City Water Stories:
Xi'an

the international water association

Population
- 10 million – The ancient capital city of China, dating back to more than 3000 years ago. Fast urban expansion was seen in the past three decades, with only 2 million in 1980s.

Geography
- Located in the middle of the Yellow River basin with the Qinling Mountains to the south. Urban area 800 km^2.

Main challenge
- Water shortages, deteriorated urban water environment, rapid industrialization & population growth overusing water resources.

Main solution
- Ensuring the quality & abundance of freshwater for the growing urban area and water quality improvement through integrated urban water management.

An ancient Water City with "Eight Rivers Surrounding the Capital"

Xi'an was the ancient capital city of China, dating back to 1046 BC for the West Zhou Dynasty. Until AD 907, Xi'an had been the political center of China for 13 dynasties; the Qin Dynasty (221–206 BC) signified the beginning of the unification of China. During the Tang Dynasty (AD 618–907), as the capital, the urban area of Xi'an was as large as 83.1 km^2 and the population up to 1 million in its most prosperous times, and that made Xi'an the greatest ancient city in Chinese history. In ancient times, there was plentiful water running down from the nearby Qinling Mountains, feeding many rivers passing near the city and forming the ancient beauty of "Eight Rivers Surrounding the Capital". Yet, over time, climate change, hydrogeological variation, rapid industrialization and urbanization, overuse and improper management of the water resources all resulted in the disappearance of the ancient water quality and abundance; the environmental deterioration has become a major problem hindering the sustainable development of the city.

The fast expansion of the city can be seen from the frequently updated urban development plans. This inevitably brought about increased demand for water supply and aggravated the problem of water pollution.

Water Resources Management for the City

Xi'an is located in the middle of the Yellow River basin. Its annual precipitation is about 550 mm, yet the evaporation amount far exceeds this amount of rainfall. Although the Wei-River passing through the northern suburb of the city is the largest tributary of the Yellow River, due to overconsumption of the river water in the upstream area, it is almost impossible nowadays to withdraw surface water for water supply to Xi'an. Groundwater used to be important source water, but for the prevention of ground subsidence, its development has to be strictly prohibited. Since 1990, more than 70% of the water supply to the central urban area has depended on water transfer for about 140 km from a set of dams built on rivers originated from the Qinling Mountain which is the dividing line of the Yellow River and Yangtze River basins. To further increase water supply capacity, not only for Xi'an but also the whole Wei-River basin area, a new development project is under construction for inter-basin transfer through a tunnel across the Qinling Mountain.

As local water resources are insufficient, the basic principles for urban water management are set as water conservation, equilibrium distribution, systematic governance, and maximized utilization. Water saving, multifunctional and cascaded water use, rainwater harvesting, and water reclamation are important measures in the urban water management plan implemented by Xi'an Water Authority.

Case Study: The "Eight-Rivers Regeneration" Project

This project includes the construction of water supply lines, restoration of 7 wetlands, rehabilitation of 8 river channels, and reconstruction of 28 lakes, including some surrounded parks designed to imitate Tang Dynasty landscapes known from ancient illustrations. It follows an integrated plan that uses all kinds of water – natural precipitation, streams, and reclaimed water to create a quasi-natural water cycle in the urban water environment. Expansion of urban green spaces make the city more resilient and environmentally sustainable. The project will be completed by 2020. At that time, Xi'an will not only be featured by its rich historical and cultural remains, but also its new appearance of a "Water City" with various water elements, a livable city with beautiful water environment, and a more active city with great potential for sustainable development.

Xi'an City

Xi'an's Journey to Become a Water-Wise City

A closer look at how Xi'an is satisfying the IWA Principles for Water-Wise Cities

1 Regenerative Water Services

Replenish Waterbodies & their Ecosystems

✓ Guidelines and standards put forward jointly by General Administration of Quality Supervision, Inspection and Quarantine, and Ministry of Environmental Protection.

Reduce the Amount of Water & Energy Used

✓ Regulations on Water & Energy Conservation.

Reuse, Recover, Recycle

✓ Regulation on urban sewage treatment and water reuse.

Apply a Systemic Approach for Integration with Other Urban Services

✓ "Eight-Rivers Regeneration" project implementation plan.

✓ Sponge City Construction plan for Xi'an-Xianyang New District.

Increase the Modularity of Systems and Ensure Multiple Options

✓ Work is focused to the development of various system models for water service.

2 Water Sensitive Urban Design

Enable Regenerative Water Services

✓ Integrated plans are formulated for newly developed districts following the municipal regulations.

Design Urban Spaces to Reduce Flood Risks

✓ Plans to increase urban green space to 50% by 2020.

✓ Flood regulation and storage for newly built public facilities.

Enhance Liveability with Visible Water

✓ "Eight-Rivers Regeneration" project to increase the surface water area in Xi'an to 50 km^2.

Modify & Adapt Urban Materials to Minimise Environmental Impact

✓ Permeable pavement materials application to reduce surface runoff.

✓ River ecological slope protection in the "Eight-Rivers Regeneration" project.

3 Basin Connected Cities

Plan to Secure Water Resources & Mitigate Drought

✓ Surface water transfer to the city by dam construction on the river from the Qinling Mountain.

✓ Inter-basin water transfer project.

Protect the Quality of Water Resources

✓ Regulations for water resource protection.

✓ Urban non-point source reduction to protect urban streams.

Prepare for Extreme Events

✓ Integrated water cycle management plan to increase the buffering capacity.

4 Water-Wise Communities

Empowered Citizens

✓ Citizens involvement and water environment education through the "Eight-Rivers Regeneration" project.

Professionals Aware of Water Co-Benefits

✓ Various committees and working groups to support major water projects through collaboration of governmental agencies, universities, engineering consultants and investors.

Transdisciplinary Planning Teams

✓ Planning and engineering teams with urban planners, environmental engineers and socioeconomic scholars.

Policy Makers Enabling Water-Wise Action

✓ Policy making through collaboration across sectors.

Leaders that Engage and Engender Trust

✓ Coordination between governmental and technological leaderships.

5 Building Blocks for Xi'an on the journey to water-wise cities

Vision

Regeneration of a water city with maximized utilization of all kinds of water to create a quasi-natural water cycle in the urban environment and provide both reliable water resources and attractive landscapes.

Governance

A newly reformed Municipal Water Authority as the sole government agency in charge of all water issues – water resources, water supply, urban drainage, wastewater treatment and reclamation, water reuse in one integrated urban water management plan.

Knowledge & Capacity

Exchange and knowledge sharing with a number of sister cities all over the world.

Involvement of universities, engineering consultants for technological support of urban water management.

Citizens' participation in water environmental protection.

Planning Tools

National regulations, standards and guidelines for urban water planning and management.

The latest urban development plan and a series of plans on water resources and water environment.

Development of Water Cycle Management tools and models.

Implementation Tools

Government-led implementation.

Promotion of Public-Private-Partnerships to supplement investment.

Phased implementation of major project, such as the "Eight-Rivers Regeneration" along with municipal infrastructure construction work.