

Group 2

The growing issue of flooding events and
creating sponge cities as a solution

日益严重的洪水问题和创建海绵城市作为解决方案

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Policy Brief

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Sponge Cities AN URBAN SOLUTION WITH CO-BENEFITS

- ▶ Climate-induced **flood risk has increased** for urban settlements in China and New Zealand
- ▶ A **Sponge City has several co-benefits** to support it as a worthwhile urban flooding solution
- ▶ **China** has a Sponge City Initiative which **faces planning and financial feasibility challenges**
- ▶ **Auckland** has great potential to be a successful Sponge City but **faces similar challenges**
- ▶ **Adopting a no-regrets strategy** which acknowledges the co-benefits of a Sponge City **could overcome these challenges** and facilitate meaningful progress

Background

Climate change, coupled with rapid urbanization, has brought significant changes resulting in serious environmental issues across all sectors of urban socio-ecological systems. Under the circumstance of more extreme climate-induced weather events, a reducing tree coverage ratio and increasing reliance on engineered urban drainage systems, flooding risk has increased.

For China, floods have had a significant impact on their economy. It was reported that the direct economic losses from natural disasters in China reached 41 billion yuan (around 9 billion NZD) in July 2023, which is more than the total from January to June. In addition, floods affected more than 7 million people nationwide.

Auckland floods: city begins clean-up after 'biggest climate event' in New Zealand's history



Chinese firefighter 'dies heroic death' as Beijing reports heaviest rain in 140 years



For New Zealand, floods are the most common and costly climate change impact. New Zealand encounters a significant flood event approximately every eight months, resulting in annual direct economic damages exceeding 160 million NZD. These floods also have persistent effects on the social and cultural aspects of the region.

What is a Sponge City?

To engineer a 'Sponge City', a shift from traditional 'grey infrastructure' towards 'green' and 'blue' nature-based solutions, is required. Direct benefits of a sponge city include improved water absorption during flooding events and increasing water storage capability during droughts. Indirect benefits including reducing surface temperatures, absorbing carbon, and increasing biodiversity. These co-benefits strengthen the argument for sponge cities as an urban solution to address significant challenges beyond climate change.



China's Sponge City Initiative – Shenzhen

China already has an established Sponge City Initiative and Shenzhen is 1 of 30 pilot sponge cities selected by the central government across 2015 and 2016. Between 2017 and 2022, the city completed over 2,800 sponge city projects, covering a total of 275 square kilometers (28% of the city's urban land area). Shenzhen aims to increase its "sponge" coverage to 80% of its total urban land area by 2035.



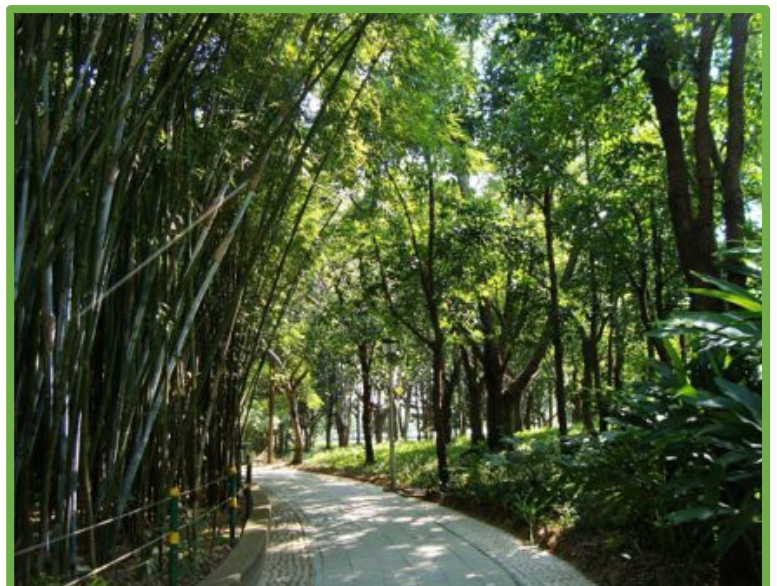
Notable Projects - Shenzhen

Shenzhen Talent Park contains floodable greenways around a coastal lake, which acts as a sink for canals diverting the runoff from the nearby, ultra-dense Houhai neighborhood.



Xiangmi Park was created on the grounds of a former agricultural research center. It added a 6-kilometre greenway with permeable trails, retention ponds, flower gardens, urban forests, and a science library.

Futian Mangrove Nature Reserve was established in 2017, as hundreds of tiny seedlings of 16 different species of mangrove trees. These seedlings have now developed into a mangrove forest, covering a square kilometer. Over 200 bird species have been identified there, becoming a major destination for migratory birds. These wetlands are part of a Great Green Wall, which now helps protect the most densely-developed areas of Shenzhen's 260-kilometre coastline from flooding.



Challenges – Financial Feasibility

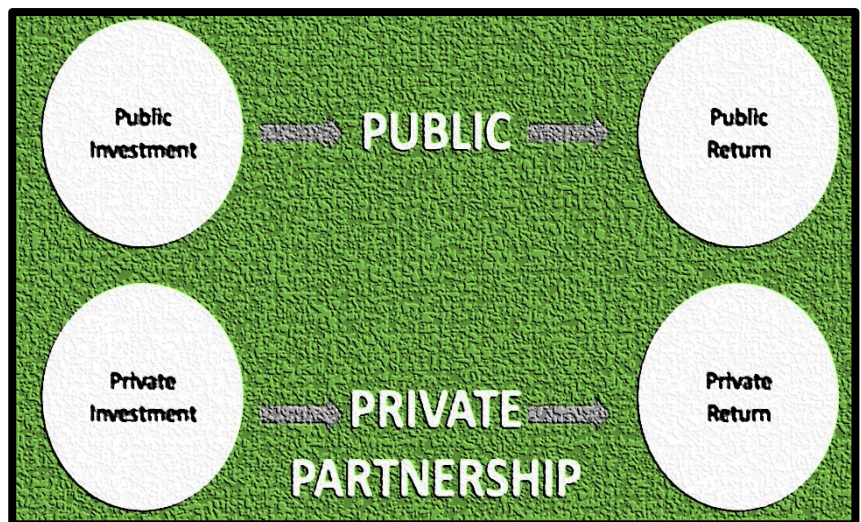
Since 2015, the Chinese Government started to establish 16 additional sponge cities such as Chongqing, Zhenjiang, Xiamen, and Wuhan. According to the sponge city proposal, 435km² of sponge city area will be built in these cities, costing a total of 87 billion Chinese Yuan (20 billion NZD) which initially appears expensive.

However, the Chinese National Bureau of Statistics announced that 62% of Chinese cities experienced floods between 2011 and 2014 with direct economic losses of around 700 billion Chinese Yuan. The returns clearly outweigh the costs of the sponge city initiative, making it a financially feasible way to respond to flooding.

Improvements

To construct a Sponge City, financial resources appear to be one of the primary considerations despite insufficient funding in many cities. We suggest that a PPP financing model is a feasible funding channel for Sponge City development.

The Public-Private Partnership model (PPP), is a cooperative arrangement between government agencies and private sector companies. The purpose is to design, implement, and operate projects and services that are traditionally provided by the public sector. PPPs are typically used in infrastructure development, such as public transportation systems, hospitals, and schools.

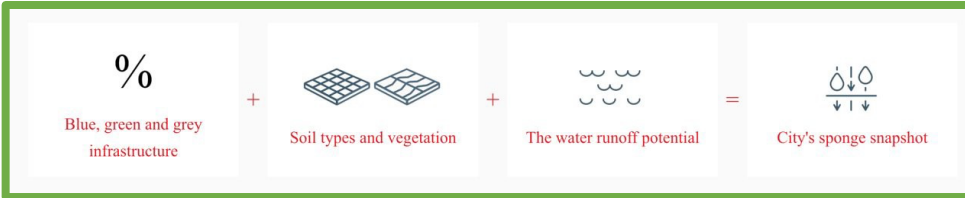


3 benefits of a PPP Model

1. Providing a low-cost, focused financing channel instead of credits from institutions
2. Providing increasing transparency during Sponge City construction
3. Alleviating the Government Grant pressure.

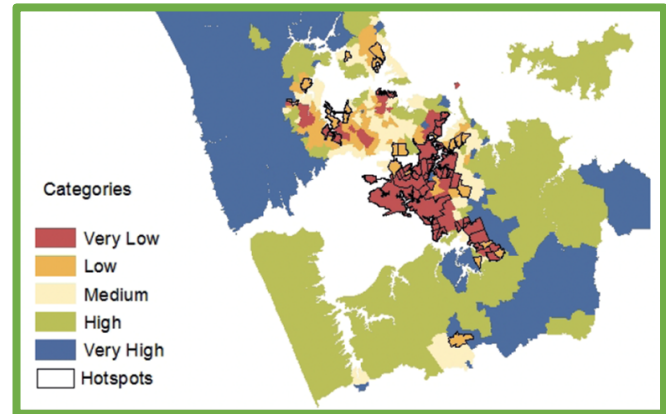
Auckland

According to ARUP, an engineering consultancy, Auckland is one of the world’s spongier cities. With around 50% of existing green and blue infrastructure, there is great potential to further develop Auckland’s sponge snapshot.



Vulnerability

A risk and vulnerability assessment was published in 2019 which revealed that 23% of buildings in Auckland are highly exposed to flooding. Overall climatic impacts are fairly balanced across Auckland although the capacity to adapt is not. Vulnerability hotspots were identified in western and southern suburbs with key factors being socio-economic (lower levels of income and house ownership) and geographic (poor and inadequate infrastructure).

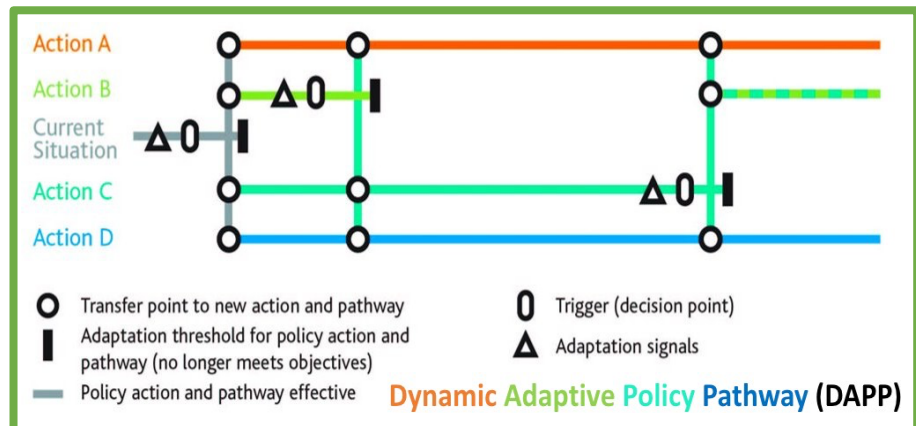


Opportunities within Auckland’s Climate Change Plan

A climate change plan was published in 2020 which clearly identifies flooding as the most common climate hazard for Auckland. To address this hazard, future precautions are in place such as locating new developments outside of floodplains. There are also plans which support opportunities for a sponge city such as improving green infrastructure and reducing grey infrastructure. Integrating more nature-based solutions into development plans also has potential to improve the overall sponginess of Auckland.

Improvements

A key feature of Auckland’s climate change plan is their Dynamic Adaptive Policy Pathway (DAPP). This is a flexible approach that aims to balance scientific uncertainty and risk. While there are benefits to this approach, we argue that a sponge city is more suitable under a No Regrets Adaptation Pathway (NRAP) due to having several co-benefits beyond flood resistance.



Other Challenges

In New Zealand, there is a sharply reducing tree coverage ratio due to increasing demand for housing. Between 2001 and 2022, New Zealand lost 13% of total tree cover. More importantly, the perception that implementation costs of a Sponge City are expensive will hinder its development. Compared with other projects, Sponge City investment is a long-term commitment and its returns also require time to accumulate and settle. For example, the Wuhan Sponge City can save around \$600 USD compared with the costs of equivalent grey infrastructure.

Summary

Climate-induced flood risk has increased for urban settlements in China and New Zealand. A Sponge City has several co-benefits to support it as a worthwhile urban flooding solution. Although China has a Sponge City Initiative, it faces significant planning and financial feasibility challenges. While Auckland has great potential to be a successful Sponge City, it faces similar challenges around planning and financial feasibility. We believe that adopting a no-regrets strategy, which acknowledges the co-benefits of a Sponge City, could overcome these challenges and facilitate meaningful Sponge City progress.

Strategy Recommendation

