# WUHAN'S BATTLE AGAINST WATER

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## WUHAN - CITY OF HUNDRED LAKES

The city of Wuhan, originally known as the "city of a hundred lakes", is located on the crossing of Mainland China's main development axes, the Yangtze river and the North-South axis. Its rapid development into a city of over 10 million inhabitants has led to the disappearance of many lakes which used to play an important role in flood mitigation. The city is now facing many water challenges such as urban flooding.

Due to the history of severe flooding, in 2015, Wuhan was one of the first 16 pilot cities selected for the implementation of the Sponge City Programme (SCP) by the Chinese government. The SCP has a high level of ambition involved in the transformation of high density environments into sponge cities. As the programme's name states, the goal is to create cities that function as a 'sponge', allowing for the storage, infiltration and purification of rainwater, slowing release, thereby reducing urban flooding, and facilitating reuse when needed. This strategy of so-called low impact development (LID) consists of green infrastructure such as bioswales, ponds and green roofs.


Figure 1. Location of Wuhan in China

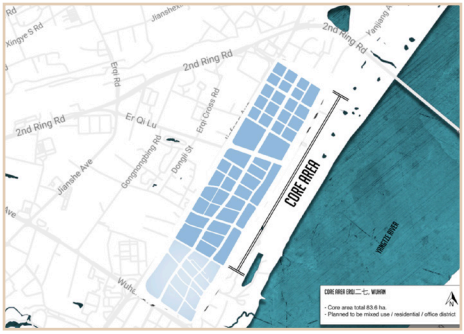


Figure 2. Location of the project-site, ErQi

## THE SPONGE CITY PROJECT WUHAN

Arcadis, a leading global Design & Consultancy firm for natural and built assets, tasked a multidisciplinary team of six MSc students from Delft University of Technology to support the implementation of the SCP in a new development in Wuhan.

After assessing the SCP, the team concluded that LID alone lacks the capacity to cope with large rainfall events, requiring gray measures. Considering how the intensity and frequency of high rainfall events is increasing due to climate change, it is critical to develop interventions suited for current and future extreme urban flooding events. The SCP, however, was not considered in the planning and designing phases of the new ErQi International Business District (ErQi) development, adding to the challenge.

In light of this, there was a need for  shifting the scope of the Sponge City Programme towards an integrated and resilient approach, adding robust capacity for large rainfall events to the rigid urban plan under development for ErQi along the Yangtze river.



## FINDING THE RIGHT SOLUTION

From January 2018 till September 2018 the project team worked on a research by design strategy, comprised of using design to illustrate the spatial consequences of the present problems, test alternatives and create solutions. During the one year project, the team spent two months on site in Wuhan.

By combining the sponge city approach with the resilience approach to cope with future extreme events, the team was led to assess the urban water challenges at different scales. There are several features of developments of Asian cities, that can be included in the required transformations. E.g. the widespread adoption of elevated walkways (or pedestrian bridges) connecting amenities, alters the perception of what the plinth is considered to be. However, due to an often sectoral approach, this reconsideration tends to

be limited to architecture, urbanism and traffic planning, while these works have the potential to be an integral part of the urban water system.

An analysis of the main components of the ErQi urban plan led to the identification of two major components:

- A large green area (50,283m2) potentially suitable to store large amounts of rainwater.
- An extensive system of pedestrian bridges, connecting the city's buildings to the green area and extending towards the Yangtze river.

This resulted in a conceptual design coined ''MengQiao bridge". This design can be seen as the key feature of raising visual water awareness to the community. When the system capacity is full, the excess water flows out of the bridge to ensure its continuous functioning. Compared to a regular walkway, this allows visitors to better experience the water system while providing more storage. It uses the network of elevated walkways connecting the city's buildings as a stormwater carrier to transport water from the buildings' green roof to the park. After the park has reached its maximum storage capacity, excess stormwater is discharged into the Yangtze river. This helps to keep ErQi Business District safe and dry.

This hybrid green and gray infrastructure increases resilience as it can accommodate unexpected shocks such as higher rainfall events, while maintaining the liveability. In addition, through high visibility, it has the potential to increase the awareness and appreciation of water in the city, increasing the district's perceived value and attractiveness.

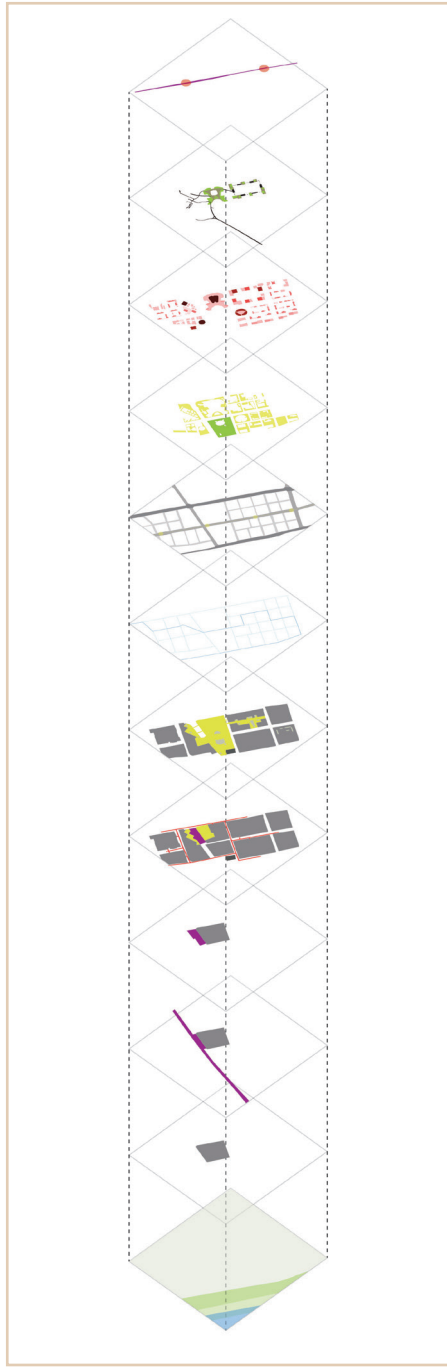

**Figure 3: An axonometric view of the area showing the various layers of occupation, ranging from soil and underground to the ground level and above ground pathways.**

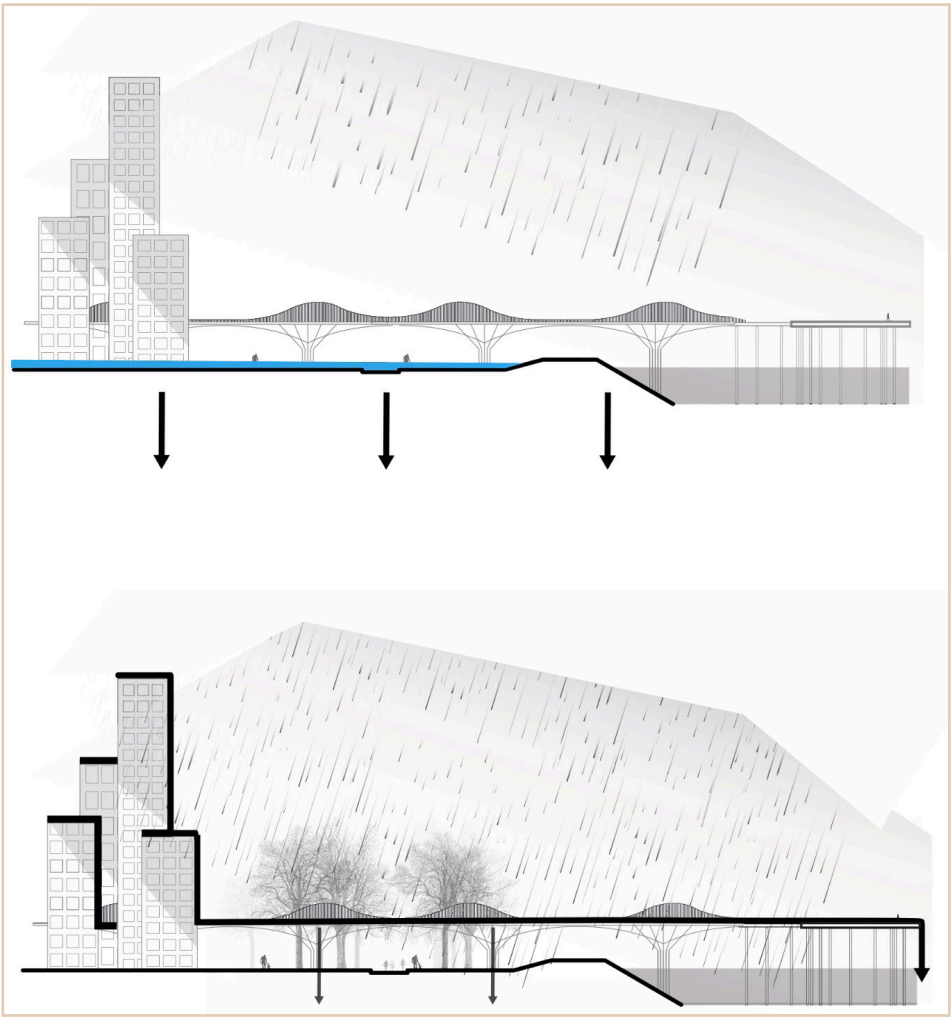

Figure 4. Section of the ErQi business district with and without the implementation of the pedestrian bridge as a stormwater system

## BUILDING BRIDGES

One of the main challenges was working as an interdisciplinary team, with each expertise integrated in the process and in the resulting design. Since designers and engineers tend to have different approaches to design, it was easier said than done. To deal with that, the design process of the entire group became an iterative process with each expertise expanding the frame of reference and the design laboratory by finding ways to create a common language. We had to build bridges through sketching, modelling, calculations, through proactive group discussions and pressure cooker workshops. The projected high-density environment requires a reconsideration of space altogether. The strong competition for land demands innovative solutions and the interdisciplinarity of the team helped in overcoming this challenge.

While many Chinese stakeholders are also working on implementing the SCP in the project area, it currently remains a challenge to bridge the gap between the various developers, institutions and designers working on site. The designers tend to work in a traditional way where people from different expert fields work independently. Therefore, part of the team's objective relies on demonstrating the potential benefits of an integrated approach for the various Chinese stakeholders, who consider this approach unconventional. In order to achieve this, ongoing close communication with the Chinese partners was crucial. Building trust and gaining respect were vital in the process of not only procuring data, but also for maintaining the stakeholder's engagement during this process. Thanks to the incorporation of various difficulties that they encountered; more comprehensive solutions were proposed.

## DO'S & DONT'S

The most important lessons would be that you need to be patient, curious, flexible and resourceful.

- Patient as integrated interdisciplinary approaches initially take more time than the conventional sectoral approach.
- Curious as it is a learning process, we and the experts from other disciplines need to learn from one another. Flexible, as some ideas, even those supported broadly, can't currently be realised and require alternatives.
- And finally resourceful. Space is limited, so sometimes you must either look up or below for additional opportunities to create meaningful places while housing necessary infrastructures.

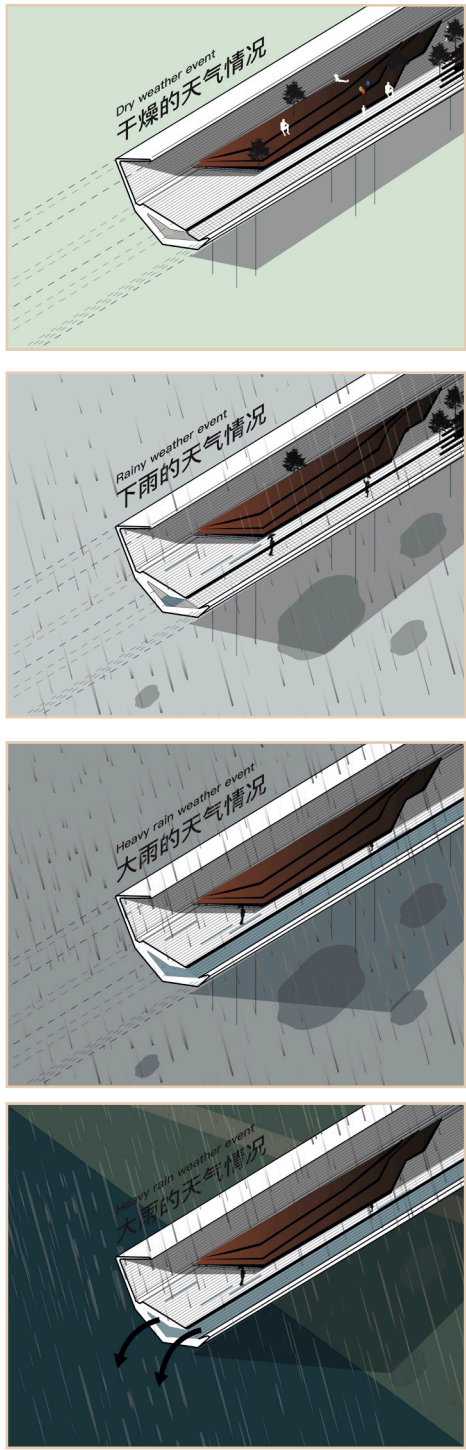


**Figure 5. Section of the 'MengQiao bridge' under different rainfall events.**

## ABOUT THE SPONGE CITY TEAM

The Sponge City Project consists of a multi-disciplinary team of six MSc students from the disciplines of Hydraulic Engineering, Water Management, Architecture and Urbanism.

The team worked closely together with TU Delft's Delft Infrastructures & Mobility Initiative (DIMI) and also received strong support throughout the project from various partners, with Arcadis as being the main collaboration partner. and TU Delft's Delft Infrastructures & Mobility Initiative (DIMI) being the second partner.

**Camille Fong** was the instigator of the inter-disciplinary Sponge City Project, and graduated from the TU Delft Water Management in 2020. Her ambition has been on integrating water and especially the value of water in the planning and design of cities. Focus: opportunity creation through integration of expertise and stakeholder cooperation.

**Mesut Ülku** his ambition, as TU Delft Delft Architecture graduate, is to shift the idea of the existing city to a city of potential, a laboratory for life improving technologies. Focus: development of novel approaches for integration of architecture and infra-structure.

**Thomas Dillon Peynado** his ambition, as TU Delft Urbanism graduate, has been to work towards liveable high density environments. Focus: ways to increase the potential of infrastructures and systems to increase the liveability of dense urban enivronments short and longterm.

**Jiechen Zheng** her ambition, as TU Delft Hydraulic Engineering graduate, has been to redress the function and quality of water in high density environments through the use of data. Focus: the feasibility and durability of systems and the potential positive externalities.

**Michael van der Lans** his ambition, as TU Delft Hydraulic Engineering graduate, has been to work towards sustainable security and innovative management of waterworks. Focus: ways to gather and process data for the development of multifunctional water systems.

**Xinxin Sui** her ambition, as TU Delft water management graduate, is to move beyond knowledge and technology, towards works that contribute to a life with water. Focus: integration of water as vital part of urban development.


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