

WATER CHALLENGES AND NATURE-BASED SOLUTIONS



KEY POINTS

- Water supply sustainability and quality are key considerations when cities face sustainability challenges
- The design and retrofitting of water infrastructure is critical to build resilience to floods and droughts
- Green infrastructure, often in combination with grey and blue, is a good way to tackle water challenges
- New partnerships, new ways of finance and increasing collaboration bring resilient urban water solutions
- This is shown by nature-based solutions from China, Mexico, the Netherlands, South Africa and Sweden

ABOUT THE PROJECT

NATure-based URban innoVATION is a 4-year project involving 14 institutions across Europe in the fields of urban development, geography, innovation studies and economics. We are creating a step-change in how we understand and use nature-based solutions for sustainable urbanisation.





Water Solution Stories

Water infrastructure is critical for cities to maintain a clean sustainable water supply and build resilience to floods and droughts. Nature-based solutions for water challenges are innovative approaches to tackle social and environmental challenges.

Growing urban populations around the world are causing a rising demand for water. Concurrently, changing climate is increasing extreme events in cities, from drought to floods, with severe social and economic consequences. One in four large cities already faces water stress, and demand for water is projected to increase 55% by 2050.¹ This calls for extensive renewal and expansion of urban water infrastructure, changes that provide opportunities to re-design, retrofit and better manage water resources to deliver multiple benefits for all. The nature-based solutions (NBS) described here demonstrate how five cities work with nature and technological solutions while recognising the complexity of urban water systems, their relationship with the built environment and green infrastructure, and interconnections with communities and stakeholders. Rethinking water in cities, new partnerships and funding arrangements, new ways of working, enhanced public participation, increased collaboration, and long-term city planning are key factors to achieve environmental, social and economic benefits and create healthier, more resilient and more prosperous cities.



Utrecht: Sustainable closed-circuit water systems in new development
Over 100,000 residents of the largest urban development project in the Netherlands will enjoy the multiple benefits linked to the clear and clean surface water delivered by the sustainable closed-circuit water system of Leidsche Rijn.

The water system is an integral component of the Leidsche Rijn urban development project (1997-2025) which provides about 30,000 new homes for Utrecht. It includes natural wetlands, bioswales, pumping stations and permeable paving which reduces maintenance costs by organically filtering stormwater. The water system has successfully delivered its goals to (i) contribute to an attractive living environment, including increased opportunities for recreation, while (ii) providing important biodiversity benefits and (iii) supporting urban climate change mitigation. Key success factors include a dedicated task force, long-term multi-level partnerships, coordinated plan implementation, ambitious political targets and experimentation. ***“... a water system of this scale was only made possible because we could start from scratch while having clarity about all requirements right from the beginning.”***² The water system is being further improved by (i) connecting it with the surrounding countryside through green and blue infrastructure and (ii) diversifying vegetation on bioswales to support wildlife. There is also (iii) ongoing public education about the water system to prevent people from abusing the bioswales as dumping grounds or blocking drains.



Malmö: Interactive stormwater management in urban renewal

The open stormwater management system is part of the urban regeneration of Augustenborg to create a sustainable neighborhood where social and economic decline once prevailed.

Augustenborg's 300 apartments were built in the 1950s to provide housing for Malmö's fast growing industrial population. In the 1980s and 90s, ***"the annual floodings and the need for healthier homes pressured the city to find a more sustainable solution for this neighbourhood."***³ In need of social and environmental regeneration and improved flood risk management, municipal departments and the district administration of Malmö City developed an open storm water management system. Substantial help came from governmental funding, a strong commitment from the municipal housing company (owner of 90% of the properties in Augustenborg) and the engagement of residents. Rainwater from roofs, roads and car parks is channeled through trenches, ditches, ponds and wetlands. Only the surplus is directed into the city's conventional sewer system. Due to the open water system, six km of waterways, ten retention ponds and more than 10,000 m² of green roofs, flooding has ceased. Comprehensive national and local policy leadership, integrated water system design, and interactive multi-stakeholder processes also ensured that community commitment made Augustenborg a green, attractive and multicultural neighbourhood.



Tianjin: Ecological wetland park in a free-trade harbour zone

Combining landscape use, water purification and nature conservation in a highly industrialized port area that had minimal biodiversity and degraded saline-alkaline soil makes the wetland park one of China's most innovative nature-based solutions.

Tianjin, a port city and free-trade zone in northern China, faces pressing challenges from air and water pollution, persistent droughts and rapid urbanization at the expense of agricultural land. As a response, the city is involved in China's Sponge Cities Project, with several pilot sites that aim to capture, store and utilize at least 75% of the rainfall through transforming the built environment. Between 2010-2013, the state-owned Tianjin Harbor Construction and Development Company and the local government with financing from the Asian Development Bank created an artificial wetland park on a ca. 63 ha parcel in a high-tech, coastal industrial zone. The wetland park has three distinct functions: (i) wastewater treatment on a 17 ha water surface to minimize pollutant discharge, (ii) ecological restoration to increase biodiversity, through planting 29,000 trees and 155,000 shrubs of over 130 species, as well as establishing three protected islands as habitat for vulnerable coastal species and (iii) recreational space creation with eleven thematic zones to increase livability and attract a skilled workforce. The park is a popular sight to visit, not the least among other local governments, who seek to replicate its success. ***"... the biggest innovation is that we integrate the wetland park with the water treatment process."***⁴



Mexico City: Water Forest

In recognition that Mexico City used to be a lake, the Water Forest initiative works with the entire Mexico City basin and the wider ecosystem in which trees and native grasses are essential for ensuring a water supply for Mexico City.

For hundreds of years, infrastructure has been developed to take rainwater and sewage out of Mexico City, and to bring drinking water in. Despite massive investments, both flooding and water shortages are common, threatening the continued existence of this city of 20 million. Mexico City sits in a basin. Rainwater flows down to the centre of the city unless it is retained higher up, where it can be stored for later use, for instance through recharge of aquifers. Once water reaches the bottom, it tends to stay there because the former lake bed underlying the city is virtually impermeable. The Water Forest initiative recognizes that trees and native grasses help retain water for the city and works to protect these habitats in the basin and wider ecosystem. The initiative assembles many actors working between different levels, requiring regional agreements and resourcing as well as local communities making changes on the ground. It also encourages residents to view the forest as an essential part of the city that they depend on for their water *“...without forest there's no water and without water there is no future for the city.”*⁵



Cape Town: Atlantis Water Fund

Creating a water fund is an innovative multi-stakeholder governance approach for finding new ways to ensure the city's sustainable water supply while creating economic opportunities for disadvantaged communities.

Discussions about Cape Town's water security have increased in recent years with the city experiencing severe droughts and nearly running out of water. While many of the proposed solutions have been related to grey infrastructure, there is an emerging argument that nature-based solutions can improve the resiliency of the city's water supply. The Water Fund run by the Nature Conservancy supports the Atlantis Aquifer Invasive Plant Clearing pilot, which aims to conserve water by removing invasive plant species from the area that recharges Atlantis, the largest aquifer supplying water to Cape Town. These invasive plant species use much more water than indigenous ones, and are thought to remove millions of liters of water from the catchment area annually. The Water Fund, as a new *“neutral body, could play a very strong role in actually bringing together the various parties and facilitating the necessary dialogue and discussion”*⁶ to find new ways to fund and coordinate wider efforts to enhance groundwater recharge through catchment clearing. At the same time, the pilot also creates plant clearing jobs by training and employing women from nearby disadvantaged communities.

¹ Arup, 2015; ² Senior advisor green environment, 2017; ³ Graham, T. 2017; ⁴ Project Manager, Tianjin Harbor Landscape Construction Company, 2018; ⁵ Water Forest Project Director, 2018; ⁶ Principal Researcher, CSIR, 2018. Photo credit: CEAMIP Tianjin, 2015; VaSyd Malmö, 2008.