C CASE STUDY

HAIKOU | MEISHE RIVER GREENWAY

Turning Grey Into Green

For decades, the city of Haikou suffered from flooding and water pollution. To help the city cope, Professor Yu Kongjian and the team at landscape architecture firm Turenscape used nature-based solutions to transform grey concrete waterways into resilient green infrastructure.

Dr Yu Kongjian is a landscape architect and founder of Turenscape, a planning and design firm. He is also professor and founder of the College of Architecture and Landscape Architecture at Peking University.

Before the "grey-to-green" project, Meishe River was a lifeless, concretised waterway.
Image: Turenscape

The Challenge

Haikou, the capital of China's Hainan province, is its most populous city, with 2.3 million residents. Located on Hainan Island in the South China Sea, the city has a tropical monsoon climate.

Running through Haikou is the 23 km Meishe River, known as the city's "mother river". Despite the endearing moniker, amid rapid urbanisation over the past four decades, Meishe River became increasingly polluted by sewage from drains that opened directly into the river, and by urban and suburban runoffs. The river and its waterways also suffered from regular flooding during monsoon seasons.

Over the years, little attention was given to infrastructure and policies for urban water and sewage or preserving the natural water system. To counter flooding, waterways were instead lined with flood control walls. This turned them into lifeless, concrete channels.

Other piecemeal solutions included building walls and locks to control floods and sea tides, dredging river beds, growing flowers and green lawns on the river bank, and locking off polluted tributaries. However, without comprehensive infrastructure and policies for sewage collection and treatment, these measures did not improve the situation. Pollution continued to spill into the river and its waterways. With murky waters, dead fish and a foul odour, Meishe River earned itself an unenviable place on China's Ministry of Ecology and Environment's list of "black and smelly rivers".

The Solution

In 2016, the Haikou government took a systemic approach to address these issues. It commissioned Turenscape to lead a "grey-to-green" masterplanning and design project, covering the 13 km-long corridor of Meishe River running through densely built areas and the 80-hectare (0.8 km^2) Fengxiang Park.

The masterplan took a "sponge city" approach: Rather than paving over natural river channels with concrete, how could we work with nature to absorb, clean and use the water?

With this approach in mind, the necessary "grey" civil engineering works, such as cutting off major pollution sources and developing comprehensive sewage collection and treatment infrastructure, were planned and developed alongside nature-based, ecological infrastructure, from December 2016 to December 2017.

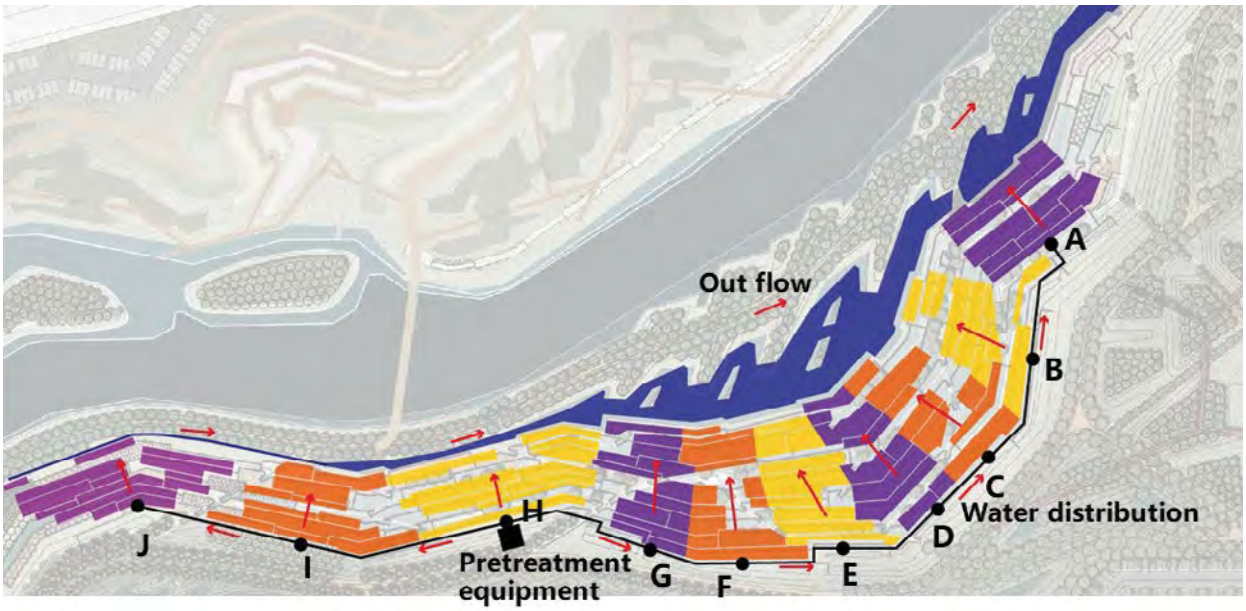
Developing the ecological infrastructure involved several aspects. Firstly, based on terrain, land use, and hydrological processes, Meishe River and all its tributaries, wetlands and potential green spaces were planned as an integrated system to collect, store and drain storm waters—the "green sponge".

Wherever possible, grey infrastructure was turned green. Concrete flood walls were replaced with an eco-friendly riverbank, including newly created shallow beaches where mangrove seedlings and wetland plants were reintroduced. Previously walled-off waterways were reconnected to the ocean to allow tides to re-enter the city; wetlands and shallow shores along the river were reconstructed so that mangroves could rehabilitate them.

To work with nature to absorb and clean the water, interconnected terraces of constructed wetlands were built along the river bank. The terraces were designed as water cleansing facilities for contaminated runoff and pre-treated sewage (or grey water) from local urban villages without access to the centralised sewage treatment system. Biomass from the wetland was harvested and decomposed into fertilisers for use in the landscape.

The waterways were also designed as an ecological infrastructure where cultural and social services could be harvested. The green sponge was integrated into an interconnected pedestrian and recreational network. Continuous, elevated pedestrian paths created waterfront access, with resting places and pavilions dotted along the waterways to provide shelter and shade, allowing visitors to fully take in the lush greenery and water landscapes.

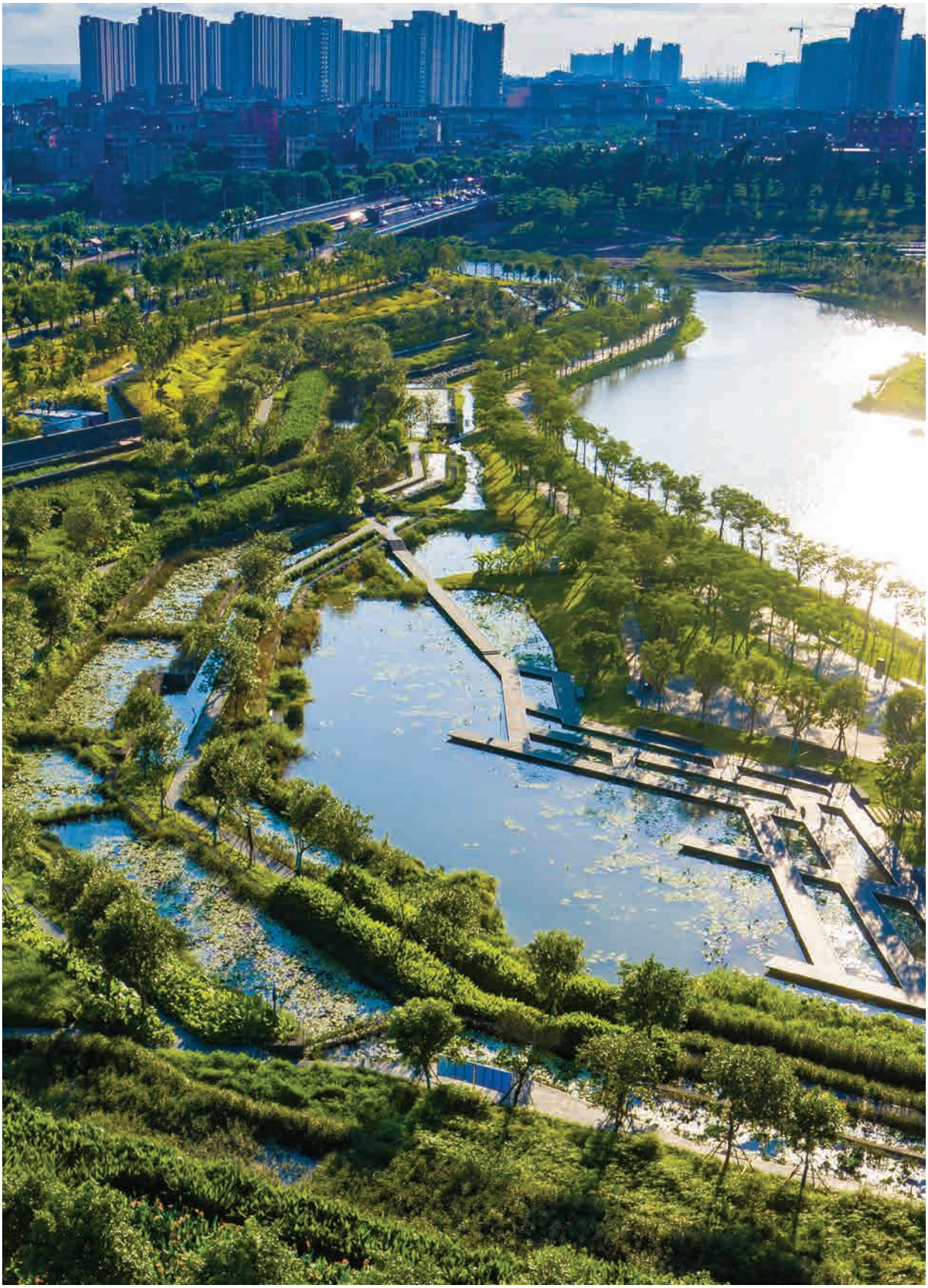
Meishe River, its wetlands and green spaces were planned as a 'green sponge' to collect, store and drain storm waters.



By integrating the pretreatment facility with the wetlands, domestic sewage and contaminated urban runoff is cleansed.
Image: Turenscape

The wetlands are constructed as ecological infrastructure that integrates storm water management and cleansing of runoff with access to beautiful recreational spaces.
Image: Turenscape

Meishe River, during the rehabilitation and construction process.
Image: Turenscape



After the smell of the sewage is removed through the upper terraces, water is exposed at the lower terraces for various floating plants to grow, further removing contaminants from the water.
Image: Turenscape

Along the Meishe River, walking paths, resting places and sports grounds and playgrounds are created for residents of all ages.
Image: Turenscape

> We can make friends with water. We can make friends with floods. Nature and waterways have so much to offer as ecological infrastructure.

The Outcome

Meishe River's grey-to-green project has been a success. The river water has become clean again, certified as III or IV grade surface water, of swimmable or recreational quality. Five hectares (0.05 km^2) of mangroves have been re-established, and wildlife such as fishes and birds have returned. Daily, the reinstated wetland now cleans 6,000 tons of urban runoff and 3,500 tons of domestic sewage from the local urban villages.

Meishe River is once again the city's "mother river", attracting residents and visitors alike. Visitorship to the river has increased by 620,000 annually. Land values around the river have gone up by 20%. In 2018, Haikou was accredited as one of 18 International Wetland Cities by the Contracting Parties to the Ramsar Convention, for its achievement in tapping on its urban wetlands to enhance the city's liveability.

More significantly, the nature-based solutions adopted in Haikou can also be done inexpensively and at extensive scale in other cities. According to the UN, globally over 85% of sewage in urban areas, mainly in developing countries, goes untreated—polluting rivers, lakes and oceans. Alongside "grey" infrastructure such as centralised sewage systems, which may be expensive, the Meishe River project demonstrates that nature-based solutions can play an important role in remediating urban water quality.

We can make friends with water. We can make friends with floods. Nature and waterways have so much to offer as ecological infrastructure, with the potential to address flooding and pollution, recover habitats for biodiversity, create pleasant recreation opportunities, and bring beauty to urban environments.