

Water and development in the urban setting

By Ger Bergkamp, Bert Diphooorn and Corinne Trommsdorff

Introduction: water and cities | Water is the lifeline of human civilization. Since time immemorial, access to water has been a key defining factor in the location and prosperity of cities. Rivers like the Nile, Euphrates, Tigris and Indus enabled agricultural activities and trade to thrive ensuring the development of some of humanity's most recognised civilizations. Great civilizations such as the Roman Empire, Egyptian civilization, the Venetian Empire and the Omayyad Dynasty, among others, were founded on riverbanks. The Romans, for example, were the first to pipe water into their growing cities, especially with their aqueducts. And today, modern cities like London, Paris, Moscow, Cairo, New Delhi and Stockholm are likewise built on the banks of rivers and lakes.

The central role of water in the development of cities can, therefore, hardly be overstated. Water for drinking and for sanitation sustains the health, livelihood and the general living environment of city residents. A sustainable urban economy is also dependent on the quality, reliability and cost of water supply. Providing sufficient water for drinking and adequate sanitation is one of a city's key responsibilities. Water and sanitation services are the cornerstone of a local government's contact with its residents, and are one of the most tangible results for which communities hold their elected officials accountable.

Rapid urbanization: implications for water | The current pace of urban growth is unprecedented in human history. At the beginning of the 19th century, only 2 per cent of the world's population was urban. By the beginning of the 20th century, the percentage had increased to 10. During the first decade of the 21st century, a historic milestone was reached when the population living in cities and towns exceeded 50 per cent of the global population, thus making urban centres the dominant habitat of humankind. And rapid urbanization continues, with 60 per cent of the world's population expected to live in cities by 2030 and nearly 70 per cent by 2050. This equates to the world's cities adding up to three billion

people to their ranks in the next 35 years, nearly doubling the existing urban population. Most of this growth, at least 90 per cent, will take place in low-income countries, some of which are fragile states plagued with recurrent conflicts (UN-Habitat, 2013).

In general, and particularly where urbanization is fastest, cities are failing to sufficiently prepare themselves for urbanization with advance planning and services. In many countries, urban expansion has often been characterised by informality, illegality and unplanned settlements, especially in developing countries. Above all, urban growth has been strongly associated with slum growth, which is primarily due to a lack of appropriate planning and affordable housing as well as low incomes. The number of people living in urban slums since 1990 has increased by 33 per cent. If current trends continue, between 75 and 90 per cent of future urban growth will take place in peri-urban settlements comprising the inner-city slums and squatter settlements. Currently, these settlements accommodate between 30 and 60 per cent of urban populations in developing country cities and towns (UN-Habitat, 2013).

As cities grow and their populations increase, so does demand for water, and the generation of wastewater, much of which, in developing countries, is discharged untreated into the environment. By 2025, annual demand for municipal water in the world's large cities is expected to have increased by nearly 80 billion cubic meters, from around 190 billion cubic meters per year in 2012 to about 270 billion cubic meter per year. Building or expanding the municipal water supply infrastructure will require cumulative investment of about USD 480 billion by 2025, including investment to increase supply and to expand the distribution and treatment of wastewater (McKinsey Global Institute, 2012). This rate of withdrawal increase is unsustainable for many metropolitan areas, without looking to mining water resources in adjacent basins, building extensive conveyance infrastructures or desalination for coastal cities.

In the developing world, the supply of water has not kept pace with the high demand created by continued and rapid urban population growth combined with rising consumption patterns. Furthermore, the lack of adequate institutional arrangements and infrastructure to manage increasing volumes of wastewater and faecal sludge continue to pose major public health and environmental hazards. Internally, cities' capacity to deliver adequate and affordable water and sanitation is hampered by many factors such as poor planning, weak governance and legal frameworks, fragile institutions, or low capacity of local authorities to finance, build and operate essential infrastructure.

A key issue is that urban planning today is highly undervalued in developing countries and its practice outdated. By the time a plan is finalised the conditions on which it was based are no longer valid. There is a need for a different type of planning, more proactive, flexible, and reactive that can anticipate urban growth and prevent slum formation and its related water challenges. Furthermore, there is a need for more holistic approaches that integrate water and sanitation planning into the urban planning process, as well as an adaptive capacity and resilience to respond to rapid change, including disruptive events such as flooding and droughts expected to be more frequent with climate change, or a slow changing context.

With large sections of the urban population living in informal settlements where water and basic sanitation are severely deficient, cities will increasingly have to face the challenge of how to expand and upgrade these services to keep pace with urban growth, while ensuring access to an adequate level of services for the poor. This has implications for the planning process, as optimal solutions must be found to achieve the right balance between investments in bulk centralised and decentralised infrastructure to accommodate urban growth, as well as service extensions to the informal settlements.

Embracing urban growth for sustainable water management in cities, beyond basic service provision | We can observe a historical continuum on water in cities, which does not need to be followed for future expansions of our growing cities.

Cities have focused on developing water and sanitation services that ensure public health of their citizens: safe water and sanitation for all. However, in most cases the development of these services has been done in a subsystems approach – water first, then sanitation, and disconnected from the natural water cycle principles. The protection of the environment by ensuring safe withdrawals and waste discharges adequate for the natural treatment capacity of ecosystems has been the next focus of many stakeholders, e.g. utilities in the developed world, and will be a focus for the world cities driven by the newly defined SDGs. Beyond the healthy city, there are the healthy ecosystems for the City.



Photo: iStock

The concern for healthy ecosystems in and around the city being addressed, the development of water for comfort and well-being, water as a driver for attracting businesses, and for giving citizens a sense of belonging is more and more a focus. Water in Cities has increased its scope from contributing to a healthy city to fostering a liveable city.

Climate change awareness has brought Cities to face the reality of water-related disasters and chronic stress. Climate change adaptation has come up on Cities' agenda with water being a major focus point. Cities are now working on reducing their water-related risk to move towards the risk-resilient city. The realisation that the urban water cycle needs to reconnect to the natural water cycle is central to this transition. New urban areas and infills will embrace principles such as increasing the buffer capacity to cope with natural rainfall, shaping the urban landscape to allow for non-destructive flooding, reconnecting to the upstream watersheds to restore healthy hydraulic regimes of rivers. The notion of safe withdrawal in an uncertain climatic future and population growth requires many cities to plan for potential future water scarcity, which can be dealt with by implementing two different approaches: 1/ look for more water in adjacent basins and build major infrastructure to convey it, or 2/ reduce the needs within the City through usage reduction and fit-for-purpose re-use and recycling. For the long-term sustainability of our cities within their ecosystems, the second option -reducing, re-using, and recycling – allows reducing dependency on uncertain future resources, and fosters much stronger risk resilience. Coincidentally, if all energy and materials fluxes are considered using an “urban metabolism” approach, this second option is likely to be more energy-efficient, as well as resources-efficient through the recovery of

nutrients in wastewater treated to be reused as irrigation water.

Water security for cities can be achieved by realising that the water cycle is a natural system that is severely impacted by urbanization. Many stakeholders impact this water cycle upstream, within and downstream of a city and the governance across the water cycle has evolved as our cities grew and now often provides an impediment to integrated water management.

The historical development of urban water, sanitation and storm water management in Europe or North America, for example, has been sequential in time and has produced an infrastructure often not flexible enough, that does not easily adapt to changing dimensioning criteria (flood level, reduced water supply, etc.). It has also resulted in an urban water cycle disconnected from the natural water cycle – where forests and soils provide a buffer to floods, where water is reused by different ecosystems. This disconnection results in an infrastructure that is insufficiently risk-resilient and resource-consumptive.

Embracing the concepts of “re-duce”, “re-use”, “re-cover”, “re-cycle” and “re-plenish” for a Regenerative City allows increased risk-resiliency, both in regards to acute risk and chronic stress or slow changes, as well as increasing the sustainability of our cities by only using resources that can be regenerated.

The goal is to provide water security for cities by embracing a city planning agenda for a “regenerative city” which enables better planning for the healthy, liveable, risk-resilient city. This agenda goes beyond water and addresses all urban disciplines, it recognises how water actually shapes urban landscapes both because of natural waterways, storm and flood management, and also because regenerative urban water services are only fully implementable if integrated in urban landscapes at the building, district and metro scales. For example, the City of Sydney is re-developing the Barangaroo area into a carbon-neutral, water-positive, zero waste precinct that enhances the wellbeing of the community. This development integrates energy production, district cooling and water treatment into an urban landscape with plenty of public and green spaces to enable this “regenerative” city planning. Another example of a city embracing the “regenerative” approach is the city of Rotterdam with its stormwater management that includes filtration and storage for reuse as well as green roofs to limit rainwater surges. In addition, the Rotterdam Innovative Nutrients, Energy and Water management (RINEW) project investigates the possibilities of recovering and reusing water, nutrients and energy locally, regenerating the resources’ uses.

Rapid urbanization is a challenge, but it also opens up an opportunity to embrace the constraints of uncertain future climatic conditions and limited water supply in a

given geographical area, to plan our cities’ growth along the “5 Rs” principles of Reduce, Reuse, Recycle, Recover, and Replenish, finding inspiration in the way the natural water cycle works. This requires water-related planning to be more integrated with urban landscapes and other urban services, as well as to be connected to its basin and associated ecosystems services. It is an opportunity to adopt flexible and reactive integrated planning, with a cluster approach, where trans-disciplinary teams work together at the building and district scale, while maintaining the coordination with the metro and the catchment (IWA, 2012, TNC, 2014). The Semizentral concept developed by TU-Darmstadt and implemented in Qingdao, China, is a successful example of this decentralized cluster approach, allowing water reuse and energy production locally in a compact urban plant, with a replicable design of a precinct that is implementing all 5Rs principles.

The need for integrated planning: “A new urban agenda” | It is estimated that urban areas account for about 70 per cent of the world’s gross domestic product: some 55 per cent of GDP in low-income countries, 73 per cent in middle-income countries, and 85 per cent in high-income countries. In spite of the relatively weak global economic growth since the beginning of the financial crisis in 2008, many developing countries have witnessed high economic growth rates of over 7 per cent per year since 2010, and most of this growth is concentrated around industrial activities of towns and cities, often enhanced by increasing inputs from rural areas.

Cities offer benefits of agglomeration, the potential for greater productivity gains where specialised or complementary activities cluster together. Agglomeration brings the factors of production into proximity, optimises specialisation and increases the relative size of urban markets. Because productive activities in industry and services cluster in cities it is estimated that almost 80 per cent of the world’s gross domestic product is generated by cities. Cities offer opportunities, with their higher density, to cost effectively provide water and sanitation, as well as provide resource recovery and synergies with other sectors. However, the higher density is also a threat to the preservation of waterways, to sustainable water withdrawals, to the population settling on high-risk land. In order to seize these opportunities and best mitigate the threat, cities need to be planned with buildings and urban landscapes that reconnect the City to its natural water cycle, with water flows shaping the city, waste being recovered as a resource, and water reused as necessary to ensure withdrawals that match the natural capacity of the catchment. This type of planning requires a change of paradigm from the way we have often planned water and sanitation in the past, in a sequential pluri-disciplinary approach. The outdated approach by sub-systems leads to sub-optimal solutions, missing opportunities for synergies between sectors: water services, waste, energy, food, transport, spatial planning, etc...

Urban planning is moving from being multidisciplinary sequential to transdisciplinary holistic, where different disciplines inspire each other to identify synergies and mutually beneficial solutions. The Cities of Sydney and Rotterdam are good examples of this transition. The trans-disciplinary team includes engineers and architects but also social scientists that can place the right priorities on how to best address the needs of people and their roles in the cities. This integrated planning of basic services and infrastructure strategies, including water and sanitation, green infrastructure, transport and mobility, is therefore people-centred. With a cluster approach integrated at the metro scale it can work on housing programmes and land-use plans, which address the needs of city residents, of new urban dwellers arriving in the cities, as well as the needs of the vulnerable and marginalised groups.

Integrated planning however is often impeded by institutional constraints rather than technical. To achieve integrated planning, change is needed at several levels: institutional, regulatory, city planning departments, and urban planning professionals, including water professionals. In order to initiate this transition, political, technical and societal leadership is essential, as it will inspire professionals and citizens to drive the necessary change. The City of New York illustrates how political leadership associated with participative processes results in a resilient and regenerative reconstruction. Capacity development is also critical to bring city planners, institutions and all urban professionals to work in the same direction. Cities sharing their experiences and inspiring each other highly contributes to this capacity building.

The challenges are numerous, with a major one being the financing of this integrated infrastructure for all. It requires a shift in financing models where shared public benefits, such as increased resilience, or the ability to react a changing context, can be accounted for. New businesses

in the city around the green economy can highly contribute to this shift in business model, through partnerships for reuse, resources recovery, or energy efficiency.

The third United Nations Conference on Housing and Sustainable Urban Development (Habitat III), planned in October 2016 in Quito, offers an excellent opportunity for the UN system organisations to reflect on the role of urbanization in sustainable development and to come up with a system-wide approach that is guided by the content and spirit of international human rights instruments, including on women's rights and gender equality. Similarly, the discussions on the Post-2015 development agenda are crucial to developing a shared perspective on sustainable cities and human settlements, and for discussing the challenges and opportunities that urbanization offers for the future implementation of the Sustainable Development Goals (SDGs).

Conclusion | The proposed “new urban agenda” represents a paradigm shift towards a new model of urbanization that can better respond to the challenges of our age, optimising resources to harness potential. The “new urban agenda” should promote sustainable cities and other human settlements that are environmentally sustainable and resilient; socially inclusive, safe and violence-free; economically productive; and better connected to and contributing towards sustained rural transformation. Such a vision should be fully in line with all of the evolving Post-2015 sustainable development goals, most particularly the proposed goal on sustainable cities and human settlements.

Water is a central element to cities. It can be a great entry point to this transition to a new urban agenda by engaging leaders and citizens in reconnecting with the natural water cycle and embracing the 5Rs principles: Reduce the amount of water used, Reuse the water, Recycle the materials and nutrients, Recover the energy, Replenish the surrounding environment.



Photo: iStock

THE AUTHORS

Dr Ger Bergkamp

Executive Director
International Water Association (IWA)

Bert Diphooen

Former Director
Donor Relations and Resource Mobilization Service (DRRMS)
UN-HABITAT

Corinne Trommsdorff

Cities of the Future
Programme Manager
International Water Association (IWA)