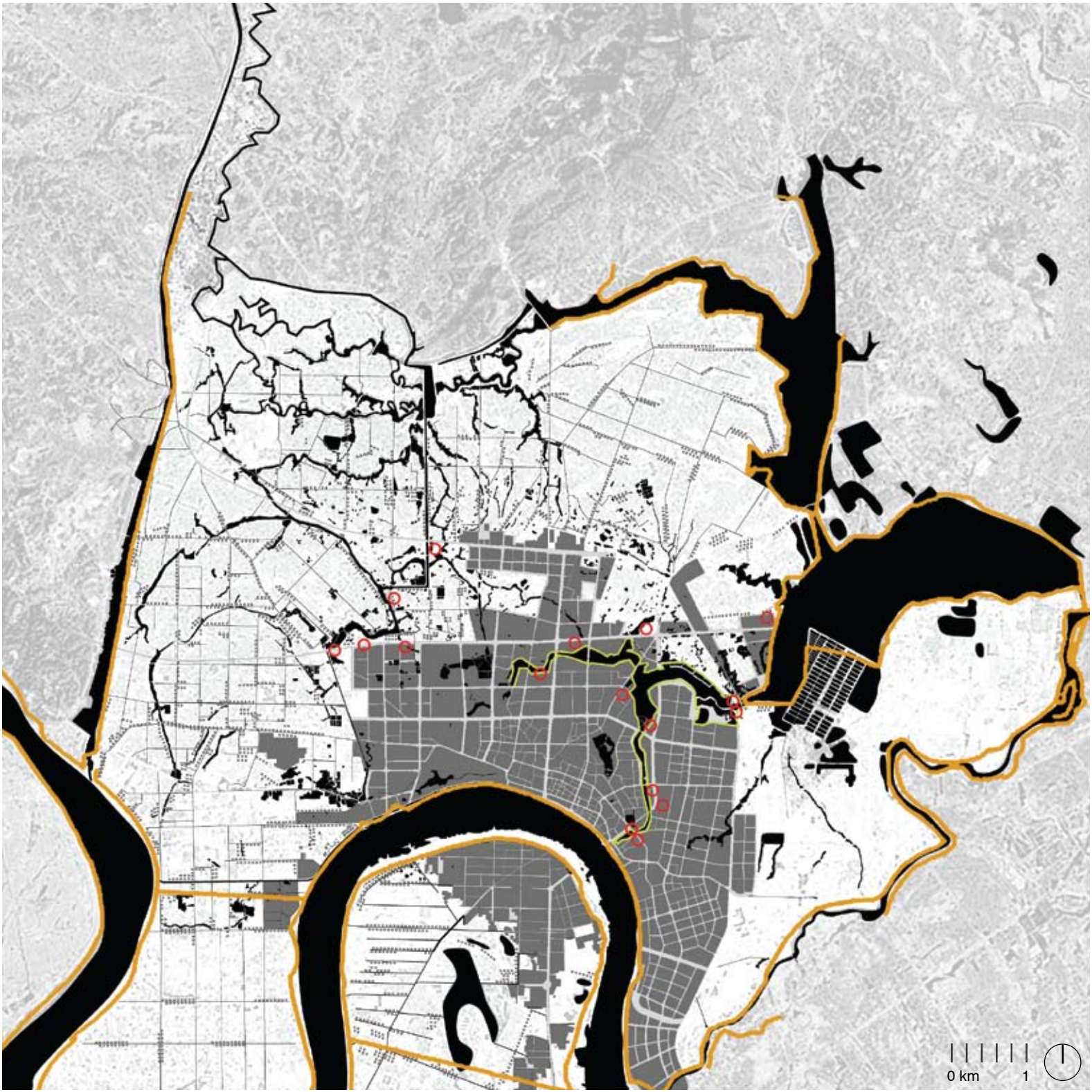
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REINVENTING WATERSCAPE URBANISM

Changde, China

Changde: Dry-scape City within Water-scape Territory

The city of Changde, a typical thriving medium-sized city of modern China, promotes itself as 'a fairyland city of three mountains and three rivers'. It is located in the western plain of Lake Dongting and on the shore of Yuan River, which is one of the four major tributaries of Southern China's Yangtse River. Its territory is criss-crossed by more than 400 small rivers, lakes and wetlands. The agricultural landscape around the city-centre is dominated by linear farming villages within an urban-agricultural network of small-scale canals, ditches and reservoirs. The irrigation network supports terraced rice-paddies and provides enough water for two crops of rice per year. Water buffalos and white herons, the most common domestic and wild animals adapted for life in wet landscapes, are extensively present within this territory. Indigenous water resource management techniques have evolved from an intimate association with climatic, topographic and hydraulic conditions to create a productive water-based urbanism.

However, within Changde's modern urban centre these natural qualities of the territory have been concealed. All rivers and water flows within and around the densely built-up city have been engineered to stay outside, pass around and under it rather than through its core. The quayside road along the Yuan River is blocked by a green concrete dike, leaving only a narrow strip of waterfront park along the river. As well, newly-constructed parks along Chuanzi River, which is to become the new 'golden belt' of the growing city, do not relate to the water. This is partly due an engineering approach which addresses strong water level fluctuations and the poor water quality caused by overflow from open sewage basins located along the river.

The contrast between Changde city's dryscape, embedded within a larger productive waterscape territory, represents a typical situation of many modern-day Chinese cities. Taking into account China's socio-hydrological conditions and contemporary urban development challenges, how can Changde's identity be reconstructed based on a hydrologic-infrastructural approach to its urban landscape?

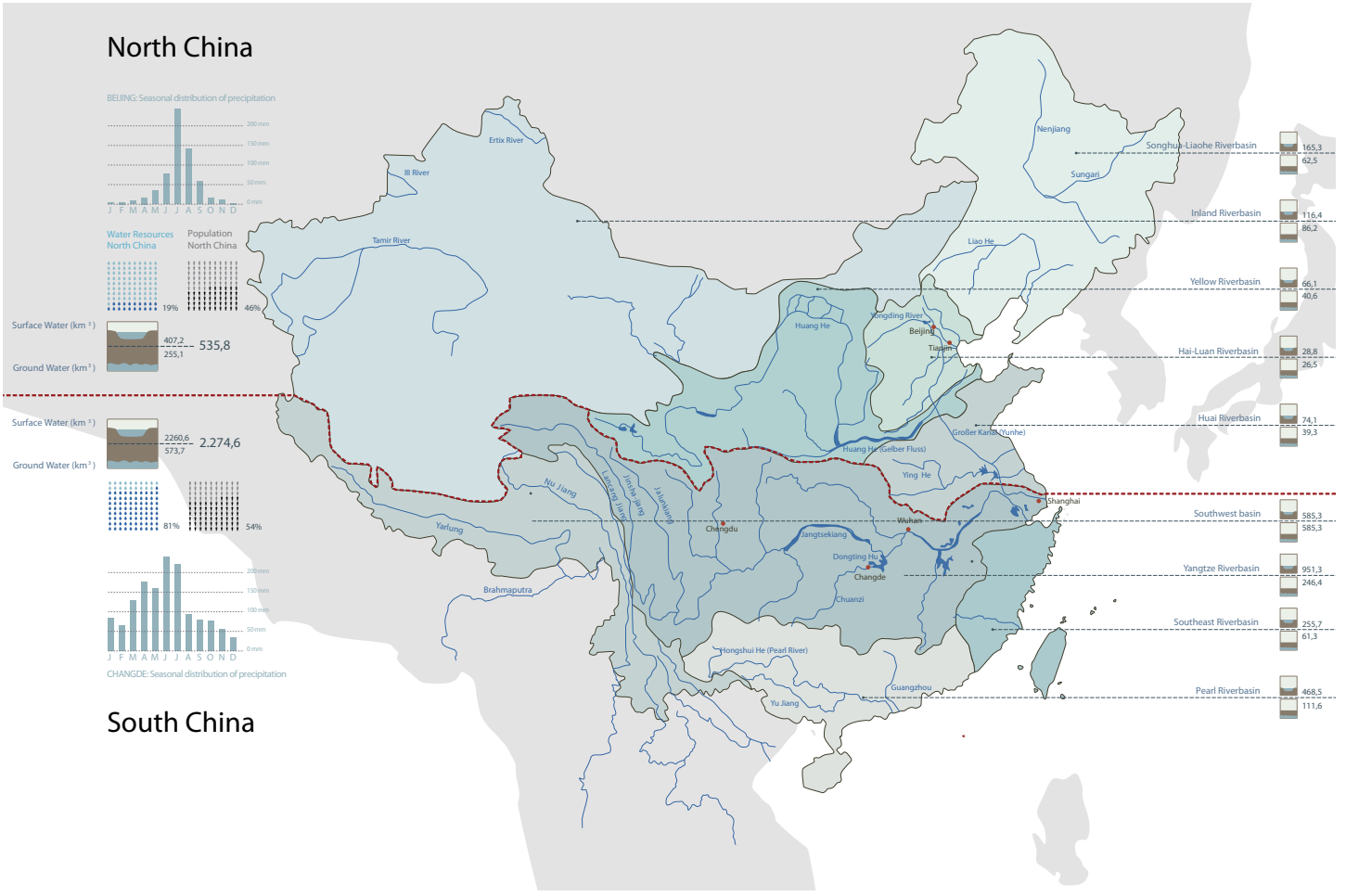


Fig. 1 Uneven Distribution of Water Resources

As China's population grows and becomes more urbanized, pressure is increasing on national water resources, already 25% lower than the global per capita average. Today, out of about 600 cities in China, the number of cities experiencing water shortage problems exceeds 400.

Distribution of water across the country is highly uneven, with the southern river systems (including Yuan River as part of the Yangtze River Basin) supplying 81% of water, but supporting only half of China's population across one third of its territory. North of the Yangtze, 46% of the total population survives on just 19% of total water resources.

China is subject to a strong monsoon climate with dry winters and humid summers. The annual precipitation in areas of southern China is more than 2000 mm (Changde 1417 mm); in northwestern China it is usually less than 200 mm (Beijing 619 mm). Precipitation and river runoff vary greatly from year to year and from season to season, with the ratio of maximum annual runoff to minimum exceeding more than 10 in some areas. Affected by climate and topography, China experiences more frequent drought, flood and waterlogging hazards than most countries in the world (Sternfeld 1997).

Indigenous China´s Hydraulic Society

To understand the co-existence of indigenous and modern techniques of water management in China (resulting in different appearances of urban and regional territories), one has to take a closer look at the social and spatial aspects present throughout the country's long tradition of water management.

The distribution of water in China is highly unbalanced – both geographically and seasonally (fig. 1). The consequence is frequent occurrences of drought and flooding events and, subsequently, unstable agricultural production, unsafe urban construction and a serious imbalance between water supply and demand. Due to such unfavourable conditions, the regulation and distribution of water has challenged the Chinese for thousands of years. Even in Chinese mythology, the origins of civilization are closely linked to the regulation of water. Going back to Xia Dynasty [21-17 BC], the prominent position of Yu as a controller of water shows the early integration of water control with control of the state. Chinese cultural landscapes are not only organized and structured by small-scale irrigation systems and terraced fields, but are also the first historically verified, large-scale, government-managed works of irrigation and flood control (going back more than 3000 years). One famous example, still maintained today, is the Dujiangyan irrigation system near Chengdu which was built in 256 BC to solve multiple problems of flood, drought and navigation. By irrigating over 5,300 square kilometres of land, it made this part of Sichuan one of the most productive agricultural regions in China.

Both small-scale irrigation works by local farmers, and large-scale, government-managed works of irrigation and flood control, based on a deep understanding of water-related natural characteristics and ecosystem performances, were needed to ensure survival in such unpredictable natural conditions. This intimate knowledge of complex and dynamic hydrologic processes was actively applied in the physical construction of sophisticated water infrastructure landscapes – formed by the integration of geo-morphological, hydraulic and technical structures (fig. 2). Such information induced western historians to call China a 'hydraulic society'. As Wittfogel stated: 'Evidently the masters of hydraulic society [...] were great builders. The formula is usually invoked for both the aesthetic and the technical aspect of the matter; and these two aspects are indeed closely interrelated' [Wittfogel 1957].

Until the 18th century, China was quite advanced in the field of comprehensive, small and large-scale, environmental and hydraulic engineering and landscape transformation. However, during the course of the 20th century, China seemingly lost its ability to transform its historical tradition, characterized by the formation of strong linkages between watershed logics, cultivation practices and urbanization patterns, into a modern urban development paradigm.

From Waterscape to Watertech Urbanism

Within the preindustrial phase of urbanization and land-use intensification, hydraulic engineering was a major component

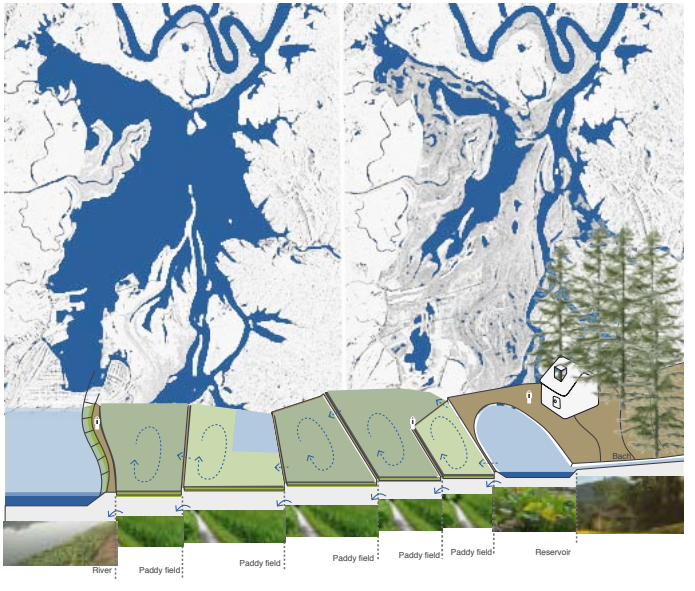


Fig. 2 Terraced Water and Storage
Cultivated terraces around Dongting Lake are based on existing hydrologic landscape structure in order to balance seasonal water fluctuations.

Fig. 3 Water in the Modern Chinese City

With the concreting and canalizing of waterways, the current separation between culture and nature in China becomes highly visible. Urban and landscape designers have been charged with screening and cosmetically beautifying the appearance of concrete river banks and dikes by the mere addition of standardized, exchangeable elements, such as stones and statues, benches and fences, contour-cut shrubs and flowerpots. Creating a new, controlled image of landscape, their designs do not respond in any way to existing natural features or other peculiarities of place. Natural processes and patterns, such as changing water levels, the formative force of water or water-adapted vegetation are not integrated, but rather suppressed by superimposed forms and structures. However, outside the scope of official planning, the open space along many urban waterways is taken over by informal productive landscapes managed by citizens.

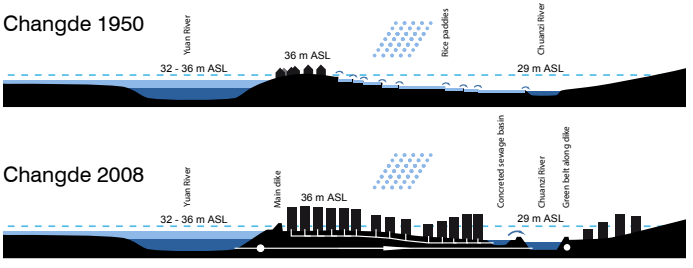


Fig. 4 Changde´s Traditional and Contemporary Layout

Changde´s expanded urban territory depends on expensive water defence, drainage and pumping techniques – the logics of the watershed have been compromised through strategies of disassociation (instead of adaptation).

Fig. 5 Engineered Waterways

The planted concrete dike blocks view and access to Yuan River. The overflow from concrete open sewage basins pollute urban watercourses. Park's within the city's 'golden belt' are without relationship to Chuanzi River.

of territorial planning and water infrastructure systems were extremely prominent in most Chinese cities – gaining even more importance as a structural and visual component of urban and regional form than in cultural landscapes dominated by agricultural land-use [Yu at al. 2008]. Man-made open canals and retention ponds created water-adaptive cities and could create synergies with other important urban functions such as providing transportation routes for goods and building materials, serving as an open space network for social needs, supplying water for domestic and industrial uses as well as serving as a system for storm water retention, irrigation, food production and waste water disposal. Many of the few still existing examples of such kinds of water cities in China have become popular tourist sites – clearly showing that the most profoundly moving urban water landscapes are nothing more than the irrigation, domestic water supply, transportation, sanitary sewer and flood control systems of the time. These landscapes allow the site-specific natural processes to be revealed and utilized within the urban setting.

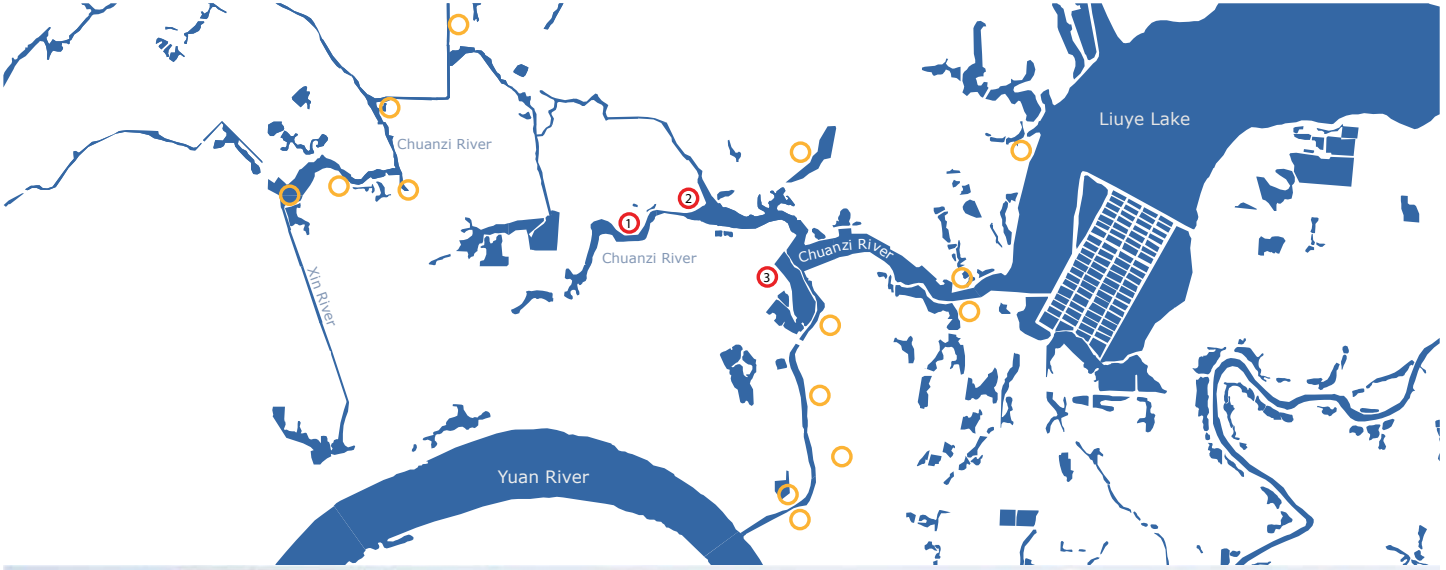
However, rapid industrialization since the 1950s, accompanied by the communist regime's political campaigns of the 'Great Leap Forward' which promoted a philosophy of conquest in defiance of nature, put a sudden end to the long tradition of building water-adaptive cities. Due to a strong belief in modern technologies in order to overcome natural restrictions and the rejection of traditional techniques related to agriculture, most of today's Chinese urban agglomerations have become increasingly dry, with a strong separation between functional, non-aesthetic engineering realizations in contrast to non-functional, beautiful landscape decorations. Along with rapid urbanization, the total area covered by impermeable surfaces has increased dramatically. A vast network of underground water pipes and sewer systems is replacing polluted and dangerous open water courses; this is considered to be major 'progress' in the field of engineering and urban planning. At the same time, the urban structures of cities are increasingly dissociated from the organization of hydraulic systems, erasing the visual and spatial logic of urban watersheds. Continuing population growth puts more pressure on the limited available space suitable for construction and, as a result, more and more people settle in areas that are even more susceptible to flooding. At the same time, since rivers are perceived as major threats to urbanization, most of them have been transformed into concrete channels.

Current Chinese urban development practices treat nature as an enemy that can only be overcome by increasingly aggressive technological and beautification interventions (fig. 3). Water problems are solved by engineers in a technical and preferably hidden way, so the urban and landscape designers gain the freedom of being able to focus on aesthetic and spatial design issues of the urban layout – with the effect that their designs become arbitrary, exchangeable and with one city, looking much like another, regardless of where it is being built. But despite all human efforts, nature cannot be conquered by technology. Hydraulic engineering frequently loses its battle against water and today, millions of people in China remain threatened by severe flooding and water pollution.

Although the reality of water experiences in the modern Chinese city reflects a strong culturally dominated landscape image, there is an increasing effort by city governments and investors to establish a closer relationship with the qualities of a natural and water–based environment. As in Changde, many Chinese cities are currently developing visions to open up their inner-city waterfront locations, trying to attract new residents with concepts like 'lake paradise' or 'modern fairyland city'. Yet this desire is highly contradictory. While longing for a natural dimension, many projects merely turn the urban landscape into a series of high-maintenance, unsustainable and segregated water theme parks. There is a missed opportunity to reinvent waterscape traditions to integrate present and future requirements of water management, ecology and open space development.

Constructed Ecologies and Contemporary Waterscape Urbanism

An interdisciplinary group of Chinese and German experts, through ongoing cooperation between the cites of Changde and Hannover, continues to explore ways to develop Changde's



Inflow of sewage water | Coarse rack | Deposition of solids | Pumping station II | Outlet into Chuanzi

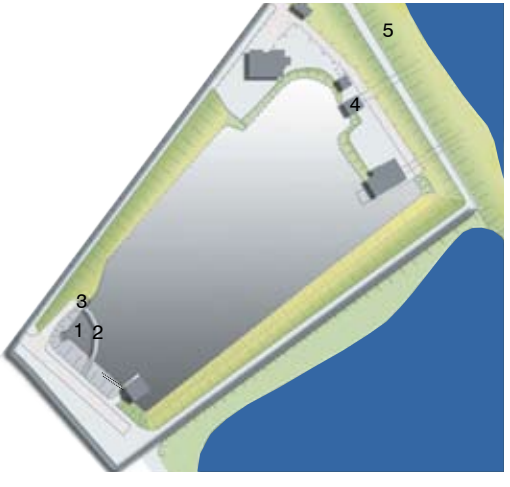


Fig. 6 Mapping of Changde´s open wastewater basins along Chuanzi river

This project critically examined and mapped Changde´s existing waste water system and its 17 open rain and wastewater retention basins located along the urban watercourses. Although connected to the wastewater treatment plant, in Changde´s monsoon climate their frequent overflow is a main source of water pollution. Within the landscape design for the new green belt along Chuanzi River these basins were not considered despite being located within it. Also, the engineers avoided upgrading the existing system, but prefered costly centralized solutions.

dry urban territory within a wet fluvial plain, where a natural hydrologic network is replaced by a drainage network (fig. 4, fig. 5, fig. 6). The aim is to examine and give guidelines in order to create an urban water landscape with a clear connection between the underlying structures of topography, hydrology and soils as the major structuring foundation of urban form, including the use of catchments as the basis for physical planning and regulation. At the same time, it aims to make use of the obvious synergies between the need to create networks of open space to serve social and ecological needs within the growing city and affordable approaches to engineering and urban water management.

In current investigations, the different elements of water infrastructure no longer relate only to their own networks defined merely by functionality and efficiency, but also to their context of cultural, social and ecological processes within the urban matrix. This means developing ideas of infrastructure to become landscape and landscape to become infrastructure towards more integrated hybrid typologies. The design of every infrastructure element should be integrated into the urban open space framework. This way, the infrastructure of water management can simultaneously be used by people as their public open space as well as to store, conduct and purify water.

Two research projects demonstrate how drainage and water purification systems, as a hybrid of built infrastructure, ecological functions and public green space can serve as fundamental components to change the urban landscape (fig. 7, fig. 8). Making use of dynamic and self-correcting natural processes, the designed urban infrastructures perform as 'artificial ecologies'. They contain a higher degree of ecological resilience, require less intervention and technical control than conventional systems and, at the same time, offer attractive landscape experiences.

The aim to reinvent concepts of waterscape urbanism can be considered a strategic chance to strengthen the cooperation between civil engineers, ecologists, urban designers and landscape architects. In such projects the emerging discipline of landscape urbanism could take on a major role as its strength lies in its knowledge about incorporating the performance of natural processes into spatial design strategies, linking them with engineering, ecological and urban design thinking. By reuniting the engineered and the natural, we may find new logics towards a more resilient development of infrastructural landscapes, which in turn could become a base of sustainable urban and regional form.

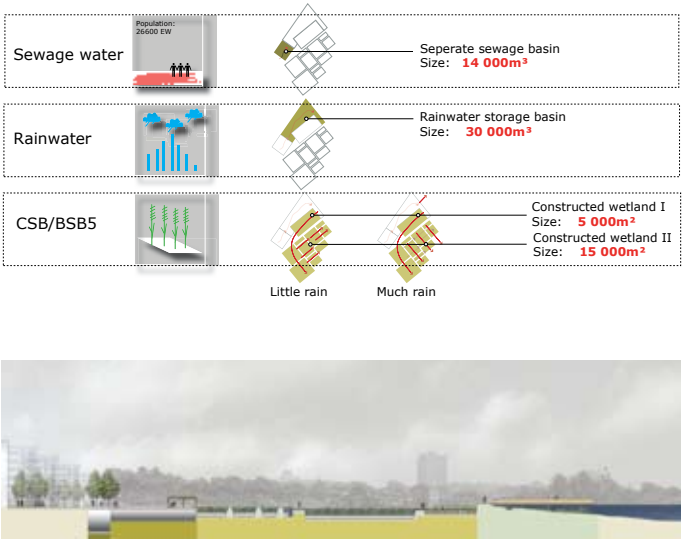


Fig. 7 Wastewater Basins as Green Infrastructure
Rather than investing a huge sum of money in technical, centralized solutions for a new drainage and water treatment system, in addition to an expensive park design, this proposal takes the upgrading of Boziyuan Wastewater Basin as an example of how to combine the low-cost improvement of its technical performance with affordable measures to improve the accessibility and ecology of the Chuanzi Waterfront Park. It suggested subdividing the basin into several chambers to assure that the volumes of each chamber are utilized completely by separating the different qualities of water and shortening retention time. The rainwater overflow will be cleaned in a series of constructed wetlands which are open to the public and become an essential part of the river park's landscape design.

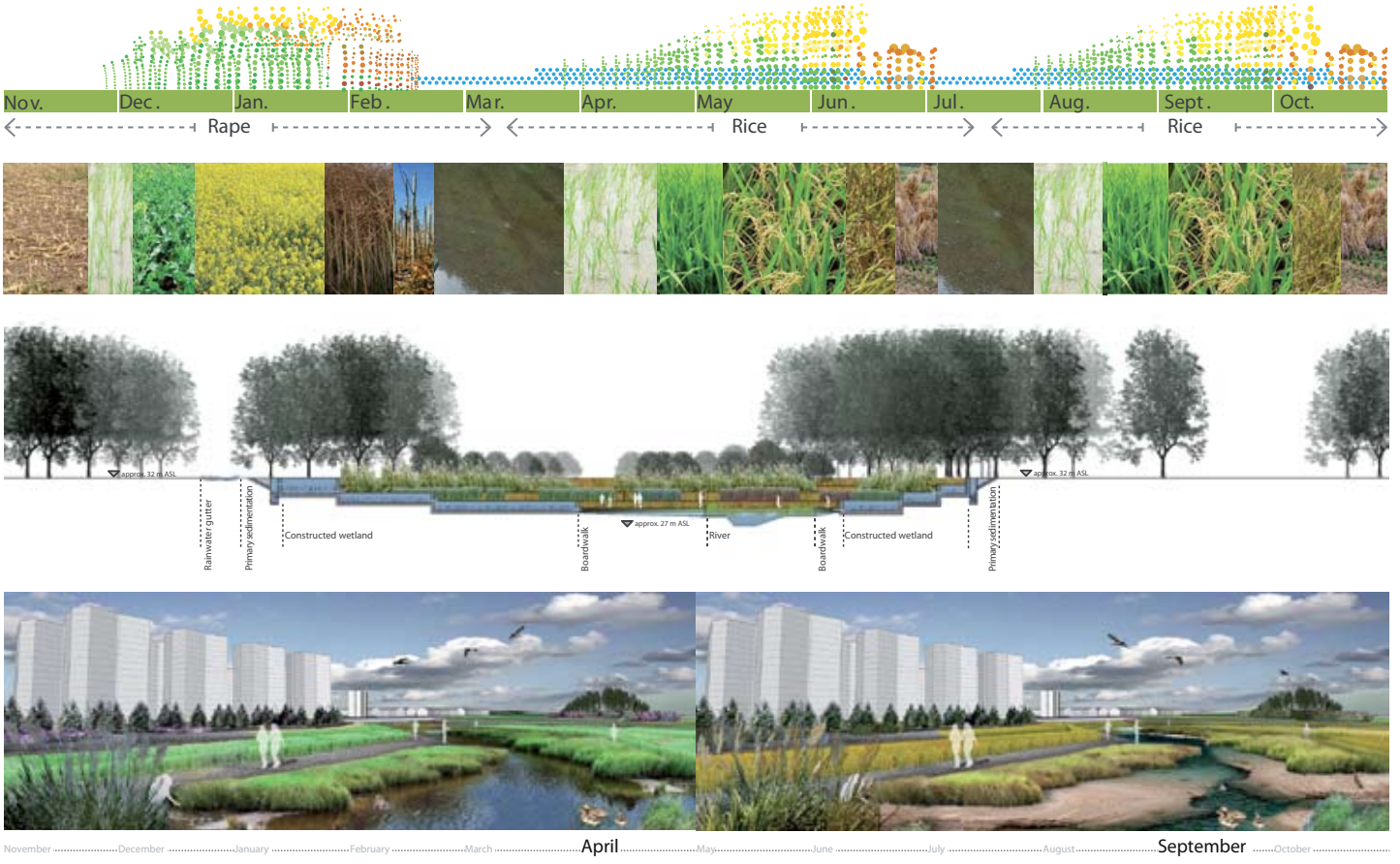


Fig. 8 Wetland Park Xiajiadang, Changde

The existing waterways in Changde´s suburban areas serve as open wastewater channels, as there is no existing sewer system. According to the 2020 master plan these will be developed to become green corridors that might be much less ecological and productive and also loose their connection with the urban wastewater system; instead, an underground sewer system is to be connected to the central wastewater treatment plant.

In a counterproposal, a multifunctional network of open space along waterways and functions is created as a system of retention reservoirs for excess water during floods, for water purification and, at the same time, as a productive public park landscape. The rice paddy-dominated agricultural identity of the territory is seen as a very special quality and is used to spatially organize the juxtaposition of urban and rural activities within green corridors. The design seeks to use rice, native plants and crops to strengthen the city's identity while also fulfilling a new role as an urban environment – namely becoming a productive landscape for work and leisure, and a technical landscape for storing and purifying water.

One of the key problems of current urbanization trends in the case of Changde and China is related to the deficiencies of conventional engineering concepts of urban drainage and purification systems – and a lot of money is to be invested in exploring new solutions in the future. Rather than leaving this field to engineers, landscape urbanists should use this window of opportunity to take a leading role in the reconstruction and development of urban infrastructure systems – using the landscape as a point of departure. As Elisabeth Mossop and Kongjian Yu suggest in their recent claims for 'affordable landscapes' [Mossop 2005] and 'Recovering landscape architecture as the art of survival' [Yu 2006], all disciplines involved in the development of urban territories need to shift their focus towards integrated, landscape-based solutions to the seemingly independent challenges of water and infrastructure provision, environmental and social improvement and the creation of site-specific identities. Rather than trying to eliminate ecological processes and invest huge sums of money to replace them within controlled technical systems, we need an 'intellectual leap by comprehensively applying the understanding of ecological processes and natural systems to human settlements and planning' [Mossop 2006]. For the landscape to become infrastructural, we need a more profound and practical knowledge about the interrelationships between ecological, infrastructure and urban systems. We need to educate ourselves in natural hydrology as well as civil engineering and dare to bridge the different disciplines. The ancient traditions and current challenges of China demonstrate the strengths and weaknesses of hydraulic engineering and territorial planning, and highlight the potential of water infrastructure reclamation and its crucial role in urban and landscape design.

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