

# Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



## Graduation Plan: All tracks

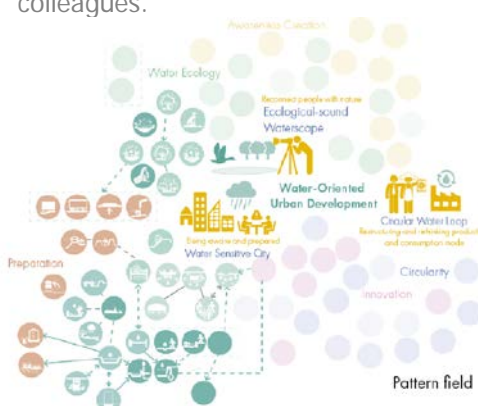
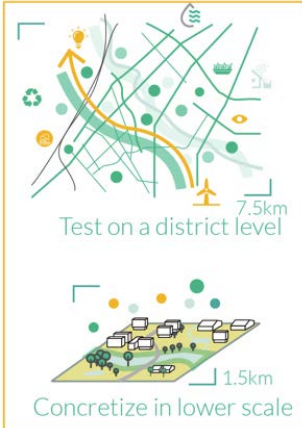
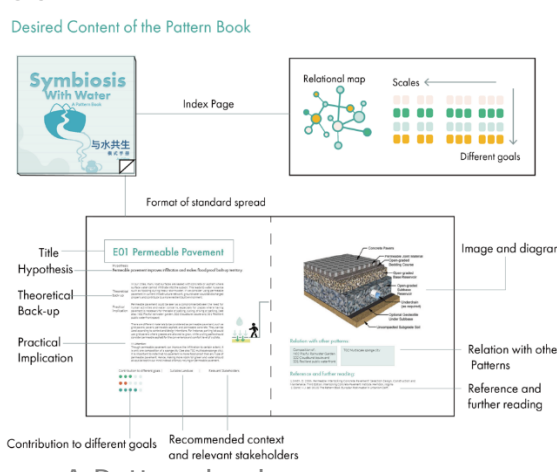
Submit your Graduation Plan to the Board of Examiners ([Examencommissie-BK@tudelft.nl](mailto:Examencommissie-BK@tudelft.nl)), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Jiaqi Wang
Student number	5216540

Studio		
Name / Theme	Urban Metabolism and Climate	
Main mentor	Kristel Aalbers	Environmental Technology and Design: focusing on water
Second mentor	Remon Rooij	Spatial Planning & Strategy
Argumentation of choice of the studio	The studio of urban metabolism and climate focuses on addressing climate challenges in a synergetic and systemic way by designing with the flow that shapes the built environment in a more sustainable way. And my project is searching for water-oriented spatial interventions that could guide future urban development, relink people with nature and solve the current water issues (including water safety, water quantity and water quality issues) in a synergetic way.	

Graduation project	
Title of the graduation project	Live with water—A sustainable water-oriented urban development pattern
Goal	
Location:	The Lake Chao Basin, Anhui, China
The posed problem,	<p>Like many human habitats around the world, the Lake Chao Basin on the periphery of the Yangtze River Delta enjoyed its flourishing thanks to the water.</p> <p>However, in the past few decades, this area has experienced rapid urbanization, where the size of the cities has grown exponentially. Despite its contribution to the rise of people's overall living standard and local economy, this has led to increasing water issues in the basin. The sprawling urban territory has largely occupied the originally unpaved surface and slowed down the natural infiltration process extremely, resulting in the growing flood risk in front of the extreme storm events (Hao et al., 2019). The emissions from the expanding urban area also bring severe contaminations to the</p>

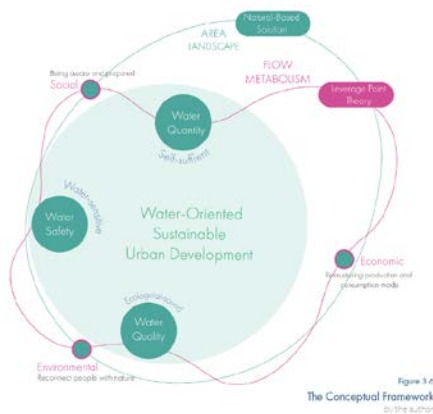
	<p>water body within the basin. This not only leads to the degradation of the local ecosystem but also makes the water of Lake Chao hardly suitable for consumption since 2007(P. Xie, 2008), which put extra pressure on the local drinking water supply. Additionally, with the increasing intensity and frequency of drought and flooding in this area since the 20th century (CMA, 2021; Jia,2012), further stress on water issues is foreseeable under the threat of global climate change.</p> <p>The newly-proposed water management infrastructure, the Yangtze-to-Huai Canal, aiming to address the aforementioned water issues once for all, is never a panacea to the futureproof, and even probably trigger another round of blind urbanisation. Therefore, it is high time to consider a more sustainable water-oriented urban development pathway to support future growth in such an area.</p>
<p>research questions</p>	<p>How can a sustainable water-oriented urban development pattern contribute to a future-proof water system in the Lake Chao Basin?</p>
<p>design assignment in which these result.</p>	<p>Note: The pattern language method is based on Based on A Pattern Language: Towns, Buildings, Construction(Alexander et al.,1977)and The Timeless Way of Building(Alexander, 1979) by Christopher and his colleagues.</p>  <p>A Pattern Field</p> <div style="display: flex; justify-content: space-between;"> <div data-bbox="526 1545 829 1971">  <p>Test on a district level 7.5km</p> <p>Concretize in lower scale 1.5km</p> <p>Test of pattern</p> </div> <div data-bbox="845 1523 1404 1993"> <p>Desired Content of the Pattern Book</p>  <p>Index Page</p> <p>Relational map Scales ←</p> <p>← Different goals</p> <p>Format of standard spread</p> <p>Title Hypothesis Theoretical Back-up Practical Implication</p> <p>Image and diagram</p> <p>Relation with other Patterns Reference and further reading</p> <p>Contribution to different goals Recommended context and relevant stakeholders</p> <p>A Pattern book</p> </div> </div>

1. A pattern field that contains water-oriented spatial interventions strategies and principles, which also clarify the relation between patterns.
2. Test the patterns on a district within the study region and do a pilot urban design project on a zoom-in scale.
3. Assess the pattern field and provide transferable knowledge by a pattern book

## Literature Research

### Q0.1: How to define the sustainable water-oriented urban development?

Theoretical framework, Conceptual framework



### Q0.2: What are the ideal goals and principles to formulate a sustainable water-oriented urban development pattern field?

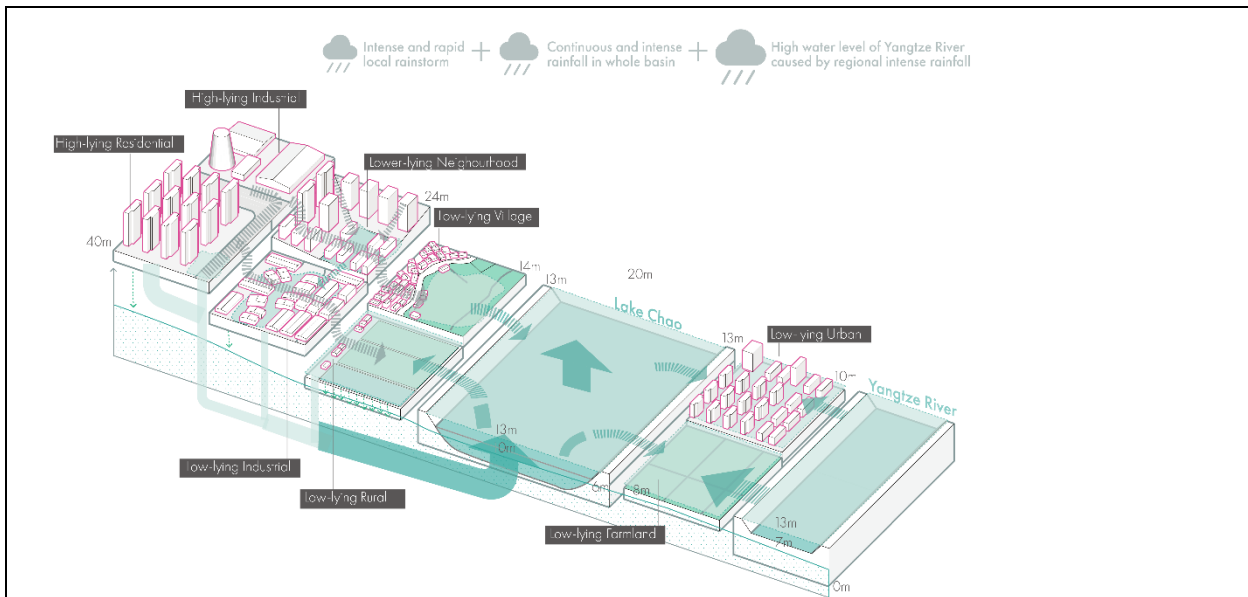
- Goals to guide the patterns and for assessment



## Research and Diagnosis

### Q1.1. What is the current water metabolism under the impact of urbanisation in Lake Chao Basin?

- Understanding of current metabolism by systemic mapping and drawings



**Q1.2. Where are the potentials and risks from the urbanisation of the region to its water metabolism?**

- Conclusion of potentials and risks

**Pattern Field Construction**

**Q2.1: What kind of urban development pattern field can be designed to transform the water metabolism towards sustainability in the Lake Chao Basin based on the goals set up?**

- A set of patterns that aims at improve the water metabolism

**Q2.2: How can they be improved to motivate more stakeholders?**

- A improved pattern field with each of them linking to potential actors

**Test and Assessment**

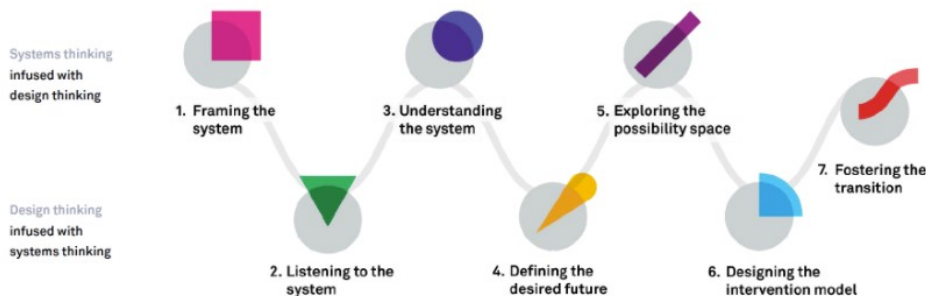
**Q3: How can the implementation of the pattern on a district level contribute to the goals and provide transferable knowledge to other locations?**

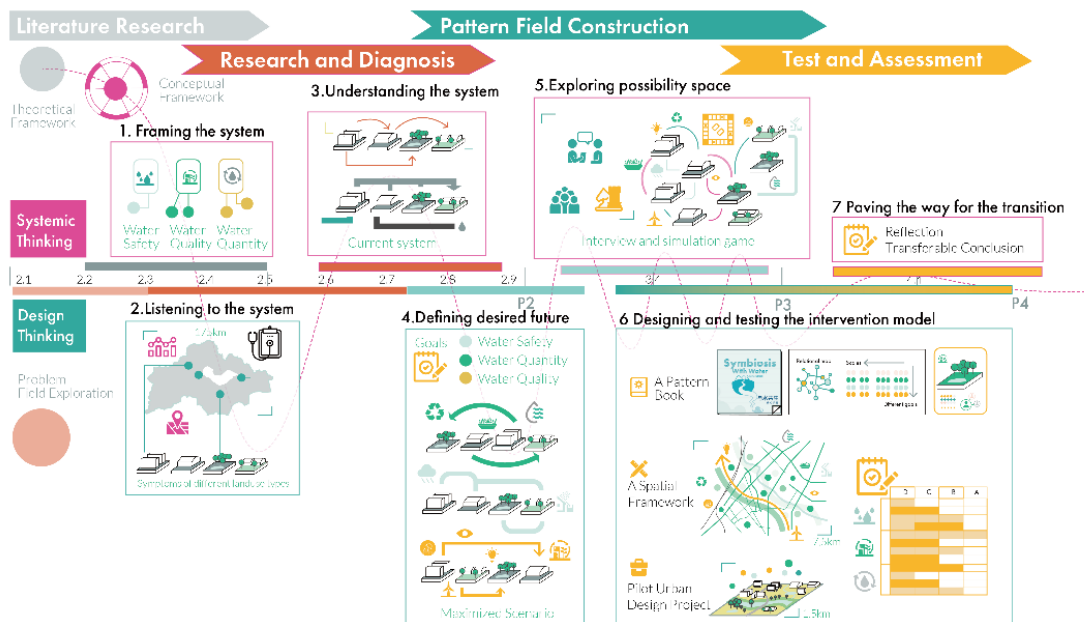
- A spatial planning framework with pilot urban design project
- A pattern book with transferable knowledge to other locations

**Process**

**Method description**

The research of this graduation project is framed up following the 7 steps of systemic Developed by Kristel van Ael of Namahn:





## Literature Research

### 1. Framing the system

The literature review provides a foundation of existing experience and insights from prior research on a certain topic. In this stage, knowledge and argument related to water from different perspectives will be gathered and reviewed critically, in search of a possible synergy between them. A conceptual framework will be set up to define the concept of sustainable water-oriented development.

## Research and Diagnosis

### 2. Listening to the system

Data and geographical information related to them will be collected and summarized by different types of symptoms to prepare for the making of systemic maps. These documentations should involve three aspects of water: water quality (mainly about the surface water in the ecosystem), water quantity (drink water) and water safety (mainly involves precipitation).

### 3. Understanding the system

Based on the typological study from previous analysis, the systemic mapping should be made to visualize how water metabolism happens between different territories and how they are shaped by the current urban morphology and water consumption modes.

Meanwhile, considering the location is still undergoing rapid densification and construction of new infrastructure, a policy document review is needed to understand how the district is projected to transform in the near future. This helps to fully understand the current paradigm of urban development and how it might have a negative impact on water metabolism further.

## Pattern Field Construction

### 4. Defining desired future

Following the end of the diagnosis period, an evaluation tool based on the **DCBA method\*** will be established according to the situation of the study location. Afterwards, three maximized scenarios will be formulated in each separate layer according to the 'A-level' goals that have been set up.

## 5. Exploring possibility space

Following the completion of maximization scenarios, the '**SWOT**'\* analysis outcome from previous stage will be further developed into a '**TOWS**'\* to find out how the synergy could happen between the three scenarios.

Meanwhile, several interviews with local professionals will be then conducted to find out the bottlenecks of these maximized patterns in real practice. Based on these understanding, the different maximized layers will be synergized to one optimized pattern field, where merges, compromise between different patterns might happen from time to time. To make the patterns more engaging, an identification of potential actors linking with different patterns should be done. An interview with several real stakeholders can also be a plus. A several simulation games will then be organized with colleagues and friends. The participants will imagine themselves being a given stakeholder and give suggestions towards appointed patterns or choice patterns that he/she is more satisfied with. These games will serve as a good weapon to finalize the pattern field and make it qualified to be implemented in a spatial framework in the next stage.

### Test and Assessment

## 6. Testing the intervention model

In the last stage, the pattern field from previous stage will be test on a district level. A spatial framework for a chosen location within the study region will be established (at around 7.5km district level) with a pilot urban design project (within 1.5km). It will elaborate on which patterns will be used in this spatial framework and illustrate the expected spatial quality.

This spatial framework will be assessed according to the **DCBA**\* assessment tool to understand the limitations of the implementation process, which provides the materials for the final reflections. Also, the patterns will be assessed by a metric to decide their transferability.

This full package will answer the final sub research question: Q3: How can the implementation of the pattern on a district level contribute to the goals and provide transferable knowledge to other locations?

## 7. Paving the way for the transition

A final reflection will be done based on the assessment of the design project and finalizing of the pattern book.

Meanwhile, it should also give a reflective answer to the main research question: How can a sustainable water-oriented urban development pattern contribute to a future-proof water system in the Lake Chao Basin? By clarifying the problems and limitations of the whole execution of the graduation thesis and point out potential further research direction, the project could shed more light on the way to sustainable development.

Note:

\*DCBA method

D = normal situation or just sufficient situation;

C = correction of the normal situation, there is consideration for the environment(or the related topic);

B = limited damage to the environment as far as possible(or related topic has been fully considered);

A = absolutely the least damage to the environment (or to the related theme).

TOWS and SWOT are acronyms for different arrangements of the words Strengths, Weaknesses, Opportunities and Threats.

## Literature and general practical preference

Literature:

-Water sensitive city

theory by Wong, T. H. F., & Brown, R. R.

-Sponge city  
theory by Kongjian Yu and critics from others

-Urban Metabolism  
Three ecologies by David Wachsmuth

-Ecocity  
Ecopolis theory by Sybrand Tjallingii  
Synergetic urban landscape planning by Nico Tillie

-Circular Economy  
Report by Ellen MacArthur Foundation

-Circular Water Economy  
Reports from organisations and corporations such as World Bank, GWSP and Arup

-Leverage points Theory  
Multi-level perspective on sustainability transitions by Frank W. Geels  
Leverage points theory by Donella Meadows  
Leverage points for sustainability transition David J. Abson

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Main reference of water-oriented practical strategies:

1. De urbanisten studio <http://www.urbanisten.nl/>
2. A CATALOGUE OF NATURE-BASED SOLUTIONS FOR URBAN RESILIENCE  
<https://www.gfdr.org/en/publication/catalogue-nature-based-solutions-urban-resilience>
3. Green-blue grid for resilient cities: <https://www.urbangreenbluegrids.com/>
4. Metabolic.nl <https://www.metabolic.nl/projects/>

## Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

My graduation thesis is about dealing with the metabolism of water. With the issues of water exacerbated by urbanisation in recent decades in China, as a student from the MSc AUBS programme, I find it vital to think of a solution to tackle these water issues from a spatial design and planning perspective and to promote a more sustainable relationship between nature and humans. Especially as an urbanist student, I wish to synergy the knowledge between different disciplines and translate them into trans-scalar spatial interventions and motivate more actors in the transition towards a more sustainable relationship with water. This topic is exactly in line with the topic of my graduation lab: 'urban metabolism and climate' with its focus points on finding holistic spatial environmental solutions to address challenges from climate change. (The issue of water is undoubtedly a prominent one of them.)

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

### Societal Relevance

From a societal perspective, although the local government has been devoted to fighting against the water issues, a huge amount of money has already been spent yet brings little effect. The flooding in the lower Yangtze River plain in 2020 still caused tremendous loss to the inhabitants in this region and also put a huge economic burden on the local authorities.



The water shortage is currently mitigated by the government's temporary methods like water diversion from other areas, which is not only energy-consuming but also can not sustain itself in the long run. Also, though a protective wetland has been established around Lake Chao, the capacity from such biological cleansing is after all limited. So the thesis would hopefully offer a new pathway to tackle these challenges systematically and serve as an inspiration for the local government.

Meanwhile, it will provide knowledge for the execution of the current planning framework of the Yangtze River Delta. The current planning document emphasised both economic further industrialisation in Lake Chao Basin Area and the improvement of water quality of Lake Chao, but failed to mention how the synergy could happen between them with a concrete urban development strategy. Moreover, the end result of the project also aims at creating people's awareness towards sustainable development and their attachment to water, which would make a difference in people's values and thinking patterns.

On a broader scale, the outcome of the thesis can also be transferable to other areas in the Yangtze River Delta, especially second-tier cities and rural districts. Moreover, the goals, conceptual framework and certain design principles might be transferable to other cities troubled by similar water problems.

### **Scientific Relevance**

There are already abundant theories and discussions on different water issues. However, the research into 'water ecology', 'circular economy' and 'urban flooding' are usually not from the same disciplines. And there are few integrated solutions to tackle the water issues in a systemic way by spatial intervention through the lens of built environment and design aspect. For example, though the recently developed theory of 'Sponge city' in China proposes a multi-scalar framework from an urban design/landscape architecture perspective to address flooding issues, it does not take the concept of circular economy into consideration and fail to organize its natural-based strategies in a broader urban metabolism context and thus fail to stimulate a systemic change. So, this project may shed some light on filling the knowledge gap in searching for a more synergic water-oriented urban development framework to design upon the deeper leverage points.