Royal Park Wetlands, Melbourne, Australia - A strategic water-quality intervention for the city of Melbourne. A major drainage outlet for the city was diverted to a treatment wetland integrated with the park's public realm Treated storrwater from the wetland was reused locally to keep Melbourne's public parks green during summ

A DESIGNATION OF THE OWNER.

Water-smart cities

Restoring a long-lost relationship – re-designing water management in our cities through water-sensitive urban design

By Celeste Morgan, Director, Sustainability, AECOM UK

Historic connections

Cities have had a tumultuous courtship with water throughout history. Our greatest urban centres owe their very existence to the harbours, rivers and drinking water sources that provided inspiration for development and the means for economic prosperity. Yet, despite our instinctive attraction to water, we have all too often exploited the relationship by confining it, degrading it and largely ignoring it.

A critical resource issue

With either too much or too little of it, water is undoubtedly one of the most critical resource issues we face this century, and cities are likely to be where we experience its dramatic impact. In our eagerness to develop close-by water courses, we effectively paved over natural drainage systems and found ourselves discharging wastes into the same water sources we rely upon for our health and well-being. The effects are obvious. Urban flooding attracts headlines every year and securing potable water supply for our water-hungry urban populations in the Midlands and South-East England has overstretched local resources and forced us to rely on carbon-intensive water supplies pumped in from distant catchments. And to make matters worse, climate change will only intensify flood risk and water scarcity.

Changing our perspective

Our social consciousness of water is nebulous. Dr Sarah Bell of University College London has studied the relationship between communities and water in the UK. She states: "Our relationship with water has been defined by an assumption that water supply is endless. Some may call for a change in people's attitude to water, but the problem is that people don't even *have* an attitude to water in the first place. It's a hidden resource, and the myth that water is endless is constantly reinforced by our design of our infrastructure, our appliances and our places."

The urban solution

Ironically, through our nonchalance, we may have created the future solution to our water-management problems - the city itself. A city is perhaps the largest concrete reservoir one could hope to build and, by using that reservoir as a platform to treat and store water, it is possible to both supply our water locally and reduce our flooding problems downstream. But our cities need a far-reaching facelift if we hope to rekindle a better relationship with water. The re-design of our cities as an intelligent watermanagement platform can only be done well with the help of the artisans of the urban environment: our planners, architects, urban designers, landscape architects and engineers, all working towards a common cause and working with our communities. Water Sensitive Urban Design, or WSUD, is the philosophy that describes this re-design of urban areas to be water smart by considering the management of the whole water cycle through the urban planning and design process. If WSUD is not already part of the design vocabulary, it should be. It may be the greatest influence practitioners in the built environment can have on creating resilient cities. Equally, the change will not be possible without urban designers embracing the WSUD approach. A design process, not a product, Water Sensitive Urban Design is about a change in the way we think about water in our urban environment. It should

not be confused with 'SUDS' or sustainable urban drainage systems, although use of sustainable drainage components is a core part of the philosophy. WSUD tackles the water cycle in the round by considering how integrated design can enable local water recycling and wastewater management. Importantly, WSUD is also about a celebration of water through design, creating urban areas that are actively managing water, while also being ecologically rich, carbon efficient, easy to manage and attractive places to live.

Global approaches

The concept of Water Sensitive Urban Design emerged from Australia, following a 20-year-long rethink of urban water-management systems. The journey began when public concern about the health of urban rivers triggered questioning over how stormwater quality was managed in cities. The design community responded and one of the first projects to embrace the early principles of WSUD was the Royal Park Wetlands in Melbourne. Here, a grimy urban waterway was intercepted and the water treated naturally before making its way into the ecologically sensitive Port Phillip Bay.

With the help of planning regulation, the response was extended across Melbourne to target new development areas. An intelligent water quality design tool, 'MUSIC' (Model for Urban Stormwater Improvement Conceptualization) was utilised to require developers to include interlinked watermanagement features on buildings and in public spaces. This helped to regulate flows and treated stormwater to a very high quality.

The redevelopment of the Melbourne Docklands area was the first major example of an integrated

urban design vision for water, with urban spaces becoming water-management machines in their own right. Micro-wetlands were delivered in commercial courtyard areas and rain gardens designed into the central reservations of urban streets. The crowning glory was that, through good architectural design and an integrated public art strategy, water management had become both beautiful and unnoticeable – a

seamless part of the city landscape. The Australian journey accelerated when watershortage events began to take their toll and desalination plants began to drive up the cost of water and the carbon impact of water supply. Wastewater recycling for reuse became a popular option and, with high-quality stormwater on-hand, stormwater recycling developed into a low-cost, low-carbon solution to water supply. Currently the concept of 'Cities as Catchments' continues to drive design philosophy in Australia and integrated water management is being demonstrated through projects in all of its mainr cities.

Dr Peter Breen, Design Principal and Ecological Engineer in AECOM's Melbourne office has been a leading figure in the WSUD journey and continues to work with urban designers to push new water solutions in the urban realm: "We are at the point now where we can design urban developments to be 'zero-water', where recycled wastewater provides non-potable supply and stormwater runoff from urban roofs and streets is captured and treated for potable water supply using smart landscape features to filter out pollutants. Developments can now be taken off-line with no external water supply or wastewater drainage infrastructure needed."

An integrated approach

In the UK, water is often considered as an afterthought once development plans have progressed to detailed design. More often than not, water is thought of as an 'engineering-only' design element with little creative input from those who shape the form and function of our urban places. The engineering of water management is also often segregated, with one engineer designing the drainage scheme, another conducting a flood-risk assessment, another considering water supply and wastewater-management arrangements, and the building engineers separately struggling to meet water-use-reduction targets on a building-bybuilding basis.

The UK has proved that it can design in a much more integrated way. Compare our approach to water to how far we have come with low-carbon energy design in new development. Planning and architecture disciplines have led the charge, actively shaping developments to minimise energy demand and to accommodate renewable-energy sources and decentralised energy systems. Yet our design response to water has so far been much less successful.

Our planning and design process needs to change so that an integrated water strategy is developed at the conception of a project and the urban design process is used to create the solutions to local water management. Understanding topography and natural drainage paths should shape development from the start, using built form and green infrastructure to guide and filter water, simultaneously using water as a design inspiration to craft the layout and character of urban places. Equally, an understanding of the potable and non-potable water demands of a development should shape the local water-supply solution and the on-site infrastructure that goes with it - whether that be rainwater, treated wastewater, treated stormwater, or an external supply, and whether water supply is managed at a building, block or community-wide scale.

Changing attitudes in the UK

The WSUD approach is beginning to be implemented in a few progressive developments in the UK. The University of Cambridge has shaped the masterplan for its new mixed-use community scheme in North West Cambridge with a strong emphasis on the management of water through a series of interlinked natural landscapes and wetlands to prevent



Shanghai Chemical Industrial Park, Natural Wastewater Treatment System, Shanghai, China - This area of Shanghai consists of more than a dozen modern petrochemical industrial acilities. AECOM designed a natural water-treatment system to purify industrial wastewater effluent for recycling within the industrial park while also creating a new public wetland park





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Waitangi Park, Wellington, New Zealand - Fronting onto Wellington Harbour, the regeneration of the public waterfront area provided an opportunity to naturally filter stormwater run-off from the city before it entered the bay. Designed in tandem with the landscape and public art vision for the area, the wetland corridor has become an iconic feature.

downstream flooding and improve stormwater guality. Research is being conducted into site-scale wastewater and stormwater recycling to assist buildings in reaching Code for Sustainable Homes Level 5 to respond to water stress in the Cambridge area. We have a long way to go if we are going to make our relationship with water a harmonious one. Paul Shaffer, of best-practice research body CIRIA, has been leading the transition towards greater use of sustainable drainage systems over the last 10 years and believes "a water-sensitive urban design approach is essential if we are going to make headway on both our flooding and broader water and environmental protection objectives." The response needs to be cross-disciplinary but also needs to capitalise on the broader design benefits of WSUD delivering green infrastructure, responding to climate change and creating great places to live. CIRIA, in the long term, intends to develop Water Sensitive Urban Design guidelines for the UK to support design practitioners in implementing a new approach to urban water management, but for now is focussing on demonstrating the benefits of WSUD.

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Jinji Lake Waterfront, Suzhou, China

AECOM was appointed by the Suzhou Industrial Park Administrative Committee to masterplan a waterfront community and its interface with the 740ha Jinji Lake, the most prominent natural landscape feature in the Suzhou Industrial Park. Drawing on Suzhou's celebrated features – its canals and walled gardens – AECOM conceptualised the district as eight neighbourhoods with a wide array of water and landscape features around Jinji Lake.

All the neighbourhoods are connected by a continuous walkway along the 14.5km (9 miles) perimeter of the lake. A variety of hard and soft water edges, created and natural wetlands, and green spaces work together to clean surface water and filter pollutants in agricultural and stormwater runoff. A two-kilometre-long (1.2 miles) vehicular and pedestrian bridge across a bay at the lake's northern end will symbolize the transition from the old to the new Suzhou as the community grows around Jinji Lake and the center of gravity moves eastward from the old city. On completion, Jinji Lake Waterfront will fulfill its masterplan as a new town for 600,000 residents, an economic generator and a template for environmental sustainability.





Southport Broadwater Parklands, Gold Coast, Queensland, Australia

Exemplary landscape, urban and environmental design is set to reinvent Southport Broadwater Parklands as one of Australia's great foreshore parks – an iconic gateway for the city and a popular destination, where events, history and water combine to create an active green waterfront.

As part of the parklands' water-sensitive urban design, run-off from a significant portion of the Southport Central Business District is treated in a number of vegetated stormwater treatment systems including a central urban wetland and bioretention systems before its discharge into the Broadwater. A newly created mangrove wetland enhances the quality of the stormwater discharged by providing conditions which support sedimentation, thereby increasing pollutant uptake. Initiatives such as the mangrove wetland and central urban wetland reduce stormwater pollutant loads entering the Broadwater and increase the diversity of marine habitat within the parklands. Footpaths and paved areas are designed so that runoff is directed onto adjacent landscaped areas, providing for passive irrigation, whilst a newly installed irrigation infrastructure allows easy crossover to future use and provision of recycled water. The 'Rockpools' children's waterplay area utilises saltwater drawn from the adjacent Broadwater to minimize the use of potable water.



A Water Sensitive Urban Design approach to the Northwest Cambridge Masterplan

Proposals for the long-term expansion of the University of Cambridge to the north west of Cambridge are being developed by AECOM. This represents the largest plans for expansion in the University's 800-year history and includes a mixed-use sustainable development of University research and academic facilities, affordable housing for University staff, student housing, market housing, community facilities and public open space on the 150ha site.

Water has been a core shaping element in the evolution of the masterplan, with the layout being designed around an interconnected matrix of green corridors that capture and manage water in the public realm and feed a landscaped wetland area adjacent to the local brook. Building design and landscape design are being considered simultaneously to ensure that a holistic approach to water is taken across the site. With the strategic water management design now integrated into the masterplan vision, the next stage of design will detail streetscapes, public spaces and building design to explore how water can be treated and reused locally. Buildings on-site are targeting Code for Sustainable Homes Level 5 and BREEAM Excellent certifications, which provides an opportunity to explore how water can be locally reused, and how the public landscape can be used to provide treatment and storage of water sources.

The project has received additional funding from the UK Technology Strategy Board to consider how the masterplan approach can help the area to adapt to climate change.

AECOM hosted a launch event for Water Sensitive Urban Design in the UK in September. Speakers from both Australia and the UK shared experience and urged the design community to take a leading role in re-shaping urban water management. www.aecom.com