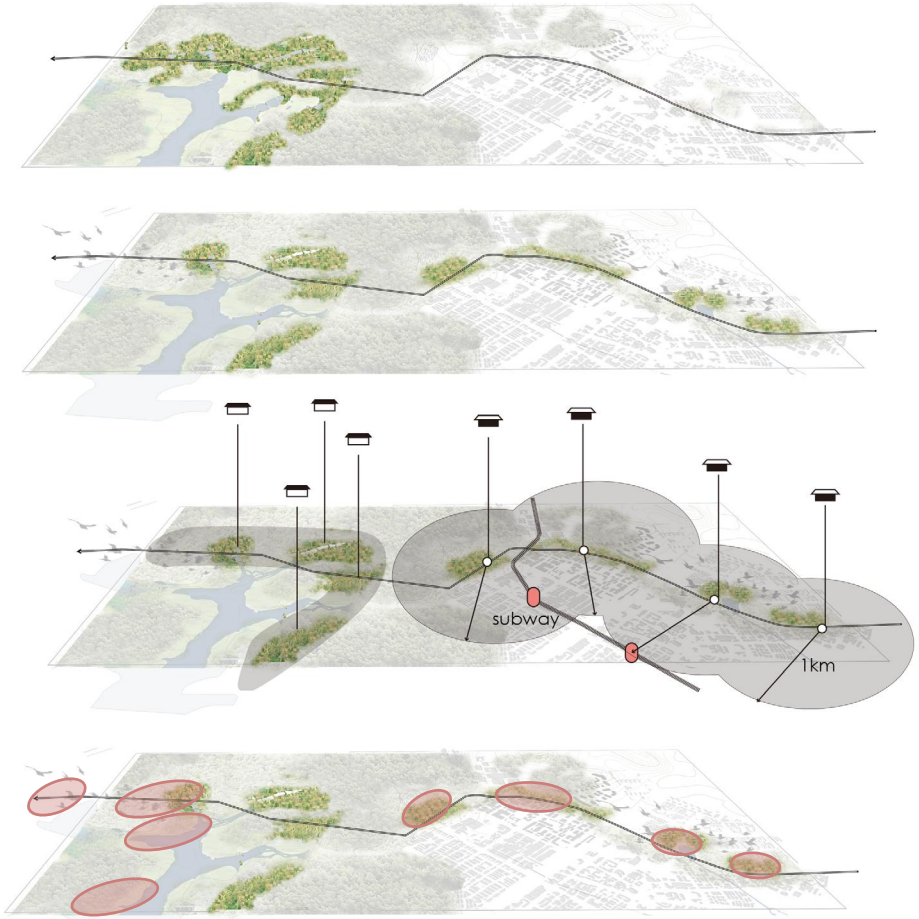
transfer grey infrastrature to green

04.04 'Cycling with Culture'

vision



04.05 Food Revolution
principle & structure

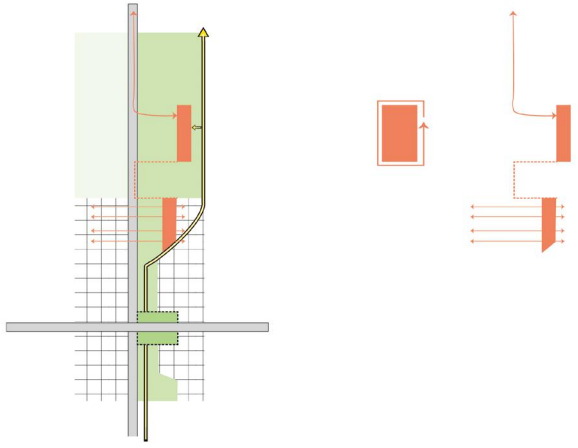


existing cultivated area

transfer tthe over-cultivated area into urban

connect food industry with current situation

the design area for choosing

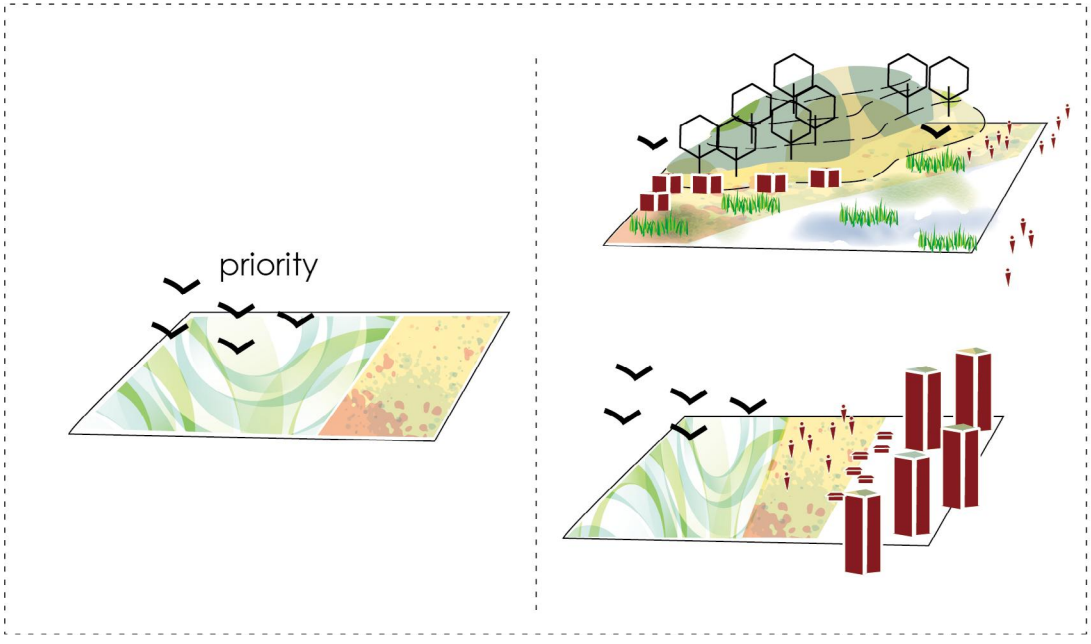


Food Revolution

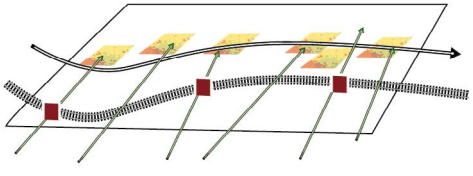
1) Give priority for ecological link
Under the premise of leaving enough room for an ecological wedge, creating a more sustainable productive landscape. Then in the natural-sensitive area, return over-occupied farmland, and combine with farm and nature, forming 'agritourism' industry. In the urban gap area, facing the needs of manufacturing industrial transformation, release some farmlands to the urban area, and set the function, 'food market,' to promote economic development and provide new job opportunities to the worker.

2) Create greenways for neighborhood

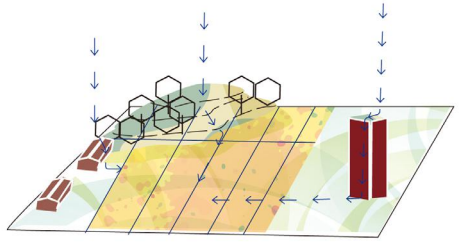
3) Collecting grey water and rainwater for irrigation



Give priority for ecological link



Create greenways for neighborhood



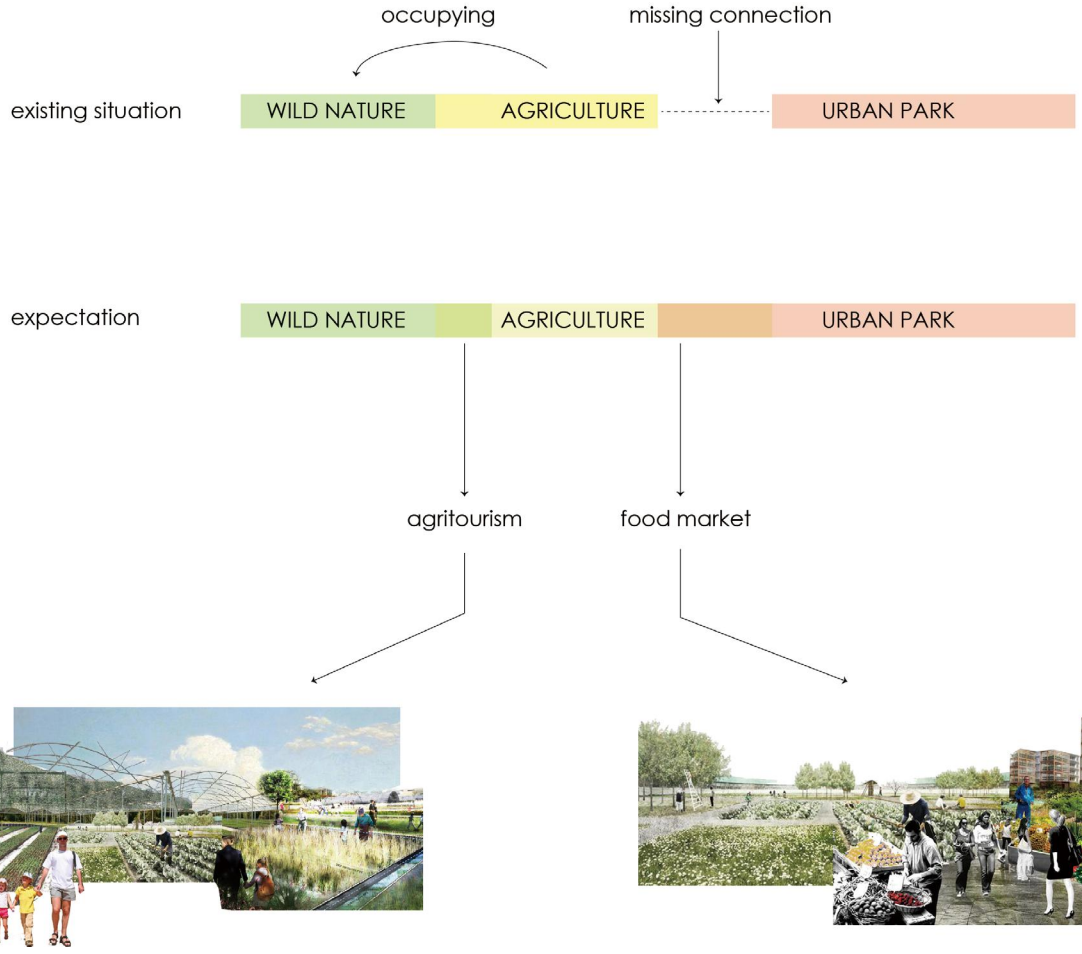
Collecting grey water and rainwater for irrigation

04.05.01
Setting new programm in food hubs

The food produced in the agri-tourism area, firstly, should satisfy resident's self-sufficient. And then, because of it close to the wild nature, and not far away from the city, that means, it has potential tourists and citizens.

So developing a beautiful, productive landscape can attract customers to visit there and experience the farming work. What's more, family hotel for visitors can keep them stay longer. and extra food product can transport to the nearby food market, then sell to surrounding neighbourhood

So two detailed system structure can be introduced into the design:



04.05.02 Sustainable food circulation in rural area

FOOD

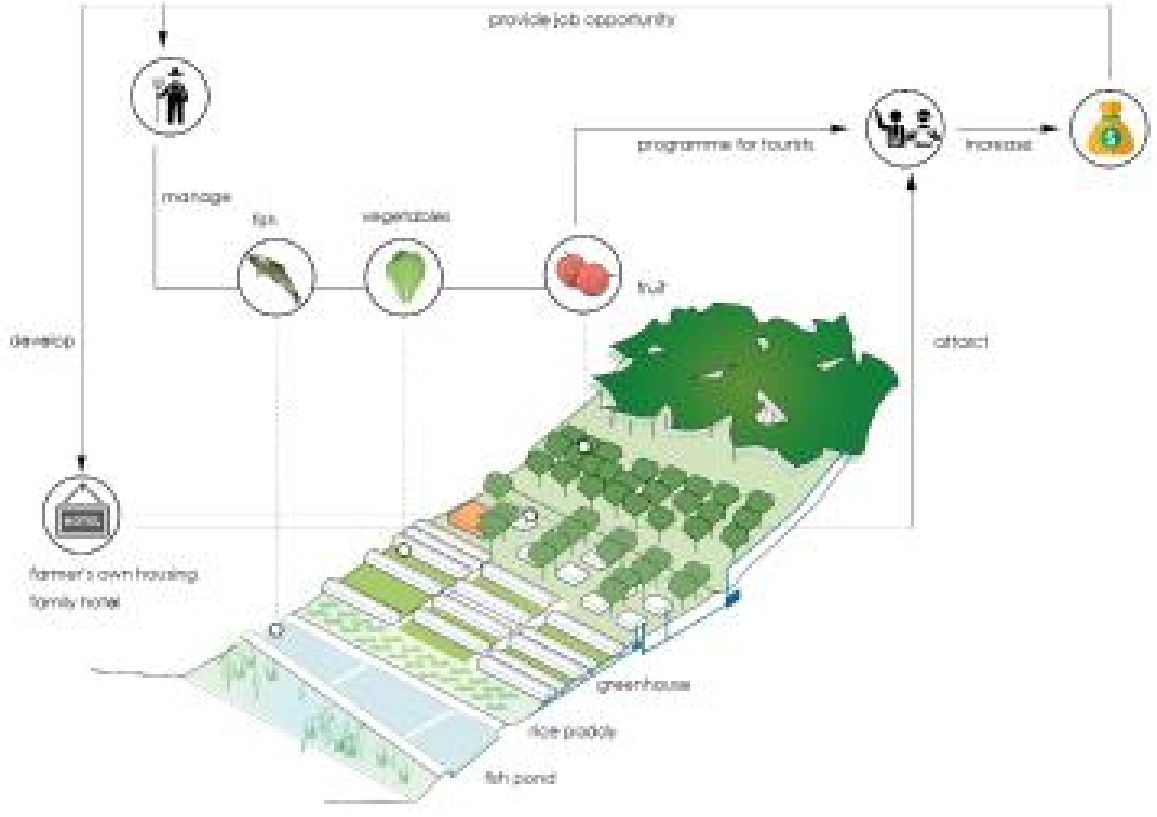
We can realize the sustainable circulation from mulberry trees, using the leaves to raise the silkworms, and its excretion fertilizes the fish ponds. Then using the fishing program, picking fresh fruits and vegetation to attract people come there and also those food products can be used for the family hotel.

SUSTAINABLE WATER MANAGEMENT

The rainwater, runoffs on the hillside and the grey water in farmer's house, irrigation water and fish ponds need to be considered into management, realizing the sustainable development

ECONOMY

As cultivated lands invade nature, most of the land needs to return to ecologically sensitive areas. However, this measurement dramatically affects the interests of local farmers and landowners. However, because there are some rural bicycle roads and provincial parks nearby, it is possible to upgrade sole agriculture industry to agritourism by using Airbnb-style accommodation and new recreational programms to gain new incomes.



04.05.03 Sustainable food circulation in urban area

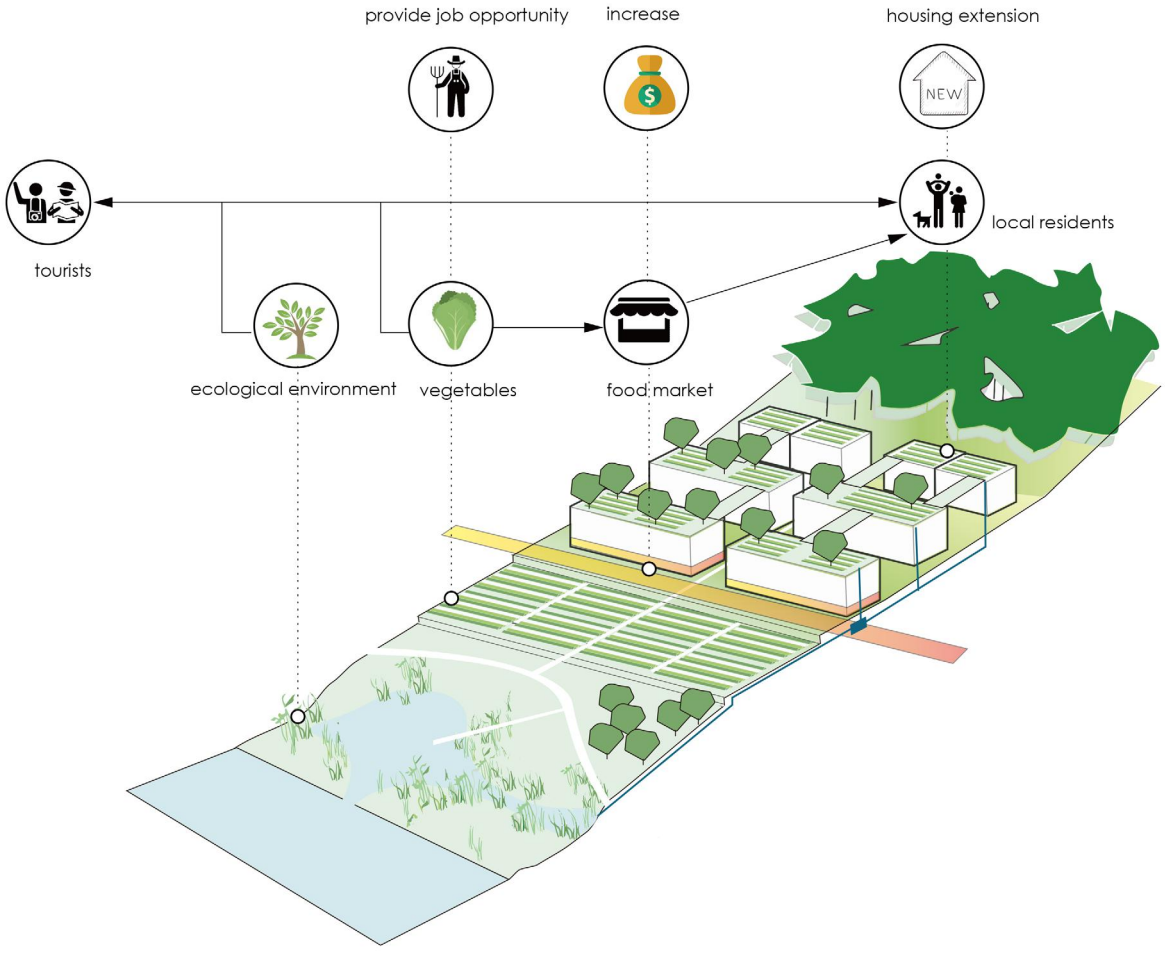
SUSTAINABLE WATER MANAGEMENT

The rainwater, runoffs on the hillside and the grey water in residents' house, irrigation water and ecological wetlands need to be considered into management, realizing the sustainable development.

ECONOMY

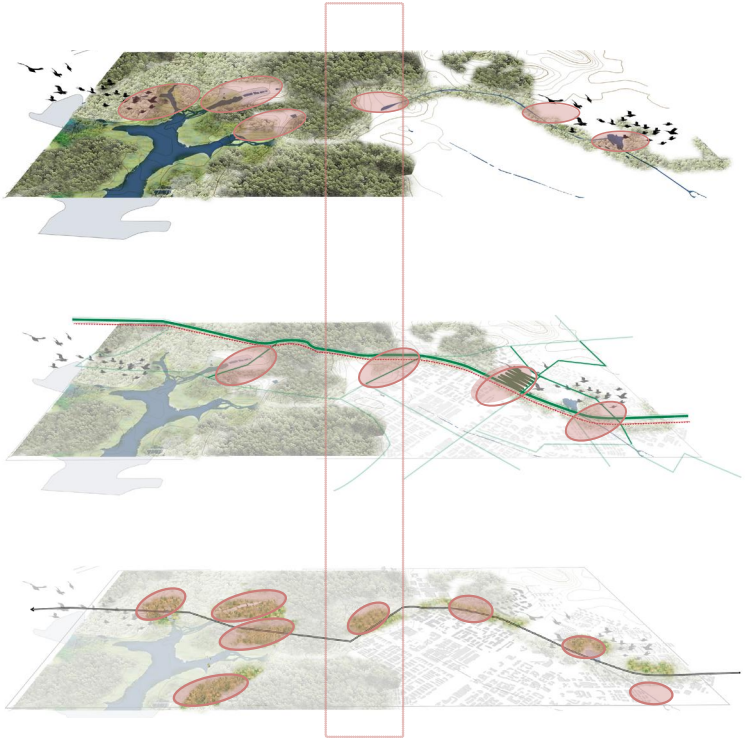
- When the cultivated land enters the city, it is possible to use the vacant space in the urban area or some manufacturing factories that need to be updated. However, this will inevitably lead to the loss of people's unemployment, so new industries such as the food market and new occupations brought by food can be provided to those workers.

- When the environment becomes better, new investment will come behind. Some area will attract housing extension project. So for the new house typology, we need to introduce roof garden to ensure the number of cultivated land.

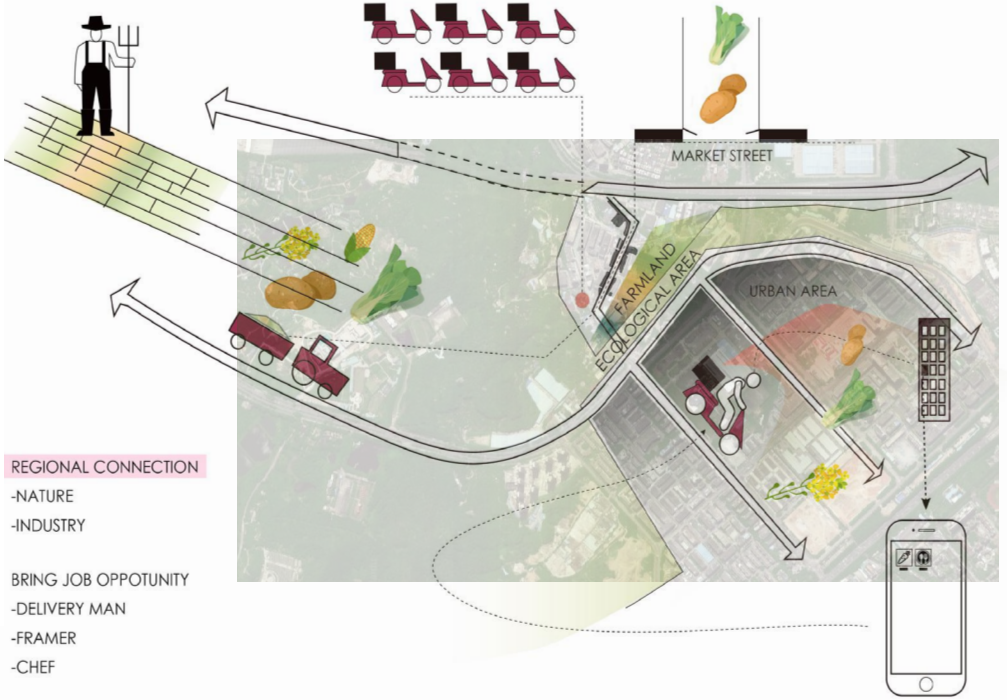


5 DESIGN APPLICATION

05.01 Site choosing



05.02 Requirement & Site Advantages



REGIONAL CONNECTION
-NATURE
-INDUSTRY

BRING JOB OPPOTUNITY
-DELIVERY MAN
-FRAMER
-CHEF

I chose the place that needs to be transformed into the three layers. This area shows extreme complexity where green, blue and transportation three infrastructure involved in, and also it is a food hub where can be regarded as a test site for industrial transformation. Moreover, it is still the area where the vehicle road passes along the fence, so it also takes cultural into consideration. So for such a complex demand, I will give the most detailed explanation of this site.

The site locates at the edge of the urban environment, full of the chaotic and vacant area. The reason why is so chaotic, because it is the area closing to the fast lane, so the city is used to gather lots of cheap manufacturing plants, temporary houses, and also some existing vacant space. Although it is near the canal, the canal is channelized seriously.

Under the large-scale regional planning, we know that this area needs to leave space in the ecological area and increase cultivated land to relief the environmental burden on environmentally sensitive areas. Meanwhile, from culture aspect, the fence also go through this area, how to integrate the road along the line also need to be considered.

The potential has three:

1) In the ecology aspects, the disorder and vacant areas provide some spaces to recovery ecology, hoping from establishing an ecological area to improve the environmental quality, attracting more people to come rather than ignoring. The high-quality environment also can draw investment's attention in the future.

2) As for the productive landscape, it needs to take the responsibility to increase cultivated land to relieve the pressure of ecological area.

a. With the help of the existing shopping street, establishing the pedestrian-priority environment for the neighbors to the shopping hubs, thereby increasing more social interactions.

b. More intervention like, creating new apps that can extend the selling distance, so that gives a chance for more people to contact the fresh food and also bring some new job opportunity to local people and encourage people to replace the old one.

We expect the setting of the food market, to change the current manufactory industry structure, help people who used to provide cheap labor, engaging into the industry related to the farmland, like the farmer, the chef even the delivery man.

3) For cultural interface, the vehicle road along the fence need to change to the greenway, connecting to the surrounding area to form the system.

05.03
building texture
&
potential development space

According to the current building fabric, getting rid of the temporary or poor-quality and low-rise houses and factory, leave the retained texture. Add some new building to increase the continuity, and also for providing the high-quality home for residents who used to live in the low-quality dwellings.

1 CURRENT SITUATION

2 RETAINED TEXTURE

3 INCREMENT OF CONTINUITY

4 FINAL SITUATION

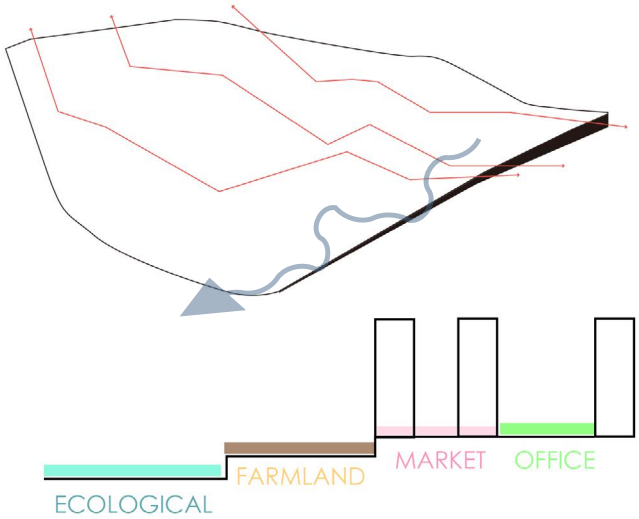
05.04.01
Setting Boundary & Function

Because it is on the gentle hillside, so I set the boundary according to the contour line for later water management.

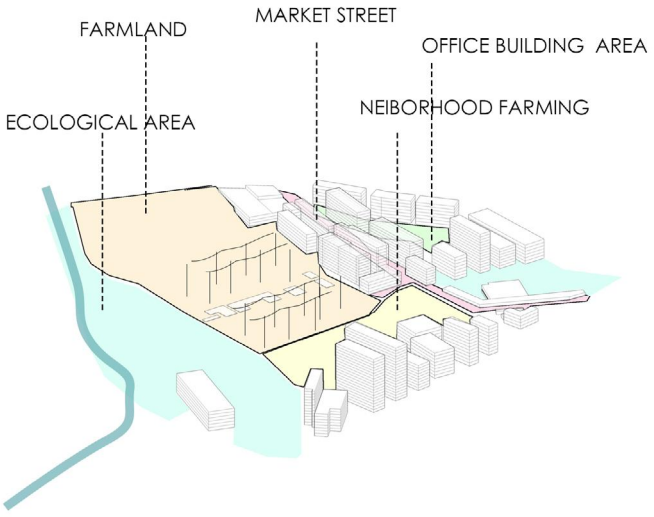
From high to low, it has four central functional area. Except for the existing manufactory plants and some resident building, the urban area still has sizeable vacant space where the temporary or poor-quality and low-rise houses and factory used to locate. Based on large-scale requirement, these areas will change to the farmland and ecological zone.

SETTING BOUNDARY

-WATER MANAGEMENT

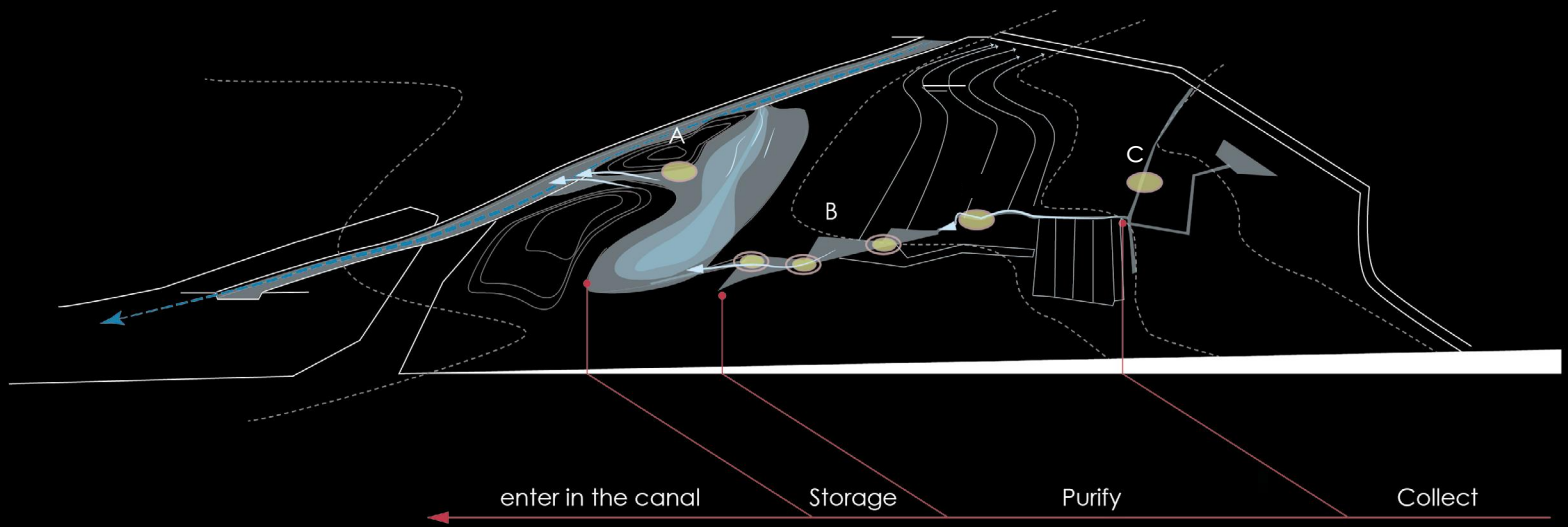


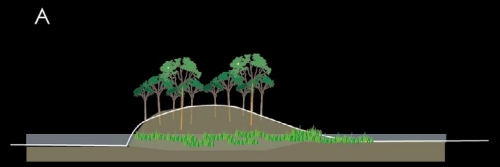
FUNCTION

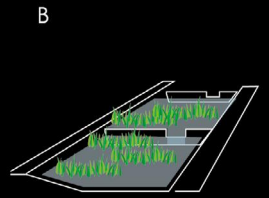


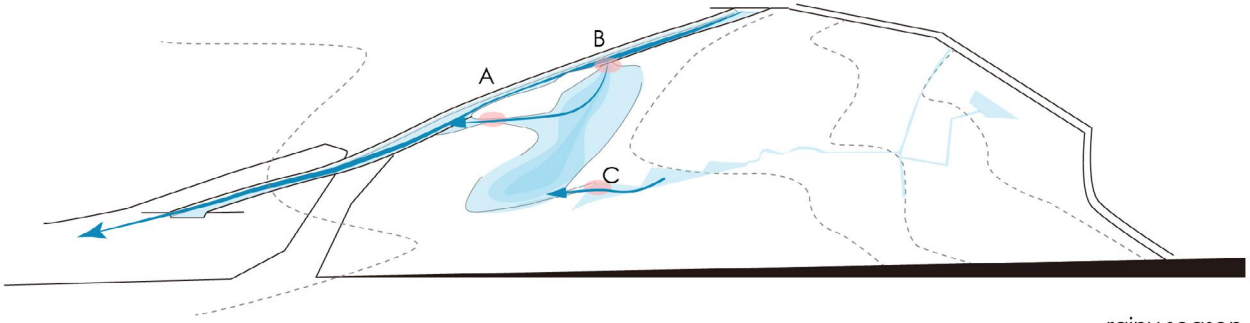
05.04.02
Water Management

From high to low, we collect the water from the building area, purifying through the agriculture area, and store in the lowland, and then entering in the canal. And then the water concerntrate at the low land, can use for agriculture irragation.The water collect at the low land, can apply for agriculture irragation, also can deal with some extremely weather.

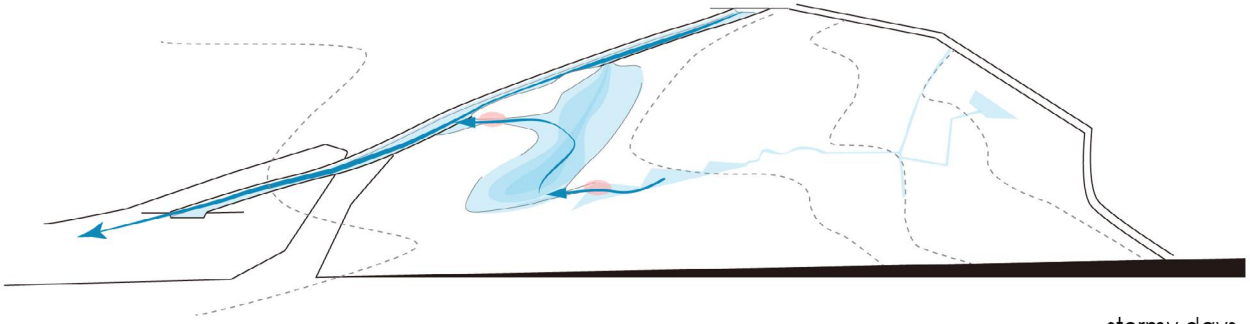




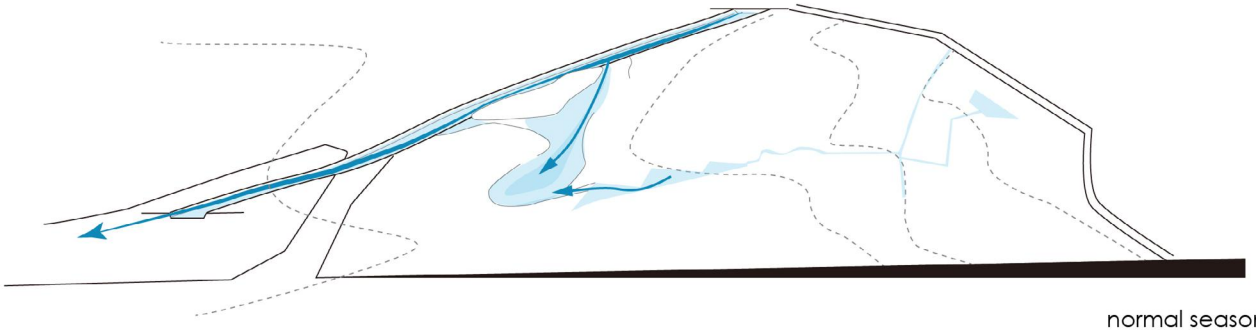




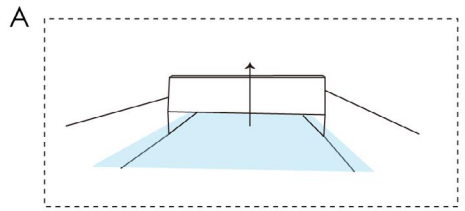
rainy season

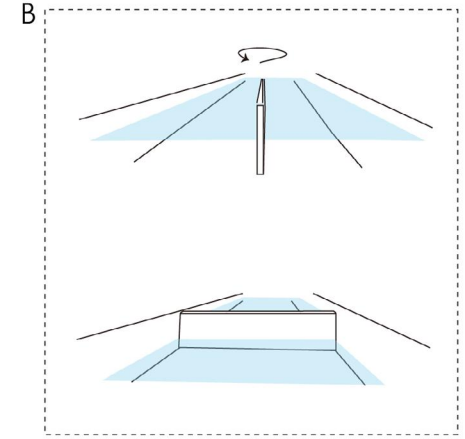


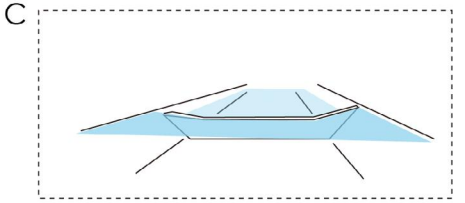
stormy days



normal season







05.05 Physical Connection

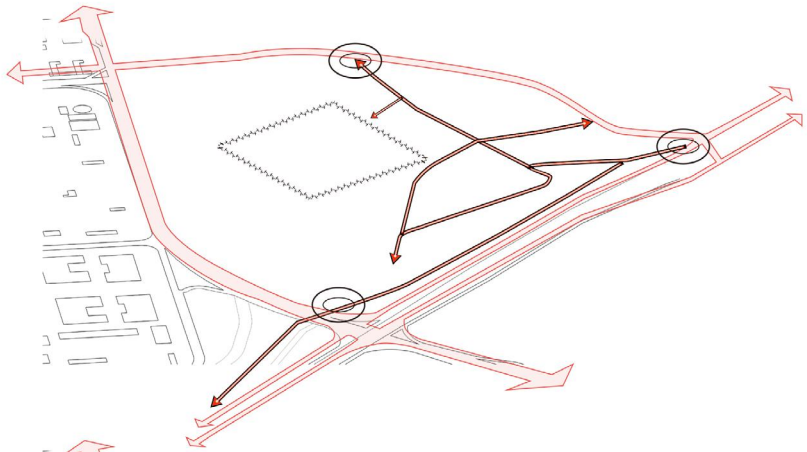
All the road in the site are vehicle road, so here i introduce the pedestrian and vehicle dividing system, except for vehicle road at the edge, only leave one vehicle road for residential area. the others using pedestrian road to instead.

PHYSICAL CONNECTION

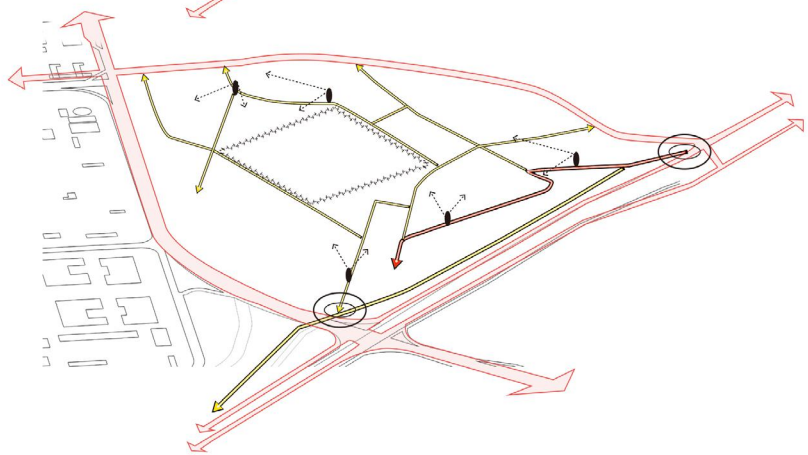
-PEDESTRIAN-AND-VEHICLE DIVIDING SYSTEM

-VIEW CONNECTION

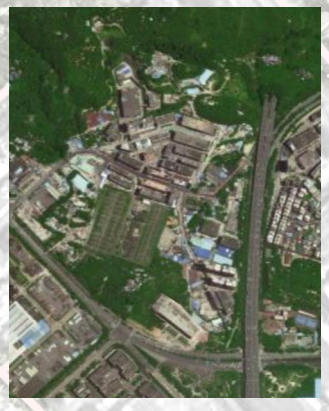
BEFORE

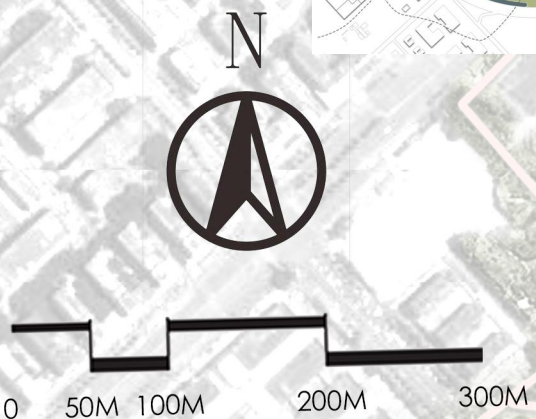


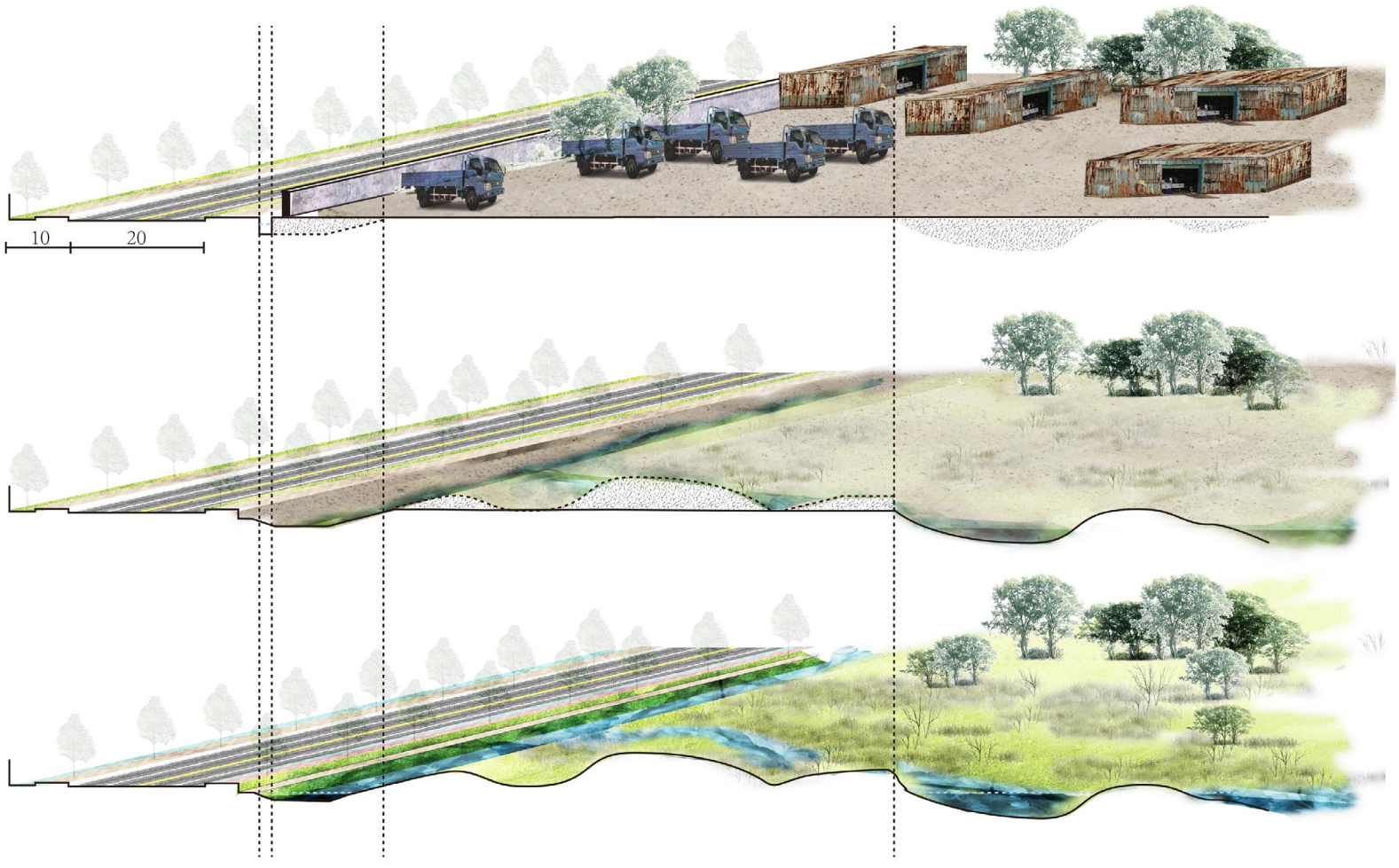
AFTER



05.06 Phasing



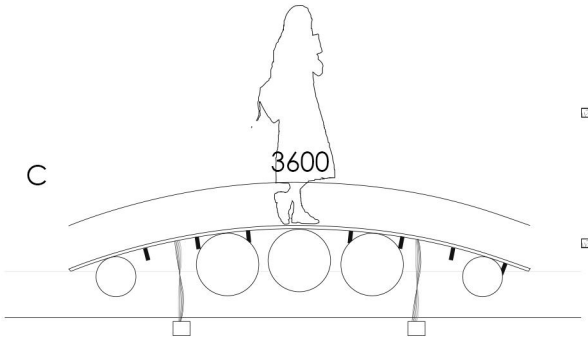


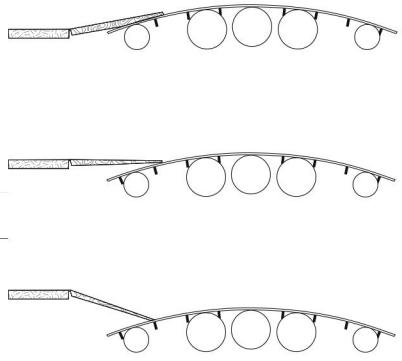


05.07.01
Habitate in Ecological Zone

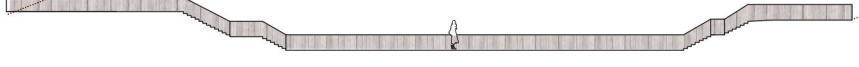
In the ecological area, the current situation is the site gather lots of poor houses and logistic car parking area, and also the river was canalized.

I extend the canal capacity and turn the hard bank to soft, then build the the microtopography and also use the water to improve the bio-diversity. Then waiting for the nature succession take place in this area.


C
3600

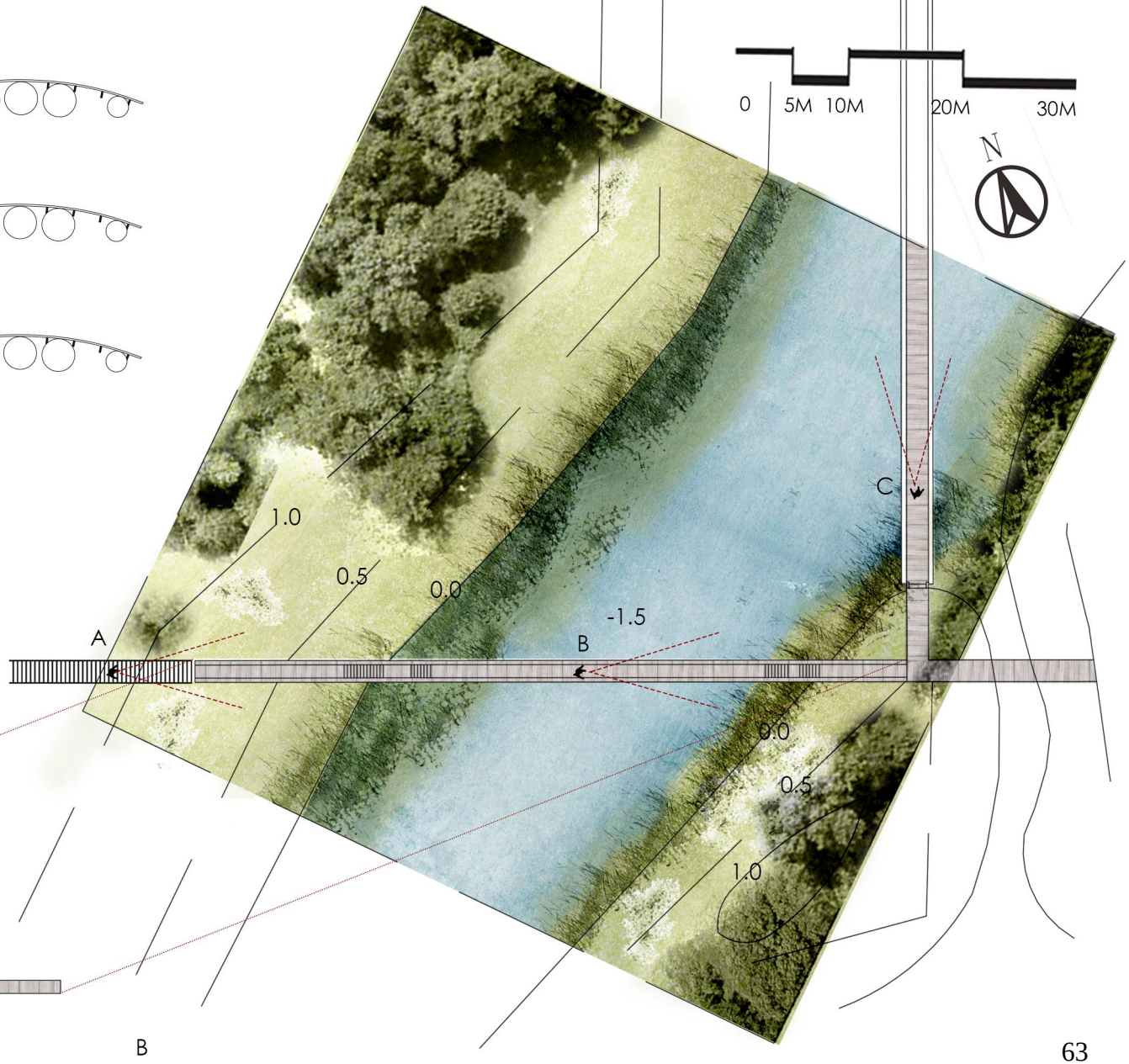



A


B

0
5M
10M
20M
30M

N


1.0
0.5
0.0
-1.5
A
B
C
0.0
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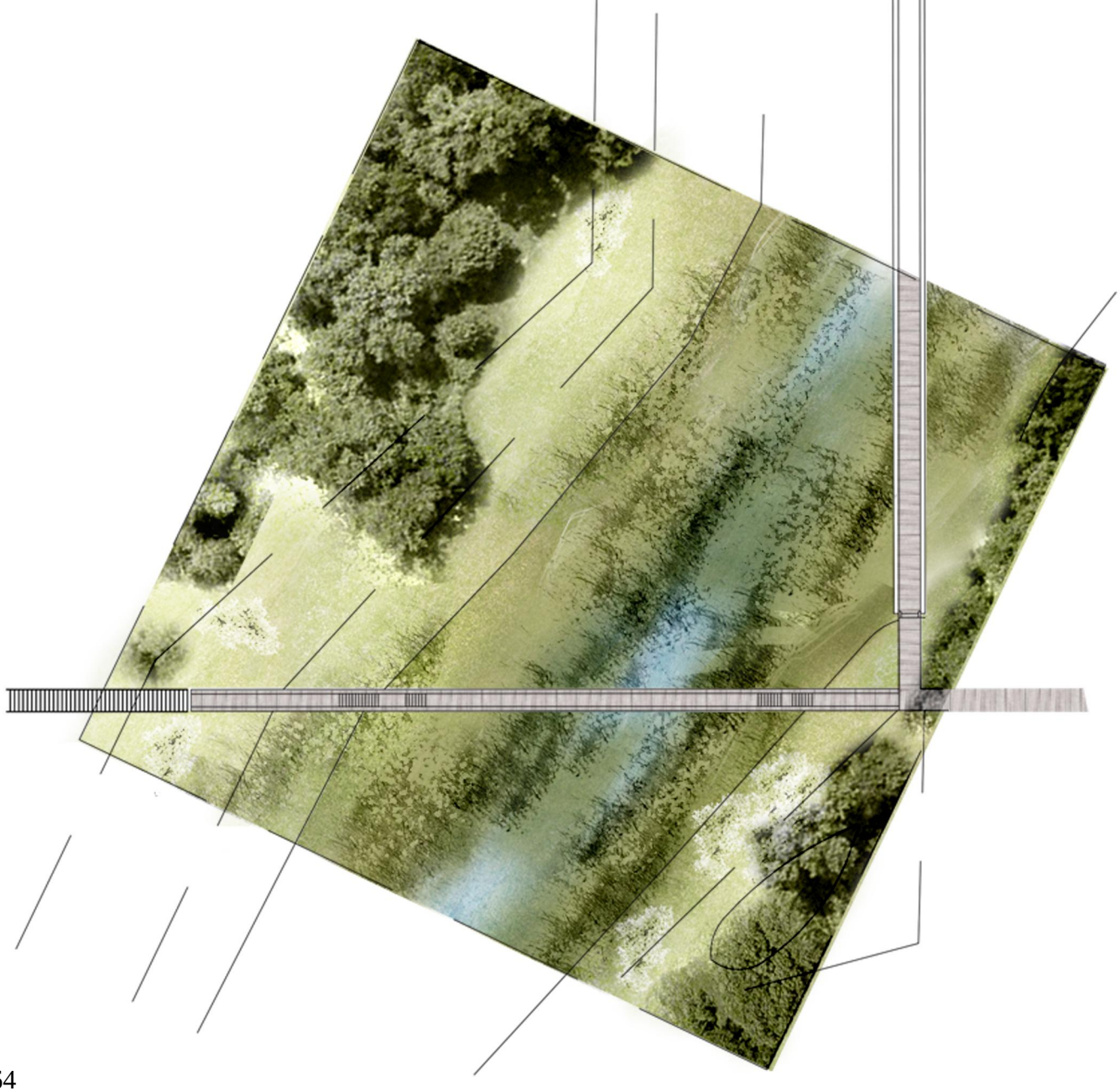
1.0



05.07.02
Dynamic Water Level

Shenzhen enjoys an abundant rainfall, faces highly risk of the rainstorm in the summer but have less rain in winter. Therefore, in different seasons, the lowland areas of the site will show dynamic water level, resulting in different spatial quality.

Except for creating more habitats, it is also important to consider that the ecological environment should make people experience dynamic nature better, and provide space to interact closer with water. So in the lowland meadow area, weathering steel constitute path so that people can directly feel the natural grass, while not affecting the ecological restorations in other areas.In the B area, people can get an unusual perspective to observe the natural and water changes by using a sinking bridge. Other areas use floating bridges to connect without affecting accessibility.

Perspective from Location A

Other Season

Rainy Season

Perspective from Location B

Other Season

Rainy Season

Perspective from Location C

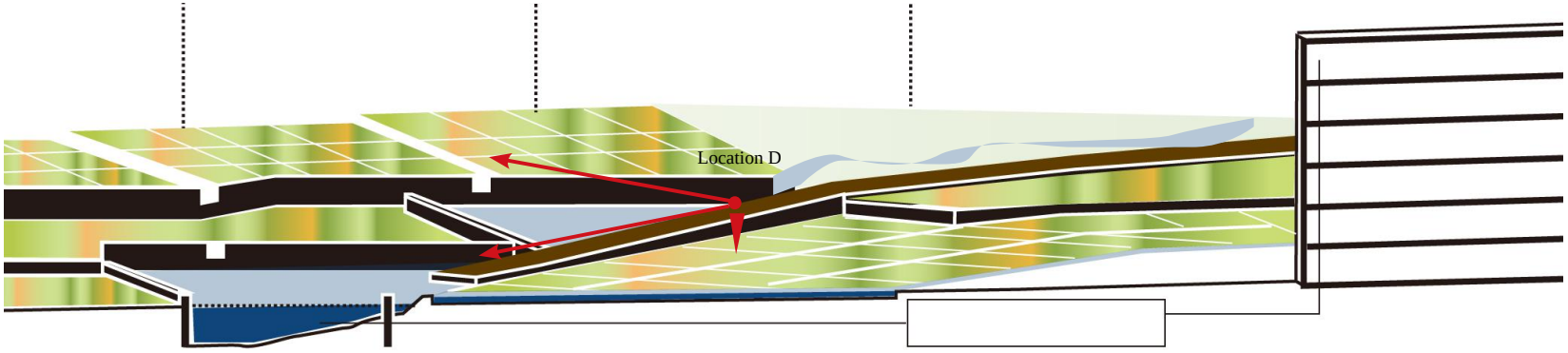
Other Season

Rainy Season

05.08
Farmland Zone

Some of the irrigation water comes from the grey water in the surrounding houses. After purification, these water enter into the ditches. These farmland are managed by specialized farmers, so some jobs can be provided for the unemployed workers in the past manufacturing plants. Also, residents are encouraged to rent the farmland or buy the crops from the farmland. Under this conditions, space can be created for more social interactions while working.

Neighborhood farming is not just about providing crops. Also, it is also a place for children to perceive the outside world. The residential community can carry out some workshops to encourage children to own their botanical gardens and recognize crops. In the past, there is a tremendous amount of abandoned areas or traffic spaces. However, now the environment will be more attractive. The local people are more willing to come out to social and experience their surrounding environment.



A-A'

Perspective from Location D

Purification plants

Juncus effusus

Phragmites australis

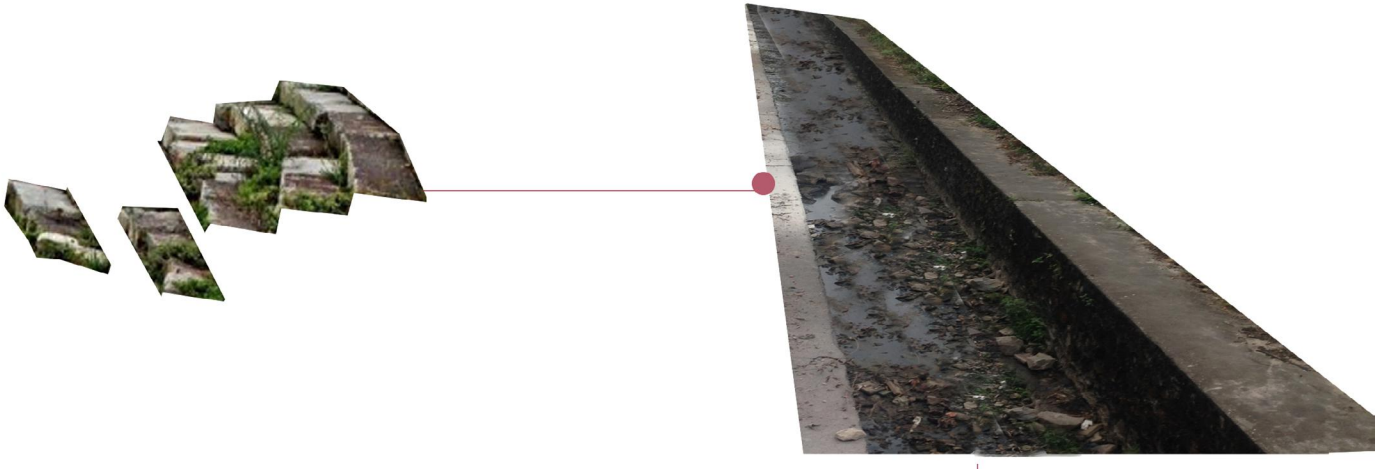
Thalia dealbata

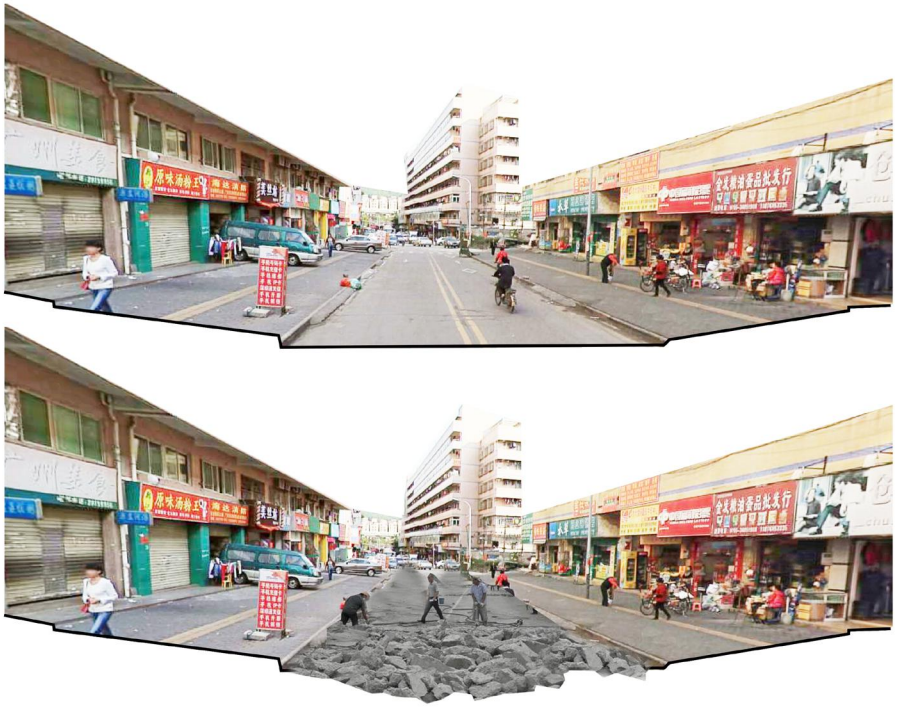
Cyperus alternifolius L. subsp. flabelliformis (Rottb.) KüKenth.

Material Reuse

Using purification ponds purify rain and grey water to imitate the wetland process, reduce the Nitrogen and Phosphorus content in the water. Also, this measurement can educate and spread ecological purification knowledge to neighborhood, make the rainwater purification processes are visualized readable.

The construction process is also a re-design process. Because in the ecological area, we change canal's bank from hard to soft, the material of hard bank can reuse to this area, for setting the boundary.





05.09
Food Market

The left first image is the current situation in market street. You can see the water pipe drain the water to the ground directly. You can still see the water stains in the picture. Some shopfronts are vacant.

The first step is to demolish the vehicle road and reuse those brick as the new materials.

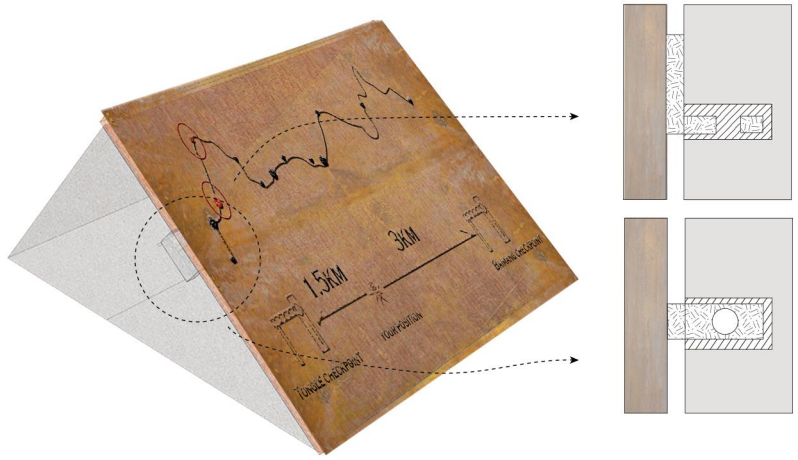
Using the green area instead of the vehicle road, increase the street trees,
drain the water to the grass then using the pipe to the middle green area. And use permeable pavement take place the old one.

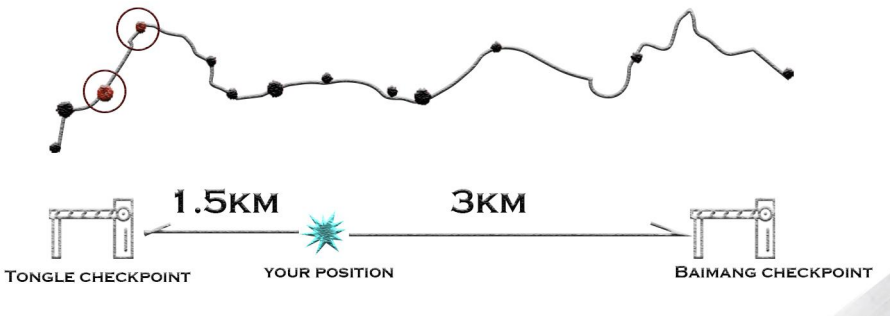
Using the abandoned brick as the bridge connect two sides, and change the vacant shop to sell the fresh food products

05.10.01
Cycling with culture

When Facing the requirement of ’cycling with culture‘, except for changing the patrolling road to the greenway, this area also need to connect with the ecological zone, so I use the steel grating so that, won’t influence the ecology succession and also, people can perceive the underneath plants while walking or cycling.

To build the cultural thematic routes, open part of the fence and reuse the fence material to emphasise the cultural connection. Also, signage on weathering steel can let people know their position in the past boundary line, and How far are they from the nearby checkpoints.





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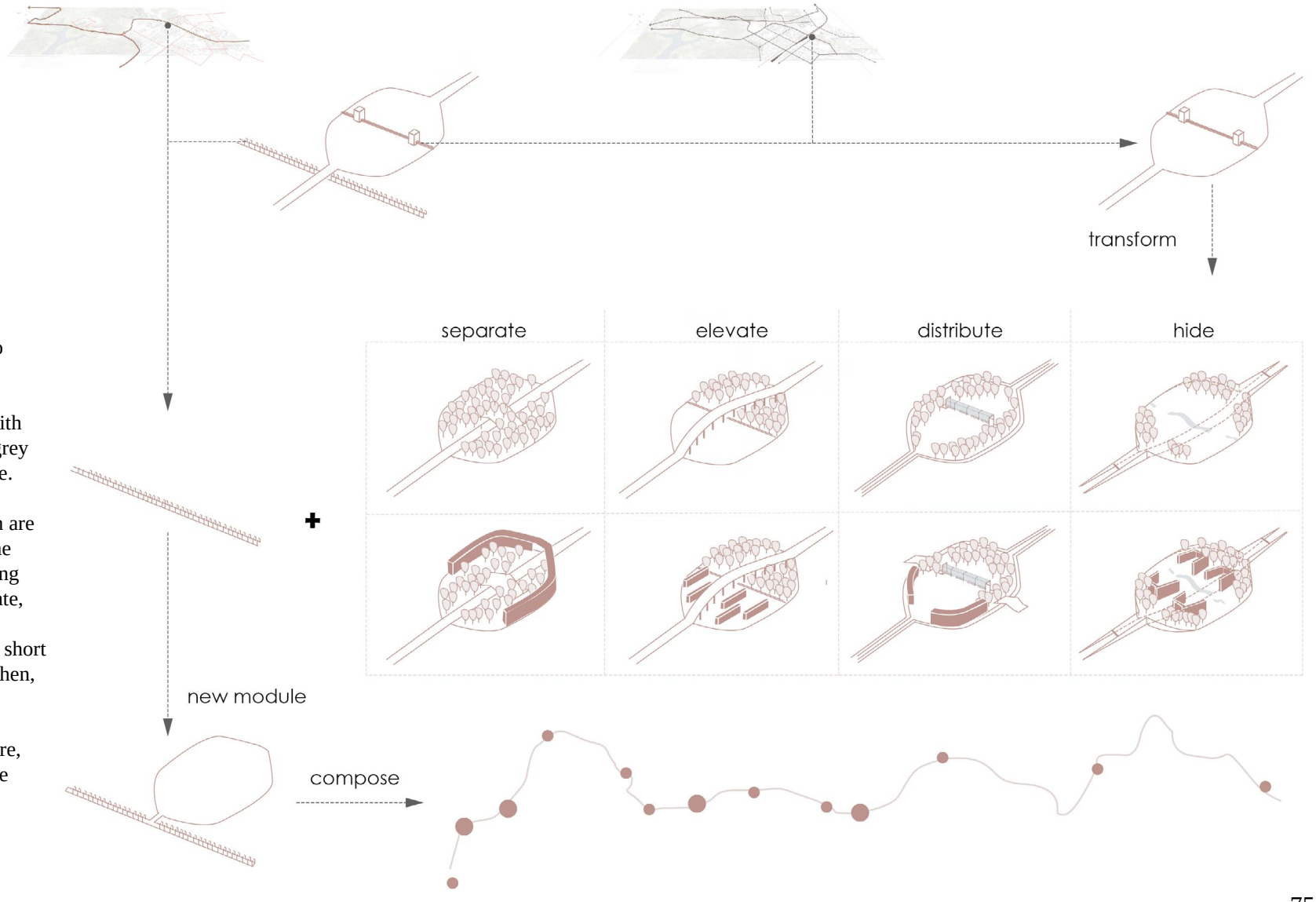
05.10.02
Checkpoints

Checkpoints on this cultural line is also a interesting points to design. But due to the uncertainty of the checkpoints' surrounding environment, I come up with some typologies for turning this huge grey infrastructure to the green infrastructure.

Here are eight typologies. Four of them are discuss spatial relationships between the highway and extra vacant space, dividing into four spatial quality: separate, elevate, distribute and hide. Because with the development of urbanisation as well as short supply of urban land property in Shenzhen, The other four typologies add the layer of housing extension.So this patrolling greenway with those green infrastructure, can make the 84kilometres area become lively.



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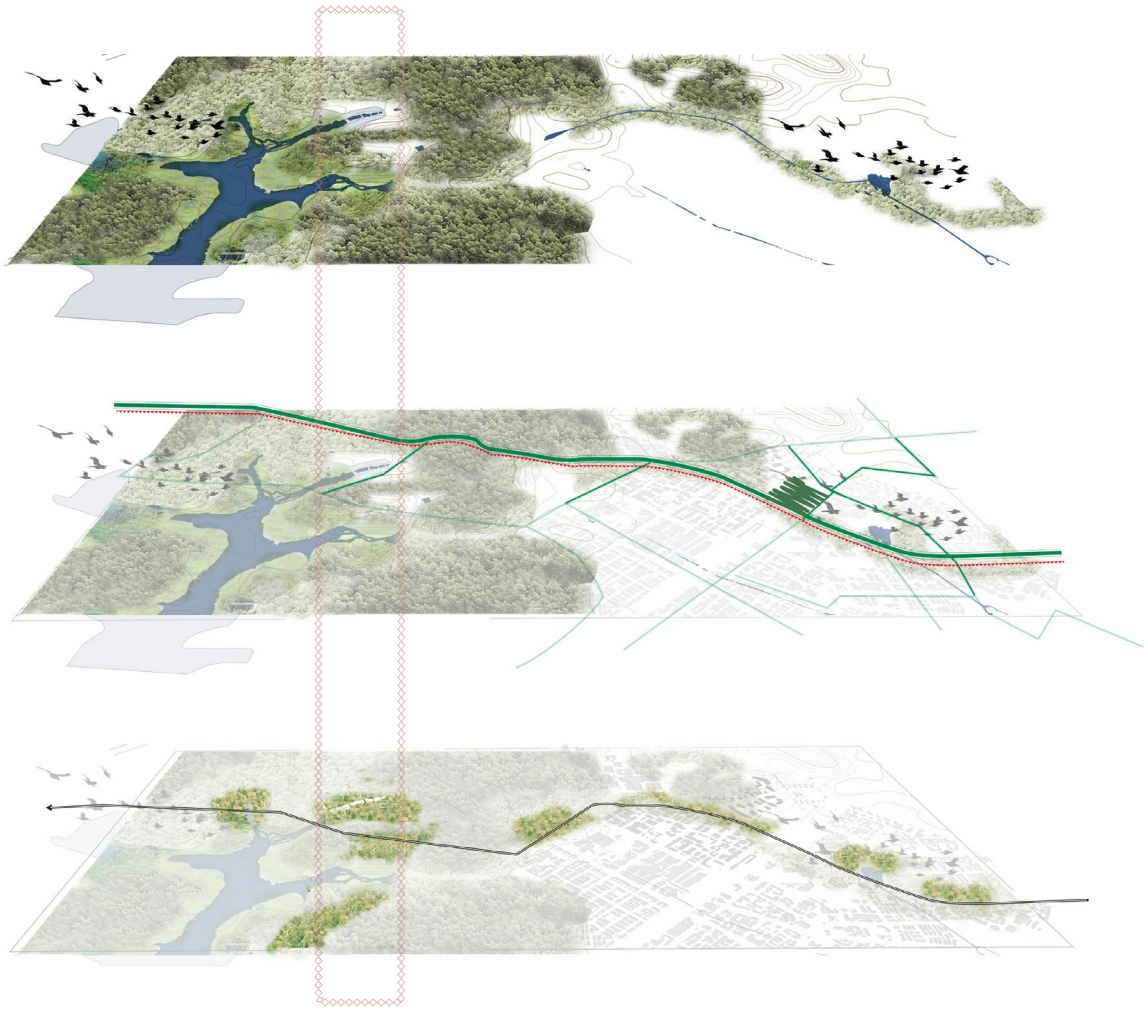
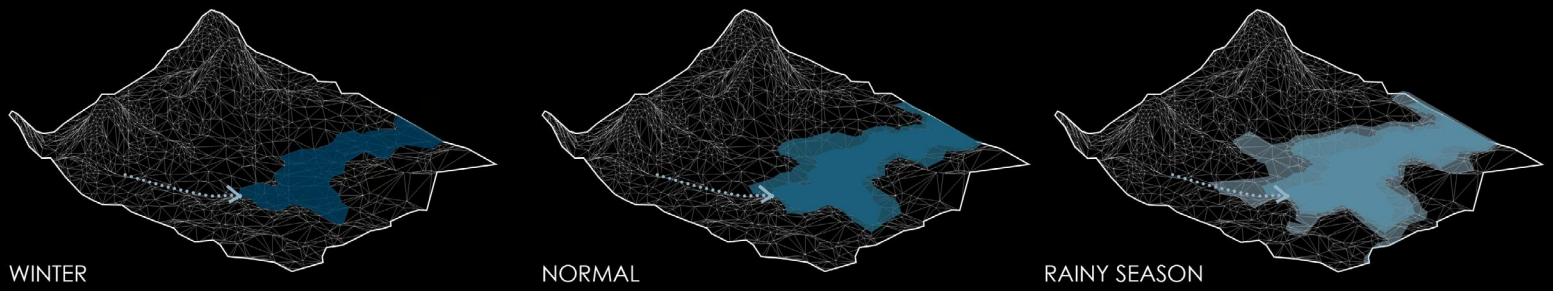
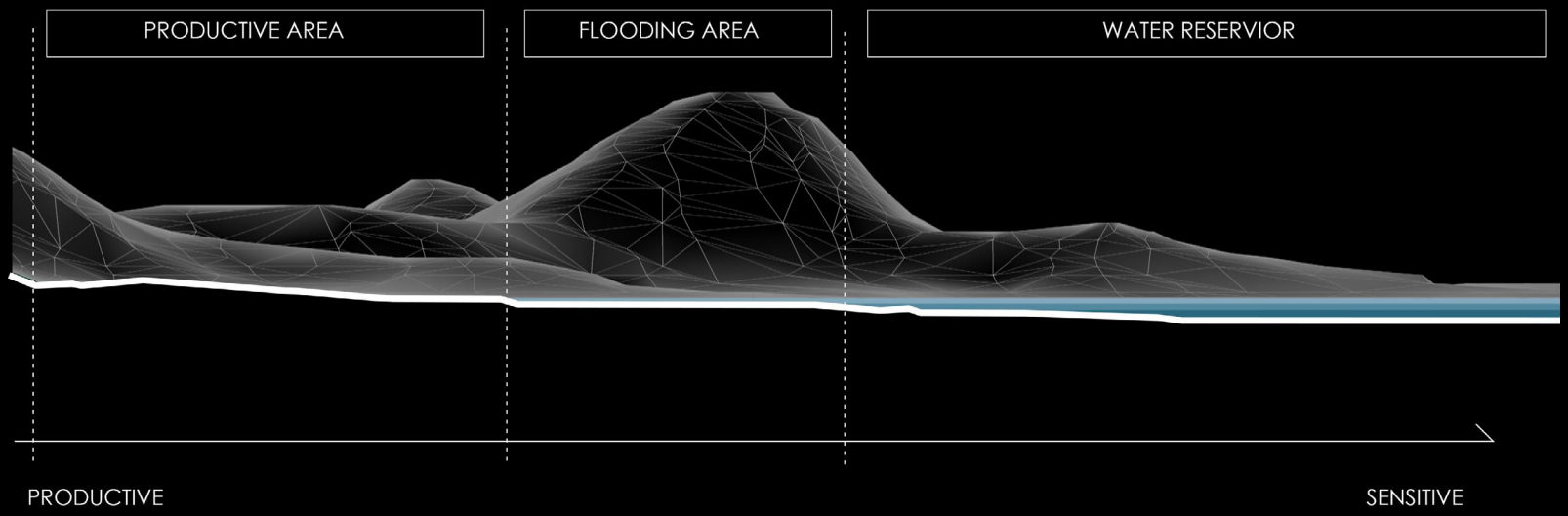
05.11.01 Testing feasibility

Becasue the farmland will replace some poor manufacturing plants. However, this will inevitably lead to some people losing job, so this site are expected to active the new industry and also provide new job opptunities. Except for the need of farmer, more job opportunity like deliveryman and chef are needed after creating food ordering apps.

Another challenge need to consider, because , in order to enhance the ecological structure some farmland was return back to the ecological successions. But some local farmers are living on this farmland. So here I build a new development model to response to the challenge, because this area near the wild nature bring lots of tourists, which means, it is possible to upgrade agriculture industry to agritourism by using Airbnb-style accommodation and new recreational programs. To test its feasibility, I have a quick design experiment.

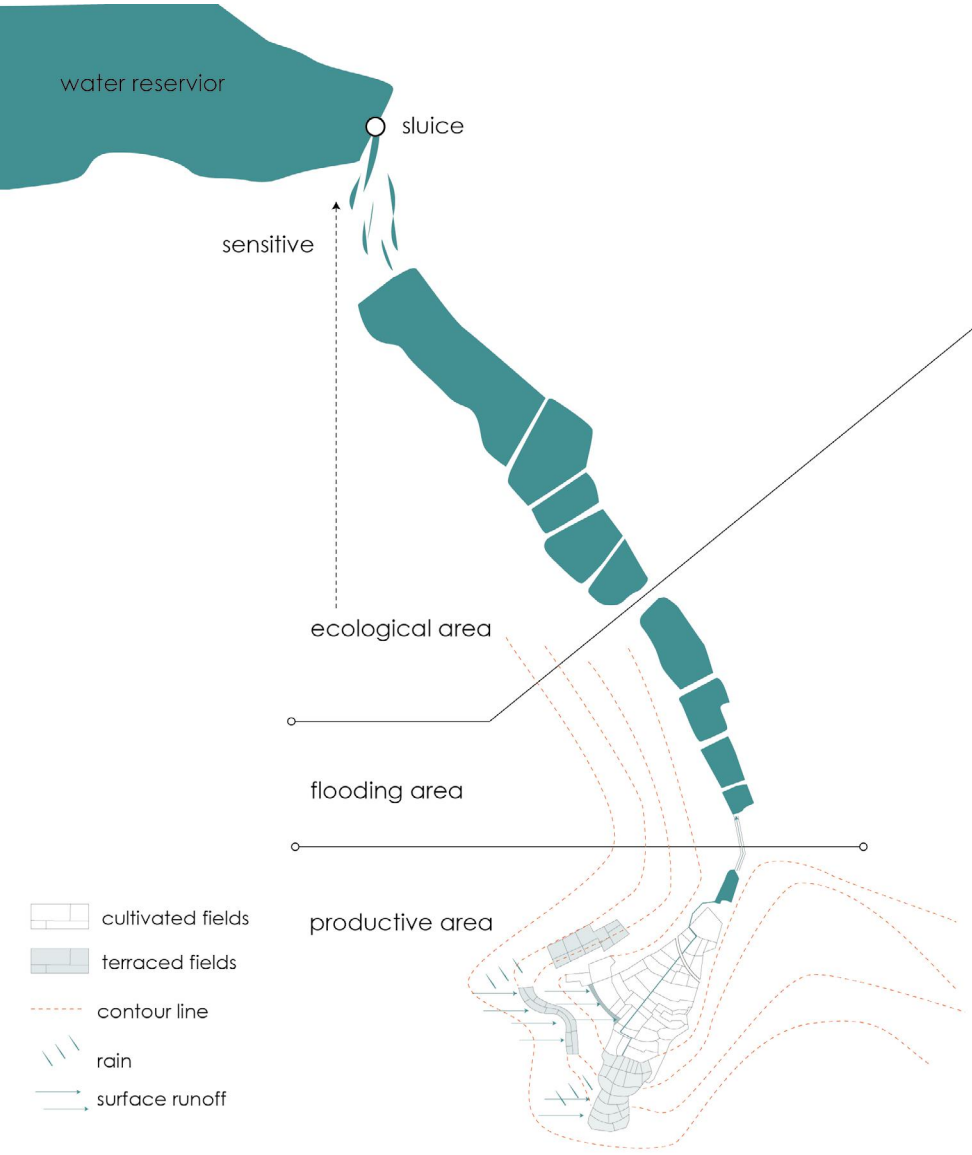


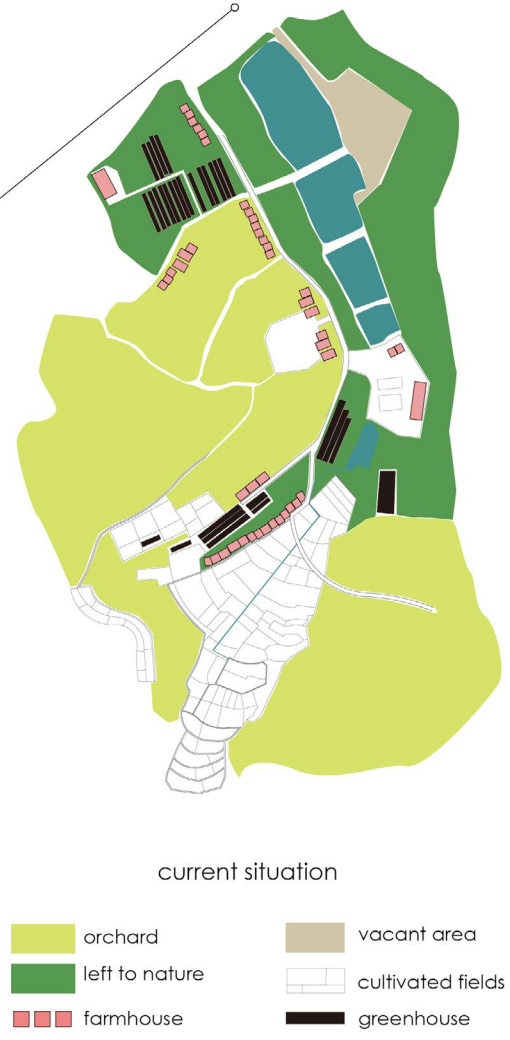




05.11.02
Local Anaysis

when we look into the site i choose, we find, the reservoir water level changed in different season, but most of time it will remain one fixed level because people control it. so from the section it is clear to see some area won't be influence by the dynamic level and already develop agriculture, so there is a gradient form productive to the sensitive.





05.11.03
Current Landuse

From the plan, the occupation in the ecological area should return back to the ecology succession, which aim to protect the drink water quality.

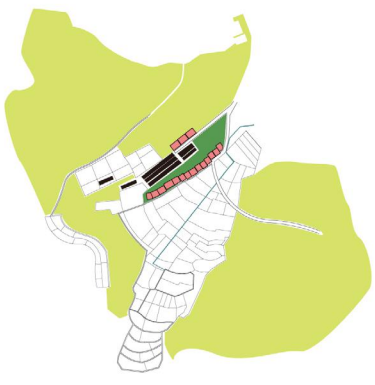
As for flooding area and productive area, we can consider more to promoting the productivity and living quality. Now greenhouses and farmland are fragment, the area doing nature succession insert into the fish ponds and orchard causally. There is any consideration about water system management

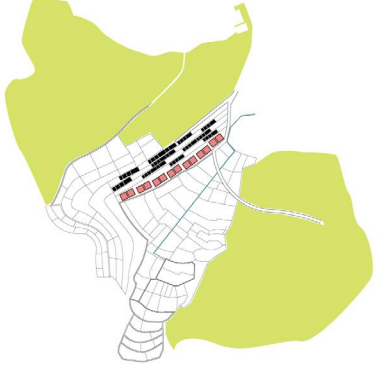
05.11.04 Phasing

The first step is adjusting the core agriculture area, like connect the fragmentary farmland, replace the temporary farmhouses, rearrange the water system.

Then in the second step, concentrated recreation and residential area development (including house for raise silkworm, renting bikes or fishing tools and more new farmer hoses for airbnb). Connect the fish pond and greenhouses, providing an ecological habitat for recreation and also productive landscape to community.

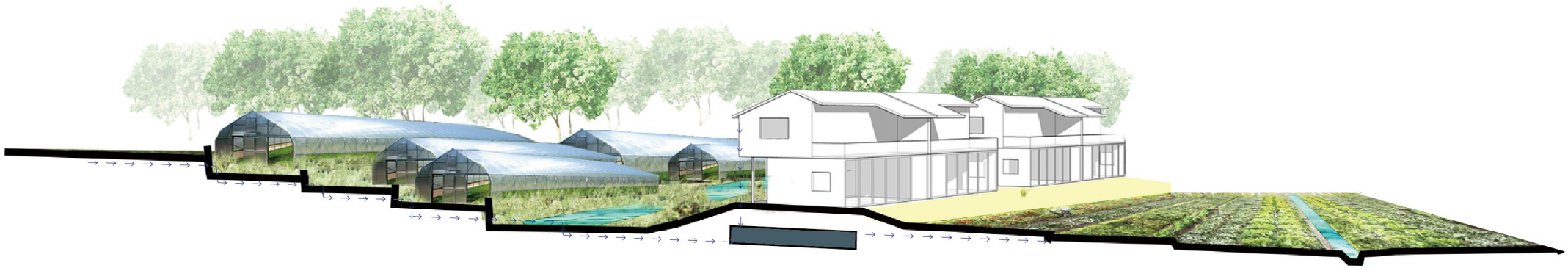
Third, it depends on the number of visitors and need for food, if increasing, will increasing the housing and farmland.





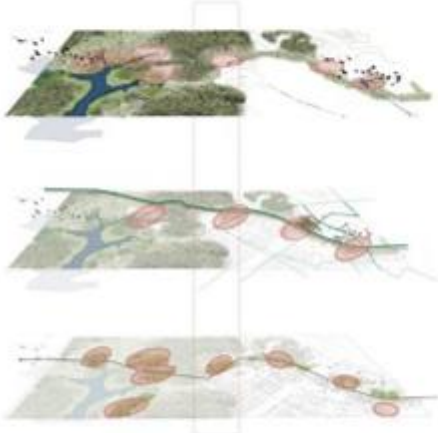
05.11.05 First Step

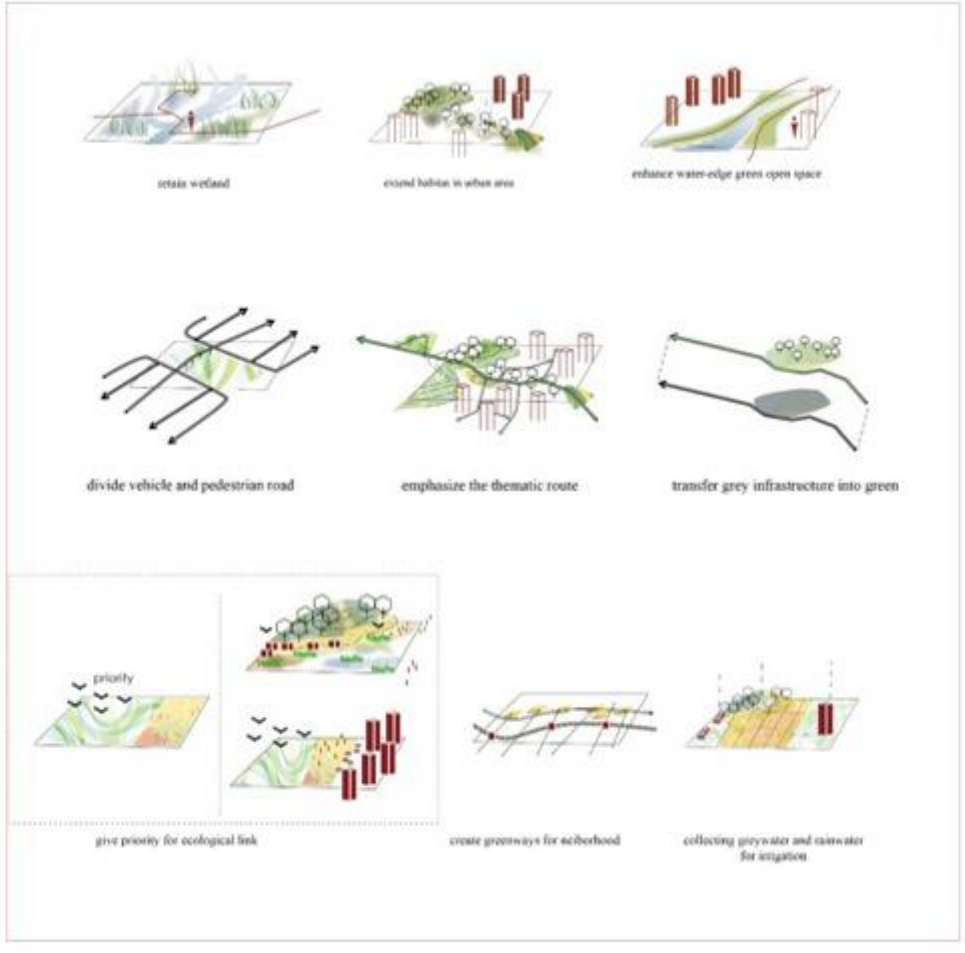
The right image shows the current situation. When we see the section, we can see the farmhouses have good view from one side to the farmland, but the view connecting to the other side is blocked by wild shrubs. Also, the house don’t have any collective space, it directly connect to the farmland and unmanaged area. and it drainage the waste water directly to the ground.
so new intervention is firstly using micro-topography to keep the water for greenhouse, dig the area between farmhouses and greenhouses, and use the soil to elevate the farmhouses area, so that forming a sunken area to collect water, and then use it for irrigation . and also, this intervention can provide a new landscape for the back of the house. What’s more, house need to be changed, because current one is poor and temporary, so a new house typology are needed for not only improve the farmer's living quality but also attracting visitors.



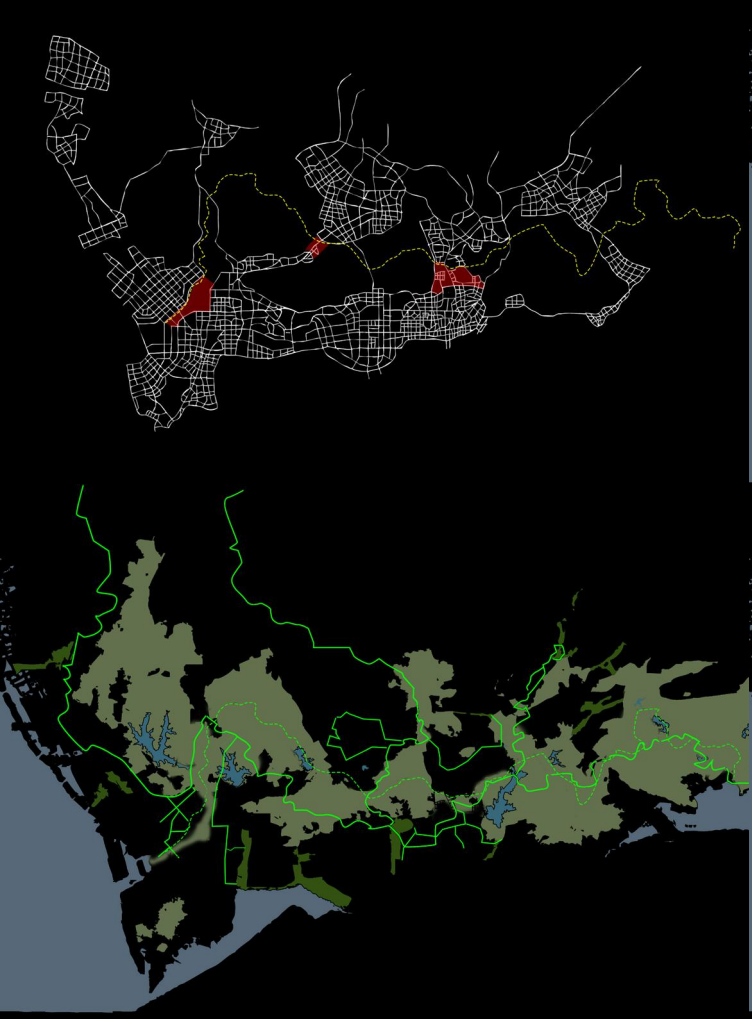
6 CONCLUSION & REFLECTION

06.01 from Gap to Local





06.02 From Gap to Regional

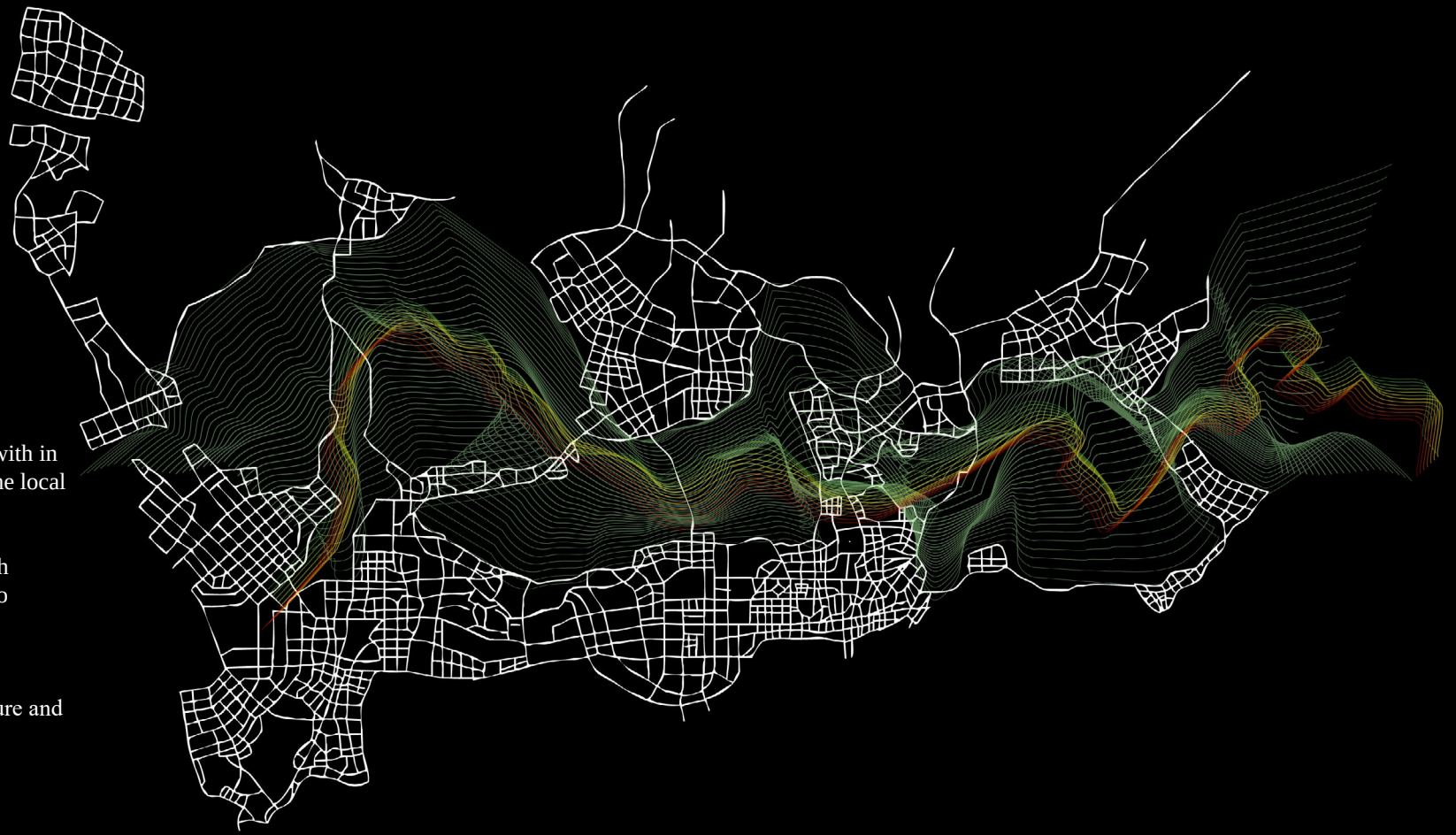


06.03 Flowscape

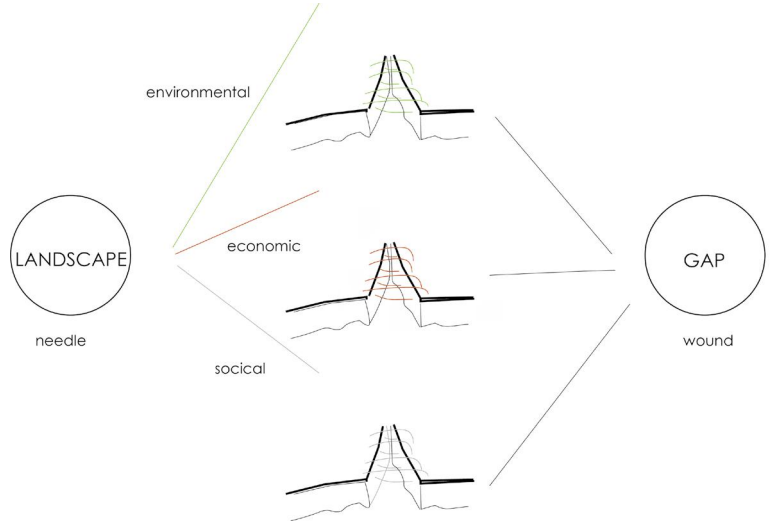
Therefore, design principles was come up with in the gap scale, then it can apply and guide the local scale sustainable development,

Three strategies 'green wedge', 'cycling with culture' and also 'agriculture revolution' also can be use in the other gap area sustainable development

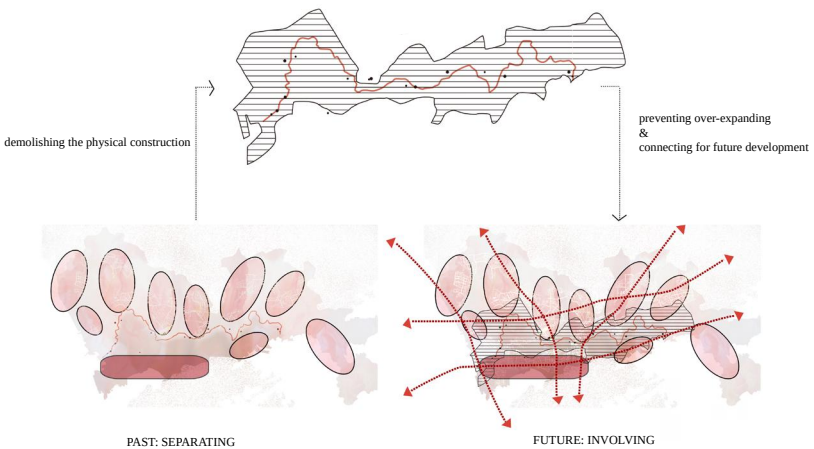
In the final to form a great productive, culture and green flows in the regional scale.



06.04 Societal relevance



NOW: NEGALECTING



PAST: SEPARATING

FUTURE: INVOLVING

This barrier line is 84km, existing inside Shenzhen City, breaking many flows. The city loses some fundamental infrastructure and severely hinders urban development. My research on the urban gap area can provide a nature-based framework for future development. It provides the society with a more sustainable environment containing three dimensions of sustainability: environmental, social and economic.

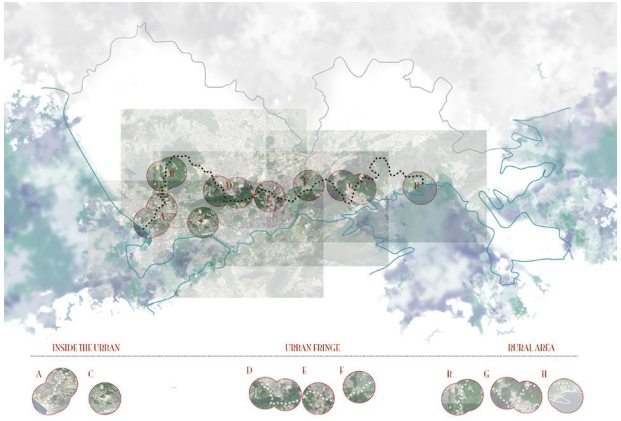
More valuable things in my research are:
(1) Start from the regional landscape level, forming a robust framework, also leave room for the recreation, agriculture and urbanization
(2) Provide landscape solution strategy and principles for the chaotic environment in the urban gap area.
(3) The value of the border is no longer the neglected area, but a new flow to create new benefits for society.

The significance of this research has both general and specific character. The particularity is that because of policy reasons, such site around the world are not very common, but it provides crucial suggestions and directions for the further development in Shenzhen. At the same time, the reflections of this area can give the reference for the area like Shenzhen-Hong Kong border, USA - Mexico border. The general thing is that boundary region development is a relatively common problem. Around the world, some design guidelines for improving capacity for regional development can be applied to other general boundaries.

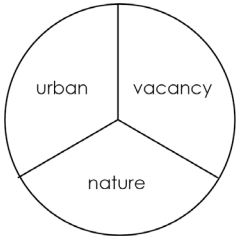
06.05
Reflection about Research Methodology

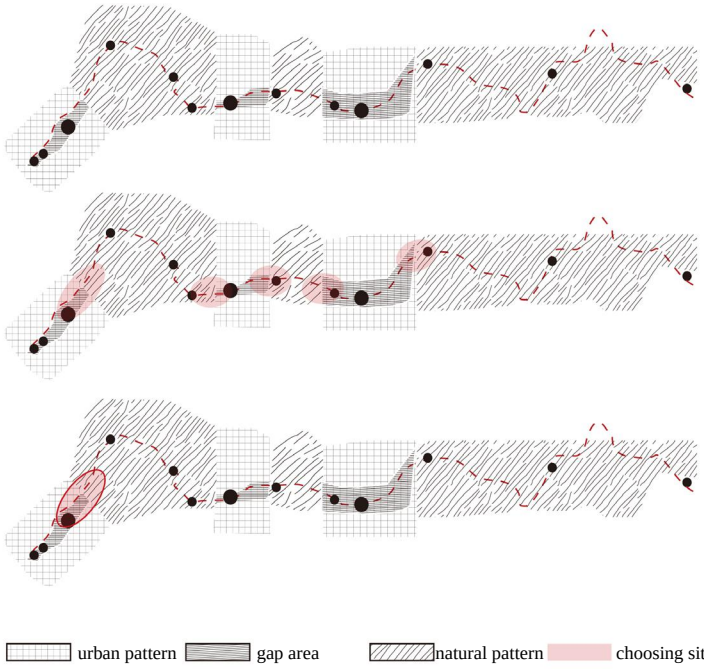
First choice

Second choice



Third choice





Reflection about Research Methodology

(1) The choice of research scale

At the beginning of the research, in fact, it spent me quite long time to consider research scale. After all, Shenzhen is a super-large-scale city, and the barrier line is 84km. Also, this line will go through many different environments. Which scale is the most suitable for research become the toughest phase in my research

I understood very early that the question is not just a barrier line but a regional problem. It was an essential cause resulting in a fragmented system and structure between urban and natural area.

Regarding choosing the selected scale, I attempted many times. In the beginning, I tried to discuss the whole 84km. However, after comparison, I found that on such a large scale, the environment facing such complexity will require a lot of The data support. Also, not every area of this barrier line go through have similar priority to be changed, so I found this scale is better to be the context of the research study. It makes sense for indicating the direction for understanding the line.

Then I changed the research method. In my second attempt, I tried to take the checkpoint who repeatedly appear on this line as a breakthrough for research scale. I hope to classify it by checkpoints' location, like in the rural area, urban fringe and downtown area. However, this scale also has limitations, because it overemphasizes the importance of transportation infrastructure. However, transportation is just a superficial problem brought by barrier line. It still lacks deeper considerations for the entire city and natural systems.

So in the end, I decomposed and overlapped maps to conclude the line pass through ecologically sensitive areas and urban areas. At the same time, through the supplement of background knowledge and field research, I discovered that along with barrier lines, the most severe challenges and the most complicated issue I face is in the urban gap area. However, these urban gaps have similarities regardless of the formation causes or the problem issue they bring.

So in the end, I decomposed and overlapped maps, drawing the conclusion that the line pass through ecologically sensitive areas and urban areas. At the same time, through the supplement of background knowledge and field research, I found that along barrier lines, the most severe challenges and the most complicated issue I face is in the urban gap area. However, these urban gap areas have similarities regardless of their formation causes or the problem issue they bring.

The landscape is viewed as a scale-continuum. (Steffen Nijhuis, 2013), so the regional structure has a powerful correlation with the small-scale design. They will influence each other, so although I choose an urban gap area as my last research scale, I will analyse on different scales for helping me understand the site. Analysis with multi-scale will lead to the whole process of thinking not being linear but back and forth.

At the same time, in the design phase, the strategies proposed in the regional design also need to have the ability to guide small-scale design.

2) Apply framework model into Shenzhen

'casco-approach' (sijmons, 1992) is the evolution of the ‘Dutch layer approach’, essential to this approach is the frameworks and ecological structure as the backbone of the natural system. But this regional landscape framework has certain limitations, to some extent. It is ideally based on nature-based landscape as an infrastructure to improve the site. Also, the design method is also natural-oriented. However, this may be more suitable for the border areas（like intersection area between cities or countries), because these places are vital for ecological protection, and is relatively weak in economics, social demand.

For the second line in Shenzhen, it has its particularity. Part of the barrier line enters the urban area even downtown area. So the region needs to be transformed urgently to adapt to the sustainable development of the city.

For the rare lands meets large population and facing rapid growth, in fact, the capital intervention will be more intense and powerful. Only the environmental protection or ecological maximisation, in fact, is tough in operation. Although I regard nature-based as principles during the research and design, I also think about other principles related to social and economic, which, is also the reason why I always consider housing extension and spend time thinking about how can food combine with other industries, how to use landscape to brings population, economic growth, and even the industry transformation.

So the landscape is not only the infrastructure to guide structure and framework, but also can become the catalyst to active and influence the local culture and economic development.

3) Shortages of collecting data

a. In fact, there are tremendous obstacles for collecting data. I have to admit China is far less transparent in sharing information than in European countries. Sometimes, I have to depend on the photographs I took from the site to collect information I need. Especially historical maps, it is difficult to find geographical data before 1978, so this is the regret to help me understand the site. The design is based almost on the understanding of the status quo and lacks the reflection about the landscape as the cultural representation

b. Besides, there is not enough data for people's needs. Although in the site investigation, some local people were interviewed to share their complaints or expectations about the current situation, the number of interviews are not enough for persuasion. In the beginning, some methods, such as distributing a certain amount of questionnaires should be used to collect suggestions from local people, to enhance the interaction between designers and local people. But on the other hand, my design can regard as a kind of designer's vision, inspire local people and government to think about the transformation of the site in the future and provide the nature-based design strategies and principles for this line and surrounding region.

06.06 Reference

Needham, B. (2014). Dutch land-use planning : The principles and the practice. Surrey, England: Ashgate.

Robert Edwin. Roggema (2012). Swarm planning : the development of a planning methodology to deal with climate adaptation.

Portugali, J., & Stolk, E. (Eds.). (2016). Complexity, cognition, urban planning and design : Post-proceedings of the 2nd delft international conference (Springer proceedings in complexity). Switzerland: Springer Internatinal Publishing.

D.F. Sijmons, Het Casco-Concept. Een benaderingswijze voor de landschapsplanning (Ministerie LNV, Utrecht, 1991)

Sijmons, D. (1990) Regional Planning as a Strategy. Landscape and Urban Planning 18: 265-273

D.F. Sijmons, Simple rules: emerging order? A designer's curiosity about complexity theories, in Complexity Theories of Cities Have Come of Age. An overview with Implications to Urban Planning and Design, ed. by Y. Portugali, V.J. Meyer, E.H. Stolk, R.E. Tan (Springer, Berlin, 2012), pp. 281–309

Nijhuis, S. (2013). Principles of Landscape Architecture. https://howdoyoulandscape.wordpress.com/2013/12/20/principles-of-landscape-architecture/

Tjallingii, S. (2015). Planning with water and traffic networks. Carrying structures of the urban landscape. Research In Urbanism Series, 3(1), 57-80.

Tjallingii, S.P. (2004) 'Sustainable and Green: ECOPOLIS and Urban Planning', in: C. Konijnendijk, J. Schipperijn & K.K. Hoyer (eds.) Forestry Serving Urbanised Societies, selected papers of the IUFRO European Regional Conference Copenhagen 2002, IUFRO World Series Vol 14; IUFRO Headquarters, Vienna, pp 43-63

Tjallingii, S.P. (2005) 'Carrying Structures for the Urban Ecosystem', in: E. Hulsbergen, I. Klaasen & I. Kriens (eds.) Shifting Sense. Amsterdam, Techne press, pp 355-368

Aalbers, C. & J. Jonkhof (2003) Planning on Principle, the Strategy of the Two Networks Revisited. Boxtel, Aeneas publishers

Waldheim, C. (2006) 'Landscape as Urbanism', in: Waldheim, C. (ed.) The landscape Urbanism Reader. New York, Princeton Architectural Press, pp 35-54

Werquin, A. et al. (eds.) (2005) Green structure and urban planning. (Luxemburg) Final Report of COST action C11. Luxemburg, Office for Official Publications of the European Communities